CITROËN XSARA PICASSO

2000 to 2002 (W registration onwards) Petrol & Diesel

Haynes **Service and Repair Manual**

Includes **Roadside Repairs** and **MOT Test Checks**

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LIVING WITH YOUR CITROEN XSARA PICASSO

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The following pages are intended to help in dealing with common roadside emergencies and breakdowns. You will find more detailed fault finding information at the back of the manual, and repair information in the main chapters.

Car won't start

Starter motor doesn't turn

- ☐ Lift the front passenger's seat, take off the battery cover and make sure that the battery terminals are clean and tight.
- ☐ Switch on the headlights and try to start the engine. If the headlights go very dim when you're trying to start, the battery is probably flat. Get out of trouble by jump starting (see below) using a friend's car.

Starter motor turns as normal

- ☐ Is there fuel in the tank?
- ☐ Remove the engine cover (where fitted) and spray all visible electrical connectors with a water-dispersant spray like WD40 if you suspect a problem due to damp.

Jump starting

When jump-starting a car using a booster battery, observe the following precautions:

- ✔ Before connecting the booster battery, make sure that the ignition is switched off.
- ✔ Ensure that all electrical equipment (lights, heater, wipers, etc) is switched off.
- ✔ Take note of any special precautions printed on the battery case.
- ✔ Make sure that the booster battery is the same voltage as the discharged one in the vehicle.
- ✔ If the battery is being jump-started from the battery in another vehicle, the two vehicles MUST NOT TOUCH each other.
- ✔ Make sure that the transmission is in neutral (or PARK, in the case of automatic transmission).

HAYNES HiNT

Jump starting will get you out of trouble, but you must correct whatever made the battery go flat in the first place. There are three possibilities:

1 The battery has been drained by repeated attempts to start, or by leaving the lights on.

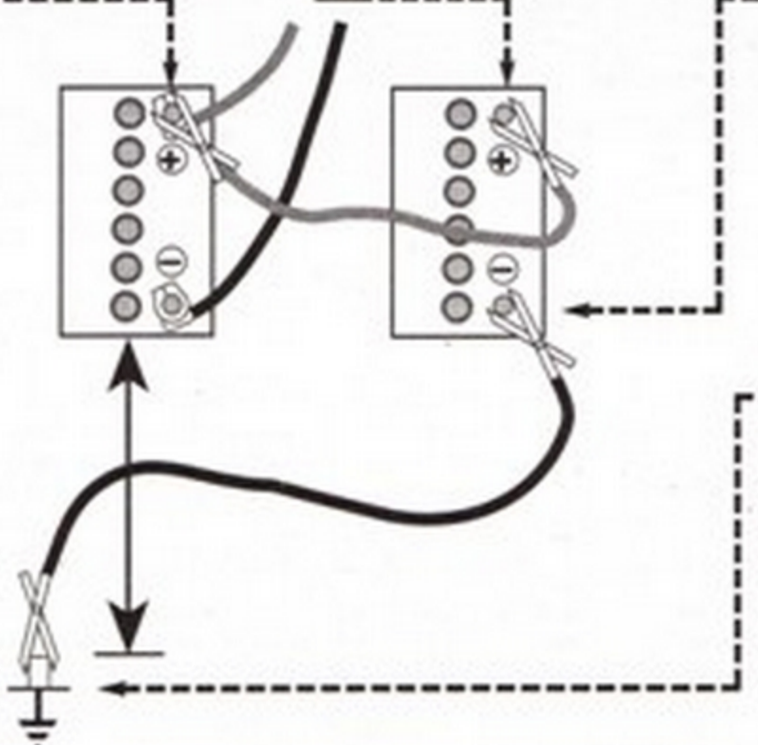
2 The charging system is not working properly (alternator drivebelt slack or broken, alternator wiring fault or alternator itself faulty).

3 The battery itself is at fault (electrolyte low, or battery worn out).

1 Lift up the cover over the flat battery's positive (+) cable terminal box located behind the air cleaner and connect one end of the red jump lead to the terminal stud.

2 Connect the other end of the red lead to the positive (+) terminal of the booster battery.

3 Connect one end of the black jump lead to the negative (-) terminal of the booster battery.



4 Connect the other end of the black jump lead to a bolt or bracket on the engine block on the vehicle to be started.

5 Make sure that the jump leads will not come into contact with the fan, drivebelts or any other moving parts of the engine.

6 Start the engine using the booster battery and run it at idle speed. Disconnect the jump leads in the reverse order of connection.

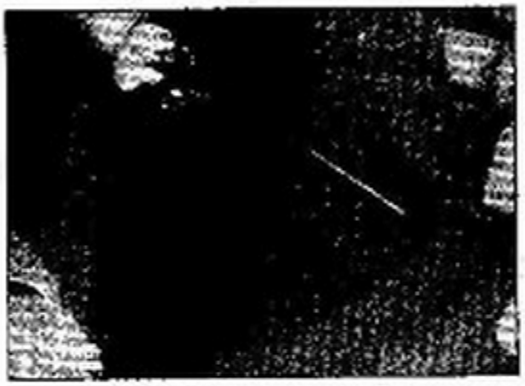
Wheel changing

Warning: Do not change a wheel in a situation where you risk being hit by other traffic. On busy roads, try to stop in a lay-by or a gateway. Be wary of passing traffic while changing the wheel – it is easy to become distracted by the job in hand.

Preparation

- ☐ When a puncture occurs, stop as soon as it is safe to do so.
- ☐ Park on firm level ground, if possible, and well out of the way of other traffic.
- ☐ If you have one, use a warning triangle to alert other drivers of your presence.
- ☐ Apply the handbrake and engage first or reverse gear.
- ☐ Use hazard warning lights if necessary.
- ☐ If the ground is soft, use a flat piece of wood to spread the load under the foot of the jack.

Changing the wheel



1 Lift up the lid on the under floor storage box behind the front seat and take out the wheelbrace.

2 From inside the boot area, use the wheelbrace to lower the spare wheel cradle.

3 Slide the spare wheel and tool kit out from the underside of the car.

4 Open the box and take out the jack. Use the chock supplied to chock the wheel diagonally opposite the one being removed.

5 Slacken each wheel bolt by a half turn.

6 Locate the jack below the reinforced jacking point and on firm ground (don't jack the car at any other point on the sill). Turn the jack handle clockwise until the wheel is raised clear of the ground, remove the bolts and wheel trim (where applicable), then lift the wheel clear.

7 Position the space-saver spare wheel and fit the wheel bolts. Tighten the bolts moderately with the wheelbrace, then lower the car to the ground. Tighten the wheel bolts in a diagonal sequence, then secure the punctured wheel in the spare wheel cradle.

Finally...

- ☐ Remove the wheel chocks. Stow the jack and tools in the appropriate locations in the car.
- ☐ Check the tyre pressure on the wheel just fitted. If it is low, or if you don't have a pressure gauge with you, drive slowly to the nearest garage and inflate the tyre to the correct pressure. Have the damaged tyre or wheel repaired, or renew it, as soon as possible.
- ☐ Don't leave the spare wheel cradle empty and unsecured – it could drop onto the ground while the car is moving.

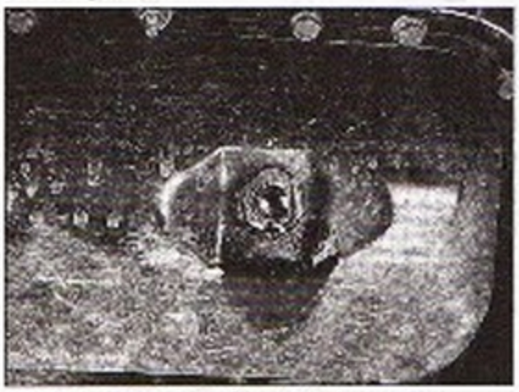
Identifying leaks

Puddles on the garage floor or drive, or obvious wetness under the bonnet or underneath the car, suggest a leak that needs investigating. It can sometimes be difficult to decide where the leak is coming from, especially if the engine bay is very dirty already. Leaking oil or fluid can also be blown rearwards by the passage of air under the car, giving a false impression of where the problem lies.

Warning! Most automotive oils and fluids are poisonous. Wash them off skin, and change out of contaminated clothing, without delay.

HAYNES HINT *The smell of a fluid leaking from the car may provide a clue to what's leaking. Some fluids are distinctively coloured. It may help to clean the car carefully and to park it over some clean paper overnight as an aid to locating the source of the leak.*
Remember that some leaks may only occur while the engine is running.

Sump oil



Engine oil may leak from the drain plug...

Oil from filter

...or from the base of the oil filter.

Gearbox oil

Gearbox oil can leak from the seals at the inboard ends of the driveshafts.

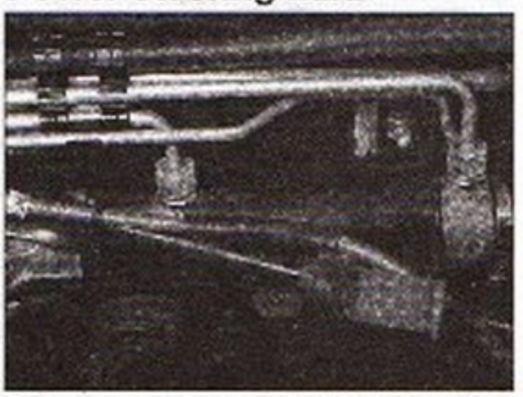
Antifreeze

Leaking antifreeze often leaves a crystalline deposit like this.

Brake fluid

A leak occurring at a wheel is almost certainly brake fluid.

Power steering fluid



Power steering fluid may leak from the pipe connectors on the steering rack.

Towing

When all else fails, you may find yourself having to get a tow home – or of course you may be helping somebody else. Long-distance recovery should only be done by a garage or breakdown service. For shorter distances, DIY towing using another car is easy enough, but observe the following points:

☐ Use a proper tow-rope – they are not expensive. The vehicle being towed must display an ON TOW sign in its rear window.

☐ Always turn the ignition key to the 'on' position when the vehicle is being towed, so that the steering lock is released, and that the direction indicator and brake lights will work.

☐ Only attach the tow-rope to the towing eyes provided. These are located in or below the bumpers at the front and rear.

☐ Before being towed, release the handbrake and select neutral on the transmission.

☐ Note that greater-than-usual pedal pressure will be required to operate the brakes, since the vacuum servo unit is only operational with the engine running.

☐ Greater-than-usual steering effort will also be required.

☐ The driver of the car being towed must keep the tow-rope taut at all times to avoid snatching.

☐ Make sure that both drivers know the route before setting off.

☐ Only drive at moderate speeds and keep the distance towed to a minimum. Drive smoothly and allow plenty of time for slowing down at junctions.

Introduction

There are some very simple checks which need only take a few minutes to carry out, but which could save you a lot of inconvenience and expense.

These 'Weekly checks' require no great skill or special tools, and the small amount of time they take to perform could prove to be very well spent, for example;

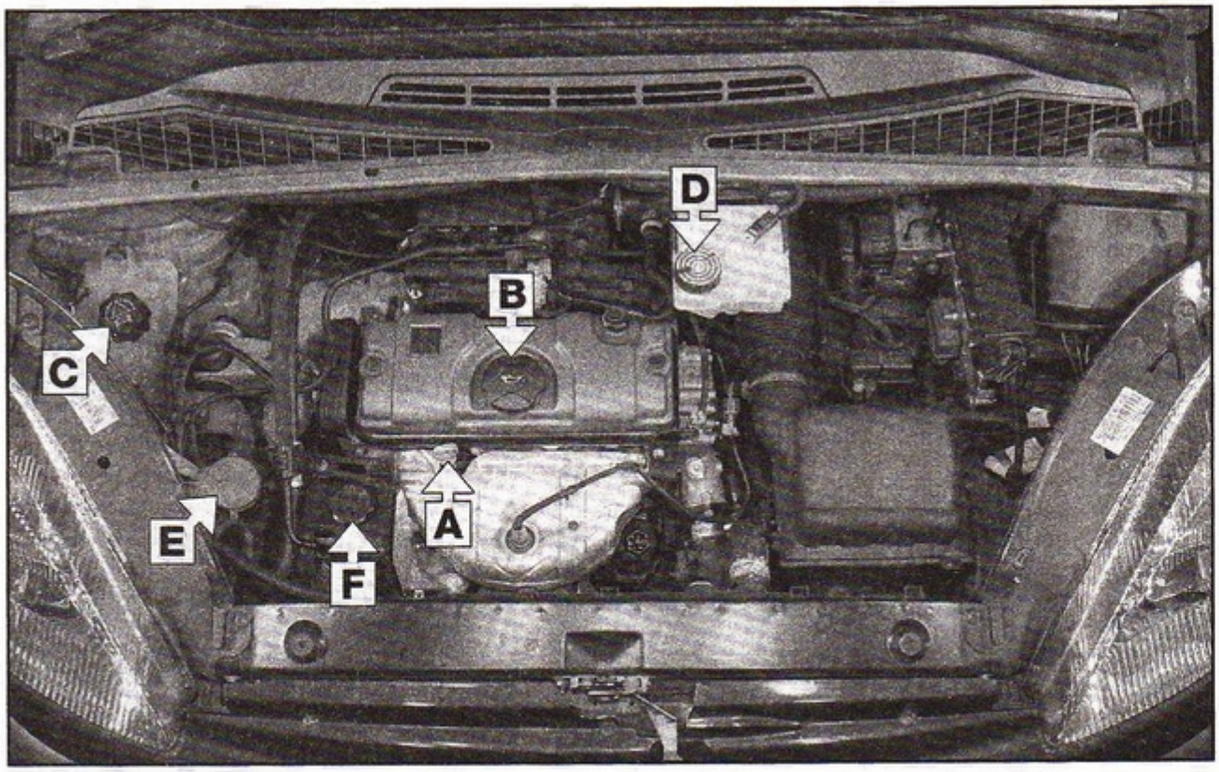
☐ Keeping an eye on tyre condition and pressures, will not only help to stop them wearing out prematurely, but could also save your life.

☐ Many breakdowns are caused by electrical problems. Battery-related faults are particularly common, and a quick check on a regular basis will often prevent the majority of these.

☐ If your car develops a brake fluid leak, the first time you might know about it is when your brakes don't work properly. Checking the level regularly will give advance warning of this kind of problem.

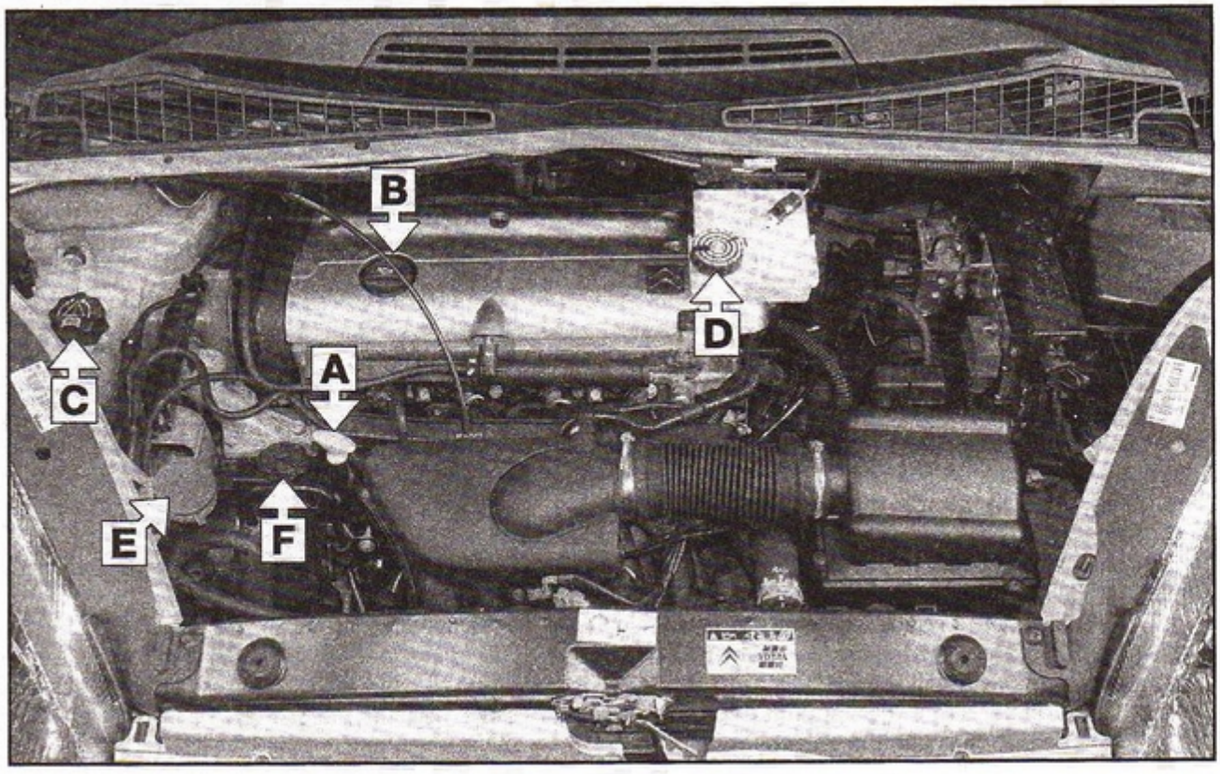
☐ If the oil or coolant levels run low, the cost of repairing any engine damage will be far greater than fixing the leak, for example.

Underbonnet check points



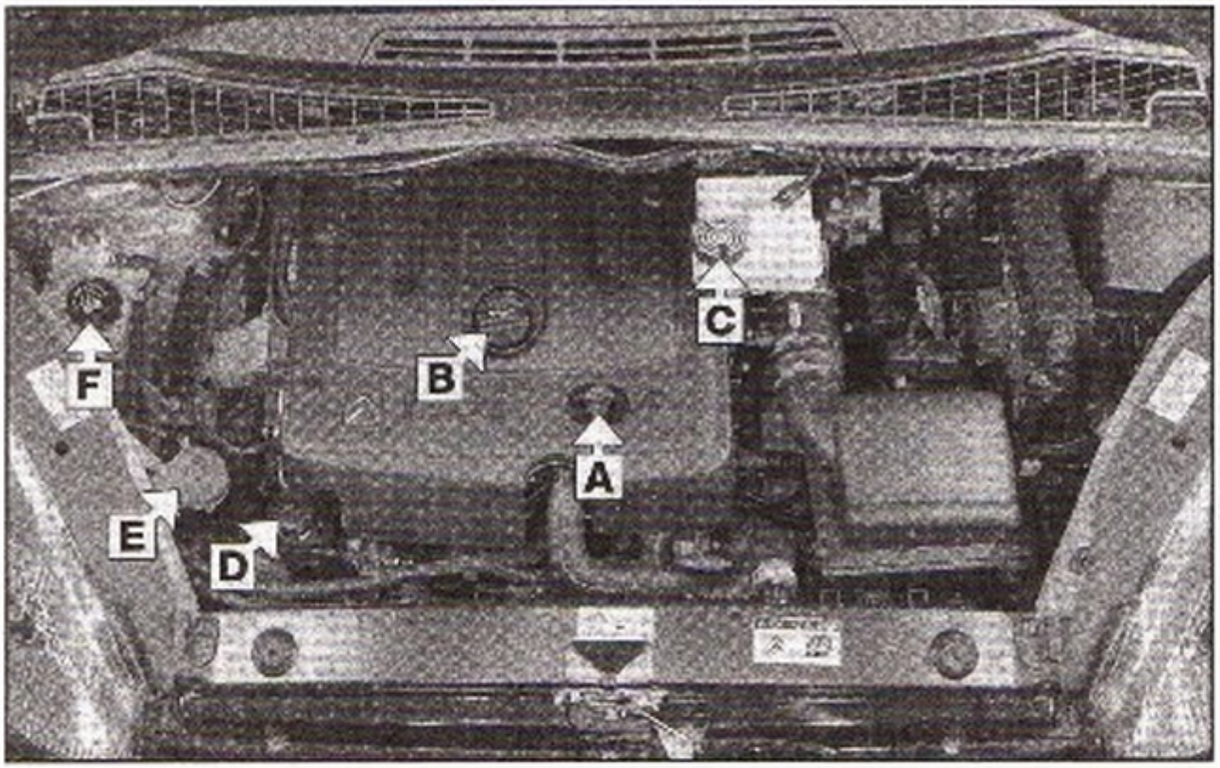
◀ 1.6 litre petrol

A *Engine oil level dipstick*
B *Engine oil filler cap*
C *Coolant expansion tank*
D *Brake fluid reservoir*
E *Screen washer fluid reservoir*
F *Power steering fluid reservoir*



◀ 1.8 litre petrol

A *Engine oil level dipstick*
B *Engine oil filler cap*
C *Coolant expansion tank*
D *Brake fluid reservoir*
E *Screen washer fluid reservoir*
F *Power steering fluid reservoir*



◀ 2.0 litre diesel

A *Engine oil level dipstick*
B *Engine oil filler cap*
C *Brake fluid reservoir*
D *Power steering fluid reservoir*
E *Screen washer fluid reservoir*
F *Coolant expansion tank*

Engine oil level

Before you start

✔ Make sure that your car is on level ground.
✔ Check the oil level before the car is driven, or at least 5 minutes after the engine has been switched off.

HAYNES HiNT *If the oil is checked immediately after driving the vehicle, some of the oil will remain in the upper engine components, resulting in an inaccurate reading on the dipstick!*

The correct oil

Modern engines place great demands on their oil. It is very important that the correct oil for your car is used (See 'Lubricants and fluids').

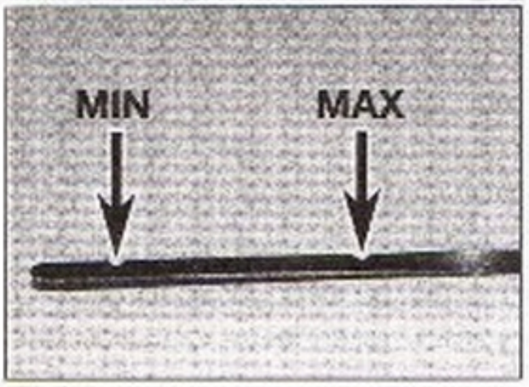
Car Care

● If you have to add oil frequently, you should check whether you have any oil leaks. Place some clean paper under the car overnight, and check for stains in the morning. If there are no leaks, the engine may be burning oil.

● Always maintain the level between the upper and lower dipstick marks (see photo 3). If the level is too low severe engine damage may occur. Oil seal failure may result if the engine is overfilled by adding too much oil.

1 The dipstick is often brightly coloured for easy identification. Withdraw the dipstick.

2 Using a clean rag or paper towel, wipe all the oil from the dipstick. Insert the clean dipstick into the tube as far as it will go, then withdraw it again.



3 Note the oil level on the end of the dipstick, which should be between the upper (MAX) mark and lower (MIN) mark. Approximately 1.25 litres of oil will raise the level from the lower mark to the upper mark.

4 Oil is added through the filler cap. Unscrew the cap and top-up the level; a funnel may help to reduce spillage. Add the oil slowly, checking the level on the dipstick often. Don't overfill (see *Car Care*).

Power steering fluid level

Before you start:

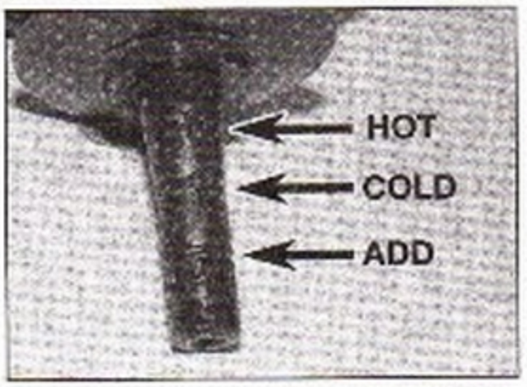
✔ Park the vehicle on level ground.
✔ Set the steering wheel straight-ahead.
✔ The engine should be turned off.

HAYNES HiNT *For the check to be accurate, the steering must not be turned once the engine has been stopped.*

Safety First!

● The need for frequent topping-up indicates a leak, which should be investigated immediately.

1 The power steering fluid reservoir is integral with the power steering pump located at the front of the engine. With the engine stopped, wipe clean the area around the reservoir filler neck and unscrew the filler cap/dipstick from the reservoir.



2 Dip the fluid with the filler cap/dipstick. When the engine is cold, the fluid level should be between the ADD mark and the COLD mark; when hot it should be between the ADD and HOT marks. Top-up when the fluid is at the ADD mark.

3 When topping-up use the specified type of fluid and do not overfill the reservoir. When the level is correct, securely refit the cap.

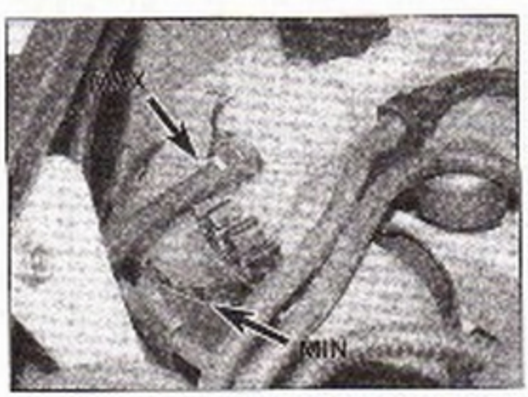
Coolant level

⚠ ***Warning: DO NOT attempt to remove the expansion tank pressure cap when the engine is hot, as there is a very great risk of scalding. Do not leave open containers of coolant about, as it is poisonous.***

Car Care

● With a sealed-type cooling system, adding coolant should not be necessary on a regular basis. If frequent topping-up is required, it is likely there is a leak. Check the radiator, all hoses and joint faces for signs of staining or wetness, and rectify as necessary.

● It is important that antifreeze is used in the cooling system all year round, not just during the winter months. Don't top-up with water alone, as the antifreeze will become too diluted.



1 The coolant level varies with engine temperature. The level is checked in the expansion tank, which is located at the rear, right-hand side of the engine compartment. When the engine is cold, the coolant level should be between the MAX and MIN marks on the side of the tank.

2 If topping-up is necessary, **wait until the engine is cold** then turn the expansion tank cap slowly anti-clockwise, and pause until any pressure remaining in the system is released. Unscrew the cap and lift off.

3 Add a mixture of water and antifreeze to the expansion tank, until the coolant level is up to the MAX level mark. Refit the cap, turning it clockwise as far as it will go until it is secure.

Screen washer fluid level

Screenwash additives not only keep the winscreen clean during foul weather, they also prevent the washer system freezing in cold weather - which is when you are likely to need it most. Don't top up using plain water as the screenwash will become too diluted, and will freeze during cold weather. ***On no account use coolant antifreeze in the washer system - this could discolour or damage paintwork.***

1 The windscreen/tailgate washer fluid reservoir is located at the front right-hand side of the engine compartment. If topping-up is necessary, open the cap.

2 When topping-up the reservoir, a screenwash additive should be added in the quantities recommended on the bottle.

Brake and clutch fluid level

Note: *Not all models have a hydraulic clutch.*

Warning:

- ***Brake fluid can harm your eyes and damage painted surfaces, so use extreme caution when handling and pouring it.***
- ***Do not use fluid that has been standing open for some time, as it absorbs moisture from the air, which can cause a dangerous loss of braking effectiveness.***

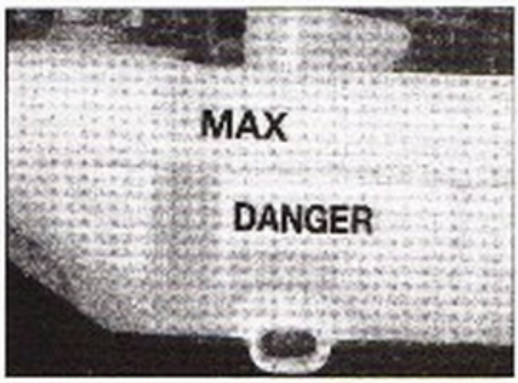
HAYNES HiNT

• Make sure that your car is on level ground.

• The fluid level in the reservoir will drop slightly as the brake pads wear down, but the fluid level must never be allowed to drop below the DANGER mark.

Safety First!

- If the reservoir requires repeated topping-up this is an indication of a fluid leak somewhere in the system, which should be investigated immediately.
- If a leak is suspected, the car should not be driven until the braking system has been checked. Never take any risks where brakes are concerned.



1 The MAX and DANGER marks are indicated on the edge of the reservoir, which is located at the rear of the engine compartment, just to the left of centre. The fluid level must be kept between these two marks.

2 If topping-up is necessary, first wipe the area around the filler cap with a clean rag before removing the cap. When adding fluid, it's a good idea to inspect the reservoir. The system should be drained and refilled if dirt is seen in the fluid (see Chapter 9).

3 Carefully add fluid, avoiding spilling it on surrounding paintwork. Use only the specified hydraulic fluid; mixing different types of fluid can cause damage to the system and/or a loss of braking effectiveness. After filling to the correct level, refit the cap securely and wipe off any spilt fluid.

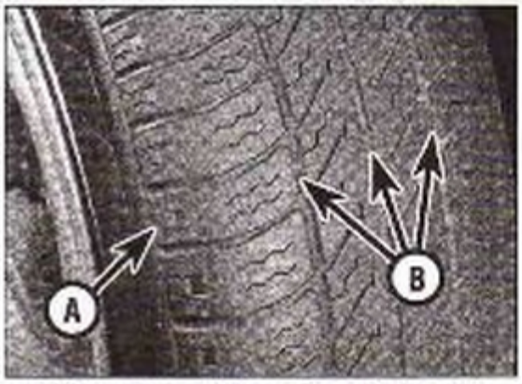
Tyre condition and pressure

It is very important that tyres are in good condition, and at the correct pressure - having a tyre failure at any speed is highly dangerous. Tyre wear is influenced by driving style - harsh braking and acceleration, or fast cornering, will all produce more rapid tyre wear. As a general rule, the front tyres wear out faster than the rears. Interchanging the tyres from front to rear ("rotating" the tyres) may result in more even wear. However, if this is completely effective, you may have the expense of replacing all four tyres at once!

Remove any nails or stones embedded in the tread before they penetrate the tyre to cause deflation. If removal of a nail does reveal that the tyre has been punctured, refit the nail so that its point of penetration is marked. Then immediately change the wheel, and have the tyre repaired by a tyre dealer.

Regularly check the tyres for damage in the form of cuts or bulges, especially in the sidewalls. Periodically remove the wheels, and clean any dirt or mud from the inside and outside surfaces. Examine the wheel rims for signs of rusting, corrosion or other damage. Light alloy wheels are easily damaged by "kerbing" whilst parking; steel wheels may also become dented or buckled. A new wheel is very often the only way to overcome severe damage.

New tyres should be balanced when they are fitted, but it may become necessary to re-balance them as they wear, or if the balance weights fitted to the wheel rim should fall off. Unbalanced tyres will wear more quickly, as will the steering and suspension components. Wheel imbalance is normally signified by vibration, particularly at a certain speed (typically around 50 mph). If this vibration is felt only through the steering, then it is likely that just the front wheels need balancing. If, however, the vibration is felt through the whole car, the rear wheels could be out of balance. Wheel balancing should be carried out by a tyre dealer or garage.

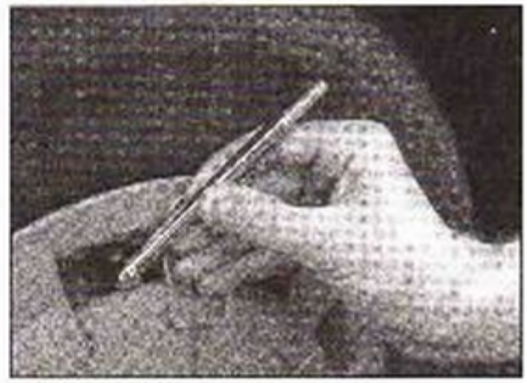


1 *Tread Depth - visual check*

The original tyres have tread wear safety bands (B), which will appear when the tread depth reaches approximately 1.6 mm. The band positions are indicated by a triangular mark on the tyre sidewall (A).

2 *Tread Depth - manual check*

Alternatively, tread wear can be monitored with a simple, inexpensive device known as a tread depth indicator gauge.



3 *Tyre Pressure Check*

Check the tyre pressures regularly with the tyres cold. Do not adjust the tyre pressures immediately after the vehicle has been used, or an inaccurate setting will result. Tyre pressures are shown on page 0•18.

Tyre tread wear patterns

Shoulder Wear

Underinflation (wear on both sides)
Under-inflation will cause overheating of the tyre, because the tyre will flex too much, and the tread will not sit correctly on the road surface. This will cause a loss of grip and excessive wear, not to mention the danger of sudden tyre failure due to heat build-up.
Check and adjust pressures
Incorrect wheel camber (wear on one side)
Repair or renew suspension parts
Hard cornering
Reduce speed!

Centre Wear

Overinflation
Over-inflation will cause rapid wear of the centre part of the tyre tread, coupled with reduced grip, harsher ride, and the danger of shock damage occurring in the tyre casing.
Check and adjust pressures

If you sometimes have to inflate your car's tyres to the higher pressures specified for maximum load or sustained high speed, don't forget to reduce the pressures to normal afterwards.

Uneven Wear

Front tyres may wear unevenly as a result of wheel misalignment. Most tyre dealers and garages can check and adjust the wheel alignment (or "tracking") for a modest charge.
Incorrect camber or castor
Repair or renew suspension parts
Malfunctioning suspension
Repair or renew suspension parts
Unbalanced wheel
Balance tyres
Incorrect toe setting
Adjust front wheel alignment
Note: *The feathered edge of the tread which typifies toe wear is best checked by feel.*

Battery

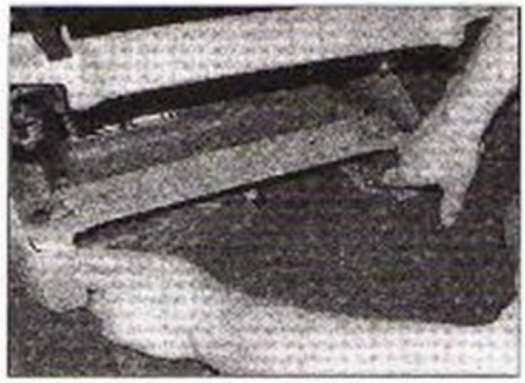
Caution: Before carrying out any work on the vehicle battery, read the precautions given in 'Safety first' at the start of this manual.

✔ Make sure that the battery tray is in good condition, and that the clamp is tight. Corrosion on the tray, retaining clamp and the battery itself can be removed with a solution of water and baking soda, after removing the affected components from the car (see Chapter 5A). Thoroughly rinse all cleaned areas with water. Any metal parts damaged by corrosion should be covered with a zinc-based primer, then painted.

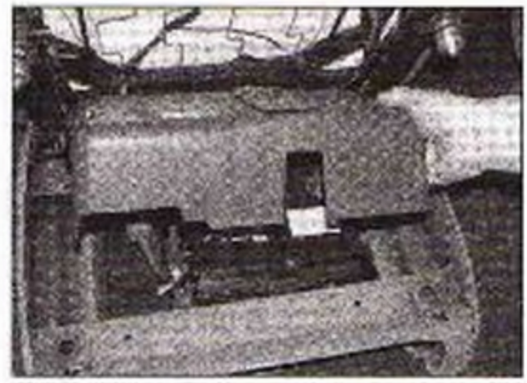
✔ Periodically (approximately every three months), check the charge condition of the battery as described in Chapter 5A.

✔ If the battery is flat, and you need to jump start your vehicle, see *Roadside Repairs*.

Battery corrosion can be kept to a minimum by applying a layer of petroleum jelly to the clamps and terminals after they are reconnected.

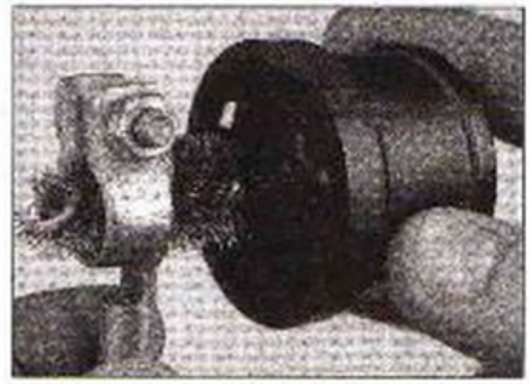


1 The battery is located inside the car under the front passenger's seat. To gain access, move the front seat fully rearward then depress the locking catches located at the rear of the seat on each side.



2 Tip the seat forward then release the locking clip on the top of the battery cover. Lift off the cover for access to the battery.

3 Check the tightness of the battery cable clamps to ensure good electrical connections. You should not be able to move them. Also check each cable for cracks and frayed conductors.



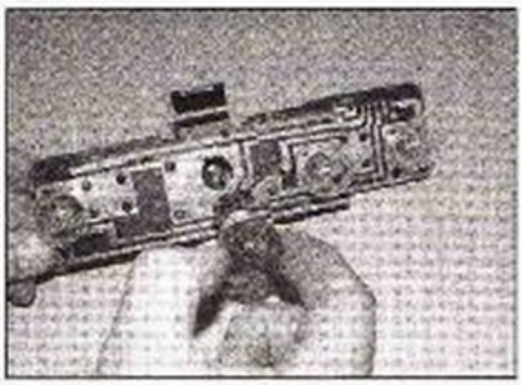
4 If corrosion (white, fluffy deposits) is evident, remove the cables from the battery terminals, clean them with a small wire brush, then refit them. Automotive stores sell a useful tool for cleaning the battery post and terminals

Electrical systems

✔ Check all external lights and the horn. Refer to the appropriate Sections of Chapter 12 for details if any of the circuits are found to be inoperative.

✔ Visually check all accessible wiring connectors, harnesses and retaining clips for security, and for signs of chafing or damage.

If you need to check your brake lights and indicators unaided, back up to a wall or garage door and operate the lights. The reflected light should show if they are working properly.

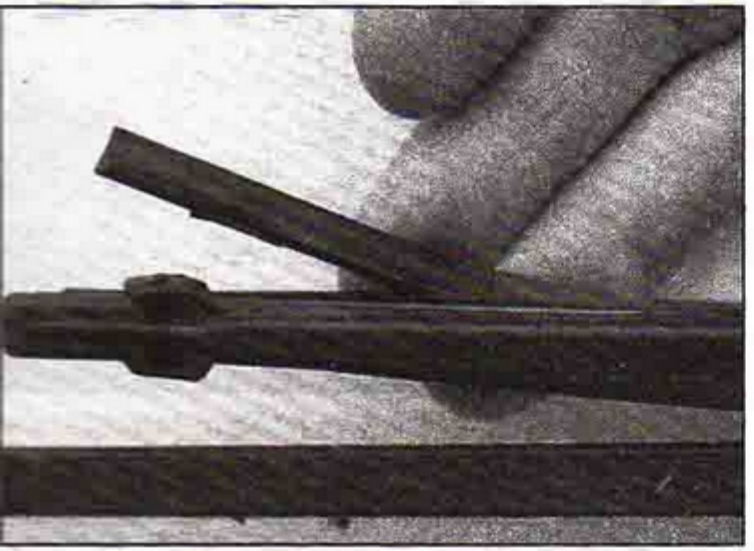


1 If a single indicator light, brake light or headlight has failed, it is likely that a bulb has blown and will need to be renewed. Refer to Chapter 12 for details. If both brake lights have failed, it is possible that the brake light switch operated by the brake pedal has failed. Refer to Chapter 9 for details.

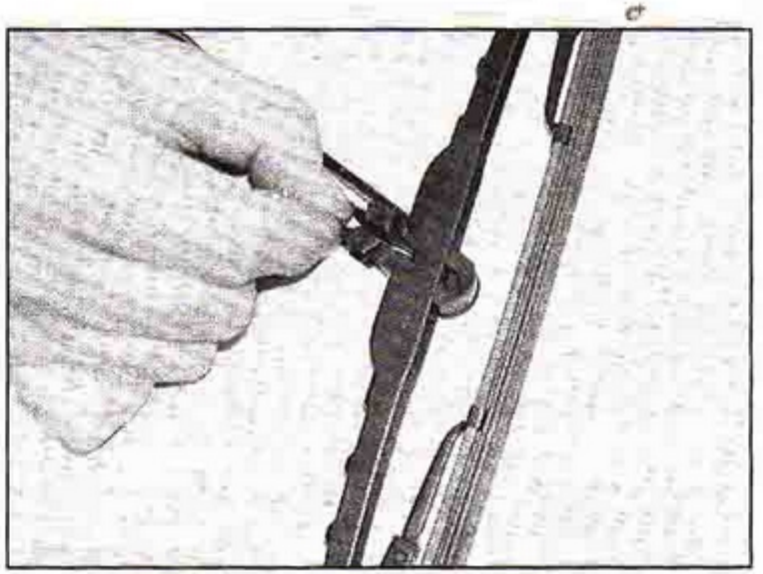
2 If more than one indicator light or tail light has failed it is likely that either a fuse has blown or that there is a fault in the circuit (see Chapter 12). The main fuses are located in the fuse/relay boxes situated behind the cover in the facia on the driver's side, and in the engine compartment (refer to Chapter 12).

3 To renew a blown fuse, remove it, where applicable, using the plastic tool provided. Fit a *new* fuse of the same rating, available from car accessory shops. It is important that you find the reason that the fuse blew (see *Electrical fault finding* in Chapter 12).

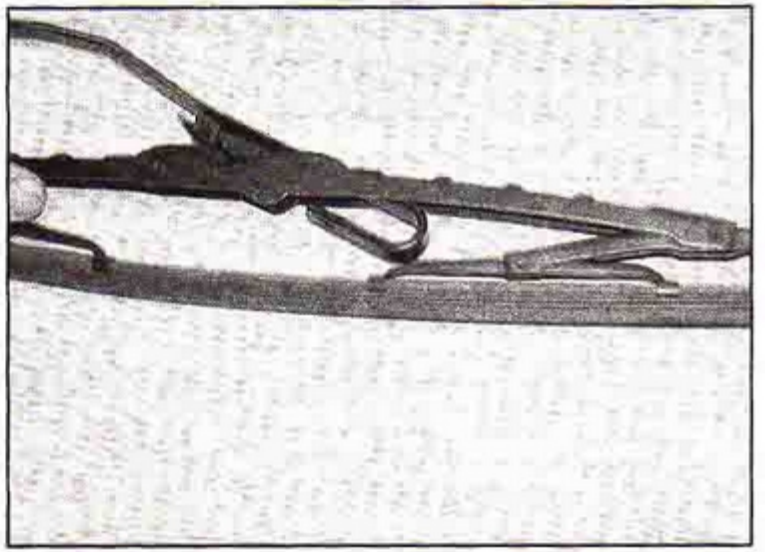
Wiper blades



1 Check the condition of the wiper blades; if they are cracked or show any signs of deterioration, or if the glass swept area is smeared, renew them. Wiper blades should be renewed annually.



2 To remove a windscreen wiper blade, pull the arm fully away from the screen until it locks. Swivel the blade through 90°, then depress the locking clip at the base of the mounting block.



3 Move the blade down the arm to disengage the mounting block, then slide the blade from the arm. Don't forget to check the tailgate wiper blade as well.

Lubricants and fluids

Engine:	
Petrol	Multigrade engine oil, viscosity SAE 5W/40 to 10W/40, to API SJ or SJ-EC and ACEA-A3.98
Diesel	Multigrade engine oil, viscosity SAE 5W/40 to 10W/40, to API CF or CF-EC and ACEA-B3.98
Cooling system	Ethylene glycol-based antifreeze and soft water
Transmission	Total BV 75W/80 gear oil
Braking system	Hydraulic fluid to SAE J1703F or DOT 4
Power steering	Dexron type II ATF

Choosing your engine oil

Engines need oil, not only to lubricate moving parts and minimise wear, but also to maximise power output and to improve fuel economy.

HOW ENGINE OIL WORKS

• *Beating friction*

Without oil, the moving surfaces inside your engine will rub together, heat up and melt, quickly causing the engine to seize. Engine oil creates a film which separates these moving parts, preventing wear and heat build-up.

• *Cooling hot-spots*

Temperatures inside the engine can exceed 1000° C. The engine oil circulates and acts as a coolant, transferring heat from the hot-spots to the sump.

• *Cleaning the engine internally*

Good quality engine oils clean the inside of your engine, collecting and dispersing combustion deposits and controlling them until they are trapped by the oil filter or flushed out at oil change.

OIL CARE - FOLLOW THE CODE

To handle and dispose of used engine oil safely, always:

- ***Avoid skin contact with used engine oil. Repeated or prolonged contact can be harmful.***
- ***Dispose of used oil and empty packs in a responsible manner in an authorised disposal site. Call 0800 663366 to find the one nearest to you. Never tip oil down drains or onto the ground.***

Chapter 1 Part A:
Routine maintenance and servicing – petrol engine models

Contents

Degrees of difficulty

Easy, suitable for novice with little experience

Fairly easy, suitable for beginner with some experience

Fairly difficult, suitable for competent DIY mechanic

Difficult, suitable for experienced DIY mechanic

Very difficult, suitable for expert DIY or professional

Lubricants and fluids	Refer to end of *Weekly checks* on page 0•17

Capacities

Engine oil (including filter)	
1.6 litre engines	3.50 litres
1.8 litre engines	4.25 litres
Difference between MAX and MIN dipstick marks (approx)	1.25 litres
Cooling system (approximate)	
1.6 litre engines	5.8 litres
1.8 litre engines	6.5 litres
Transmission	1.8 litres
Fuel tank	55.0 litres

Engine

Auxiliary drivebelt tension (for use with electronic tension checking tool – see text):	
1.6 litre engines:	
With air conditioning	Controlled by automatic tensioner
Without air conditioning	120 SEEM units
1.8 litre engines	Controlled by automatic tensioner

Cooling system

Antifreeze mixture:	
28% antifreeze	Protection down to –15°C
50% antifreeze	Protection down to –30°C

Note: *Refer to antifreeze manufacturer for latest recommendations*

Ignition system

Spark plugs:	
1.6 litre engines	Bosch FR7KDC
1.8 litre engines	Bosch FR8ME
Spark plug electrode gap:	
1.6 litre engines	0.9 mm
1.8 litre engines	1.0 mm

Brakes

Brake pad friction material minimum thickness	2.0 mm
Brake shoe friction material minimum thickness	1.5 mm

Tyre pressures	Refer to end of *Weekly checks* on page 0•18

Torque wrench settings

	Nm	lbf ft
Oil filter cover (later 1.6 litre engines)	25	18
Roadwheel bolts	85	63
Spark plugs	25	18
Transmission oil filler/level plug	20	15

The maintenance intervals in this manual are provided with the assumption that you, not the dealer, will be carrying out the work. These are the minimum maintenance intervals recommended for vehicles driven daily. If you wish to keep your vehicle in peak condition at all times, you may wish to perform some of these procedures more often. We encourage frequent maintenance, because it enhances the efficiency, performance and resale value of your vehicle.

If the vehicle is driven in dusty areas, used to tow a trailer, or driven frequently at slow speeds (idling in traffic) or on short journeys, more frequent maintenance intervals are recommended.

When the vehicle is new, it should be serviced by a factory-authorised dealer service department, in order to preserve the factory warranty.

Valve clearance adjustment is hydraulic on 1.8 litre models, and on 1.6 litre model checking is no longer specified as part of the routine maintenance schedule. Check the valve clearances if there is any tapping or rattling from the top of the engine, or in the event of an unexplained lack of performance. The prudent owner may wish to check the clearances more often, perhaps at 25 000 mile (40 000 km) or two-yearly intervals.

Every 250 miles (400 km) or weekly

- ☐ Refer to *Weekly checks*

Every 12 500 miles (20 000 km) or 12 months – whichever comes first

- ☐ Renew the engine oil and filter (Section 3)*.
- ☐ Check all underbonnet/underbody components for fluid leaks (Section 4).
- ☐ Check the condition of the auxiliary drivebelt (Section 5).
- ☐ Check the clutch control mechanism (Section 6).
- ☐ Renew the pollen filter (Section 7).
- ☐ Check the condition of the driveshaft rubber gaiters (Section 8).
- ☐ Check the steering and suspension components (Section 9).
- ☐ Check the condition of the front brake pads (Section 10).
- ☐ Check the condition of the exhaust system (Section 11).
- ☐ Check the condition of the rear brake shoes (Section 12).
- ☐ Operate and lubricate all hinges and locks (Section 13).
- ☐ Road test (Section 14).

***Note:** *The engine oil renewal interval shown is based on the use of either a semi-synthetic or fully synthetic engine oil. If a mineral oil is used, the interval should be reduced. Consult your Citroën dealer for further information.*

Every 25 000 miles (40 000 km) or 2 years – whichever comes first

In addition to all the items listed above, carry out the following:

- ☐ Renew the brake fluid (Section 15)*.

***Note:** *Also renew the fluid on models with a hydraulic clutch.*

Every 37 500 miles (60 000 km) or 3 years – whichever comes first

In addition to all the items listed above, carry out the following:

- ☐ Renew the spark plugs (Section 16).
- ☐ Renew the air filter (Section 17).
- ☐ Check the manual transmission oil level (Section 18).
- ☐ Check the condition and operation of the braking system components (Section 19).
- ☐ Check the operation of the handbrake (Section 20).
- ☐ Renew the fuel filter (Section 21).
- ☐ Renew the timing belt (Section 22).

Note: *Although the normal interval for timing belt renewal is 75 000 miles (120 000 km), it is strongly recommended that the interval is halved to 37 500 miles (60 000 km) on vehicles which are subjected to intensive use, ie, mainly short journeys or a lot of stop-start driving. The actual belt renewal interval is therefore very much up to the individual owner, but bear in mind that severe engine damage will result if the belt breaks.*

Every 75 000 miles (120 000 km) or 5 years – whichever comes first

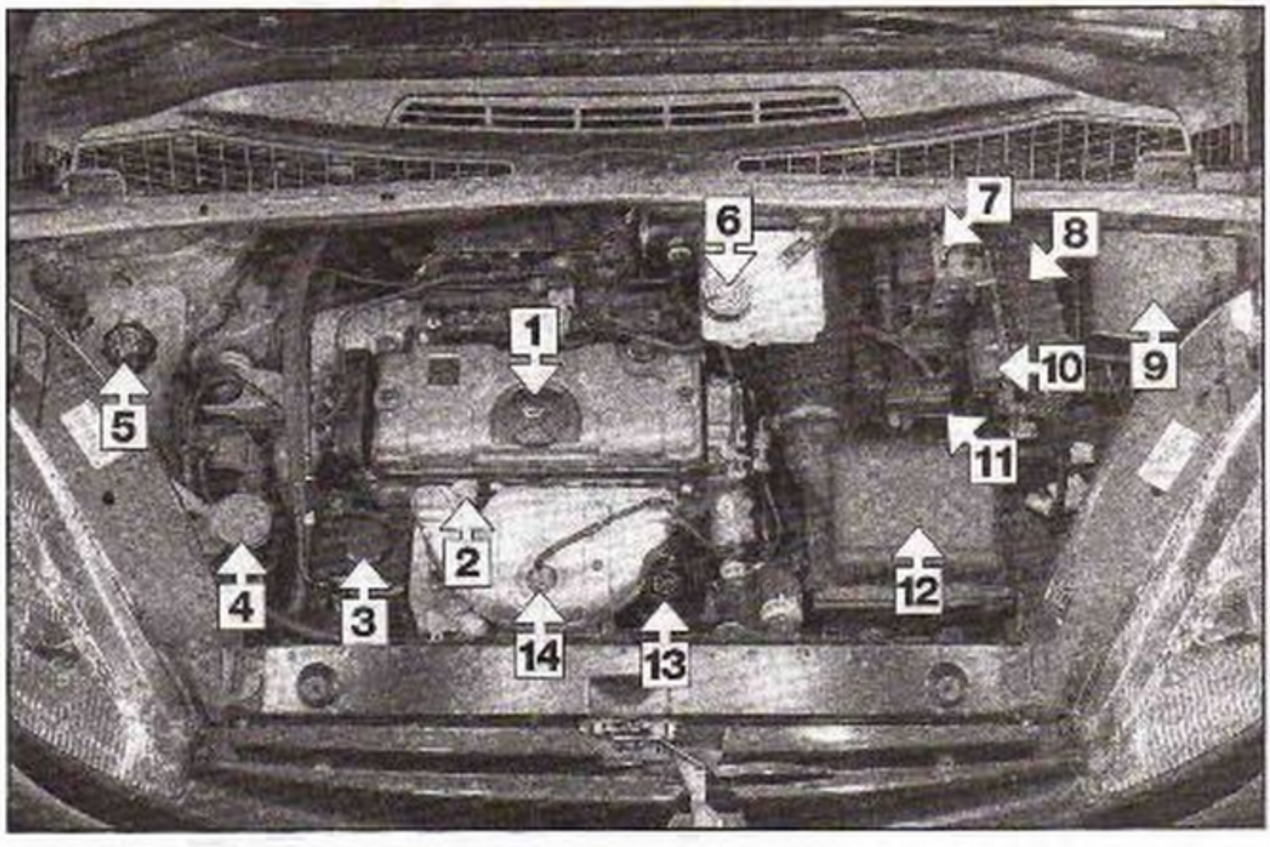
In addition to all the items listed above, carry out the following:

- ☐ Renew the coolant (Section 23).

Every 10 years – regardless of mileage

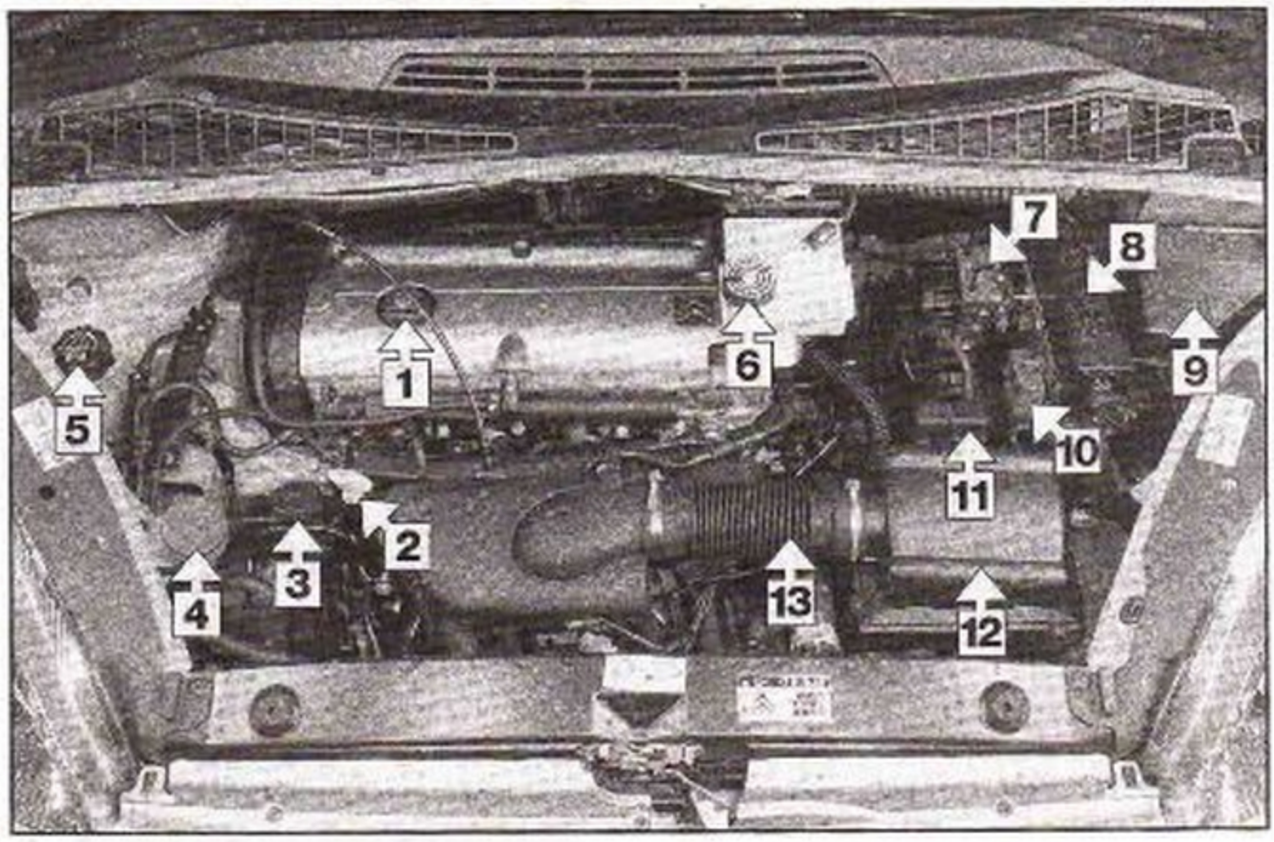
- ☐ Renew the air bag(s) and seat belt pretensioners (Section 24).

Underbonnet view of a 1.6 litre engine (later model)



1 *Engine oil filler cap*
2 *Engine oil dipstick*
3 *Power steering fluid reservoir filler cap*
4 *Windscreen/tailgate washer fluid reservoir filler cap*
5 *Coolant expansion tank filler cap*
6 *Brake master cylinder fluid reservoir*
7 *ABS hydraulic modulator*
8 *Engine management ECU*
9 *Engine compartment fuse/relay box*
10 *Injection double relay*
11 *Battery positive cable terminal box*
12 *Air cleaner housing*
13 *Oil filter housing*
14 *Lambda sensor*

Underbonnet view of a 1.8 litre engine



1 *Engine oil filler cap*
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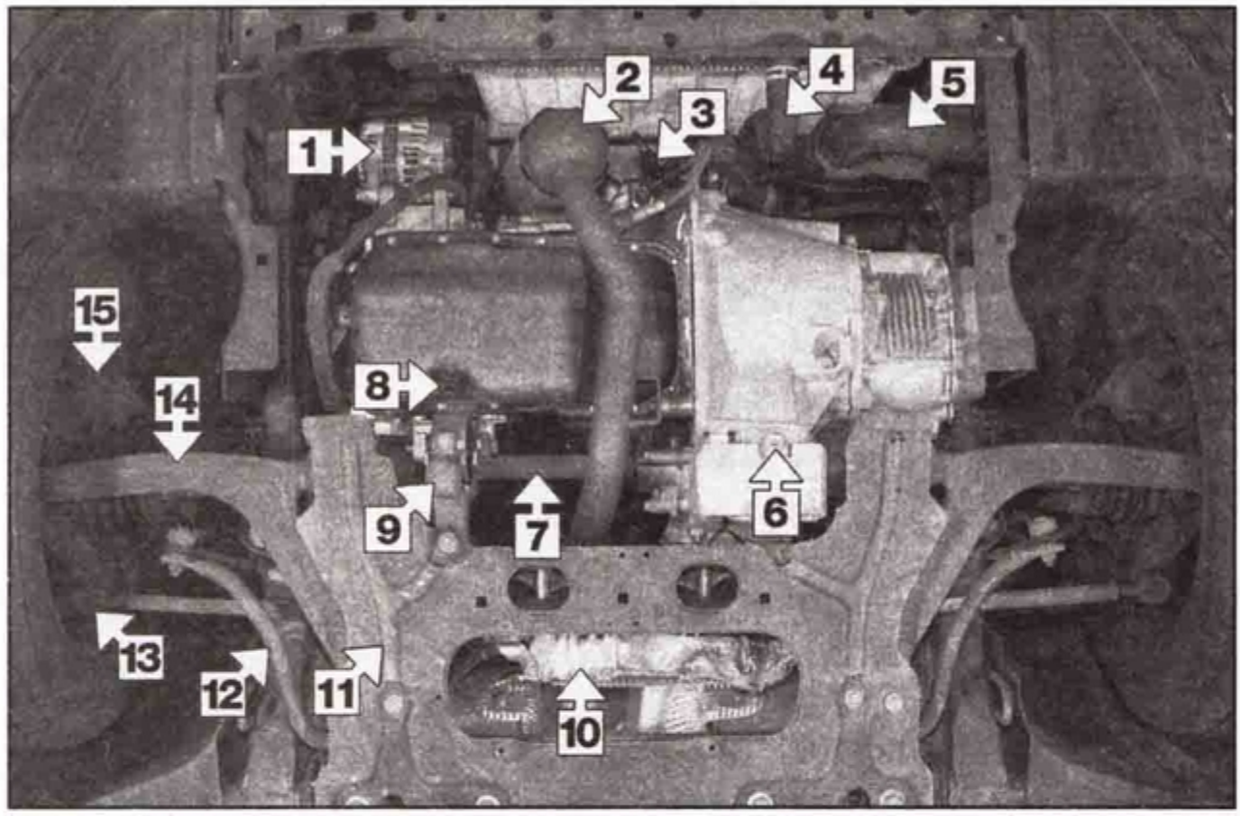
7 *ABS hydraulic modulator*
8 *Engine management ECU*
9 *Engine compartment fuse/relay box*
10 *Injection double relay*
11 *Battery positive cable terminal box*
12 *Air cleaner housing*
13 *Air inlet duct*

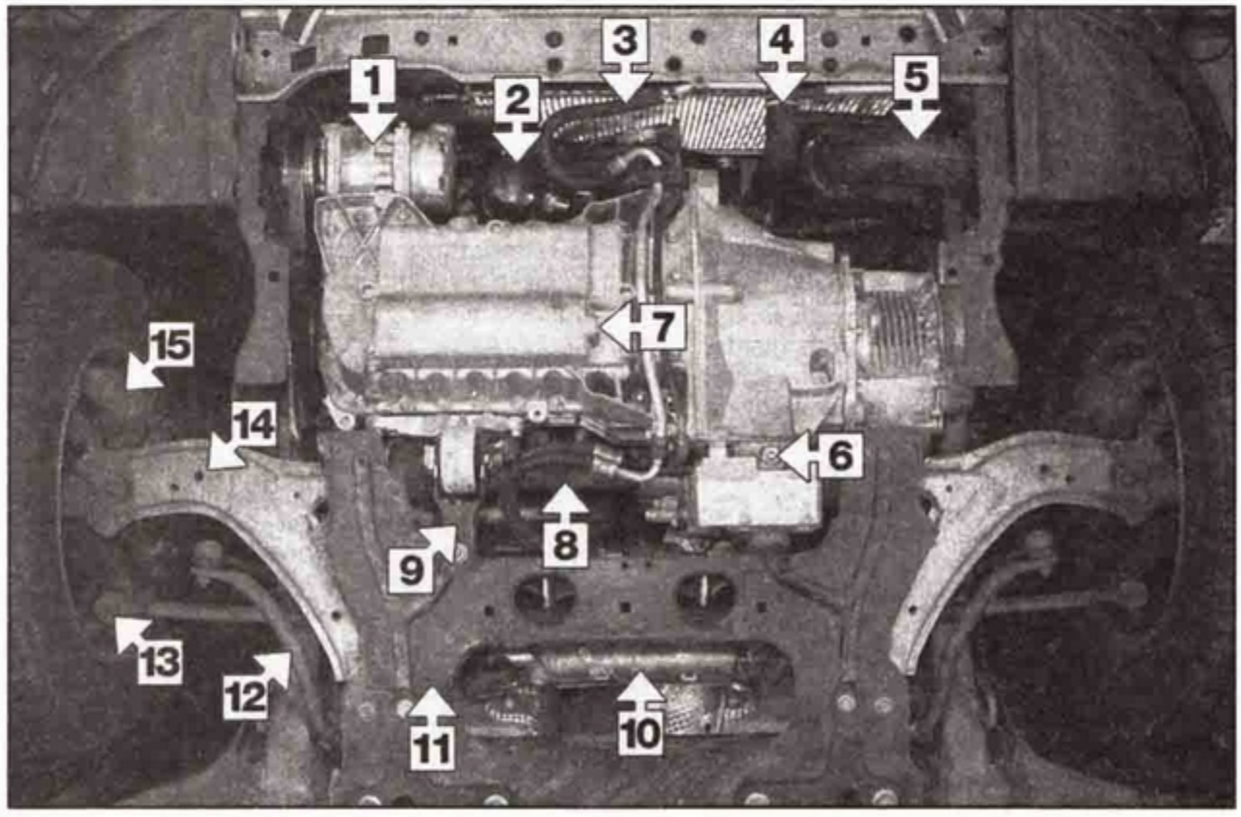
Front underbody view (1.6 litre model)

1 *Alternator*
2 *Exhaust front pipe (catalytic converter)*
3 *Clutch slave cylinder*
4 *Radiator bottom hose*
5 *Air cleaner air inlet duct*
6 *Transmission oil drain plug*
7 *Driveshaft*
8 *Sump drain plug*
9 *Engine/transmission rear mounting*
10 *Rack and pinion steering gear*
11 *Front suspension subframe*
12 *Front anti-roll bar*
13 *Track rod balljoint*
14 *Front suspension lower arm*
15 *Front brake caliper*

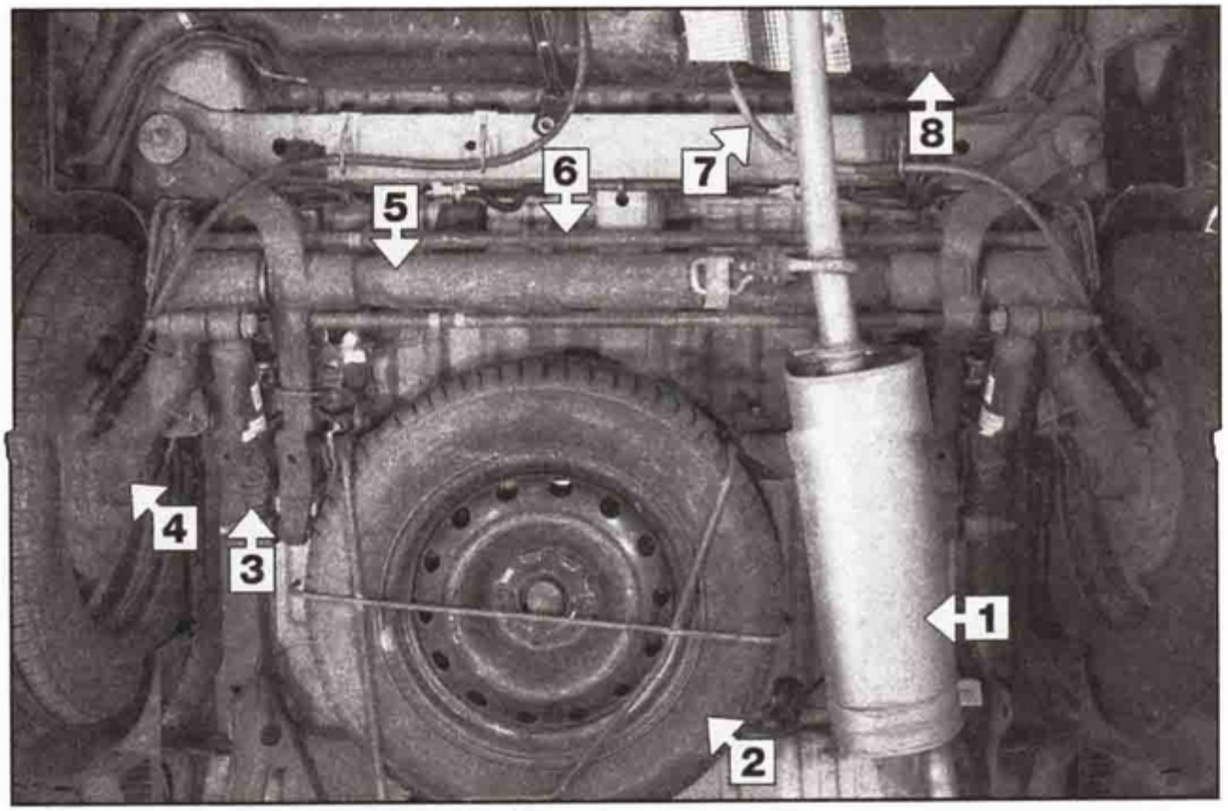


Front underbody view (1.8 litre model)

1 *Air conditioning compressor*
2 *Engine oil filter*
3 *Power steering fluid hoses*
4 *Radiator bottom hose*
5 *Air cleaner air inlet duct*
6 *Transmission oil drain plug*
7 *Sump drain plug*
8 *Driveshaft*
9 *Engine/transmission rear mounting*
10 *Rack and pinion steering gear*
11 *Front suspension subframe*
12 *Front anti-roll bar*
13 *Track rod balljoint*
14 *Front suspension lower arm*
15 *Front brake caliper*



Rear underbody view (1.6 litre model – 1.8 similar)



1 *Rear silencer*
2 *Spare wheel*
3 *Rear shock absorber*
4 *Rear suspension trailing arm*
5 *Rear suspension tubular crossmember*
6 *Rear suspension torsion bar*
7 *Handbrake cable*
8 *Fuel tank*

Maintenance procedures

1 General information

This Chapter is designed to help the home mechanic maintain his/her vehicle for safety, economy, long life and peak performance.

The Chapter contains a master maintenance schedule, followed by Sections dealing specifically with each task in the schedule. Visual checks, adjustments, component renewal and other helpful items are included. Refer to the accompanying illustrations of the engine compartment and the underside of the vehicle for the locations of the various components.

Servicing your vehicle in accordance with the mileage/time maintenance schedule and the following Sections will provide a planned maintenance programme, which should result in a long and reliable service life. This is a comprehensive plan, so maintaining some items but not others at the specified service intervals will not produce the same results.

As you service your vehicle, you will discover that many of the procedures can – and should – be grouped together, because of the particular procedure being performed, or because of the proximity of two otherwise-unrelated components to one another. For example, if the vehicle is raised for any reason, the exhaust can be inspected at the same time as the suspension and steering components.

The first step in this maintenance programme is to prepare yourself before the actual work begins. Read through all the Sections relevant to the work to be carried out, then make a list and gather all the parts and tools required. If a problem is encountered, seek advice from a parts specialist, or a dealer service department.

Service interval display

Certain models are equipped with a service interval display indicator in the instrument panel. When the ignition is initially switched on, a spanner appears in the display window and the total number of miles remaining until the next service is due is also shown.

The display should not necessarily be used as a definitive guide to the servicing needs of your Xsara, but it is useful as a reminder, to ensure that servicing is not accidentally overlooked. Owners of older cars, or those covering a small annual mileage, may feel inclined to service their car more often, in which case the service interval display is perhaps less relevant.

The display should be reset whenever a service is carried out, and this is achieved using the trip meter reset button on the instrument panel as follows.

With the ignition switched off, press and hold down the trip meter reset button. Switch the ignition on and the mileage remaining until the next service will flash. Continue to hold the button down for a further ten seconds. The spanner symbol will disappear and the mileage will return to zero.

2 Regular maintenance

1 If, from the time the vehicle is new, the routine maintenance schedule is followed closely, and frequent checks are made of fluid levels and high-wear items, as suggested throughout this manual, the engine will be kept in relatively good running condition, and the need for additional work will be minimised.

2 It is possible that there will be times when the engine is running poorly due to the lack of regular maintenance. This is even more likely if a used vehicle, which has not received regular and frequent maintenance checks, is purchased. In such cases, additional work

may need to be carried out, outside of the regular maintenance intervals.

3 If engine wear is suspected, a compression test (refer to relevant Part of Chapter 2) will provide valuable information regarding the overall performance of the main internal components. Such a test can be used as a basis to decide on the extent of the work to be carried out. If, for example, a compression test indicates serious internal engine wear, conventional maintenance as described in this Chapter will not greatly improve the performance of the engine, and may prove a waste of time and money, unless extensive overhaul work is carried out first.

4 The following series of operations are those most often required to improve the performance of a generally poor-running engine:

Primary operations

a) Clean, inspect and test the battery (See 'Weekly checks').
b) Check all the engine-related fluids (See 'Weekly checks').
c) Check the condition of all hoses, and check for fluid leaks (Section 4).
d) Check the condition and tension of the auxiliary drivebelt (Section 5).
e) Renew the spark plugs (Section 16).
f) Check the condition of the air filter, and renew if necessary (Section 17).
g) Renew the fuel filter (Section 21).

5 If the above operations do not prove fully effective, carry out the following secondary operations:

Secondary operations

All items listed under *Primary operations*, plus the following:

a) Check the valve clearances – 1.6 litre engines (Chapter 2A)
b) Check the charging system (Chapter 5A).
c) Check the ignition system (Chapter 5B).
d) Check the fuel system (Chapter 4A).

Every 12 500 miles (20 000 km) or 12 months

3 Engine oil and filter renewal

Note: *A suitable square-section wrench will be required to undo the sump drain plug. These wrenches can be obtained from most motor factors.*

1 Frequent oil and filter changes are the most important preventative maintenance procedures which can be undertaken by the DIY owner. As engine oil ages, it becomes diluted and contaminated, which leads to premature engine wear.

2 Before starting this procedure, gather together all the necessary tools and materials. Also make sure that you have plenty of clean rags and newspapers handy, to mop up any spills. Ideally, the engine oil should be warm, as it will drain better, and any impurities suspended in the oil will be removed with it. Take care, however, not to touch the exhaust or any other hot parts of the engine when working under the vehicle. To avoid any possibility of scalding, and to protect yourself from possible skin irritants and other harmful contaminants in used engine oils, it is advisable to wear rubber gloves when carrying out this work. Access to the underside of the vehicle will be greatly improved if it can be raised on a lift, driven onto ramps, or jacked up and supported on axle stands (see *Jacking and vehicle support*).

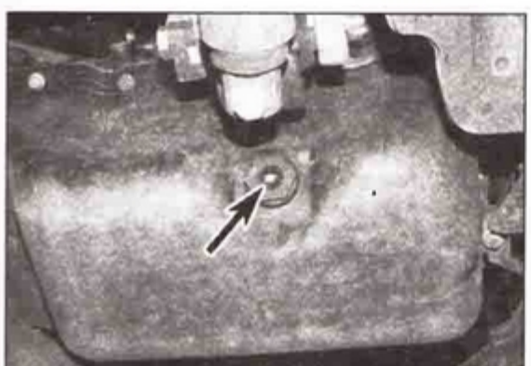
3 Remove the engine undertray, then slacken the sump drain plug about half a turn **(see illustrations)**. Position the draining container under the drain plug, then remove the plug completely. If possible, try to keep the plug pressed into the sump while unscrewing it by hand the last couple of turns **(see Haynes Hint)**. Recover the sealing ring from the drain plug.

4 Allow some time for the old oil to drain, noting that it may be necessary to reposition the container as the oil flow slows to a trickle.

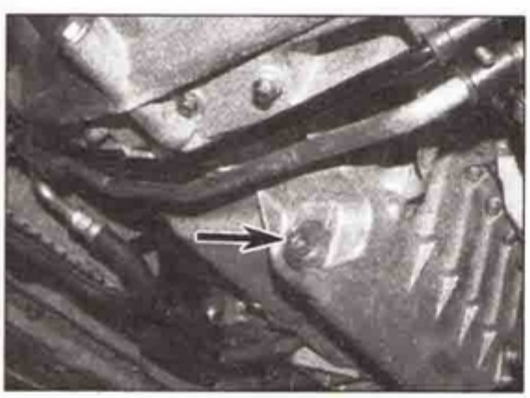
5 After all the oil has drained, wipe off the drain plug with a clean rag, and fit a new sealing washer. Clean the area around the drain plug opening, and refit the plug. Tighten the plug securely.

6 Move the container into position under the oil filter, which is located on the front facing side of the cylinder block.

7 On early 1.6 litre engines, and all 1.8 litre engines, the oil filter is of the disposable metal canister type screwed into the front of the cylinder block or into the oil filter housing on the front of the cylinder block. On later 1.6 litre engines, the oil filter consists of a separate disposable paper element contained in a plastic housing. The housing is located on the front of the cylinder block adjacent to the radiator hoses **(see illustration)**. Proceed as follows according to filter type.

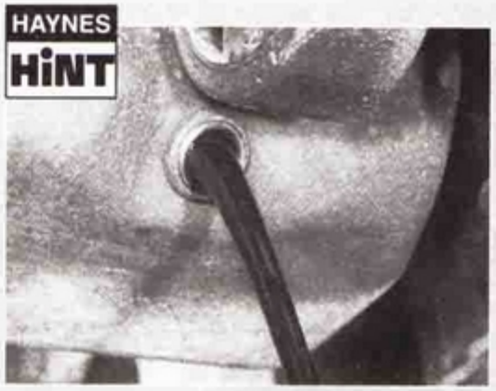


3.3a Sump drain plug location (arrowed) – 1.6 litre engines

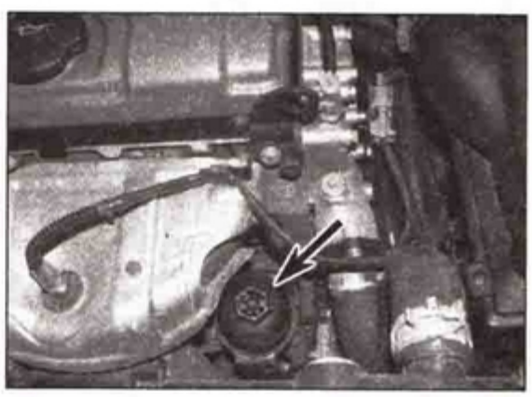


3.3b Sump drain plug location (arrowed) – 1.8 litre engines

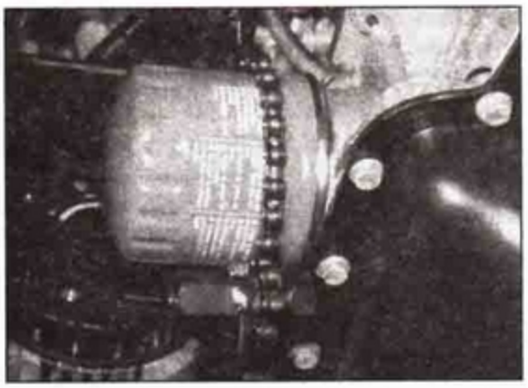
HAYNES HiNT



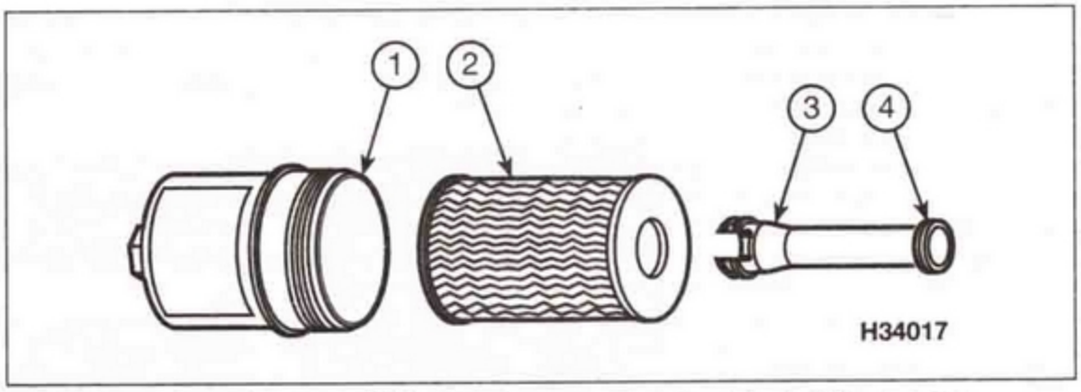
As the drain plug releases from the threads, move it away sharply so the stream of oil issuing from the sump runs into the container, not up your sleeve.



3.7 Cartridge type oil filter housing location (arrowed) – later 1.6 litre engines



3.8 Using an oil filter removal tool to slacken the canister type oil filter



3.11 Cartridge type oil filter housing components – later 1.6 litre engines

1 Oil filter cover 2 Oil filter cartridge 3 Plunger tube 4 Plunger tube O-ring

Metal canister type filter

8 Using an oil filter removal tool if necessary, slacken the filter initially, then unscrew it by hand the rest of the way **(see illustration)**. Empty the oil in the old filter into the container. To ensure that the old filter is completely empty before disposal, puncture the filter dome in at least two places and allow any remaining oil to drain through the punctures and into the container.

9 Use a clean rag to remove all oil and dirt from the filter sealing area on the engine. Check the old filter to make sure that the rubber sealing ring hasn't stuck to the engine. If it has, carefully remove it.

10 Apply a light coating of clean engine oil to the sealing ring on the new filter, then screw it into position on the engine. Tighten the filter firmly by hand only – do not use any tools.

Paper element type filter

11 Using a 27 mm socket or spanner, slacken the oil filter cover initially, then unscrew it by hand the rest of the way. As the cover is unscrewed, the plunger tube located internally in the housing will be lifted off its seat allowing the oil remaining in the housing to drain back into the sump **(see illustration)**.

12 Lift the filter cover off the housing and remove the paper element. Withdraw the plunger tube from the oil filter cover. Note that a new plunger tube should always be fitted when renewing the oil filter. The tube should be supplied together with the new oil filter, but if this is not the case, obtain a new plunger tube from your Citroën dealer.

13 Use a clean rag to remove all oil and dirt from the oil filter housing and clean the filter cover inside and out using a suitable solvent.

14 Place the new oil filter on the filter housing then insert the new plunger tube into its location in the cover. Lightly lubricate the seal in the filter cover and the O-ring on the end of the plunger tube with clean engine oil.

15 Screw the filter cover onto the housing and tighten it to the specified torque.

All engines

16 Refit the engine undertray then remove the old oil and all tools from under the car. Lower the car to the ground (if applicable).

17 Remove the dipstick, then unscrew the oil filler cap from the cylinder head cover. Fill the engine, using the correct grade and type of oil (see *Weekly checks*). An oil can spout or funnel may help to reduce spillage. Pour in half the specified quantity of oil first, then wait a few minutes for the oil to fall to the sump. Continue adding oil a small quantity at a time until the level is up to the lower mark on the dipstick. Adding approximately 1.25 litres will bring the level up to the upper mark on the dipstick. Refit the filler cap.

18 Start the engine and run it for a few minutes; check for leaks around the oil filter seal and the sump drain plug. Note that there may be a delay of a few seconds before the oil pressure warning light goes out when the engine is first started, as the oil circulates through the engine oil galleries and the new oil filter before the pressure builds-up.

19 Switch off the engine, and wait a few minutes for the oil to settle in the sump once more. With the new oil circulated and the filter completely full, recheck the level on the dipstick, and add more oil as necessary.

20 Dispose of the used engine oil and filter safely, with reference to *General repair procedures* at the rear of this manual. Do not discard the old filter with domestic household waste. The facility for waste oil disposal provided by many local council refuse tips generally has a filter receptacle alongside.

A leak in the cooling system will usually show up as white- or rust-coloured deposits on the area adjoining the leak.

4 Underbonnet/ underbody component/ hose fluid leak check

Warning: Refer to the safety information given in 'Safety First!' and Chapter 3 before disturbing any of the cooling system components.

1 Carefully check the radiator and heater coolant hoses along their entire length. Renew any hose which is cracked, swollen or which shows signs of deterioration. Cracks will show up better if the hose is squeezed. Pay close attention to the clips that secure the hoses to the cooling system components. Hose clips that have been over-tightened can pinch and puncture hoses, resulting in cooling system leaks.

2 Inspect all the cooling system components (hoses, joint faces, etc) for leaks. Where any problems of this nature are found on system components, renew the component or gasket with reference to Chapter 3 **(see Haynes Hint)**.

Fuel

Warning: Refer to the safety information given in 'Safety First!' and Part A of Chapter 4 before disturbing any of the fuel system components.

3 Petrol leaks are difficult to pinpoint, unless the leakage is significant and hence easily visible. Fuel tends to evaporate quickly once it comes into contact with air, especially in a hot engine bay. Small drips can disappear before you get a chance to identify the point of leakage. If you suspect that there is a fuel leak from the area of the engine bay, leave the vehicle overnight then start the engine from cold, with the bonnet open. Metal components tend to shrink when they are cold, and rubber seals and hoses tend to harden, so any leaks will be more apparent whilst the engine is warming-up from a cold start.

4 Check all fuel lines at their connections to the fuel rail, fuel pressure regulator and fuel filter. Examine each rubber fuel hose along its length for splits or cracks. Check for leakage

from the crimped joints between rubber and metal fuel lines. Examine the unions on the metal fuel lines and check the area around the fuel injectors for signs of O-ring leakage.

5 To identify fuel leaks between the fuel tank and the engine bay, the vehicle should be raised and securely supported on axle stands (see *Jacking and vehicle support*). Inspect the petrol tank and filler neck for punctures, cracks and other damage. The connection between the filler neck and tank is especially critical. Sometimes a rubber filler neck or connecting hose will leak due to loose retaining clamps or deteriorated rubber.

6 Carefully check all rubber hoses and metal fuel lines leading away from the petrol tank. Check for loose connections, deteriorated hoses, kinked lines, and other damage. Pay particular attention to the vent pipes and hoses, which often loop up around the filler neck and can become blocked or kinked, making tank filling difficult. Follow the fuel supply and return lines to the filter, then to the front of the vehicle, carefully inspecting them all the way for signs of damage or corrosion. Renew damaged sections as necessary.

Engine oil

7 Inspect the area around the cylinder head cover, cylinder head, oil filter and sump joint faces. Bear in mind that, over a period of time, some very slight seepage from these areas is to be expected – what you are really looking for is any indication of a serious leak caused by gasket failure. Engine oil seeping from the base of the timing belt cover or the transmission bellhousing may be an indication of crankshaft or transmission input shaft oil seal failure. Should a leak be found, renew the failed gasket or oil seal by referring to the appropriate Chapter in this manual.

Power steering fluid

8 Examine the power steering fluid feed and return hoses and pipes running between the power steering pump and the steering rack. To identify any problems where the pipes run under the engine, the vehicle should be raised and securely supported on axle stands (see *Jacking and vehicle support*).

9 Check the condition of each pipe and hose carefully. Look for deterioration caused by corrosion and damage from grounding, or debris thrown up from the road surface.

10 Pay particular attention to crimped unions, and the area surrounding the hoses that are secured with adjustable worm drive clips. Power steering fluid is a thin oil, and is usually red in colour.

Air conditioning refrigerant

Warning: Refer to the safety information given in 'Safety First!' and Chapter 3, regarding the dangers of disturbing any of the air conditioning system components.

11 The air conditioning system is filled with a liquid refrigerant, which is retained under high pressure. If the air conditioning system is opened and depressurised without the aid of specialised equipment, the refrigerant will immediately turn into gas and escape into the atmosphere. If the liquid comes into contact with your skin, it can cause severe frostbite. In addition, the refrigerant contains substances which are environmentally damaging; for this reason, it should *never* be allowed to escape into the atmosphere.

12 Any suspected air conditioning system leaks should be immediately referred to a Citroën dealer or air conditioning specialist. Leakage will be shown up as a steady drop in the level of refrigerant in the system.

13 Note that water may drip from the condenser drain pipe, underneath the car, immediately after the air conditioning system has been in use. This is normal, and should not be cause for concern.

Hydraulic fluid

Warning: Refer to the safety information given in 'Safety First!' and Chapter 9, regarding the dangers of handling brake fluid.

14 With reference to Chapter 9, examine the area surrounding the brake pipe unions at the master cylinder for signs of leakage. Check the area around the base of fluid reservoir, for signs of leakage caused by seal failure. Also examine the brake pipe unions at the ABS hydraulic unit.

15 If fluid loss is evident, but the leak cannot be pinpointed in the engine bay, the brake calipers/wheel cylinders and underbody brake lines should be carefully checked with the vehicle raised and supported on axle stands (see *Jacking and vehicle support*). Leakage of fluid from the braking system is a serious fault that must be rectified immediately.

16 Hydraulic fluid is a toxic substance with a watery consistency. New fluid is almost colourless, but it becomes darker with age and use.

17 On models with a hydraulically-operated clutch, the hydraulic system is supplied with fluid from the brake master cylinder reservoir. Inspect all the clutch hydraulic pipes and connections at the master and slave cylinders in the same way as for the brake fluid checks, referring to Chapter 6 for additional information.

Unidentified fluid leaks

18 If there are signs that a fluid of some description is leaking from the vehicle, but you cannot identify the type of fluid or its exact origin, park the vehicle overnight and slide a large piece of card underneath it. Providing that the card is positioned in roughly the right location, even the smallest leak will show up on the card. Not only will this help you to pinpoint the exact location of the leak, it should be easier to identify the fluid from its colour. Bear in mind, though, that the leak may only be occurring when the engine is running.

Vacuum hoses

19 Although the braking system is hydraulically-operated, the brake servo unit amplifies the effort applied at the brake pedal, by making use of the vacuum in the inlet manifold, generated by the engine. Vacuum is ported to the servo by means of a medium-bore plastic hose. Any leaks that develop in this hose will reduce the effectiveness of the braking system, and may affect the running of the engine.

20 In addition, a number of the underbonnet components, particularly the emission control components, are driven by vacuum supplied from the inlet manifold via narrow-bore rubber hoses. A leak in a vacuum hose means that air is being drawn into the hose (rather than escaping from it) and this makes leakage very difficult to detect. One method is to use an old length of vacuum hose as a kind of stethoscope – hold one end close to (but not in) your ear and use the other end to probe the area around the suspected leak. When the end of the hose is directly over a vacuum leak, a hissing sound will be heard clearly through the hose. Care must be taken to avoid contacting hot or moving components, as the engine must be running when testing in this manner. Renew any vacuum hoses that are found to be defective.

5 Auxiliary drivebelt check and renewal

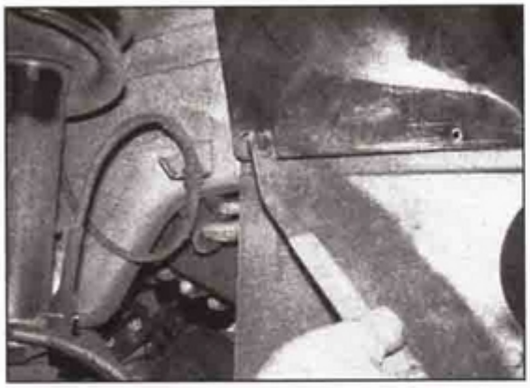
Note: *Citroën specify the use of an electronic tension checking tool (SEEM 4122-T) to accurately check the auxiliary drivebelt tension on 1.6 litre engines not equipped with air conditioning. If access to this equipment (or suitable alternative equipment calibrated to display belt tension in SEEM units) cannot be obtained, an approximate setting can be achieved as described below. If an approximate setting method is used, the tension must be checked using the electronic tool at the earliest possible opportunity.*

1 A single, multi-ribbed auxiliary drivebelt is used on all models. The belt drives the alternator, power steering pump and air conditioning compressor according to equipment fitted. On 1.6 litre engines without air conditioning, the belt is adjusted manually, whereas on all other engines, adjustment is by means of an automatic spring-loaded tensioning mechanism.

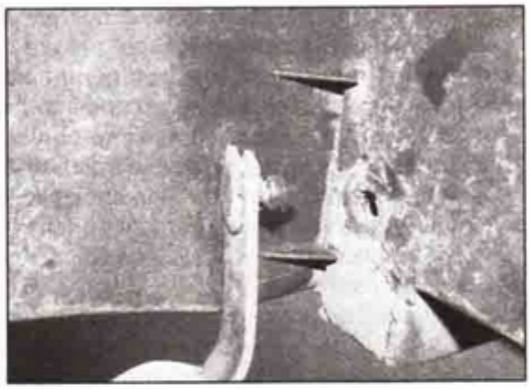
Checking the drivebelt condition

2 Chock the rear wheels then jack up the front of the vehicle and support it on axle stands (see *Jacking and vehicle support*). Remove the right-hand front roadwheel.

3 To gain access to the right-hand end of the engine, the centre section of the wheelarch plastic liner must be removed. The liner is secured by stud-type plastic clips along its



5.3a Using a forked type tool, extract the wheelarch liner upper . . .



5.3b . . . and lower retaining clips . . .

5.3c . . . then remove the liner centre section from under the front wing

upper and front edges. These clips can be removed using a forked type tool, or alternatively, with a large screwdriver (although there is a risk of breakage if the screwdriver method is used). Extract all the clips, then remove the liner centre section from under the front wing **(see illustrations)**. It will be necessary to ease back the front liner section slightly to allow the front edge of the centre section to be released. Note how the two sections overlap as you do this to aid refitting.

4 Using a suitable socket and extension bar fitted to the crankshaft pulley bolt, rotate the crankshaft so that the entire length of the drivebelt can be examined. Examine the drivebelt for cracks, splitting, fraying or damage. Check also for signs of glazing (shiny patches) and for separation of the belt plies. Renew the belt if worn or damaged.

5 If the condition of the belt is satisfactory, on engines where the belt is adjusted manually, check the drivebelt tension as described below, bearing in mind the Note at the start of this Section. On engines with an automatic spring-loaded tensioner, there is no need to check the drivebelt tension.

Drivebelt with manual adjuster

6 If not already done, proceed as described in paragraphs 2 and 3.

7 Slacken the tensioner pulley retaining nut then rotate the pulley using a suitable Torx spanner until there is sufficient slack for the drivebelt to be removed from the pulleys.

8 If the belt is being renewed, ensure that the correct type is used. Fit the belt around the pulleys, ensuring that the ribs on the belt are correctly engaged with the grooves in the pulleys, and that the drivebelt is correctly routed **(see illustration)**. Tension the belt as follows.

9 If not already done, proceed as described in paragraphs 2 and 3.

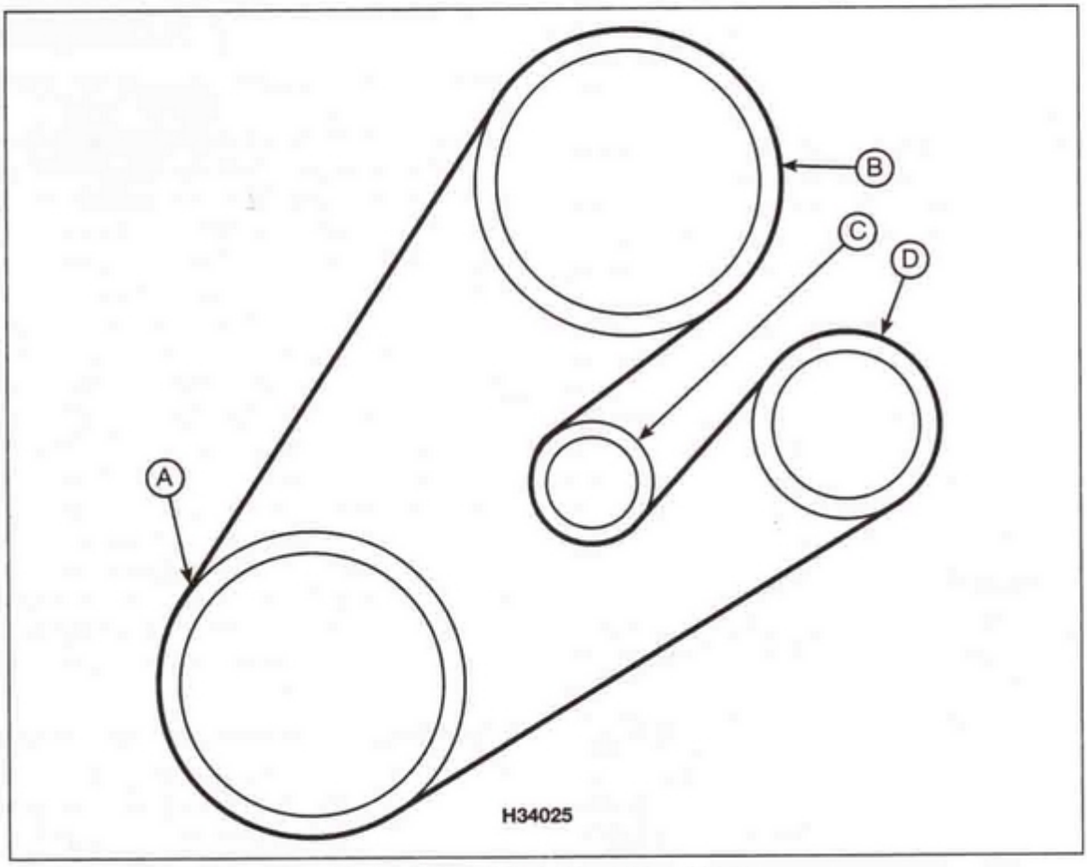
10 If the electronic tool is not being used, the belt should be tensioned so that, under firm thumb pressure, there is about 5.0 mm of free movement at the mid-point between the pulleys on the longest belt run. If the electronic tool is being used, the tool sensor should be positioned on the belt midway between the crankshaft pulley and power steering pump pulley

11 To adjust the tension, with the tensioner pulley retaining nut slackened, rotate the pulley until the correct hand tension is achieved, or the specified number of SEEM units are displayed on the electronic tool. Refer to the Specifications for the SEEM unit tension settings. Hold the pulley in this position and tighten the retaining nut.

12 Remove the tool (if used), and rotate the crankshaft through four complete revolutions in the normal direction of rotation.

13 Recheck the belt tension using firm thumb pressure or the electronic tool and, if necessary, readjust.

14 Clip the coolant hoses into position (where necessary), then refit the wheelarch liner. Refit the roadwheel, and lower the vehicle to the ground.



5.8 Auxiliary drivebelt configuration – 1.6 litre engines without air conditioning

A Crankshaft pulley
B Power steering pump pulley
C Manual tensioner pulley
D Alternator pulley

Drivebelt with automatic adjuster

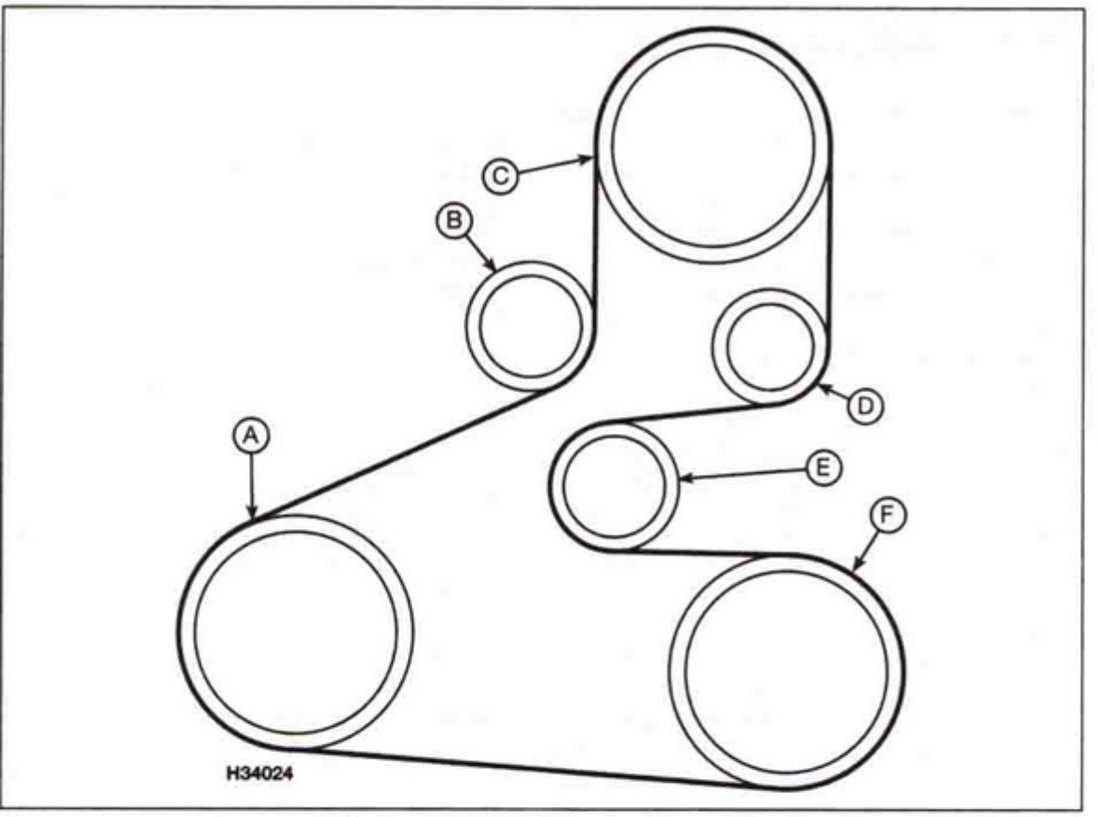
1.6 litre engines

15 If not already done, proceed as described in paragraphs 2 and 3.

16 Move the tensioner pulley away from the drivebelt, using a ratchet handle or extension bar with 3/8 inch square-section end engaged in the square hole in the automatic tensioner arm. Once the tensioner is released, retain it in the released position by inserting a 6.0 mm Allen key or similar in the hole provided.

17 Disengage the drivebelt from all the pulleys and remove the belt from the engine.

18 If the belt is being renewed, ensure that the correct type is used. Fit the belt around the pulleys, ensuring that the ribs on the belt are correctly engaged with the grooves in the pulleys, and that the drivebelt is correctly routed **(see illustration)**.

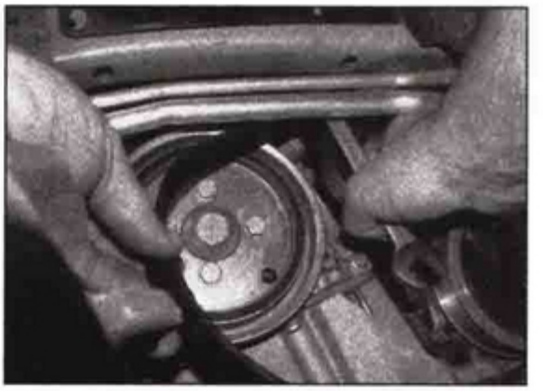


5.18 Auxiliary drivebelt configuration – 1.6 litre engines with air conditioning

A Crankshaft pulley
B Automatic tensioner pulley
C Power steering pump pulley
D Alternator pulley
E Idler pulley
F Air conditioning compressor pulley

19 Take the load off the tensioner arm and remove the Allen key or similar retaining tool. Release the tensioner arm and allow the assembly to automatically tension the belt.

20 Clip the coolant hoses into position (where necessary), then refit the wheelarch liner. Refit the roadwheel, and lower the vehicle to the ground.



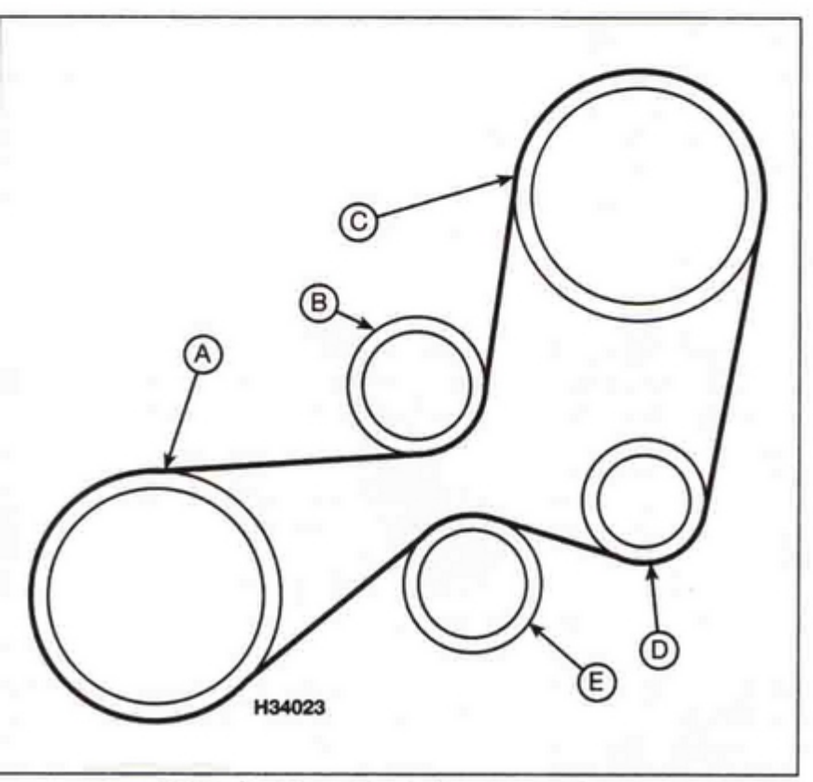
5.22 Rotate the tensioner pulley anti-clockwise using a spanner, and slip the belt off the pulleys – 1.8 litre engines

1.8 litre engines

21 If not already done, proceed as described in paragraphs 2 and 3.

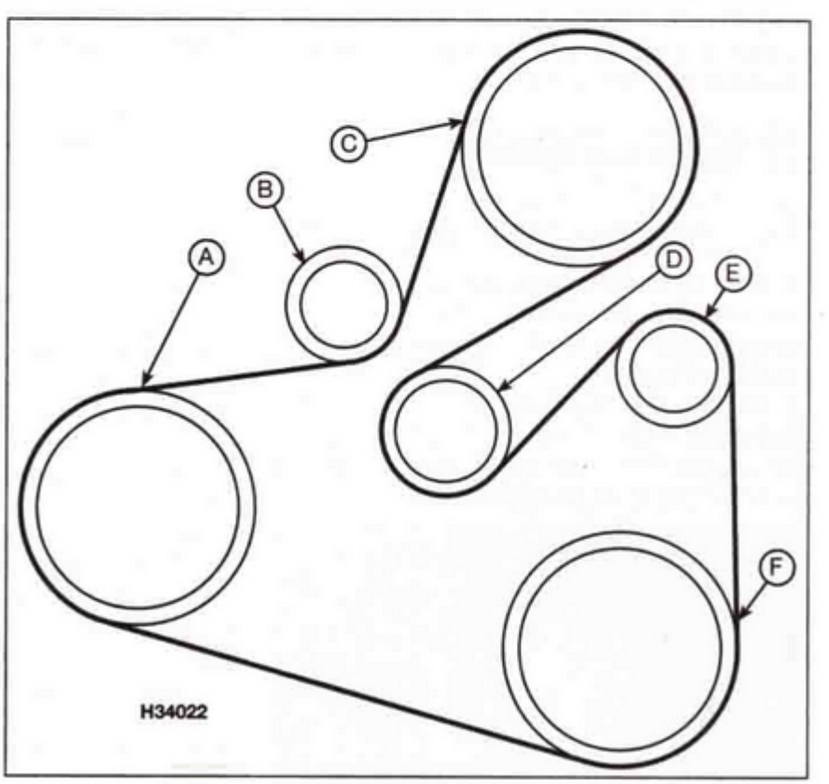
22 From under the wheelarch, rotate the tensioner pulley anti-clockwise, against spring tension, using a spanner on the tensioner pulley retaining bolt. Hold the tensioner pulley in this position and slip the belt off the pulleys **(see illustration)**. Release the tensioner pulley and remove the belt from the engine.

23 If the belt is being renewed, ensure that the correct type is used. Fit the belt around all the pulleys, except the tensioner pulley, ensuring that the ribs on the belt are correctly engaged with the pulley grooves, and that the drivebelt is correctly routed **(see illustrations)**.



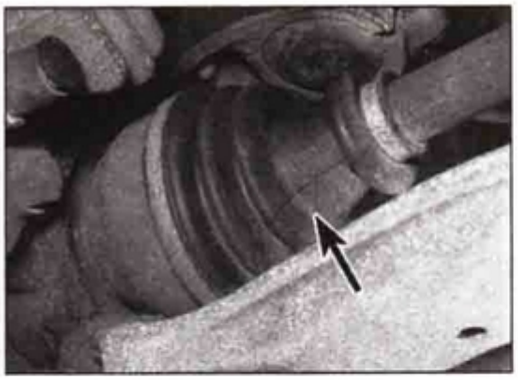
5.23a Auxiliary drivebelt configuration – 1.8 litre engines without air conditioning

A Crankshaft pulley
B Automatic tensioner pulley
C Power steering pump pulley
D Alternator pulley
E Idler pulley



5.23b Auxiliary drivebelt configuration – 1.8 litre engines with air conditioning

A Crankshaft pulley
B Automatic tensioner pulley
C Power steering pump pulley
D Idler pulley
E Alternator pulley
F Air conditioning compressor pulley



8.1 Check the condition of the driveshaft gaiters (arrowed)

24 Rotate the tensioner pulley anti-clockwise, hold it in this position and slide the belt around it. Release the tensioner and allow the assembly to automatically tension the belt.
25 Clip the coolant hoses into position (where necessary), then refit the wheelarch liner. Refit the roadwheel, and lower the vehicle to the ground.

6 Clutch control mechanism check

1 Check that the clutch pedal moves smoothly and easily through its full travel, and that the clutch itself functions correctly, with no trace of slip or drag.
2 On models with a cable-operated clutch, if excessive effort is required to operate the clutch, check first that the cable is correctly routed and undamaged, then remove the pedal and check that its pivot is properly greased. See Chapter 6 for more information.

7 Pollen filter renewal

1 Working in the engine compartment, undo the plastic nuts securing the filter access cover to the centre of the engine compartment bulkhead.
2 Remove the cover and withdraw the filter from its location. Clean the filter housing and the access cover, then fit the new filter using a reversal of the removal procedure.

9.4 Check for wear in the hub bearings by grasping the wheel and trying to rock it

8 Driveshaft gaiter check

1 With the vehicle raised and securely supported on axle stands (see *Jacking and vehicle support*), and the undertray removed, turn the steering onto full lock, then slowly rotate the roadwheel. Inspect the condition of the outer constant velocity (CV) joint rubber gaiters, squeezing the gaiters to open out the folds **(see illustration)**. Check for signs of cracking, splits or deterioration of the rubber, which may allow the grease to escape, and lead to water and grit entry into the joint. Also check the security and condition of the retaining clips. Repeat these checks on the inner CV joints. If any damage or deterioration is found, the gaiters should be renewed (see Chapter 8).
2 At the same time, check the general condition of the CV joints themselves by first holding the driveshaft and attempting to rotate the wheel. Repeat this check by holding the inner joint and attempting to rotate the driveshaft. Any appreciable movement indicates wear in the joints, wear in the driveshaft splines, or a loose driveshaft retaining nut.

9 Steering and suspension check

Front suspension and steering

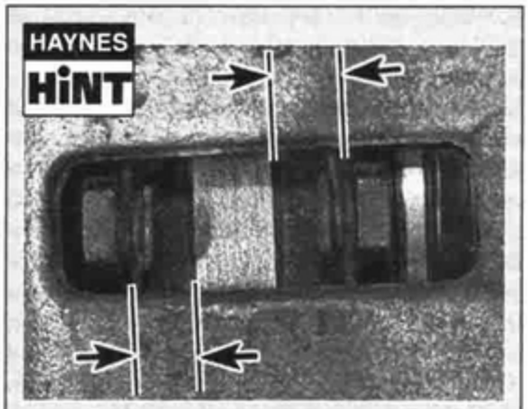
1 Firmly apply the handbrake, then jack up the front of the car and support it securely on axle stands (see *Jacking and vehicle support*). Remove the engine undertray, then refit it again after completing all the checks at the front of the vehicle.
2 Visually inspect the balljoint dust covers and the steering rack-and-pinion gaiters for splits, chafing or deterioration. Any wear of these components will cause loss of lubricant, together with dirt and water entry, resulting in rapid deterioration of the balljoints or steering gear.
3 Check the power steering fluid hoses for chafing or deterioration, and the pipe and hose unions for fluid leaks. Also check for signs of fluid leakage under pressure from the steering gear rubber gaiters, which would indicate failed fluid seals within the steering gear.
4 Grasp the roadwheel at the 12 o'clock and 6 o'clock positions, and try to rock it **(see illustration)**. Very slight free play may be felt, but if the movement is appreciable, further investigation is necessary to determine the source. Continue rocking the wheel while an assistant depresses the footbrake. If the movement is now eliminated or significantly reduced, it is likely that the hub bearings are at fault. If the free play is still evident with the footbrake depressed, then there is wear in the suspension joints or mountings.
5 Now grasp the wheel at the 9 o'clock and 3 o'clock positions, and try to rock it as before. Any movement felt now may again be caused by wear in the hub bearings or the steering track rod balljoints. If the inner or outer balljoint is worn, the visual movement will be obvious.
6 Using a large screwdriver or flat bar, check for wear in the suspension mounting bushes by levering between the relevant suspension component and its attachment point. Some movement is to be expected as the mountings are made of rubber, but excessive wear should be obvious. Also check the condition of any visible rubber bushes, looking for splits, cracks or contamination of the rubber.
7 With the vehicle standing on its wheels, have an assistant turn the steering wheel back-and-forth about an eighth of a turn each way. There should be very little, if any, lost movement between the steering wheel and roadwheels. If this is not the case, closely observe the joints and mountings previously described, but in addition, check the steering column universal joints for wear, and the rack-and-pinion steering gear itself.

Suspension strut and shock absorber

8 Check for any signs of fluid leakage around the suspension strut/shock absorber body, or from the rubber gaiter around the piston rod. Should any fluid be noticed, the suspension strut/shock absorber is defective internally, and should be renewed. **Note:** *Suspension struts/shock absorbers should always be renewed in pairs on the same axle.*
9 The efficiency of the suspension strut/shock absorber may be checked by bouncing the vehicle at each corner. Generally speaking, the body will return to its normal position and stop after being depressed. If it rises and returns on a rebound, the suspension strut/shock absorber is probably suspect. Examine also the suspension strut/shock absorber upper and lower mountings for any signs of wear.

10 Front brake pad condition check

1 Firmly apply the handbrake, then jack up the front of the vehicle and support it securely on axle stands (see *Jacking and vehicle support*). Remove the front roadwheels.
2 It is now possible to check the thickness of the pad friction material **(see Haynes Hint)**. If any pad's friction material is worn to the specified thickness or less, *all four pads must be renewed as a set.* **Note:** *If any pad is approaching the minimum thickness, consider renewal as a precautionary measure in case the pads wear out before the next service.*



For a quick check, the thickness of friction material on each brake pad can be measured through the aperture in the caliper body.

3 For a comprehensive check, the brake pads should be removed and cleaned. The operation of the caliper can then be checked, and the brake disc itself can be fully examined on both sides. Refer to Chapter 9 for details.

11 Exhaust system check

1 With the engine cold (at least an hour after the vehicle has been driven), check the complete exhaust system from the engine to the end of the tailpipe. The exhaust system is most easily checked with the vehicle raised on a hoist, or suitably supported on axle stands, so that the exhaust components are readily visible and accessible (see *Jacking and vehicle support*).

2 Check the exhaust pipes and connections for evidence of leaks, severe corrosion and damage. Make sure that all brackets and mountings are in good condition, and that all relevant nuts and bolts are tight. Leakage at any of the joints or in other parts of the system will usually show up as a black sooty stain in the vicinity of the leak.

3 Rattles and other noises can often be traced to the exhaust system, especially the brackets and mountings. Try to move the pipes and silencers. If the components are able to come into contact with the body or suspension parts, secure the system with new mountings. Otherwise separate the joints (if possible) and twist the pipes as necessary to provide additional clearance.

12 Rear brake shoe condition check

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

2 For a quick check, the thickness of friction material remaining on one of the brake shoes can be measured through the slot in the brake backplate that is exposed by prising out its sealing grommet **(see illustrations)**. If a rod of the same diameter as the specified minimum thickness is placed against the shoe friction material, the amount of wear can quickly be assessed – a small mirror may help observation. If any shoe's friction material is worn to the specified thickness or less, all four shoes must be renewed as a set. **Note**: *If any shoe is approaching the minimum thickness, consider renewal as a precautionary measure in case the shoes wear out before the next service.*

3 For a comprehensive check, the brake drums should be removed and cleaned. This will permit the wheel cylinders to be checked and the condition of the brake drum itself to be fully examined. Refer to Chapter 9 for further information.

13 Hinge and lock operation and lubrication

1 Work around the vehicle, and lubricate the hinges of the bonnet, doors and tailgate with a small amount of general-purpose oil.

2 Lightly lubricate the bonnet release mechanism and exposed section of inner cable with a smear of grease.

3 Check carefully the security and operation of all hinges, latches and locks, adjusting them where required. Check the operation of the central locking system.

4 Check the condition and operation of the tailgate struts, renewing them if they are leaking or no longer able to support the tailgate securely when raised.

14 Road test

Instruments/ electrical equipment

1 Check the operation of all instruments and electrical equipment.

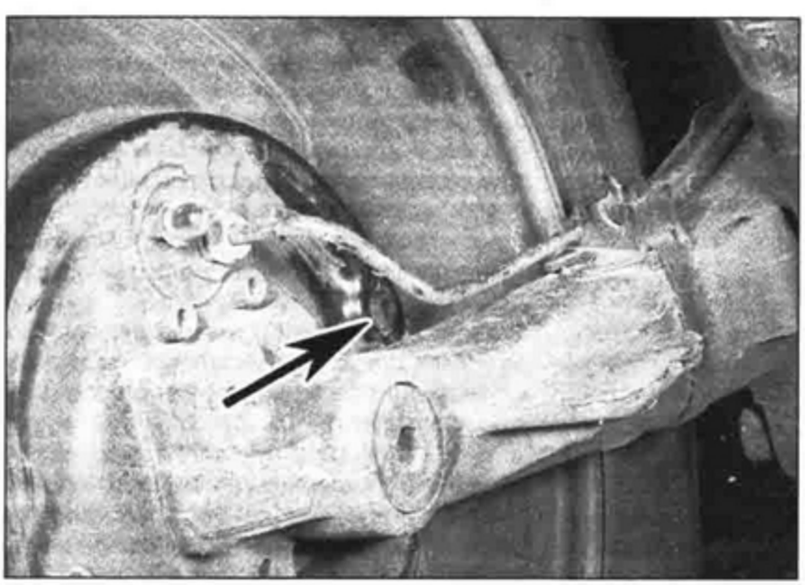
2 Make sure that all instruments read correctly, and switch on all electrical equipment in turn to check it functions properly.

Steering and suspension

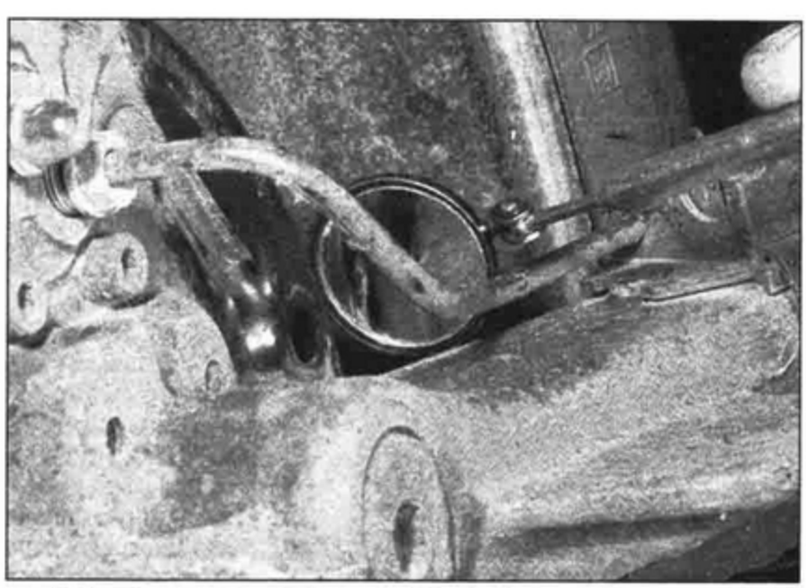
3 Check for any abnormalities in the steering, suspension, handling or road 'feel'.

4 Drive the vehicle, and check that there are no unusual vibrations or noises.

5 Check that the steering feels positive, with no excessive 'sloppiness', or roughness, and check for any suspension noises when cornering, or when driving over bumps.



12.2a Prise the grommet (arrowed) from the rear drum brake backplate



12.2b Viewing the thickness of the brake shoe lining using a small mirror

Drivetrain

6 Check the performance of the engine, clutch, transmission and driveshafts.
7 Listen for any unusual noises from the engine, clutch and transmission.
8 Make sure that the engine runs smoothly when idling, and that there is no hesitation when accelerating.
9 Check that the clutch action is smooth and progressive, that the drive is taken up smoothly, and that the pedal travel is not excessive. Also listen for any noises when the clutch pedal is depressed.
10 Check that all gears can be engaged smoothly without noise, and that the gear lever action is smooth and not abnormally vague or 'notchy'.
11 Listen for a metallic clicking sound from the front of the vehicle, as the vehicle is driven slowly in a circle with the steering on full lock. Carry out this check in both directions. If a clicking noise is heard, this indicates lack of lubrication or wear in a driveshaft constant velocity joint (see Chapter 8).

Braking system

12 Make sure that the vehicle does not pull to one side when braking, and that the wheels do not lock prematurely when braking hard (models without ABS).
13 Check that there is no vibration through the steering when braking.
14 Check that the handbrake operates correctly, without excessive movement of the lever, and that it holds the vehicle on a slope.
15 Test the operation of the brake servo unit as follows. With the engine off, depress the footbrake four or five times to exhaust the vacuum. Start the engine, holding the brake pedal depressed. As the engine starts, there should be a noticeable 'give' in the brake pedal as vacuum builds-up. Allow the engine to run for at least two minutes, and then switch it off. If the brake pedal is depressed now, it should be possible to detect a hiss from the servo as the pedal is depressed. After about four or five applications, no further hissing should be heard, and the pedal should feel considerably firmer.

Every 25 000 miles (40 000 km) or 2 years

15 Brake fluid renewal

Warning: Brake hydraulic fluid can harm your eyes and damage painted surfaces, so use extreme caution when handling and pouring it. Do not use fluid that has been standing open for some time, as it absorbs moisture from the air. Excess moisture can cause a dangerous loss of braking effectiveness.

Note: *Also renew the fluid on models fitted with a hydraulic clutch, with reference to Chapter 6.*

1 The procedure is similar to that for the bleeding of the hydraulic system as described in Chapter 9, except that the brake fluid reservoir should be emptied by syphoning, using a clean poultry baster or similar before starting, and allowance should be made for the old fluid to be expelled when bleeding a section of the circuit.
2 Alternatively, to empty the reservoir, working as described in Chapter 9, open the first bleed screw in the sequence, and pump the brake pedal gently until nearly all the old fluid has been emptied from the master cylinder reservoir.

HAYNES HiNT
Old hydraulic fluid is invariably much darker in colour than the new, making it easy to distinguish the two.

3 Top-up to the MAX level with new fluid, and continue pumping until only the new fluid remains in the reservoir, and new fluid can be seen emerging from the bleed screw. Tighten the screw, and top the reservoir level up to the MAX level line.
4 Work through all the remaining bleed screws in the sequence until new fluid can be seen at all of them. Be careful to keep the master cylinder reservoir topped-up to above the DANGER level at all times, or air may enter the system and increase the length of the task.
5 When the operation is complete, check that all bleed screws are securely tightened, and that their dust caps are refitted. Wash off all traces of spilt fluid, and recheck the master cylinder reservoir fluid level.
6 Check the operation of the brakes before taking the car on the road.

Every 37 500 miles (60 000 km) or 3 years

16 Spark plug renewal

1 The correct functioning of the spark plugs is vital for the correct running and efficiency of the engine. It is essential that the plugs fitted are appropriate for the engine (a suitable type is specified at the start of this Chapter). If this type is used and the engine is in good condition, the spark plugs should not need attention between scheduled replacement intervals. Spark plug cleaning is rarely necessary, and should not be attempted unless specialised equipment is available, as damage can easily be caused to the firing ends.

16.4 Unscrew the spark plugs using a spark plug spanner or a deep socket and extension bar

2 Remove the ignition coil module/unit as described in Chapter 5B.
3 It is advisable to remove the dirt from the spark plug recesses using a clean brush, vacuum cleaner or compressed air before removing the plugs, to prevent dirt dropping into the cylinders.
4 Unscrew the plugs using a spark plug spanner, suitable box spanner or a deep socket and extension bar **(see illustration)**. Keep the socket aligned with the spark plug – if it is forcibly moved to one side, the ceramic insulator may be broken off. As each plug is removed, examine it as follows.
5 Examination of the spark plugs will give a good indication of the condition of the engine. If the insulator nose of the spark plug is clean and white, with no deposits, this is indicative of a weak mixture or too hot a plug (a hot plug transfers heat away from the electrode slowly, a cold plug transfers heat away quickly).
6 If the tip and insulator nose are covered with hard black-looking deposits, then this is indicative that the mixture is too rich. Should the plug be black and oily, then it is likely that the engine is fairly worn, as well as the mixture being too rich.
7 If the insulator nose is covered with light tan to greyish-brown deposits, then the mixture is correct and it is likely that the engine is in good condition.
8 The spark plug electrode gap is of considerable importance as, if it is too large or too small, the size of the spark and its efficiency will be seriously impaired.
9 Measure the gap with a feeler blade, and then bend open, or closed, the outer plug electrode(s) until the correct gap is achieved

(see illustration). The centre electrode should never be bent, as this may crack the insulator and cause plug failure, if nothing worse. If using feeler blades, the gap is correct when the appropriate-size blade is a firm sliding fit.

10 Special spark plug electrode gap adjusting tools are available from most motor accessory shops, or from spark plug manufacturers.

11 Check that the threaded connector sleeves are tight, and that the plug exterior and threads are clean, then insert the spark plugs into their locations **(see Haynes Hint)**.

12 Remove the rubber hose (if used), and tighten the plug to the specified torque using the spark plug socket and a torque wrench. Refit the remaining spark plugs in the same manner.

13 Refit the ignition coil module/unit as described in Chapter 5B.

17 Air filter renewal

1 Undo the screws securing the lid to the air filter housing. Lift the lid up and take out the air filter element **(see illustrations)**.

2 Wipe clean the inside of the filter housing and fit the new element.

3 Locate the air filter lid in position and secure with the retaining screws.

18 Transmission oil level check

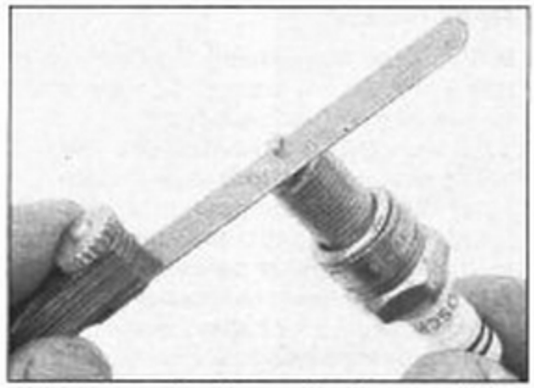
Note: *A suitable square-section wrench will be required to undo the transmission filler/level plug. These wrenches can be obtained from most motor factors or your Citroën dealer. A new sealing washer will also be required when refitting the transmission filler/level plug.*

> **HAYNES HiNT**
> ***It may be possible to use the square end fitting on a ratchet handle (as found in a typical socket set) to undo the plug.***

1 The manual transmission oil does not need to be renewed as part of the regular maintenance schedule, but the oil level must be checked and if necessary topped-up at the interval specified here. To drain the transmission as part of a repair procedure, refer to the information given in Chapter 7.

2 The oil level must be checked before the car is driven, or at least 5 minutes after the engine has been switched off. If the oil is checked immediately after driving the car, some of the oil will remain distributed around the transmission components, resulting in an inaccurate level reading.

3 With the car on level ground, firmly apply the handbrake, then jack up the front and rear

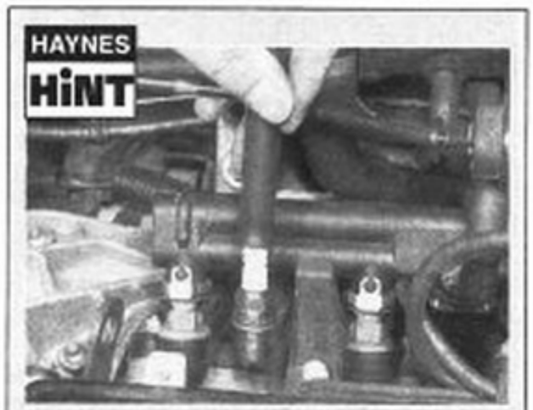


16.9 Measuring the spark plug gap with a feeler blade

of the car and support it securely on axle stands (see *Jacking and vehicle support*). Note that the car must be level, to ensure accuracy, when checking the oil level.

4 For improved access to the filler/level plug, the centre section of the left-hand wheelarch plastic liner can be removed after removing the roadwheel. The liner is secured by stud-type plastic clips along it upper and front edges which can be removed using a forked type tool. Extract all the clips, and remove the liner centre section from under the front wing **(see illustration)**. It will be necessary to ease back the front section slightly to allow the front edge of the centre section to be released. Note how the two sections overlap, as you do this, to aid refitting.

5 Wipe clean the area around the filler/level plug, which is on the left-hand end of the transmission. Unscrew the plug and clean it; discard the sealing washer.



> **HAYNES HiNT**
> ***It is very often difficult to insert spark plugs into their holes without cross-threading them. To avoid this possibility, fit a short length of 5/16 inch internal diameter rubber hose over the end of the spark plug. The flexible hose acts as a universal joint to help align the plug with the plug hole. Should the plug begin to cross-thread, the hose will slip on the spark plug, preventing thread damage to the cylinder head.***

6 The oil level should reach the lower edge of the filler/level hole. A certain amount of oil will have gathered behind the filler/level plug, and will trickle out when it is removed; this does **not** necessarily indicate that the level is correct. To ensure that a true level is established, wait until the initial trickle has stopped, then add oil as necessary until a trickle of new oil can be seen emerging **(see illustration)**. The level will be correct when

17.1a Undo the air filter housing lid retaining screws . . .

17.1b . . . lift the lid up and take out the air filter element

18.4 Extract the clips and remove the wheelarch liner centre section for access to the transmission filler/level plug

18.6 Top-up the transmission until a trickle of new oil can be seen emerging from the filler/level plug

the flow ceases; use only good-quality oil of the specified type (refer to *Lubricants and fluids*).

7 If the transmission has been overfilled so that oil flows out as soon as the filler/level plug is removed, check that the car is completely level (front-to-rear and side-to-side), and allow the surplus to drain off into a container.

8 When the level is correct, fit a new sealing washer to the filler/level plug, refit the plug and tighten it to the specified torque.

9 Refit the wheelarch liner and roadwheel, then lower the car to the ground. Tighten the roadwheel bolts to the specified torque.

19 Braking system check

Front brakes

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

2 Inspect the area around both brake calipers for signs of brake fluid leakage, either from the piston seals, the brake pipe union or the bleed screw.

3 Examine the brake hoses leading to each caliper and check for signs of cracking, chafing or damage. Renew a hose which shows signs of deterioration without delay.

4 Ensure that the transmission is in neutral, then grasp each front wheel hub and turn it by hand. Slight resistance is normal, but if the hub is difficult to turn smoothly, this indicates that the brake pads are binding, possibly due to a seized or partially-seized brake caliper piston; refer to Chapter 9 for details of caliper removal and overhaul.

5 Remove the front brake pads as described in Chapter 9. Examine the brake pads and measure the depth of the remaining friction material. Renew all four pads, if any are worn below their minimum limit.

6 Using proprietary brake cleaning fluid and a stiff brush, wash all traces of dirt and brake dust from the brake calipers – take care to avoid inhaling any of the airborne brake dust. Examine the piston dust seal for signs of damage or deterioration and check that it is securely seated in its retaining groove.

7 Check the condition of the brake disc with reference to the information given in Chapter 9.

8 Refit the front brake pads as described in Chapter 9, then refit the roadwheels and lower the front of the car to the ground. Tighten the roadwheel bolts to the specified torque.

Rear brakes

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

10 Ensure that the handbrake is released, then grasp each rear roadwheel and turn it by hand. Slight resistance is normal, but if the wheel is difficult to turn smoothly, this could be due to a seized or partially-seized wheel cylinder, or incorrect handbrake adjustment; refer to Chapter 9 for further details.

11 Remove the rear roadwheels, then with reference to Chapter 9, remove the rear brake shoes. Examine the brake shoes and measure the depth of the remaining friction material. Renew all four brake shoes, if any are worn below their minimum limit.

12 Check the brake drums for wear and damage and check the area around the wheel cylinder piston seals for signs of fluid leakage. Check at the rear of the brake backplate for evidence of fluid leakage from the brake pipe union or bleed screw. Renew the wheel cylinder without delay if it shows signs of leakage; see Chapter 9 for details.

13 Using proprietary brake cleaning fluid and a stiff brush, wash all traces of dirt and brake dust from the wheel cylinders and backplates – take care to avoid inhaling any of the airborne brake dust.

14 On completion, refit the brake shoes, brake drums and roadwheels, then lower the car to the ground. Tighten the roadwheel bolts to the specified torque.

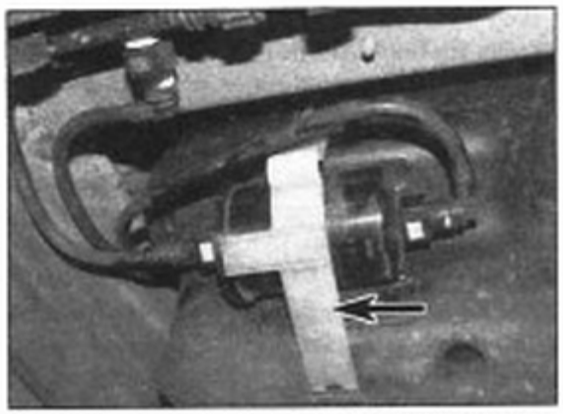
20 Handbrake check and adjustment

Refer to Chapter 9.

21 Fuel filter renewal

Warning: Before carrying out the following operation, refer to the precautions given in 'Safety first!' at the beginning of this manual, and follow them implicitly. Petrol is a highly-dangerous and volatile liquid, and the precautions necessary when handling it cannot be overstressed.

1 The fuel filter is situated underneath the rear of the vehicle, on the side of the fuel tank. To gain access to the filter, chock the front wheels then jack up the rear of the car and support it on axle stands (see *Jacking and vehicle support*).



21.3 Unclip the retaining strap (arrowed) to release the fuel filter from the fuel tank

2 Seal off the fuel hoses leading to and from the filter, using proprietary hose clamps, with rounded jaws – do not use G-clamps, self-locking grips, or similar with flat or square jaws as these could damage the hose internally, causing leakage later.

3 Unclip the filter retaining strap from the fuel tank **(see illustration)**.

4 Noting the direction of the arrow marked on the filter body, release the quick-release fittings and disconnect the fuel hoses from the filter.

5 Remove the filter from the car. Dispose of the old filter safely; it will be highly flammable, and may explode if thrown on a fire.

6 Slide the new filter into position and clip the filter strap back onto the fuel tank. Ensure that the arrow on the filter body is pointing in the direction of the fuel flow, as noted when removing the old filter. The flow direction can otherwise be determined by tracing the fuel hoses back along their length.

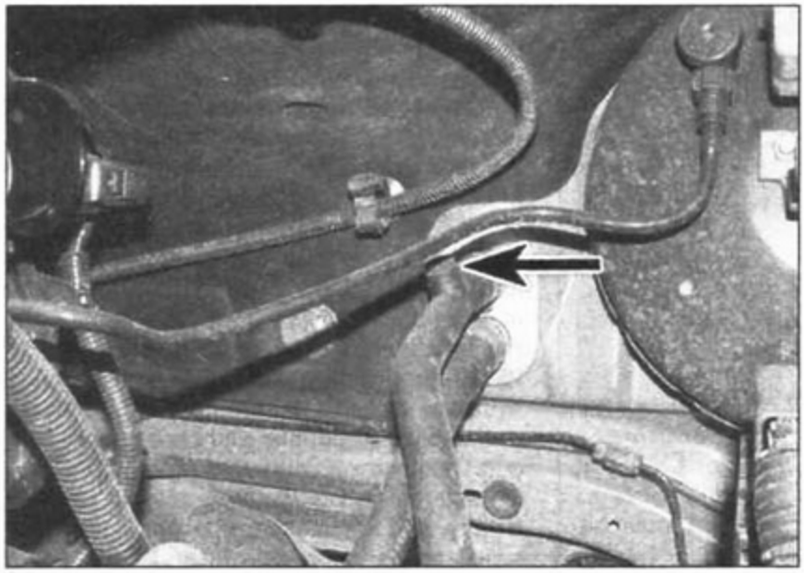
7 Connect the fuel hoses to the filter by pressing each hose onto its respective filter port until it 'snaps' into position. Remove the hose clamps.

8 Start the engine, check the filter hose connections for leaks, then lower the vehicle to the ground.

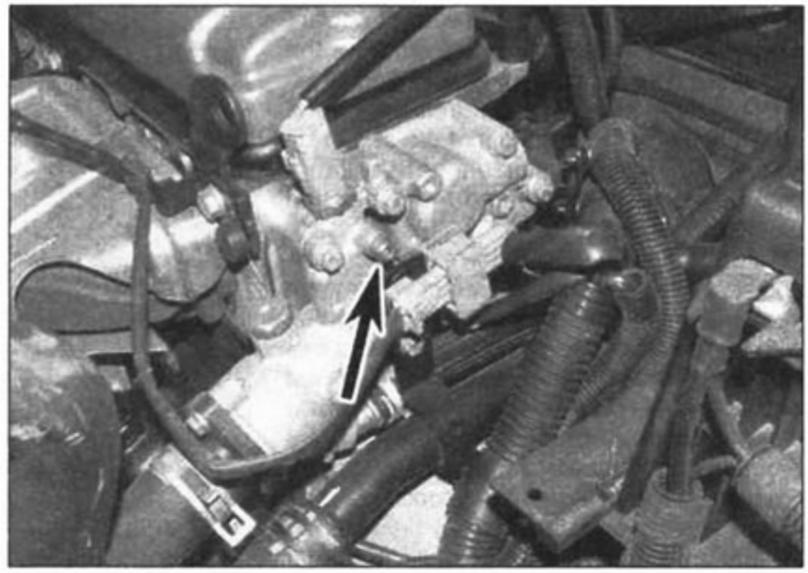
22 Timing belt renewal

Refer to Chapter 2A or 2B as applicable.

Note: *Although the normal interval for timing belt renewal is 75 000 miles (120 000 km), it is strongly recommended that the interval is halved to 37 500 miles (60 000 km) on vehicles which are subjected to intensive use, ie, mainly short journeys or a lot of stop-start driving. The actual belt renewal interval is therefore very much up to the individual owner, but bear in mind that severe engine damage will result if the belt breaks.*



23.4a Cooling system bleed screws are located in the heater matrix outlet hose (arrowed) . . .



23.4b . . . and in the coolant outlet housing (arrowed) – 1.6 litre engine

Every 75 000 miles (120 000 km) or 5 years

23 Coolant renewal

Warning: Wait until the engine is cold before starting this procedure. Do not allow antifreeze to come in contact with your skin, or with the painted surfaces of the vehicle. Rinse off spills immediately with plenty of water. Never leave antifreeze lying around in an open container, or in a puddle in the driveway or on the garage floor. Children and pets are attracted by its sweet smell, but antifreeze can be fatal if ingested.

Cooling system draining

Note: *Later models are filled with a 'long-life' coolant during vehicle assembly which is claimed to be suitable for ten years use before renewal is required. If you are sure that the vehicle is filled with this type of coolant, then renewal may not be necessary at this service interval. Consult your Citroën dealer for details of coolant specification and renewal recommendations.*

1 With the engine completely cold, remove the expansion tank filler cap. Turn the cap slowly anti-clockwise, wait until any pressure remaining in the system is released, then fully unscrew the cap.

2 Firmly apply the handbrake, then jack up the front of the vehicle and support it securely on axle stands (see *Jacking and vehicle support*). Remove the engine undertray.

3 Position a suitable container beneath the bottom hose connection on the radiator. Release the retaining clip, then disconnect the hose and allow the coolant to drain into the container.

4 To assist draining, open the cooling system bleed screws which are located in the heater matrix outlet hose union on the engine compartment bulkhead, and on the coolant outlet housing on the left-hand end of the cylinder head **(see illustrations)**.

5 The manufacturers do not specify a requirement to drain the cylinder block at the time of routine coolant renewal. If, however, the coolant is being drained as part of an engine repair procedure (such as cylinder head gasket renewal), then it is advisable to drain the cylinder block also. Note that the cylinder block drain plugs are virtually inaccessible and it may be necessary to move certain cables, brackets or hoses to one side for access.

6 To drain the cylinder block, reposition the container below the drain plug located at the front left-hand side of the cylinder block on 1.6 litre engines, and at the rear left-hand side of the cylinder block on 1.8 litre engines. Remove the drain plug, and allow the coolant to drain into the container.

7 On completion of draining, refit the radiator bottom hose and cylinder block drain plugs (where applicable). Refit any components disturbed for access, then refit the engine undertray and lower the vehicle to the ground.

Cooling system flushing

8 If coolant renewal has been neglected, or if the antifreeze mixture has become diluted, then in time, the cooling system may gradually lose efficiency, as the coolant passages become restricted due to rust, scale deposits, and other sediment. The cooling system efficiency can be restored by flushing the system clean.

9 The radiator should be flushed separately from the engine, to avoid excess contamination.

Radiator flushing

10 To flush the radiator, disconnect the top and bottom hoses and any other relevant hoses from the radiator, with reference to Chapter 3.

11 Insert a garden hose into the radiator top inlet. Direct a flow of clean water through the radiator, and continue flushing until clean water emerges from the radiator bottom outlet.

12 If after a reasonable period, the water still does not run clear, the radiator can be flushed with a suitable proprietary cleaning agent, suitable for radiators of plastic/aluminium construction. It is important that the instructions provided with the product are followed carefully. If the contamination is particularly bad, insert the hose in the radiator bottom outlet, and reverse-flush the radiator.

Engine flushing

13 To flush the engine, tighten the cooling system bleed screws, then remove the thermostat (see Chapter 3). Temporarily refit the thermostat cover, without the thermostat.

14 With the top and bottom hoses disconnected from the radiator, insert a garden hose into the radiator top hose. Direct a clean flow of water through the engine, and continue flushing until clean water emerges from the radiator bottom hose.

15 When flushing is complete, refit the thermostat and reconnect the hoses with reference to Chapter 3.

Cooling system filling

16 Before attempting to fill the cooling system, make sure that all hoses and clips are in good condition, and that the clips are tight. Note that an antifreeze mixture must be used all year round, to prevent corrosion of the engine components (see the following sub-Section).

17 If not already done, remove the expansion tank filler cap and open all the cooling system bleed screws (see paragraph 4).

18 To provide the required 'head' of coolant necessary to force all trapped air from the system, a 'header tank' must be used when refilling. Although Citroën dealers use a special header tank, the same effect can be achieved by using a suitable bottle, with a seal between the bottle and the expansion tank **(see Haynes Hint)**.

19 Fit the 'header tank' to the expansion tank and slowly fill the system. Coolant will emerge from each of the bleed screws in turn, starting with the lowest screw. As soon as coolant free from air bubbles emerges from the lowest screw, tighten that screw, and watch the next bleed screw in the system. Repeat the procedure until the coolant is emerging from the highest bleed screw in the cooling system and all bleed screws are securely tightened.

20 Ensure that the 'header tank' is full (at least 0.5 litres of coolant). Start the engine, and run it at a fast idle speed (do not exceed 2000 rpm) until the cooling fan cuts in, and then cuts out three times. Stop the engine.
Note: *Take great care not to scald yourself.*

21 Allow the engine to cool, then remove the 'header tank'.

22 When the engine has cooled, check the coolant level with reference to *Weekly checks*. Top-up the level if necessary, and refit the expansion tank cap.

HAYNES HiNT

Cut the bottom off an old antifreeze container to make a 'header tank' for use when refilling the cooling system. The seal at the point arrowed must be as airtight as possible.

Antifreeze mixture

23 The antifreeze should always be renewed at the specified intervals (see the note at the beginning of this Section). This is necessary not only to maintain the antifreeze properties, but also to prevent corrosion which would otherwise occur as the corrosion inhibitors become progressively less effective.

24 Always use an ethylene-glycol based antifreeze which is suitable for use in mixed-metal cooling systems. A general guide to the quantity of antifreeze and levels of protection is given in the Specifications, but follow the instructions provided by the antifreeze manufacturer for exact requirements.

25 Before adding antifreeze, the cooling system should be completely drained, preferably flushed, and all hoses checked for condition and security.

26 After filling with antifreeze, a label should be attached to the expansion tank, stating the type and concentration of antifreeze used, and the date installed. Any subsequent topping-up should be made with the same type and concentration of antifreeze.

27 Do not use engine antifreeze in the windscreen/tailgate washer system, as it will damage the vehicle paintwork. A screenwash additive should be added to the washer system in the quantities stated on the bottle.

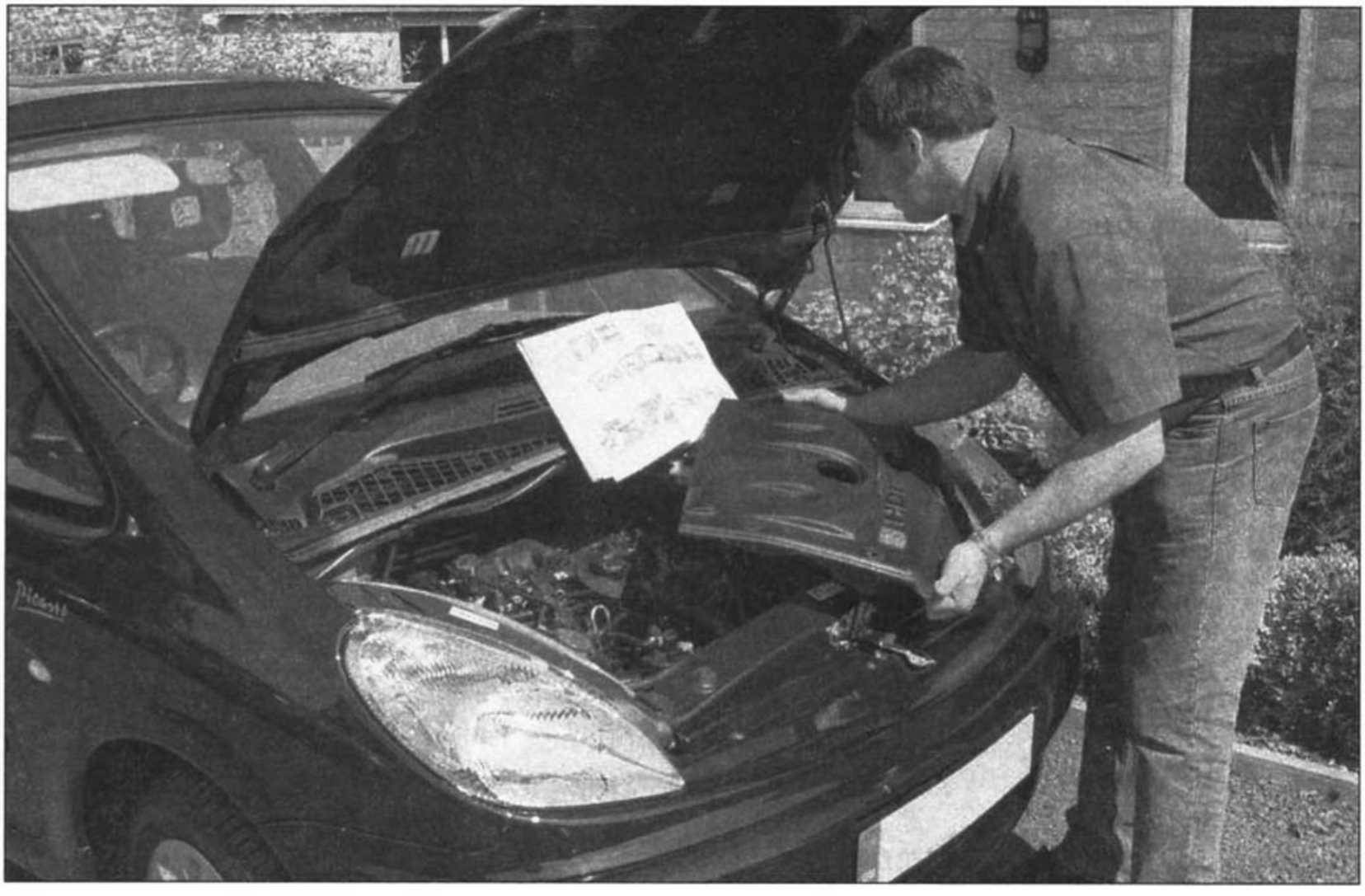
Every 10 years – regardless of mileage

24 Air bag(s) and seat belt pretensioner renewal

Due to the safety critical nature of the air bag and seat belt pretensioner components, these operations must be carried out by a Citroën dealer.

Chapter 1 Part B:
Routine maintenance and servicing – diesel engine models

Contents



Degrees of difficulty

Easy, suitable for novice with little experience

Fairly easy, suitable for beginner with some experience

Fairly difficult, suitable for competent DIY mechanic

Difficult, suitable for experienced DIY mechanic

Very difficult, suitable for expert DIY or professional

Servicing specifications – diesel engine models

Lubricants and fluids	Refer to end of *Weekly checks* on page 0•17

Capacities

Engine oil (including filter)	4.5 litres
Difference between MAX and MIN dipstick marks (approx)	1.25 litres
Cooling system (approximate)	11.0 litres
Transmission	1.8 litres
Fuel tank	60.0 litres

Cooling system

Antifreeze mixture:	
28% antifreeze	Protection down to –15°C
50% antifreeze	Protection down to –30°C

Note: *Refer to antifreeze manufacturer for latest recommendations*

Preheating system

Glow plugs	Bosch 2 250 202 032

Brakes

Brake pad friction material minimum thickness	2.0 mm
Brake shoe friction material minimum thickness	1.5 mm

Tyre pressures	Refer to end of *Weekly checks* on page 0•18

Torque wrench settings

	Nm	lbf ft
Auxiliary drivebelt eccentric tensioner pulley bolt	44	32
Auxiliary drivebelt tensioner pulley arm retaining bolt	95	70
Roadwheel bolts	85	63
Transmission oil filler/level plug	20	15

The maintenance intervals in this manual are provided with the assumption that you, not the dealer, will be carrying out the work. These are the minimum maintenance intervals recommended for vehicles driven daily. If you wish to keep your vehicle in peak condition at all times, you may wish to perform some of these procedures more often. We encourage frequent maintenance, because it enhances the efficiency, performance and resale value of your vehicle.

If the vehicle is driven in dusty areas, used to tow a trailer, or driven frequently at slow speeds (idling in traffic) or on short journeys, more frequent maintenance intervals are recommended.

When the vehicle is new, it should be serviced by a factory-authorised dealer service department, in order to preserve the factory warranty.

Valve clearance adjustment is hydraulic.

Every 250 miles (400 km) or weekly

- ☐ Refer to Weekly checks

Every 12 500 miles (20 000 km) or 12 months – whichever comes first

- ☐ Renew the engine oil and filter (Section 3)*.
- ☐ Drain any water from the fuel filter (Section 4).
- ☐ Check all underbonnet/underbody components for fluid leaks (Section 5).
- ☐ Check the condition of the auxiliary drivebelt (Section 6).
- ☐ Check the clutch control mechanism (Section 7).
- ☐ Renew the pollen filter (Section 8).
- ☐ Check the condition of the driveshaft rubber gaiters (Section 9).
- ☐ Check the steering and suspension components (Section 10).
- ☐ Check the condition of the front brake pads (Section 11).
- ☐ Check the condition of the exhaust system (Section 12).
- ☐ Check the condition of the rear brake shoes (Section 13).
- ☐ Operate and lubricate all hinges and locks (Section 14).
- ☐ Road test (Section 15).

***Note:** *The engine oil renewal interval shown is based on the use of either a semi-synthetic or fully synthetic engine oil. If a mineral oil is used, the interval should be reduced. Consult your Citroën dealer for further information.*

Every 25 000 miles (40 000 km) or 2 years – whichever comes first

In addition to all the items listed above, carry out the following:

- ☐ Renew the brake fluid (Section 16).

Every 37 500 miles (60 000 km) or 3 years – whichever comes first

In addition to all the items listed above, carry out the following:

- ☐ Renew the fuel filter (Section 17).
- ☐ Renew the air filter (Section 18).
- ☐ Check the manual transmission oil level (Section 19).
- ☐ Check the condition and operation of the braking system components (Section 20).
- ☐ Check the operation of the handbrake (Section 21).
- ☐ Renew the timing belt (Section 22).

Note: *Although the normal interval for timing belt renewal is 75 000 miles (120 000 km), it is strongly recommended that the interval is halved to 37 500 miles (60 000 km) on vehicles which are subjected to intensive use, ie, mainly short journeys or a lot of stop-start driving. The actual belt renewal interval is therefore very much up to the individual owner, but bear in mind that severe engine damage will result if the belt breaks.*

Every 75 000 miles (120 000 km) or 5 years – whichever comes first

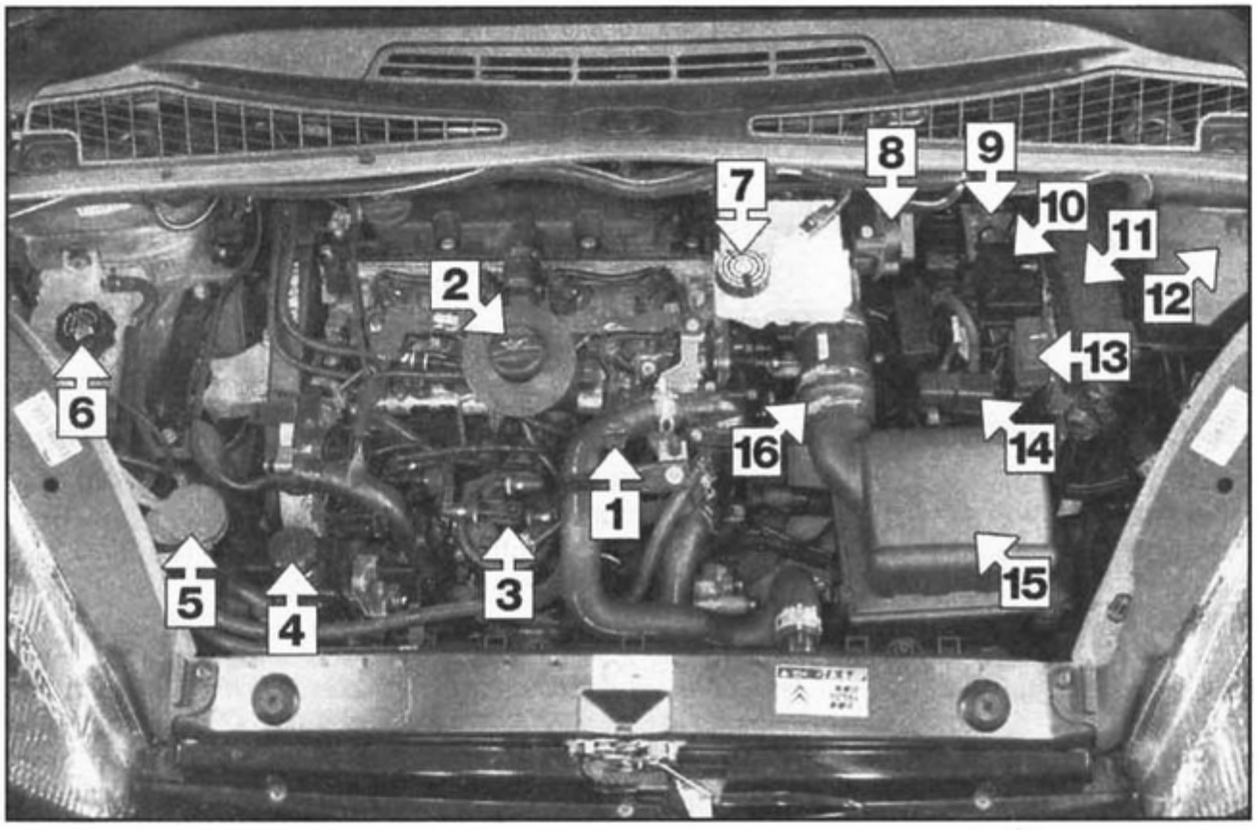
In addition to all the items listed above, carry out the following:

- ☐ Renew the coolant (Section 23).

Every 10 years – regardless of mileage

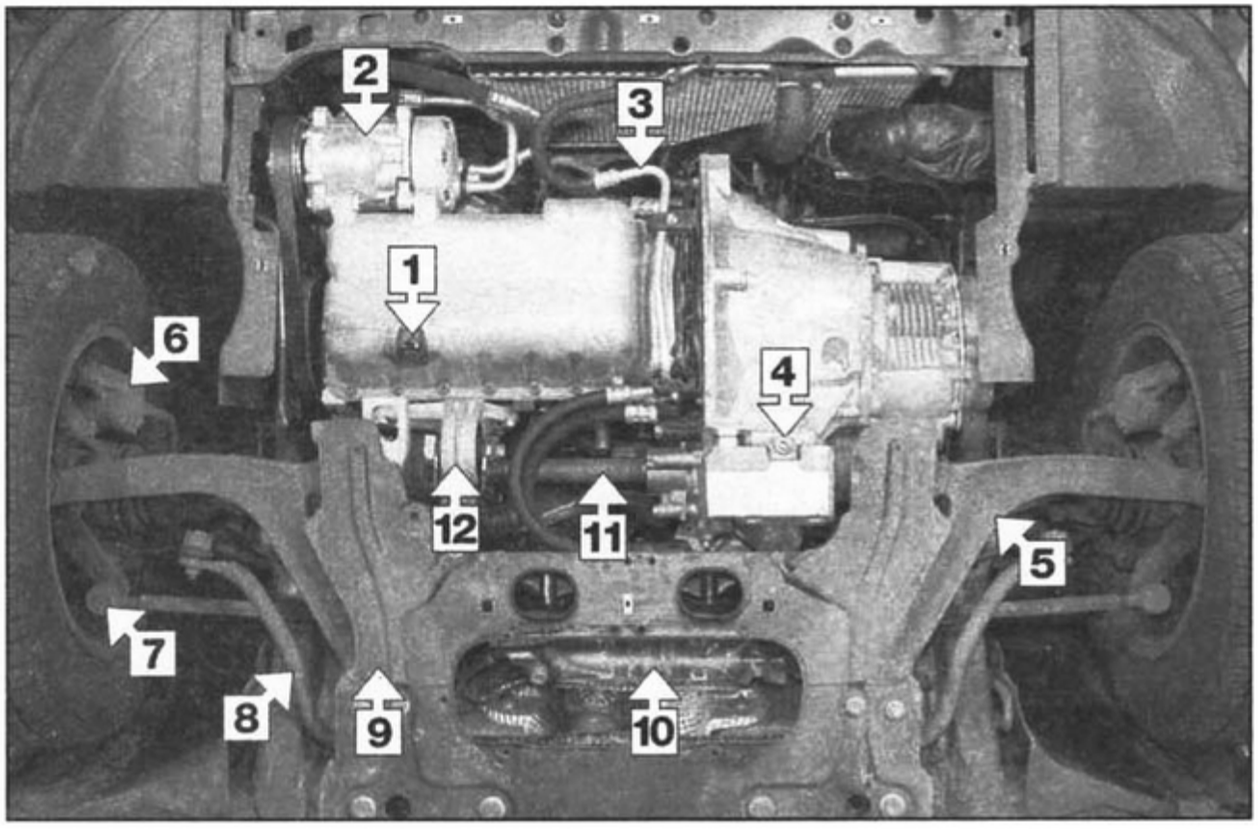
- ☐ Renew the air bag(s) and seat belt pretensioners (Section 24).

Underbonnet view



1 *Engine oil dipstick*
2 *Engine oil filler cap*
3 *Fuel filter*
4 *Power steering fluid reservoir filler cap*
5 *Windscreen/tailgate washer fluid reservoir filler cap*
6 *Coolant expansion tank filler cap*
7 *Brake master cylinder fluid reservoir*
8 *Accelerator pedal position sensor*
9 *ABS hydraulic modulator*
10 *Diesel preheating system control unit*
11 *Engine management ECU*
12 *Engine compartment fuse/relay box*
13 *Injection double relay*
14 *Battery positive cable terminal box*
15 *Air cleaner housing*
16 *Air mass meter*

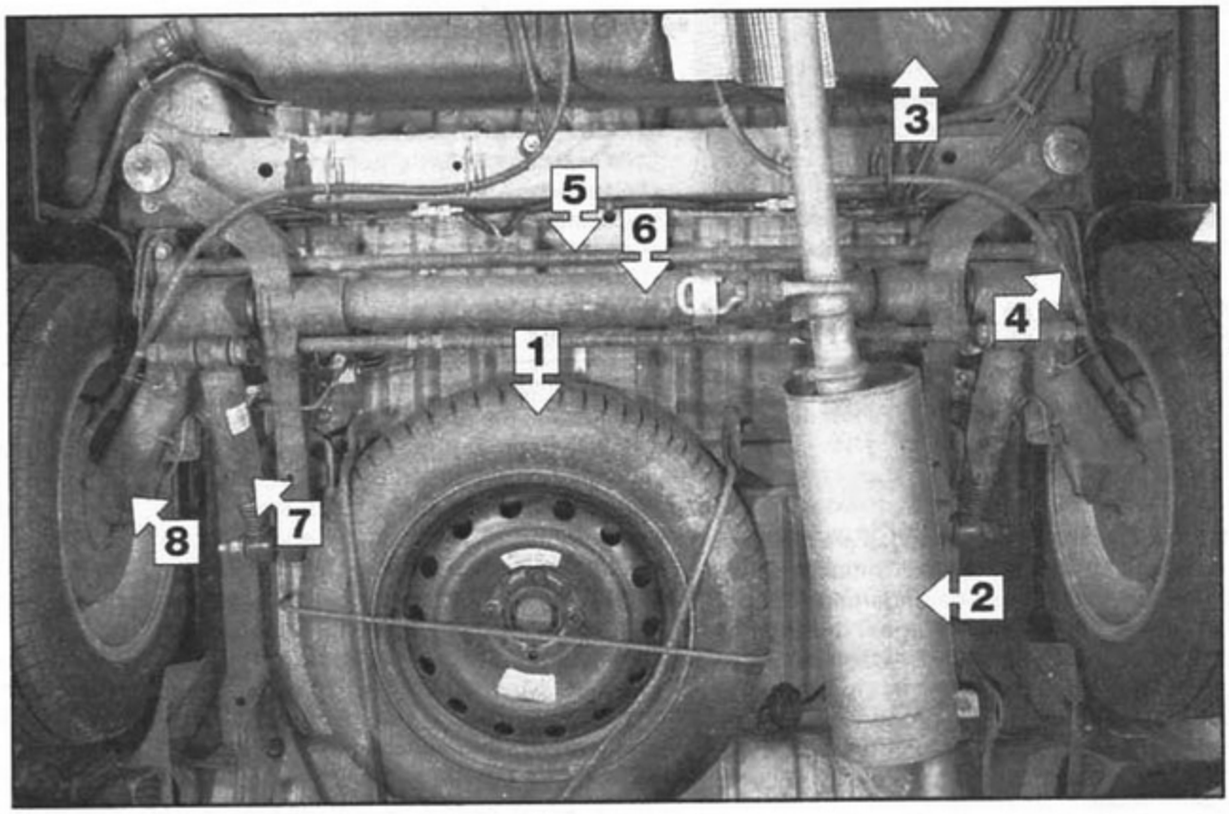
Front underbody view



1 *Sump drain plug*
2 *Alternator*
3 *Power steering pipe*
4 *Transmission oil drain plug*
5 *Front suspension lower arm*
6 *Front brake caliper*
7 *Track rod balljoint*
8 *Front anti-roll bar*
9 *Front suspension subframe*
10 *Steering gear assembly*
11 *Right-hand driveshaft*
12 *Engine/transmission rear mounting*

Rear underbody view

1 *Spare wheel*
2 *Rear silencer*
3 *Fuel tank*
4 *Handbrake cable*
5 *Rear suspension torsion bar*
6 *Rear suspension tubular crossmember*
7 *Rear shock absorber*
8 *Rear suspension trailing arm*



Maintenance procedures

1 General information

This Chapter is designed to help the home mechanic maintain his/her vehicle for safety, economy, long life and peak performance.

The Chapter contains a master maintenance schedule, followed by Sections dealing specifically with each task in the schedule. Visual checks, adjustments, component renewal and other helpful items are included. Refer to the accompanying illustrations of the engine compartment and the underside of the vehicle for the locations of the various components.

Servicing your vehicle in accordance with the mileage/time maintenance schedule and the following Sections will provide a planned maintenance programme, which should result in a long and reliable service life. This is a comprehensive plan, so maintaining some items but not others at the specified service intervals will not produce the same results.

As you service your vehicle, you will discover that many of the procedures can – and should – be grouped together, because of the particular procedure being performed, or because of the proximity of two otherwise-unrelated components to one another. For example, if the vehicle is raised for any reason, the exhaust can be inspected at the same time as the suspension and steering components.

The first step in this maintenance programme is to prepare yourself before the actual work begins. Read through all the Sections relevant to the work to be carried out, then make a list and gather all the parts and tools required. If a problem is encountered, seek advice from a parts specialist, or a dealer service department.

Service interval display

Certain models are equipped with a service interval display indicator in the instrument panel. When the ignition is initially switched on, a spanner appears in the display window and the total number of miles remaining until the next service is due is also shown.

The display should not necessarily be used as a definitive guide to the servicing needs of your Xsara, but it is useful as a reminder, to ensure that servicing is not accidentally overlooked. Owners of older cars, or those covering a small annual mileage, may feel inclined to service their car more often, in which case the service interval display is perhaps less relevant.

The display should be reset whenever a service is carried out, and this is achieved using the trip meter reset button on the instrument panel as follows.

With the ignition switched off, press and hold down the trip meter reset button. Switch the ignition on and the mileage remaining until the next service will flash. Continue to hold the button down for a further ten seconds. The spanner symbol will disappear and the mileage will return to zero.

2 Regular maintenance

1 If, from the time the vehicle is new, the routine maintenance schedule is followed closely, and frequent checks are made of fluid levels and high-wear items, as suggested throughout this manual, the engine will be kept in relatively good running condition, and the need for additional work will be minimised.

2 It is possible that there will be times when the engine is running poorly due to the lack of regular maintenance. This is even more likely if a used vehicle, which has not received regular and frequent maintenance checks, is purchased. In such cases, additional work

may need to be carried out, outside of the regular maintenance intervals.

3 If engine wear is suspected, a compression test or leakdown test (refer to Chapter 2C) will provide valuable information regarding the overall performance of the main internal components. Such a test can be used as a basis to decide on the extent of the work to be carried out. If, for example, a compression or leakdown test indicates serious internal engine wear, conventional maintenance as described in this Chapter will not greatly improve the performance of the engine, and may prove a waste of time and money, unless extensive overhaul work is carried out first.

4 The following series of operations are those most often required to improve the performance of a generally poor-running engine:

Primary operations

a) Clean, inspect and test the battery (See 'Weekly checks').
b) Check all the engine-related fluids (see 'Weekly checks').
c) Check the fuel filter (Sections 4 and 17).
d) Check the condition of all hoses, and check for fluid leaks (Section 5).
e) Check the condition of the auxiliary drivebelt (Section 6).
f) Check the condition of the air filter, and renew if necessary (Section 18).

5 If the above operations do not prove fully effective, carry out the following secondary operations:

Secondary operations

All items listed under *Primary operations*, plus the following:

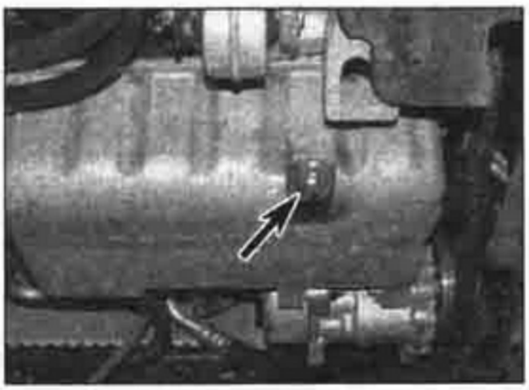
a) Check the charging system (Chapter 5A).
b) Check the preheating system (Chapter 5C).
c) Check the fuel system (Chapter 4B).

Every 12 500 miles (20 000 km) or 12 months

3 Engine oil and filter renewal

1 Frequent oil and filter changes are the most important preventative maintenance procedures which can be undertaken by the DIY owner. As engine oil ages, it becomes diluted and contaminated, which leads to premature engine wear.

2 Before starting this procedure, gather together all the necessary tools and materials. Also make sure that you have plenty of clean rags and newspapers handy, to mop up any spills. Ideally, the engine oil should be warm, as it will drain better, and any impurities suspended in the oil will be removed with it. Take care, however, not to touch the exhaust or any other hot parts of the engine when working under the vehicle. To avoid any possibility of scalding, and to protect yourself from possible skin irritants and other harmful contaminants in used engine oils, it is advisable to wear rubber gloves when carrying out this work. Access to the underside of the vehicle will be greatly improved if it can be raised on a lift, driven onto ramps, or jacked up and supported on axle stands (see *Jacking and vehicle support*). Whichever method is chosen, make sure that the vehicle remains level, or if it is at an angle, that the drain plug is at the lowest point.



3.3 Engine oil sump drain plug location (arrowed)

3 Remove the engine undertray, then slacken the sump drain plug about half a turn **(see illustration)**. Position the draining container under the drain plug, then remove the plug completely. If possible, try to keep the plug pressed into the sump while unscrewing it by hand the last couple of turns **(see Haynes Hint)**. Recover the sealing ring from the drain plug.

4 Allow some time for the old oil to drain, noting that it may be necessary to reposition the container as the oil flow slows to a trickle.

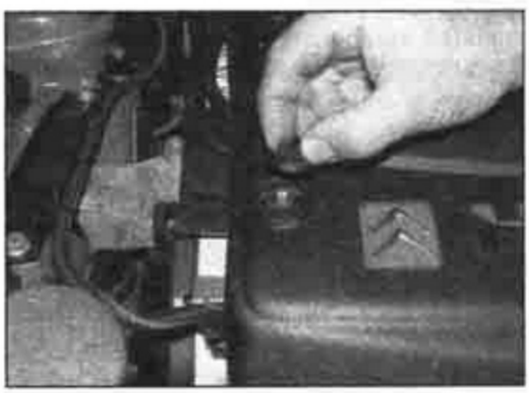
5 After all the oil has drained, wipe off the drain plug with a clean rag, and fit a new sealing washer. Clean the area around the drain plug opening, and refit the plug. Tighten the plug securely.

6 Release the four plastic fasteners and lift off the engine cover **(see illustrations)**.

7 Move the container into position under the oil filter, which is located on the front facing side of the cylinder block **(see illustration)**.

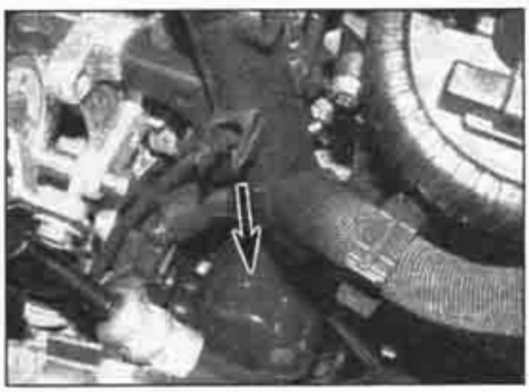
8 Using an oil filter removal tool if necessary, slacken the filter initially, then unscrew it by hand the rest of the way. Empty the oil in the old filter into the container. To ensure that the old filter is completely empty before disposal, puncture the filter dome in at least two places and allow any remaining oil to drain through the punctures and into the container.

9 Use a clean rag to remove all oil and dirt from the filter sealing area on the engine. Check the old filter to make sure that the rubber sealing ring hasn't stuck to the engine. If it has, carefully remove it.



3.6a Release the four plastic fasteners . . .

3.6b . . . and lift off the engine cover



3.7 Engine oil filter location (arrowed)

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As the drain plug releases from the threads, move it away sharply so the stream of oil issuing from the sump runs into the container, not up your sleeve.

10 Apply a light coating of clean engine oil to the sealing ring on the new filter, then screw it into position on the engine. Tighten the filter firmly by hand only – do not use any tools.

11 Refit the engine undertray then remove the old oil and all tools from under the vehicle. Lower the vehicle to the ground (if applicable).

12 Remove the dipstick, then unscrew the oil filler cap from the oil filler/breather neck. Fill the engine, using the correct grade and type of oil (see *Lubricants and fluids*). An oil can spout or funnel may help to reduce spillage. Pour in half the specified quantity of oil first, then wait a few minutes for the oil to fall to the sump. Continue adding oil a small quantity at a time until the level is up to the lower mark on the dipstick. Adding approximately 1.25 litres will bring the level up to the upper mark on the dipstick. Refit the filler cap.

13 Start the engine and run it for a few minutes; check for leaks around the oil filter seal and the sump drain plug. Note that there may be a delay of a few seconds before the oil pressure warning light goes out when the engine is first started, as the oil circulates through the engine oil galleries and the new oil filter before the pressure builds-up.

14 Switch off the engine, and wait a few minutes for the oil to settle in the sump once more. With the new oil circulated and the filter completely full, recheck the level on the dipstick, and add more oil as necessary.

15 Refit the engine cover and secure with the four fasteners.

16 Dispose of the used engine oil and filter safely, with reference to *General repair procedures* at the rear of this manual. Do not discard the old filter with domestic household waste. The facility for waste oil disposal provided by many local council refuse tips generally has a filter receptacle alongside.

4 Fuel filter water draining

1 Release the four plastic fasteners and remove the engine cover from the top of the engine.

2 Firmly apply the handbrake, then jack up the front of the vehicle and support it securely on axle stands (see *Jacking and vehicle support*). Remove the engine undertray.

3 Place a container beneath the fuel filter housing on the front of the engine. Note that there is a drain tube extending down to the underside of the engine, below the filter housing

4 Open the drain tap, located at the base of the filter, by turning it anti-clockwise **(see illustration)**.

5 Allow fuel and water to drain until fuel, free from water, emerges from the drain tube. Close the drain tap, and tighten it securely.

6 Dispose of the drained fuel safely.

7 Refit the engine undertray and lower the vehicle to the ground.

8 Refit the engine cover and start the engine. Priming is not required as the fuel system is self-bleeding.

5 Underbonnet/underbody component/hose fluid leak check

Warning: Refer to the safety information given in 'Safety First!' and Chapter 3 before disturbing any of the cooling system components.

1 Release the four plastic fasteners and remove the engine cover from the top of the engine.

2 Carefully check the radiator and heater coolant hoses along their entire length. Renew any hose which is cracked, swollen or which shows signs of deterioration. Cracks will show up better if the hose is squeezed. Pay close attention to the clips that secure the hoses to the cooling system components. Hose clips that have been over-tightened can pinch and puncture hoses, resulting in cooling system leaks.

3 Inspect all the cooling system components (hoses, joint faces, etc) for leaks. Where any problems of this nature are found on system components, renew the component or gasket with reference to Chapter 3 **(see Haynes Hint)**.

Fuel

Warning: Refer to the safety information given in 'Safety First!' and Chapter 4B before disturbing any of the fuel system components.

4 Unlike petrol leaks, diesel leaks are fairly easy to pinpoint; diesel fuel tends to settle on the surface around the point of leakage collecting dirt, rather than evaporate. If you suspect that there is a fuel leak from the area of the engine bay, leave the vehicle overnight then start the engine from cold, and allow it to idle with the bonnet open. Metal components tend to shrink when they are cold, and rubber seals and hoses tend to harden, so any leaks may be more apparent whilst the engine is warming-up from a cold start.

5 Check all fuel lines at their connections to the high pressure fuel pump, and fuel filter. Examine each rubber fuel hose along its length for splits or cracks. Check for leakage from the crimped joints between rubber and metal fuel lines. Examine the unions between the metal fuel lines and the fuel filter housing. Also check the area around the fuel injectors for signs of leakage.

6 To identify fuel leaks between the fuel tank and the engine bay, the vehicle should be raised and securely supported on axle stands (see *Jacking and vehicle support*). Inspect the fuel tank and filler neck for punctures, cracks and other damage. The connection between the filler neck and tank is especially critical. Sometimes a rubber filler neck or connecting hose will leak due to loose retaining clamps or deteriorated rubber.

4.4 Fuel filter water drain tap location (arrowed)

7 Carefully check all rubber hoses and metal fuel lines leading away from the fuel tank. Check for loose connections, deteriorated hoses, kinked lines, and other damage. Pay particular attention to the vent pipes and hoses, which often loop up around the filler neck and can become blocked or kinked, making tank filling difficult. Follow the fuel supply and return lines to the front of the vehicle, carefully inspecting them all the way for signs of damage or corrosion. Renew damaged sections as necessary.

Engine oil

8 Inspect the area around the cylinder head cover, cylinder head, oil filter and sump joint faces. Bear in mind that, over a period of time, some very slight seepage from these areas is to be expected – what you are really looking for is any indication of a serious leak caused by gasket failure. Engine oil seeping from the base of the timing belt cover or the transmission bellhousing may be an indication of crankshaft or transmission input shaft oil seal failure. Should a leak be found, renew the failed gasket or oil seal by referring to the appropriate Chapter in this manual.

Power steering fluid

9 Examine the power steering fluid feed and return hoses and pipes running between the power steering pump and the steering rack. To identify any problems where the pipes run under the engine, the vehicle should be raised

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A leak in the cooling system will usually show up as white- or rust-coloured deposits on the area adjoining the leak.

and securely supported on axle stands (see *Jacking and vehicle support*). The engine undertray should also be removed.

10 Check the condition of each hose carefully. Look for deterioration caused by corrosion and damage from grounding, or debris thrown up from the road surface.

11 Pay particular attention to crimped unions, and the area surrounding the hoses that are secured with adjustable worm drive clips. Power steering fluid is a thin oil, and is usually red in colour.

Air conditioning refrigerant

⚠ ***Warning: Refer to the safety information given in 'Safety First!' and Chapter 3, regarding the dangers of disturbing any of the air conditioning system components.***

12 The air conditioning system is filled with a liquid refrigerant, which is retained under high pressure. If the air conditioning system is opened and depressurised without the aid of specialised equipment, the refrigerant will immediately turn into gas and escape into the atmosphere. If the liquid comes into contact with your skin, it can cause severe frostbite. In addition, the refrigerant contains substances which are environmentally damaging; for this reason, it should not be allowed to escape into the atmosphere.

13 Any suspected air conditioning system leaks should be immediately referred to a Citroën dealer or air conditioning specialist. Leakage will be shown up as a steady drop in the level of refrigerant in the system.

14 Note that water may drip from the condenser drain pipe, underneath the vehicle, immediately after the air conditioning system has been in use. This is normal, and should not be cause for concern.

Hydraulic fluid

⚠ ***Warning: Refer to the safety information given in 'Safety First!' and Chapter 9, regarding the dangers of handling brake fluid.***

15 With reference to Chapter 9, examine the area surrounding the brake pipe unions at the master cylinder for signs of leakage. Check the area around the base of fluid reservoir, for signs of leakage caused by seal failure. Also examine the brake pipe unions at the ABS hydraulic unit.

16 If fluid loss is evident, but the leak cannot be pinpointed in the engine bay, the brake calipers/wheel cylinders and underbody brake lines should be carefully checked with the vehicle raised and supported on axle stands (see *Jacking and vehicle support*). Leakage of fluid from the braking system is a serious fault that must be rectified immediately.

17 Hydraulic fluid is a toxic substance with a watery consistency. New fluid is almost colourless, but it becomes darker with age and use.

18 On models with a hydraulically-operated clutch, the hydraulic system is supplied with fluid from the brake master cylinder reservoir. Inspect all the clutch hydraulic pipes and connections at the master and slave cylinders in the same way as for the brake fluid checks, referring to Chapter 6 for additional information.

Unidentified fluid leaks

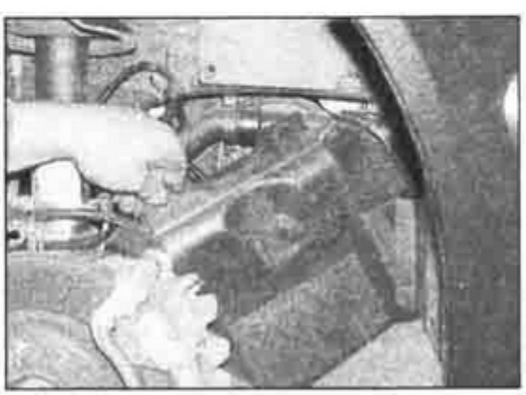
19 If there are signs that a fluid of some description is leaking from the vehicle, but you cannot identify the type of fluid or its exact origin, park the vehicle overnight and slide a large piece of card underneath it. Providing that the card is positioned in roughly the right location, even the smallest leak will show up on the card. Not only will this help you to pinpoint the exact location of the leak, it should be easier to identify the fluid from its colour. Bear in mind, though, that the leak may only be occurring when the engine is running.

Vacuum hoses

20 Although the braking system is hydraulically-operated, the brake servo unit amplifies the effort applied at the brake pedal, by making use of the vacuum generated by the engine-driven vacuum pump. Vacuum is ported to the servo by means of a medium-bore hose. Any leaks that develop in this hose will seriously reduce the effectiveness of the braking system.

21 In addition, a number of the underbonnet components, particularly the emission control components, are driven by vacuum supplied from the vacuum pump via narrow-bore hoses. A leak in a vacuum hose means that air is being drawn into the hose (rather than escaping from it) and this makes leakage very difficult to detect. One method is to use an old length of vacuum hose as a kind of stethoscope – hold one end close to (but not in) your ear and use the other end to probe the area around the suspected leak. When the end of the hose is directly over a vacuum leak, a hissing sound will be heard clearly through the hose. Care must be taken to avoid contacting hot or moving components, as the engine must be running, when testing in this manner. Renew any vacuum hoses that are found to be defective.

6.3a Using a forked type tool, extract the wheelarch liner retaining studs . . .



6.3b . . . then remove the liner centre section from under the front wing

6 Auxiliary drivebelt check and renewal

1 A single, multi-ribbed auxiliary drivebelt is fitted. The belt drives the alternator, power steering pump and air conditioning compressor according to equipment fitted, and is adjusted by means of an automatic spring-loaded tensioning mechanism.

Checking the drivebelt condition

2 Chock the rear wheels then jack up the front of the vehicle and support it on axle stands (see *Jacking and vehicle support*). Remove the right-hand front roadwheel.

3 To gain access to the right-hand end of the engine, the centre section of the wheelarch plastic liner must be removed. The liner is secured by stud-type plastic clips along its upper and front edges. These clips can be removed using a forked type tool, or alternatively, with a large screwdriver (although there is a risk of breakage if the screwdriver method is used). Extract all the clips, then remove the liner centre section from under the front wing **(see illustrations)**. It will be necessary to ease back the front liner section slightly to allow the front edge of the centre section to be released. Note how the two sections overlap as you do this to aid refitting. Unclip the coolant hoses from under the wing to improve access further.

4 Using a suitable socket and extension bar fitted to the crankshaft pulley bolt, rotate the crankshaft so that the entire length of the drivebelt can be examined. Examine the drivebelt for cracks, splitting, fraying or damage. Check also for signs of glazing (shiny patches) and for separation of the belt plies. Renew the belt if worn or damaged.

Removal

Note: *The following procedure is applicable to engines with and without air conditioning.*

5 If not already done, proceed as described in paragraphs 2 and 3.

6 Using a suitable spanner engaged with the hexagonal stud in the centre of the automatic tensioner pulley, move the pulley toward the rear of the vehicle to release the tension on

the drivebelt, then slip the belt off the pulleys **(see illustration)**. Note that considerable effort will be needed to move the pulley against spring tension and it may be necessary to use some form of extension piece on the spanner to exert sufficient leverage.

Refitting and tensioning

7 Using the spanner on the hexagonal stud of the automatic tensioner pulley, move the pulley toward the rear of the vehicle until the hole in the pulley arm is aligned with the hole in the mounting bracket behind. When the holes are aligned, slide a suitable locking tool (a bolt or cranked length of bar of approximately 4.0 mm diameter) through the hole in the arm and into the mounting bracket **(see illustrations)**. It is useful to have a small mirror available to enable the alignment of the locking holes to be more easily seen in the limited space available.

8 Working under the wheelarch, slacken the retaining bolt located in the centre of the eccentric tensioner pulley **(see illustration)**.

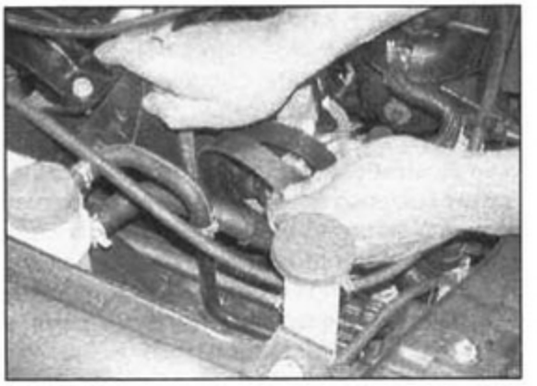
9 If the belt is being renewed, ensure that the correct type is used. Fit the belt around the pulleys, ensuring that the ribs on the belt are correctly engaged with the grooves in the pulleys, and that the drivebelt is correctly routed **(see illustrations)**.

10 Turn the eccentric tensioner pulley to apply tension to the drivebelt, until the load is released from the locking tool in the automatic tensioner. Without altering the position of the eccentric tensioner pulley, tighten its retaining bolt to the specified torque.

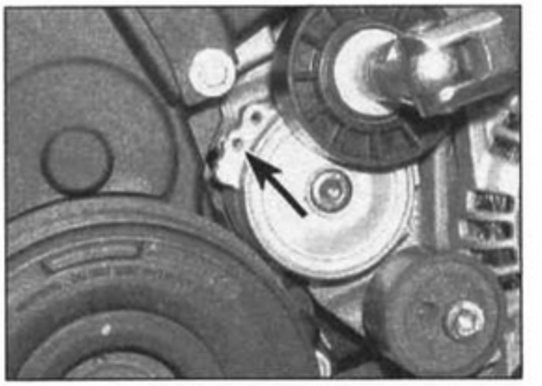
11 Remove the locking tool from the automatic tensioner, then rotate the crankshaft through four complete revolutions in the normal direction of rotation.

12 Check that the holes in the automatic adjuster and the mounting bracket are still aligned, and that it is now possible to insert a setting tool of 2.0 mm diameter through both holes. If the setting tool will not slide in easily, slacken the eccentric tensioner pulley retaining bolt and repeat the entire tensioning procedure.

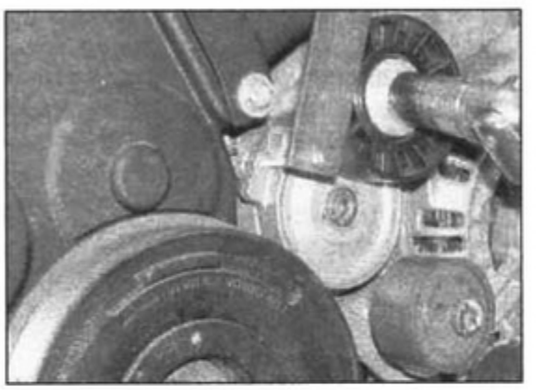
13 On completion, clip the coolant hoses into position (where necessary), then refit the wheelarch liner. Refit the roadwheel and lower the vehicle to the ground.



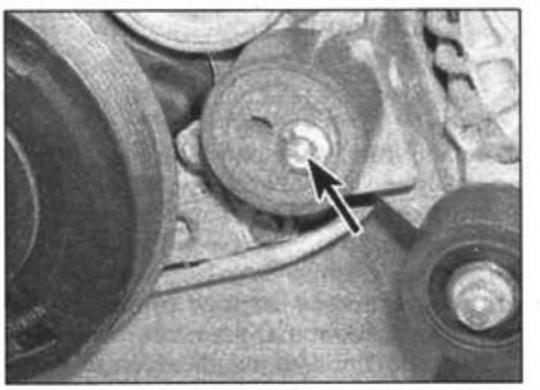
6.6 Using a spanner, move the automatic tensioner pulley rearwards, then slip the drivebelt off the pulleys



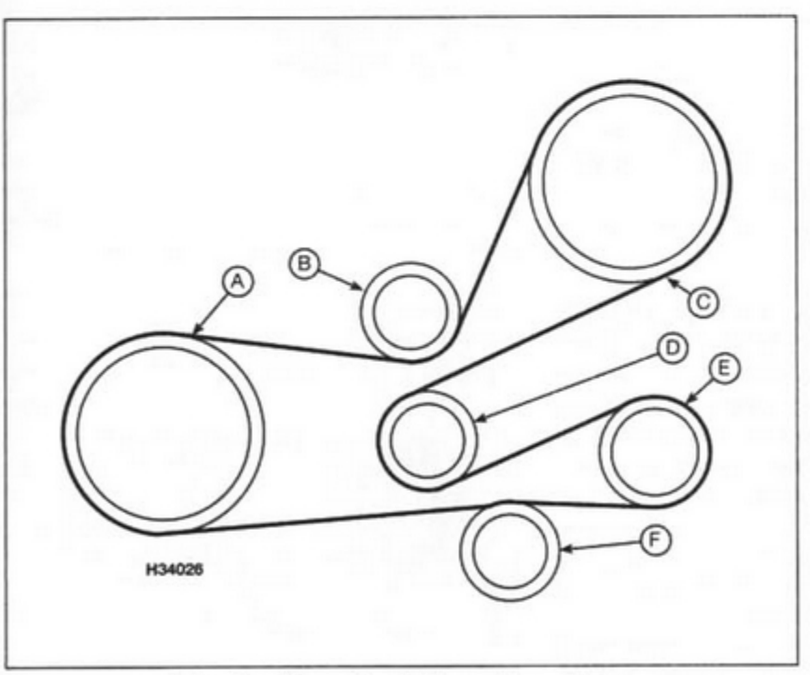
6.7a Turn the tensioner pulley until the hole in the pulley arm (arrowed) is aligned with the hole in the mounting bracket . . .



6.7b . . . then insert a 4.0 mm locking tool through the hole and into the mounting bracket

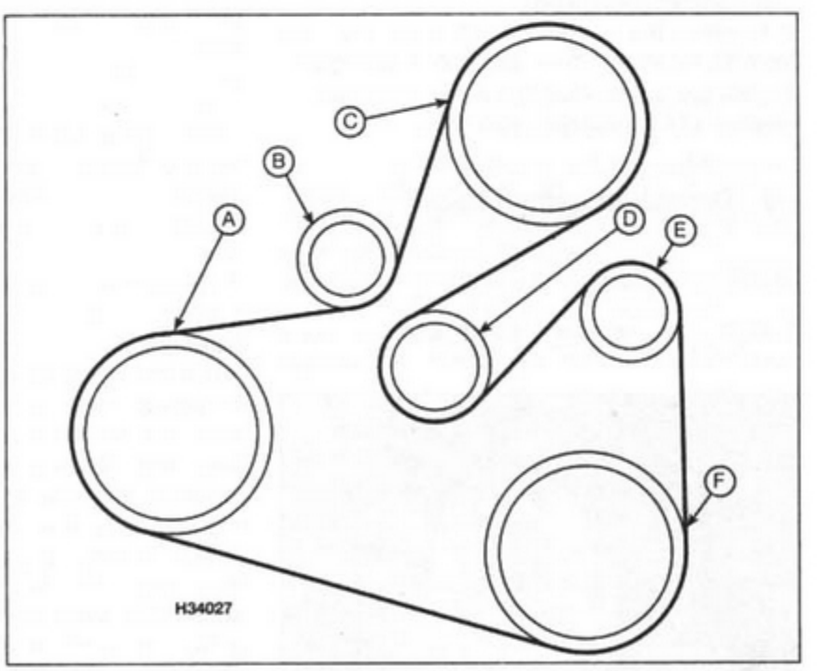


6.8 Slacken the retaining bolt (arrowed) located in the centre of the eccentric tensioner pulley



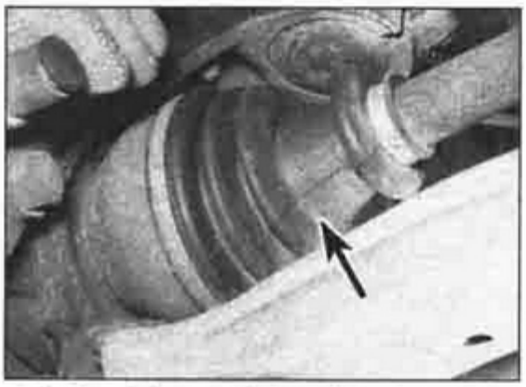
6.9a Auxiliary drivebelt configuration – engines without air conditioning

A Crankshaft pulley
B Automatic tensioner pulley
C Power steering pump pulley
D Eccentric tensioner pulley
E Alternator pulley
F Idler pulley



6.9b Auxiliary drivebelt configuration – engines with air conditioning

A Crankshaft pulley
B Automatic tensioner pulley
C Power steering pump pulley
D Eccentric tensioner pulley
E Alternator pulley
F Air conditioning compressor pulley



9.1 Check the condition of the driveshaft gaiters (arrowed)

7 Clutch control mechanism check

1 Check that the clutch pedal moves smoothly and easily through its full travel, and that the clutch itself functions correctly, with no trace of slip or drag.

2 On models with a cable-operated clutch, if excessive effort is required to operate the clutch, check first that the cable is correctly routed and undamaged, then remove the pedal and check that its pivot is properly greased. See Chapter 6 for more information.

8 Pollen filter renewal

1 Working in the engine compartment, undo the plastic nuts securing the filter access cover to the centre of the engine compartment bulkhead.

2 Remove the cover and withdraw the filter from its location. Clean the filter housing and the access cover, then fit the new filter using a reversal of the removal procedure.

9 Driveshaft gaiter check

1 With the vehicle raised and securely supported on stands (see *Jacking and vehicle support*), and the undertray removed, turn the steering onto full lock, then slowly rotate the roadwheel. Inspect the condition of the outer constant velocity (CV) joint rubber gaiters, squeezing the gaiters to open out the folds **(see illustration)**. Check for signs of cracking, splits or deterioration of the rubber, which may allow the grease to escape, and lead to water and grit entry into the joint. Also check the security and condition of the retaining clips. Repeat these checks on the inner CV joints. If any damage or deterioration is found, the gaiters should be renewed (see Chapter 8).

2 At the same time, check the general condition of the CV joints themselves by first holding the driveshaft and attempting to rotate the wheel. Repeat this check by holding the inner joint and attempting to rotate the driveshaft. Any appreciable movement indicates wear in the joints, wear in the driveshaft splines, or a loose driveshaft retaining nut.

10.4 Check for wear in the hub bearings by grasping the wheel and trying to rock it

10 Steering and suspension check

Front suspension and steering

1 Firmly apply the handbrake, then jack up the front of the vehicle and support it securely on axle stands (see *Jacking and vehicle support*). Remove the engine undertray, then refit it again after completing all the checks at the front of the vehicle.

2 Visually inspect the balljoint dust covers and the steering rack-and-pinion gaiters for splits, chafing or deterioration. Any wear of these components will cause loss of lubricant, together with dirt and water entry, resulting in rapid deterioration of the balljoints or steering gear.

3 Check the power steering fluid hoses for chafing or deterioration, and the pipe and hose unions for fluid leaks. Also check for signs of fluid leakage under pressure from the steering gear rubber gaiters, which would indicate failed fluid seals within the steering gear.

4 Grasp the roadwheel at the 12 o'clock and 6 o'clock positions, and try to rock it **(see illustration)**. Very slight free play may be felt, but if the movement is appreciable, further investigation is necessary to determine the source. Continue rocking the wheel while an assistant depresses the footbrake. If the movement is now eliminated or significantly reduced, it is likely that the hub bearings are at fault. If the free play is still evident with the footbrake depressed, then there is wear in the suspension joints or mountings.

5 Now grasp the wheel at the 9 o'clock and 3 o'clock positions, and try to rock it as before. Any movement felt now may again be caused by wear in the hub bearings or the steering track rod balljoints. If the inner or outer balljoint is worn, the visual movement will be obvious.

6 Using a large screwdriver or flat bar, check for wear in the suspension mounting bushes by levering between the relevant suspension component and its attachment point. Some movement is to be expected as the mountings are made of rubber, but excessive wear should be obvious. Also check the condition of any visible rubber bushes, looking for splits, cracks or contamination of the rubber.

7 With the vehicle standing on its wheels, have an assistant turn the steering wheel back-and-forth about an eighth of a turn each way. There should be very little, if any, lost movement between the steering wheel and roadwheels. If this is not the case, closely observe the joints and mountings previously described, but in addition, check the steering column universal joints for wear, and the rack-and-pinion steering gear itself.

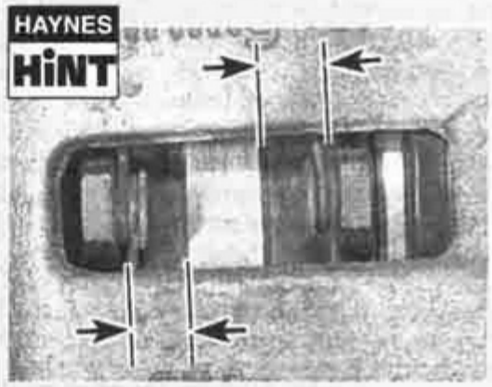
Suspension strut/shock absorber

8 Check for any signs of fluid leakage around the suspension strut/shock absorber body, or from the rubber gaiter around the piston rod. Should any fluid be noticed, the suspension strut/shock absorber is defective internally, and should be renewed. **Note:** *Suspension struts/shock absorbers should always be renewed in pairs on the same axle.*

9 The efficiency of the suspension strut/shock absorber may be checked by bouncing the vehicle at each corner. Generally speaking, the body will return to its normal position and stop after being depressed. If it rises and returns on a rebound, the suspension strut/shock absorber is probably suspect. Examine also the suspension strut/shock absorber upper and lower mountings for any signs of wear.

11 Front brake pad condition check

1 Firmly apply the handbrake, then jack up the front of the vehicle and support it securely on axle stands (see *Jacking and vehicle support*). Remove the front roadwheels.



For a quick check, the thickness of friction material remaining on each brake pad can be measured through the aperture in the caliper body.

2 It is now possible to check the thickness of the pad friction material **(see Haynes Hint)**. If any pad's friction material is worn to the specified thickness or less, *all four pads must be renewed as a set.* **Note:** *If any pad is approaching the minimum thickness, consider renewal as a precautionary measure in case the pads wear out before the next service.*

3 For a comprehensive check, the brake pads should be removed and cleaned. The operation of the caliper can then be checked, and the brake disc itself can be fully examined on both sides. Refer to Chapter 9 for details.

12 Exhaust system check

1 With the engine cold (at least an hour after the vehicle has been driven), check the complete exhaust system from the engine to the end of the tailpipe. The exhaust system is most easily checked with the vehicle raised on a hoist, or suitably supported on axle stands, so that the exhaust components are readily visible and accessible (see *Jacking and vehicle support*).

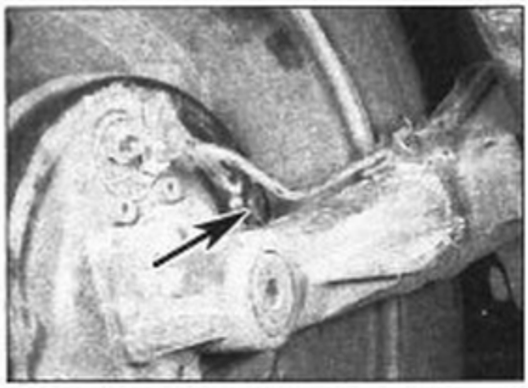
2 Check the exhaust pipes and connections for evidence of leaks, severe corrosion and damage. Make sure that all brackets and mountings are in good condition, and that all relevant nuts and bolts are tight. Leakage at any of the joints or in other parts of the system will usually show up as a black sooty stain in the vicinity of the leak.

3 Rattles and other noises can often be traced to the exhaust system, especially the brackets and mountings. Try to move the pipes and silencers. If the components are able to come into contact with the body or suspension parts, secure the system with new mountings. Otherwise separate the joints (if possible) and twist the pipes as necessary to provide additional clearance.

13 Rear brake shoe condition check

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

2 For a quick check, the thickness of friction material remaining on one of the brake shoes can be measured through the slot in the brake backplate that is exposed by prising out its sealing grommet **(see illustrations)**. If a rod of the same diameter as the specified minimum thickness is placed against the shoe friction material, the amount of wear can quickly be assessed – a small mirror may help observation. If any shoe's friction material is worn to the specified thickness or less, all four shoes must be renewed as a set. **Note:** *If any shoe is approaching the minimum thickness, consider renewal as a precautionary measure in case the shoes wear out before the next service.*



13.2a Prise the grommet (arrowed) from the rear drum brake backplate

13.2b Viewing the thickness of the brake shoe lining using a small mirror

3 For a comprehensive check, the brake drums should be removed and cleaned. This will permit the wheel cylinders to be checked and the condition of the brake drum itself to be fully examined. Refer to Chapter 9 for further information.

14 Hinge and lock operation and lubrication

1 Work around the vehicle, and lubricate the hinges of the bonnet, doors and tailgate with a small amount of general-purpose oil.

2 Lightly lubricate the bonnet release mechanism and exposed section of inner cable with a smear of grease.

3 Check carefully the security and operation of all hinges, latches and locks, adjusting them where required. Check the operation of the central locking system.

4 Check the condition and operation of the tailgate struts, renewing them if they are leaking or no longer able to support the tailgate securely when raised.

15 Road test

Instruments/ electrical equipment

1 Check the operation of all instruments and electrical equipment.

2 Make sure that all instruments read correctly, and switch on all electrical equipment in turn to check that it works properly.

Steering and suspension

3 Check for any abnormalities in the steering, suspension, handling or road 'feel'.

4 Drive the vehicle, and check that there are no unusual vibrations or noises.

5 Check that the steering feels positive, with no excessive 'sloppiness', or roughness, and check for any suspension noises when cornering, or when driving over bumps.

Drivetrain

6 Check the performance of the engine, clutch, transmission and driveshafts.

7 Listen for any unusual noises from the engine, clutch and transmission.

8 Make sure that the engine runs smoothly when idling, and that there is no hesitation when accelerating.

9 Check that the clutch action is smooth and progressive, that the drive is taken up smoothly, and that the pedal travel is not excessive. Also listen for any noises when the clutch pedal is depressed.

10 Check that all gears can be engaged smoothly, without noise, and that the gear lever action is smooth and not abnormally vague or 'notchy'.

11 Listen for a metallic clicking sound from the front of the vehicle, as the vehicle is driven slowly in a circle with the steering on full lock. Carry out this check in both directions. If a clicking noise is heard, this indicates lack of lubrication or wear in a driveshaft constant velocity joint (see Chapter 8).

Braking system

12 Make sure that the vehicle does not pull to one side when braking, and that the wheels do not lock prematurely when braking hard (models without ABS).

13 Check that there is no vibration through the steering when braking.

14 Check that the handbrake operates correctly, without excessive movement of the lever, and that it holds the vehicle stationary on a slope.

15 Test the operation of the brake servo unit as follows. With the engine off, depress the footbrake four or five times to exhaust the vacuum. Start the engine, holding the brake pedal depressed. As the engine starts, there should be a noticeable 'give' in the brake pedal as vacuum builds-up. Allow the engine to run for at least two minutes, and then switch it off. If the brake pedal is depressed now, it should be possible to detect a hiss from the servo as the pedal is depressed. After about four or five applications, no further hissing should be heard, and the pedal should feel considerably firmer.

Every 25 000 miles (40 000 km) or 2 years

16 Brake fluid renewal

Warning: Brake hydraulic fluid can harm your eyes and damage painted surfaces, so use extreme caution when handling and pouring it. Do not use fluid that has been standing open for some time, as it absorbs moisture from the air. Excess moisture can cause a dangerous loss of braking effectiveness.

Note: *Also renew the fluid on models fitted with a hydraulic clutch, with reference to Chapter 6.*

1 The procedure is similar to that for the bleeding of the hydraulic system as described in Chapter 9, except that the brake fluid reservoir should be emptied by syphoning, using a clean poultry baster or similar before starting, and allowance should be made for the old fluid to be expelled when bleeding a section of the circuit.

2 Alternatively, to empty the reservoir, working as described in Chapter 9, open the first bleed screw in the sequence, and pump the brake pedal gently until nearly all the old fluid has been emptied from the master cylinder reservoir.

> **HAYNES HiNT** ***Old hydraulic fluid is invariably much darker in colour than the new, making it easy to distinguish the two.***

3 Top-up to the MAX level with new fluid, and continue pumping until only the new fluid remains in the reservoir, and new fluid can be seen emerging from the bleed screw. Tighten the screw, and top the reservoir level up to the MAX level line.

4 Work through all the remaining bleed screws in the sequence until new fluid can be seen at all of them. Be careful to keep the master cylinder reservoir topped-up to above the DANGER level at all times, or air may enter the system and increase the length of the task.

5 When the operation is complete, check that all bleed screws are securely tightened, and that their dust caps are refitted. Wash off all traces of spilt fluid, and recheck the master cylinder reservoir fluid level.

6 Check the operation of the brakes before taking the vehicle on the road.

Every 37 500 miles (60 000 km) or 3 years

17 Fuel filter renewal

Warning: Refer to the safety information given in 'Safety First!' and Chapter 4B before disturbing any of the fuel system components.

Early type filter assembly

Note: *The early type filter assembly can be recognised by the absence of an electrical connector on the filter housing cover.*

1 Firmly apply the handbrake, then jack up the front of the vehicle and support it securely on axle stands (see *Jacking and vehicle support*). Remove the engine undertray.

2 Release the four plastic fasteners and remove the engine cover from the top of the engine.

3 The fuel filter is located in a plastic housing at the front of the engine.

4 Cover the area below the filter housing with rags or a piece of plastic sheeting, to protect against fuel spillage.

5 Thoroughly clean the exterior of filter housing, paying particular attention to the fuel hose unions and the area around the cover-to-housing joint.

6 Position a suitable container under the fuel filter drain outlet. Open the drain screw on the base of the filter housing, and allow the fuel to drain completely. Securely tighten the drain screw when the fuel has completely drained.

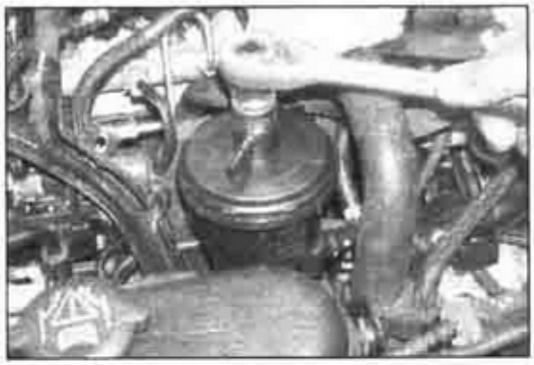
7 At the connections on the filter housing cover, disconnect the fuel supply and return hose quick-release fittings using a small screwdriver to release the locking clip **(see illustration)**. Suitably plug or cover the open hose unions to prevent dirt entry.

8 Using a suitable socket engaged with the hexagonal moulding on the filter housing cover, turn the cover approximately a quarter turn anti-clockwise to release the locking lugs **(see illustration)**.

9 Lift off the housing cover, and collect the metal sealing ring and the O-ring seal, then lift out the filter element **(see illustrations)**.

10 Remove all traces of dirt or debris from inside the filter housing then fit the new fuel filter element.

17.7 Disconnect the fuel supply and return hose quick-release fittings . . .

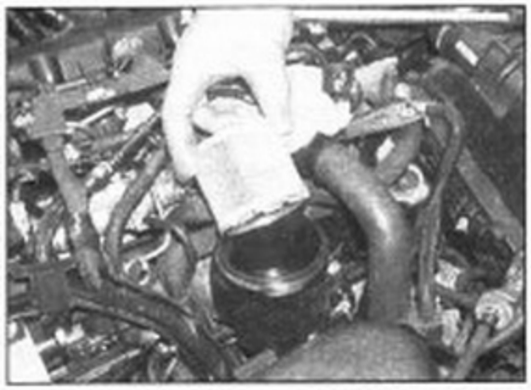


17.8 . . . then turn the filter housing cover anti-clockwise to release the locking lugs – early type filter assembly

17.9a Lift off the filter housing cover . . .

17.9b . . . remove the metal sealing ring . . .

17.9c . . . and the sealing O-ring . . .



17.9d . . . then lift out the filter element – early type filter assembly

11 Locate the O-ring seal in position, followed by the metal sealing ring.
12 Refit the housing cover and turn it clockwise until the arrow on the housing cover is in line with the filter drain outlet **(see illustration)**.
13 Reconnect the fuel supply and return hoses, then start the engine and check for fuel leaks.
14 On completion, refit the engine cover and engine undertray and lower the vehicle to the ground.

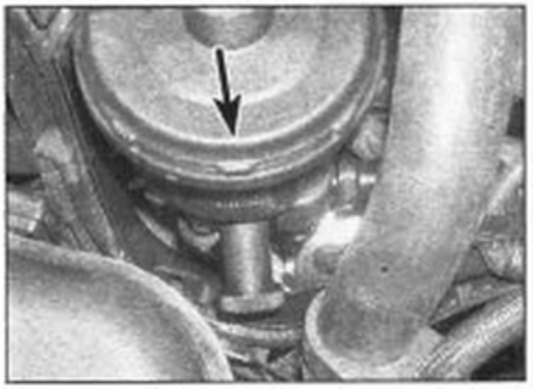
Later type filter assembly

Note: *The later type filter assembly incorporates a fuel heating element and can be recognised by the presence of an electrical connector on the filter housing cover.*

15 Carry out the operations described previously in paragraphs 1 to 5.
16 At the connections on the filter housing cover, disconnect the fuel hose quick-release fittings using a small screwdriver to release the locking clip **(see illustration)**. Suitably plug or cover the open hose unions to prevent dirt entry.
17 Disconnect the wiring connector from the fuel heating element.
18 Unscrew the locking ring securing the filter housing cover to the filter housing.
19 Lift off the housing cover, collect the seals and lift out the filter element.
20 Remove all traces of dirt or debris from inside the filter housing then fit the new fuel filter element.
21 Locate the new seals in position and place the housing cover on the filter housing.
22 Screw the locking ring onto the housing and tighten it securely.
23 Reconnect the fuel hoses, then start the engine and check for fuel leaks.
24 On completion, refit the engine cover and engine undertray and lower the vehicle to the ground.

18 Air filter renewal

1 Disconnect the wiring connector from the underside of the air mass meter **(see illustration)**.



17.12 Refit the filter housing cover and turn it clockwise until the arrow is in line with the drain outlet – early type assembly

2 Slacken the hose clip securing the air mass meter inlet duct to the filter housing lid.
3 Undo the screws securing the lid to the air filter housing.
4 Lift up the lid and detach the air mass meter inlet duct, then withdraw the filter element from the housing.
5 Wipe clean the inside of the filter housing, then fit the new filter element.
6 Refit the lid to the inlet duct and filter housing. Tighten the hose clip and secure the lid with the retaining screws.
7 Reconnect the air mass meter wiring connector.

19 Transmission oil level check

Note: *A suitable square-section wrench may be required to undo the transmission filler/level plug. These wrenches can be obtained from most motor factors or your Citroën dealer. A new sealing washer will also be required when refitting the transmission filler/level plug.*

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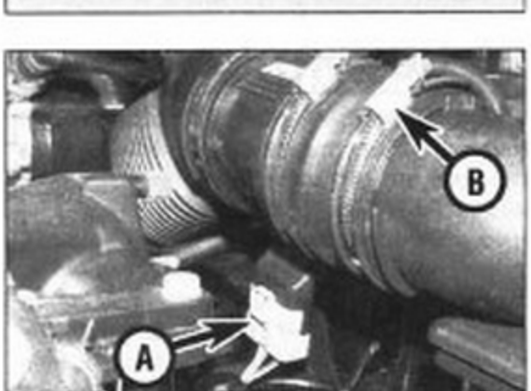
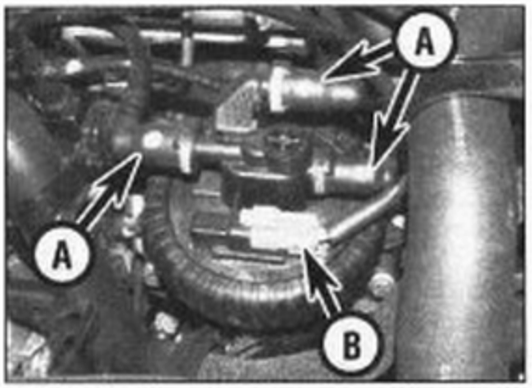
It may be possible to use the square end fitting on a ratchet handle (as found in a typical socket set) to undo the plug.



18.1 Disconnect the air mass meter wiring connector (A), then slacken the inlet duct retaining clip (B)



17.16 Fuel hose quick-release fittings (A) and wiring connector (B) – later type filter assembly

1 The manual transmission oil does not need to be renewed as part of the regular maintenance schedule, but the oil level must be checked and if necessary topped-up at the interval specified here. To drain the transmission as part of a repair procedure, refer to the information given in Chapter 7.
2 The oil level must be checked before the vehicle is driven, or at least 5 minutes after the engine has been switched off. If the oil is checked immediately after driving the vehicle, some of the oil will remain distributed around the transmission components, resulting in an inaccurate level reading.
3 With the vehicle on level ground, firmly apply the handbrake, then jack up the front and rear of the vehicle and support it securely on axle stands (see *Jacking and vehicle support*). Note that the vehicle must be level, to ensure accuracy, when checking the oil level.
4 For improved access to the filler/level plug, the centre section of the left-hand wheelarch plastic liner can be removed after removing the roadwheel. The liner is secured by stud-type plastic clips along it upper and front edges which can be removed using a forked type tool. Extract all the clips, and remove the liner centre section from under the front wing **(see illustration)**. It will be necessary to ease back the front section slightly to allow the front edge of the centre section to be released. Note how the two sections overlap, as you do this, to aid refitting.
5 Wipe clean the area around the filler/level

19.4 Extract the clips and remove the wheelarch liner centre section for access to the transmission filler/level plug

plug, which is on the left-hand end of the transmission. Unscrew the plug and clean it; discard the sealing washer.

6 The oil level should reach the lower edge of the filler/level hole. A certain amount of oil will have gathered behind the filler/level plug, and will trickle out when it is removed; this does **not** necessarily indicate that the level is correct. To ensure that a true level is established, wait until the initial trickle has stopped, then add oil as necessary until a trickle of new oil can be seen emerging **(see illustration)**. The level will be correct when the flow ceases; use only good-quality oil of the specified type (refer to *Lubricants and fluids*).

7 If the transmission has been overfilled so that oil flows out as soon as the filler/level plug is removed, check that the vehicle is completely level (front-to-rear and side-to-side), and allow the surplus to drain off into a container.

8 When the level is correct, fit a new sealing washer to the filler/level plug, refit the plug and tighten it to the specified torque.

9 Refit the wheelarch liner and roadwheel, then lower the vehicle to the ground. Tighten the roadwheel bolts to the specified torque.

19.6 Top-up the transmission until a trickle of new oil can be seen emerging from the filler/level plug

20 Braking system check

Front brakes

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

2 Inspect the area around both brake calipers for signs of brake fluid leakage, either from the piston seals, the brake pipe union or the bleed screw.

3 Examine the brake hoses leading to each caliper and check for signs of cracking, chafing or damage. Renew a hose which shows signs of deterioration without delay.

4 Ensure that the transmission is in neutral, then grasp each front wheel hub and turn it by hand. Slight resistance is normal, but if the hub is difficult to turn smoothly, this indicates that the brake pads are binding, possibly due to a seized or partially-seized brake caliper piston; refer to Chapter 9 for details of caliper removal and overhaul.

5 Remove the front brake pads as described in Chapter 9. Examine the brake pads and measure the depth of the remaining friction material. Renew all four pads, if any are worn below their minimum limit.

6 Using proprietary brake cleaning fluid and a stiff brush, wash all traces of dirt and brake dust from the brake calipers – take care to avoid inhaling any of the airborne brake dust. Examine the piston dust seal for signs of damage or deterioration and check that it is securely seated in its retaining groove.

7 Check the condition of the brake disc with reference to the information given in Chapter 9.

8 Refit the front brake pads as described in Chapter 9, then refit the roadwheels and lower the front of the vehicle to the ground. Tighten the roadwheel bolts to the specified torque.

Rear brakes

9 Chock the front wheels then jack up the rear of the vehicle and support it on axle stands (see *Jacking and vehicle support*).

10 Ensure that the handbrake is released, then grasp each rear roadwheel and turn it by hand. Slight resistance is normal, but if the wheel is difficult to turn smoothly, this could be due to a seized or partially-seized wheel cylinder, or incorrect handbrake adjustment; refer to Chapter 9 for further details.

11 Remove the rear roadwheels, then with reference to Chapter 9, remove the rear brake shoes. Examine the brake shoes and measure the depth of the remaining friction material. Renew all four brake shoes, if any are worn below their minimum limit.

12 Check the brake drums for wear and damage and check the area around the wheel cylinder piston seals for signs of fluid leakage. Check at the rear of the brake backplate for evidence of fluid leakage from the brake pipe union or bleed screw. Renew the wheel cylinder without delay if it shows signs of leakage; see Chapter 9 for details.

13 Using proprietary brake cleaning fluid and a stiff brush, wash all traces of dirt and brake dust from the wheel cylinders and backplates – take care to avoid inhaling any of the airborne brake dust.

14 On completion, refit the brake shoes, brake drums and roadwheels, then lower the vehicle to the ground. Tighten the roadwheel bolts to the specified torque.

21 Handbrake check and adjustment

Refer to Chapter 9.

22 Timing belt renewal

Refer to Chapter 2C.

Note: *Although the normal interval for timing belt renewal is 75 000 miles (120 000 km), it is strongly recommended that the interval is halved to 37 500 miles (60 000 km) on vehicles which are subjected to intensive use, ie, mainly short journeys or a lot of stop-start driving. The actual belt renewal interval is therefore very much up to the individual owner, but bear in mind that severe engine damage will result if the belt breaks.*

Every 75 000 miles (120 000 km) or 5 years

23 Coolant renewal

Cooling system draining

Warning: Wait until the engine is cold before starting this procedure. Do not allow antifreeze to come in contact with your skin, or with the painted surfaces of the vehicle. Rinse off spills immediately with plenty of water. Never leave antifreeze lying around in an open container, or in a puddle in the driveway or on the garage floor. Children and pets are attracted by its sweet smell, but antifreeze can be fatal if ingested.

Note: *Later models are filled with a 'long-life' coolant during vehicle assembly which is claimed to be suitable for ten years use before renewal is required. If you are sure that the vehicle is filled with this type of coolant, then renewal may not be necessary at this service interval. Consult your Citroën dealer for details of coolant specification and renewal recommendations.*

1 With the engine completely cold, remove the expansion tank filler cap. Turn the cap slowly anti-clockwise, wait until any pressure remaining in the system is released, then fully unscrew the cap. Release the four plastic fasteners and lift off the engine cover

2 Firmly apply the handbrake, then jack up the front of the vehicle and support it securely on axle stands (see *Jacking and vehicle support*). Remove the engine undertray.

3 Position a suitable container beneath the bottom hose connection on the radiator. Release the retaining clip, then disconnect the hose and allow the coolant to drain into the container.

4 To assist draining, open the cooling system bleed screws which are located in the heater matrix outlet hose union on the engine compartment bulkhead, and on the thermostat cover.

5 The manufacturers do not specify a requirement to drain the cylinder block at the time of routine coolant renewal. If, however, the coolant is being drained as part of an engine repair procedure (such as cylinder head gasket renewal), then it is advisable to drain the cylinder block also. Note that the cylinder block drain plug is virtually inaccessible and it may be necessary to move certain cables, brackets or hoses to one side for access.

6 To drain the cylinder block, reposition the container below the drain plug located at the rear left-hand side of the cylinder block. Remove the drain plug, and allow the coolant to drain into the container.

7 On completion of draining, refit the radiator bottom hose and cylinder block drain plug (where applicable). Refit any components disturbed for access then, unless the system is to be flushed, refit the engine undertray and lower the vehicle to the ground.

Cooling system flushing

8 If coolant renewal has been neglected, or if the antifreeze mixture has become diluted, then in time, the cooling system may gradually lose efficiency, as the coolant passages become restricted due to rust, scale deposits, and other sediment. The cooling system efficiency can be restored by flushing the system clean.

9 The radiator should be flushed separately from the engine, to avoid excess contamination.

Radiator flushing

10 To flush the radiator, disconnect the top and bottom hoses and any other relevant hoses from the radiator, with reference to Chapter 3.

11 Insert a garden hose into the radiator top inlet. Direct a flow of clean water through the radiator, and continue flushing until clean water emerges from the radiator bottom outlet.

12 If after a reasonable period, the water still does not run clear, the radiator can be flushed with a suitable proprietary cleaning agent, suitable for radiators of plastic/aluminium construction. It is important that the instructions provided with the product are followed carefully. If the contamination is particularly bad, insert the hose in the radiator bottom outlet, and reverse-flush the radiator.

Engine flushing

13 To flush the engine, tighten the cooling system bleed screws, then remove the thermostat (see Chapter 3). Temporarily refit the thermostat cover, without the thermostat.

14 With the top and bottom hoses disconnected from the radiator, insert a garden hose into the radiator top hose. Direct a clean flow of water through the engine, and continue flushing until clean water emerges from the radiator bottom hose.

15 When flushing is complete, refit the thermostat and reconnect the hoses with reference to Chapter 3.

Cooling system filling

16 Before attempting to fill the cooling system, make sure that all hoses and clips are in good condition, and that the clips are tight. Note that an antifreeze mixture must be used all year round, to prevent corrosion of the engine components (see the following sub-Section).

17 If not already done, remove the expansion tank filler cap and open all the cooling system bleed screws (see paragraph 4).

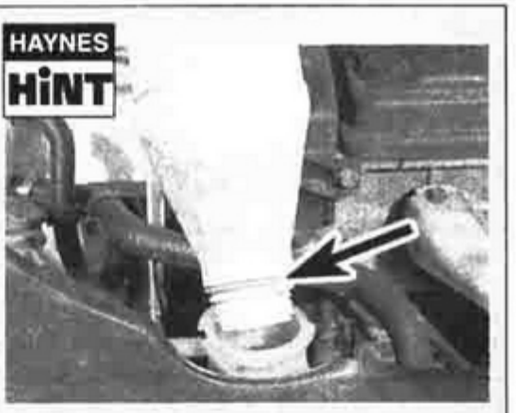
18 To provide the required 'head' of coolant necessary to force all trapped air from the system, a 'header tank' must be used when refilling. Although Citroën dealers use a special header tank, the same effect can be achieved by using a suitable bottle, with a seal between the bottle and the expansion tank **(see Haynes Hint)**.

19 Fit the 'header tank' to the expansion tank and slowly fill the system. Coolant will emerge from each of the bleed screws in turn, starting with the lowest screw. As soon as coolant free from air bubbles emerges from the lowest screw, tighten that screw, and watch the next bleed screw in the system. Repeat the procedure until the coolant is emerging from the highest bleed screw in the cooling system and all bleed screws are securely tightened.

20 Ensure that the 'header tank' is full (at least 0.5 litres of coolant). Start the engine, and run it at a fast idle speed (do not exceed 2000 rpm) until the cooling fan cuts in, and then cuts out three times. Stop the engine.

Note: *Take great care not to scald yourself.*

21 Allow the engine to cool, then remove the 'header tank'.



Cut the bottom off an old antifreeze container to make a 'header tank' for use when refilling the cooling system. The seal at the point arrowed must be as airtight as possible.

22 When the engine has cooled, check the coolant level with reference to *Weekly checks*. Top-up the level if necessary, and refit the expansion tank cap and engine cover.

Antifreeze mixture

23 The antifreeze should always be renewed at the specified intervals (see the note at the beginning of this Section). This is necessary not only to maintain the antifreeze properties, but also to prevent corrosion which would otherwise occur as the corrosion inhibitors become progressively less effective.

24 Always use an ethylene-glycol based antifreeze which is suitable for use in mixed-metal cooling systems. A general guide to the quantity of antifreeze and levels of protection is given in the Specifications, but follow the instructions provided by the antifreeze manufacturer for exact requirements.

25 Before adding antifreeze, the cooling system should be completely drained, preferably flushed, and all hoses checked for condition and security.

26 After filling with antifreeze, a label should be attached to the expansion tank, stating the type and concentration of antifreeze used, and the date installed. Any subsequent topping-up should be made with the same type and concentration of antifreeze.

27 Do not use engine antifreeze in the windscreen/tailgate washer system, as it will damage the vehicle paintwork. A screenwash additive should be added to the washer system in the quantities stated on the bottle.

Every 10 years – regardless of mileage

24 Air bag(s) and seat belt pretensioner renewal

Due to the safety critical nature of the air bag and seat belt pretensioner components, these operations must be carried out by a Citroën dealer.

Chapter 2 Part A:
TU series petrol engine in-car repair procedures

Contents

Degrees of difficulty

Easy, suitable for novice with little experience 

Fairly easy, suitable for beginner with some experience 

Fairly difficult, suitable for competent DIY mechanic 

Difficult, suitable for experienced DIY mechanic 

Very difficult, suitable for expert DIY or professional 

Specifications

Engine (general)

Designation	TU5
Capacity	1587 cc (1.6 litre)
Engine codes*:	
Up to 2001 model year	NFZ (TU5JP+/L3)
2001 model year onward	NFV (TU5JP/L4)
Bore	78.50 mm
Stroke	82.00 mm
Direction of crankshaft rotation	Clockwise (viewed from right-hand side of vehicle)
No 1 cylinder location	At transmission end of block
Compression ratio (typical):	
NFZ (TU5JP+/L3)	9.6 : 1
NFV (TU5JP/L4)	10.5 : 1

**The engine code is situated on front left-hand end of the engine, stamped directly on the cylinder block*

Timing belt

Tension setting (see text – Section 6):	
Initial setting	44 SEEM units
Final setting	29 to 33 SEEM units

Camshaft

Drive	Toothed belt
Number of bearings	5
Camshaft bearing journal diameter (outside diameter):	
No 1	36.950 to 36.925 mm
No 2	40.650 to 40.625 mm
No 3	41.250 to 41.225 mm
No 4	41.850 to 41.825 mm
No 5	42.450 to 42.425 mm
Cylinder head bearing journal diameter (inside diameter):	
No 1	37.000 to 37.039 mm
No 2	40.700 to 47.739 mm
No 3	41.300 to 41.339 mm
No 4	41.900 to 41.939 mm
No 5	42.500 to 42.539 mm

Valve clearances (engine cold)

Inlet	0.20 mm
Exhaust	0.40 mm

Lubrication system

Oil pump type	Gear-type, chain-driven off the crankshaft
Minimum oil pressure at 90°C	4 bars at 4000 rpm
Oil pressure warning switch operating pressure	0.8 bars

Torque wrench settings

	Nm	lbf ft
Big-end bearing cap nuts	38	28
Camshaft sprocket retaining bolt	80	59
Camshaft thrust fork retaining bolt	16	12
Crankshaft pulley retaining bolts	8	6
Crankshaft sprocket retaining bolt	110	81
Cylinder head bolts:		
Stage 1	20	15
Stage 2	Angle-tighten a further 120°	
Stage 3	Angle-tighten a further 120°	
Cylinder head cover nuts	16	12
Engine-to-transmission fixing bolts	50	37
Engine/transmission left-hand mounting:		
Mounting bracket-to-body bolts	25	18
Mounting bracket-to-transmission bolts	65	48
Rubber mounting centre nut	65	48
Rubber mounting-to-bracket nuts	22	16
Engine/transmission rear mounting:		
Connecting link-to-mounting bracket bolt	55	41
Connecting link-to-subframe bolt	55	41
Mounting bracket-to-cylinder block bolts	40	30
Engine/transmission right-hand mounting:		
Lower support brace-to-engine	26	19
Upper mounting bracket-to-engine bolts	45	33
Upper mounting bracket-to-mounting rubber nut	32	24
Upper support brace-to-engine	26	19
Upper support brace-to-upper mounting bracket	45	33
Flywheel retaining bolts	65	48
Main bearing cap bolts:		
Stage 1	20	15
Stage 2	Angle-tighten a further 50°	
Oil pump retaining bolts	8	6
Piston oil jet spray tube bolts	10	7
Sump drain plug	30	22
Sump retaining nuts and bolts	8	6
Timing belt cover bolts	8	6
Timing belt tensioner pulley nut	23	17

1 General information

Using this Chapter

This Part of Chapter 2 is devoted to in-vehicle repair procedures for the TU series petrol engines. Similar information covering the EW series petrol engines, and the diesel engine will be found in Chapters 2B and 2C. All procedures concerning engine removal and refitting, and engine block/cylinder head overhaul for petrol and diesel engines can be found in Chapters 2D and 2E as applicable.

Most of the operations included in Chapter 2A are based on the assumption that the engine is still installed in the vehicle. Therefore, if this information is being used during a complete engine overhaul, with the engine already removed, many of the steps included here will not apply.

TU series engine description

The TU series engine is a well-proven unit which has been fitted to many previous Citroën and Peugeot vehicles. The engine is of the in-line four-cylinder, single overhead camshaft (SOHC) type, mounted transversely at the front of the vehicle, with the transmission attached to its left-hand end.

The crankshaft runs in five main bearings. Thrustwashers are fitted to No 2 main bearing (upper half) to control crankshaft endfloat.

The connecting rods rotate on horizontally-split bearing shells at their big-ends. The pistons are attached to the connecting rods by gudgeon pins, which are an interference fit in the connecting rod small-end eyes. The aluminium-alloy pistons are fitted with three piston rings – two compression rings and an oil control ring.

The inlet and exhaust valves are each closed by coil springs, and operate in guides pressed into the cylinder head; the valve seat inserts are also pressed into the cylinder head, and can be renewed separately if worn.

The camshaft rotates directly in the cylinder head, is driven by a toothed timing belt, and operates the eight valves via rocker arms. Valve clearances are adjusted by a screw-and-locknut arrangement. The timing belt also drives the coolant pump.

Lubrication is by means of an oil pump, which is driven (via a chain and sprocket) off the right-hand end of the crankshaft. It draws oil through a strainer located in the sump, and then forces it through an externally-mounted filter into galleries in the cylinder block/crankcase. From there, the oil is distributed to the crankshaft (main bearings) and camshaft. The big-end bearings are supplied with oil via internal drillings in the crankshaft, while the camshaft bearings also receive a pressurised supply. The camshaft lobes and valves are lubricated by splash, as are all other engine components.

Throughout this manual, it is often necessary to identify the engines not only by their capacity, but also by their engine code which is incorporated in the engine number. This can be found stamped on a machined surface on the front face of the cylinder block at the flywheel end. The first part of the engine number gives the engine code – eg, NFZ **(see illustration)**.

Repair operations possible with the engine in the vehicle

The following work can be carried out with the engine in the vehicle:

- *a) Compression pressure – testing.*
- *b) Cylinder head cover – removal and refitting.*
- *c) Timing belt covers – removal and refitting.*
- *d) Timing belt – removal, refitting and adjustment.*
- *e) Timing belt tensioner and sprockets – removal and refitting.*
- *f) Camshaft oil seal(s) – renewal.*
- *g) Camshaft and rocker arms – removal, inspection and refitting.**
- *h) Cylinder head – removal and refitting.*
- *i) Cylinder head and pistons – decarbonising.*
- *j) Sump – removal and refitting.*
- *k) Oil pump – removal, overhaul and refitting.*
- *l) Crankshaft oil seals – renewal.*
- *m) Engine/transmission mountings – inspection and renewal.*
- *n) Flywheel – removal, inspection and refitting.*

**The cylinder head must be removed for the successful completion of this work. Refer to Section 10 for details.*

2 Compression test – description and interpretation

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

1.9 Engine code is stamped on a plate (arrowed) attached to the front of the cylinder block – viewed from above

2 The engine must be fully warmed-up to normal operating temperature, the battery must be fully charged, and all the spark plugs must be removed (see Chapter 1A). The aid of an assistant will also be required.

3 Referring to Chapter 12, disable and depressurise the fuel system by identifying and removing the fuel pump fuse from the engine compartment fusebox. Start the engine, and run it until it cuts out.

4 Disable the ignition system by disconnecting the LT wiring connector from the ignition coil module, referring to Chapter 5B for further information.

5 Fit a compression tester to the No 1 cylinder spark plug hole – the type of tester which screws into the plug thread is to be preferred.

6 Have the assistant hold the throttle wide open, and crank the engine on the starter motor; after one or two revolutions, the compression pressure should build up to a maximum figure, and then stabilise. Record the highest reading obtained.

7 Repeat the test on the remaining cylinders, recording the pressure in each.

8 All cylinders should produce very similar pressures; a difference of more than 2 bars between any two cylinders indicates a fault. Note that the compression should build-up quickly in a healthy engine; low compression on the first stroke, followed by gradually-increasing pressure on successive strokes, indicates worn piston rings. A low compression reading on the first stroke, which does not build-up during successive strokes, indicates leaking valves or a blown head gasket (a cracked head could also be the cause). Deposits on the undersides of the valve heads can also cause low compression.

9 Although Citroën do not specify exact compression pressures, as a guide, any cylinder pressure of below 10 bars can be considered as less than healthy. Refer to a Citroën dealer or other specialist if in doubt as to whether a particular pressure reading is acceptable.

10 If the pressure in any cylinder is low, carry out the following test to isolate the cause. Introduce a teaspoonful of clean oil into that cylinder through its spark plug hole, and repeat the test.

11 If the addition of oil temporarily improves the compression pressure, this indicates that bore or piston wear is responsible for the pressure loss. No improvement suggests that leaking or burnt valves, or a blown head gasket, may be to blame.

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

13 If the compression reading is unusually high, the combustion chambers are probably coated with carbon deposits. If this is the case, the cylinder head should be removed and decarbonised.

14 On completion of the test, refit the spark plugs and fuel pump fuse, and reconnect the ignition coil module wiring connector.

3 Engine assembly/valve timing holes – general information and usage

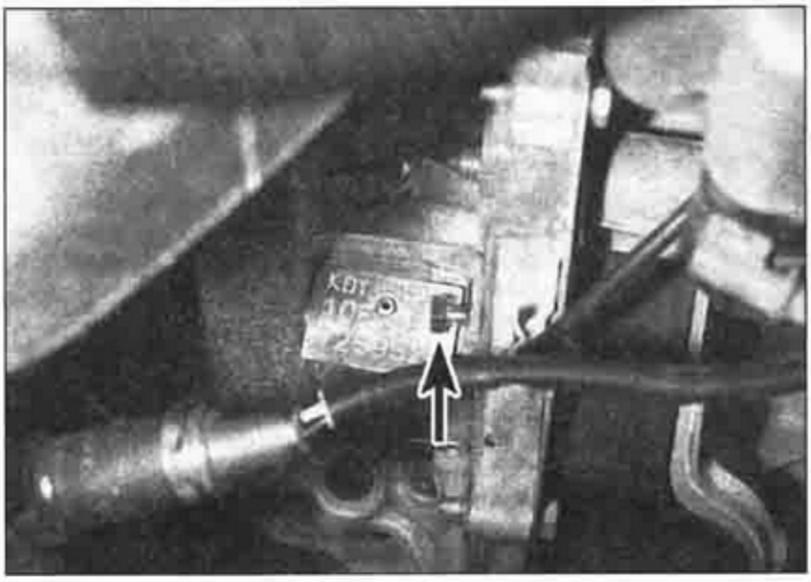
Note: *Do not attempt to rotate the engine whilst the crankshaft/camshaft are locked in position. If the engine is to be left in this state for a long period of time, it is a good idea to place warning notices inside the vehicle, and in the engine compartment. This will reduce the possibility of the engine being accidentally cranked on the starter motor, which is likely to cause damage with the locking pins in place.*

1 On all engines, timing holes are drilled in the camshaft sprocket and in the flywheel. The holes are used to ensure that the crankshaft and camshaft are correctly positioned when assembling the engine (to prevent the possibility of the valves contacting the pistons when refitting the cylinder head), or refitting the timing belt. When the timing holes are aligned with access holes in the cylinder head and the cylinder block, suitable diameter pins or bolts can be inserted to lock both the camshaft and crankshaft in position, preventing them from rotating. Proceed as follows.

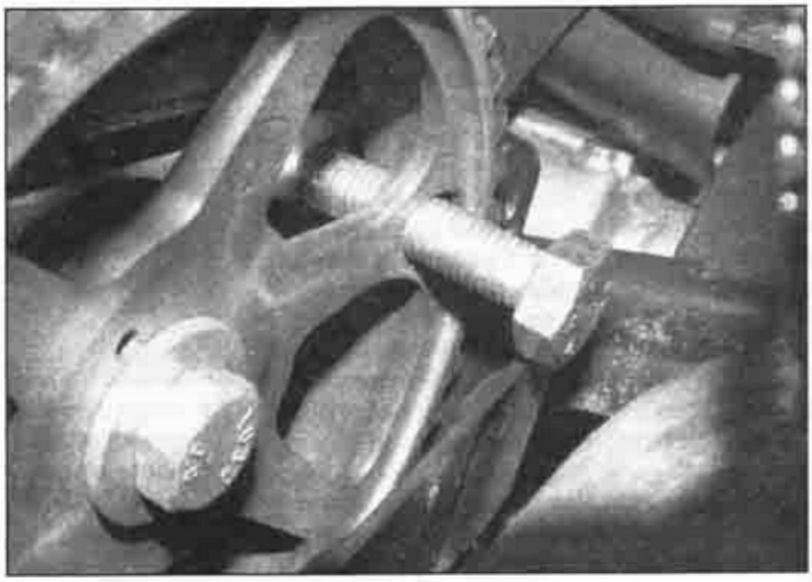
2 Remove the timing belt upper cover as described in Section 5.

3 The crankshaft must now be turned until the timing hole in the camshaft sprocket is aligned with the corresponding hole in the cylinder head. The holes are aligned when the camshaft sprocket hole is in the 2 o'clock position, when viewed from the right-hand end of the engine. The crankshaft can be turned by using a spanner on the crankshaft sprocket bolt, noting that it should always be rotated in a clockwise direction (viewed from the right-hand end of the engine).

4 With the camshaft sprocket hole correctly positioned, insert a 6 mm diameter bolt or drill bit through the hole in the front, left-hand



3.4 Insert a 6 mm bolt (arrowed) through the hole in cylinder block flange and into the timing hole in the flywheel . . .



3.5 . . . then insert a 10 mm bolt through the camshaft sprocket timing hole, and locate it in the cylinder head

flange of the cylinder block, and locate it in the timing hole in the flywheel **(see illustration)**. Note that it may be necessary to rotate the crankshaft slightly, to get the holes to align.

5 With the flywheel correctly positioned, insert a 10 mm diameter bolt or drill bit through the timing hole in the camshaft sprocket, and locate it in the hole in the cylinder head **(see illustration)**.

6 The crankshaft and camshaft are now locked in position, preventing unnecessary rotation.

4.2 Disconnect the breather hose from the cylinder head cover

4 Cylinder head cover – removal and refitting

Removal

1 Disconnect the battery negative terminal (refer to *Disconnecting the battery* in the Reference Chapter).

2 Release the quick-release fitting and withdraw the breather assembly from the cylinder head cover **(see illustration)**.

3 Undo the two retaining nuts, and remove the washer from each of the cylinder head cover studs.

4 Lift off the cylinder head cover, and remove it along with its rubber seal. Examine the seal for signs of damage and deterioration, and if necessary, renew it.

5 Remove the spacer from each stud, and lift off the oil baffle plate.

Refitting

6 Carefully clean the cylinder head and cover mating surfaces, and remove all traces of oil.

7 Fit the rubber seal over the edge of the cylinder head cover, ensuring that it is correctly located along its entire length.

8 Refit the oil baffle plate to the engine, and locate the spacers in their recesses in the baffle plate.

9 Carefully refit the cylinder head cover to the engine, taking great care not to displace the rubber seal.

10 Check that the seal is correctly located, then refit the washers and cover retaining nuts, and tighten them to the specified torque.

11 Refit the breather assembly to the stub on the cylinder head cover, pushing it down until it locks into place.

12 Reconnect the battery negative terminal on completion.

5 Timing belt covers – removal and refitting

Removal

Upper cover

1 Unclip the hose from the top of the upper cover. Slacken and remove the two retaining bolts (one at the front and one at the rear), and remove the upper timing cover from the cylinder head **(see illustrations)**.

5.1a Unclip the hose from the upper timing belt cover . . .

5.1b . . . undo the front mounting bolt . . .

5.1c . . . and rear mounting bolt . . .

5.1d . . . then lift off the upper cover

Lower cover

2 Remove the auxiliary drivebelt as described in Chapter 1A.
3 Remove the upper cover as described previously.
4 Slacken and remove the three retaining bolts (one at the rear of the cover, beneath the engine mounting plate, and two directly above the crankshaft pulley).
5 Undo the three crankshaft pulley retaining bolts and remove the pulley, noting which way round it is fitted.
6 Slacken and remove the remaining retaining bolt(s), and slide the lower cover off the end of the crankshaft.

Refitting

Upper cover

7 Refit the cover, ensuring it is correctly located with the lower cover, and tighten its retaining bolts. Locate the hose in its retaining clip on the cover.

Lower cover

8 Locate the lower cover over the timing belt sprocket, and tighten its retaining bolt(s).
9 Fit the pulley to the end of the crankshaft, ensuring it is fitted the correct way round, and tighten its bolts to the specified torque.
10 Refit the upper cover as described above, then refit and tension the auxiliary drivebelt as described in Chapter 1A.

6 Timing belt – general information, removal and refitting

Note: *Citroën specify the use of an electronic belt tension checking tool (SEEM 4122-T), and valve rocker contact plate (4533-T.Z.) to correctly set the timing belt tension. The following procedure assumes that this equipment (or suitable alternatives) is available. Accurate tensioning of the timing belt is essential, and if access to this equipment cannot be obtained, it is recommended that the work is entrusted to a Citroën dealer or suitably-equipped garage.*

General information

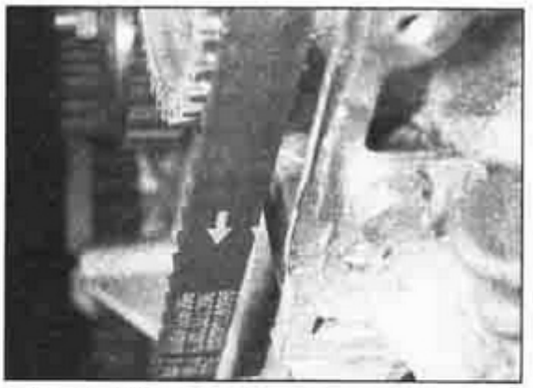
1 The timing belt drives the camshaft and coolant pump from a toothed sprocket on the right-hand end of the crankshaft. If the belt breaks or slips in service, the pistons are likely to hit the valve heads, resulting in extensive (and expensive) damage.
2 The timing belt should be renewed at the specified intervals (see Chapter 1A), or earlier if it is contaminated with oil or if it is at all noisy in operation (a 'scraping' noise due to uneven wear).
3 If the timing belt is being removed, it is a wise precaution to check the condition of the coolant pump at the same time (check for signs of coolant leakage). This may avoid the need to remove the timing belt again at a later stage, should the coolant pump fail.

Removal

4 Disconnect the battery negative terminal (refer to *Disconnecting the battery* in the Reference Section of this manual).
5 Align the engine assembly/valve timing holes as described in Section 3, and lock both the camshaft sprocket and the flywheel in position. *Do not* attempt to rotate the engine whilst the locking tools are in position.
6 Remove the timing belt upper and lower covers as described in Section 5.
7 Loosen the timing belt tensioner pulley retaining nut. Allow the pulley to pivot in a clockwise direction, to relieve the tension from the timing belt. Retighten the tensioner pulley retaining nut to secure it in the slackened position.
8 If the timing belt is to be re-used, use white paint or similar to mark the direction of rotation on the belt (if markings do not already exist) **(see illustration)**. Slip the belt off the sprockets.
9 Check the timing belt carefully for any signs of uneven wear, splitting, or oil contamination. Pay particular attention to the roots of the teeth. Renew the belt if there is the slightest doubt about its condition. If the engine is undergoing an overhaul, renew the belt as a matter of course, regardless of its apparent condition. The cost of a new belt is nothing when compared to the cost of repairs, should the belt break in service. If signs of oil contamination are found, trace the source of the oil leak, and rectify it. Wash down the engine timing belt area and all related components, to remove all traces of oil.

Refitting

10 Prior to refitting, thoroughly clean the timing belt sprockets. Check that the tensioner pulley rotates freely, without any sign of roughness. If necessary, renew the tensioner pulley as described in Section 7. Make sure that the locking tools are still in place, as described in Section 3.
11 Manoeuvre the timing belt into position, ensuring that the arrows on the belt are pointing in the direction of rotation (clockwise, when viewed from the right-hand end of the engine).
12 Do not twist the timing belt sharply while

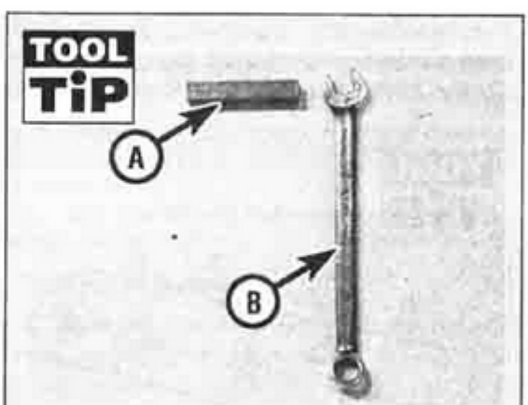


6.8 Mark the direction of rotation on the belt, if it is to be re-used

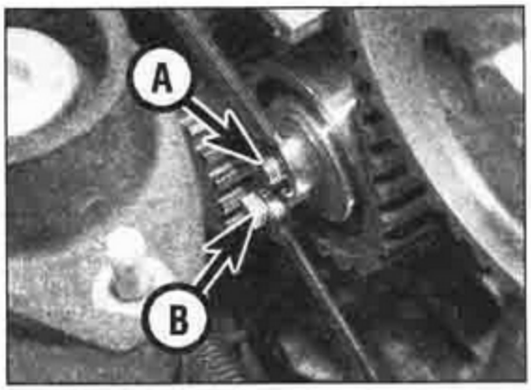
refitting it. Fit the belt over the crankshaft and camshaft sprockets. Make sure that the 'front run' of the belt is taut – ie, ensure that any slack is on the tensioner pulley side of the belt. Fit the belt over the coolant pump sprocket and tensioner pulley. Ensure that the belt teeth are seated centrally in the sprockets.
13 Slacken the tensioner pulley retaining nut and insert a short length of 8.0 mm square bar into the square hole on the front face of the tensioner pulley **(see Tool Tip 1)**. Using the square bar and a spanner, pivot the pulley anti-clockwise to remove all free play from the timing belt, then retighten the nut.
14 The timing belt must now be accurately tensioned using electronic belt tension measuring equipment as follows.

Tensioning

15 Fit the sensor head of the belt tensioning measuring equipment to the 'front run' of the timing belt, approximately midway between the camshaft and crankshaft sprockets.
16 Slacken the tensioner pulley retaining nut, then using the square bar and spanner, pivot the tensioner pulley anti-clockwise until an initial setting of 44 SEEM units is displayed on



Tool Tip 1: A square section tool to fit the timing belt tensioner pulley can be made from a length of standard 8 mm door handle rod (A), obtained from a DIY shop, and then cut to size. Once the rod has been fitted to the tensioner, the timing belt can be tensioned by turning the rod with an 8 mm spanner (B).



6.16 Slacken the tensioner centre nut, then pivot the tensioner pulley anti-clockwise using the 8 mm bar and a spanner

A Tensioner centre nut
B 8 mm bar

the tensioning measuring equipment **(see illustration)**. Hold the tensioner pulley in that position and retighten the retaining nut.

17 Remove the locking tools from the camshaft sprocket and flywheel, and remove the tension measuring equipment from the belt.

18 Using a suitable socket and extension bar on the crankshaft sprocket bolt, rotate the crankshaft through four complete rotations in a clockwise direction (viewed from the right-hand end of the engine). *Do not* at any time rotate the crankshaft anti-clockwise. Refit the locking tool to the flywheel and check that the camshaft sprocket timing hole is aligned.

19 To enable an accurate belt tension final setting to be achieved, all the load exerted on the camshaft lobes through the action of the valve springs and rocker arms must be removed. To do this, Citroën mechanics use a valve rocker contact plate (special tool 4533-T.Z.) which is simply a steel plate fitted over the rocker arms in place of the cylinder head cover, and secured using the cylinder head cover retaining nuts. Eight studs and suitable locknuts are fitted to the plate, with each stud located directly over the valve stem end of each rocker arm. The studs are then screwed down until they just lift the rocker arms away from the camshaft lobes and are then secured in that position with the locknuts. This has the effect of removing all the load from the camshaft, allowing it to move very slightly as the belt tension is adjusted. If this is not done, the tension reading shown on the belt tension measuring equipment will be inaccurate. If the special tool cannot be obtained, a suitable alternative can be fabricated **(see Tool Tip 2)**.

20 Remove the cylinder head cover (see Section 4). Slacken the eight rocker arm contact bolts in the valve rocker contact plate and fit the contact plate to the cylinder head, observing the correct fitted direction. Tighten each rocker arm contact bolt until the rockers are just free of the camshaft lobes. Do not over-tighten the contact bolts otherwise the valves will contact the pistons.

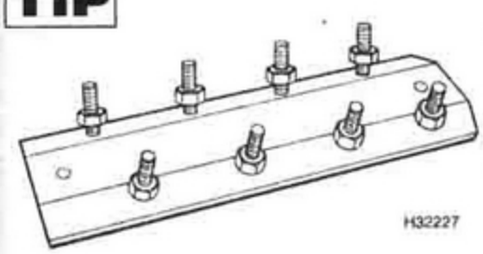
21 Ensure that the flywheel locking tool is in place, but the camshaft sprocket locking tool is removed.

22 Refit the tension measuring equipment to the belt, slacken the tensioner pulley retaining nut, and turn the tensioner pulley until a setting of between 29 and 33 SEEM units is indicated on the measuring equipment. Hold the tensioner pulley in this position and tighten the retaining nut to the specified torque.

23 Remove the measuring equipment from the belt, the valve rocker contact plate from the cylinder head, and the locking tool from the flywheel. Rotate the crankshaft through another two complete rotations in a clockwise direction and check that both the camshaft sprocket and flywheel timing holes are realigned, and that the locking tools can be inserted. *Do not* at any time rotate the crankshaft anti-clockwise. If the locking tools cannot be inserted, repeat the refitting and tensioning procedure. If all is satisfactory, remove the locking tools.

24 With the belt tension correctly set, refit the cylinder head cover and timing belt covers, and reconnect the battery negative terminal.

TOOL TiP



Tool Tip 2: A valve rocker contact plate can be made from steel sheet with eight studs and locknuts to contact the rocker arms.

7 Timing belt tensioner and sprockets – removal, inspection and refitting

Note 1: *This Section describes the removal and refitting of the components concerned as individual operations. If more than one of them is to be removed at the same time, start by removing the timing belt as described in Section 6; remove the component as described below, ignoring the preliminary dismantling steps.*

Note 2: *The following operations entail the slackening and then retensioning of the timing belt. Refer to Section 6 and ensure that the necessary equipment to accurately tension the timing belt is available, before proceeding.*

Removal

1 Disconnect the battery negative terminal (refer to *Disconnecting the battery* in the Reference Chapter).

2 Position the engine assembly/valve timing holes as described in Section 3, and lock both the camshaft sprocket and flywheel in position. *Do not* attempt to rotate the engine whilst the locking tools are in position.

Camshaft sprocket

3 Remove the timing belt upper and lower covers as described in Section 5.

4 Loosen the timing belt tensioner pulley retaining nut. Rotate the pulley in a clockwise direction, using a suitable square-section bar fitted to the hole in the pulley hub (see **Tool Tip 1** in Section 6). Retighten the retaining nut to hold the pulley in the slackened position.

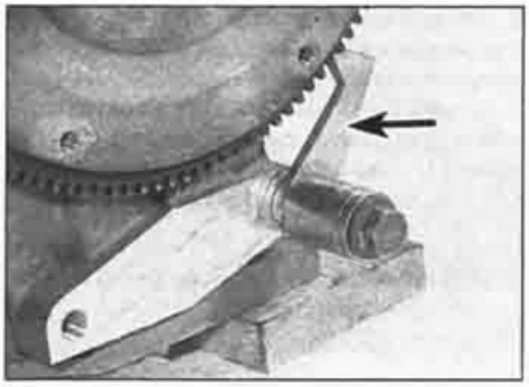
5 Disengage the timing belt from the sprocket, and move the belt clear, taking care not to bend or twist it sharply. Remove the locking tool from the camshaft sprocket.

6 Slacken the camshaft sprocket retaining bolt and remove it, along with its washer. To prevent the camshaft rotating as the bolt is slackened, a sprocket-holding tool will be required. In the absence of the special Citroën tool, an acceptable substitute can be easily fabricated **(see Tool Tip)**. *Do not* attempt to use the locking tool inserted into the engine assembly/valve timing hole to prevent the sprocket from rotating whilst the bolt is slackened.

7 With the retaining bolt removed, slide the sprocket off the end of the camshaft. If the locating peg is a loose fit in the rear of the sprocket, remove it for safe-keeping. Examine the camshaft oil seal for signs of oil leakage and, if necessary, renew it as described in Section 8.

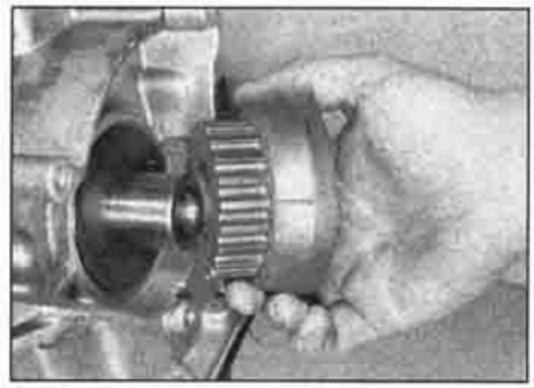
TOOL TiP

To make a camshaft sprocket holding tool, obtain two lengths of steel strip about 6 mm thick by 30 mm wide or similar, one 600 mm long, the other 200 mm long (all dimensions approximate). Bolt the two strips together to form a forked end, leaving the bolt slack so that the shorter strip can pivot freely. At the end of each 'prong' of the fork, secure a bolt with a nut and a locknut, to act as the fulcrums; these will engage with the cut-outs in the sprocket, and should protrude by about 30 mm.



7.10 Lock the flywheel ring gear to prevent the crankshaft rotating

7.11a Remove the crankshaft sprocket bolt . . .



7.11b . . . then slide off the sprocket

Crankshaft sprocket

8 Remove the upper and lower timing belt covers as described in Section 5.

9 Loosen the timing belt tensioner pulley retaining nut. Rotate the pulley in a clockwise direction, using a suitable square-section bar fitted to the hole in the pulley hub (see **Tool Tip 1** in Section 6). Retighten the retaining nut to hold the pulley in the slackened position.

10 To prevent crankshaft rotation whilst the sprocket retaining bolt is slackened, select top gear and have an assistant apply the brakes firmly. Alternatively, the flywheel ring gear can be locked using a suitable tool made from steel angle; remove the cover plate from the base of the transmission bellhousing and bolt the tool to the bellhousing flange so it engages with the ring gear teeth. If the engine has been removed from the vehicle, lock the flywheel ring gear, using an arrangement similar to that shown **(see illustration)**. *Do not* be tempted to use the flywheel locking tool described in Section 3 to prevent the crankshaft from rotating; temporarily remove the locking tool from the flywheel prior to slackening the pulley bolt, then refit it once the bolt has been slackened.

11 Unscrew the retaining bolt and washer, then slide the sprocket off the end of the crankshaft **(see illustrations)**. Refit the locking tool to the flywheel.

12 If the Woodruff key is a loose fit in the crankshaft, remove it and store it with the sprocket for safe-keeping. If necessary, also slide the flanged spacer off the end of the crankshaft **(see illustration)**. Examine the crankshaft oil seal for signs oil leakage and, if necessary, renew as described in Section 14.

Tensioner pulley

13 Remove the timing belt upper and lower covers as described in Section 5.

14 Slacken and remove the timing belt tensioner pulley retaining nut, and slide the pulley off its mounting stud. Examine the mounting stud for signs of damage and, if necessary, renew it.

Inspection

15 Clean the sprockets thoroughly, and renew any that show signs of wear, damage or cracks. If any of the sprockets are to be renewed, the timing belt should also be renewed as a matter of course.

16 Clean the tensioner assembly, but do not use any strong solvent which may enter the pulley bearing. Check that the pulley rotates freely about its hub, with no sign of stiffness or of free play. Renew the tensioner pulley if there is any doubt about its condition, or if there are any obvious signs of wear or damage.

Refitting

Camshaft sprocket

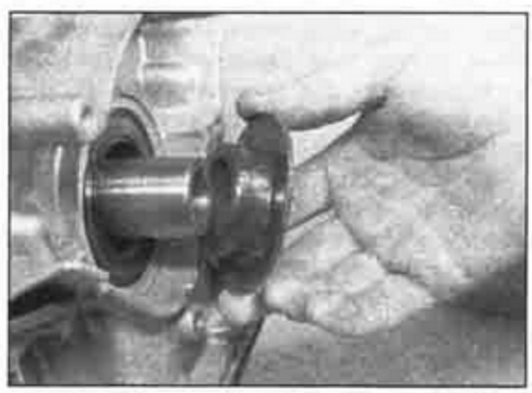
17 Refit the locating peg (where removed) to the rear of the sprocket, then locate the sprocket on the end of the camshaft. Ensure that the locating peg is correctly engaged with the cut-out in the camshaft end.

18 Refit the sprocket retaining bolt and washer. Tighten the bolt to the specified torque, whilst retaining the sprocket with the holding tool.

19 Realign the timing hole in the camshaft sprocket (see Section 3) with the corresponding hole in the cylinder head, and refit the locking tool.

20 Refit the timing belt to the camshaft sprocket. Ensure that the 'front run' of the belt is taut – ie, ensure that any slack is on the tensioner pulley side of the belt. Do not twist the belt sharply while refitting it, and ensure that the belt teeth are seated centrally in the sprockets.

21 Loosen the tensioner pulley retaining nut. Using the square-section bar and a spanner, rotate the pulley anti-clockwise to remove all free play from the timing belt, then retighten the nut.



7.12 Remove the flanged spacer if necessary

22 Tension the timing belt as described in Section 6.

23 Refit the timing belt covers as described in Section 5.

Crankshaft sprocket

24 Where removed, locate the Woodruff key in the crankshaft end, then slide on the flanged spacer, aligning its slot with the Woodruff key.

25 Align the crankshaft sprocket slot with the Woodruff key, and slide it onto the end of the crankshaft.

26 Temporarily remove the locking tool from the flywheel, then refit the crankshaft sprocket retaining bolt and washer. Tighten the bolt to the specified torque, whilst preventing crankshaft rotation using the method employed on removal. Refit the locking tool to the flywheel.

27 Relocate the timing belt on the crankshaft sprocket. Ensure that the 'front run' of the belt is taut – ie, ensure that any slack is on the tensioner pulley side of the belt. Do not twist the belt sharply while refitting it, and ensure that the belt teeth are seated centrally in the sprockets.

28 Loosen the tensioner pulley retaining nut. Using the square-section bar and a spanner, rotate the pulley anti-clockwise to remove all free play from the timing belt, then retighten the nut.

29 Tension the timing belt as described in Section 6.

30 Refit the timing belt covers as described in Section 5.

Tensioner pulley

31 Refit the tensioner pulley to its mounting stud, and fit the retaining nut.

32 Ensure that the 'front run' of the belt is taut – ie, ensure that any slack is on the pulley side of the belt. Check that the belt is centrally located on all its sprockets. Rotate the pulley anti-clockwise to remove all free play from the timing belt, then tighten the pulley retaining nut securely.

33 Tension the belt as described in Section 6.

34 Refit the timing belt covers as described in Section 5.

8.2 Carefully prise the camshaft oil seal from its housing with a flat-bladed screwdriver

8 Camshaft oil seal – renewal

Note: *If the camshaft oil seal is to be renewed with the timing belt still in place, check first that the belt is free from oil contamination. (Renew the belt as a matter of course if signs of oil contamination are found; see Section 6.) Cover the belt to protect it from oil contamination while work is in progress. Ensure that all traces of oil are removed from the area before the belt is refitted.*

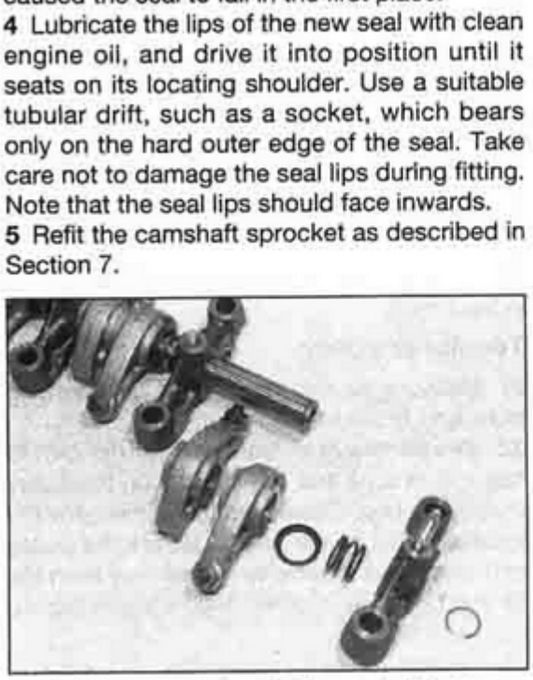
1 Remove the camshaft sprocket as described in Section 7.

2 Punch or drill two small holes opposite each other in the oil seal. Screw a self-tapping screw into each, and pull on the screws with pliers to extract the seal. Alternatively, carefully prise the seal from its housing with a flat-bladed screwdriver **(see illustration)**. Take great care to avoid scoring the cylinder head and camshaft sealing surfaces.

3 Clean the seal housing, and polish off any burrs or raised edges, which may have caused the seal to fail in the first place.

4 Lubricate the lips of the new seal with clean engine oil, and drive it into position until it seats on its locating shoulder. Use a suitable tubular drift, such as a socket, which bears only on the hard outer edge of the seal. Take care not to damage the seal lips during fitting. Note that the seal lips should face inwards.

5 Refit the camshaft sprocket as described in Section 7.



10.4 Remove the circlip, and slide the components off the end of the rocker arm

9 Valve clearances – checking and adjustment

Note: *The valve clearances must be checked and adjusted only when the engine is cold.*

1 The importance of having the valve clearances correctly adjusted cannot be overstressed, as they vitally affect the performance of the engine. If the clearances are too big, the engine will be noisy (characteristic rattling or tapping noises) and engine efficiency will be reduced, as the valves open too late and close too early. A more serious problem arises if the clearances are too small, however. If this is the case, the valves may not close fully when the engine is hot, resulting in serious damage to the engine (eg, burnt valve seats and/or cylinder head warping/cracking). The clearances are checked and adjusted as follows.

2 Remove the cylinder head cover as described in Section 4.

3 The engine can now be turned using a suitable socket and extension bar fitted to the crankshaft sprocket/pulley bolt.

> **HAYNES HiNT** ***Turning the engine will be easier if the spark plugs are removed first – see Chapter 1A.***

4 It is important that the clearance of each valve is checked and adjusted only when the valve is fully closed, with the rocker arm resting on the heel of the cam (directly opposite the peak). This can be ensured by carrying out the adjustments in the following sequence, noting that No 1 cylinder is at the transmission end of the engine. The correct valve clearances are given in the Specifications at the start of this Chapter. The valve locations can be determined from the position of the manifolds.

Valve fully open	Adjust valves
No 1 exhaust	*No 3 in. and No 4 ex.*
No 3 exhaust	*No 4 in. and No 2 ex.*
No 4 exhaust	*No 2 in. and No 1 ex.*
No 2 exhaust	*No 1 in. and No 3 ex.*

5 Start by turning the crankshaft in the normal direction of rotation until the exhaust valve for No 1 cylinder is fully open. The clearances for No 3 cylinder inlet valve and No 4 cylinder exhaust valve can now be checked. The clearances are checked by inserting a feeler blade of the correct thickness between the valve stem and the rocker arm adjusting screw. The feeler blade should be a light, sliding fit, similar to a knife through butter. If adjustment is necessary, slacken the adjusting screw locknut, and turn the screw as necessary. Once the correct clearance is obtained, hold the adjusting screw and securely tighten the locknut. Recheck the valve clearance, and adjust again if necessary.

6 Rotate the crankshaft until the next valve in the sequence is fully open, and check the clearances of the next two specified valves.

7 Repeat the procedure until all eight valve clearances have been checked (and if necessary, adjusted), then refit the cylinder head cover as described in Section 4.

10 Camshaft and rocker arms – removal, inspection and refitting

General information

1 The rocker arm assembly is secured to the top of the cylinder head by the cylinder head bolts. Although in theory it is possible to undo the head bolts and remove the rocker arm assembly without removing the head, in practice, this is not recommended. Once the bolts have been removed, the head gasket will be disturbed, and the gasket will almost certainly leak or blow after refitting. For this reason, removal of the rocker arm assembly cannot be done without removing the cylinder head and renewing the head gasket.

2 The camshaft is slid out of the right-hand end of the cylinder head, and it therefore cannot be removed without first removing the cylinder head, due to a lack of clearance.

Removal

Rocker arm assembly

3 Remove the cylinder head as described in Section 11.

4 To dismantle the rocker arm assembly, carefully prise off the circlip from the right-hand end of the rocker shaft; retain the rocker pedestal, to prevent it being sprung off the end of the shaft. Slide the various components off the end of the shaft, keeping all components in their correct fitted order **(see illustration)**. Make a note of each component's correct fitted position and orientation as it is removed, to ensure it is fitted correctly on reassembly.

5 To separate the left-hand pedestal and shaft, first unscrew the cylinder head cover retaining stud from the top of the pedestal; this can be achieved using a stud extractor, or two nuts locked together. With the stud removed, unscrew the grub screw from the top of the pedestal, and withdraw the rocker shaft **(see illustrations)**.

Camshaft

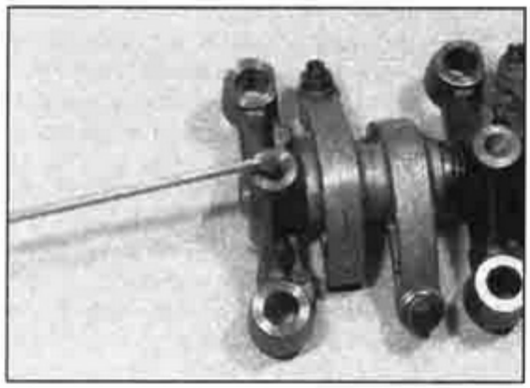
6 Remove the cylinder head as described in Section 11.

7 With the head on a bench, remove the sprocket locking tool, then remove the camshaft sprocket as described in Section 7.

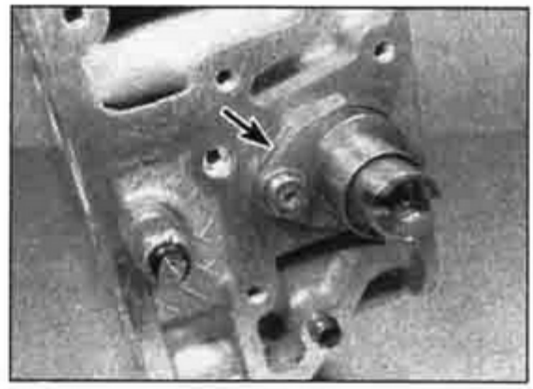
8 Unbolt the coolant housing from the left-hand end of the cylinder head. Undo the retaining bolt, and remove the camshaft thrust fork from the cylinder head **(see illustration)**.

9 Using a large flat-bladed screwdriver, carefully prise the oil seal out of the right-hand

10.5a To remove the left-hand pedestal, lock two nuts together and unscrew the stud . . .



10.5b . . . then remove the grub screw



10.8 Undo the retaining bolt, and remove the camshaft thrust fork (arrowed) . . .

end of the cylinder head, then slide out the camshaft **(see illustrations)**. Discard the seal – a new one must be used on refitting.

Inspection

Rocker arm assembly

10 Roller rocker arms are used incorporating a roller bearing at the camshaft lobe contact point. Check for any sign of excess play of the roller bearing or any roughness as it is rotated. Renew worn components as necessary. If a rocker arm roller bearing contact surface is badly scored, also examine the corresponding lobe on the camshaft for wear, as both will likely be worn.

11 Inspect the ends of the (valve clearance) adjusting screws for signs of wear or damage, and renew as required.

12 If the rocker arm assembly has been dismantled, examine the rocker arm and shaft bearing surfaces for wear ridges and scoring. If there are obvious signs of wear, the relevant rocker arm(s) and/or the shaft must be renewed.

Camshaft

13 Examine the camshaft bearing surfaces and cam lobes for signs of wear ridges and scoring. Renew the camshaft if any of these conditions are apparent. Examine the condition of the bearing surfaces, both on the camshaft journals and in the cylinder head. If the head bearing surfaces are worn excessively, the cylinder head will need to be renewed. If the necessary measuring equipment is available, camshaft bearing journal wear can be checked by direct measurement, noting that No 1 journal is at the transmission end of the head.

14 Examine the thrust fork for signs of wear or scoring, and renew as necessary.

Refitting

Rocker arm assembly

15 If the rocker arm assembly was dismantled, refit the rocker shaft to the left-hand pedestal, aligning its locating hole with the pedestal threaded hole. Refit the grub screw, and tighten it securely. With the grub screw in position, refit the cylinder head cover mounting stud to the pedestal, and tighten it securely. Apply a smear of clean engine oil to the shaft, then slide on all removed components, ensuring each is correctly fitted in its original position. Once all components are in position on the shaft, compress the right-hand pedestal and refit the circlip. Ensure that the circlip is correctly located in its groove on the shaft.

16 Refit the cylinder head and rocker arm assembly as described in Section 11.

Camshaft

17 Ensure that the cylinder head and camshaft bearing surfaces are clean, then liberally oil the camshaft bearings and lobes. Slide the camshaft back into position in the cylinder head.

18 Locate the thrust fork with the left-hand end of the camshaft. Refit the fork retaining bolt, tightening it to the specified torque setting.

19 Ensure that the coolant housing and cylinder head mating surfaces are clean and dry, with all traces of old sealant removed. Using RTV sealant, refit the coolant housing to the left-hand end of the cylinder head. Tighten the retaining bolts securely in a progressive sequence.

20 Lubricate the lips of the new seal with clean engine oil, then drive it into position until it seats on its locating shoulder. Use a suitable tubular drift, such as a socket, which bears only on the hard outer edge of the seal. Take care not to damage the seal lips during fitting. Note that the seal lips should face inwards.

21 Refit the camshaft sprocket as described in Section 7.

22 Refit the cylinder head as described in Section 11.

11 Cylinder head – removal and refitting

Note: *The following operations entail the slackening and then retensioning of the timing belt. Refer to Section 6 and ensure that the necessary equipment to accurately tension the timing belt is available, before proceeding.*

Removal

1 Disconnect the battery negative terminal (refer to *Disconnecting the battery* in the Reference Chapter).

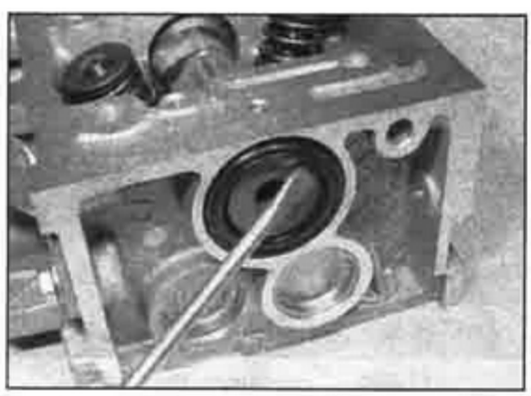
2 Drain the cooling system as described in Chapter 1A.

3 Remove the cylinder head cover as described in Section 4.

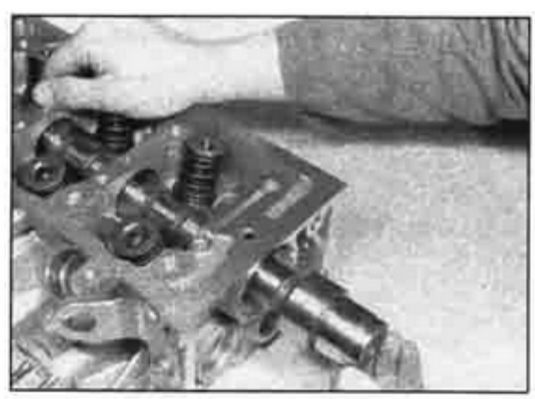
4 Align the engine assembly/valve timing holes as described in Section 3, and lock both the camshaft sprocket and flywheel in position. *Do not* attempt to rotate the engine whilst the locking tools are in position.

5 Note that the following text assumes that the cylinder head will be removed with both inlet and exhaust manifolds attached; this is easier, but makes it a bulky and heavy assembly to handle. If it is wished to remove the manifolds first, proceed as described in Chapter 4A.

6 Working as described in Chapter 4A, disconnect the exhaust system front pipe from the manifold. Disconnect or release the



10.9a . . . prise out the oil seal . . .



10.9b . . . and slide out the camshaft

lambda sensor wiring, so that it is not strained by the weight of the exhaust.

7 Remove the air cleaner housing and inlet duct assembly as described in Chapter 4A.

8 Carry out the following operations as described in Chapter 4A:

a) Depressurise the fuel system, and disconnect the fuel feed hose from the fuel rail (plug all openings, to prevent loss of fuel and entry of dirt into the fuel system).

b) Disconnect the accelerator cable.

c) Disconnect the relevant electrical connectors from the throttle housing, fuel injectors and the idle speed stepper motor.

d) Disconnect the vacuum servo unit hose, coolant hose(s) and all the other relevant/breather hoses from the manifold.

9 Remove the lower timing belt cover as described in Section 5.

10 Loosen the timing belt tensioner pulley retaining nut. Pivot the pulley in a clockwise direction, using an 8.0 mm square-section bar fitted to the hole in the pulley hub (see Section 6), then retighten the retaining nut.

11 Disengage the timing belt from the camshaft sprocket, and position the belt clear of the sprocket. Ensure that the belt is not bent or twisted sharply.

12 Slacken the retaining clips, and disconnect the coolant hoses from the thermostat housing (on the left-hand end of the cylinder head).

13 Depress the retaining clip(s), and disconnect the wiring connector(s) from the electrical switch and/or sensor(s) which are screwed into the thermostat housing/cylinder head (as appropriate).

14 Disconnect the wiring connector from the ignition coil module. If the cylinder head is to be dismantled for overhaul, remove the ignition coil module as described in Chapter 5B.

15 Slacken and remove the bolt securing the engine oil dipstick tube to the cylinder head.

16 Working in the *reverse* of the sequence shown in illustration 11.33, progressively slacken the ten cylinder head bolts by half a turn at a time, until all bolts can be unscrewed by hand.

17 With all the cylinder head bolts removed, lift the rocker arm assembly off the cylinder head. Note the locating pins which are fitted to the base of each rocker arm pedestal. If any pin is a loose fit in the head or pedestal, remove it for safe-keeping.

18 Carefully lift the cylinder head off the engine. Seek assistance if possible, as it is a heavy assembly, especially if it is being removed complete with the manifolds.

19 Remove the gasket from the top of the block, noting the two locating dowels. If the locating dowels are a loose fit, remove them and store them with the head for safe-keeping.

20 If the cylinder head is to be dismantled for overhaul, remove the camshaft as described in Section 10, then refer to Part D of this Chapter.

Preparation for refitting

21 The mating faces of the cylinder head and cylinder block/crankcase must be perfectly clean before refitting the head. Citroën recommend the use of a scouring agent for this purpose, but acceptable results can be achieved by using a hard plastic or wood scraper to remove all traces of gasket and carbon. The same method can also be used to clean the piston crowns. Take particular care to avoid scoring or gouging the cylinder head/cylinder block mating surfaces during the cleaning operations, as aluminium alloy is easily damaged. Also, make sure that the carbon debris is not allowed to enter the oil and water passages – this is particularly important for the lubrication system, as carbon could block the oil supply to the engine's components. Using adhesive tape and paper, seal the water, oil and bolt holes in the cylinder block/crankcase.

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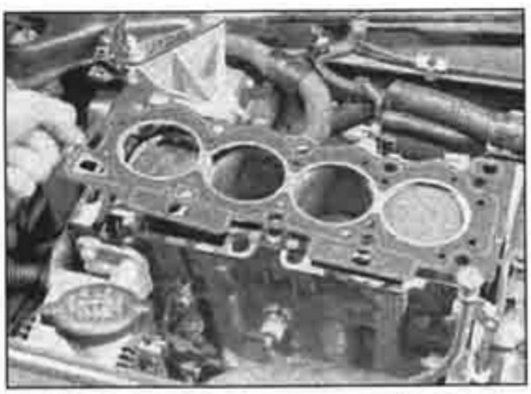
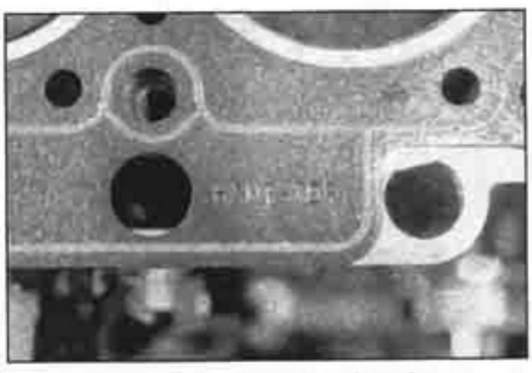
To prevent carbon debris entering the gap between the pistons and bores, smear a little grease in the gap. After cleaning each piston, use a small brush to remove all traces of grease and carbon from the gap, then wipe away the remainder with a clean rag.



11.28a Position a new gasket on the cylinder block surface . . .



11.28b . . . ensuring that the manufacturers identification markings (HAUT – TOP) face upwards

22 Check the mating surfaces of the cylinder block and the cylinder head for nicks, deep scratches and other damage. If slight, they may be removed carefully with a file, but if excessive, machining may be the only alternative to renewal.

23 Thoroughly clean the threads of the cylinder head bolt holes in the cylinder block. Ensure that the bolts run freely in their threads, and that all traces of oil and water are removed from each bolt hole.

24 If warpage of the cylinder head gasket surface is suspected, use a straight-edge to check it for distortion. Refer to Part D of this Chapter if necessary.

25 When purchasing a new cylinder head gasket, it is essential that a gasket of the correct thickness is obtained. At the time of writing, only one thickness of gasket was available, but confirm that this is still the case with your dealer or parts supplier. If you have any doubts, take the old gasket along to your dealer or parts supplier, and have him confirm the type of replacement gasket required.

26 Check the condition of the cylinder head bolts, and particularly their threads, whenever they are removed. Wash the bolts in a suitable solvent, and wipe them dry. Check each bolt for any sign of visible wear or damage, renewing them if necessary. Measure the length of each bolt from the underside of its head to the end of the bolt. The bolts may be re-used if their length does not exceed 175.5 mm. If any one bolt is longer than the specified length, *all* of the bolts should be renewed as a complete set. Considering the stress which the cylinder head bolts are under, it is highly recommended that they are renewed, regardless of their apparent condition.

Refitting

27 Wipe clean the mating surfaces of the cylinder head and cylinder block/crankcase. Check that the two locating dowels are in position at each end of the cylinder block/crankcase surface.

28 Position a new gasket on the cylinder block surface, ensuring that the manufacturer's identification markings face upwards **(see illustrations)**.

29 Check that the flywheel and camshaft sprocket are still correctly locked in position with their respective locking tools then, with the aid of an assistant, carefully refit the cylinder head assembly to the block, aligning it with the locating dowels.

30 Ensure that the locating pins are in position in the base of each rocker pedestal, then refit the rocker arm assembly to the cylinder head **(see illustration)**.

31 Apply a smear of grease to the threads, and to the underside of the heads, of the cylinder head bolts **(see illustration)**. Citroën specify Molykote G Rapid Plus grease (available from your Citroën dealer – a sachet may supplied with the top-end gasket set).

32 Carefully enter each bolt into its relevant

hole (*do not drop them in*) and screw in, by hand only, until finger-tight.

33 Working progressively and in the sequence shown, tighten the cylinder head bolts to their Stage 1 torque setting, using a torque wrench and suitable socket **(see illustration)**.

34 Once all the bolts have been tightened to their Stage 1 setting, working again in the given sequence, angle-tighten the bolts through the specified Stage 2 angle, then the Stage 3 angle, using a socket and extension bar. It is recommended that an angle-measuring gauge is used during this stage of the tightening, to ensure accuracy.

35 With the cylinder head bolts correctly tightened, refit the dipstick tube retaining bolt and tighten it securely.

36 Refit the timing belt to the camshaft sprocket. Ensure that the 'front run' of the belt is taut – ie, ensure that any slack is on the tensioner pulley side of the belt. Do not twist the belt sharply while refitting it, and ensure that the belt teeth are seated centrally in the sprockets.

37 Loosen the tensioner pulley retaining nut. Pivot the pulley anti-clockwise to remove all free play from the timing belt, then retighten the nut.

38 Tension the belt as described in Section 6, then refit the timing belt covers as described in Section 5.

39 If removed, refit the ignition coil module, as described in Chapter 5B, or alternatively reconnect the wiring connector.

40 Reconnect the wiring connector(s) to the coolant switch/sensor(s) on the left-hand end of the head.

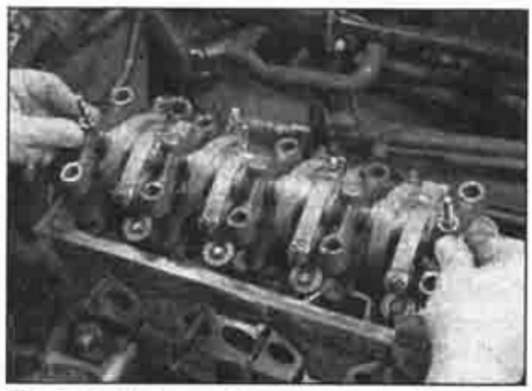
41 Reconnect the coolant hoses to the thermostat housing, securely tightening their retaining clips.

42 Working as described in Chapter 4A, carry out the following tasks:

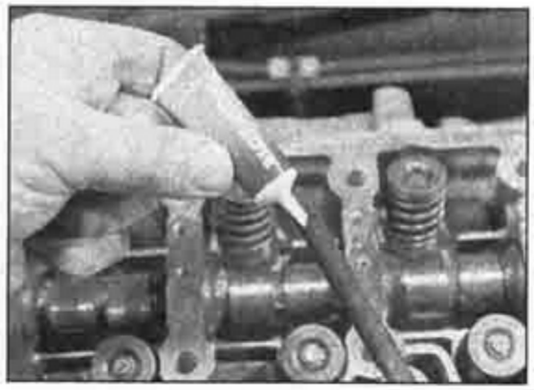
a) Refit all disturbed wiring, hoses and control cable(s) to the inlet manifold and fuel system components.

b) Reconnect and adjust the accelerator cable.

c) Reconnect the exhaust system front pipe to the manifold. If applicable, reconnect the lambda sensor wiring connector.



11.30 Refit the rocker arm assembly to the cylinder head



11.31 Apply a smear of the grease supplied with the gasket set to the threads, and to the underside of the heads, of the cylinder head bolts

d) Refit the air cleaner housing and inlet duct.

43 Check and, if necessary, adjust the valve clearances as described in Section 9.

44 On completion, reconnect the battery, and refill the cooling system as described in Chapter 1A.

12 Sump – removal and refitting

Removal

1 Disconnect the battery negative terminal (refer to *Disconnecting the battery* in the Reference Chapter). Chock the rear wheels then jack up the front of the vehicle and support it on axle stands (see *Jacking and vehicle support*).

2 Drain the engine oil, then clean and refit the engine oil drain plug, tightening it to the specified torque. If the engine is nearing its service interval when the oil and filter are due for renewal, it is recommended that the filter is also removed, and a new one fitted. After reassembly, the engine can then be refilled with fresh oil. Refer to Chapter 1A for further information.

3 Remove the exhaust system front pipe as described in Chapter 4A.

4 Progressively slacken and remove all the sump nuts and bolts. It may be necessary to unbolt the flywheel cover plate from the transmission to gain access to the left-hand sump fasteners.

5 Try to break the joint by striking the sump with the palm of your hand, then lower and withdraw the sump from under the vehicle **(see illustration)**. If the sump is stuck (which is quite likely) use a putty knife or similar, carefully inserted between the sump and block. Ease the knife along the joint until the sump is released.

6 While the sump is removed, take the opportunity to check the oil pump pick-up/strainer for signs of clogging or splitting. If necessary, remove the pump as described in Section 13, and clean or renew the strainer.

Refitting

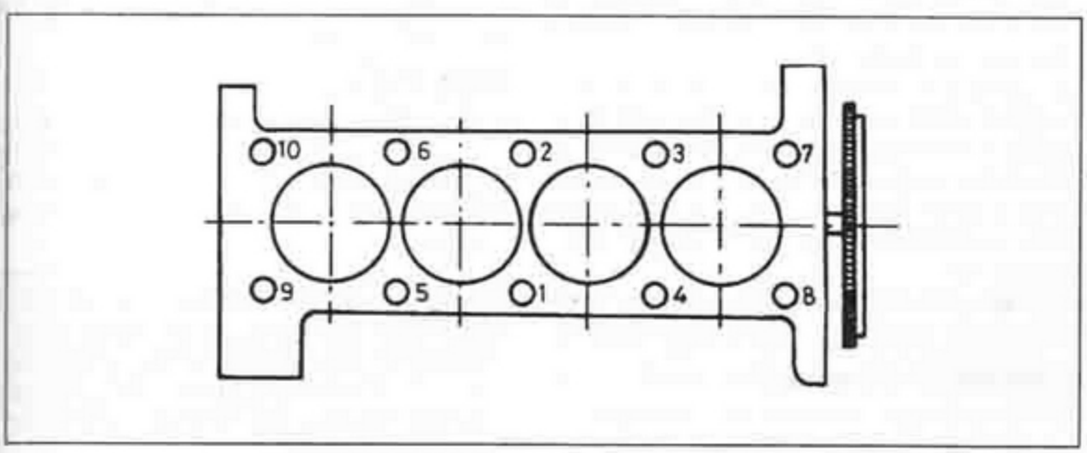
7 Clean all traces of sealant from the mating surfaces of the cylinder block and sump, then use a clean rag to wipe out the sump and the engine's interior.

8 Ensure that the sump and cylinder block mating surfaces are clean and dry, then apply a coating of suitable sealant to the sump mating surface.

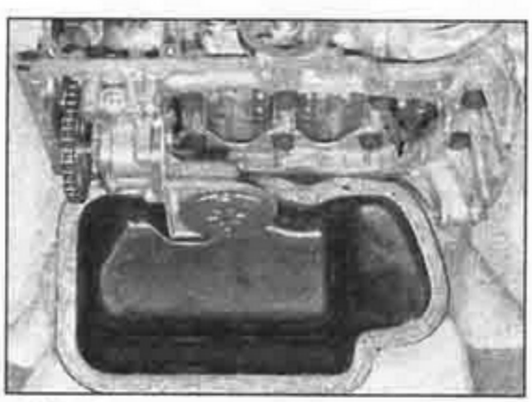
9 Offer up the sump, locating it on its retaining studs, and refit its retaining nuts and bolts. Tighten the nuts and bolts evenly and progressively to the specified torque.

10 Refit the exhaust front pipe as described in Chapter 4A.

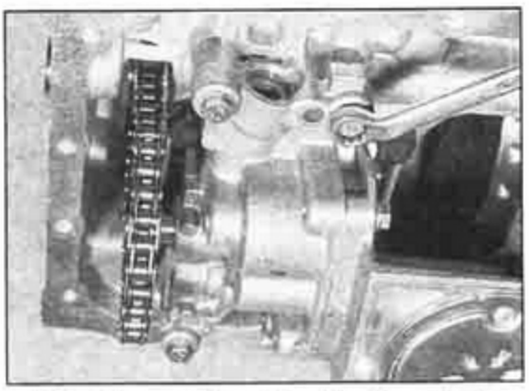
11 Replenish the engine oil as described in Chapter 1A.



11.33 Cylinder head bolt tightening sequence



12.5 Slacken and remove the sump nuts and bolts, then remove the sump from the engine



13.2 Oil pump is retained by three bolts

13 Oil pump – removal, inspection and refitting

Removal

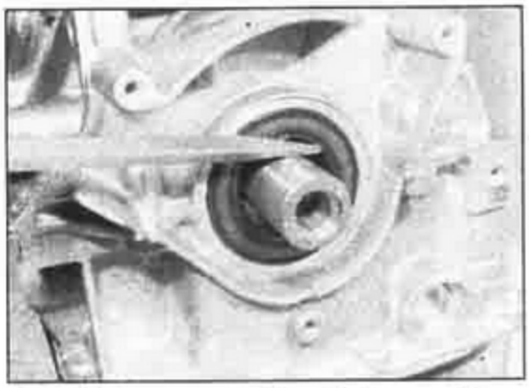
1 Remove the sump as described in Section 12.
2 Slacken and remove the three bolts securing the oil pump in position **(see illustration)**. Disengage the pump sprocket from the chain, and remove the oil pump. If the pump locating dowel is a loose fit, remove and store it with the bolts for safe-keeping.

Inspection

3 Examine the oil pump sprocket for signs of damage and wear, such as chipped or missing teeth. If the sprocket is worn, the pump assembly must be renewed, as the sprocket is not available separately. It is also recommended that the chain and drive sprocket, fitted to the crankshaft, are renewed at the same time. The drive sprocket and chain can be removed with the engine *in situ*, once the crankshaft sprocket has been removed and the crankshaft oil seal housing has been unbolted.
4 Slacken and remove the bolts securing the strainer cover to the pump body, then lift off the strainer cover. Remove the relief valve piston, spring and guide pin, noting which way round they are fitted.
5 Examine the pump rotors and body for signs of wear ridges and scoring. If worn, the complete pump assembly must be renewed.
6 Examine the relief valve piston for signs of wear or damage, and renew if necessary. The condition of the relief valve spring can only be measured by comparing it with a new one; if there is any doubt about its condition, it should also be renewed. Both the piston and spring are available individually.
7 Thoroughly clean the oil pump strainer with a suitable solvent, and check it for signs of clogging or splitting. If the strainer is damaged, the strainer and cover assembly must be renewed.
8 Locate the relief valve spring, piston and guide pin in the strainer cover, then refit the cover to the pump body. Align the relief valve piston with its bore in the pump. Refit the cover retaining bolts, tightening them securely.

Refitting

9 Ensure that the locating dowel is in position, then engage the pump sprocket with its drive chain. Locate the pump on its dowel, and refit the pump retaining bolts, tightening them to the specified torque setting.
10 Refit the sump as described in Section 12.



14.2 Using a screwdriver to lever out the crankshaft right-hand oil seal

14 Crankshaft oil seals – renewal

Right-hand oil seal

1 Remove the crankshaft sprocket and flanged spacer as described in Section 7. Secure the timing belt clear of the working area, so that it cannot be contaminated with oil. Make a note of the correct fitted depth of the seal in its housing.
2 Punch or drill two small holes opposite each other in the seal. Screw a self-tapping screw into each, and pull on the screws with pliers to extract the seal. Alternatively, the seal can be levered out of position using a suitable flat-bladed screwdriver, taking great care not to damage the crankshaft shoulder or seal housing **(see illustration)**.
3 Clean the seal housing, and polish off any burrs or raised edges, which may have caused the seal to fail in the first place.
4 Lubricate the lips of the new seal with clean engine oil, and carefully locate the seal on the end of crankshaft. Note that its sealing lip must face inwards. Take care not to damage the seal lips during fitting.
5 Using a suitable tubular drift (such as a socket) which bears only on the hard outer edge of the seal, tap the seal into position, to the same depth in the housing as the original was prior to removal. The inner face of the seal must be flush with the inner wall of the crankcase.
6 Wash off any traces of oil, then refit the crankshaft sprocket as described in Section 7.

Left-hand oil seal

7 Remove the flywheel as described in Section 15.
8 Make a note of the correct fitted depth of the seal in its housing. Punch or drill two small holes opposite each other in the seal. Screw a self-tapping screw into each, and pull on the screws with pliers to extract the seal.
9 Clean the seal housing, and polish off any burrs or raised edges, which may have caused the seal to fail in the first place.
10 Lubricate the lips of the new seal with clean engine oil, and carefully locate the seal on the end of the crankshaft.
11 Using a suitable tubular drift, which bears only on the hard outer edge of the seal, drive the seal into position, to the same depth in the housing as the original was prior to removal.
12 Wash off any traces of oil, then refit the flywheel as described in Section 15.

15 Flywheel – removal, inspection and refitting

Removal

1 Remove the transmission as described in Chapter 7, then remove the clutch assembly as described in Chapter 6.
2 Prevent the flywheel from turning by locking the ring gear teeth with a similar arrangement to that shown in illustration 7.10. Alternatively, bolt a strap between the flywheel and the cylinder block. *Do not* attempt to lock the flywheel in position using the locking tool described in Section 3.
3 Slacken and remove the flywheel retaining bolts, and remove the flywheel from the end of the crankshaft. Be careful not to drop it; it is heavy. If the flywheel locating dowel is a loose fit in the crankshaft end, remove it and store it with the flywheel for safe-keeping. Discard the flywheel bolts; new ones must be used on refitting.

Inspection

4 Examine the flywheel for scoring of the clutch face, and for wear or chipping of the ring gear teeth. If the clutch face is scored, the flywheel may be surface-ground, but renewal is preferable. Seek the advice of a Citroën dealer or engine reconditioning specialist to see if machining is possible. If the ring gear is worn or damaged, the flywheel must be renewed, as it is not possible to renew the ring gear separately.

Refitting

5 Clean the mating surfaces of the flywheel and crankshaft. Remove any remaining locking compound from the threads of the crankshaft holes, using the correct size of tap, if available.

> **HAYNES HiNT** ***If a suitable tap is not available, cut two slots along the threads of one of the old flywheel bolts, and use the bolt to remove the locking compound from the threads.***

6 If the new flywheel retaining bolts are not supplied with their threads already pre-coated, apply a suitable thread-locking compound to the threads of each bolt.

7 Ensure that the locating dowel is in position. Offer up the flywheel, locating it on the dowel, and fit the new retaining bolts.

8 Lock the flywheel using the method employed on dismantling, and tighten the retaining bolts to the specified torque.

9 Refit the clutch as described in Chapter 6. Remove the flywheel locking tool, and refit the transmission as described in Chapter 7.

16 Engine/transmission mountings – inspection and renewal

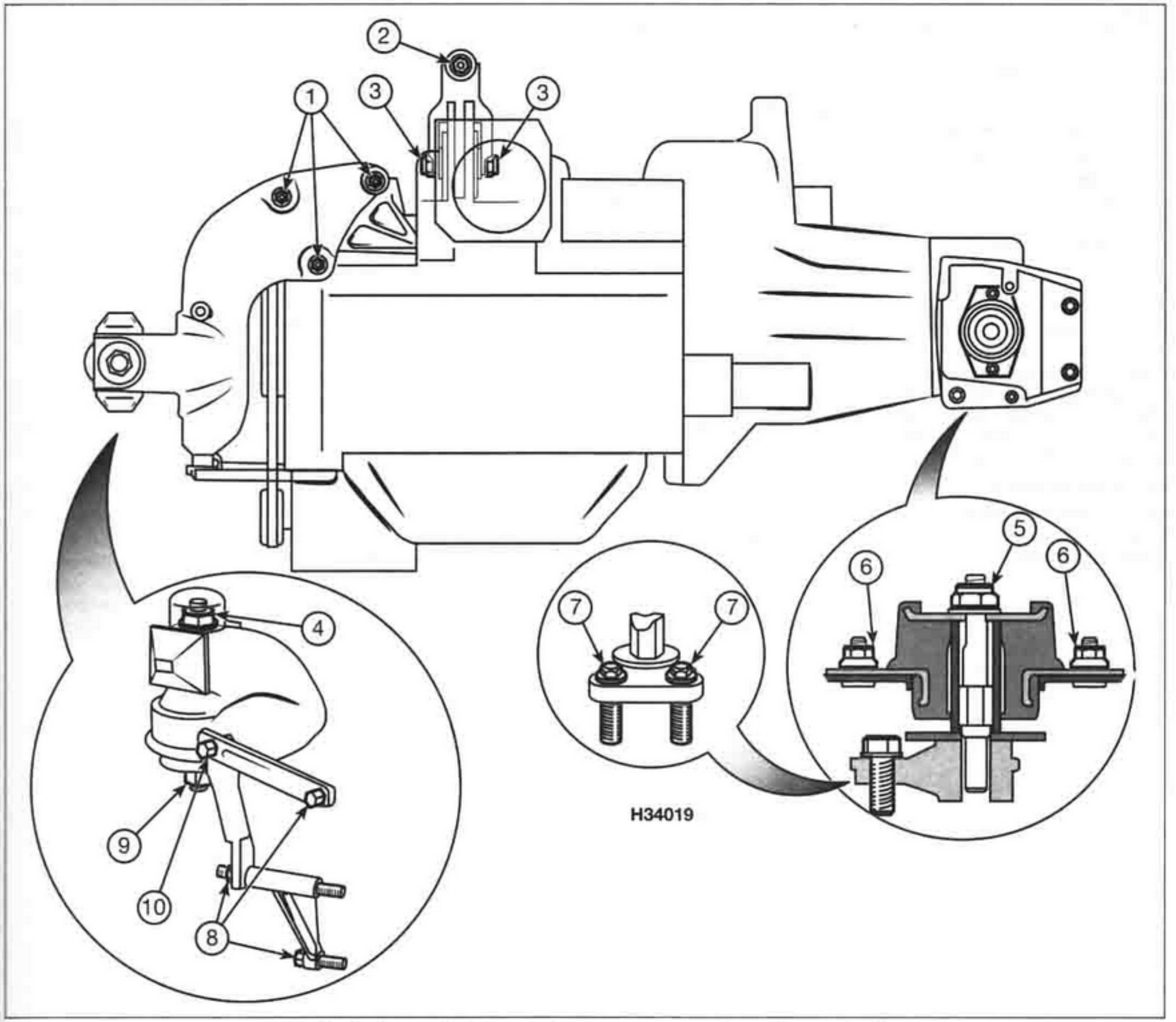
Inspection

1 If improved access is required, firmly apply the handbrake, then jack up the front of the vehicle and support it securely on axle stands (see *Jacking and vehicle support*).

2 Check the mounting rubber to see if it is cracked, hardened or separated from the metal at any point; renew the mounting if any such damage or deterioration is evident.

3 Check that all the mountings' fasteners are securely tightened; use a torque wrench to check if possible **(see illustration).**

4 Using a large screwdriver or a crowbar, check for wear in the mounting by carefully levering against it to check for free play. Where this is not possible, enlist the aid of an assistant to move the engine/transmission back-and-forth, or from side-to-side, while you watch the mounting. While some free play is to be expected even from new components,



16.3 Engine/transmission mounting components and attachment details

1 Upper mounting bracket-to-engine bolts
2 Rear mounting connecting link-to-subframe bracket bolt
3 Rear mounting connecting link-to-cylinder block bracket bolt
4 Right-hand rubber mounting centre nut
5 Left-hand rubber mounting centre nut
6 Left-hand rubber mounting-to-bracket nuts
7 Left-hand mounting bracket-to-transmission bolts
8 Right-hand mounting support brace-to-engine bolts/nuts
9 Right-hand rubber mounting
10 Right-hand mounting support brace-to-upper mounting bracket bolt

excessive wear should be obvious. If excessive free play is found, check first that the fasteners are secure, then renew any worn components as described below.

Renewal

Right-hand mounting

5 Disconnect the battery negative terminal (refer to *Disconnecting the battery* in the Reference Chapter).

6 Place a jack beneath the engine, with a block of wood on the jack head. Raise the jack until it is supporting the weight of the engine.

7 Slacken and remove the three nuts securing the right-hand engine mounting upper bracket to the bracket on the cylinder block. Unscrew the single nut securing the bracket to the rubber mounting, and lift off the bracket.

8 Unscrew the rubber mounting from the body. A strap wrench or similar may be used to unscrew the mounting, or alternatively fabricate a tool from suitable metal tube with projections to engage in the cut-outs in the mounting.

9 Check for signs of wear or damage on all components, and renew as necessary.

10 On reassembly, securely tighten the rubber mounting in the body, then install the mounting bracket.

11 Tighten the mounting bracket retaining nuts to the specified torque wrench setting.

12 Remove the jack from under the engine, and reconnect the battery negative terminal.

Left-hand mounting

13 Disconnect the battery negative terminal (refer to *Disconnecting the battery* in the Reference Chapter).

14 Remove the air cleaner assembly and intake ducting as described in Chapter 4A.

15 Lift up the covers on the battery positive cable terminal box and unscrew the nuts securing the battery cables to the terminal studs. Lift the cables off the studs and suitably label them for correct refitting.

16 Withdraw the engine management ECU from its location on the support tray and move it to one side.

17 Release the wiring harness from the retaining clips on the ECU support tray, then undo the retaining bolts and lift out the support tray.

18 Place a jack beneath the transmission, with a block of wood on the jack head. Raise the jack until it is supporting the weight of the transmission.

19 Slacken and remove the centre nut and washer from the left-hand mounting, then undo the nuts securing the mounting to the mounting bracket. Lift off the mounting and remove it from the engine compartment.

20 If necessary, slide the spacer (where fitted) off the mounting stud, then unscrew the stud from the top of the transmission housing, and remove it along with its washer. If the mounting stud is tight, a universal stud extractor can be used to unscrew it.

21 Check all components carefully for signs of wear or damage, and renew as necessary.

22 Clean the threads of the mounting stud, and apply a coat of thread-locking compound to its threads. Refit the stud and washer to the top of the transmission, and tighten it to the specified torque setting.

23 Slide the spacer (where fitted) onto the mounting stud, then refit the rubber mounting. Tighten both the mounting-to-bracket nuts and the mounting centre nut to their specified torque settings, and remove the jack from underneath the transmission.

24 Refit the ECU support tray, and clip the wiring harness back into position.

25 Refit the ECU to the support tray and reconnect the battery positive cables to their respective terminal studs.

26 Refit the air cleaner assembly and intake ducting as described in Chapter 4A, then reconnect the battery negative terminal.

Rear mounting

27 If not already done, firmly apply the handbrake, then jack up the front of the vehicle and support it securely on axle stands (see *Jacking and vehicle support*).

28 Unscrew and remove the bolt securing the rear mounting connecting link to the mounting on the rear of the cylinder block.

29 Remove the bolt securing the connecting link to the bracket on the subframe. Withdraw the link.

30 To remove the mounting assembly it will first be necessary to remove the right-hand driveshaft as described in Chapter 8.

31 With the driveshaft removed, undo the retaining bolts and remove the mounting from the rear of the cylinder block.

32 Check carefully for signs of wear or damage on all components, and renew them where necessary.

33 On reassembly, fit the rear mounting assembly to the rear of the cylinder block, and tighten its retaining bolts to the specified torque. Refit the driveshaft as described in Chapter 8.

34 Refit the rear mounting connecting link, and tighten both its bolts to their specified torque settings.

35 Lower the vehicle to the ground.

Chapter 2 Part B:
EW series petrol engine in-car repair procedures

Contents

Degrees of difficulty

Easy, suitable for novice with little experience 

Fairly easy, suitable for beginner with some experience 

Fairly difficult, suitable for competent DIY mechanic 

Difficult, suitable for experienced DIY mechanic 

Very difficult, suitable for expert DIY or professional 

Specifications

Engine (general)

Designation	EW7
Capacity	1749 cc (1.8 litre)
Engine code*	6FZ (EW7J4)
Bore	82.7 mm
Stroke	81.4 mm
Direction of crankshaft rotation	Clockwise (viewed from the right-hand side of vehicle)
No 1 cylinder location	At the transmission end of block
Compression ratio	10.8 : 1

**The engine code is stamped onto the right-hand front face of the cylinder block, adjacent to the engine mounting bracket*

Camshafts

Drive	Toothed belt
No of bearings	5
Camshaft bearing journal diameter (nominal):	
No 1 (transmission end)	28.0 – 0.020; – 0.041 mm
No 2	28.5 – 0.020; – 0.041 mm
No 3	29.0 – 0.020; – 0.041 mm
No 4	29.5 – 0.020; – 0.041 mm
No 5	30.0 – 0.020; – 0.041 mm
Cylinder head bearing journal diameter (nominal):	
No 1 (transmission end)	28.0 – 0; + 0.033 mm
No 2	28.5 – 0; + 0.033 mm
No 3	29.0 – 0; + 0.033 mm
No 4	29.5 – 0; + 0.033 mm
No 5	30.0 – 0; + 0.033 mm

Lubrication system

Oil pump type	Rotor-type, driven directly off the crankshaft
Minimum oil pressure at 90°C	6.3 bars at 4000 rpm

Torque wrench settings	Nm	lbf ft
Ancillary components mounting bracket	19	14
Auxiliary drivebelt tensioner pulley bolt	20	15
Auxiliary drivebelt idler pulley	37	27
Big-end bearing cap bolts*:		
Stage 1	10	7
Stage 2	Slacken by 180°	
Stage 3	23	17
Stage 4	Angle-tighten a further 46°	
Camshaft bearing cap housing bolts:		
Stage 1	5	4
Stage 2	10	7
Camshaft sprocket retaining bolt:		
Stage 1	30	22
Stage 2	75	55
Crankshaft bearing cap housing:		
Stage 1:		
M11 bolts	10	7
M6 bolts	2	1
Stage 2:		
M11 bolts	Fully slacken	
Stage 3:		
M11 bolts	20	15
Stage 4:		
M11 bolts	Angle-tighten a further 70°	
Stage 5:		
M6 bolts	10	7
Crankshaft pulley-to-sprocket retaining bolts:		
Stage 1	15	11
Stage 2	20	15
Crankshaft sprocket centre bolt:		
Stage 1	40	30
Stage 2	Angle-tighten a further 53°	
Cylinder head bolts:		
Stage 1	15	11
Stage 2	50	37
Stage 3	Slacken by 360° then tighten to:	
Stage 4	20	15
Stage 5	Angle-tighten a further 285°	
Cylinder head cover bolts:		
Stage 1	5	4
Stage 2	11	8
Engine-to-transmission fixing bolts	50	37
Engine/transmission left-hand mounting:		
Mounting bracket-to-body bolts	22	16
Mounting bracket-to-transmission bolts	60	44
Rubber mounting centre nut	65	48
Rubber mounting-to-bracket nuts	22	16
Engine/transmission rear mounting:		
Connecting link-to-mounting bracket bolt	55	41
Connecting link-to-subframe bolt	55	41
Mounting bracket-to-cylinder block bolts	45	33
Engine/transmission right-hand mounting:		
Rubber mounting centre nut	45	33
Rubber mounting-to-body	22	16
Upper mounting bracket-to-lower (engine) bracket nuts	61	45
Flywheel retaining bolts*:		
Stage 1	25	18
Stage 2	Fully slacken then tighten to:	
Stage 3	8	6
Stage 4	20	15
Stage 5	Angle-tighten a further 21°	
Oil pump retaining bolts	8	6
Sump retaining bolts	8	6
Timing belt idler pulley bolt	37	27
Timing belt tensioner pulley bolt	20	15

**New nuts/bolts must be used.*

1 General information

Using this Chapter

This Part of Chapter 2 is devoted to in-car repair procedures for the EW series petrol engine. Similar information covering the TU series petrol engine, and the diesel engine will be found in Chapters 2A and 2C. All procedures concerning engine removal and refitting, and engine block/cylinder head overhaul for petrol and diesel engines can be found in Chapters 2D and 2E as applicable.

Most of the operations included in Chapter 2B are based on the assumption that the engine is still installed in the car. Therefore, if this information is being used during a complete engine overhaul, with the engine already removed, many of the steps included here will not apply.

EW series engine description

The EW series engine is of the DOHC 16-valve, in-line four-cylinder type, mounted transversely at the front of the car with the clutch and transmission attached to its left-hand end.

The aluminium alloy cylinder block/crankcase is of modular construction consisting of three sections – the cylinder block itself, the crankshaft bearing cap housing and the sump. The cylinder block incorporates four cast iron dry cylinder liners which are cast into the block and cannot be renewed.

The crankshaft is supported in five shell-type main bearings with thrustwashers fitted to No 2 main bearing, to control crankshaft endfloat.

The connecting rods are attached to the crankshaft by horizontally-split shell-type big-end bearings, and to the pistons by gudgeon pins which are an interference fit in the connecting rod small-end eyes. The aluminium alloy pistons are of the slipper type, and are fitted with three piston rings – two compression rings and a scraper-type oil control ring.

The cylinder head is of the crossflow type, the inlet ports being at the front of the engine and the exhaust ports at the rear. The camshafts run in plain bearings integral with the cylinder head and with the two camshaft bearing cap housings. The inlet and exhaust valves are each closed by single coil springs, and operate in guides pressed into the cylinder head. Valve actuation is by self-adjusting hydraulic tappets acted upon directly by the camshaft lobes.

Drive to the camshafts is by a toothed timing belt and sprockets and incorporating an automatic tensioning mechanism. The timing belt also drives the coolant pump. All accessories are driven from the crankshaft pulley by a single multi-ribbed auxiliary drivebelt.

The lubrication system is of the full-flow, pressure-feed type. Oil is drawn from the sump by a rotor type pump, driven directly from the front of the crankshaft. The pump draws oil through a strainer located in the sump and then forces it through an externally-mounted filter into galleries in the cylinder block. From there, the oil is distributed to the crankshaft (main bearings) and camshafts. The big-end bearings are supplied with oil via internal drillings in the crankshaft; the camshaft bearings also receive a pressurised supply. The camshaft lobes and valves are lubricated by splash, as are all other engine components.

Throughout this manual, it is often necessary to identify the engines not only by their capacity, but also by their engine code which is incorporated in the engine number. This can be found stamped onto the right-hand front face of the cylinder block, adjacent to the engine mounting bracket. The first part of the engine number gives the engine code – eg, 6FZ.

Repair operations possible with the engine in the vehicle

The following work can be carried out with the engine in the vehicle:

a) Compression pressure – testing.
b) Cylinder head covers – removal and refitting.
c) Crankshaft pulley – removal and refitting.
d) Timing belt covers – removal and refitting.
e) Timing belt – removal, refitting and adjustment.
f) Timing belt tensioner and sprockets – removal and refitting.
g) Camshaft oil seals – renewal.
h) Camshafts and tappets – removal, inspection and refitting.
i) Cylinder head – removal and refitting.
j) Cylinder head and pistons – decarbonising.
k) Sump – removal and refitting.
l) Crankshaft oil seals – renewal.
m) Engine/transmission mountings – inspection and renewal.
n) Flywheel – removal, inspection and refitting.

2 Compression test – description and interpretation

Refer to Chapter 2A, Section 2.

3 Engine assembly/valve timing holes – general information and usage

Note 1: *The following procedure entails the use of Citroën special tool (-).0189.B (camshaft setting rods). If the Citroën tool is not available, details for fabricating suitable alternatives are given in the text.*

Note 2: *Do not attempt to rotate the engine whilst the crankshaft/camshafts are locked in position. If the engine is to be left in this state for a long period of time, it is a good idea to place suitable warning notices inside the vehicle, and in the engine compartment. This will reduce the possibility of the engine being accidentally cranked on the starter motor, which is likely to cause damage with the locking pins in place.*

1 Timing holes are drilled in the crankshaft sprocket end plate and in the two camshaft sprockets. The holes are used to ensure that the crankshaft and camshafts are correctly positioned when assembling the engine (to prevent the possibility of the valves contacting the pistons when refitting the cylinder head), or refitting the timing belt. When the timing holes are aligned with corresponding holes in the cylinder head and oil pump housing, suitable diameter pins or bolts can be inserted to lock both the camshafts and crankshaft in position, preventing them from rotating. To set the engine in the timing position, proceed as follows.

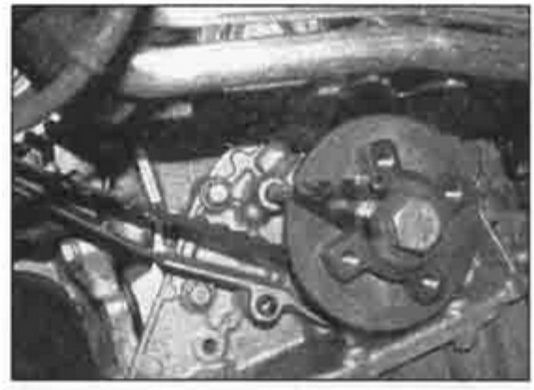
2 Remove the crankshaft pulley as described in Section 5.

3 Remove the timing belt upper (outer) and lower covers as described in Section 6.

4 Using a socket and extension bar fitted to the crankshaft sprocket centre bolt, turn the crankshaft in the normal direction of rotation until the timing holes in both camshaft sprockets are aligned with their corresponding holes in the cylinder head. The holes are aligned when the inlet camshaft sprocket hole is in approximately the 5 o'clock position and the exhaust camshaft sprocket hole is in approximately the 7 o'clock position, when viewed from the right-hand end of the engine. Use a small mirror to accurately observe the position of the holes.

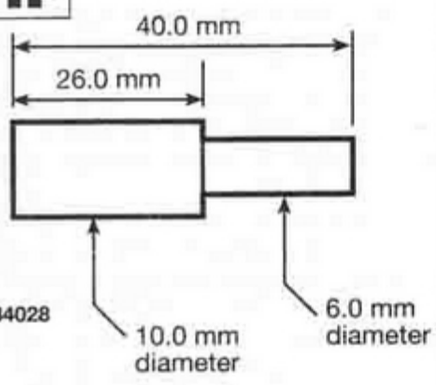
5 With the camshaft sprocket holes correctly positioned, insert an 8.0 mm diameter drill bit or bolt through the timing hole in the crankshaft sprocket end plate, and locate it in the corresponding hole in the oil pump housing **(see illustration)**.

6 The camshaft sprockets can now be locked



3.5 8.0 mm diameter drill bit inserted through the crankshaft sprocket end plate timing hole, and engaged in the corresponding hole in the oil pump housing

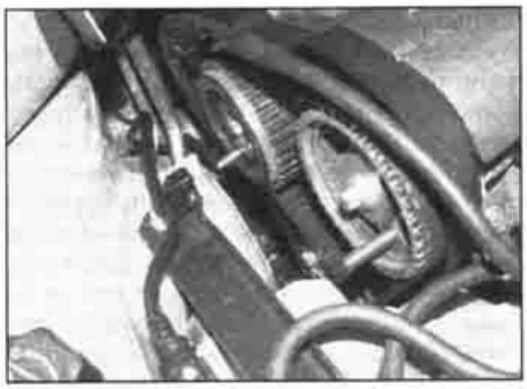
TOOL TiP



Camshaft sprocket locking tools can be made from 10.0 mm diameter steel bar, fabricated to the dimensions shown.

in position using the Citroën camshaft setting rods, or suitable home-made alternatives **(see Tool Tip)**. With the crankshaft locked in position, insert the Citroën special tools, or alternatives, through the timing hole in each camshaft sprocket and locate it in the corresponding hole in the cylinder head **(see illustration)**.

7 The crankshaft and camshafts are now locked in position, preventing rotation. In this position the crankshaft is at 90° BTDC and all the pistons are positioned half way down their cylinder bores.



3.6 Camshaft sprocket locking tools inserted through the timing hole in each sprocket

4 Cylinder head covers – removal and refitting

Removal

1 Disconnect the battery negative terminal (refer to *Disconnecting the battery* in the Reference Chapter).

2 Undo the six screws and lift off the engine cover.

3 Disconnect the crankcase breather hose at the quick-fit connector on the rear cylinder head cover **(see illustration)**.

4 Disconnect the wiring connector at the camshaft position sensor, then undo the bolt and remove the sensor from the rear cylinder head cover **(see illustrations)**.

5 Working in the reverse sequence to that shown in illustration 4.10, progressively slacken, then remove the eleven retaining bolts from each cylinder head cover.

6 Lift off each cover in turn and remove it **(see illustrations)**. The cover seal should remain attached as the cover is removed – do not try to remove it, unless it is obviously damaged.

Refitting

7 Clean the cylinder head and cylinder head cover mating surfaces, and remove all traces of oil.

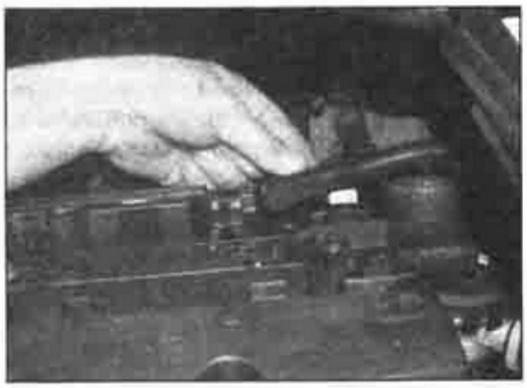
8 Check the condition of the rubber seal attached to each cover. The seal is designed to be re-usable, and so should not automatically be renewed unless its condition is suspect. If renewal is necessary, locate the seal in the cover groove, ensuring that it is fully seated along its entire length **(see illustration)**.

9 Carefully refit the cylinder head cover(s) to the engine.

10 Refit the cover retaining bolts and, working in the sequence shown, tighten them to the specified torque in the two Stages given in the Specifications **(see illustration)**.

11 Check the condition of the O-ring seal on the camshaft position sensor and renew the seal if it is in any way suspect.

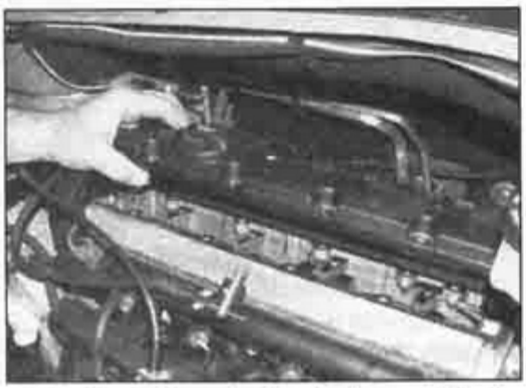
12 Refit the camshaft position sensor and secure with the retaining bolt. Reconnect the sensor wiring connector.



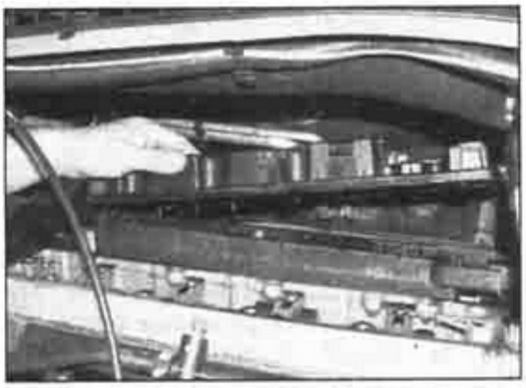
4.3 Disconnect the crankcase breather hose from the rear cylinder head cover

4.4a Disconnect the camshaft position sensor wiring connector . . .

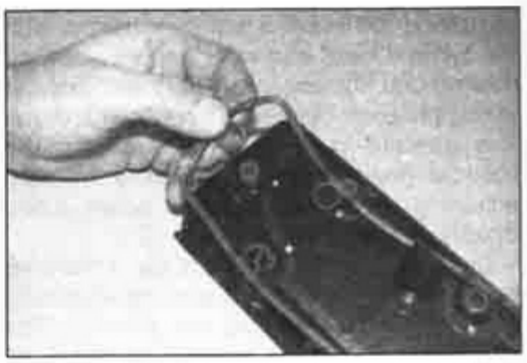
4.4b . . . then undo the bolt and remove the sensor from the rear cylinder head cover



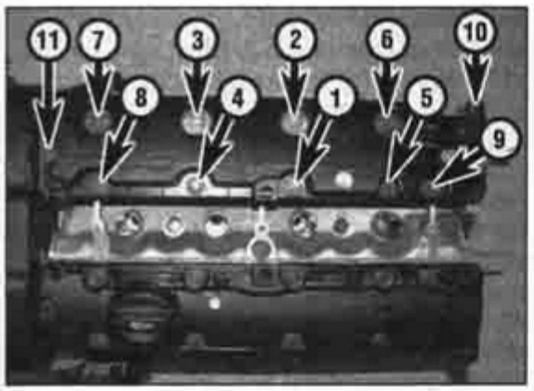
4.6a Undo the retaining bolts and lift off the front . . .



4.6b . . . and rear cylinder head covers



4.8 Locate the cylinder head cover seal in the groove, ensuring that it is fully seated along its entire length



4.10 Cylinder head cover bolt tightening sequence (rear cover shown)

13 Reconnect the breather hoses to the rear cover.

14 Refit the engine cover then reconnect the battery negative terminal.

5 Crankshaft pulley – removal and refitting

Removal

1 Remove the auxiliary drivebelt as described in Chapter 1A.

2 Undo the four crankshaft pulley retaining bolts and remove the pulley from the crankshaft sprocket end plate **(see illustrations)**.

5.2a Undo the four crankshaft pulley retaining bolts . . .

5.2b . . . and remove the pulley from the crankshaft sprocket end plate

Refitting

3 Locate the pulley on the crankshaft sprocket end plate, refit the four retaining bolts and tighten them to the specified torque.

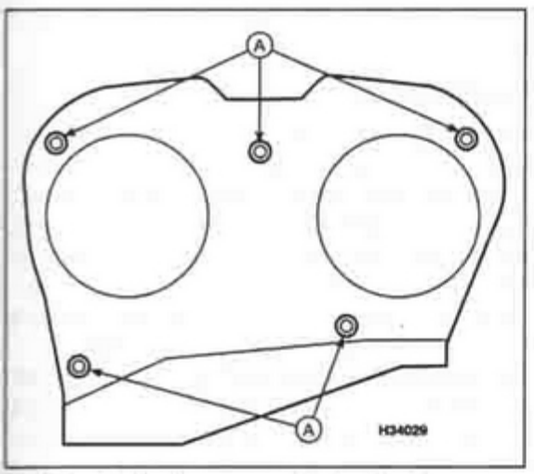
4 Refit and tension the auxiliary drivebelt as described in Chapter 1A.

6 Timing belt covers – removal and refitting

Removal

Upper (outer) cover

1 Release the retaining clip, and free the fuel inlet hose from the rear of the upper (outer) cover.



6.2a Undo the upper timing belt cover retaining bolts (A) . . .

6.2b . . . and withdraw the cover from the cylinder head

2 Using a suitable Allen key, undo the five retaining bolts and withdraw the cover from the cylinder head **(see illustrations)**.

Lower cover

3 Remove the upper (outer) cover as described previously.

4 Remove the crankshaft pulley as described in Section 5.

5 Undo the five cover retaining bolts and release the cover from the locating dowels **(see illustration)**.

6 Manipulate the cover clear of the crankshaft sprocket then twist it round so that it can be withdrawn upwards from between the engine and bulkhead **(see illustration)**. Clearance is extremely limited and considerable patience will be needed.

Upper (inner) cover

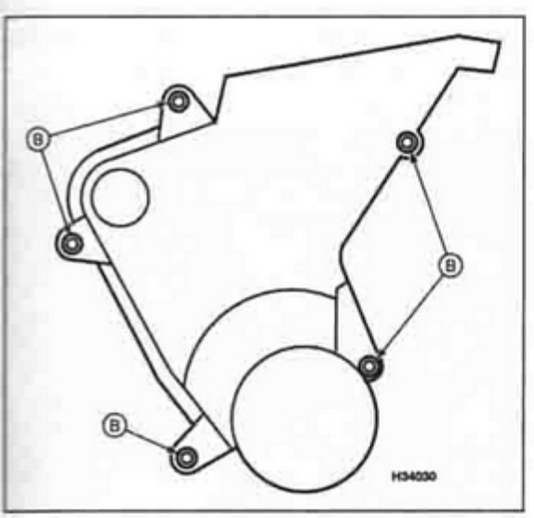
7 Remove the timing belt as described in Section 7.

8 Remove both camshaft sprockets as described in Section 8.

9 Undo the five bolts securing the cover to the cylinder head and remove the cover from the engine **(see illustration)**.

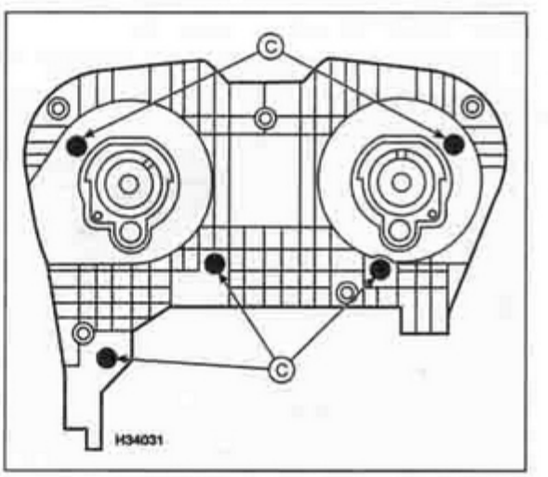
Refitting

10 Refitting is a reversal of the relevant removal procedure, ensuring that each cover section is correctly located, and that the cover retaining bolts are securely tightened. When refitting the upper (inner) cover, apply thread locking compound to the retaining bolts.

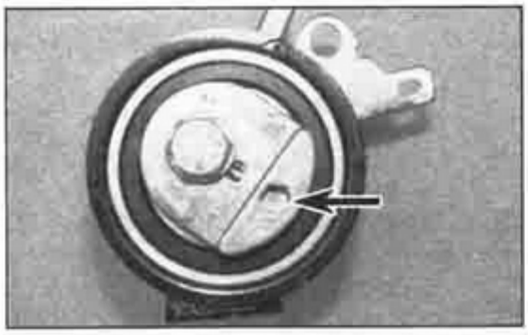


6.5 Undo the lower timing belt cover retaining bolts (B) . . .

6.6 . . . and manipulate the cover up and out from between the engine and bulkhead

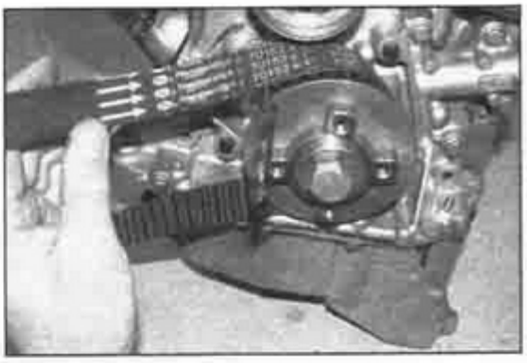


6.9 Upper (inner) timing belt cover retaining bolts (C)



7.8 Using an Allen key in the hole (arrowed) on the tensioner pulley, rotate the pulley clockwise to relieve the tension from the timing belt

7.9 With the tensioner released, slip the timing belt off the sprockets and pulleys



7.13 Locate the timing belt on the crankshaft sprocket, with the arrows on the belt pointing in the direction of rotation

11 Refit the camshaft sprockets and timing belt as described in Sections 8 and 7 after refitting the upper (inner) cover.

12 Refit the crankshaft pulley as described in Section 5 after refitting the lower cover.

7 Timing belt – general information, removal and refitting

Note: *The following procedure entails the use of Citroën special tool 6310-T to prevent the crankshaft rotating when the sprocket retaining bolt is slackened and tightened. If the Citroën tool is not available, details for fabricating a suitable alternative are given in the text.*

General information

1 The timing belt drives the camshafts and coolant pump from a toothed sprocket on the right-hand end of the crankshaft. If the belt breaks or slips in service, the pistons are likely to hit the valve heads, resulting in extensive (and expensive) damage.

2 The timing belt should be renewed at the specified intervals (see Chapter 1A), or earlier if it is contaminated with oil or if it is at all noisy in operation (a 'scraping' noise due to uneven wear).

3 If the timing belt is being removed, it is a wise precaution to check the condition of the coolant pump at the same time (check for signs of coolant leakage). This may avoid the need to remove the timing belt again at a later stage, should the coolant pump fail.

4 The crankshaft sprocket is a two-piece assembly consisting of the toothed sprocket itself and an outer end plate. The end plate is locked to the crankshaft by means of a conventional Woodruff key. When the sprocket retaining bolt is slackened, the sprocket is free to turn on the crankshaft within the limits afforded by an additional keyway within the end plate. When the sprocket retaining bolt is tightened the complete assembly is locked to the crankshaft. This arrangement allows accurate tensioning of the timing belt when refitting, provided that the procedures contained in this Section are strictly adhered to.

Removal

5 Disconnect the battery negative terminal (refer to *Disconnecting the battery* in the Reference Chapter).

6 Remove the upper (outer) and lower timing belt covers as described in Section 6.

7 Align the engine assembly/valve timing holes as described in Section 3, and lock the crankshaft sprocket and camshaft sprockets in position. *Do not* attempt to rotate the engine whilst the locking tools are in position.

8 Loosen the timing belt tensioner pulley retaining bolt. Using an Allen key in the hole provided on the front of the pulley, rotate the pulley in a clockwise direction, to relieve the tension from the timing belt **(see illustration)**. Retighten the tensioner pulley retaining bolt to secure it in the slackened position.

9 If the timing belt is to be re-used, use white paint or chalk to mark the direction of rotation on the belt (if markings do not already exist), then slip the belt off the sprockets and pulleys **(see illustration)**. Note that the crankshaft must not be rotated whilst the belt is removed.

10 Check the timing belt carefully for any signs of uneven wear, splitting, or oil contamination. Pay particular attention to the roots of the teeth. Renew it if there is the slightest doubt about its condition. If the engine is undergoing an overhaul, it is advisable to renew the belt as a matter of course, regardless of its apparent condition. The cost of a new belt is nothing compared with the cost of repairs, should the belt break in service. If signs of oil contamination are found, trace the source of the oil leak and rectify it. Wash down the engine timing belt area and all related components, to remove all traces of oil.

Refitting

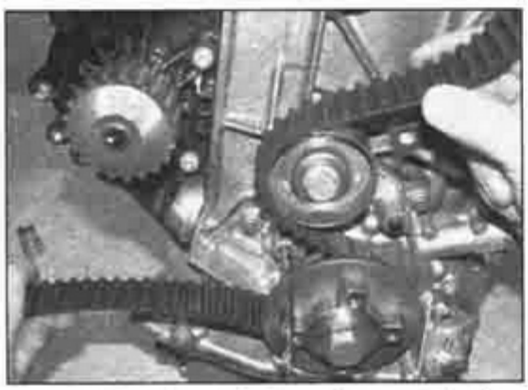
11 Before refitting, thoroughly clean the timing belt sprockets. Check that the tensioner and idler pulleys rotate freely, without any sign of roughness. If necessary, renew the relevant pulley as described in Section 8.

12 Ensure that the crankshaft and camshaft sprocket locking tools are still in position.

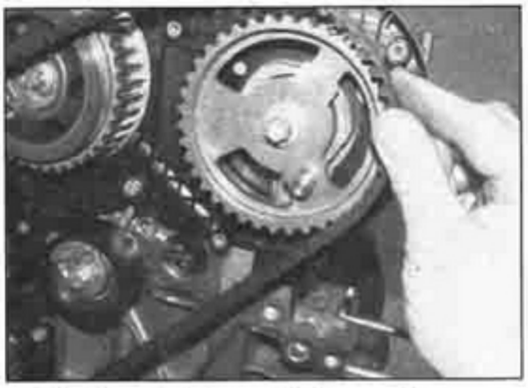
13 Locate the timing belt on the crankshaft sprocket, ensuring that any arrows on the belt are pointing in the direction of rotation (clockwise when viewed from the right-hand end of the engine) **(see illustration)**.

14 Retain the timing belt on the crankshaft sprocket then, keeping it taut, feed the belt over the remaining sprockets and pulleys in the following order **(see illustrations)**:

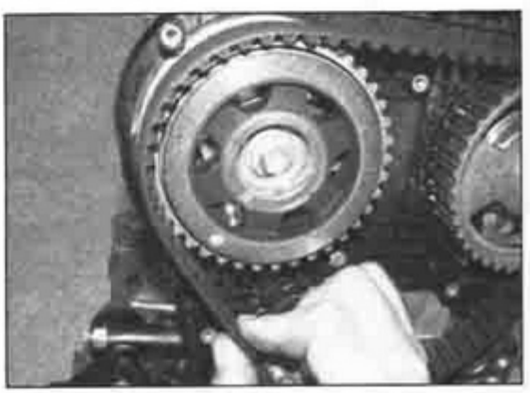
a) Idler pulley.



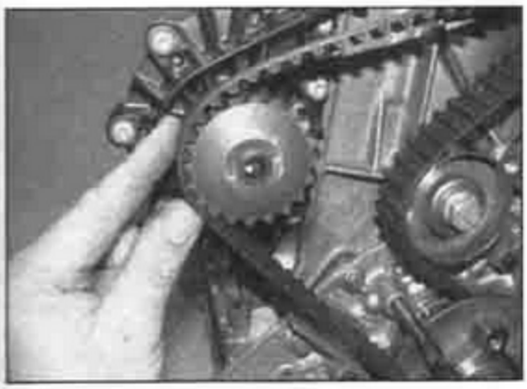
7.14a Retain the belt on the crankshaft sprocket and feed it over the idler pulley . . .



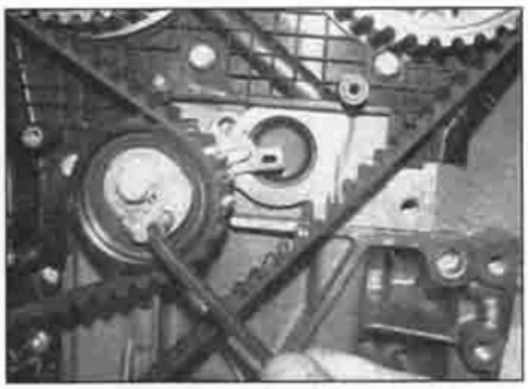
7.14b . . . inlet camshaft sprocket . . .



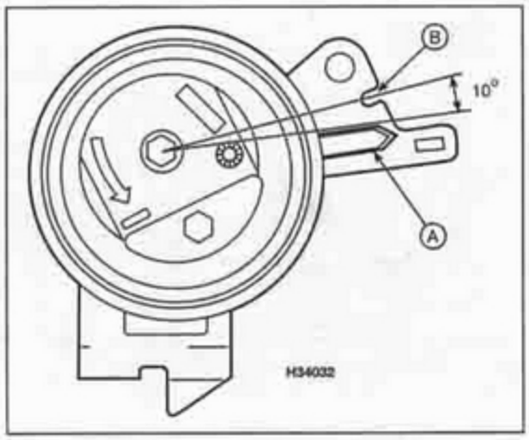
7.14c exhaust camshaft sprocket . . .



7.14d . . . coolant pump and tensioner pulley



7.16a Using an Allen key, turn the tensioner pulley anti-clockwise . . .



7.16b . . . until the upper edge of the index pointer (A) is positioned approximately 10° past the slot (B) in the backing plate

b) Inlet camshaft.
c) Exhaust camshaft.
d) Coolant pump.
e) Tensioner pulley.

15 Remove the locking tool from the exhaust camshaft sprocket.

16 Slacken the tensioner pulley retaining bolt and turn the tensioner pulley anti-clockwise, by means of the Allen key, so that the upper edge of the index pointer is positioned approximately 10° past the slot in the backing plate **(see illustrations)**. Note that if the index pointer will not attain a position of at least 10° past the backing plate slot, then the tensioner pulley, or both the tensioner pulley and the timing belt must be renewed.

17 Now rotate the tensioner pulley clockwise until the index pointer is exactly aligned with the slot in the backing plate **(see illustration)**. Hold the pulley in this position and tighten the retaining bolt to the specified torque. With the timing belt tensioned and the tensioner pulley retaining bolt tightened, the Allen key slot in the pulley should be below the cylinder head gasket level. If this is not the case, then the tensioner pulley, or both the tensioner pulley and the timing belt must be renewed.

18 Remove the remaining camshaft and crankshaft locking tools and rotate the crankshaft through ten complete rotations in a clockwise direction (viewed from the right-hand end of the engine). Realign the engine assembly/valve timing holes and refit the inlet camshaft sprocket locking tool.

19 Check that the tensioner pulley index pointer is still aligned with the slot in the backing plate. If not repeat the tensioning operation from paragraph 16 onward.

20 With the inlet camshaft sprocket locking tool in place, it should now also be possible to fit the crankshaft sprocket locking tool. If so, continue with the refitting procedure from paragraph 24 onward. If the crankshaft sprocket locking tool will not engage, then the crankshaft sprocket end plate must be repositioned as follows.

21 Slacken the crankshaft sprocket retaining bolt while holding the sprocket end plate stationary using Citroën special tool 6310-T or a suitable home-made alternative (see **Tool Tip** in Section 8). *Do not* attempt to use only the sprocket locking tools inserted in the engine assembly/valve timing holes to prevent rotation whilst the bolt is slackened.

22 With the sprocket retaining bolt slackened, turn the end plate until the sprocket locking tool can be fully inserted through the end plate and into the hole in the oil pump housing.

23 Hold the end plate with the holding tool and tighten the sprocket retaining bolt to the specified torque, then through the specified angle **(see illustrations)**.

24 Remove the camshaft and crankshaft locking tools and refit the lower and upper (outer) timing belt covers as described in Section 6.

25 Refit the crankshaft pulley as described in Section 5.

8 Timing belt tensioner and sprockets – removal, inspection and refitting

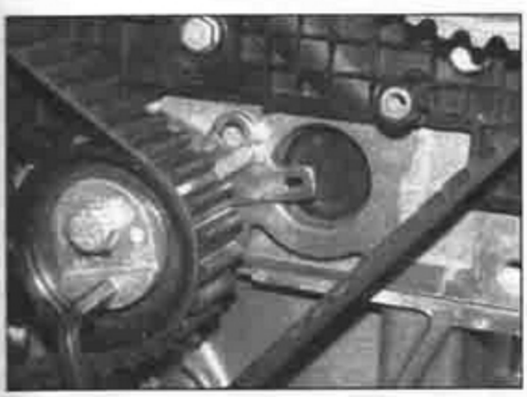
Removal

Note: *The following procedures entail the use of certain Citroën special tools. If the Citroën tools are not available, details for fabricating suitable alternative are given in the text.*

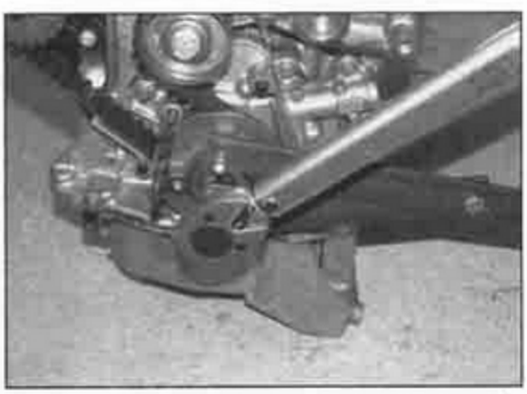
Camshaft sprockets

1 Remove the timing belt as described in Section 7.

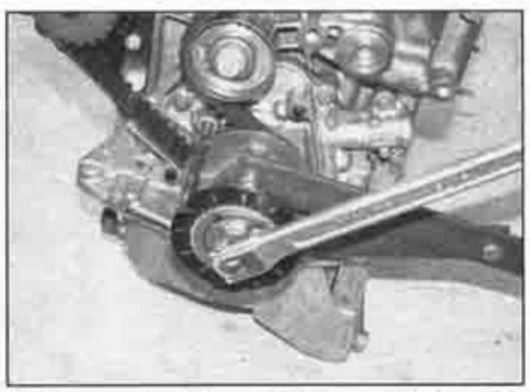
2 The camshafts must now be prevented from rotating to allow the sprocket retaining bolts to be slackened. If working on the exhaust camshaft sprocket, it will be necessary to remove the rear cylinder head cover (see Section 4) to allow a spanner to be engaged with a square section of the camshaft, provided for this purpose. This is because the sprocket contains a rubber vibration damper incorporated into the sprocket hub. If the sprocket itself is held as the bolt is slackened, the rubber hub will be damaged. The inlet camshaft sprocket is conventional and can be held using Citroën tool 6016-T, or an acceptable substitute can be fabricated at home **(see Tool Tip)**.



7.17 Now rotate the pulley clockwise until the index pointer is exactly aligned with the slot in the backing plate



7.23a Hold the crankshaft sprocket end plate with the holding tool and tighten the retaining bolt to the specified torque . . .

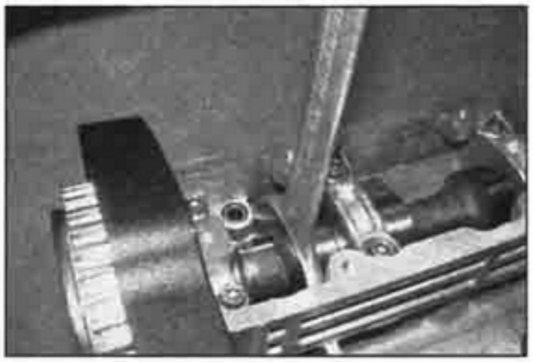


7.23b . . . then through the specified angle

HAYNES HiNT

To make a sprocket holding tool, obtain two lengths of steel strip about 6 mm thick by about 30 mm wide or similar, one 600 mm long, the other 200 mm long (all dimensions approximate). Bolt the two strips together to form a forked end, leaving the bolt slack so that the shorter strip can pivot freely. At the other end of each 'prong' of the fork, drill a suitable hole and fit a nut and bolt to engage with the spokes or holes in the sprocket. The same tool can be used to hold both the camshaft sprocket and crankshaft sprocket.

Alternatively, remove the front cylinder head cover and hold the camshaft with a spanner as described for the exhaust camshaft. *Do not* attempt to use the engine assembly/valve timing hole locking tools to prevent the sprockets from rotating whilst the bolts are slackened.



8.3 The camshafts can be held with a spanner engaged with the square section adjacent to No 8 cam lobe

8.4b . . . and withdraw the relevant sprocket from the end of the camshaft

3 Remove the engine assembly/valve timing hole locking tool from the relevant sprocket, then slacken the centre retaining bolt. If a spanner is being used to prevent camshaft rotation, the spanner should be engaged with the square section of the camshaft adjacent to No 8 cam lobe **(see illustration)**.

8.4a Remove the previously slackened sprocket retaining bolt and washer . . .

8.6 Hold the crankshaft sprocket end plate with the home-made tool while the retaining bolt is slackened

4 Remove the previously slackened sprocket retaining bolt and washer, and withdraw the relevant sprocket from the end of the camshaft **(see illustrations)**.

Crankshaft sprocket

5 Remove the timing belt as described in Section 7.

6 Remove the crankshaft sprocket locking tool and slacken the crankshaft sprocket retaining bolt. Prevent the crankshaft from turning while the bolt is slackened using Citroën special tool 6310-T or a suitable home-made alternative, such as that described in the previous sub-Section, bolted to the sprocket end plate **(see illustration)**. *Do not* attempt to use only the sprocket locking tools inserted in the engine assembly/valve timing holes to prevent rotation whilst the bolt is slackened.

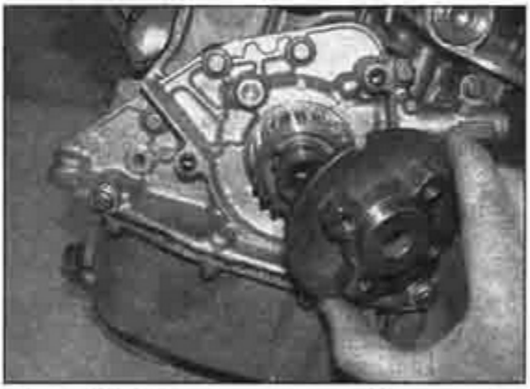
7 Unscrew the retaining bolt and slide the sprocket end plate and the sprocket itself off the end of the crankshaft. If loose, remove the Woodruff key from the crankshaft, and store it with the sprocket components for safe-keeping **(see illustrations)**.

8 Examine the crankshaft oil seal for signs of oil leakage and, if necessary, renew it as described in Section 13.

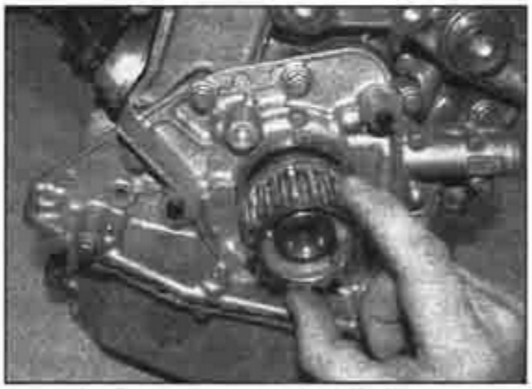
Tensioner and idler pulleys

9 Remove the timing belt as described in Section 7.

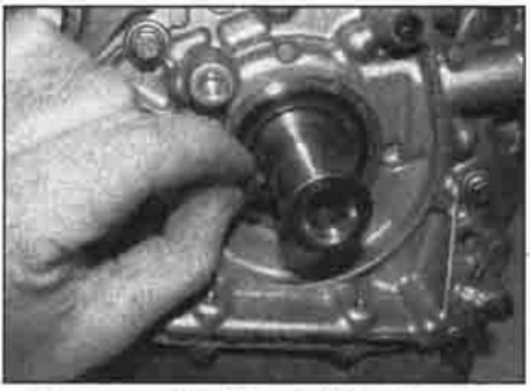
10 Undo the tensioner and idler pulley retaining bolts and remove the relevant pulley from the engine **(see illustrations)**.



8.7a Withdraw the crankshaft sprocket end plate . . .

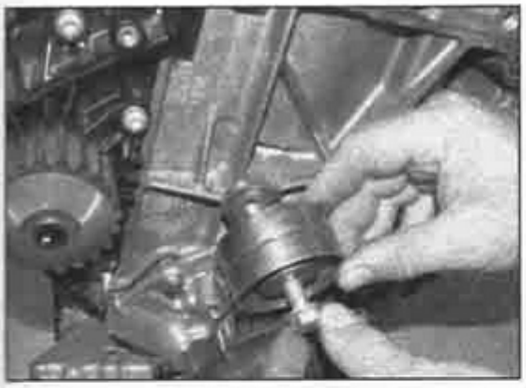


8.7b . . . the sprocket itself . . .



8.7c . . . and the Woodruff key from the end of the crankshaft

8.10a Removing the timing belt tensioner pulley . . .



8.10b . . . and idler pulley

Inspection

11 Clean the camshaft/crankshaft sprockets thoroughly, and renew any that show signs of wear, damage or cracks. Check the condition of the rubber vibration damper in the exhaust camshaft sprocket and renew the sprocket if there is any sign of deterioration of the rubber.

12 Clean the tensioner/idler pulleys, but do not use any strong solvent which may enter the pulley bearings. Check that the pulleys rotate freely, with no sign of stiffness or free play. Renew them if there is any doubt about their condition, or if there are any obvious signs of wear or damage.

Refitting

Camshaft sprockets

13 Locate the relevant sprocket on the end of the camshaft, engaging the lug in the sprocket hub with the slot in the end of the camshaft.

14 Refit the sprocket retaining bolt and washer, and tighten it to the specified torque. Prevent the sprocket from turning as the bolt is tightened using the method employed for removal.

15 Realign the hole in the camshaft sprocket with the corresponding hole in the cylinder head, and refit the locking tool. Check that the crankshaft pulley locking tool is still in position.

16 Where removed, refit the cylinder head cover(s) as described in Section 4.

17 Refit and tension the timing belt as described in Section 7.

Crankshaft sprocket

18 Refit the Woodruff key (if removed) to its slot in the crankshaft end.

19 Slide on the crankshaft sprocket followed by the sprocket end plate, then refit the retaining bolt.

20 Hold the end plate with the holding tool and tighten the sprocket retaining bolt to the specified torque, then through the specified angle.

21 Realign the hole in the sprocket end plate with the corresponding hole in the oil pump housing, and refit the locking tool. Check that the camshaft sprocket locking tools are still in position.

22 Refit and tension the timing belt as described in Section 7.

Tensioner and idler pulleys

23 Refit the tensioner and idler pulleys, ensuring that the slot on the tensioner pulley body correctly engages with the projecting web on the cylinder block **(see illustration)**.

24 Secure the pulleys with the retaining bolts tightened to the specified torque.

25 Refit and tension the timing belt as described in Section 7.

9 Camshaft oil seal(s) – renewal

1 Remove the timing belt as described in Section 7.

2 Remove the camshaft sprocket(s) as described in Section 8.

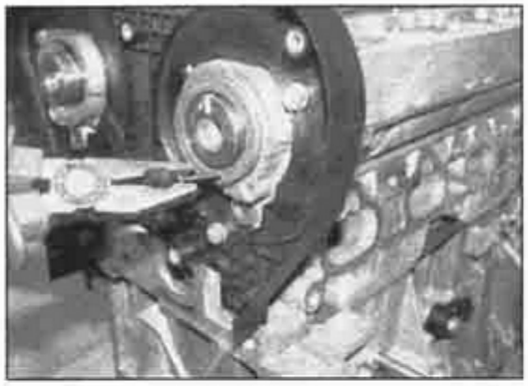
3 Punch or drill a small hole in the face of the oil seal. Screw a self-tapping screw into the hole, and pull on the screw with pliers to extract the seal **(see illustration)**.

4 Clean the seal housing, and polish off any burrs or raised edges, which may have caused the seal to fail in the first place.

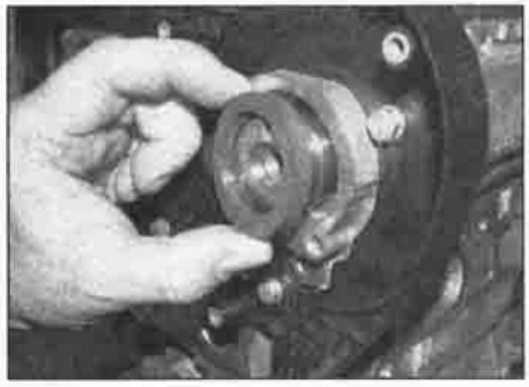
5 Lubricate the lips of the new seal with clean engine oil, and locate it in position with the seal lips facing inwards **(see illustration)**.

6 Using a block of wood, tap the seal into place initially, then finish using a suitable drift until the seal is fully seated **(see illustrations)**. Take care not to damage the seal lips during fitting.

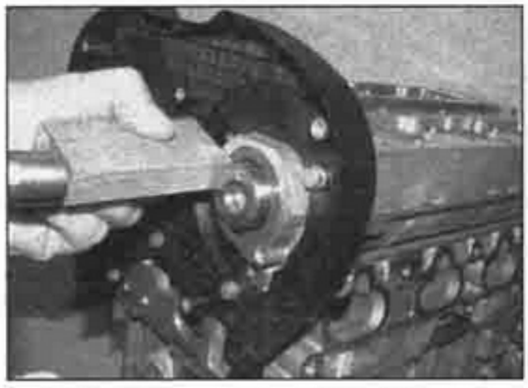
7 Refit the camshaft sprocket(s) as described in Section 8.



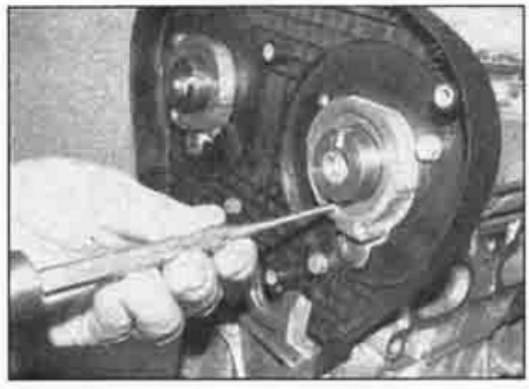
9.3 Using pliers and a self-tapping screw to extract the inlet camshaft oil seal



9.5 Locate the new seal in position with the seal lips facing inwards



9.6a Using a block of wood, tap the new seal into place initially . . .



9.6b . . . then finish using a suitable drift until the seal is fully seated

8.23 Ensure that the slot (arrowed) on the tensioner pulley body engages with the web on the cylinder block when refitting

8 Refit and tension the timing belt as described in Section 7.

10 Camshafts and tappets – removal, inspection and refitting

Removal

1 Disconnect the battery negative terminal (refer to *Disconnecting the battery* in the Reference Chapter).

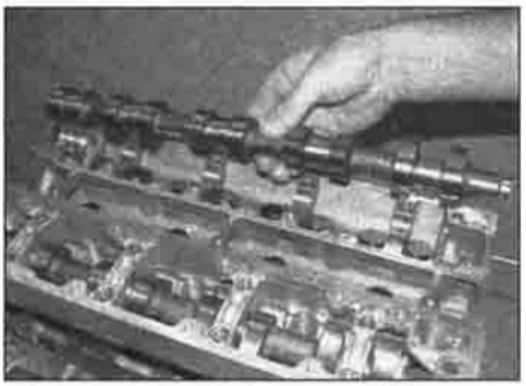
2 Remove both cylinder head covers as described in Section 4.

3 Refer to Section 8 and remove both camshaft sprockets.

4 Remove the timing belt upper (inner) cover as described in Section 6.

5 Progressively slacken, by a few turns at a

10.5 Progressively slacken and remove the retaining bolts, then lift off camshaft bearing cap housing(s)



10.7 Carefully lift the camshaft(s) up and out of their locations

10.8 Use a rubber sucker to withdraw the hydraulic tappets

time, the twelve bolts securing each camshaft bearing cap housing to the cylinder head. Release the bearing cap housings from their dowels and cylinder head locations. When each housing is free, remove the bolts completely, and lift off the housings **(see illustration)**.

6 As both camshafts are visually identical, suitably mark them inlet and exhaust, or front and rear before removal.

7 Tilt the camshafts by pressing them down at their transmission end to release the centralising bearing at the timing belt end. Carefully lift the camshafts up and out of their locations and slide the oil seal off each camshaft end **(see illustration)**.

8 Obtain sixteen small, clean plastic containers, and number them inlet 1 to 8 and exhaust 1 to 8; alternatively, divide a larger container into sixteen compartments and number each compartment accordingly. Using a rubber sucker, withdraw each hydraulic tappet in turn, and place it in its respective container **(see illustration)**. Do not interchange the tappets, or the rate of wear will be much increased.

Inspection

9 Thoroughly clean the sealant from the mating surfaces of the cylinder head and bearing cap housings. Use a suitable liquid gasket dissolving agent (available from Citroën dealers) together with a soft putty knife; do not use a metal scraper or the faces will be damaged. As there is no conventional gasket used, the cleanliness of the mating faces is of the utmost importance.

10 Examine the camshaft bearing surfaces and cam lobes for signs of wear ridges and scoring. Renew the camshaft if any of these conditions are apparent. Examine the condition of the bearing surfaces, both on the camshaft journals and in the cylinder head/bearing cap housings. If the head bearing surfaces are worn excessively, the cylinder head will need to be renewed. If suitable measuring equipment is available, camshaft bearing journal wear can be checked by direct measurement, noting that No 1 journal is at the transmission end of the head.

11 Examine the hydraulic tappet bearing surfaces which contact the camshaft lobes for wear ridges and scoring. Renew any tappet on which these conditions are apparent. If a tappet bearing surface is badly scored, also examine the corresponding lobe on the camshaft for wear, as it is likely that both will be worn. Renew worn components as necessary.

10.13a Lubricate the hydraulic tappet bores and the tappets . . .

10.13b . . . then refit the tappets ensuring that each is refitted to its original bore

Refitting

12 Prior to refitting, remove all traces of oil from the bearing cap housing retaining bolt holes in the cylinder head, using a clean rag. Also ensure that both the cylinder head and bearing cap housing mating faces are clean and free from oil.

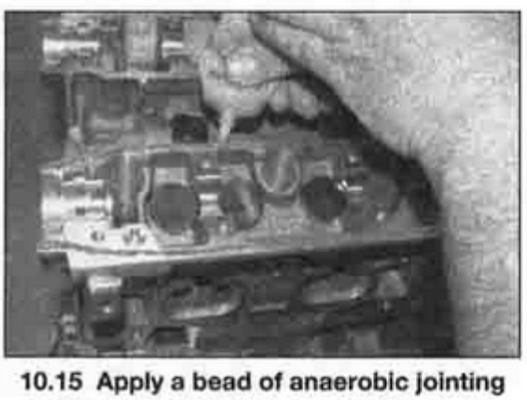
13 Liberally oil the cylinder head hydraulic tappet bores and the tappets. Carefully refit the tappets to the cylinder head, ensuring that each tappet is refitted to its original bore **(see illustrations)**. Some care will be required to enter the tappets squarely into their bores. Check that each tappet rotates freely in its bore.

14 Ensure that the four locating dowels are in position, one at each corner of the cylinder head.

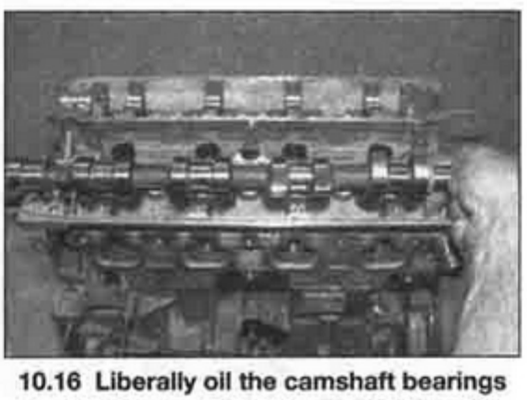
15 Apply a bead of anaerobic jointing compound around the perimeter of the cylinder head mating faces **(see illustration)**.

16 Liberally oil the camshaft bearings in the cylinder head and the camshaft lobes, then lay the camshafts in the cylinder head, ensuring that they are in their correct locations **(see illustration)**. Turn the camshafts so that the cam lobes are in the best position to facilitate the seating of the bearing cap housings.

17 Liberally oil the camshaft bearings and carefully locate the bearing cap housings over



10.15 Apply a bead of anaerobic jointing compound around the perimeter of the cylinder head mating faces



10.16 Liberally oil the camshaft bearings and lobes, then lay the camshafts in the cylinder head

10.17 Carefully locate the bearing cap housings over the camshafts

the camshafts **(see illustration)**. Refit the retaining bolts and progressively tighten them finger tight only at this stage.

18 Working in the order shown, progressively tighten the bearing cap housing retaining bolts to the Stage 1 torque setting then to the Stage 2 setting **(see illustration)**.

19 Refit the timing belt upper (inner) cover as described in Section 6.

20 Fit a new oil seal to each camshaft, using the information given in Section 9, then refit the camshaft sprockets as described in Section 8.

21 Refit the cylinder head covers as described in Section 4.

11 Cylinder head – removal and refitting

Removal

1 Disconnect the battery negative terminal (refer to *Disconnecting the battery* in the Reference Chapter).

2 Drain the cooling system as described in Chapter 1A.

3 Remove the timing belt as described in Section 7.

4 Remove the cylinder head covers as described in Section 4.

5 Remove the air cleaner assembly and intake ducting as described in Chapter 4A.

6 Remove the inlet manifold as described in Chapter 4A.

7 Working as described in Chapter 4A, disconnect the catalytic converter from the exhaust manifold. Where necessary, disconnect or release the lambda sensor wiring, so that it is not strained by the weight of the exhaust.

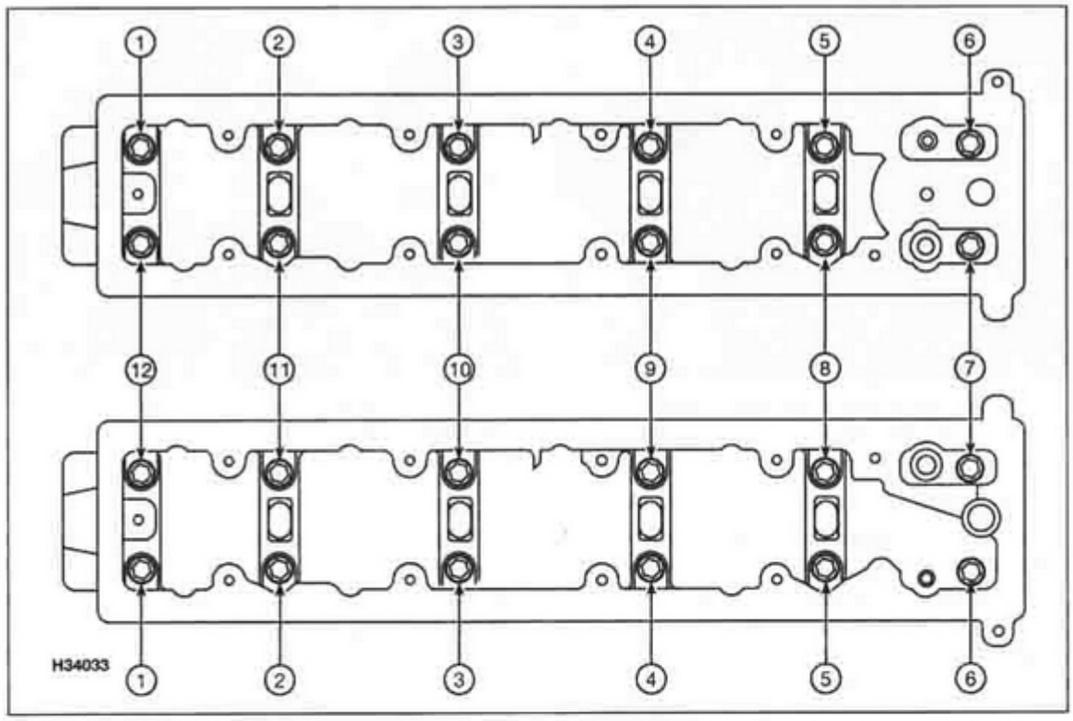
8 Disconnect the radiator hoses from the coolant outlet housing and thermostat cover.

9 Disconnect the air inlet hose from the secondary air injection valve at the left-hand end of the cylinder head **(see illustration)**.

10 Disconnect the wiring connector from the left-hand end of the ignition coil unit **(see illustration)**.

11 Disconnect the wiring connectors from the EGR valve and coolant temperature sensor **(see illustrations)**.

12 Undo the nuts securing the wiring harness support bracket to the studs on the coolant outlet housing. Release any additional cable ties and clips then move the support bracket, wiring harness and hoses clear of the cylinder head **(see illustration)**.

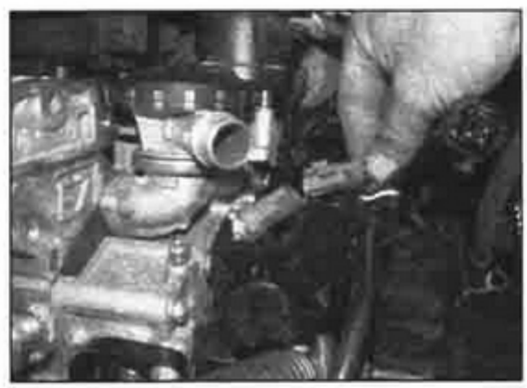


10.18 Camshaft bearing cap housing retaining bolt tightening sequence

11.9 Disconnect the air inlet hose from the secondary air injection valve

11.10 Disconnect the wiring connector from the ignition coil unit

11.11a Disconnect the wiring connectors from the EGR valve . . .



11.11b . . . and coolant temperature sensor

11.12 Undo the wiring harness support bracket nuts, release the cable ties and clips then move the bracket, wiring harness and hoses clear of the cylinder head

11.13 Disconnect the two heater hose from the heater matrix pipes

11.14 Remove the bolt and horseshoe-shaped clamp plate securing the coolant pipe to the coolant outlet housing

13 Disconnect the two heater hose from the heater matrix pipes **(see illustration)**.

14 Undo the bolt and remove the horseshoe-shaped clamp plate securing the coolant pipe to the rear of the coolant outlet housing **(see illustration)**. Withdraw the coolant pipe from the housing and recover the sealing O-ring.

15 Undo the bolt securing the lower (engine) mounting bracket to the cylinder head **(see illustration)**. Ensure that the bolt is fully unscrewed but note that there is insufficient clearance to completely remove the bolt from its location.

16 Undo the nuts securing the brake master cylinder reservoir support bracket to the body panel and move the reservoir and bracket to one side.

17 Check that all vacuum/breather hoses, pipes, and electrical connectors likely to impede removal have been disconnected from the cylinder head.

18 Working in the *reverse* of the sequence shown in illustration 11.37, progressively slacken the ten cylinder head bolts by half a turn at a time, until all bolts can be unscrewed by hand. Remove the bolts along with their washers.

19 Connect an engine hoist or suitable lifting gear to the two lifting brackets on the cylinder head.

20 Release the joint between the cylinder head and gasket using two L-shaped metal bars which fit into the cylinder head bolt holes. Using the bars, gently 'rock' the cylinder head free towards the front of the vehicle. *Do not* try to swivel the head on the cylinder block as it is located by dowels.

21 When the joint is broken, obtain the help of an assistant and slowly raise the hoist to lift the cylinder head off the block **(see illustration)**. At the same time, support the head at the rear as it will tend to tip backwards due to the offset position of the lifting brackets. Take care as the head is lifted as it is very easy to break the lower rear projecting corner of the upper (inner) timing belt cover. Try to keep the head as level as possible until it is raised sufficiently to clear the cylinder block.

22 During removal, check that the camshaft oil supply non-return valve (located in the underside of the cylinder head at the timing belt end) does not drop out; it is easily lost if it does.

23 When sufficient clearance exists, move the hoist forward, raise it further and lift the cylinder head out of the engine compartment.

24 Remove the gasket from the top of the block, noting the two locating dowels. If the locating dowels are a loose fit, remove them and store them with the head for safe-keeping. Do not discard the gasket; it may be needed for identification purposes.

25 If the cylinder head is to be dismantled for overhaul, refer to Part D of this Chapter.

Preparation for refitting

26 The mating faces of the cylinder head and cylinder block must be perfectly clean before refitting the head. Citroën recommend the use of a scouring agent for this purpose, but acceptable results can be achieved by using a hard plastic or wood scraper to remove all traces of gasket and carbon. The same method can also be used to clean the piston crowns. Take particular care to avoid scoring or gouging the cylinder head/cylinder block mating surfaces during the cleaning operations, as aluminium alloy is easily damaged. Make sure that the carbon is not allowed to enter the oil and water passages – this is particularly important for the lubrication system, as carbon could block the oil supply to the engine's components. Using adhesive tape and paper, seal the water, oil and bolt holes in the cylinder block. To prevent carbon entering the gap between the pistons and bores, smear a little grease in the gap. After cleaning each piston, use a small brush to remove all traces of grease and carbon from the gap, then wipe away the remainder with a clean rag.

27 Check the mating surfaces of the cylinder block and the cylinder head for nicks, deep scratches and other damage. If slight, they may be removed carefully with a file, but if excessive, machining may be the only alternative to renewal. If warpage of the cylinder head gasket surface is suspected, use a straight-edge to check it for distortion. Refer to Part D of this Chapter if necessary.

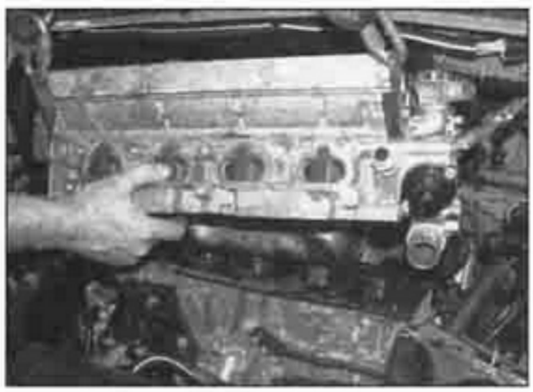
28 Thoroughly clean the threads of the cylinder head bolt holes in the cylinder block. Ensure that the bolts run freely in their threads, and that all traces of oil and water are removed from each bolt hole.

29 When purchasing a new cylinder head gasket, it is essential that a gasket of the correct thickness is obtained. At the time of writing, there are two different thicknesses available – the standard gasket which is fitted at the factory, and a slightly thicker 'repair' gasket (+ 0.3 mm), for use once the head gasket face has been machined. If the cylinder head has been machined, it should be marked '-0.3' on the upper corner, on the inlet manifold side, at the timing belt end. Note that modifications to the cylinder head gasket material, type, and manufacturer are constantly taking place; seek the advice of a Citroën dealer as to the latest recommendations.

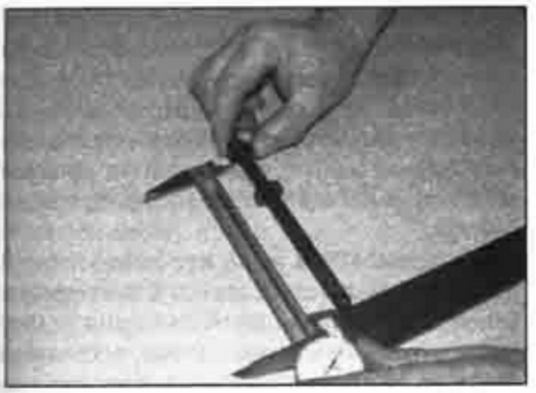
30 Check the condition of the cylinder head bolts, and particularly their threads, whenever they are removed. Wash the bolts in a suitable solvent, and wipe them dry. Check each bolt for any sign of visible wear or damage, renewing them if necessary. Measure the length of each bolt from the underside of its head to the end of the bolt **(see illustration)**. Two different lengths of cylinder head bolts may be encountered according to the date of manufacture of the engine. Early engines were fitted with bolts 127.5 mm in length, whereas on later engines the length was increased to 144.5 mm. The bolts may be re-used if their length does not exceed the following dimensions.

Early engines	*129.0 mm*
Later engines	*147.0 mm*

11.15 Undo the bolt securing the lower (engine) mounting bracket to the cylinder head



11.21 Removing the cylinder head from the block



11.30 Measure the length of the cylinder head bolts from the underside of the head to the end of the bolt

31 If any one bolt is longer than the specified length, *all* of the bolts should be renewed as a complete set. Considering the stress which the cylinder head bolts are under, it is highly recommended that they are renewed, regardless of their apparent condition.

Refitting

32 Wipe clean the mating surfaces of the cylinder head and cylinder block and check that the two locating dowels are in position at each diagonally opposite end of the block. Check also that the camshaft oil supply non-return valve is in place in the oil feed bore at the timing belt end of the cylinder head **(see illustrations)**.

33 Position a new gasket on the cylinder block surface, with the word TOP uppermost and toward the oil filter side of the block **(see illustration)**.

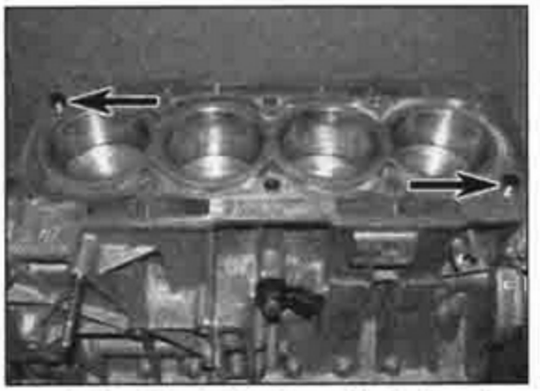
34 Check that the crankshaft pulley and camshaft sprockets are still locked in position with their respective locking tools. With the aid of an assistant, carefully refit the cylinder head assembly to the block, aligning it with the locating dowels.

35 Apply a smear of grease to the threads, and to the underside of the heads, of the cylinder head bolts. Citroën recommend the use of Molykote G Rapid Plus for this purpose.

36 Carefully enter each bolt and washer into its relevant hole (*do not drop it in*) and screw it in finger-tight.

37 Working in the sequence shown, tighten all the cylinder head bolts first to their Stage 1 torque setting, then to their Stage 2 torque setting using a torque wrench and a suitable socket **(see illustration)**.

11.33 Position the cylinder head gasket with the word TOP uppermost and toward the oil filter side of the block



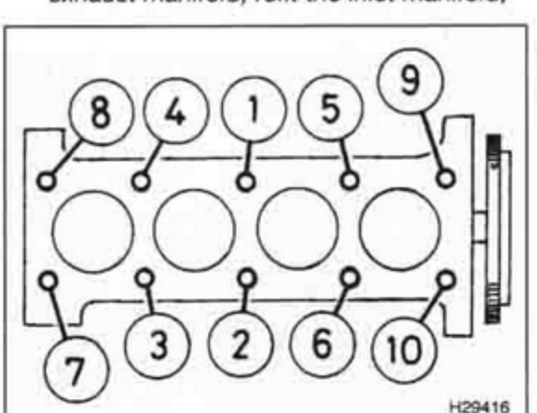
11.32a Check that the cylinder head locating dowels (arrowed) are in position in the block . . .

38 Once all the bolts have been tightened to their Stage 2 torque setting, slacken all the head bolts by one complete turn, working in the reverse of the tightening sequence. Once the bolts are loose, and again working in the sequence shown, tighten all the bolts to the Stage 4 torque setting.

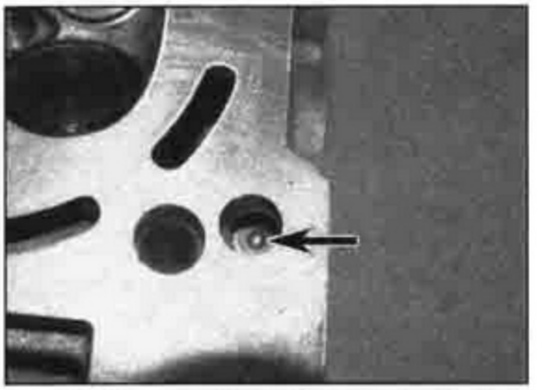
39 When all the bolts have been tightened to the Stage 4 torque setting, tighten each bolt in the sequence shown through the specified Stage 5 angle, using a socket and extension bar. It is recommended that an angle-measuring gauge is used during this stage of tightening, to ensure accuracy.

40 The remainder of the refitting procedure is a reversal of removal, noting the following points:

a) Fit new O-ring seals to all applicable components.
b) Ensure that all wiring is correctly routed, and that all connectors are securely reconnected to the correct components.
c) Ensure that all coolant, vacuum and breather hoses are correctly reconnected, and that their retaining clips are securely tightened, where applicable.
d) Refit and tension the timing belt as described in Section 7.
e) Refit the cylinder head covers as described in Section 4.
f) Reconnect the catalytic converter to the exhaust manifold, refit the inlet manifold, air cleaner assembly and intake ducting as described in Chapter 4A.
g) On completion, refill the cooling system as described in Chapter 1A, and reconnect the battery.



11.37 Cylinder head bolt tightening sequence



11.32b . . . and that the camshaft oil supply non-return valve (arrowed) is in place in the cylinder head

12 Sump – removal and refitting

Removal

1 Disconnect the battery negative terminal (refer to *Disconnecting the battery* in the Reference Chapter).

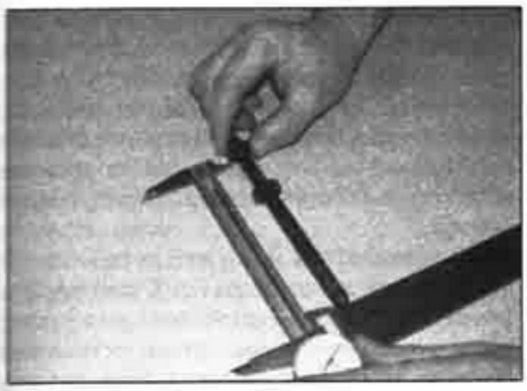
2 Chock the rear wheels then jack up the front of the vehicle and support it on axle stands (see *Jacking and vehicle support*). Remove the engine undertray.

3 Drain the engine oil, then clean and refit the engine oil drain plug, tightening it securely. If the engine is nearing its service interval when the oil and filter are due for renewal, it is recommended that the filter is also removed, and a new one fitted. After reassembly, the engine can then be refilled with fresh oil. Refer to Chapter 1A for further information.

4 Withdraw the engine oil dipstick from the guide tube.

5 Undo the bolt securing the upper end of the dipstick guide tube to the ancillary components mounting bracket. Undo the bolt securing the base of the guide tube to the sump and remove the guide tube **(see illustration)**. Collect the two O-rings from the

12.5 Undo the upper and lower retaining bolts and remove the dipstick guide tube



11.30 Measure the length of the cylinder head bolts from the underside of the head to the end of the bolt

31 If any one bolt is longer than the specified length, *all* of the bolts should be renewed as a complete set. Considering the stress which the cylinder head bolts are under, it is highly recommended that they are renewed, regardless of their apparent condition.

Refitting

32 Wipe clean the mating surfaces of the cylinder head and cylinder block and check that the two locating dowels are in position at each diagonally opposite end of the block. Check also that the camshaft oil supply non-return valve is in place in the oil feed bore at the timing belt end of the cylinder head **(see illustrations)**.

33 Position a new gasket on the cylinder block surface, with the word TOP uppermost and toward the oil filter side of the block **(see illustration)**.

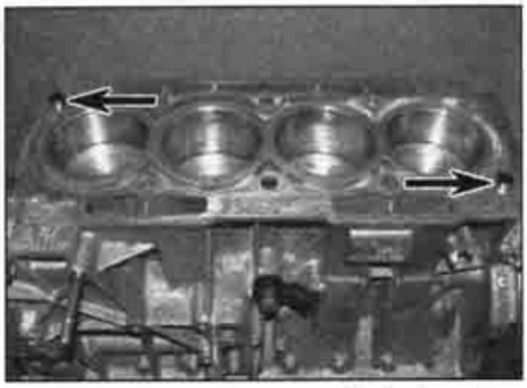
34 Check that the crankshaft pulley and camshaft sprockets are still locked in position with their respective locking tools. With the aid of an assistant, carefully refit the cylinder head assembly to the block, aligning it with the locating dowels.

35 Apply a smear of grease to the threads, and to the underside of the heads, of the cylinder head bolts. Citroën recommend the use of Molykote G Rapid Plus for this purpose.

36 Carefully enter each bolt and washer into its relevant hole (*do not drop it in*) and screw it in finger-tight.

37 Working in the sequence shown, tighten all the cylinder head bolts first to their Stage 1 torque setting, then to their Stage 2 torque setting using a torque wrench and a suitable socket **(see illustration)**.

11.33 Position the cylinder head gasket with the word TOP uppermost and toward the oil filter side of the block



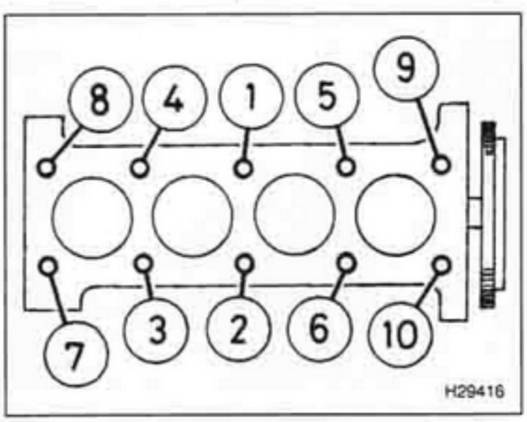
11.32a Check that the cylinder head locating dowels (arrowed) are in position in the block . . .

38 Once all the bolts have been tightened to their Stage 2 torque setting, slacken all the head bolts by one complete turn, working in the reverse of the tightening sequence. Once the bolts are loose, and again working in the sequence shown, tighten all the bolts to the Stage 4 torque setting.

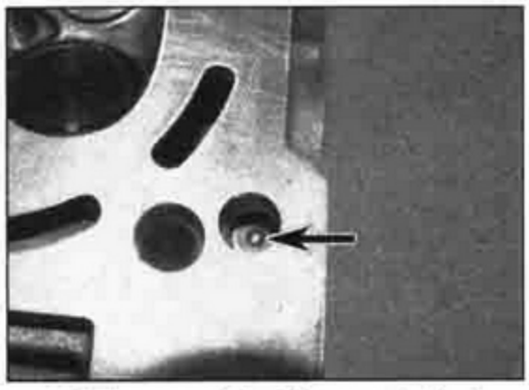
39 When all the bolts have been tightened to the Stage 4 torque setting, tighten each bolt in the sequence shown through the specified Stage 5 angle, using a socket and extension bar. It is recommended that an angle-measuring gauge is used during this stage of tightening, to ensure accuracy.

40 The remainder of the refitting procedure is a reversal of removal, noting the following points:

a) Fit new O-ring seals to all applicable components.
b) Ensure that all wiring is correctly routed, and that all connectors are securely reconnected to the correct components.
c) Ensure that all coolant, vacuum and breather hoses are correctly reconnected, and that their retaining clips are securely tightened, where applicable.
d) Refit and tension the timing belt as described in Section 7.
e) Refit the cylinder head covers as described in Section 4.
f) Reconnect the catalytic converter to the exhaust manifold, refit the inlet manifold, air cleaner assembly and intake ducting as described in Chapter 4A.
g) On completion, refill the cooling system as described in Chapter 1A, and reconnect the battery.



11.37 Cylinder head bolt tightening sequence



11.32b . . . and that the camshaft oil supply non-return valve (arrowed) is in place in the cylinder head

12 Sump – removal and refitting

Removal

1 Disconnect the battery negative terminal (refer to *Disconnecting the battery* in the Reference Chapter).

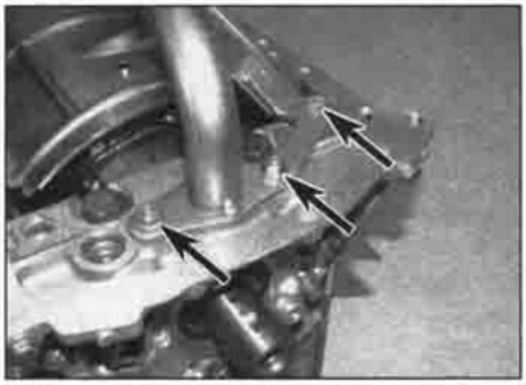
2 Chock the rear wheels then jack up the front of the vehicle and support it on axle stands (see *Jacking and vehicle support*). Remove the engine undertray.

3 Drain the engine oil, then clean and refit the engine oil drain plug, tightening it securely. If the engine is nearing its service interval when the oil and filter are due for renewal, it is recommended that the filter is also removed, and a new one fitted. After reassembly, the engine can then be refilled with fresh oil. Refer to Chapter 1A for further information.

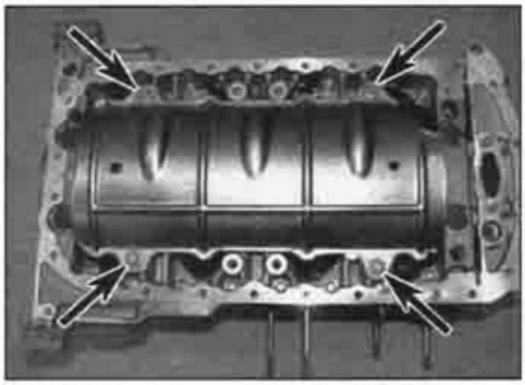
4 Withdraw the engine oil dipstick from the guide tube.

5 Undo the bolt securing the upper end of the dipstick guide tube to the ancillary components mounting bracket. Undo the bolt securing the base of the guide tube to the sump and remove the guide tube **(see illustration)**. Collect the two O-rings from the

12.5 Undo the upper and lower retaining bolts and remove the dipstick guide tube



12.11a Oil pump pick-up tube retaining nuts and retaining bolt locations (arrowed)



12.11b Crankcase splash plate retaining bolt locations (arrowed)

base of the guide tube, noting that new O-rings will be required for refitting.

6 Release the retaining clamps securing the power steering fluid pipes to the sump. Move the pipes as far as possible towards the transmission and suitably retain them in this position.

7 Where fitted, disconnect the wiring connector from the oil temperature sender unit, which is screwed into the rear of the sump.

8 Undo the lower centre bolt securing the sump to the transmission bellhousing.

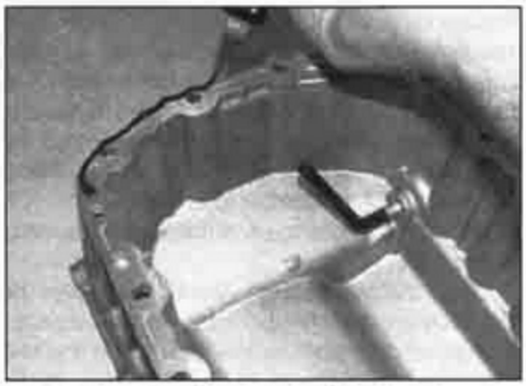
9 Progressively slacken and remove all the sump retaining bolts noting that there are nineteen short bolts and seven long bolts.

10 Carefully insert a putty knife or similar between the sump and cylinder block. Ease the knife along the joint to break the seal, carefully levering down at the same time. When the sump is released, lower it straight down from its location and remove it from under the vehicle.

11 If access to the crankshaft components is required, undo the bolt and two nuts and remove the oil pump pick-up tube and gasket. Similarly, undo the four bolts and remove the crankcase splash plate **(see illustrations)**.

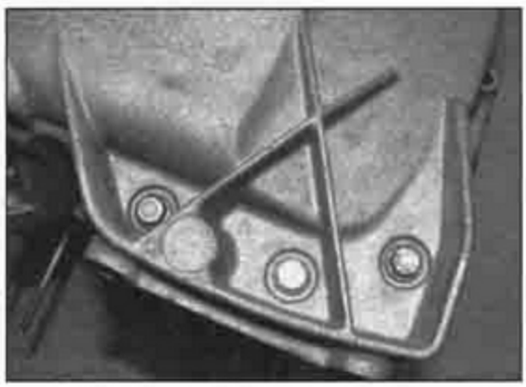
Refitting

12 Thoroughly clean all the removed components ensuring that all traces of sealant and gasket are removed from the mating surfaces of the sump, cylinder block, oil pump and oil pump pick-up tube, as applicable. Use a suitable liquid gasket dissolving agent (available from Citroën dealers) together with a soft putty knife; do not use a metal scraper or the faces will be damaged. As there is no conventional gasket used between the sump and cylinder block, the cleanliness of the mating faces is of the utmost importance.

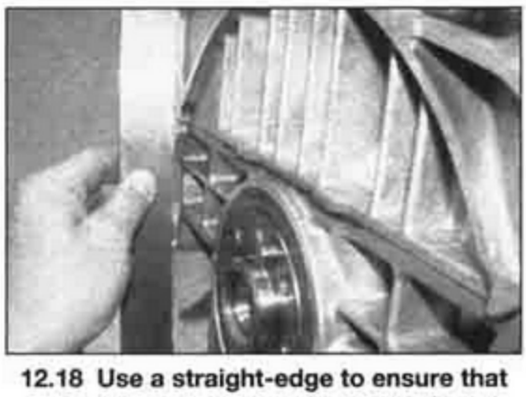


12.15 Apply a thin bead of RTV sealant to the sump mating surface

12.16a Four of the long sump retaining bolts are fitted at the transmission end . . .



12.16b . . . and three are fitted at the timing belt end on the oil filter side



12.18 Use a straight-edge to ensure that the rear faces of the cylinder block and sump are flush

13 If removed, locate the splash plate in position and secure with the four bolts securely tightened.

14 If the oil pump pick-up tube was removed, locate a new gasket over the oil pump studs then place the tube in position. Fit the retaining nuts and bolt and tighten them securely.

15 Ensure that the sump and cylinder block mating faces are clean and dry, then apply a thin bead of RTV sealant to the sump mating surface **(see illustration)**. Citroën recommend the use of Loctite Autojoint Noir for this purpose.

16 Check that the centring dowel is in place in the cylinder block then locate the sump in position. Refit the retaining bolts noting that four of the long bolts are fitted at the transmission end, and three at the timing belt end on the oil filter side of the engine **(see illustrations)**. Tighten the bolts finger tight only at this stage.

17 If the engine is in the vehicle with the transmission attached, refit the lower centre bolt securing the sump to the transmission bellhousing and tighten it sufficiently to hold the sump in contact with the bellhousing face. Tighten the sump to cylinder block retaining bolts evenly and progressively to the specified torque setting. When the sump retaining bolts have been tightened, tighten the sump to bellhousing bolt to the specified torque.

18 If the engine is out of the vehicle or the transmission has been removed, use a straight-edge to ensure that the rear faces of the cylinder block and sump are flush **(see illustration)**. Hold the sump in this position and tighten the retaining bolts evenly and progressively to the specified torque setting.

19 Lubricate the two new O-rings and locate them on the end of the dipstick guide tube. Engage the guide tube with the sump and fit the upper and lower retaining bolts. Tighten the bolts securely, then refit the dipstick.

20 Move the power steering fluid pipes back into position under the sump and secure with the retaining clamps.

21 Where fitted, reconnect the wiring connector to the oil temperature sender unit at the rear of the sump.

22 Refit the engine undertray, lower the vehicle to the ground, then refill the engine with oil as described in Chapter 1A.

13 Crankshaft oil seals – renewal

Right-hand oil seal

1 Remove the crankshaft sprocket as described in Section 8.

2 Make a note of the correct fitted depth of the seal in the oil pump housing, then punch or drill a small hole in the face of the seal. Screw a self-tapping screw into the hole and pull on the screw with pliers to extract the

seal. Alternatively, the seal can be levered out of position. Use a flat-bladed screwdriver, and take great care not to damage the oil pump drive flange or seal housing.

3 Clean the seal housing, and polish off any burrs or raised edges on the pump drive flange, which may have caused the seal to fail in the first place.

4 Lubricate the lips of the new seal with clean engine oil, and carefully locate the seal over the oil pump drive flange. Note that its sealing lip must be facing inwards. Take care not to damage the seal lips during fitting.

5 Tap the seal into position, using a suitable drift, to the same depth in the housing as the original was prior to removal **(see illustration)**.

6 Wash off any traces of oil, then refit the crankshaft sprocket as described in Section 8.

Left-hand oil seal

7 Remove the flywheel as described in Section 14. Make a note of the correct fitted depth of the seal in its location.

8 Punch or drill two small holes opposite each other in the seal. Screw a self-tapping screw into each, and pull on the screws with pliers to extract the seal.

9 Clean the seal housing, and polish off any burrs or raised edges on the crankshaft, which may have caused the seal to fail in the first place.

10 The new seal will normally be supplied with a plastic fitting sleeve to protect the seal lips as the seal is fitted. If so, lubricate the fitting sleeve and locate it over the end of the crankshaft **(see illustration)**.

11 Lubricate the lips of the new seal with clean engine oil, and carefully locate the seal over the fitting sleeve and onto the end of the crankshaft **(see illustration)**.

12 Drive the seal into position, using a suitable tubular drift, to the same depth in the housing as the original was prior to removal.

13 Remove the fitting sleeve, wash off any traces of oil, then refit the flywheel as described in Section 14.

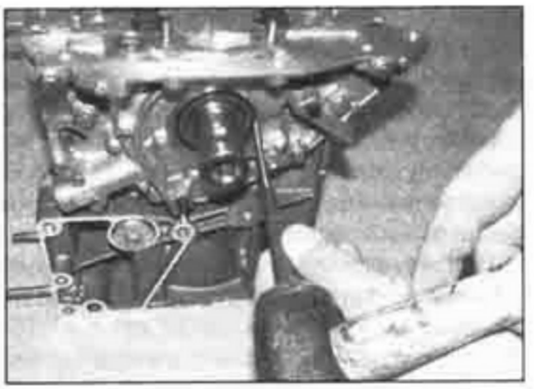
14 Flywheel – removal, inspection and refitting

Removal

1 Remove the transmission as described in Chapter 7, then remove the clutch assembly as described in Chapter 6.

2 Prevent the flywheel from turning using a sturdy screwdriver inserted between the ring gear teeth and the cylinder block. Alternatively, bolt a strap between one of the clutch pressure plate mounting bolt holes and an adjacent hole on the cylinder block end face. *Do not* attempt to lock the flywheel in position using the crankshaft pulley locking tool described in Section 3.

3 Slacken and remove the flywheel retaining bolts, and remove the flywheel from the end of the crankshaft. Be careful not to drop it; it is heavy. If the flywheel locating dowel is a loose fit in the crankshaft end, remove it and store it with the flywheel for safe-keeping. Discard the flywheel bolts; new ones must be used on refitting.



13.5 Tap the crankshaft right-hand oil seal into position using a suitable drift

Inspection

4 Examine the flywheel for scoring of the clutch face, and for wear or chipping of the ring gear teeth. If the clutch face is scored, the flywheel may be surface-ground, but renewal is preferable. Seek the advice of a Citroën dealer or engine reconditioning specialist to see if machining is possible. If the ring gear is worn or damaged, the flywheel must be renewed, as it is not possible to renew the ring gear separately.

Refitting

5 Clean the mating surfaces of the flywheel and crankshaft. Remove any remaining locking compound from the threads of the crankshaft holes, using the correct size of tap, if available.

> **HAYNES HiNT** ***If a suitable tap is not available, cut two slots along the threads of one of the old flywheel bolts, and use the bolt to remove the locking compound from the threads.***

6 If the new flywheel retaining bolts are not supplied with their threads already pre-coated, apply a suitable thread-locking compound to the threads of each bolt prior to fitting.

7 Ensure that the locating dowel is in position. Offer up the flywheel, locating it on the dowel, and fit the new retaining bolts.

8 Lock the flywheel using the method employed on removal, and tighten the retaining bolts to the specified torque and through the specified angle, in the stages given in the Specifications.

9 Refit the clutch as described in Chapter 6. Remove the flywheel locking tool, and refit the transmission as described in Chapter 7.

15 Engine/transmission mountings – inspection and renewal

Inspection

1 If improved access is required, firmly apply the handbrake, then jack up the front of the vehicle and support it securely on axle stands (see *Jacking and vehicle support*). Remove the engine undertray.

2 Check the mounting rubbers to see if they are cracked, hardened or separated from the metal at any point; renew the mounting if any such damage or deterioration is evident.

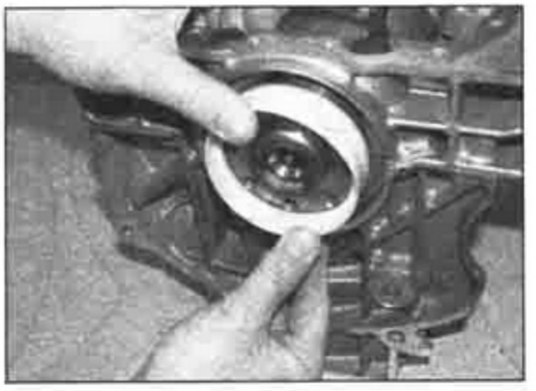
3 Check that all the mountings' fasteners are securely tightened; use a torque wrench to check if possible **(see illustration overleaf)**.

4 Using a large screwdriver or a crowbar, check for wear in each mounting by carefully levering against it to check for free play. Where this is not possible, enlist the aid of an assistant to move the engine/transmission back-and-forth, or from side-to-side, while you watch the mounting. While some free play is to be expected even from new components, excessive wear should be obvious. If excessive free play is found, check first that the fasteners are correctly secured, then renew any worn components as described below.

Renewal

Right-hand mounting

5 Disconnect the battery negative terminal



13.10 Lubricate the crankshaft left-hand oil seal fitting sleeve and locate it over the end of the crankshaft

13.11 Locate the oil seal over the fitting sleeve and onto the end of the crankshaft

(refer to *Disconnecting the battery* in the Reference Chapter). Release all the relevant hoses and wiring from their retaining clips, and position them clear of the mounting so that they do not hinder the removal procedure.

6 Undo the two bolts and remove the stiffener bracket located over the top of the mounting.

7 Place a jack beneath the engine, with a block of wood on the jack head. Raise the jack until it is supporting the weight of the engine.

8 Slacken and remove the three bolts, securing the upper mounting bracket to the lower (engine) bracket. Remove the single nut securing the upper bracket to the rubber mounting, and lift off the bracket.

9 Lift the rubber buffer plate off the rubber mounting stud, then remove the washer, unscrew the rubber mounting from the body, and remove it from the vehicle. A strap wrench or similar may be used to unscrew the mounting, or alternatively fabricate a tool from suitable metal tube with projections to engage in the cut-outs in the mounting.

10 Check all components carefully for signs of wear or damage, and renew them where necessary.

11 On reassembly, screw the mounting into the vehicle body, and tighten it securely.

12 Refit the rubber buffer plate to the rubber mounting stud, and install the upper mounting bracket. Tighten the retaining nuts/bolts to the specified torque setting.

13 Refit the stiffener bracket then secure all disturbed hoses and wiring in their relevant retaining clips.

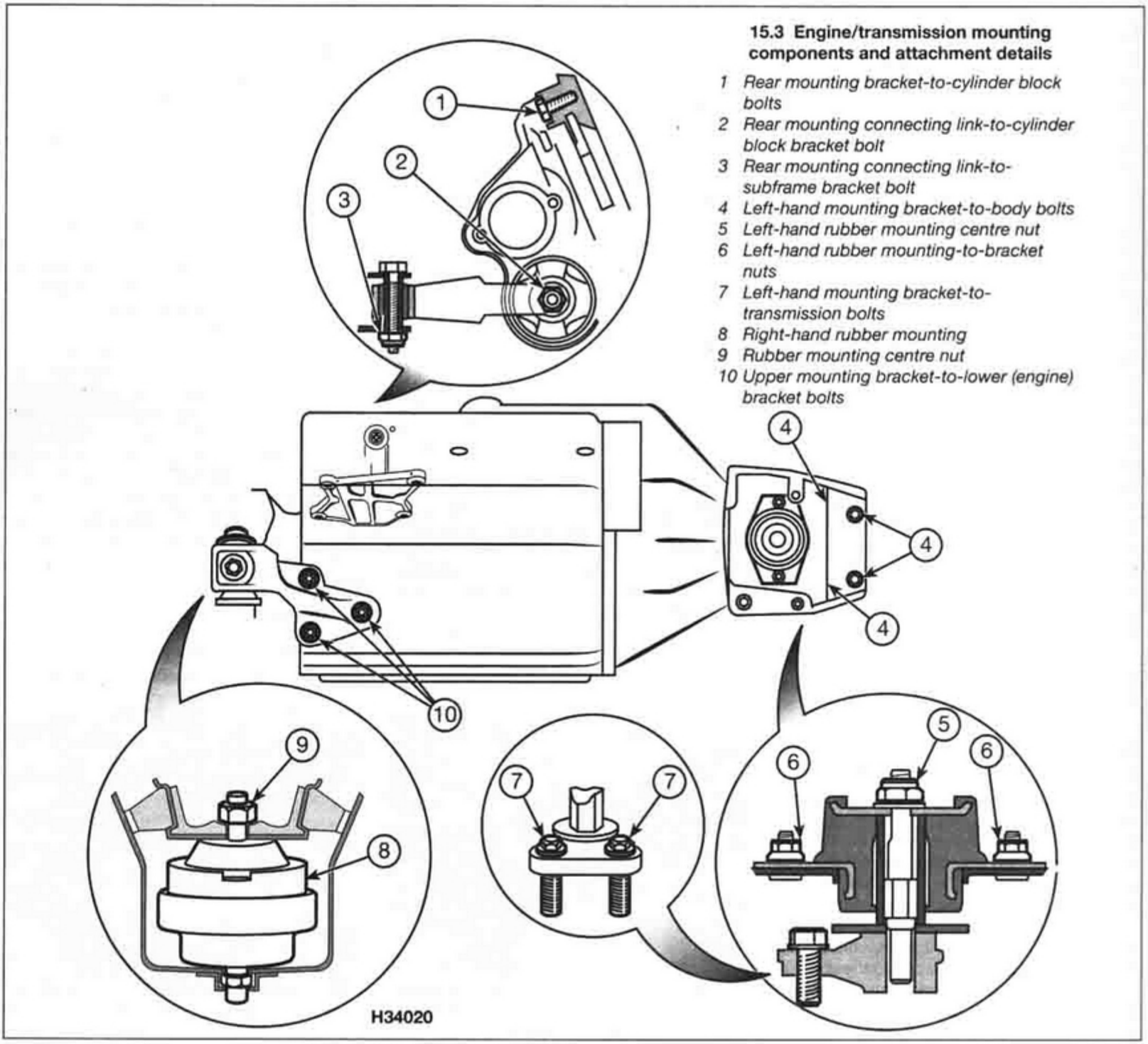
14 Remove the jack from underneath the engine, and reconnect the battery negative terminal.

Left-hand mounting

15 Disconnect the battery negative terminal (refer to *Disconnecting the battery* in the Reference Chapter).

16 Remove the air cleaner assembly and intake ducting as described in Chapter 4A.

17 Lift up the covers on the battery positive cable terminal box and unscrew the nuts securing the battery cables to the terminal studs. Lift the cables off the studs and suitably label them for correct refitting.



15.3 Engine/transmission mounting components and attachment details

1 *Rear mounting bracket-to-cylinder block bolts*
2 *Rear mounting connecting link-to-cylinder block bracket bolt*
3 *Rear mounting connecting link-to-subframe bracket bolt*
4 *Left-hand mounting bracket-to-body bolts*
5 *Left-hand rubber mounting centre nut*
6 *Left-hand rubber mounting-to-bracket nuts*
7 *Left-hand mounting bracket-to-transmission bolts*
8 *Right-hand rubber mounting*
9 *Rubber mounting centre nut*
10 *Upper mounting bracket-to-lower (engine) bracket bolts*

18 Withdraw the engine management ECU from its location on the support tray and move it to one side.

19 Release the wiring harness from the retaining clips on the ECU support tray, then undo the retaining bolts and lift out the support tray.

20 Place a jack beneath the transmission, with a block of wood on the jack head. Raise the jack until it is supporting the weight of the transmission.

21 Slacken and remove the centre nut and washer from the left-hand mounting, then undo the nuts securing the mounting to the mounting bracket. Lift off the mounting and remove it from the engine compartment.

22 If necessary, slide the spacer (where fitted) off the mounting stud, then unscrew the stud from the top of the transmission housing, and remove it along with its washer. If the mounting stud is tight, a universal stud extractor can be used to unscrew it.

23 Check all components carefully for signs of wear or damage, and renew as necessary.

24 Clean the threads of the mounting stud, and apply a coat of thread-locking compound to its threads. Refit the stud and washer to the top of the transmission, and tighten it to the specified torque setting.

25 Slide the spacer (where fitted) onto the mounting stud, then refit the rubber mounting. Tighten both the mounting-to-bracket nuts and the mounting centre nut to their specified torque settings, and remove the jack from underneath the transmission.

26 Refit the ECU support tray, and clip the wiring harness back into position.

27 Refit the ECU to the support tray and reconnect the battery positive cables to their respective terminal studs.

28 Refit the air cleaner assembly and intake ducting as described in Chapter 4A, then reconnect the battery negative terminal.

Rear mounting

29 If not already done, firmly apply the handbrake, then jack up the front of the vehicle and support it securely on axle stands (see *Jacking and vehicle support*). Remove the engine undertray.

30 Unscrew and remove the bolt securing the rear mounting connecting link to the mounting bracket on the rear of the cylinder block.

31 Remove the bolt securing the connecting link to the bracket on the subframe and withdraw the link.

32 To remove the mounting assembly it will first be necessary to remove the right-hand driveshaft as described in Chapter 8.

33 With the driveshaft removed, undo the retaining bolts and remove the mounting from the rear of the cylinder block.

34 Check carefully for signs of wear or damage on all components, and renew them where necessary.

35 On reassembly, fit the rear mounting assembly to the rear of the cylinder block, and tighten its retaining bolts to the specified torque. Refit the driveshaft as described in Chapter 8.

36 Refit the rear mounting connecting link, and tighten both its bolts to their specified torque settings.

37 Lower the vehicle to the ground.

Chapter 2 Part C:
Diesel engine in-car repair procedures

Contents

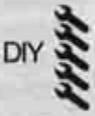
Degrees of difficulty

Easy, suitable for novice with little experience 

Fairly easy, suitable for beginner with some experience 

Fairly difficult, suitable for competent DIY mechanic 

Difficult, suitable for experienced DIY mechanic 

Very difficult, suitable for expert DIY or professional 

Specifications

Engine (general)

Designation	DW10
Capacity	1997 cc (2.0 litre)
Engine code*	RHY (DW10TD)
Bore	85.00 mm
Stroke	88.00 mm
Direction of crankshaft rotation	Clockwise (viewed from the right-hand side of vehicle)
No 1 cylinder location	At the transmission end of block
Compression ratio	17.6 : 1

**The engine code is stamped on a plate attached centrally to the lower front of the cylinder block*

Compression pressures (engine hot, at cranking speed)

Normal	25 to 35 bars (363 to 508 psi)
Maximum difference between any two cylinders	5 bars (73 psi)

Timing belt

Tension setting (see text – Section 7):	
Initial setting	98 ± 2 SEEM units
Final setting	54 ± 3 SEEM units

Camshaft

Drive	Toothed belt
No of bearings	6

Lubrication system

Oil pump type	Gear-type, chain-driven off the crankshaft right-hand end
Minimum oil pressure at 90°C	4.0 bars at 4000 rpm
Oil pressure warning switch operating pressure	0.8 bars

Torque wrench settings	Nm	lbf ft
Big-end bearing cap nuts*:		
Stage 1	20	15
Stage 2	Tighten through a further 70°	
Camshaft bearing housing bolts	10	7
Camshaft sprocket hub-to-camshaft bolts	43	32
Camshaft sprocket-to-hub bolts	20	15
Crankshaft oil seal housing bolts	14	10
Crankshaft pulley bolt (see text – Section 5):		
Early type pulley without green paint mark:		
Stage 1	50	37
Stage 2	Tighten through a further 51°	
Later type pulley with green paint mark:		
Stage 1	70	52
Stage 2	Tighten through a further 82°	
Cylinder head bolts:		
Stage 1	20	15
Stage 2	60	44
Stage 3	Tighten through a further 220°	
Cylinder head cover bolts	8	6
Engine-to-transmission fixing bolts	45	33
Engine/transmission left-hand mounting:		
Mounting bracket-to-body bolts	22	16
Mounting bracket-to-transmission bolts	50	37
Mounting stud-to-transmission bracket	50	37
Rubber mounting centre nut	65	48
Rubber mounting-to-mounting bracket nuts	22	16
Engine/transmission rear mounting:		
Connecting link-to-mounting bracket nut/bolt	45	33
Connecting link-to-subframe nut/bolt	45	33
Mounting bracket-to-cylinder block bolts	45	33
Engine/transmission right-hand mounting:		
Lower (engine) bracket bolts	45	33
Rubber mounting domed buffer nut	22	16
Rubber mounting-to-body	45	33
Stiffener bracket bolts	20	15
Upper mounting bracket-to-lower (engine) bracket bolts	61	45
Upper mounting bracket-to-rubber mounting nut	45	33
Flywheel bolts*	50	37
High-pressure fuel pump sprocket nut	50	37
Main bearing cap bolts:		
Stage 1	25	18
Stage 2	Tighten through a further 60°	
Oil pump mounting bolts	18	13
Piston oil jet spray tube bolt	10	7
Sump bolts	16	12
Timing belt idler pulley bolt	25	18
Timing belt tensioner pulley bolt	25	18

**New nuts/bolts must be used.*

1 General information and precautions

Using this Chapter

This Part of Chapter 2 is devoted to in-car repair procedures for the DW series diesel engine. Similar information covering the petrol engines will be found in Chapters 2A and 2B. All procedures concerning engine removal and refitting, and engine block/cylinder head overhaul for petrol and diesel engines can be found in Chapters 2D and 2E as applicable.

Most of the operations included in Chapter 2C are based on the assumption that the engine is still installed in the car. Therefore, if this information is being used during a complete engine overhaul, with the engine already removed, many of the steps included here will not apply.

DW series engine description

The DW series engine is a relatively new power unit based on the well-proven XUD series engine which has appeared in many Citroën and Peugeot vehicles. The engine is of four-cylinder single overhead camshaft design, mounted transversely, with the transmission mounted on the left-hand side.

A toothed timing belt drives the camshaft, high-pressure fuel pump and coolant pump. The camshaft operates the inlet and exhaust valves via rocker arms which are supported at their pivot ends by hydraulic self-adjusting tappets. The camshaft is supported by six bearings machined directly in the cylinder head and camshaft bearing housing.

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

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

The oil pump is chain-driven from the end of the crankshaft and an oil cooler is fitted to all engines.

Throughout the manual, it is often necessary to identify the engines not only by

their cubic capacity, but also by their engine code. The engine code, consists of four characters (eg, DW10). The code is stamped on a plate attached centrally to the lower front of the cylinder block.

Repair operations – precaution

The DW10 engine is a complex unit with numerous accessories and ancillary components. The design of the engine compartment is such that every conceivable space has been utilised, and access to virtually all of the engine components is extremely limited. In many cases, ancillary components will have to be removed, or moved to one side, and wiring, pipes and hoses will have to be disconnected or removed from various cable clips and support brackets.

When working on this engine, read through the entire procedure first, look at the vehicle and engine at the same time, and establish whether you have the necessary tools, equipment, skill and patience to proceed. Allow considerable time for any operation, and be prepared for the unexpected. Any major work on this engine is not for the faint-hearted!

Because of the limited access, many of the engine photographs appearing in this Chapter were, by necessity, taken with the engine removed from the vehicle.

Warning: It is essential to observe strict precautions when working on the fuel system components, particularly the high-pressure side of the system. Before carrying out any engine operations that entail working on, or near, any part of the fuel system, refer to the special information given in Chapter 4B, Section 2.

Repair operations possible with the engine in the vehicle

The following work can be carried out with the engine in the vehicle:

a) *Compression pressure – testing.*
b) *Cylinder head cover – removal and refitting.*
c) *Crankshaft pulley – removal and refitting.*
d) *Timing belt covers – removal and refitting.*
e) *Timing belt – removal, refitting and adjustment.*
f) *Timing belt tensioner and sprockets – removal and refitting.*
g) *Camshaft oil seal – renewal.*
h) *Camshaft, rocker arms and hydraulic tappets – removal, inspection and refitting.*
i) *Sump – removal and refitting.*
j) *Oil pump – removal and refitting.*
k) *Crankshaft oil seals – renewal.*
l) *Engine/transmission mountings – inspection and renewal.*
m) *Flywheel – removal, inspection and refitting.*

Note: *Access between the cylinder head and engine compartment bulkhead, and to the rear underside of the engine is so restricted that it is impossible to remove the cylinder head with the engine in the car unless considerable additional dismantling is carried out first (eg, removal of the front suspension subframe and related components). Cylinder head removal and refitting procedures are therefore contained in Part E, assuming that the engine/transmission has been removed from the vehicle.*

2 Compression and leakdown tests – description and interpretation

Compression test

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

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

2 A compression tester specifically intended for diesel engines must be used, because of the higher pressures involved. The tester is connected to an adapter which screws into the glow plug or injector hole. On these engines, an adapter suitable for use in the glow plug holes will be required, so as not to disturb the fuel system components. It is unlikely to be worthwhile buying such a tester for occasional use, but it may be possible to borrow or hire one – if not, have the test performed by a garage.

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

a) *The battery must be in a good state of charge, the air filter must be clean, and the engine should be at normal operating temperature.*
b) *All the glow plugs should be removed as described in Chapter 5C before starting the test.*
c) *The wiring connector on the engine management system ECU must be disconnected. Refer to Chapter 4B for further information.*

4 The actual compression pressures measured are not so important as the balance between cylinders. Values are given in the Specifications.

5 The cause of poor compression is less easy to establish on a diesel engine than on a petrol one. The effect of introducing oil into the cylinders ('wet' testing) is not conclusive, because there is a risk that the oil will sit in the swirl chamber or in the recess on the piston crown instead of passing to the rings. However, the following can be used as a rough guide to diagnosis.

6 All cylinders should produce very similar pressures; any difference greater than that specified indicates the existence of a fault. Note that the compression should build-up quickly in a healthy engine; low compression on the first stroke, followed by gradually-increasing pressure on successive strokes, indicates worn piston rings. A low compression reading on the first stroke, which does not build-up during successive strokes, indicates leaking valves or a blown head gasket (a cracked head could also be the cause). Deposits on the undersides of the valve heads can also cause low compression.

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

8 If the compression reading is unusually high, the cylinder head surfaces, valves and pistons are probably coated with carbon deposits. If this is the case, the cylinder head should be removed and decarbonised (see Part E).

Leakdown test

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

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

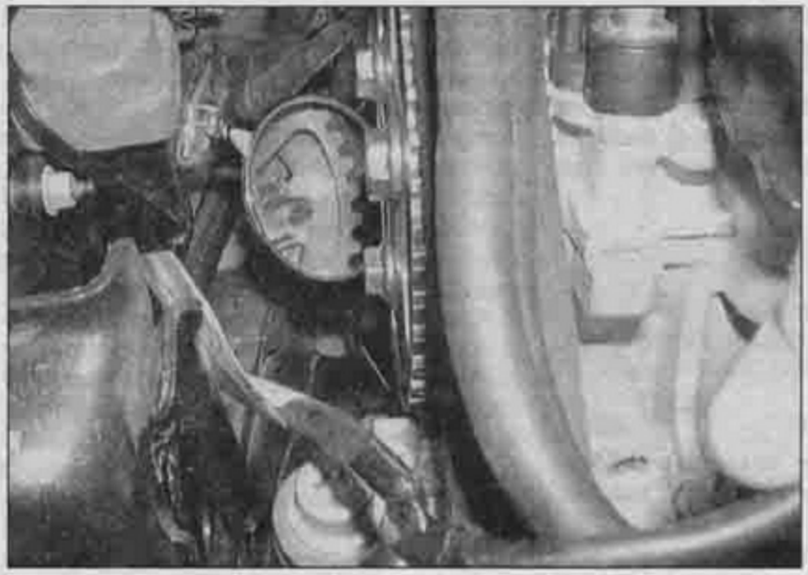
3 Engine assembly/ valve timing holes – general information and usage

General

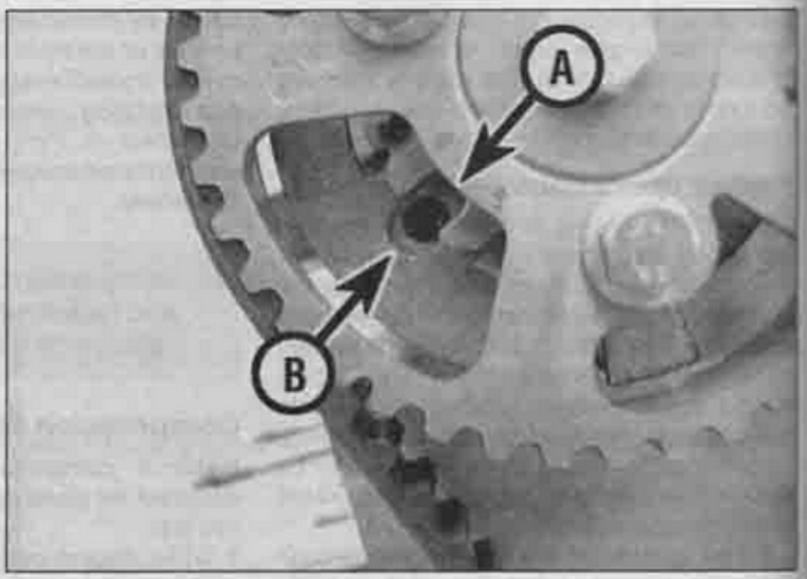
Note: *Do not attempt to rotate the engine whilst the crankshaft and camshaft are locked in position. If the engine is to be left in this state for a long period of time, it is a good idea to place suitable warning notices inside the vehicle, and in the engine compartment. This will reduce the possibility of the engine being accidentally cranked on the starter motor, which is likely to cause damage with the locking tools in place.*

1 Timing holes or slots are located in the flywheel and in the camshaft sprocket or sprocket hub. The holes/slots are used to align the crankshaft and camshaft at the TDC position for Nos 1 and 4 pistons. This will ensure that the valve timing is maintained during operations that require removal and refitting of the timing belt and, on later engines, the crankshaft pulley. When the holes/slots are aligned with their corresponding holes in the cylinder block and cylinder head, suitable diameter bolts/pins can be inserted to lock the crankshaft and camshaft in position, preventing rotation.

Note: *With the timing holes aligned, No 4 piston is at TDC on its compression stroke.*



3.5a Use a mirror to observe the camshaft sprocket hub timing slot



3.5b Camshaft sprocket hub timing slot (A) aligned with the cylinder head timing hole (B)

2 The HDi type fuel system used on these engines does not have a conventional diesel injection pump, but instead uses a high-pressure fuel pump that does not have to be timed. The alignment of the fuel pump sprocket (and hence the fuel pump itself) with respect to crankshaft and camshaft position is therefore irrelevant.

3 To align the engine assembly/valve timing holes, proceed as follows.

4 Remove the upper timing belt cover as described in Section 6.

5 Using a suitable socket and extension bar, turn the crankshaft by means of the pulley bolt, until the timing slot in the camshaft sprocket hub is aligned with the corresponding hole in the cylinder head. Note that the crankshaft must always be turned in a clockwise direction (viewed from the right-hand side of vehicle). Use a small mirror so that the position of the sprocket hub timing slot can be observed **(see illustrations)**. When the slot is aligned with the corresponding hole in the cylinder head, the engine is positioned at TDC for Nos 1 and 4 pistons.

6 Insert an 8 mm diameter bolt, rod or drill through the hole in the left-hand flange of the cylinder block by the starter motor; if necessary, carefully turn the crankshaft a little either way until the rod enters the timing hole in the flywheel **(see illustration)**.

7 Insert an 8 mm bolt, rod or drill through the slot in the camshaft sprocket hub and into engagement with the cylinder head **(see illustration)**.

8 The crankshaft and camshaft are now locked in position, preventing unnecessary rotation.

4 Cylinder head cover – removal and refitting

Removal

1 Remove the timing belt upper cover as described in Section 6.

2 Slacken or release the clips securing the crankcase ventilation hoses to the centre and left-hand end of the cylinder head cover and disconnect the hoses.

3 Undo the bolts as necessary and move the engine cover and cable guide support bracket clear of the right-hand end of the cylinder head cover.

4 Disconnect the camshaft position sensor wiring connector.

5 Release the wiring harness from the clip on the cylinder head cover and move the harness to one side.

6 Undo the bolts securing the cylinder head cover to the camshaft carrier and collect the washers. Carefully lift off the cover taking care not to damage the camshaft position sensor as the cover is removed. Recover the seal from the cover.

Refitting

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

a) Examine the cover seal for signs of damage and deterioration, and renew if necessary.

b) Tighten the cylinder head cover bolts to the specified torque.

c) On early engines with a two-piece camshaft sprocket (see Section 7), adjust the camshaft position sensor air gap as described in Chapter 4B before refitting the upper timing belt cover.

5 Crankshaft pulley – removal and refitting

Removal

1 Remove the auxiliary drivebelt as described in Chapter 1B.

2 It is now necessary to determine the type of pulley fitted, as there are two different removal and refitting procedures accordingly.

3 From under the wheelarch, observe the flat front face of the pulley. If there is a green paint mark on the pulley face it is of the later type. If no paint mark is present, the pulley is an early type. Proceed as described in the appropriate following sub-sections, according to pulley type.

3.6 Rod (arrowed) inserted through the cylinder block into the flywheel timing hole

3.7 Insert an 8 mm bolt (arrowed) through the sprocket timing slot and into the cylinder head to lock the camshaft

Pulley without green paint mark

4 To prevent crankshaft rotation whilst the pulley retaining bolt is being slackened, the flywheel ring gear must be locked using a suitable tool made from steel angle **(see Tool Tip)**. Release the power steering fluid pipes from the clamps on the cover plate at the base of the transmission bellhousing. Remove the cover plate from the bellhousing and bolt the tool to the lower bolt hole in the bellhousing flange so it engages with the ring gear teeth.

5 Using a suitable socket and extension bar, unscrew the retaining bolt, remove the washer, then slide the pulley off the end of the crankshaft **(see illustration)**. If the pulley is a tight fit, it can be drawn off the crankshaft using a suitable puller. If a puller is being used, refit the pulley retaining bolt without the washer, to avoid damaging the crankshaft as the puller is tightened.

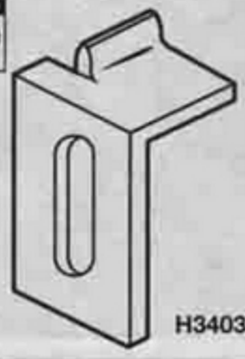
Pulley with green paint mark

6 Align the engine assembly/valve timing holes as described in Section 3, and lock the crankshaft and the camshaft sprocket in position. The crankshaft timing belt sprocket used with the later type pulley incorporates a wider keyway for the locating Woodruff key. When the pulley retaining bolt is slackened, the sprocket is free to turn on the crankshaft within the limits afforded by the wider keyway. This provides a certain degree of lateral movement of the sprocket for accurate adjustment of the timing belt tension. It is therefore essential that the flywheel and camshaft are locked in the engine assembly/valve timing position when the pulley bolt is slackened, otherwise the sprockets will turn slightly and the valve timing will be lost.

7 To prevent crankshaft rotation whilst the pulley retaining bolt is being slackened, make up and fit a flywheel ring gear locking tool as described in paragraph 4. *Do not* attempt to use only the engine assembly/valve timing locking tools to prevent rotation whilst the bolt is slackened.

8 Using a suitable socket and extension bar, unscrew the retaining bolt, remove the washer, then slide the pulley off the end of the crankshaft. If the pulley is a tight fit, it can be drawn off the crankshaft using a suitable puller. If a puller is being used, refit the pulley retaining bolt without the washer, to avoid damaging the crankshaft as the puller is tightened.

TOOL TiP



A flywheel ring gear locking tool can be made from a short strip of steel bent to form a right-angle. Cut a slot in the upper part and bend this part up to engage with the ring gear teeth. File the edges to form a tooth profile. Drill a hole in the lower part to enable the tool to be bolted to the bellhousing flange.

Refitting

9 If working on the later type pulley, ensure that the engine assembly/valve timing holes are still aligned as described in Section 3, and the crankshaft and camshaft sprocket are locked in position.

10 Locate the pulley in position on the end of the crankshaft.

11 Thoroughly clean the threads of the pulley retaining bolt, then apply a coat of locking compound to the bolt threads. Citroën recommend the use of Loctite (available from your Citroën dealer); in the absence of this, any good-quality locking compound may be used.

12 Refit the crankshaft pulley retaining bolt and washer. Tighten the bolt to the specified torque, then through the specified angle, preventing the crankshaft from turning using the tool employed for removal **(see illustrations)**. Note that different torque and angle settings are given in the Specifications, according to pulley type.

5.5 Removing the crankshaft pulley

13 Remove the flywheel ring gear locking tool and, where applicable, the crankshaft and camshaft sprocket locking tools.

14 Refit the cover plate to the transmission bellhousing and secure the power steering fluid pipes in position.

15 If working on the later type pulley, refit the upper timing belt cover as described in Section 6.

16 Refit and tension the auxiliary drivebelt as described in Chapter 1B.

6 Timing belt covers – removal and refitting

Removal

Warning: Refer to the precautionary information contained in Section 1 before proceeding.

Upper cover

1 Disconnect the battery negative terminal (refer to *Disconnecting the battery* in the Reference Chapter).

2 Release the four plastic fasteners and remove the engine cover from the top of the engine.

3 Firmly apply the handbrake, then jack up the front of the vehicle and support it securely on axle stands (see *Jacking and vehicle support*). Remove the right-hand front roadwheel.

5.12a Refit the crankshaft pulley retaining bolt after applying locking compound to the threads

5.12b Tighten the pulley bolt to the specified Stage 1 torque . . .

5.12c . . . then through the specified Stage 2 angle

6.5 Disconnect the fuel supply and return hose quick-release fittings

6.6 Release the two fuel hoses from the retaining clips on the timing belt upper cover

4 Using a forked type removal tool, release the stud fasteners securing the centre section of the right-hand wheelarch liner. Withdraw the liner from under the front wing for access to the right-hand side of the engine. Unclip the coolant hoses from under the wing to improve access further.

5 At the connections above the fuel pump, disconnect the fuel supply and return hose quick-release fittings using a small screwdriver to release the locking clip **(see illustration)**. Cover the open unions to prevent dirt entry, using small plastic bags, or fingers cut from clean rubber gloves.

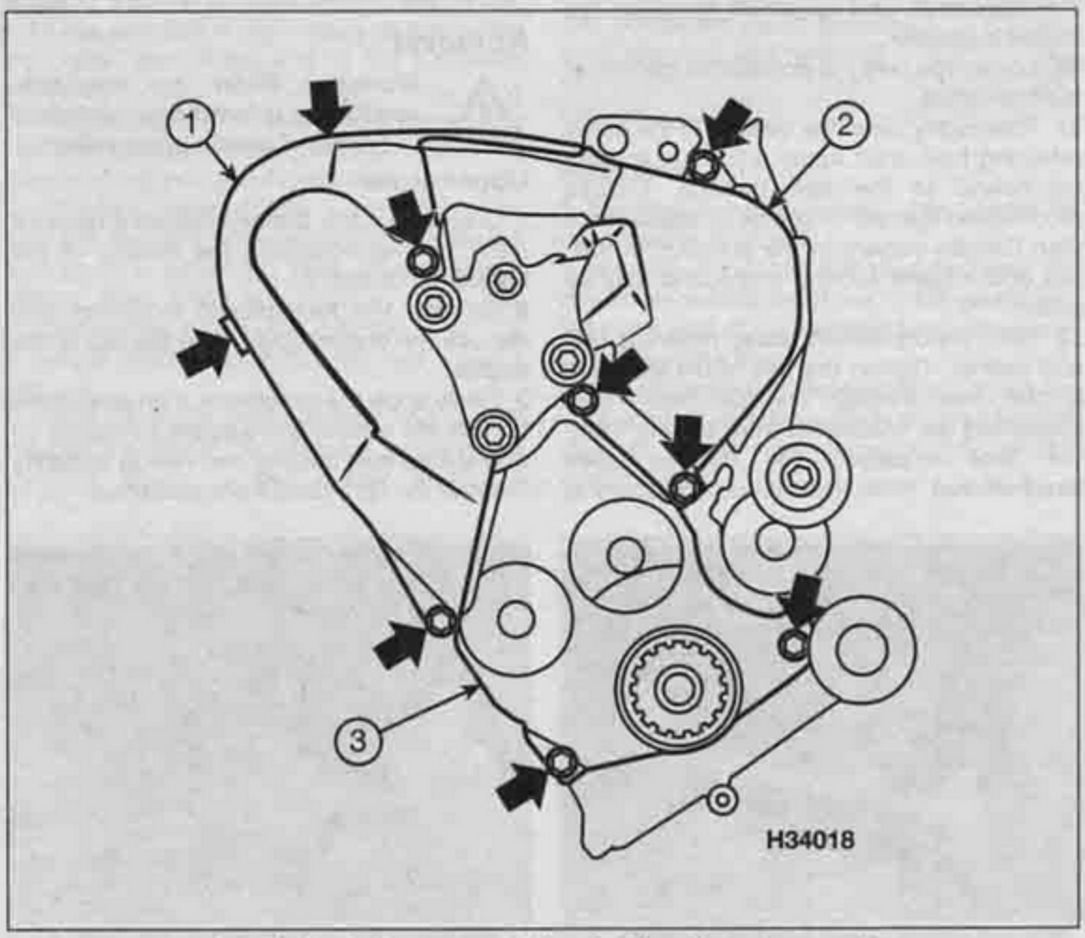
6 Release the two hoses from the retaining clips on the upper timing belt cover and move them to one side **(see illustration)**.

7 Release the EGR solenoid valve vacuum hose from the clip on the upper cover. If necessary for improved access, undo the EGR solenoid valve mounting bracket nuts and move the valve to one side.

8 Undo the bolt securing the upper cover to the cylinder head cover **(see illustration)**.

9 Undo the upper bolt on the edge of the cover nearest to the engine compartment bulkhead.

10 Undo the lower bolt on the bulkhead side of the cover, at the join between the upper and lower covers. Note that this bolt also retains the coolant pump. To avoid coolant leakage, after the upper cover is removed, refit the bolt fitted with a 17.0 mm spacer, and tighten it securely.



6.8 Timing belt cover retaining bolt locations (arrowed)

1 Upper cover *2 Intermediate cover* *3 Lower cover*

11 Undo the remaining bolt in the centre of the cover, just above the engine mounting bracket.

12 Disengage the upper cover from the intermediate cover and manipulate the upper cover from its location.

Intermediate cover

13 Remove the upper cover as described previously.

14 Connect an engine hoist or suitable lifting gear to the two lifting brackets on the cylinder head. Raise the hoist to just take the weight of the engine.

15 For additional stability, place a jack beneath the right-hand side of the engine, with a block of wood on the jack head. Raise the jack until it is just contacting the sump.

16 Slacken and remove the three bolts securing the right-hand engine/transmission mounting upper bracket to the lower (engine) bracket.

17 Undo the two bolts securing the right-hand mounting stiffener bracket to the body and lift off the bracket. Unscrew the domed buffer nut, then unscrew the single nut securing the upper bracket to the rubber mounting. Remove the upper bracket from the rubber mounting and lower (engine) bracket.

18 Undo the two nuts and remove the through bolts securing the rear engine/transmission mounting connecting link to the mounting bracket on the subframe and on the rear of the cylinder block. Release and remove the connecting link from the mounting brackets.

19 With the two engine mountings removed, alternatively raise and lower the lifting gear and the jack under the engine, as necessary, for access to the timing belt cover retaining bolts.

20 Undo the upper bolt on the top edge of the intermediate cover.

21 Undo the two remaining bolts at the join between the intermediate cover and lower cover, then manipulate the intermediate cover from its location.

Lower cover

22 Remove the crankshaft pulley as described in Section 5.

23 Remove the upper and intermediate covers as described previously.

24 Undo the two remaining bolts on the edge of the cover, one on either side of the crankshaft pulley location.

25 Lift the cover off the front of the engine and manipulate it from its location.

Refitting

26 Refitting of all the covers is a reversal of the relevant removal procedure, ensuring that each cover section is correctly located, and that the cover retaining bolts are securely tightened. Ensure that all disturbed hoses are reconnected and retained by their relevant clips, and that all nuts/bolts are tightened to their specified torque wrench settings (where given).

7 Timing belt – general information, removal and refitting

Note: *Citroën specify the use of an electronic belt tension checking tool (SEEM 4122–T) to correctly set the timing belt tension. The following procedure assumes that this equipment (or suitable alternative equipment calibrated to display belt tension in SEEM units) is available. Accurate tensioning of the timing belt is essential, and if the electronic equipment is not available, it is recommended that the work is entrusted to a Citroën dealer or suitably-equipped garage.*

General information

1 The timing belt drives the camshaft, high-pressure fuel pump, and coolant pump from a toothed sprocket on the end of the crankshaft. The belt also drives the brake servo vacuum pump indirectly via the flywheel end of the camshaft. If the belt breaks or slips in service, the pistons are likely to hit the valve heads, resulting in expensive damage.

2 The timing belt should be renewed at the specified intervals, or earlier if it is contaminated with oil, or at all noisy in operation (a 'scraping' noise due to uneven wear).

3 If the timing belt is being removed, it is a wise precaution to check the condition of the coolant pump at the same time (check for signs of coolant leakage). This may avoid the need to remove the timing belt again at a later stage, should the coolant pump fail.

4 Two types of timing belt sprocket arrangements may be encountered. On early engines, the camshaft sprocket is of the 'floating' type, secured to the sprocket hub with three bolts. The bolt holes are elongated and allow for a certain degree of lateral movement of the sprocket for accurate tensioning of the timing belt when refitting. On later engines, the camshaft sprocket is fixed, but the crankshaft sprocket becomes the 'floating' component. Lateral movement of the crankshaft sprocket is achieved by using a wider keyway for the locating Woodruff key. Timing belt removal procedures are the same for both types, but different procedures must be used when refitting.

Removal

5 Remove the crankshaft pulley as described in Section 5. Refit and tighten the pulley retaining bolt to allow the engine to be turned in subsequent operations.

6 Remove the upper, intermediate and lower timing belt covers as described in Section 6.

7 It is now necessary to identify the type of timing belt sprocket arrangement fitted by observing the design of the camshaft sprocket. On early engines the sprocket and hub is a two-piece assembly. The sprocket is secured to the sprocket hub by three retaining bolts, with the hub being secured to the camshaft by a single centre bolt. On later

7.9 Slacken the three camshaft sprocket-to-sprocket hub retaining bolts

engines the sprocket and hub are a single fixed assembly secured to the camshaft by a centre retaining bolt only. When refitting, proceed as described in the appropriate sub-Sections according to sprocket type.

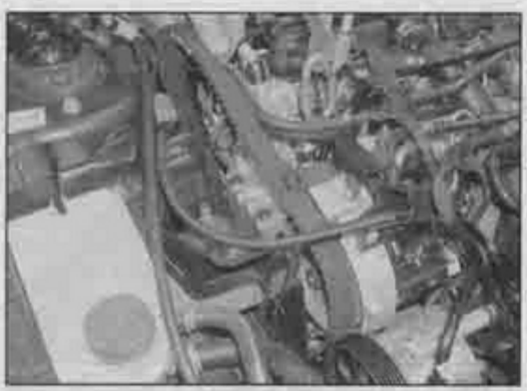
8 If not already done, align the engine assembly/valve timing holes as described in Section 3, and lock the crankshaft and the camshaft sprocket in position. *Do not* attempt to rotate the engine whilst the locking pins are in position.

9 On early engines, slacken the three bolts securing the camshaft sprocket to the sprocket hub **(see illustration)**.

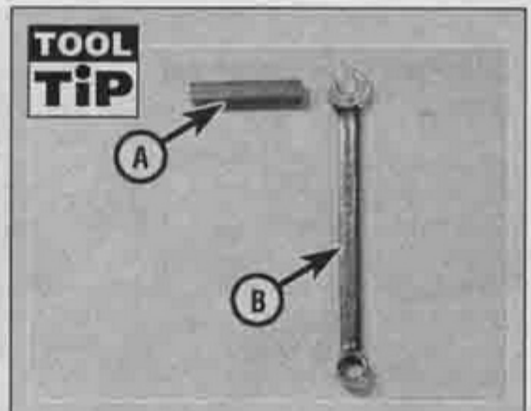
10 Slacken the timing belt tensioner pulley retaining bolt and insert a short length of 8.0 mm square bar into the square hole on the front face of the tensioner pulley **(see Tool Tip)**. Alternatively, although clearance is restricted, the square end of a 1/4 inch drive socket bar can also be used. Using the bar and a spanner, turn the pulley in a clockwise direction, to relieve the tension from the timing belt. Retighten the tensioner pulley retaining bolt to secure it in the slackened position.

11 If the timing belt is to be re-used, use white paint or chalk to mark the direction of rotation on the belt (if markings do not already exist), then slip the belt off the sprockets **(see illustration)**. Note that the crankshaft must not be rotated whilst the belt is removed.

12 Check the timing belt carefully for any signs of uneven wear, splits or oil contamination. Pay particular attention to the roots of the teeth. Renew it if there is the slightest doubt about its condition. If the



7.11 Removing the timing belt



A square section tool to fit the timing belt tensioner pulley can be made from a length of standard 8 mm door handle rod (A), obtained from a DIY shop, and then cut to size. Once the rod has been fitted to the tensioner, the timing belt can be tensioned by turning the rod with an 8 mm spanner (B).

engine is undergoing an overhaul, renew the belt as a matter of course, regardless of its apparent condition. The cost of a new belt is nothing compared with the cost of repairs, should the belt break in service. If signs of oil contamination are found, trace the source of the oil leak and rectify it. Wash down the engine timing belt area and all related components, to remove all traces of oil. Check that the tensioner pulley and idler roller rotate freely, without any sign of roughness. If necessary, renew them as described in Section 8.

Refitting

Two-piece camshaft sprocket

13 Commence refitting by ensuring that the engine assembly/valve timing holes are still aligned as described in Section 3, and the crankshaft, and camshaft sprocket hub are locked in position.

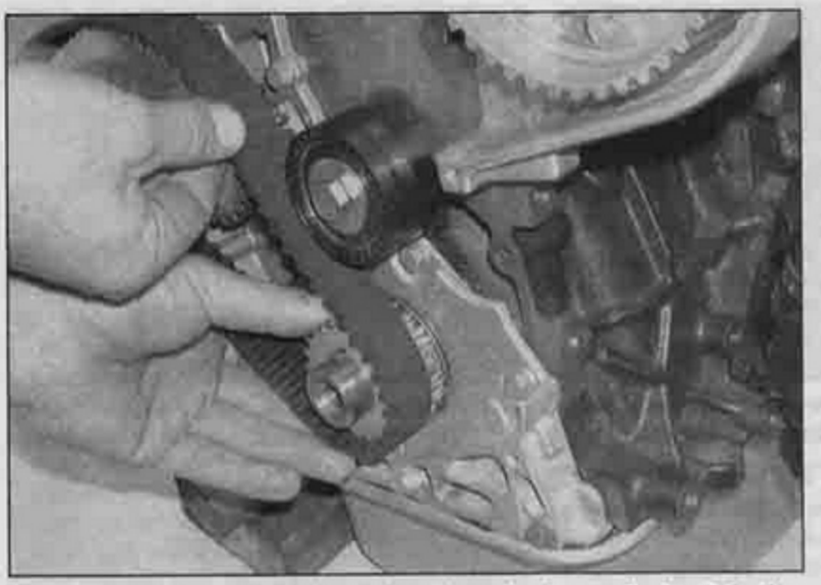
14 Tighten the camshaft sprocket retaining bolts lightly so that the sprocket can still move within the elongated slots. Turn the sprocket fully clockwise to the ends of the slots.

15 Locate the timing belt on the crankshaft sprocket making sure that the direction of rotation arrow is facing the correct way.

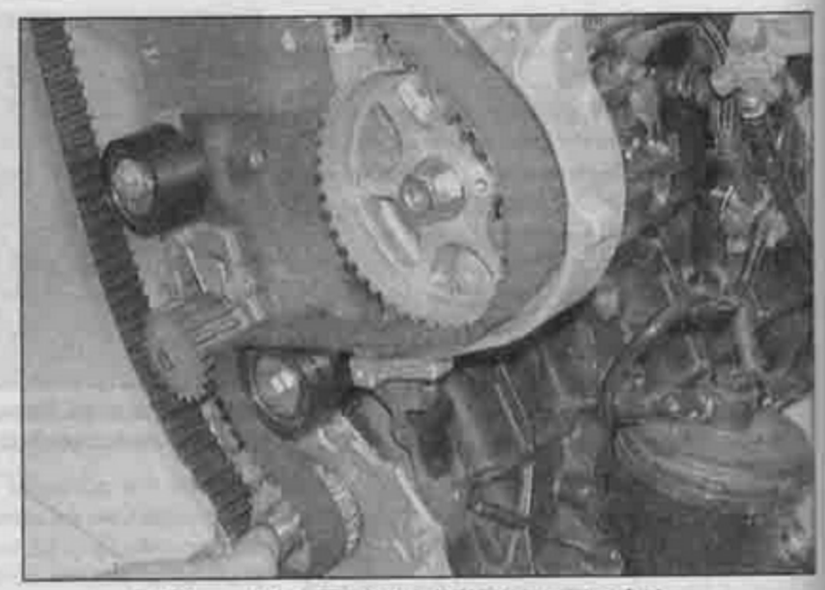
16 Hold the belt on the crankshaft sprocket and, while keeping the 'lower run' of the belt taut (between the crankshaft and idler roller), feed the belt over the remaining sprockets and pulleys in the following order **(see illustrations)**:

a) Idler roller.
b) High-pressure fuel pump.
c) Camshaft.
e) Coolant pump.
d) Tensioner pulley.

17 Fit the sensor head of the electronic belt tension measuring equipment to the 'top run' of the timing belt, approximately midway between the camshaft and fuel pump sprockets.



7.16a On engines with a two-piece camshaft sprocket, retain the timing belt on the crankshaft sprocket and feed it around the idler roller . . .



7.16b . . . high-pressure fuel pump sprocket . . .

18 Slacken the tensioner pulley retaining bolt and, using the square bar and spanner, pivot the tensioner pulley anti-clockwise until an initial setting of 98 ± 2 SEEM units is displayed on the tension measuring equipment **(see illustrations)**. Hold the tensioner pulley in that position and retighten the retaining bolt.

19 Check that the camshaft sprocket retaining bolts are not at the ends of their slots (if necessary, remove one of the sprocket bolts to check this). If they are, repeat the refitting operation. If all is satisfactory, refit the removed bolt and tighten all three sprocket retaining bolts to the specified torque.

20 Remove the belt tension measuring equipment and the crankshaft, and camshaft sprocket hub locking tools.

21 Rotate the crankshaft through eight complete rotations in a clockwise direction (viewed from the right-hand end of the engine). Realign the engine assembly/valve timing holes and refit the crankshaft locking tool only.

22 Slacken the camshaft sprocket retaining bolts and refit the camshaft sprocket hub locking tool.

23 Slacken the tensioner pulley retaining bolt once more.

24 Refit the belt tension measuring equipment to the top run of the belt, and turn the tensioner pulley to give a final setting of 54 ± 2 SEEM units on the tensioning gauge. Hold the tensioner pulley in this position and tighten the retaining bolt to the specified torque.

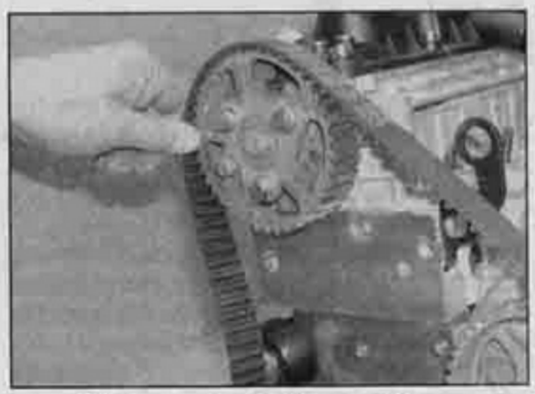
25 Retighten the camshaft sprocket retaining bolts to the specified torque.

26 Release the sensor head of the belt tension measuring equipment, then refit it again and check that a reading of 54 ± 3 SEEM units is indicated. Remove the tension measuring equipment.

27 Remove the locking tools, then rotate the crankshaft once again through two complete rotations in a clockwise direction. Realign the engine assembly/valve timing holes and refit the crankshaft locking tool.

28 Check that it is possible to insert the camshaft sprocket hub locking tool. If the tool cannot be inserted, check that the offset between the timing slot in the sprocket hub and the corresponding hole in the cylinder head is not greater than 1.0 mm. If it is, repeat the complete timing belt refitting and tensioning procedure.

29 Refit the lower, intermediate and upper timing belt covers as described in Section 6. Refit the crankshaft pulley as described in Section 5 after refitting the lower cover.



7.16c . . . camshaft sprocket . . .

7.16d . . . coolant pump and tensioner pulley

7.18a Pivot the tensioner pulley anti-clockwise, then tighten the retaining bolt . . .

7.18b . . . when the specified tension value is shown on the tensioning measuring equipment

Fixed camshaft sprocket

30 Ensure that the engine assembly/valve timing holes are still aligned as described in Section 3, and the crankshaft and camshaft sprocket are locked in position.

31 Turn the crankshaft sprocket anti-clockwise to the limit of the movement afforded by the keyway. Lock the sprocket in this position by inserting a small screwdriver or similar implement down the left-hand side of the Woodruff key.

32 Locate the timing belt on the camshaft sprocket, making sure that the direction of rotation arrow is facing the correct way.

33 Retain the timing belt on the camshaft

sprocket using a cable tie to ensure that it does not jump a tooth. Keeping the 'top run' of the belt taut (between the camshaft and fuel pump sprockets), feed the belt over the remaining sprockets and pulleys in the following order:

a) High-pressure fuel pump.
b) Idler roller.
c) Crankshaft.
d) Coolant pump.
e) Tensioner pulley.

34 Cut off the cable tie securing the timing belt to the camshaft sprocket and remove the screwdriver from the crankshaft sprocket keyway.

35 Fit the sensor head of the electronic belt tension measuring equipment to the 'top run' of the timing belt, approximately midway between the camshaft and fuel pump sprockets.

36 Slacken the tensioner pulley retaining bolt and, using the square bar and spanner, pivot the tensioner pulley anti-clockwise until an initial setting of 98 ± 2 SEEM units is displayed on the tension measuring equipment. Hold the tensioner pulley in that position and retighten the retaining bolt.

37 If not already in place, refit the crankshaft pulley retaining bolt and washer and tighten the bolt to 70 Nm (52 lbf ft). Prevent the crankshaft from turning using the flywheel ring gear locking tool described for pulley removal in Section 5. *Do not* attempt to use only the engine assembly/valve timing locking tools to prevent rotation whilst the bolt is tightened.

38 Remove the belt tension measuring equipment, the flywheel ring gear locking tool and the engine assembly/valve timing locking tools.

39 Rotate the crankshaft through eight complete rotations in a clockwise direction (viewed from the right-hand end of the engine). Realign the engine assembly/valve timing holes and refit the crankshaft and camshaft sprocket locking tools.

40 Refit the flywheel ring gear locking tool and slacken the crankshaft pulley retaining bolt.

41 Slacken the tensioner pulley retaining bolt once more. Refit the belt tension measuring equipment to the top run of the belt, and turn the tensioner pulley to give a final setting of 54 ± 2 SEEM units on the tensioning gauge. Hold the tensioner pulley in this position and tighten the retaining bolt to the specified torque.

42 Release the sensor head of the belt tension measuring equipment, then refit it again and check that a reading of 54 ± 3 SEEM units is indicated. If not, repeat the complete tensioning procedure. If the reading is correct, remove the tension measuring equipment.

43 Remove all the locking tools, then rotate the crankshaft once again through two complete rotations in a clockwise direction. Realign the engine assembly/valve timing holes and refit the crankshaft and camshaft sprocket locking tools. If it is not possible to fit both locking tools, repeat the complete tensioning procedure.

44 If all is satisfactory, locate the lower timing belt cover in position, refit the retaining bolts and tighten them securely.

45 With the engine assembly/valve timing holes aligned and the crankshaft and camshaft sprocket locking tools in place, refit the flywheel ring gear locking tool and unscrew the crankshaft pulley retaining bolt.

46 Locate the crankshaft pulley in position on the end of the crankshaft.

47 Thoroughly clean the threads of the pulley retaining bolt, then apply a coat of locking compound to the bolt threads. Citroën recommend the use of Loctite (available from your Citroën dealer); in the absence of this, any good-quality locking compound may be used.

48 Refit the crankshaft pulley retaining bolt and washer. Tighten the bolt to the specified torque, then through the specified angle.

49 Remove the flywheel ring gear locking tool and the crankshaft and camshaft sprocket locking tools.

50 Refit the intermediate and upper timing belt covers as described in Section 6, then refit and tension the auxiliary drivebelt as described in Chapter 1B.

8 Timing belt sprockets and tensioner – removal and refitting

Two-piece camshaft sprocket

Removal

1 Remove the timing belt as described in Section 7.

2 Remove the locking tool from the camshaft sprocket hub. Slacken the sprocket hub retaining bolt, and the three sprocket-to-hub retaining bolts. To prevent the camshaft rotating as the bolts are slackened, a sprocket holding tool will be required. In the absence of the special Citroën tool, an acceptable substitute can be fabricated at home **(see Tool Tip 1)**. *Do not* attempt to use the engine assembly/valve timing locking tool to prevent the sprocket from rotating whilst the bolt is slackened.

3 Remove the sprocket hub retaining bolt and washer, and slide the sprocket and hub off the end of the camshaft. Examine the camshaft oil seal for signs of oil leakage and, if necessary, renew it as described in Section 12.

4 If necessary, the sprocket can be separated from the hub after removing the three retaining bolts.

5 Clean the camshaft sprocket thoroughly, and renew it if there are any signs of wear, damage or cracks.

Refitting

6 If removed, refit the sprocket to the hub and secure with the three retaining bolts, moderately tightened only at this stage.

7 Refit the sprocket and hub to the camshaft, then refit the hub retaining bolt and washer. Tighten the bolt to the specified torque, preventing the camshaft from turning as during removal.

8 Align the engine assembly/valve timing slot in the camshaft sprocket hub with the hole in the cylinder head and refit the locking tool.

9 The air gap between the tip of the camshaft position sensor and the target plate at the rear of the camshaft sprocket hub must now be adjusted.

10 Slacken the camshaft position sensor retaining bolt and move the sensor away from the sprocket hub to the limit of its elongated retaining bolt slot.

11 Undo the three camshaft sprocket retaining bolts and remove the sprocket from the hub.

12 Select feeler blades to the value of 1.2 mm total thickness and insert them between the tip of the camshaft position sensor and the target plate inner face.

13 Move the sensor toward the sprocket until it just contacts the feeler blades. Hold the sensor in this position and tighten the retaining bolt.

14 With the gap correctly adjusted, refit the camshaft sprocket to the sprocket hub and secure with the three retaining bolts tightened finger tight only at this stage.

15 Refit the timing belt as described in Section 7.

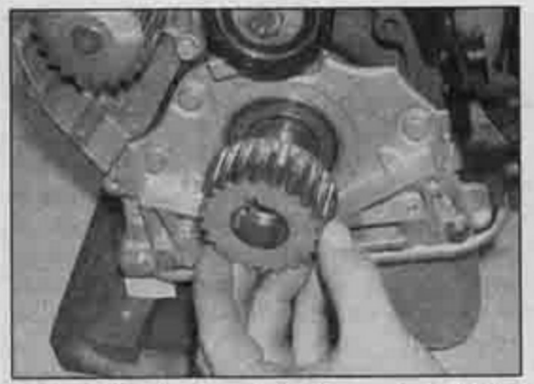
Fixed camshaft sprocket

Removal

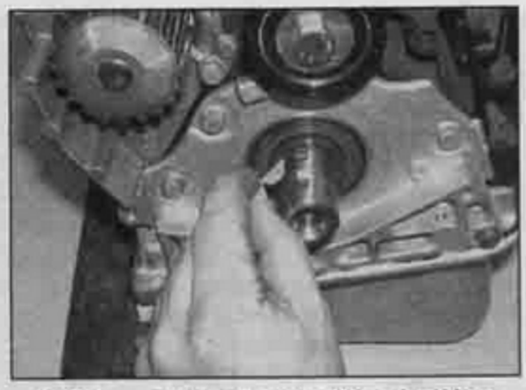
16 Remove the timing belt as described in Section 7.

17 Remove the locking tool from the camshaft sprocket. Slacken the sprocket retaining bolt while preventing the camshaft from rotating using the tool described in paragraph 2. *Do not* attempt to use the engine assembly/valve timing locking tool to prevent the sprocket from rotating whilst the bolt is slackened.

Tool Tip 1: A sprocket holding tool can be made from two lengths of steel strip bolted together to form a forked end. Bend the ends of the strip through 90° to form the fork 'prongs'.



8.24a Slide the crankshaft sprocket off the end of the crankshaft . . .



8.24b . . . and collect the Woodruff key

18 Remove the sprocket retaining bolt and washer, and slide the sprocket off the end of the camshaft. Examine the camshaft oil seal for signs of oil leakage and, if necessary, renew it as described in Section 12.
19 Clean the camshaft sprocket thoroughly, and renew it if there are any signs of wear, damage or cracks.

Refitting

20 Refit the sprocket to the camshaft, then refit the retaining bolt and washer. Tighten the bolt to the specified torque, preventing the camshaft from turning as during removal.
21 Align the engine assembly/valve timing hole in the camshaft sprocket with the hole in the cylinder head and refit the locking tool.
22 Refit the timing belt as described in Section 7.

Crankshaft sprocket

Removal

23 Remove the timing belt as described in Section 7.
24 Slide the sprocket off the end of the crankshaft and collect the Woodruff key **(see illustrations)**.
25 Examine the crankshaft oil seal for signs of oil leakage and, if necessary, renew it as described in Section 12.
26 Clean the crankshaft sprocket thoroughly, and renew it if there are any signs of wear, damage or cracks.

Tool Tip 2: Make a sprocket releasing tool from a short strip of steel. Drill two holes in the strip to correspond with the two holes in the sprocket. Drill a third hole just large enough to accept the flats of the sprocket retaining nut.

Refitting

27 Refit the Woodruff key to the end of the crankshaft, then refit the crankshaft sprocket (with the flange nearest the cylinder block).
28 Refit the timing belt as described in Section 7.

Fuel pump sprocket

Removal

29 Remove the timing belt as described in Section 7.
30 Using a suitable socket, undo the pump sprocket retaining nut. The sprocket can be held stationary as the nut is slackened using a suitable forked tool engaged with the holes in the sprocket **(see Tool Tip 1)**.
31 The pump sprocket is a taper fit on the pump shaft and it will be necessary to make up another tool to release it from the taper **(see Tool Tip 2)**.
32 Partially unscrew the sprocket retaining nut, fit the home-made tool, and secure it to the sprocket with two suitable bolts. Prevent the sprocket from rotating as before, and unscrew the sprocket retaining nut **(see illustration)**. The nut will bear against the tool as it is undone, forcing the sprocket off the shaft taper. Once the taper is released, remove the tool, unscrew the nut fully, and remove the sprocket from the pump shaft.
33 Clean the sprocket thoroughly, and renew it if there are any signs of wear, damage or cracks.

Refitting

34 Refit the pump sprocket and retaining nut, and tighten the nut to the specified torque. Prevent the sprocket rotating as the nut is tightened using the sprocket holding tool.
35 Refit the timing belt as described in Section 7.

8.32 Using the home-made tools to remove the fuel pump sprocket

Coolant pump sprocket

36 The coolant pump sprocket is integral with the pump, and cannot be removed.

Tensioner pulley

Removal

37 Remove the timing belt as described in Section 7.
38 Remove the tensioner pulley retaining bolt, and slide the pulley off its mounting stud.
39 Clean the tensioner pulley, but do not use any strong solvent which may enter the pulley bearings. Check that the pulley rotates freely, with no sign of stiffness or free play. Renew the pulley if there is any doubt about its condition, or if there are any obvious signs of wear or damage.
40 Examine the pulley mounting stud for signs of damage and if necessary, renew it.

Refitting

41 Refit the tensioner pulley to its mounting stud, and fit the retaining bolt.
42 Refit the timing belt as described in Section 7.

Idler roller

Removal

43 Remove the timing belt as described in Section 7.
44 Undo the retaining bolt and withdraw the idler roller from the engine.
45 Clean the idler roller, but do not use any strong solvent which may enter the bearings. Check that the roller rotates freely, with no sign of stiffness or free play. Renew the idler roller if there is any doubt about its condition, or if there are any obvious signs of wear or damage.

Refitting

46 Locate the idler roller on the engine, and fit the retaining bolt. Tighten the bolt to the specified torque.
47 Refit the timing belt as described in Section 7.

9 Camshaft, tappets and rocker arms – removal, inspection and refitting

Removal

1 Remove the cylinder head cover as described in Section 4.
2 Remove the camshaft sprocket as described in Section 8.
3 Remove the braking system vacuum pump as described in Chapter 9.
4 Progressively slacken the camshaft bearing housing retaining bolts, working in a spiral pattern in the reverse order to that shown in illustration 9.25. When all the bolts have been

slackened, unscrew and remove them from their locations.

5 Carefully release the camshaft bearing housing from the cylinder head. The housing is likely to be initially tight to release as it is located by two dowels on the forward facing side of the cylinder head. If necessary, very carefully prise up the housing using a screwdriver inserted in the slotted lug adjacent to each dowel location.

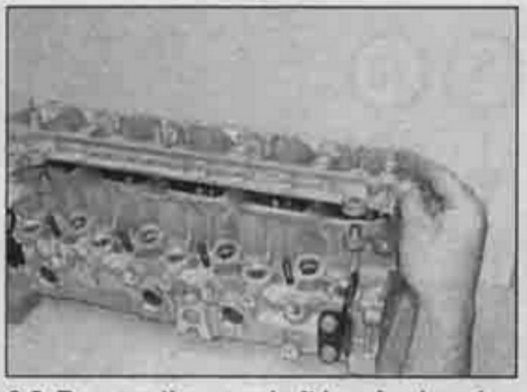
6 Once the bearing housing is free, lift it squarely from the cylinder head **(see illustration)**. The camshaft will rise up slightly under the pressure of the valve springs – be careful it doesn't tilt and jam in the cylinder head or bearing housing section.

7 Lift the camshaft from the cylinder head and remove the oil seal **(see illustration)**. Discard the seal, a new one should be used on refitting.

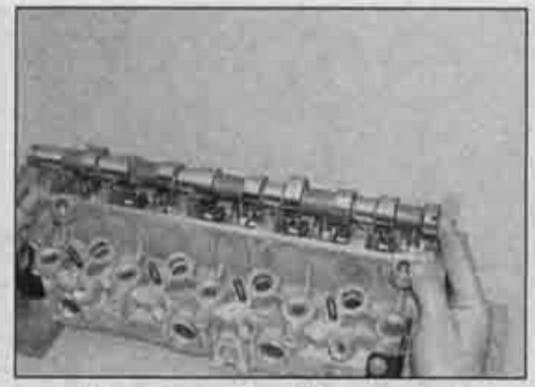
8 Have ready a suitable box divided into eight segments, or some containers or other means of storing and identifying the rocker arms and hydraulic tappets after removal. The box or containers for the hydraulic tappets must be oil tight and deep enough to allow the tappets to be almost totally submerged in oil. Mark the segments in the boxes or the containers with the number for each rocker arm and tappet (ie, 1 to 8).

9 Lift out each rocker arm and release it from the spring clip on the tappet. Place the rocker arms in their respective positions in the box or containers **(see illustration)**.

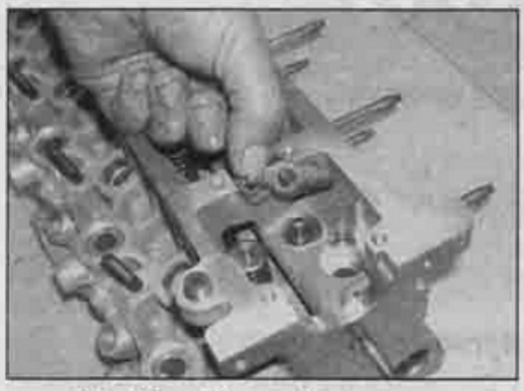
10 Similarly lift out the tappets and place them in their respective positions in the box or containers **(see illustrations)**. Once all the tappets have been removed, add clean engine oil to the box or container so that the tappet is submerged.



9.6 Remove the camshaft bearing housing from the cylinder head . . .



9.7 . . . then lift out the camshaft



9.9 Lift out the rocker arms . . .

9.10a . . . followed by the hydraulic tappets . . .

Inspection

11 Inspect the cam lobes and the camshaft bearing journals for scoring or other visible evidence of wear. Once the surface hardening of the cam lobes has been eroded, wear will occur at an accelerated rate. **Note:** *If these symptoms are visible on the tips of the camshaft lobes, check the corresponding rocker arm, as it will probably be worn as well.*

12 Examine the condition of the bearing surfaces in the cylinder head and camshaft bearing housing. If wear is evident, the cylinder head and bearing housing will both have to be renewed, as they are a matched assembly.

13 Inspect the rocker arms and tappets for scuffing, cracking or other damage and renew any components as necessary. Also check the condition of the tappet bores in the cylinder head. As with the camshafts, any wear in this area will necessitate cylinder head renewal.

Refitting

14 Thoroughly clean the sealant from the mating surfaces of the cylinder head and camshaft bearing housing. Use a suitable liquid gasket dissolving agent (available from Citroën dealers) together with a soft putty knife; do not use a metal scraper or the faces will be damaged. As there is no conventional gasket used, the cleanliness of the mating faces is of the utmost importance.

15 Clean off any oil, dirt or grease from both components and dry with a clean lint free cloth. Ensure that all the oilways are completely clean.

16 To prevent any possibility of the valves contacting the pistons as the camshaft is refitted, remove the crankshaft locking tool and turn the crankshaft a quarter turn in the *opposite* direction to normal rotation, to position all the pistons at mid-stroke.

17 Liberally lubricate the tappet bores in the cylinder head with clean engine oil.

18 Insert the tappets into their original bores in the cylinder head unless they have been renewed.

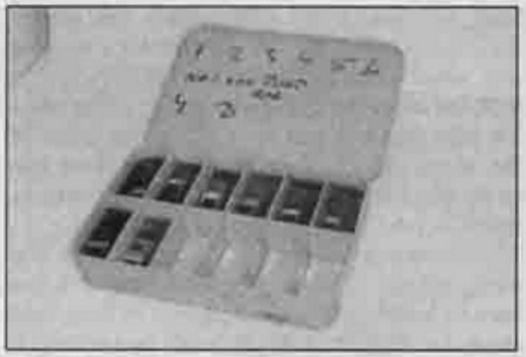
19 Lubricate the rocker arms and place them over their respective tappets and valve stems. Ensure that the ends of the rocker arms engage with the spring clips on the tappets.

20 Lubricate the camshaft bearing journals in the cylinder head sparingly with oil, taking care not to allow the oil to spill over onto the camshaft bearing housing contact areas.

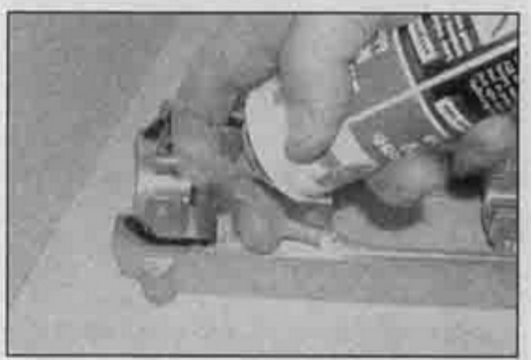
21 Lay the camshaft in the cylinder head and temporarily locate the camshaft sprocket in position. Turn the camshaft so that the engine assembly/valve timing slot in the sprocket or sprocket hub is approximately aligned with the timing hole in the cylinder head. Remove the sprocket.

22 Ensure that the mating faces of the cylinder head and camshaft bearing housing are clean and free of any oil or grease.

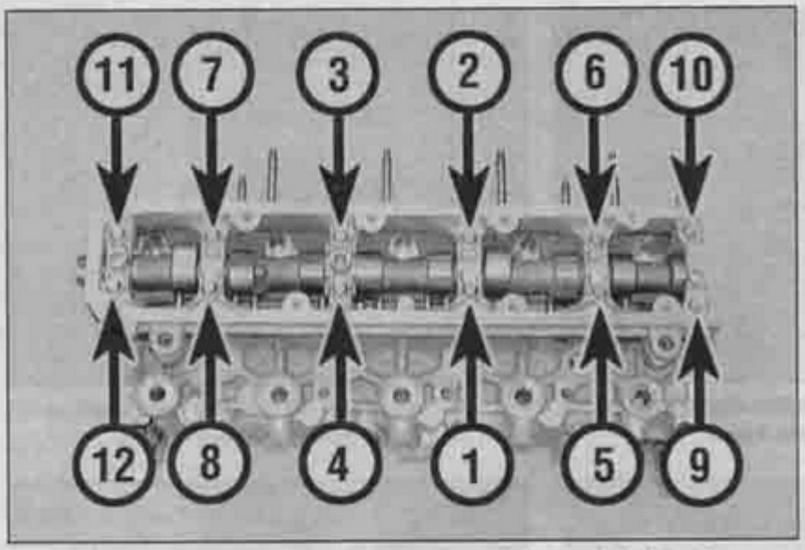
23 Sparingly apply a bead of RTV sealant to the mating face of the camshaft bearing housing, taking care not to allow the product to contaminate the camshaft bearing journal areas **(see illustration)**.



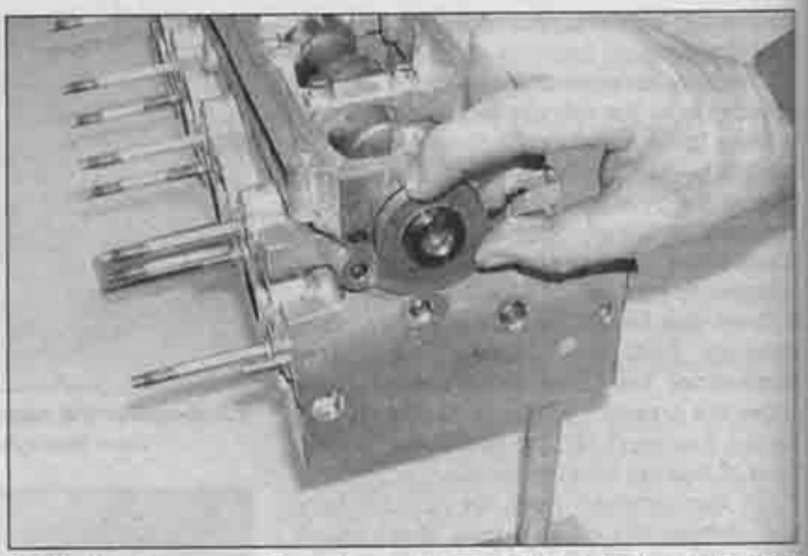
9.10b . . . and place all the components in their respective positions in a segmented box



9.23 Apply a bead of RTV sealant to the mating face of the camshaft bearing housing



9.25 Camshaft bearing housing retaining bolt tightening sequence



9.26a Locate a new oil seal over the camshaft, with its sealing lip facing inwards . . .

24 Locate the bearing housing over the camshaft and into position on the cylinder head.

25 Insert all the bearing housing retaining bolts and progressively tighten them to the specified torque, in the sequence shown **(see illustration)**.

26 Smear the lips of the new oil seal with clean engine oil and fit it over the camshaft, making sure its sealing lip is facing inwards. Press the seal into position until it is flush with the end face of the cylinder head. Use a suitable bolt (screwed into the end of the camshaft), washers and a tube or socket to press the seal into position **(see illustrations)**.

27 Refit the braking system vacuum pump as described in Chapter 9.

28 Again, temporarily locate the sprocket on the end of the camshaft, and make sure that the sprocket timing slot is aligned with the corresponding cut-out in the cylinder head.

29 Turn the crankshaft a quarter turn in the normal direction of rotation so that pistons 1 and 4 are again at TDC. Realign the engine assembly/valve timing hole and refit the crankshaft locking tool.

30 Refit the camshaft sprocket as described in Section 8.

31 Refit the cylinder head cover as described in Section 4.

9.26b . . . then use a bolt and socket or similar arrangement to press the seal into place

10 Sump – removal and refitting

Removal

1 Disconnect the battery negative terminal (refer to *Disconnecting the battery* in the Reference Chapter).

2 Drain the engine oil, then clean and refit the engine oil drain plug, tightening it securely. If the engine is nearing its service interval when the oil and filter are due for renewal, it is recommended that the filter is also removed, and a new one fitted. After reassembly, the engine can then be refilled with fresh oil. Refer to Chapter 1B for further information.

3 Chock the rear wheels then jack up the front of the vehicle and support it on axle stands (see *Jacking and vehicle support*).

4 On models with air conditioning, where the compressor is mounted onto the side of the sump, remove the auxiliary drivebelt as described in Chapter 1B. Unbolt the compressor, and position it clear of the sump. Support the weight of the compressor by tying it to the vehicle, to prevent any excess strain being placed on the compressor lines. *Do not* disconnect the refrigerant lines from the compressor (refer to the warnings given in Chapter 3).

5 Where necessary, disconnect the wiring connector from the oil temperature sender unit, which is screwed into the sump.

6 Release the power steering fluid pipes from the clamps on the cover plate at the base of the transmission bellhousing. Remove the cover plate from the bellhousing for access to the sump rear retaining bolts.

7 Progressively slacken and remove all the sump retaining bolts. Since the sump bolts vary in length, remove each bolt in turn, and store it in its correct fitted order by pushing it through a clearly-marked cardboard template. This will avoid the possibility of installing the bolts in the wrong locations on refitting.

8 Try to break the joint by striking the sump with the palm of your hand, then lower and withdraw the sump from under the car. If the sump is stuck (which is quite likely) use a putty knife or similar, carefully inserted between the sump and block. Ease the knife along the joint until the sump is released. Remove the gasket (where fitted), and discard it; a new one must be used on refitting. While the sump is removed, take the opportunity to check the oil pump pick-up/strainer for signs of clogging or splitting. If necessary, remove the pump as described in Section 11, and clean or renew the strainer.

9 On some engines, a large spacer plate is fitted between the sump and the base of the cylinder block/crankcase. If this plate is fitted, undo the two retaining screws from diagonally-opposite corners of the plate. Remove the plate from the base of the engine, noting which way round it is fitted.

Refitting

10 Clean all traces of sealant/gasket from the mating surfaces of the cylinder block and sump, then use a clean rag to wipe out the sump and the engine's interior.

11 Where a spacer plate is fitted, remove all traces of sealant/gasket from the spacer plate, then apply a thin coating of suitable sealant to the plate upper mating surface. Offer up the plate to the base of the cylinder block/crankcase, and securely tighten its retaining screws **(see illustrations)**.

12 On engines where the sump was fitted without a gasket, ensure that the sump mating surfaces are clean and dry, then apply a thin coating of RTV sealant to the sump mating surface.

13 On engines where the sump was fitted with a gasket, ensure that all traces of the old gasket have been removed, and that the sump mating surfaces are clean and dry. Position the new gasket on the top of the sump, using a dab of grease to hold it in position.

14 Offer up the sump to the cylinder block. Refit its retaining bolts, ensuring that each is screwed into its original location. Tighten the bolts evenly and progressively to the specified torque setting.
15 Reconnect the wiring connector to the oil temperature sensor (where fitted).
16 Refit the cover plate to the transmission bellhousing and secure the power steering fluid pipes in position.
17 Where necessary, align the air conditioning compressor with its mountings on the sump, and insert the retaining bolts. Securely tighten the compressor retaining bolts, then refit the auxiliary drivebelt as described in Chapter 1B.
18 Lower the vehicle to the ground, then refill the engine with oil as described in Chapter 1B.

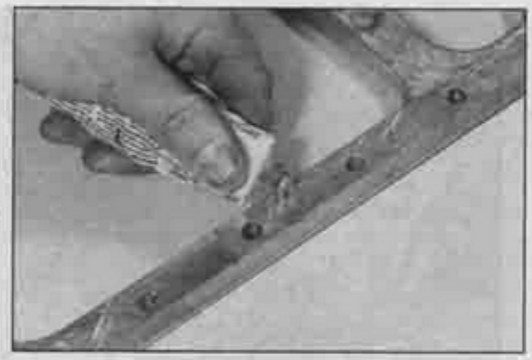
11 Oil pump and drive chain – removal, inspection and refitting

Removal

1 Remove the sump as described in Section 10.
2 Where necessary, undo the two retaining screws, and slide the sprocket cover off the front of the oil pump.
3 Slacken and remove the three bolts securing the oil pump to the base of the cylinder block. Disengage the pump sprocket from the chain, and remove the oil pump **(see illustration)**. Where necessary, also remove the spacer plate which is fitted behind the oil pump.

Inspection

4 Examine the oil pump sprocket for signs of damage and wear, such as chipped or missing teeth. If the sprocket is worn, the pump assembly must be renewed, since the sprocket is not available separately. It is also recommended that the chain and drive sprocket, fitted to the crankshaft, be renewed at the same time. To renew the chain and drive sprocket, first remove the crankshaft timing belt sprocket as described in Section 8. Unbolt the oil seal carrier from the cylinder block. The sprocket, spacer (where fitted) and chain can then be slid off the end of the crankshaft.
5 Slacken and remove the bolts (along with the baffle plate, where fitted) securing the strainer cover to the pump body. Lift off the strainer cover, and take off the relief valve piston and spring, noting which way round they are fitted **(see illustrations)**.
6 Examine the pump rotors and body for signs of wear ridges or scoring. If worn, the complete pump assembly must be renewed.
7 Examine the relief valve piston for signs of wear or damage, and renew if necessary. The condition of the relief valve spring can only be measured by comparing it with a new one; if there is any doubt about its condition, it should also be renewed. Both the piston and spring are available individually.



10.11a Where a sump spacer plate is fitted, apply sealant to the plate upper surface . . .

10.11b . . . then refit the plate to the base of the cylinder block

8 Thoroughly clean the oil pump strainer with a suitable solvent, and check it for signs of clogging or splitting. If the strainer is damaged, the strainer and cover assembly must be renewed.
9 Locate the relief valve spring and piston in the strainer cover. Refit the cover to the pump body, aligning the relief valve piston with its bore in the pump. Refit the baffle plate (where fitted) and the cover retaining bolts, and tighten them securely.
10 Prime the pump by filling it with clean engine oil before refitting.

Refitting

11 If removed, refit the drive sprocket, spacer (where fitted) and chain to the crankshaft, then refit the oil seal carrier using a new gasket. Refit the crankshaft timing belt sprocket as described in Section 8.
12 Offer up the spacer plate (where fitted), then engage the pump sprocket with its drive chain. Seat the pump on the base of the cylinder block. Refit the pump retaining bolts, and tighten them to the specified torque setting.
13 Where necessary, slide the sprocket cover into position on the pump. Refit its retaining bolts, tightening them securely.
14 Refit the sump as described in Section 10.

12 Oil seals – renewal

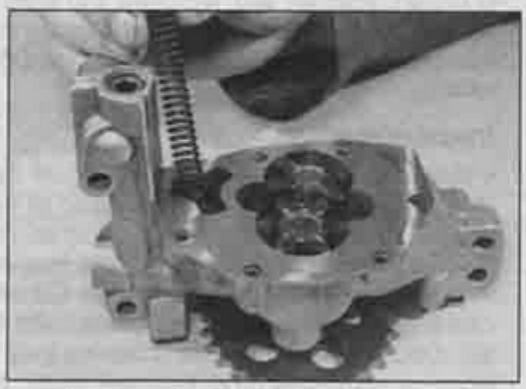
Crankshaft

Right-hand oil seal

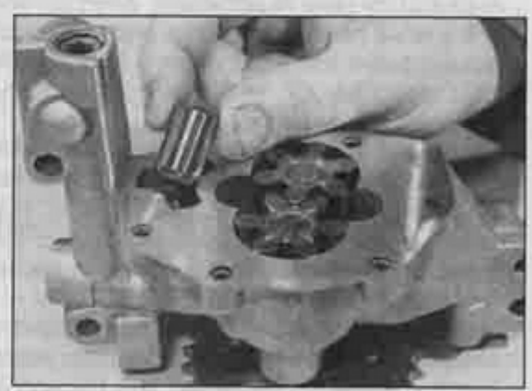
1 Remove the crankshaft sprocket as described in Section 8.

11.3 Removing the oil pump

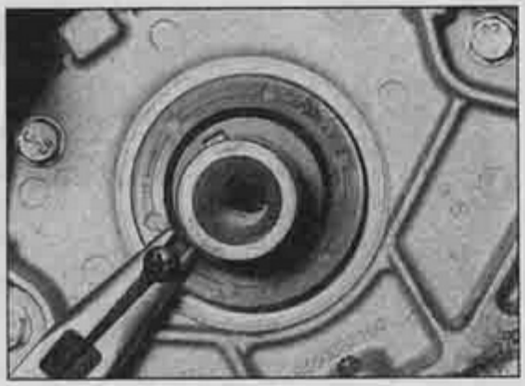
11.5a Remove the oil pump cover retaining bolts . . .



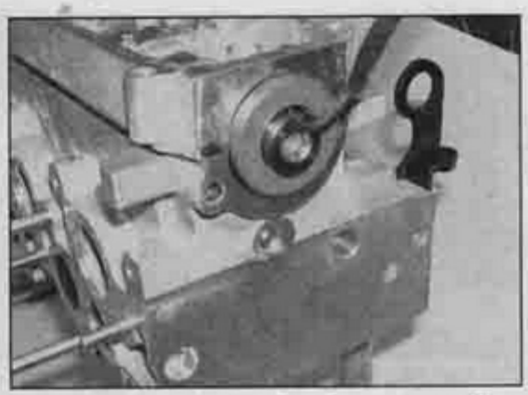
11.5b . . . then lift off the cover and remove the spring . . .



11.5c . . . and relief valve piston, noting which way round it is fitted



12.3 Self-tapping screw and pliers used to remove the crankshaft right-hand oil seal



12.12 Using a hooked tool to remove the camshaft oil seal

2 Note the fitted depth of the oil seal.
3 Pull the oil seal from the housing using a hooked instrument. Alternatively, drill a small hole in the oil seal, and use a self-tapping screw and a pair of pliers to remove it **(see illustration)**.
4 Clean the oil seal housing and the crankshaft sealing surface.
5 Dip the new oil seal in clean engine oil, and press it into the housing (open end first) to the previously-noted depth, using a suitable tube or socket. A piece of thin plastic or tape wound around the front of the crankshaft is useful to prevent damage to the oil seal as it is fitted.
6 Where applicable, remove the plastic or tape from the end of the crankshaft.
7 Refit the crankshaft sprocket as described in Section 8.

Left-hand oil seal

8 Remove the flywheel as described in Section 13.
9 Proceed as described in paragraphs 2 to 6, noting that when fitted, the outer lip of the oil seal must point outwards; if it is pointing inwards, use a piece of bent wire to pull it out. Take care not to damage the oil seal.
10 Refit the flywheel as described in Section 13.

Camshaft

Right-hand oil seal

11 Remove the camshaft sprocket as described in Section 8.
12 Pull the oil seal from the housing using a hooked tool **(see illustration)**. Alternatively, drill a small hole in the oil seal and use a self-tapping screw and a pair of pliers to remove it.
13 Clean the oil seal housing and the camshaft sealing surface.
14 Smear the lips of the new oil seal with clean engine oil, then fit it over the end of the camshaft, open end first. A piece of thin plastic or tape wound round the front of the camshaft should prevent damage to the oil seal as it is fitted.
15 Press the seal into the housing until it is flush with the end face of the cylinder head. Use a suitable bolt (screwed into the end of the camshaft), washers and a tube or socket to press the seal into position.
16 Refit the camshaft sprocket as described in Section 8.

Left-hand oil seal

17 No oil seal is fitted to the left-hand end of the camshaft. The sealing is provided by an O-ring fitted to the braking system vacuum pump flange. The O-ring can be renewed after unbolting the pump from the cylinder head (see Chapter 9). Note the smaller O-ring which seals the oil feed gallery to the pump – this may also cause leakage from the pump/cylinder head mating faces if it deteriorates or fails.

13 Flywheel – removal, inspection and refitting

Removal

1 Remove the transmission as described in Chapter 7, then remove the clutch assembly as described in Chapter 6.
2 Prevent the flywheel from turning using a sturdy screwdriver inserted between the ring gear teeth and the cylinder block. Alternatively, bolt a strap between one of the clutch pressure plate mounting bolt holes and an adjacent hole on the cylinder block end face. *Do not* attempt to lock the flywheel in position using the engine assembly/valve timing locking tools described in Section 3.
3 Slacken and remove the flywheel retaining bolts, and remove the flywheel from the end of the crankshaft. Be careful not to drop it; it is heavy. If the flywheel locating dowel is a loose fit in the crankshaft end, remove it and store it with the flywheel for safe-keeping. Discard the flywheel bolts; new ones must be used on refitting.

Inspection

4 Examine the flywheel for scoring of the clutch face, and for wear or chipping of the ring gear teeth. If the clutch face is scored, the flywheel may be surface-ground, but renewal is preferable. Seek the advice of a Citroën dealer or engine reconditioning specialist to see if machining is possible. If the ring gear is worn or damaged, the flywheel must be renewed, as it is not possible to renew the ring gear separately.

Refitting

5 Clean the mating surfaces of the flywheel and crankshaft. Remove any remaining locking compound from the threads of the crankshaft holes, using the correct size of tap if available.

> **HAYNES HiNT** ***If a suitable tap is not available, cut two slots along the threads of one of the old flywheel bolts, and use the bolt to remove the locking compound from the threads.***

6 If the new flywheel retaining bolts are not supplied with their threads already pre-coated, apply a suitable thread-locking compound to the threads of each bolt prior to fitting.
7 Ensure that the locating dowel is in position. Offer up the flywheel, locating it on the dowel, and fit the new retaining bolts.
8 Lock the flywheel using the method employed on removal, and tighten the retaining bolts to the specified torque.
9 Refit the clutch as described in Chapter 6. Remove the flywheel locking tool, and refit the transmission as described in Chapter 7.

14 Engine/transmission mountings – inspection and renewal

Inspection

1 If improved access is required, firmly apply the handbrake, then jack up the front of the vehicle and support it securely on axle stands (see *Jacking and vehicle support*).
2 Check the mounting rubbers to see if they are cracked, hardened or separated from the metal at any point; renew the mounting if any such damage or deterioration is evident.
3 Check that all the mounting's fasteners are securely tightened; use a torque wrench to check if possible **(see illustration)**.
4 Using a large screwdriver or a crowbar, check for wear in each mounting by carefully levering against it to check for free play. Where this is not possible, enlist the aid of an assistant to move the engine/transmission back-and-forth, or from side-to-side, while you watch the mounting. While some free play is to be expected even from new components, excessive wear should be obvious. If excessive free play is found, check first that the fasteners are correctly secured, then renew any worn components as described below.

Renewal

Right-hand mounting

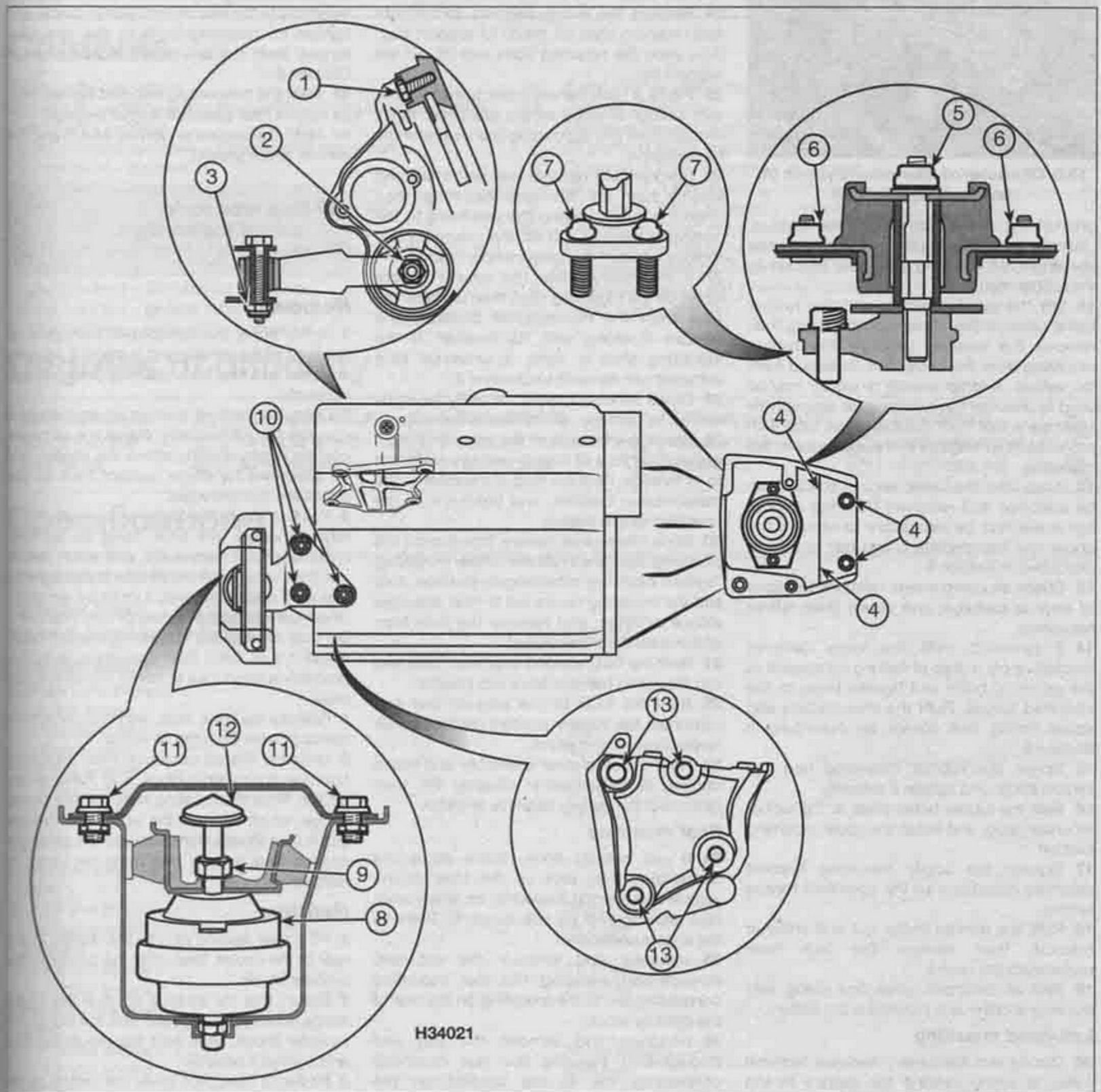
5 Disconnect the battery negative terminal (refer to *Disconnecting the battery* in the Reference Chapter).
6 Release the four plastic fasteners and remove the engine cover from the top of the engine.

7 Release all the relevant hoses and wiring from their retaining clips. Place the hoses/wiring clear of the mounting so that the removal procedure is not hindered.

8 Place a jack beneath the engine, with a block of wood on the jack head. Raise the jack until it is supporting the weight of the engine.

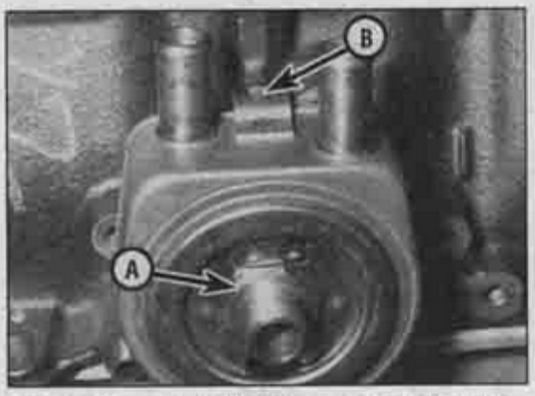
9 Slacken and remove the three bolts securing the upper mounting bracket to the lower (engine) bracket.

10 Undo the two bolts securing the stiffener



14.3 Engine/transmission mounting components and attachment details

1 *Rear mounting bracket-to-cylinder block bolts*
2 *Rear mounting connecting link-to-cylinder block bracket nut*
3 *Rear mounting connecting link-to-subframe bracket nut*
4 *Left-hand mounting bracket-to-body bolts*
5 *Left-hand rubber mounting centre nut*
6 *Left-hand rubber mounting-to-bracket nuts*
7 *Left-hand mounting bracket-to-transmission bolts*
8 *Right-hand rubber mounting*
9 *Right-hand upper mounting bracket-to-rubber mounting nut*
10 *Right-hand upper mounting bracket-to-lower (engine) bracket bolts*
11 *Right-hand mounting stiffener bracket bolts*
12 *Right-hand rubber mounting domed buffer nut*
13 *Right-hand mounting lower (engine) bracket bolts*



15.5 Oil cooler/oil filter mounting bolt (A) and locating notch (B)

bracket to the body and lift off the bracket. Unscrew the domed buffer nut, then unscrew the single nut securing the upper bracket to the rubber mounting.

11 Lift the upper bracket and the rubber buffer plate off the rubber mounting stud, then remove the washer, unscrew the rubber mounting from the body, and remove it from the vehicle. A strap wrench or similar may be used to unscrew the mounting, or alternatively fabricate a tool from suitable metal tube with projections to engage in the cut-outs in the mounting.

12 If required, the lower (engine) bracket can be unbolted and removed from the engine, but it will first be necessary to remove the upper and intermediate timing belt covers as described in Section 6.

13 Check all components carefully for signs of wear or damage, and renew them where necessary.

14 If removed, refit the lower (engine) bracket, apply a drop of locking compound to the retaining bolts and tighten them to the specified torque. Refit the intermediate and upper timing belt covers as described in Section 6.

15 Screw the rubber mounting into the vehicle body, and tighten it securely.

16 Refit the rubber buffer plate to the rubber mounting stud, and install the upper mounting bracket.

17 Tighten the upper mounting bracket retaining nuts/bolts to the specified torque setting.

18 Refit the domed buffer nut and stiffener bracket, then remove the jack from underneath the engine.

19 Refit all disturbed hoses and wiring, refit the engine cover and reconnect the battery.

Left-hand mounting

20 Disconnect the battery negative terminal (refer to *Disconnecting the battery* in the Reference Chapter).

21 Remove the air cleaner assembly and intake ducting as described in Chapter 4B.

22 Lift up the covers on the battery positive cable terminal box and unscrew the nuts securing the battery cables to the terminal studs. Lift the cables off the studs and suitably label them for correct refitting.

23 Withdraw the engine management ECU from its location on the support tray and move it to one side.

24 Release the wiring harness connectors and retaining clips on the ECU support tray, then undo the retaining bolts and lift out the support tray.

25 Place a jack beneath the transmission, with a block of wood on the jack head. Raise the jack until it is supporting the weight of the transmission.

26 Slacken and remove the centre nut and washer from the left-hand mounting, then undo the nuts securing the mounting to the mounting bracket. Lift off the mounting and remove it from the engine compartment.

27 If necessary, slide the spacer (where fitted) off the mounting stud, then unscrew the stud from the transmission bracket, and remove it along with its washer. If the mounting stud is tight, a universal stud extractor can be used to unscrew it.

28 Check all components carefully for signs of wear or damage, and renew as necessary.

29 Clean the threads of the mounting stud, and apply a coat of thread-locking compound to its threads. Refit the stud and washer to the transmission bracket, and tighten it to the specified torque setting.

30 Slide the spacer (where fitted) onto the mounting stud, then refit the rubber mounting. Tighten both the mounting-to-bracket nuts and the mounting centre nut to their specified torque settings, and remove the jack from underneath the transmission.

31 Refit the ECU support tray, reconnect and clip the wiring harness back into position.

32 Refit the ECU to the support tray and reconnect the battery positive cables to their respective terminal studs.

33 Refit the air cleaner assembly and intake ducting as described in Chapter 4B, then reconnect the battery negative terminal.

Rear mounting

34 If not already done, firmly apply the handbrake, then jack up the front of the vehicle and support it securely on axle stands (see *Jacking and vehicle support*). Remove the engine undertray.

35 Unscrew and remove the nut and through-bolt securing the rear mounting connecting link to the mounting on the rear of the cylinder block.

36 Unscrew and remove the nut and through-bolt securing the rear mounting connecting link to the bracket on the subframe. Withdraw the link.

37 To remove the mounting assembly it will first be necessary to remove the right-hand driveshaft as described in Chapter 8.

38 With the driveshaft removed, undo the retaining bolts and remove the mounting from the rear of the cylinder block.

39 Check carefully for signs of wear or damage on all components, and renew them where necessary.

40 On reassembly, fit the rear mounting assembly to the rear of the cylinder block, and tighten its retaining bolts to the specified torque. Refit the driveshaft as described in Chapter 8.

41 Refit the connecting link, and tighten both its nuts to their specified torque settings.

42 Refit the engine undertray and lower the vehicle to the ground.

15 Engine oil cooler – removal and refitting

Removal

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

2 Drain the cooling system as described in Chapter 1B. Alternatively, clamp the oil cooler coolant hoses directly above the cooler, and be prepared for some coolant loss as the hoses are disconnected.

3 Position a suitable container beneath the oil filter. Unscrew the filter using an oil filter removal tool if necessary, and drain the oil into the container. If the oil filter is damaged or distorted during removal, it must be renewed. Given the low cost of a new oil filter relative to the cost of repairing the damage which could result if a re-used filter springs a leak, it is probably a good idea to renew the filter in any case.

4 Release the hose clips, and disconnect the coolant hoses from the oil cooler.

5 Unscrew the oil cooler/oil filter mounting bolt from the cylinder block, and withdraw the cooler. Note the locating notch in the cooler flange, which fits over the lug on the cylinder block **(see illustration)**. Discard the oil cooler sealing ring; a new one must be used on refitting.

Refitting

6 Fit a new sealing ring to the recess in the rear of the cooler, then offer the cooler to the cylinder block.

7 Ensure that the locating notch in the cooler flange is correctly engaged with the lug on the cylinder block, then refit the mounting bolt and tighten it securely.

8 Fit the oil filter, then lower the vehicle to the ground. Top-up the engine oil level as described in *Weekly checks*.

9 Refill or top-up the cooling system as described in Chapter 1B or *Weekly checks*. Start the engine, and check the oil cooler for signs of leakage.

Chapter 2 Part D:
Petrol engine removal and overhaul procedures

Contents

Degrees of difficulty

Easy, suitable for novice with little experience 

Fairly easy, suitable for beginner with some experience 

Fairly difficult, suitable for competent DIY mechanic 

Difficult, suitable for experienced DIY mechanic 

Very difficult, suitable for expert DIY or professional 

Specifications

Note: *At the time of writing, certain specifications were not available. Where the relevant specifications are not given here, refer to your Citroën dealer for further information*

Cylinder head

Maximum gasket face distortion	0.05 mm

Cylinder block

Cylinder bore diameter:	
1.6 litre engine:	
Standard size	78.00 mm
Repair size	Not available
1.8 litre engine:	
Standard size	82.70 mm
Repair size	83.30 mm

Valves

Valve head diameter:	
Inlet:	
1.6 litre engine	39.5 mm
1.8 litre engine	29.8 mm
Exhaust:	
1.6 litre engine	31.4 mm
1.8 litre engine	27.2 mm
Valve stem diameter:	
Inlet:	
1.6 litre engine	Not available
1.8 litre engine	5.98 mm
Exhaust:	
1.6 litre engine	Not available
1.8 litre engine	5.97 mm
Overall length:	
Inlet:	
1.6 litre engine	Not available
1.8 litre engine	104.17 mm
Exhaust:	
1.6 litre engine	Not available
1.8 litre engine	104.10 mm

Valve springs

Free length:	
1.6 litre engines	Not available
1.8 litre engines	48.0 mm

Pistons

Piston diameter:	
1.6 litre engine	Not available
1.8 litre engine:	
Standard size	82.657 mm
Repair size	83.257 mm

Piston rings

End gaps:	
Top compression ring	0.20 to 0.45 mm
Second compression ring	0.20 to 0.40 mm

Crankshaft

Endfloat:	
1.6 litre engine	0.07 to 0.32 mm
1.8 litre engine	0.06 to 0.15 mm
Main bearing journal diameter:	
1.6 litre engine:	
Standard	49.965 to 49.981 mm
Repair size	49.665 to 49.681 mm
1.8 litre engine:	
Standard	59.975 to 60.000 mm
Repair size	59.675 to 59.700 mm
Big-end bearing journal diameter:	
1.6 litre engine:	
Standard	44.992 to 45.008 mm
Repair size	44.692 to 44.708 mm
1.8 litre engine:	
Standard	44.975 to 45.000 mm
Repair size	44.675 to 44.700 mm
Maximum bearing journal out-of-round (all engines)	0.007 mm
Main bearing running clearance:	
1.6 litre engine	0.023 to 0.048 mm
1.8 litre engine	0.019 to 0.049 mm
Big-end bearing running clearance (all engines)	0.030 to 0.054 mm

Torque wrench settings

1.6 litre (TU series) engines

Refer to Chapter 2A Specifications.

1.8 litre (EW series) engines

Refer to Chapter 2B Specifications.

1 General information

Included in this Part of Chapter 2 are details of removing the engine/transmission from the car and general overhaul procedures for the cylinder head, cylinder block and all other engine internal components.

The information given ranges from advice concerning preparation for an overhaul and the purchase of replacement parts, to detailed step-by-step procedures covering removal, inspection, renovation and refitting of engine internal components.

After Section 5, all instructions are based on the assumption that the engine has been removed from the vehicle. For information concerning in-car engine repair, as well as the removal and refitting of those external components necessary for full overhaul, refer to Part A or B of this Chapter (as applicable) and to Section 5. Ignore any preliminary dismantling operations described in Part A or B that are no longer relevant once the engine has been removed.

Apart from torque wrench settings, which are given at the beginning of Part A or B (as applicable), all available specifications relating to engine overhaul are at the beginning of this Part of Chapter 2.

2 Engine overhaul – general information

It is not always easy to determine when, or if, an engine should be completely overhauled, as a number of factors must be considered.

High mileage is not necessarily an indication that an overhaul is needed, while low mileage does not preclude the need for an overhaul. Frequency of servicing is probably the most important consideration. An engine which has had regular and frequent oil and filter changes, as well as other required maintenance, should give many thousands of miles of reliable service. Conversely, a neglected engine may require an overhaul very early in its life.

Excessive oil consumption is an indication that piston rings, valve seals and/or valve guides are in need of attention. Make sure that oil leaks are not responsible before deciding that the rings and/or guides are worn. Perform a compression test, as described in Part A of this Chapter, to determine the likely cause of the problem.

Check the oil pressure with a gauge fitted in place of the oil pressure switch, and compare it with that specified in Part A or B of this Chapter. If it is extremely low, the main and big-end bearings, and/or the oil pump, are probably worn out.

Loss of power, rough running, knocking or metallic engine noises, excessive valve gear noise, and high fuel consumption may also point to the need for an overhaul, especially if they are all present at the same time. If a complete service does not remedy the situation, major mechanical work is the only solution.

An engine overhaul involves restoring all internal parts to the specification of a new engine. During an overhaul, the cylinder bores are rebored (where necessary), and the pistons and piston rings are renewed. New main and big-end bearings are generally fitted; if necessary, the crankshaft may be reground, to restore the journals. The valves are also serviced as well, since they are usually in less-than-perfect condition at this point. The end result should be an as-new engine that will give many trouble-free miles.

Note: *Critical cooling system components such as the hoses, thermostat and coolant pump should be renewed when an engine is overhauled. The radiator should be checked carefully, to ensure that it is not clogged or leaking. Also, it is a good idea to renew the oil pump whenever the engine is overhauled.*

Before beginning the engine overhaul, read through the entire procedure, to familiarise yourself with the scope and requirements of the job. Overhauling an engine is not difficult if you follow carefully all of the instructions, have the necessary tools and equipment, and pay close attention to all specifications. It can, however, be time-consuming. Plan on the car being off the road for a minimum of two weeks, especially if parts must be taken to an engineering works for repair or reconditioning. Check on the availability of parts and make sure that any necessary special tools and equipment are obtained in advance. Most work can be done with typical hand tools, although a number of precision measuring tools are required for inspecting parts to determine if they must be renewed. Often the engineering works will handle the inspection of parts and offer advice concerning reconditioning and renewal.

Always wait until the engine has been completely dismantled, and until all components (especially the cylinder block and the crankshaft) have been inspected, before deciding what service and repair operations must be performed by an engineering works. The condition of these components will be the major factor to consider when determining whether to overhaul the original engine, or to buy a reconditioned unit. Do not, therefore, purchase parts or have overhaul work done on other components until they have been thoroughly inspected. As a general rule, time is the primary cost of an overhaul, so it does not pay to fit worn or sub-standard parts.

As a final note, to ensure maximum life and minimum trouble from a reconditioned engine, everything must be assembled with care, in a spotlessly-clean environment.

3 Engine/transmission removal – methods and precautions

If you have decided that the engine must be removed for overhaul or major repair work, several preliminary steps should be taken.

Locating a suitable place to work is extremely important. Adequate work space, along with storage space for the vehicle, will be needed. If a workshop or garage is not available, at the very least, a flat, level, clean work surface is required.

Cleaning the engine compartment and engine/transmission before beginning the removal procedure will help keep tools clean and organised.

An engine hoist will also be necessary. Make sure the equipment is rated in excess of the combined weight of the engine and transmission. Safety is of primary importance, considering the potential hazards involved in removing the engine/transmission from the vehicle.

If this is the first time you have removed an engine, an assistant should ideally be available. Advice and aid from someone more experienced would also be helpful. There are many instances when one person cannot simultaneously perform all of the operations required during engine/transmission removal.

Plan the operation ahead of time. Before starting work, arrange for the hire of or obtain all of the tools and equipment you will need. Some of the equipment necessary to perform engine/transmission removal and installation safely (in addition to an engine hoist) is as follows: a heavy duty trolley jack, complete sets of spanners and sockets as described at the rear of this manual, wooden blocks, and plenty of rags and cleaning solvent for mopping-up spilled oil, coolant and fuel. If the hoist must be hired, make sure that you arrange for it in advance, and perform all of the operations possible without it beforehand. This will save you money and time.

Plan for the vehicle to be out of use for quite a while. An engineering works will be required to perform some of the work which the do-it-yourselfer cannot accomplish without special equipment. These places often have a busy schedule, so it would be a good idea to consult them before removing the engine, in order to accurately estimate the amount of time required to rebuild or repair components that may need work.

During the engine/transmission removal procedure, it is advisable to make notes of the locations of all brackets, cable ties, earthing points, etc, as well as how the wiring harnesses, hoses and electrical connections are attached and routed around the engine and engine compartment. An effective way of doing this is to take a series of photographs of the various components before they are disconnected or removed. A simple inexpensive disposable camera is ideal for this and the resulting photographs will prove invaluable when the engine is refitted.

Always be extremely careful when removing and refitting the engine/transmission. Serious injury can result from careless actions. Plan ahead and take your time, and a job of this nature, although major, can be accomplished successfully.

The engine and transmission assembly is removed downwards from the engine compartment on all models described in this manual.

4 Engine and transmission – removal, separation, reconnection and refitting

Removal

Note: *The engine is removed downwards from the engine compartment as a complete unit with the transmission; the two are then separated for overhaul.*

1 Disconnect the battery negative terminal (refer to *Disconnecting the battery* in the Reference Section of this manual).

2 Open and support the bonnet in its maximum height position.

3 Carry out the following operations, using the information given in Chapter 4A:

a) Remove the air cleaner assembly and air inlet ducts.

b) Depressurise the fuel system, and disconnect the fuel feed hose at the fuel rail.

c) Disconnect the accelerator cable.

4 On 1.8 litre engines, disconnect the air inlet hose from the secondary air injection valve, then disconnect the vacuum hoses and wiring connector at the EGR solenoid valve.

5 Disconnect the purge valve and/or braking system servo vacuum hoses from the inlet manifold (as applicable).

6 Lift off the engine compartment fuse/relay box cover and unscrew the nuts securing the two supply cables to the terminal studs **(see illustration)**. Lift the cables off the studs,

4.6 Unscrew the nuts (arrowed) securing the two supply cables to the fuse/relay box terminal studs

4.7 Disconnect the battery positive cables from the terminal box studs

release them from the fuse/relay box and suitably label them.

7 Similarly, lift up the covers on the battery positive cable terminal box and unscrew the nuts securing the battery cables to the terminal studs. Lift the cables off the studs and suitably label them for correct refitting **(see illustration)**.

8 Remove the engine management ECU as described in Chapter 4A, Section 13.

9 Release the wiring harness from the retaining clips and cable ties on the ECU support tray, then undo the retaining bolts and lift out the support tray **(see illustration)**.

10 Disconnect the main engine wiring harness at the connectors in front of the ECU support tray location.

11 Working as described in Chapter 6, on models with a cable-operated clutch, disconnect the clutch cable from the transmission, and position it clear of the working area. On models with a hydraulically-operated clutch, unbolt the slave cylinder from the front of the transmission. Release the hydraulic fluid supply pipe from the support brackets and move the pipe and cylinder assembly clear of the engine/transmission.

12 Working as described in Chapter 7, disconnect the gearchange selector cable end fittings from the transmission levers then release the cables from the support bracket.

13 Undo the bolt and release the transmission earth cable from body side-member.

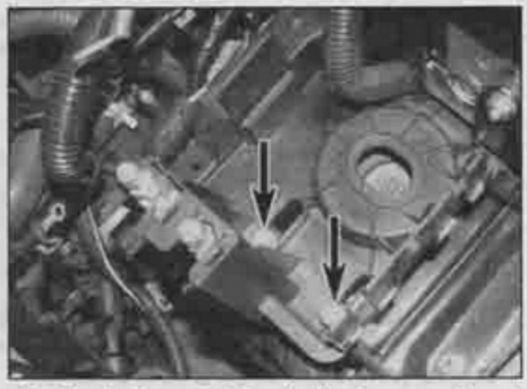
14 Firmly apply the handbrake, then jack up the front of the vehicle and support it securely on axle stands (see *Jacking and vehicle support*). Note that the vehicle must be raised sufficiently high (approximately 500 mm) to enable the engine/transmission assembly to be withdrawn from under the front of the vehicle. Remove the front roadwheels.

15 Remove the auxiliary drivebelt as described in Chapter 1A.

16 If the engine is to be dismantled, drain the engine oil referring to Chapter 1A if necessary. Clean and refit the drain plug, tightening it securely.

17 Drain the cooling system as described in Chapter 1A.

18 Drain the transmission oil as described in Chapter 7. Refit the drain and filler plugs, and tighten them to their specified torque settings.



4.9 Undo the retaining bolts (arrowed) and lift out the ECU support tray

19 Remove the exhaust system front pipe as described in Chapter 4A.

20 Disconnect the radiator top and bottom hoses from the coolant outlet housing or coolant pipe, and thermostat cover.

21 Release the retaining clips and disconnect the heater matrix hoses from their connection on the engine compartment bulkhead.

22 Disconnect the wiring connector from the power steering pressure switch.

1.6 litre engines

23 Remove the heat shield from the rear of the power steering pump.

24 Position a suitable container beneath the power steering gear pump. Release the retaining clip and disconnect the power steering fluid return hose from the pump. Allow the power steering fluid to drain into the container. When the fluid has finished draining, suitably cover the hose end and the outlet on the pump.

25 Unscrew the union nut and disconnect the fluid supply pipe from the pump. Release the supply pipe and return hose from the retaining clamps and move the pipe and hose clear of the engine. Suitably cover the pipe end and pump orifice.

1.8 litre engines

26 Release the power steering fluid pipes from the clamps on each side of the transmission bellhousing.

27 Position a suitable container beneath the power steering gear assembly. Undo the bolt securing the fluid pipe flange plate to the rack housing and ease the flange plate from the rack. Allow the power steering fluid to drain into the container. When the fluid has finished draining, suitably cover the pipe ends and the orifices in the rack to prevent dirt ingress.

28 Slacken the retaining clip and disconnect the fluid return hose from the pipe connection below the radiator. Unscrew the union nut and disconnect the fluid supply hose from the pump. Release the pipe and hose assembly from the support bracket clamps and remove the pipes from under the vehicle. Suitably cover the pipe and hose ends and the orifices in the pump to prevent dirt ingress.

All engines

29 On models with air conditioning, disconnect the compressor wiring connector, then unbolt the compressor and position it clear of the engine. Support the weight of the compressor by tying it to the vehicle body, to prevent any excess strain being placed on the compressor lines whilst the engine is removed. *Do not* disconnect the refrigerant lines from the compressor (refer to the warnings given in Chapter 3).

30 Disconnect the wiring connector from the vehicle speed sensor.

31 Remove both driveshafts as described in Chapter 8.

32 Remove the front suspension subframe as described in Chapter 10.

33 Check that all the relevant wiring connectors have been disconnected, and that the harness is released from all the clips or ties, so that it is free to be removed with the engine/transmission.

34 Manoeuvre an engine hoist into position, and attach it to the engine lifting brackets. Raise the hoist until it is just supporting the weight of the engine.

35 Slacken and remove the centre nut and washer from the engine/transmission left-hand mounting. Undo the two nuts and washers securing the mounting to its bracket, remove the mounting from the engine compartment and recover the washer and spacer.

36 Working on the right-hand engine/transmission mounting, on 1.8 litre engines, undo the two bolts securing the stiffener bracket to the body and lift off the bracket. Unscrew the nut securing the upper mounting bracket to the rubber mounting. Unscrew the three bolts securing the upper mounting bracket to the lower (engine bracket) and, on 1.6 litre engines, the additional bolt at the front securing the support brace to the upper mounting bracket. Remove the upper mounting bracket from the lower (engine) bracket.

37 Make a final check that any components which would prevent the removal of the engine/transmission from the vehicle have been removed or disconnected.

38 Carefully lower the engine/transmission assembly from the engine compartment, ensuring that nothing is trapped or damaged **(see illustration)**. Enlist the help of an assistant during this procedure, as it will be necessary to tilt and twist the assembly

4.38 Lowering the engine/transmission from the engine compartment

slightly to clear the body panels and adjacent components.

39 Ensure that the assembly is adequately supported using jacks or a suitable trolley, then disconnect the engine hoist and withdraw the engine/transmission out from under the front of the vehicle.

Separation

40 With the engine/transmission assembly removed, support the unit on suitable blocks of wood on a workbench (or failing that, on a clean area of the workshop floor).

41 Disconnect all the individual wiring connectors from the various components on the engine and transmission to enable the main engine wiring harness to be removed. Make notes or attach labels to each connector to aid reconnection.

42 With all wiring disconnected, detach the wiring harness support brackets and plastic ducting mountings, release the relevant cable ties and remove the complete harness assembly from the engine/transmission.

43 Where fitted, undo the retaining bolts, and remove the cover plate from the transmission bellhousing.

44 Slacken and remove the retaining bolts, and remove the starter motor from the transmission.

45 Ensure that both engine and transmission are adequately supported, then slacken and remove the remaining bolts securing the transmission housing to the engine. Note the correct fitted positions of each bolt (and the relevant brackets) as they are removed, to use as a reference on refitting.

46 Carefully withdraw the transmission from the engine, ensuring that the weight of the transmission is not allowed to hang on the input shaft while it is engaged with the clutch friction disc.

47 If they are loose, remove the locating dowels from the engine or transmission, and keep them in a safe place.

Reconnection

48 Apply a smear of high-melting-point grease (Citroën recommend the use of Molykote BR2 plus – available from your Citroën dealer) to the splines of the transmission input shaft. Do not apply too much, otherwise there is a possibility of the grease contaminating the clutch friction disc.

49 Ensure that the locating dowels are correctly positioned in the engine or transmission.

50 Carefully offer the transmission to the engine, until the locating dowels are engaged. Ensure that the weight of the transmission is not allowed to hang on the input shaft as it is engaged with the clutch friction disc.

51 Refit the transmission housing-to-engine bolts, ensuring that all the necessary brackets are correctly positioned, and tighten them securely.

52 Refit the starter motor, and securely tighten its retaining bolts.

53 Locate the main engine wiring harness on the engine and transmission and reconnect the relevant wiring connectors.

54 Where applicable, refit the cover plate to the transmission bellhousing, and securely tighten its retaining bolts.

Refitting

55 Manoeuvre the engine/transmission into position beneath the engine compartment and reconnect the hoist and lifting tackle to the engine lifting brackets. With the aid of an assistant, slowly lift the assembly into the engine compartment.

56 Manoeuvre the unit as necessary to clear the surrounding components, until it is possible to attach the engine mountings. Locate the right-hand mounting upper bracket onto the lower (engine) bracket and over the rubber mounting stud. Secure the bracket to the lower (engine) bracket with the bolts tightened to the specified torque. Refit the retaining nut to the stud on the rubber mounting and tighten it by hand only at this stage.

57 Working on the left-hand mounting, refit the rubber mounting, the mounting retaining nuts and washers, and the centre nut and washer, tightening them lightly only.

58 Rock the engine to settle it on its mountings, then go around and tighten all the mounting nuts and bolts to their specified torque settings. On 1.8 litre engines, refit the stiffener bracket to the right-hand mounting, tightening the retaining bolts securely.

59 It is advisable at this stage to refit the front suspension subframe as described in Chapter 10. The rear engine/transmission mounting connecting link can then be refitted, thus stabilising the power unit on its mountings. The hoist can then be detached from the engine and removed.

60 The remainder of the refitting procedure is a direct reversal of the removal sequence, noting the following points:

a) Ensure that the wiring loom is correctly routed and retained by all the relevant retaining clips; all connectors should be correctly and securely reconnected.
b) Use new O-ring seals when refitting the power steering fluid pipes.
c) Prior to refitting the driveshafts to the transmission, renew the driveshaft oil seals as described in Chapter 7.
d) Ensure that all coolant hoses are correctly reconnected, and securely retained by their retaining clips.
e) Adjust the gearchange selector cables as described in Chapter 7 after reconnection.
f) Adjust the accelerator cable as described in Chapter 4A.
g) Refill the engine and transmission with the correct quantity and type of lubricant, as described in Chapters 1A and 7.
h) Refill the cooling system as described in Chapter 1A.
i) Bleed the power steering system as described in Chapter 10.
j) Bleed the hydraulic clutch system as described in Chapter 10.

5 Engine overhaul – dismantling sequence

1 It is much easier to dismantle and work on the engine if it is mounted on a portable engine stand. These stands can often be hired from a tool hire shop. Before the engine is mounted on a stand, the flywheel should be removed, so that the stand bolts can be tightened into the end of the cylinder block.

2 If a stand is not available, it is possible to dismantle the engine with it blocked up on a sturdy workbench, or on the floor. Be extra careful not to tip or drop the engine when working without a stand.

3 If you are going to obtain a reconditioned engine, all the external components must be removed first, to be transferred to the replacement engine (just as they will if you are doing a complete engine overhaul yourself). These components include the following:

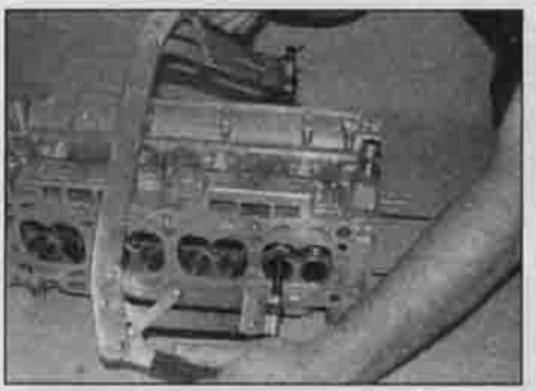
a) Alternator (Chapter 5A).
b) Power steering pump (Chapter 10).
c) Power steering pump and air conditioning compressor bracket(s), as applicable.
d) Engine mounting brackets.
e) Coolant pump, thermostat and housing, and coolant outlet housing (Chapter 3).
f) Dipstick tube.
g) Fuel system components (Chapter 4A).
h) All electrical switches and sensors.
i) Inlet and exhaust manifolds (Chapter 4A).
j) Oil filter (Chapter 1A).
k) Flywheel (Chapter 2A or 2B).

Note: *When removing the external components from the engine, pay close attention to details that may be helpful or important during refitting. Note the fitted position of gaskets, seals, spacers, pins, washers, bolts, and other small items.*

4 If you are obtaining a 'short' engine (cylinder block, crankshaft, pistons and connecting rods all assembled), then the cylinder head, sump, oil pump, and timing belt will have to be removed also.

5 If you are planning a complete overhaul, the engine can be dismantled, and the internal components removed, in the order given below, referring to Part A or B of this Chapter unless otherwise stated.

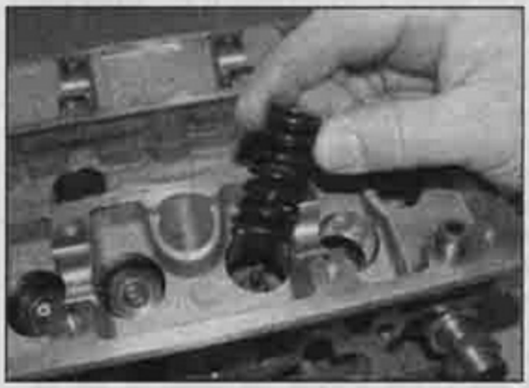
a) Inlet and exhaust manifolds (Chapter 4A).
b) Timing belt, sprockets, tensioner and idler(s).
c) Coolant pump (Chapter 3).
d) Cylinder head.
e) Flywheel.
f) Sump.
g) Oil pump (Chapter 2A or Section 10 of this Chapter – as applicable).
h) Pistons/connecting rods (Section 9 of this Chapter).
i) Crankshaft (Section 11 of this Chapter).
j) All external brackets and housings.



6.9a Compress the valve spring with a spring compressor . . .

6.9b . . . remove the two split collets . . .

6.9c . . . release the compressor and lift off the spring retainer . . .



6.9d . . . and the valve spring

6 Before beginning the dismantling and overhaul procedures, make sure that you have all of the tools necessary. Refer to *Tools and working facilities* for further information.

6 Cylinder head – dismantling

Note: *New and reconditioned cylinder heads are available from the manufacturer, and from engine overhaul specialists. Some specialist tools are required for dismantling and inspection, and new components may not be readily available. It may therefore be more practical and economical for the home mechanic to purchase a reconditioned head, rather than dismantle, inspect and recondition the original head.*

1.6 litre engines

1 Remove the cylinder head as described in Part A of this Chapter.

2 If not already done, remove the inlet and exhaust manifolds with reference to Chapter 4A.

6.12a Secure a self-locking nut of suitable diameter to a long bolt . . .

6.12b . . . then use this tool to remove the valve stem oil seal – 1.8 litre engines

6.13 Place each valve and its associated components in a labelled polythene bag

3 Remove the camshaft and rocker arms as described in Part A of this Chapter.

4 Using a valve spring compressor, compress each valve spring in turn until the split collets can be removed. Release the compressor, and lift off the spring retainer, spring and spring seat. Using a pair of pliers, carefully extract the valve stem oil seal from the top of the guide.

5 If, when the valve spring compressor is screwed down, the spring retainer refuses to free and expose the split collets, gently tap the top of the tool, directly over the retainer, with a light hammer. This will free the retainer.

6 Withdraw the valve through the combustion chamber.

1.8 litre engines

7 Remove the cylinder head as described in Part B of this Chapter.

8 Remove the following components from the cylinder head as described in the Chapters indicated:

a) Camshafts and tappets (Part B of this Chapter).
b) Ignition coil module (Chapter 5B).
c) Exhaust manifold (Chapter 4B).
d) Coolant outlet housing (Chapter 3).

9 Using a valve spring compressor, compress each valve spring in turn until the split collets can be removed. Release the compressor, and lift off the spring retainer and spring **(see illustrations)**.

10 If, when the valve spring compressor is screwed down, the spring retainer refuses to free and expose the split collets, gently tap the top of the tool, directly over the retainer, with a light hammer. This will free the retainer.

11 Withdraw the valve through the combustion chamber.

12 The valve stem oil seal also forms the spring seat and is deeply recessed in the cylinder head. It is also a tight fit on the valve guide making it difficult to remove with pliers or a conventional valve stem oil seal removal tool. It can be easily removed, however, using a self-locking nut of suitable diameter screwed onto the end of a bolt and locked with a second nut. Push the nut down onto the top of the seal; the locking portion of the nut will grip the seal allowing it to be withdrawn from the top of the valve guide **(see illustrations)**.

All engines

13 It is essential that each valve is stored together with its collets, retainer, spring, and spring seat. The valves should also be kept in their correct sequence, unless they are so badly worn that they are to be renewed. If they are going to be kept and used again, place each valve assembly in a labelled polythene bag or similar small container **(see illustration)**. Number the bags or containers 1 to 8, or 1 to 8 inlet, and 1 to 8 exhaust, as applicable. Note that No 1 valve is nearest to the transmission (flywheel) end of the engine.

14 Remove all the remaining valves in the same way.

7.6 Checking the cylinder head gasket surface for distortion

7.11a Apply compressed air to the oil feed bore of the inlet camshaft and seal the bore in the exhaust camshaft with a rag . . .

7.11b . . . the camshaft oil supply non-return valve will be ejected from the underside of the head

7 Cylinder head and valves – cleaning and inspection

1 Thorough cleaning of the cylinder head and valve components, followed by a detailed inspection, will enable you to decide how much valve service work must be carried out during the engine overhaul. **Note:** *If the engine has been severely overheated, it is best to assume that the cylinder head is warped – check carefully for signs of this.*

Cleaning

2 Remove all traces of old gasket material from the cylinder head. Citroën recommend the use of a scouring agent for this purpose, but acceptable results can be achieved by using a hard plastic or wood scraper to remove all traces of gasket and carbon.

3 Similarly, remove the carbon from the combustion chambers and ports, then wash the cylinder head thoroughly with paraffin or a suitable solvent.

4 Scrape off any heavy carbon deposits that may have formed on the valves, then use a power-operated wire brush to remove deposits from the valve heads and stems.

Inspection

Note: *Be sure to perform all the following inspection procedures before concluding that the services of a machine shop or engine overhaul specialist are required. Make a list of all items that require attention.*

Cylinder head

5 Inspect the head very carefully for cracks, evidence of coolant leakage, and other damage. If cracks are found, a new cylinder head should be obtained.

6 Use a straight-edge and feeler blade to check that the cylinder head gasket surface is not distorted **(see illustration)**. If it is, it may be possible to have it machined, provided that the cylinder head height is not significantly reduced.

7 Examine the valve seats in each of the combustion chambers. If they are severely pitted, cracked, or burned, they will need to be renewed or recut by an engine overhaul specialist. If they are only slightly pitted, this can be removed by grinding-in the valve heads and seats with fine valve-grinding compound, as described below.

8 Check the valve guides for wear by inserting the relevant valve, and checking for side-to-side motion of the valve. A very small amount of movement is acceptable. If the movement seems excessive, remove the valve. Measure the valve stem diameter (see below), and renew the valve if it is worn. If the valve stem is not worn, the wear must be in the valve guide, and the guide must be renewed. The renewal of valve guides is best carried out by an engine overhaul specialist, who will have the necessary tools available. Where no valve stem diameter is specified, seek the advice of the specialist carrying out the work, or a Citroën dealer on the best course of action.

9 If renewing the valve guides, the valve seats should be recut or reground only *after* the guides have been fitted.

10 On 1.8 litre engines, examine the camshaft oil supply non-return valve in the oil feed bore at the timing belt end of the cylinder head. Check that the valve is not loose in the cylinder head and that the ball is free to move within the valve body. If the valve is a loose fit in its bore, or if there is any doubt about its condition, it should be renewed.

11 The non-return valve can be removed (assuming it is not loose), using compressed air, such as that generated by a tyre foot pump. Place the pump nozzle over the oil feed bore of the inlet camshaft No 4 bearing journal and seal the corresponding oil feed bore in the exhaust camshaft with a rag. Apply the compressed air and the valve will be forced out of its location in the underside of the cylinder head **(see illustrations)**.

12 Fit the new non-return valve to its bore on the underside of the head ensuring it is fitted the correct way. Oil should be able to pass upwards through the valve to the camshafts, but the ball in the valve should prevent the oil from returning back to the cylinder block. Use a thin socket or similar to push the valve fully into position.

7.14 Measuring a valve stem diameter

Valves

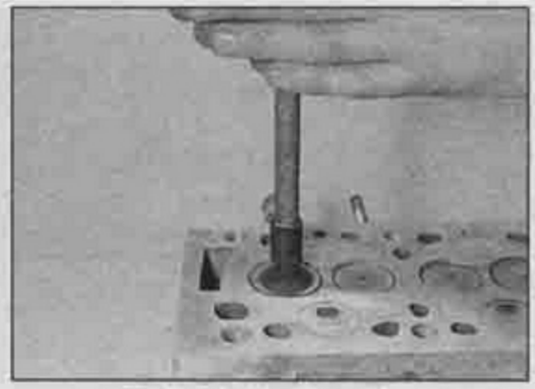
13 Examine the head of each valve for pitting, burning, cracks, and general wear. Check the valve stem for scoring and wear ridges. Rotate the valve, and check for any obvious indication that it is bent. Look for pits or excessive wear on the tip of each valve stem. Renew any valve that shows any such signs of wear or damage.

14 If the valve appears satisfactory at this stage, measure the valve stem diameter at several points using a micrometer **(see illustration)**. Any significant difference in the readings obtained indicates wear of the valve stem. Should any of these conditions be apparent, the valve(s) must be renewed.

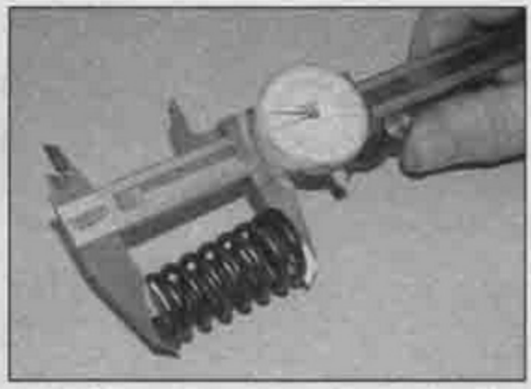
15 If the valves are in satisfactory condition, they should be ground (lapped) into their respective seats, to ensure a smooth, gas-tight seal. If the seat is only lightly pitted, or if it has been recut, fine grinding compound *only* should be used to produce the required finish. Coarse valve-grinding compound should *not* be used, unless a seat is badly burned or deeply pitted. If this is the case, the cylinder head and valves should be inspected by an expert, to decide whether seat recutting, or even the renewal of the valve or seat insert (where possible) is required.

16 Valve grinding is carried out as follows. Place the head upside-down on blocks, on a bench.

17 Smear a trace of (the appropriate grade of) valve-grinding compound on the seat face, and press a suction grinding tool onto the



7.17 Grinding-in a valve



7.20 Measuring valve spring free length

valve head **(see illustration)**. With a semi-rotary action, grind the valve head to its seat, lifting the valve occasionally to redistribute the grinding compound. A light spring placed under the valve head will greatly ease this operation.

18 If coarse grinding compound is being used, work only until a dull, matt even surface is produced on both the valve seat and the valve, then wipe off the used compound, and repeat the process with fine compound. When a smooth unbroken ring of light grey matt finish is produced on both the valve and seat, the grinding operation is complete. *Do not* grind-in the valves any further than absolutely necessary, or the seat will be prematurely sunk into the cylinder head.

19 When all the valves have been ground-in, carefully wash off *all* traces of grinding compound using paraffin or a suitable solvent, before reassembling the cylinder head.

Valve components

20 Examine the valve springs for signs of damage and discoloration. Stand each spring on a flat surface, and check it for squareness noting that on 1.8 litre engines, the springs are tapered at the top. Measure the free length of the spring and compare it with the dimension given in the Specifications **(see illustration)**. On 1.6 litre engines, no minimum free length is specified by Citroën, so the only way of judging valve spring wear is by comparison with a new component.

21 If any of the springs are damaged, distorted or have lost their tension, obtain a complete new set of springs. It is normal to fit new springs as a matter of course if a major overhaul is being carried out.

22 Renew the valve stem oil seals regardless of their apparent condition.

8 Cylinder head – reassembly

1.6 litre engines

1 Lubricate the stems of the valves, and insert the valves into their original locations. If new valves are being fitted, insert them into the locations to which they have been ground.

2 Refit the spring seat then, working on the first valve, dip the new valve stem oil seal in fresh engine oil. Carefully locate it over the valve and onto the guide. Take care not to damage the seal as it is passed over the valve stem. Use a suitable socket or tube to press the seal firmly onto the guide.

3 Locate the valve spring on top of its seat, then refit the spring retainer.

4 Compress the valve spring, and locate the split collets in the recess in the valve stem. Release the compressor, then repeat the procedure on the remaining valves.

HAYNES HiNT ***Use a little dab of grease to hold the collets in position on the valve stem while the spring compressor is released.***

5 With all the valves installed, place the cylinder head on blocks on the bench and, using a hammer and interposed block of wood, tap the end of each valve stem to settle the components.

6 Refit the camshaft and rocker arms as described in Part A of this Chapter.

7 Refit the inlet and exhaust manifolds with reference to Chapter 4A.

8 The cylinder head can then be refitted as described in Part A of this Chapter.

1.8 litre engines

9 Dip the new valve stem oil seal in fresh engine oil and place it in position over the valve guide. Use a suitable socket or tube to press the seal firmly onto the guide **(see illustrations)**.

10 Lubricate the stem of the valve, and insert the valve into the guide. Be sure to insert the valves into their original locations or, if new valves are being fitted, into the locations to which they have been ground.

11 Locate the valve spring on top of the oil seal/spring seat with its larger diameter towards the cylinder head.

12 Refit the spring retainer, compress the valve spring, and locate the split collets in the recess in the valve stem. Release the compressor, then repeat the procedure on the remaining valves.

13 With all the valves installed, place the cylinder head on blocks on the bench and, using a hammer and interposed block of wood, tap the end of each valve stem to settle the components.

14 Refit the following components to the cylinder head as described in the Chapters indicated:

a) Camshafts and tappets (Part B of this Chapter).
b) Ignition coil module (Chapter 5B).
c) Exhaust manifold (Chapter 4B).
d) Coolant outlet housing (Chapter 3).

15 The cylinder head can then be refitted as described in Part B of this Chapter.

9 Piston/connecting rod assembly – removal

1 On 1.6 litre engines, remove the cylinder head, sump and oil pump as described in Part A of this Chapter. On 1.8 litre engines, remove the cylinder head and sump as described in Part B of this Chapter.

2 If there is a pronounced wear ridge at the top of any bore, it may be necessary to remove it with a scraper or ridge reamer, to avoid piston damage during removal. Such a ridge indicates excess bore wear.

3 Using quick-drying paint or similar, mark each connecting rod and big-end bearing cap with its respective cylinder number on the flat machined surface provided; if the engine has been dismantled before, note carefully any identifying marks made previously **(see illustration)**. Note that No 1 cylinder is at the transmission (flywheel) end of the engine.

8.9a Place the valve stem oil seal over the valve guide . . .

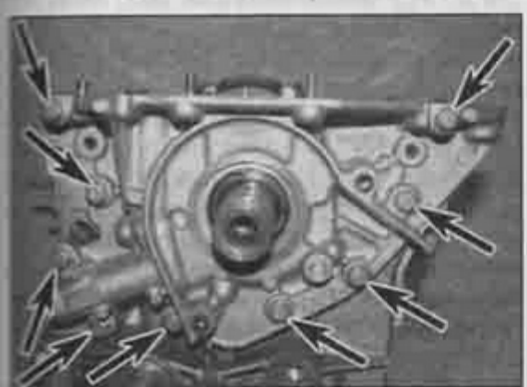
8.9b . . . and use a suitable socket or tube to press the seal onto the guide

9.3 Connecting rod and big-end bearing cap identification marks (No 3 shown)

4 Turn the crankshaft to bring pistons 1 and 4 to BDC (bottom dead centre).
5 Unscrew the nuts or bolts, as applicable from No 1 piston big-end bearing cap. Take off the cap, and recover the bottom half bearing shell **(see illustration)**. If the bearing shells are to be re-used, tape the cap and the shell together.
6 On 1.6 litre engines, to prevent the possibility of damage to the crankshaft bearing journals, tape over the connecting rod stud threads.
7 Using a hammer handle, push the piston up through the bore, and remove it from the top of the cylinder block. Recover the bearing shell, and tape it to the connecting rod for safe-keeping.
8 Loosely refit the big-end cap to the connecting rod, and secure with the nuts/bolts – this will help to keep the components in their correct order.
9 Remove No 4 assembly in the same way.
10 Turn the crankshaft through 180° to bring pistons 2 and 3 to BDC (bottom dead centre), and remove them in the same way.

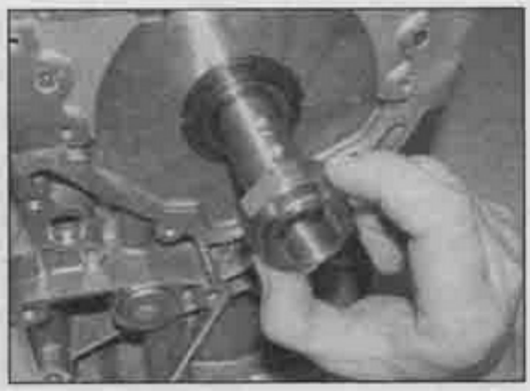
10 Oil pump (1.8 litre engines) – removal

1 Remove the crankshaft sprocket and the sump as described in Part B of this Chapter.
2 Undo the nine bolts and carefully ease the oil pump housing off the cylinder block and the locating dowels **(see illustration)**. Use a screwdriver if necessary inserted in the recess at the rear of the housing to break the seal. With the pump housing removed, collect the O-ring seal from the outlet stub on the rear of the pump.
3 Slide the oil pump drive collar off the end of the crankshaft and collect the O-ring located behind the collar **(see illustrations)**.



10.2 Oil pump housing retaining bolt locations (arrowed) – 1.8 litre engines

9.5 Removing a big-end bearing cap and shell



10.3a Slide the oil pump drive collar off the crankshaft . . .

11 Crankshaft – removal

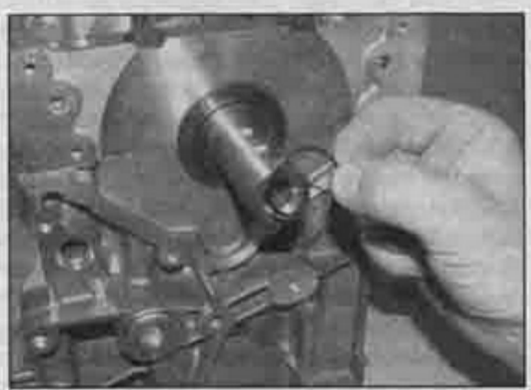
1 On 1.6 litre engines, remove the crankshaft sprocket and the oil pump as described in Part A of this Chapter. On 1.8 litre engines, remove the oil pump as described in Section 10 of this Part.
2 Remove the pistons and connecting rods, as described in Section 9. If no work is to be done on the pistons and connecting rods, there is no need to remove the cylinder head, or to push the pistons out of the cylinder bores. The pistons should just be pushed far enough up the bores so that they are positioned clear of the crankshaft journals.
3 Check the crankshaft endfloat as described in Section 15, then proceed as follows.

1.6 litre engines

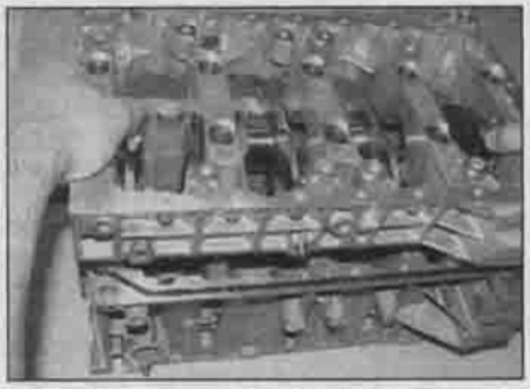
4 Unbolt and remove the crankshaft left- and right-hand oil seal housings from each end of the cylinder block, noting the correct fitted locations of the locating dowels. If the locating dowels are a loose fit, remove them and store them with the housings for safe-keeping.
5 Remove the oil pump drive chain, and slide the drive sprocket off the end of the crankshaft. Remove the Woodruff key, and store it with the sprocket for safe-keeping.
6 The main bearing caps should be numbered 1 to 5 from the transmission (flywheel) end of the engine. If not, mark them accordingly using quick-drying paint.
7 Unscrew and remove the main bearing cap retaining bolts, and withdraw the caps. Recover the lower main bearing shells, and tape them to their respective caps for safe-keeping.
8 Carefully lift out the crankshaft, taking care not to displace the upper main bearing shell.
9 Recover the upper bearing shells from the cylinder block, and tape them to their respective caps for safe-keeping. Remove the thrustwasher halves from the side of No 2 main bearing, and store them with the bearing cap.

1.8 litre engines

10 Working around the inner periphery of the crankcase, unscrew the 16 small (M6) bolts securing the crankshaft bearing cap housing to the base of the cylinder block. Note the correct fitted depth of the left-hand crankshaft oil seal in the cylinder block/bearing cap housing.
11 Working in the reverse of the sequence shown in illustration 19.48, evenly and progressively slacken the ten large (M11) bearing cap housing retaining bolts by a turn at a time. Once all the bolts are loose, remove them from the housing.
12 With all the retaining bolts removed, tap around the outer periphery of the bearing cap housing using a soft-faced mallet to break the seal between the housing and cylinder block. Once the seal is released and the housing is clear of the locating dowels, lift it up and off the crankshaft and cylinder block **(see illustration)**. Recover the lower main bearing shells, and tape them to their respective locations in the housing. If the two locating dowels are a loose fit, remove them and store them with the housing for safe-keeping.



10.3b . . . and collect the O-ring located behind the collar – 1.8 litre engines



11.12 Removing the crankshaft bearing cap housing – 1.8 litre engines

13 Lift out the crankshaft, and collect the left-hand oil seal.

14 Recover the upper main bearing shells, and store them along with the relevant lower bearing shell. Also recover the two thrustwashers (one fitted either side of No 2 main bearing) from the cylinder block.

12 Cylinder block/crankcase – cleaning and inspection

Cleaning

1 Remove all external components and electrical switches/sensors from the block.

2 Remove all traces of gasket/sealant from the cylinder block, and from the crankshaft bearing cap housing (1.8 litre engines), taking care not to damage the gasket/sealing surfaces.

3 If any of the castings are extremely dirty, all should be steam-cleaned.

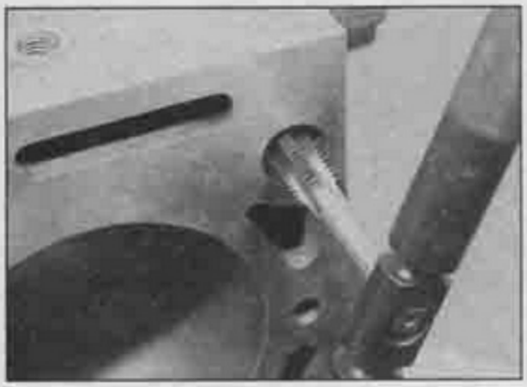
4 After the castings are returned, clean all oil holes and oil galleries one more time. Flush all internal passages with warm water until the water runs clear. Dry thoroughly, and apply a light film of oil to the cylinder bores to prevent rusting. If you have access to compressed air, use it to speed up the drying process, and to blow out all the oil holes and galleries.

Warning: Wear eye protection when using compressed air.

5 If the castings are not very dirty, you can do an adequate cleaning job with very hot, soapy water and a stiff brush. Take plenty of time, and do a thorough job. Regardless of the cleaning method used, be sure to clean all oil holes and galleries very thoroughly, and to dry all components well. Protect the cylinder bores as described above, to prevent rusting.

6 All threaded holes must be clean, to ensure accurate torque readings during reassembly. To clean the threads, run the correct-size tap into each of the holes to remove rust, corrosion, thread sealant or sludge, and to restore damaged threads **(see illustration)**. If possible, use compressed air to clear the holes of debris produced by this operation.

Warning: Wear eye protection when using compressed air.



12.6 Cleaning a cylinder block threaded hole using a suitable tap

7 If the engine is not going to be reassembled right away, cover it with a large plastic bag to keep it clean; protect all mating surfaces and the cylinder bores as described above, to prevent rusting.

Inspection

8 Visually check the castings for cracks and corrosion. Look for stripped threads in the threaded holes. If there has been any history of internal water leakage, it may be worthwhile having an engine overhaul specialist check the cylinder block with special equipment. If defects are found, have them repaired if possible, or renew the assembly.

9 Check each cylinder bore for scuffing and scoring. Check for signs of a wear ridge at the top of the cylinder, indicating that the bore is excessively worn.

10 If the necessary measuring equipment is available, measure the bore diameter of each cylinder at the top (just under the wear ridge), centre, and bottom of the cylinder bore, parallel to the crankshaft axis.

11 Next, measure the bore diameter at the same three locations, at right-angles to the crankshaft axis. Compare the results with the figures given in the Specifications. Where no figures are stated by Citroën, if there is any doubt about the condition of the cylinder bores, seek the advice of an engine reconditioning specialist or Citroën dealer.

12 At the time of writing, it was not clear whether oversize pistons were available for all engines. Consult your Citroën dealer for the latest information on piston availability. If oversize pistons are available, then it may be possible to have the cylinder bores rebored and fit the oversize pistons. If oversize pistons are not available, and the bores are worn, renewal of the block seems to be the only option.

13.2 Removing a piston ring with the aid of a feeler blade

13 Piston/connecting rod assembly – inspection

1 Before the inspection process can begin, the piston/connecting rod assemblies must be cleaned, and the original piston rings removed from the pistons.

2 Carefully expand the old rings over the top of the pistons. The use of two or three old feeler blades will be helpful in preventing the rings dropping into empty grooves **(see illustration)**. Be careful not to scratch the piston with the ends of the ring. The rings are brittle, and will snap if they are spread too far. They are also very sharp – protect your hands and fingers. Note that the third ring incorporates an expander. Always remove the rings from the top of the piston. Keep each set of rings with its piston if the old rings are to be re-used.

3 Scrape away all traces of carbon from the top of the piston. A hand-held wire brush (or a piece of fine emery cloth) can be used, once the majority of the deposits have been scraped away.

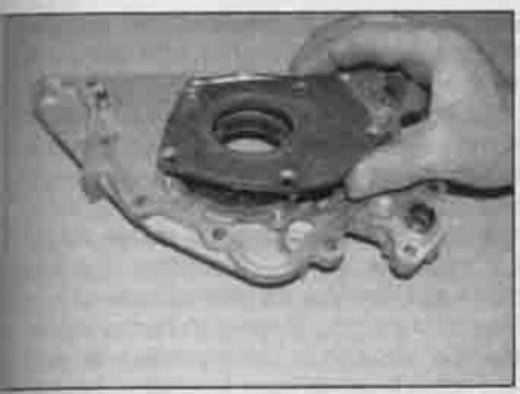
4 Remove the carbon from the ring grooves in the piston, using an old ring. Break the ring in half to do this (be careful not to cut your fingers – piston rings are sharp). Be careful to remove only the carbon deposits – do not remove any metal, and do not nick or scratch the sides of the ring grooves.

5 Once the deposits have been removed, clean the piston/connecting rod assembly with paraffin or a suitable solvent, and dry thoroughly. Make sure that the oil return holes in the ring grooves are clear.

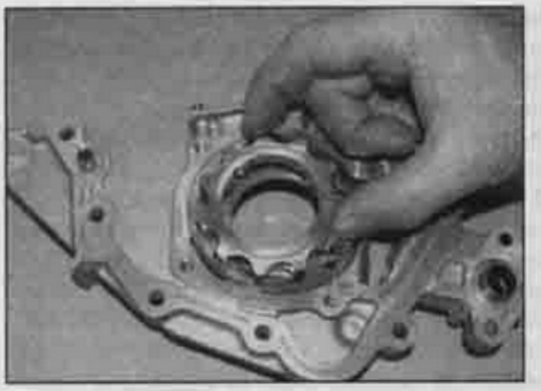
6 If the pistons and cylinder bores are not damaged or worn excessively, and if the cylinder block does not need to be rebored, the original pistons can be refitted. Normal piston wear shows up as even vertical wear on the piston thrust surfaces, and slight looseness of the top ring in its groove. New piston rings should always be used when the engine is reassembled.

7 Carefully inspect each piston for cracks around the skirt, around the gudgeon pin holes, and at the piston ring 'lands' (between the ring grooves).

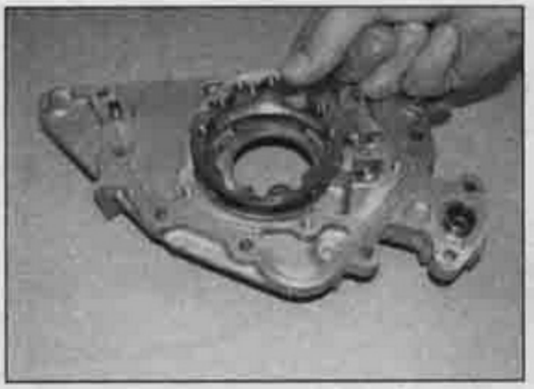
8 Look for scoring and scuffing on the piston skirt, holes in the piston crown, and burned areas at the edge of the crown. If the skirt is scored or scuffed, the engine may have been suffering from overheating, and/or abnormal combustion which caused excessively high operating temperatures. The cooling and lubrication systems should be checked thoroughly. Scorch marks on the sides of the pistons show that blow-by has occurred. A



14.1 Undo the five screws and lift off the oil pump rear cover – 1.8 litre engines



14.2a Remove the inner rotor . . .



14.2b . . . and outer rotor from the pump housing – 1.8 litre engines

hole in the piston crown, or burned areas at the edge of the piston crown, indicates that abnormal combustion (pre-ignition, knocking, or detonation) has been occurring. If any of the above problems exist, the causes must be investigated and corrected, or the damage will occur again.

8 Corrosion of the piston, in the form of pitting, indicates that coolant has been leaking into the combustion chamber and/or the crankcase. Again, the cause must be corrected, or the problem may persist in the rebuilt engine.

9 Examine each connecting rod carefully for signs of damage, such as cracks around the big-end and small-end bearings. Check that the rod is not bent or distorted. Damage is highly unlikely, unless the engine has been seized or badly overheated. Detailed checking of the connecting rod assembly can only be carried out by an engine specialist or Citroën dealer with the necessary equipment.

10 On all engines, the gudgeon pins are an interference fit in the connecting rod small-end bearing. Therefore, piston and/or connecting rod renewal should be entrusted to an engine repair specialist who will have the necessary tooling to remove and install the gudgeon pins.

14 Oil pump (1.8 litre engines) – inspection

1 Undo the five screws and lift off the pump rear cover plate **(see illustration)**.

2 Lift out the inner and outer rotor, checking carefully for any identification markings indicating their fitted direction **(see illustrations)**.

3 Note the fitted depth of the crankshaft right-hand oil seal, then support the pump housing on blocks and tap out the seal using a suitable drift.

4 Thoroughly clean all the components, then inspect the rotors, pump housing and rear cover plate for any sign of wear or scoring. Oil pump clearances are not quoted by Citroën but if there is any doubt whatsoever as to the condition of the pump, the complete assembly should be renewed. Apart from the oil seals, individual oil pump components are not available separately.

5 Prior to reassembly, obtain new O-rings and a new crankshaft right-hand oil seal.

6 Refit the inner and outer rotors to the pump body, respecting any identification markings noted during removal.

7 Liberally lubricate the rotors with clean engine oil then refit the rear cover plate. Refit the cover plate retaining screws and tighten them securely.

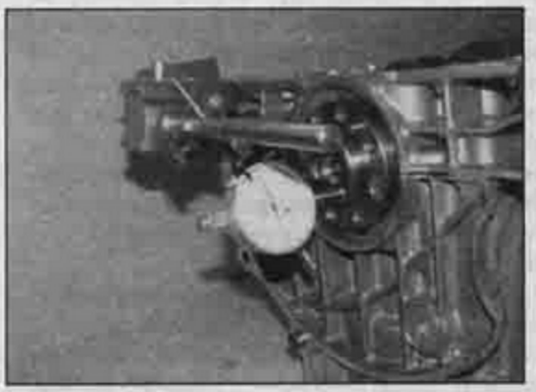
15 Crankshaft – inspection

Checking endfloat

1 If the crankshaft endfloat is to be checked, this must be done when the crankshaft is still installed in the cylinder block, but is free to move.

2 Check the endfloat using a dial gauge in contact with the end of the crankshaft. On 1.8 litre engines it may be necessary to bolt a suitable steel bracket to the rear of the cylinder block if the dial gauge incorporates a magnetic base. Push the crankshaft fully one way, and then zero the gauge. Push the crankshaft fully the other way, and check the endfloat. The result can be compared with the specified amount, and will give an indication as to whether new thrustwashers are required **(see illustration)**.

3 If a dial gauge is not available, feeler blades can be used. First push the crankshaft fully towards the flywheel end of the engine, then use feeler blades to measure the gap between the web of No 2 crankpin and the thrustwasher.



15.2 Checking crankshaft endfloat using a dial gauge

Inspection

4 Clean the crankshaft using paraffin or a suitable solvent, and dry it, preferably with compressed air if available. Be sure to clean the oil holes with a pipe cleaner or similar probe, to ensure that they are not obstructed.

Warning: Wear eye protection when using compressed air.

5 Check the main and big-end bearing journals for uneven wear, scoring, pitting and cracking.

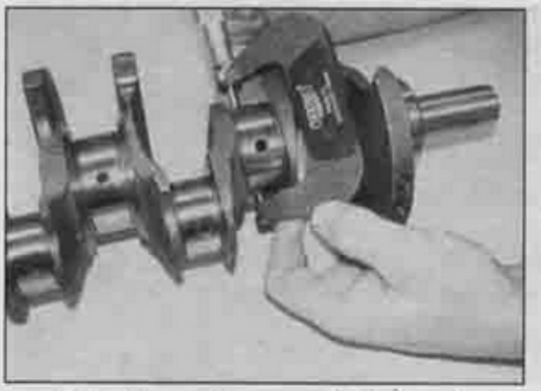
6 Big-end bearing wear is accompanied by distinct metallic knocking when the engine is running (particularly noticeable when the engine is pulling from low speed) and some loss of oil pressure.

7 Main bearing wear is accompanied by severe engine vibration and rumble – getting progressively worse as engine speed increases – and again by loss of oil pressure.

8 Check the bearing journal for roughness by running a finger lightly over the bearing surface. Any roughness (which will be accompanied by obvious bearing wear) indicates that the crankshaft requires regrinding (where possible) or renewal.

9 If the crankshaft has been reground, check for burrs around the crankshaft oil holes (the holes are usually chamfered, so burrs should not be a problem unless regrinding has been carried out carelessly). Remove any burrs with a fine file or scraper, and thoroughly clean the oil holes as described previously.

10 Using a micrometer, measure the diameter of the main and big-end bearing journals, and compare the results with the Specifications **(see illustration)**. By measuring the diameter at a number of points around each journal's circumference, you will be able to determine whether or not the journal is out-of-round. Take the measurement at each end of the journal, near the webs, to determine if the journal is tapered. Compare the results obtained with those given in the Specifications.



15.10 Measuring a crankshaft main bearing journal diameter

11 Check the oil seal contact surfaces on the crankshaft for wear and damage. If the seal has worn a deep groove in the surface of the crankshaft, consult an engine overhaul specialist; repair may be possible, but otherwise a new crankshaft will be required.

12 Citroën produce a set of oversize bearing shells for both the main and big-end bearings. Where oversize bearing shells are available, and if the crankshaft journals have not already been reground, it may be possible to have the crankshaft reconditioned, and to fit oversize shells. If the crankshaft has worn beyond the specified limits, it will have to be renewed. Consult your Citroën dealer or engine specialist for further information on parts availability.

16 Main and big-end bearings – inspection

1 Even though the main and big-end bearings should be renewed during the engine overhaul, the old bearings should be retained for close examination, as they may reveal valuable information about the condition of the engine. The bearing shells are graded by thickness, the grade of each shell being indicated by the colour code, or size identification, marked on it.

2 Bearing failure can occur due to lack of lubrication, the presence of dirt or other foreign particles, overloading the engine, or corrosion **(see illustration)**. Regardless of the cause of bearing failure, the cause must be corrected (where applicable) before the engine is reassembled, to prevent it from happening again.

3 When examining the bearing shells, remove them from the cylinder block, the main bearing caps or cap housing (as appropriate), the connecting rods and the connecting rod big-end bearing caps. Lay them out on a clean surface in the same general position as their location in the engine. This will enable you to match any bearing problems with the corresponding crankshaft journal. *Do not* touch any shell's bearing surface with your fingers while checking it, or the delicate surface may be scratched.

4 Dirt and other foreign matter gets into the engine in a variety of ways. It may be left in the engine during assembly, or it may pass through filters or the crankcase ventilation system. It may get into the oil, and from there into the bearings. Metal chips from machining operations and normal engine wear are often present. Abrasives are sometimes left in engine components after reconditioning, especially when parts are not thoroughly cleaned using the proper cleaning methods. Whatever the source, these foreign objects often end up embedded in the soft bearing material, and are easily recognised. Large particles will not embed in the bearing, and will score or gouge the bearing and journal. The best prevention for this cause of bearing failure is to clean all parts thoroughly, and keep everything spotlessly-clean during engine assembly. Frequent and regular engine oil and filter changes are also recommended.

5 Lack of lubrication (or lubrication breakdown) has a number of interrelated causes. Excessive heat (which thins the oil), overloading (which squeezes the oil from the bearing face) and oil leakage (from excessive bearing clearances, worn oil pump or high engine speeds) all contribute to lubrication breakdown. Blocked oil passages, which usually are the result of misaligned oil holes in a bearing shell, will also oil-starve a bearing, and destroy it. When lack of lubrication is the cause of bearing failure, the bearing material is wiped or extruded from the steel backing of the bearing. Temperatures may increase to the point where the steel backing turns blue from overheating.

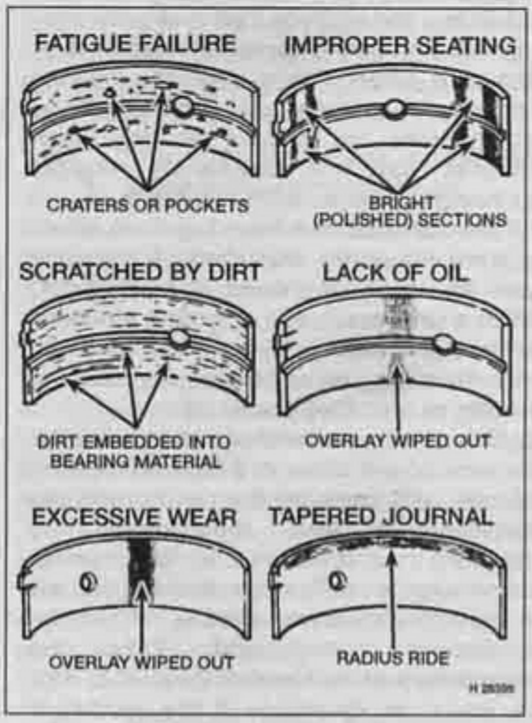
6 Driving habits can have a definite effect on bearing life. Full-throttle, low-speed operation (labouring the engine) puts very high loads on bearings, tending to squeeze out the oil film. These loads cause the bearings to flex, which produces fine cracks in the bearing face (fatigue failure). Eventually, the bearing material will loosen in pieces, and tear away from the steel backing.

7 Short-distance driving leads to corrosion of bearings, because insufficient engine heat is produced to drive off the condensed water and corrosive gases. These products collect in the engine oil, forming acid and sludge. As the oil is carried to the engine bearings, the acid attacks and corrodes the bearing material.

8 Incorrect bearing installation during engine assembly will lead to bearing failure as well. Tight-fitting bearings leave insufficient bearing running clearance, and will result in oil starvation. Dirt or foreign particles trapped behind a bearing shell result in high spots on the bearing, which lead to failure.

9 *Do not* touch any shell's bearing surface with your fingers during reassembly; there is a risk of scratching the delicate surface, or of depositing particles of dirt on it.

10 As mentioned at the beginning of this Section, the bearing shells should be renewed as a matter of course during engine overhaul; to do otherwise is false economy. Refer to Sections 19 and 20 for details of bearing shell selection.



16.2 Typical bearing failures

17 Engine overhaul – reassembly sequence

1 Before reassembly begins, ensure that all new parts have been obtained, and that all necessary tools are available. Read through the entire procedure to familiarise yourself with the work involved, and to ensure that all items necessary for reassembly of the engine are at hand. In addition to all normal tools and materials, thread-locking compound will be needed. A suitable tube of liquid sealant will also be required for the joint faces that are fitted without gaskets. It is recommended that Citroën's own products are used, which are specially formulated for this purpose; the relevant product names are quoted in the text of each Section where they are required.

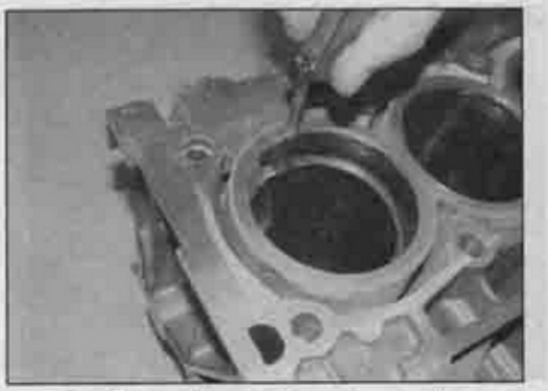
2 In order to save time and avoid problems, engine reassembly can be carried out in the following order:

a) Crankshaft (See Section 19).
b) Piston/connecting rod assemblies (See Section 20).
c) Oil pump (See Part A or Section 21 of this Part – as applicable).
d) Sump (See Part A or B – as applicable).
e) Flywheel (See Part A or B – as applicable).
f) Cylinder head (See Part A or B – as applicable).
g) Timing belt tensioner and sprockets, and timing belt (See Part A or B – as applicable).
h) Engine external components.

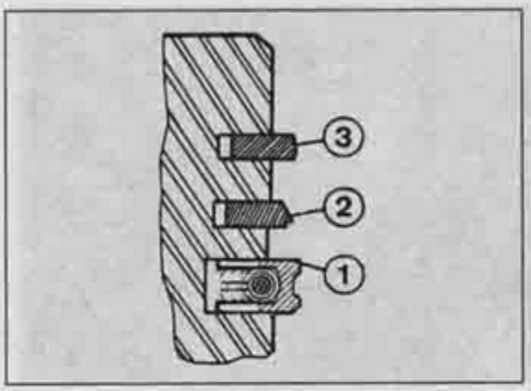
3 At this stage, all engine components should be absolutely clean and dry, with all faults repaired. The components should be laid out (or in individual containers) on a completely clean work surface.

18 Piston rings – refitting

1 Before fitting new piston rings, the ring end gaps must be checked as follows.
2 Lay out the piston/connecting rod assemblies and the new piston ring sets, so that the ring sets will be matched with the same piston and cylinder during the end gap measurement and subsequent engine reassembly.
3 Insert the top ring into the first cylinder, and push it down the bore using the top of the piston. This will ensure that the ring remains square with the cylinder walls. Position the ring near the bottom of the cylinder bore, at the lower limit of ring travel. Note that the top and second compression rings are different. The second ring is easily identified by the step on its lower surface, and by the fact that its outer face is tapered.
4 Measure the end gap using feeler blades.
5 Repeat the procedure with the ring at the top of the cylinder bore, at the upper limit of its travel and compare the measurements with the figures given in the Specifications **(see illustration)**.
6 If the gap is too small (unlikely if genuine Citroën parts are used), it must be enlarged, or the ring ends may contact each other during engine operation, causing serious damage. Ideally, new piston rings providing the correct end gap should be fitted. As a last resort, the end gap can be increased by filing the ring ends very carefully with a fine file. Mount the file in a vice equipped with soft jaws, slip the ring over the file with the ends contacting the file face, and slowly move the ring to remove material from the ends. Take care, as piston rings are sharp, and are easily broken.
7 With new piston rings, it is unlikely that the end gap will be too large. If the gaps are too large, check that you have the correct rings for your engine and for the cylinder bore size.
8 Repeat the checking procedure for each ring in the first cylinder, and then for the rings in the remaining cylinders. Remember to keep rings, pistons and cylinders matched up.
9 Once the ring end gaps have been checked and if necessary corrected, the rings can be fitted to the pistons.
10 Fit the piston rings using the same technique as for removal. Fit the bottom (oil control) ring first, and work up. When fitting the oil control ring on 1.6 litre engines, first insert the expander (where fitted), then fit the ring with its gap positioned 180° from the expander gap. The oil control ring used on 1.8 litre engines is a one-piece type and does not have a gap.
11 Ensure that the second compression ring is fitted the correct way up, with its identification mark (either a dot of paint or the word TOP stamped on the ring surface) at the top, and the stepped surface at the bottom



18.5 Measuring a piston ring end gap



18.11 Piston ring fitting diagram (typical)

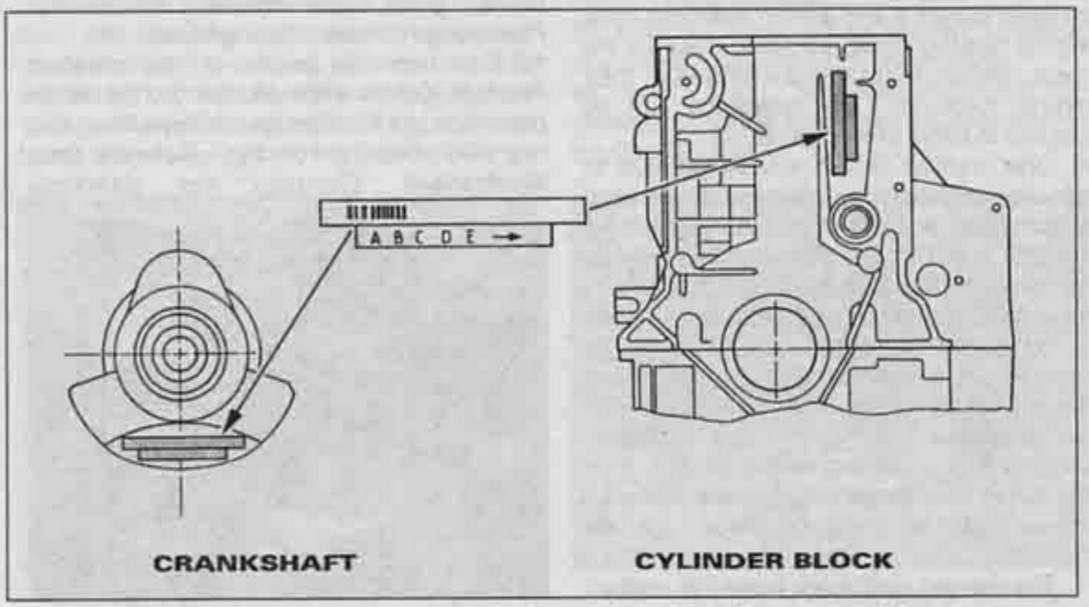
1 Oil control ring
2 Second compression ring
3 Top compression ring

(see illustration). On 1.6 litre engines, arrange the gaps of the top and second compression rings 120° either side of the oil control ring gap. On 1.8 litre engines, position the rings so that the gaps are 180° apart and offset by 90° from the gudgeon pin centreline.
Note: *Always follow any instructions supplied with the new piston ring sets – different manufacturers may specify different procedures. Do not mix up the top and second compression rings, as they have different cross-sections.*

19 Crankshaft – refitting and main bearing running clearance check

Selection of bearing shells

1 There are two different sizes of main bearing shell available; the standard size shell for use with an original crankshaft and an oversize shell for use once the crankshaft has been reground. Within these two size classes there are additional thickness sizes (grades) for both the upper and lower shells, to allow the main bearing running clearance to be accurately set. The grades are indicated by a colour-coding marked on the edge of each shell, which denotes the shell's thickness.
2 The relevant set of bearing shells required can be obtained by measuring the diameter of the crankshaft main bearing journals (see Section 15). This will show if the crankshaft is original or whether its journals have been reground, identifying if either standard or oversize bearing shells are required.
3 The grade of the new bearing shells required (either standard size or oversize) is selected using the reference marks on the cylinder block and on the crankshaft. The cylinder block marks identify the diameter of the bearing bores in the block, and the crankshaft marks identify the diameter of the crankshaft journals.
4 On 1.6 litre engines, the cylinder block reference marks are on the right-hand (timing belt) end of the block, whereas on 1.8 litre engines they are on the front facing (oil filter) side adjacent to No 2 cylinder **(see illustration)**. On all engines, the crankshaft reference marks are on the right-hand (timing belt) end of the crankshaft, on the right-hand web of No 4 crankpin. These marks can be used for selection of bearing shells of the required thickness grade.



19.4 Cylinder block and crankshaft main bearing reference markings – 1.6 litre engines

19.13 Plastigauge in place on a crankshaft main bearing journal

19.16 Measure the width of the deformed Plastigauge using the scale on the card

5 Numerous grades of standard and oversize bearing shells are available, depending on the engine type, year of manufacture, and country of export. Using the cylinder block and crankshaft reference marks together with the crankshaft journal diameter, a Citroën dealer or engine overhaul specialist will be able to supply the correct bearing shells to give the required bearing running clearance for each journal.

6 Whether the original shells or new shells are being fitted, it is recommended that the running clearance is checked as follows prior to crankshaft installation.

Main bearing clearance check

1.6 litre engines

7 The running clearance check can be carried out using the original bearing shells. However, it is preferable to use a new set, since the results obtained will be more conclusive.

8 Clean the backs of the bearing shells, and the bearing locations in both the cylinder block and the main bearing caps.

9 Press the bearing shells into their locations, ensuring that the tab on each shell engages in the notch in the cylinder block or bearing cap. Take care not to touch any shell's bearing surface with your fingers. Note that the grooved bearing shells, both upper and lower, are fitted to Nos 2 and 4 main bearings. If the original bearing shells are being used for the check, ensure that they are refitted in their original locations. The clearance can be checked in either of two ways.

10 One method (which will be difficult to achieve without a range of internal micrometers or internal/external expanding calipers) is to refit the main bearing caps to the cylinder block, with bearing shells in place. With the cap retaining bolts tightened to the specified torque and through the specified angle, measure the internal diameter of each assembled pair of bearing shells. If the diameter of each corresponding crankshaft journal is measured and then subtracted from the bearing internal diameter, the result will be the main bearing running clearance.

11 The second (and more accurate) method is to use an American product known as Plastigauge. This consists of a fine thread of perfectly-round plastic, which is compressed between the bearing shell and the journal. When the shell is removed, the plastic is deformed, and can be measured with a special card gauge supplied with the kit. The running clearance is determined from this gauge. Plastigauge should be available from your Citroën dealer; otherwise, enquiries at one of the larger specialist motor factors should produce the name of a stockist in your area. The procedure for using Plastigauge is as follows.

12 With the main bearing upper shells in place, carefully lay the crankshaft in position. Do not use any lubricant; the crankshaft journals and bearing shells must be perfectly clean and dry.

13 Cut several lengths of the appropriate-size Plastigauge (they should be slightly shorter than the width of the main bearings), and place one length on each crankshaft journal axis **(see illustration)**.

14 With the main bearing lower shells in position, refit the main bearing caps, tightening their retaining bolts to the specified torque and through the specified angle. Take care not to disturb the Plastigauge, and *do not* rotate the crankshaft at any time during this operation.

15 Remove the main bearing caps, again taking great care not to disturb the Plastigauge or rotate the crankshaft.

16 Compare the width of the crushed Plastigauge on each journal to the scale printed on the Plastigauge envelope, to obtain the main bearing running clearance **(see illustration)**. Compare the clearance measured with that in the Specifications at the start of this Chapter.

19.25 Fitting a thrustwasher to No 2 main bearing upper location – 1.6 litre engines

17 If the clearance is significantly different from that expected, the bearing shells may be the wrong size (or excessively worn, if the original shells are being re-used). Before deciding that different-size shells are required, make sure that no dirt or oil was trapped between the bearing shells and the caps or block when the clearance was measured. If the Plastigauge was wider at one end than at the other, the crankshaft journal may be tapered.

18 Where necessary, obtain the required grades of bearing shell, and repeat the running clearance checking process described above.

19 On completion, carefully scrape away all traces of the Plastigauge material from the crankshaft and bearing shells. Use your fingernail, or a wooden or plastic scraper which is unlikely to score the bearing surfaces.

1.8 litre engines

20 The running clearance check can be carried out using the original bearing shells. However, it is preferable to use a new set, since the results obtained will be more conclusive.

21 Clean the backs of the bearing shells, and the bearing locations in both the cylinder block and in the crankshaft main bearing cap housing.

22 Press the bearing shells into their locations, ensuring that the tab on each shell engages in the notch in the cylinder block or crankshaft bearing cap housing location. Take care not to touch any shell's bearing surface with your fingers. Note that the grooved bearing shells are fitted to the cylinder block and the plain bearing shells are fitted to the bearing cap housing. If the original bearing shells are being used for the check, ensure that they are refitted in their original locations.

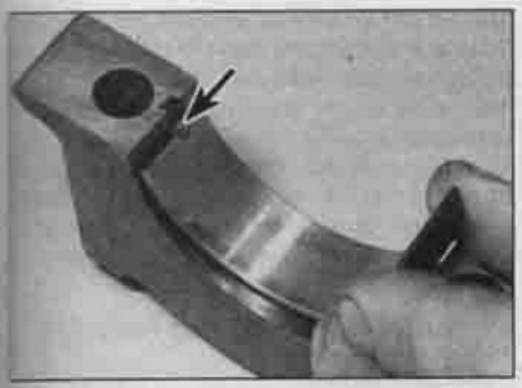
23 The clearance can now be checked using the procedures described in paragraphs 10 to 19, noting that the crankshaft bearing cap housing is removed as an assembly rather than the removal of each individual main bearing cap. When fitting the bearing cap housing for the running clearance check, tighten the retaining bolts to the specified torque settings, following the procedure and tightening sequence contained in paragraphs 47 to 51.

Final crankshaft refitting

1.6 litre engines

24 Carefully lift the crankshaft out of the cylinder block once more.

25 Using a little grease, stick the upper thrustwashers to each side of the No 2 main bearing upper location. Ensure that the oilway grooves on each thrustwasher face outwards (away from the cylinder block) **(see illustration)**.



19.26 Ensure that the tab (arrowed) is correctly located in the cap when fitting the bearing shells – 1.6 litre engines

26 Place the bearing shells in their locations as described earlier **(see illustration)**. If new shells are being fitted, ensure that all traces of protective grease are cleaned off using paraffin. Wipe dry the shells and connecting rods with a lint-free cloth. Liberally lubricate each bearing shell in the cylinder block and cap with clean engine oil.

27 Lower the crankshaft into position so that Nos 2 and 3 cylinder crankpins are at TDC; Nos 1 and 4 cylinder crankpins will be at BDC, ready for fitting No 1 piston.

28 Lubricate the lower bearing shells in the main bearing caps with clean engine oil. Make sure that the locating lugs on the shells engage with the corresponding recesses in the caps.

29 Fit the main bearing caps to their correct locations, ensuring that they are fitted the correct way round (the bearing shell lug recesses in the block and caps must be on the same side). Insert the bolts loosely.

30 Tighten the main bearing cap bolts to the specified Stage 1 torque wrench setting. Once all the bolts have been tightened to the Stage 1 setting, angle-tighten the bolts through the specified Stage 2 angle, using a socket and extension bar. It is recommended that an angle-measuring gauge is used during this stage of the tightening, to ensure accuracy.

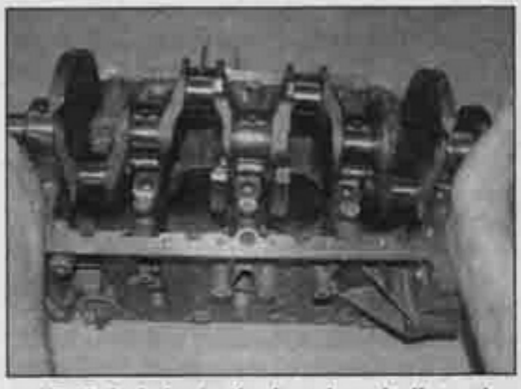
31 Check that the crankshaft rotates freely.

32 Refit the piston/connecting rod assemblies to the crankshaft as described in Section 20.

33 Refit the Woodruff key to the crankshaft groove, and slide on the oil pump drive sprocket. Locate the drive chain on the sprocket.

34 Ensure that the mating surfaces of the right-hand oil seal housing and cylinder block are clean and dry. Note the correct fitted depth of the oil seal then, using a large flat-bladed screwdriver, lever the seal out of the housing.

35 Apply a smear of RTV sealant to the oil seal housing mating surface (Citroën recommend the use of Loctite Autojoint Noir), and make sure that the locating dowels are in position. Slide the housing over the end of the crankshaft, and into position on the cylinder block. Tighten the housing retaining bolts securely.



19.43 Lubricate the bearing shells and lower the crankshaft into the cylinder block – 1.8 litre engines

36 Repeat the operations in paragraphs 34 and 35, and fit the left-hand oil seal housing.

37 Fit a new right-hand and left-hand crankshaft oil seal as described in Part A of this Chapter.

38 Ensuring that the chain is correctly located on the drive sprocket, refit the oil pump and sump as described in Part A of this Chapter.

39 Refit the flywheel as described in Part A of this Chapter.

40 Refit the cylinder head and install the crankshaft sprocket and timing belt as described in Part A of this Chapter.

1.8 litre engines

41 Carefully lift the crankshaft out of the cylinder block once more.

42 Place the bearing shells in their locations as described earlier. If new shells are being fitted, ensure that all traces of protective grease are cleaned off using paraffin. Wipe dry the shells with a lint-free cloth.

43 Liberally lubricate each bearing shell in the cylinder block with clean engine oil then lower the crankshaft into position **(see illustration)**.

44 Insert the thrustwashers to either side of No 2 main bearing upper location and push them around the bearing journal until their edges are horizontal **(see illustration)**. Ensure that the oilway grooves on each thrustwasher face outwards (away from the bearing journal).

19.44 Insert the thrustwashers to either side of No 2 main bearing upper location – 1.8 litre engines

45 Thoroughly degrease the mating surfaces of the cylinder block and the crankshaft bearing cap housing. Apply a thin bead of RTV sealant to the bearing cap housing mating surface **(see illustration)**. Citroën recommend the use of Loctite Autojoint Noir for this purpose.

46 Lubricate the lower bearing shells with clean engine oil, then refit the bearing cap housing, ensuring that the shells are not displaced, and that the locating dowels engage correctly.

47 Install the ten M11, and sixteen M6 crankshaft bearing cap housing retaining bolts, and screw them in until they are just making contact with the housing.

48 Working in the sequence shown, tighten all the M11 bolts to the Stage 1 torque setting given in the Specifications **(see illustration)**. Now tighten all the M6 bolts to the Stage 1 torque setting (finger tight).

49 Fully slacken all the M11 bolts (Stage 2), then tighten them to the Stage 3 setting, working in the correct sequence.

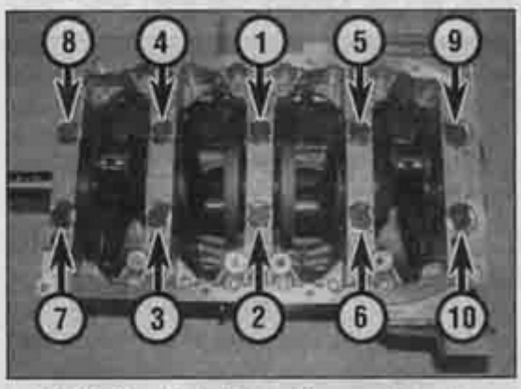
50 Finally tighten all the M11 bolts, in the correct sequence, through the specified Stage 4 angle, using an angle tightening gauge.

51 The M6 bolts can now be tightened to the Stage 5 torque setting.

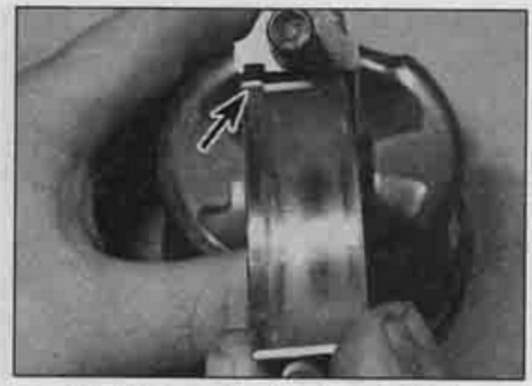
52 With the bearing cap housing in place, check that the crankshaft rotates freely.

53 Refit the piston/connecting rod assemblies to the crankshaft as described in Section 20.

19.45 Apply a thin bead of RTV sealant to the bearing cap housing mating surface – 1.8 litre engines



19.48 Crankshaft bearing cap housing retaining bolt tightening sequence – 1.8 litre engines



20.7 Ensure the bearing shell tab (arrowed) engages with the recess in the connecting rod

54 Refit the oil pump as described in Section 21 of this Part and the sump as described in Part B of this Chapter.
55 Fit a new crankshaft left-hand oil seal, then refit the flywheel as described in Part B.
56 Refit the cylinder head, crankshaft sprocket and timing belt also as described in Part B.

20 Piston/connecting rod assembly – refitting and big-end bearing running clearance check

Selection of bearing shells

1 There are two different sizes of big-end bearing shell available; the standard size shell for use with an original crankshaft and an oversize shell for use once the crankshaft has been reground. Within these two size classes there are additional thickness sizes (grades) for the lower bearing shells, to allow the big-end bearing running clearance to be accurately set. The grades are indicated by a colour-coding marked on the edge of each shell, which denotes the shell's thickness.
2 The relevant set of bearing shells required can be obtained by measuring the diameter of the crankshaft big-end bearing journals (see Section 15). This will show if the crankshaft is original or whether its journals have been reground, identifying if either standard or oversize bearing shells are required.
3 The grade of the new bearing shells required (either standard size or oversize) is selected using the reference marks on the crankshaft. The reference marks are on the left-hand (flywheel) end of the crankshaft, on the left-hand web of No 1 crankpin. These marks can be used for selection of bearing shells of the required thickness grade.
4 Numerous grades of standard and oversize bearing shells are available, depending on the engine type, year of manufacture, and country of export. Using the crankshaft reference marks together with the crankshaft big-end bearing journal diameter, a Citroën dealer or engine overhaul specialist will be able to supply the correct bearing shells to give the required bearing running clearance for each journal.
5 Whether the original shells or new shells are being fitted, it is recommended that the running clearance is checked as follows.

20.19 Tap the piston into the bore using a hammer handle – 1.6 litre engines

Big-end bearing clearance check

6 Clean the backs of the bearing shells, and the bearing locations in both the connecting rod and bearing cap.
7 Press the bearing shells into their locations, ensuring that the tab on each shell engages in the notch in the connecting rod and cap. Take care not to touch any shell's bearing surface with your fingers **(see illustration)**. If the original bearing shells are being used for the check, ensure that they are refitted in their original locations. The clearance can be checked in either of two ways.
8 One method is to refit the big-end bearing cap to the connecting rod, ensuring that they are fitted the correct way around (see paragraph 20), with the bearing shells in place. With the cap retaining nuts/bolts correctly tightened, use an internal micrometer or vernier caliper to measure the internal diameter of each assembled pair of bearing shells. If the diameter of each corresponding crankshaft journal is measured and then subtracted from the bearing internal diameter, the result will be the big-end bearing running clearance.
9 The second, and more accurate method is to use Plastigauge (see Section 19).
10 Ensure that the bearing shells are correctly fitted. Place a strand of Plastigauge on each (cleaned) crankpin journal.
11 Refit the (clean) piston/connecting rod assemblies to the crankshaft, and refit the big-end bearing caps, using the marks made or noted on removal to ensure that they are fitted the correct way around.
12 Tighten the bearing cap nuts/bolts as described below in paragraph 21 or 29 (as applicable). Take care not to disturb the Plastigauge, nor rotate the connecting rod during the tightening sequence.
13 Dismantle the assemblies without rotating the connecting rods. Use the scale printed on the Plastigauge envelope to obtain the big-end bearing running clearance.
14 If the clearance is significantly different from that expected, the bearing shells may be the wrong size (or excessively worn, if the original shells are being re-used). Make sure that no dirt or oil was trapped between the bearing shells and the caps or block when the clearance was measured. If the Plastigauge was wider at one end than at the other, the crankshaft journal may be tapered.
15 On completion, carefully scrape away all traces of the Plastigauge material from the crankshaft and bearing shells. Use your fingernail, or some other object which is unlikely to score the bearing surfaces.

Piston/connecting rod refitting

1.6 litre engines

16 Ensure that the bearing shells are correctly fitted as described earlier. If new shells are being fitted, ensure that all traces of the protective grease are cleaned off using paraffin. Wipe dry the shells and connecting rods with a lint-free cloth.
17 Lubricate the cylinder bores, the pistons, and piston rings, then lay out each piston/connecting rod assembly in its respective position.
18 Start with assembly No 1. Make sure that the piston rings are still spaced as described in Section 18, then clamp them in position with a piston ring compressor.
19 Insert the piston/connecting rod assembly into the top of cylinder No 1, ensuring that the arrow on the piston crown is pointing towards the timing belt end of the engine. Using a block of wood or hammer handle against the piston crown, tap the assembly into the cylinder bore until the piston crown is flush with the top of the cylinder block **(see illustration)**.
20 Ensure that the bearing shell is still correctly installed. Liberally lubricate the crankpin and both bearing shells. Taking care not to mark the cylinder bores, pull the piston/connecting rod assembly down the bore and onto the crankpin. Refit the big-end bearing cap, tightening the nuts finger-tight at first. Note that the faces with the identification marks must match (which means that the bearing shell locating tabs abut each other).
21 Tighten the bearing cap retaining nuts evenly and progressively to the specified torque setting.

1.8 litre engines

22 Ensure that the bearing shells are correctly fitted as described earlier. If new shells are being fitted, ensure that all traces of the protective grease are cleaned off using paraffin. Wipe dry the shells and connecting rods with a lint-free cloth.
23 Lubricate the cylinder bores, the pistons, and piston rings, then lay out each piston/connecting rod assembly in its respective position.
24 Due to the construction and small size of the oil control piston ring on these engines, it is very easy to damage the ring when fitting the piston/connecting rod assembly if a conventional piston ring compressor is used. The lower part of the ring slips out of the ring compressor just before it enters the cylinder bore and can easily be bent or distorted if the

TOOL TiP

To make a piston ring compressing tool for 1.8 litre engines, cut a strip of thin steel packing so that when it is wrapped tightly around the piston, the ends of the strip abut each other. Wrap the strip around the piston and secure with two large worm-drive hose clips to compress the rings.

fitting process continues. Citroën specify the use of a tapered cone type piston ring compressor tool, but a suitable alternative can easily be fabricated **(see Tool Tip)**.

25 Start with assembly No 1. Check that the piston rings are still spaced as described in Section 18, then liberally lubricate the piston and rings. Locate the Citroën ring compressor tool over the piston, or clamp the rings with the home-made alternative. If the home-made tool is being used, ensure that the oil control ring is fully compressed into its groove by the tool.

26 Insert the piston/connecting rod assembly into the top of cylinder No 1, ensuring that the arrow on the piston crown is pointing towards the timing belt end of the engine.

27 Hold the ring compressor tool hard against the top of the cylinder block (there must be no gap whatsoever between the bottom edge of the tool and the block face) then tap the assembly into the cylinder bore using a hammer handle against the piston crown. Continue until all the piston rings have entered the cylinder bore and the piston crown is flush with the top of the cylinder block.

28 Ensure that the upper bearing shell is still correctly installed. Liberally lubricate the crankpin and both bearing shells. Taking care not to mark the cylinder bores, pull the piston/connecting rod assembly down the bore and onto the crankpin. Refit the big-end bearing cap and insert the new retaining bolts tightened finger tight. Note that the faces with the identification marks must match (which means that the bearing shell locating tabs abut each other).

29 Tighten the bearing cap retaining bolts evenly and progressively to the specified torque setting, then through the specified angle using an angle tightening gauge.

All engines

30 Once the bearing cap retaining nuts/bolts have been correctly tightened, rotate the crankshaft. Check that it turns freely; some stiffness is to be expected if new components have been fitted, but there should be no signs of binding or tight spots.

31 Refit the other three piston/connecting rod assemblies in the same way.

32 Refit the cylinder head, oil pump and sump as described in Part A, Part B or Section 21 of this Chapter (as applicable).

21 Oil pump (1.8 litre engines) – refitting

1 Ensure that the mating surfaces of the oil pump housing and cylinder block are clean and free of oil.

2 Check that the locating dowels are in position on the pump flange then locate a new O-ring over the oil pump outlet stub **(see illustration)**.

3 Apply a thin bead of RTV sealant to the oil pump mating surface. Citroën recommend the use of Loctite Autojoint Noir for this purpose **(see illustration)**.

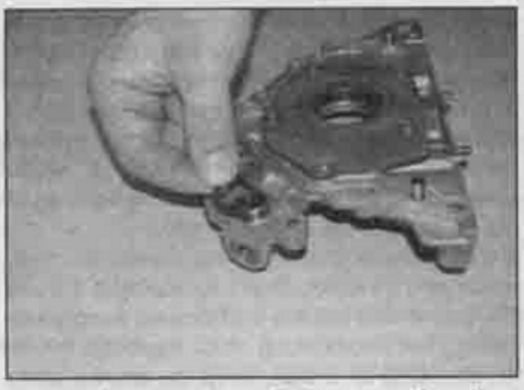
4 Prime the oil pump by injecting clean engine oil into the outlet stub, then place the pump in position on the cylinder block, engaging the locating dowels.

5 Apply thread locking compound to the threads of the nine oil pump retaining bolts, then refit the bolts and tighten them to the specified torque.

6 Position a new oil pump drive collar O-ring on the end of the crankshaft **(see illustration)**.

7 Lubricate the sealing lips of the new crankshaft right-hand oil seal and carefully fit the seal over the oil pump drive collar **(see illustrations)**. Note that the open part of the seal must be towards the shoulder of the drive collar.

8 Slide the drive collar over the end of the crankshaft and engage it with the oil pump inner rotor **(see illustration)**. As the collar

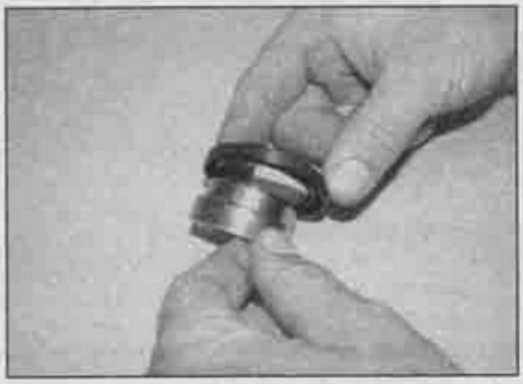


21.2 Locate a new O-ring over the oil pump outlet stub – 1.8 litre engines

21.3 Apply a thin bead of RTV sealant to the oil pump mating surface – 1.8 litre engines

21.6 Position a new oil pump drive collar O-ring on the end of the crankshaft – 1.8 litre engines

21.7a Lubricate the sealing lips of the new crankshaft right-hand oil seal . . .



21.7b . . . and carefully fit the seal over the oil pump drive collar – 1.8 litre engines

21.8 Slide the drive collar onto the crankshaft and engage it with the oil pump inner rotor – 1.8 litre engines

engages with the pump inner rotor, push the oil seal initially into place in the oil pump housing. Tap the seal fully into position using a suitable drift.

9 Refit the sump and crankshaft sprocket as described in Part B of this Chapter.

22 Engine – initial start-up after overhaul

1 With the engine refitted in the vehicle, double-check the engine oil and coolant levels. Make a final check that everything has been reconnected, and that there are no tools or rags left in the engine compartment.

2 Start the engine, noting that this may take a little longer than usual, due to the fuel system components having been disturbed. Make sure that the oil pressure warning light goes out then allow the engine to idle.

3 While the engine is idling, check for fuel, water and oil leaks. Don't be alarmed if there are some odd smells and smoke from parts getting hot and burning off oil deposits.

4 Assuming all is well, keep the engine idling until hot water is felt circulating through the top hose, then switch off the engine.

5 After a few minutes, recheck the oil and coolant levels as described in *Weekly checks*, and top-up as necessary.

6 Note that there is no need to retighten the cylinder head bolts once the engine has first run after reassembly.

7 If new pistons, rings or crankshaft bearings have been fitted, the engine must be treated as new, and run-in for the first 500 miles (800 km). *Do not* operate the engine at full-throttle, or allow it to labour at low engine speeds in any gear. It is recommended that the oil and filter be changed at the end of this period.

Chapter 2 Part E:
Diesel engine removal and overhaul procedures

Contents

Degrees of difficulty

Easy, suitable for novice with little experience 

Fairly easy, suitable for beginner with some experience 

Fairly difficult, suitable for competent DIY mechanic 

Difficult, suitable for experienced DIY mechanic 

Very difficult, suitable for expert DIY or professional 

Specifications

Note: At the time of writing, certain specifications were not available. Where the relevant specifications are not given here, refer to your Citroën dealer for further information

Cylinder head

Maximum gasket face distortion	0.03 mm
Cylinder head height	133.0 mm
Swirl chamber protrusion	0 to 0.03 mm

Cylinder block

Cylinder bore diameter:	
Standard	85.000 to 85.018 mm

Pistons

Piston diameter:	
Standard	84.210 to 84.228 mm
Maximum weight difference between any two pistons	4.0 g

Piston rings

End gaps:	
Top compression ring	0.20 to 0.35 mm
2nd compression ring	0.40 to 0.60 mm
Oil control ring	0.25 to 0.50 mm

Crankshaft

Endfloat	0.07 to 0.32 mm
Main bearing journal diameter:	
Standard	59.977 to 60.000 mm
Repair size	59.677 to 59.700 mm
Big-end bearing journal diameter:	
Standard	49.980 to 50.000 mm
Maximum bearing journal out-of-round	0.007 mm
Main bearing running clearance*	0.025 to 0.050 mm
Big-end bearing running clearance*	0.025 to 0.050 mm

These are suggested figures, typical for these types of engine – no exact values are stated by Citroën

Torque wrench settings

Refer to Chapter 2C Specifications.

1 General information

Included in this Part of Chapter 2 are details of removing the engine/transmission from the vehicle and general overhaul procedures for the cylinder head, cylinder block and all other engine internal components.

The information given ranges from advice concerning preparation for an overhaul and the purchase of replacement parts, to detailed step-by-step procedures covering removal, inspection, renovation and refitting of engine internal components.

After Section 4, all instructions are based on the assumption that the engine has been removed from the car. For information concerning in-car engine repair, as well as the removal and refitting of those external components necessary for full overhaul, refer to Part C of this Chapter and to Section 6. Ignore any preliminary dismantling operations described in Part C that are no longer relevant once the engine has been removed.

Apart from torque wrench settings, which are given at the beginning of Part C, all available specifications relating to engine overhaul are at the beginning of this Part of Chapter 2.

2 Engine overhaul – general information

It is not always easy to determine when, or if, an engine should be completely overhauled, as a number of factors must be considered.

High mileage is not necessarily an indication that an overhaul is needed, while low mileage does not preclude the need for an overhaul. Frequency of servicing is probably the most important consideration. An engine which has had regular and frequent oil and filter changes, as well as other required maintenance, should give many thousands of miles of reliable service. Conversely, a neglected engine may require an overhaul very early in its life.

Excessive oil consumption is an indication that piston rings, valve seals and/or valve guides are in need of attention. Make sure that oil leaks are not responsible before deciding that the rings and/or guides are worn. Perform a compression or leakdown test, as described in Part C of this Chapter, to determine the likely cause of the problem.

Check the oil pressure with a gauge fitted in place of the oil pressure switch, and compare it with that specified. If it is extremely low, the main and big-end bearings, and/or the oil pump, are probably worn out.

Loss of power, rough running, knocking or metallic engine noises, excessive valve gear noise, and high fuel consumption may also point to the need for an overhaul, especially if they are all present at the same time. If a complete service does not remedy the situation, major mechanical work is the only solution.

An engine overhaul involves restoring all internal parts to the specification of a new engine. During an overhaul, the cylinder bores are rebored (where necessary), and the pistons and the piston rings are renewed. New main and big-end bearings are generally fitted; if necessary, the crankshaft may be reground, to restore the journals. The valves are also serviced as well, since they are usually in less-than-perfect condition at this point. The end result should be an as-new engine that will give many trouble-free miles.

Note: *Critical cooling system components such as the hoses, thermostat and coolant pump should be renewed when an engine is overhauled. The radiator should be checked carefully, to ensure that it is not clogged or leaking. Also, it is a good idea to renew the oil pump whenever the engine is overhauled.*

Before beginning the engine overhaul, read through the entire procedure, to familiarise yourself with the scope and requirements of the job. Overhauling an engine is not difficult if you follow carefully all of the instructions, have the necessary tools and equipment, and pay close attention to all specifications. It can, however, be time-consuming. Plan on the vehicle being off the road for a minimum of two weeks, especially if parts must be taken to an engineering works for repair or reconditioning. Check on the availability of parts and make sure that any necessary special tools and equipment are obtained in advance. Most work can be done with typical hand tools, although a number of precision measuring tools are required for inspecting parts to determine if they must be renewed. Often the engineering works will handle the inspection of parts and offer advice concerning reconditioning and renewal.

Always wait until the engine has been completely dismantled, and until all components (especially the cylinder block and the crankshaft) have been inspected, before deciding what service and repair operations must be performed by an engineering works. The condition of these components will be the major factor to consider when determining whether to overhaul the original engine, or to buy a reconditioned unit. Do not, therefore, purchase parts or have overhaul work done on other components until they have been thoroughly inspected. As a general rule, time is the primary cost of an overhaul, so it does not pay to fit worn or sub-standard parts.

As a final note, to ensure maximum life and minimum trouble from a reconditioned engine, everything must be assembled with care, in a spotlessly-clean environment.

3 Engine/transmission removal – methods and precautions

If you have decided that the engine must be removed for overhaul or major repair work, several preliminary steps should be taken.

Locating a suitable place to work is extremely important. Adequate work space, along with storage space for the vehicle, will be needed. If a workshop or garage is not available, at the very least, a flat, level, clean work surface is required.

Cleaning the engine compartment and engine/transmission before beginning the removal procedure will help keep tools clean and organised.

An engine hoist will also be necessary. Make sure the equipment is rated in excess of the combined weight of the engine and transmission. Safety is of primary importance, considering the potential hazards involved in removing the engine/transmission from the vehicle.

If this is the first time you have removed an engine, an assistant should ideally be available. Advice and aid from someone more experienced would also be helpful. There are many instances when one person cannot simultaneously perform all of the operations required during engine/transmission removal.

Plan the operation ahead of time. Before starting work, arrange for the hire of or obtain all of the tools and equipment you will need. Some of the equipment necessary to perform engine/transmission removal and installation safely (in addition to an engine hoist) is as follows: a heavy duty trolley jack, complete sets of spanners and sockets as described at the rear of this manual, wooden blocks, and plenty of rags and cleaning solvent for mopping-up spilled oil, coolant and fuel. If the hoist must be hired, make sure that you arrange for it in advance, and perform all of the operations possible without it beforehand. This will save you money and time.

Plan for the vehicle to be out of use for quite a while. An engineering works will be required to perform some of the work which the do-it-yourselfer cannot accomplish without special equipment. These places often have a busy schedule, so it would be a good idea to consult them before removing the engine, in order to accurately estimate the amount of time required to rebuild or repair components that may need work.

During the engine/transmission removal procedure, it is advisable to make notes of the locations of all brackets, cable ties, earthing points, etc, as well as how the wiring harnesses, hoses and electrical connections are attached and routed around the engine and engine compartment. An effective way of doing this is to take a series of photographs of the various components before they are disconnected or removed. A simple inexpensive disposable camera is ideal for this and the resulting photographs will prove invaluable when the engine is refitted.

Always be extremely careful when removing and refitting the engine/transmission. Serious injury can result from careless actions. Plan ahead and take your time, and a job of this nature, although major, can be accomplished successfully.

The engine and transmission assembly is removed downwards from the engine compartment on all models described in this manual.

4 Engine and transmission – removal, separation, reconnection and refitting

Warning: It is essential to observe strict precautions when working on the fuel system components. Before carrying out any of the following operations, refer to the special information given in Chapter 4B, Section 2.

Removal

Note: *The engine is removed downwards from the engine compartment as a complete unit with the transmission; the two are then separated for overhaul.*

1 Disconnect the battery negative terminal (refer to *Disconnecting the battery* in the Reference Section of this manual).

2 Open and support the bonnet in its maximum height position.

3 Remove the air cleaner assembly and air inlet ducts as described in Chapter 4B.

4 Unbolt and remove the air cleaner support bracket.

5 Disconnect the vacuum hose from the braking system vacuum pump **(see illustration)**.

6 Disconnect the vacuum hoses and wiring connector at the EGR solenoid valve **(see illustration)**.

7 Referring to Chapter 4B, disconnect the fuel supply and return hose quick-release fittings at the connections above the fuel pump. Suitably plug or cover the open unions to prevent dirt entry. Release the fuel hoses from their retaining clips and move them clear of the engine.

8 Lift up the covers on the battery positive cable terminal box and unscrew the nuts securing the battery cables to the terminal studs. Lift the cables off the studs and suitably label them for correct refitting.

9 Similarly, lift off the fuse/relay box cover and unscrew the nuts securing the battery positive cables to the terminal studs. Lift the cables off the studs, release them from the fuse/relay box and suitably label them.

10 Disconnect the wiring connector from the accelerator pedal position sensor.

11 Remove the engine management ECU as described in Chapter 4B, Section 13.

12 Release the wiring harness from the retaining clips and cable ties on the ECU support tray, then undo the retaining bolts and lift out the support tray.

13 Disconnect the main engine wiring harness at the connectors in front of the fuse/relay box.

14 Working as described in Chapter 6, on models with a cable-operated clutch, disconnect the clutch cable from the transmission, and position it clear of the working area. On models with a hydraulically-operated clutch, unbolt the slave cylinder from the front of the transmission. Release the hydraulic fluid supply pipe from the support brackets and move the pipe and cylinder assembly clear of the engine/transmission.

4.5 Disconnect the vacuum hose from the braking system vacuum pump

4.6 Disconnect the EGR solenoid valve vacuum hoses and wiring connector

15 Working as described in Chapter 7, disconnect the gearchange selector cable end fittings from the transmission levers then release the cables from the support bracket.

16 Undo the bolt and release the transmission earth cable from body side-member.

17 Firmly apply the handbrake, then jack up the front of the vehicle and support it securely on axle stands (see *Jacking and vehicle support*). Note that the vehicle must be raised sufficiently high (approximately 500 mm) to enable the engine/transmission assembly to be withdrawn from under the front of the vehicle. Remove the front roadwheels.

18 Remove the auxiliary drivebelt as described in Chapter 1B.

19 If the engine is to be dismantled, drain the engine oil referring to Chapter 1B if necessary. Clean and refit the drain plug, tightening it securely.

20 Drain the cooling system as described in Chapter 1B.

21 Drain the transmission oil as described in Chapter 7. Refit the drain and filler plugs, and tighten them to their specified torque settings.

22 Disconnect the radiator top and bottom hoses from the coolant outlet housing and thermostat cover.

23 Disconnect the expansion tank hose from the coolant outlet housing.

24 Release the retaining clip and disconnect the heater matrix hoses from their connection on the engine compartment bulkhead.

25 Release the power steering fluid pipes from the clamps on the cover plate at the base of the transmission bellhousing **(see illustrations)**.

26 Position a suitable container beneath the power steering gear assembly. Undo the bolt securing the fluid pipe flange plate to the rack housing and ease the flange plate from the rack. Allow the power steering fluid to drain into the container. When the fluid has finished draining, suitably cover the pipe ends and the orifices in the rack to prevent dirt ingress.

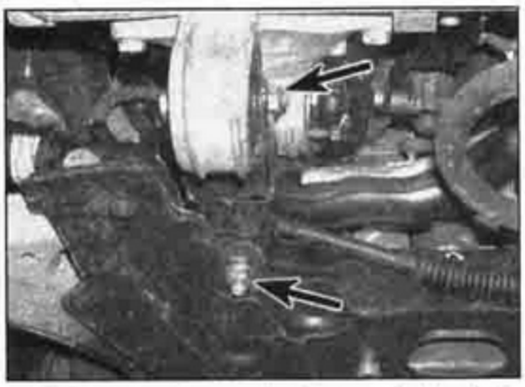
27 Slacken the retaining clip and disconnect the fluid return hose from the pipe connection below the radiator. Unscrew the union nut and disconnect the fluid supply hose from the pump. Release the pipe and hose assembly from the support bracket clamps and remove the pipes from under the vehicle. Suitably cover the pipe and hose ends and the orifices in the pump to prevent dirt ingress.

28 On models with air conditioning, disconnect the compressor wiring connector, then unbolt the compressor and position it clear of the engine. Support the weight of the compressor by tying it to the vehicle body, to prevent any excess strain being placed on the compressor lines whilst the engine is removed. *Do not* disconnect the refrigerant lines from the compressor (refer to the warnings given in Chapter 3).

29 Disconnect the exhaust system front pipe from the turbocharger.

4.25a Release the power steering fluid pipes from the clamps (arrowed) on the front . . .

4.25b . . . and rear of the transmission bellhousing cover plate



4.35 Remove the engine/transmission left-hand mounting

30 Disconnect the wiring connector from the vehicle speed sensor.
31 Remove both driveshafts as described in Chapter 8.
32 Remove the front suspension subframe as described in Chapter 10.
33 Check that all the relevant wiring connectors have been disconnected, and that the harness is released from all the clips or ties, so that it is free to be removed with the engine/transmission.
34 Manoeuvre an engine hoist into position, and attach it to the engine lifting brackets. Raise the hoist until it is just supporting the weight of the engine.
35 Slacken and remove the centre nut and washer from the engine/transmission left-hand mounting. Undo the two nuts and washers securing the mounting to its bracket, remove the mounting from the engine compartment and recover the washer and spacer **(see illustration)**.
36 Working on the right-hand engine/transmission mounting, undo the two bolts securing the stiffener bracket to the body and lift off the bracket. Unscrew the domed buffer nut, then unscrew the single nut securing the upper bracket to the rubber mounting **(see illustrations)**. Unscrew the three bolts and remove the upper bracket from the lower (engine) bracket.
37 Make a final check that any components which would prevent the removal of the engine/transmission from the vehicle have been removed or disconnected.
38 Carefully lower the engine/transmission assembly from the engine compartment, ensuring that nothing is trapped or damaged. Enlist the help of an assistant during this procedure, as it will be necessary to tilt and twist the assembly slightly to clear the body panels and adjacent components.
39 Ensure that the assembly is adequately supported using jacks or a suitable trolley, then disconnect the engine hoist and withdraw the engine/transmission out from under the front of the vehicle.

Separation

40 With the engine/transmission assembly removed, support the unit on suitable blocks of wood on a workbench (or failing that, on a clean area of the workshop floor).
41 Disconnect all the individual wiring connectors from the various components on the engine and transmission to enable the main engine wiring harness to be removed. Make notes or attach labels to each connector to aid reconnection.
42 With all wiring disconnected, detach the wiring harness support brackets and plastic ducting mountings, release the relevant cable ties and remove the complete harness assembly from the engine/transmission.
43 Undo the retaining bolts, and remove the cover plate from the transmission bellhousing.
44 Slacken and remove the retaining bolts, and remove the starter motor from the transmission.
45 Undo the bolts and release the coolant heating housing from the transmission, noting the location of the earth leads and cable clips also secured by the housing retaining bolts.
46 Ensure that both engine and transmission are adequately supported, then slacken and remove the remaining bolts securing the transmission housing to the engine. Note the correct fitted positions of each bolt (and the relevant brackets) as they are removed, to use as a reference on refitting.
47 Carefully withdraw the transmission from the engine, ensuring that the weight of the transmission is not allowed to hang on the input shaft while it is engaged with the clutch friction disc.
48 If they are loose, remove the locating dowels from the engine or transmission, and keep them in a safe place.

Reconnection

49 Apply a smear of high-melting-point grease (Citroën recommend the use of Molykote BR2 plus – available from your Citroën dealer) to the splines of the transmission input shaft. Do not apply too much, otherwise there is a possibility of the grease contaminating the clutch friction disc.
50 Ensure that the locating dowels are correctly positioned in the engine or transmission.
51 Carefully offer the transmission to the engine, until the locating dowels are engaged. Ensure that the weight of the transmission is not allowed to hang on the input shaft as it is engaged with the clutch friction disc.
52 Refit the transmission housing-to-engine bolts, ensuring that all the necessary brackets are correctly positioned, and tighten them securely.
53 Locate the main engine wiring harness on the engine and transmission and reconnect the relevant wiring connectors.
54 Refit the coolant heating housing to the transmission, ensuring that the earth leads and cable clips are correctly attached.
55 Refit the starter motor, and securely tighten its retaining bolts.
56 Refit the cover plate to the transmission bellhousing, and securely tighten its retaining bolts.

Refitting

57 Manoeuvre the engine/transmission into position beneath the engine compartment and reconnect the hoist and lifting tackle to the engine lifting brackets. With the aid of an assistant, slowly lift the assembly into the engine compartment.
58 Manoeuvre the unit as necessary to clear the surrounding components, until it is possible to attach the engine mountings. Locate the right-hand mounting upper bracket onto the lower (engine) bracket and over the rubber mounting stud. Secure the bracket to the lower (engine) bracket with the three bolts tightened to the specified torque. Refit the retaining nut to the stud on the rubber mounting and tighten it by hand only at this stage.
59 Working on the left-hand mounting, refit the rubber mounting, the mounting retaining nuts and washers, and the centre nut and washer, tightening them lightly only.
60 Rock the engine to settle it on its mountings, then go around and tighten all the mounting nuts and bolts to their specified torque settings. Once the right-hand mounting bracket nut has been tightened, refit the domed buffer nut and stiffener bracket, tightening the retaining bolts to the specified torque.
61 It is advisable at this stage to refit the front suspension subframe as described in Chapter 10. The rear engine/transmission mounting connecting link can then be refitted, thus stabilising the power unit on its mountings. The hoist can then be detached from the engine and removed.

4.36a Remove the right-hand engine mounting stiffener bracket . . .

4.36b . . . then undo the domed buffer nut and the upper bracket retaining nut

22 The remainder of the refitting procedure is a direct reversal of the removal sequence, noting the following points:

a) *Ensure that the wiring loom is correctly routed and retained by all the relevant retaining clips; all connectors should be correctly and securely reconnected.*
b) *Use new O-ring seals when refitting the power steering fluid pipes.*
c) *Prior to refitting the driveshafts to the transmission, renew the driveshaft oil seals as described in Chapter 7.*
d) *Ensure that all coolant hoses are correctly reconnected, and securely retained by their retaining clips.*
e) *Adjust the gearchange selector cables as described in Chapter 7 after reconnection.*
f) *Refill the engine and transmission with the correct quantity and type of lubricant, as described in Chapters 1B and 7.*
g) *Refill the cooling system as described in Chapter 1B.*
h) *Bleed the power steering system as described in Chapter 10.*
i) *Bleed the hydraulic clutch system as described in Chapter 6.*

5 Cylinder head – removal and refitting

Note: *Due to the limited access at the rear of the engine, it is impossible to remove the cylinder head with the engine in the car unless considerable additional dismantling is carried out first (eg, removal of the front suspension subframe and related components). The following information describes the cylinder head removal and refitting procedure with the engine/transmission removed from the car.*

Removal

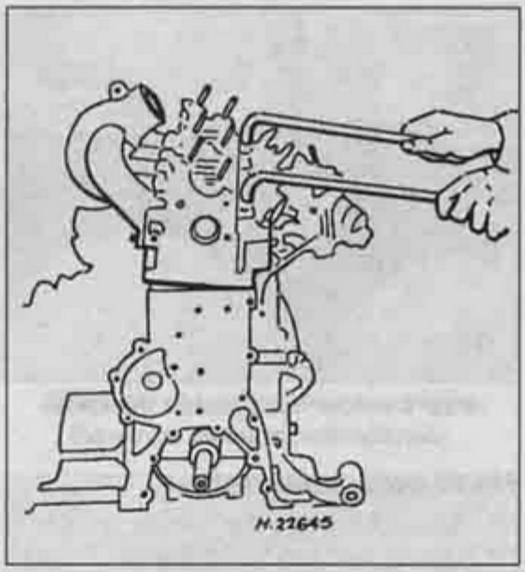
1 Remove the engine/transmission assembly as described in Section 4.
2 Remove the timing belt as described in Chapter 2C.
3 Carry out the following operations as described in Chapter 4B:

a) *Remove the exhaust manifold and turbocharger.*
b) *Remove the inlet manifold.*
c) *Remove the fuel system accumulator rail.*

4 Undo the bolts securing the right-hand engine mounting lower (engine) bracket to the cylinder head and block and remove the bracket.
5 Remove the braking system vacuum pump as described in Chapter 9.
6 Disconnect the wiring connectors and coolant hoses at the coolant outlet housing on the left-hand end of the cylinder head.
7 Undo the bolts and release the wiring harness guide from the coolant outlet housing.
8 Undo the retaining nuts and bolts and remove the fuel injector wiring harness guide left-hand support bracket.
9 Undo the mounting bolt and release the dipstick tube from the cylinder head.
10 Move all the adjacent components clear, then undo the three bolts and two nuts securing the coolant outlet housing to the cylinder head. Lift off the hose and cable support bracket, then withdraw the housing. Recover the housing gasket.
11 Remove the cylinder head cover as described in Chapter 2C.
12 Progressively slacken the cylinder head bolts, in the reverse order to that shown in illustration 5.29.
13 When all the bolts are loose, unscrew them fully and remove them from the cylinder head.
14 Release the cylinder head from the cylinder block and location dowels by rocking it. The Citroën tool for doing this consists simply of two metal rods with 90-degree angled ends **(see illustration)**. Do not prise between the mating faces of the cylinder head and block, as this may damage the gasket faces.
15 Lift the cylinder head from the block, and recover the gasket.

Preparation for refitting

16 The mating faces of the cylinder head and cylinder block must be perfectly clean before refitting the head. Citroën recommend the use of a scouring agent for this purpose, but acceptable results can be achieved by using a hard plastic or wood scraper to remove all traces of gasket and carbon. The same method can be used to clean the piston crowns. Take particular care to avoid scoring or gouging the cylinder head/cylinder block mating surfaces during the cleaning operations, as aluminium alloy is easily damaged. Make sure that the carbon is not allowed to enter the oil and water passages – this is particularly important for the lubrication system, as carbon could block the oil supply to the engine's components. Using adhesive tape and paper, seal the water, oil and bolt holes in the cylinder block. To prevent carbon entering the gap between the pistons and bores, smear a little grease in the gap. After cleaning each piston, use a small brush to remove all traces of grease and carbon from the gap, then wipe away the remainder with a clean rag.
17 Check the mating surfaces of the cylinder block and the cylinder head for nicks, deep scratches and other damage. If slight, they may be removed carefully with a file, but if excessive, machining may be the only alternative to renewal. If warpage of the cylinder head gasket surface is suspected, use a straight-edge to check it for distortion. Refer to Section 8 if necessary.
18 Thoroughly clean the threads of the cylinder head bolt holes in the cylinder block. Ensure that the bolts run freely in their threads, and that all traces of oil and water are removed from each bolt hole.

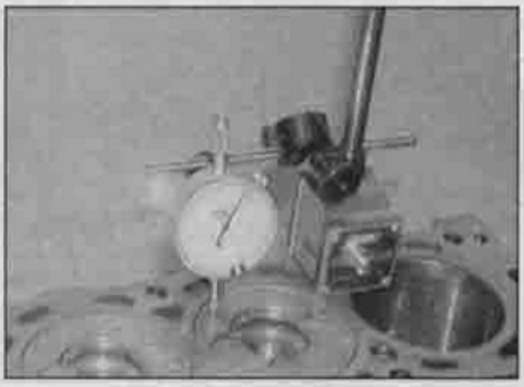


5.14 Freeing the cylinder head using angled rods

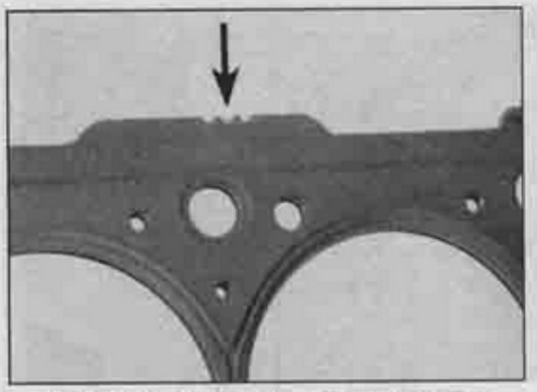
Gasket selection

19 Turn the crankshaft until pistons 1 and 4 are at TDC. Position a dial test indicator (dial gauge) on the cylinder block, and zero it on the block face. Transfer the probe to the edge of No 1 piston, then slowly turn the crankshaft back and forth past TDC, noting the highest reading on the indicator. Record this reading.
20 Repeat this measurement procedure on No 4 piston, then turn the crankshaft half a turn (180°) and repeat the procedure on Nos 2 and 3 pistons **(see illustration)**.
21 If a dial test indicator is not available, piston protrusion may be measured using a straight-edge and feeler blades or vernier calipers. However, this is much less accurate, and cannot therefore be recommended.
22 Note down the greatest piston protrusion measurement, and use this to determine the correct cylinder head gasket from the following table. The series of up to five notches on the side of the gasket are used for thickness identification **(see illustration)**.

Piston protrusion	Gasket identification
0.470 to 0.605 mm	*1 notch*
0.605 to 0.655 mm	*2 notches*
0.655 to 0.705 mm	*3 notches*
0.705 to 0.755 mm	*4 notches*
0.755 to 0.830 mm	*5 notches*



5.20 Measuring piston protrusion



5.22 Cylinder head gasket thickness identification notches (arrowed)

Head bolt examination

23 Carefully examine the cylinder head bolts for signs of damage to the threads or head, and for any sign of corrosion. If the bolts are in a satisfactory condition, measure the length of each bolt from the underside of the head, to the end of the shank. The bolts may be re-used providing that the measured length does not exceed 133.3 mm. **Note:** *Considering the stress to which the cylinder head bolts are subjected, it is highly recommended that they are all renewed, regardless of their apparent condition.*

Refitting

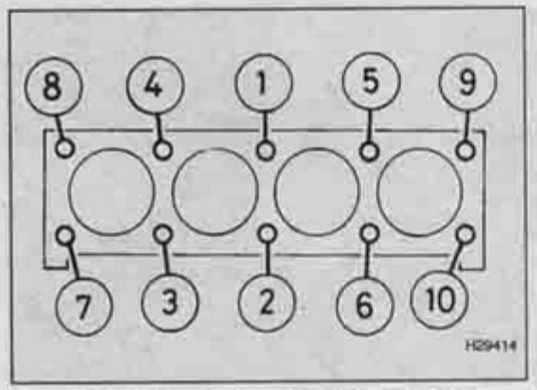
24 Turn the crankshaft clockwise (viewed from the timing belt end) until Nos 1 and 4 pistons pass bottom dead centre (BDC) and begin to rise, then position them halfway up their bores. Nos 2 and 3 pistons will also be at their mid-way positions, but descending their bores.

25 Make sure that the locating dowels are in place, then fit the correct gasket the right way round on the cylinder block, with the identification notches toward the fuel pump side of the engine.

26 Lower the cylinder head onto the block.

27 Apply a smear of grease to the threads, and to the underside of the heads, of the cylinder head bolts. Citroën recommend the use of Molykote G Rapid Plus (available from your Citroën dealer).

28 Carefully enter each bolt into its relevant hole (*do not drop it in*) and screw it in finger-tight.



5.29 Cylinder head bolt tightening sequence

29 Working progressively and in the sequence shown, tighten the cylinder head bolts to their Stage 1 torque setting, using a torque wrench and suitable socket **(see illustration)**.

30 Once all the bolts have been tightened to their Stage 1 torque setting, working again in the specified sequence, tighten each bolt to the specified Stage 2 setting. Finally, angle-tighten the bolts through the specified Stage 3 angle. It is recommended that an angle-measuring gauge is used during this stage of tightening, to ensure accuracy.

31 Refit the cylinder head cover as described in Chapter 2C.

32 Ensure that the mating face of the cylinder head and coolant outlet housing are clean then refit the housing using a new gasket. Refit the hose and cable support bracket and the housing retaining nuts and bolts. Tighten the nuts and bolts securely.

33 Refit and tighten the dipstick tube retaining bolt.

34 Refit the wiring harness guide support brackets.

35 Reconnect the coolant hoses to the thermostat housing.

36 Refit the timing belt as described in Chapter 2C.

37 Refit the accumulator rail, inlet manifold, and the exhaust manifold and turbocharger, in strict accordance with the procedures described in Chapter 4B.

38 Refit the braking system vacuum pump as described in Chapter 9.

39 Refit the right-hand engine mounting bracket with reference to Chapter 2C.

40 Refit the engine/transmission assembly as described in Section 4.

6 Engine overhaul – dismantling sequence

1 It is much easier to dismantle and work on the engine if it is mounted on a portable engine stand. These stands can often be hired from a tool hire shop. Before the engine is mounted on a stand, the flywheel should be removed, so that the stand bolts can be tightened into the end of the cylinder block.

2 If a stand is not available, it is possible to dismantle the engine with it blocked up on a sturdy workbench, or on the floor. Be extra-careful not to tip or drop the engine when working without a stand.

3 If you are going to obtain a reconditioned engine, all the external components must be removed first, to be transferred to the replacement engine (just as they will if you are doing a complete engine overhaul yourself). These components include the following:

a) Engine wiring harness and support brackets.
b) Alternator, power steering pump and air conditioning compressor mounting bracket.
c) Engine mounting brackets.
d) Coolant outlet housing.
e) Fuel filter housing.
f) Dipstick tube.
g) Fuel system components.
h) All electrical switches and sensors.
i) Inlet and exhaust manifolds and turbocharger.
j) Oil filter and oil cooler.
k) Flywheel.

Note: *When removing the external components from the engine, pay close attention to details that may be helpful or important during refitting. Note the fitted position of gaskets, seals, spacers, pins, washers, bolts, and other small items.*

4 If you are obtaining a 'short' engine (cylinder block, crankshaft, pistons and connecting rods all assembled), then the cylinder head, sump, oil pump, and timing belt will have to be removed also.

5 If you are planning a complete overhaul, the engine can be dismantled, and the internal components removed, in the order given below, referring to Part C of this Chapter unless otherwise stated.

a) Inlet and exhaust manifolds (Chapter 4B).
b) Timing belt, sprockets and tensioner.
c) Cylinder head (Section 5).
d) Flywheel.
e) Sump.
f) Oil pump.
g) Pistons/connecting rods (Section 10).
h) Crankshaft (Section 11).

6 Before beginning the dismantling and overhaul procedures, make sure that you have all of the tools necessary. Refer to *Tools and working facilities* for further information.

7 Cylinder head – dismantling

Note: *New and reconditioned cylinder heads are available from the manufacturer, and from engine overhaul specialists. Some specialist tools are required for dismantling and inspection, and new components may not be readily available. It may therefore be more practical and economical for the home mechanic to purchase a reconditioned head, rather than dismantle, inspect and recondition the original head.*

1 Remove the cylinder head as described in Section 5.

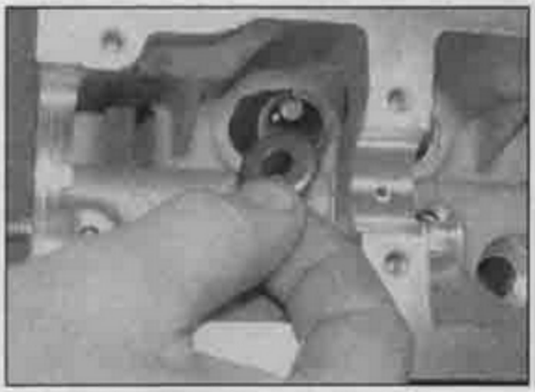
2 If not already done, remove the inlet and exhaust manifolds with reference to Chapter 4B.

3 Remove the camshaft, rocker arms and hydraulic tappets as described in Part C of this Chapter.

4 Remove the glow plugs as described in Chapter 5C and the injectors as described in Chapter 4B.

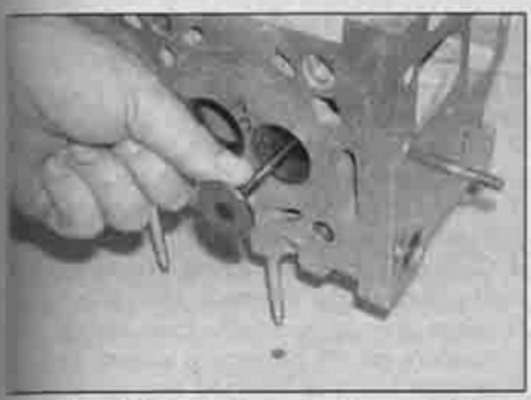
5 Using a valve spring compressor, compress each valve spring in turn until the split collets can be removed. Release the compressor, and lift off the spring retainer, and spring **(see illustrations)**.

7.5a Compress the valve spring with a spring compressor and extract the split collets



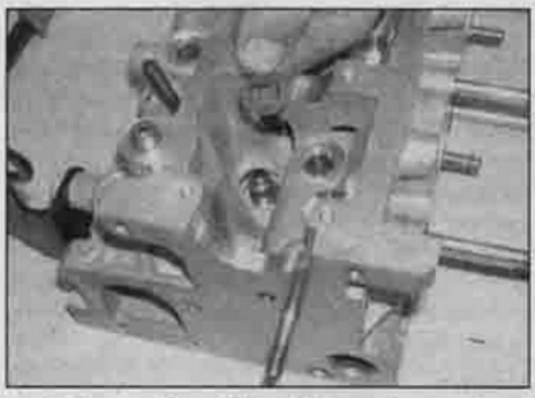
7.5b Remove the spring retainer . . .

7.5c . . . followed by the valve spring



7.7a Withdraw the valve through the combustion chamber . . .

7.7b . . . remove the valve stem oil seal . . .



7.7c . . . then lift out the spring seat

4 If, when the valve spring compressor is screwed down, the spring retainer refuses to free and expose the split collets, gently tap the top of the tool, directly over the retainer, with a light hammer. This will free the retainer.

7 Withdraw the valve through the combustion chamber, remove the valve stem oil seal from the top of the guide, then lift out the spring seat **(see illustrations)**.

8 It is essential that each valve is stored together with its collets, retainer, spring, and spring seat. The valves should also be kept in their correct sequence, unless they are so badly worn that they are to be renewed. If they are going to be kept and used again, place each valve assembly in a labelled polythene bag or similar small container **(see illustration)**. Note that No 1 valve is nearest to the transmission (flywheel) end of the engine.

8 Cylinder head and valves – cleaning and inspection

1 Thorough cleaning of the cylinder head and valve components, followed by a detailed inspection, will enable you to decide how much valve service work must be carried out during the engine overhaul. **Note:** *If the engine has been severely overheated, it is best to assume that the cylinder head is warped – check carefully for signs of this.*

Cleaning

2 Remove all traces of old gasket material from the cylinder head. Citroën recommend the use of a scouring agent for this purpose, but acceptable results can be achieved by using a hard plastic or wood scraper to remove all traces of gasket and carbon.

3 Similarly, remove the carbon from the combustion chambers and ports, then wash the cylinder head thoroughly with paraffin or a suitable solvent.

4 Scrape off any heavy carbon deposits that may have formed on the valves, then use a power-operated wire brush to remove deposits from the valve heads and stems.

Inspection

Note: *Be sure to perform all the following inspection procedures before concluding that the services of a machine shop or engine overhaul specialist are required. Make a list of all items that require attention.*

Cylinder head

5 Inspect the head very carefully for cracks, evidence of coolant leakage, and other damage. If cracks are found, a new cylinder head should be obtained.

6 Use a straight-edge and feeler blade to check that the cylinder head gasket surface is not distorted **(see illustration)**. If it is, it may be possible to have it machined, provided that the cylinder head height is not significantly reduced.

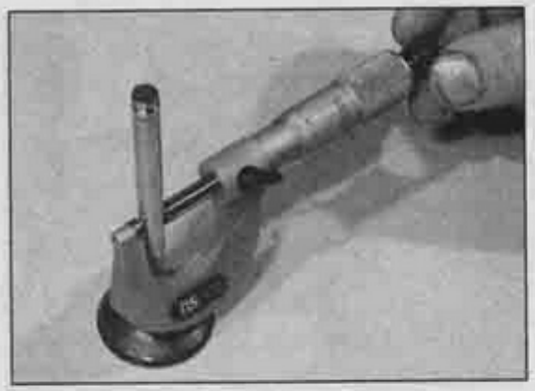
7 Examine the valve seats in each of the combustion chambers. If they are severely pitted, cracked, or burned, they will need to be renewed or recut by an engine overhaul specialist. If they are only slightly pitted, this

7.8 Place each valve and its associated components in a labelled polythene bag

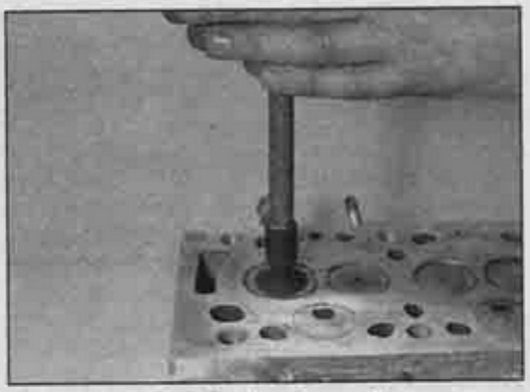
can be removed by grinding-in the valve heads and seats with fine valve-grinding compound, as described below.

8 Check the valve guides for wear by inserting the relevant valve, and checking for

8.6 Checking the cylinder head gasket surface for distortion



8.11 Measuring a valve stem diameter



8.14 Grinding-in a valve

side-to-side motion of the valve. A very small amount of movement is acceptable. If the movement seems excessive, remove the valve. Measure the valve stem diameter (see below), and renew the valve if it is worn. If the valve stem is not worn, the wear must be in the valve guide, and the guide must be renewed. The renewal of valve guides is best carried out by an engine overhaul specialist, who will have the necessary tools available.

9 If renewing the valve guides, the valve seats should be recut or reground only *after* the guides have been fitted.

Valves

10 Examine the head of each valve for pitting, burning, cracks, and general wear. Check the valve stem for scoring and wear ridges. Rotate the valve, and check for any obvious indication that it is bent. Look for pits or excessive wear on the tip of each valve stem. Renew any valve that shows any such signs of wear or damage.

11 If the valve appears satisfactory at this stage, measure the valve stem diameter at several points using a micrometer **(see illustration)**. Any significant difference in the readings obtained indicates wear of the valve stem. Should any of these conditions be apparent, the valve(s) must be renewed.

12 If the valves are in satisfactory condition, they should be ground (lapped) into their respective seats, to ensure a smooth, gas-tight seal. If the seat is only lightly pitted, or if it has been recut, fine grinding compound *only* should be used to produce the required finish. Coarse valve-grinding compound should *not* be used, unless a seat is badly burned or deeply pitted. If this is the case, the cylinder head and valves should be inspected by an expert, to decide whether seat recutting, or even the renewal of the valve or seat insert (where possible) is required.

13 Valve grinding is carried out as follows. Place the head upside-down on blocks, on a bench.

14 Smear a trace of (the appropriate grade of) valve-grinding compound on the seat face, and press a suction grinding tool onto the valve head **(see illustration)**. With a semi-rotary action, grind the valve head to its seat, lifting the valve occasionally to redistribute the grinding compound. A light spring placed under the valve head will greatly ease this operation.

15 If coarse grinding compound is being used, work only until a dull, matt even surface is produced on both the valve seat and the valve, then wipe off the used compound, and repeat the process with fine compound. When a smooth unbroken ring of light grey matt finish is produced on both the valve and seat, the grinding operation is complete. *Do not* grind-in the valves any further than absolutely necessary, or the seat will be prematurely sunk into the cylinder head.

16 When all the valves have been ground-in, carefully wash off *all* traces of grinding compound using paraffin or a suitable solvent, before reassembling the cylinder head.

Valve components

17 Examine the valve springs for signs of damage and discoloration. No minimum free length is specified by Citroën, so the only way of judging valve spring wear is by comparison with a new component.

18 Stand each spring on a flat surface, and check it for squareness. If any of the springs are damaged, distorted or have lost their tension, obtain a complete new set of springs. It is normal to fit new springs as a matter of course if a major overhaul is being carried out.

19 Renew the valve stem oil seals regardless of their apparent condition.

9 Cylinder head – reassembly

1 Working on the first valve assembly, refit the spring seat then dip the new valve stem oil seal in fresh engine oil. Locate the seal on the valve guide and press the seal firmly onto the guide using a suitable socket **(see illustrations)**.

2 Lubricate the stem of the first valve, and insert it in the guide **(see illustration)**.

3 Locate the valve spring on top of its seat, then refit the spring retainer.

4 Compress the valve spring, and locate the split collets in the recess in the valve stem. Release the compressor, then repeat the procedure on the remaining valves. Ensure that each valve is inserted into its original location. If new valves are being fitted, insert them into the locations to which they have been ground.

> **HAYNES HiNT** ***Use a little dab of grease to hold the collets in position on the valve stem while the spring compressor is released.***

5 With all the valves installed, place the cylinder head on blocks on the bench and, using a hammer and interposed block of wood, tap the end of each valve stem to settle the components.

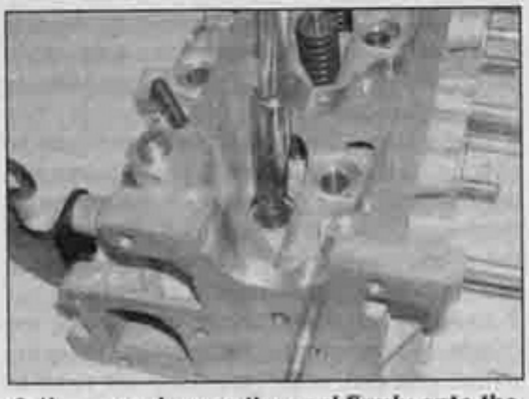
6 Refit the camshaft, hydraulic tappets and rocker arms as described in Part C of this Chapter.

7 Refit the glow plugs as described in Chapter 5C.

8 Refit the inlet and exhaust manifolds and fuel injectors with reference to Chapter 4B.

9 The cylinder head can then be refitted as described in Section 5.

9.1a Locate the valve stem oil seal on the valve guide . . .



9.1b . . . and press the seal firmly onto the guide using a suitable socket

9.2 Lubricate the stem of the valve and insert it in the guide

10 Piston/connecting rod assembly – removal

1 Remove the cylinder head, sump and oil pump as described in this Part, or in Part C of this Chapter (as applicable).
2 If there is a pronounced wear ridge at the top of any bore, it may be necessary to remove it with a scraper or ridge reamer, to avoid piston damage during removal. Such a ridge indicates excess bore wear.
3 Using quick-drying paint, mark each connecting rod and big-end bearing cap with its respective cylinder number on the flat machined surface provided; if the engine has been dismantled before, note carefully any identifying marks made previously **(see illustration)**. Note that No 1 cylinder is at the transmission (flywheel) end of the engine.
4 Turn the crankshaft to bring pistons 1 and 4 to BDC (bottom dead centre).
5 Unscrew the nuts from No 1 piston big-end bearing cap. Take off the cap, and recover the bottom half bearing shell **(see illustration)**. If the bearing shells are to be re-used, tape the cap and the shell together.
6 To prevent the possibility of damage to the crankshaft bearing journals, tape over the connecting rod stud threads.
7 Using a hammer handle, push the piston up through the bore, and remove it from the top of the cylinder block. Recover the bearing shell, and tape it to the connecting rod for safe-keeping.

10.3 Connecting rod and big-end bearing cap identification marks (No 3 shown)

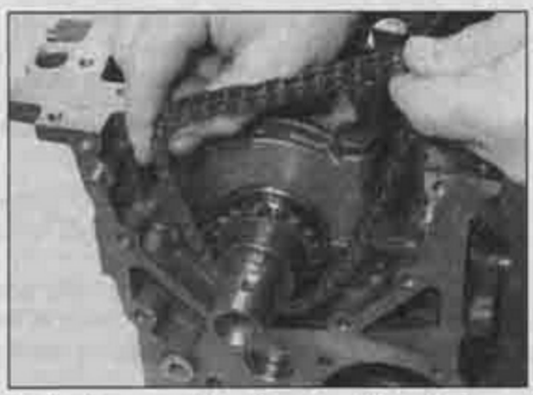
10.5 Removing a big-end bearing cap and shell

8 Loosely refit the big-end cap to the connecting rod, and secure with the nuts – this will help to keep the components in their correct order.
9 Remove No 4 assembly in the same way.
10 Turn the crankshaft through 180° to bring pistons 2 and 3 to BDC (bottom dead centre), and remove them in the same way.

11 Crankshaft – removal

1 Remove the crankshaft sprocket and the oil pump as described in Part C of this Chapter.
2 Remove the pistons and connecting rods, as described in Section 10. If no work is to be done on the pistons and connecting rods, there is no need to remove the cylinder head, or to push the pistons out of the cylinder bores. The pistons should just be pushed far enough up the bores so that they are positioned clear of the crankshaft journals.
3 Check the crankshaft endfloat as described in Section 14, then proceed as follows.
4 Slacken and remove the retaining bolts, and remove the oil seal carrier from the right-hand end of the cylinder block, along with its gasket (where fitted) **(see illustration)**.
5 Remove the oil pump drive chain, and slide the drive sprocket and spacer (where fitted) off the end of the crankshaft. Remove the Woodruff key, and store it with the sprocket for safe-keeping **(see illustrations)**.
6 The main bearing caps should be numbered 1 to 5, starting from the transmission (flywheel) end of the engine **(see illustration)**. If not, mark them accordingly using quick-drying paint. Also note the correct fitted depth of the left-hand crankshaft oil seal in the bearing cap.
7 Slacken and remove the main bearing cap retaining bolts, and lift off each bearing cap. Recover the lower bearing shells, and tape them to their respective caps for safe-keeping. Also recover the lower thrustwasher halves from the side of No 2 main bearing cap **(see illustration)**. Remove the sealing strips from the sides of No 1 main bearing cap, and discard them.
8 Lift out the crankshaft **(see illustration)**, and discard the left-hand oil seal.
9 Recover the upper bearing shells from the

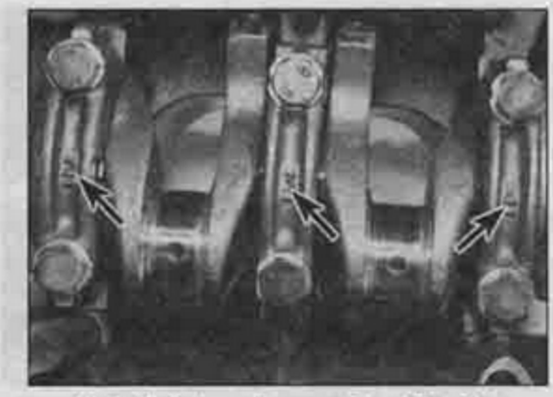
11.4 Removing the oil seal carrier from the right-hand end of the block



11.5a Remove the oil pump drive chain . . .

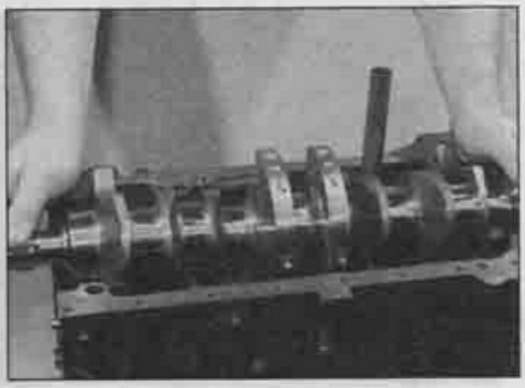
11.5b . . . then slide off the drive sprocket . . .

11.5c . . . and remove the Woodruff key from the crankshaft

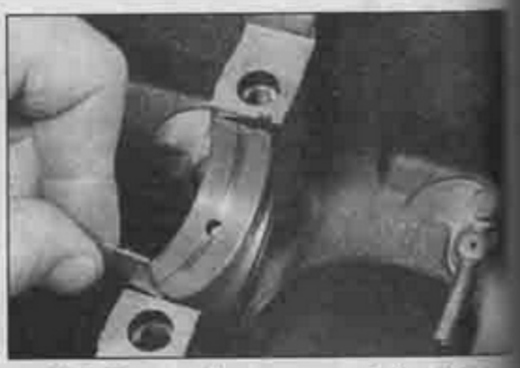


11.6 Main bearing cap identification markings (arrowed)

11.7 Removing No 2 main bearing cap. Note the thrustwasher (arrowed)



11.8 Lifting out the crankshaft



11.9 Remove the upper main bearing shells from the cylinder block, and store them with their lower shells

cylinder block **(see illustration)**, and tape them to their respective caps for safe-keeping. Remove the upper thrustwasher halves from the side of No 2 main bearing, and store them with the lower halves.

12 Cylinder block/crankcase – cleaning and inspection

Cleaning

1 Remove all external components and electrical switches/sensors from the block. For complete cleaning, the core plugs should ideally be removed **(see illustration)**. Drill a small hole in the plugs, then insert a self-tapping screw into the hole. Pull out the plugs by pulling on the screw with a pair of grips, or by using a slide hammer.

2 Undo the retaining bolt and remove the piston oil jet spray tube from inside the cylinder block.

3 Scrape all traces of gasket from the cylinder block, taking care not to damage the gasket/sealing surfaces.

4 Remove all oil gallery plugs (where fitted). The plugs are usually very tight – they may have to be drilled out, and the holes retapped. Use new plugs when the engine is reassembled.

5 If the cylinder block is extremely dirty, it should be steam-cleaned.

6 After steam-cleaning, clean all oil holes and oil galleries one more time. Flush all internal passages with warm water until the water runs clear. Dry thoroughly, and apply a light film of oil to the cylinder bores and all mating surfaces, to prevent rusting. If you have access to compressed air, use it to speed up the drying process, and to blow out all the oil holes and galleries.

Warning: Wear eye protection when using compressed air.

7 If the cylinder block is not very dirty, you can do an adequate cleaning job with very hot, soapy water and a stiff brush. Take plenty of time, and do a thorough job. Regardless of the cleaning method used, be sure to clean all oil holes and galleries very thoroughly, and to dry all components well. Protect the cylinder bores as described above, to prevent rusting.

8 All threaded holes must be clean, to ensure accurate torque readings during reassembly. To clean the threads, run the correct-size tap into each of the holes to remove rust, corrosion, thread sealant or sludge, and to restore damaged threads **(see illustration)**. If possible, use compressed air to clear the holes of debris produced by this operation.

Warning: Wear eye protection when using compressed air.

9 Apply suitable sealant to the new oil gallery plugs, and insert them into the holes in the block. Tighten them securely.

10 Apply suitable sealant to the new core plugs, and insert them into the holes in the block. Tap them into place with a socket which just fits into the plugs.

11 On engines with a piston oil jet spray tube, clean the threads of the oil jet retaining bolt, and apply a drop of thread-locking compound to the bolt threads. Refit the piston oil jet spray tube to the cylinder block, and tighten its retaining bolt to the specified torque setting.

12 If the engine is not going to be reassembled right away, cover it with a large plastic bag to keep it clean; protect all mating surfaces and the cylinder bores as described above, to prevent rusting.

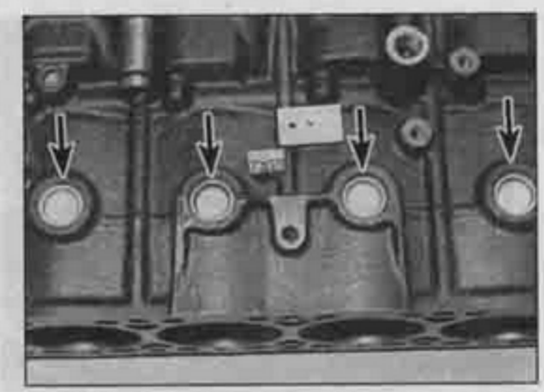
Inspection

13 Visually check the block for cracks and corrosion. Look for stripped threads in the threaded holes. If there has been any history of internal water leakage, it may be worthwhile having an engine overhaul specialist check the cylinder block with special equipment. If defects are found, have them repaired if possible, or renew the assembly.

14 Check each cylinder bore for scuffing and scoring. Check for signs of a wear ridge at the top of the cylinder, indicating that the bore is excessively worn.

15 If the necessary measuring equipment is available, measure the bore diameter of each cylinder at the top (just under the wear ridge), centre, and bottom of the cylinder bore, parallel to the crankshaft axis.

16 Next, measure the bore diameter at the same three locations, at right-angles to the crankshaft axis. Compare the results with the figures given in the Specifications. If there is any doubt about the condition of the cylinder bores, seek the advice of an engine reconditioning specialist or Citroën dealer.



12.1 Cylinder block core plugs (arrowed)

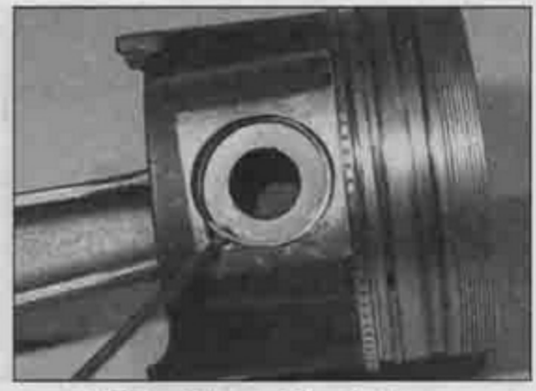
12.8 Cleaning a cylinder block threaded hole using a suitable tap

13 Piston/connecting rod assembly – inspection

1 Before the inspection process can begin, the piston/connecting rod assemblies must be cleaned, and the original piston rings removed from the pistons.

2 Carefully expand the old rings over the top of the pistons. The use of two or three old feeler blades will be helpful in preventing the rings dropping into empty grooves **(see illustration)**. Be careful not to scratch the piston with the ends of the ring. The rings are brittle, and will snap if they are spread too far

13.2 Removing a piston ring with the aid of a feeler blade



13.14a Prise out the circlip . . .

13.14b . . . and withdraw the gudgeon pin

They are also very sharp – protect your hands and fingers. Note that the third ring incorporates an expander. Always remove the rings from the top of the piston. Keep each set of rings with its piston if the old rings are to be re-used.

3 Scrape away all traces of carbon from the top of the piston. A hand-held wire brush (or a piece of fine emery cloth) can be used, once the majority of the deposits have been scraped away.

4 Remove the carbon from the ring grooves in the piston, using an old ring. Break the ring in half to do this (be careful not to cut your fingers – piston rings are sharp). Be careful to remove only the carbon deposits – do not remove any metal, and do not nick or scratch the sides of the ring grooves.

5 Once the deposits have been removed, clean the piston/connecting rod assembly with paraffin or a suitable solvent, and dry thoroughly. Make sure that the oil return holes in the ring grooves are clear.

6 If the pistons and cylinder bores are not damaged or worn excessively, the original pistons can be refitted. Normal piston wear shows up as even vertical wear on the piston thrust surfaces, and slight looseness of the top ring in its groove. New piston rings should always be used when the engine is reassembled.

7 Carefully inspect each piston for cracks around the skirt, around the gudgeon pin holes, and at the piston ring 'lands' (between the ring grooves).

8 Look for scoring and scuffing on the piston skirt, holes in the piston crown, and burned areas at the edge of the crown. If the skirt is scored or scuffed, the engine may have been suffering from overheating, and/or abnormal combustion which caused excessively high operating temperatures. The cooling and lubrication systems should be checked thoroughly. Scorch marks on the sides of the pistons show that blow-by has occurred. A hole in the piston crown, or burned areas at the edge of the piston crown, indicates that abnormal combustion has been occurring. If any of the above problems exist, the causes must be investigated and corrected, or the damage will occur again.

9 Corrosion of the piston, in the form of pitting, indicates that coolant has been leaking into the combustion chamber and/or the crankcase. Again, the cause must be corrected, or the problem may persist in the rebuilt engine.

10 Examine each connecting rod carefully for signs of damage, such as cracks around the big-end and small-end bearings. Check that the rod is not bent or distorted. Damage is highly unlikely, unless the engine has been seized or badly overheated. Detailed checking of the connecting rod assembly can only be carried out by an engine specialist with the necessary equipment.

11 Note that the big-end cap nuts and bolts must be renewed as a complete set prior to refitting. This should be done after the big-end bearing running clearance check has been carried out (see Section 19). The bolts can be simply tapped out of the connecting rods and new bolts fitted in the same way.

12 The gudgeon pins are of the floating type, secured in position by two circlips in each piston. The pistons and connecting rods can be separated as follows.

13 Before separating the piston and connecting rod, check the position of the valve recesses on the piston crown in relation to the connecting rod big-end bearing shell cut-outs and make a note of the orientation. On the new engine dismantled in the Haynes workshop during the preparation of this manual, the piston-to-connecting rod orientation did not agree with the manufacturer's technical documentation.

14 Using a small flat-bladed screwdriver, prise out the circlips, and push out the gudgeon pin **(see illustrations)**. Hand pressure should be sufficient to remove the pin. Identify the piston and rod to ensure correct reassembly. Discard the circlips – new ones *must* be used on refitting.

15 Examine the gudgeon pin and connecting rod small-end bearing for signs of wear or damage. Wear can be cured by renewing both the pin and bush. Bush renewal, however, is a specialist job – press facilities are required, and the new bush must be reamed accurately.

16 The connecting rods themselves should not be in need of renewal, unless seizure or some other major mechanical failure has occurred. Check the alignment of the connecting rods visually, and if the rods are not straight, take them to an engine overhaul specialist for a more detailed check.

17 Examine all components, and obtain any new parts from your Citroën dealer. If new pistons are purchased, they will be supplied complete with gudgeon pins and circlips. Circlips can also be purchased individually.

18 Position the piston in relation to the connecting rod as noted during separation.

19 Apply a smear of clean engine oil to the gudgeon pin and slide it into the piston and through the connecting rod small-end. Check that the piston pivots freely on the rod, then secure the gudgeon pin in position with two new circlips. Ensure that each circlip is correctly located in its groove in the piston.

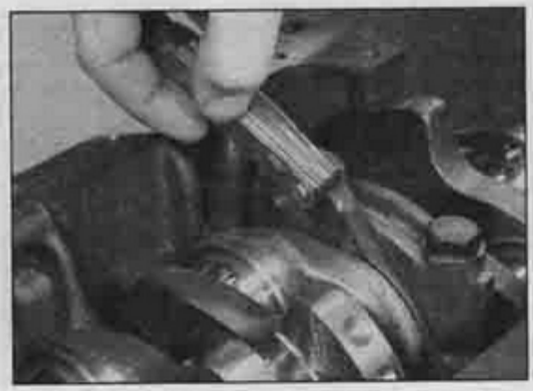
14 Crankshaft – inspection

Checking endfloat

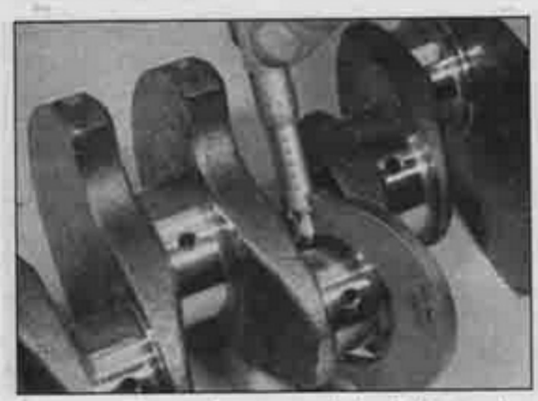
1 If the crankshaft endfloat is to be checked, this must be done when the crankshaft is still installed in the cylinder block, but is free to move.

2 Check the endfloat using a dial gauge in contact with the end of the crankshaft. Push the crankshaft fully one way, and then zero the gauge. Push the crankshaft fully the other way, and check the endfloat. The result can be compared with the specified amount, and will give an indication as to whether new thrustwashers are required **(see illustration)**.

14.2 Checking crankshaft endfloat using a dial gauge



14.3 Checking crankshaft endfloat using feeler blades



14.10 Measuring a crankshaft big-end journal diameter

3 If a dial gauge is not available, feeler blades can be used. First push the crankshaft fully towards the flywheel end of the engine, then use feeler blades to measure the gap between the web of No 2 crankpin and the thrustwasher **(see illustration)**.

Inspection

4 Clean the crankshaft using paraffin or a suitable solvent, and dry it, preferably with compressed air if available. Be sure to clean the oil holes with a pipe cleaner or similar probe, to ensure that they are not obstructed.

Warning: Wear eye protection when using compressed air.

5 Check the main and big-end bearing journals for uneven wear, scoring, pitting and cracking.

6 Big-end bearing wear is accompanied by distinct metallic knocking when the engine is running (particularly noticeable when the engine is pulling from low speed) and some loss of oil pressure.

7 Main bearing wear is accompanied by severe engine vibration and rumble – getting progressively worse as engine speed increases – and again by loss of oil pressure.

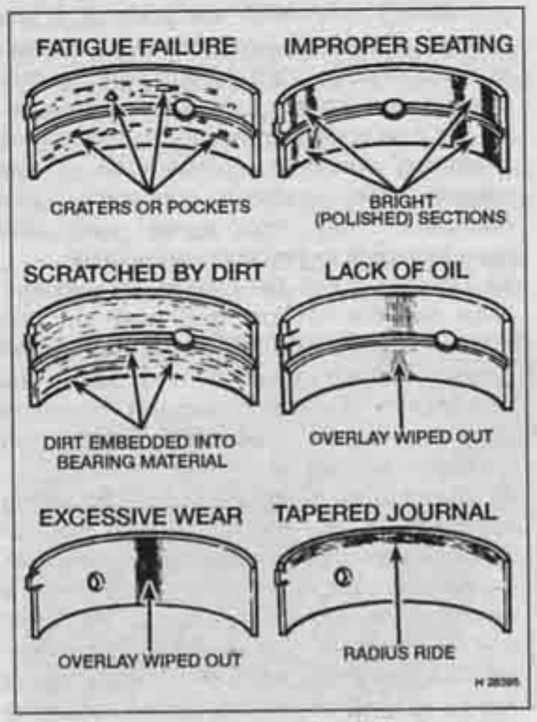
8 Check the bearing journal for roughness by running a finger lightly over the bearing surface. Any roughness (which will be accompanied by obvious bearing wear) indicates that the crankshaft requires regrinding (where possible) or renewal.

9 If the crankshaft has been reground, check for burrs around the crankshaft oil holes (the holes are usually chamfered, so burrs should not be a problem unless regrinding has been carried out carelessly). Remove any burrs with a fine file or scraper, and thoroughly clean the oil holes as described previously.

10 Using a micrometer, measure the diameter of the main and big-end bearing journals, and compare the results with the Specifications **(see illustration)**. By measuring the diameter at a number of points around each journal's circumference, you will be able to determine whether or not the journal is out-of-round. Take the measurement at each end of the journal, near the webs, to determine if the journal is tapered. Compare the results obtained with those given in the Specifications.

11 Check the oil seal contact surfaces at each end of the crankshaft for wear and damage. If the seal has worn a deep groove in the surface of the crankshaft, consult an engine overhaul specialist; repair may be possible, but otherwise a new crankshaft will be required.

12 Citroën supply oversize bearing shells for the main bearings but not for the big-end bearings. It may, however, be possible to obtain oversize big-end bearing shells from an alternative source. Where oversize bearing shells are available, if the crankshaft journals have not already been reground, it may be possible to have the crankshaft reconditioned, and to fit the oversize shells. Where oversize shells are not available, or if the crankshaft has already been reconditioned, it will have to be renewed if worn beyond the specified limits. Consult your Citroën dealer or engine specialist for further information on parts availability.



15.2 Typical bearing failures

15 Main and big-end bearings – inspection

1 Even though the main and big-end bearings should be renewed during the engine overhaul, the old bearings should be retained for close examination, as they may reveal valuable information about the condition of the engine. The bearing shells are graded by thickness, the grade of each shell being indicated by the colour code, or size identification, marked on it.

2 Bearing failure can occur due to lack of lubrication, the presence of dirt or other foreign particles, overloading the engine, or corrosion **(see illustration)**. Regardless of the cause of bearing failure, the cause must be corrected (where applicable) before the engine is reassembled, to prevent it from happening again.

3 When examining the bearing shells, remove them from the cylinder block, the main bearing caps, the connecting rods and the connecting rod big-end bearing caps. Lay them out on a clean surface in the same general position as their location in the engine. This will enable you to match any bearing problems with the corresponding crankshaft journal. *Do not* touch any shell's bearing surface with your fingers while checking it, or the delicate surface may be scratched.

4 Dirt and other foreign matter gets into the engine in a variety of ways. It may be left in the engine during assembly, or it may pass through filters or the crankcase ventilation system. It may get into the oil, and from there into the bearings. Metal chips from machining operations and normal engine wear are often present. Abrasives are sometimes left in engine components after reconditioning, especially when parts are not thoroughly cleaned using the proper cleaning methods. Whatever the source, these foreign objects often end up embedded in the soft bearing material, and are easily recognised. Large particles will not embed in the bearing, and will score or gouge the bearing and journal. The best prevention for this cause of bearing failure is to clean all parts thoroughly, and keep everything spotlessly-clean during engine assembly. Frequent and regular engine oil and filter changes are also recommended.

5 Lack of lubrication (or lubrication breakdown) has a number of interrelated causes. Excessive heat (which thins the oil), overloading (which squeezes the oil from the bearing face) and oil leakage (from excessive bearing clearances, worn oil pump or high engine speeds) all contribute to lubrication breakdown. Blocked oil passages, which usually are the result of misaligned oil holes in a bearing shell, will also oil-starve a bearing and destroy it. When lack of lubrication is the cause of bearing failure, the bearing material is wiped or extruded from the steel backing of

the bearing. Temperatures may increase to the point where the steel backing turns blue from overheating.

6 Driving habits can have a definite effect on bearing life. Full-throttle, low-speed operation (labouring the engine) puts very high loads on bearings, tending to squeeze out the oil film. These loads cause the bearings to flex, which produces fine cracks in the bearing face (fatigue failure). Eventually, the bearing material will loosen in pieces, and tear away from the steel backing.

7 Short-distance driving leads to corrosion of bearings, because insufficient engine heat is produced to drive off the condensed water and corrosive gases. These products collect in the engine oil, forming acid and sludge. As the oil is carried to the engine bearings, the acid attacks and corrodes the bearing material.

8 Incorrect bearing installation during engine assembly will lead to bearing failure as well. Tight-fitting bearings leave insufficient bearing running clearance, and will result in oil starvation. Dirt or foreign particles trapped behind a bearing shell result in high spots on the bearing, which lead to failure.

9 *Do not* touch any shell's bearing surface with your fingers during reassembly; there is a risk of scratching the delicate surface, or of depositing particles of dirt on it.

10 As mentioned at the beginning of this Section, the bearing shells should be renewed as a matter of course during engine overhaul; to do otherwise is false economy.

16 Engine overhaul – reassembly sequence

1 Before reassembly begins, ensure that all new parts have been obtained, and that all necessary tools are available. Read through the entire procedure to familiarise yourself with the work involved, and to ensure that all items necessary for reassembly of the engine are at hand. In addition to all normal tools and materials, thread-locking compound will be needed. A suitable tube of liquid sealant will also be required for the joint faces that are fitted without gaskets. It is recommended that Citroën's own products are used, which are specially formulated for this purpose; the relevant product names are quoted in the text of each Section where they are required.

2 In order to save time and avoid problems, engine reassembly can be carried out in the following order:

a) *Crankshaft (See Section 18).*
b) *Piston/connecting rod assemblies (See Section 19).*
c) *Oil pump (See Part C).*
d) *Sump (See Part C).*
e) *Flywheel (See Part C).*
f) *Cylinder head (See Section 5).*
g) *Timing belt tensioner and sprockets, and timing belt (See Part C).*

17.5 Measuring a piston ring end gap

h) Engine external components.

3 At this stage, all engine components should be absolutely clean and dry, with all faults repaired. The components should be laid out (or in individual containers) on a completely clean work surface.

17 Piston rings – refitting

1 Before fitting new piston rings, the ring end gaps must be checked as follows.

2 Lay out the piston/connecting rod assemblies and the new piston ring sets, so that the ring sets will be matched with the same piston and cylinder during the end gap measurement and subsequent engine reassembly.

3 Insert the top ring into the first cylinder, and push it down the bore using the top of the piston. This will ensure that the ring remains square with the cylinder walls. Position the ring near the bottom of the cylinder bore, at the lower limit of ring travel. Note that the top and second compression rings are different. The second ring is easily identified by the fact that its outer face is tapered.

4 Measure the end gap using feeler blades.

5 Repeat the procedure with the ring at the top of the cylinder bore, at the upper limit of its travel, and compare the measurements with the figures given in the Specifications **(see illustration)**.

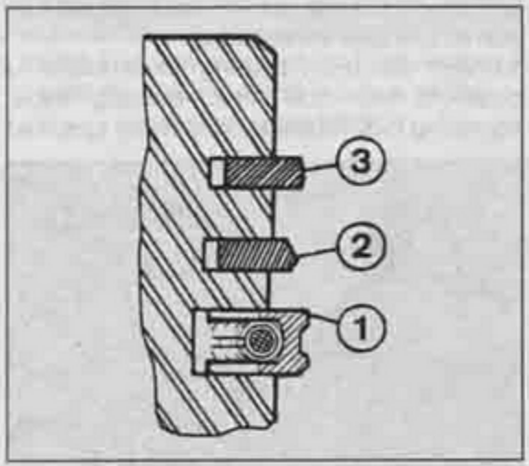
6 If the gap is too small (unlikely if genuine Citroën parts are used), it must be enlarged, or the ring ends may contact each other during engine operation, causing serious damage. Ideally, new piston rings providing the correct end gap should be fitted. As a last resort, the end gap can be increased by filing the ring ends very carefully with a fine file. Mount the file in a vice equipped with soft jaws, slip the ring over the file with the ends contacting the file face, and slowly move the ring to remove material from the ends. Take care, as piston rings are sharp, and are easily broken.

7 With new piston rings, it is unlikely that the end gap will be too large. If the gaps are too large, check that you have the correct rings for your engine and for the cylinder bore size.

8 Repeat the checking procedure for each ring in the first cylinder, and then for the rings in the remaining cylinders. Remember to keep rings, pistons and cylinders matched up.

9 Once the ring end gaps have been checked and if necessary corrected, the rings can be fitted to the pistons.

10 Fit the piston rings using the same technique as for removal. Fit the bottom (oil control) ring first, and work up. When fitting the oil control ring, first insert the expander (where fitted), then fit the ring with its gap positioned 180° from the expander gap. Ensure that the second compression ring is fitted the correct way up, with its identification mark (either a dot of paint or the word TOP stamped on the ring surface) at the top, and the stepped surface, or the larger diameter of the taper at the bottom **(see illustration)**. Arrange the gaps of the top and second compression rings 120° either side of the oil control ring gap. **Note:** *Always follow any instructions supplied with the new piston ring sets – different manufacturers may specify different procedures. Do not mix up the top and second compression rings, as they have different cross-sections.*



17.10 Piston ring fitting diagram (typical)

1 Oil control ring
2 Second compression ring
3 Top compression ring

18 Crankshaft – refitting and main bearing running clearance check

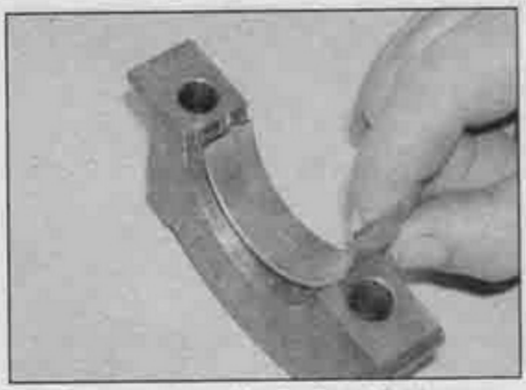
Note: *It is recommended that new main bearing shells are fitted regardless of the condition of the original ones.*

Selection of bearing shells

1 There are two different sizes of main bearing shell available; the standard size shell for use with an original crankshaft and an oversize shell for use once the crankshaft has been reground.

2 The relevant set of bearing shells required can be obtained by measuring the diameter of the crankshaft main bearing journals (see Section 14). This will show if the crankshaft is original or whether its journals have been

18.7a Fit the bearing shells, ensuring that the tab engages in the notch in the cylinder block . . .



18.7b . . . and in the bearing cap

18.12 Plastigauge in place on a crankshaft main bearing journal

reground, identifying if either standard or oversize bearing shells are required.

3 If the access to the necessary measuring equipment cannot be gained, the size of the bearing shells can be identified by the markings stamped on the rear of each shell. Details of these markings should be supplied to your Citroën dealer who will then be able to identify the size of shell fitted.

4 Whether the original shells or new shells are being fitted, it is recommended that the running clearance is checked as follows prior to installation.

Main bearing clearance check

5 The running clearance check can be carried out using the original bearing shells. However, it is preferable to use a new set, since the results obtained will be more conclusive.

6 Clean the backs of the bearing shells, and the bearing locations in both the cylinder block and the main bearing caps.

7 Press the bearing shells into their locations, ensuring that the tab on each shell engages in the notch in the cylinder block or bearing cap **(see illustrations)**. Take care not to touch any shell's bearing surface with your fingers. Note that the upper bearing shells all have a grooved bearing surface, whereas the lower shells have a plain bearing surface. If the original bearing shells are being used for the check, ensure that they are refitted in their original locations.

8 The clearance can be checked in either of two ways.

9 One method (which will be difficult to achieve without a range of internal micrometers or internal/external expanding calipers) is to refit the main bearing caps to the cylinder block, with bearing shells in place. With the cap retaining bolts tightened to the specified torque, measure the internal diameter of each assembled pair of bearing shells. If the diameter of each corresponding crankshaft journal is measured and then subtracted from the bearing internal diameter, the result will be the main bearing running clearance.

10 The second (and more accurate) method is to use an American product known as Plastigauge. This consists of a fine thread of perfectly-round plastic, which is compressed between the bearing shell and the journal. When the shell is removed, the plastic is deformed, and can be measured with a special card gauge supplied with the kit. The running clearance is determined from this gauge. Plastigauge should be available from your Citroën dealer; otherwise, enquiries at one of the larger specialist motor factors should produce the name of a stockist in your area. The procedure for using Plastigauge is as follows.

11 With the main bearing upper shells in place, carefully lay the crankshaft in position. Do not use any lubricant; the crankshaft journals and bearing shells must be perfectly clean and dry.

12 Cut several lengths of the appropriate-size Plastigauge (they should be slightly shorter than the width of the main bearings), and place one length on each crankshaft journal axis **(see illustration)**.

13 With the main bearing lower shells in position, refit the main bearing caps, tightening their retaining bolts to the specified torque. Take care not to disturb the Plastigauge, and *do not* rotate the crankshaft at any time during this operation.

14 Remove the main bearing caps, again taking great care not to disturb the Plastigauge or rotate the crankshaft.

15 Compare the width of the crushed Plastigauge on each journal to the scale printed on the Plastigauge envelope, to obtain the main bearing running clearance **(see illustration)**. Compare the clearance measured with that in the Specifications at the start of this Chapter.

16 If the clearance is significantly different from that expected, the bearing shells may be the wrong size (or excessively worn, if the original shells are being re-used). Before deciding that different-size shells are required, make sure that no dirt or oil was trapped between the bearing shells and the caps or block when the clearance was measured. If the Plastigauge was wider at one end than at the other, the crankshaft journal may be tapered.

17 Note that Citroën do not specify a running clearance for these engines. The figure given in the Specifications is a guide figure which is typical for this type of engine. Before condemning the components concerned, seek the advice of your Citroën dealer or suitable engine repair specialist. They will also be able to inform as to the best course of action and whether it is possible to have the crankshaft journals reground (where possible) or whether renewal will be necessary.

18 Where necessary, obtain the correct size of bearing shell and repeat the running clearance checking procedure as described above.

19 On completion, carefully scrape away all traces of the Plastigauge material from the crankshaft and bearing shells using a fingernail or other object which is unlikely to score the bearing surfaces.

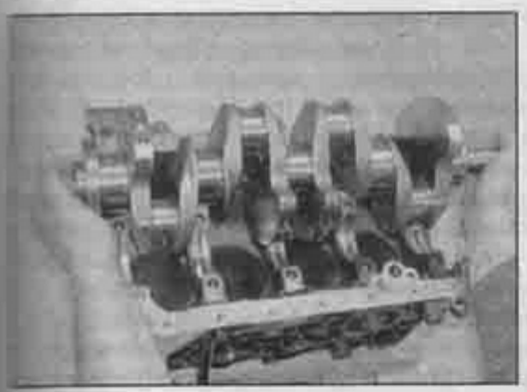
Final crankshaft refitting

20 Carefully lift the crankshaft out of the cylinder block once more.

21 Using a little grease, stick the upper thrustwashers to each side of the No 2 main bearing upper location. Ensure that the oilway grooves on each thrustwasher face outwards (away from the cylinder block) **(see illustration)**.

18.15 Measure the width of the deformed Plastigauge using the scale on the card

18.21 Fit the upper thrustwashers to No 2 main bearing location with the oilway grooves facing outwards



18.23 Lower the crankshaft into position in the cylinder block

22 Place the bearing shells in their locations as described earlier. If new shells are being fitted, ensure that all traces of protective grease are cleaned off using paraffin. Wipe dry the shells with a lint-free cloth. Liberally lubricate each bearing shell in the cylinder block and cap with clean engine oil.

23 Lower the crankshaft into position so that Nos 2 and 3 cylinder crankpins are at TDC; Nos 1 and 4 cylinder crankpins will be at BDC, ready for fitting No 1 piston **(see illustration)**. Check the crankshaft endfloat as described in Section 14.

24 Lubricate the lower bearing shells in the main bearing caps with clean engine oil. Make sure that the locating lugs on the shells engage with the corresponding recesses in the caps.

25 Fit main bearing caps Nos 2 to 5 to their correct locations, ensuring that they are fitted the correct way round (the bearing shell tab recesses in the block and caps must be on the same side). Insert the bolts, tightening them only loosely at this stage.

26 Apply a small amount of sealant to the No 1 main bearing cap mating face on the cylinder block, around the sealing strip holes and in the corners **(see illustration)**.

27 Locate the tab of each sealing strip over the pins on the base of No 1 bearing cap, and press the strips into the bearing cap grooves **(see illustration)**. It is now necessary to obtain two thin metal strips, of 0.25 mm thickness or less, in order to prevent the strips moving when the cap is being fitted. Metal strips, such as old feeler blades, can be used, provided all burrs which may damage the sealing strips are first removed.

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

29 Tighten all the main bearing cap bolts evenly to the specified torque and through the specified angle. Using a sharp knife, trim off the ends of the No 1 bearing cap sealing strips, so that they protrude above the cylinder block mating surface by approximately 1 mm **(see illustrations)**.

30 Fit a new crankshaft left-hand oil seal as described in Part C of this Chapter.

18.26 Apply sealant to the No 1 main bearing cap mating face on the cylinder block, around the sealing strip holes and in the corners

31 Refit the piston/connecting rod assemblies to the crankshaft as described in Section 19.

32 Refit the Woodruff key, then slide on the oil pump drive sprocket and spacer (where fitted), and locate the drive chain on the sprocket.

33 Ensure that the mating surfaces of the right-hand oil seal carrier and cylinder block are clean and dry. Note the correct fitted depth of the oil seal then, using a large flat-bladed screwdriver, lever the old seal out of the housing.

34 Apply a smear of suitable sealant to the oil seal carrier mating surface. Ensure that the locating dowels are in position, then slide the carrier over the end of the crankshaft and into position on the cylinder block. Tighten the carrier retaining bolts securely.

18.28 Use two metal strips (arrowed) to hold the sealing strips in place as the bearing cap is fitted

18.29b . . . and through the specified angle

18.27 Fit the sealing strips to No 1 main bearing cap

35 Fit a new crankshaft right-hand oil seal as described in Part C of this Chapter.

36 Ensuring that the drive chain is correctly located on the sprocket, refit the oil pump and sump as described in Part C of this Chapter.

37 Where removed, refit the cylinder head as described in Section 5.

19 Piston/connecting rod assembly – refitting and big-end bearing running clearance check

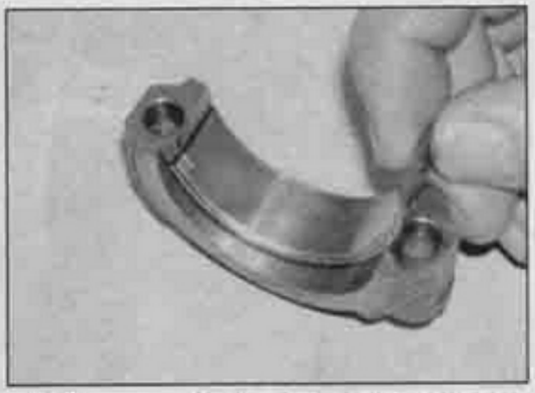
Selection of bearing shells

1 Citroën supply only one size of big-end bearing shell for use with a standard size crankshaft, however it may be possible to obtain oversize big-end bearing shells from an alternative source.

18.29a Tighten all the main bearing cap bolts to the specified torque . . .

18.29c Trim off the ends of No 1 bearing cap sealing strips, so that they protrude by approximately 1 mm

19.5a Fit the big-end bearing shells ensuring that the tab engages in the notch in the connecting rod . . .



19.5b . . . and in the connecting rod cap

2 Consult your Citroën dealer or engine specialist for further information on parts availability. Always quote the diameter of the crankshaft big-end crankpins when ordering bearing shells.

3 Before refitting the piston/connecting rod assemblies, we recommend that the big-end bearing running clearance is checked as follows.

Big-end bearing clearance check

4 Clean the backs of the bearing shells, and the bearing locations in both the connecting rod and bearing cap.

5 Press the bearing shells into their locations, ensuring that the tab on each shell engages in the notch in the connecting rod and cap **(see illustrations)**. Take care not to touch any shell's bearing surface with your fingers. If the original bearing shells are being used for the check, ensure that they are refitted in their original locations. The clearance can be checked in either of two ways.

6 One method is to refit the big-end bearing cap to the connecting rod, ensuring that they are fitted the correct way around (see paragraph 20), with the bearing shells in place. With the cap retaining nuts correctly tightened, use an internal micrometer or vernier caliper to measure the internal diameter of each assembled pair of bearing shells. If the diameter of each corresponding crankshaft journal is measured and then subtracted from the bearing internal diameter, the result will be the big-end bearing running clearance.

7 The second, and more accurate method is to use Plastigauge (see Section 18).

8 Ensure that the bearing shells are correctly fitted. Place a strand of Plastigauge on each (cleaned) crankpin journal.

9 Refit the (clean) piston/connecting rod assemblies to the crankshaft, and refit the big-end bearing caps, using the marks made or noted on removal to ensure that they are fitted the correct way around.

10 Tighten the bearing cap nuts to the specified torque, then through the specified angle. Take care not to disturb the Plastigauge, nor rotate the connecting rod during the tightening sequence.

11 Dismantle the assemblies without rotating the connecting rods. Use the scale printed on the Plastigauge envelope to obtain the big-end bearing running clearance.

12 If the clearance is significantly different from that expected, the bearing shells may be the wrong size (or excessively worn, if the original shells are being re-used). Make sure that no dirt or oil was trapped between the bearing shells and the caps or block when the clearance was measured. If the Plastigauge was wider at one end than at the other, the crankshaft journal may be tapered.

13 Note that Citroën do not specify a recommended big-end bearing running clearance. The figure given in the Specifications is a guide figure, which is typical for this type of engine. Before condemning the components concerned, refer to your Citroën dealer or engine reconditioning specialist for further information on the specified running clearance. Their advice on the best course of action to be taken can then also be obtained.

14 On completion, carefully scrape away all traces of the Plastigauge material from the crankshaft and bearing shells. Use your fingernail, or some other object which is unlikely to score the bearing surfaces.

15 Fit the new bearing cap retaining bolts to the connecting rods as described in Section 13.

Piston/connecting rod refitting

16 Ensure that the bearing shells are correctly fitted as described earlier. If new shells are being fitted, ensure that all traces of the protective grease are cleaned off using paraffin. Wipe dry the shells and connecting rods with a lint-free cloth.

17 Lubricate the cylinder bores, the pistons and piston rings, then lay out each piston/connecting rod assembly in its respective position.

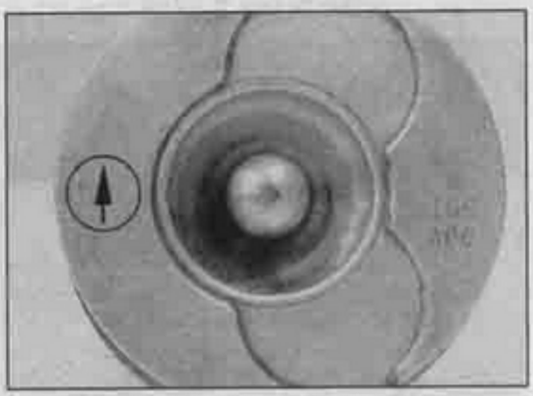
18 Make sure that the piston rings are still spaced as described in Section 17, then clamp them in position with a piston ring compressor.

19 Insert the first piston/connecting rod assembly into the top of its corresponding cylinder. Ensure that the arrow on the piston crown is pointing towards the timing belt end of the engine. Using a block of wood or hammer handle against the piston crown, tap the assembly into the cylinder until the piston crown is flush with the top of the block **(see illustrations)**.

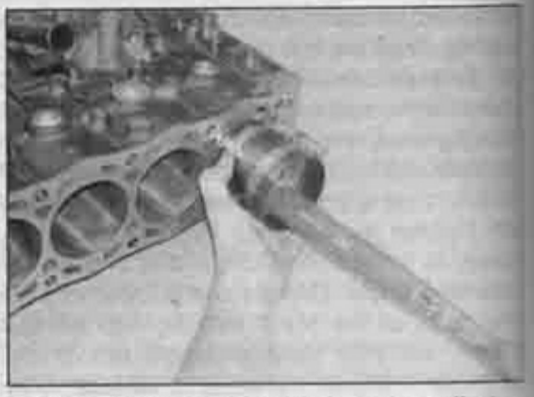
20 Ensure that the bearing shell is still correctly installed. Liberally lubricate the crankpin and both bearing shells. Taking care not to mark the cylinder bores, pull the piston/connecting rod assembly down the bore and onto the crankpin. Refit the big-end bearing cap, tightening the nuts finger-tight at first. Note that the faces with the identification marks must match (which means that the bearing shell locating tabs abut each other).

21 Tighten the bearing cap retaining nuts

19.19a Insert the piston/connecting rod assembly into the top of the relevant cylinder



19.19b The arrow on the piston crown must point towards the timing belt end of the engine



19.19c Tap the assembly into the cylinder bore until the piston crown is flush with the top of the block

evenly and progressively to the Stage 1 torque setting **(see illustration)**.

22 Once both nuts have been tightened to the Stage 1 setting, angle-tighten them through the specified Stage 2 angle, using a socket and extension bar. It is recommended that an angle-measuring gauge is used during this stage of the tightening, to ensure accuracy **(see illustration)**.

23 Once the bearing cap retaining nuts have been correctly tightened, rotate the crankshaft. Check that it turns freely; some stiffness is to be expected if new components have been fitted, but there should be no signs of binding or tight spots.

24 Refit the other three piston/connecting rod assemblies in the same way.

25 Refit the cylinder head and oil pump as described in Section 5 and in Part C of this Chapter.

20 Engine – initial start-up after overhaul

1 With the engine refitted in the vehicle, double-check the engine oil and coolant levels. Make a final check that everything has been reconnected, and that there are no tools or rags left in the engine compartment.

19.21 Tighten the bearing cap retaining nuts evenly and progressively to the Stage 1 torque setting . . .

19.22 . . . then angle-tighten them through the specified Stage 2 angle

2 Turn the ignition key to position M, and wait for the preheating warning light to go out.

3 Start the engine, noting that this may take a little longer than usual, due to the fuel system components having been disturbed. Make sure that the oil pressure warning light goes out then allow the engine to idle.

4 While the engine is idling, check for fuel, water and oil leaks. Don't be alarmed if there are some odd smells and smoke from parts getting hot and burning off oil deposits.

5 Assuming all is well, keep the engine idling until hot water is felt circulating through the top hose, then switch off the engine.

6 After a few minutes, recheck the oil and coolant levels as described in *Weekly checks*, and top-up as necessary.

7 Note that there is no need to retighten the cylinder head bolts once the engine has first run after reassembly.

8 If new pistons, rings or crankshaft bearings have been fitted, the engine must be treated as new, and run-in for the first 500 miles (800 km). *Do not* operate the engine at full-throttle, or allow it to labour at low engine speeds in any gear. It is recommended that the oil and filter be changed at the end of this period.

Chapter 3
Cooling, heating and air conditioning systems

Contents

Degrees of difficulty

Easy, suitable for novice with little experience 

Fairly easy, suitable for beginner with some experience 

Fairly difficult, suitable for competent DIY mechanic 

Difficult, suitable for experienced DIY mechanic 

Very difficult, suitable for expert DIY or professional 

Specifications

General

Maximum system pressure	1.4 bars

Thermostat

Opening temperature:	
Petrol engine models	89°C
Diesel engine models	83°C

Torque wrench settings

	Nm	lbf ft
Coolant pump retaining bolts/nuts:		
1.6 litre petrol engines	15	11
1.8 litre petrol engines:		
Stage 1	3	2
Stage 2	8	6
Stage 3	14	10
Diesel engines	15	11
Coolant temperature sensors	18	13

1 General information and precautions

General information

The cooling system is of pressurised type, comprising a coolant pump driven by the timing belt, an aluminium crossflow radiator, expansion tank, electric cooling fan, a thermostat, heater matrix, and all associated hoses and switches.

The system functions as follows. Cold coolant in the bottom of the radiator passes through the bottom hose, through additional coolant pipes or housings (according to engine) to the coolant pump, where it is pumped around the cylinder block and head passages, and through the oil cooler (diesel engines). After cooling the cylinder bores, combustion surfaces and valve seats, the coolant reaches the underside of the thermostat, which is initially closed. The coolant passes through the heater, and is returned to the coolant pump.

When the engine is cold, the coolant circulates only through the cylinder block, cylinder head, and heater. When the coolant reaches a predetermined temperature, the thermostat opens, and the coolant passes through the top hose to the radiator. As the coolant circulates through the radiator, it is cooled by the in-rush of air when the car is in forward motion. The airflow is supplemented by the action of the electric cooling fan when necessary. Upon reaching the bottom of the radiator, the coolant has now cooled, and the cycle is repeated.

When the engine is at normal operating temperature, the coolant expands, and some of it is displaced into the expansion tank. Coolant collects in the tank, and is returned to the radiator when the system cools.

The electric cooling fan is mounted in a plastic housing located in front of the radiator. On early 1.6 litre petrol engine models, the fan is controlled by a thermostatic switch. On later 1.6 litre petrol engine models, and all other models, the fan is controlled by the engine management ECU. At a predetermined coolant temperature, the switch or the ECU actuates the fan.

Precautions

⚠ ***Warning: Do not attempt to remove the expansion tank filler cap, or to disturb any part of the cooling system, while the engine is hot, as there is a high risk of scalding. If the expansion tank filler cap must be removed before the engine and radiator have fully cooled (even though this is not recommended), the pressure in the cooling system must first be relieved. Cover the cap with a thick layer of cloth to avoid scalding, and slowly unscrew the filler cap until a hissing sound is heard. When the hissing has stopped, indicating that the pressure has reduced, slowly unscrew the filler cap until it can be removed; if more hissing sounds are heard, wait until they have stopped before unscrewing the cap. At all times, keep well away from the filler cap opening, and protect your hands.***

2.3 Releasing a radiator top hose spring clip

⚠ ***Warning: Do not allow antifreeze to come into contact with your skin, or with the painted surfaces of the vehicle. Rinse off spills immediately, with plenty of water. Never leave antifreeze lying around in an open container, or in a puddle in the driveway or on the garage floor. Children and pets are attracted by its sweet smell, but antifreeze can be fatal if ingested.***

⚠ ***Warning: If the engine is hot, the electric cooling fan may start rotating even if the engine is not running. Be careful to keep your hands, hair, and any loose clothing well clear when working in the engine compartment.***

⚠ ***Warning: Refer to Section 11 for precautions to be observed when working on models equipped with air conditioning.***

2 Cooling system hoses – disconnection and renewal

Note: *Refer to the warnings given in Section 1 of this Chapter before proceeding. Hoses should only be disconnected once the engine has cooled sufficiently to avoid scalding.*

2.11 Using angled circlip pliers to spread the retaining clip and remove the heater hose – petrol engine models

General instructions

1 The number, routing and pattern of hoses will vary according to model, but the same basic procedure applies. Before commencing work, make sure that the new hoses are to hand, along with new hose clips if needed. It is good practice to renew the hose clips at the same time as the hoses.

2 Drain the cooling system, as described in Chapter 1A or 1B (as applicable), saving the coolant if it is fit for re-use. Squirt a little penetrating oil onto the hose clips if they are corroded.

3 Release the hose clips from the hose concerned. Two types of clip are used; worm drive and spring. The worm drive clip is released by turning its screw anti-clockwise. The spring clip is released by squeezing its tags together with pliers, at the same time working the clip away from the hose stub **(see illustration)**.

4 Unclip any wires, cables or other hoses which may be attached to the hose being removed. Make notes for reference when refitting if necessary.

5 Release the hose from its stubs, using a gentle twisting motion. Be careful not to damage the stubs on delicate components such as the radiator. If the hose is stuck fast, try carefully prising the end of the hose with a screwdriver or similar, taking care not to use excessive force. The best course is often to cut off a stubborn hose using a sharp knife, but again be careful not to damage the stubs.

6 Before fitting the new hose, smear the stubs with washing-up liquid or a suitable rubber lubricant to aid fitting. Do not use oil or grease, which may attack the rubber.

7 Fit the hose clips over the ends of the hose, then fit the hose over its stubs. Work the hose into position. When satisfied, locate and tighten the hose clips.

8 Refill the cooling system as described in Chapter 1A or 1B. Run the engine, and check that there are no leaks.

9 Recheck the tightness of the hose clips on any new hoses after a few hundred miles.

10 Top-up the coolant level if necessary.

Heater matrix connections

Note: *New O-rings should be used when reconnecting the hoses on diesel engine models.*

Removal – petrol models

11 Using angled circlip pliers engaged with the ends of the retaining spring clip, spread the clip and withdraw the relevant hose from the matrix pipe stub **(see illustration)**.

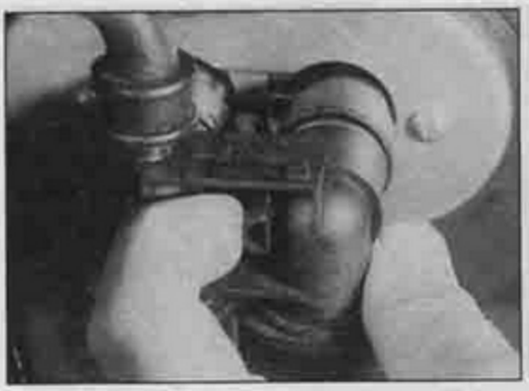
Removal – diesel models

12 The two hoses are connected to the matrix by means of a single connector.

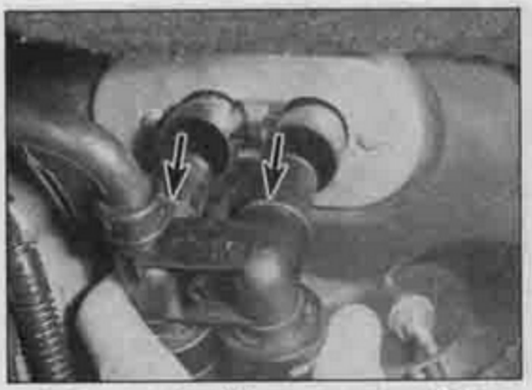
13 Prise the metal retaining clip from the top of the connector **(see illustration)**.

14 Release the plastic retaining clip by pushing it towards the left-hand hose connection **(see illustration)**.

2.13 Remove the metal clip from the top of the heater matrix connector . . .



2.14 . . . then release the plastic retaining clip . . .



2.15 . . . and pull the connector off the pipes. Recover the O-rings (arrowed) – diesel engine models

15 Pull the connector assembly from the heater matrix. Recover the O-ring seals from the connector, and discard them; new ones should be used on refitting **(see illustration)**.

Refitting – all models

16 Refitting is a reversal of the removal procedure, using new O-rings on diesel engine models.

17 Refill the cooling system as described in Chapter 1A or 1B. Run the engine, and check that there are no leaks.

3 Radiator – removal, inspection and refitting

Note: *If leakage is the reason for removing the radiator, bear in mind that minor leaks can often be cured using a radiator sealant with the radiator in situ.*

Removal

1 Disconnect the battery negative terminal (refer to *Disconnecting the battery* in the Reference Chapter).

2 Drain the cooling system as described in Chapter 1A or 1B as applicable.

3 Remove the air cleaner assembly and air inlet ducting as described in Chapter 4A or 4B as applicable.

4 Disconnect all the coolant hoses from the radiator with reference to Section 2.

5 Undo the nut and remove the washer securing the upper left-hand and right-hand corners of the cooling fan shroud to the front body panel **(see illustration)**.

6 Carefully ease the top of the radiator and fan shroud toward the engine.

7 Undo the screw and remove the washer securing each radiator upper mounting bracket to the fan shroud. Lift the brackets off the radiator mounting studs **(see illustrations)**.

8 Lift the radiator upward to disengage the lower locating lugs and remove the radiator from the engine compartment **(see illustration)**. Take care not to damage the radiator fins on surrounding components as it is lifted out.

Inspection

9 If the radiator has been removed due to suspected blockage, reverse flush it as described in Chapter 1A or 1B.

10 Clean dirt and debris from the radiator fins, using an air line (in which case, wear eye protection) or a soft brush. Be careful, as the fins are sharp, and easily damaged.

11 If necessary, a radiator specialist can perform a 'flow test' on the radiator, to establish whether an internal blockage exists.

12 A leaking radiator must be referred to a specialist for permanent repair. Do not attempt to weld or solder a leaking radiator, as damage to the plastic components may result.

13 Inspect the condition of the radiator mounting rubbers, and renew them if necessary.

Refitting

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

a) Ensure that the lower lugs on the radiator are correctly engaged with the mounting rubbers in the body panel.

b) Reconnect the coolant hoses with reference to Section 2.

c) Refit the air cleaner assembly and air inlet ducting as described in Chapter 4A or 4B.

d) On completion, refill the cooling system as described in Chapter 1A or 1B.

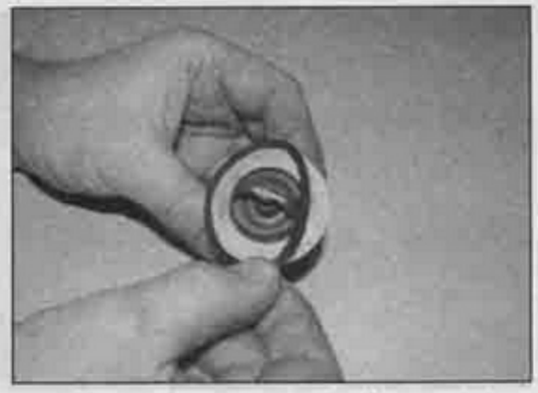
3.5 Remove the nut and washer securing the upper corners of the cooling fan shroud to the front body panel

3.7a Remove the screw and washer (arrowed) securing the radiator upper mounting brackets to the fan shroud . . .

3.7b . . . then lift the brackets off the radiator mounting studs

3.8 Lift the radiator to disengage the lower lugs and remove it from the engine compartment

4.6a Lift off the thermostat cover and withdraw the thermostat . . .



4.6b . . . then remove the thermostat sealing ring

4 Thermostat – removal, testing and refitting

Removal

1 On all engines, the thermostat is located in the coolant outlet housing at the left-hand end of the cylinder head.
2 Disconnect the battery negative terminal (refer to *Disconnecting the battery* in the Reference Chapter).
3 Drain the cooling system as described in Chapter 1A or 1B.
4 On 1.8 litre petrol engine models, remove the air cleaner assembly and air inlet ducting as described in Chapter 4A. On all models, where necessary, release any relevant wiring and hoses from their retaining clips, and position them clear of the coolant outlet housing to improve access.
5 Release the clip and disconnect the coolant hose from the thermostat cover.
6 Unscrew the retaining bolts, and carefully withdraw the thermostat cover to expose the thermostat. Lift the thermostat from the housing, noting which way round the thermostat is fitted, and recover the sealing ring **(see illustrations)**.

Testing

7 A rough test of the thermostat may be made by suspending it with a piece of string in a container full of water. Heat the water to bring it to the boil – the thermostat must open by the time the water boils. If not, renew it.
8 If a thermometer is available, the precise opening temperature of the thermostat may be determined; compare with the figures given in the Specifications. The opening temperature is also marked on the thermostat.
9 A thermostat which fails to close as the water cools must also be renewed.

Refitting

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

a) Examine the sealing ring for damage or deterioration, and if necessary, renew.
b) Ensure that the thermostat is fitted the correct way round as noted during removal.
c) On 1.8 litre petrol engine models, refit the air cleaner assembly and air inlet ducting as described in Chapter 4A.
d) On completion, refill the cooling system as described in Chapter 1A or 1B.

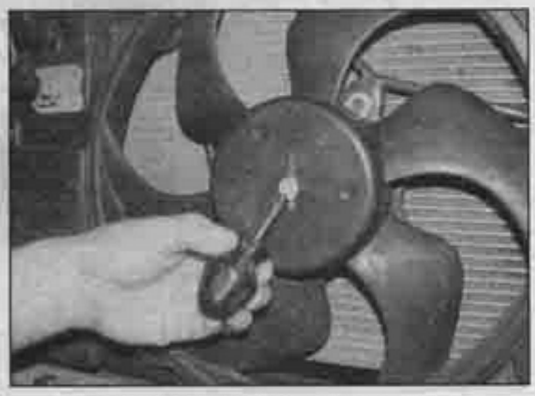
5 Electric cooling fan – removal and refitting

General information

1 On all models a single electric cooling fan is fitted, mounted in a shroud located between the front bumper and the radiator, or between the bumper and air conditioning condenser as applicable.
2 On vehicles without air conditioning, the fan is a single-speed unit on petrol engine models and a two-speed unit on diesel engine models. On vehicles with air conditioning, initially a two-speed fan was used for petrol engine models, with a three-speed fan being fitted to diesels. From the 2001 model year, all models equipped with air conditioning were fitted with a three-speed fan.
3 On all except early 1.6 litre petrol engine models, the operation of the cooling fan is controlled by the engine management ECU (and air conditioning system control unit where applicable) using coolant temperature information supplied by a coolant temperature sensor mounted in the coolant outlet housing. On early 1.6 litre petrol engine models, a separate thermal switch, mounted in the cylinder head was used to control the fan. From the 2001 model year, this arrangement was replaced by engine management ECU control, in line with all other models.

Removal

4 Disconnect the battery negative terminal (refer to *Disconnecting the battery* in the Reference Chapter).
5 Remove the front bumper assembly as described in Chapter 11.
6 Undo the retaining screw and withdraw the fan from the fan motor spindle **(see illustration)**. Note that the fan retaining screw has a **left-hand thread** and is unscrewed by turning it clockwise.
7 Undo the three screws and withdraw the fan motor from the shroud **(see illustration)**.
8 To remove the speed control resistor, disconnect the wiring plug, then undo the



5.6 Undo the retaining screw and withdraw the fan from the fan motor spindle

5.7 Undo the three screws and withdraw the fan motor from the shroud

5.8a Disconnect the speed control resistor wiring plug . . .

5.8b . . . undo the retaining screw . . .

retaining screw. Lift the retaining screw end of the resistor from the fan shroud, then disengage the locating lugs at the other end **(see illustrations)**.

Refitting

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

a) *Ensure that the fan motor wiring plug fully engages with the wiring socket on the shroud as the motor is refitted.*
b) *Refit the front bumper as described in Chapter 11.*

5.8c . . . and withdraw the resistor from the fan shroud

6 Cooling system electrical switches and sensors – removal and refitting

1.6 litre petrol models pre-2001

Cooling fan thermal switch

1 On models without air conditioning, the cooling fan thermal switch has a blue wiring connector and is located in the left-hand side of the cylinder head, below the coolant outlet housing.

2 On models with air conditioning, the cooling fans are controlled by the air conditioning system control unit in conjunction with a temperature sensor located in the left-hand side of the cylinder head, below the coolant outlet housing. The sensor can be identified by its blue or brown wiring connector.

Temperature warning light switch/gauge sensor

3 The coolant temperature warning light switch/temperature gauge sensor has a blue wiring connector and is located in the top of the coolant outlet housing at the left-hand end of the cylinder head **(see illustration)**.

Engine ECU temperature sensor

4 The engine management system coolant temperature sensor has a green wiring connector and is located above the thermostat in the coolant outlet housing at the left-hand end of the cylinder head.

1.6 litre petrol models from 2001

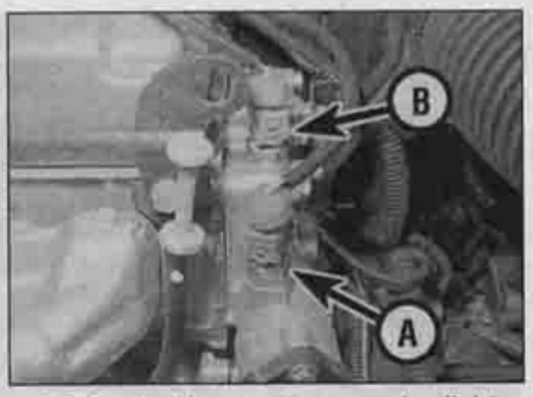
Engine ECU temperature sensor

5 On later engines, the coolant temperature sensor has a blue or green wiring connector and is located above the thermostat in the coolant outlet housing at the left-hand end of the cylinder head. The temperature signal from this sensor is used by the engine management ECU for fuel injection/ignition regulation and to control the operation of the cooling fan, air conditioning system and temperature warning light/gauge.

1.8 litre petrol models

Engine ECU temperature sensor

6 On 1.8 litre petrol engines the coolant temperature sensor has a green wiring connector and is located in the coolant outlet housing at the left-hand end of the cylinder head **(see illustration)**. The temperature signal from this sensor is used by the engine management ECU for fuel injection/ignition regulation, and to control the operation of the exhaust gas recirculation, secondary air injection, cooling fan, air conditioning system and temperature warning light/gauge.



6.3 Coolant temperature warning light switch/temperature gauge sensor (A) and engine management coolant temperature sensor (B) – early 1.6 litre petrol engine models

Diesel models

Engine ECU temperature sensor

7 On diesel engines the coolant temperature sensor has a green wiring connector and is mounted in the coolant outlet housing at the left-hand end of the cylinder head **(see illustration)**. The temperature signal from this sensor is used by the engine management ECU for diesel injection regulation and to control the operation of the exhaust gas recirculation, cooling fans, pre/post-heating control unit, air conditioning system and temperature warning light/gauge.

Removal

Warning: The engine should be cold before removing a cooling system switch or sensor.

8 Disconnect the battery negative terminal (refer to *Disconnecting the battery* in the Reference Chapter).

9 Partially drain the cooling system to just below the level of the switch/sensor (as described in Chapter 1A or 1B). Alternatively, have ready a suitable bung to plug the switch aperture in the housing when the switch is removed. If this method is used, take care not to use anything which will allow foreign matter to enter the cooling system.

10 Where necessary, refer to Chapter 4A or 4B and remove the air cleaner and air inlet ducts for access to the switches/sensors located in the coolant outlet housing or cylinder head.

11 Unplug the wiring connector from the relevant switch/sensor.

12 Carefully unscrew the switch/sensor from its mounting and recover the sealing ring (where applicable). If the system has not been drained, plug the switch/sensor aperture to prevent further coolant loss.

Refitting

13 If the switch/sensor was originally fitted using sealing compound, clean the switch/sensor threads thoroughly, and coat them with fresh sealing compound. If the switch was originally fitted using a sealing ring, use a new sealing ring on refitting.

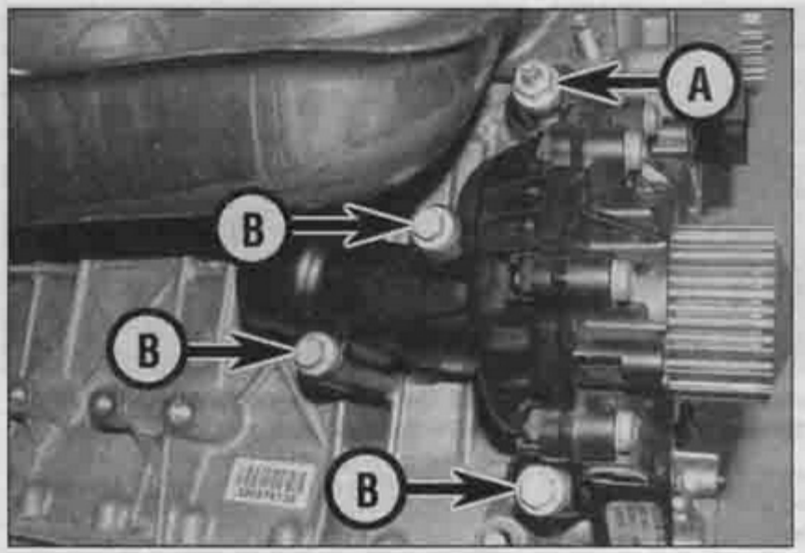
14 Fit the switch/sensor to its location, tighten it securely and reconnect the wiring connector.

15 Refill and bleed the cooling system as described in Chapter 1A or 1B. Follow the bleeding instructions carefully, to ensure that all air is expelled from the cooling system.

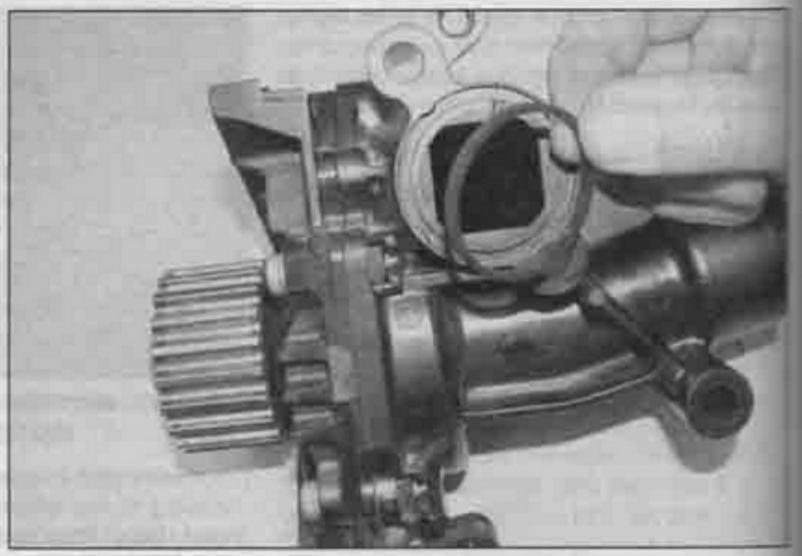
16 On completion, refit any components removed for access, then start the engine and run it until it reaches normal operating temperature. Continue to run the engine, and check that the component(s) controlled by the switch/sensor operate correctly.

6.6 Engine management coolant temperature sensor (arrowed) – 1.8 litre petrol engine models

6.7 Engine management coolant temperature sensor (arrowed) – diesel engine models



7.14 Coolant pump retaining nut (A) and retaining bolts (B) – 1.8 litre petrol engine models



7.16a Recover the rubber seal from the pump outlet aperture . . .

7 Coolant pump – removal and refitting

1.6 litre petrol models

Removal

Note: *A new pump assembly O-ring will be required on refitting.*

1 The coolant pump is driven by the timing belt and is located in the cylinder block at the timing belt end of the engine.

2 Drain the cooling system as described in Chapter 1A.

3 Remove the timing belt as described in the relevant Chapter 2A.

4 Remove the securing bolts, and withdraw the pump assembly from the cylinder block (access is most easily obtained from under the wheelarch). Recover the O-ring.

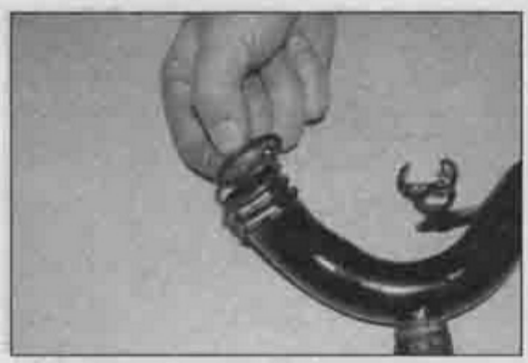
Refitting

5 Ensure that all mating faces are clean.

6 Refit the pump assembly to the cylinder block, using a new O-ring.

7 Refit the timing belt as described in Chapter 2A.

8 Refill the cooling system as described in Chapter 1A.



7.16b . . . and the O-ring from the end of the coolant pipe – 1.8 litre petrol engine models

1.8 litre petrol models

General information

9 The coolant pump is driven by the timing belt and is bolted to the rear of the cylinder block at the timing belt end of the engine.

10 Although it is theoretically possible to remove and refit the coolant pump with the engine installed in the vehicle, access to the rear and left-hand side of the engine is virtually non-existent. Bearing in mind the tools, equipment and working facilities available to even the most competent of do-it-yourself mechanic, this operation will prove to be extremely difficult. For this reason, it has to be recommended that the engine/transmission be removed from the vehicle for removal and refitting of the coolant pump.

11 Read through the procedure first, then look at the engine compartment and coolant pump location. Establish whether you have the necessary tools, equipment, skill and patience to proceed with the engine installed. If not, either remove the engine/transmission assembly as described in Chapter 2D, or entrust the work to a Citroën dealer or suitably-equipped garage.

Removal

Note: *A new coolant pipe O-ring and pump outlet rubber seal will be required on refitting.*

12 If the engine/transmission have not been removed, drain the cooling system as described in Chapter 1A.

13 Remove the timing belt as described in Chapter 2B.

14 Undo the upper nut and the three lower bolts securing the coolant pump to the rear of the cylinder block **(see illustration)**.

15 Unscrew the pump upper retaining stud, ease the pump off the locating dowels, then disengage the rear of the pump from the coolant pipe. Withdraw the pump assembly from the cylinder block.

16 Recover the rubber seal from the pump outlet aperture, and the O-ring from the end of the coolant pipe **(see illustrations)**. A new seal and O-ring must be obtained for refitting.

17 Note that only a complete pump assembly is available from Citroën parts stockists. Although the front and rear sections of the pump can be separated, they are not individually available.

Refitting

18 Ensure that the mating faces of the pump and cylinder block are clean.

19 Fit a new O-ring to the end of the coolant pipe and position a new rubber seal on the pump outlet. Check that the two locating dowels are in position in the cylinder block or in the pump.

20 Engage the pump with the coolant pipe then locate it on the cylinder block.

21 Refit the three retaining bolts tightening them finger tight only at this stage.

22 Screw the pump upper retaining stud into the cylinder block and tighten it securely. Fit the nut to the stud and tighten it finger tight only.

23 Starting with the lower retaining bolt and working in an anti-clockwise spiral pattern, tighten the retaining bolts and upper nut to the specified torque in the three stages given in the Specifications.

24 Refit the timing belt as described in Chapter 2B.

25 On completion of all other operations (depending on the pump removal/refitting method chosen), refill the cooling system as described in Chapter 1A.

Diesel models

26 The coolant pump removal and refitting procedures are the same as those given for 1.6 litre petrol engine models in paragraphs 1 to 8, substituting Chapter 1B and 2C for all references to Chapter 1A and 2A. Note, however, that working clearances in the engine compartment are extremely limited and the information contained in paragraphs 10 and 11 is equally applicable to diesel engine models. If the engine/transmission are to be removed, refer to the procedures contained in Chapter 2E.

8 Coolant outlet housing – removal and refitting

1.6 litre petrol models

Removal

1 Disconnect the battery negative terminal (refer to *Disconnecting the battery* in the Reference Chapter).
2 Drain the cooling system as described in Chapter 1A.
3 Remove the air cleaner assembly and air inlet ducts as described in Chapter 4A.
4 Disconnect and release the wiring connectors at the coolant outlet housing sensors, with reference to Section 6.
5 Disconnect the coolant hoses from the front and rear of the housing.
6 Undo the housing retaining bolts and move the wiring harness bracket or coolant pipe to one side.
7 Remove the housing from the side of the cylinder head and collect the gasket (where fitted). Obtain a new gasket, or a tube of RTV sealant (as applicable) for refitting.

Refitting

8 Clean all traces of old gasket/sealant from the mating faces of the coolant outlet housing and cylinder head mating faces.
9 Locate a new gasket in position on the housing, or apply a bead of RTV sealant to the housing mating face, as applicable.
10 Refit the housing to the cylinder head, locate the wiring harness bracket or coolant pipe in position and refit the retaining bolts, tightened securely.
11 Reconnect the coolant hoses to the housing.
12 Refit the air cleaner assembly and air inlet ducts as described in Chapter 4A.
13 Refill the cooling system as described in Chapter 1A then reconnect the battery negative terminal.

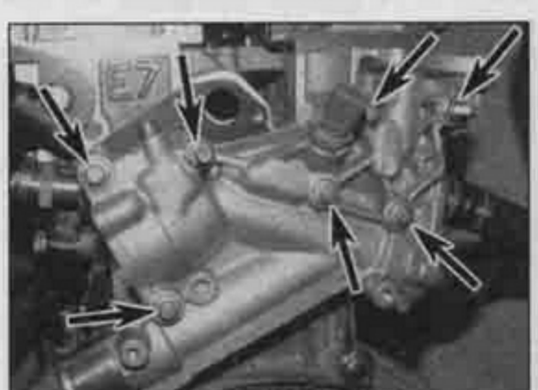
1.8 litre petrol models

Removal

14 Disconnect the battery negative terminal (refer to *Disconnecting the battery* in the Reference Chapter).
15 Drain the cooling system as described in Chapter 1A.
16 Remove the air cleaner assembly and air inlet ducts as described in Chapter 4A.
17 Disconnect the radiator hoses from the coolant outlet housing and thermostat cover. Disconnect the heater hose from the rear of the coolant outlet housing.
18 Disconnect the air inlet hose from the secondary air injection valve at the left-hand end of the cylinder head. Undo the two bolts and remove the air injection valve.
19 Disconnect the wiring connectors from the EGR valve and coolant temperature sensor.
20 Undo the nuts/bolts securing the wiring harness support bracket to the coolant outlet housing. Release any additional cable ties and clips then move the support bracket, wiring harness and hoses clear of the cylinder head.
21 Undo the bolt and remove the horseshoe-shaped clamp plate securing the coolant pipe to the rear of the coolant outlet housing. Withdraw the coolant pipe from the housing and recover the sealing O-ring.
22 Undo the remaining coolant outlet housing retaining bolts and the two stud nuts **(see illustration)**. Unscrew the two studs, then remove the coolant outlet housing from the cylinder head. Recover the housing gasket.
23 If required, the EGR valve can be removed from the housing after undoing the two retaining bolts.
24 Obtain new gaskets and O-rings for all disturbed components prior to refitting.

Refitting

25 Thoroughly clean the coolant outlet housing and cylinder head mating faces ensuring that all traces of old gasket are removed.
26 Where applicable, place a new EGR valve gasket on the housing, ensuring that the gasket is positioned with the word TOP uppermost. Refit the EGR valve and secure with the two bolts, tightened securely.
27 Using a new gasket, locate the coolant outlet housing on the cylinder head and refit the retaining bolts finger tight only at this stage.
28 Refit and tighten the two housing studs. Refit the nuts to the studs then progressively tighten all the retaining bolts/nuts securely.
29 Fit a new O-ring to the coolant pipe, then engage the pipe with the coolant outlet housing. Refit the horseshoe-shaped clamp plate and secure with the retaining bolt.
30 Position the wiring harness support bracket on the coolant outlet housing and secure with the retaining nuts/bolts. Ensure that the cable harness is secured with the retaining clips and new cable ties as necessary.
31 Reconnect the wiring connectors to the EGR valve and coolant temperature sensor.



8.22 Coolant outlet housing retaining bolt and nut locations (arrowed) – 1.8 litre petrol engine models

32 Refit the secondary air injection valve to the cylinder head and secure with the two bolts. Refit the air inlet hose to the valve.
33 Reconnect the radiator hoses and heater hose.
34 Refit the air cleaner assembly and air inlet ducts as described in Chapter 4A.
35 Refill the cooling system as described in Chapter 1A then reconnect the battery negative terminal.

Diesel models

Removal

36 Disconnect the battery negative terminal (refer to *Disconnecting the battery* in the Reference Chapter).
37 Drain the cooling system as described in Chapter 1B.
38 Remove the air cleaner assembly and air inlet ducts as described in Chapter 4B.
39 Disconnect the radiator hoses, expansion tank hoses and oil cooler hoses from the coolant outlet housing and thermostat cover. Disconnect the heater hose from the rear of the coolant outlet housing.
40 Disconnect the wiring connector from the coolant temperature sensor.
41 Undo the nuts and bolts securing the wiring harness support bracket to the coolant outlet housing. Release any additional cable ties and clips then move the support bracket and wiring harness clear of the cylinder head.
42 Undo the remaining coolant outlet housing retaining bolts and the two stud nuts. Unscrew the two studs, then remove the coolant outlet housing from the cylinder head. Recover the housing gasket.
43 Obtain new gaskets for all disturbed components prior to refitting.

Refitting

44 Thoroughly clean the coolant outlet housing and cylinder head mating faces ensuring that all traces of old gasket are removed.
45 Using a new gasket, locate the coolant outlet housing on the cylinder head and refit the retaining bolts finger tight only at this stage.
46 Refit and tighten the two housing studs. Refit the nuts to the studs then progressively tighten all the retaining bolts/nuts securely.
47 Position the wiring harness support bracket on the coolant outlet housing and secure with the retaining nuts/bolts. Ensure that the cable harness is secured with the retaining clips and new cable ties as necessary.
48 Reconnect the wiring connectors to the coolant temperature sensor.
49 Reconnect the radiator, expansion tank and oil cooler hoses
50 Refit the air cleaner assembly and air inlet ducts as described in Chapter 4B.
51 Refill the cooling system as described in Chapter 1B then reconnect the battery negative terminal.

10.3 Undo the four screws (arrowed) securing the heater/ventilation control unit to the facia

10.4a Lift the control unit up to disengage the two lower lugs, then turn it over . . .

10.4b . . . for access to the control cables and wiring

9 Heating and ventilation system – general information

The heating/ventilation system consists of a four-speed blower motor (housed behind the facia), face level vents in the centre and at each end of the facia, and air ducts to the front and rear footwells.

The control unit is located in the facia, and the controls operate flap valves to deflect and mix the air flowing through the various parts of the heating/ventilation system. The flap valves are contained in the air distribution housing, which acts as a central distribution unit, passing air to the various ducts and vents.

Cold air enters the system through the grille at the rear of the engine compartment. If required, the airflow is boosted by the blower, and then flows through the various ducts, according to the settings of the controls. Stale air is expelled through ducts at the rear of the vehicle. If warm air is required, the cold air is passed over the heater matrix, which is heated by the engine coolant.

A recirculation switch enables the outside air supply to be closed off, while the air inside the vehicle is recirculated. This can be useful to prevent unpleasant odours entering from outside the vehicle, but should only be used briefly, as the recirculated air inside the vehicle will soon become stale.

10 Heater/ventilation components – removal and refitting

Heater/ventilation control unit

Removal

1 Disconnect the battery negative terminal (refer to *Disconnecting the battery* in the Reference Chapter).

2 Remove the facia upper centre panel as described in Chapter 11.

3 Undo the four screws securing the heater/ventilation control unit to the facia **(see illustration)**.

4 Lift the unit up to disengage the two lower locating lugs, feed it back into the aperture, then turn it over for access to the rear **(see illustrations)**.

5 Disconnect the wiring plug, then note the locations and correct fitted positions of the three control cables. Using a small screwdriver, release the outer cables from the support brackets, then disengage the inner cables from the operating levers.

6 Withdraw the control unit through the facia aperture and remove it from the car.

Refitting

7 Refitting is a reversal of removal, but ensure that the control cables are securely reconnected to their original locations.

Heater/ventilation control cables

Removal

8 Disconnect the cables from the heater/ventilation control unit, as described previously in this Section during the control unit removal procedure.

9 Working through the facia aperture or under the facia (it will be necessary to remove certain facia panels for access – see Chapter 11 – depending on which cable is to be removed), release the clips and disconnect the relevant cable from the air distribution housing. Note the routing of the cable to ensure correct refitting.

Refitting

10 Refitting is a reversal of removal, ensuring that the cables are correctly routed, and securely reconnected.

Heater matrix

Note: *New heater matrix connecting pipe O-rings must be used on refitting.*

Removal

11 Disconnect the battery negative terminal (refer to *Disconnecting the battery* in the Reference Chapter).

12 Drain the cooling system as described in Chapter 1A or 1B.

13 Working in the engine compartment, disconnect the heater hoses from the matrix pipes with reference to Section 2.

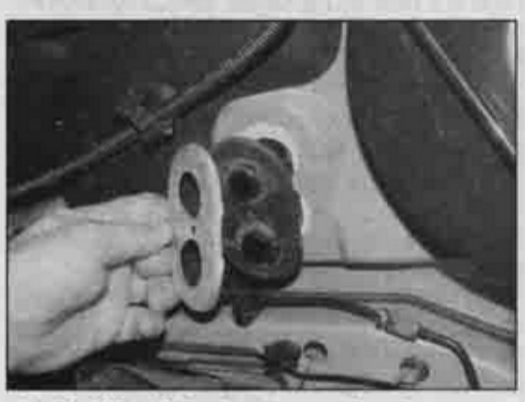
14 Undo the screw securing the cover plate over the matrix pipes bulkhead seal. Lift off the cover plate, and remove the rubber bulkhead seal **(see illustration)**.

15 Remove the facia lower centre panel as described in Chapter 11.

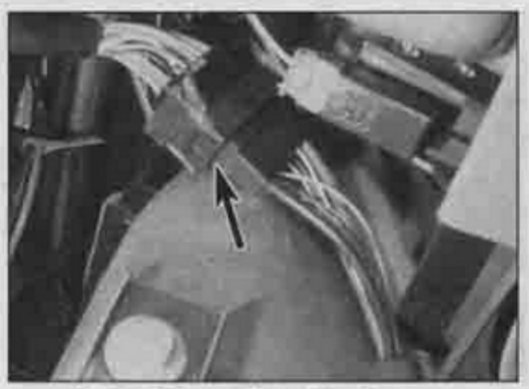
16 Working under the facia on the left-hand side, where applicable, release the wiring harness connector from its location above the front strengthening brace **(see illustration)**. Once the harness is released, disconnect the connector.

17 Undo the bolts securing the front and rear strengthening braces at the left-hand side of the air distribution housing **(see illustrations)**.

18 Undo the three screws and remove the air duct from the left-hand side of the air distribution housing **(see illustration)**.



10.14 Lift off the heater matrix pipe cover plate, and remove the rubber bulkhead seal



10.16 Release the wiring harness connector (arrowed) located above the facia front strengthening brace

10.17a Undo the bolts (arrowed) securing the front strengthening brace . . .

10.17b . . . and rear strengthening brace at the left-hand side of the air distribution housing

10.18 Undo the three screws and remove the air duct

19 Place suitable protective sheets on the carpet below the heater matrix and be prepared for coolant spillage.

20 Undo the retaining screw in the centre of the connecting pipe assembly **(see illustration)**.

21 Undo the remaining screw securing the flange of the connecting pipe assembly to the heater matrix. Collect the retaining nut from the rear of the connecting pipe flange **(see illustrations)**.

22 Unclip the matrix from the air distribution housing, then carefully withdraw the matrix until it can be released from the connecting pipe flange **(see illustrations)**.

23 Withdraw the matrix, then remove the connecting pipe assembly **(see illustrations)**.

24 Remove the O-ring seals from the connecting pipe assembly and obtain new seals for refitting **(see illustration)**.

10.20 Undo the connecting pipe assembly centre retaining screw

10.21a Undo the screw securing the connecting pipe flange to the heater matrix . . .

Refitting

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

a) Fit new O-ring seals to the matrix connecting pipe assembly.

b) Reconnect the heater hoses to the matrix pipes with reference to Section 2.

c) Refit the facia lower centre panel as described in Chapter 11.

d) Refill the cooling system as described in Chapter 1A or 1B on completion.

10.21b . . . and collect the retaining nut from the rear of the flange

10.22a Unclip the matrix from the air distribution housing . . .

10.22b . . . then release it from the connecting pipe flange

10.23a Withdraw the matrix . . .

10.23b . . . then remove the connecting pipe assembly

10.24 Recover the O-ring seals from the connecting pipe assembly

10.29 Disconnect the wiring connector from the front of the blower motor

10.30 Rotate the motor clockwise and withdraw the unit from the air distribution housing

Heater blower motor

Removal – right-hand drive models

26 Disconnect the battery negative terminal (refer to *Disconnecting the battery* in the Reference Chapter).

27 Remove the facia lower centre panel as described in Chapter 11.

28 Working under the facia on the left-hand side, release the wiring harness connector from its location above the front strengthening brace. Once the harness is released, disconnect the connector.

29 Disconnect the wiring connector from the front of the blower motor **(see illustration)**.

30 Rotate the motor assembly clockwise to release it from the retaining lugs, then withdraw the unit from the air distribution housing **(see illustration)**.

Refitting – right-hand drive models

31 Refitting the heater blower motor is a reversal of removal. Refer to Chapter 11 when refitting the facia lower centre panel.

Removal – left-hand drive models

32 Disconnect the battery negative terminal (refer to *Disconnecting the battery* in the Reference Chapter).

33 Remove the facia lower centre panel, and the lower side panel beneath the steering column as described in Chapter 11.

34 Set the roadwheels in the straight-ahead position and remove the ignition key to engage the steering lock.

35 Make alignment marks on the steering column upper universal joint and the intermediate shaft, then unscrew the universal joint pinch-bolt.

36 Separate the intermediate shaft from the universal joint and move the shaft away from the air distribution housing. Make sure that the steering lock remains engaged while the shaft is disconnected in order to maintain the position of the rotary connector.

37 Proceed as described for right-hand drive models in paragraphs 28 to 30.

Refitting – left-hand drive models

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

a) Ensure that the marks made on removal are aligned when reconnecting the intermediate shaft to the steering column universal joint.

b) Tighten the universal joint pinch-bolt to the specified torque as given in Chapter 10.

c) Refit the facia panels as described in Chapter 11.

11 Air conditioning system – general information and precautions

General information

An air conditioning system is available as standard or optional equipment on all models. It enables the temperature of incoming air to be lowered, and also dehumidifies the air, which makes for rapid demisting and increased comfort. On high specification models, a fully electronic version of the system is available, whereby the temperature and airflow through the vehicle are automatically regulated according to the temperature selected.

The cooling side of the system works in the same way as a domestic refrigerator. Refrigerant gas is drawn into a belt-driven compressor, and passes into a condenser mounted on the front of the radiator, where it loses heat and becomes liquid. The liquid passes through an expansion valve to an evaporator, where it changes from liquid under high pressure to gas under low pressure. This change is accompanied by a drop in temperature, which cools the evaporator. The refrigerant returns to the compressor, and the cycle begins again.

Air blown through the evaporator passes to the air distribution unit, where it is mixed with hot air blown through the heater matrix to achieve the desired temperature in the passenger compartment.

The heating side of the system works in the same way as on models without air conditioning (see Section 9).

The operation of the system is controlled by an electronic control unit, which controls the electric cooling fan, the compressor and the facia-mounted warning light. Any problems with the system should be referred to a Citroën dealer.

Precautions

When an air conditioning system is fitted, it is necessary to observe special precautions whenever dealing with any part of the system, or its associated components. If for any reason the system must be disconnected, entrust this task to your Citroën dealer or a refrigeration engineer.

Warning: The air conditioning system contains a liquid refrigerant, and it is therefore dangerous to disconnect any part of the system without specialised knowledge and equipment.

The refrigerant is potentially dangerous, and should only be handled by qualified persons. If it is splashed onto the skin, it can cause frostbite. It is not itself poisonous, but in the presence of a naked flame (including a cigarette) it forms a poisonous gas. Uncontrolled discharging of the refrigerant is dangerous, and potentially damaging to the environment.

12 Air conditioning system components – removal and refitting

Note: *Do not operate the air conditioning system if it is known to be short of refrigerant, as this may damage the compressor.*

1 As the heating side of the system works in the same way as on models without air conditioning, the heater/ventilation control unit, control cables, heater matrix and heater blower motor removal and refitting procedures described in Section 10, are also applicable to models equipped with air conditioning. Note, however, that when working on the fully electronic version of the air conditioning system, there are no control cables to disconnect at the heater/ventilation control unit.

2 The only other operation which can be carried out without discharging the refrigerant is the renewal of the auxiliary (compressor) drivebelt. This is described in the relevant Part of Chapter 1. All other operations must be referred to a Citroën dealer or an air conditioning specialist.

3 If necessary, the compressor can be unbolted and moved aside, without disconnecting its flexible hoses, after removing the drivebelt.

Warning: Do not attempt to open the refrigerant circuit. Refer to the precautions given in Section 11.

Chapter 4 Part A:
Fuel/exhaust systems – petrol engines

Contents

Degrees of difficulty

Easy, suitable for novice with little experience

Fairly easy, suitable for beginner with some experience

Fairly difficult, suitable for competent DIY mechanic

Difficult, suitable for experienced DIY mechanic

Very difficult, suitable for expert DIY or professional

Specifications

System type

1.6 litre engines:	
Pre-2001 models (engine code NFZ)	Bosch Motronic MP7.2
2001 models onward (engine code NFV)	Bosch Motronic ME7.4.4
1.8 litre engines	Sagem S2000

Fuel system data

Fuel pump type	Electric, immersed in tank
Idle speed*:	
1.6 litre engines:	
Without air conditioning	850 ± 50 rpm
With air conditioning	900 ± 50 rpm
1.8 litre engines	700 ± 50 rpm
Idle mixture CO content*	Less than 0.5%

Not adjustable – controlled by ECU

Recommended fuel

Minimum octane rating	95 RON unleaded

Torque wrench settings

	Nm	lbf ft
Exhaust manifold nuts:		
1.6 litre engines	16	12
1.8 litre engines	35	26
Inlet manifold nuts/bolts	20	15

2.1 Slacken the clip and disconnect the air inlet duct from the air cleaner lid – 1.6 litre engines

2.2 Lift the air cleaner assembly upward off the support bracket and remove it from the engine compartment – 1.6 litre engines

2.3 Release the quick-release fitting and withdraw the breather hose from the air inlet duct – 1.6 litre engines

1 General information and precautions

The fuel supply system consists of a fuel tank (which is mounted under the centre of the vehicle, with an electric fuel pump immersed in it), a fuel filter and fuel feed lines. The fuel pump supplies fuel to the fuel rail, which acts as a reservoir for the four fuel injectors which inject fuel into the inlet tracts. The fuel filter incorporated in the feed line from the pump to the fuel rail ensures that the fuel supplied to the injectors is clean.

Warning: Many of the procedures in this Chapter require the removal of fuel lines and connections, which may result in some fuel spillage. Before carrying out any operation on the fuel system, refer to the precautions given in 'Safety first!' at the beginning of this manual, and follow them implicitly. Petrol is a highly dangerous and volatile liquid, and the precautions necessary when handling it cannot be overstressed.

Refer to Section 6 for further information on the operation of each fuel injection system, and to Section 16 for information on the exhaust system.

Note: *Residual pressure will remain in the fuel lines long after the vehicle was last used. When disconnecting any fuel line, first depressurise the fuel system as described in Section 7.*

2.4 Slacken the clip and detach the duct from the throttle housing – 1.6 litre engines

2 Air cleaner assembly and air inlet ducts – removal and refitting

Removal

1.6 litre engines

1 Slacken the retaining clip securing the air inlet duct to the air cleaner lid and disconnect the duct **(see illustration)**.

2 Lift the air cleaner assembly upward to release it from the support bracket and remove it from the engine compartment **(see illustration)**.

3 To remove the air inlet duct, release the quick-release fitting and withdraw the breather hose from the duct **(see illustration)**.

4 Slacken the retaining clip and detach the duct from the throttle housing **(see illustration)**.

2.6 Slacken the clip and disconnect the air inlet flexible duct from the throttle housing fixed duct – 1.8 litre engines

5 If the air cleaner assembly is still in position, slacken the clip securing the inlet duct to the front of the air cleaner lid and remove the duct assembly from the engine compartment.

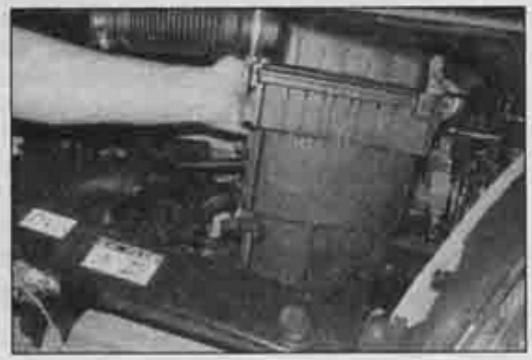
1.8 litre engines

6 Slacken the retaining clip securing the air inlet flexible duct to the air cleaner lid or the fixed duct on the throttle housing **(see illustration)**.

7 Disconnect the flexible duct and lift the air cleaner assembly upward to release it from the support bracket, then remove it from the engine compartment **(see illustration)**.

8 To remove the fixed duct on the throttle housing, release the quick-release fitting and withdraw the breather hose from the duct **(see illustration)**.

9 Insert a screwdriver through the aperture in the side of the duct and slacken the retaining clip **(see illustration)**.



2.7 Lift the air cleaner assembly upward off the support bracket and remove it from the engine compartment – 1.8 litre engines

2.8 Release the quick-release fitting and withdraw the breather hose from the throttle housing fixed duct – 1.8 litre engines

2.9 Insert a screwdriver through the aperture and slacken the retaining clip – 1.8 litre engines

2.10 Lift the fixed duct off the throttle housing – 1.8 litre engines

10 Lift the fixed duct off the throttle housing **(see illustration)**.

Refitting

11 Refitting is a reversal of the removal procedure, ensuring that all air ducts are correctly seated and securely held by their retaining clips.

3 Accelerator cable – removal, refitting and adjustment

Removal

1 On 1.8 litre engines, remove the throttle housing fixed air inlet duct as described in Section 2.

2 Free the accelerator inner cable from the throttle housing cam, then pull the outer cable out from its mounting bracket rubber grommet. Remove the spring clip from its groove in the outer cable **(see illustration)**.

3 Working back along the length of the cable, free it from any retaining clips or ties, noting its correct routing.

4 Extract the stud-type plastic clips, using a forked type tool, and remove the facia lower trim panel above the pedals on the driver's side.

5 Reach up under the facia, depress the ends of the cable end fitting, and detach the inner cable from the top of the accelerator pedal **(see illustration)**.

6 Slide out the plastic retainer securing the outer cable to the bulkhead grommet.

7 Return to the engine compartment, pull the outer cable from the bulkhead grommet and withdraw the cable.

Refitting

8 Feed the accelerator cable through the bulkhead grommet, then return to the car and secure the outer cable with the plastic retainer. Locate the inner cable end fitting in the pedal and push it home until it locks in place.

9 From within the engine compartment, work along the cable, securing it in position with the retaining clips and ties, and ensuring that the cable is correctly routed.

10 Pass the outer cable through its throttle housing mounting bracket grommet, and reconnect the inner cable to the throttle cam. Adjust the cable as described below.

3.2 Free the accelerator inner cable from the throttle cam, and pull the outer cable from its mounting bracket grommet

Adjustment

11 Ensuring that the throttle cam is fully against its stop, gently pull the cable out of its grommet until all free play is removed from the inner cable.

12 With the cable held in this position, refit the spring clip to the last exposed outer cable groove in front of the rubber grommet. When the clip is refitted and the outer cable is released, there should be only a small amount of free play in the inner cable.

13 Have an assistant depress the accelerator pedal, and check that the throttle cam opens fully and returns smoothly to its stop.

14 Refit the facia lower trim panel and, on 1.8 litre engines, refit the throttle housing fixed duct as described in Section 2.

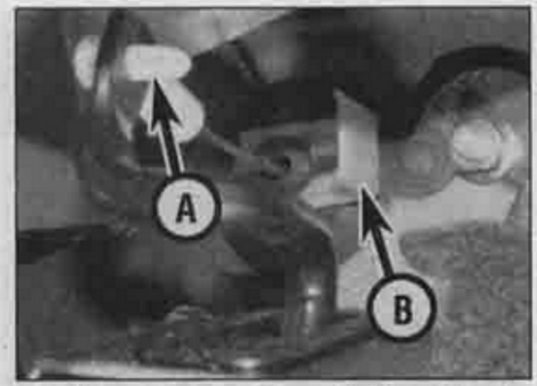
4 Accelerator pedal – removal and refitting

Removal

1 Extract the stud-type plastic clips, using a forked type tool, and remove the facia lower trim panel above the pedals on the driver's side.

2 Reach up under the facia, depress the ends of the accelerator cable end fitting, and detach the inner cable from the top of the accelerator pedal.

4.3 Accelerator pedal pivot retaining clips (arrowed)



3.5 Accelerator cable end fitting (A) and outer cable plastic retainer (B)

3 Extract the pedal pivot retaining clips, slide the pedal out of the pivot bushes and manipulate it out of the pedal bracket **(see illustration)**.

4 Examine the pivot bushes for signs of wear and, if necessary, renew the bushes.

Refitting

5 Refitting is a reversal of the removal procedure, applying a little multi-purpose grease to the pedal pivot. On completion, adjust the accelerator cable as described in Section 3.

5 Unleaded petrol – general information and usage

Note: *The information given in this Chapter is correct at the time of writing. If updated information is thought to be required, check with a Citroën dealer. If travelling abroad, consult one of the motoring organisations (or a similar authority) for advice on the fuel available.*

1 All Citroën Xsara Picasso petrol engines are designed to run on unleaded fuel with a minimum octane rating of 95 (RON). All engines have a catalytic converter, and so must be run on unleaded fuel **only**. Under no circumstances should leaded fuel, or lead replacement petrol (LRP) be used, as this will damage the catalytic converter.

2 The manufacturer's do state, however, that for improved vehicle performance (and possibly increased fuel economy), 98 (RON) unleaded petrol may be used, where this is available.

6 Fuel injection systems – general information

Note: *The fuel injection ECU is of the 'self-learning' type, meaning that as it operates, it also monitors and stores the settings which give optimum engine performance under all operating conditions. When the battery is disconnected, these settings are lost and the ECU reverts to the base settings programmed into its memory at the factory. On restarting,*

this may lead to the engine running/idling roughly for a short while, until the ECU has relearned the optimum settings. This process is best accomplished by taking the vehicle on a road test (for approximately 15 minutes), covering all engine speeds and loads, concentrating mainly in the 2500 to 3500 rpm region.

On all engines, the fuel injection and ignition functions are combined into a single engine management system. The systems fitted are manufactured by Bosch and Sagem, and are very similar to each other in most respects, the only significant differences being in the software contained in the system ECU, and specific component location according to engine type. Each system incorporates a closed-loop catalytic converter and an evaporative emission control system, and complies with the latest emission control standards. Refer to Chapter 5B for information on the ignition side of each system; the fuel side of the system operates as follows.

The fuel pump supplies fuel from the tank to the fuel rail, via a replaceable cartridge filter mounted on the side of the fuel tank. The pump itself is mounted inside the tank, with the pump motor permanently immersed in fuel, to keep it cool. The fuel rail is mounted directly above the fuel injectors and acts as a fuel reservoir.

Fuel rail supply pressure is controlled by the pressure regulator, also located in the fuel tank. The regulator contains a spring-loaded valve, which lifts to allow excess fuel to recirculate within the tank when the optimum operating pressure of the fuel system is exceeded (eg, during low speed, light load cruising).

The fuel injectors are electromagnetic pintle valves, which spray atomised fuel into the combustion chambers under the control of the engine management system ECU. There are four injectors, one per cylinder, mounted in the inlet manifold close to the cylinder head. Each injector is mounted at an angle that allows it to spray fuel directly onto the back of the inlet valve(s). The ECU controls the volume of fuel injected by varying the length of time for which each injector is held open. The fuel injection systems are typically of the sequential type, whereby each injector operates individually in cylinder sequence.

The electrical control system consists of the ECU, along with the following sensors:

a) Throttle potentiometer – informs the ECU of the throttle valve position, and the rate of throttle opening/closing.
b) Coolant temperature sensor – informs the ECU of engine temperature.
c) Inlet air temperature sensor – informs the ECU of the temperature of the air passing through the throttle housing.
d) Lambda sensors – inform the ECU of the oxygen content of the exhaust gases (explained in greater detail in Part C of this Chapter).
e) Manifold pressure sensor – informs the ECU of the load on the engine (expressed in terms of inlet manifold vacuum).
f) Crankshaft sensor – informs the ECU of engine speed and crankshaft angular position.
g) Vehicle speed sensor – informs the ECU of the vehicle speed.
h) Knock sensor – informs the ECU of pre-ignition (detonation) within the cylinders.
i) Camshaft sensor – informs the ECU of which cylinder is on the firing stroke on systems with sequential injection.

Signals from each of the sensors are compared by the ECU and, based on this information, the ECU selects the response appropriate to those values, and controls the fuel injectors (varying the pulse width – the length of time the injectors are held open – to provide a richer or weaker air/fuel mixture, as appropriate). The air/fuel mixture is constantly varied by the ECU, to provide the best settings for cranking, starting (with either a hot or cold engine) and engine warm-up, idle, cruising and acceleration.

The ECU also has full control over the engine idle speed, via a stepper motor fitted to the throttle housing. The stepper motor controls the amount of air passing through a bypass drilling at the side of the throttle. When the throttle valve is closed (accelerator pedal released), the ECU uses the motor to open or close an air passage, controlling the amount of air bypassing the throttle valve and so controlling the idle speed. The ECU also carries out 'fine tuning' of the idle speed by varying the ignition timing to increase or reduce the torque of the engine as it is idling. This helps to stabilise the idle speed when electrical or mechanical loads (such as headlights, air conditioning, etc) are switched on and off.

The throttle housing is also fitted with an electric heating element. The heater is supplied with current by the ECU, warming the throttle housing on cold starts to help prevent icing of the throttle valve.

The exhaust and evaporative loss emission control systems are described in more detail in Chapter 4C.

If there is any abnormality in any of the readings obtained from the coolant temperature sensor, the inlet air temperature sensor or the lambda sensor, the ECU enters its 'back-up' mode. If this happens, the erroneous sensor signal is overridden, and the ECU assumes a pre-programmed 'back-up' value, which will allow the engine to continue running, albeit at reduced efficiency. If the ECU enters this mode, the warning lamp on the instrument panel will be illuminated, and the relevant fault code will be stored in the ECU memory.

If the warning light illuminates, the vehicle should be taken to a Citroën dealer at the earliest opportunity. Once there, a complete test of the engine management system can be carried out, using a special electronic diagnostic test unit, which is plugged into the system's diagnostic connector.

7 Fuel injection system – depressurisation

Note: *Refer to the warning note in Section 1 before proceeding.*

Warning: The following procedure will merely relieve the pressure in the fuel system – remember that fuel will still be present in the system components and take precautions accordingly before disconnecting any of them.

1 The fuel system referred to in this Section is defined as the tank-mounted fuel pump, the fuel filter, the fuel injectors, the fuel rail and the metal pipes and flexible hoses of the fuel lines between these components. All these contain fuel which will be under pressure while the engine is running, and/or while the ignition is switched on. The pressure will remain for some time after the ignition has been switched off, and must be relieved in a controlled fashion when any of these components are disturbed for servicing work.

2 Disconnect the battery negative terminal (refer to *Disconnecting the battery* in the Reference Chapter).

3 On 1.8 litre engines, remove the engine cover.

4 Place a container beneath the connection or union to be disconnected, and have a large rag ready to soak up any escaping fuel not being caught by the container.

5 Slowly loosen the connection or union nut to avoid a sudden release of pressure, and position the rag around the connection to catch any fuel spray which may be expelled. Once the pressure is released, disconnect the fuel line. Plug the pipe ends, to minimise fuel loss and prevent the entry of dirt into the fuel system.

6 On 1.8 litre engines a Schrader valve is fitted to the centre of the fuel rail and can, if desired, be used for depressurisation. The Schrader valve operates like a tyre valve whereby on depressing the central plunger the system pressure will be released. Ensure that the valve is protected with rags to soak up escaping fuel as this is done.

8 Fuel pump – removal and refitting

Note: *Refer to the warning note in Section 1 before proceeding.*

Removal

1 Remove the fuel tank as described in Section 10.

2 Wipe clean the area around the fuel pump external components located on the top of the fuel tank.

3 Disconnect the wiring connector from the centre of the fuel pump.

10.7 Fuel pump wiring harness connector (arrowed)

4 Mark the hoses for identification purposes, then disconnect the quick-release fittings using a small screwdriver to release the locking clip. Disconnect both hoses from the top of the pump, and plug the hose ends.

5 Noting the alignment marks on the pump cover and the locking ring, unscrew the ring and remove it from the tank. This is best accomplished by making up a simple tool from two strips of metal, suitably drilled and joined together with two lengths of threaded bar and locknuts. Engage the tool with the raised ribs of the locking ring, and turn the ring anti-clockwise until it can be unscrewed by hand.

6 Lift the fuel pump and sender unit assembly out of the fuel tank, taking great care not to damage the float arm. Recover the sealing O-ring and discard it – a new one must be used on refitting.

7 Note that the fuel pump and sender unit is only available as a complete assembly – no components are available separately.

Refitting

8 Ensure the fuel pump pick-up filter is clean and free of debris, then locate the new sealing O-ring on the top of the fuel tank.

9 Carefully manoeuvre the pump and sender unit assembly into the fuel tank, aligning the notch on the pump body with the cut-out in the tank. Take care not to displace the O-ring as the pump is fitted.

10 Refit the locking ring and securely tighten it until the small raised arrow on the ring is aligned with the arrow on the top of the pump.

11 Reconnect the feed and return hoses to the top of the fuel pump, using the marks made on removal to ensure that they are correctly reconnected.

12 Reconnect the pump wiring connector.

13 Refit the fuel tank as described in Section 10.

9 Fuel gauge sender unit – removal and refitting

The fuel gauge sender unit is integral with the fuel pump. Refer to the procedures contained in Section 8.

10.9 Release the retaining clip (arrowed) and disconnect the main filler neck hose from the fuel tank

10 Fuel tank – removal and refitting

Note: *Refer to the warning note in Section 1 before proceeding.*

Removal

1 Before removing the fuel tank, all fuel must be drained from the tank. Since a fuel tank drain plug is not provided, it is therefore preferable to carry out the removal operation when the tank is nearly empty. Before proceeding, disconnect the battery negative terminal (refer to *Disconnecting the battery* in the Reference Chapter) and syphon or hand-pump the remaining fuel from the tank.

2 Chock the front wheels then jack up the rear of the vehicle and support it securely on axle stands (see *Jacking and vehicle support*). Remove the right-hand rear roadwheel.

3 For access to the filler neck and breather hose connections, remove the right-hand rear wheel arch liner. The liner is secured by a combination of screws and push-fit clips. Removal is self-evident and the clips can be released using a forked-shaped tool.

4 Disconnect the fuel tank breather hoses now accessible at their upper and lower quick-release connectors.

5 Remove the exhaust system and the heat shield below the fuel tank as described in Section 16.

6 Release the two handbrake cables from the plastic clips on the fuel tank, and from the wire retaining hooks on the underbody. Move the cables away from the tank as far as possible.

10.11 Fuel tank support rod rear retaining bolt (arrowed)

7 Disconnect the wiring harness connector located in front of the tank on the right-hand side **(see illustration)**.

8 Disconnect the fuel filter outlet hose at the quick-release connector on the filter. Similarly, disconnect the fuel return hose (where fitted) at the quick-release connector just in front of the fuel filter.

9 Release the retaining clip and disconnect the main filler neck hose from the fuel tank **(see illustration)**. Suitably cover the end of the disconnected hose and the tank outlet.

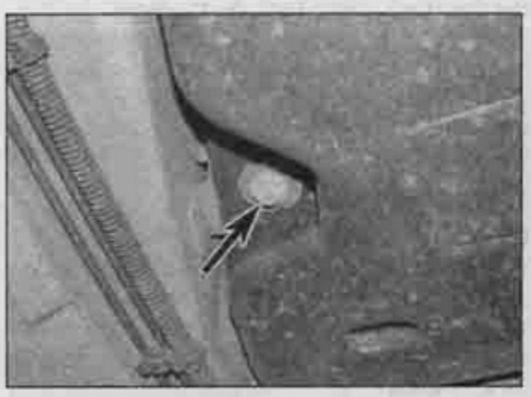
10 Place a trolley jack with an interposed block of wood beneath the tank, then raise the jack until it is supporting the weight of the tank.

11 Undo and remove the two retaining bolts, then remove the support rod from the underside of the tank **(see illustration)**.

12 Undo and remove the fuel tank mounting bolt on each side of the tank **(see illustrations)**. Collect the large flat washers from each bolt.

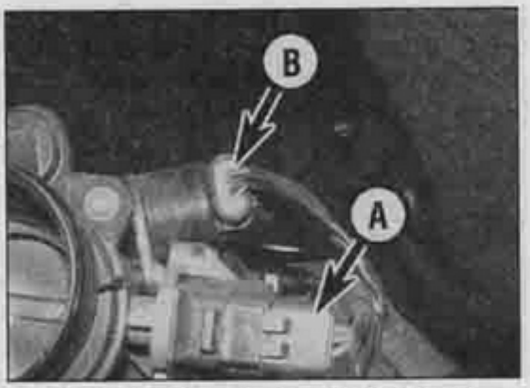
13 Slowly lower the fuel tank out of position, and remove the tank from underneath the vehicle.

14 If the tank is contaminated with sediment or water, remove the fuel pump as described in Section 8, and swill the tank out with clean fuel. The tank is injection-moulded from a synthetic material – if seriously damaged, it should be renewed. However, in certain cases, it may be possible to have small leaks or minor damage repaired. Seek the advice of a specialist before attempting to repair the fuel tank.



10.12a Undo and remove the fuel tank left-hand mounting bolt (arrowed) . . .

10.12b . . . and right-hand mounting bolt (arrowed)



12.4 Throttle potentiometer (A) and stepper motor (B) wiring connectors – later 1.6 litre engines

Refitting

15 Refitting is the reverse of the removal procedure, noting the following points:

a) When lifting the tank back into position, take care to ensure that none of the hoses become trapped between the tank and vehicle body.

b) Ensure all pipes and hoses are correctly routed, and securely held in position with their retaining clips.

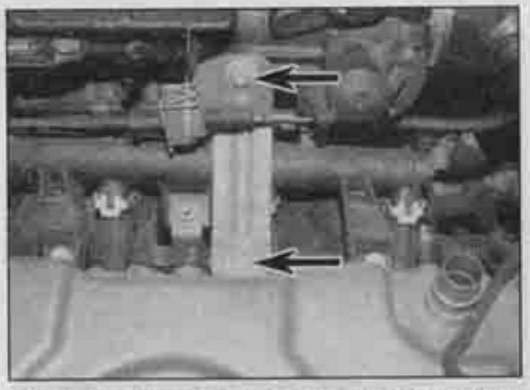
c) On completion, refill the tank with a small amount of fuel, and check for signs of leakage prior to taking the vehicle out on the road.

11 Fuel injection system – testing and adjustment

Testing

1 If a fault appears in the fuel injection/engine management system, first ensure that all the system wiring connectors are securely connected and free of corrosion. Ensure that the fault is not due to poor maintenance; ie, check that the air cleaner filter element is clean, the spark plugs are in good condition and correctly gapped, the cylinder compression pressures are correct, and that the engine breather hoses are clear and undamaged, referring to the relevant Parts of Chapters 1, 2 and 5 for further information.

2 If these checks fail to reveal the cause of the problem, the vehicle should be taken to a Citroën dealer or suitably-equipped garage for testing. A diagnostic socket is located adjacent to the passenger compartment fusebox in which a fault code reader or other suitable test equipment can be connected. By using the code reader or test equipment, the engine management ECU (and the various other vehicle system ECUs) can be interrogated, and any stored fault codes can be retrieved. This will allow the fault to be quickly and simply traced, alleviating the need to test all the system components individually, which is a time-consuming operation that carries a risk of damaging the ECU.



13.4 Accelerator cable mounting bracket retaining bolts (arrowed) – later 1.6 litre engines

Adjustment

3 Experienced home mechanics with a considerable amount of skill and equipment (including a tachometer and an accurately calibrated exhaust gas analyser) may be able to check the exhaust CO level and the idle speed. However, if these are found to be outside the specified tolerance, the car must be taken to a suitably-equipped garage for further testing. Neither the mixture adjustment (exhaust gas CO level) nor the idle speed are adjustable, and should either be incorrect, a fault may be present in the engine management system.

12 Throttle housing – removal and refitting

Removal

1 Disconnect the battery negative terminal (refer to *Disconnecting the battery* in the Reference Chapter).

1.6 litre engines

2 Remove the air cleaner assembly and air inlet ducts as described in Section 2.

3 Disconnect the accelerator inner cable from the throttle cam, then withdraw the outer cable from the mounting bracket, along with its spring clip.

4 Disconnect the wiring connectors from the throttle potentiometer, stepper motor and, where applicable, from the inlet air temperature sensor and electric heating element on the throttle housing **(see illustration)**.

5 Slacken and remove the retaining screws, and remove the throttle housing from the inlet manifold. Recover the O-ring from manifold (where fitted) and discard it; a new one must be used when refitting.

1.8 litre engines

6 Remove the air inlet fixed duct from the throttle housing as described in Section 2.

7 Disconnect the accelerator inner cable from the throttle cam, then withdraw the outer cable from the mounting bracket along with its spring clip.

8 Depress the retaining clips, and disconnect the wiring connectors from the throttle potentiometer, the electric heating element, the inlet air temperature sensor and idle speed stepper motor.

9 Disconnect the two breather hoses at the quick-release connectors behind the throttle housing.

10 Slacken and remove the retaining bolts and remove the throttle housing from the inlet manifold. Remove the O-ring from the manifold, and discard it – a new one must be used on refitting.

Refitting

11 Refitting is a reversal of the removal procedure, noting the following points:

a) Fit a new O-ring to the manifold, then refit the throttle housing and securely tighten its retaining screws or bolts (as applicable).

b) Ensure all hoses are correctly reconnected and, where necessary, are securely held in position by the retaining clips.

c) Ensure all wiring is correctly routed, and that the connectors are securely reconnected.

d) Adjust the accelerator cable as described in Section 3.

e) Refit the air cleaner and air inlet components as described in Section 2.

13 Fuel injection system components – removal and refitting

1.6 litre engines

Fuel rail and injectors

Note: *Refer to the warning note in Section 1 before proceeding. If a faulty injector is suspected, before condemning the injector, it is worth trying the effect of one of the proprietary injector-cleaning treatments which are available from car accessory shops.*

1 Disconnect the battery negative terminal (refer to *Disconnecting the battery* in the Reference Chapter).

2 Remove the ignition coil unit as described in Chapter 5B.

3 Disconnect the accelerator inner cable from the throttle cam, then withdraw the outer cable from the mounting bracket along with its spring clip.

4 Undo the retaining bolts and remove the accelerator cable mounting bracket **(see illustration)**.

5 Bearing in mind the information given in Section 7, depress the catch on the fuel feed hose quick-release fitting, and disconnect the hose from the fuel rail **(see illustration)**. Suitably seal or plug the hose and the fuel rail union after disconnection.

6 Depress the retaining tangs and disconnect the wiring connectors from the four injectors.

7 Unclip the brake servo vacuum hose from the clips on the fuel rail (where applicable).

8 Slacken and remove the three fuel rail retaining bolts, then carefully ease the fuel rail

and injector assembly out from the inlet manifold and remove it from the engine. Remove the O-rings from the end of each injector and discard them; they must be renewed whenever they are disturbed.

9 Slide out the retaining clip(s) and remove the relevant injector(s) from the fuel rail. Remove the upper O-ring from each disturbed injector and discard; all disturbed O-rings must be renewed.

10 Refitting is a reversal of the removal procedure, noting the following points.

a) *Fit new O-rings to all disturbed injector unions.*
b) *Apply a smear of engine oil to the O-rings to aid installation, then ease the injectors and fuel rail into position ensuring that none of the O-rings are displaced.*
c) *Refit the ignition coil unit as described in Chapter 5B.*
d) *Adjust the accelerator cable as described in Section 3.*
e) *On completion, start the engine and check for fuel leaks.*

Throttle potentiometer

11 Disconnect the battery negative terminal (refer to *Disconnecting the battery* in the Reference Chapter).

12 Depress the retaining clip and disconnect the wiring connector from the throttle potentiometer **(see illustration)**.

13 Slacken and remove the two retaining screws, then disengage the potentiometer from the throttle valve spindle and remove it from the engine.

14 Refit in the reverse order of removal. Ensure that the potentiometer is correctly engaged with the throttle valve spindle.

Electronic control unit (ECU)

Note: *If a new ECU is to be fitted, this work must be entrusted to a Citroën dealer. It is necessary to initialise the new ECU after installation which requires the use of dedicated Citroën diagnostic equipment.*

15 The ECU is located on the right-hand side of the engine compartment adjacent to the fuse/relay box. The ECU can be withdrawn from its location and moved to one side, without disconnecting its wiring connectors, if this is required for access to other components. To remove the ECU completely, it will be necessary to drill out the pop rivets securing the metal tamperproof cover over the top of the wiring connectors. These rivets are larger than the standard type and it will be necessary to obtain new rivets and a suitable rivet gun for refitting.

16 Disconnect the battery negative terminal (refer to *Disconnecting the battery* in the Reference Chapter).

17 If necessary for improved access, remove the air cleaner assembly as described in Section 2.

18 Disconnect the wiring connector from the fuel injection double relay on the side of the ECU case.

19 Release the ECU wiring harness from the retaining clip at the base of the ECU support tray.

20 Lift the ECU up and out of the support tray, then drill out the pop rivets securing the metal cover over the wiring connectors. Lift off the metal cover and release the protective boot over the connectors **(see illustrations)**.

21 Release the retaining clips on the connector locking catches using a small screwdriver. Rotate the locking catches and disconnect the three wiring connectors from the ECU.

22 If necessary the ECU can be unbolted and removed from its case.

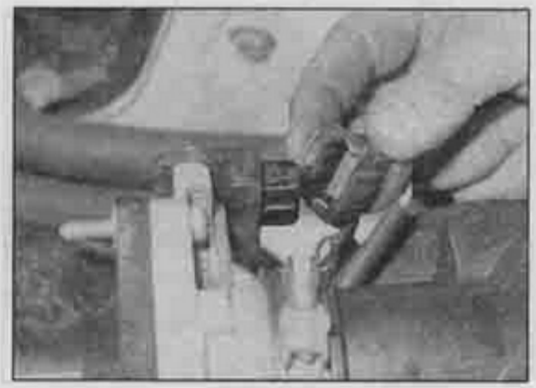
23 To refit the ECU, first attach it to the case (if removed) and secure with the retaining bolts.

24 Locate the ECU in position in its engine compartment support tray.

25 Reconnect the three wiring connectors and lock them in place by rotating the retaining catches **(see illustration)**.

26 Refit the protective boot over the wiring connectors, then locate the metal cover in position. Secure the cover in position using new pop rivets **(see illustrations)**.

13.5 Fuel feed hose quick-release fitting (arrowed) at the fuel rail – later 1.6 litre engines



13.12 Disconnect the throttle potentiometer wiring connector – early 1.6 litre engines

13.20a Drill out the pop rivets securing the metal cover over the ECU wiring connectors . . .

13.20b . . . then lift the metal cover off the ECU – 1.6 litre engines

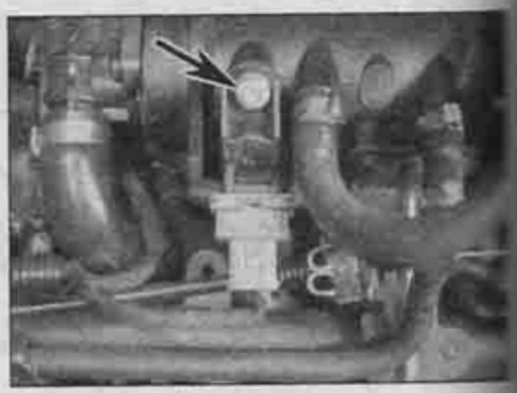
13.25 Reconnect the three ECU wiring connectors and lock them by rotating the retaining catches – 1.6 litre engines

13.26a Refit the protective boot over the ECU wiring connectors . . .

13.26b . . . locate the metal cover in position . . .

13.26c . . . and secure the cover using new pop rivets – 1.6 litre engines

13.32 Idle speed stepper motor securing screw (arrowed) – early 1.6 litre engines



13.36 Manifold pressure sensor securing screw (arrowed) – early 1.6 litre engines

27 Reconnect the injection double relay wiring connector and clip the ECU wiring harness to the support tray.

28 Refit the air cleaner assembly (if removed) and reconnect the battery.

Idle speed stepper motor

29 The idle speed stepper motor is located on the right-hand end of the inlet manifold on early engines, and on the side of the throttle housing assembly on later engines.

30 Disconnect the battery negative terminal (refer to *Disconnecting the battery* in the Reference Chapter).

31 Release the retaining clip and disconnect the wiring connector from the motor. On early engines, release the retaining clip and disconnect the air hose.

32 Slacken and remove the two retaining screws, and withdraw the motor from the manifold or throttle housing **(see illustration)**.

33 Refitting is a reversal of the removal procedure.

Manifold pressure sensor

34 The manifold pressure sensor is located on the front face of the inlet manifold.

35 Disconnect the battery negative terminal (refer to *Disconnecting the battery* in the Reference Chapter).

36 On early engines, remove the securing screw and withdraw the sensor from the manifold **(see illustration)**. Disconnect the wiring connector, and remove the sensor from the engine.

37 On later engines, disconnect the breather hose quick-release connector and move the hose to one side for improved access to the pressure sensor.

38 Disconnect the wiring connector, then undo the retaining bolt and withdraw the sensor from the manifold **(see illustrations)**.

39 Refitting is the reverse of the removal procedure but fit a new sealing O-ring to the sensor body.

Coolant temperature sensor

40 Refer to Chapter 3, Section 6.

Inlet air temperature sensor

41 On early engines, the inlet air temperature sensor is located on the underside of the throttle housing. On later engines the sensor is integral with the manifold pressure sensor.

42 Disconnect the battery negative terminal (refer to *Disconnecting the battery* in the Reference Chapter).

43 Disconnect the wiring connector, then unscrew the sensor and remove it from the manifold.

44 Refitting is the reverse of removal.

Crankshaft sensor

45 The crankshaft sensor is situated on the upper face of the transmission bellhousing and is virtually inaccessible.

46 Disconnect the battery negative terminal (refer to *Disconnecting the battery* in the Reference Chapter).

47 Release the cable clips, cable ties and coolant hose support clips for access to the sensor as necessary.

48 Disconnect the sensor to the wiring connector.

49 Slacken the sensor retaining bolt (there is no need to remove it completely) and rotate the sensor body to disengage it from the retaining bolt **(see illustration)**. Withdraw the sensor upward and out of its location.

50 Refitting is reverse of the removal procedure, ensuring that all wiring and hoses are correctly clipped back into place.

Knock sensor

51 Refer to Chapter 5B.

Vehicle speed sensor

52 The vehicle speed sensor is an integral part of the speedometer drive housing. Refer to Chapter 7 for removal and refitting details.

1.8 litre engines

Fuel rail and injectors

Note: *Refer to the warning note in Section 1 before proceeding. If a faulty injector is suspected, before condemning the injector it is worth trying the effect of one of the proprietary injector-cleaning treatments which are available from car accessory shops.*

53 Disconnect the battery negative terminal (refer to *Disconnecting the battery* in the Reference Chapter).

54 Bearing in mind the information given in Section 7, depress the catch on the fuel feed hose quick-release fitting, and disconnect the hose from the fuel rail **(see illustration)**. Suitably seal or plug the hose and the fuel rail union after disconnection.

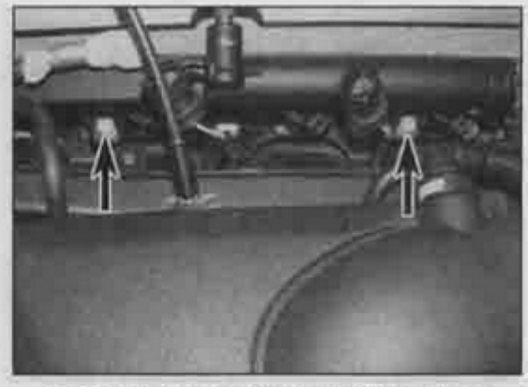
13.38a Disconnect the manifold pressure wiring connector . . .

13.38b . . . then undo the bolt and withdraw the sensor from the manifold – later 1.6 litre engines

13.49 Rotate the crankshaft sensor body to disengage it from the retaining bolt – 1.6 litre engines

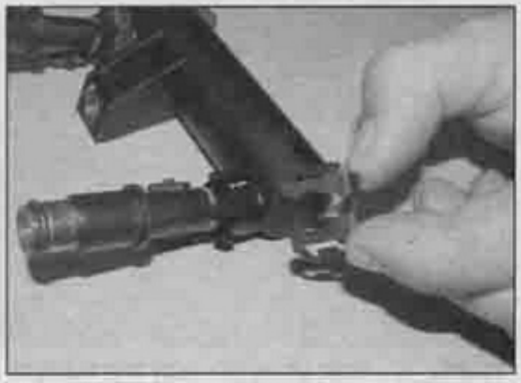
13.54 Depress the catch on the fuel feed hose quick-release fitting, and disconnect the hose from the fuel rail – 1.8 litre engines

13.55 Disconnect the wiring connectors from the four fuel injectors – 1.8 litre engines



13.56a Undo the two fuel rail retaining bolts (arrowed) . . .

13.56b . . . then ease the fuel rail and injector assembly out from the inlet manifold – 1.8 litre engines



13.57a Slide out the retaining clip(s) . . .

13.57b . . . and remove the relevant injector(s) from the fuel rail – 1.8 litre engines

55 Using a small screwdriver, release the locking clip and disconnect the wiring connectors from the four fuel injectors **(see illustration)**.

56 Undo the two fuel rail retaining bolts, then carefully ease the fuel rail and injector assembly out from the inlet manifold and remove it from the engine **(see illustrations)**. Remove the O-rings from the end of each injector and discard them; they must be renewed whenever they are disturbed.

57 Slide out the retaining clip(s) and remove the relevant injector(s) from the fuel rail **(see illustrations)**. Remove the upper O-ring from each disturbed injector and discard; all disturbed O-rings must be renewed.

58 Refitting is a reversal of the removal procedure, noting the following points.

a) *Fit new O-rings to all disturbed injector unions.*

b) *Apply a smear of engine oil to the O-rings to aid installation, then ease the injectors and fuel rail into position ensuring that none of the O-rings are displaced.*

c) *On completion, start the engine and check for fuel leaks.*

Throttle potentiometer

59 Disconnect the battery negative terminal (refer to *Disconnecting the battery* in the Reference Chapter).

60 Remove the air inlet fixed duct from the throttle housing as described in Section 2.

61 Depress the retaining clip and disconnect the wiring connector from the throttle potentiometer, located on the side of the throttle housing **(see illustration)**.

62 Slacken and remove the two retaining screws, then disengage the potentiometer from the throttle valve spindle and remove it from the engine.

63 Refit in the reverse order of removal. Ensure that the potentiometer is correctly engaged with the throttle valve spindle.

Electronic control unit (ECU)

64 Refer to paragraphs 15 to 28.

Idle speed stepper motor

65 The idle speed stepper motor is located on the side of the throttle housing.

66 Disconnect the battery negative terminal (refer to *Disconnecting the battery* in the Reference Chapter).

67 Remove the air inlet fixed duct from the throttle housing as described in Section 2.

68 Release the retaining clip and disconnect the wiring connector from the motor **(see illustration)**.

69 Slacken and remove the two retaining screws, and withdraw the motor from the throttle housing.

70 Refitting is a reversal of the removal procedure.

Manifold pressure sensor

71 The manifold pressure sensor is located on the front face of the inlet manifold, just below the throttle housing.

72 Disconnect the battery negative terminal (refer to *Disconnecting the battery* in the Reference Chapter).

73 Remove the air inlet fixed duct from the throttle housing as described in Section 2.

74 Disconnect the wiring connector, then undo the retaining bolt and withdraw the

13.61 Throttle potentiometer wiring connector (arrowed) – 1.8 litre engines

13.68 Idle speed stepper motor wiring connector (arrowed) – 1.8 litre engines

13.74 Disconnect the manifold pressure sensor wiring connector – 1.8 litre engines

13.77 Inlet air temperature sensor location (arrowed) – 1.8 litre engines

13.86a Disconnect the camshaft position sensor wiring connector . . .

13.86b . . . then undo the bolt and remove the sensor from the rear cylinder head cover – 1.8 litre engines

sensor from the manifold **(see illustration)**.

75 Refitting is the reverse of the removal procedure but fit a new sealing O-ring to the sensor body.

Coolant temperature sensor

76 Refer to Chapter 3, Section 6.

Inlet air temperature sensor

77 The inlet air temperature sensor is located on the front face of the throttle housing **(see illustration)**.

78 Disconnect the battery negative terminal (refer to *Disconnecting the battery* in the Reference Chapter).

79 Remove the air inlet fixed duct from the throttle housing as described in Section 2.

80 Disconnect the wiring connector, then withdraw the sensor from the manifold.

81 Refitting is the reverse of removal.

Camshaft position sensor

82 The camshaft position sensor is located at the left-hand end of the exhaust camshaft cylinder head cover.

83 Disconnect the battery negative terminal (refer to *Disconnecting the battery* in the Reference Chapter).

84 Undo the six screws and lift off the engine cover.

85 Disconnect the crankcase breather hose at the quick-fit connector on the rear cylinder head cover.

86 Disconnect the wiring connector at the camshaft position sensor, then undo the bolt and remove the sensor from the rear cylinder head cover **(see illustrations)**.

87 Refitting is the reverse of removal but fit a new sealing O-ring to the sensor body.

Crankshaft sensor

88 Refer to paragraphs 45 to 50.

Knock sensor

89 Refer to Chapter 5B.

14.16a Disconnect the left-hand breather hose . . .

14.16b . . . and right-hand breather hose from their connections at the rear of the throttle housing – 1.8 litre engines

Vehicle speed sensor

90 The vehicle speed sensor is an integral part of the speedometer drive housing. Refer to Chapter 7 for removal and refitting details.

14 Inlet manifold – removal and refitting

Removal

Note: *Refer to the warning note in Section 1 before proceeding.*

1 Disconnect the battery negative terminal (refer to *Disconnecting the battery* in the Reference Chapter) then proceed as described under the relevant sub-heading.

1.6 litre engines

2 Remove the air cleaner assembly air inlet ducts as described in Section 2.

3 Remove the ignition coil unit as described in Chapter 5B.

4 Disconnect the accelerator inner cable from the throttle cam, then withdraw the outer cable from the mounting bracket, along with its spring clip.

5 Undo the retaining bolts and remove the accelerator cable mounting bracket.

6 Disconnect the wiring connectors from the throttle potentiometer, stepper motor, inlet air temperature sensor and electric heating element on the throttle housing.

7 Release the retaining clips (where fitted) and disconnect all the relevant vacuum and breather hoses from the manifold. Make identification marks on the hoses to ensure they are connected correctly on refitting.

8 Bearing in mind the information given in Section 7, depress the catch on the fuel feed hose quick-release fitting, and disconnect the hose from the fuel rail. Suitably seal or plug the hose and the fuel rail union after disconnection.

9 Depress the retaining tangs and disconnect the wiring connectors from the four injectors. Free the wiring from any relevant retaining clips and position it clear of the manifold.

10 Unclip the brake servo vacuum hose from the clips on the fuel rail (where applicable).

11 Undo the manifold retaining nuts and withdraw the manifold from the cylinder head. Recover the four manifold seals and discard them; new ones must be used on refitting.

1.8 litre engines

12 Remove the air inlet fixed duct from the throttle housing as described in Section 2.

13 Depress the retaining tangs and disconnect the wiring connectors from the four injectors.

14 Disconnect the accelerator inner cable from the throttle cam, then withdraw the outer cable from the mounting bracket along with its spring clip.

15 Depress the retaining clips, and disconnect the wiring connectors from the throttle potentiometer, the inlet air temperature

14.17 Disconnect the brake servo vacuum hose from below the throttle housing – 1.8 litre engines

14.18 Undo the two screws and release the wiring harness plastic duct from the inlet manifold – 1.8 litre engines

14.19 Release the locking clip and disconnect the EGR pipe from the cylinder head – 1.8 litre engines

14.20 Disconnect the fuel feed hose from the fuel rail – 1.8 litre engines

14.21 Undo the retaining bolts and the two nuts and withdraw the manifold from the cylinder head – 1.8 litre engines

14.22 Remove the manifold seals and use new ones when refitting – 1.8 litre engines

sensor the manifold pressure sensor and the idle speed stepper motor.

16 Depress the catches on the quick-release connectors and disconnect the two breather hoses at the rear of the throttle housing **(see illustrations)**. Disconnect the wiring connector located between the two breather hose connections.

17 Depress the catch on the quick-release connector and disconnect the brake servo vacuum hose from below the throttle housing **(see illustration)**.

18 Undo the two screws and release the wiring harness plastic duct from the inlet manifold. Move the duct and wiring harness to one side **(see illustration)**.

19 Using a small screwdriver, release the locking clip and disconnect the EGR pipe from the connection on the cylinder head **(see illustration)**.

20 Bearing in mind the information given in Section 7, depress the catch on the fuel feed hose quick-release fitting, and disconnect the hose from the fuel rail **(see illustration)**. Suitably seal or plug the hose and the fuel rail union after disconnection.

21 Undo the retaining bolts and the two nuts securing the manifold to the cylinder head. Withdraw the manifold from its location and remove it from the engine compartment **(see illustration)**.

22 Remove the four manifold seals and discard them; new ones must be used on refitting **(see illustration)**.

Refitting

23 Refitting is a reverse of the relevant removal procedure, noting the following points:

a) Ensure that the manifold and cylinder head mating surfaces are clean and dry, then locate the new seals in their recesses in the manifold. Refit the manifold and tighten its retaining nuts and bolts to the specified torque.

b) Ensure that all relevant hoses are reconnected to their original positions and are securely held (where necessary) by the retaining clips.

c) Refit and reconnect all removed components as described in the Sections indicated in the removal procedure.

d) On completion, adjust the accelerator cable as described in Section 3.

15 Exhaust manifold – removal and refitting

15.2 Disconnect the lambda sensor wiring connector at the side of the coolant outlet housing – 1.6 litre engines

15.3a Release the lambda sensor wiring from the clip on the engine lifting bracket . . .

Removal

1.6 litre engines

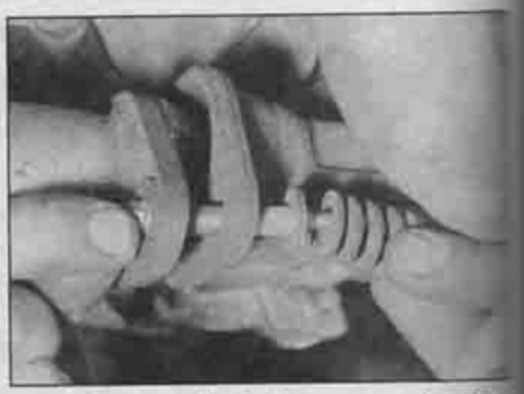
1 Disconnect the battery negative terminal (refer to *Disconnecting the battery* in the Reference Chapter).

2 Release the retaining catch and disconnect the lambda sensor wiring connector located on the side of the coolant outlet housing **(see illustration)**. Release the wiring from the clip and free it from the coolant outlet housing.

3 Release the lambda sensor wiring from the clip on the left-hand engine lifting bracket, then undo the retaining bolt and remove the lifting bracket **(see illustrations)**.

15.3b . . . then undo the bolt and remove the lifting bracket – 1.6 litre engines

15.4 Undo the two bolts and lift the heat shield off the manifold – 1.6 litre engines



16.8 Remove the fasteners securing the exhaust front pipe to the catalytic converter – 1.6 litre engines

4 Undo the two bolts and lift the heat shield off the manifold, feeding the lambda sensor wiring through the hole in the centre of the shield as it is removed **(see illustration)**.

5 Firmly apply the handbrake, then jack up the front of the car and support it securely on axle stands (see *Jacking and vehicle support*).

6 Undo the nuts/bolts securing the exhaust front pipe to the manifold, then remove the bolt securing the front pipe to its mounting bracket. Disconnect the front pipe from the manifold, and recover the gasket. Support the front pipe on a block of wood.

7 Undo the eight retaining nuts securing the manifold to the cylinder head. Manoeuvre the manifold out of the engine compartment, and discard the manifold gaskets.

1.8 litre engines

8 Disconnect the battery negative terminal (refer to *Disconnecting the battery* in the Reference Chapter).

9 Remove the cylinder head cover over the exhaust camshaft as described in Chapter 2B.

10 Firmly apply the handbrake, then jack up the front of the vehicle and support it securely on axle stands (see *Jacking and vehicle support*).

11 Undo the nut and remove the through bolt, then spread the clamping ring securing the exhaust front pipe to the manifold. Withdraw the front pipe from the clamp.

12 Undo the ten nuts securing the exhaust manifold to the cylinder head. Withdraw the manifold from the cylinder head studs and manoeuvre it out from the rear of the engine with the gasket face uppermost.

13 Collect the gasket from the manifold studs.

Refitting

14 Refitting is the reverse of the removal procedure, noting the following points:

a) Examine all the exhaust manifold studs for signs of damage and corrosion; remove all traces of corrosion, and repair or renew any damaged studs.

b) Ensure that the manifold and cylinder head sealing faces are clean and flat, and fit the new manifold gasket(s). Tighten the manifold retaining nuts to the specified torque.

c) Reconnect the front pipe to the manifold, using the information given in Section 16.

d) On 1.8 litre engines, refit the cylinder head cover as described in Chapter 2B.

16 Exhaust system – general information, removal and refitting

General information

1 The exhaust system consists of three or four sections according to engine type, ie, the front pipe, the catalytic converter, the intermediate pipe and centre silencer, and the tailpipe and main silencer. All exhaust sections are secured by clamping rings, with a flexible section incorporated in the front pipe to cater for engine movement.

2 The system is suspended throughout its entire length by rubber mountings.

Removal – 1.6 litre engines

3 Each exhaust section can be removed individually, or alternatively, the complete system can be removed as a unit. Even if only one part of the system needs attention, it is often easier to remove the whole system and separate the sections on the bench.

4 To remove the system or part of the system, first jack up the front or rear of the car and support it on axle stands (see *Jacking and vehicle support*). Alternatively, position the car over an inspection pit or on car ramps.

5 On early engines, the catalytic converter is incorporated into the intermediate section, whereas on later engines the converter is part of the front pipe.

Front pipe/catalytic converter

6 On later engines, trace the wiring back from the downstream lambda sensor to the wiring connector and disconnect the connector.

7 Undo the nuts securing the front pipe flange joint to the manifold, and the single bolt securing the front pipe to its transmission mounting bracket. Separate the flange joint and collect the gasket.

8 According to the arrangement fitted, undo the nuts securing the front pipe flange joint to the intermediate pipe flange joint and recover the spring cups and springs **(see illustration)**. Alternatively, undo the nut and remove the through-bolt, then spread the clamping ring securing the front pipe flange joint to the intermediate pipe. Withdraw the front pipe from underneath the vehicle, and recover the gasket.

Intermediate pipe/catalytic converter

9 Slacken the clamping ring bolts or undo the flange joint nuts, as applicable and disengage the clamp(s) from the front and rear flange joints.

10 Unhook the intermediate pipe from its mounting rubber and remove it from underneath the vehicle.

Tailpipe

11 Slacken the tailpipe clamping ring nut and bolt and disengage the clamp from the flange joint.

12 Unhook the tailpipe from its mounting rubbers and remove it from the vehicle.

Complete system

13 Disconnect the lambda sensor wiring connectors from the main wiring harness.

14 Undo the nuts securing the front pipe flange joint to the manifold, and the single bolt securing the front pipe to its transmission mounting bracket. Separate the flange joint and collect the gasket. Free the system from all its mounting rubbers and lower it from under the vehicle.

Heat shield(s)

15 The heat shields are secured to the underside of the body by various nuts and bolts. Each shield can be removed once the relevant exhaust section has been removed. If a shield is being removed to gain access to a component located behind it, it may prove sufficient in some cases to remove the retaining nuts and/or bolts, and simply lower the shield, without disturbing the exhaust system.

Removal – 1.8 litre engines

16 Each exhaust section can be removed individually, or alternatively, the complete system can be removed as a unit. Even if only one part of the system needs attention, it is often easier to remove the whole system and separate the sections on the bench.

17 To remove the system or part of the system, first jack up the front or rear of the car and support it on axle stands (see *Jacking and vehicle support*). Alternatively, position the car over an inspection pit or on car ramps.

Front pipe/catalytic converter

18 Trace the wiring back from the lambda sensor to its wiring connector and disconnect the wiring from the main harness.

19 Undo the nut and remove the through-bolt, then spread the clamping ring securing the front pipe flange joint to the exhaust manifold.

20 Similarly, release the clamping ring securing the front pipe to the intermediate pipe. Separate the joints and remove the front pipe from underneath the vehicle.

Intermediate pipe

21 Undo the nuts and remove the through-bolts, then spread the clamping rings to disengage the front and rear flange joints.

22 Unhook the intermediate pipe from its mounting rubber and remove it from underneath the vehicle.

Tailpipe

23 Undo the nut and remove the through-bolt, then spread the clamping ring securing the intermediate section to the tailpipe.

24 Disengage the clamp from the flange joint, unhook the tailpipe from its mounting rubbers, and remove it from the vehicle.

Complete system

25 Disconnect the lambda sensor wiring connectors from the main wiring harness.

26 Undo the nut and remove the through-bolt, then spread the clamping ring securing the front pipe flange joint to the exhaust manifold.

27 Free the system from all its mounting rubbers and lower it from under the vehicle.

Heat shield(s)

28 Refer to paragraph 15.

Refitting – all engines

29 Each section is refitted by reversing the removal sequence, noting the following points:

a) Ensure that all traces of corrosion have been removed from the flanges and renew all necessary gaskets.

b) Inspect the rubber mountings for signs of damage or deterioration, and renew as necessary.

c) Where joints are secured together by a clamping ring, apply a smear of exhaust system jointing paste to the flange joint, to ensure a gas-tight seal.

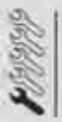
d) Prior to tightening the exhaust system fasteners, ensure that all rubber mountings are correctly located, and that there is adequate clearance between the exhaust system and vehicle underbody.

e) Ensure that the lambda sensor wiring is reconnected correctly and secured to the underbody by the relevant retaining clips.

Chapter 4 Part B:
Fuel/exhaust systems – diesel engines

Contents

Degrees of difficulty

Easy, suitable for novice with little experience 

Fairly easy, suitable for beginner with some experience 

Fairly difficult, suitable for competent DIY mechanic 

Difficult, suitable for experienced DIY mechanic 

Very difficult, suitable for expert DIY or professional 

Specifications

General

System type	HDi (High-pressure Diesel injection) with full electronic control, direct injection and turbocharger
Designation	Bosch EDC 15
Firing order	1-3-4-2 (No 1 at flywheel end)
Fuel system operating pressure	1350 bars

High-pressure fuel pump

Type	Bosch CP 1
Direction of rotation	Clockwise, viewed from sprocket end

Injectors

Type	Electromagnetic

Turbocharger

Type	Garrett GT15 or KKK K03
Boost pressure (approximate)	1 bar at 3000 rpm

Torque wrench settings

	Nm	lbf ft
Accumulator rail mounting bolts	23	17
Exhaust manifold nuts	20	15
Exhaust system fasteners:		
Front pipe-to-manifold nuts	10	7
Clamping ring nuts	20	15
Fuel injector clamp nuts	30	22
Fuel pressure sensor to accumulator rail	45	33
High-pressure fuel pipe union nuts*:		
Accumulator rail-to-fuel injector fuel pipe unions	25	18
Fuel pump-to-accumulator rail fuel pipe unions	20	15
High-pressure fuel pump front mounting bolts and nut	20	15
High-pressure fuel pump rear mounting bolt and nut	22	16
High-pressure fuel pump sprocket nut	50	37

** These torque settings are base on the use of Citroën crow-foot adaptors – see Section 2*

1 General information and system operation

General information

The fuel system consists of a centrally-mounted fuel tank and fuel lift pump, a fuel cooler mounted under the car, a fuel filter with integral water separator, and a turbocharged, electronically-controlled High-pressure Diesel injection (HDi) system.

The exhaust system is conventional, but to meet the latest emission levels an unregulated catalytic converter and an exhaust gas recirculation system are fitted to all models.

The HDi system (generally known as a 'common rail' system) derives its name from the fact that a common rail (also referred to as an accumulator rail) or fuel reservoir, is used to supply fuel to all the fuel injectors. Instead of an in-line or distributor type injection pump, which distributes the fuel directly to each injector, a high-pressure pump is used, which generates a very high fuel pressure (approximately 1350 bars) in the accumulator rail. The accumulator rail stores fuel, and maintains a constant fuel pressure, with the aid of a pressure control valve. Each injector is supplied with high-pressure fuel from the accumulator rail, and the injectors are individually controlled via signals from the system electronic control unit (ECU). The injectors are electromagnetically-operated.

In addition to the various sensors used on models with a conventional fuel injection pump, common rail systems also have a fuel pressure sensor. The fuel pressure sensor allows the ECU to maintain the required fuel pressure, via the pressure control valve.

System operation

For the purposes of describing the operation of a common rail injection system, the components can be divided into three sub-systems; the low-pressure fuel system, the high-pressure fuel system and the electronic control system.

Low-pressure fuel system

The low-pressure fuel system consists of the following components:

a) Fuel tank.
b) Fuel lift pump.
c) Fuel cooler.
d) Fuel filter/water trap.
e) Low-pressure fuel lines.

The low-pressure system (fuel supply system) is responsible for supplying clean fuel to the high-pressure fuel system.

High-pressure fuel system

The high-pressure fuel system consists of the following components:

a) High-pressure fuel pump with pressure control valve.
b) High-pressure accumulator rail.
c) Fuel injectors.
d) High-pressure fuel lines.

After passing through the fuel filter, the fuel reaches the high-pressure pump, which forces it into the accumulator rail, generating a pressure of 1350 bars. As diesel fuel has a certain elasticity, the pressure in the accumulator rail remains constant, even though fuel leaves the rail each time one of the injectors operates. Additionally, a pressure control valve mounted on the high-pressure pump ensures that the fuel pressure is maintained within pre-set limits.

The pressure control valve is operated by the ECU. When the valve is opened, fuel is returned from the high-pressure pump to the tank, via the fuel return lines, and the pressure in the accumulator rail falls. To enable the ECU to trigger the pressure control valve correctly, the pressure in the accumulator rail is measured by a fuel pressure sensor.

The electromagnetically-controlled fuel injectors are operated individually, via signals from the ECU, and each injector injects fuel directly into the relevant combustion chamber. The fact that high fuel pressure is always available allows very precise and highly flexible injection in comparison to a conventional injection pump: for example combustion during the main injection process can be improved considerably by the pre-injection of a very small quantity of fuel.

Electronic control system

The electronic control system consists of the following components:

a) Electronic control unit (ECU).
b) Crankshaft speed/position sensor.
c) Camshaft position sensor.
d) Accelerator pedal position sensor.
e) Coolant temperature sensor.
f) Fuel temperature sensor.
g) Air mass meter.
h) Fuel pressure sensor.
i) Fuel injectors.
j) Fuel pressure control valve.
k) Preheating control unit.
l) EGR solenoid valve.

The information from the various sensors is passed to the ECU, which evaluates the signals. The ECU contains electronic 'maps' which enable it to calculate the optimum quantity of fuel to inject, the appropriate start of injection, and even pre- and post-injection fuel quantities, for each individual engine cylinder under any given condition of engine operation.

Additionally, the ECU carries out monitoring and self-diagnostic functions. Any faults in the system are stored in the ECU memory, which enables quick and accurate fault diagnosis using appropriate diagnostic equipment (such as a suitable fault code reader).

System Components

Fuel lift pump

The fuel lift pump and integral fuel gauge sender unit is electrically-operated, and is mounted in the fuel tank.

High-pressure pump

The high-pressure pump is mounted on the engine in the position normally occupied by the conventional distributor fuel injection pump. The pump is driven at half engine speed by the timing belt, and is lubricated by the fuel which it pumps.

The fuel lift pump forces the fuel into the high-pressure pump chamber, via a safety valve.

The high-pressure pump consists of three radially-mounted pistons and cylinders. The pistons are operated by an eccentric cam mounted on the pump drive spindle. As a piston moves down, fuel enters the cylinder through an inlet valve. When the piston reaches bottom dead centre (BDC), the inlet valve closes, and as the piston moves back up the cylinder, the fuel is compressed. When the pressure in the cylinder reaches the pressure in the accumulator rail, an outlet valve opens, and fuel is forced into the accumulator rail. When the piston reaches top dead centre (TDC), the outlet valve closes due to the pressure drop, and the pumping cycle is repeated. The use of multiple cylinders provides a steady flow of fuel, minimising pulses and pressure fluctuations.

As the pump needs to be able to supply sufficient fuel under full-load conditions, it will supply excess fuel during idle and part-load conditions. This excess fuel is returned from the high-pressure circuit to the low-pressure circuit (to the tank) via the pressure control valve.

The pump incorporates a facility to effectively switch off one of the cylinders to improve efficiency and reduce fuel consumption when maximum pumping capacity is not required. When this facility is operated, a solenoid-operated needle holds the inlet valve in the relevant cylinder open during the delivery stroke, preventing the fuel from being compressed.

Accumulator rail

As its name suggests, the accumulator rail acts as an accumulator, storing fuel and preventing pressure fluctuations. Fuel enters the rail from the high-pressure pump, and each injector has its own connection to the rail. The fuel pressure sensor is mounted in the rail, and the rail also has a connection to the fuel pressure control valve on the pump.

Pressure control valve

The pressure control valve is operated by the ECU, and controls the system pressure. The valve is integral with the high-pressure pump and cannot be separated.

If the fuel pressure is excessive, the valve opens, and fuel flows back to the tank. If the pressure is too low, the valve closes, enabling the high-pressure pump to increase the pressure.

The valve is an electromagnetically-operated ball valve. The ball is forced against its seat, against the fuel pressure, by a

powerful spring, and also by the force provided by the electromagnet. The force generated by the electromagnet is directly proportional to the current applied to it by the ECU. The desired pressure can therefore be set by varying the current applied to the electromagnet. Any pressure fluctuations are damped by the spring.

Fuel pressure sensor

The fuel pressure sensor is mounted in the accumulator rail, and provides very precise information on the fuel pressure to the ECU.

Fuel injector

The injectors are mounted on the engine in a similar manner to conventional diesel fuel injectors. The injectors are electromagnetically-operated via signals from the ECU, and fuel is injected at the pressure existing in the accumulator rail. The injectors are high-precision instruments and are manufactured to very high tolerances.

Fuel flows into the injector from the accumulator rail, via an inlet valve and an inlet throttle, and an electromagnet causes the injector nozzle to lift from its seat, allowing injection. Excess fuel is returned from the injectors to the tank via a return line. The injector operates on a hydraulic servo principle: the forces resulting inside the injector due to the fuel pressure effectively amplify the effects of the electromagnet, which does not provide sufficient force to open the injector nozzle directly. The injector functions as follows.

Five separate forces are essential to the operation of the injector.

a) *A nozzle spring forces the nozzle needle against the nozzle seat at the bottom of the injector, preventing fuel from entering the combustion chamber.*
b) *In the valve at the top of the injector, the valve spring forces the valve ball against the opening to the valve control chamber. The fuel in the chamber is unable to escape through the fuel return.*
c) *When triggered, the electromagnet exerts a force which overcomes the valve spring force, and moves the valve ball away from its seat. This is the triggering force for the start of injection. When the valve ball moves off its seat, fuel enters the valve control chamber.*
d) *The pressure of the fuel in the valve control chamber exerts a force on the valve control plunger, which is added to the nozzle spring force.*
e) *A slight chamfer towards the lower end of the nozzle needle causes the fuel in the control chamber to exert a force on the nozzle needle.*

When these forces are in equilibrium, the injector is in its rest (idle) state, but when a voltage is applied to the electromagnet, the forces work to lift the nozzle needle, injecting fuel into the combustion chamber. There are four phases of injector operation as follows:

a) *Rest (idle) state – all forces are in equilibrium. The nozzle needle closes off the nozzle opening, and the valve spring forces the valve ball against its seat.*
b) *Opening – the electromagnet is triggered which opens the nozzle and triggers the injection process. The force from the electromagnet allows the valve ball to leave its seat. The fuel from the valve control chamber flows back to the tank via the fuel return line. When the valve opens, the pressure in the valve control chamber drops, and the force on the valve plunger is reduced. However, due to the effect of the input throttle, the pressure on the nozzle needle remains unchanged. The resulting force in the valve control chamber is sufficient to lift the nozzle from its seat, and the injection process begins.*
c) *Injection – within a few milliseconds, the triggering current in the electromagnet is reduced to a lower holding current. The nozzle is now fully open, and fuel is injected into the combustion chamber at the pressure present in the accumulator rail.*
d) *Closing – the electromagnet is switched off, at which point the valve spring forces the valve ball firmly against its seat, and in the valve control chamber, the pressure is the same as that at the nozzle needle. The force at the valve plunger increases, and the nozzle needle closes the nozzle opening. The forces are now in equilibrium once more, and the injector is once more in the idle state, awaiting the next injection sequence.*

ECU and sensors

The ECU and sensors are described earlier in this Section – see *Electronic control system*.

2 High-pressure diesel injection system – special information

Warnings and precautions

1 It is essential to observe strict precautions when working on the fuel system components, particularly the high-pressure side of the system. Before carrying out any operations on the fuel system, refer to the precautions given in *Safety first!* at the beginning of this manual, and to the following additional information.

⚠ ***Warning: Do not carry out any repair work on the high-pressure fuel system unless you are competent to do so, have all the necessary tools and equipment required, and are aware of the safety implications involved.***

Before starting any repair work on the fuel system, wait at least 30 seconds after switching off the engine to allow the fuel circuit to return to atmospheric pressure.

Never work on the high-pressure fuel system with the engine running.

Keep well clear of any possible source of fuel leakage, particularly when starting the engine after carrying out repair work. A leak in the system could cause an extremely high-pressure jet of fuel to escape, which could result in severe personal injury.

Never place your hands or any part of your body near to a leak in the high-pressure fuel system.

Do not use steam cleaning equipment or compressed air to clean the engine or any of the fuel system components.

Repair procedures and general information

2 Strict cleanliness must be observed at all times when working on any part of the fuel system. This applies to the working area in general, the person doing the work, and the components being worked on.

3 Before working on the fuel system components, they must be thoroughly cleaned with a suitable degreasing fluid. Citroën recommend the use of a specific product (SODIMAC degreasing fluid – available from Citroën dealers). Alternatively, a suitable brake cleaning fluid may be used. Cleanliness is particularly important when working on the fuel system connections at the following components:

a) *Fuel filter.*
b) *High-pressure fuel pump.*
c) *Accumulator rail.*
d) *Fuel injectors.*
e) *High-pressure fuel pipes.*

4 After disconnecting any fuel pipes or components, the open union or orifice must be immediately sealed to prevent the entry of dirt or foreign material. Plastic plugs and caps in various sizes are available in packs from motor factors and accessory outlets, and are particularly suitable for this application **(see illustration)**. Fingers cut from disposable rubber gloves should be used to protect components such as fuel pipes, fuel injectors and wiring connectors, and can be secured in place using elastic bands. Suitable gloves of this type are available at no cost from most petrol station forecourts.

2.4 Typical plastic plug and cap set for sealing disconnected fuel pipes and components

2.7 Two crow-foot adaptors will be necessary for tightening the fuel pipe unions

5 Whenever any of the high-pressure fuel pipes are disconnected or removed, a new pipes must be obtained for refitting.

6 On the completion of any repair on the high-pressure fuel system, Citroën recommend the use of ARDROX 9D1 BRENT leak-detecting compound. This is a powder which is applied to the fuel pipe unions and connections and turns white when dry. Any leak in the system will cause the product to darken indicating the source of the leak.

7 The torque wrench settings given in the Specifications must be strictly observed when tightening component mountings and connections. This is particularly important when tightening the high-pressure fuel pipe unions. To enable a torque wrench to be used on the fuel pipe unions, two crow-foot adaptors are required (Citroën special tools -4220-T.D. and -4220-T.C.). Suitable alternatives are available from motor factors and accessory outlets **(see illustration)**.

3 Fuel system – priming and bleeding

1 The fuel system is entirely self-bleeding because the fuel lift pump supplies fuel to the high-pressure pump whenever the ignition is switched on.

2 In the case of running out of fuel, or after disconnecting any part of the fuel supply system, ensure that there is fuel in the tank, then start the engine in the normal way.

4 Air cleaner assembly and air inlets ducts – removal and refitting

Removal

Air cleaner and front air inlet ducts

1 Disconnect the battery negative terminal (refer to *Disconnecting the battery* in the Reference Chapter).

2 Undo the four plastic nuts and lift off the engine cover **(see illustration)**.

3 Disconnect the wiring connector from the underside of the air mass meter **(see illustration)**.

4 Slacken the hose clip securing the air mass meter inlet duct to the cleaner assembly lid.

5 Lift the air cleaner assembly upward to release it from the support bracket then detach the air mass meter inlet duct. Remove the air cleaner assembly from the engine compartment.

6 To remove the air mass meter inlet duct, slacken the remaining clips (where applicable), and disconnect the duct from the turbocharger rigid inlet duct. Remove the inlet duct complete with air mass meter from the engine compartment. Suitably plug or cover the turbocharger rigid inlet duct, using clean rag to prevent any dirt or foreign material from entering.

Turbocharger inlet and outlet ducts

7 The rigid ducts at the rear of the engine, connecting the turbocharger to the flexible air inlet duct and to the inlet manifold are inaccessible with the engine in the car. To gain access it will be necessary to either remove the engine/transmission unit as described in Chapter 2E, or remove the front suspension subframe as described in Chapter 10.

8 Once access has been gained, begin removal of the turbocharger rigid inlet duct by disconnecting the crankcase ventilation hose at the top of the duct **(see illustration)**.

9 Undo the bolt securing the duct to the inlet manifold elbow **(see illustration)**.

10 At the lower end, undo the bolt securing the duct to the turbocharger **(see illustration)**. Lift off the duct and recover the seal from the lower end.

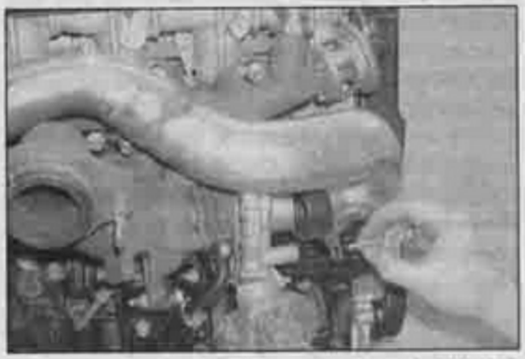
11 To remove the turbocharger-to-inlet manifold rigid plastic duct, slacken the retaining clip and release the connecting hose from the inlet manifold elbow **(see illustration)**.

4.2 Undo the four plastic nuts and lift off the engine cover

4.3 Air mass meter wiring connector (A) and inlet duct retaining clip (B)

4.8 Disconnect the crankcase ventilation hose at the top of the turbocharger rigid inlet duct

4.9 Undo the bolt (arrowed) securing the rigid inlet duct to the inlet manifold elbow



4.10 Undo the bolt securing the rigid inlet duct to the turbocharger and remove the duct

4.11 Slacken the clip and release the plastic duct connecting hose from the inlet manifold elbow

12 Slacken the clip securing the connecting hose at the lower end of the duct to the turbocharger. Release the attachment strap from the lug on the turbocharger and withdraw the duct from the engine **(see illustration)**.

Refitting

13 Refitting is a reverse of the removal procedure. Examine the condition of the seals and retaining clips and renew if necessary.

14 Where applicable, refit the engine/transmission as described in Chapter 2E, or the front suspension subframe as described in Chapter 10.

15 Reconnect and adjust the accelerator cable as described in Section 5.

5 Accelerator cable – removal, refitting and adjustment

Removal

1 Undo the four plastic nuts and lift off the engine cover.

2 Undo the two bolts and lift the accelerator pedal position sensor off the master cylinder reservoir mounting bracket **(see illustration)**.

3 Rotate the pedal position sensor quadrant, and release the inner cable from the quadrant **(see illustration)**.

4 Withdraw the outer cable from the grommet in the pedal position sensor body, and remove the spring clip.

5 Release the cable from the remaining clips and brackets in the engine compartment, noting its routing.

6 Extract the stud-type plastic clips, using a forked type tool, and remove the facia lower trim panel above the pedals on the driver's side.

7 Reach up under the facia, depress the ends of the cable end fitting, and detach the inner cable from the top of the accelerator pedal **(see illustration)**.

8 Slide out the plastic retainer securing the outer cable to the bulkhead grommet.

9 Return to the engine compartment, pull the outer cable from the bulkhead grommet and withdraw the cable.

5.2 Undo the two bolts (arrowed) securing the pedal position sensor to the reservoir mounting bracket

4.12 Slacken the connecting hose clip, release the attachment strap and withdraw the plastic duct from the engine

Refitting

10 Refitting is a reversal of removal, but ensure that the cable is routed as noted before removal and, on completion, adjust the cable as follows.

Adjustment

11 Remove the spring clip from the accelerator outer cable. Ensuring that the pedal position sensor quadrant is against its stop, gently pull the cable out of its grommet until all free play is removed from the inner cable.

12 With the cable held in this position, refit the spring clip to the last exposed outer cable groove in front of the rubber grommet. When the clip is refitted and the outer cable is released, there should be only a small amount of free play in the inner cable.

13 Have an assistant depress the accelerator pedal, and check that the pedal position sensor quadrant opens fully and returns smoothly to its stop.

14 Refit the engine cover and facia lower trim panel on completion.

6 Accelerator pedal – removal and refitting

Refer to Chapter 4A, Section 4, but adjust the accelerator cable as described above.

5.3 Release the accelerator inner cable from the sensor quadrant

7 Fuel lift pump – removal and refitting

The diesel fuel lift pump is located in the same position as the conventional fuel pump on petrol models, and the removal and refitting procedures are virtually identical. Refer to Chapter 4A, Section 8.

8 Fuel gauge sender unit – removal and refitting

The fuel gauge sender unit is integral with the fuel lift pump. Refer to Chapter 4A, Section 8.

9 Fuel tank – removal and refitting

Refer to Chapter 4A, Section 10.

10 High-pressure fuel pump – removal and refitting

Removal

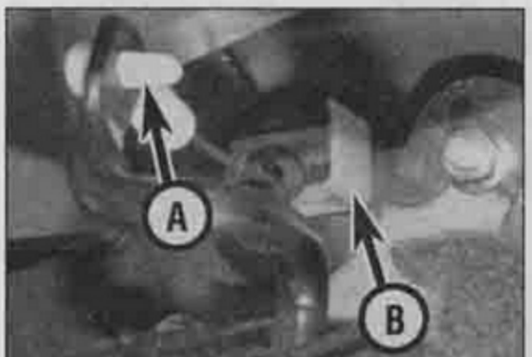
Warning: Refer to the information contained in Section 2 before proceeding.

Note: *A new fuel pump-to-accumulator rail high-pressure fuel pipe will be required for refitting.*

1 Remove the timing belt as described in Chapter 2C. After removal of the timing belt, temporarily refit the right-hand engine mounting.

2 At the connections above the fuel pump, disconnect the fuel supply and return hose quick-release fittings using a small screwdriver to release the locking clip **(see illustration)**. Suitably plug or cover the open unions to prevent dirt entry.

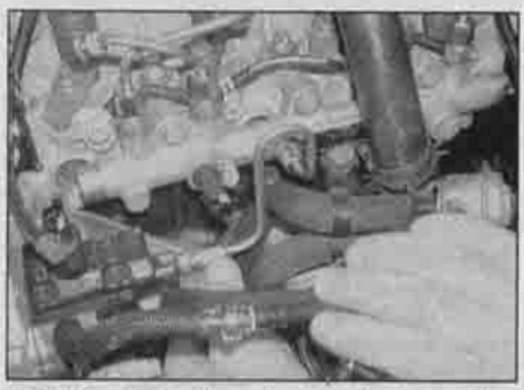
3 Similarly disconnect the supply and return



5.7 Accelerator cable end fitting (A) and outer cable plastic retainer (B)

10.2 Disconnect the fuel supply and return hose quick-release fittings at the connections above the fuel pump

10.6 Undo the bolt (arrowed) to release the plastic wiring harness guide



10.8 Unscrew the unions and remove the high pressure fuel pipe

10.9 Undo the nut and bolt (arrowed) securing the fuel pump rear mounting to the mounting bracket

hose quick-release fittings at the fuel filter and plug or cover the open unions. Release the fuel hoses from the relevant retaining clips.

4 On early engines, lift the fuel filter out of its mounting bracket and move it slightly to one side, away from the pump. Undo the bolts and remove the filter mounting bracket from the engine.

5 On later engines, undo the two bolts and move fuel filter assembly slightly to one side, away from the pump

6 Undo the bolts securing the plastic wiring harness guide to the front of the engine **(see illustration)**. It will be necessary to lift up the wiring harness as far as possible for access to the rear of the fuel pump. If necessary, disconnect the relevant wiring connectors to enable the harness and guide assembly to be moved further for additional access.

7 Disconnect the wiring connector at the pressure control valve on the rear of the fuel pump, and at the piston de-activator switch on the top of the pump.

8 Thoroughly clean the high-pressure fuel pipe unions on the fuel pump and accumulator rail. Using an open-ended spanner, unscrew the union nuts securing the high-pressure fuel pipe to the fuel pump and accumulator rail. Counterhold the unions on the pump and accumulator rail with a second spanner, while unscrewing the union nuts. Withdraw the high-pressure fuel pipe and plug or cover the open unions to prevent dirt entry **(see illustration)**. Note that a new high-pressure fuel pipe will be required for refitting.

9 Undo the nut and bolt securing the fuel pump rear mounting to the mounting bracket **(see illustration)**.

10 Using a suitable socket, undo the fuel pump sprocket retaining nut. The sprocket can be held stationary as the nut is slackened using a suitable forked tool engaged with the holes in the sprocket **(see Tool Tip 1)**.

11 The fuel pump sprocket is a taper fit on the pump shaft and it will be necessary to make up another tool to release it from the taper **(see Tool Tip 2)**.

12 Partially unscrew the sprocket retaining nut, fit the home-made tool, and secure it to the sprocket with two suitable bolts. Prevent the sprocket from rotating as before, and unscrew the sprocket retaining nut **(see illustration)**. The nut will bear against the tool as it is undone, forcing the sprocket off the shaft taper. Once the taper is released, remove the tool, unscrew the nut fully, and remove the sprocket from the pump shaft.

13 Undo the nut and two bolts securing the front of the fuel pump to the mounting bracket **(see illustrations)**. Withdraw the pump, complete with fuel supply and return hoses, rearwards, and lift it off the engine.

Caution: The high-pressure fuel pump is manufactured to extremely close

10.12 Using the home-made tools to remove the fuel pump sprocket

10.13a Fuel pump front mounting bolts (arrowed) . . .

Tool Tip 1: A sprocket holding tool can be made from two lengths of steel strip bolted together to form a forked end. Bend the ends of the strip through 90° to form the fork 'prongs'.

Tool Tip 2: Make a sprocket releasing tool from a short strip of steel. Drill two holes in the strip to correspond with the two holes in the sprocket. Drill a third hole just large enough to accept the flats of the sprocket retaining nut.

tolerances and must not be dismantled in any way. Do not unscrew the fuel pipe male union on the rear of the pump, or attempt to remove the pressure control valve, piston de-activator switch, or the seal on the pump shaft. No parts for the pump are available separately and if the unit is in any way suspect, it must be renewed.

Refitting

14 Locate the pump on the mounting bracket, and refit the front retaining nut and the two bolts. Refit the nut and bolt securing the fuel pump rear mounting to the mounting bracket, then tighten all the mountings to the specified torque.

15 Refit the pump sprocket and retaining nut and tighten the nut to the specified torque. Prevent the sprocket rotating as the nut is tightened using the sprocket holding tool.

16 Remove the blanking plugs from the fuel pipe unions on the pump and accumulator rail. Locate a new high-pressure fuel pipe over the unions and screw on the union nuts finger tight at this stage.

17 Using a torque wrench and crow-foot adaptor, tighten the fuel pipe union nuts to the specified torque. Counterhold the unions on the pump and accumulator rail with an open-ended spanner, while tightening the union nuts **(see illustration)**.

18 Reconnect the wiring connector at the pressure control valve on the rear of the fuel pump.

19 Reposition and secure the plastic wiring harness guide to the front of the engine, and reconnect any additional wiring disconnected for access.

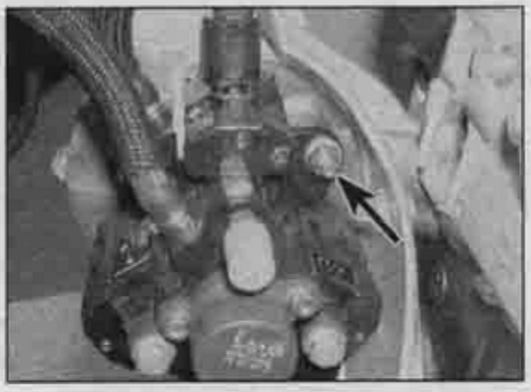
20 Refit the filter mounting bracket or the filter assembly as applicable, to the engine and securely tighten the retaining bolts. Where applicable, locate the fuel filter back in position in the mounting bracket.

21 Remove the blanking plugs and reconnect the supply and return hose quick-release fittings at the fuel filter, and at the connections above the fuel pump. Secure the hoses with their respective retaining clips.

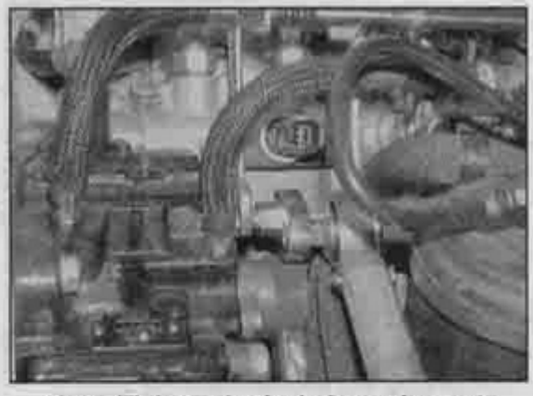
22 Refit the timing belt as described in Chapter 2C.

23 With everything reassembled and reconnected, and observing the precautions listed in Section 2, start the engine and allow it to idle. Check for leaks at the high-pressure fuel pipe unions with the engine idling. If satisfactory, increase the engine speed to 4000 rpm and check again for leaks. Take the car for a short road test and check for leaks once again on return. If any leaks are detected, obtain and fit another new high-pressure fuel pipe. **Do not** attempt to cure even the slightest leak by further tightening of the pipe unions.

24 Refit the engine cover on completion.



10.13b . . . and mounting nut (arrowed)



10.17 Tighten the fuel pipe union nuts using a torque wrench and crow-foot adaptor

11 Accumulator rail – removal and refitting

Removal

Warning: Refer to the information contained in Section 2 before proceeding.

Note: *A complete new set of high-pressure fuel pipes will be required for refitting.*

1 Disconnect the battery negative terminal (refer to *Disconnecting the battery* in the Reference Chapter).

2 Undo the four plastic nuts and lift off the engine cover.

3 Disconnect the wiring connectors at the fuel injectors and at the piston de-activator switch on the top of the fuel pump **(see illustrations)**.

4 Undo the two nuts securing the plastic wiring harness guide to the cylinder head. Lift the guide off the two mounting studs and move it clear of the accumulator rail **(see illustration)**. Disconnect any additional wiring connectors as necessary to enable the harness and guide assembly to be moved further for increased access.

5 Release the retaining clip and disconnect the crankcase ventilation hose from the cylinder head cover.

6 At the connections above the fuel pump, disconnect the fuel supply and return hose quick-release fittings using a small screwdriver to release the locking clip. Suitably plug or cover the open unions to prevent dirt entry.

7 Similarly disconnect the supply and return hose quick-release fittings at the fuel filter and plug or cover the open unions. Release the fuel hoses from the relevant retaining clips.

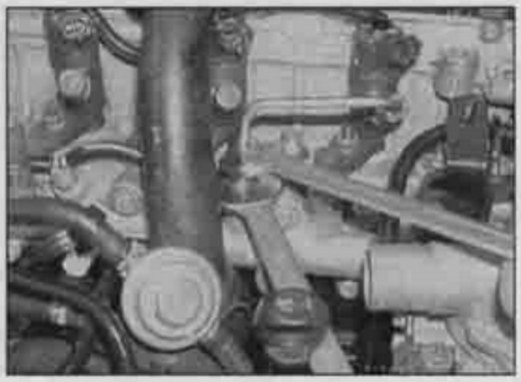
8 Thoroughly clean all the high-pressure fuel pipe unions on the accumulator rail, fuel pump and injectors. Using an open-ended spanner, unscrew the union nuts securing the high-pressure fuel pipe to the fuel pump and accumulator rail. Counterhold the unions on the pump and accumulator rail with a second spanner, while unscrewing the union nuts. Withdraw the high-pressure fuel pipe and plug or cover the open unions to prevent dirt entry.

9 Again using two spanners, hold the unions and unscrew the union nuts securing the high-pressure fuel pipes to the fuel injectors and accumulator rail **(see illustrations)**. Withdraw the high-pressure fuel pipes and plug or cover the open unions to prevent dirt entry.

11.3a Disconnect the wiring connectors at the fuel injectors . . .

11.3b . . . and at the piston de-activator switch on top of the fuel pump

11.4 Undo the two nuts and lift off the plastic wiring harness guide



11.9a Using two spanners, unscrew the fuel pipe unions at the accumulator rail . . .

11.9b . . . and at each injector

10 Disconnect the wiring connectors at the fuel temperature sensor and fuel pressure sensor on the accumulator rail **(see illustration)**.

11 Undo the three bolts securing the accumulator rail to the cylinder head and withdraw the rail from its location **(see illustrations)**.

Caution: Do not attempt to remove the four high-pressure fuel pipe male unions from the accumulator rail. These parts are not available separately and if disturbed are likely to result in fuel leakage on reassembly.

12 Obtain a complete new set of high-pressure fuel pipes for refitting.

Refitting

13 Locate the accumulator rail in position, refit the three securing bolts and tighten to the specified torque.

14 Working on one fuel injector at a time, remove the blanking plugs from the fuel pipe unions on the accumulator rail and the relevant injector. Locate a new high-pressure fuel pipe over the unions and screw on the union nuts finger tight at this stage.

15 When all four fuel pipes are in place, hold the unions with a spanner and tighten the union nuts to the specified torque using a torque wrench and crow-foot adaptor **(see illustration)**.

16 Similarly, fit a new high-pressure fuel pipe to the fuel pump and accumulator rail, and tighten the union nuts to the specified torque.

17 Reconnect the fuel temperature sensor and fuel pressure sensor wiring connectors.

18 Remove the blanking plugs and reconnect the supply and return hose quick-release fittings at the fuel filter, and at the connections above the fuel pump. Secure the hoses with their respective retaining clips.

19 Reconnect the crankcase ventilation hose to the cylinder head cover.

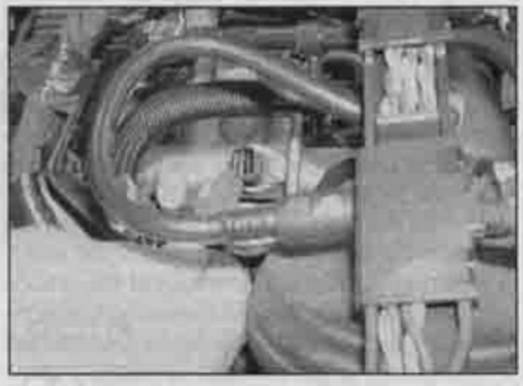
20 Reposition the plastic wiring harness guide over the two mounting studs and secure with the retaining nuts.

21 Reconnect the fuel injector and pump piston de-activator switch wiring connectors and reconnect any additional wiring disconnected for access.

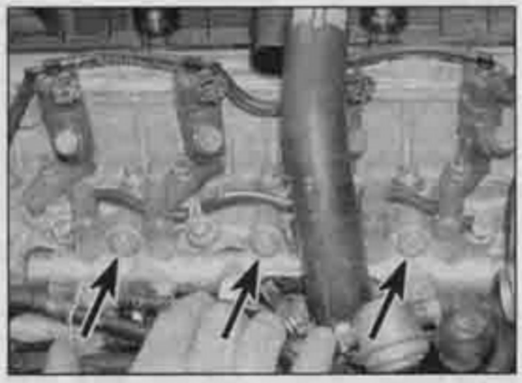
22 Check that everything has been reconnected and secured with the relevant retaining clips then reconnect the battery negative terminal.

23 Observing the precautions listed in Section 2, start the engine and allow it to idle. Check for leaks at the high-pressure fuel pipe unions with the engine idling. If satisfactory, increase the engine speed to 4000 rpm and check again for leaks. Take the car for a short road test and check for leaks once again on return. If any leaks are detected, obtain and fit additional new high-pressure fuel pipes as required. **Do not** attempt to cure even the slightest leak by further tightening of the pipe unions.

24 Refit the engine cover on completion.



11.10 Disconnect the wiring connector at the fuel temperature sensor



11.11a Undo the three accumulator rail retaining bolts (arrowed) . . .

11.11b . . . and withdraw the accumulator rail from the engine

11.15 Using a torque wrench and crow-foot adaptor, tighten the fuel pipe union nuts

12 Fuel injectors – removal and refitting

Note: *The following procedure describes the removal and refitting of the injectors as a complete set, however each injector may be removed individually if required. New copper washers, upper seals, injector clamp retaining nuts and a high-pressure fuel pipe will be required for each disturbed injector when refitting.*

Removal

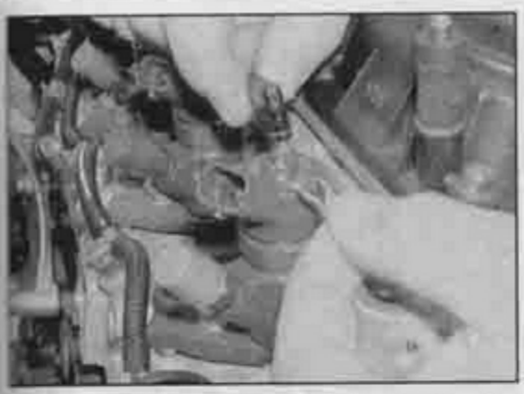
Warning: Refer to the information contained in Section 2 before proceeding.

1 Carry out the operations described in Section 11, paragraphs 1 to 4.

2 At the connections above the fuel pump, disconnect the fuel supply and return hose quick-release fittings using a small screwdriver to release the locking clips. Suitably plug or cover the open unions to prevent dirt entry, then release the fuel hoses from the relevant retaining clips.

3 Thoroughly clean all the high-pressure fuel pipe unions on the fuel injectors and accumulator rail. Using two open-ended spanners, unscrew the union nuts securing the high-pressure fuel pipes to the fuel injectors and accumulator rail. Withdraw the high-pressure fuel pipes and plug or cover the open unions on the injectors and accumulator rail to prevent dirt entry. Note that a new high-pressure fuel pipe will be required for each removed injector when refitting.

4 Extract the retaining circlip and disconnect the leak-off pipe from each fuel injector **(see illustration)**.



12.4 Extract the circlip and disconnect the injector leak-off pipes

12.5a Unscrew the injector clamp retaining nut . . .

12.5b . . . and remove the washer

5 Unscrew the nut and remove the washer securing each injector clamp to its cylinder head stud **(see illustrations)**. Note that new clamp nuts will be required for refitting.

6 Withdraw the injectors, together with their clamps, from the cylinder head **(see illustration)**. Slide the clamp off the injector once it is clear of the mounting stud. If the injectors are a tight fit in the cylinder head and cannot be released, unscrew the mounting stud using a stud extractor and slide off the injector clamp. Using an open-ended spanner engaged with the clamp locating slot on the injector body, free the injector by twisting it and at the same time lifting it upwards.

7 Recover the injector clamp locating dowel from the cylinder head **(see illustration)**.

8 Remove the copper washer and the upper seal from each injector, or from the cylinder head if they remained in place during injector removal. New copper washers and upper seals will be required for refitting.

9 Examine each injector visually for any signs of obvious damage or deterioration. If any defects are apparent, renew the injector(s).

Caution: The injectors are manufactured to extremely close tolerances and must not be dismantled in any way. Do not unscrew the fuel pipe union on the side of the injector, or separate any parts of the injector body. Do not attempt to clean carbon deposits from the injector nozzle or carry out any form of ultra-sonic or pressure testing.

10 If the injectors are in a satisfactory condition, plug the fuel pipe union (if not already done) and suitably cover the electrical element and the injector nozzle.

11 Prior to refitting, obtain new copper washers, upper seals, injector clamp retaining nuts and high-pressure fuel pipes for each removed injector.

Refitting

12 Locate a new upper seal on the body of each injector, and place a new copper washer on the injector nozzle **(see illustrations)**.

13 Refit the injector clamp locating dowels to the cylinder head.

14 Place the injector clamp in the slot on each injector body and refit the injectors to the cylinder head. Guide the clamp over the mounting stud and onto the locating dowel as each injector is inserted.

15 Fit the washer and a new injector clamp retaining nut to each mounting stud. Tighten the nuts finger tight only at this stage.

16 Working on one fuel injector at a time, remove the blanking plugs from the fuel pipe unions on the accumulator rail and the relevant injector. Locate a new high-pressure fuel pipe over the unions and screw on the union nuts. Take care not to cross-thread the nuts or strain the fuel pipes as they are fitted. Once the union nut threads have started, tighten the nuts moderately tight only at this stage.

17 When all the fuel pipes are in place, tighten the injector clamp retaining nuts to the specified torque.

18 Using an open-ended spanner, hold each fuel pipe union in turn and tighten the union nut to the specified torque using a torque wrench and crow-foot adaptor. Tighten all the disturbed union nuts in the same way.

19 Connect the leak-off pipes to each fuel injector and secure with the retaining circlips.

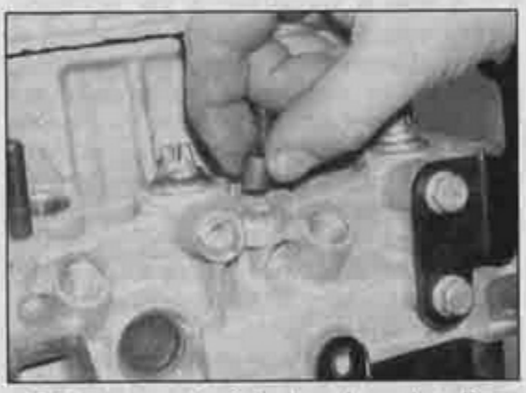
20 Remove the blanking plugs and reconnect the supply and return hose quick-release fittings at the connections above the fuel pump. Secure the hoses with their respective retaining clips.

21 Reposition the plastic wiring harness guide over the two mounting studs and secure with the retaining nuts.

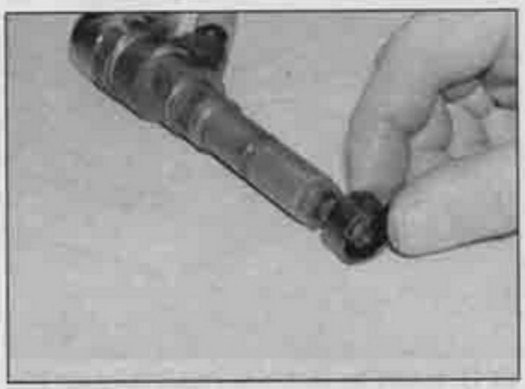
22 Reconnect the fuel injector and pump piston de-activator switch wiring connectors, and reconnect any additional wiring disconnected for access.

23 Check that everything has been reconnected and secured with the relevant retaining clips then reconnect the battery negative terminal.

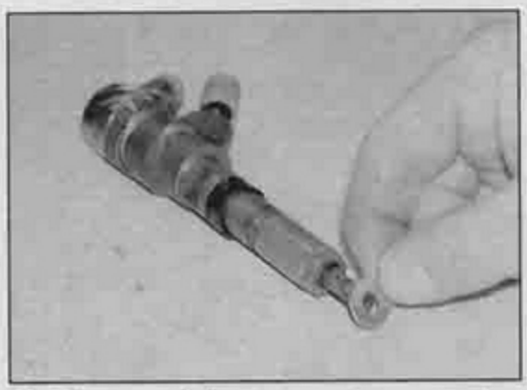
12.6 Withdraw the injectors, together with their clamps, from the cylinder head



12.7 Recover the injector clamp locating dowel from the cylinder head



12.12a Locate a new upper seal on the body of each injector . . .



12.12b . . . and place a new copper washer on the injector nozzle

13.6 Release the plastic wiring harness guide for access to the crankshaft speed/position sensor

13.8 Slacken the bolt securing the sensor to the bellhousing

13.9 Turn the sensor body to clear the bolt and withdraw it from the bellhousing

24 Observing the precautions listed in Section 2, start the engine and allow it to idle. Check for leaks at the high-pressure fuel pipe unions with the engine idling. If satisfactory, increase the engine speed to 4000 rpm and check again for leaks. Take the car for a short road test and check for leaks once again on return. If any leaks are detected, obtain and fit additional new high-pressure fuel pipes as required. **Do not** attempt to cure even the slightest leak by further tightening of the pipe unions.

25 Refit the engine cover on completion.

13 Electronic control system components – testing, removal and refitting

Testing

1 If a fault is suspected in the electronic control side of the system, first ensure that all the wiring connectors are securely connected and free of corrosion. Ensure that the suspected problem is not of a mechanical nature, or due to poor maintenance; ie, check that the air cleaner filter element is clean, the engine breather hoses are clear and undamaged, and that the cylinder compression pressures are correct, referring to Chapters 1B and 2C for further information.

2 If these checks fail to reveal the cause of the problem, the vehicle should be taken to a Citroën dealer or suitably-equipped garage for testing. A diagnostic socket is located adjacent to the passenger compartment fusebox in which a fault code reader or other suitable test equipment can be connected. By using the code reader or test equipment, the engine management ECU (and the various other vehicle system ECUs) can be interrogated, and any stored fault codes can be retrieved. This will allow the fault to be quickly and simply traced, alleviating the need to test all the system components individually, which is a time-consuming operation that carries a risk of damaging the ECU.

Removal and refitting

3 Before carrying out any of the following procedures, disconnect the battery negative terminal (refer to *Disconnecting the battery* in the Reference Chapter). Reconnect the battery on completion of refitting.

Electronic control unit (ECU)

Note: *If a new ECU is to be fitted, this work must be entrusted to a Citroën dealer. It is necessary to initialise the new ECU after installation, which requires the use of dedicated Citroën diagnostic equipment.*

4 Refer to the procedures contained in Chapter 4A, Section 13.

Crankshaft speed/position sensor

5 The crankshaft speed/position sensor is located at the top of the transmission bellhousing, directly above the engine flywheel. To gain access, remove the air cleaner assembly and air inlet ducts as described in Section 4.

6 Undo the retaining nuts and bolts and release the plastic wiring harness guide from its mountings **(see illustration)**.

7 Working below the coolant outlet housing, disconnect the wiring connector from the crankshaft speed/position sensor.

8 Slacken the bolt securing the sensor to the bellhousing **(see illustration)**. It is not necessary to remove the bolt completely as the sensor mounting flange is slotted.

9 Turn the sensor body to clear the mounting bolt, then withdraw the sensor from the bellhousing **(see illustration)**.

10 Refitting is reverse of the removal procedure ensuring the sensor retaining bolt is securely tightened.

Camshaft position sensor

11 The camshaft position sensor is mounted on the right-hand end of the cylinder head cover, directly behind the camshaft sprocket.

12 Remove the timing belt upper and intermediate covers as described in Chapter 2C.

13 Disconnect the sensor wiring connector **(see illustration)**.

14 Undo the retaining bolt and lift the sensor off the cylinder head cover.

15 To refit and adjust the sensor position, locate the sensor on the cylinder head cover and loosely refit the retaining bolt.

16 The air gap between the tip of the sensor and the target plate at the rear of the camshaft sprocket hub must be set to 1.2 mm, using feeler blades. Clearance for the feeler blades is limited with the timing belt and camshaft sprocket in place, but it is just possible if the feeler blades are bent through 90° so they can be inserted through the holes in the sprocket, to rest against the inner face of the target plate.

17 With the feeler blades placed against the target plate, move the sensor toward the sprocket until it just contacts the feeler blades. Hold the sensor in this position and tighten the retaining bolt **(see illustration)**.

18 With the gap correctly adjusted, reconnect the sensor wiring connector, then refit the timing belt upper and intermediate covers as described in Chapter 2C.

Accelerator pedal position sensor

19 The accelerator pedal position sensor is located on the side of the master cylinder reservoir mounting bracket.

20 Undo the two bolts and remove the sensor assembly from the mounting bracket.

13.13 Disconnect the camshaft position sensor wiring connector

13.17 Insert feeler blades bent through 90° through the sprocket to measure the camshaft position sensor air gap

21 Rotate the pedal position sensor quadrant, and release the accelerator inner cable from the quadrant **(see illustration)**. Withdraw the outer cable from the grommet in the pedal position sensor body.
22 Refitting is reverse of the removal procedure, but adjust the accelerator cable as described in Section 5 on completion.

Coolant temperature sensor

23 Refer to Chapter 3, Section 6.

Fuel temperature sensor

Warning: Refer to the information contained in Section 2 before proceeding.

Note: *Do not remove the sensor from the accumulator rail unless there is a valid reason to do so. At the time of writing there was no information as to the availability of the sensor seal as a separate item. Consult a Citroën parts stockist for the latest information before proceeding.*
24 The fuel temperature sensor is located towards the right-hand end of the accumulator rail **(see illustration)**.
25 Undo the four plastic nuts and lift off the engine cover.
26 Disconnect the fuel temperature sensor wiring connector.
27 Thoroughly clean the area around the sensor and its location on the accumulator rail.
28 Suitably protect the components below the sensor and have plenty of clean rags handy. Be prepared for considerable fuel spillage.
29 Undo the retaining bolt and withdraw the sensor from the accumulator rail. Plug the opening in the accumulator rail as soon as the sensor is withdrawn.
30 Prior to refitting, if the original sensor is to be refitted, renew the sensor seal, where applicable (see the note at the start of this sub-Section).
31 Locate the sensor in the accumulator rail and refit the retaining bolt, tightened securely.
32 Refit the sensor wiring connector.
33 Observing the precautions listed in Section 2, start the engine and allow it to idle. Check for leaks at the fuel temperature sensor with the engine idling. If satisfactory, increase the engine speed to 4000 rpm and check again for leaks. Take the car for a short road test and check for leaks once again on return. If any leaks are detected, obtain and fit a new sensor.
34 Refit the engine cover on completion.

Air mass meter

35 The air mass meter is located in the flexible air inlet duct just behind the air cleaner lid.
36 Undo the four plastic nuts and lift off the engine cover.
37 Disconnect the wiring connector from the underside of the air mass meter.
38 Slacken the hose clips on each side of the air mass meter body.

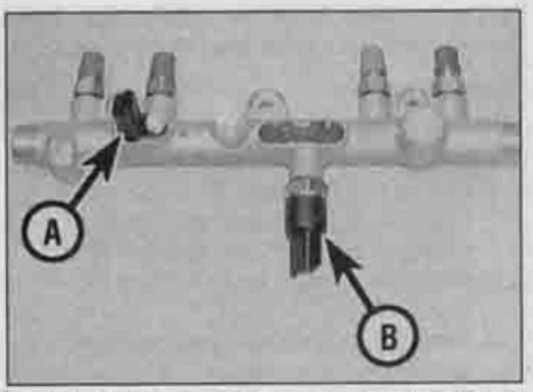
13.21 Release the accelerator inner cable from the accelerator pedal position sensor quadrant

39 Lift the air cleaner assembly upward to release it from the support bracket then detach the air mass meter from the front inlet duct.
40 Withdraw the air mass meter from the rear inlet duct and remove it from the engine compartment. Suitably plug or cover the rear inlet duct using clean rag to prevent any dirt or foreign material from entering the turbocharger.
41 Refitting is reverse of the removal procedure.

Fuel pressure sensor

Warning: Refer to the information contained in Section 2 before proceeding.

Note: *Citroën special tool (-).4220 TH (27 mm forked adaptor) or suitable equivalent will be required for this operation.*
42 The fuel pressure sensor is located centrally on the underside of the accumulator rail **(see illustration 13.24)**.
43 Undo the four plastic nuts and lift off the engine cover.
44 Release the retaining clip and disconnect the crankcase ventilation hose from the cylinder head cover.
45 Disconnect the fuel supply and return hose quick-release fittings at the fuel filter, using a small screwdriver to release the locking clip. Suitably plug or cover the open unions to prevent dirt entry. Release the fuel hoses from the relevant retaining clips.
46 Disconnect the fuel pressure sensor wiring connector.
47 Thoroughly clean the area around the sensor and its location on the accumulator rail.
48 Suitably protect the components below the sensor and have plenty of clean rags handy. Be prepared for considerable fuel spillage.
49 Using the Citroën special tool (or suitable alternative 27 mm forked adaptor) and a socket bar, unscrew the fuel pressure sensor from the base of the accumulator rail.
50 Obtain and fit a new sealing ring to the sensor prior to refitting.
51 Locate the sensor in the accumulator rail and tighten it to the specified torque using the special tool (or alternative) and a torque wrench.



13.24 Fuel temperature sensor (A) and fuel pressure sensor (B) locations on the accumulator rail (shown removed for clarity)

52 Refit the sensor wiring connector.
53 Observing the precautions listed in Section 2, start the engine and allow it to idle. Check for leaks at the fuel pressure sensor with the engine idling. If satisfactory, increase the engine speed to 4000 rpm and check again for leaks. Take the car for a short road test and check for leaks once again on return. If any leaks are detected, obtain and fit another new sensor sealing ring.
54 Refit the engine cover on completion.

Fuel pressure control valve

55 The fuel pressure control valve is integral with the high-pressure fuel pump and cannot be separated.

Preheating system control unit

56 Refer to Chapter 5C.

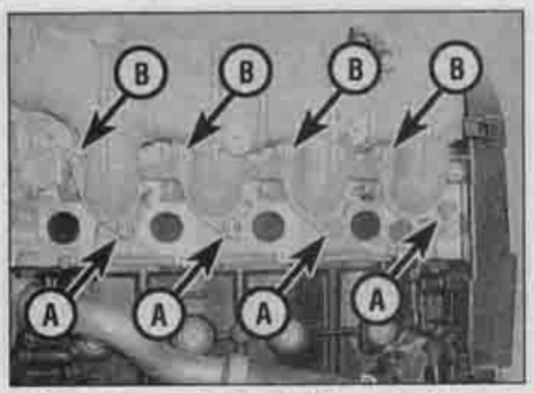
EGR solenoid valve

57 Refer to Chapter 4C.

14 Inlet manifold – removal and refitting

Removal

Note: *Renew the manifold gasket when refitting.*
1 Remove the exhaust manifold as described in Section 15.
2 Undo the four bolts and four nuts securing the inlet manifolds flanges to the cylinder head **(see illustration)**. Recover the washers.



14.2 Inlet manifold retaining nuts (A) and bolts (B)

3 Lift the manifold off the cylinder head studs and recover the gasket **(see illustrations)**.

Refitting

4 Refitting is reverse of the removal procedure, bearing in mind the following points.

a) Ensure that the manifold and cylinder head mating faces are clean, with all traces of old gasket removed.
b) Use a new gasket when refitting the manifold.
c) Ensure that all fixings and attachments are securely tightened.
d) Refit the exhaust manifold as described in Section 15.

14.3a Lift the manifold off the cylinder head studs . . .

14.3b . . . and recover the gasket

15 Exhaust manifold – removal and refitting

Removal

***Note:** The exhaust manifold is removed complete with the turbocharger and there is insufficient clearance to gain access to all the relevant attachments from either above or below with the engine in the car. Two alternatives are possible; either remove the complete engine/transmission unit from the car as described in Chapter 2E, or remove the front suspension subframe as described in Chapter 10. Both are involved operations and the course of action taken is largely dependent on the tools, equipment, skill and patience available.*

1 The following procedure is based on the assumption that the engine/transmission unit has been removed from the car. If the front suspension subframe has been removed instead, the operations are basically the same, but it may be necessary to disconnect and move aside certain additional items, and to be prepared for considerable manipulation to withdraw the components from the engine compartment.

2 If not already done, disconnect the battery negative terminal (refer to *Disconnecting the battery* in the Reference Chapter).

3 If the engine is in the car, remove the catalytic converter as described in Section 18.

4 Remove the turbocharger rear inlet and outlet ducts as described in Section 4.

5 Unscrew the union nut securing the turbocharger oil feed pipe to the cylinder block, then withdraw the pipe from its location **(see illustration)**.

6 Remove the filter from the end of the oil feed pipe, and examine it for contamination **(see illustration)**. Clean or renew it as necessary.

7 Undo the two bolts securing the oil return pipe flange to the turbocharger. Separate the flange and recover the gasket **(see illustrations)**.

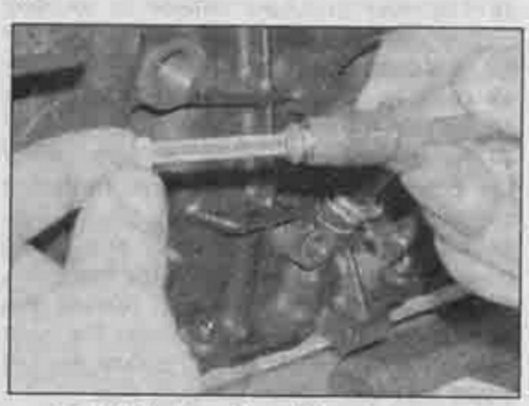
8 Remove the exhaust gas recirculation (EGR) valve and connecting pipe from the exhaust manifold as described in Chapter 4C.

9 Undo the eight exhaust manifold retaining nuts and recover the spacers from the studs **(see illustrations)**.

10 Undo the nut and bolt securing the base of the turbocharger to the support bracket on the cylinder block.

11 Withdraw the turbocharger and exhaust manifold off the mounting studs and remove the assembly from the engine. Recover the manifold gasket **(see illustrations)**.

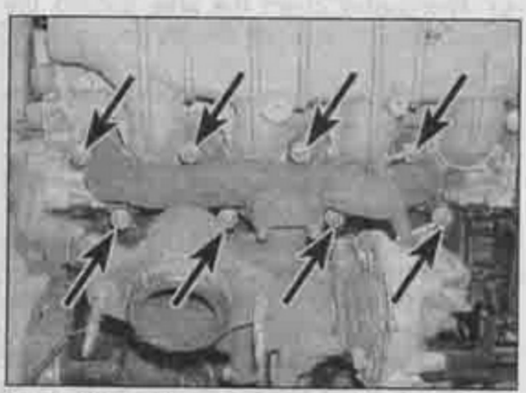
15.5 Unscrew the turbocharger oil feed pipe union nut



15.6 Withdraw the oil feed pipe and remove the filter

15.7a Undo the oil return pipe flange securing bolts (arrowed) . . .

15.7b . . . separate the flange and recover the gasket



15.9a Undo the exhaust manifold retaining nuts (arrowed)

15.9b . . . and recover the spacers from the studs

Refitting

12 Refitting is a reverse of the removal procedure, bearing in mind the following points:

a) Ensure that the manifold and cylinder head mating faces are clean, with all traces of old gasket removed.
b) Use new gaskets when refitting the manifold to the cylinder head and the oil return pipe flange to the turbocharger.
c) Tighten the exhaust manifold retaining nuts to the specified torque.
d) Refit the EGR valve and connecting pipe as described in Chapter 4C.
e) Refit the turbocharger rear inlet and outlet ducts as described in Section 4.
f) If the engine is in the car, refit the catalytic converter as described in Section 18.
g) Refit the engine/transmission unit or the front suspension subframe with reference to Chapter 2E or 10 as applicable.

16 Turbocharger – description and precautions

Description

1 The turbocharger increases engine efficiency by raising the pressure in the inlet manifold above atmospheric pressure. Instead of the air simply being sucked into the cylinders, it is forced in.

2 Energy for the operation of the turbocharger comes from the exhaust gas. The gas flows through a specially-shaped housing (the turbine housing) and, in so doing, spins the turbine wheel. The turbine wheel is attached to a shaft, at the end of which is another vaned wheel known as the compressor wheel. The compressor wheel spins in its own housing, and compresses the inlet air on the way to the inlet manifold.

3 Boost pressure (the pressure in the inlet manifold) is limited by a wastegate, which diverts the exhaust gas away from the turbine wheel in response to a pressure-sensitive actuator.

4 The turbo shaft is pressure-lubricated by an oil feed pipe from the main oil gallery. The shaft 'floats' on a cushion of oil. A drain pipe returns the oil to the sump.

Precautions

5 The turbocharger operates at extremely high speeds and temperatures. Certain precautions must be observed, to avoid premature failure of the turbo, or injury to the operator.

6 Do not operate the turbo with any of its parts exposed, or with any of its hoses removed. Foreign objects falling onto the rotating vanes could cause excessive damage, and (if ejected) personal injury.

7 Do not race the engine immediately after start-up, especially if it is cold. Give the oil a few seconds to circulate.

15.11a Withdraw the turbocharger and exhaust manifold off the mounting studs . . .

15.11b . . . and recover the gasket

8 Always allow the engine to return to idle speed before switching it off – do not blip the throttle and switch off, as this will leave the turbo spinning without lubrication.

9 Allow the engine to idle for several minutes before switching off after a high-speed run.

10 Observe the recommended intervals for oil and filter changing, and use a reputable oil of the specified quality. Neglect of oil changing, or use of inferior oil, can cause carbon formation on the turbo shaft, leading to subsequent failure.

17 Turbocharger – removal, inspection and refitting

Removal

1 Remove the exhaust manifold as described in Section 15. The turbocharger and exhaust manifold are removed from the engine as a complete assembly. The turbocharger can then be separated from the manifold on the bench as follows.

2 Undo the four bolts securing the exhaust outlet elbow to the turbocharger body and separate the elbow from the turbocharger **(see illustration)**.

3 Undo the three retaining nuts and lift the turbocharger off the manifold studs **(see illustration)**.

Inspection

4 With the turbocharger removed, inspect the housing for cracks or other visible damage.

5 Spin the turbine or the compressor wheel, to verify that the shaft is intact and to feel for excessive shake or roughness. Some play is normal, since in use, the shaft is 'floating' on a film of oil. Check that the wheel vanes are undamaged.

6 If oil contamination of the exhaust or induction passages is apparent, it is likely that turbo shaft oil seals have failed.

7 No DIY repair of the turbo is possible and none of the internal or external parts are available separately. If the turbocharger is suspect in any way a complete new unit must be obtained.

Refitting

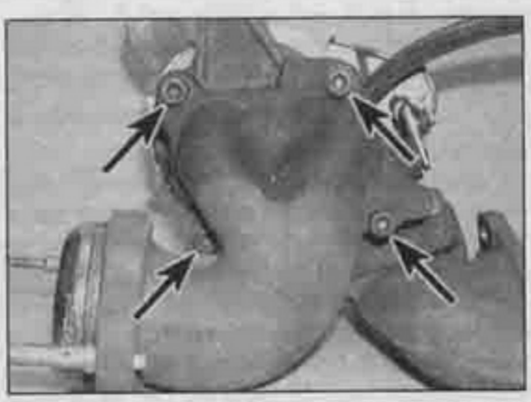
8 Refitting is a reverse of the removal procedure, bearing in mind the following points:

a) If a new turbocharger is being fitted, change the engine oil and filter. Also renew the filter in the oil feed pipe.
b) Prime the turbocharger by injecting clean engine oil through the oil feed pipe union before reconnecting the union.

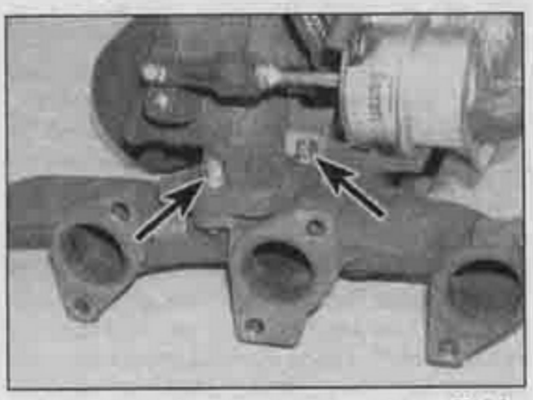
18 Exhaust system – general information and component renewal

General information

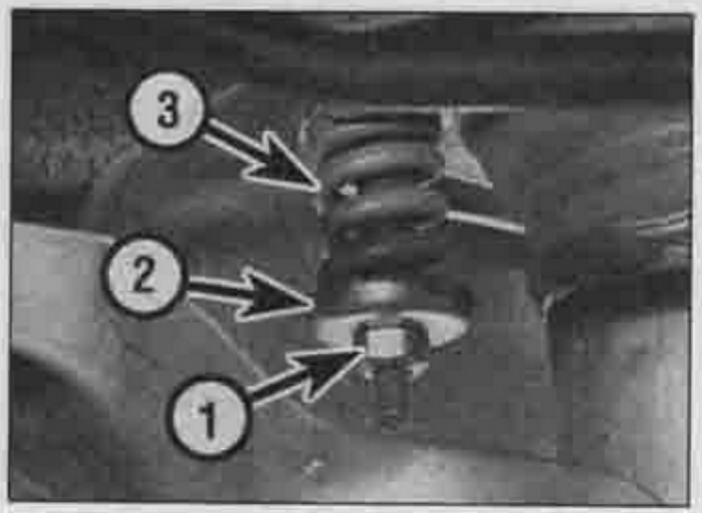
1 The exhaust system consists of three sections comprising a front pipe with catalytic converter, an intermediate pipe, and a tailpipe.



17.2 Exhaust outlet elbow-to-turbocharger retaining bolts (arrowed)



17.3 Turbocharger-to-exhaust manifold retaining nuts (arrowed)



18.7 Exhaust front pipe-to-turbocharger securing nut (1), spring seat (2) and spring (3)

2 The front pipe-to-manifold joint is of the spring-loaded ball type, to allow for movement in the exhaust system, and the other joints are secured by clamping rings.

3 The system is suspended throughout its entire length by rubber mountings.

Removal

4 Each exhaust section can be removed individually, or alternatively, the complete system can be removed as a unit. Even if only one part of the system needs attention, it is often easier to remove the whole system and separate the sections on the bench.

5 To remove the system or part of the system, first jack up the front or rear of the car, and support it on axle stands (see *Jacking and vehicle support*). Alternatively, position the car over an inspection pit, or on car ramps.

Front pipe/catalytic converter

6 Slacken the clamping ring nut and bolt, and disengage the clamp from the intermediate pipe flange joint.

7 Slacken and remove the two nuts securing the front pipe to the turbocharger, and recover the spring cups and springs **(see illustration)**. Withdraw the bolts and remove the front pipe and catalytic converter from underneath the vehicle. Recover the wire-mesh gasket from the manifold joint.

Intermediate pipe

8 Slacken the clamping ring nuts and bolts, and disengage both clamps from the flange joints.

9 Release the pipe from its mounting rubber and remove it from underneath the vehicle.

Tailpipe

10 Slacken the tailpipe clamping ring nut and bolt, and disengage the clamp from the flange joint.

11 Unhook the tailpipe from its mounting rubbers, and remove it from the vehicle.

Complete system

12 Slacken and remove the two nuts securing the front pipe flange joint to the manifold, and recover the spring cups and springs. Remove the bolts, then free the system from its mounting rubbers and remove it from underneath the vehicle. Recover the wire-mesh gasket from the manifold joint.

Heat shield(s)

13 The heat shields are secured to the underside of the body by various nuts and bolts. Each shield can be removed once the relevant exhaust section has been removed. If a shield is being removed to gain access to a component located behind it, it may prove sufficient in some cases to remove the retaining nuts and/or bolts, and simply lower the shield, without disturbing the exhaust system.

Refitting

14 Each section is refitted by reversing the removal sequence, noting the following points:

a) *Ensure that all traces of corrosion have been removed from the flanges, and renew all necessary gaskets.*

b) *Inspect the rubber mountings for signs of damage or deterioration, and renew as necessary.*

c) *Prior to assembling the spring-loaded joint, a smear of high-temperature grease should be applied to the joint mating surfaces.*

d) *On joints secured together by a clamping ring, apply a smear of exhaust system jointing paste to the flange joint, to ensure a gas-tight seal.*

e) *Prior to tightening the exhaust system fasteners, ensure that all rubber mountings are correctly located, and that there is adequate clearance between the exhaust system and vehicle underbody.*

Chapter 4 Part C:
Emission control systems

Contents

Degrees of difficulty

Easy, suitable for novice with little experience

Fairly easy, suitable for beginner with some experience

Fairly difficult, suitable for competent DIY mechanic

Difficult, suitable for experienced DIY mechanic

Very difficult, suitable for expert DIY or professional

1 General information

All petrol engines use unleaded petrol and have various other features built into the fuel system to help minimise harmful emissions. In addition, all engines are equipped with the crankcase emission control system described below, and are also equipped with a catalytic converter and an evaporative emission control system. 1.8 litre petrol engines also utilise a secondary air injection system to quickly bring the catalytic converter up to normal working temperature and are equipped with an exhaust gas recirculation (EGR) system.

The diesel engines are also designed to meet the strict emission requirements and are equipped with a crankcase emission control system and a catalytic converter. To further reduce exhaust emissions, diesel engines are also fitted with an exhaust gas recirculation (EGR) system.

The emission control systems function as follows.

Petrol engines

Crankcase emission control

To reduce the emission of unburned hydrocarbons from the crankcase into the atmosphere, the engine is sealed and the blow-by gases and oil vapour are drawn from inside the crankcase, through an oil separator, into the inlet tract to be burned by the engine during normal combustion.

Under all conditions the gases are forced out of the crankcase by the (relatively) higher crankcase pressure; if the engine is worn, the raised crankcase pressure (due to increased blow-by) will cause more of the flow to return under all manifold conditions.

Exhaust emission control

To minimise the amount of pollutants which escape into the atmosphere, all models are fitted with a catalytic converter in the exhaust system. The system is of the closed-loop type, in which one or two lambda sensors in the exhaust system provide the engine management ECU with constant feedback, enabling the ECU to adjust the air/fuel mixture ratio to provide the best possible conditions for the converter to operate.

The lambda sensor has a heating element built-in that is controlled by the ECU to quickly bring the sensor's tip to an efficient operating temperature. The sensor's tip is sensitive to oxygen and sends the ECU a varying voltage depending on the amount of oxygen in the exhaust gases; if the intake air/fuel mixture is too rich, the exhaust gases are low in oxygen so the sensor sends a low-voltage signal, the voltage rising as the mixture weakens and the amount of oxygen rises in the exhaust gases. Peak conversion efficiency of all major pollutants occurs if the intake air/fuel mixture is maintained at the chemically-correct ratio for the complete combustion of petrol of 14.7 parts (by weight) of air to 1 part of fuel (the 'stoichiometric' ratio). The sensor output voltage alters in a large step at this point, the ECU using the signal change as a reference point and correcting the intake air/fuel mixture accordingly by altering the fuel injector pulse width.

On early 1.6 litre engines, a single lambda sensor is used, located upstream of the catalytic converter. On later 1.6 litre engines, and all 1.8 litre engines, two lambda sensors are used, one upstream, and one downstream of the catalytic converter.

Evaporative emission control

To minimise the escape into the atmosphere of unburned hydrocarbons, an evaporative emission control system is fitted to all models. The fuel tank filler cap is sealed and a charcoal canister is mounted underneath the right-hand front wing to collect the petrol vapours generated in the tank when the car is parked. It stores them until they can be cleared from the canister (under the control of the engine management ECU) via the purge valve into the inlet tract to be burned by the engine during normal combustion.

To ensure that the engine runs correctly when it is cold and/or idling and to protect the catalytic converter from the effects of an over-rich mixture, the purge control valve(s) is/are not opened by the ECU until the engine has warmed-up, and the engine is under load; the valve solenoid is then modulated on and off to allow the stored vapour to pass into the inlet tract.

Secondary air injection

Note: *The secondary air injection system described below is also fitted to certain later 1.6 litre engines, however, no information on the system layout was available at the time of writing.*

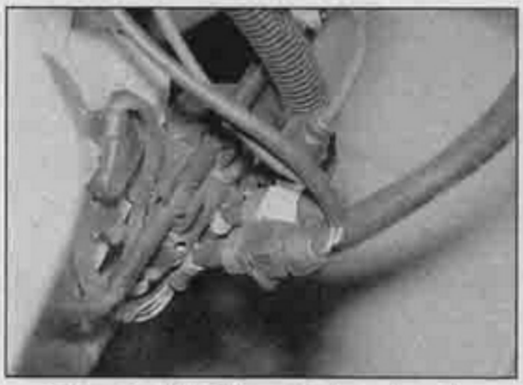
1.8 litre engines are also equipped with a secondary air injection system. This system is designed to reduce exhaust emissions in the period between first starting the engine, and until the catalytic converter reaches operating (functioning) temperature. Introduction of air into the exhaust system during the initial start-up period, creates an 'afterburner' effect which quickly increases the temperature in the exhaust system front pipe, thus bringing the catalytic converter up to normal operating temperatures very quickly.

The system consists of an air pump, mounted under the front left-hand wheelarch, an air injection valve, mounted on the left-hand end of the cylinder head, and an interconnecting air hose.

The system operates for between 10 and 80 seconds after engine start-up, dependant on coolant temperature.

Exhaust gas recirculation system

An exhaust gas recirculation system is fitted to 1.8 litre engines. The system is designed to recirculate small quantities of exhaust gas into the inlet tract, and therefore into the combustion process. This process reduces the level of oxides of nitrogen present in the final exhaust gas which is released into the atmosphere.



2.14a On all 1.6 litre petrol engines the lambda sensor wiring connectors are clipped onto the front of the transmission . . .

The volume of exhaust gas recirculated is controlled by vacuum supplied from the brake servo unit, via a solenoid valve.

A vacuum-operated valve located on the cylinder head is used to regulate the quantity of exhaust gas recirculated. The valve is operated by the vacuum supplied via the solenoid valve.

The system is controlled by the engine management ECU, which receives information on coolant temperature, engine load, and engine speed, via the coolant temperature sensor, throttle position sensor and crankshaft speed/position sensor respectively.

Diesel engines

Crankcase emission control

To reduce the emission of unburned hydrocarbons from the crankcase into the atmosphere, the engine is sealed and the blow-by gases and oil vapour are drawn from inside the crankcase, through a wire mesh oil separator, into the inlet tract to be burned by the engine during normal combustion.

Under all conditions the gases are forced out of the crankcase by the (relatively) higher crankcase pressure; if the engine is worn, the raised crankcase pressure (due to increased blow-by) will cause more of the flow to return under all manifold conditions.

Exhaust emission control

To minimise the level of exhaust pollutants released into the atmosphere, a catalytic converter is fitted in the exhaust system.

2.14b . . . and on later engines, also clipped to the side of the coolant outlet housing

The catalytic converter consists of a canister containing a fine mesh impregnated with a catalyst material, over which the hot exhaust gases pass. The catalyst speeds up the oxidation of harmful carbon monoxide, unburnt hydrocarbons and soot, effectively reducing the quantity of harmful products released into the atmosphere via the exhaust gases.

Exhaust gas recirculation system

This system is designed to recirculate small quantities of exhaust gas into the inlet tract, and therefore into the combustion process. This process reduces the level of oxides of nitrogen present in the final exhaust gas which is released into the atmosphere.

The volume of exhaust gas recirculated is controlled by vacuum supplied from the brake servo vacuum pump, via a solenoid valve controlled by the preheating system, in conjunction with the engine management ECU.

A vacuum-operated valve is fitted to the exhaust manifold, to regulate the quantity of exhaust gas recirculated. The valve is operated by the vacuum supplied via the solenoid valve.

2 Emission control systems (petrol engines) – testing and component renewal

Crankcase emission control

1 The components of this system require no attention other than to check that the hose(s) are clear and undamaged at regular intervals.

Evaporative emission control

Testing

2 If the system is thought to be faulty, disconnect the hoses from the charcoal canister and purge control valve and check that they are clear by blowing through them. If the purge control valve(s) or charcoal canister are thought to be faulty, they must be renewed.

Charcoal canister renewal

3 The charcoal canister is located behind the right-hand front wing. To gain access to the canister, firmly apply the handbrake, then jack up the front of the car and support it securely on axle stands (see *Jacking and vehicle support*). The wheelarch plastic liner must now be removed. The liner is secured by screws and stud-type plastic clips along its upper and front edges. The clips can be removed using a forked type tool, or alternatively, with a large screwdriver (although there is a risk of breakage if the screwdriver method is used). Extract all the clips, then remove the liner centre section and front section from under the front wing. Note how the two sections overlap as you do this to aid refitting.

4 Slacken and remove the retaining bolt then free the canister from its mounting clamp and lower it out from underneath the wing. Mark the hoses for identification purposes.

5 Slacken the retaining clips then disconnect both hoses and remove the canister from the vehicle. Where the crimped-type hose clips are fitted, cut the clips and discard them, replace them with standard worm-drive hose clips on refitting. Where the hoses are equipped with quick-release fittings depress the centre collar of the fitting with a small flat-bladed screwdriver then detach the hose from the canister.

6 Refitting is a reverse of the removal procedure ensuring the hoses are correctly reconnected.

Purge valve(s) renewal

7 The purge valve is located on the right-hand side of the engine compartment below the washer reservoir filler neck.

8 Disconnect the battery negative terminal (refer to *Disconnecting the battery* in the Reference Chapter).

9 Depress the retaining clip and disconnect the wiring connector from the valve. Disconnect the hoses from either end of the valve then release the valve from its retaining clip or strap and remove it from the engine compartment, noting which way around it is fitted.

10 Refitting is a reversal of the removal procedure, ensuring the valve is fitted the correct way around and the hoses are securely connected.

Exhaust emission control

Testing

11 The performance of the catalytic converter can only be checked by measuring the exhaust gases using a good-quality, carefully-calibrated exhaust gas analyser. If access to such equipment can be gained, it should be connected and used according with the maker's instructions.

12 If the CO level at the tailpipe is too high, the vehicle should be taken to a Citroën dealer so that the complete engine management system can be thoroughly checked using the special diagnostic equipment. Once these have been checked and are known to be free from faults, the fault must be in the catalytic converter, which must be renewed.

Catalytic converter renewal

13 Refer to Chapter 4A, Section 16.

Lambda sensor(s) renewal

Note 1: *The lambda sensor is delicate and will not work if it is dropped or knocked, if its power supply is disrupted, or if any cleaning materials are used on it.*

Note 2: *Later 1.6 litre engines and all 1.8 litre engines are fitted with a 'downstream' lambda sensor located after the catalytic converter. Removal and refitting procedures are the same for both sensors.*

14 Trace the wiring back from the relevant lambda sensor, located in the exhaust manifold or exhaust front pipe. Disconnect the wiring connectors and free the wiring from any relevant retaining clips or ties **(see illustrations)**.

15 Unscrew the sensor from its location and remove it, along with its sealing washer **(see illustrations)**.

16 Refitting is a reverse of the removal procedure, using a new sealing washer. Prior to installing the sensor apply a smear of high temperature grease to the sensor threads. Ensure the sensor is securely tightened and that the wiring is correctly routed and in no danger of contacting either the exhaust system or engine.

Secondary air injection

Testing

17 The components of this system require no attention other than to check that the hose(s) and air pump air intake filter are clear and undamaged at periodic intervals.

18 Accurate testing of the system operation entails the use of diagnostic test equipment and should be entrusted to a Citroën dealer.

Air pump air intake filter cleaning

19 The air intake filter is contained in the air pump housing which is located under the left-hand side wheelarch.

20 Disconnect the battery negative terminal (refer to *Disconnecting the battery* in the Reference Chapter).

21 Remove the front bumper as described in Chapter 11. Remove the air cleaner assembly as described in Chapter 4A.

22 Disconnect the pump motor wiring connector then detach the air hose from the base of the pump **(see illustrations)**.

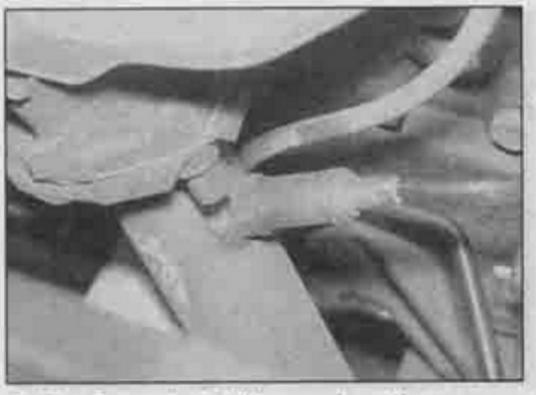
23 Undo the nut securing the pump lower support bracket to the body **(see illustration)**.

24 From within the engine compartment, slacken the two upper mounting nuts located on the body panel beneath the air cleaner location **(see illustration)**.

25 From under the wheelarch, slide the unit rearwards to disengage the mounting nuts from their elongated slots, then remove the pump assembly from under the wing **(see illustration)**.

26 Undo the central retaining bolt and lift off the pump housing cover **(see illustration)**.

27 The air filter can now be withdrawn from the cover **(see illustration)**. Wash the filter thoroughly and allow it to dry completely.



2.15a On early 1.6 litre engines the sensor is screwed into the top of the exhaust front pipe

2.15b On later 1.6 litre engines the upstream sensor is screwed into the exhaust manifold (shown with heat shield removed) . . .

2.15c . . . and the downstream sensor is screwed into the exhaust front pipe

2.15d On 1.8 litre engines, the sensors are located either side of the catalytic converter (downstream sensor shown)

28 Refit the filter and pump housing cover, then refit the air pump assembly using a reverse of the removal procedure.

29 Refit the front bumper as described in Chapter 11, and the air cleaner as described in Chapter 4A.

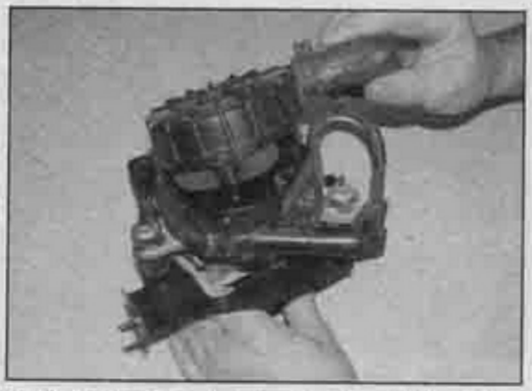
2.22a Disconnect the air pump motor wiring connector . . .

2.22b . . . then detach the air hose from the base of the pump

2.23 Undo the nut securing the pump lower support bracket to the body

2.24 Slacken the two upper mounting nuts (arrowed) . . .

2.25 . . . then slide the unit rearwards to disengage the mounting nuts



2.26 Undo the retaining bolt and lift off the pump housing cover

2.27 The air filter can now be withdrawn from the cover

Air pump renewal

30 Proceed as described in paragraphs 20 to 25.
31 With the pump assembly removed, undo the three retaining nuts and remove the air pump from the mounting bracket.
32 Refitting is the reverse of the removal procedure.
33 With the pump assembly installed, refit the front bumper as described in Chapter 11, and the air cleaner as described in Chapter 4A.

Air injection valve renewal

34 Disconnect the battery negative terminal (refer to *Disconnecting the battery* in the Reference Section of this manual).
35 Undo the six screws and lift off the engine cover.
36 Disconnect the air inlet hose quick-release connector from the air injection valve at the left-hand end of the cylinder head **(see illustration)**.

2.36 Disconnect the air inlet hose from the secondary air injection valve

2.37 Undo the two bolts and carefully withdraw the air injection valve from the cylinder head

2.43 Undo the two bolts and withdraw the EGR valve from the coolant outlet housing

2.45 Locate a new EGR valve gasket in position with the word TOP uppermost

37 Undo the two retaining bolts and carefully withdraw the valve from the cylinder head **(see illustration)**. Try not to damage the gasket as the valve is removed, otherwise it will be necessary to remove the coolant outlet housing to renew the gasket (see Chapter 3).
38 Refitting is the reverse of the removal procedure.

Exhaust gas recirculation

Testing

39 Testing of the system should be entrusted to a Citroën dealer.

EGR valve renewal

40 Disconnect the battery negative terminal (refer to *Disconnecting the battery* in the Reference Section of this manual).
41 Undo the six screws and lift off the engine cover.
42 Disconnect the wiring connector from the EGR valve located on the coolant outlet housing at the left-hand end of the cylinder head.
43 Undo the two bolts and withdraw the valve from the housing **(see illustration)**. Remove the gasket and obtain a new gasket for refitting.
44 Clean all traces of old gasket from the mating faces of the EGR valve and coolant outlet housing.
45 Locate a new gasket in position with the word TOP uppermost **(see illustration)**.
46 Fit the valve and the retaining bolts and tighten the bolts securely.
47 Reconnect the wiring connector, refit the engine cover and reconnect the battery.

3 Emission control systems (diesel engines) – testing and component renewal

Crankcase emission control

1 The components of this system require no attention other than to check that the hoses are clear and undamaged at regular intervals.

Exhaust emission control

Testing

2 The performance of the catalytic converter can only be checked by measuring the exhaust gases using a good-quality, carefully calibrated exhaust gas analyser. If access to such equipment can be gained, it should be connected and used according with the maker's instructions.
3 If the exhaust emissions are excessive, before assuming the catalytic converter is faulty, it is worth checking the problem is not due to a faulty injector(s), or other diesel fuel system fault. Refer to your Citroën dealer for further information.

Catalytic converter renewal

4 Refer to Chapter 4B, Section 18.

Exhaust gas recirculation

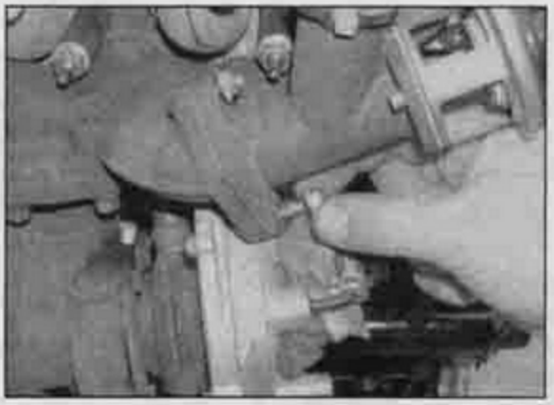
Testing

5 Testing of the system should be entrusted to a Citroën dealer.

EGR valve renewal

Note 1: *There is insufficient clearance to gain access to all the relevant EGR valve attachments from either above or below with the engine in the car. Two alternatives are possible; either remove the complete engine/transmission unit from the car as described in Chapter 2E, or remove the front suspension subframe as described in Chapter 10. Both are involved operations and the course of action taken is largely dependent on the tools, equipment, skill and patience available.*
Note 2: *On certain early engines the EGR pipe incorporated a heat exchanger. If this arrangement is encountered, the procedures*

3.6 On diesel engines, undo the bolts securing the EGR pipe support clips to the inlet manifold . . .



3.7 . . . and the two nuts securing the EGR valve to the exhaust manifold

3.8a Undo the two bolts (arrowed) securing the EGR pipe to the inlet manifold elbow . . .

are the same as described below, but it will be necessary to drain the cooling system as described in Chapter 1B if the engine is in the car. Disconnect the coolant hoses at the heat exchanger after draining.

6 Undo the bolts securing the EGR pipe support clips to the inlet manifold **(see illustration)**.

7 Disconnect the vacuum hose, then undo the two nuts securing the EGR valve to the exhaust manifold **(see illustration)**.

8 Undo the two bolts securing the EGR pipe to the inlet manifold elbow. Withdraw the EGR valve and pipe assembly from the manifold and recover the gasket at the EGR pipe-to-inlet manifold flange **(see illustrations)**.

9 To separate the EGR pipe from the valve, remove the clip securing the upper flexible portion of the pipe to the valve. If the original crimped clip is still in place, cut it off; new clips are supplied by Citroën parts stockists with a screw clamp fixing. If a screw clamp type clip is fitted, undo the screw and manipulate the clip off the pipe.

10 Refitting is a reverse of the removal procedure, bearing in mind the following points:

a) Ensure that the EGR valve and exhaust manifold mating faces are clean.
b) Secure the EGR pipe with new screw clamp type clips, if crimped type clips were initially fitted.
c) Refit the engine/transmission unit or the front suspension subframe as described in Chapter 2E or 10, as applicable.

EGR solenoid valve renewal

11 The EGR solenoid valve is located in the right-hand rear corner of the engine compartment **(see illustration)**.

12 To remove the EGR solenoid valve, disconnect the two vacuum hoses and the wiring connector. Undo the mounting bracket nuts and remove the valve from the engine compartment.

13 Refitting is a reverse of the removal procedure.

3.8b . . . then withdraw the valve and pipe assembly and recover the gasket at the EGR pipe flange

3.11 EGR solenoid valve location (arrowed)

4 Catalytic converter – general information and precautions

1 The catalytic converter is a reliable and simple device which needs no maintenance in itself, but there are some facts of which an owner should be aware if the converter is to function properly for its full service life.

Petrol engines

a) DO NOT use leaded or lead replacement petrol (LRP) in a car equipped with a catalytic converter – the lead will coat the precious metals, reducing their converting efficiency and will eventually destroy the converter.
b) Always keep the ignition and fuel systems well-maintained in accordance with the manufacturer's schedule.
c) If the engine develops a misfire, do not drive the car at all (or at least as little as possible) until the fault is cured.
d) DO NOT push- or tow-start the car – this will soak the catalytic converter in unburned fuel, causing it to overheat when the engine does start.
e) DO NOT switch off the ignition at high engine speeds.
f) DO NOT use fuel or engine oil additives – these may contain substances harmful to the catalytic converter.
g) DO NOT continue to use the car if the engine burns oil to the extent of leaving a visible trail of blue smoke.
h) Remember that the catalytic converter operates at very high temperatures. DO NOT, therefore, park the car in dry undergrowth, over long grass or piles of dead leaves after a long run.
i) Remember that the catalytic converter is FRAGILE – do not strike it with tools during servicing work.
j) In some cases a sulphurous smell (like that of rotten eggs) may be noticed from the exhaust. This is common to many catalytic converter-equipped cars and once the car has covered a few thousand miles the problem should disappear.
k) The catalytic converter, used on a well-maintained and well-driven car, should last for between 50 000 and 100 000 miles – if the converter is no longer effective it must be renewed.

Diesel engines

2 Refer to parts f, g, h and i of the petrol engine information given above.