Chapter 1
Routine maintenance and servicing

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

Lubricants and fluids

Refer to “Weekly Checks”

Capacities

Engine oil

Including filter:	
1.4 litre	3.0 litres
1.6 litre	3.5 litres
1.8 and 2.0 litre SOHC models	4.0 litres
20 XEJ and C 20 XE	4.5 litres
X 20 XEV	4.0 litres
Quantity of oil required to raise level on dipstick from “MIN” to “MAX”:	
1.4 litre	0.8 litre
All other models	1.0 litre

Cooling system (approx.)

1.4 litre models	5.6 litres
1.6 litre models (except C 16 NZ2) - manual transmission	5.8 litres
1.6 litre models (except C 16 NZ2) - automatic transmission	5.6 litres
C 16 NZ2, 1.8 and 2.0 litre SOHC models - manual transmission	7.2 litres
C 16 NZ2, 1.8 and 2.0 litre SOHC models - automatic transmission	7.1 litres
DOHC models	7.2 litres

Transmission

Manual transmission codes:	
F10 and F13	1.6 litres
F16, F18 and F20	1.9 litres
Automatic - at fluid change	3.0 to 3.5 litres
Difference between dipstick MAX and MIN marks - approximate:	
+ 20°C side	0.25 litre
+ 80°C side	0.40 litre

Power steering fluid

Approximately	1.0 litre

Fuel tank

All models	63.0 ± 2 litres

Washer fluid

Without headlamp washers	2.6 litres
With headlamp washers	4.5 litres

Engine

Oil filter	Champion G102

Cooling system

Antifreeze mixture:	
28% antifreeze	Protection down to -15°C (5°F)
50% antifreeze	Protection down to -30°C (-22°F)

Note: *Refer to antifreeze manufacturer for latest recommendations.*

Fuel system

Note: *Ignition timing adjustment is not possible on some models, shown for information only. For further details refer to Chapters 4A or 4B, as applicable.*

Idle speed:

14 NV	925 ± 25 rpm
16 SV	
Manual transmission models	925 ± 25 rpm
Automatic transmission models	825 ± 25 rpm
18 SV	925 ± 25 rpm
C 16 NZ and X 16 SZ	850 ± 80 rpm
C 16 NZ2	880 ± 80 rpm
C 18 NZ	
Manual transmission models	880 ± 80 rpm
Automatic transmission models	830 ± 80 rpm
20 NE, C 20 NE and 20 SEH	800 ± 80 rpm
20 XEJ and C 20 XE	940 ± 80 rpm
X 20 XEV	850 ± 160 rpm

Idle mixture CO content:	
All carburettor models	0.5 to 1.5%
20 NE and 20 SEH	1.0 max.
20 XEJ	0.7 to 1.2%
All other injection models	0.3 % (at 2800 to 3200 rpm)
Air filter element:	
1.4 and 1.6 litre 'round type'	Champion W103
1.6 and 1.8 litre 'square type'	Champion U512
1.8 litre 'round type'	Champion type not available
2.0 litre	Champion U554
Fuel filter:	
1.6, 1.8 and 2.0 litre 'in-line'	Champion L201

Ignition system:

Ignition timing	Refer to Chapter 5
Spark plugs	
SOHC models	Champion RN9YCC or RN9YC
DOHC models:	
except C20 XE and X20 XEV	Champion RC9MCC *
C20 XE and X20 XEV	Vauxhall P/N 90444724 (FR8LDC)
Plug gap:	
RN9YCC and RC9MCC *	0.8 mm
RN9YC *	0.7 mm
FR8LDC	0.7 to 0.8 mm

** Information on spark plug types and electrode gaps is as recommended by Champion Spark Plug. Where alternative types are used, refer to the manufacturer's recommendations*

Brakes

Minimum pad friction material thickness (including backing plate):	
All models	7.0 mm
Minimum shoe friction material thickness:	
All models	0.5 mm above rivet heads

Tyres

Tyre size:	
51/2 J x 13 wheels	165 R13-82T
51/2 J x 14 wheels	175/70 R14-82T, 195/60 R14-85H, or 195/60 R14-85V
6J x 15 wheels	195/60 R15-87V or 205/55 R15-87V
Pressures	**See "Weekly checks"**

Torque wrench settings

	Nm	lbf ft
Automatic transmission drain plug	45	33
Roadwheel	110	81
Spark plugs	25	18
Engine oil (sump) drain plug	55	41

Maintenance schedule

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 by the manufacturer 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. Vauxhall recommend that the service intervals are halved for vehicles that are used under these conditions.

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

Maintenance is essential for ensuring safety and for getting the best in terms of performance and economy from your vehicle. Over the years, the need for periodic lubrication - oiling, greasing, and so on - has been drastically reduced, if not eliminated. This has unfortunately tended to lead some owners to think that because no action is required, components either no longer exist, or will last for ever. This is certainly not the case; it is essential to carry out regular visual examination comprehensively to spot any possible defects at an early stage before they develop into major expensive repairs.

The following service schedules are a list of the maintenance requirements, and the intervals at which they should be carried out, as recommended by the manufacturers. Where applicable, these procedures are covered in greater detail near the beginning of each relevant Chapter.

Every 250 miles (400 km) or weekly

☐ Refer to "*Weekly checks*"

Basic service, every 9000 miles (15 000 km) or 12 months - whichever comes sooner

Along with the items in "*Weekly checks*", carry out the following:

☐ Renew the engine oil and oil filter (Section 3).
☐ Check all hoses and other components for fluid leaks (Section 4).
☐ Check the steering and suspension components (Section 5).
☐ Check the condition of the driveshaft rubber gaiters (Section 6).
☐ Check the automatic transmission fluid level (if applicable), (Section 7).
☐ Check the radiator for blockage (e.g. dead insects) and clean as necessary (Section 8).
☐ Check and adjust the idle speed and mixture (if applicable), (Section 9).
☐ Check the throttle linkage and lubricate if necessary (Section 10).
☐ Check the exhaust system for corrosion, leaks and security (Section 11).
☐ Check all wiring for condition and security (Section 12).
☐ Check and adjust the ignition timing (if applicable), (Section 13).
☐ Renew the brake fluid (Section 14).
☐ Check the brake pad friction material for wear (Section 15).
☐ Check the handbrake linkage (Section 16).
☐ Check the power steering fluid level (if applicable), (Section 17).
☐ Check the power steering pump drivebelt (if applicable), (Section 18).
☐ Check the rear suspension level control system height, if fitted (Section 19).
☐ Check the bodywork (Section 20).
☐ Lubricate all locks and hinges (Section 21).
☐ Check the alternator V-belt (Section 22).
☐ Check the headlamp alignment (Section 23).
☐ Replace battery in the door-lock key (if applicable), (Section 24).
☐ Carry out a road test (Section 25).

Note: *Vauxhall specify that an Exhaust Emissions Test should be carried out at least annually. However, this requires special equipment, and is performed as part of the MOT test (refer to the end of the manual).*

Full service, every 18 000 miles (30 000 km) or 24 months - whichever comes sooner

Along with the 'basic service', carry out the following:

☐ Renew the coolant (Section 26).
☐ Renew the air cleaner element (Section 27).
☐ Check the operation of the air cleaner air inlet temperature control (carburettor models only), (Section 28).
☐ Renew the fuel filter (Section 29).
☐ Renew the spark plugs (SOHC only), (Section 30) *.
☐ Inspect and clean the distributor cap and HT leads (Section 31).
☐ Check the clutch cable adjustment (Section 32).
☐ Check the manual transmission oil level (Section 33).
☐ Check the automatic transmission (Section 34).
☐ Check the brake drum shoe for wear (Section 35).

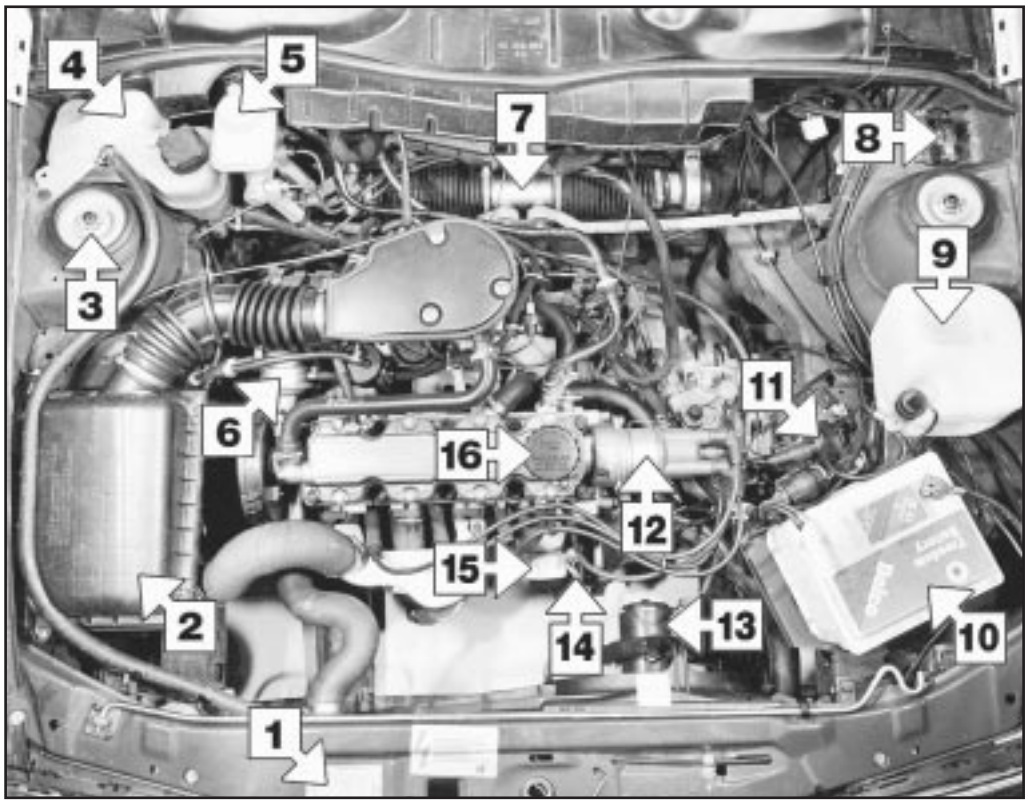
Major service, every 36 000 miles (60 000 km) or 48 months - whichever comes sooner

Along with the 'full service', carry out the following:

☐ Renew timing belt (Section 36).
☐ Renew the spark plugs (DOHC models only), (Section 37).
☐ Renew automatic transmission fluid (Section 38) *.

*** Note:** *If a vehicle is used for heavy-duty work (e.g. taxi work, caravan/trailer towing, mostly short-distance, stop-start city driving) the fluid must be changed every 36 months or 27 000 miles (45 000 km), whichever occurs first.*

Underbonnet view of a 1989 1.6 L model (16 SV engine)



1 VIN plate
*2 Air cleaner casing **
3 Suspension strut top
4 Coolant expansion tank
5 Brake fluid reservoir
6 Fuel pump
7 Steering rack
8 Octane rating plug
9 Washer fluid reservoir
10 Battery
11 Ignition coil
12 Distributor (Bosch type)
13 Cooling fan motor
14 Engine oil level dipstick
15 Oil filter
16 Oil filler cap
** Refer to Chapter 4A for alternative type*

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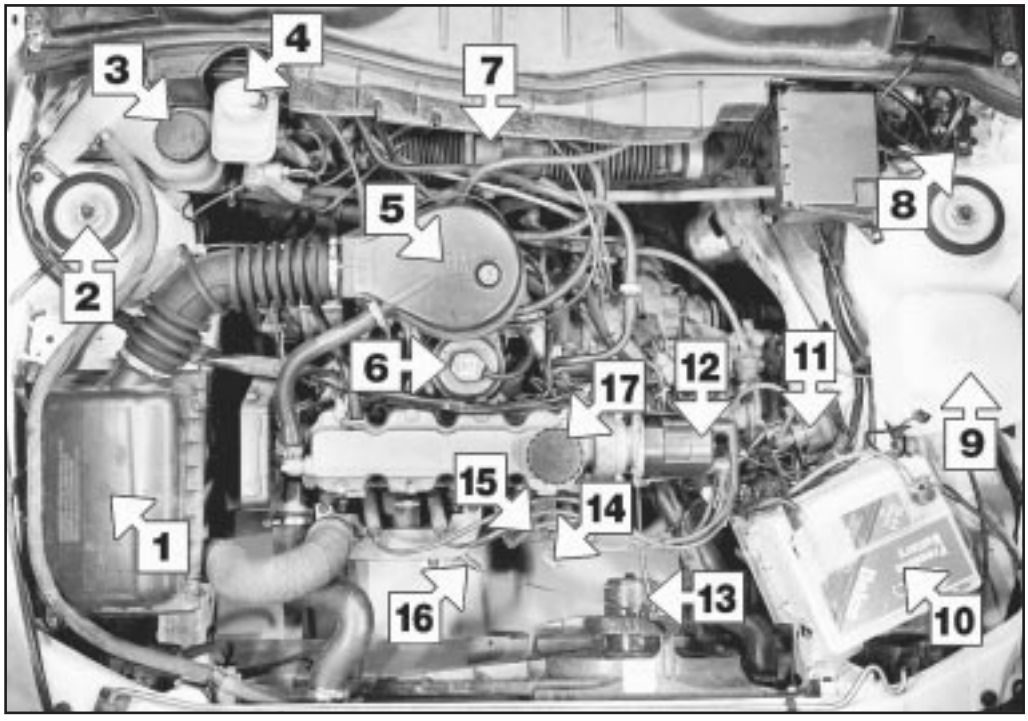
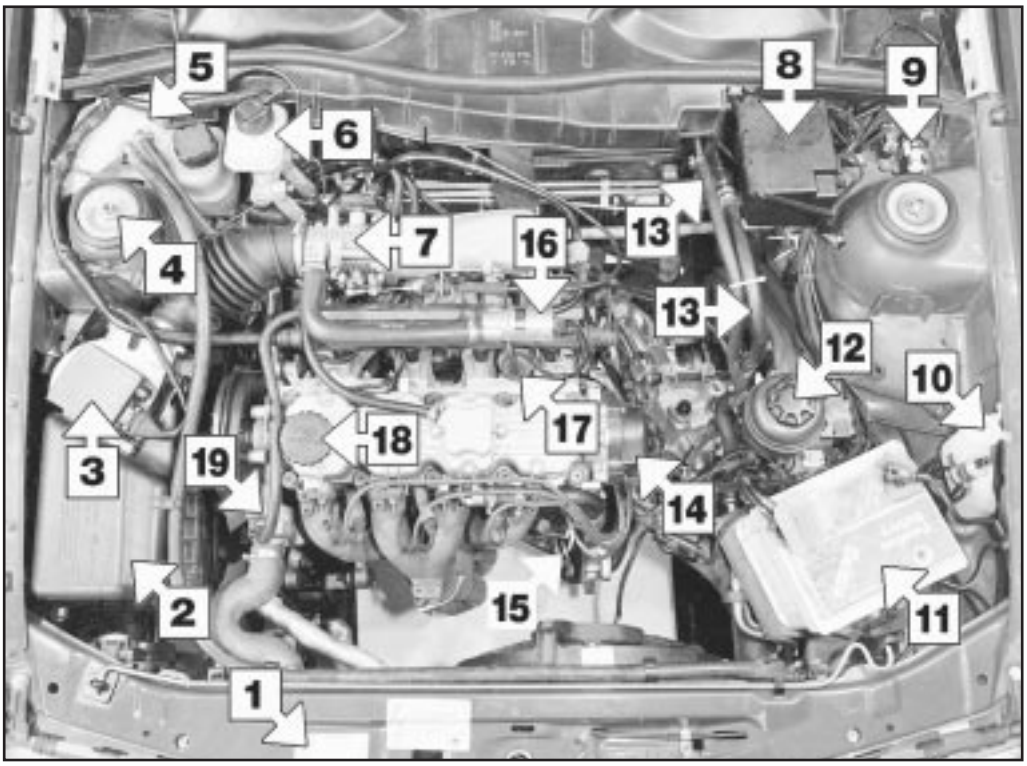
Underbonnet view of a 1991 model Cavalier 1.6 L (C16 NZ engine)



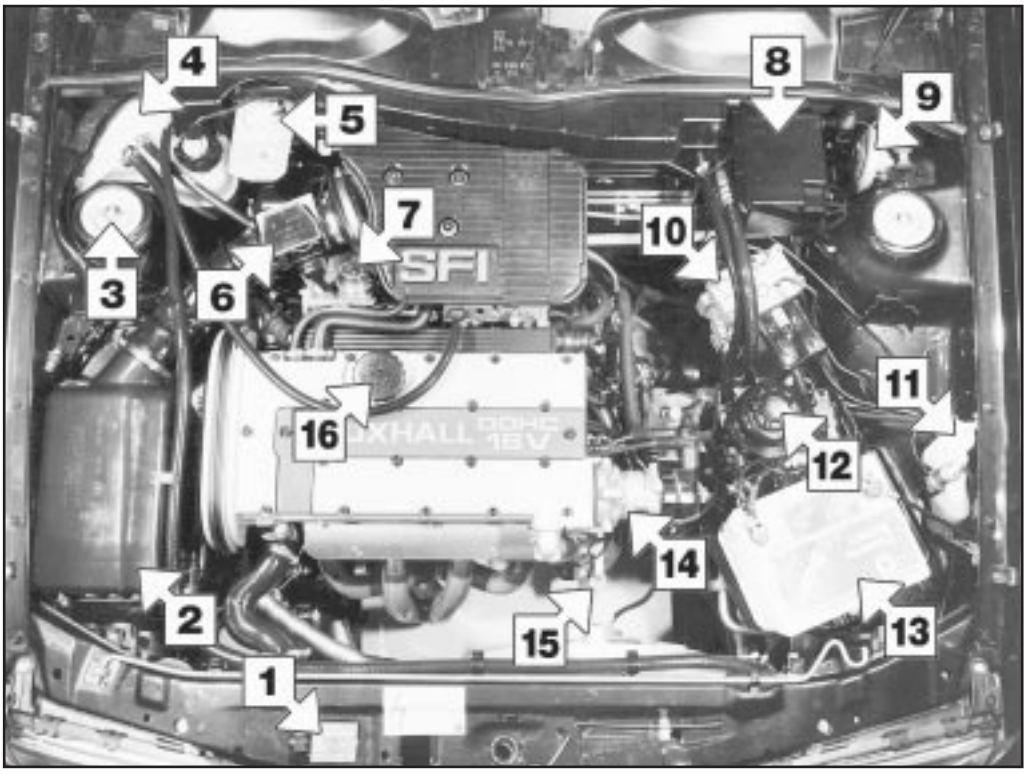
1 Air cleaner casing
2 Suspension strut top
3 Coolant expansion tank
4 Brake fluid reservoir
5 Air box
6 Exhaust gas recirculation valve
7 Steering gear
8 Octane coding plug
9 Washer fluid reservoir
10 Battery
11 Ignition coil
12 Distributor
13 Cooling fan motor
14 Engine oil level dipstick
15 Engine oil filter
16 Oxygen sensor
17 Engine oil filler cap

Underbonnet view of a 1989 2.0 SRi model (20 SEH engine)



1 VIN plate
2 Air cleaner casing
3 Airflow meter
4 Suspension strut top
5 Coolant expansion tank
6 Brake fluid reservoir
7 Throttle body
8 Relay box
9 Octane rating plug
10 Washer fluid reservoir
11 Battery
12 Power steering fluid reservoir
13 Power steering fluid hoses
14 Distributor cap
15 Engine oil level dipstick
16 Idle speed adjuster
17 Fuel pressure regulator
18 Oil filler cap
19 Thermostat housing

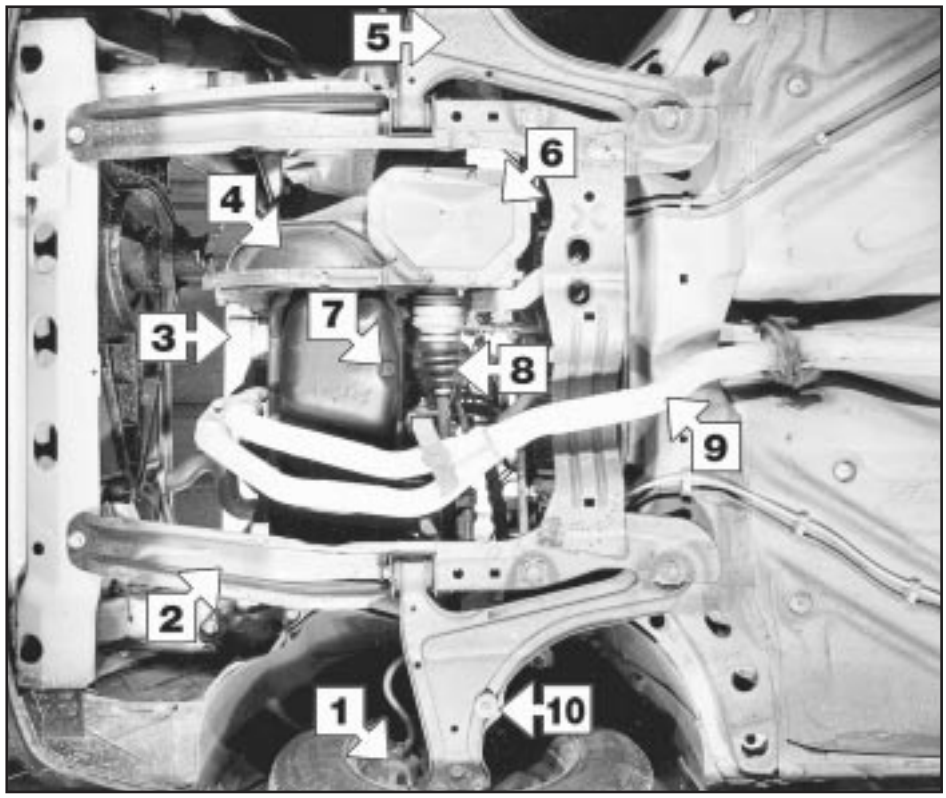
Underbonnet view of a 1990 GSi 2000 model (20 XEJ engine)



1 VIN plate
2 Air cleaner casing
3 Suspension strut top
4 Coolant expansion tank
5 Brake fluid reservoir
6 Air mass meter
7 Fuel pressure regulator
8 Relay box
9 Anti-theft alarm horn
10 ABS hydraulic modulator
11 Washer fluid reservoir
12 Power steering fluid reservoir
13 Battery
14 Distributor
15 Engine oil level dipstick
16 Oil filler cap

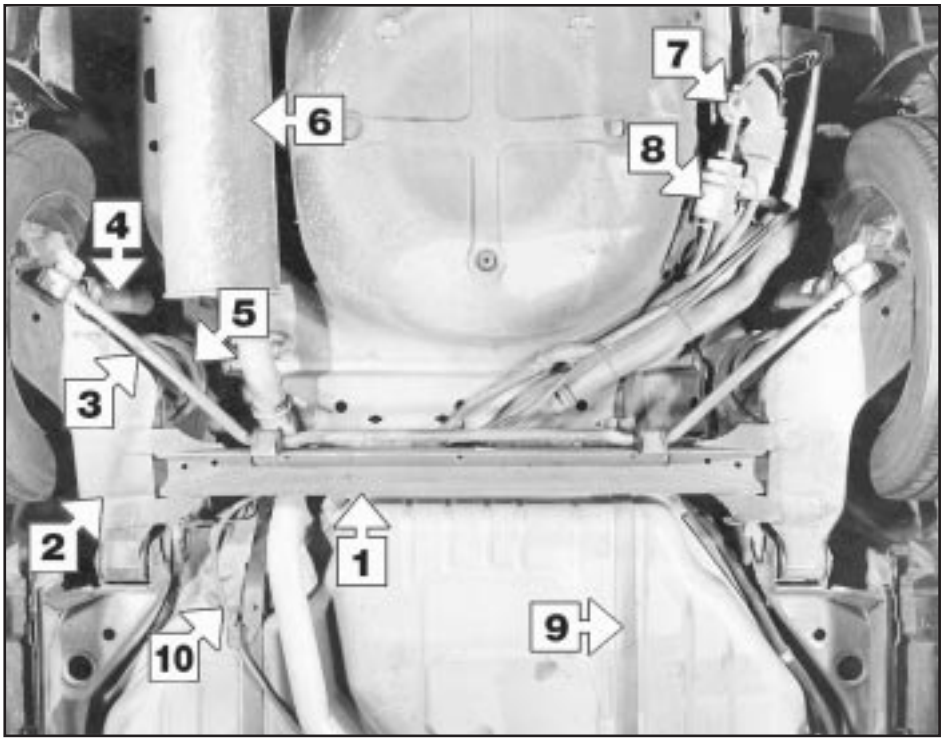
Front underbody view of a 1989 1.6 L model (16 SV engine)

1 Brake caliper
2 Subframe
3 Oil filter
4 Clutch cover plate
5 Suspension lower arm
6 Differential cover plate
7 Engine oil drain plug
8 Driveshaft gaiter
9 Exhaust pipe
10 Anti-roll bar securing nut

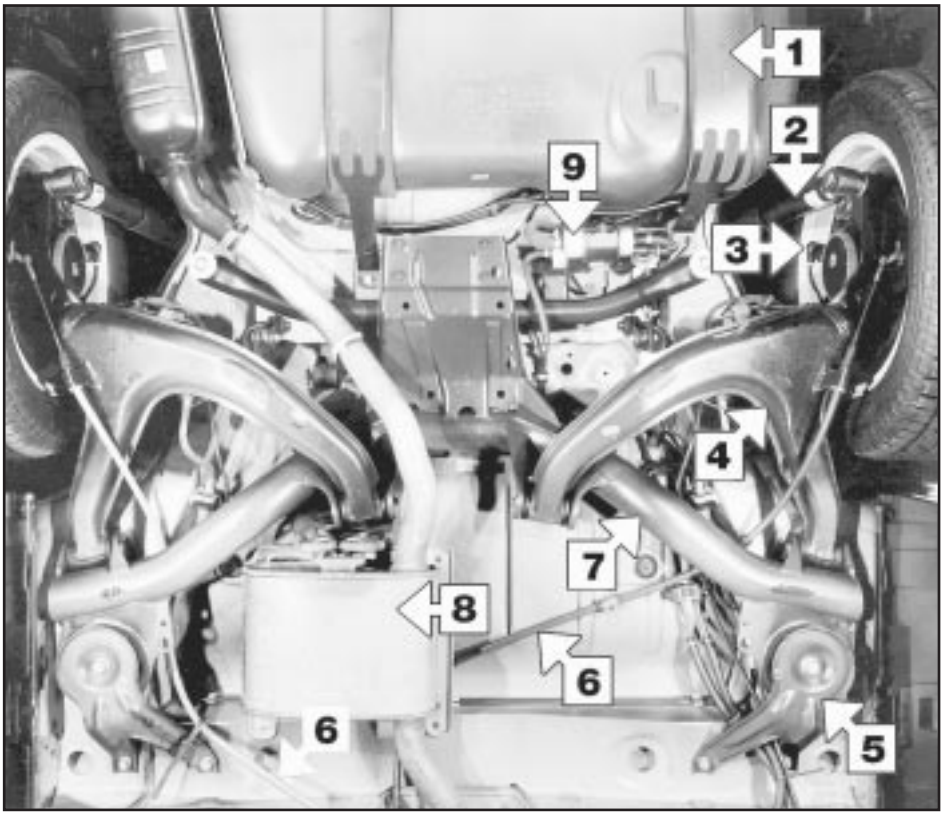


Rear underbody view of a 1989 2.0 SRi model (semi-independent rear suspension)

1 Torsion beam
2 Trailing arm
3 Anti-roll bar
4 Shock absorber
5 Coil spring
6 Exhaust expansion box
7 Fuel flow damper
8 Fuel filter
9 Fuel tank securing strap
10 Handbrake cable



Rear underbody view of a 1990 GSi 2000 model (fully independent rear suspension)



1 Fuel tank securing strap
2 Shock absorber
3 ABS wheel sensor
4 Semi-trailing arm
5 Suspension crossmember mounting bracing bracket
6 Handbrake cable
7 Suspension crossmember
8 Exhaust expansion box
9 Fuel pump

Maintenance procedures

1 Introduction

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 according to 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 found, seek advice from a parts specialist, or a dealer service department.

2 Intensive maintenance

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

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.

If engine wear is suspected, a compression

test (refer to Chapter 2A) 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. It may also prove a waste of time and money, unless extensive overhaul work is carried out first.

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 and tension of the auxiliary drivebelt (Sections 18 and 22, as appropriate).
d) Renew the spark plugs (Sections 30 and 37, as appropriate).
e) Inspect the distributor cap, rotor arm and HT leads, as applicable (Section 31).
f) Check the condition of the air filter, and renew if necessary (Section 27).
g) Check the fuel filter (Section 29).
h) Check the condition of all hoses, and check for fluid leaks (Section 4).
i) Check the idle speed and mixture settings, as applicable (Section 9).

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 5).
b) Check the ignition system (Chapter 5).
c) Check the fuel system (Chapters 4A and 4B).
d) Renew the distributor cap and rotor arm (Section 31).
e) Renew the ignition HT leads (Section 31).

Basic service, every 9000 miles (15 000 km) or 12 months

3 Engine oil and filter - renewal

1 Ideally, the oil should be drained with the engine hot, just after the vehicle has been driven.
2 On DOHC models, remove the engine undershield to expose the sump drain plug and the oil filter.
3 Place a container beneath the oil drain plug at the rear of the sump.
4 Remove the oil filler cap from the camshaft cover, then using a socket or spanner, unscrew the oil drain plug, and allow the oil to drain **(see illustration)**. Take care to avoid scalding if the oil is hot.

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As the drain plug releases from the threads, move it away quickly so the stream of oil, running out of the sump, goes into the container not up your sleeve (see illustration).

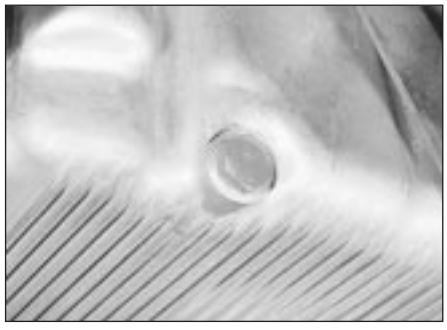
5 Allow ten to fifteen minutes for the oil to drain completely, then move the container and position it under the oil filter.

6 On 1.8 and 2.0 litre models, improved access to the oil filter can be gained by jacking up the front of the vehicle and removing the right-hand roadwheel **(see illustration)**. Ensure that the handbrake is applied, and that the vehicle is securely supported on axle stands (see "*Jacking and Vehicle Support*"). Note that further oil may drain from the sump as the vehicle is raised.
7 Using a strap wrench or a filter removal tool if necessary, slacken the filter and unscrew it from the mounting. Alternatively, if the filter is very tight, a screwdriver can be driven through the filter casing and used as a lever. Discard the filter.
8 Wipe the mating face on the filter mounting with a lint-free rag, then smear the sealing ring of the new filter with clean engine oil of the specified grade.
9 Screw the new filter into position and tighten it by hand only, do not use any tools.
10 Where applicable, refit the roadwheel and lower the vehicle to the ground. Fully tighten the roadwheel bolts with the vehicle resting on its wheels.
11 Examine the condition of the oil drain plug sealing ring and renew if necessary, then refit the drain plug and tighten it to the specified torque.

12 Refill the engine through the filler on the camshaft cover, using the specified grade and quantity of oil. Fill until the level reaches the "MAX" mark on the dipstick, allowing time for the oil to drain through the engine to the sump.
13 Refit the oil filler cap, then start the engine and check for leaks. Note that the oil pressure warning lamp may stay illuminated for a few seconds when the engine is started as the oil filter fills with oil.
14 Stop the engine and recheck the oil level, topping-up if necessary.
15 On DOHC models, refit the engine undershield.
16 Dispose of the old engine oil safely; do not pour it down a drain.

OIL CARE
FOLLOW THE CODE
OIL BANK LINE
0800 66 33 66

Note: It is antisocial and illegal to dump oil down the drain. To find the location of your local oil recycling bank, call this number free.



3.4 Sump drain plug location - 2.0 litre DOHC model (engine undershield removed)

3.6 Oil filter viewed through right-hand wheel arch - SOHC model

4 Hose and fluid leak check

1 Visually inspect the engine joint faces, gaskets and seals for any signs of water or oil leaks. Pay particular attention to the areas around the camshaft cover, cylinder head, oil filter and sump joint faces. Remember 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. Should a leak be found, renew the offending gasket or oil seal by referring to the appropriate Chapters in this manual.

2 Also check the security and condition of all the engine related pipes and hoses. Ensure that all cable-ties or securing clips are in place, and in good condition. Clips that are broken or missing can lead to chafing of the hoses, pipes or wiring, which could cause more serious problems in the future.

3 Carefully check the radiator hoses and heater hoses along their entire length. Renew any hose that is cracked, swollen or deteriorated. Cracks will show up better if the hose is squeezed. Pay close attention to the hose clips that secure the hoses to the cooling system components. Hose clips can pinch and puncture hoses, resulting in cooling system leaks. It is always beneficial to renew hose clips whenever possible.

4 Inspect all the cooling system components (hoses, joint faces, etc.) for leaks.

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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

5 Where any problems are found on system components, renew the component or gasket with reference to Chapter 3.

6 Where applicable, inspect the automatic transmission fluid cooler hoses for leaks or deterioration.

7 With the vehicle raised, 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.

8 Carefully check all rubber hoses and metal fuel lines leading away from the petrol tank. Check for loose connections, deteriorated hoses, crimped 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 crimped. Follow the lines to the front of the vehicle, carefully inspecting them all the way. Renew damaged sections as necessary.

9 From within the engine compartment, check the security of all fuel hose attachments and pipe unions, and inspect the fuel hoses and vacuum hoses for kinks, chafing and deterioration.

10 Where applicable, check the condition of the power steering fluid hoses and pipes.

5 Steering and suspension check

Front suspension and steering check

1 Raise the front of the car, and support on axle stands ("*Jacking and Vehicle Support*").

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 wear of the balljoints or steering gear.

3 On vehicles with power steering, check the 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 Inspect the front suspension lower arms for distortion or damage (Chapter 10, Section 5).

8 With the car 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 check

Note: *Suspension struts/shock absorbers should always be renewed in pairs on the same axle.*

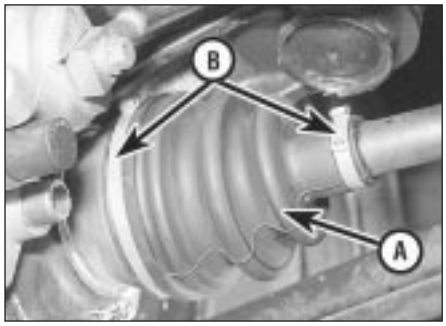
5.4 Check for wear in the hub bearings by grasping the wheel and trying to rock it

9 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.

10 The efficiency of the suspension strut/shock absorber may be checked by bouncing the vehicle at each corner. 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.

6 Driveshaft gaiter check

With the vehicle raised and securely supported on stands, 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 as described in Chapter 8.



6.1 Check the condition of the driveshaft gaiters (A) and clips (B)

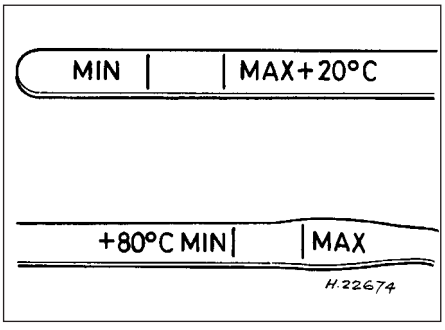
At the same time, check the general condition of the CV joints themselves by first holding the driveshaft and attempting to rotate the wheel. Repeat this check by holding the inner joint and attempting to rotate the driveshaft. Any appreciable movement indicates wear in the joints, wear in the driveshaft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

7 Automatic transmission fluid level check

Note: *The transmission fluid level can be checked either when it is cold (only below 35ºC (100ºF) outside temperature) or when it is fully warmed up to normal operating temperature (after driving for a distance of approximately 12 miles/20 km). Since the fluid level must be checked with the engine running, ensure that the vehicle is parked on level ground with the handbrake firmly applied before leaving the driver's seat. Be careful to keep loose clothing, long hair, etc., well clear of hot or moving components when working under the bonnet*

Transmission cold

1 Park the vehicle on level ground and apply the handbrake firmly. With the engine running at no more than idle speed and your foot firmly on the brake pedal, move the selector lever through all positions, ending in position "P". Allow the engine to idle for one minute, then check the level within two minutes.
2 With the engine still idling and position "P" still selected, open the bonnet and withdraw the transmission dipstick from the filler tube located in the front of the transmission casing, at the left-hand end of the engine.
3 Note the fluid's condition (see below), then wipe clean the dipstick using a clean, non-fluffy rag, insert it fully back into the tube and withdraw it again.
4 The level should be up to the "MAX" mark on the "+20°C" side of the dipstick **(see illustration)**.
5 If topping-up is required, switch off the ignition and add only good quality fluid of the specified type through the filler tube. If significant amounts of fluid are being lost (carefully note the amounts being added, and how often), check the transmission for leaks and either repair the fault or take the vehicle to a Vauxhall dealer for attention.
6 When the level is correct, ensure that the dipstick is pressed firmly into the filler tube.



7.4 When checking the fluid level, ensure side of dipstick used corresponds with fluid temperature

Transmission fully warmed up

7 Work exactly as described above, but take the level reading from the "+ 80°C" side of the dipstick. In this case, the level must be between the dipstick "MAX" and "MIN" marks.

Checking the fluid's condition

8 Whenever the fluid level is checked, examine the condition of the fluid and compare its colour, smell and texture with that of new fluid.
9 If the fluid is dark, almost black, and smells burnt, it is possible that the transmission friction material is worn or disintegrating. The vehicle should be taken to a Vauxhall dealer or automatic transmission specialist for immediate attention.
10 If the fluid is milky, this is due to the presence of emulsified droplets of water. This may be caused either by condensation after a prolonged period of short journeys or by the entry of water through the dipstick/filler tube or breather. If the fluid does not revert to its normal appearance after a long journey it must be renewed or advice should be sought from a Vauxhall dealer or automatic transmission specialist.
11 If the fluid is varnish-like (i.e. light to dark brown and tacky) it has oxidised due to overheating or to over or under filling. If renewal of the fluid does not cure the problem, the vehicle should be taken to a Vauxhall dealer or automatic transmission specialist for immediate attention.
12 If at any time on checking the fluid level or on draining the fluid, particles of dirt, metal chips or other foreign matter are found in the fluid, the vehicle must be taken to a Vauxhall dealer or automatic transmission specialist for immediate attention. It may be necessary to strip, clean and reassemble at least the valve body, if not the complete transmission, to rectify any fault.

8 Radiator inspection and cleaning

1 Inspect radiator for leaks or corrosion, especially around the outlet or inlet connectors.
2 Clean the radiator with a soft brush or compressed air. Remove any debris, like dead insects or leaves.
3 If leaks are visible, replace radiator. Refer to Chapter 3, if necessary.

9 Idle speed and mixture - adjustment

Note: *On certain models, the idle and mixture are automatically adjusted by a control unit, therefore cannot be altered.*

Refer to Chapters 4A or 4B as applicable.

10 Throttle linkage maintenance

On models built before 1992, lubricate the throttle linkage, as described in Chapters 4A or 4B, as applicable.

11 Exhaust system check

1 With the engine off, check the security of the exhaust system. Pay particular attention to the rubber mountings that suspend the exhaust.
2 Start the engine and check underneath for leaks, which can be heard. This job is made easier if you have access to a ramp.
3 Listen for exhaust leaks from around the front pipe to exhaust manifold joint.
4 For further information, refer to Chapter 4C

12 Wiring check

1 Check all wiring in both the engine compartment and under the car.
2 Ensure that all wiring clips/clamps are secure.
3 Pay particular attention to wiring near components that get hot, i.e. exhaust systems.
4 Make sure that electrical connections are secure and undamaged.

13 Ignition timing

Warning: Voltages produced by an electronic ignition system are considerably higher than those produced by conventional ignition systems. Extreme care must be taken when working on the system with the ignition switched on. Persons with surgically implanted cardiac pacemaker devices should keep away from the ignition circuits, components and test equipment.

Refer to Chapter 5 for details.

14 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.

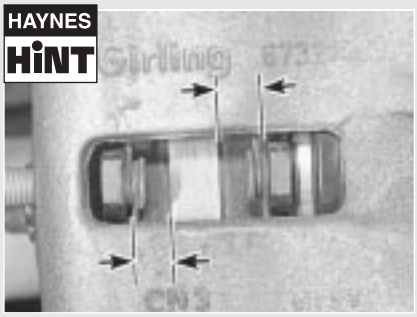
HAYNES HINT

Old hydraulic fluid is usually darker in colour than new fluid.

Renew the brake and bleed the system. Refer to Chapter 9 for full details.

15 Brake pad check

HAYNES HINT



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

With the front or rear (as applicable) of the vehicle raised, remove the wheels and check brake pads for wear. Renew the pads if the lining is below that specified. See Chapter 9, for specifications and full details.

16 Handbrake linkage check

With the vehicle raised, check the operation of the handbrake and lubricate the linkages. Refer to Chapter 9, for further details.

17 Power steering fluid check

1 With the engine off, remove the cap from the power steering reservoir. It is fitted with a dipstick.
2 The fluid should be visible up to the 'MAX' mark (1), **(see illustration)**. If not, top it up using specified fluid.
3 Start the engine and immediately top-up the fluid to the 'MIN' mark (2).
4 Do not allow the reservoir to run dry.
5 For details on how to bleed the system, refer to Chapter 10.

18 Power steering pump drivebelt check

Note: *Vauxhall specify the use of a special gauge. Checking values for use with this gauge are given in the Specifications in Chapter 10, for reference.*

Checking

1 The correct belt tension can be approximated by adjusting the length of the threaded rod. This should give a belt deflection of approximately 10.0 mm (0.4 in) under moderate thumb pressure at the midpoint of the belt run between the pulleys. If in doubt, err on the slack side, as an excessively tight belt may cause pump damage.
2 Check the condition of the belt and renew it if there are any signs of damage or excessive wear

Adjustment

3 Slacken the adjuster and mounting bolts.
4 Slacken the adjuster nuts, and adjust the length of the threaded rod to remove or tension the belt as desired **(see illustration)**.
5 Tighten the adjuster nuts, and tighten the adjuster and mounting bolts to the specified torque (see Chapter 10), on completion.
6 If a new drivebelt has been fitted, recheck the tension after a few hundred miles.

18.4 Adjusting the length of the power steering pump threaded rod

17.2 Topping-up the power steering fluid level

19 Rear suspension level control system check

Refer to Chapter 10, for details.

20 Bodywork check

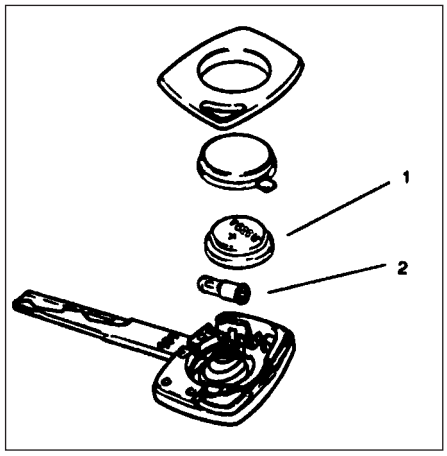
1 Clean the outside of the vehicle. If possible, clean underneath as well. If using a pressure cleaner take care not to damage any electrical components, especially in the engine compartment.
2 Check all around for signs of damage or corrosion and treat accordingly. Repair stone chips when you can to prevent rusting.
3 Read Chapter 11, for more details.

21 Lock and hinge check

1 Lubricate locks and hinges on all doors, tailgates (or boot lid) and bonnet.
2 Check for wear or damage and ensure correct operation of safety catches.
3 Check security of the bonnet stay and it's securing clip.
4 Read Chapter 11, for further details.

22 Alternator V-belt check

Note: *The new ribbed V-belt, fitted to later models, can not be adjusted.*
1 Although special tools are available for measuring the belt tension, a good approximation can be achieved. Tension the belt so that there is approximately 13.0 mm (0.5 in) of free movement under firm thumb pressure at the mid-point of the longest run between pulleys.
2 With the mounting bolts just holding the unit, lever the alternator away from the engine using a wooden lever at the mounting bracket end until the correct tension is achieved. Then



24.3 Replacing the battery in the door lock key

1 Battery (note, positive '+' side up)
2 Bulb

tighten the mounting nuts and bolts. On no account lever at the free end of the alternator, as serious internal damage could be caused.
3 For details of replacement, see Chapter 5.

23 Headlamp alignment

Refer to Chapter 12 for details.

24 Door lock key battery - replacement

1 Carefully prise open the outer cover from the key. Take care not to lose any of the internal components, as they are loose.
2 Remove the battery and discard it safely.
3 Place the new battery, "+" side up **(see illustration)**. Check the operation of the key. If the bulb does not light obtain a replacement.
4 Replace the outer cover.

25 Road test

Instruments and 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 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.

Drivetrain

6 Check the performance of the engine, clutch, transmission and driveshafts.
7 Turn the radio/cassette off and 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 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 wear in a driveshaft joint, in which case, the complete driveshaft must be renewed (see Chapter 8).

1

Full service, every 18 000 miles (30 000 km) or 24 months

26 Coolant renewal

Warning: Wait until the engine is cold before starting the procedure. Do not allow antifreeze to come in contact with your skin or with painted surfaces of the vehicle. Rinse off spills with plenty of water. Never leave antifreeze lying around in an open container. Always clean spilt fluids, as it can be harmful if swallowed.

Refer to Chapter 3 for details.

27 Air cleaner element - renewal

Early round type

1 Release the spring clips from the perimeter of the air cleaner cover.
2 Unscrew and remove the small cross-head screw securing the cover extension to the main body near the inlet duct.
3 Unscrew and remove the three central cross-head cap nuts securing the air cleaner to the carburettor, taking care not to drop the washers and seals **(see illustration)**.
4 Separate the cover from the main body, then lift out the element **(see illustration)**.
5 Wipe clean the inside surfaces of the cover and main body.
6 Locate the new element in the air cleaner body, and refit the cover using a reversal of the removal procedure.

Square type with air box

7 If desired, to improve access, unclip the coolant expansion tank hose from the air cleaner cover.
8 Release the two clips from the left-hand side of the cover, and unscrew the two screws from the right-hand side, then lift the cover sufficiently to remove the element.
9 Wipe clean the inside surfaces of the cover and main body.
10 Refitting is a reversal of removal, noting that the element fits with the rubber locating flange uppermost.

27.3 Air cleaner-to-carburettor mounting cap nuts

27.4 Removing the air cleaner element - note clip for crankcase ventilation hose (arrowed)

28 Air inlet temperature control check (carburettor models only)

Refer to Chapter 4A for details.

29 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.

Fuel filters are fitted in various locations throughout the range. Some may be 'in-line' in the fuel tank itself, or fitted into the carburettor.

Refer to Chapters 4A or 4B, as appropriate.

30 Spark plug renewal (SOHC)

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. Refer to the specifications in Chapter 5. If this type is used and the engine is in good condition, the spark plugs should not need attention between scheduled service 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.

2 Identify each HT lead for position so that the leads can be refitted to their correct cylinders. Then disconnect the leads from the plugs by pulling on the connectors, not the leads.

3 Clean the area around each spark plug using a small paintbrush, then using a plug spanner (preferably with a rubber insert), unscrew and remove the plugs **(see illustration)**. Cover the spark plug holes with a clean rag to prevent the ingress of any foreign matter.

30.3 Removing a spark plug

4 The condition of the spark plugs will tell much about the overall condition of the engine.

5 If the insulator nose of the spark plug is clean and white, with no deposits, this is a sign 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 is 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.

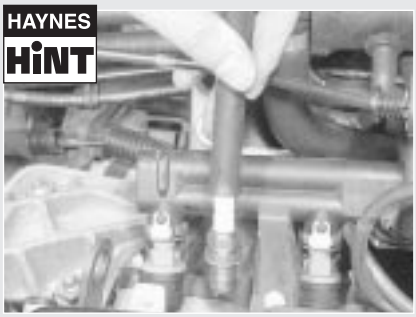
7 If the insulator nose is covered with light tan to greyish brown deposits, then the mixture is correct, and it is likely that the engine is in good condition.

8 The spark plug gap is of considerable importance, because if it is either too large or too small, the size of the spark and its efficiency will be seriously impaired. The spark plug gap should be set to the figure given in the Specifications, in Chapter 5.

9 To set it, measure the gap with a feeler blade and then bend open, or close, the outer plug electrode until the correct gap is achieved. The centre electrode should never be bent, as this may crack the insulation and cause plug failure, if nothing worse **(see illustrations)**.

10 Before fitting new spark plugs check that their threaded connector sleeves are tight.

HAYNES HiNT



It is very often difficult to insert spark plugs into their holes without cross-threading them. To avoid this, fit a short length of 8 mm (internal diameter), rubber hose over the end of the spark plug. The flexible hose acts as a universal joint to help align the plug correctly. Should the plug begin to cross-thread, the hose will slip on the spark plug, preventing damage to the thread in the cylinder head.

11 Screw in the plugs by hand, then tighten them to the specified torque. Do not exceed the torque figure.

12 Push the HT leads firmly onto the spark plugs, ensuring that they are connected to their correct cylinders.

31 Distributor cap and HT lead check

1 Remove the distributor cap and HT leads, and wipe them clean.

HAYNES HiNT

Number the HT leads before removal to ensure correct refitting.

2 Also wipe clean the coil connections. Remove the rotor arm, then visually check the distributor cap, rotor arm and HT leads for hairline cracks, and signs of arcing.

30.9A Tools required for spark plug removal, gap adjustment and refitting

30.9B Measuring the spark plug gap with wire gauge

30.9C Measuring the spark plug gap with feeler blade

3 When refitting the distributor cap, check that the ends of the HT leads are fitted securely to the cap, plugs and coil. Also make sure that the spring-tensioned carbon brush in the centre of the distributor cap moves freely, and that the HT segments are not worn excessively.
4 Inspect the electrical and vacuum connections of the ignition/engine management systems, and make sure that they are clean and secure.

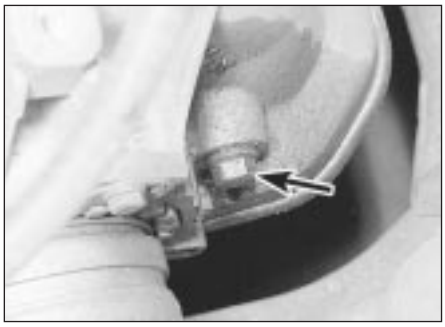
32 Clutch cable check

Check the clutch cable adjustment, as described in Chapter 6.

Check also, the condition of the cable. Inspect the cable strands for fraying, and ensure that the cable is correctly routed, to avoid chafing against surrounding components. Renew the cable, as described in Chapter 6, if excessive wear or damage is evident.

33 Manual transmission fluid check

Note: *Models built after 1994 it is no longer necessary to check levels.*
1 Ensure that the vehicle is on level ground.
2 Unscrew the transmission oil level plug, which is located in the rear left of the differential housing on F10 and F13 transmissions, and in the rear right of the differential housing on F16 and F20 transmissions **(see illustrations)**. The oil level should be up to the bottom of the level plug orifice.
3 If necessary, top-up the oil level through the breather/filler orifice in the gear selector cover. Unscrew the breather/filler plug, and top-up with the specified grade of oil, until oil just begins to run from the level plug orifice. Refit the level plug and the breather/filler plug on completion **(see illustrations)**.
4 Renewal of the transmission oil is not specified by the manufacturers, and no drain plug is provided. If it is desired to renew the oil as a precaution, the oil may be drained by removing the differential cover plate. Use a new gasket when refitting the cover plate. Fill the transmission through the breather/filler orifice, as described previously in this Section.
5 Periodically inspect the transmission for oil leaks, and check the gear selector linkage components for wear and smooth operation.



33.2A Transmission oil level plug (arrowed) - F13 type transmission (viewed from above)

33.2B Transmission oil level plug (arrowed) - F16 type transmission (viewed from below, with driveshaft removed)

33.3A Transmission breather/filler plug (arrowed) - F16 type transmission

33.3B Topping-up the transmission oil level - F13 type transmission

34 Automatic transmission check

1 Carry out a thorough road test, ensuring that all gearchanges occur smoothly, without snatching and with no increase in engine speed between changes.
2 Check the operation of the kickdown. Check that all gear positions can be engaged at the appropriate movement of the selector lever and with the vehicle at rest, check that the operation of the parking pawl in position "P" prevents it from being moved. Ensure that the starter motor will work only with the selector lever in positions "P" or "N", and that the reversing lamps light only when position "R" is selected.
3 The manufacturer's schedule calls for a regular check of the electrical control system using the special Vauxhall test equipment; owners will have to have this check carried out by a Vauxhall dealer.
4 Periodically inspect the transmission casing, checking all joint surfaces and seals for signs of fluid leaks. If any are found, the fault must be rectified immediately.
5 Check also that the transmission breather hose (under the battery mounting bracket) is clear and not blocked, kinked or twisted.

35 Brake shoe check

Note: *On models fitted with rear brake pads, the handbrake operates brake shoes that are located inside the rear brake discs.*

Refer to Chapter 9, for details.

BUSCANOS EN YOUTUBE Y FACEBOOK
COMO: FULL MOTORES CHECK
FMC

Major service, every 36 000 miles (60 000 km) or 48 months

36 Timing belt renewal

1 To minimise risk of major damage to the engine the timing belt (or cambelt, as it is sometimes called), needs replacing at least, on every major service.
2 It is good practise however, not only to renew the belt whenever major engine work is carried out, but also if you buy a used car with unclear service history.
3 Some models are fitted with an inspection cover to view the condition of the belt. Whilst others involve a lot more work.
4 Full details on checking and replacement are shown in Chapters 2A or 2B, as appropriate.

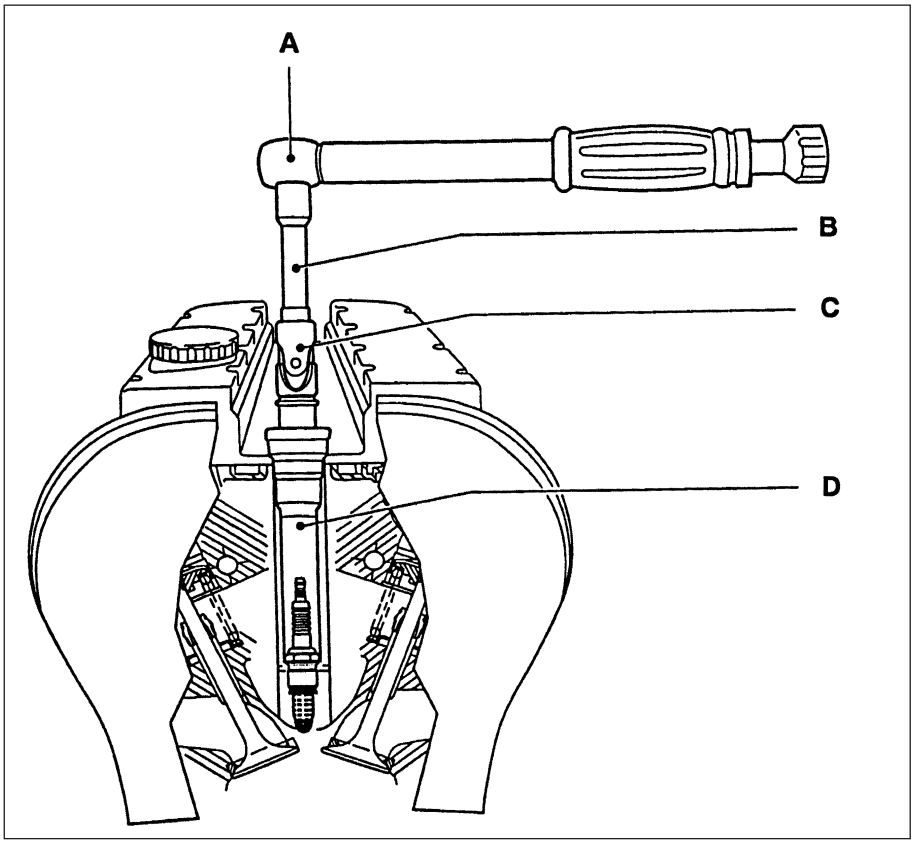
37 Spark plug renewal (DOHC)

1 This procedure is basically the same shown in Section 30. However on these models, a spark plug cover needs to be removed from the camshaft cover before the plugs can be removed.
2 Take great care when removing and refitting spark plugs on these engines **(see illustration)**. Hairline cracks in the ceramic of the plug can cause occasional or complete ignition failure. Damage to the catalytic converter may also occur.
3 Special tool (Vauxhall No. KM-194-B), with a 3 part conical sliding element have been made available, to reduce the risk of plug damage **(see illustration)**.
4 After refitting the spark plugs, remember to replace the plug cover.

38 Automatic transmission fluid renewal

Renew the transmission fluid as detailed in Chapter 7B.

37.2 Removing a spark plug - DOHC model



37.3 Removing spark plugs using special adapter (DOHC models)

A Torque wrench
B Extension
C Joint
D Special adapter (P/N KM-194-B)

Chapter 2 Part A:
SOHC engine 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

General

Type	
All models	Four-cylinder, in-line, water-cooled, transversely mounted at front of vehicle. Single belt-driven overhead camshaft, acting on hydraulic valve lifters
Manufacturer’s engine codes:	
14 NV	1.4 litre (1389 cc)
16 SV	1.6 litre (1598 cc)
X16 SZ	1.6 litre (1598 cc) ‘Ecotec’ type engine
C16 NZ	1.6 litre (1598 cc) + catalyst
C16 NZ2	1.6 litre (1598 cc) + catalyst
18 SV	1.8 litre (1796 cc)
C18 NZ	1.8 litre (1796 cc) + catalyst
20 NE	2.0 litre (1998 cc)
20 SEH	2.0 litre (1998 cc) + early SRi
C20 NE	2.0 litre (1998 cc) + catalyst

Pistons:	Bore (mm)	Stroke (mm)
14 NV	77.6	73.4
16 SV, C16 SV, C16 NZ and X16 SZ	79.0	81.5
C16 NZ2	80.0	79.5
18 SV and C18 NZ	84.8	79.5
20 NE, 20 SEH and C20 NE	86.0	86.0

Compression ratio		
14 NV	9.4 : 1	
16 SV, X16 SZ, 18 SV and 20 SEH	10.0 : 1	
C16 NZ, C16 NZ2, C18 NZ, 20 NE and C20 NE	9.2 : 1	
Maximum power:		
14 NV	55 kW (75 bhp) at 5600 rpm	
16 SV	60 kW (82 bhp) at 5400 rpm	
X16 SZ	52 kW (71 bhp) at 5000 rpm	
C16 NZ and C16 NZ2	55 kW (75 bhp) at 5200 rpm	
18 SV and C18 NZ	66 kW (90 bhp) at 5400 rpm	
20 NE and C20 NE	85 kW (116 bhp) at 5200 rpm	
20 SEH	95 kW (129 bhp) at 5600 rpm	
Maximum torque:		
14 NV	108 Nm at 3000 rpm	
X16 SZ	128 Nm at 2800 rpm	
16 SV	130 Nm at 2600 rpm	
C16 NZ and C16 NZ2	125 Nm at 2800 rpm	
18 SV	148 Nm at 2800 rpm	
C18 NZ	145 Nm at 3000 rpm	
20 NE	175 Nm at 2600 rpm	
20 SEH	180 Nm at 4600 rpm	
C20 NE	170 Nm at 2600 rpm	
Firing order:		
All models	1-3-4-2 (No 1 cylinder at timing belt end)	

Cylinder block:

Material	Cast iron
Maximum permissible bore out-of round	0.013 mm
Maximum permissible bore taper	0.013 mm
Maximum permissible rebore oversize	0.5 mm

Crankshaft and bearings

Number of main bearings	5	
Main bearing journal diameter (mm):		
14 NV, 16 SV, C16 NZ and X16 SZ		
Standard	54.980 to 54.997	
0.25mm undersize	54.730 to 54.747	
0.50mm undersize	54.482 to 54.495	
C16 NZ2, 18 SV, C18 NZ, 20 NE, C20 NE and 20 SEH		
Standard	57.974 to 57.995	
0.25mm undersize	57.732 to 57.745	
0.50mm undersize	57.482 to 57.495	
Main bearing shell colour codes:	**Bearing cap shells**	**Cylinder block shells**
14 NV, 16 SV, C16 NZ and X16 SZ		
Standard	Brown	Green
0.25 mm undersize	Brown/blue	Green/blue
0.50 mm undersize	Brown/white	Green/white
C16 NZ2, 18 SV, C18 NZ, 20 NE, C20 NE and 20 SEH		
Standard	Brown/green/white	
0.25mm undersize	Brown/blue and Green/blue	
0.50mm undersize	Brown/white and Green/white	
Centre (thrust) main bearing journal width (mm):		
14 NV, 16 SV, C16 NZ and X 16 SZ		
Standard	26.000 to 26.052	
0.25mm undersize	26.200 to 26.252	
0.50mm undersize	26.400 to 26.452	
C16 NZ2, 18 SV, C18 NZ, 20 NE, C20 NE and 20 SEH		
Standard	25.950 to 26.002	
0.25mm undersize	26.150 to 26.202	
0.50mm undersize	26.350 to 26.402	
Big-end bearing journal diameter (mm):		
14 NV, 16 SV, C16 NZ and X16 SZ		
Standard	42.971 to 42.987	
0.25mm undersize	42.721 to 42.737	
0.50mm undersize	42.471 to 42.487	
C16 NZ2, 18 SV, C18 NZ, 20 NE, C20 NE and 20 SEH		
Standard	48.970 to 48.988	
0.25mm undersize	48.720 to 48.738	
0.50mm undersize	48.470 to 48.488	

Crankshaft and bearings (continued)

Big-end bearing shell colour codes (all models):	
Standard	None
0.25 mm undersize	Blue
0.50 mm undersize	White
Main and big-end bearing journal out-of-round (all models)	0.04 mm maximum
Main bearing permissible movement (mm):	
14 NV, 16 SV, C16 NZ and X16 SZ	0.017 to 0.047
C16 NZ2, 18 SV, C18 NZ, 20 NE, C20 NE and 20 SEH	0.015 to 0.040
Big-end bearing permissible movement (mm):	
14 NV, 16 SV, C16 NZ and X16 SZ	0.019 to 0.071
C16 NZ2, 18 SV, C18 NZ, 20 NE, C20 NE and 20 SEH	0.006 to 0.031
Crankshaft endfloat (mm):	
14 NV, 16 SV, C16 NZ and X16 SZ	0.1 to 0.2
C16 NZ2, 18 SV, C18 NZ, 20 NE, C20 NE and 20 SEH	0.050 to 0.152
Connecting rod endfloat (mm) (all models)	0.07 to 0.24

Piston and cylinder bores (Ø in mm)

	Bore diameter	Piston dia	ID mark
14 NV:			
Production size 1	77.56	77.54	6
	77.57	77.55	7
	77.58	77.56	8
Production size 2	77.59	77.57	99
	77.60	77.58	00
	77.61	77.59	01
	77.62	77.60	02
0.5 mm oversize	78.07	78.05	7 + 0.5
16 SV, C16 NZ and X16 SZ:			
Production size 1	78.95	78.93	5
	78.96	78.94	6
	78.97	78.95	7
	78.98	78.96	8
Production size 2	78.99	78.97	99
	79.00	78.98	00
	79.01	78.99	01
	79.02	79.00	02
Production size 3	79.03	79.01	03
	79.04	79.02	04
	79.05	79.03	05
	79.06	79.04	06
Production size 4	79.07	79.05	07
	79.08	79.06	08
	79.09	79.07	09
	79.10	79.08	1
0.5 mm oversize	79.48	79.45	7 + 0.5
C16 NZ2:			
Production	79.98	n/a	98
	79.90	n/a	99
	80.00	n/a	00
	80.01	n/a	01
	80.02	n/a	02
18 SV and C18 NZ:			
Production size 1	84.78 mm	84.76 mm	8
Production size 2	84.79 mm	84.77 mm	99
	84.80 mm	84.78 mm	00
	84.81 mm	84.79 mm	01
	84.82 mm	84.80 mm	02
0.5 mm oversize	85.27 mm	85.25 mm	7 + 0.5
20 NE, C20 NE and 20 SEH:			
Production size 1	85.98 mm	85.96 mm	8
Production size 2	85.99 mm	85.97 mm	99
	86.00 mm	85.98 mm	00
	86.01 mm	85.99 mm	01
	86.02 mm	86.00 mm	02
0.5 mm oversize	86.47 mm	86.45 mm	7 + 0.5
Piston clearance in bore (mm) (all models)	0.02 to 0.04		

Piston rings

Number (per piston) (all models)	2 compression, 1 oil control
Ring end gap (mm):	
Compression	0.3 to 0.5
Oil control (top and bottom sections)	0.4 to 1.4
Ring gap offset (to gap of adjacent ring)*	180º

** See Section 32 for oil control ring sections*

Cylinder head

Material (all models)	Light alloy
Maximum permissible distortion of sealing face (all models)	0.025 mm
Height of cylinder head (sealing surface to sealing surface) (all models)	96.00 ± 0.25 mm
Valve seat width (mm):	
14 NV, 16 SV, C16 NZ, X 16 SZ and C16 NZ2	
Inlet	1.3 to 1.5
Exhaust	1.6 to 1.8
18 SV, C18 NZ, 20 NE, C20 NE and 20 SEH	
Inlet	1.0 to 1.5
Exhaust	1.7 to 2.2

Camshaft

Camshaft bearing journal diameter:	**Normal (mm)**	**0.1 mm undersize**
14 NV, 16 SV, C16 NZ and X16 SZ:		
No 1	39.435 to 39.455	
No 2	39.685 to 39.705	
No 3	39.935 to 39.955	
No 4	40.185 to 40.205	
No 5	40.435 to 40.455	
C16 NZ2, 18 SV, C18 NZ, 20 NE, C20 NE and 20 SEH:		
No 1	42.455 to 42.470	42.355 to 42.370
No 2	42.705 to 42.720	42.605 to 42.620
No 3	42.955 to 42.970	42.855 to 42.870
No 4	43.205 to 43.220	43.105 to 43.120
No 5	43.455 to 43.470	43.355 to 43.370
Camshaft bearing diameter in housing:		
14 NV, 16 SV, C16 NZ and X16 SZ:		
No 1	39.500 to 39.525	
No 2	39.750 to 39.775	
No 3	40.000 to 40.025	
No 4	40.250 to 40.275	
No 5	40.500 to 40.525	
C16 NZ2, 18 SV, C18 NZ, 20 NE, C20 NE and 20 SEH:		
No 1	42.500 to 42.525	42.400 to 42.425
No 2	42.750 to 42.775	42.650 to 42.675
No 3	43.000 to 43.025	42.900 to 42.925
No 4	43.250 to 43.275	43.150 to 43.175
No 5	43.500 to 43.525	43.400 to 43.425
Cam lift (mm):		
14 NV (inlet and exhaust)	6.12	
16 SV and C16 NZ:		
Inlet	5.61	
Exhaust	6.12	
C16 NZ2, 18 SV and C18 NZ		
Inlet	6.01	
Exhaust	6.39	
C20 NE and 20 NE (inlet and exhaust)	6.67	
20 SEH (inlet and exhaust)	6.70	
Maximum permissible radial run-out (mm) (all models)	0.04	
Endfloat (mm) (all models)	0.09 to 0.21	

Timing belt (engines without automatic tension roller)

Tension, using Vauxhall gauge KM-51 0-A (see Section 11):	
14NV, 16 SV and C16 NZ:	
New belt, cold	5.5
New belt, warm	8.0
Used belt, cold	4.0
Used belt, warm	7.0

18 SV, C18 NZ, 20 NE, C20 NE and 20 SEH:	
New belt, cold	4.5
New belt, warm	7.5
Used belt, cold	2.5
Used belt, warm	7.0

Valves and guides

	Inlet	Exhaust
Overall length - production (mm):		
14 NV	105.0	105.0
16 SV, X 16 SZ and C16 NZ	101.5	101.5
C16 NZ2	104.2	104.2
18 SV, C18 NZ, 20 NE, C20 NE and 20 SEH	104.2	104.0
Overall length - service (mm):		
14 NV	104.6	104.6
16 SV, X 16 SZ and C16 NZ	101.1	101.1
C16 NZ2	103.8	103.8
18 SV, C18 NZ, 20 NE, C20 NE and 20 SEH	103.8	103.6
Head diameter (mm):		
14 NV	33.0	29.0
16 SV, X 16 SZ, C16 NZ and C16 NZ2	38.0	31.0
18 SV, C18 NZ, 20 NE, C20 NE and 20 SEH	41.8	36.5
Stem diameter (mm), (all engines):		
Standard	6.998 to 7.012	6.978 to 6.992
0.075 mm oversize	7.073 to 7.087	7.053 to 7.067
0.150 mm oversize	7.148 to 7.162	7.128 to 7.142
0.250 mm oversize	7.248 to 7.262	7.228 to 7.242
Valve guide bore (mm), (all engines):		
Standard	7.030 to 7.050	
0.075 mm oversize	7.105 to 7.125	
0.150 mm oversize	7.180 to 7.200	
0.250 mm oversize	7.280 to 7.300	
Valve clearance in guide (mm), (all engines):		
Inlet	0.018 to 0.052	
Exhaust	0.038 to 0.072	
Valve seat angle:		
All models	44º	
Valve clearances:		
All models	Automatic adjustment by hydraulic lifters	

Flywheel

Maximum permissible lateral run-out of starter ring gear (all models)	0.5 mm
Refinishing limit - maximum depth of material that may be removed from clutch friction surface (all models)	0.3 mm

Lubrication system

Lubricant type/specification	See *Lubricants and fluids* in "*Weekly checks*"
Lubricant capacity	See Chapter 1 Specifications
Oil pump clearances:	
Inner-to-outer gear teeth clearance (backlash) (all models)	0.0 to 0.2 mm
Gear-to-housing clearance (endfloat):	
14 NV, 16 SV, C16 NZ and X 16 SZ	0.08 to 0.15 mm
C16 NZ2, 18 SV, C18 NZ, 20 NE, C20 NE and 20 SEH	0.03 to 0.10 mm
Oil pressure at idle (engine warm) (all models)	1.5 bar (21.8 lbf/in^2)

Torque wrench settings

Note: *Use new bolts where asterisked (*). The torque settings stated for the cylinder head are only applicable to latest specification bolts, available from Vauxhall. Earlier type or alternative make, head bolts may require different torques. Consult your supplier.*

	Nm	lbf ft
Air inlet pre-heat to exhaust manifold	8	6
Alternator and inlet manifold to brackets:		
1.4 and 1.6 litre, (except C16 NZ2)	20	15
C16 NZ2, 1.8 and 2.0 litre	18	13
Alternator to bracket (M8)	30	22
Alternator to bracket (M10)	40	30
Alternator to shackle	25	18
Big-end bearing cap: *		
1.4 and 1.6 litre, (except C16 NZ2)		
Stage 1	25	18
Stage 2	Angle tighten by 30º	

Torque wrench settings (continued)	Nm	lbf ft
Big-end bearing cap: *		
C16 NZ2, 1.8 and 2.0 litre:		
Stage 1	35	26
Stage 2	Angle tighten by 45º	
Stage 3	Angle tighten by 15º	
Camshaft housing cover to housing	8	6
Camshaft pulley to camshaft	45	33
Camshaft thrust plate	8	6
Coolant outlet to thermostat housing:		
C 16 NZ2, 1.8 and 2.0 litre	8	6
Coolant pump to cylinder block:		
1.4 and 1.6 litre, (except C 16 NZ2) (M6)	8	6
C16 NZ2, 1.8 and 2.0 litre (M8)	25	18
Crankshaft sensor wheel:		
C16 NZ2, 1.8 and 2.0 litre	13	10
Cylinder head to cylinder block: *		
1.4 and 1.6 litre, (except C16 NZ2):		
Stage 1	25	18
Stage 2	Angle tighten by 60º	
Stage 3	Angle tighten by 60º	
Stage 4	Angle tighten by 60º	
C16 NZ2, 1.8 and 2.0 litre:		
Stage 1	25	18
Stage 2	Angle tighten by 90º	
Stage 3	Angle tighten by 90º	
Stage 4	Angle tighten by 90º	
Drivebelt (ribbed) pulley/timing belt drive to crankshaft: *		
1.4 and 1.6 litre, (except C16 NZ2):		
Stage 1	55	41
Stage 2	Angle tighten by 45º	
Stage 3	Angle tighten by 15º	
Drivebelt pulley to timing belt drive	20	15
Drivebelt (ribbed) tensioner to cylinder block	20	15
Drivebelt (ribbed) tensioner to support:		
1.4 and 1.6 litre, (except C16 NZ2)	20	15
C16 NZ2, 1.8 and 2.0 litre	18	13
Engine bracket to cylinder block	60	44
Engine bracket to transmission	60	44
Engine mounting bracket to engine bracket	60	44
Engine mounting to engine mounting bracket	65	48
Engine mounting to front axle housing	40	30
Engine mounting to power steering pump support	60	44
Engine mounting to side member	65	48
Exhaust manifold to cylinder head	22	16
Exhaust pipe to manifold	25	18
Flexplate to crankshaft	60	44
Flywheel to crankshaft: *		
1.4 and 1.6 litre, (except C16 NZ2):		
Stage 1	35	26
Stage 2	Angle tighten by 30º	
Stage 3	Angle tighten by 15º	
C16 NZ2, 1.8 and 2.0 litre:		
Stage 1	65	48
Stage 2	Angle tighten by 30º	
Stage 3	Angle tighten by 15º	
Front timing belt cover to rear cover	4	3
Fuel pump to camshaft housing	18	13
Guide sleeve, release bearing to transmission	22	16
Heat shield sleeves to cylinder head	30	22
Inlet manifold to cylinder head	22	16
Knock sensor to cylinder block (X16 SZ)	13	10
Main bearing cap: *		
Stage 1	50	37
Stage 2	Angle tighten by 45º	
Stage 3	Angle tighten by 15º	
Oil filter to oil pump/cylinder block	6	4

Oil pick-up pipe bracket to cylinder block	6	4
Oil pick-up pipe to oil pump	8	6
Oil pipes to radiator	22	16
Oil pressure switch to oil pump:		
1.4 and 1.6 litre, (except C16 NZ2)	30	22
C16 NZ2, 1.8 and 2.0 litre	40	30
Oil pressure relief valve to oil pump	30	22
Oil pump cover to oil pump	6	4
Oil pump to cylinder block	6	4
Oxygen sensor to exhaust manifold	30	22
Power steering pump bracket to support:		
C16 NZ2, 1.8 and 2.0 litre	18	13
Power steering pump to support	25	18
Right engine mounting to subframe	65	48
Shackle to alternator	25	18
Spark plugs	25	18
Starter to cylinder block (M10)	45	33
Starter to cylinder block (M12)	60	44
Sump:		
1.4 and 1.6 litre, (except C16 NZ2)	8	6
C16 NZ2, 1.8 and 2.0 litre	15	11
Sump drain plug	55	41
Support to cylinder block	35	26
Temperature sender to cylinder head	20	15
Thermostat housing:		
1.4 and 1.6 litre, (except C16 NZ2)	10	7
C16 NZ2, 1.8 and 2.0 litre	15	11
Timing belt tensioner to oil pump:		
1.4 and 1.6 litre, (except C16 NZ2)	55	41
Timing belt cover to oil pump/camshaft housing:		
1.4 and 1.6 litre, (except C16 NZ2)	12	9
C16 NZ2, 1.8 and 2.0 litre	6	4
Timing belt drive gear to crankshaft:		
C16 NZ2, 1.8 and 2.0 litre:		
Stage 1	130	96
Stage 2	Angle tighten by between 40º to 50º	
Transmission to engine (M10)	45	33
Transmission to engine (M12)	60	44

1 General description

General

The engine is of four-cylinder, in-line single or double overhead camshaft type (depending on model), mounted transversely at the front of the vehicle.

The crankshaft runs in five shell-type bearings, and the centre bearing incorporates a thrust bearing shell to control crankshaft endfloat.

The connecting rods are attached to the crankshaft by horizontally split shell-type big-end bearings. On single overhead camshaft (SOHC) models, the pistons are attached to the connecting rods by gudgeon pins, which are an interference fit in the connecting rod small-end bore. The aluminium alloy pistons are fitted with three piston rings: two compression rings and an oil control ring.

The camshaft on SOHC engines is driven from the crankshaft by a toothed composite rubber belt. Each cylinder has two valves (one inlet and one exhaust), operated through rocker arms that are supported at their pivot ends by hydraulic self-adjusting valve lifters (tappets).

The inlet and exhaust valves are each closed by a single valve spring, and operate in guides pressed into the cylinder head.

A gear-type oil pump is located in a housing attached to the front of the cylinder block, and is driven directly from the crankshaft. A full-flow type oil filter is fitted.

The distributor is driven directly from the end of the camshaft. On carburettor models, the mechanical fuel pump is operated from the front end of the camshaft. The coolant pump is located at the front of the cylinder block, and is driven by the timing belt.

Chapter 2A describes the SOHC engine repair procedures. Many repairs and specifications to the DOHC engine are similar to the 2.0 litre SOHC. However where they differ, details can be found in Chapter 2B.

Engine identification codes - general

Before ordering spare parts, or carrying out any repair or overhaul operations on the engine, it is essential to identify the exact engine type being worked on. Later engines, although outwardly similar in appearance, often have significant differences in repair procedures, even though they may be of the same displacement and model year.

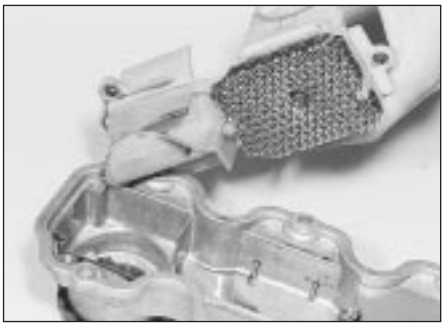
The following sub-Sections in this Chapter are mainly specific to engine type, as will be noted from the sub-Section headings. Check the engine identification code first, which is located on a horizontal surface on the exhaust manifold side of the cylinder block, at the distributor end. On later engines, the code is on the cylinder block-to-transmission flange, next to the engine oil dipstick.

2 Crankcase ventilation system - description and maintenance

Description

1 A crankcase ventilation system is fitted to all models, but the systems differ in detail depending on the model concerned.

2 Oil fumes and blow-by gases (combustion gases that have passed by the piston rings) are drawn from the crankcase into the area of



2.3 Crankcase ventilation filter removed from camshaft cover - 1.6 litre engine

the cylinder head above the camshaft(s) through a hose. From here the gases are drawn into the inlet manifold/throttle body (as applicable) and/or the air box on the carburettor (where applicable), where they are re-burnt with fresh air/fuel mixture, hence reducing harmful exhaust emissions.

Maintenance

3 Certain models have a mesh filter inside the camshaft cover, which should be cleaned in paraffin if clogging is evident **(see illustration)**.

4 On high mileage vehicles, particularly when regularly used for short journeys, a jelly-like deposit may be evident inside the crankcase ventilation system hoses. If excessive deposits are present, the relevant hose(s) should be removed and cleaned.

5 Periodically inspect the system hoses for security and damage, and renew as necessary. Note that damaged or loose hoses can cause various engine running problems that can be difficult to trace.

6 The crankcase breather/dipstick tube can be unbolted from the cylinder block after disconnecting the hose. Use a new gasket when refitting.

3 Compression test - description

Description

1 If engine performance is poor, or if misfiring occurs which cannot be attributed to the ignition or fuel system, a compression test can provide diagnostic clues. If the test is performed regularly, it can give warning of trouble on a high mileage engine before any other symptoms become apparent.

2 The engine must be at operating temperature, the battery must be fully charged, and the spark plugs must be removed. The help of an assistant will also be required.

3 Disable the ignition system by disconnecting the coil LT ("+15") wire. Fit the compression tester to No 1 cylinder spark plug hole.

4 Have the assistant hold the throttle wide open and crank the engine on the starter. Record the highest reading obtained on the compression tester.

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

6 The difference in pressure between any two cylinders should be no more than 1.0 bar (14.5 lbf/in2). If the pressure in any cylinder is low, pour a teaspoonful of clean engine oil into the spark plug hole, and repeat the test.

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

8 A low reading from two adjacent cylinders is almost certainly due to the head gasket leaking between them.

9 On completion of the test, refit the spark plugs and reconnect the coil LT wire.

4 Major operations possible with the engine in the vehicle

1 The following operations may be carried out without removing the engine from the vehicle:

a) Removal and refitting of oil pressure relief valve (see Section 30)
b) Removal and refitting of timing belt and sprockets
c) Removal and refitting of camshaft housing (SOHC engines)
d) Removal and refitting of camshaft(s)
e) Removal and refitting of cylinder head
f) Removal and refitting of sump
g) Removal and refitting of oil pump
h) Removal and refitting of piston/connecting rod assemblies
i) Removal and refitting of flywheel
j) Renewal of crankshaft front oil seal
k) Removal and refitting of engine/transmission mountings

Note: *It is possible to renew the crankshaft rear oil seal with the engine in the vehicle, but this requires the use of special tools, and is a difficult operation, due to the lack of working space. For this reason, this operation is described with the engine removed from the vehicle.*

5 Major operations requiring engine removal

The engine must be removed from the vehicle to carry out the following operations:

a) Renewal of the crankshaft main bearings
b) Removal and refitting of the crankshaft
c) Renewal of crankshaft rear oil seal

6 Method of engine removal

The engine may be removed either on its own, or together with the transmission. Unless work is also necessary on the transmission, it is recommended that the engine is removed on its own. In either case, the engine or engine/transmission assembly must be lifted out through the top of the engine compartment, using a hoist and lifting tackle.

7 Engine - removal and refitting, (leaving transmission in car)

Note: *A hoist and lifting tackle will be required for this operation. If the torque converter is removed (even partially) from the transmission, a considerable amount of the fluid inside it will leak out. To prevent this, when prising the engine from the transmission and removing it, be careful to keep the torque converter pressed firmly into the transmission. If the transmission is to be removed for some time, retain the torque converter by bolting a strip of metal across the bellhousing mating surface.*

Removal

1 Disconnect the battery negative lead.

2 Remove the bonnet (Chapter 11).

3 Apply the handbrake, then jack up the front of the vehicle, and support securely on axle stands (see "*Jacking and Vehicle Support*").

4 Drain the cooling system, remove the radiator and transmission fluid cooler hoses (automatic models), as described in Chapter 3.

5 Drain the engine oil as described in Chapter 1, remove the oil filter and discard, safely.

6 Remove the air cleaner (or air cleaner cover), the air cleaner trunking, and the air box from the carburettor or throttle body (as applicable), referring to Chapter 4A or 4B, if necessary. On carburettor models, disconnect the hot air hose from the exhaust manifold hot air shroud and the air cleaner, and remove the hose. On automatic models, disconnect additional wiring, hoses, etc., from the carburettor, as described in Chapter 4A.

7 Remove the alternator, as described in Chapter 5.

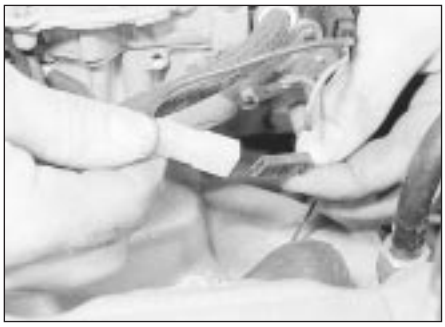
8 On models with power steering, remove the hydraulic pump, as described in Chapter 10.

9 Disconnect the brake servo vacuum hose from the inlet manifold.

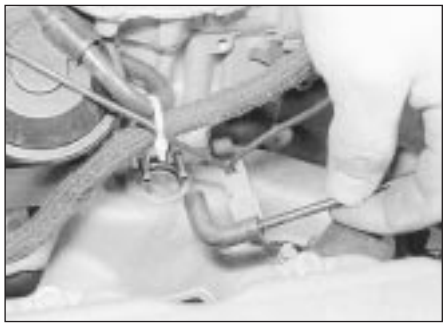
10 Disconnect the throttle cable from the throttle lever and the bracket on the carburettor or inlet manifold, as applicable.

11 On carburettor models, disconnect the coolant hoses from the automatic choke housing, and disconnect the wiring from the automatic choke heater and the choke pull-down solenoid **(see illustrations)**. Also disconnect the air box vacuum pipe from the carburettor.

7.11A Disconnect the coolant hoses from the automatic choke housing . . .



7.11B . . .and disconnect the choke heater/pull-down solenoid wiring plug - 1.6 litre model

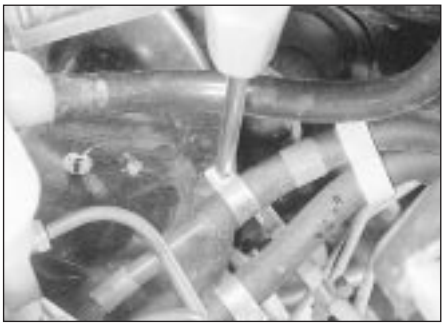


7.12 Disconnect the pressure sensor vacuum pipe from the carburettor - 1.6 litre model

12 Disconnect the pressure sensor vacuum pipe from the carburettor **(see illustration)**.
13 Remove the coolant hose(s) from the inlet manifold and/or throttle body, as applicable.
14 Disconnect the fuel hoses from the fuel pump and vapour separator on carburettor models or from the fuel pipes at the right-hand side of the engine compartment on other models. Be prepared for fuel spillage, and take adequate fire precautions. Plug the open ends of the pipes and hoses, to prevent dirt ingress and further fuel leakage **(see illustrations)**.
15 Disconnect all relevant wiring connections and plugs, and remove the fuel injection wiring harness. Pull up on the wiring harness housing, and compress the wiring plug retaining clips to release the harness housing from the fuel injectors **(see illustration)**.

7.14A Disconnecting a fuel hose from the fuel pump - 1.6 litre model

16 Disconnect the heater coolant hoses from the coolant gallery at the rear of the cylinder block.
17 Disconnect the wiring from the following components (where applicable):
a) Starter motor
b) Distributor (note HT lead positions)
c) Oil pressure switch
d) Oil temperature switch
e) TDC sensor
f) Oil level sensor
g) Knock sensor
h) Coolant temperature sensor
i) Temperature gauge sender
18 Make a final check to ensure that all relevant hoses, pipes and wires have been disconnected, and that they are positioned clear of the engine.
19 Remove the front section of the exhaust system, as described in Chapter 4C.
20 Unbolt and remove the bellhousing cover plate **(see illustration)**.
21 Remove the clutch (if applicable), as described in Chapter 6. On automatic models, use chalk or a felt-tip pen to mark the relationship of the torque converter to the flexplate before unbolting the torque converter. Refer to note at the beginning of this Section and to Chapter 7B for further information.
22 Remove the crankshaft pulley. Some pulleys are secured by four bolts, which must be unscrewed using an Allen key or hexagon bit. Unscrew each of the three bolts in turn and remove them. On other engines, the pulley is secured by a single bolt, which also secures the crankshaft sprocket. On manual transmission models, if the engine is in the vehicle, the crankshaft can be prevented from turning by having an assistant engage first gear and depress the brake pedal. Alternatively, the flywheel (or flexplate, on automatics), ring gear teeth can be jammed, through the bellhousing cover aperture using a large screwdriver, or similar tool. Access to the crankshaft pulley is most easily obtained through the right-hand wheel arch, after removing the roadwheel.
23 Attach a hoist and lifting gear to the engine lifting brackets on the cylinder head, and support the weight of the engine.
24 Unscrew and remove two of the three upper engine-to-transmission bolts, accessible from the engine compartment, leaving one fastened for safety.
25 Unbolt the right-hand engine mounting from the body and from the cylinder block, and withdraw the mounting bracket.
26 Unscrew and remove the four lower engine-to-transmission bolts.
27 Support the transmission using a trolley jack and interposed block of wood. Remove the last upper transmission bolt.
28 Manipulate the engine as necessary to separate it from the transmission. Note that the transmission locates on dowels in the cylinder block.
29 Carefully raise the hoist, and lift the engine from the vehicle, taking care not to damage any of the surrounding components in the engine compartment.



7.14B Fuel hose-to-pipe connections at right-hand side of engine compartment - 2.0 litre SOHC model

7.15 Removing the fuel injection wiring harness - 2.0 litre SOHC model

7.20 Removing the transmission bellhousing cover plate

30 With the engine removed, the transmission can be supported by placing a length of wood between the bellhousing and the front suspension subframe. Once the wooden support is in place, remove the trolley jack from under the transmission.

Refitting

Note: *New left and right-hand engine/transmission mounting-to-body bolts must be used on refitting.*

31 Use an M10 x 1.25 bottoming tap to clean the threads in the torque converters threaded bosses and ensure that new bolts are available for reassembly, where applicable.

> **HAYNES HiNT** ***If a tap is not available, cut two slots into the threads of one of the old flywheel bolts and use the bolt to remove the locking compound from the threads.***

32 Support the transmission with a trolley jack and remove the length of wood from between the bellhousing and the subframe.

33 Support the engine with the hoist and lifting tackle, and gently lower it into position in the engine compartment.

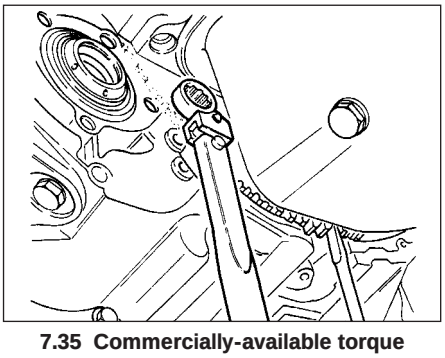
34 Mate the engine and transmission together, ensuring that the transmission locates on the dowels in the cylinder block, then refit the three upper engine-to-transmission bolts.

35 Tighten all nuts and bolts to their specified torque wrench settings. When tightening the torque converter-to-flexplate bolts to their specified torque wrench settings, a commercially available adapter will be required **(see illustration).**

36 If the clutch is still bolted to the flywheel, 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.

37 Refit the four lower engine-to-transmission bolts, but again do not fully tighten them at this stage.

38 Fit the right-hand engine mounting bracket to the cylinder block, and tighten the securing bolts to the specified torque.



7.35 Commercially-available torque wrench adapter being used to tighten torque converter bolts

39 Manipulate the engine and transmission as necessary to enable the right-hand engine mounting-to-body bolts to be fitted, then fit new bolts and tighten them to the specified torque.

40 Tighten all the engine-to-transmission bolts to the specified torque, then disconnect the lifting tackle and hoist from the engine, and remove the trolley jack from beneath the transmission.

41 Refit the transmission bellhousing cover plate.

42 Refit the clutch, as described in Chapter 6.

43 Refit the front section of the exhaust system, as described in Chapter 4C.

44 Refit the crankshaft pulley using a reversal of the removal procedure described earlier in paragraph 22, and tighten the securing bolt(s) to the specified torque.

45 Lower the vehicle to the ground.

46 Refit all relevant wires, pipes and hoses, etc., using a reversal of the removal procedure described earlier.

47 Where applicable, refit the power steering pump, tension the pump drivebelt, and bleed the hydraulic fluid circuit, as described in Chapter 10.

48 Refit the alternator and tension the drivebelt, as described in Chapter 5.

49 Refit the air cleaner components, referring to Chapter 4A or 4B, if necessary. On carburettor models reconnect the hot air hose to the exhaust manifold hot air shroud.

50 Fit a new oil filter (if not already replaced), and fill the engine with oil, as described in Chapter 1.

51 Refit the radiator and refill the cooling system, as described in Chapter 3.

52 Refit the bonnet as described in Chapter 11.

53 Reconnect the battery negative lead.

54 Refer to Section 37

8 Engine and transmission - removal, separation, reconnection and refitting

Note: *A hoist and lifting tackle will be required for this operation*

Removal

1 Proceed as described in Section 7, paragraphs 1 to 18 inclusive.

2 Working in the engine compartment, remove the gear selector linkage, as described in Chapters 7A and 7B, as appropriate.

3 On manual transmission models, remove the retaining clip, then slide the clutch cable from the release lever, pushing the release lever back towards the bulkhead if necessary to allow the cable to be disconnected. On automatic models disconnect the selector cable from the actuating lever, then either unbolt the cable bracket or release the cable from the bracket. In either case, pull the cable support from the bracket on the transmission casing, then move the cable and secure to one side out of the way, taking note of its routing.

4 Disconnect the wiring from the reversing lamp switch, which is located at the front of the manual transmission casing, above the left-hand mounting bracket. On automatic models, disconnect the transmission wiring by unplugging the five connector plugs from the various switches, solenoids and sensors. Release also the wiring from any clips or ties securing to the vehicle.

5 Where applicable, withdraw the automatic transmission breather hose from under the battery bracket. Disconnect the oxygen sensor wiring if fitted.

6 Unscrew the securing sleeve, and disconnect the speedometer cable from the transmission.

7 Unscrew the retaining nut, and disconnect the earth strap from the transmission endplate.

8 Make a final check to ensure that all relevant hoses, pipes, wires etc. have been disconnected, and that they are positioned clear of the engine and transmission.

9 Proceed as described in Section 7, paragraphs 19 and 22.

10 Disconnect the inboard ends of the driveshafts from the differential, referring to the relevant paragraphs of Chapter 8. Be prepared for oil spillage as the driveshafts are withdrawn, and plug the apertures in the differential, to prevent further loss of oil and dirt ingress. Support the driveshafts by suspending them with wire or string - do not allow them to hang down under their own weight.

11 Attach a hoist and lifting gear to the engine lifting brackets on the cylinder head, and support the weight of the engine.

12 Remove the left-hand transmission mounting completely by unscrewing the two bolts securing the rubber mounting to the vehicle, body, and the three bolts securing the mounting bracket to the transmission **(see illustration)**.

13 Unbolt the right-hand engine mounting from the body and from the cylinder block, and withdraw the mounting bracket.

8.12 Left-hand transmission mounting viewed from underside of vehicle

8.14A Rear engine/transmission mounting-to-front subframe nuts

8.14B Rear engine/transmission mounting-to-transmission bolts (arrowed)

14 Working under the vehicle, unscrew and remove the two nuts securing the engine/transmission rear mounting to the front subframe, and the three bolts securing the mounting bracket to the transmission, then withdraw the mounting bracket **(see illustrations)**.

15 Carefully swing the engine/transmission assembly across the engine compartment as necessary, to allow the assembly to be lifted vertically from the vehicle by raising the hoist. Take care not to damage any of the surrounding components in the engine compartment.

Separation

16 With the engine/transmission assembly removed, support the assembly on blocks of wood positioned on a workbench, or failing that, on a clean area of the workshop floor.

17 Clean away any external dirt using paraffin or a water-soluble solvent and a stiff brush.

18 Unbolt and remove the transmission bellhousing cover plate.

19 Ensure that both engine and transmission are adequately supported, then unscrew and remove the engine-to-transmission bolts.

20 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. Note that the transmission locates on dowels positioned in the cylinder block.

21 On automatic models unbolt the transmission bellhousing cover plate (three bolts), then use chalk or a felt-tip pen to mark the relationship of the torque converter to the flexplate before unbolting the torque converter. **Note:** *If the torque converter is removed (even partially) from the transmission, a considerable amount of the fluid inside it will leak out. To prevent this, when prising the transmission off its locating dowels and removing it, be careful to keep the torque converter pressed firmly into the transmission. If the transmission is to be removed for some time, retain the torque converter by bolting a strip of metal across the bellhousing mating surface.* Applying a spanner to the crankshaft pulley/sprocket bolt, rotate the crankshaft until the first bolt appears, then use a screwdriver or similar to jam the flexplate ring gear teeth to prevent it from rotating as the bolt is unscrewed. Unscrew each of the three bolts in turn and remove them.

Reconnection

22 Before beginning the refitting operations, check that the two original bolts that secured the left-hand transmission rubber mounting to the vehicle body rotate freely in their threaded bores in the body. If necessary, re-cut the threaded bores using an M10 x 1.25 mm tap.

> **HAYNES HiNT** ***If a tap is not available, cut two slots into the threads of one of the old flywheel bolts and use the bolt to remove the locking compound from the threads.***

23 Where applicable, if the clutch assembly has been removed from the flywheel, it will prove easier to refit after the transmission has been refitted.

24 On automatics, if any fluid was spilled from the torque converter, be careful to refill it as much as possible. Wipe clean the converter's spigot to prevent damage to the transmission's input shaft oil seal as the converter is installed, and ensure that the converter engages correctly on the fluid pump shaft.

25 If the transmission has been renewed, be careful to flush clean the radiator fluid cooler passages. Vauxhall recommend the use of low-pressure compressed air, but this will require great care to avoid deforming the radiator.

26 Be very careful to ensure that all components are scrupulously clean, to avoid the risk of dirt getting into the system.

27 Use an M10 x 1.25 bottoming tap to clean the threads in the torque converters threaded bosses and ensure that new bolts are available for reassembly, where applicable.

28 Tighten all nuts and bolts to their specified torque wrench settings.

29 Refer also to Section 7, paragraphs 35 and 36.

30 Carefully offer the transmission to the engine until the bellhousing is located on the dowels in the cylinder block, then refit the engine-to-transmission bolts, and tighten them to the specified torque.

31 Refit the transmission bellhousing cover plate.

Refitting

32 Working under the vehicle, refit the rear engine/transmission mounting to the transmission, using new locking plates under the bolt heads, and tighten the bolts to the specified torque.

33 Fit the two bolts securing the engine/transmission rear mounting to the front subframe, but do not fully tighten at this stage.

34 Fit the right-hand engine mounting bracket to the cylinder block, and tighten the securing bolts to the specified torque.

35 Fit new right-hand engine mounting-to-body bolts, but do not fully tighten them at this stage.

36 Fit the left-hand transmission mounting bracket to the transmission, and tighten the securing bolts to the specified torque.

37 Fit new left-hand transmission mounting-to-body bolts, and tighten them to the specified torque.

38 Tighten the right-hand engine mounting-to-body bolts and the engine/transmission rear mounting-to-front subframe bolts to their specified torques, then remove the lifting tackle and hoist from the engine.

39 Where applicable, the clutch can now be fitted, and the transmission input shaft can be pressed into engagement with the splined hub of the clutch friction disc, (see Chapter 5).

40 Reconnect the inboard ends of the driveshafts to the differential, with reference to the relevant paragraphs of Chapter 8, and using new snap rings.

41 Refit the front section of the exhaust system, as described in Chapter 4C.

42 Refit the crankshaft pulley, using a reversal of the removal procedure described in Section 7, paragraph 22, and tighten the securing bolt(s) to the specified torque.

43 On automatic models, connect the wires to the various switches, solenoids and sensors. Replace the transmission breather hose and oxygen sensor (if fitted).

44 Reconnect the transmission earth strap, and tighten the securing nut.

45 Lower the vehicle to the ground.

46 Reconnect the speedometer cable to the transmission, and tighten the securing sleeve.

47 Reconnect the reversing lamp wiring.

48 On manual transmission models, refit the clutch cable to the bracket on the transmission casing, then reconnect the cable to the release lever, and adjust the cable as described in Chapter 6. Ensure that the cable is routed as noted during removal.

49 Refit the gear selector linkage, as described in Chapter 7A, if applicable.

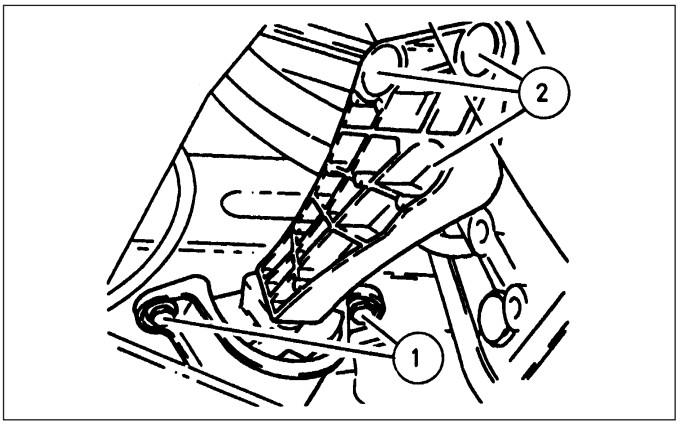
50 Proceed as described in Section 7, paragraphs 41 to 52 inclusive.

51 Top-up the transmission oil level, as described in Chapters 7A and 7B.

52 Adjust the selector cable on completion, and refill the transmission with fluid (see above).

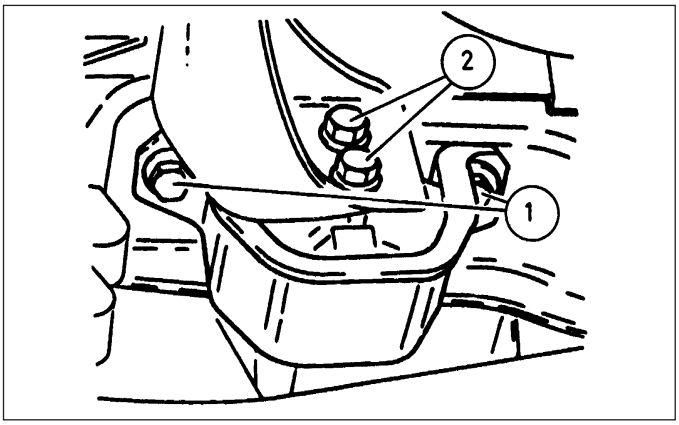
53 Reconnect the battery negative lead.

54 Refer to Section 37



9.4 Right-hand engine mounting

1 Mounting block-to-body bolts
2 Mounting bracket-to-cylinder block bolts



9.12 Left-hand engine/transmission mounting

1 Mounting block-to-body bolts
2 Mounting block-to-mounting bracket bolts

9 Engine and transmission mountings - renewal

Note: *New left and right-hand engine/transmission mounting-to-body bolts must be used on refitting*

1 The engine/transmission assembly is suspended in the engine compartment on three mountings, two of which are attached to the transmission, and one to the engine.

Right-hand mounting

2 If not already done, apply the handbrake, then raise the front of the vehicle, and support securely on axle stands (see "*Jacking and Vehicle Support*")..

3 Attach lifting tackle and a hoist to the engine lifting brackets on the cylinder head, and support the weight of the engine.

4 Working under the vehicle, unbolt the engine mounting bracket from the cylinder block, and unbolt the mounting block from the body, then withdraw the bracket/mounting assembly **(see illustration)**.

5 Unbolt the mounting block from the bracket.

6 Fit the new mounting block to the bracket, and tighten the securing bolts to the specified torque.

7 Refit the mounting bracket to the cylinder block, and tighten the securing bolts to the specified torque.

8 Fit new mounting block-to-body bolts, and tighten them to the specified torque.

9 Disconnect the lifting tackle and hoist from the engine.

10 Lower the vehicle to the ground.

Left-hand mounting

11 Proceed as described in paragraphs 2 and 3.

12 Working under the vehicle, unbolt the mounting block from the mounting bracket and the body **(see illustration)**.

13 Before fitting the new mounting block, check that the original engine bolts which secured the mounting block to the body rotate freely in their threaded bores in the body. If necessary, re-cut the threaded bores using an M10 x 1.25 mm tap.

> **HAYNES HiNT** ***If a tap is not available, cut two slots into the threads of one of the old flywheel bolts and use the bolt to remove the locking compound from the threads.***

14 Fit the new mounting block to the bracket, and tighten the securing bolts to the specified torque.

15 Fit new mounting block-to-body bolts, and tighten them to the specified torque.

16 Proceed as described in paragraphs 9 and 10.

Rear mounting

17 Proceed as described in paragraphs 2 and 3.

18 Working under the vehicle, unbolt the mounting block from the front subframe and the mounting bracket.

19 Fit the new mounting block to the subframe and mounting bracket, and tighten the securing bolts to the specified torque.

20 Proceed as described in paragraphs 9 and 10.

10 Engine dismantling and reassembly - general

General

1 Ideally, the engine should be mounted on a dismantling stand, but if this is not available, stand the engine on a strong bench, at a comfortable working height. Failing this, the engine will have to be stripped down on the floor.

2 Cleanliness is most important, and if the engine is dirty, it should be cleaned with paraffin in an upright position.

3 Avoid working with the engine directly on a concrete floor, as grit presents a real source of trouble.

4 If the engine oil appears extremely dirty or contaminated, avoid inverting the engine until the sump has been removed. This will prevent any contaminated "sludge" from entering the oilways.

5 As parts are removed, clean them in a paraffin bath. Do not immerse parts with internal oilways in paraffin, as it is difficult to remove, usually requiring a high pressure hose. Clean oilways with nylon pipe cleaners.

6 It is advisable to have containers available to hold small items, to prevent loss and confusion when refitting.

7 Always obtain complete sets of gaskets when the engine is being dismantled. Keep the old gaskets as they can be used as patterns to make replacements should new gaskets not be available.

8 Where possible, refit nuts, bolts and washers to their locations after removal of the relevant components, as this helps protect the threads, and will also prove helpful during reassembly.

9 Retain unserviceable components, to compare them with the new components supplied.

10 Many of the engine components are secured using socket-headed "Torx" or "Allen" bolts, and tools will be required to remove and refit such bolts.

11 Read through each relevant Section of this Chapter carefully *before beginning work,* to ensure that any special tools that may be required are available. Many components (gaskets, oil seals, and certain bolts) must be renewed on reassembly; where applicable, obtain the required new components before starting work.

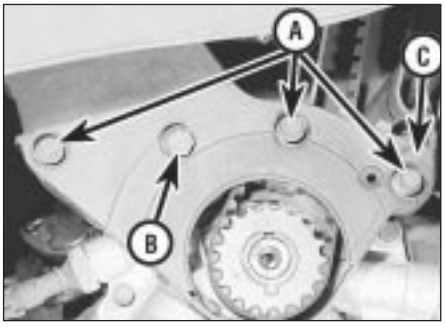
12 Before beginning a complete strip of the engine, the following ancillary components can be removed once the engine has been removed from the vehicle:

a) Inlet and exhaust manifolds (where applicable)
b) Starter motor
c) Rear coolant gallery and hoses
d) Oil pressure switch
e) Oil temperature switch (where applicable)
f) Oil level sensor (where applicable)
g) Knock sensor (where applicable)
h) TDC sensor (where applicable)
i) Distributor components
j) Fuel pump (where applicable)
k) Thermostat/housing (N 16 NZ2, 1.8 and 2.0 litre models)
l) Power steering pump and mounting bracket (where applicable)
m) Alternator mounting bracket
n) Engine lifting brackets
o) Dipstick/crankcase breather tube
p) Inlet manifold mounting bracket (where applicable)

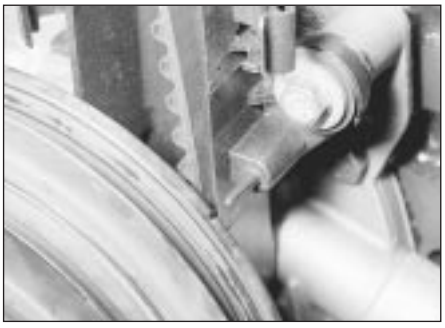
13 To ensure maximum life, with minimum trouble, from a rebuilt engine, not only must everything be correctly assembled, but it must also be spotlessly clean. All oilways and coolant passages must be clear, and all washers must be fitted in their original positions. Oil all bearings and other moving surfaces thoroughly with clean engine oil during assembly.

14 Before assembly begins, renew any bolts or studs with damaged threads.

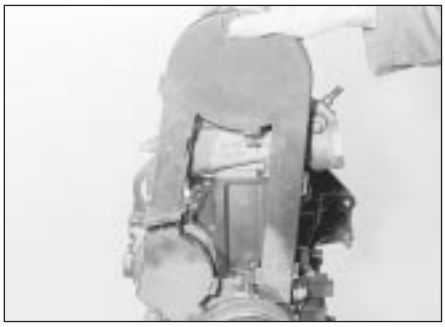
15 Obtain a torque wrench, an angle-torque gauge, sockets and bits, an oil can, clean lint-free rag, and a set of engine gaskets and oil seals, together with a new oil filter.



11.5C Timing belt lower (small) outer cover screws (A), tensioner screw (B), ignition timing fixed reference mark (C)



11.7B . . .and notch in crankshaft pulley aligned with pointer on rear timing belt cover - 2.0 litre engine



11.5A Remove the main outer timing belt cover . . .

16 If they have been removed, new cylinder head bolts, flywheel bolts, big-end bearing cap bolts and main bearing cap bolts will also be required.

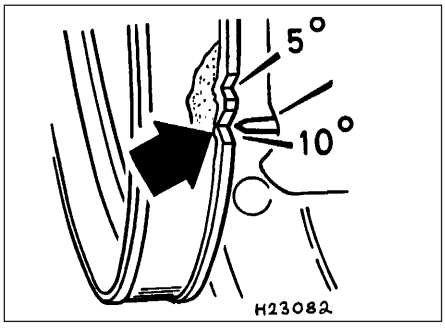
17 On completion of reassembly, refit the applicable ancillary components listed in paragraph 12.

18 Follow procedure shown in Section 37.

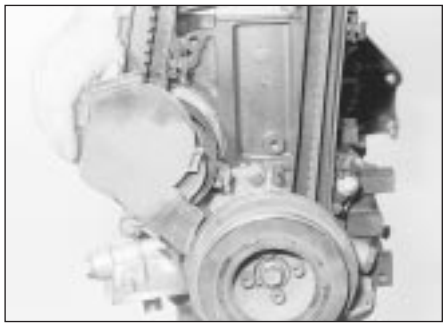
11 Timing belt and sprockets (without automatic tensioner) - removal, refitting and adjustment

Note: *A two-legged puller may be required to remove the crankshaft sprocket on N 16 NZ2, 1.8 and 2.0 litre models. Some of the later 1.4 and 1.6 litre engines, identifiable by the squared-off top surfaces of the timing belt covers, are fitted with spring-loaded auto-matic timing belt tensioners to ensure correct belt tensioning on assembly.*

11.7A Camshaft sprocket TDC mark aligned with notch in rear timing belt cover . . .



11.7C Crankshaft pulley 10° BTDC notch aligned with pointer on rear timing belt cover - 1.4 litre engine



11.5B . . .and the smaller cover from the coolant pump - 2.0 litre engine

Removal

1 Disconnect the battery negative lead.

2 On models with power steering, remove the pump drivebelt, see Chapters 1 and 10.

3 Remove the alternator drivebelt, as described in Chapter 5.

4 On C 16 NZ2, 1.8 and 2.0 litre models, disconnect the wiring from the temperature gauge sender.

5 Release the securing clips (or hexagon-headed screws, if fitted), and remove the main outer timing belt cover, then unclip the smaller outer timing belt cover from the coolant pump. Where applicable, three screws retain the lower (small) outer cover to the rear cover, the fourth secures the tensioner **(see illustrations)**.

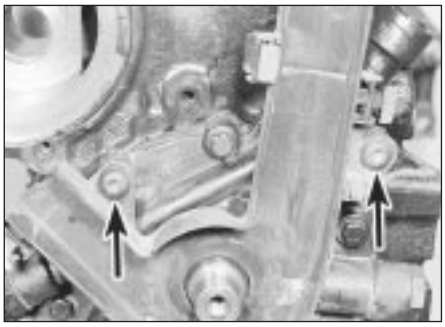
6 On 1.6 litre models with power steering, remove the power steering pump, as described in Chapter 10.

7 Turn the crankshaft using a socket or spanner on the crankshaft sprocket bolt, until the timing mark on the camshaft sprocket is aligned with the notch in the rear timing belt cover, and the notch in the crankshaft pulley is aligned with the pointer on the rear timing belt cover **(see illustrations)**. Note that on 1.4 litre engine there are two notches in the crankshaft pulley, representing 5° and 10° BTDC, and the 10° BTDC notch should be aligned with the pointer **(see illustration)**.

8 Loosen the three coolant pump securing bolts **(see illustration)**, and turn the pump to relieve the tension in the timing belt, then slide the belt from the camshaft sprocket.

11.8 Loosening a coolant pump securing bolt - 2.0 litre engine

11.17A Loosening the main rear timing belt cover lower securing bolt - 2.0 litre engine



11.17B Main rear timing belt cover lower securing bolts (arrowed) - 1.6 SV engine

11.18 Unscrewing the coolant pump rear belt cover securing bolt - 2.0 litre engine

9 The crankshaft pulley must now be removed. On 1.4 and 1.6 litre engines (except C 16 NZ2), the pulley is secured by a single bolt, which also secures the crankshaft sprocket. On C 16 NZ2, 1.8 and 2.0 litre engines, the pulley is secured by four bolts, which must be unscrewed using an Allen key or hexagon bit. On manual transmission models, if the engine is in the vehicle, the crankshaft can be prevented from turning by having an assistant engage first gear and depress the brake pedal. Alternatively, the flywheel ring gear teeth can be jammed using a large screwdriver or similar tool.

10 With the crankshaft pulley removed, the timing belt can be withdrawn.

11 If desired, the sprockets and the rear timing belt cover can be removed as follows, otherwise go on to paragraph 23.

12 To remove the camshaft sprocket, first disconnect the breather hose(s) from the camshaft cover, then unscrew the securing bolts noting the locations of the HT lead brackets and any other wiring brackets, and remove the camshaft cover.

13 Recover the gasket. Prevent the camshaft from turning by holding it with a spanner on the flats provided between No's 3 and 4 camshaft lobes, and unscrew the camshaft sprocket bolt.

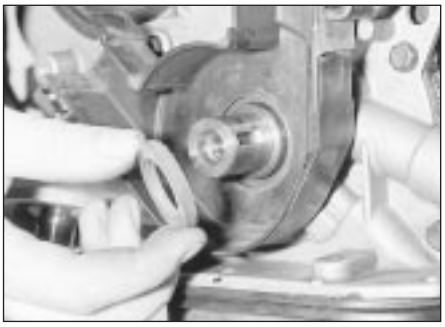
14 Withdraw the sprocket from the end of the camshaft.

15 To remove the crankshaft sprocket on 1.4 and 1.6 litre engines (except C 16 NZ2), if necessary, remove the lower securing bolts from the main rear timing belt cover and use two large screwdrivers behind the cover to lever off the sprocket. Remove the Woodruff key if it is loose.

16 To remove the crankshaft sprocket on C 16 NZ2, 1.8 and 2.0 litre engines, it will be necessary to prevent the crankshaft from turning, as described in paragraph 9. Take care when unscrewing the sprocket bolt, as it is very tight. If necessary, use a two-legged puller to remove the sprocket. Recover the Woodruff key and the thrustwasher from the end of the crankshaft.

17 To remove the main rear timing belt cover on C 16 NZ2, 1.8 and 2.0 litre models disconnect the TDC sensor wiring plug and unclip the wiring from the belt cover. Then unscrew the two upper securing bolts and the lower securing bolt(s) (one in the case of C 16 NZ2, 1.8 and 2.0 litre engines, two on other SOHC engines). Withdraw the cover, manipulating it from the smaller rear belt cover on the coolant pump **(see illustrations)**.

18 If desired, the smaller rear belt cover can be removed from the coolant pump, after unscrewing the securing bolt **(see illustration)**, by rotating it to disengage it from the retaining flange on the pump.



11.20A Refit the thrustwasher . . .

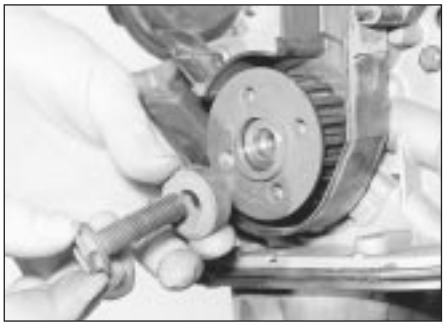
11.20B . . . the Woodruff key . . .

Refitting

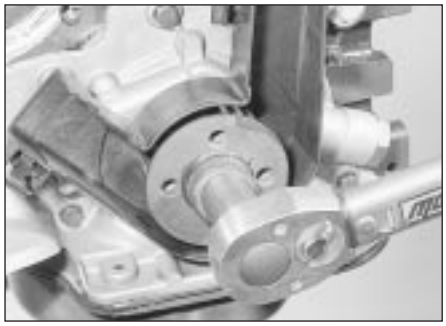
19 Refit the rear timing belt cover(s) using a reversal of the removal procedure, and ensuring that the main cover engages correctly with the smaller cover on the coolant pump.

20 On C 16 NZ2, 1.8 and 2.0 litre engines, refit the thrustwasher and the Woodruff key to the end of the crankshaft. Then refit the crankshaft sprocket, and tighten the securing bolt to the specified torque in the two stages given in the Specifications. Ensure that the washer is in place under the bolt head, and prevent the crankshaft from turning as during removal **(see illustrations)**.

11.20C . . .the crankshaft sprocket . . .



11.20D . . .and the washer and bolt



11.20E Tighten the bolt to the specified torque . . .

11.20F . . .then through the specified angle - 2.0 litre engine

11.21 Crankshaft sprocket fits with flange and pulley locating lug outermost - 1.6 litre engine

11.22A Refit the camshaft sprocket . . .

11.22B . . . and tighten the securing bolt to the specified torque - 2.0 litre engine

11.22C Fit the camshaft cover gasket . . .

11.22D . . . fit the cover and tighten the bolts. Note position of HT lead brackets

21 On 1.4 and 1.6 litre engines (except C 16 NZ2), refit the Woodruff key to the end of the crankshaft where applicable. Then refit the crankshaft sprocket with the flange and locating lug for the crankshaft pulley outermost **(see illustration)**.

22 Refit the camshaft sprocket, ensuring that the locating pin on the end of the camshaft engages with the hole in the sprocket, and tighten the securing bolt to the specified torque. Prevent the camshaft from turning as during removal. Check the condition of the camshaft cover gasket and renew if necessary, then refit the camshaft cover, ensuring that the HT lead brackets and any other wiring bracket are correctly located, and reconnect the breather hose(s) **(see illustrations)**.

23 Temporarily refit the crankshaft pulley and ensure that the crankshaft pulley and camshaft sprocket timing marks are still aligned as described in paragraph 7, then refit the timing belt around the sprockets **(see illustration)**, starting at the crankshaft sprocket.

24 Refit the crankshaft pulley, and tighten the securing bolt(s) to the specified torque **(see illustrations)**. If necessary, prevent the crankshaft from turning as during removal.

25 Adjust the timing belt tension, as described in Section 11.

26 On 1.6 litre models with power steering, refit the power steering pump, as described in Chapter 10.

27 Refit the outer timing belt covers, and on C 16 NZ2, 1.8 and 2.0 litre models, reconnect the temperature gauge sender wiring.

28 Refit the alternator drivebelt and adjust the drivebelt tension, as described in Chapter 5.

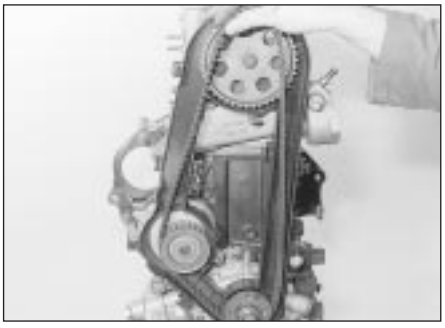
29 On C 16 NZ2, 1.8 and 2.0 litre models with power steering, refit the power steering pump drivebelt and adjust the drivebelt tension, as described in Chapters 1 and 10.

30 Reconnect the battery negative lead.

Adjustment

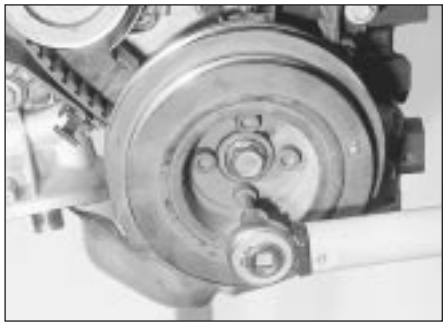
Note: *The manufacturers specify the use of a special gauge Vauxhall tool No KM-510-A for checking the timing belt tension. If access to a gauge cannot be obtained it is strongly recommended that the vehicle is taken to a Vauxhall dealer to have the belt tension checked at the earliest opportunity*

31 The tension of a used timing belt should be checked with the engine at normal operating temperature. The tension of a new timing belt should be checked with the engine cold.

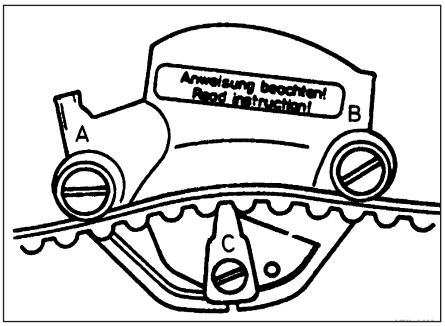


11.23 Refitting the timing belt - 2.0 litre engine

11.24A Refitting the crankshaft pulley - 1.6 litre engine

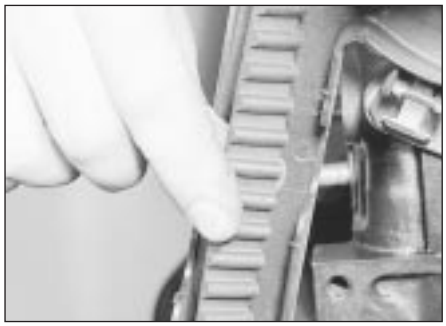


11.24B Tightening a crankshaft pulley securing bolt - 2.0 litre engine



11.34 Tension blade KM-510-A correctly positioned on timing belt. Belt must pass through points A, B and C - SOHC engines

11.35 Note the reading on the scale of the tension gauge - 1.6 litre engine



11.42 Checking timing belt tension by twisting belt through 90º between thumb and forefinger

32 Release the securing clips and remove the main outer timing belt cover, then unclip the smaller outer timing belt cover from the coolant pump.

33 Turn the crankshaft through at least quarter of a turn clockwise using a socket or spanner on the crankshaft sprocket bolt.

34 If the special gauge is available, place the locked gauge at the centre of the belt run between the coolant pump and the camshaft sprocket. The gauge should locate on the timing belt **(see illustration)**.

35 Slowly release the operating lever on the gauge, then lightly tap the gauge two or three times, and note the reading on the scale **(see illustration)**.

36 If the reading is not as specified, loosen the three coolant pump securing bolts, and rotate the pump in the required direction to achieve the desired reading on the gauge. Rotate the pump clockwise to increase the belt tension, or anti-clockwise to decrease the tension.

37 Lightly tighten the coolant pump securing bolts.

38 Remove the tensioning gauge, and turn the crankshaft through one full turn clockwise.

39 Re-check the belt tension as described in paragraphs 4 and 5.

40 If the tension is not as specified, repeat paragraphs 6 to 9 inclusive until the desired, consistent, reading is obtained.

41 On completion of adjustment, remove the checking gauge, tighten the coolant pump bolts to the specified torque, and refit the outer timing belt covers.

42 If the special checking gauge is not available, the timing belt tension can be checked approximately by twisting the belt between the thumb and forefinger, at the centre of the run between the coolant pump and the camshaft sprocket. It should just be possible to twist the belt through 90° using moderate pressure **(see illustration)**. If adjustment is necessary, continue as described previously in this Section, but have the belt tension checked by a Vauxhall dealer using the special gauge at the earliest opportunity. If in doubt, err on the tight side when adjusting the tension, as if the belt is too slack, it may jump on the sprockets, which could result in serious engine damage.

12 Timing belt and tensioner 1.4 and 1.6 models (not C16 NZ2) - removal, refitting and adjustment

Removal

1 Remove the timing belt outer covers as described in Section 11, paragraphs 1 to 5.

2 To lock the tensioner in its slackest position for removal and refitting, move the tensioner indicator arm clockwise until the holes align in the baseplate and the arm. Then insert a close-fitting pin, such as a drift, to retain them **(see illustration)**. The tensioner can then be unbolted, or the belt can be removed.

3 Check that the tensioner roller rotates smoothly and easily, with no noises or signs of free play, roughness or notchy movement. Check also that there is no sign of physical wear or damage. If the tensioner is faulty in any way, or if there is any reason to doubt the continued efficiency of its spring, the complete assembly must be renewed.

Refitting

4 On refitting, ensure that the tensioner baseplate lug engages with the hole in the oil pump housing, then tighten the tensioner bolt securely and remove the locking pin; the tensioner should be quite free to move.

5 Set the belt tension as described below.

Adjustment

6 Whenever the timing belt is disturbed, whether during belt renewal or any other engine overhaul work, its tension must be set on assembly - note that this procedure must **only** be carried out on a **cold** engine.

7 It is assumed that the belt has been removed and refitted, i.e. that the crankshaft pulley and timing belt outer covers are removed, that the tensioner is unlocked (see above) and that No 1 cylinder is in its firing position (just before TDC on the compression stroke). Temporarily refit the crankshaft pulley bolt and remove the spark plugs so that the crankshaft can be rotated easily.

8 Note also that turning the coolant pump with the precision required is a great deal easier if a special spanner (Kent-Moore Part No KM-421-A) is used. Alternatives are available from manufacturers such as Sykes-Pickavant (Part No 031300) **(see illustration)**.

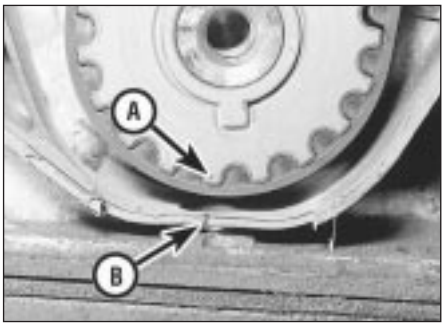
9 With the belt refitted and correctly routed (see Section 11), ensure that the punch mark on the crankshaft sprocket and the stamped line on the camshaft sprocket are aligned with their respective timing belt rear cover notches **(see illustrations)**.

10 Tighten the belt by slackening its three securing bolts, and turning the coolant pump clockwise until the holes align in the tensioner indicator arm and baseplate (the tensioner indicator arm will then have moved fully clockwise to its stop). Lightly tighten the pump securing bolts, just sufficiently to prevent the pump from moving.

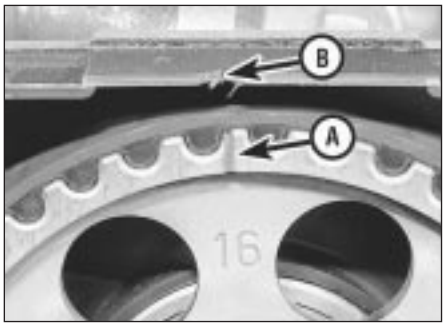
11 Using a spanner applied to the crankshaft pulley bolt, turn the crankshaft smoothly

12.2 Using a close-fitting drift to lock the tensioner. Note baseplate lug engaged in oil pump housing (arrowed)

12.8 Using a special spanner to adjust the timing belt by moving the coolant pump



12.9A Align punch mark (A) on crankshaft sprocket with timing belt rear cover notch (B) . . .



12.9B . . . and stamped line (A) on camshaft sprocket with timing belt rear cover notch (B)

12.12 Timing belt tension is correct when the tensioner indicator pointer aligns with the centre of the baseplate notch

(without jerking it or the belt may jump a tooth), through 2 complete revolutions (720°) clockwise, until the camshaft and crankshaft sprocket timing marks are once again aligned as described in paragraph 13. The position of the coolant pump must not alter.

12 Slacken the timing belt by turning the coolant pump anti-clockwise until the tensioner's indicator pointer is in the centre of its baseplate notch; the timing belt tension is then correct **(see illustration)**. Tighten the coolant pump bolts to the specified torque wrench setting (see Chapter 3), then turn the crankshaft through two further turns clockwise and recheck the setting.

13 If the pointer and notch are not aligned, the operation must be repeated from paragraph 7. On completion, refit all components removed.

13 Timing belt cover aperture, 1.4 and 1.6 models - general

General

The rear timing belt cover fitted to 1991 and 1992 model year 1.4 and 1.6 litre engines, incorporates a small aperture just above the oil pump housing. In certain circumstances, it is possible for foreign objects, such as gravel, to penetrate through this aperture and cause the timing belt to jump a tooth on its sprockets. For this reason, it is desirable to cover the aperture to prevent the possibility of this occurrence. A modified cover without an aperture was introduced for 1993 models.

A piece of suitably moulded sponge rubber (P/N 90469594), is available from Vauxhall dealers to enable the aperture to be covered. On models without power steering, the sponge rubber can be inserted into the cover aperture from above. If power steering is fitted, the sponge rubber is inserted into place from below. If access is difficult, particularly if the drivebelt is of the ribbed V-belt type, it may be easier to remove the alternator/power steering pump drivebelt as described in Chapter 5. Refit, and where applicable adjust, the belt tension on completion.

14 Timing belt and tensioner C16 NZ2, 1.8 and 2.0 litre - removal, refitting and adjustment

Removal

1 An alternative type of spring loaded automatic timing belt tensioner is fitted to these engines, from 1993 onward **(see illustration)**. The tensioner assembly is similar to other automatic tensioners, but the removal and refitting procedures vary as follows.

2 The timing belt main outer cover may be secured either by clips or by hexagon-headed screws to the rear cover; in some cases, a combination of clips and screws may be used.

3 To release the belt tension before removal, unscrew the timing belt tensioner securing bolt slightly then, with a tool inserted in the slot on the tensioner arm, turn the tensioner arm until the timing belt is slack. If necessary, remove completely and examine the tensioner as described in Section 12.

Refitting

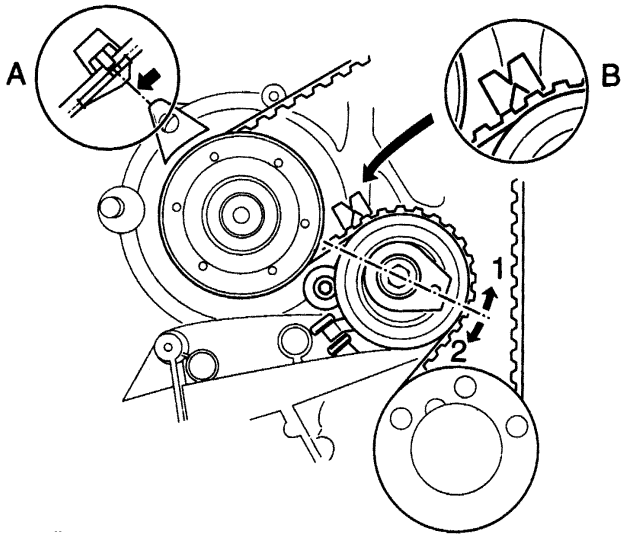
4 Refit the tensioner into position and tighten the securing bolt slightly.

5 Ensure that the coolant pump is correctly positioned by checking that the lug on the coolant pump flange is aligned with the corresponding lug on the cylinder block. If this is not the case, slacken the coolant pump mounting bolts slightly and move the pump accordingly (see Chapter 3). Tighten the bolts to the specified torque on completion.

6 Refit the timing belt then tension it as follows.

Adjustment

7 Slacken the automatic tensioner securing bolt and move the tensioner arm anti-clockwise, until the tensioner pointer lies at its stop. Tighten the tensioner securing bolt to hold the tensioner in this position.



14.1 Timing belt automatic tensioner details (alternative type)

A Alignment lugs on coolant pump and cylinder block
B Tensioner pointer aligned with notch in tensioner bracket
1 Move the tensioner arm anti-clockwise to release the belt tension
2 Move the tensioner arm clockwise to tension the belt

8 Turn the crankshaft through two complete revolutions in the normal direction of rotation, and check that with the crankshaft pulley TDC mark aligned with the pointer on the rear timing belt cover. The TDC mark on the camshaft sprocket is still aligned with the notch in the timing belt rear cover. Slacken the automatic tensioner securing bolt again and move the tensioner arm clockwise, until the tensioner pointer is aligned with the notch in the tensioner bracket. In the first few hours of operation a new belt will be subjected to 'settling-in', (known as the running-in procedure). If you are refitting a used belt (one that has been 'run-in'), align the pointer to approximately 4 mm to the left of the notch **(see illustration)**.

9 Tighten the tensioner securing bolt securely. Turn the crankshaft through one complete revolution, in the normal direction of rotation, and check that the crankshaft and camshaft timing marks still align. Then refit the remainder of the components as described in Section 12.

10 With the timing belt adjustment set in this way, correct tension will always be maintained by the automatic tensioner and no further checking or adjustment will be necessary.

15 Camshaft front oil seal - removal and refitting

Removal

1 The camshaft front oil seal may be renewed with the engine in the vehicle without removing the camshaft as follows.

2 Remove the timing belt and the camshaft sprocket, as described in Section 11.

3 Punch or drill a small hole in the centre of the now-exposed oil seal. Screw in a self-tapping screw, and pull on the screw with pliers to extract the seal.

Refitting

4 Clean the oil seal seat with a wooden or plastic scraper.

5 Grease the lips of the new seal, and drive it into position until it is flush with the housing, using a socket or tube. Take care not to damage the seal lips during fitting.

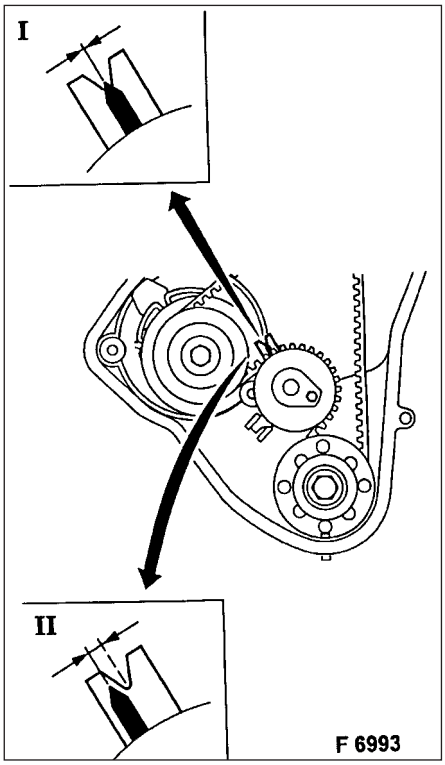
6 Refit the camshaft sprocket and the timing belt and tension the timing belt as described in Section 11.

16 Camshaft rear oil seal - removal and refitting

Removal

1 The camshaft rear oil seal may be renewed with the engine in the vehicle without removing the camshaft as follows.

2 Remove the distributor as described in Chapter 5



14.8 Timing belt adjustment

1 Alignment for new belts
2 Alignment for 'run-in' belts (gap is approximately 4 mm to the left of centre)

3 On 1.4 and 1.6 litre models (except C16 NZ2), the seal takes the form of an O-ring on the rear of the distributor body. Prise off the old O-ring carefully, using a screwdriver.

4 On C16 NZ2, 1.8 and 2.0 litre models, prise the seal from the camshaft housing

Refitting

5 On 1.4 and 1.6 litre models (except C16 NZ2), fit the new O-ring, and refit the distributor as described in Chapter 5.

6 On C16 NZ2, 1.8 and 2.0 litre models, fit the new seal so that it is flush with the end of the housing, then refit the distributor components as described in Chapter 5.

17 Camshaft housing and camshaft - general

Note: *The engine must be cold when removing the camshaft housing.* **Do not** *remove the camshaft housing from a hot engine. New cylinder head bolts must be used on refitting and sealer will be required when refitting the camshaft housing. Also see paragraph 3 before starting work:*

General

1 The camshaft can only be removed without disturbing the housing, if a special tool is available to depress the cam followers whilst the camshaft is withdrawn.

2 If such a tool is available, the camshaft can be removed, after removing the timing belt and camshaft sprocket as described in Section 11.

3 If the special tool is not available, the camshaft housing must be removed. Since the cylinder head bolts must be removed, it is strongly recommended that a new cylinder head gasket is fitted. If the gasket is not renewed, and it "blows" on reassembly, the cylinder head will have to be removed to renew the gasket, and another new set of bolts will have to be obtained for refitting. You have been warned!

4 Removal and refitting of the camshaft housing is described in Section 18, along with cylinder head removal and refitting. If it is decided not to disturb the cylinder head, the relevant paragraphs referring specifically to cylinder head removal and refitting can be ignored.

5 Removal of the camshaft from the housing is described in Section 18.

18 Camshaft housing and camshaft - dismantling, inspection and reassembly

Dismantling

1 With the camshaft housing removed from the cylinder head as described in Section 18, continue as follows.

2 Remove the distributor and it's components as described in Chapter 5 and on C 16 NZ2, 1.8 and 2.0 litre, carefully prise out the camshaft rear oil seal.

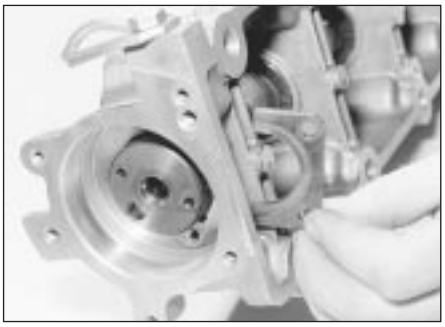
3 On carburettor models, remove the fuel pump, referring to Chapter 4A, if necessary.

4 Working at the distributor end of the camshaft, unscrew the two camshaft thrustplate securing bolts, using an Allen key or hexagon bit **(see illustration)**.

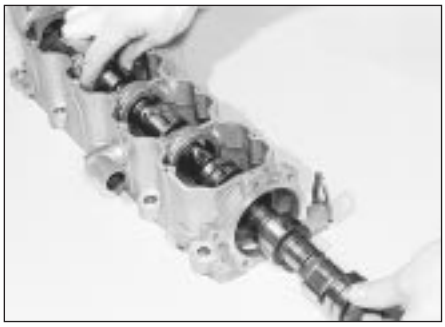
5 Withdraw the thrustplate, noting which way round it is fitted **(see illustration)**.

6 Carefully withdraw the camshaft from the distributor end of the camshaft housing, taking care not to damage the bearing journals **(see illustration)**.

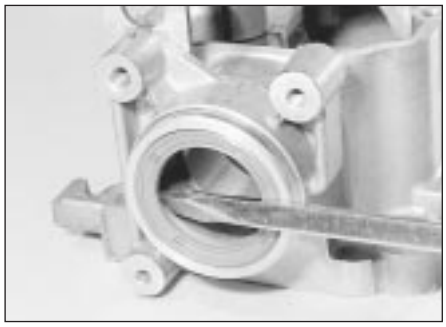
18.4 Camshaft thrustplate and securing bolts - 1.6 litre engine



18.5 Removing the camshaft thrustplate - 2.0 litre engine



18.6 Withdrawing the camshaft from the housing - 2.0 litre engine



18.10 Prising out the camshaft front oil seal - 2.0 litre engine

Inspection

7 With the camshaft removed, examine the bearings in the camshaft housing for signs of obvious wear or pitting. If evident, a new camshaft housing will probably be required.

8 The camshaft itself should show no marks or scoring on the journal or cam lobe surfaces. If evident, renew the camshaft. Note that if the camshaft is renewed, all the rocker arms should also be renewed.

9 Check the camshaft thrustplate for signs of wear or grooves, and renew if evident.

10 It is advisable to renew the camshaft front oil seal as a matter of course if the camshaft has been removed. Prise out the old seal using a screwdriver **(see illustration)**.

Reassembly

11 Carefully drive in the new front seal until it is flush with the housing, using a socket or tube. On C 16 NZ2, 1.8 and 2.0 litre models, fit a new camshaft rear oil seal. Replace the distributor O-ring on other models **(see illustrations)**.

12 Begin reassembly by liberally oiling the bearings in the housing and the oil seal lip. Carefully insert the camshaft into the housing from the distributor end, taking care to avoid damage to the bearings.

13 Refit the thrustplate, and tighten the securing bolts **(see illustration)**. Check the camshaft endfloat by inserting a feeler blade between the thrustplate and the camshaft end flange. If the endfloat exceeds that specified, renew the thrustplate.

14 Where applicable, refit the fuel pump, referring to Chapter 4, if necessary.

15 Refit the distributor as described in Chapter 5.

16 Refit the camshaft housing, as described in Section 18.

17 If a new camshaft has been fitted, it is important to observe the following running-in schedule (unless otherwise specified by the manufacturer) immediately after initially starting the engine:

One minute at 2000 rpm
One minute at 1500 rpm
One minute at 3000 rpm
One minute at 2000 rpm

18 Change the engine oil (but not the filter, unless due) approximately 600 miles (1000 km) after fitting a new camshaft.

19 Camshafts, "undersize" C16 NZ2, 1.8 and 2.0 litre engines - general

General

1 The camshafts and camshaft housings for these engines are sorted on production into one of two size groups; standard and 0.10 mm "undersize". Note that this is not intended to provide replacements for worn engines, but is to allow for production tolerances; either may be fitted to new engines.

2 "Undersize" components are marked with a spot of violet-coloured paint, that on the camshaft housing being applied on top at the timing belt end.

3 Whenever the camshaft or its housing are to be renewed, check (by direct measurement, if necessary) whether they are standard or undersize and ensure that only matching items are obtained for reassembly.

20 Cylinder head - removal and refitting (engine in vehicle)

Note: *The engine must be cold when the cylinder head is removed. Do not remove the cylinder head from a hot engine. New cylinder head bolts and a new cylinder head gasket must be used on refitting and sealer will be required when refitting the camshaft housing. The torque settings stated are only applicable to latest specification head bolts, available from Vauxhall. Earlier type or alternative make, head bolts may require different torques. Consult your supplier.*

Removal

1 Disconnect the battery negative lead.

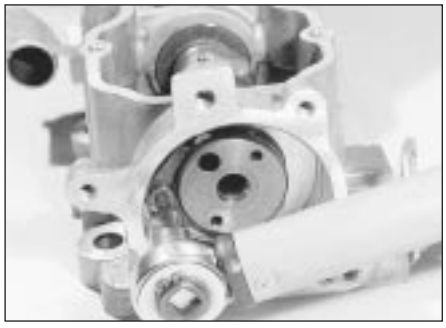
2 Drain the cooling system, as described in Chapter 3.

3 Disconnect the exhaust downpipe from the manifold, referring to Chapter 4C.

4 The cylinder head can be removed complete with the manifolds, or the manifolds can be detached from the cylinder head before removal, with reference to the relevant Sections of Chapter 4A, 4B or 4C. If no work is to be carried out on the inlet manifold, it can be unbolted from the cylinder head and

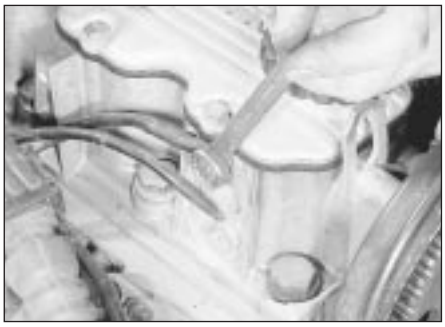
18.11A Fitting a new camshaft front oil seal using a special tool - 2.0 litre engine

18.11B Fitting a new camshaft rear oil seal - 2.0 litre engine



18.13 Tightening a camshaft thrustplate securing bolt - 2.0 litre engine

20.7 Disconnecting a camshaft cover breather hose - 2.0 litre engine



20.10 Unbolting the fuel injection wiring harness earth leads from the camshaft housing - 2.0 litre engine

20.11 Disconnecting the crankcase breather tube stub hose - 1.6 litre engine

supported to one side out of the way, thus avoiding the need to disconnect the relevant hoses, pipes and wiring.

5 If the cylinder head is to be removed complete with the manifolds, disconnect all relevant hoses, pipes and wiring from the inlet manifold and associated components, referring to Chapter 4A or 4B. On carburettor models, disconnect the hot air hose from the shroud on the exhaust manifold. Loosen the alternator mountings, with reference to Chapter 5, then unbolt the upper alternator mounting from the inlet manifold.

6 If the inlet manifold is to be left in the engine compartment, continue as follows, otherwise go on to paragraph 15.

7 Disconnect the air cleaner trunking from the air box on the carburettor or throttle body, or directly from the throttle body (as applicable), and disconnect the camshaft cover breather hose that runs to the carburettor or throttle body (as applicable), **(see illustration)**.

8 On C 16 NZ2, 1.8 and 2.0 litre models, disconnect the smaller coolant hose from the top of the thermostat housing.

9 On 1.6 litre models (except C 16 NZ2), disconnect the breather hose (which runs from the camshaft cover to the inlet manifold) at the camshaft cover.

10 On fuel injection models, unbolt the two wiring harnesses earth leads from the camshaft housing **(see illustration)**.

11 On 1.4 and 1.6 litre models (except C 16 NZ2), disconnect the stub hose that connects the crankcase breather tube to the rear of the camshaft housing **(see illustration)**.

12 Loosen the alternator mountings, referring to Chapter 5, then unbolt the upper alternator mounting from the inlet manifold.

13 Make a final check to ensure that all necessary hoses, pipes and wires have been disconnected, then unscrew the securing nuts, noting the location of the engine lifting bracket, and lift the inlet manifold from the cylinder head. Ensure that the manifold is properly supported, taking care not to strain any of the hoses, pipes and wires, etc., which are still connected.

14 Recover the manifold gasket from the cylinder head.

15 If desired, remove the exhaust manifold, with reference to Chapter 4C.

16 Remove the timing belt and the camshaft sprocket, as described in Section 11.

17 Unscrew the two upper rear timing belt cover securing bolts from the camshaft housing.

18 Disconnect the HT leads from the spark plugs and the coil, labelling them if necessary to aid refitting, and remove the distributor cap, referring to Chapter 5. Where applicable, disconnect the distributor wiring plug.

19 If not already done, disconnect the stub hose that connects the crankcase breather tube to the camshaft housing. If applicable unscrew the bolt securing the crankcase breather tube bracket to the end of the cylinder head **(see illustrations)**.

20 Disconnect the coolant hoses from the thermostat housing.

21 On carburettor models, disconnect the fuel hoses from the fuel pump. Be prepared for fuel spillage, and plug the open ends of the hoses, to prevent further fuel loss and dirt ingress.

22 Make a final check to ensure that all relevant hoses, pipes and wires, etc., have been disconnected.

23 Working from the outside inwards in a spiral pattern as shown **(see illustration)**, loosen all the cylinder head bolts by a quarter of a turn. Then loosen all the bolts by half a turn, and finally loosen and remove the bolts. Recover the washers.

24 Lift the camshaft housing from the cylinder head **(see illustration)**. If necessary, tap the housing gently with a soft-faced mallet to free it from the cylinder head, but do not lever at the mating faces. Note that the camshaft housing is located on dowels.

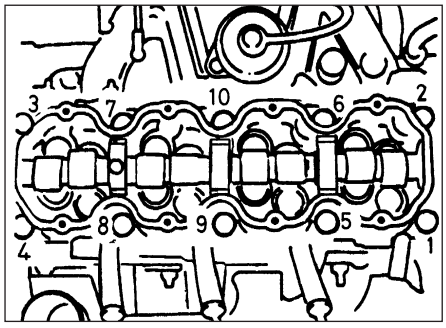
25 Lift the rocker arms and their thrust pads from the cylinder head, keeping them in order so that they can be refitted in their original positions **(see illustrations)**.

26 Lift the hydraulic valve lifters from the cylinder head, and place them upright in an oil bath until they are to be refitted **(see illustration)**. Ensure that the depth of oil is sufficient to fully cover the valve lifters, and keep the lifters in order, so that they can be refitted in their original positions.

27 Lift the cylinder head from the cylinder block **(see illustration)**. If necessary, tap the cylinder head gently with a soft-faced mallet to free it from the block, but do not lever at the mating faces. Note that the cylinder head is located on dowels.

20.19A Disconnecting the crankcase breather tube stub hose - 2.0 litre engine

20.19B Unbolting the crankcase breather tube bracket from the cylinder head - 2.0 litre model



20.23 Cylinder head bolt loosening sequence - SOHC engines

20.24 Lifting the camshaft housing from the cylinder head - 1.6 litre engine

20.25A Lift the rocker arms . . .

20.25B . . . and their thrust pads from the cylinder head - 1.6 litre engine

28 Recover the cylinder head gasket and discard it.

Refitting

29 Clean the cylinder head and block mating faces, and the camshaft housing and cylinder head mating faces by careful scraping. Take care not to damage the cylinder head and camshaft housing, which are made of light alloy and are easily scored. Cover the coolant passages and other openings with masking tape or rag to prevent dirt and carbon falling in. Mop out all the oil from the bolt holes; if oil is left in the holes, hydraulic pressure could crack the block when the bolts are refitted.

30 If desired, the cylinder head can be dismantled and inspected as described in Sections 22 and 23, and the camshaft housing can be dismantled as described in Section 18.

31 Begin refitting by locating a new gasket on the block so that the word "OBEN" or "TOP" can be read from above **(see illustrations)**.

32 With the mating faces scrupulously clean, locate the cylinder head on the block so that the positioning dowels engage in their holes.

33 Refit the hydraulic valve lifters, thrust pads and rocker arms to the cylinder head in their original positions. Liberally oil the valve lifter bores, and if new lifters are being fitted initially immerse each one in a container of clean engine oil and compress it (by hand) several times to charge it. Lubricate the contact faces of the valve lifters, thrust pads and rocker arms with a little molybdenum disulphide grease **(see illustration)**.

34 Temporarily refit the crankshaft sprocket, and ensure that the timing marks are still positioned as they were before the timing belt was removed (see Section 11).

35 Apply sealing compound (Vauxhall part No 90094714, or equivalent) to the cylinder head top mating face **(see illustration)**, then refit the camshaft housing to the cylinder head.

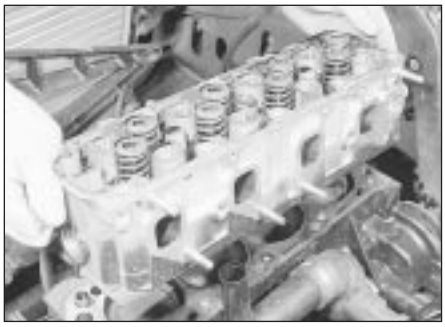
36 Fit the new cylinder head bolts, ensuring that the washers are in place under their heads, and screw the bolts in *by hand* as far as possible **(see illustration)**.

37 Tighten the bolts working from the inside outwards in a spiral pattern as shown **(see illustration)**. Tighten the bolts in the four stages given in the Specifications - i.e. tighten all bolts to the Stage 1 torque, then tighten all bolts to Stage 2 and so on **(see illustrations)**.

38 Further refitting is a reversal of the removal procedure, remembering the following points.

39 Ensure that the HT leads are refitted to their correct cylinders.

20.26 Lift the hydraulic valve lifters from the cylinder head - 1.6 litre engine



20.27 Lifting the cylinder head from the cylinder block - 1.6 litre engine

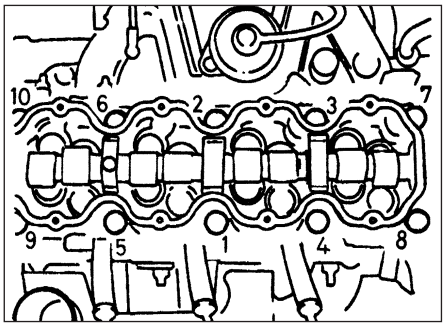
20.31A Cylinder head gasket "Oben/TOP" markings

20.31B Cylinder head gasket correctly located over dowel in cylinder block

20.33 Lubricate the valve lifter contact faces with molybdenum disulphide grease

20.35 Apply sealing compound to the cylinder head top mating face

20.36 Fit new cylinder head bolts, ensuring that the washers are in place



20.37A Cylinder head bolt tightening sequence - SOHC engines

20.37B Tighten the cylinder head bolts to the specified torque . . .

20.37C . . .then through the specified angle - 2.0 litre engine

40 Refit the camshaft sprocket and the timing belt and tension the timing belt as described in Section 11.
41 Where applicable, refit the manifolds to the cylinder head, with reference to Chapter 4A, 4B or 4C, using new gaskets.
42 Reconnect the exhaust downpipe to the manifold, using a new gasket, referring to Chapter 4C, if necessary.
43 Refit the upper alternator mounting to the inlet manifold, then adjust the alternator drivebelt tension, as described in Chapter 5.
44 Refill the cooling system, as described in Chapter 3.
45 On completion, check that all relevant hoses, pipes and wires, etc., have been reconnected.
46 When the engine is started, check for signs of leaks.
47 Once the engine has reached normal operating temperature, check and if necessary adjust the idle speed (where applicable) and the mixture (where applicable), with reference to Chapter 4A or 4B.

21 Cylinder head - removal and refitting (engine removed)

Note: *New cylinder head bolts and a new cylinder head gasket must be used on refitting, and sealer will be required when refitting the camshaft housing.*
The torque settings stated are only applicable to latest specification head bolts, available from Vauxhall. Earlier type or alternative make, head bolts may require different torques. Consult your supplier.

Removal

1 The cylinder head can be removed complete with the manifolds, or the manifolds can be detached from the cylinder head before removal, with reference Chapter 4A, 4B or 4C.
2 Remove the timing belt and the camshaft sprocket, as described in Section 11.
3 Unscrew the two upper rear timing belt cover securing bolts from the camshaft housing **(see illustration)**.
4 Disconnect the HT leads from the spark plugs, labelling them if necessary to aid refitting, and remove the distributor cap referring to Chapter 5.
5 If not already done, disconnect the stub hose that connects the crankcase breather tube to the camshaft housing. If applicable, unscrew the bolt securing the crankcase breather tube bracket to the end of the cylinder head.
6 Make a final check to ensure that all relevant hoses, pipes and wires have been disconnected.

Refitting

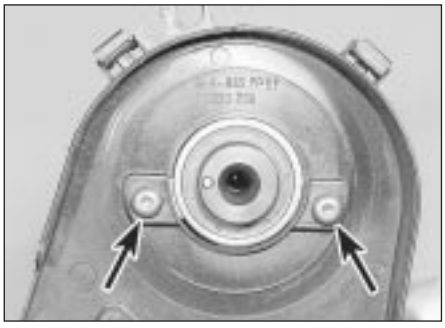
7 Proceed as described in Section 21, paragraphs 23 to 41 inclusive, but in addition note the following.
8 On completion check that all relevant hoses, pipes and wires, etc., have been reconnected.

22 Cylinder head - dismantling and reassembly

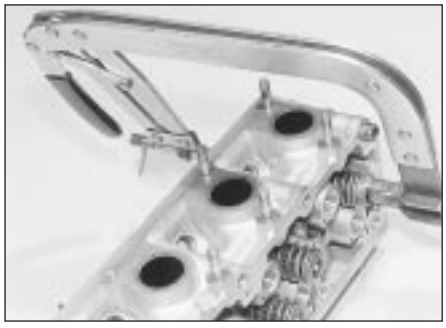
Note: *A valve spring compressor tool will be required for this operation. New valve stem oil seals must be used on reassembly*

Dismantling

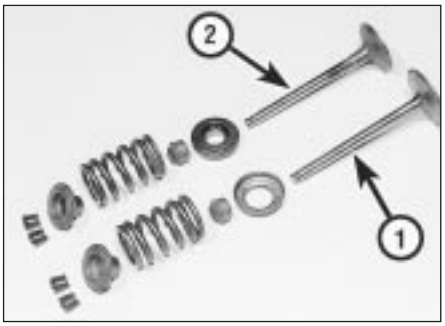
1 With the cylinder head removed as described in Section 21, clean away all external dirt.
2 If not already done, remove the thermostat housing, and on 1.4 and 1.6 litre models, the thermostat, as described in Chapter 3. Remove the manifolds as described in Chapter 4A, 4B or 4C. Remove the spark plugs if not already done.
3 To remove a valve, fit a valve spring compressor tool. Ensure that the arms of the compressor tool are securely positioned on the head of the valve and the spring cap **(see illustration)**.
4 Compress the valve spring to relieve the pressure of the spring cap acting on the collets. If the spring cap sticks on the valve stem, support the compressor tool and give the end a light tap with a hammer to help free the spring cap.
5 Extract the two split collets, then slowly release the compressor tool.
6 Remove the spring cap, spring, valve stem oil seal, and the spring seat, then withdraw the valve.



21.3 Upper rear timing belt cover securing bolts (arrowed) - 1.6 litre engine



22.3 Valve spring compressor tool fitted to No 1 exhaust valve - 2.0 litre engine



22.7 Inlet (1) and exhaust (2) valve components

22.11 Inserting an exhaust valve into its guide

22.12 Fit the valve seat (exhaust valve shown)

7 Repeat the procedure for the remaining valves, keeping all components in strict order, so that they can be refitted in their original positions **(see illustration)**.

8 The cylinder head and valves can be inspected for wear and damage as described in Section 23.

Reassembly

9 With all components cleaned, begin reassembly as follows.

10 Starting at one end of the cylinder head, fit the valve components as follows.

11 Insert the appropriate valve into its guide, ensuring that the valve stem is well lubricated with clean engine oil **(see illustration)**. Note that if the original components are being refitted, all components must be refitted in their original positions.

12 Fit the spring seat **(see illustration)**.

13 New valve stem oil seals should be supplied with a fitting sleeve, which fits over the collet groove in the valve stem, to prevent damage to the oil seal as it is slid down the valve stem **(see illustration)**. If no sleeve is supplied, wind a short length of tape round the top of the valve stem to cover the collet groove.

14 Push the valve stem oil seal down the valve stem using a tube until the seal is fully engaged with the spring seat **(see illustrations)**. Remove the fitting sleeve or tape, as applicable, from the valve stem.

15 Fit the valve spring and the spring cap **(see illustrations)**.

16 Fit the spring compressor tool, and compress the valve spring until the spring cap passes beyond the collet groove in the valve stem.

17 Apply a little grease to the collet groove, then fit the split collets into the groove, with the narrow ends nearest the spring **(see illustration)**. The grease should hold them in the groove.

18 Slowly release the compressor tool, ensuring that the collets are not dislodged from the groove. When the compressor is fully released, give the top of the valve assembly a sharp tap with a soft-faced mallet to settle the components.

19 Repeat the procedure for the remaining valves, ensuring that all components are refitted in their original positions, where applicable.

20 Where applicable, refit the manifolds as described in Chapter 4A, 4B or 4C, and/or the thermostat and thermostat housing as described in Chapter 3. Refit the spark plugs if desired.

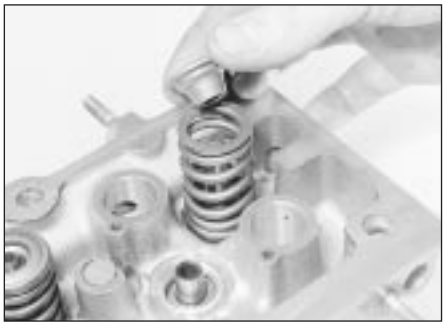
21 Refit the cylinder head as described in Section 21.

22.13 Slide the oil seal fitting sleeve down the valve stem . . .

22.14A . . . then fit the valve stem oil seal . . .

22.14B . . . and push onto the spring seat using a socket

22.15A Fit the valve spring . . .



22.15B . . .and the spring cap

22.17 Retain the split collets with a little grease

23 Cylinder head - inspection and renovation

Note: *Refer to a dealer for advice before attempting to carry out valve grinding or valve seat reciting operations, as these operations may not be possible for the DIY mechanic. This is due to the fitment of hardened valve seats for use with unleaded petrol*

Warning: The exhaust valves fitted to 20 XEJ and C 20 XE (DOHC) models are fitted with sodium to improve their heat transfer. Sodium is a highly reactive metal, which will ignite or explode spontaneously on contact with water (including water vapour in the air). These must NOT be disposed of with ordinary scrap. Seek advice from a Vauxhall dealer or your Local Authority, if the valves are to be disposed of.

Inspection

1 Remember that the cylinder head is of light alloy construction and is easily damaged, use a blunt scraper or rotary wire brush to clean all traces of carbon deposits from the combustion spaces and the ports. The valve stems and valve guides should also be freed from any carbon deposits. Wash the combustion spaces and ports down with paraffin and scrape the cylinder head surface free of any foreign matter with the side of a steel rule, or a similar article.

2 If the engine is installed in the car, clean the pistons and the top of the cylinder bores. If the pistons are still in the block, it is essential that great care is taken to ensure that no carbon gets into the cylinder bores. This could scratch the cylinder walls or cause damage to the pistons and rings. To ensure this does not happen, first turn the crankshaft so that two of the pistons are at the top of their bores. Insert rag into the other two bores or seal them off with paper and masking tape. The waterways should also be covered with small pieces of masking tape, to prevent particles of carbon entering the cooling system and damaging the coolant pump.

3 Press a little grease into the gap between the cylinder walls and the two pistons that are to be worked on. With a blunt scraper, carefully scrape away the carbon from the piston crown, taking great care not to scratch the aluminium. Also scrape away the carbon from the surrounding lip of the cylinder wall. When all carbon has been removed, scrape away the grease that will now be contaminated with carbon particles, taking care not to press any into the bores. To assist prevention of carbon build-up, the piston crown can be polished with a metal polish. Remove the rags or masking tape from the other two cylinders, and turn the crankshaft so that the two pistons that were at the bottom are now at the top. Place rag or masking tape in the cylinders that have been decarbonised, and continue as just described.

23.9 Renewing the thermostat housing sealing ring - 2.0 litre engine

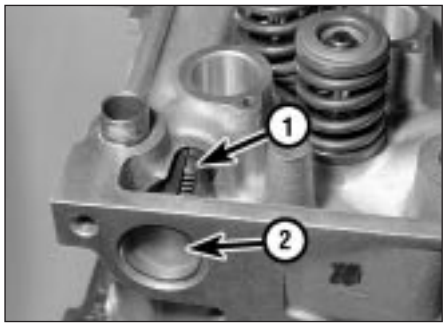
4 Examine the heads of the valves for pitting and burning, especially the heads of the exhaust valves. The valve seatings should be examined at the same time. If the pitting on the valve and seat is very slight, the marks can be removed by grinding the seats and valves together with coarse, and then fine, valve grinding paste.

5 Where bad pitting has occurred to the valve seats, it will be necessary to recut them and fit new valves. This latter job should be entrusted to the local dealer or engineering works. In practice it is very seldom that the seats are so badly worn. Normally it is the valve that is too badly worn for refitting, and the owner can easily buy a new set of valves and match them to the seats by valve grinding.

Renovation

6 Valve grinding is carried out as follows. Smear a trace of coarse carborundum paste on the seat face and apply a suction grinder tool to the valve head. With a semi-rotary motion, grind the valve head to its seat, lifting the valve occasionally to redistribute the grinding paste. When a dull matt even surface is produced on both the valve seat and the valve, wipe off the paste and repeat the process with fine carborundum paste, lifting and turning the valve to redistribute the paste as before. A light spring placed under the valve head will greatly ease this operation. When a smooth unbroken ring of light grey matt finish is produced, on both valve and valve seat faces, the grinding operation is complete. Carefully clean away every trace of grinding compound, taking great care to leave none in the ports or in the valve guides. Clean the valves and valve seats with a paraffin-soaked rag, then with a clean rag, and finally, if an air line is available, blow the valves, valve guides and valve ports clean.

7 Check that all valve springs are intact. If any one is broken, all should be renewed. Check the free height of the springs against new ones. If some springs are not long enough, replace them all. Springs suffer from fatigue and it is a good idea to renew them even if they look serviceable.



23.10 Oil pressure regulating valve (1) and plug (2) - 2.0 litre engine

8 The cylinder head can be checked for warping either by placing it on a piece of plate glass or using a straight-edge and feeler blades. If there is any doubt or if its block face is corroded, have it re-faced by your dealer or motor engineering works.

9 On 1.8 and 2.0 litre, always renew the sealing ring between the cylinder head and the thermostat housing when the head is removed for overhaul **(see illustration)**. Reference to Chapter 21 will show that a considerable amount of work is involved if it is wished to renew the sealing ring with the cylinder head installed.

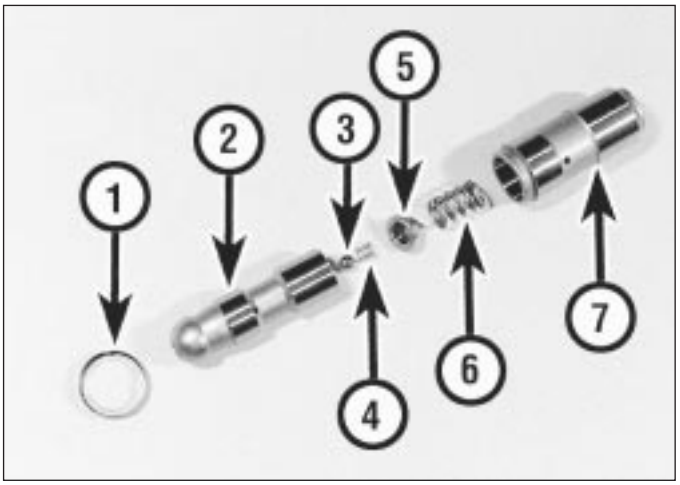
10 If the oil pressure regulating valve in the cylinder head is to be renewed, access is gained through the circular plug covering the end of the valve **(see illustration)**. The old valve must be crushed, then its remains extracted, and a thread (M10) cut in the valve seat to allow removal using a bolt. A new valve and plug can then be driven into position. In view of the intricacies of this operation, it is probably best to have the valve renewed by a Vauxhall dealer if necessary.

24 Hydraulic valve lifters - inspection

Inspection

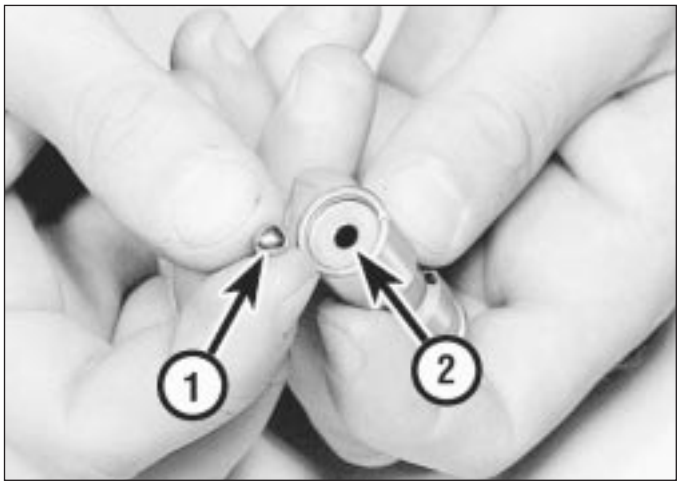
1 On engines that have covered a high mileage, or for which the service history (particularly oil changes) is suspect, it is possible for the valve lifters to suffer internal contamination. In extreme cases this may result in increased engine top end noise and wear. To minimise the possibility of problems occurring later in the life of the engine, it is advisable to dismantle and clean the hydraulic valve lifters as follows whenever the cylinder head is overhauled. Note that no spare parts are available for the valve lifters, and if any of the components are unserviceable, the complete assembly must be renewed **(see illustration)**.

2 With the cylinder head removed and dismantled as described in Sections 21 and 23, first inspect the valve lifter bores in the



24.1 Hydraulic valve lifter components - SOHC engines

1 Collar
2 Plunger
3 Ball
4 Small spring
5 Plunger cap
6 Large spring
7 Cylinder



24.8 Locate the ball (1) on it's seat (2) in the base of the plunger

cylinder head for wear. If excessive wear is evident, the cylinder head must be renewed. Also check the valve lifter oil holes in the cylinder head for obstructions.

3 Starting with number 1 valve lifter, carefully pull the collar from the top of the valve lifter cylinder. It should be possible to remove the collar by hand - if a tool is used, take care not to distort the collar.

4 Withdraw the plunger from the cylinder, and recover the spring.

5 Using a small screwdriver, carefully prise the cap from the base of the plunger. Recover the spring and ball from under the cap, taking care not to lose them as the cap is removed.

6 Carefully clean all the components using paraffin or solvent, paying particular attention to the machined surfaces of the cylinder (internal surfaces), and piston (external surfaces). Thoroughly dry all the components using a lint-free cloth. Carefully examine the springs for damage or distortion - the complete valve lifter must be renewed if the springs are not in perfect condition.

7 Lubricate the components sparingly with clean engine oil of the correct grade, then reassemble as follows.

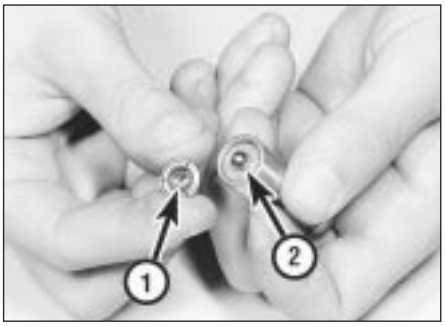
8 Invert the plunger, and locate the ball on its seat in the base of the plunger **(see illustration)**.

9 Locate the smaller spring on its seat in the plunger cap, then carefully refit the cap and spring, ensuring that the spring locates on the ball. Carefully press around the flange of the cap, using a small screwdriver if necessary, until the flange is securely located in the groove in the base of the plunger **(see illustrations)**.

10 Locate the larger spring over the plunger cap, ensuring that the spring is correctly seated, and slide the plunger and spring assembly into the cylinder **(see illustrations)**.

11 Slide the collar over the top of the plunger, and carefully compress the plunger by hand, until the collar can be pushed down to engage securely with the groove in the cylinder **(see illustration)**.

12 Repeat the above procedures on the remaining valve lifters.



24.9A Spring (1) located in plunger cap, and ball (2) located on seat in plunger

24.9B Locate the cap flange in the plunger groove

24.10A Locate the spring over the plunger cap . . .

24.10B . . .then slide the plunger and spring assembly into the cylinder

24.11 Slide the collar (1) over the top of the plunger and engage with the groove (2) in the cylinder

25 Flywheel - removal, inspection and refitting

Note: *New flywheel securing bolts must he used on refitting. Certain models are fitted with a 'Pot type' flywheel. Although, it has a deeply recessed surface for the clutch disc, the operations below are the same.*

Removal

1 If not already done, remove the clutch, (Chapter 6), and the starter motor, (Chapter 5).
2 If the engine is in the vehicle, remove the clutch release bearing and its guide sleeve, as described in Chapter 6.
3 Although the flywheel bolt holes are offset so that the flywheel can only be fitted in one position, it will make refitting easier if alignment marks are made between the flywheel and the end of the crankshaft.
4 Prevent the flywheel from turning by jamming the ring gear teeth using a large screwdriver or similar tool. Access is most easily obtained through the starter motor aperture if the engine is in the vehicle.
5 Unscrew the securing bolts, and remove the flywheel **(see illustration)**. *Take care, as the flywheel is heavy!*

Inspection

6 With the flywheel removed, it can be inspected as follows.
7 If the teeth on the flywheel starter ring are badly worn, or if some are missing, then it will be necessary to remove the ring and fit a new one.
8 The old ring can be split with a cold chisel, after making a cut with a hacksaw blade between two gear teeth. Take great care not to damage the flywheel during this operation, and use eye protectors always. Once the ring has been split, it will spread apart and can be lifted from the flywheel.
9 The new ring gear must be heated to 180 to 230°C (356 to 446°F) and unless facilities for heating by oven or flame are available, leave the fitting to a dealer or motor engineering works. The new ring gear must not be overheated during this work, or the temper of the metal will be altered.
10 The ring should be tapped gently down onto its register, and left to cool naturally - the contraction of the metal on cooling will ensure that it is a secure and permanent fit.
11 If the clutch friction disc contact surface of the flywheel is scored, or on close inspection, show's evidence of small hairline cracks (caused by overheating), it may be possible to have the flywheel surface ground. This is provided that the overall thickness of the flywheel is not reduced too much. Consult a specialist engine repairer and if it is not possible, renew the flywheel complete.

Refitting

12 Refitting is a reversal of removal, remembering the following points.
13 Align the previously made marks on the flywheel and crankshaft, and fit new flywheel securing bolts. Tighten them to the specified torque in the two stages given in the Specifications, whilst preventing the flywheel from turning, as during removal **(see illustrations)**.
14 Where applicable, refit the clutch release bearing, guide sleeve, and the clutch, as described in Chapter 6.

26 Flexplate (automatic transmission) - removal and refitting

Removal

1 Remove the transmission (Chapter 7B).
2 Prevent the flexplate from turning by jamming its ring gear teeth using a large screwdriver or similar tool.
3 Unbolt and remove the flexplate. Examine the bolts and renew them all as a set if there is the slightest doubt about their condition.
4 The ring gear can be checked, and renewed if necessary, as described in Section 25.

Refitting

5 Refitting is the reverse of the removal procedure. If the bolts are to be re-used, use a wire brush to clean their threads, apply a few drops of thread-locking compound (Vauxhall Part No 90167347, or equivalent) to the threads of each bolt on refitting. Tighten the bolts to the specified torque wrench setting.

25.5 Removing the flywheel - 1.6 litre engine

6 Refit the transmission, refer to Chapter 7B if necessary.

27 Crankshaft front oil seal - renewal

Renewal

1 Remove the timing belt and the rear timing belt cover, as described in Section 11.
2 Ensure that the Woodruff key is removed from the end of the crankshaft.
3 Punch or drill a small hole in the centre of the now-exposed oil seal. Screw in a self-tapping screw, and pull on the screw with pliers to extract the seal. Several attempts may be necessary. Be careful not to damage the sealing face of the crankshaft.
4 Clean the oil seal seat with a wooden or plastic scraper.
5 Before fitting the new oil seal, steps must be taken to protect the oil seal lips from damage, and from turning back on the shoulder at the front end of the crankshaft. Grease the seal lips, and then wind tape around the end of the crankshaft to form a gentle taper.
6 Tap the seal into position using a large socket or tube, until the seal is flush with the outer face of the oil pump housing.
7 Refit the rear timing belt cover and the timing belt tension the timing belt as described in Section 11.

25.13A Tool for locking flywheel fitted to engine-to-transmission bolt hole - 1.6 litre engine

25.13B Tighten the flywheel securing bolts to the specified toque . . .

25.13C . . .and then through the specified angle - 1.6 litre engine

28.4 Fitting a new crankshaft rear oil seal - 2.0 litre engine

28 Crankshaft rear oil seal - renewal

Renewal

1 With the engine removed from the vehicle, remove the flywheel, or flexplate (as applicable) as described in Sections 25 and 26.
2 Punch or drill a small hole in the centre of the now-exposed oil seal. Screw in a self-tapping screw, and pull on the screw with pliers to extract the seal. Several attempts may be necessary. Be careful not to damage the sealing face of the crankshaft.
3 Clean the oil seal seat with a wooden or plastic scraper.
4 Grease the lips of the new seal, then tap the seal into position using a tube, until flush with the outer faces of the cylinder block and rear main bearing cap **(see illustration).**
5 Refit the flywheel or flexplate (if applicable), as described in Sections 25 or 26.

29 Sump - removal and refitting

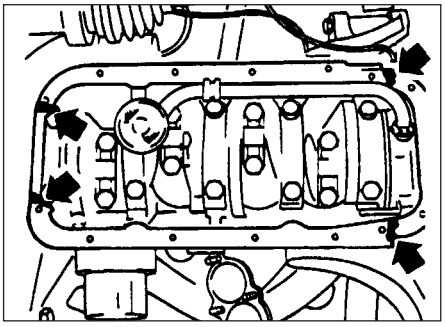
Note: *The sump gasket(s) must be renewed on refitting and sealer will be required for use on the oil pump and rear main bearing cap-to-cylinder block joints*

Removal

1 If the engine is in the vehicle, continue as follows, otherwise go on to paragraph 9.
2 Disconnect the battery negative lead.
3 Drain the engine oil, referring to Chapter 1 if necessary, then refit and tighten the drain plug.
4 Apply the handbrake, then jack up the front of the vehicle, and support securely on axle stands (see "*Jacking and Vehicle Support*").
5 Remove the front section of the exhaust system, as described in Chapter 4C.
6 Where applicable, disconnect the wiring from the oil level sensor.
7 Unscrew the securing bolts and remove the engine-to-transmission blanking plate from the bellhousing.
8 Remove the securing bolts, and withdraw the sump. Note that on most models, the sump baffle will probably be pulled away from the cylinder block with the sump, but cannot be removed until the oil pick-up pipe has been removed.
9 On 1.6, 1.8 and 2.0 litre models, to remove the sump baffle, it is necessary to unbolt the bracket securing the oil pick-up pipe to the cylinder block. The baffle can then be manipulated over the oil pick-up pipe. On C 16 NZ2, 1.8 and 2.0 litre models, prise the rubber gasket from the sump baffle.
10 If need be, the oil pick-up pipe can be removed by unscrewing the single bolt securing the support bracket to the cylinder block (if not already done). Then remove the two bolts securing the end of the pipe to the oil pump. Recover the O-ring.
11 Clean all traces of old gasket and sealing compound from the mating faces of the cylinder block, sump baffle (where applicable), and sump.

Refitting

12 Begin refitting by applying sealing compound (Vauxhall part No 90485251 or equivalent) to the joints between the oil pump and cylinder block, and the rear main bearing cap and cylinder block **(see illustrations)**.
13 On C 16 NZ2, 1.8 and 2.0 litre locate a new rubber gasket over the sump baffle flange, ensuring that it is seated correctly **(see illustration)**.
14 On 1.6, 1.8 and 2.0 litre models, offer the sump baffle up to the cylinder block, manipulating it over the oil pick-up pipe where applicable.
15 If the oil pick-up pipe has been removed, refit it to the oil pump using a new O-ring and tighten bolts to the specified torque **(see illustrations)**.
16 Where applicable, refit the bracket securing the oil pick-up pipe to the cylinder block, ensuring that it passes through the relevant hole in the sump baffle, if applicable **(see illustration)**.
17 Coat the sump securing bolts with thread-locking compound (i.e. Vauxhall part No. 90167347), then refit the sump, and tighten the bolts to the specified torque **(see illustrations)**.

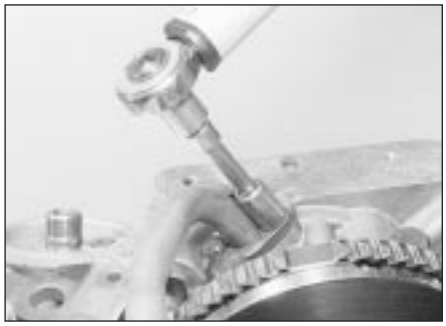


29.12A Apply sealing compound (arrowed) to oil pump and rear main bearing cap joints before refitting sump

29.12B Applying sealing compound to the joint between the oil pump and cylinder block - 2.0 litre engine

29.13 Locate a new rubber gasket over the sump baffle flange - 2.0 litre engine

29.15A Fit a new O-ring to the oil pick-up pipe . . .



29.15B . . .and tighten the securing bolts to the specified torque - 2.0 litre engine

29.16 Refitting the oil pick-up pipe bracket - 2.0 litre engine

29.17A Coat the sump securing bolts with thread-locking compound before fitting

29.17B Refitting the sump - 2.0 litre engine

18 If the engine is in the vehicle, further refitting is a reversal of the removal procedure, but refit the front section of the exhaust system referring to Chapter 4C. On completion, refill the engine with oil, as described in Chapter 1.

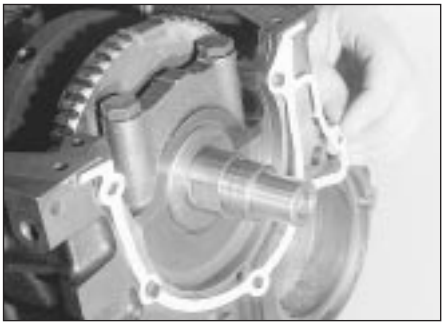
30 Oil pump - removal and refitting

Removal

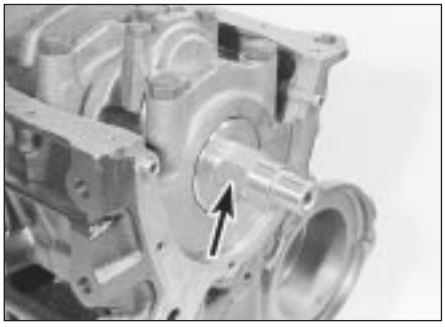
1 Remove the timing belt, sprockets and the rear timing belt cover, as shown in Section 11.
2 Remove the sump, oil pick-up pipe and sump baffle (where applicable), as described in Section 29.
3 On C 16 NZ2, 1.8 and 2.0 litre engines, unscrew the oil filter from its mounting on the oil pump, referring to Chapter 1, if necessary.
4 Disconnect the wiring from the oil pressure switch mounted on the oil pump.
5 Remove the securing bolts, and withdraw the oil pump from the cylinder block. Recover the gasket.
6 The oil pump can be dismantled for inspection, as described in Section 31.

Refitting

7 Thoroughly clean the mating faces of the oil pump and cylinder block, then locate a new gasket on the block **(see illustration)**.
8 Before refitting the oil pump, steps must be taken to protect the oil seal lips from damage, and from turning back on the shoulder at the front end of the crankshaft. Grease the seal lips, and then wind tape around the crankshaft to form a gentle taper.
9 Refit the oil pump, ensuring that the inner gear engages with the flats on the crankshaft, and tighten the securing bolts to the specified torque, then remove the tape from the end of the crankshaft **(see illustrations)**.
10 Reconnect the wiring to the oil pressure switch.
11 On C 16 NZ2, 1.8 and 2.0 litre engines, fit a new oil filter, with reference to Chapter 1.
12 Refit the sump baffle (where applicable), oil pick-up tube and sump, as described in Section 29.
13 Refit the rear timing belt cover and the timing belt, and tension the timing belt as described in Section 11.



30.7 Fit a new oil pump gasket to the cylinder block - 2.0 litre engine



30.9A Oil pump inner gear must engage with hexagon flats on crankshaft (arrowed) on 1.4 and 1.6 litre engines . . .

30.9B . . .and with two flats (arrowed) on 1.8 and 2.0 litre engines

30.9C Tighten the oil pump securing bolts to the specified torque - 2.0 litre SOHC engine

31 Oil pump - dismantling, inspection and reassembly

Note: *A new crankshaft front oil seal must be used on reassembly*

Dismantling

1 With the oil pump removed as described in Section 30, continue as follows.
2 Remove the securing screws and withdraw the rear cover **(see illustration)**. The screws may be very tight, in which case it may be necessary to use an impact driver to remove them.

31.2 Removing an oil pump rear cover securing screw - 2.0 litre SOHC engine

31.3 Check the clearance between the inner and outer gear teeth . . .

31.4 . . .and between the edges of the gears and the housing - 2.0 litre SOHC engine

31.7 Oil pressure relief valve components - 2.0 litre SOHC engine

Inspection

3 Check the clearance between the inner and outer gear teeth (backlash) using a feeler blade **(see illustration)**.

4 Check the clearance between the edges of the gears and the housing (endfloat) using a straight edge and a feeler blade **(see illustration)**.

5 If any of the clearances are outside the specified limits, renew the components as necessary.

6 Ensure that the gears and the interior of the pump body are scrupulously clean before reassembly, and note that the outer gear is marked with a punch dot to indicate the gear outer face.

7 The oil pressure relief valve components can be removed from the pump by unscrewing the cap **(see illustration)**. Examine the spring and plunger, and renew if necessary.

Reassembly

8 Thoroughly clean the components before refitting.

9 Always renew the crankshaft front oil seal at the front of the oil pump housing. Prise out the old seal using a screwdriver, and fit the new seal using a socket or tube, so that it is flush with the outer face of the housing **(see illustrations)**.

10 Ensure that the mating faces of the rear cover and the pump housing are clean, then coat the pump housing mating face with sealing compound (Vauxhall part No 90485251, or equivalent) and refit the rear cover. Refit and tighten the securing screws.

11 Refit the pump, as described in Section 30.

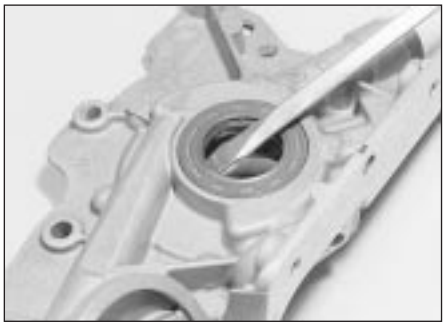
32 Pistons and connecting rods - removal and refitting

Note: *New big-end cap bolts must be used on refitting*

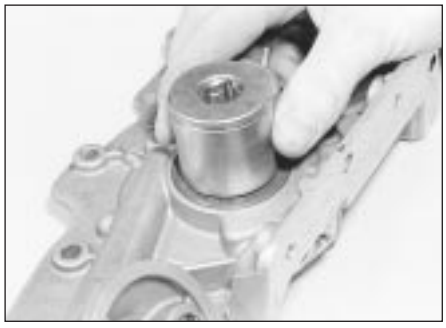
Removal

1 Remove the cylinder head, as described previously in Section 20.

2 Remove the sump, oil pick-up pipe and sump baffle (where applicable), as described in Section 29.



31.9A Prise out the old crankshaft front oil seal . . .



31.9B . . .and fit the new seal using a socket - 2.0 litre SOHC engine

3 If the connecting rods and big-end caps are not marked to indicate their positions in the cylinder block (i.e. cylinder numbers), centre-punch them at adjacent points either side of the cap/rod joint. Note to which side of the engine the marks face **(see illustration)**.

4 Unscrew the big-end cap bolts from the first connecting rod, and remove the cap. If the bearing shells are to be re-used, tape the cap and shell together.

5 Check the top of the piston bore for a wear ridge. If evident, carefully scrape it away with a ridge reaming tool, otherwise as the piston is pushed out of the block, the piston rings may jam against the ridge.

6 Place the wooden handle of a hammer against the bottom of the connecting rod, and push the piston/rod assembly up and out of the cylinder bore. Recover the bearing shell, and tape it to the connecting rod if it is to be re-used.

7 Remove the remaining three assemblies in a similar way. Rotate the crankshaft as necessary to bring the big-end bolts to the most accessible position.

8 The piston can be separated from the connecting rod by removing the circlips that secure the fully floating gudgeon pin. Note the orientation of the piston and connecting rod before separation, and if necessary, make alignment marks. Reassembly is a reversal of dismantling ensuring that the piston and connecting rod are correctly orientated.

9 The pistons and connecting rods can be examined for wear and damage, as described in Section 33, and the bearings can be examined as described in Section 35.

Refitting

10 Begin reassembly by laying the piston/connecting rod assemblies out in their correct order, complete with bearing shells, ready for refitting into their respective bores in the cylinder block.

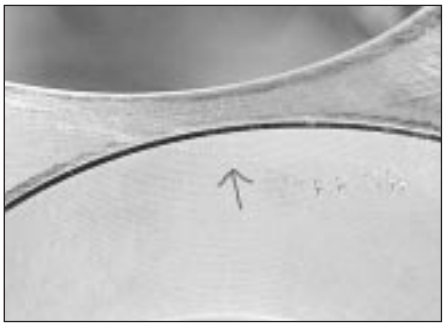
11 Ensure that the seats for the bearing shells are absolutely clean, and then fit the shells into the seats.

12 Wipe out the cylinder bores and oil them. Oil the piston rings liberally, and ensure that the ring gaps are positioned as described in Section 33.

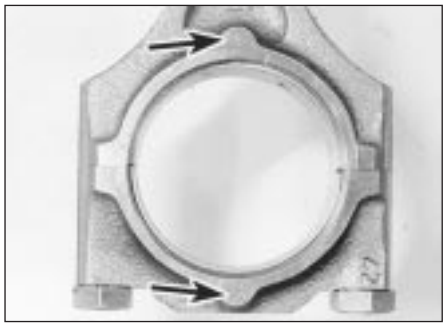
13 Fit a piston ring compressor tool to the first assembly to be installed.

32.3 Big-end cap centre punch identification marks (circled). Note that lug on bearing cap faces flywheel end of engine - 2.0 litre SOHC engine

32.14A Piston crown arrow must point towards timing belt end of engine - 1.6 litre engine



32.14B . . .and similarly for the 2.0 litre SOHC engine



32.14C Lugs (arrowed) on connecting rod and big-end cap must point towards flywheel end of engine - 1.6 litre engine

14 Insert the rod and piston into the top of the cylinder bore, so that the base of the compressor stands on the block. Check that the connecting rod markings are towards the side of the engine noted during removal. Note that the arrow or notch, as applicable, on the piston crown should point towards the timing belt end of the engine, and the lugs on the connecting rods should point towards the flywheel end of the engine **(see illustrations)**.

15 Apply the wooden handle of a hammer to the piston crown and tap the assembly into the bore, at the same time releasing the compressor **(see illustration)**.

16 Oil the relevant crankpin, then guide the big-end of the connecting rod near to the crankpin, and pull it firmly onto the crankpin. Ensure that the bearing shell remains in position in the connecting rod.

17 Fit the big-end cap, with the markings towards the side of the engine noted during removal **(see illustration)**. Note that the lug should point towards the flywheel end of the engine.

18 Fit new big-end cap bolts, and tighten them to the specified torque in the two stages given in the Specifications **(see illustrations)**.

19 Repeat the procedure on the remaining three assemblies.

20 Refit the sump baffle (where applicable), oil pick-up pipe and sump, as described in Section 29.

21 Refit the cylinder head, as described previously in this Section 20.

32.15 Tapping a piston into its bore - 2.0 litre SOHC engine

32.17 Fitting a big-end bearing cap - 2.0 litre SOHC engine

33 Pistons and connecting rods - examination and renovation

Examination

1 Examine the mating faces of the big-end caps to see if they have ever been filed, in a mistaken attempt to take up bearing wear. This is extremely unlikely, but if evident, the offending connecting rods and caps must be renewed.

2 Check the alignment of the rods visually, and if all is not well, take the rods to a Vauxhall dealer for a more detailed check.

3 The gudgeon pins are an interference (shrink) fit in the connecting rod small ends. Separation of the pistons and rods is a job for a dealer due to the special tools required, as is any remedial action required if the gudgeon pin is no longer an interference fit in the rod.

4 Examine the pistons for ovality, scoring and scratches.

5 If new rings are to be fitted to the existing pistons, expand the old rings over the tops of the pistons. The use of two or three old feeler blades will be helpful in preventing the rings dropping into empty grooves. Note that the oil control ring is in three sections, and note which way up each ring is fitted, for use when refitting **(see illustrations)**.

Renovation

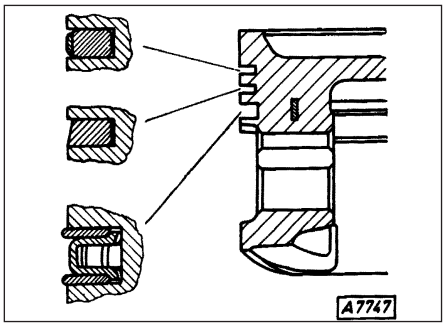
6 Before fitting the new rings to the pistons, insert them into their relevant cylinder bores, and check that the ring end gaps are within the specified limits using a feeler blade **(see illustration)**. Check the ring gaps at the upper and lower limits of the piston travel in the bores.

32.18A Tighten the big-end cap bolts to the specified torque . . .

32.18B . . .then through the specified angle - 2.0 litre SOHC engine

33.5A Using a feeler blade to aid removal of a piston ring - 2.0 litre SOHC engine

33.5B Removing the centre section of the oil control ring - 2.0 litre SOHC engine



33.5C Sectional view showing correct orientation of piston rings - all engines

7 If any of the ring end gaps exceed the specified tolerance, the relevant rings will have to be renewed, and if the ring grooves in the pistons are worn, new pistons may be required.
8 Clean out the piston ring grooves using a piece of old piston ring as a scraper. Take care not to scratch the surface of the pistons. Protect your fingers, piston ring edges are sharp. Also probe the groove oil return holes, to ensure that they are not blocked.
9 Check the cylinder bores for signs of wear ridges towards the top of the bores. If wear ridges are evident, and new piston rings are being fitted, the top ring must be stepped to clear the wear ridge, or the bore must be de-ridged using a scraper.
10 Fit the oil control ring sections with the lower steel ring gap offset 25 to 50 mm to the right of the spreader ring gap, and the upper steel ring gap offset by the same distance to the left of the spreader ring gap.
11 Fit the lower compression ring, noting that the ring is tapered or stepped. The ring should be fitted with the word "TOP" uppermost.
12 Fit the upper compression ring, and offset the ring gap by 180° to the lower compression ring gap. If a stepped ring is being fitted, fit the ring with the smaller diameter of the step uppermost.
13 If new pistons are to be fitted, they must be selected from the grades available, after measuring the cylinder bores as described in Section 36.
14 Normally the appropriate oversize pistons are supplied by the dealer when the block is rebored.
15 Whenever new piston rings are being installed, the glaze on the original cylinder bores should be "broken", using either abrasive paper or a glaze-removing tool in an electric drill. If abrasive paper is used, use strokes at 60° to the bore centre line, to create a cross-hatching effect.

34 Crankshaft and bearings - removal and refitting

Note: *New main bearing cap bolts must be used on refitting*

Removal

1 With the engine removed from the vehicle, continue as follows.
2 Remove the cylinder head, as described previously in Section 20.
3 Remove the sump, oil pick-up pipe and sump baffle (where applicable), as described in Section 29.
4 Remove the oil pump, as described in Section 30.
5 Remove the flywheel or flexplate (if applicable), as described in Sections 25 and 26.
6 Remove the pistons and connecting rods, as described in Section 32.
7 Invert the engine so that it is standing on the top face of the cylinder block.
8 The main bearing caps are numbered 1 to 4 from the timing belt end of the engine. The rear (flywheel end) cap is not marked. To ensure that the caps are refitted the correct way round, note that the numbers are read from the coolant pump side of the engine with the engine inverted **(see illustration)**.
9 Unscrew and remove the main bearing cap bolts, and tap off the bearing caps. If the bearing shells are to be re-used, tape them to their respective caps.
10 Note that the centre bearing shell incorporates thrust flanges to control crankshaft endfloat.
11 Lift the crankshaft (complete with timing sensor wheel, if fitted), from the crankcase.
12 Extract the upper bearing shells, and identify them for position if they are to be re-used.
13 The crankshaft, bearings and sensor wheel can be examined for wear and damage, as described in Section 35, and the cylinder block and bores can be examined as described in Section 36.

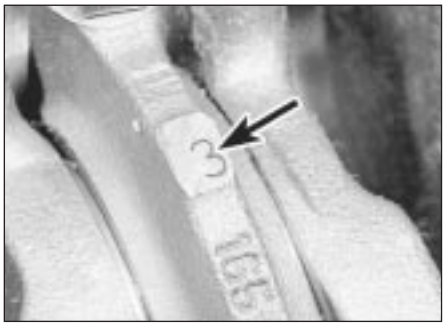
Refitting

14 Begin refitting by ensuring that the crankcase and crankshaft are thoroughly clean, and that all oilways are clear. If possible, blow through the oil drillings with compressed air, and inject clean engine oil into them.

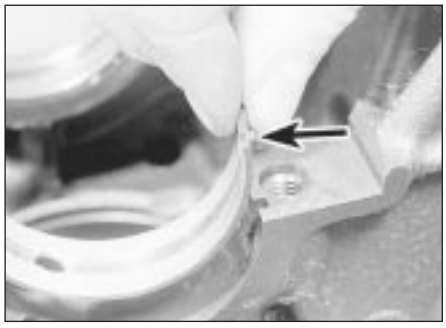
> **HAYNES HiNT** ***A good alternative to compressed air, is to use a water dispersing lubricant spray into each hole, using the spout provided.***

15 If the crankshaft is being replaced, where applicable, transfer the timing sensor wheel and tighten to correct torque.
16 Wipe clean the bearing shell seats in the crankcase and the bearing caps, then fit the upper bearing shells to their seats.
17 Note that there is a tag on the back of each bearing shell, which engages with a groove in the relevant seat in the crankcase or bearing cap **(see illustration)**.
18 If new bearing shells are being fitted, wipe away all traces of protective grease.

33.6 Measuring a piston ring end gap using a feeler blade



34.8 Main bearing cap identification mark (arrowed) - 1.6 litre engine



34.17 Main bearing shell tag (arrowed) engages with groove in cylinder block - 2.0 litre SOHC engine

34.19 Fitting a central main bearing shell. Note thrust flanges - 2.0 litre SOHC engine

19 Note that the central bearing shells have thrust flanges which control crankshaft endfloat **(see illustration)**. Note also that the shells fitted to the crankcase all have oil duct holes, while only the centre main bearing cap shell has an oil duct hole.

20 When the shells are firmly located in the crankcase and the bearing caps, lubricate them with clean engine oil.

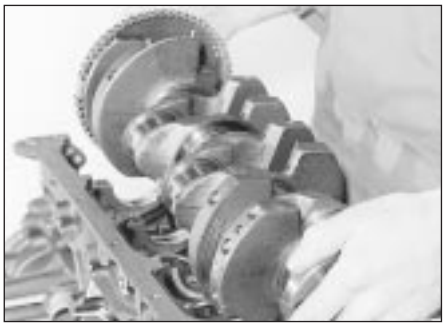
21 Fill the lips of a new crankshaft rear oil seal with grease, and fit it to the end of the crankshaft.

22 Carefully lower the crankshaft into position in the crankcase **(see illustration)**.

23 If necessary, seat the crankshaft using light blows with a rubber hammer on the crankshaft balance webs.

24 Lubricate the main bearing journals and shells **(see illustration)**, and then fit numbers 2, 3 and 4 main bearing caps, and tighten the new bolts as far as possible by hand.

34.27A Tighten the main bearing cap bolts to the specified torque . . .



34.22 Lowering the crankshaft into the crankcase - 2.0 litre SOHC engine

34.25A Fill the side grooves of the rear main bearing cap with RTV jointing compound . . .

25 Fill the side grooves of the rear main bearing cap with RTV jointing compound (Vauxhall part No 90485251, or equivalent). Coat the lower surfaces of the bearing cap with sealing compound (Vauxhall part No 15 04 200, or equivalent), **(see illustrations)**. Fit the bearing cap, and tighten the new bolts as far as possible by hand.

26 Fit the front (No 1) main bearing cap, and tighten the new bolts as far as possible by hand, ensuring that the bearing cap is exactly flush with the end face of the cylinder block.

27 Working from the centre bearing cap outwards, tighten the bearing cap securing bolts to the specified torque in the two stages given in the Specifications; i.e. tighten all bolts to Stage 1, then tighten all bolts to Stage 2 and Stage 3 **(see illustrations)**.

34.24 Lubricate the main bearing shells before fitting the caps - 2.0 litre SOHC engine

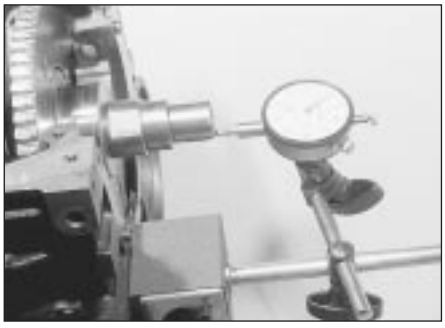
34.25B . . .and the lower surfaces with sealing compound - 2.0 litre SOHC engine

28 When all bolts have been fully tightened, inject further RTV jointing compound into the side grooves of the rear main bearing cap, until it is certain that they are full.

29 Now rotate the crankshaft, and check that it turns freely, with no signs of binding or tight spots.

30 Check that the crankshaft endfloat is within the specified limits, using a dial gauge, or by inserting a feeler blade between the thrust flange of the centre main bearing shell and the machined surface of the crankshaft **(see illustrations)**. Before measuring, ensure that the crankshaft is fully forced towards one end of the crankcase, to give the widest possible gap at the measuring location. Incorrect endfloat will most likely be due to crankshaft wear or to incorrect regrinding, assuming that the correct bearing shells have been fitted.

34.27B . . .then through the specified angle - 2.0 litre SOHC engine



34.30A Check crankshaft endfloat using a dial gauge . . .

34.30B . . .or a feeler blade - 2.0 litre SOHC engine

31 Refit the previously removed components, referring to the relevant Sections of this Chapter.

35 Crankshaft and bearings - examination

Examination

1 Examine the crankpin and main journal surfaces for signs of scoring or scratches, and check the ovality and taper of the crankpins and main journals. If the bearing surface dimensions do not fall within the tolerance ranges given in the Specifications at the beginning of this Chapter, the crankpins and/or main journals will have to be reground.
2 Big-end and crankpin wear is accompanied by distinct metallic knocking, particularly noticeable when the engine is pulling from low revs, and some loss of oil pressure.
3 Main bearing and main journal wear is accompanied by severe engine vibration rumble - getting progressively worse as engine rev's increase - and again by loss of oil pressure.
4 If the crankshaft requires regrinding, take it to an engine reconditioning specialist, who will machine it for you and supply the correct undersize bearing shells.
5 Inspect the big-end and main bearing shells for signs of general wear, scoring, pitting and scratches. The bearings should be matt grey in colour. With leadindium bearings, should a trace of copper colour be noticed, the bearings are badly worn, as the lead bearing material has worn away to expose the indium underlay. Renew the bearings if they are in this condition, or if there are any signs of scoring or pitting. ***You are strongly advised to renew the bearings - regardless of their condition at time of major overhaul. Refitting used bearings is a false economy.***
6 The undersizes available are designed to correspond with crankshaft regrind sizes. The bearings are in fact, slightly more than the stated undersize, as running clearances have been allowed for during their manufacture.
7 Main and big-end bearing shells can be identified as to size by the marking on the back of the shell. Standard size shell bearings are marked STD or .00, undersize shells are marked with the undersize such as 0.020 u/s. This marking method applies only to replacement bearing shells, and not to those used during production.
8 An accurate method of determining bearing wear is by using a Plastigage. The crankshaft is located in the main bearings (and, if necessary, the big-end bearings), and the Plastigage filament is located across the journal. Vauxhall recommend that the crankshaft journal and bearing shells are lightly lubricated, to prevent the Plastigage from tearing as the bearing cap is removed. The bearing cap should be fitted, and the bolts tightened to the specified torque. The cap is then removed, and the width of the filament is checked against a scale that shows the bearing running clearance. The clearance should be compared with that given in the Specifications.
9 Where applicable, check the teeth of the crankshaft TDC sensor wheel for damage **(see illustration).** If evident, the crankshaft must be renewed.
10 Similarly, check the condition of the pins in the front crankshaft balance weight, which serve as detect points for the plug-in diagnostic sensor used by Vauxhall dealers **(see illustration)**.

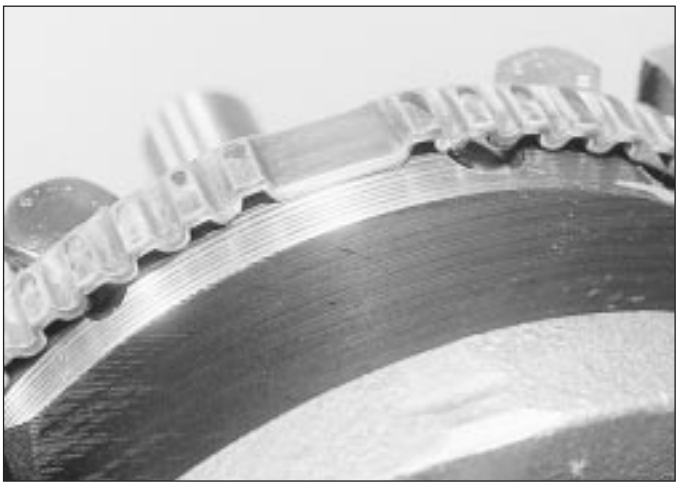
36 Cylinder block and bores - examination and renovation

Examination

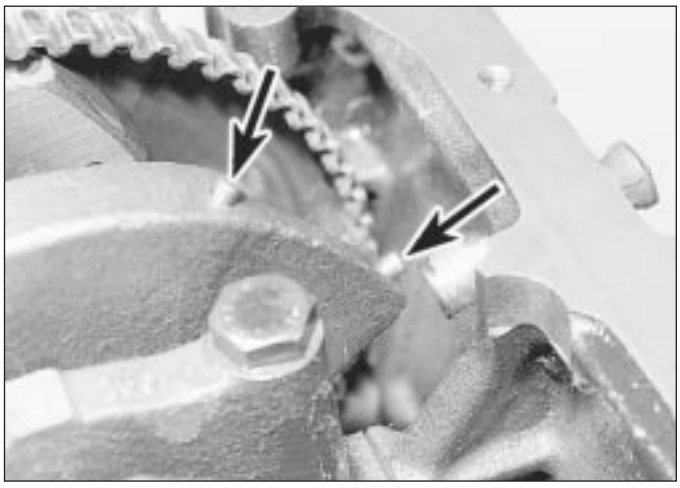
1 Examine the cylinder bores for taper, ovality, scoring and scratches. Start by carefully examining the top of the cylinder bores. If they are at all worn, a very slight ridge will be found on the thrust side. This marks the top of the piston ring travel. The owner will have a good indication of the bore wear before dismantling the engine, or removing the cylinder head. Excessive oil consumption, accompanied by blue smoke from the exhaust, is a sure sign of worn cylinder bores and piston rings.
2 Measure the bore diameter across the block, and just below any ridge. This can be done with an internal micrometer or a dial gauge. Compare this with the diameter of the bottom of the bore, which is not subject to wear. If no measuring instruments are available, use a piston from which the rings have been removed, and measure the gap between it and the cylinder wall with a feeler blade. Refer to the Specifications. If the cylinder wear exceeds the permitted tolerances, then the cylinders will need reboring, in which case note the following points:

a) Piston and cylinder bores are closely matched in production. The actual diameter of the piston is indicated by numbers on its crown; the same numbers stamped on the crankcase indicate the bore diameter
b) After reboring has taken place, the cylinder bores should be measured accurately and oversize pistons selected from the grades available to give the specified piston-to-bore clearance
c) For grading purposes, the piston diameter is measured across the bottom of the skirt

3 If the wear is marginal and within the tolerances given, new special piston rings can be fitted to offset the wear.
4 Thoroughly examine the crankcase and cylinder block for cracks and damage, and use a piece of wire to probe all oilways and waterways to ensure that they are unobstructed.



35.9 Check the condition of the TDC sensor wheel teeth at the front of the crankshaft - 2.0 litre SOHC engine



35.10 Check the condition of the pins (arrowed) in the front crankshaft balance weight - 2.0 litre SOHC engine

5 Note that the rubber plug located next to the bellhousing flange on the cylinder block covers the aperture for the installation of a diagnostic TDC sensor. The sensor, when connected to a monitoring unit, indicates TDC from the position of the pins set into the crankshaft balance weight.

37 Examination and renovation - general

General

1 With the engine completely stripped, clean all components and examine them for wear. Each component should be checked, and where necessary renewed or renovated, as described in the relevant Sections of this Chapter.

2 Renew main and big-end bearing shells as a matter of course, unless it is known that they have had little wear, and are in perfect condition.

3 If in doubt whether to renew a component that is still just serviceable, consider the time and effort that will be incurred should the component fail at an early date after rebuild. Obviously, the age and expected life of the vehicle must influence the standards applied.

4 Gaskets, oil seals and O-rings must all be renewed as a matter of routine. Flywheel, cylinder head, and main and big-end bearing cap bolts must be renewed, because of the high stress to which they are subjected.

5 Renew the engine core plugs while they are easily accessible, if they show signs of leakage. Knock out the old plugs with a hammer and chisel or punch. Clean the plug seats, smear the new plugs with sealing compound, and tap them squarely into position.

38 Initial start-up after major overhaul or repair

1 Make a final check to ensure that everything has been reconnected to the engine, and that no rags or tools have been left in the engine compartment.

2 Check that oil and coolant levels are correct.

3 Start the engine. This may take a little longer than usual, as fuel is pumped to the engine.

4 Check that the oil pressure warning lamp goes out when the engine starts. This may take a few seconds as the new oil filter fills with oil.

5 Run the engine at a fast tickover, and check for leaks of oil, fuel and coolant. If a new camshaft has been fitted, pay careful attention to the running-in procedure given in Section 18, paragraphs 17 and 18. Where applicable, check the power steering and/or automatic transmission fluid cooler unions for leakage. Some smoke and odd smells may be experienced, as assembly lubricants and sealers burn off the various components.

6 Bring the engine to normal operating temperature. Check the ignition timing, idle speed and the mixture (where applicable), as described in Chapter 4A or 4B.

7 Allow the engine to cool, then recheck the oil and coolant levels. Top-up if necessary

8 If new bearings, pistons, etc., have been fitted, the engine should be run-in at reduced speeds and loads for the first 500 miles (800 km) or so. It is beneficial to change the engine oil and filter after this mileage.

Chapter 2 Part B:
DOHC engine 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: *All specifications as for 2.0 litre SOHC engines, unless shown otherwise*

General

Type (all models)	Four-cylinder, in-line, water-cooled, transversely mounted. Double belt-driven overhead camshafts, acting on hydraulic valve lifters
Manufacturer's engine codes:	
20 XEJ	2.0 litre (1998 cc)
C20 XE	2.0 litre (1998 cc) + catalyst
X20 XEV	2.0 litre (1998 cc) + catalyst. 'Ecotec' type engine
Compression ratio:	
20 XEJ and C20 XE	10.5 : 1
X20 XEV	10.8 : 1
Maximum power:	
20 XEJ and C20 XE	110 kW (150 bhp) at 6000 rpm
X20 XEV	100 kW (136 bhp) at 5400 rpm
Maximum torque:	
20 XEJ	196 Nm at 4800 rpm
C20 XE	
Up to model year 1993	196 Nm at 4800 rpm
1993-on	196 Nm at 4600 rpm
X20 XEV	185 Nm at 4000 rpm

Cylinder Head

Overall height of cylinder head (sealing surface to sealing surface):	
20 XEJ and C20 XE	135.58 to 135.68 mm
X20 XEV	134.00 mm
Installation height of valve guide:	
20 XEJ and C20 XE	10.70 to 11.00 mm
X20 XEV	13.70 to 14.00 mm

Camshaft

Camshaft bearing journal diameter (all models)	27.939 to 27.960 mm
Camshaft bearing diameter in housing (all models)	28.000 to 28.021 mm
Cam lift:	
20 XEJ and C20 XE	9.5 mm
X20 XEV	10.0 mm
Maximum permissible radial run-out:	
20 XEJ and C20 XE	0.04 mm
X20 XEV	0.06 mm
Endfloat (all models)	0.040 to 0.144 mm

Valves and guides	Inlet	Exhaust
Overall length - production (mm):		
20 XEJ and C20 XE	105.0	105.0
X20 XEV	102.0	92.0
Overall length - service (mm):		
20 XEJ and C20 XE	104.6	104.6
X20 XEV	101.7	91.8
Head diameter (mm):		
20 XEJ and C20 XE	33.0 ± 0.1	29.0 ± 0.1
X20 XEV	32.0 ± 0.1	29.0 ± 0.1
Stem diameter (mm):		
20 XEJ and C20 XE		
Standard	6.955 to 6.970	6.945 to 6.960
0.075 mm oversize	7.030 to 7.045	7.020 to 7.035
0.150 mm oversize	7.105 to 7.120	7.095 to 7.110
0.250 mm oversize	7.205 to 7.220	7.195 to 7.210
X20 XEV		
Standard	5.955 to 5.970	5.945 to 5.960
0.075 mm oversize	6.030 to 6.045	6.020 to 6.035
0.150 mm oversize	6.105 to 6.120	6.095 to 6.110
Valve guide bore (mm):		
20 XEJ and C20 XE		
Standard	7.000 to 7.015	
0.075 mm oversize	7.075 to 7.090	
0.150 mm oversize	7.150 to 7.165	
0.250 mm oversize	7.400 to 7.415	
X20 XEV		
Standard	6.000 to 6.012	
0.075 mm oversize	6.075 to 6.090	
0.150 mm oversize	6.150 to 6.165	
Valve seat angle (all models)	44° 40’	

Lubrication system	
Lubricant capacity	See Chapter 1 Specifications
Oil pressure at idle (engine warm):	
20 XEJ and C20 XE	2.5 bar
X20 XEV	1.5 bar

Torque wrench settings	Nm	lbf ft
***Note**: Use new bolts (or nuts, if applicable), where asterisked (*).*		
Alternator to cylinder block bracket	35	26
Brake servo line to inlet manifold	20	15
Camshaft bearing cap to cylinder head (M6)	10	7
Camshaft bearing cap to cylinder head (M8)	20	15
Camshaft bearing cap to head (X20 XEV)	8	6
Camshaft pulley to camshaft (1993-on models):		
Stage 1	50	37
Stage 2	Angle tighten by 60°	
Stage 3	Angle tighten by 15°	
Coolant pipe to cylinder block	20	15
Cover to cylinder head (M6 bolts)	9	7
Cover to cylinder head (M8 nuts)	22	16
Cover to exhaust manifold (X20 XEV)	5	4
Crankshaft pulse pick-up	6	4
Exhaust manifold to cylinder head *	22	16
Exhaust pipe to adapter	12	9
Inlet manifold support to cylinder block	25	18
Intermediate shaft bracket to cylinder block	55	41
Knock sensor to cylinder block	20	14
Oil cooler lines to adapter/oil cooler	30	22
Oil filter to oil pump	15	11
Oil dipstick flange to cylinder block	25	18
Oil pump safety valve	30	22
Oil pump, threaded adapter	23	17
Power steering pump to support	25	18
Spark plug lead cover to cylinder head cover:		
20 XEJ and C20 XE	8	6
X 20 XEV	6	4

Torque wrench settings (continued)	Nm	lbf ft
Starter to cylinder block	45	33
Starter support to cylinder block	25	18
Temperature regulator plug (M20) *	30	22
Timing belt cover	8	6
Timing belt drive gear to crankshaft: *		
Stage 1	250	184
Stage 2	Angle tighten by between 40° and 50°	
Timing belt guide roller bracket to block	25	18
Timing belt guide roller to bracket	25	18
Timing belt guide roller to cylinder block:		
Engines up to 1993		
Stage 1	25	18
Stage 2	Angle tighten by 45°	
Stage 3	Angle tighten by 15°	
1993-on engines	25	18
Transfer box bracket to cylinder block	60	44
Transmission to cylinder block	60	44

1 General

This part of Chapter 2 describes procedures that are specific to the DOHC engine. It should be read in conjunction with Part A.

The lower engine is basically the same as the 2.0 litre SOHC. However the pistons are attached to the connecting rods by gudgeon pins, which are fully floating, and are secured by circlips.

Both camshafts on these engines are driven from the crankshaft by one toothed composite rubber belt. Each cylinder has four valves (two inlet and two exhaust), operated directly from the camshafts by hydraulic self-adjusting valve lifters. One camshaft operates the inlet valves, and the other operates the exhaust valves.

DOHC models are fitted with a remotely mounted oil cooler.

The distributor is driven directly from the exhaust camshaft.

2 Engine - removal and refitting

Removal

1 Carry out procedure in Chapter 2A, noting the following differences.
2 With the car safely raised, remove the engine undershield.
3 The fuel hoses need to be disconnected from the fuel rail.
4 Disconnect coolant hoses from the cylinder block and cylinder head. Also disconnect the oil cooler pipe unions from the oil pump.
5 Unbolt the right-hand driveshaft centre bearing support bracket from the rear of the cylinder block.

Refitting

6 Refitting the engine is similar to the procedure in Chapter 2A. The exceptions being, replacement of the right-hand driveshaft centre bearing support bracket at the rear of the cylinder block and retightening the securing bolts.
7 Replace the undershield.

3 Engine/transmission mountings - renewal

The procedure for replacing the engine/transmission is similar to SOHC models, see Chapter 2A. However this engine is fitted with an undershield that needs to be removed before replacing the mounts. Do not forget to replace the undershield before lowering the car.

4 Timing belt, sprockets and belt tensioner and idler pulleys - removal, refitting and adjustment

Note: *The timing belt should be renewed on refitting. A two-legged puller may be required to remove the crankshaft sprocket*

Removal

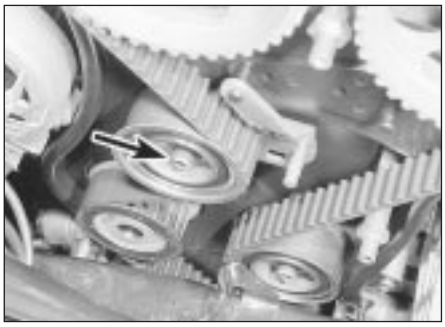
1 Disconnect the battery negative lead.
2 Disconnect the air cleaner trunking from the airflow meter, then remove the cover and the air cleaner element from the air cleaner. If desired, for improved access, the complete air cleaner assembly can be removed, as described in Chapter 4B.
3 Remove the power steering pump drivebelt, as described in Chapter 10.
4 Remove the alternator drivebelt, as described in Chapter 5.
5 Remove the three securing screws, and withdraw the outer timing belt cover. Recover the rubber grommets from the screw holes in the cover if they are loose.
6 Turn the crankshaft using a Torx socket on the crankshaft sprocket bolt, until the timing marks on the camshaft sprockets are aligned with the notches in the camshaft cover. The notch in the crankshaft pulley should also be aligned with the pointer on the rear timing belt cover **(see illustrations)**.
7 Extract the six securing bolts using a splined bit, and withdraw the crankshaft pulley **(see illustration)**. If necessary, counterhold the crankshaft using a socket on the crankshaft sprocket bolt. If the engine is in the vehicle, the crankshaft can be prevented from turning by having an assistant engage first gear and depress the brake pedal. Alternatively, the flywheel ring gear teeth can be jammed using a large screwdriver or similar tool. Before removing the pulley, check that the timing marks are still aligned.

4.6A Camshaft sprocket TDC mark aligned with notch in camshaft cover

4.6B . . .and notch in crankshaft pulley aligned with pointer on rear timing belt cover (circled)

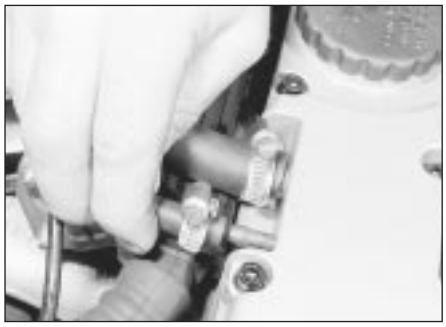
4.7 Crankshaft pulley and securing bolts viewed through right-hand wheel arch

8 Loosen the securing bolt and release the timing belt tensioner pulley, then slide the belt from the sprockets and pulleys **(see illustration)**.
9 If desired, the sprockets, tensioner and idler pulleys, and the rear timing belt cover can be removed as follows, otherwise go on to paragraph 27.
10 To remove the camshaft sprockets, first disconnect the breather hoses from the camshaft cover **(see illustration)**.
11 Extract the two securing bolts and remove the spark plug cover **(see illustration)**, then disconnect the HT leads from the spark plugs, and unclip them from the end of the camshaft cover. If necessary, mark the HT leads for position, to avoid confusion when refitting.
12 Unscrew the twenty securing bolts and withdraw the camshaft cover **(see illustration)**.



4.8 Timing belt tensioner pulley securing bolt (arrowed)

13 Recover the one-piece rubber gasket **(see illustration)**.
14 Prevent the relevant camshaft from turning by holding it with a spanner on the flats provided in front of No 1 cam lobe, and unscrew the camshaft sprocket bolt **(see illustration)**.
15 Withdraw the sprocket from the end of the camshaft, then repeat the procedure for the remaining camshaft sprocket.
16 Remove the crankshaft sprocket. It will be necessary to prevent the crankshaft from turning by bolting a metal bar to the sprocket using two of the crankshaft pulley bolts, or by jamming the flywheel ring gear teeth. A Torx socket will be required to unscrew the sprocket bolt - take care, as the bolt is very tight. If necessary, use a two-legged puller to remove the sprocket. Recover the thrustwashers from the end of the crankshaft, and from under the bolt head.



4.10 Disconnecting a breather hose from the rear of the camshaft cover

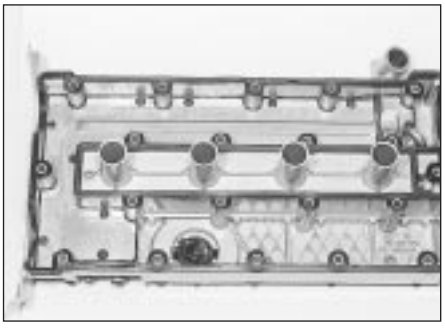
17 To remove the belt tensioner pulley, simply unscrew the securing bolt from the centre of the pulley, then withdraw the pulley complete with mounting plate **(see illustration)**. Recover the spacer sleeve from the pulley bolt.
18 To remove the belt idler pulley, unscrew the securing bolt from the centre of the pulley, then withdraw the pulley and recover the spacer sleeve from the pulley bolt.
19 The rear timing belt cover can now be removed after unscrewing the upper and middle studs for the timing belt outer cover screws. Note that the upper stud simply unscrews from the cylinder head, but the middle stud is secured by a bolt. Unscrew the two upper and single lower right-hand rear belt cover securing bolts, and withdraw the rear belt cover **(see illustrations)**.

Refitting

20 Refit the rear timing belt cover using a reversal of the removal procedure.
21 Refit the belt idler and tensioner pulleys, noting that the spacer sleeves should be fitted with their smaller diameters against the pulleys **(see illustration)**. Do not fully tighten the tensioner pulley bolt at this stage.
22 Refit the thrustwasher to the end of the crankshaft, then refit the crankshaft sprocket.

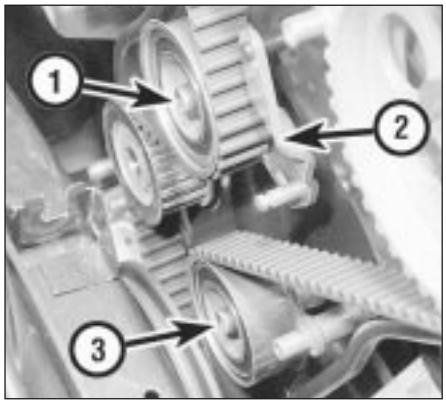
4.11 Removing the spark plug cover

4.12 Unscrewing a camshaft cover securing bolt

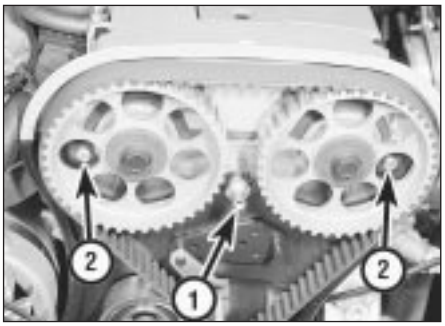


4.13 Camshaft cover removed to show one-piece rubber gasket

4.14 Spanner positioned to counterhold exhaust camshaft

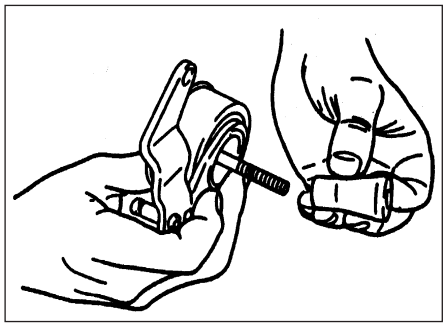


4.17 Timing belt pulley components
1 Tensioner pulley securing bolt
2 Tensioner pulley mounting plate
3 Idler pulley securing bolt



4.19A Timing belt outer cover screw upper stud (1) and rear belt cover upper securing bolts (2)

4.19B Rear timing belt cover lower right-hand securing bolt



4.21 Belt tensioner pulley and spacer sleeve. Note that smaller diameter of spacer sleeve fits against pulley

Apply a little grease to the threads of the securing bolt, and tighten it to the specified torque in the two stages given in the Specifications. Ensure that the thrustwasher is in place under the bolt head, and prevent the crankshaft from turning as during removal.

23 Refit the camshaft sprockets. Ensure that the locating pins on the ends of the camshafts engage with the holes in the sprockets and with the sprocket timing marks facing forwards. Then tighten the securing bolts to the specified torque in the two stages given in the Specifications. Prevent the camshafts from turning as during removal.

24 Check the condition of the camshaft cover rubber gasket and renew if necessary, then refit the camshaft cover and tighten the securing bolts **(see illustration)**.

25 Refit the HT leads to the spark plugs (ensuring that they are refitted to their correct cylinders), then clip the leads to the end of the camshaft cover. Refit the spark plug cover and tighten the securing bolts.

26 Reconnect the breather hose to the camshaft cover.

27 Temporarily refit the crankshaft pulley, and ensure that the crankshaft pulley and camshaft sprocket timing marks are still aligned as described in paragraph 6. Then fit a new timing belt around the sprockets and pulleys, starting at the crankshaft sprocket.

28 Refit the crankshaft pulley, and tighten the securing bolts to the specified torque. If necessary, prevent the crankshaft from turning as during removal.

4.24 Tightening a camshaft cover securing bolt

29 Adjust the timing belt tension, as described from paragraph 35 onwards.

30 Refit the outer timing belt cover, ensuring that the rubber grommets are in place in the screw holes, and tighten the securing screws.

31 Refit the alternator drivebelt and adjust the drivebelt tension, as described in Chapter 5.

32 Refit the power steering pump drivebelt and adjust the drivebelt tension, as described in Chapter 10.

33 Refit the air cleaner components as applicable, referring to Chapter 4B, if necessary.

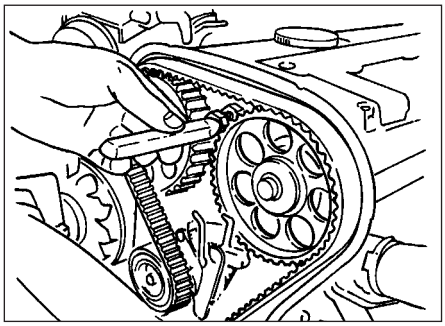
34 Reconnect the battery negative lead.

Adjustment

Note: *The manufacturers specify the use of special adjustment wrench Vauxhall tool No KM-666 for adjusting the timing belt tension. If access to this tool cannot be obtained an approximate adjustment can be achieved using the method described in this Section. However it is emphasised that the vehicle should be taken to a dealer at the earliest possible opportunity to have the tension adjusted using the special tool. Do not drive the vehicle over any long distance until the belt tension has been adjusted by a dealer*

Approximate adjustment

35 No checking of timing belt adjustment is specified, and the following adjustment procedure applies to a newly fitted belt. The adjustment must be carried out with the engine cold.



4.44 Working anti-clockwise from the TDC mark on the exhaust camshaft sprocket, mark the seventh tooth on the sprocket

36 With the timing belt cover removed and the tensioner pulley bolt slackened, ensure that the TDC marks on the camshaft sprockets and the crankshaft pulley are aligned as described in paragraph 6. If necessary, turn the crankshaft to achieve alignment.

37 Have an assistant press the tensioner pulley against the belt until the belt can just be twisted through 45°, using moderate pressure with the thumb and forefinger, on the longest belt run between the exhaust camshaft sprocket and the belt idler pulley.

38 Have the assistant hold the tensioner pulley in position, and tighten the tensioner pulley bolt to the specified torque in the two stages given in the Specifications.

39 Turn the crankshaft clockwise through two complete revolutions, and check that, with the crankshaft pulley TDC mark aligned with the pointer on the rear timing belt cover, the TDC marks on the camshaft sprockets are still aligned with the notches in the camshaft cover.

40 Proceed as described in paragraphs 30 to 34, inclusive.

41 Have the belt tension adjusted by a Vauxhall dealer using the manufacturer's special tool at the earliest opportunity.

Adjustment using Vauxhall special tool (KM-666)

42 Proceed as described in paragraphs 35 and 36.

43 Fit the special tool KM-666 to the belt tensioner pulley mounting plate, in accordance with the tool manufacturer's instructions.

44 Working anti-clockwise from the TDC mark on the exhaust camshaft sprocket, mark the seventh tooth on the sprocket **(see illustration).**

45 Turn the crankshaft clockwise until this tooth is aligned with the TDC notch in the camshaft cover. The crankshaft must be turned evenly and without jerking, to prevent the timing belt from jumping off the sprockets and pulleys.

46 Tighten the tensioner pulley bolt to the specified torque in the two stages given in the Specifications.

47 Remove the special tool.

48 Turn the crankshaft clockwise until the TDC marks on the camshaft sprockets are aligned with the notches in the camshaft cover, and check that the crankshaft pulley TDC mark is aligned with the pointer on the rear timing belt cover.
49 Proceed as described in paragraphs 30 to 34 inclusive.

5 Timing belt, with automatic adjuster - removal, refitting and adjustment

Removal

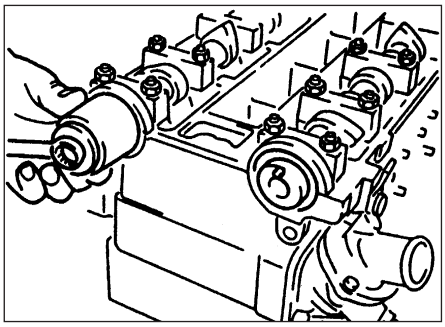
1 The operations are essentially the same as described in Section 4, except that the tensioner pulley incorporates an automatic adjuster that simplifies the procedure as follows.
2 To release the belt tension before removal, unscrew the timing belt tensioner pulley securing bolt slightly then, with a large screwdriver (or similar tool) inserted in the slot on the tensioner arm, turn the tensioner arm until the timing belt is slack. Tighten the securing bolt slightly to hold the tensioner in this position.

Refitting

3 To refit the timing belt, first ensure that the coolant pump is correctly positioned by checking that the lug on the coolant pump flange is aligned with the corresponding lug on the cylinder block. If this is not the case, slacken the coolant pump mounting bolts slightly and move the pump accordingly. Tighten the bolts to the specified torque on completion (see Chapter 3).
4 Refit the timing belt as described in Section 4, then tension it as follows.

Adjustment

5 Slacken the tensioner pulley securing bolt and move the tensioner arm anti-clockwise, until the tensioner pointer lies at its stop. Tighten the tensioner pulley securing bolt to hold the tensioner in this position.
6 Turn the crankshaft through two complete revolutions in the normal direction of rotation and check that with the crankshaft pulley TDC mark aligned with the pointer on the rear timing belt cover, the TDC marks on the camshaft sprockets are still aligned with the notches in the camshaft cover.
7 Slacken the tensioner pulley securing bolt once again and move the tensioner arm clockwise, until the tensioner pointer is aligned with the notch in the tensioner. In the first few hours of operation a new belt will be subjected to 'settling-in', (known as the running-in procedure). If you are refitting a used belt (one that has been 'run-in'), align the pointer to approximately 4 mm to the left of the notch, refer to Section 14 in Chapter 2A. Tighten the tensioner pulley securing bolt securely. Turn the crankshaft through one complete revolution in the normal direction of rotation and check that the crankshaft and camshaft timing marks still align, then refit the remainder of the components as described in Section 4.
8 With the timing belt adjustment set in this way, correct tension will always be maintained by the automatic tensioner and no further checking or adjustment will be necessary.



6.5 Using the camshaft sprocket bolt, washer, and a tube to fit a new camshaft front oil seal

6 Camshaft front oil seal - removal and refitting

Note: A *new timing belt should be used on refitting*

Removal

1 The camshaft front oil seals may be renewed with the engine in the vehicle without removing the camshafts as follows.
2 Remove the timing belt and the relevant camshaft sprocket(s), as described in Section 4.
3 Punch or drill a small hole in the centre of the now-exposed oil seal. Screw in a self-tapping screw, and pull on the screw with pliers to extract the seal.
4 Clean the oil seal seat with a wooden or plastic scraper.
5 Turn the camshaft until the locating peg for the camshaft sprocket is uppermost, then lubricate the lips of a new camshaft front oil seal with a little grease, and fit the oil seal, using a tube or socket of similar diameter with a washer and the camshaft sprocket bolt. Screw the camshaft sprocket bolt into the end of the camshaft to draw the oil seal into position on its shoulder **(see illustration)**.
6 Where applicable, repeat the procedure on the remaining camshaft oil seal.

Refitting

7 Refit the camshaft sprockets, the timing belt and tension the timing belt as described in Sections 4 and 5.

7 Camshafts - removal, inspection and refitting

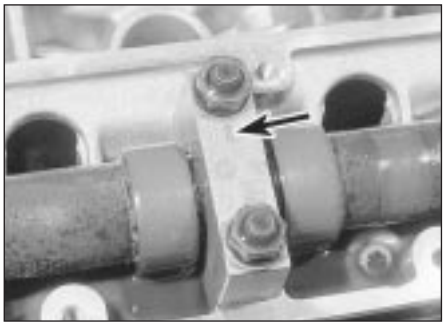
Note: A *new timing belt should be used on refitting*

Removal

1 Remove the timing belt and the relevant camshaft sprockets, as described in Section 4.
2 If the exhaust camshaft is to be removed, unscrew the two securing bolts and remove the distributor from the end of the cylinder head, referring to Chapter 5, if necessary.
3 Check the camshaft bearing caps for identification marks, and if none are present, make corresponding marks on the bearing caps and the top surface of the cylinder head using a centre punch. Note the orientation of the bearing caps before removal, as they must be refitted in exactly the same positions from which they are removed **(see illustration)**.
4 Loosen the relevant camshaft bearing cap nuts by half a turn, then loosen all the nuts by a further half turn and so on (this is necessary to slowly relieve the tension in the valve springs). Note that the exhaust camshaft rear bearing cap that also supports the distributor is secured by four nuts **(see illustration)**.
5 Remove the bearing cap nuts and the bearing caps, then carefully lift the relevant camshaft from the cylinder head without jerking.
6 Repeat the procedure for the remaining camshaft if desired.

Inspection

7 With the camshaft(s) removed, examine the bearing surfaces in the cylinder head and bearing caps for signs of obvious wear or



7.3 Camshaft bearing cap. Note position of identification mark (arrowed)

7.4 Exhaust camshaft rear bearing cap securing nuts (arrowed)

pitting. If evident, the cylinder head and all bearing caps must be renewed as a matched set, as there is no provision for refacing if the bearing caps cannot be renewed individually.
8 The camshaft(s) should show no marks or scoring on the journal or cam lobe surfaces. if evident, renew the camshaft(s).
9 It is advisable to renew the camshaft front oil seal(s) as a matter of course. Prise the old seal(s) from the front of the camshaft(s) and discard them.

Refitting

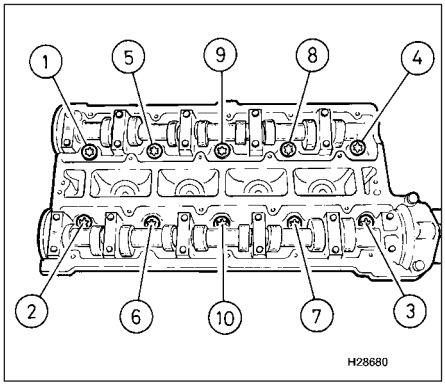
10 Begin refitting by liberally coating the contact faces of the hydraulic valve lifters and the camshaft(s) with molybdenum disulphide paste.
11 Coat the mating faces of the front and rear bearing caps with sealing compound and refit the bearing caps in their original positions as noted during removal.
12 Tighten the camshaft bearing cap nuts to the specified torque in half-turn stages, as when loosening the nuts. Note that when refitting the exhaust camshaft, the two smaller rear bearing cap securing nuts should be tightened after all the main camshaft bearing cap nuts have been tightened. Note also that the two smaller nuts should be tightened to a lower torque wrench setting than the main nuts.
13 Turn the camshaft until the locating peg for the camshaft sprocket is uppermost, then lubricate the lips of a rear camshaft front oil seal with a little grease, and fit the oil seal, using a tube or socket of similar diameter with a washer and the camshaft sprocket bolt. Screw the camshaft sprocket bolt into the end of the camshaft to draw the oil seal into position on its shoulder.
14 Repeat the procedure for the remaining camshaft.
15 Refit the distributor with reference to Chapter 5. Fit a new timing belt and the camshaft sprockets, then adjust the timing belt as described in Section 4 or 5, as applicable.

8 **Cylinder head** - removal and refitting (engine in vehicle)

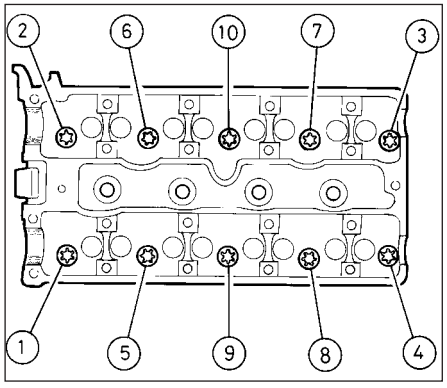
Note: *The engine must be cold when the cylinder head is removed.* **Do not** *remove the cylinder head from a hot engine. New cylinder head bolts, a new cylinder head gasket and a new timing belt must be used on refitting.*
The torque settings (as shown in Chapter 2A) are only applicable to latest specification head bolts, available from Vauxhall. Earlier type or alternative make, head bolts may require different torques. Consult your supplier

Removal

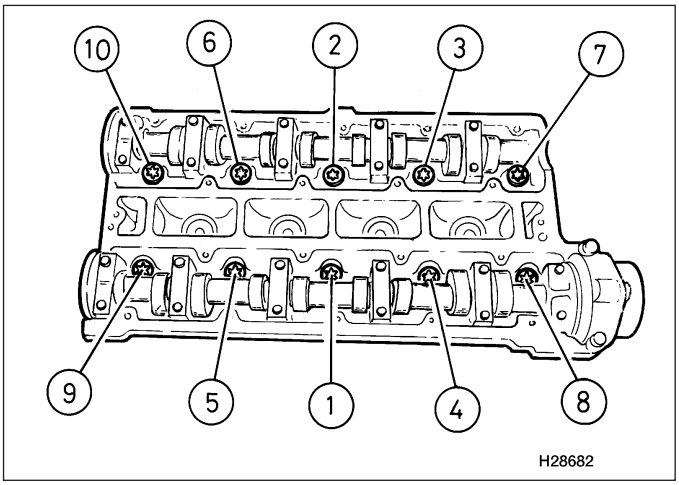
1 Disconnect the battery negative lead.
2 Drain the cooling system, as described in Chapter 3.
3 Remove the front section of the exhaust system, as described in Chapter 4C.
4 The cylinder head can be removed complete with the inlet manifold, or the inlet manifold can be detached from the cylinder head before removal, with reference to Chapter 4B. If no work is to be carried out on the inlet manifold, it can be unbolted from the cylinder head and supported to one side out of the way, thus avoiding the need to disconnect the relevant hoses, pipes and wiring.
5 If the cylinder head is to be removed complete with the inlet manifold, disconnect all relevant hoses, pipes and wiring from the inlet manifold and associated components, referring to Chapter 4B, and unbolt the manifold support bracket from the manifold. Loosen the alternator mountings with reference to Chapter 5, then unbolt the upper alternator mounting from the inlet manifold.
6 If the inlet manifold is to be left in the engine compartment, continue as follows, otherwise go on to paragraph 17.
7 Disconnect the wiring plug from the airflow meter, and the breather hose from the air box on the throttle body. Disconnect the air cleaner trunking and remove the airflow meter/air box assembly from the throttle body. Refer to Chapter 4B if necessary.
8 Disconnect the end of the throttle cable from the throttle valve lever, then unbolt the throttle cable support bracket and remove it from the inlet manifold.
9 Unscrew the two earth lead securing nuts from the fuel rail (one at each end of the rail) and disconnect the three earth leads.
10 Disconnect the wiring plug from the throttle position switch.
11 Pull up on the wiring harness housing, and disconnect the wiring plugs from the fuel injectors by compressing the retaining clips. Move the wiring harness housing to one side.
12 Disconnect the two breather hoses from the rear of the camshaft cover.
13 Loosen the alternator mountings, with reference to Chapter 5, then unbolt the upper alternator mounting from the inlet manifold.
14 Unbolt the manifold support bracket from the manifold.
15 Make a final check to ensure that all necessary hoses, pipes and wires have been disconnected, then unscrew the securing nuts and lift the inlet manifold from the cylinder head. Ensure that the manifold is properly supported, taking care not to strain any of the hoses, pipes and wires, etc., which are still connected.
16 Recover the manifold gasket from the cylinder head.
17 Remove the timing belt, camshaft sprockets, and timing belt tensioner and idler pulleys, as described in Section 4.
18 Unscrew the upper and middle studs for the timing belt outer cover screws. Note that the upper stud simply unscrews from the cylinder head, but the middle stud is secured by a bolt.
19 Unscrew the two upper rear timing belt cover securing bolts from the cylinder head.
20 Remove the distributor cap and HT leads with reference to Chapter 5.
21 Disconnect the distributor wiring plug.
22 Disconnect the coolant hose from the left-hand end of the cylinder head.
23 Unscrew the bolt securing the crankcase breather tube bracket to the end of the cylinder head.
24 Disconnect the radiator top hose from the thermostat housing, and disconnect the wiring plugs from the temperature gauge sender and the coolant temperature sensor (both situated in the thermostat housing).
25 Make a final check to ensure that all relevant hoses, pipes and wires have been disconnected.
26 On X20 XEV models, remove the camshaft, as described in Section 7.
27 Using a Torx socket, and working in the order shown **(see illustrations)**, loosen all the cylinder head bolts by a quarter of a turn, then loosen all the bolts by half a turn, and finally loosen and remove the bolts. Recover the washers. Note that the loosening sequence on X20 XEV differs to other DOHC engines.
28 Lift the cylinder head from the cylinder block. If necessary, tap the cylinder head gently with a soft-faced mallet to free it from the block, but do not lever at the mating faces. Note that the cylinder head is located on dowels.



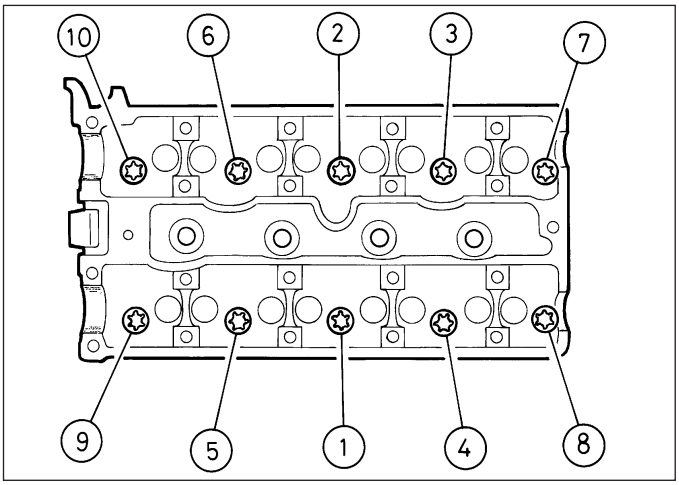
8.27A Cylinder head bolt loosening sequence - (20 XEJ and C 20 XE engines)



8.27B Cylinder head bolt loosening sequence - (X 20 XEV engines)



8.36A Cylinder head bolt tightening sequence - 20 XEJ and C 20 XE engines



8.36B Cylinder head bolt tightening sequence - X 20 XEV engines

29 Recover the cylinder head gasket and discard it.

30 Clean the cylinder head and block mating faces by careful scraping. Take care not to damage the cylinder head, which is made of light alloy and is easily scored. Cover the coolant passages and other openings with masking tape or rag, to prevent dirt and carbon falling in. Mop out all the oil from the bolt holes; if oil is left in the holes, hydraulic pressure could crack the block when the bolts are refitted.

31 If desired, the cylinder head can be dismantled and inspected as described in Section 10.

Refitting

32 Begin refitting by locating a new gasket on the block so that the word "OBEN" or "TOP" is uppermost at the timing belt end of the engine.

33 With the mating faces scrupulously clean, locate the cylinder head on the block so that the positioning dowels engage in their holes.

34 Temporarily refit the crankshaft pulley and the camshaft sprockets, and ensure that the timing marks are still positioned as they were before the timing belt was removed (see Section 4).

35 Fit the new cylinder head bolts, ensuring that the washers are in place under their heads, and screw the bolts in by hand as far as possible.

36 Tighten the bolts in the order shown **(see illustrations)**. Note that the tightening sequence on X20 XEV differs to other DOHC engines. Tighten the bolts in the four stages given in the Specification (see Chapter 2A, as 2.0 litre) - i.e. tighten all bolts to the Stage 1 torque, then tighten all bolts to Stage 2 and so on **(see illustrations)**.

37 Further refitting is a reversal of the removal procedure, remembering the following points.

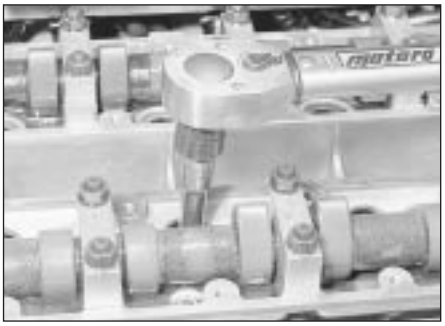
38 Refit the timing belt tensioner and idler pulleys, camshaft sprockets and a new timing belt as described in Section 4, and tension the timing belt as described in Sections 4 and 5.

39 Where applicable, refit the inlet manifold to the cylinder head with reference to Chapter 4B, using a new gasket.

40 Refit the front section of the exhaust system as described in Chapter 4C, using a new gasket.

41 Refit the upper alternator mounting to the inlet manifold (where applicable), then adjust the alternator drivebelt tension, as described in Chapter 5.

42 Refill the cooling system, (Chapter 3).



8.36C Tighten the cylinder head bolts to the specified torque . . .

8.36D . . .and then through the specified angle

43 On completion, check that all relevant hoses, pipes and wires, etc., have been reconnected.

44 When the engine is started, check for signs of leaks.

45 Once the engine has reached normal operating temperature, check and if necessary adjust the mixture (where applicable) with reference to Chapter 4B.

9 Cylinder head - removal and refitting (engine removed)

Note: *New cylinder head bolts, a new cylinder head gasket, and a new timing belt must be used on refitting.*

The torque settings (as shown in Chapter 2A) are only applicable to latest specification head bolts, available from Vauxhall. Earlier type or alternative make, head bolts may require different torques. Consult your supplier.

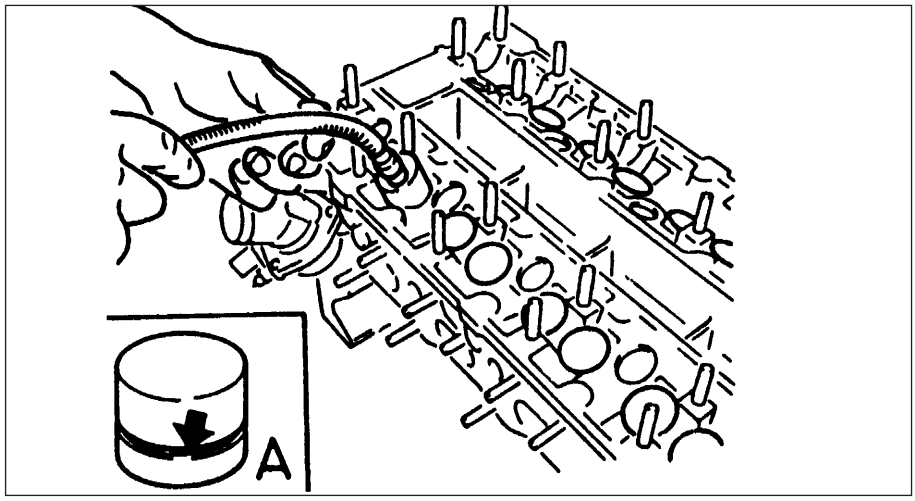
Warning: The exhaust valves fitted to 20 XEJ and C 20 XE models are fitted with sodium to improve their heat transfer. Sodium is a highly reactive metal, which will ignite or explode spontaneously on contact with water (including water vapour in the air). These must NOT be disposed of with ordinary scrap. Seek advice from a Vauxhall dealer or your Local Authority, if the valves are to be disposed.

Removal

1 The cylinder head can be removed complete with the inlet manifold, or the inlet manifold can be detached from the cylinder head before removal, with reference to Chapter 4B.

2 Proceed as described in Section 8, paragraphs 17 to 19 inclusive.

3 If not already done, remove the distributor cap and HT leads, referring to Chapter 5.



10.5 Remove the hydraulic valve lifters using a rubber plunger. Inset (A) shows valve lifter upright, with oil groove (arrowed) at bottom

4 Unscrew the bolt securing the crankcase breather tube bracket to the end of the cylinder head.
5 Make a final check to ensure that all relevant hoses, pipes and wires have been disconnected.
6 Continue as described in Section 8, paragraphs 26 to 31.

Refitting

7 Proceed as described in Section 8, paragraphs 32 to 38 inclusive but in addition note the following.
8 On completion, check that all relevant hoses, pipes and wires, etc., have been reconnected.

10 Cylinder head - dismantling and reassembly

Dismantling

1 With the cylinder head removed as described in Section 8, clean away all external dirt.
2 If not already done, remove the thermostat housing and thermostat as described in Chapter 3, and remove the manifolds as described in Chapters 4B and 4C.
3 Remove the spark plugs (if not already done), and remove the distributor with reference to Chapter 5.
4 Remove the camshafts as described in Section 7.
5 Remove the hydraulic valve lifters from their bores using a rubber suction plunger tool - do not invert the cylinder head to remove the valve lifters. Keep the valve lifters upright at all times (oil groove at bottom **(see illustration)**), and immerse them in order of removal in a container of clean engine oil until they are to be refitted.
6 To remove the valve components, continue as described in Chapter 2A, Section 22, paragraphs 3 to 7 inclusive.
7 The cylinder head and valves can be inspected for wear and damage as described in Chapter 2A, Section 23.

Reassembly

8 With all components cleaned, refit the valve components as described in Chapter 2A, Section 22, paragraphs 10 to 19 inclusive.
9 Refit the hydraulic valve lifters to the cylinder head in their original positions. Liberally oil the valve lifter bores, and if new lifters are being fitted, initially immerse each one in a container of clean engine oil and compress it (by hand) several times to charge it.
10 Refit the camshafts, as described in Section 7.
11 Refit the spark plugs if desired, and refit the distributor with reference to Chapter 5.
12 Where applicable, refit the manifolds and/or the thermostat and housing.
13 Refit the cylinder head, as described in Sections 8 and 9, as applicable.

11 Valve lifters - general

Although the valve lifters on these engines cannot be dismantled they should be carefully inspected for obvious signs of wear on the contact faces. Also check the valve lifter oil holes for obstructions and for any signs of oil sludge build-up. If excessive wear is evident (this is unlikely), all the valve lifters must be renewed as a set.

12 Crankshaft front oil seal - renewal

1 The procedure is similar to SOHC models (see Chapter 2A), noting the following points.
2 The spacer ring (if fitted), from the end of the crankshaft, must be removed, before refitting.
3 After fitting the new seal, coat the oil pump mating face of the spacer ring with sealing compound, then push the spacer ring onto the end of the crankshaft, until it is seated against the oil pump.
4 The timing belt should be renewed.
5 Refit the rear timing belt cover and the timing belt, as described in Section 4. Adjust it as described in Section 4 and 5.

13 Sump - removal and refitting

***Note**: Sump gaskets, cannot be reused. Ensure that new gaskets are obtained before removing the sump*

Removal

1 The procedure is similar to SOHC models (see Chapter 2A), with the following variations.
2 The engine undershield must be removed.
3 Remove both the cork gaskets and clean all sealing surfaces, scrupulously.

Refitting

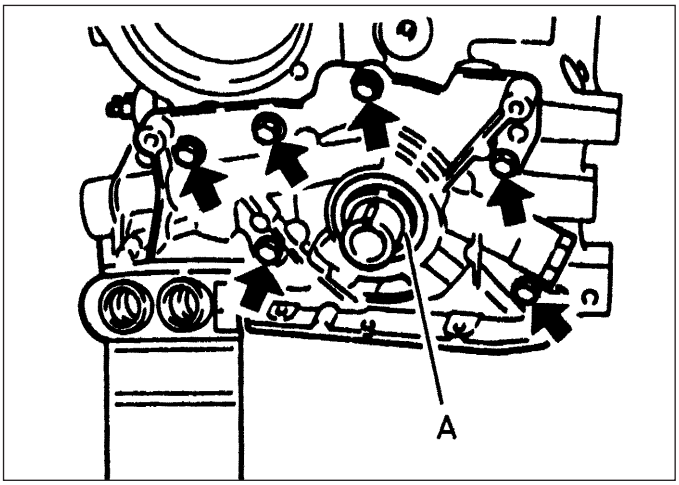
4 Locate a new gasket on the cylinder block, if necessary applying a little sealing compound to hold it in place.
5 Locate the remaining new gasket on the sump baffle, but do not use sealing compound.

14 Oil pump - removal and refitting

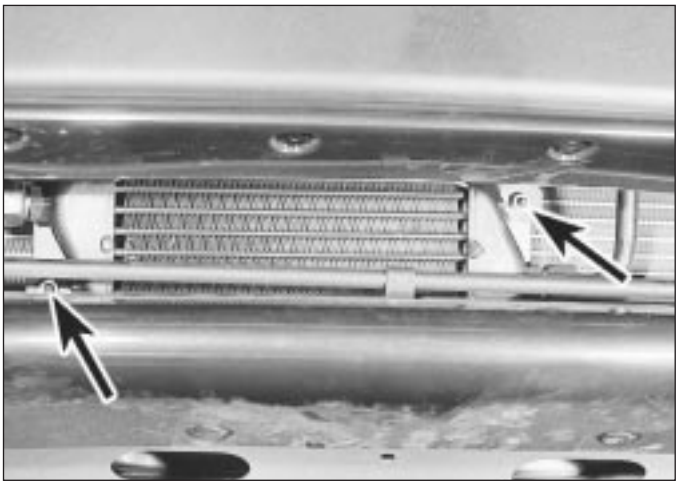
Removal

1 Apart from the following variations, the procedure is the same as for SOHC models.
2 If the engine is still in the vehicle, disconnect the oil cooler pipe unions from the oil pump, and move the pipes to one side out

14.2 Oil cooler pipe unions at oil pump



14.3 Oil pump securing bolts (arrowed) and crankshaft spacer ring (A)



15.1 Oil cooler viewed through front spoiler. Securing nuts arrowed

of the way **(see illustration)**.

3 Remove the spacer ring from the end of the crankshaft **(see illustration)**.

Refitting

4 Coat the oil pump mating face of the spacer ring with sealing compound, then push the spacer ring onto the end of the crankshaft until it is seated against the oil pump.

5 The timing belt should be renewed, see Sections 4 and 5, for details.

6 Remember also to reconnect the oil cooler pipes to the oil pump, and tighten the unions.

15 Oil cooler - removal and refitting

Removal

1 To gain sufficient access to remove the oil cooler, the radiator must be removed (as described in Chapter 3). Alternatively, the front bumper can be removed, as described in Chapter 11 **(see illustration)**.

2 With the appropriate component(s) removed for access, unscrew the oil cooler pipe unions from the oil cooler. Be prepared for oil spillage, and plug the open ends of the pipes, to prevent further oil leakage and dirt ingress.

3 Unscrew the two securing nuts, and withdraw the oil cooler from its mounting brackets.

Refitting

4 Refitting is a reversal of removal, but on completion, check and if necessary top-up the engine oil level, as described in Chapter 1.

BUSCANOS EN YOUTUBE Y FACEBOOK

COMO:

FULL MOTORES CHECK

Chapter 3
Cooling, heating and ventilation 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

System type	Pressurised, with remote expansion tank. Coolant pump driven by timing belt

Coolant

Type/specification (all models)	See *Lubricants and fluids* in "*Weekly checks*"
Capacity	See Chapter 1 Specifications

Thermostat

Starts to open at (all models)	92°C
Fully open at (all models)	107°C
Operating temperature (approx.)	80°C

Expansion tank cap

Opening pressure (all models)	1.20 to 1.35 bar
Boiling point	125°C

Cooling fan switch

Switches on at (all models)	100°C
Switches off at (all models)	95°C

Torque wrench settings

	Nm	lbf ft
Coolant pump bolts:		
1.4 and 1.6 litre models (except C16 NZ2), (M6)	8	6
C16 NZ2, 1.8 and 2.0 litre models (M8)	25	18
Oil pipes to radiator	22	16
Outlet to thermostat housing, C16 NZ2, 1.8 and 2.0 litre models	8	6
Temperature sender	10	7
Temperature sensor	11	8
Thermostat housing to cylinder head:		
1.4 and 1.6 litre models (except C16 NZ2)	10	7
C16 NZ2, 1.8 and 2.0 litre models	15	11

1 General description

HAYNES HiNT ***When renewing any hoses, use a little soapy water as a lubricant, or soften the hose in hot water. Do not use oil or grease, as this may attack the rubber.***

Engine cooling is achieved by a conventional pump-assisted system, in which the coolant is pressurised. The system consists of a radiator, a coolant pump driven by the engine timing belt, an electric cooling fan, a thermostat, an expansion tank, and connecting hoses. Hoses also carry coolant to and from the heater matrix, which provides heat for the ventilation and heating system.

The system works in the following way. Cold coolant from one side of the radiator, which is mounted at the front of the engine compartment, passes to the coolant pump, which forces the coolant through the coolant passages in the cylinder block and cylinder head. The coolant absorbs heat from the engine, and then returns to the radiator through the heater matrix. As the coolant flows across the radiator it is cooled, and the cycle is repeated.

Air flows through the radiator, to cool the coolant as a result of the vehicle's forward motion. However, if the coolant temperature exceeds a given figure, a temperature-sensitive switch in the radiator switches on the electric fan, to increase the airflow through the radiator. The fan only operates when necessary, with a consequent reduction in noise and energy consumption.

To reduce the time taken for the engine to warm up when starting from cold, the thermostat, located in the cylinder head outlet, prevents coolant flowing to the radiator until the temperature has risen sufficiently. Instead, the outflow from the cylinder head bypasses the radiator, and is redirected around the engine. When the temperature reaches a given figure, the thermostat opens, to allow coolant to flow to the radiator. The thermostat is operated by the expansion of a temperature sensitive wax capsule.

An expansion tank is incorporated in the system, to allow for coolant expansion. The system is topped up through a filler cap on the expansion tank.

Note that later models may be fitted with self-tensioning spring clamps to secure the cooling system (including heater) hoses. These clamps can be released by squeezing together their free ends using a large pair of self-grip pliers or similar so that the clamp can be moved up the hose, clear of the union. Check that the clamp is securely seated, and check for leaks on reassembly.

2 Cooling system - draining

1 With the vehicle parked on level ground, remove the expansion tank filler cap. If the engine is warm, cover the filler cap with a thick cloth, and unscrew the cap slowly, to gradually relieve the system pressure. Take care to avoid scalding by steam or coolant escaping from the pressurised system.

2 On DOHC models, remove the engine undershield, with reference to Chapter 11.

3 Position a container beneath the radiator bottom hose connection, then slacken the hose clip and ease the hose from the radiator stub. If the hose joint has not been disturbed for some time, it will be necessary to manipulate the hose to break the joint. Allow the coolant to drain into the container.

4 As no cylinder block drain plug is fitted, and the radiator bottom hose may be situated halfway up the radiator, the system cannot be drained completely. Care should therefore be taken when refilling the system to maintain antifreeze strength.

5 If the coolant has been drained for a reason other than renewal, then provided it is clean and less than two years old, it can be re-used.

6 If the coolant has been drained for renewal, and is badly contaminated, the coolant system should be flushed as described in Section 4. As the system cannot be drained completely, it is advisable to flush the system whenever the coolant is renewed, to minimise the impurities remaining in the system.

3 Cooling system - flushing

1 If coolant renewal has been neglected, or if the antifreeze mixture has become diluted, then in time the cooling system will gradually lose efficiency, as the coolant passages become restricted due to rust, scale deposits and other sediment. To restore coolant system efficiency, it is necessary to flush the system clean.

2 The radiator should be flushed independently of the engine, to avoid unnecessary contamination.

3 To flush the radiator, disconnect the top hose at the radiator, then 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 (the bottom hose should have been disconnected to drain the system). If after a reasonable period, the water still does not run clear, the radiator can be flushed with a good proprietary cleaning agent. It is important that the manufacturer's instructions are followed carefully. If the contamination is particularly bad, insert the hose in the radiator bottom outlet, and flush the radiator in reverse.

4 To flush the engine, continue as follows.

1.4 and 1.6 litre models (except C16 NZ2)

5 Remove the thermostat as described in Section 9, then temporarily refit the thermostat cover.

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

7 On completion of flushing, refit the thermostat, and reconnect the hoses.

C16 NZ2, 1.8 and 2.0 litre models

8 Remove the thermostat and cover assembly, as described in Section 9.

9 With the radiator bottom hose disconnected from the radiator, insert a garden hose into the radiator bottom hose. Direct a flow of clean water through the engine, and continue flushing until clean water emerges from the thermostat housing. It is advisable to place a sheet of plastic under the thermostat housing to deflect water away from the engine and surrounding components during the flushing process.

10 On completion of flushing, refit the thermostat and cover assembly, reconnect the hoses and remove the sheet of plastic.

4 Cooling system - filling

1 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 alloy engine components - refer to Section 5.

2 On 1.4 and 1.6 litre models (except C16 NZ2), disconnect the wire and unscrew the coolant temperature sender from the inlet manifold.

3 Remove the expansion tank cap, and fill the system by slowly pouring the coolant into the expansion tank to prevent air locks from forming.

4 If the coolant is being renewed, begin by pouring in a couple of pints of water, followed by the correct quantity of antifreeze (see Section 5), then top-up with more water.

5 On 1.4 and 1.6 litre models (except C16 NZ2), refit the coolant temperature sender when coolant free of air bubbles emerges from the orifice in the inlet manifold.

6 Top-up the coolant level to the "COLD" (or "KALT") mark on the expansion tank, then refit the expansion tank cap.

7 Start the engine and run it until it reaches normal operating temperature, then stop the engine and allow it to cool.

8 Check for leaks, particularly around disturbed components. Check the coolant

level in the expansion tank, and top-up if necessary. Note that the system must be cold before an accurate level is indicated in the expansion tank. If the expansion tank cap is removed while the engine is still warm, cover the cap with a thick cloth and unscrew the cap slowly, to gradually relieve the system pressure. Take care to avoid scalding by steam or coolant escaping from the pressurised system.

9 On DOHC models, refit the engine undershield on completion.

5 Coolant mixture - general

1 It is important to use an antifreeze mixture in the cooling system all year round, to prevent corrosion of the alloy engine components. The coolant mixture should be made up from clean, preferably soft, tap water, and a good quality antifreeze containing corrosion inhibitor. Ensure that the antifreeze is ethylene glycol based, as the cheaper methanol based types evaporate over a period of time.

2 The proportions of water and antifreeze used will depend on the degree of protection required. A coolant mixture containing 25% antifreeze should be regarded as the minimum strength required to maintain good anti-corrosion properties. Details of the degree of protection provided against freezing will be supplied with the antifreeze by the manufacturers. For absolute protection, use a 50% antifreeze mixture.

3 The coolant mixture should be renewed every two years, as the corrosion inhibitors will deteriorate with time.

4 Before filling the system with fresh coolant, drain and flush the system, as described in Sections 2 and 3, and check that all hoses are secure and that the clips are tight. Antifreeze has a searching action, and will leak more rapidly than plain water.

5 Refill the system as described in Section 4. All future topping-up should be carried out using a coolant mixture of the same proportions as that used to initially fill the system.

6 Do not use antifreeze in the windscreen wash system, as it will attack the vehicle paintwork. Note that antifreeze is poisonous, and must be handled with due care.

6.6 Compressing a radiator securing clip - 2.0 litre SOHC model

6 Radiator (manual transmission) - removal and refitting

Removal

1 The radiator can be removed complete with the coolant fan and shroud if there is no need to disturb the fan. If desired, the fan and its shroud can be removed from the radiator, with reference to Section 12.

2 Drain the cooling system, as described in Section 2.

3 Disconnect the radiator top hose and the expansion tank at the radiator.

4 Disconnect the battery negative lead, then disconnect the wiring from the cooling fan switch, located at the bottom right-hand side of the radiator.

5 Disconnect the cooling fan wiring connector, noting its location for use when refitting.

6 Compress and remove the two radiator securing clips, located at the top corners of the radiator **(see illustration)**.

7 Pull the top of the radiator back towards the engine to free it from the top mountings, then lift the radiator to disengage the lower securing lugs. Move the radiator clear of the vehicle, taking care not to damage the cooling fins **(see illustrations)**.

Refitting

8 The radiator can be inspected and cleaned as described in Section 8.

9 Refitting is a reversal of removal, bearing in mind the following points.

10 Ensure that the radiator rubber mountings are in good condition and renew if necessary, and ensure that the lower securing lugs engage correctly as the radiator is refitted.

11 Refill the cooling system, (Section 4).

7 Radiator (automatic transmission) - removal and refitting

Removal

1 On models with automatic transmission, the radiator left-hand side tank incorporates a heat exchanger to cool the transmission fluid. It is connected to the transmission by a pair of flexible hoses, with a metal pipe at each end.

2 When removing the radiator, either clamp the transmission fluid cooler flexible hoses, or slacken their clamps, work them off their unions and swiftly plug or cap each hose end and union to minimise the loss of fluid and to prevent the entry of dirt.

Refitting

3 On refitting, reverse the removal procedure and do not forget to check the transmission fluid level, topping-up as necessary to replace the lost fluid, as described in Chapter 7B.

6.7A Radiator freed from top right-hand mounting - 1.6 litre model

6.7B Withdrawing the radiator - 2.0 litre SOHC model

9.6 Remove the thermostat housing . . .

9.7 . . .and withdraw the thermostat - 1.6 litre model

9.15A Withdraw the thermostat cover complete with thermostat . . .

8 Radiator - inspection and cleaning

1 If the radiator has been removed due to suspected blockage, reverse-flush it as described in Section 3.
2 Clean dirt and debris from the radiator fins, using an air jet or a soft brush. Take care, as the fins are easily damaged and are sharp.
3 If necessary, a radiator specialist can perform a "flow test" on the radiator, to establish whether an internal blockage exists.
4 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.
5 In an emergency, minor leaks from the radiator can be cured by using a radiator sealant.

9 Thermostat - removal and refitting

Note: *A new O-ring should be used when refitting the thermostat*

1.4 and 1.6 litre models (except C16 NZ2)

Removal

1 Partially drain the cooling system, as described in Section 2.
2 Remove the timing belt and the camshaft sprocket, as described in Chapters 2A or 2B, (as applicable).
3 Unscrew and remove the two upper bolts securing the rear timing belt cover to the cylinder head, and the lower right-hand bolt securing the cover to the cylinder block.
4 Disconnect the coolant hose from the thermostat housing.
5 Pull the rear timing belt cover forwards, away from the cylinder head, for access to the two thermostat housing securing bolts.
6 Unscrew and remove the two thermostat housing securing bolts, and lift off the thermostat housing **(see illustration)**.
7 Withdraw the thermostat from the cylinder head, noting that coolant may be released from the radiator bottom outlet as the thermostat is withdrawn, even though the cooling system has been partially drained **(see illustration)**.
8 Remove the sealing ring from the edge of the thermostat.
9 If desired, the thermostat can be tested, as described in Section 10.

Refitting

10 Refitting is a reversal of removal, using a new sealing ring, and bearing in mind the following points.
11 Refit the camshaft sprocket and timing belt, and tension the timing belt, as described in Chapters 2A or 2B.
12 Refill the cooling system, (Section 4).

C16 NZ2, 1.8 and 2.0 litre models

Removal

13 Remove the engine undershield, if fitted. Partially drain the cooling system, as described in Section 2.
14 Disconnect the radiator top hose from the thermostat cover.
15 Unscrew and remove the thermostat cover securing bolts, and withdraw the cover complete with thermostat. Recover the O-ring **(see illustrations)**.
16 If desired, the thermostat can be tested, as described in Section 10.
17 Note that if it is necessary to renew the thermostat, the complete cover and thermostat must be renewed as an assembly, as the two cannot be separated.

10.2 View of thermostat showing opening temperature markings - 1.6 litre model

9.15B . . .and recover the O-ring - 2.0 litre SOHC model

Refitting

18 Refitting is a reversal of removal, but use a new O-ring, and on completion refill the cooling system, as described in Section 4.

10 Thermostat - testing

1 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.
2 If a thermometer is available, the precise opening temperature of the thermostat may be determined, and compared with the figures given in the Specifications. The opening temperature is also marked on the thermostat **(see illustration)**.
3 A thermostat that fails to close as the water cools must also be renewed.

11 Coolant pump - removal and refitting

SOHC models

Removal

1 If the engine is in the vehicle, drain the cooling system, as described in Section 2.
2 On 1.4 and 1.6 litre models (except C16 NZ2), remove the rear timing belt cover. On

11.4 Coolant pump securing bolt (arrowed) - 2.0 litre SOHC model

C16 NZ2, 1.8 and 2.0 litre models, remove the timing belt. Details are as described in Chapter 2A.

3 Remove timing belt tension roller from oil pump, where applicable.

4 Unscrew and remove the coolant pump securing bolts **(see illustration)**.

5 Withdraw the coolant pump from the cylinder block, and recover the O-ring **(see illustrations)**. It may be necessary to tap the pump lightly with a plastic-faced hammer to free it from the cylinder block.

6 If desired, the rear timing belt cover can be removed from the pump by rotating the cover to release it from the flange on the pump.

7 No overhaul of the coolant pump is possible, and if faulty, the unit must be renewed.

Refitting

8 Refitting is a reversal of removal, bearing in mind the following points.

9 Use a new O-ring when refitting the pump. Before refitting the pump, smear the pump mounting face in the cylinder block and the O-ring with a silicone grease or petroleum jelly.

10 Do not fully tighten the pump securing bolts until the timing belt has been fitted and tensioned.

11 Refit and tension the timing belt, as described in Chapter 2A.

12 If the engine is in the vehicle, refill the cooling system, as described in Section 4.

DOHC models

Removal

13 Remove the engine undershield.

14 If the engine is in the vehicle, drain the cooling system, as described in Section 2.

15 Remove the timing belt, camshaft sprockets, crankshaft sprocket, timing belt tensioner and idler rollers, and the timing belt rear cover, as described in Chapter 2B.

16 Proceed as described in paragraphs 4 and 5.

17 No overhaul of the coolant pump is possible, and if faulty, the unit must be renewed.

Refitting

18 Refitting is a reversal of removal, bearing in mind the following points.

11.5A Withdraw the coolant pump . . .

11.5B . . .and recover the O-ring - 2.0 litre SOHC model

19 Always use a new O-ring. Before fitting the pump, smear the pump mating face in the cylinder block and the O-ring with a silicone grease or petroleum jelly.

20 Refit the pump, and ensure that the lugs on the pump and the cylinder block are aligned before tightening the pump securing bolts **(see illustration)**.

21 Refit the remaining components, and tension the timing belt, as described in Chapter 2B.

22 If the engine is in the vehicle, refill the cooling system, as described in Section 4. Replace the undershield.

12 Cooling fan - removal and refitting

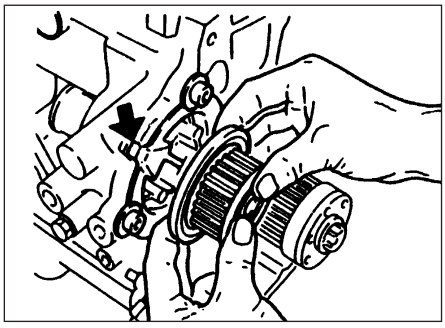
Removal

1 Disconnect the battery negative lead.

2 Disconnect the wiring from the cooling fan, noting the location of the wiring connector for use when refitting.

3 Unscrew the two upper fan shroud securing bolts from the top corners of the shroud, then tilt the assembly back slightly towards the engine, and withdraw it upwards away from the radiator **(see illustration)**.

4 To separate the fan motor from the shroud, unscrew the three securing nuts. If desired, the fan blades can be separated from the motor by removing the securing spring clip from the end of the motor shaft.



11.20 Lugs (arrowed) on coolant pump and cylinder block must be aligned - DOHC models

5 No spare parts are available for the motor, and if the unit is faulty, it must be renewed.

Refitting

6 Reassembly (where applicable), and refitting are reversals of the dismantling and removal procedures, but ensure that the lower end of the fan shroud locates correctly on the radiator.

7 On completion, start the engine and run it until it reaches normal operating temperature, then continue to run the engine and check that the cooling fan cuts in and functions correctly.

13 Expansion tank and coolant level sensor - removal and refitting

Expansion tank

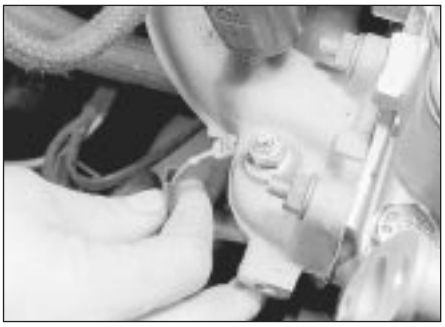
Removal

1 The expansion tank is secured by a single screw at its front edge. If the tank is to be moved for access purposes, it should be possible to move it sufficiently within the confines of the hoses once the securing screw has been removed. If the tank is to be removed completely, continue as follows.

2 Disconnect the two hoses from the top of the expansion tank, and suspend them above the height of the engine to prevent coolant loss.

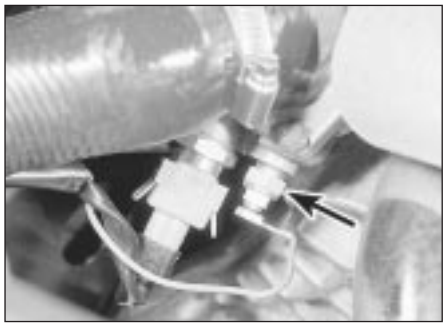
3 Remove the tank securing screw, then manipulate the tank from its location, holding it as high as possible above the engine.

12.3 Withdrawing the fan shroud assembly - 2.0 litre SOHC model



14.1A Disconnecting the wiring from the temperature gauge sender - 1.6 litre model

14.1B Temperature gauge sender location (arrowed) - 2.0 litre SOHC model



14.1C Temperature gauge sender location (arrowed) - 2.0 litre DOHC model

4 Position a container beneath the tank, then disconnect the bottom hose and allow the contents of the tank to drain into the container. Suspend the bottom hose as high as possible above the engine to prevent coolant loss.

Refitting

5 Refitting is a reversal of removal, but on completion check and if necessary top-up the coolant level, as described in Section 4. The coolant drained from the expansion tank during removal can be re-used, provided it has not been contaminated.

Coolant level sensor

6 The coolant level sensor, where fitted, is an integral part of the expansion tank cap. If the level sensor is faulty, the complete cap assembly must be renewed.

14 Temperature gauge sender - removal and refitting

Removal

1 The sender is screwed into the inlet manifold on 1.4 and 1.6 litre models (except C16 NZ2), and into the thermostat housing on C16 NZ2, 1.8 and 2.0 litre models **(see illustrations)**.
2 Partially drain the cooling system, as described in Section 2, to minimise coolant spillage.
3 Disconnect the battery negative lead.
4 Disconnect the wiring from the switch, then unscrew the switch from its location.

Refitting

5 Refitting is a reversal of removal, remembering the following points.
6 Coat the sender threads with sealant before fitting.
7 Top-up the cooling system, as described in Section 4.
8 On completion, start the engine and check the operation of the temperature gauge. Also check for coolant leaks.

15 Cooling fan switch - removal and refitting

Note: *A new sealing ring should be used when refitting the switch*

Removal

1 The cooling fan switch is located at the bottom right-hand corner of the radiator **(see illustration)**.
2 If a faulty switch is suspected, the circuit to the fan motor can be tested by temporarily bridging the terminals in the switch wiring plug, and switching on the ignition. If the cooling fan now operates, the switch is faulty and should be renewed. To remove the switch, continue as follows.
3 Disconnect the battery negative lead, then disconnect the switch wiring plug if not already done.
4 Drain the cooling system, as described in Section 2.
5 Unscrew the switch from the radiator and recover the sealing ring.

Refitting

6 Refitting is a reversal of removal, but use a new sealing ring, and refill the cooling system as described in Section 4.
7 On completion, start the engine and run it until it reaches normal operating temperature, then continue to run the engine and check that the cooling fan cuts in and functions correctly.

16 Heater control panel - removal and refitting

Removal

1 Disconnect the battery negative lead.
2 Remove the passenger side footwell trim, the steering column shrouds, and the instrument panel lower and upper trim panels, as described in Chapter 11.
3 Remove the clock or trip computer, as applicable, from the facia, referring to Chapter 12 if necessary.
4 Remove the two heater control panel securing screws from the clock/trip computer aperture, and the remaining securing screw from the right-hand end of the panel (exposed by removing the instrument panel lower trim panel), **(see illustrations)**.

15.1 Cooling fan switch location - 2.0 litre SOHC model viewed from below

16.4A Remove the two heater control panel securing screws from the clock/trip computer aperture . . .

16.4B . . . and the remaining screw from the right-hand end of the panel

16.5 Heater control cables disconnected, showing cable end securing clips

5 Working through the passenger footwell, reach up behind the facia, and disconnect the bowden cables from the control levers at the rear of the heater control panel. Note that each cable is secured by a plastic clip, and in some cases, by an additional metal clip, which must be released before the cable end can be disconnected from the control lever **(see illustration)**. This is a tricky operation, and some patience will be required. Mark the cables to ensure that they are refitted in their original positions.
6 Withdraw the heater control panel from the facia, and disconnect the wiring plugs from the rear of the panel.

Refitting

7 Refitting is a reversal of removal, but on completion, move all the control levers through their full extent of travel, and check the heater mechanism for correct operation.

17 Heater matrix - removal and refitting

Removal

1 Drain the cooling system, (Section 2).
2 Working in the engine compartment, disconnect the coolant hoses from the heater matrix pipes at the bulkhead.
3 Working inside the vehicle, remove the front centre console section, (Chapter 11).
4 Extract the two front and two rear securing screws, and remove the plastic cover from under the heater matrix **(see illustration)**.

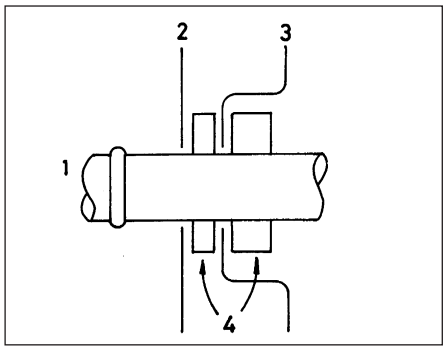
17.4 Removing the plastic cover from the heater matrix

5 Remove the two front retaining screws from the heater matrix securing straps, then lower the securing straps and withdraw the heater matrix from the facia **(see illustration)**. The pipes at the rear of the matrix must be fed through the bulkhead, and the grommets in the heater matrix housing may be displaced as the matrix is withdrawn. Where applicable, recover the grommets.

Refitting

6 Refitting is a reversal of removal, remembering the following points.
7 Ensure that the coolant pipe grommets are seated correctly in the heater matrix housing, as shown **(see illustration)**.
8 Ensure that the rubber mounting strips are correctly seated between the mounting straps and the matrix.
9 On completion, refill the cooling system, as described in Section 4.

17.5 Unscrewing a heater matrix securing strap screw



17.7 Heater matrix coolant pipe grommet location

1 Coolant pipe
2 Engine compartment bulkhead
3 Heater matrix housing
4 Grommet

18 Heater blower motor - removal and refitting

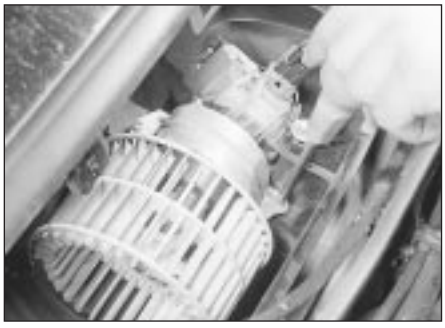
Removal

1 The heater blower motor is situated under the windscreen cowl panel.
2 Remove the windscreen cowl panel, as described in Chapter 11.
3 Remove the windscreen wiper motor and linkage, as described in Chapter 12.
4 Unclip the cover from the top of the motor **(see illustration)**.
5 Disconnect the motor wiring plug.
6 Remove the two clamp screws, then lift off the clamp and withdraw the motor assembly from its housing **(see illustration)**.
7 It is possible to renew the motor resistor by pressing the retaining clips together to release the resistor bracket. Fit the new resistor, ensuring that the retaining clips lock it into position **(see illustration)**.
8 No overhaul of the motor assembly is possible, and if faulty, the unit must be renewed.

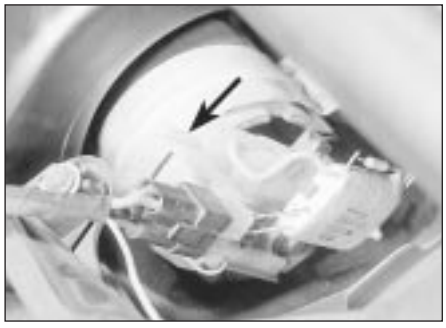
Refitting

9 Refitting is a reversal of removal, ensuring that the mounting rubber is correctly seated between the clamp and the motor.

18.4 Unclip the cover from the heater blower motor



18.6 Unscrewing a heater blower motor clamp screw



18.7 Heater blower motor resistor retaining clip (arrowed)

19.2A Using a screwdriver with protected blade . . .

19.2B . . . to release the centre facia ventilation nozzles

19 Facia ventilation nozzles - removal and refitting

Centre facia ventilation nozzles

Removal

1 Using a screwdriver, carefully prise the cap from the hazard warning flasher switch.
2 Carefully prise the nozzle assembly from the facia, using a screwdriver with a piece of card under the blade, to avoid damage to the facia trim **(see illustrations)**.
3 If desired, the nozzle housing can be removed as follows.
4 Move the knurled airflow adjuster wheel to the "O" position, then pull the actuating rod sideways from its carrier.
5 Release the two lower securing clips by levering with a screwdriver and pull the housing from the facia.

Refitting

6 Refitting is a reversal of removal, but note that if the housing has been removed, the airflow adjuster actuating rod must be pulled out to its stop, then pressed into its carrier with the adjuster wheel in the "O" position.

Passenger side facia ventilation nozzle

Removal

7 Carefully prise the nozzle from the facia, using a screwdriver with a piece of card under the blade, to avoid damage to the facia trim.
8 If desired, the nozzle housing can be removed as follows.
9 Move the knurled airflow adjuster wheel to the "O" position, then pull the actuating rod sideways from its carrier.
10 Extract the single screw securing the housing to the facia, then release the securing clips and pull the housing from the facia.

Refitting

11 Refitting is a reversal of removal, with reference to paragraph 6.

Driver's side facia ventilation nozzle

12 The procedure is as described for the passenger side nozzle, except that there is no screw securing the housing to the facia.

Side window demister nozzles

Removal

13 Simply prise the nozzle from the facia, taking care not to damage the facia trim.

Refitting

14 To refit, push the nozzle into position until it locks.

Chapter 4 Part A:
Fuel and exhaust systems - carburettor 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 

Specifications

General

Fuel tank capacity	61.0 litres
Fuel octane rating:	
Leaded	98 RON (4-star)
Unleaded	95 RON (Premium)
Carburettor type (all models)	Pierburg 2E3

Air cleaner element

Application:	
Round type	Champion W103
Square type	Champion U512

14 NV engine

Idle speed	925 ± 25 rpm	
Idle mixture (CO content)	0.5 to 1.5%	
Fast idle speed	2200 to 2600 rpm	
Choke valve gap	1.5 to 3.5 mm	
Choke pull-down gap:		
"Small"	1.7 to 2.1 mm	
"Large"	2.5 to 2.9 mm	
Idle fuel jet	45	
Idle air bleed	130	
	Primary	**Secondary**
Venturi diameter	20.0 mm	24.0 mm
Main jet	X95	X110

16 SV engine

Idle speed		
Manual transmission	925 ± 25 rpm	
Automatic transmission	825 ± 25 rpm (in 'park' or 'neutral')	
Idle mixture (CO content)	0.5 to 1.5%	
Fast idle speed	2000 to 2400 rpm	
Choke valve gap	1.5 to 3.5 mm	
Choke pull-down gap:		
Up to 1990:		
"Small"	1.3 to 1.7 mm	
"Large"	1.9 to 2.3 mm	
From 1990:		
"Small"	1.5 to 1.7 mm	
"Large"	2.0 to 2.2 mm	
Idle fuel jet	45	
Idle air bleed	132.5	
	Primary	**Secondary**
Venturi diameter	20.0 mm	24.0 mm
Main jet:		
Up to 1990	X95	X105
From 1990	X92.5	X105

18 SV engine

Idle speed	925 ± 25 rpm	
Idle mixture (CO content)	0.5 to 1.5%	
Fast idle speed	1900 to 2300 rpm	
Choke valve gap	1.5 to 3.5 mm	
Choke pull-down gap:		
"Small"	2.2 ± 0.2 mm	
"Large"	3.3 ± 0.2 mm	
Idle fuel jet	42.5	
Idle air bleed	132.5	
	Primary	**Secondary**
Main jet	107.5	125

Torque wrench settings

	Nm	**lbf ft**
Exhaust manifold nuts	22	16
Exhaust downpipe-to-manifold bolts	25	18
Exhaust fixings except flexible joint bolts	25	18
Exhaust flexible joint bolts	12	9
Fuel pump bolts	18	13
Fuel tank mounting strap bolts	20	15
Inlet manifold nuts	22	16

1 General description

The fuel system on all carburettor models comprises a fuel tank, a fuel pump, a vapour separator (1.6 and 1.8 litre models only), a downdraught carburettor, and a thermostatically-controlled air cleaner.

The fuel tank is mounted under the rear of the vehicle, forward of the rear suspension. The tank is ventilated to the atmosphere, and has a simple filler pipe and a fuel gauge sender unit.

The fuel pump is a mechanical diaphragm type, actuated by a pushrod bearing on the camshaft.

The fuel vapour separator is used to stabilise the fuel supply to the carburettor. Vapour is purged from the carburettor fuel supply, thus improving hot starting qualities.

The carburettor is a Pierburg 2E3 type, a full description of which is given in Section 12.

The air cleaner has a wax or vacuum-controlled air inlet supplying a blend of hot and cold air to suit the prevailing engine operating conditions. A fuller description is given in Section 4.

All engines available within the Cavalier range can be operated on unleaded petrol - see Chapter 5.

2 Fuel system - precautions

1 Certain adjustment points in the fuel system are protected by tamperproof caps, plugs or seals. In some territories, it is an offence to drive a vehicle with broken or missing tamperproof seals. Before disturbing a tamperproof seal, check that no local or national laws will be broken by doing so, and fit a new tamperproof seal after adjustment is complete, where required by law. Do not break tamperproof seals on a vehicle that is still under warranty.

2 When working on fuel system components, scrupulous cleanliness must be observed, and care must be taken not to introduce any foreign matter into fuel lines or components. Carburettors in particular are delicate instruments, and care should be taken not to disturb any components unnecessarily. Before attempting work on a carburettor, ensure that the relevant spares are available. Full overhaul procedures for carburettors have not been given in this Chapter. Complete stripdown of a carburettor is unlikely to cure a fault that is not immediately obvious, without introducing new problems. If persistent problems are met, it is recommended that the advice of a Vauxhall dealer or carburettor specialist is sought. Most dealers will be able to provide carburettor re-setting and servicing facilities, and if necessary it should be possible to buy a reconditioned carburettor.

3 Refer to Chapter 5, for precautions to be observed when working on vehicles fitted with an engine management system.

Warning: Many of the procedures given in this Chapter involve the disconnection of fuel pipes and system components, which may result in some fuel spillage. Before carrying out any operation on the fuel system, refer to the precautions given in the "Safety first!" Section at the beginning of this manual and follow them implicitly. Petrol is a highly dangerous and volatile substance, and the precautions necessary when handling it cannot be overstressed.

3 Air cleaner - removal and refitting

Removal

1 Remove the air cleaner element, as described in Chapter 1.
2 Release the crankcase ventilation hose from the plastic clip on the left-hand side of the air cleaner body**.**
3 Disconnect the inlet duct from the hot air hose on the exhaust manifold **(see illustration)**, and lift the air cleaner body from the carburettor.
4 With the body tilted to the rear, disconnect the crankcase ventilation hose from the stub on the underside of the body **(see illustration).** Where applicable, disconnect the vacuum hose from the air temperature control flap thermostat.
5 Remove the seal from under the air cleaner body.

Refitting

6 Check the hot air hose for condition, and renew it if necessary.
7 Fit a new air cleaner body-to-carburettor seal.
8 Connect the crankcase ventilation hose to the stub on the underside of the body, and connect the vacuum hose for the air temperature control flap.
9 Locate the body on the carburettor, and at the same time locate the inlet duct on the hot air hose on the exhaust manifold.
10 Engage the crankshaft ventilation hose in the plastic clip.
11 Refit the air cleaner element, referring to Chapter 1 if necessary.

4 Air cleaner inlet air temperature control - description and testing

Description

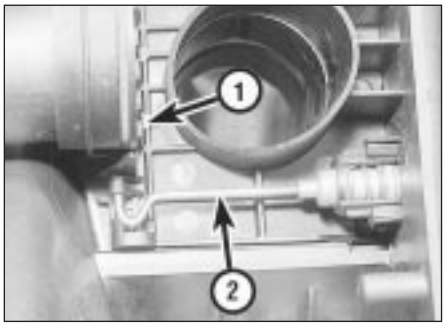
1 The air cleaner is thermostatically-controlled, to provide air at the most suitable temperature for combustion with minimum exhaust emission levels.
2 The optimum air temperature is achieved by drawing in cold air from an inlet at the front of the vehicle, and blending it with hot air drawn from a shroud on the exhaust manifold. The proportion of hot and cold air is varied by the position of a flap valve in the air cleaner inlet spout, which is controlled by either a vacuum diaphragm or wax-type unit. The vacuum diaphragm type is regulated by a heat sensor located within the air cleaner body **(see illustration)**.

3.3 The air cleaner body locates over the hot air hose

3.4 Disconnecting the crankcase ventilation hose (arrowed)

Testing

3 To check the operation of the air temperature control, the engine must be cold. First check the position of the flap valve. On the vacuum type, remove the air cleaner cover and check that the flap is open to admit only cold air from outside the car. Then start the engine and check that the flap now moves to admit only hot air from the exhaust manifold. On the wax type, the flap should already be positioned to admit only hot air from the exhaust manifold.
4 Temporarily refit the cover on the vacuum type.
5 Run the engine until it reaches its normal operating temperature.
6 On the vacuum type, remove the air cleaner cover and check that the flap is now positioned to admit only cold air from outside the car. In cold weather it should be a mixture of hot and cold air. Refit the cover after making the check. On the wax type, use a mirror to check that the flap is positioned in the same way as given for the vacuum type.
7 If the flap does not function correctly, the air cleaner casing must be renewed. Note that the vacuum type thermostat can be renewed separately if necessary.



4.2 Air cleaner flap valve operating mechanism
1 Flap valve 2 Operating rod

5 Fuel pump - testing

Note: *Refer to Section 2 before proceeding*
1 Disconnect the ignition coil LT lead.
2 Place a clean piece of rag under the pump outlet, then disconnect the pump outlet hose. Be prepared for fuel spillage, and take adequate fire precautions.
3 Have an assistant crank the engine on the starter. Well-defined spurts of fuel must be ejected from the pump outlet - if not, the pump is probably faulty (or the tank is empty). Dispose of the fuel-soaked rag safely.
4 No spare parts are available for the pump, and if faulty, the unit must be renewed.

6 Fuel pump - removal and refitting

Note: *Refer to Section 2 before proceeding*

Removal

1 The fuel pump is located at the rear right-hand end of the camshaft housing.
2 Disconnect the battery negative lead.
3 Disconnect the fuel hoses from the pump **(see illustration)**. If necessary, label the hoses so that they can be reconnected to their correct locations. Be prepared for fuel spillage, and take adequate fire precautions. Plug the open ends of the hoses to prevent dirt ingress and further fuel spillage.

6.3 Disconnecting a fuel hose from the fuel pump - 1.6 litre model

6.4 Withdrawing the fuel pump and plastic insulating block - 1.6 litre model

4 Unscrew the two securing bolts, and withdraw the pump from the camshaft housing **(see illustration)**.
5 Recover the plastic insulating block.

Refitting

6 Refitting is a reversal of removal, but ensure that the fuel hoses are reconnected to their correct locations as noted during removal, and tighten the securing bolts to the specified torque.
7 Run the engine and check for leaks on completion. If leakage is evident, stop the engine immediately and rectify the problem without delay. Note that the engine may take a longer time than usual to start when the pump has been removed, as the pump refills with fuel.

7 Fuel tank - removal, examination and refitting

Note: *Refer to Section 2 before proceeding*

Removal

1 Disconnect the battery negative lead.
2 Siphon out any remaining fuel in the tank through the filler pipe. Siphon the fuel into a clean metal container that can be sealed.
3 Chock the front wheels, then jack up the rear of the vehicle, and support securely on axle stands (see "*Jacking and Vehicle Support*") placed under the body side members.
4 Disconnect the exhaust system front flexible joint. Suspend the front section of the exhaust system with wire or string from the underbody.
5 Disconnect the rear section of the exhaust system from its rubber mountings, and allow it to rest on the rear suspension torsion beam. It is advisable to support the rear section of the exhaust at its front end, with wire or string from the underbody, to avoid straining the system.
6 Unclip the handbrake cable from the bracket on the left-hand fuel tank securing strap.
7 Disconnect the fuel hoses from the fuel level sender unit located in the right-hand side of the fuel tank. Make a note of the hose positions for use when refitting. Be prepared for fuel spillage, and take adequate fire precautions. Plug the open ends of the hoses, to prevent dirt ingress and further fuel loss.
8 Disconnect the wiring plug from the fuel level sender unit.
9 Disconnect the filler and vent hoses from the rear of the fuel tank.
10 Support the weight of the fuel tank on a jack with an interposed block of wood.
11 Unscrew the securing bolts from the tank mounting straps, then remove the straps and lower the tank sufficiently to enable the disconnection of the remaining vent hose.
12 With the aid of an assistant, withdraw the tank sideways from the right-hand side of the vehicle. Note that as the tank is withdrawn, some residual fuel may be released.

Examination

13 If the tank contains sediment or water, it may be cleaned out using two or three rinses with clean fuel. Shake vigorously using several changes of fuel, but before doing so, remove the fuel level sender unit, as described in Section 8. This procedure should be carried out in a well-ventilated area, and it is vital to take adequate fire precautions - refer to the "Safety first!" Section at the beginning of this manual for further details.
14 Any repairs to the fuel tank should be carried out by a professional. Do not under any circumstances attempt to weld or solder a fuel tank. Removal of all residual fuel vapour requires several hours of specialist cleaning.

Refitting

15 Refitting is a reversal of removal, ensuring that all hoses are reconnected to their correct locations as noted during removal.
16 On completion, fill the fuel tank, then run the engine and check for leaks. If leakage is evident, stop the engine immediately and rectify the problem without delay. Note that the engine may take a longer time than usual to start when the fuel tank has been removed, as the pump refills with fuel.

8 Fuel level sender unit - removal and refitting

Note: *Refer to Section 2 before proceeding*

Removal

1 Disconnect the battery negative lead.
2 Siphon out any remaining fuel in the tank through the filler pipe. Siphon the fuel into a clear metal container that can be sealed.
3 Chock the front wheels, then jack up the rear of the vehicle, and support securely on axle stands (see "*Jacking and Vehicle Support*") placed under the body side members.
4 The sender unit is located in the right-hand side at the fuel tank.
5 Make alignment marks on the sender unit and the fuel tank, so that the sender unit can be refitted in its original position.
6 Disconnect the fuel hoses from the sender unit. Be prepared for fuel spillage, and take adequate fire precautions. Plug the open ends of the hoses, to prevent dirt ingress and further fuel loss.
7 Disconnect the wiring plug from the fuel level sender unit.
8 To remove the sender unit, engage a flat piece of metal as a lever between two of the slots on the sender unit rim, and turn it anti-clockwise.
9 Withdraw the unit carefully, to avoid bending the float arm.
10 Recover the sealing ring.

Refitting

11 Refitting is a reversal of removal, remembering the following points.
12 Examine the condition of the sealing ring, and renew if necessary.
13 Ensure that the marks made on the sender unit and fuel tank before removal are aligned.
14 Ensure that the hoses are reconnected to their correct locations as noted during removal.
15 On completion, fill the fuel tank, then run the engine and check for leaks. Also check that the fuel gauge reads correctly. If leakage is evident, stop the engine immediately and rectify the problem without delay. Note that the engine may take a longer time than usual to start when the sender unit has been removed, as the fuel pump refills with fuel.

9 Fuel vapour separator (1.6 and 1.8 litre models) - removal and refitting

Note: *Refer to Section 2 before proceeding*

Removal

1 The fuel vapour separator is located on a bracket attached to the side of the carburettor.
2 Note the locations of the three fuel hoses, labelling them if necessary for use when refitting, then disconnect the hoses from the vapour separator. Be prepared for fuel spillage, and take adequate fire precautions. Plug the open ends of the hoses, to prevent dirt ingress and further fuel spillage.
3 Remove the two securing screws, and lift the vapour separator from its bracket.
4 Check the body of the separator for cracks or leaks before refitting, and renew if necessary.

Refitting

5 Refitting is a reversal of removal, but ensure that the three fuel hoses are connected to their correct locations as noted during removal.
6 Run the engine and check the hose connections for leaks on completion. If leakage is evident, stop the engine immediately and rectify the problem without delay.

10 Throttle pedal - removal and refitting

Removal

1 Working inside the vehicle, remove the lower trim panel from the driver's footwell.
2 Slide the cable retainer from the bracket on the top of the pedal, and disconnect the cable end from the pedal.
3 Extract the circlip from the right-hand end of the pedal pivot shaft, then slide out the pivot shaft from the left-hand side of the pivot bracket **(see illustration)**. Recover the pivot bushes and the pedal return spring.
4 Examine the pivot bushes for wear, and renew if necessary.

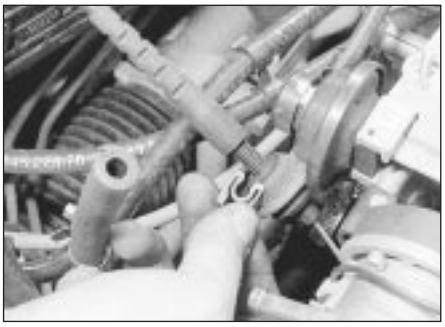
Refitting

5 Refitting is a reversal of removal, but on completion check the throttle mechanism for satisfactory operation, and check the throttle cable adjustment, as described in Section 11.

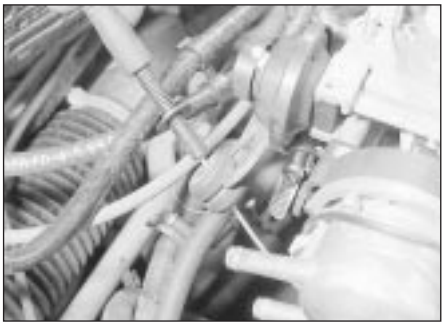
11 Throttle cable - removal, refitting and adjustment

Removal

1 Remove the air cleaner, on early models. On later models, disconnect the air trunking from the air cleaner, then disconnect the vacuum pipe and breather hose from the air box. Extract the three securing screws and lift off the air box, complete with air trunking **(see illustration).**
2 Extract the clip from the cable end fitting at the bracket on the carburettor, then slide the cable end grommet from the bracket **(see illustrations)**.
3 Slide the cable end from the throttle valve lever on the carburettor.
4 Working inside the vehicle, remove the lower trim panel from the driver's footwell.
5 Slide the cable retainer from the bracket on the top of the pedal, and disconnect the cable end from the pedal.
6 Make a careful note of the cable routing, then withdraw the cable through the bulkhead into the engine compartment.



11.2A Extract the throttle cable end clip . . .



11.2B . . .and slide the grommet from the bracket

Refitting

7 Refitting is a reversal of removal, remembering the following points.
8 Ensure that the cable is correctly routed, as noted before removal.
9 Ensure that the bulkhead grommet is correctly seated in its hole.

Adjustment

10 On completion, check the throttle mechanism for satisfactory operation, and if necessary adjust the cable, as described in the following paragraphs.
11 Two points of cable adjustment are provided. A stop screw is located on the pedal arm to control the fully released position of the pedal stop **(see illustration).** A clip is located on a threaded section of the cable sheath at the bracket on the carburettor, to adjust the cable free play.

11.11 Throttle pedal stop screw

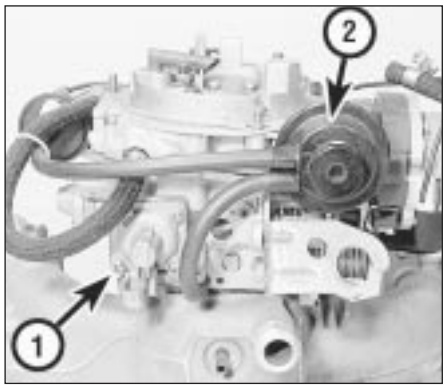
10.3 Throttle pedal pivot assembly. Circlip arrowed

11.1 Removing an air box securing screw

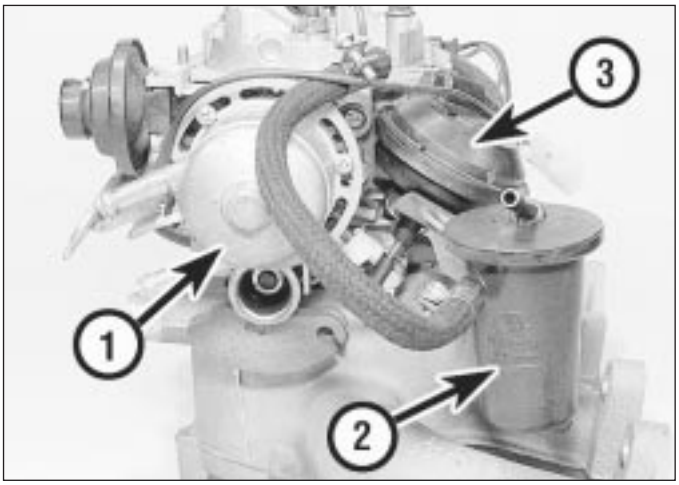
12 The cable should be adjusted so that when the throttle pedal is released, there is very slight free play in the cable at the carburettor end.
13 Check that when the throttle pedal is fully depressed, the throttle valve is fully open. Adjust the position of the clip on the cable sheath, and the pedal stop screw, to achieve the desired results.

12 Carburettor - general

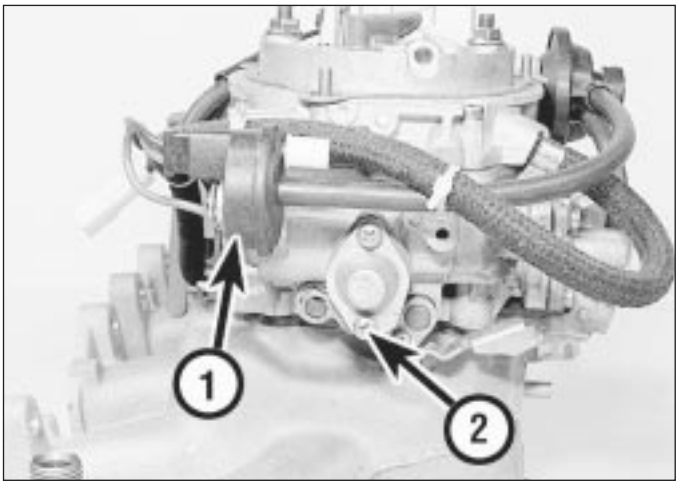
1 The Pierburg 2E3 carburettor is of twin-venturi, fixed-jet sequential throttle type. The primary throttle valve operates alone except at high engine speeds and loads, when the secondary throttle valve is operated, until at full-throttle, both are fully open. This arrangement allows good fuel economy during light acceleration and cruising, but also gives maximum power at full-throttle. The secondary throttle valve is vacuum-operated, according to the vacuum produced in the primary venturi. The primary throttle barrel and venturi diameters are smaller than their secondary counterparts. The carburettor is a complicated instrument, with various refinements and sub-systems added to achieve improved driveability, economy and exhaust emission levels **(see illustrations).**



12.1A Side view of carburettor, showing accelerator pump (1) and main choke pull-down diaphragm unit (2)



12.1B Side view of carburettor, showing automatic choke housing (1), vapour separator (2) and secondary throttle valve vacuum diaphragm (3)



12.1C Side view of carburettor, showing secondary choke pull-down solenoid (1) and power valve (2)

2 A separate idle system operates independently from the main jet system, supplying fuel by way of the mixture control screw.

3 The main jets are calibrated to suit engine requirements at mid-range throttle openings. To provide the necessary fuel enrichment at full throttle, a vacuum-operated power valve is used. The valve provides extra fuel under the low vacuum conditions associated with wide throttle openings.

4 To provide an enriched mixture during acceleration, an accelerator pump delivers extra fuel to the primary main venturi. The accelerator pump is operated mechanically by a cam on the throttle linkage.

5 A fully automatic choke is fitted, operated by a coolant and electrically heated bi-metal coil. When the engine is cold, the bi-metal coil is fully wound up, holding the choke plate (fitted to the primary barrel) closed. As the engine warms up, the bi-metal coil is heated and therefore unwinds, progressively opening the choke plate. A vacuum operated pull-down system is employed, whereby, if the engine is under choke but is only cruising (i.e. not under heavy load) the choke plate is opened against the action of the bi-metal coil. The pull-down system prevents an over-rich mixture, which reduces fuel economy and may cause unnecessary engine wear when the engine is cold. A secondary pull-down solenoid is fitted, which operates in conjunction with the main diaphragm unit to modify the pull-down characteristics, improving fuel economy.

6 1.8 litre models are fitted with an idle cut-off solenoid. This is an electrically operated valve, which interrupts the idle mixture circuit when the ignition is switched off, this preventing engine “run-on”.

13 Carburettor - removal, overhaul and refitting

Note: *Refer to Section 2 before proceeding. New gasket(s) must be used when refitting the carburettor. A tachometer and an exhaust gas analyser will be required to check the idle speed and mixture on completion*

Removal

1 Disconnect the battery negative lead.

2 Remove the air cleaner, on early models. On later models, disconnect the air trunking from the air cleaner, then disconnect the vacuum pipe and breather hose from the air box. Extract the three securing screws and lift off the air box, complete with air trunking.

3 On 1.4 litre models, disconnect the fuel supply hose from the carburettor, and on 1.6 and 1.8 litre models, disconnect the fuel supply and return hoses from the vapour separator. Be prepared for fuel spillage, and take adequate fire precautions. Plug the ends of the hoses, to prevent dirt ingress and further fuel spillage.

4 Extract the clip from the throttle cable end fitting at the bracket on the carburettor, then slide the cable end grommet from the bracket, and slide the cable end from the throttle valve lever.

5 Disconnect the coolant hoses from the automatic choke housing noting their locations, as an aid to refitting. Be prepared for coolant spillage, and plug the hoses, or secure them with their ends facing upwards, to prevent further coolant loss.

6 Disconnect the vacuum pipes from the front of the carburettor, noting their locations and routing for use when refitting **(see illustration)**.

7 Disconnect the choke heater wire and any additional wiring.

8 Unscrew the three securing nuts, and withdraw the carburettor from the inlet manifold studs.

9 Recover the gasket(s) and insulator block that fit between the carburettor and the inlet manifold.

Overhaul

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Aerosol cans of carburettor cleaner are widely available and can prove useful in helping to clean internal passages of stubborn obstructions.

10 With the carburettor removed from the vehicle, drain the fuel from the float chamber and vapour separator (where applicable). Clean the outside of the carburettor, then remove the top cover (Section 15).

11 Blow through the jets and drillings with compressed air, or air from a foot pump - do not probe them with wire. If it is wished to remove the jets, unscrew them carefully with well-fitting tools.

12 Remove the fuel filter gauze from the inlet union, refer to Section 21, for details. Vauxhall recommend that it is renewed whenever the carburettor is cleaned.

13.6 Disconnecting the air box vacuum pipe from the carburettor - 1.6 litre model

13 Clean any foreign matter from the float chamber. Renew the float, the float needle valve and seat if wear is evident, or if the float is punctured or otherwise damaged. Check that the needle valve closes completely before the float reaches the top of its movement. See Section 15, for details of float level checking.
14 Renew the diaphragms in the part-load enrichment valve and in the accelerator pump. If additional pump or valve parts are supplied in the overhaul kit, renew these parts also.
15 Further dismantling is not recommended. Pay particular attention to the throttle opening mechanism arrangement if it is decided to dismantle it; the interlocking arrangement is important.
16 Reassemble in the reverse order to dismantling. Use new gaskets and seals throughout; lubricate linkages with a smear of molybdenum based grease.

Refitting

17 Carry out the following procedure before refitting.
a) Position the fast idle adjustment screw on the highest step of the fast idle cam.
b) Use a gauge rod or twist drill of the specified diameter to measure the opening of the primary throttle valve.
c) Adjust if necessary at the fast idle adjustment screw.
d) Note that this is a preliminary adjustment; final adjustment of the fast idle speed should take place with the engine running.
18 Refitting is a reversal of removal, but renew the gasket(s).
19 After refitting, carry out the following checks and adjustments.
20 Check the throttle cable free play and adjust if necessary, as described in Section 11.
21 Check and if necessary top-up the coolant level, as described in Chapter 3.
22 Check and if necessary adjust the idle speed and mixture, as described in Section 14.

14 Idle speed and mixture - adjustment

Note: *Refer to Section 2 before proceeding. To carry out the adjustments, an accurate tachometer and an exhaust gas analyser (CO meter) will be required*
1 To check the idle speed and mixture adjustment, the following conditions must be met:
a) The engine must be at normal operating temperature
b) All electrical consumers (cooling fan, heater blower, headlamps, etc.) must be switched off
c) The ignition timing and spark plug gaps must be correctly adjusted - see Chapters 1 and 5
d) The throttle cable free play must be correctly adjusted - see Section 11
e) The air inlet trunking must be free from leaks, and the air filter must be clean

14.3 Carburettor idle speed adjustment (throttle stop) screw (arrowed)

f) On automatic models, always select position, "P".
2 Connect a tachometer and an exhaust gas analyser to the vehicle, according to the equipment manufacturer's instructions.
3 Start the engine, and run it at 2000 rpm for approximately 30 seconds, then allow it to idle. If the idle speed is outside the specified limits, adjust by means of the throttle stop screw **(see illustration)**.
4 When the idle speed is correct, check the CO level in the exhaust gas. If it is outside the specified limits, adjust by means of the idle mixture adjustment screw. In production, the screw is covered by a tamperproof plug; ensure that no local or national laws are being broken before removing the plug **(see illustration)**.
5 On automatic models, when position "D" is selected (all electrical systems switched off), the idle speed should not drop perceptibly. If it does, the vehicle should be taken to a Vauxhall dealer for the idle-up system to be checked using special Vauxhall test equipment.
6 With the idle mixture correct, readjust the idle speed if necessary.
7 If the cooling fan cuts in during the adjustment procedure, stop the adjustments, and continue when the cooling fan stops.
8 When both idle speed and mixture are correctly set, stop the engine and disconnect the test equipment.
9 Fit a new tamperproof plug to the idle mixture adjustment screw, where this is required by law.

14.4 Tamperproof plug (arrowed) covering idle mixture adjustment screw

15 Needle valve and float - removal, inspection and refitting

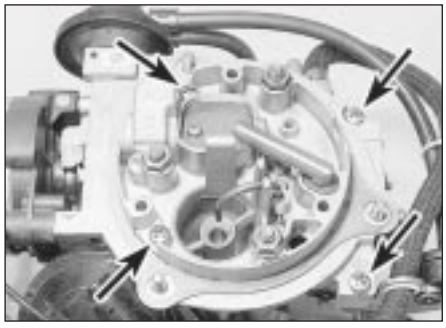
Note: *Refer to Section 2 before proceeding. A new carburettor top cover gasket must be used on reassembly. A tachometer and an exhaust gas analyser will be required to check the idle speed and mixture on completion*

Removal

1 Disconnect the battery negative lead.
2 Remove the round air cleaner, on applicable models. On other models, disconnect the air trunking from the air cleaner, then disconnect the vacuum pipe and breather hose from the air box. Extract the three securing screws and lift off the air box, complete with air trunking.
3 Thoroughly clean all external dirt from the carburettor.
4 Disconnect the fuel supply hose at the carburettor. Be prepared for fuel spillage, and take adequate fire precautions. Plug the end of the hose, to prevent dirt ingress and further fuel spillage.
5 Identify the automatic choke coolant hose locations as an aid to refitting, then disconnect the hoses. Be prepared for coolant spillage, and either plug the hoses, or secure them with their ends facing upwards, to prevent further coolant loss.
6 Disconnect the choke heater wiring plug.
7 Disconnect the lower vacuum hoses from the choke pull-down unit.
8 Remove the four carburettor top cover securing screws, noting their locations, as two lengths of screw are used **(see illustration)**.
9 Lift off the top cover and recover the gasket.

Inspection

10 Hold the cover vertically, so that the float is hanging from its pivot. Then tilt the cover until the float needle valve is just closed - the needle spring must not be compressed by the weight of the float.
11 Measure the distance, dimension x **(see illustration),** from the bottom of the float to the gasket surface on the top cover's



15.8 Carburettor top cover securing screws (arrowed)

underside. If the distance measured exceeds, or is less than, that specified, the float weight is incorrect and the float must be renewed.

12 When the float level is known to be correct, reassemble the carburettor, using a new top cover gasket. Check the idle speed and mixture settings as described in Section 14.

13 Using a pin punch, tap the float retaining pin from the base of the top cover, and lift out the float and needle valve.

14 Inspect the components for damage, and renew as necessary. Check the needle valve for wear, and check the float for leaks by shaking it to see if it contains petrol.

15 Clean the mating faces of the carburettor body and top cover.

Refitting

16 Refitting is a reversal of removal, remembering the following points.

17 After refitting, check the float and needle valve for full and free movement.

18 Use a new gasket between the top cover and the carburettor body.

19 Ensure that all hoses, pipes and wires are correctly reconnected.

20 On completion, check and if necessary top-up the coolant level, as described in Chapter 3, and check and if necessary adjust the idle speed and mixture, as described in Section 14.

16 Secondary throttle valve vacuum diaphragm - testing, removal and refitting

Note*: The diaphragm unit must be renewed in its entirety, as no spares are available*

Testing

1 If a vacuum source incorporating a gauge is available, apply approximately 300 mbars (9 in Hg) to the diaphragm unit, at the hose nearest the carburettor body. Close off the vacuum source, and check that the vacuum is held. If there is a leak, rectify or renew the leaking component. Alternately, testing of a suspect vacuum unit must be by the substitution of a known good item.

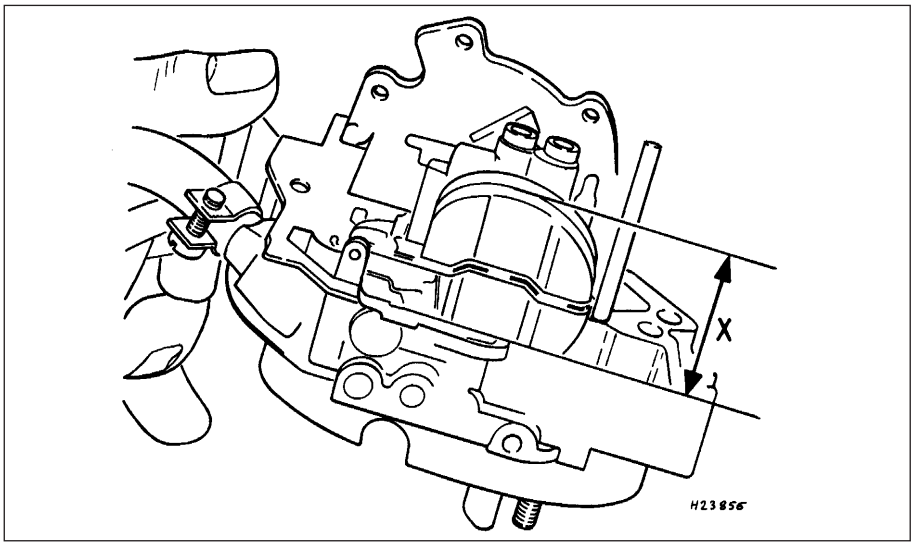
Removal

2 Remove the air cleaner, on early models. On later models, disconnect the air trunking from the air cleaner, then disconnect the vacuum pipe air breather hose from the air box. Extract the three securing screws and lift off the air box, complete with air trunking.

3 Disconnect the vacuum pipe from the diaphragm unit.

4 Prise the diaphragm operating rod balljoint from the secondary throttle valve linkage.

5 On 1.6 and 1.8 litre models, remove the two securing screws and lift the vapour separator from the bracket. Move the vapour separator to one side, taking care not to strain the fuel hoses.



15.11 Measuring the float level "X"

6 Remove the three securing screws, and withdraw the diaphragm unit complete with its bracket from the carburettor body.

Refitting

7 Refitting is a reversal of removal.

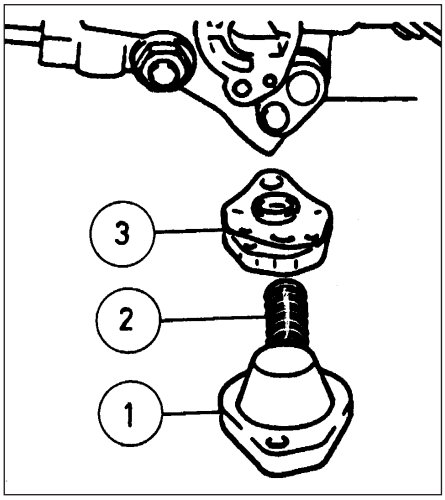
17 Power valve diaphragm - removal and refitting

Note: *Refer to Section 2 before proceeding*

Removal

1 Disconnect the battery negative lead.

2 Remove the air cleaner, on early models. On later models, disconnect the air trunking from the air cleaner, then disconnect the vacuum pipe and breather hose from the air box. Extract the three securing screws and lift off the air box, complete with air trunking.



17.7 Carburettor power valve components

1 Cover
2 Spring
3 Diaphragm assembly

3 Thoroughly clean all external dirt from the area around the power valve housing.

4 Remove the two securing screws, and lift off the power valve cover, spring, and diaphragm assembly.

Refitting

5 Clean the mating faces of the cover and housing.

6 Locate the spring on the cover and diaphragm assembly, ensuring that it is correctly seated, then press the diaphragm assembly and cover together. Note that the vacuum hole in the diaphragm must align with the corresponding holes in the housing flange and cover.

7 Further refitting is a reversal of removal, but ensure that the diaphragm is correctly seated **(see illustration)**.

18 Accelerator pump - testing, removal and refitting

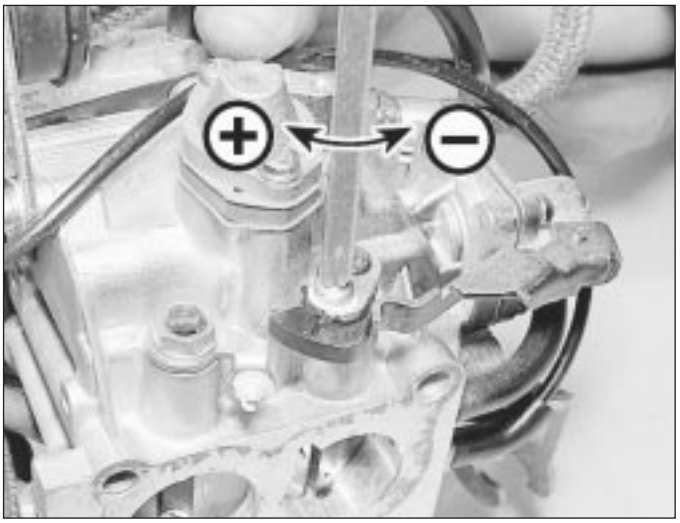
Note*: Refer to Section 2 before proceeding*

Testing

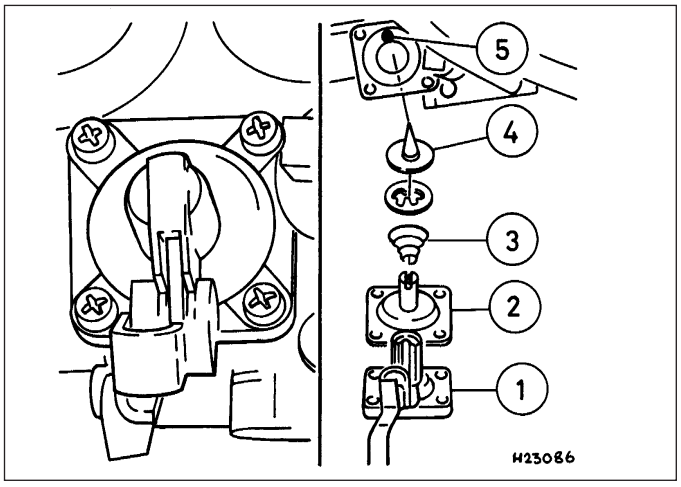
1 It will be necessary to feed the float chamber with fuel from a small reservoir during this test.

2 Position the primary barrel over an accurate measuring glass. Fully open and close the throttle ten times, taking approximately one second for each opening, and pausing for three seconds after each return stroke. Make sure that the fast idle cam is not restricting throttle travel at either end.

3 Measure the quantity of fuel delivered, and compare this with the specified value.



18.4 Accelerator pump delivery adjustment: "+" to increase, "-" to reduce



18.11 Carburettor accelerator pump components

1 Cover with operating lever
2 Diaphragm
3 Spring
4 Valve
5 Air passage

4 If adjustment is necessary, release the clamp screw and turn the cam plate in the desired direction. Tighten the clamp screw, and recheck the pump delivery **(see illustration)**.

Removal

5 Proceed as described in Section 17, paragraphs 1 and 2.
6 Thoroughly clean all external dirt from the area around the accelerator pump housing.
7 Remove the four securing screws and lift off the accelerator pump cover. Recover the diaphragm, spring, valve retainer and valve. Note the orientation of the valve retainer.

Refitting

8 Clean the mating faces of the cover and housing.
9 Check the condition of the valve, and renew if necessary.
10 Begin refitting by locating the valve, valve retainer and spring in the housing. Note that the valve retainer can only be fitted in one position. The larger diameter of the spring should rest against the valve retainer.
11 Locate the diaphragm on the housing, ensuring that the spring is correctly seated, and refit the cover. Tighten the cover securing screws progressively to avoid distorting the diaphragm **(see illustration)**.
12 Further refitting is a reversal of removal.

19 Automatic choke unit - removal, refitting and adjustment

Note: *Refer to Section 2 before proceeding. A tachometer and an exhaust gas analyser will be required to check the idle speed and mixture on completion. If the coolant housing is removed, new O-rings will be required for refitting*

Removal

1 Proceed as described in Section 17, paragraphs 1 and 2.
2 Note the position of the bi-metal housing alignment marks as an aid to refitting, if necessary making additional marks for clarity, then remove the three securing screws and lift off the bi-metal housing. Place the housing to one side, taking care not to strain the coolant hoses or electric choke heater wiring.
3 Remove the three screws securing the choke housing to the carburettor body, and withdraw the choke assembly, taking care not to bend the choke operating rod.
4 If it is necessary to remove the bi-metal housing for renewal, continue as follows; otherwise go on to paragraph 8.
5 Identify the automatic choke coolant hose locations as an aid to refitting, then disconnect the hoses. Be prepared for coolant spillage, and either plug the hoses, or secure them with their ends facing upwards, to prevent further loss of coolant.
6 Disconnect the wiring from the electric choke heater, and withdraw the bi-metal housing.
7 The coolant housing can be separated from the bi-metal housing by unscrewing the central securing bolt. Recover the O-rings from under the bolt head, and from the rim of the coolant housing.

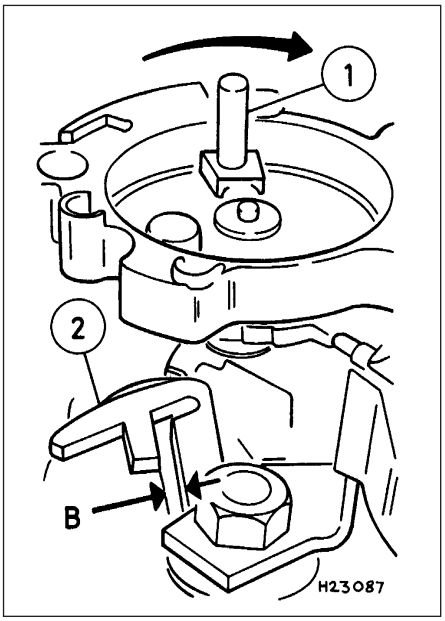
Refitting

8 Begin refitting by locating the choke assembly on the carburettor body, ensuring that the lever on the choke assembly engages with the choke operating rod. Tighten the three securing screws.
9 Check and if necessary adjust the choke valve gap and the fast idle cam position, as described in paragraphs 15 to 19, of this Section.
10 Connect the bi-metal spring to the choke lever, position the bi-metal housing on the choke housing, and loosely fit the securing screws. Align the marks on the bi-metal housing and the choke housing as noted during removal, then tighten the securing screws.
11 Where applicable, refit the coolant housing to the bi-metal housing, using new O-rings if necessary, and reconnect the coolant hoses and electric choke heater wiring.
12 Further refitting is a reversal of removal, remembering the following points.
13 If the coolant hoses have been disconnected, check the coolant level, as described in Chapter 3.
14 Check and if necessary adjust the fast idle speed, as described in paragraphs 25 to 34, of this Section.

Adjustment

Choke valve gap

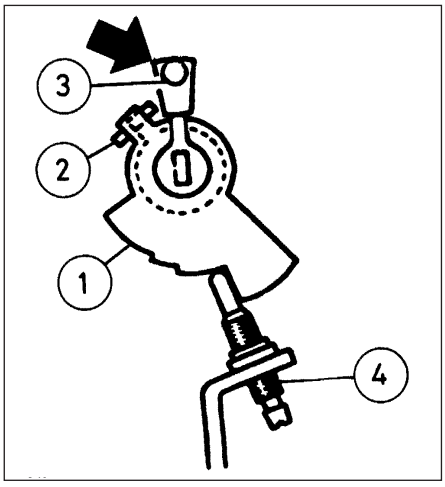
15 With the bi-metal housing removed as described in paragraphs 2 to 4, of this Section, continue as follows.
16 Press the choke operating lever fully clockwise, and retain it in position with a rubber band.
17 Move the throttle lever to the fully open position, and measure the choke valve gap between the lower side of the choke plate and the wall of the primary barrel. Check that the gap is as given in the Specifications.
18 If necessary, adjust the choke valve gap by bending the "adjuster segment (2)" If the gap is too small, enlarge gap "B", by levering with a screwdriver. If the gap is too large, decrease gap "B" using a pair of pliers **(see illustration)**.
19 If no further adjustments are to be carried out, refit the bi-metal housing, as described in paragraphs 10 to 14, of this Section.



19.18 Choke valve gap adjustment
1 Choke operating lever
2 Adjuster segment
B Choke valve gap

Fast idle cam position

20 With the bi-metal housing removed, and the choke valve gap "B", correctly set, continue as follows.
21 Open the throttle valve, then close the choke valve using light finger pressure on the choke drive lever **(see illustration)**. Close the throttle valve.
22 Check that the fast idle speed adjustment screw is resting against the stop on the second highest step of the fast idle cam.
23 If adjustment is required, first check that the choke return spring is correctly positioned, then adjust by bending the adjustment lever.
24 Refit the bi-metal housing, as described in paragraphs 10 to 14 of this Section.



19.21 Fast idle cam adjustment
1 Fast idle cam
2 Adjustment lever
3 Choke drive lever
4 Fast idle speed adjustment screw

Fast idle speed

Note: *To carry out the adjustment, an accurate tachometer and an exhaust gas analyser (CO meter) will be required*
25 Check the idle speed and mixture, as described in Section 14. The idle speed must be correct before attempting to check or adjust the fast idle speed.
26 With the engine at normal operating temperature, and a tachometer connected according to the equipment manufacturer's instructions, continue as follows.
27 Position the fast idle speed adjustment screw on the second highest step of the fast idle cam **(see illustration)**.
28 Start the engine without touching the throttle pedal, and check that the fast idle speed is as specified. If adjustment is required, stop the engine and continue as follows.
29 Remove the tamperproof cap from the fast idle speed adjustment screw, ensure that no local or national laws are being broken by doing so **(see illustration)**.
30 Ensure that the adjustment screw is still resting on the second highest step of the fast idle cam, then start the engine, again without touching the throttle pedal.
31 Turn the adjustment screw using a screwdriver, until the specified fast idle speed is obtained.
32 If the cooling fan cuts in during the adjustment procedure, stop the adjustments, and continue when the cooling fan stops.
33 On completion of adjustment, stop the engine and disconnect the tachometer.
34 Fit a new tamperproof cap to the fast idle speed adjustment screw, where this is required by law.

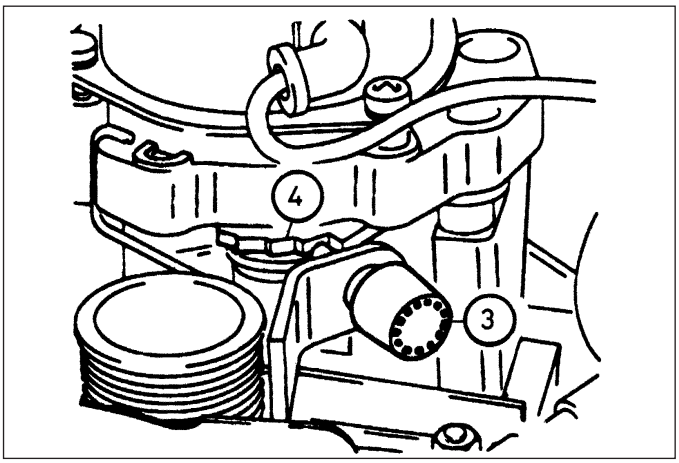
20 Automatic choke vacuum pull-down units - removal, refitting and adjustment

Main diaphragm unit

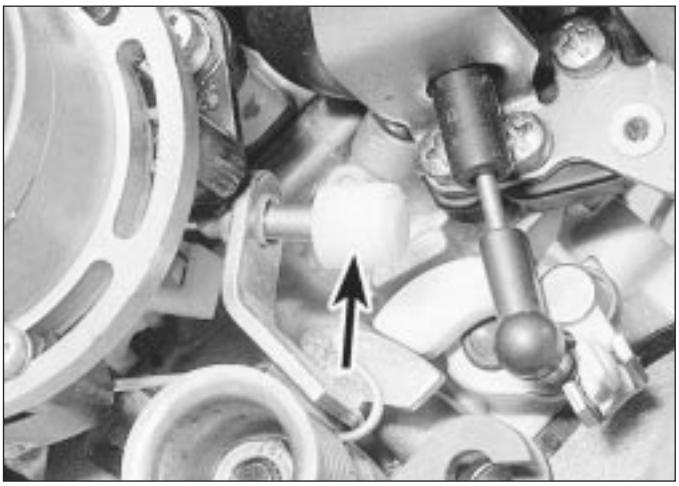
Note: *Refer to Section 2 before proceeding. A new star clip must be used when refitting the diaphragm unit. Test vacuum units as described in Section 16, paragraph 1.*

Removal

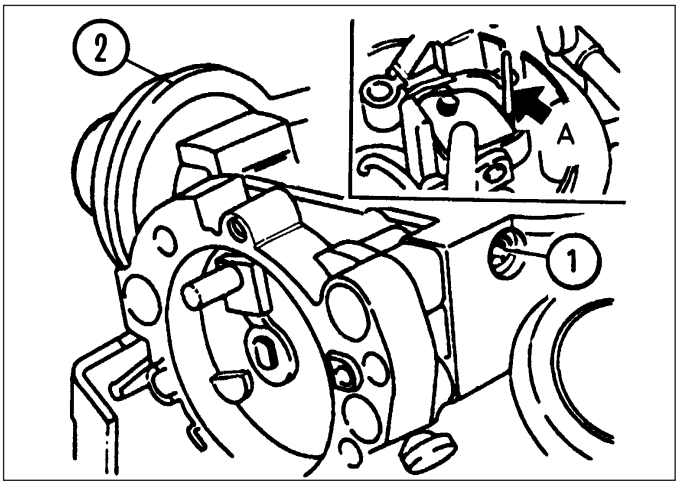
1 Proceed as described in Section 17, paragraphs 1 and 2.
2 Disconnect the diaphragm unit vacuum pipes.
3 Using a pin punch, tap out the roll pin securing the diaphragm unit to the carburettor top cover.
4 Note the position of the bi-metal housing alignment marks as an aid to refitting, if necessary making additional marks for clarity, then remove the three securing screws, and lift off the bi-metal housing. Place the housing to one side, taking care not to strain the coolant hoses or electric choke heater wiring.



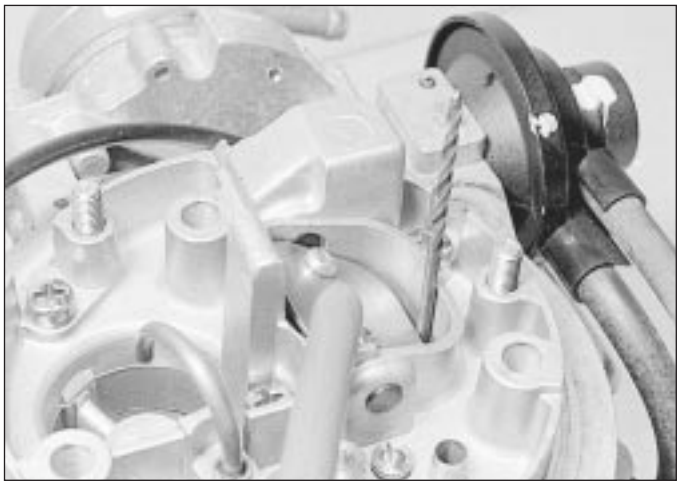
19.27 Fast idle speed adjustment
3 Fast idle speed adjustment screw
4 Screw positioned on second highest step of cam



19.29 Tamperproof cap (arrowed) fast idle speed adjustment screw



20.12A Choke vacuum pull-down adjustment
1 Adjustment screw 2 Diaphragm unit A Twist drill



20.12B Checking the vacuum pull-down gap using a twist drill

5 Remove the three screws securing the choke assembly to the carburettor body. Allow the choke assembly to drop down, but do not disconnect the choke linkage.
6 Remove the star clip that secures the diaphragm unit to the carburettor top cover, and withdraw the diaphragm unit.

Refitting

7 Refitting is a reversal of removal, but use a new star clip to secure the diaphragm unit to the carburettor top cover. Before refitting the air box to the top of the carburettor, check and if necessary adjust the choke pull-down, as follows.

Vacuum pull-down

Adjustment

8 With the air cleaner or air box removed from the top of the carburettor, as described in Section 17, paragraph 2, continue as follows.
9 Note the position of the bi-metal housing alignment marks as an aid to refitting, if necessary making additional marks for clarity, then remove the three securing screws, and lift off the bi-metal housing. Place the housing to one side, taking care not to strain the coolant hoses or electric choke heater wiring.
10 Position the fast idle speed adjustment screw on the highest step of the fast idle cam, and check that the choke valve is closed.
11 Move the pull-down arm towards the diaphragm unit by pushing on the adjustment screw until resistance is felt. Hold the arm in this position.
12 Using a drill shank of appropriate diameter, or a similar item, measure the clearance between the lower side of the choke plate and the wall of the primary barrel **(see illustrations)**. Check that the clearance is as given for the "small" choke pull-down gap in the Specifications.
13 If adjustment is necessary, turn the adjustment screw in the appropriate direction, using an Allen key, until the clearance is correct.
14 Now push the pull-down arm towards the diaphragm unit as far as its stop, and hold the arm in this position.
15 As before measure the clearance between the lower side of the choke plate and the wall of the primary barrel. Check that the clearance is as given for the "large" choke pull-down gap in the Specifications.
16 If adjustment is necessary, turn the adjustment screw in the appropriate direction until the clearance is correct.
17 Connect the bi-metal spring to the choke lever, position the bi-metal housing on the choke housing and loosely fit the securing screws. Align the marks on the bi-metal housing and the choke housing as noted during removal, then tighten the securing screws.
18 Refit the air box to the top of the carburettor on completion.

Secondary pull-down solenoid

Removal

19 This unit operates in conjunction with the main diaphragm unit.
20 To remove the solenoid unit, first continue as described in Section 17, paragraphs 1 and 2.
21 Disconnect the diaphragm unit vacuum pipe.

20.22 Secondary choke pull-down solenoid securing screw and earth lead

22 Disconnect the wiring plug, then unscrew the securing screw, and withdraw the solenoid unit and its mounting bracket from the carburettor. Note that the securing screw also secures the wiring plug earth lead **(see illustration)**.

Refitting

23 Refitting is a reversal of removal, but ensure that the wiring plug earth lead is in place under the solenoid bracket securing screw.

21 Carburettor filter - removal and refitting

Removal

1 A small tubular filter gauze is fitted into the carburettor top cover's fuel inlet union to remove any particles of dirt from the fuel.
2 To ensure a clean fuel supply and to prevent the risk of misfiring, poor starting or other problems due to a restricted fuel supply, this filter must be cleaned and/or renewed at the interval specified in Chapter 1.
3 To reach the filter, remove the air cleaner or air box, as applicable, then disconnect and plug the hose from the fuel pump or vapour separator to the top cover union.
4 Remove the filter by hooking it out with a small screwdriver, or by snaring it with a long thin screw (3 mm thread size, screwed approximately 5 mm into the filter).
5 If the filter is blocked or heavily fouled, or if it is torn, distorted or damaged in any way, it must be renewed. If it is fit for further use, clean it using a jet of compressed air or by brushing away particles of dirt with an old soft toothbrush. Then flushing it in clean solvent, taking care not to allow any overspray to get into your eyes; if petrol is used, take care to prevent the risk of fire.

Refitting

6 On refitting the filter, press it into the union until it catches **(see illustration)**. The remainder of the reassembly procedure is the reverse of removal.

22 Throttle valve dashpot (automatic models) - adjustment

1 Remove the air cleaner or air box, refer to Section 3.
2 Ensure that the lever **(see illustration)** is in the idling position.
3 Slacken the locknut and unscrew the dashpot until a gap of 0.05 mm (0.002 in) exists between the lever and the dashpot tip. Then screw the dashpot downwards 2.5 full turns and tighten the locknut.
4 Refit all removed components.

23 Throttle position sensor (automatic transmission models) - removal and refitting

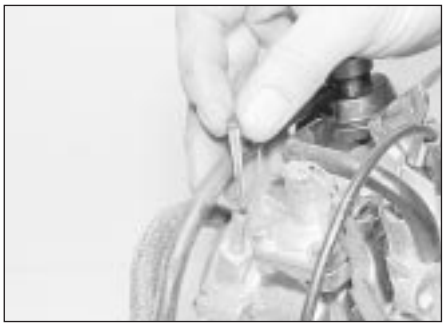
Removal

1 Disconnect the battery earth lead.
2 Disconnect the wiring plug from the sensor.
3 Either unscrew the two securing screws and withdraw the sensor from its bracket, or unbolt the bracket.

Refitting

4 Refitting is the reverse of the removal procedure, noting the following points.

*a) Install the sensor when the throttle valve is fully closed and ensure that the adapter, "1" **(see illustration),** seats correctly on the throttle valve spindle.*
b) Tighten the screws carefully.



21.6 Refitting the carburettor fuel filter

24 Idle speed increase valve - testing

1 Certain models are fitted with an idle speed increase valve that is attached to the side of the carburettor.
2 To test the operation of this valve first remove the air filter and vacuum hose.
3 With the valve's plug connected, have someone turn the ignition on (but do not start the engine). A mechanical shifting noise should be heard. If not replace the unit.
4 After refitting replace the vacuum hose and air filter.

25 Idle cut-off solenoid (1.8 litre models) - description and testing

Note: *Refer to Section 2 before proceeding*

Description

1 On 1.8 litre models, the carburettor is fitted with an idle cut-off solenoid. This is an electrically operated valve, which interrupts the idle mixture circuit when the ignition is switched off, thus preventing the engine from running-on **(see illustration)**.
2 The idle cut-off solenoid is energised all the time that the ignition is switched on. A defective solenoid, or a break in its power supply, will cause the engine to stall or idle roughly, although it will run normally at speed.

Testing

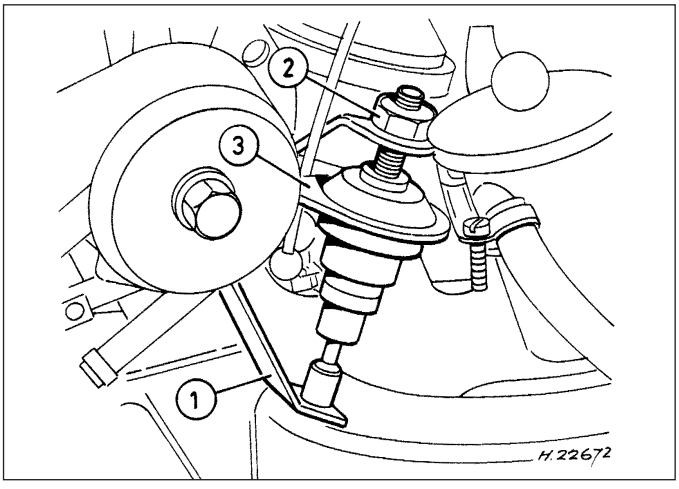
3 If the operation of the solenoid is suspect, first check that battery voltage is present at the solenoid terminal when the ignition is switched on. Use a 12 volt test lamp or similar test device.
4 If no voltage is present, then the fault lies in the wiring to the solenoid. If voltage is present, the solenoid can be tested as follows.
5 With the solenoid unscrewed from the carburettor, connect the body of the solenoid to the negative terminal of a 12 volt battery. When the battery positive terminal is connected to the solenoid centre terminal, there should be an audible click, and the needle at the tip of the solenoid should retract.
6 A defective idle cut-off solenoid must be renewed.

26 Inlet manifold - removal and refitting

Note*: Refer to Section 2 before proceeding. A new manifold gasket must be used on refitting*

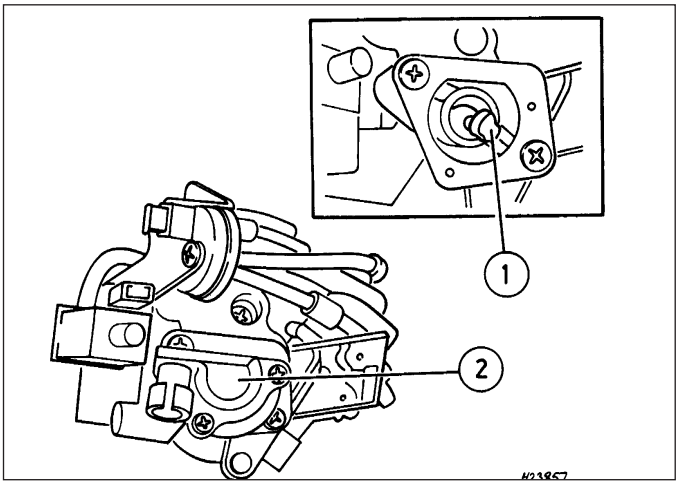
Removal

1 Disconnect the battery negative lead.
2 Drain the cooling system, as described in Chapter 3.
3 Proceed as described in Section 13, paragraphs 2 to 7 inclusive, ignoring the reference to coolant spillage in paragraph 5.



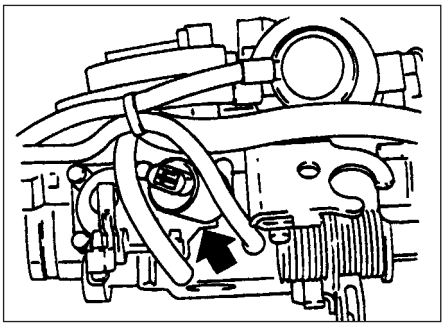
22.2 Adjusting the throttle valve dashpot - models with automatic transmission

1 Lever 2 Locknut 3 Dashpot



23.4 Throttle position sensor - models with automatic transmission

1 Adapter 2 Sensor



25.1 Carburettor idle cut-off solenoid (arrowed) - 1.8 litre models

26.4 Disconnecting the coolant hose . . .

26.5 . . .and the camshaft cover breather hose (arrowed) from the inlet manifold - 1.6 litre model

4 Disconnect the coolant hose from the rear of the manifold **(see illustration)**.
5 Where applicable, disconnect the camshaft cover breather hose from the rear of the manifold **(see illustration)**.
6 Unscrew the union and disconnect the brake servo vacuum hose from the manifold.
7 On 1.4 and 1.6 litre models, disconnect the wiring from the temperature gauge sender.
8 Unscrew and remove the top alternator mounting nut and bolt.
9 On 1.4 and 1.6 litre models, disconnect and remove the stub hose that connects the crankcase breather tube to the rear of the camshaft housing.
10 Make a final check to ensure that all relevant hoses, pipes and wires have been disconnected.
11 Unscrew the securing nuts, and withdraw the manifold from the cylinder head **(see illustration)**. Note the position of the rear engine lifting bracket, which is secured by one of the manifold nuts, and recover the manifold gasket.
12 It is possible that some of the manifold studs may be unscrewed from the cylinder head when the manifold securing nuts are unscrewed. In this event, the studs should be screwed back into the cylinder head once the manifold has been removed, using two manifold nuts locked together.
13 If desired, the carburettor can be removed from the manifold, referring to Section 13, if necessary.

Refitting

14 Refitting is a reversal of removal, remembering the following points.
15 If the carburettor has been removed from the manifold, refit it, using a new gasket.
16 If the alternator mounting bracket has been unbolted from the manifold, refit it before refitting the manifold, as access to the securing bolt is extremely limited once the manifold is in place.
17 Refit the manifold using a new gasket, and ensure that the engine lifting bracket is in place under the relevant manifold nut. Tighten the nuts to the specified torque.
18 Ensure that all relevant hoses, pipes and wires are correctly reconnected.
19 Refill the cooling system, as described in Chapter 3.
20 Check the throttle cable free play and adjust if necessary, as described in Section 11.
21 If the carburettor has been disturbed, check and if necessary adjust the idle speed and mixture, as described in Section 14.

26.11 Withdrawing the inlet manifold - 1.6 litre model

Chapter 4 Part B:
Fuel and exhaust systems - fuel injection 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

Specifications

General

Injection system type:	
C16 NZ, C16 NZ2, X16 SZ and C18 NZ	Multec Central Fuel Injection
20 NE, C20 NE and 20 SEH, (up to 1990)	Motronic M4.1
20 NE, C20 NE and 20 SEH, (from 1990)	Motronic M1.5
20 XEJ and C20 XE, (up to 1993)	Motronic M2.5
C20 XE (from 1993)	Motronic M2.8
X20 XEV	Simtec 56.1
Fuel tank capacity:	
All models	63.0 ± 2 litres
Fuel octane rating *	
Leaded	98 RON (4-star)
Unleaded (refer to Chapter 5) *	95 RON (Premium)

*** Note**: *Models fitted with a catalytic converter (engine code prefixed by 'C' or 'X'), must only be operated on* ***unleaded*** *fuel.*

Idle settings

Idle speed:	
C16 NZ and X16 SZ	850 ± 80 rpm
C16 NZ2	880 ± 80 rpm
C18 NZ	
Manual transmission models	880 ± 80 rpm
Automatic transmission models	830 ± 80 rpm
20 NE, C20 NE and 20 SEH	800 ± 80 rpm
20 XEJ and C20 XE	940 ± 80 rpm
X20 XEV	850 ± 160 rpm

Note: *Idle speed adjustment is not possible on these models, for information only*

Idle settings (continued)

Idle mixture (CO content):	
20 NE and 20 SEH	1.0 max.
20 XEJ	0.7 to 1.2%
All other models	0.3 % (at 2800 to 3200 rpm)

Fuel Pressure (regulator vacuum hose connected)

Multec	0.76 bar
Motronic 4.1:	
Feed	2.3 to 2.7 bar
Return	0.3 to 1.5 bar
Motronic 1.5:	
Feed	1.8 to 2.2 bar
Return	0.3 to 1.5 bar
Motronic 2.5	2.0 to 2.2 bar
Motronic 2.8	2.2 to 2.7 bar
Simtec 56.1	not available

Torque wrench settings

	Nm	lbf ft
All specifications as for carburettor models except for the following:		
Bracket, tank vent valve to coolant flange	8	6
Fuel distributor pipe to inlet manifold	8	6
Fuel flow damper	20	15
Fuel injector retainer	3	2
Fuel pressure regulator	2.5	2
Fuel pump clamp	4	3
Idle air control stepper motor	2.5	2
Knock sensor (X16 SZ) to block	13	10
Oxygen sensor	30	22
Throttle body mounting	20	15
Throttle body upper-to-lower section	6	4.5
Throttle potentiometer	2	1.5
Throttle valve housing to inlet manifold	9	7

1 General description

General

1 All engines available within the Cavalier range can be operated on unleaded petrol. Refer to Chapter 5 for further details. Note that models fitted with a catalytic converter must only be operated on unleaded petrol, and leaded petrol must not be used. Models with catalytic converter can be identified by the engine code, which is prefixed by the letter 'C' or 'X'.

Multec system

Note: *There is no provision for the adjustment or alteration of the idle speed; if checking the idle speed, remember that it may vary constantly under ECU control.*

2 The Multec system is essentially a simple method of air/fuel metering, replacing the carburettor with a single injector mounted in a throttle body. This type of system is therefore also known as Throttle Body Injection (TBi), Central Fuel Injection (CFi) or single- (or mono-) point injection. The whole system is best explained if considered as three sub-systems, these being fuel delivery, air metering and electrical control.

3 The fuel delivery system incorporates the fuel tank (with the electric fuel pump immersed inside it), the fuel filter, the fuel injector and pressure regulator (mounted in the throttle body), and the hoses and pipes connecting them. When the ignition is switched on (or when the engine is cranking, on X16 SZ engines) the pump is supplied with voltage, by way of the pump relay and fuse 11, under the control of the Electronic Control Unit (ECU). The pump feeds through the fuel filter to the injector. Fuel pressure is controlled by the pressure regulator, which lifts to allow excess fuel to return to the tank.

4 The air metering system includes the inlet air temperature control system and the air cleaner, but its main components are in the throttle body assembly. This incorporates the injector, which sprays fuel onto the back of the throttle valve, the throttle potentiometer. This is linked to the throttle valve spindle and sends the ECU information on the rate of throttle opening by transmitting a varying voltage. The idle air control stepper motor is controlled by the ECU to maintain the idle speed.

5 The electrical side of the fuel injection system consists of the ECU and all the sensors that provide it with information, plus the actuators by which it controls the whole system's operation. The basic method of operation is as follows; note that the ignition system is controlled by the same ECU.

6 The manifold absolute pressure sensor is connected by a hose to the inlet manifold. Variations in manifold pressure are converted into graduated electrical signals that are used by the ECU to determine the load on the engine. The throttle valve potentiometer is explained above.

7 Information on engine speed and crankshaft position comes from the distributor on C16 NZ engines and from the crankshaft speed/position sensor on C16 NZ2, X16 SZ and C18 NZ engines.

8 An odometer frequency sensor provides the ECU with information on the vehicle's road speed, and the coolant temperature sensor provides it with the engine temperature. A knock sensor located in the cylinder block between cylinders 2 and 3 on the X16 SZ engine provides additional information to the ECU by detecting pre-ignition (detonation) during the combustion process.

9 All these signals are compared by the ECU with set values pre-programmed (mapped) into its memory. Considering this information, the ECU selects the response appropriate to those values. It controls the ignition amplifier module by varying the ignition timing as required. The fuel injector is controlled by varying its pulse width the time the injector is held open, to provide a richer or weaker mixture, as appropriate. The idle air control stepper motor controls the idle speed. The fuel pump relay controls the fuel delivery and the oxygen sensor, accordingly. The mixture, idle speed and ignition timing are constantly varied by the ECU to provide the best settings for cranking, starting and engine warm-up (with either a hot or cold engine), idling,

cruising and accelerating. The injector earth is also switched off on the overrun to improve fuel economy and reduce exhaust emissions. Additionally, on the X16 SZ engine, the ECU also controls the operation of the charcoal canister purge valve in the evaporative emission control system.

10 The oxygen sensor screwed into the exhaust manifold provides the ECU with a constant feedback signal. This enables it to adjust the mixture (closed-loop control) to provide the best possible conditions for the catalytic converter to operate effectively.

11 Until the oxygen sensor is fully warmed up it gives no feedback so the ECU uses pre-programmed values (open-loop control) to determine the correct injector pulse width. When the sensor reaches its normal operating temperature, its tip (which is sensitive to oxygen) sends the ECU a varying voltage depending on the amount of oxygen in the exhaust gases. If the inlet air/fuel mixture is too rich, the exhaust gases are low in oxygen so the sensor sends a low-voltage signal. The voltage rises as the mixture weakens and the amount of oxygen rises in the exhaust gases. Peak conversion efficiency of all major pollutants occurs if the inlet 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 inlet air/fuel mixture accordingly by altering the fuel injector pulse width.

12 In addition, the ECU senses battery voltage, incorporates diagnostic capabilities, and can both receive and transmit information by way of the diagnostic connector, thus permitting engine diagnosis and tuning by Vauxhall's TECH1, test equipment.

Motronic system

13 The Motronic type is available in several different versions, depending on model. The system is under the overall control of the Motronic engine management system (Chapter 5), which also controls the ignition timing.

14 Fuel is supplied from the rear-mounted fuel tank by an electric fuel pump mounted under the rear of the vehicle, through a pressure regulator, to the fuel rail. The fuel rail acts as a reservoir for the four fuel injectors, which inject fuel into the cylinder inlet tracts, upstream of the inlet valves. On SOHC engines, the fuel injectors receive an electrical pulse once per crankshaft revolution, which operates all four injectors simultaneously. On DOHC engines, sequential fuel injection is used, whereby each injector receives an individual electrical pulse allowing the four injectors to operate independently, which enables finer control of the fuel supply to each cylinder. The duration of the electrical pulse determines the quantity of fuel-injected, and pulse duration is computed by the Motronic module, based on the information received from the various sensors.

15 On SOHC engines, inlet air passes from the air cleaner through a vane type airflow meter, before passing to the cylinder inlet tracts through the throttle valve. A flap in the vane airflow meter is deflected in proportion to the airflow; this deflection is converted into an electrical signal, and passed to the Motronic module. A potentiometer screw located on the airflow meter provides the means of idle mixture adjustment, by altering the reference voltage supplied to the Motronic module.

16 On DOHC engines, inlet air passes from the air cleaner through a hot wire type air mass meter, before passing to the cylinder inlet tracts through a two-stage throttle body assembly. The electrical current required to maintain the temperature of the hot wire in the air mass meter is directly proportional to the mass flow rate of the air trying to cool it. The current is converted into a signal, which is passed to the Motronic module. The throttle body contains two throttle valves that open progressively, allowing high torque at part throttle, and full-throttle, high-speed "breathing" capacity. A potentiometer screw located on the air mass meter provides the means of idle mixture adjustment, by altering the reference voltage supplied to the Motronic module.

17 A throttle position sensor enables the Motronic module to compute the throttle position, and on certain models, its rate of change. Extra fuel can thus be provided for acceleration when the throttle is opened suddenly. Information from the throttle position sensor is also used to cut off the fuel supply on the overrun, thus improving fuel economy and reducing exhaust gas emissions.

18 Idle speed is controlled by a variable-orifice solenoid valve, which regulates the amount of air bypassing the throttle valve. The valve is controlled by the Motronic module; there is no provision for direct adjustment of the idle speed.

19 Additional sensors inform the Motronic module of engine coolant temperature, air temperature, and on models fitted with a catalytic converter, exhaust gas oxygen content.

20 A fuel filter is incorporated in the fuel supply line, to ensure that the fuel supplied to the injectors is clean.

21 A fuel pump cut-off relay is controlled by the Motronic module, which cuts the power to the fuel pump should the engine stop with the ignition switched on, if there is an accident. All 1993-onwards models equipped with Motronic systems, have their fuel pump located inside the fuel tank.

22 The later M2.8 system is basically the same as the earlier M2.5 system apart from the following:

a) Hot Film Mass Airflow Meter - The hot wire type unit used previously is replaced on the M2.8 system by a hot film mass airflow meter. The operation is the same except that a thin, electrically heated plate rather than a wire is used. The plate is maintained at a constant temperature by electric current as the inlet air mass passing over the plate tries to cool it. The current required to maintain the temperature of the plate is directly proportional to the mass flow rate of the inlet air. The current is converted to a signal that is passed to the Motronic module.

b) Inlet Air Temperature Sensor - The sensor is located in the hose between the hot film mass airflow meter and the air cleaner for precise monitoring of inlet air temperature. Signals from the sensor are used in conjunction with other sensors to indicate the occurrence of a hot start condition. The Motronic module then interprets these signals to alter injector duration accordingly.

c) Throttle Valve Potentiometer - On the M2.8 system a throttle valve potentiometer replaces the throttle valve switch used previously.

Simtec system

23 An increased amount of electronic components are used instead of mechanical parts as sensors and actuators with the Simtec engine management system. This provides more precise operating data as well as greater problem free motoring.

24 The control unit is equipped with electronic ignition control. Called 'Microprocessor Spark Timing System, inductive triggered', (or MSTS-i), and means that the mechanical high voltage distributor is no longer needed. It is located behind the trim panel, on the right-hand side footwell (door pillar).

25 The ignition coil is replaced by a dual spark ignition coil, which is switched directly by the output stages in the control unit.

26 A camshaft sensor will maintain emergency operation, should the crankshaft inductive pulse pick-up, malfunction. These sense TDC ('Top Dead Centre'), crankshaft angle and engine speed. The signals are used by the control unit to calculate ignition point and for fuel injection.

27 The 'hot film airflow meter' determines the mass of air taken in by the engine. The system uses this information to calculate the correct amount of fuel needed for injection in the engine.

28 The air inlet temperature sensor (NTC), is fitted in the air inlet duct between the air cleaner and the hot mass air flow meter.

29 A controlled canister purge valve is actuated by the system. The tank ventilation is monitored closely with the Lambda control (or oxygen sensor) and adaptation by the computer within the control unit.

30 A knock control system is also fitted. This eliminates the need for octane number adjustment, as it is performed automatically through the control unit.

31 This engine is also fitted with an EGR (exhaust gas recirculation) valve and secondary air injection (AIR - Air Injection Reactor), to conform to the latest European exhaust emission limits (as from 1996). The EGR returns a specific amount of exhaust gas into the combustion process. This in turn reduces the formation of nitrogen oxides (No_x). The secondary air injection system has an electrically driven air pump that injects air into the exhaust manifold, reducing the amount of CO and HC emissions.

2 Fuel injection system - precautions

Warning: Many of the procedures in this sub-Section require the removal of fuel lines and connections that 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.

The fuel injection system is pressurised, therefore extra care must be taken when disconnecting fuel lines. When disconnecting a fuel line union, loosen the union slowly, to avoid a sudden release of pressure that may cause fuel to spray out.

Fuel pressure checking must be entrusted to a Vauxhall dealer, or other specialist, who has the necessary special equipment.

3 System testing - general

General

1 Apart from basic electrical tests, there is nothing that can be done by the owner to test individual fuel system components.

2 If a fault arises, check first that it is not due to poor maintenance. Check that the air cleaner filter element is clean, the spark plugs are in good condition and correctly gapped. Check also that the engine breather hoses are clear and undamaged and that the throttle cable is correctly adjusted. If the engine is running very roughly, check the compression pressures (Chapter 1) and remember the possibility that one of the hydraulic tappets might be faulty, producing an incorrect valve clearance.

3 If the fault is thought to be due to a dirty injector, it is worth trying one of the established injector-cleaning treatments before renewing, perhaps unnecessarily, the injector.

4 If the fault persists, check the ignition system components (as far as possible).

5 If the fault is still not eliminated, work methodically through the system, checking all fuses, wiring connectors and wiring, looking for any signs of poor connections, dampness, corrosion, dirt or other faults.

6 Once the system components have been checked for signs of obvious faults, take the vehicle to a Vauxhall dealer for the full system to be tested on special equipment.

7 Do not attempt to "test" any component, but particularly the ECU, with anything other than the correct test equipment, available at a Vauxhall dealer. If any of the wires to be checked lead to a component such as the ECU, always first unplug the relevant connector from the system components so that there is no risk of the component being damaged by the application of incorrect voltages from test equipment.

4 Air cleaner - removal and refitting

Note: *If 'round type' air filter is fitted, follow procedure in Chapter 4A.*

Removal

1 Unclip the coolant expansion tank hose from the air cleaner cover, and move it to one side out of the way.

4.2 Loosening the air trunking clamp screw at the airflow meter

2 Loosen the clamp screw and disconnect the air trunking from the airflow meter **(see illustration)**.

3 Disconnect the battery negative lead, then disconnect the wiring plug from the airflow meter.

4 Release the two securing clips from the left-hand side of the air cleaner cover, and unscrew the two captive securing screws from the right-hand side, then lift off the cover.

5 Lift out the filter element.

6 Loosen the preheat hoses, fastening nuts.

7 Undo the nuts securing the 2 rubber block studs which are secured through the lower half of the air cleaner housing.

8 Some models are fitted with an inlet air resonance box, to reduce induction noise. This box is located under the wheel arch, and connects to a pipe on the air inlet tube.

9 The resonance box must be removed before the air inlet tube can be removed. To do this, first apply the handbrake, then jack up the front of the vehicle, and support securely on axle stands placed under the body side members.

10 Remove the securing screws, and withdraw the lower splash shield from the wing to expose the resonance box.

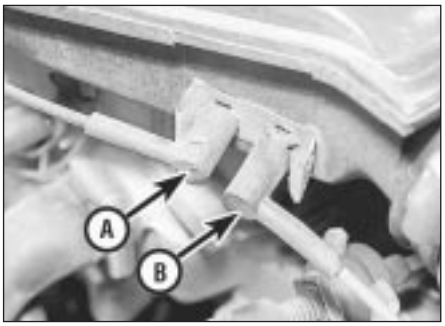
11 Unscrew the single securing screw, and pull the resonance box from the connector tube **(see illustrations)**.

12 If desired, the air inlet tube can be removed after pulling off the connector tube from under the wing **(see illustration)**.

4.11A Remove the securing screw . . .

4.11B . . . and withdraw the resonance box

4.12 Removing the resonance box connector tube



5.2 Vacuum pipe connections to air box
A To throttle body B To air cleaner

5.4A Ensure the sealing ring is located in the air box groove

5.4B Do not overtighten the air box screws

13 Manipulate the air inlet tube to release the securing lugs from the front body panel. This is a tricky operation, and patience will be required. For improved access, the headlamp can be removed, as described in Chapter 12.

Refitting

14 Refitting of all components is a reversal of removal, noting that the air cleaner element fits with the rubber locating flange uppermost.

5 Air box - removal and refitting

Removal

1 The air box, if fitted, is secured by two or three bolts to the top of the throttle body. Take note of the routing and connections of the inlet air temperature control system vacuum pipes.
2 Disconnect the engine breather hose from the air box and the vacuum pipe from the rearmost of the throttle body's three unions **(see illustration)**.
3 Do not lose the sealing ring as the air box is withdrawn.

Refitting

4 On refitting, ensure that the sealing ring is seated correctly in the slot in the underside of the air box, tighten the screws, and reconnect the vacuum pipe and breather hose **(see illustrations)**.

6 Air temperature control - description and testing

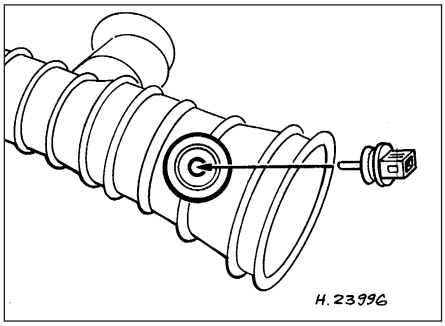
Description

1 Fitted to models with Multec systems, air temperature is controlled by a thermac switch (thermostat), mounted in the air box. When the engine is started from cold, the switch is closed to allow inlet manifold depression to act on the air temperature control valve in the air cleaner assembly. This uses a vacuum servo in the valve assembly to draw a flap valve across the cold air inlet thus allowing only (warmed) air from the exhaust manifold to enter the air cleaner.

2 As the temperature of the exhaust warmed air in the air box rises, a bi-metallic strip in the thermac switch deforms. This opens the switch to shut off the depression in the air temperature control valve. The flap is then lowered gradually across the hot air inlet. Until the engine is fully warmed up to normal operating temperature, only cold air from the front of the vehicle is entering the air cleaner.

Testing

3 To check the system, allow the engine to cool down completely, then remove the air cleaner cover; the flap valve should be securely seated across the hot air inlet. Start the engine. The flap should immediately rise to close off the cold air inlet. It should then lower steadily as the engine warms until it is eventually seated across the hot air inlet again.
4 To check the thermac switch, disconnect the control valve vacuum pipe from the switch union (on the rear face of the air box) when the engine is running. With the engine cold, full inlet manifold depression should be felt sucking at the union; none at all should be felt when the engine is fully warmed up.
5 To check the air temperature control valve, remove the air cleaner cover; the flap valve should be securely seated across the hot air inlet. Disconnect the control valve vacuum pipe from the switch union on the rear face of the air box and suck hard on its end; the flap should rise to shut off the cold air inlet.
6 If either component is faulty, it must be renewed. This means renewing the air cleaner lower casing to obtain a new air temperature control valve, or renewing the air box in the case of the thermac switch.



7.4 Removing the intake air temperature sensor from the air trunking - later models

7 Air temperature sensor (later models) - removal and refitting

Removal

1 Disconnect the battery negative lead.
2 Disconnect the wiring plug at the inlet air temperature sensor.
3 Release the hose clips and remove the air trunking then remove the inlet air temperature sensor from the trunking.

Refitting

4 Refitting is a reversal of removal but ensure that the air trunking is connected to the airflow meter as shown **(see illustration)**.

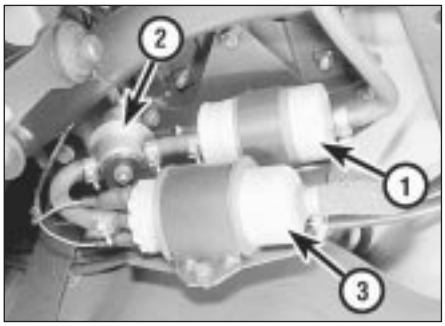
8 Depressurising the fuel system - general

Warning: The following procedures will merely relieve the pressure in the fuel system. Remember that fuel will still be present in the system components, so take precautions before disconnecting any of them. Refer to Section 2.

General

1 The fuel system consisting of the tank-mounted fuel pump, the fuel filter, the fuel injector and the pressure regulator in the throttle body. Metal pipes and flexible hoses of the fuel lines connect these components. All these contain fuel that will be under pressure while the engine is running and/or while the ignition is switched on.
2 The pressure will remain for some time after the ignition has been switched off and must be relieved before any of these components are disturbed.
3 Remove either the fuel pump fuse (number 11) or the fuel pump relay and start the engine. Allow the engine to idle until it cuts out. Turn the engine over once or twice on the starter to ensure that all pressure is released, then switch off the ignition.
4 Do not forget to refit the fuse or relay when work is complete.

9.1A Fuel filter (arrowed) - 'out of tank', fuel pump models



9.1B Fuel component assembly - 'out of tank', fuel pump models

1 Fuel filter
2 Fuel flow damper
3 Fuel pump

9 Fuel filter ('Out-of-tank' fuel pump models) - removal and refitting

Note: *Refer to Section 2 before proceeding*

Removal

1 The fuel filter is located on the fuel pump bracket under the rear of the vehicle. Either on the right-hand side of the spare wheel well or in front of the fuel tank, depending on model **(see illustrations)**.
2 Disconnect the battery negative lead.
3 Have a container to hand, to catch the fuel that will be released as the filter is removed.
4 Clamp the fuel hoses on either side of the filter, to minimise fuel loss when the hoses are disconnected.
5 Loosen the clamp screws, and disconnect the fuel hoses from the filter. Be prepared for fuel spillage, and take adequate fire precautions.
6 Loosen the clamp bolt(s), and withdraw the fuel filter from its bracket. Note the orientation of the flow direction arrow on the body of the filter, and the position of the "AUS" (out) marking on the filter end face.

Refitting

7 Refitting is a reversal of removal, ensuring that the flow direction markings are correctly orientated.
8 Run the engine and check for leaks on completion. If leakage is evident, stop the engine immediately, and rectify the problem without delay.

10 Fuel filter ('In-tank' fuel pump models) - removal and refitting

Note: *Refer to Section 2 before proceeding*

Removal

1 Depressurise the fuel system (Section 8).
2 Chock the front wheels, jack up the rear of the vehicle and support it on axle stands placed under the body side members. (see "*Jacking and Vehicle Support*"). The fuel filter is located at the rear of the fuel tank, on the right-hand side.
3 Unclip the fuel hose from the filter mounting bracket.
4 Note carefully any markings on the fuel filter casing. There should be at least an arrow (showing the direction of fuel flow) pointing in the direction of the fuel supply hose leading to the engine compartment. There may also be the words "EIN" (in) and "AUS" (out) embossed in the appropriate end of the casing.
5 Clamp the fuel filter hoses, then slacken the clips and disconnect the hoses.
6 Undo the single screw to release the mounting bracket, then open the clamp with a screwdriver to remove the fuel filter **(see illustration)**.

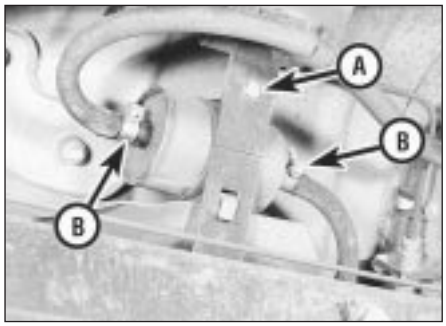
Refitting

7 Fit the new fuel filter using a reversal of the removal procedure, but ensure that the fuel flow direction arrow or markings point in the correct direction. Switch on the ignition and check carefully for leaks; if any signs of leakage are detected, the problem must be rectified before the engine is started.

11 Fuel pump - testing

Testing

1 If the fuel pump is functioning, it should be possible to hear it "buzzing" by listening under the rear of the vehicle when the ignition is switched on. Unless the engine is started, the fuel pump should switch off after approximately one second. If the noise produced is excessive, this may be due to a faulty fuel flow damper. The damper can be renewed referring to Section 18, if necessary.
2 If the pump appears to have failed completely, check the appropriate fuse and relay.
3 To test the fuel pump, special equipment is required, and it is recommended that any suspected faults are referred to a Vauxhall dealer.



10.6 Fuel filter - 'in tank', fuel pump type

A Clamp screw
B Hose clips

12 Fuel pump ('Out-of-tank' fuel pump models) - removal and refitting

Note: *Refer to Section 2 before proceeding*

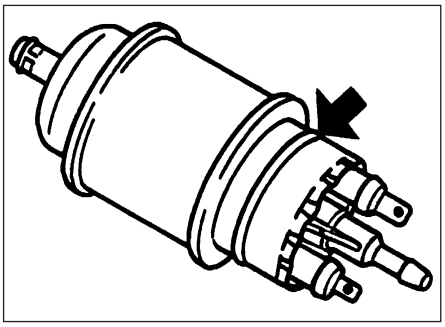
Removal

1 The fuel pump is located on a bracket under the rear of the vehicle, either on the right-hand side of the spare wheel well or in front of the fuel tank on other models.
2 Disconnect the battery negative lead.
3 Have a container to hand, to catch the fuel that will be released as the damper is removed.
4 Disconnect the wiring plug(s) from the fuel pump **(see illustration)**.
5 Clamp the fuel hoses on either side of the damper, to minimise fuel loss when the hoses are disconnected.
6 Loosen the clamp screws, and disconnect the fuel hoses from the pump. Be prepared for fuel spillage, and take adequate fire precautions.
7 Loosen the clamp bolt, and slide the pump from its bracket.

Refitting

8 Refitting is a reversal of removal, ensuring that the pump is fitted the correct way round in its bracket. Push the pump into the rubber clamping sleeve as far as the rim on the pump body **(see illustration)**.

12.4 Disconnecting a fuel pump wiring plug - 'out of tank', fuel pump model



12.8 Fuel pump clamping sleeve should rest against rim (arrowed)

9 Run the engine and check for leaks on completion. If leakage is evident, stop the engine immediately, and rectify the problem without delay.

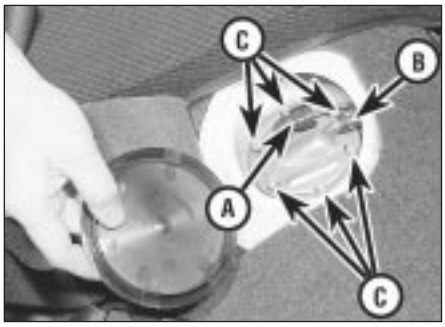
13 Fuel pump ('In-tank' fuel pump models) - removal and refitting

Removal

1 Depressurise the fuel system (Section 8), then remove and refit the fuel filler cap to ensure that the pressure is equalised inside and outside the tank.
2 Disconnect the battery negative terminal.
3 Fold forwards the rear seat cushion. Peel back the floor covering beneath it, then remove the cover plug from the vehicle floor to reach the pump mountings **(see illustration)**.
4 Noting exactly how it is connected, and making your own marks or notes to ensure that it can be reconnected the same way round, disconnect the wiring plug from the pump.
5 Release the securing clip and disconnect the fuel hose from the pump. Clamp or plug the hose to prevent the loss of fuel and the entry of dirt.
6 Undo the pump mounting bracket screws, then withdraw the mounting bracket and pump assembly from the tank. Note the position of the sealing ring and discard it, then cover the tank opening as a safety measure and to prevent the entry of dirt.
7 If the pump is to be renewed, first move it to a clean working area and carry out the following.
8 Prise off the filter at the base of the pump assembly, then release the securing clamp and disconnect the mounting bracket-to-pump fuel hose.
9 Making your own marks or notes to ensure that they can be reconnected the same way round, unsolder the wires connecting the pump to the mounting bracket.
10 Press the pump out of the rubber sleeve.

Refitting

11 Reassembly and refitting are the reverse of the removal and dismantling procedures, noting the following points.



13.3 Fuel pump - 'in-tank', fuel pump model

A Wiring connector
B Fuel hose clamp
C Mounting bracket screws

a) Ensure that the pump is seated correctly in the sleeve and that the hose is securely fastened.
b) Ensure that the wires are correctly reconnected and securely soldered.
c) Always renew the pump mounting bracket's sealing ring.
d) Apply a few drops of sealing compound (i.e. Vauxhall part no. 90485251) to the threads of the screws, then tighten them securely, but take care not to distort the sealing ring.

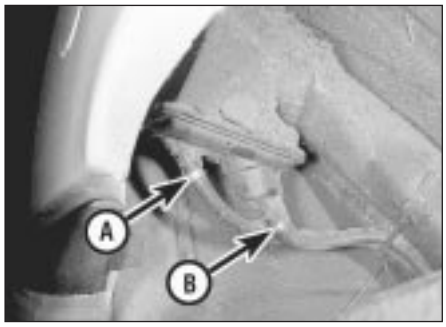
14 Fuel pump relay - renewal

The relay is mounted in the engine compartment relay box (Chapter 12). Where more than one relay is fitted, the fuel pump relay is the one with the black base.

15 Fuel tank filler pipe - removal and refitting

Removal

1 Syphon out any remaining fuel in the tank into a clean container that is designed for carrying petrol and is clearly marked as such.
2 Raise the bottom edge of the seal surrounding the filler neck and undo the single securing screw beneath.
3 Chock the front wheels, jack up the rear of the vehicle and support it securely on axle stands (see "*Jacking and Vehicle Support*") placed under the body side members.
4 Unscrew the single filler pipe mounting bolt from the underbody, then work along the length of the pipe, cutting or releasing any clips or ties securing other pipes or hoses to it. Releasing their clips, disconnect the filler and vent hoses from the pipe's lower end and the small-bore vent hoses from the unions at its upper end.
5 Having ensured that all components have been removed or disconnected which might



15.7 Vent hose connections at fuel tank filler pipe

A Charcoal canister hose
B Tank vent hose

prevent its removal, manoeuvre the pipe away from the vehicle's underside.
6 To check the operation of the pipe's anti-leak valve, invert the filler pipe and fill the lower union (now uppermost) with petrol. If the valve is functioning correctly, no petrol will leak from the other union. If petrol leaks from the other union the valve is faulty and the complete filler pipe must be renewed.

Refitting

7 Refitting is the reverse of the removal procedure, noting the following.
a) Check the condition of all hoses and clips, renewing any components that are found to be worn or damaged
*b) When reconnecting the small-bore vent hoses to the unions at the pipe's upper end, connect the hose from the charcoal canister to the uppermost union and the vent hose from the tank itself to the lower union **(see illustration)**.*
c) Replacing any that were cut on removal use the clips or ties provided to secure any other pipes or hoses to the filler pipe.
d) Check carefully for signs of leaks on refilling the tank; if any signs of leakage are detected, the problem must be rectified immediately.

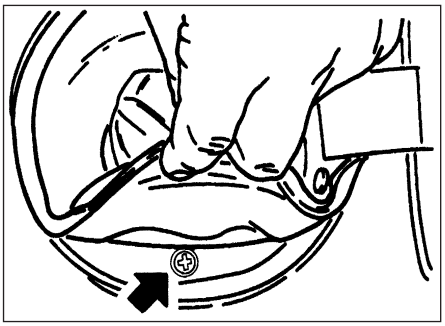
16 Fuel tank - removal and refitting

Note: *Refer to Section 2 before proceeding*

Removal

SOHC models

1 The procedure is similar as for models with carburettors. Refer to Chapter 4A, however note the following:
a) Depressurise the fuel system (Section 8).
b) On models with C16 NZ and X16 SZ engines, disconnect the exhaust system from the manifold.
c) When working on the fuel tank sender unit, note that there is only one hose to be disconnected.

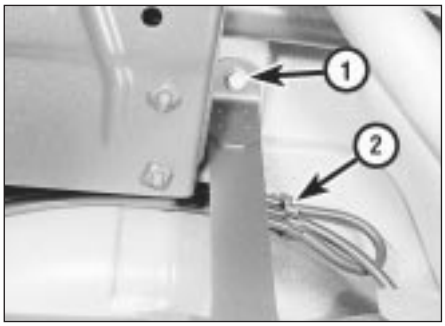


16.5 Fuel filler pipe securing screw (arrowed) - models with semi-trailing arm rear axles

d) Disconnect the fuel pump hose and wiring as described in Section 12.
e) When releasing the tank mounting straps, note that the fuel filter must either be moved aside or removed completely, whichever is most convenient
f) One of the fuel hoses connects to a pipe in the side of the tank.

DOHC models

2 Disconnect the battery negative lead.
3 Siphon out any remaining fuel in the tank through the filler pipe. Siphon the fuel into a clean metal container that can be sealed.
4 Chock the front wheels, then jack up the rear of the vehicle, and support on axle stands placed under the body side members (see "*Jacking and Vehicle Support*").
5 Open the fuel filler flap, then pull back the rubber seal to expose the fuel filler pipe securing screw **(see illustration)**. Remove the screw.
6 Release the fuel tank vent hoses from the clips on the underbody.
7 Support the weight of the fuel tank on a jack, with an interposed block of wood.
8 Unscrew the securing bolts from the tank mounting straps. Then remove the straps and lower the tank sufficiently to enable the fuel hoses, vent hoses and fuel tank sender unit wiring to be disconnected **(see illustration)**.
9 Disconnect the vent hoses and the fuel tank sender unit wiring. Note the positions of the vent hoses as an aid to refitting.
10 Disconnect the fuel hoses from the tank and the fuel tank sender unit, making a note of the hose positions for use when refitting. Be prepared for fuel spillage, and take adequate fire precautions. Plug the open ends of the hoses, to prevent dirt ingress and further fuel loss.
11 Lower the fuel tank, and withdraw it from under the vehicle.
12 If the tank contains sediment or water, it may be cleaned out using two or three rinses with clean fuel. Shake vigorously using several changes of fuel, but before doing so, remove the fuel tank sender unit, as described in Section 17. *This procedure should be carried out in a well-ventilated area, and it is vital to take adequate fire precautions - refer to the "Safety first!" Section at the beginning of this manual for further details.*



16.8 Fuel tank mounting - models with semi-trailing arm rear axles
1 Strap securing bolt 2 Vent hose securing

Refitting

13 Any repairs to the fuel tank should be carried out by a professional.
14 Refitting is a reversal of removal, ensuring that all hoses are reconnected to their correct locations as noted during removal.
15 On completion, fill the fuel tank, then run the engine and check for leaks. If leakage is evident, stop the engine immediately, and rectify the problem without delay.

17 Fuel tank sender unit - removal and refitting

Note: *Refer to Section 2 before proceeding*

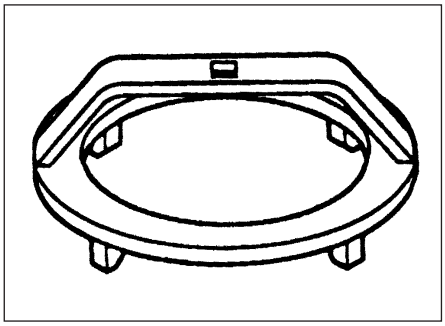
Removal

SOHC models

1 Remove the fuel tank, (refer to Section 16), if necessary. Note that there is only one hose connected to the sender unit. This must also be disconnected from the union on the inside of the unit before it can be withdrawn completely from the tank **(see illustration).**

DOHC models

2 Remove the fuel tank, as described in Section 16.
3 Make alignment marks on the sender unit and the fuel tank so that the sender unit can be refitted in its original position.
4 To remove the sender unit, an improvised tool must be used which engages with the cut-outs in the sender unit retaining ring. The Vauxhall special tool KM-673 for this purpose is shown **(see illustration)**.
5 Withdraw the unit carefully, to avoid bending the float arm.
6 Recover the sealing ring.



17.4 Vauxhall special tool KM-673 for removing fuel level sender units

17.1 Fuel level sender unit - models with semi-independent rear axles

Refitting

7 Refitting is a reversal of removal, remembering the following points.
8 Renew the sealing ring.
9 Ensure that the marks made on sender unit and fuel tank before removal are aligned.
10 Refit the fuel tank, (Section 16).

18 Fuel flow damper - removal and refitting

Note: *Refer to Section 2 before proceeding*

Removal

1 The fuel flow damper is located on the fuel pump bracket under the rear of the vehicle, on the right-hand side of the spare wheel well or in front of the fuel tank, depending on model **(see illustration)**. The damper is positioned in the fuel feed line between the fuel pump and the fuel filter, and its purpose is to reduce pressure fluctuations in the fuel return line, thus reducing noise levels.
2 Disconnect the battery negative lead.
3 Have a container to hand, to catch the fuel that will be released as the damper is removed.

18.1 Fuel flow damper - models with semi-trailing arm rear axles

4 Clamp the fuel hoses on either side of the damper, to minimise fuel loss when the hoses are disconnected.
5 Loosen the clamp screws, and disconnect the fuel hoses from the damper. Be prepared for fuel spillage, and take adequate fire precautions.
6 Unscrew the securing nut, and withdraw the damper from the bracket.

Refitting

7 Refitting is a reversal of removal.
8 Run the engine and check for leaks on completion. If leakage is evident; stop the engine immediately, and rectify the problem without delay.

19 Throttle cable - removal, refitting and adjustment

Removal

1 This procedure is basically the same as described in Chapter 4A, but note the following.
2 Not all models are fitted with an air box. Ignore references to it, if not applicable.
3 For "carburettor" substitute "throttle body", and note that the cable bracket is bolted to the inlet manifold.
4 The throttle cable end may connect to a balljoint on the throttle valve lever, which is retained by a clip **(see illustration)**.
5 If fitted, remove the air box. Refer to Section 5, if necessary.
6 Where fitted, use a pair of needle-nosed pliers to extract the wire spring clip securing the cable end balljoint to the throttle linkage. Prise the cable end off the linkage.
7 Withdraw the clip and pull the cable outer seating grommet out of the cable bracket, then release the cable as far as the bulkhead **(see illustration)**.
8 Working inside the passenger compartment, remove the driver's footwell trim panel, refer to Chapter 11, if necessary.
9 Release the end of the cable's inner wire from the "keyhole" fitting at the top of the throttle pedal by easing back the spring and prising the cable end out of the slot.
10 Prise the grommet out of the bulkhead and tie a length of string to the cable.
11 Noting carefully its routing, withdraw the cable through the bulkhead into the engine compartment; untie the string, leaving it in place, when the pedal end of the cable appears.

Refitting

12 Refitting is the reverse of the removal procedure, noting the following points.
a) First ensure that the cable is correctly routed, then draw it through the bulkhead aperture using the string.
b) Ensure that the bulkhead grommet is correctly seated.
c) Connect the cable end to the throttle linkage. Seat the cable outer grommet in the bracket and pull it through so that the cable inner wire is just taut when the throttle linkage is held fully closed. Fit the clip to secure the cable outer in that position.
d) Check the throttle operation and cable adjustment, as described below.

Adjustment

13 Refer to Chapter 4A, but for "carburettor" substitute "throttle body". If applicable, the air box must be removed.
14 First check that the pedal is at a convenient height for the driver. This setting can be adjusted by turning the pedal stop screw (it will be necessary to remove the footwell trim panel to reach the screw). Remember that the pedal must be left with enough travel for the throttle valve to open fully. Also check that the pedal pivot bushes are in good condition.
15 Returning to the engine compartment, check that the linkage pivots and balljoints are unworn and operate smoothly throughout their full travel. When the throttle valve is fully closed and the throttle pedal is released, there should be hardly any free play in the cable inner wire.
16 If adjustment is required, extract the clip securing the cable outer seating grommet in the cable bracket and replace it in the appropriate groove, so that the cable outer is repositioned correctly.
17 With an assistant operating the throttle pedal from the driver's seat. Check that when the pedal is fully depressed, the throttle valve is fully open. If there is insufficient pedal travel to permit this, unscrew the pedal stop screw, then reset the cable at the throttle linkage.
18 When cable adjustment is correct, refit all disturbed components.

19.4 Disconnecting the throttle cable end from the throttle valve lever - SOHC model

19.7 Throttle cable end grommet in bracket on inlet manifold

20 Idle mixture - checking and adjustment

Note: *No adjustment of idle mixture is possible on models fitted with a catalytic converter, and no adjustment of idle speed is possible with the Motronic system. Refer to Section 2 before proceeding. A tachometer and an exhaust gas analyser (CO meter) will be required to carry out adjustment on models fitted with Motronic systems.*

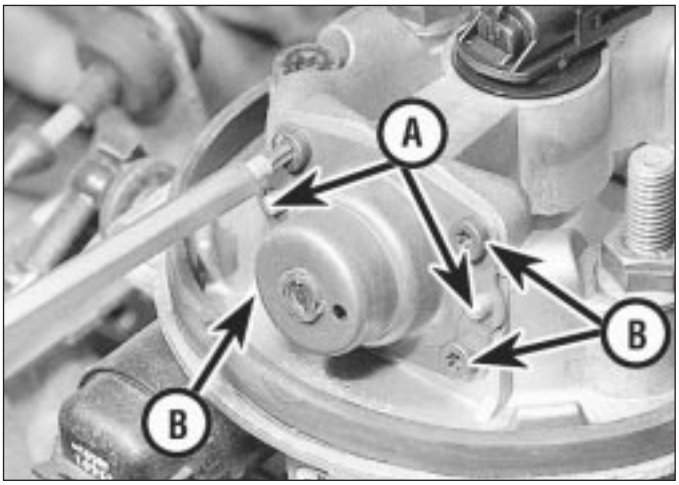
Multec systems

Checking

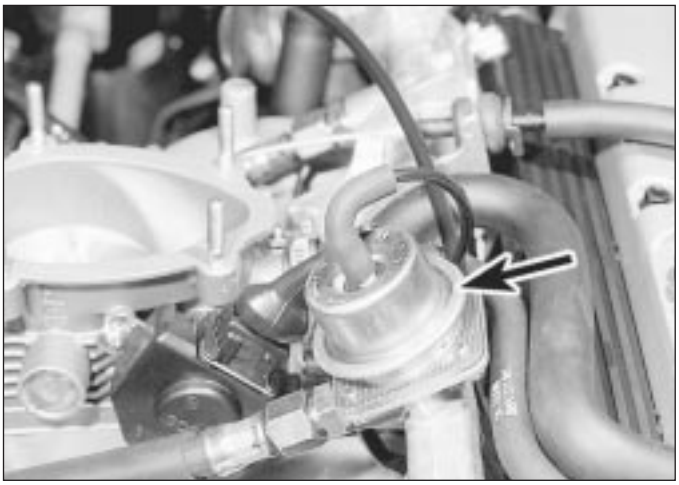
1 If the CO level reading is incorrect (or if any other symptom is encountered which causes you to suspect a fault) always check first that the air cleaner element is clean. Check also that the spark plugs are in good condition and correctly gapped. Ensure that the engine breather and vacuum hoses are clear and undamaged. Check that there are no leaks in the air inlet trunking. Check the throttle body and the manifolds for damage. Ensure that the throttle cable is correctly adjusted (see Section 19). If the engine is running very roughly, check the compression pressures (Chapter 2A) and remember the possibility that one of the hydraulic tappets might be faulty, producing an incorrect valve clearance. Check also that all wiring is in good condition, with securely fastened connectors. Check that the fuel filter has been renewed at the recommended intervals and that the exhaust system is entirely free of air leaks which might upset the operation of the catalytic converter, if fitted.

Adjustment

2 The idle mixture is controlled entirely by the ECU and there is no provision at all for any form of adjustment. Furthermore, accurate checking is not possible without the use of Vauxhall test equipment in conjunction with a good-quality, carefully calibrated exhaust gas analyser.
3 While it may be possible for owners with access to such analysers to check the mixture, the results should be regarded as no more than a rough guide. If the mixture is thought to be incorrect, the vehicle should be taken to a Vauxhall dealer for checking. If the CO level exceeds the specified value the system must be checked thoroughly by an experienced mechanic using the Vauxhall test equipment until the fault is eliminated and the defective component renewed.



21.9 Fuel pressure regulator cover
A Locating dowels B Mounting screws



21.17 Fuel pressure regulator (arrowed) - DOHC model

4 Where applicable, the only test of the catalytic converter's efficiency is to check the level of CO in the exhaust gas. This is measured at the tailpipe with the engine running (with no load) at 3000 rpm. If the CO level exceeds the specified value, the Vauxhall test equipment must be used to check the entire fuel injection/ignition system. If the engine is mechanically sound, once the system has been eliminated, the fault must lie in the converter, which must be renewed.

Motronic systems

Checking

5 In order to check the idle mixture adjustment, the following conditions must be met:

a) The engine must be at normal operating temperature
b) All electrical consumers (cooling fan, heater blower, headlamps etc.) must be switched off
c) The spark plug gaps must be correctly adjusted see Chapter 1
d) The throttle cable free play must be correctly adjusted - see Section 19
e) The air inlet trunking must be free from leaks, and the air filter must be clean

Adjustment

6 Connect a tachometer and an exhaust gas analyser to the vehicle in accordance with the equipment manufacturer's instructions.
7 Start the engine and turn it at 2000 rpm for approximately 30 seconds, then allow it to idle. Check that the idle speed is within the specified limits. No adjustment of idle speed is possible, and if outside the specified limits, the problem should be referred to a dealer.
8 With the idle speed correct, check the CO level in the exhaust gas. If it is outside the specified limits, adjust by means of the idle mixture adjustment screw in the airflow meter or air mass meter, as applicable. In production, the screw is covered by a tamperproof plug; ensure that no local or national laws are being broken before removing the plug.
9 If the cooling fan cuts in during the adjustment procedure, stop the adjustments, and proceed when the cooling fan stops.
10 When the idle mixture is correctly set, stop the engine and disconnect the test equipment.

Simtec systems

11 Adjustment is not possible on these models.

21 Fuel pressure regulator - removal and refitting

Note: *Refer to Section 2 before proceeding*

Removal

SOHC models (except Multec systems)

1 Disconnect the battery negative lead.
2 For improved access, remove the idle speed adjuster as described in Section 22. Disconnect the wiring harness housing from the fuel injectors and move it to one side, taking care not to strain the wiring. Pull up on the wiring harness housing, and compress the wiring plug retaining clips to release the harness housing from the injectors.
3 Position a wad of rag beneath the pressure regulator, to absorb the fuel that will be released as the regulator is removed.
4 Loosen the clamp screws and disconnect the fuel hoses from the regulator. Be prepared for fuel spillage, and take adequate fire precautions.
5 Disconnect the vacuum pipe from the top of the pressure regulator and withdraw the regulator.

SOHC models (with Multec system)

6 Depressurise the fuel system, as described in Section 8.
7 Remove the air box. Refer to Section 5, if necessary.
8 Disconnect the battery earth lead.
9 Noting the dowels locating the cover, carefully unscrew the fuel pressure regulator cover Torx-type screws (size TX 15). Ensure that the spring does not fly out as the cover is released. Remove the cover spring seat, spring and diaphragm, noting how each is fitted **(see illustration)**.
10 The diaphragm must be renewed whenever the cover is disturbed. If any of the regulator's other components are worn or damaged, they can be renewed only as part of the throttle body upper section assembly.

DOHC models

11 Disconnect the battery negative lead.
12 Disconnect the wiring plug from the air mass meter. Recover the sealing ring.
13 Loosen the clamp screw securing the air trunking to the right-hand end of the air mass meter.
14 Using an Allen key or hexagon bit, unscrew the four bolts securing the air box to the throttle body. Lift the air box from the throttle body and disconnect the hose from the base of the air box, then withdraw the air box/air mass meter assembly.
15 Disconnect the two breather hoses from the rear of the camshaft cover, and move them to one side.
16 Disconnect the wiring plug from the throttle position sensor.
17 Disconnect the vacuum pipe from the top of the pressure regulator **(see illustration)**.
18 Position a wad of rag beneath the regulator, to absorb the fuel that will be released as the regulator is removed.
19 Using a spanner or socket, and working underneath the regulator, unscrew the four Torx type securing bolts, then withdraw the regulator. Be prepared for fuel spillage, and take adequate fire precautions.

Refitting

20 Refitting is a reversal of removal, ensuring that all wires, pipes and hoses are correctly reconnected. Note that on DOHC models, the

22.2 Disconnecting the idle speed adjuster wiring plug - SOHC models (except with Multec systems)

22.4 Withdrawing the idle speed adjuster complete with hoses - SOHC model (except with Multec systems)

22.9 Idle speed adjuster (arrowed) viewed from underneath vehicle - DOHC model

regulator vacuum pipe should be routed over the top of the camshaft cover breather hoses.

21 On models with the Multec system note also the following:

a) Fit the new diaphragm so that it locates in the throttle body groove.

b) Ensure that the spring and spring seat are correctly engaged with each other and with the diaphragm and regulator cover. Then press the cover over its locating dowels and hold it in place while the screws are tightened.

c) Tighten the screws carefully to the specified torque wrench setting.

22 On completion, check the regulator for leaks, pressurising the system by switching the ignition on and off several times, before the engine is started.

22 Idle speed adjuster - removal and refitting

Note: *Idle speed adjustment on models fitted with Multec systems, is not possible, as it is controlled by the ECU. Refer to Section 1.*

Removal

SOHC models (except Multec system)

1 Disconnect the battery negative lead.

2 Disconnect the wiring plug from the idle speed adjuster **(see illustration)**.

3 The adjuster can be removed complete with its connecting hoses, or separately, leaving the hoses in place.

4 Loosen the relevant clamp screws, then disconnect the hoses, and withdraw the idle speed adjuster **(see illustration)**.

DOHC models

5 Disconnect the battery negative lead.

6 Loosen the clamp screw, and disconnect the hose from underneath the air box on the throttle body. Remove the clamp from the hose.

7 Apply the handbrake, then jack up the front of the vehicle, and support securely on axle stands (see "*Jacking and Vehicle Support*") placed under the body side members.

8 Remove the engine undershield, as described in Chapter 11.

9 Working underneath the vehicle, disconnect the wiring plug from the idle speed adjuster, which is located underneath the inlet manifold above the starter motor **(see illustration)**.

10 Loosen the clamp screw and disconnect the remaining idle speed adjuster hose from the inlet manifold, then withdraw the adjuster downwards complete with the hoses.

11 If the hoses are to be removed from the adjuster, mark their locations before removal so that they can be correctly reconnected. Once the adjuster has been refitted, it is impossible to swap the hose positions.

Refitting

12 Refitting is a reversal of removal. On DOHC models ensure that the idle speed adjuster rests horizontally, with the wiring routed over the top of the coolant hose. If the wiring is routed under the coolant hose, this may cause the idle speed adjuster to be bent downwards, resulting in a restriction or fracture in the air hose to the inlet manifold.

23 Throttle position sensor - removal and refitting

Removal

SOHC models

1 Disconnect the battery negative lead.

2 Disconnect the wiring plug from the throttle position sensor **(see illustration)**.

3 Remove the two securing screws and withdraw the sensor from the throttle body **(see illustration)**.

DOHC models

4 Disconnect the battery negative lead.

5 Disconnect the wiring plug from the air mass meter. Recover the sealing ring.

6 Loosen the clamp screw securing the air trunking to the right-hand end of the air mass meter.

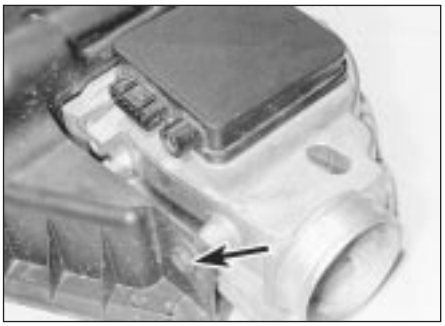
7 Using an Allen key or hexagon bit, unscrew the four bolts securing the air box to the throttle body. Lift the air box from the throttle body, and disconnect the hose from the base of the air box, then withdraw the air box/air mass meter assembly.

8 Disconnect the wiring plug from the throttle position sensor wiring plug **(see illustration)**.

23.2 Disconnecting the throttle position sensor wiring plug - early SOHC models

23.3 Removing a throttle position sensor securing screw - SOHC early model

23.8 Disconnecting the throttle position sensor wiring plug - DOHC model



25.2 Airflow meter securing bolt (arrowed) - SOHC model

9 Remove the two securing screws and withdraw the sensor from the throttle body.

Refitting

10 Refitting is a reversal of removal.
11 On Motronic M4.1 system models, before tightening the securing screws, adjust the position of the sensor as follows:

a) Turn the sensor body anti-clockwise until resistance is felt, then tighten the securing screws.
b) When the throttle valve is opened, an audible click should be noticeable from the sensor, and similarly, this should be repeated as the throttle valve is closed.
c) If necessary, adjust the position of the sensor until a click is heard just as the throttle valve begins to open.

12 On M 1.5 systems, no adjustment is required when refitting, as the sensor can only be fitted in one position.

24 Throttle valve potentiometer - removal and refitting

Removal

1 Disconnect the battery negative lead.
2 Disconnect the wiring plugs at the inlet air temperature sensor and at the hot film mass airflow meter.
3 Undo and remove the bolts securing the air box to the throttle body. Remove the air box complete with air trunking.

26.2 Recover the sealing ring from the air mass meter wiring plug - DOHC model

25.3 Airflow meter securing bolts and reinforcing plates, and air funnel

4 Disconnect the wiring plug at the throttle valve potentiometer, then undo the two screws and withdraw the potentiometer from the throttle body.

Refitting

5 Refitting is a reversal of removal.

25 Airflow meter (if fitted) - removal and refitting

Note: *If the air funnel is removed, a new gasket must be used on refitting. The airflow meter securing bolts must be coated with thread-locking compound on refitting*

Removal

1 Remove the air cleaner assembly, as described in Section 4.
2 Unscrew the single bolt securing the airflow meter to the front of the air cleaner cover **(see illustration)**.
3 Unscrew the four securing bolts from inside the air cleaner cover, recover the two reinforcing plates, and withdraw the airflow meter **(see illustration)**.
4 If desired, the air funnel can be unclipped from inside the air cleaner cover.

Refitting

5 Refitting is a reversal of removal, remembering the following points.
6 If the air funnel has been removed, refit it using a new gasket.
7 Coat the threads of the four airflow meter securing bolts that fit inside the air cleaner cover with thread-locking compound.

26 Air mass meter (if fitted) - removal and refitting

Removal

1 Disconnect the battery negative lead.
2 Disconnect the wiring plug from the air mass meter. Recover the sealing ring **(see illustration)**.
3 Loosen the clamp screws from the air trunking on either side of the air mass meter, then disconnect the air trunking and withdraw the meter.

Refitting

4 Refitting is a reversal of removal, but inspect the air mass meter wiring plug sealing ring and renew if necessary.

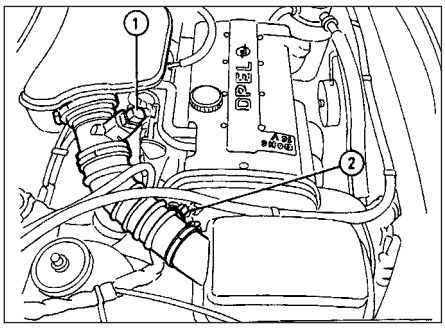
27 Hot film mass airflow meter - removal and refitting

Removal

1 Disconnect the battery negative lead.
2 Disconnect the wiring plug at the hot film mass airflow meter and at the inlet air temperature sensor.
3 Remove the upper part of the air cleaner together with the inlet air trunking and air flow meter.
4 Release the hose clamps and separate the airflow meter from the inlet air trunking, noting the position of the trunking with the air flow meter. If there is any external damage replace the unit.

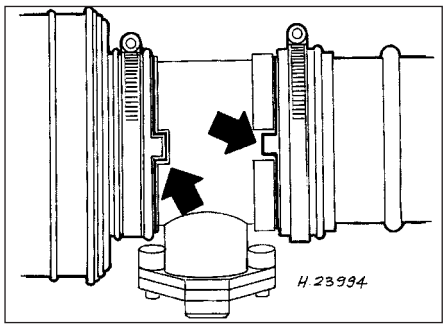
Refitting

5 Refitting is a reversal of removal but ensure that the air trunking is connected to the airflow meter as shown **(see illustration)**. Also ensure that the marks on the air trunking and air box are aligned as shown **(see illustration)**.



27.5A Hot film mass airflow meter attachments - Motronic M2.8

1 Hot film mass airflow meter wiring plug
2 Inlet air temperature sensor wiring plug

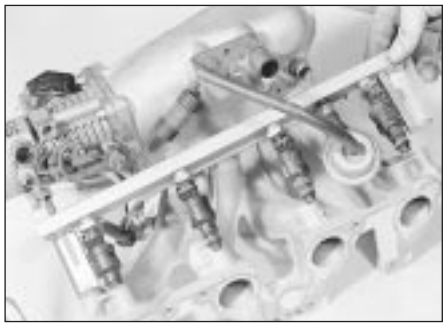


27.5B Correct attachment of air trunking to hot film mass airflow meter - Motronic M2.8

Arrows indicate air trunking to airflow meter alignment notches

28.6A Remove the outer . . .

28.6B . . . and inner fuel rail securing bolts . . .



28.6C . . . and lift the fuel rail from the inlet manifold (inlet manifold removed for clarity) - SOHC model

28 Fuel injectors (except Multec system) - removal and refitting

Note: *Refer to Section 2 before proceeding. New O-rings must be used when refitting the injectors. Where applicable, a tachometer and an exhaust gas analyser will be required to check the idle mixture on completion*

Removal

SOHC models

1 Disconnect the battery negative lead.
2 Unscrew the union nut, and disconnect the brake servo vacuum hose from the inlet manifold.
3 Remove the idle speed adjuster, complete with hoses, referring to Section 22 if necessary.
4 Disconnect the vacuum pipe from the top of the fuel pressure regulator.
5 Disconnect the wiring harness housing from the fuel injectors, and move it to one side, taking care not to strain the wiring. Pull up on the wiring harness housing, and compress the wiring plug retaining clips to release the harness housing from the injectors.
6 Remove the four bolts from the brackets securing the fuel rail to the inlet manifold, then lift the fuel rail complete with fuel injectors sufficiently to enable the injector(s) to be removed **(see illustrations)**. Take care not to strain the fuel hoses.
7 To remove an injector from the fuel rail, prise out the metal securing clip using a screwdriver, then pull the injector from the fuel rail **(see illustrations)**.

Refitting

8 Overhaul of the fuel injectors is not possible, as no spares are available. If faulty, an injector must be renewed.
9 Begin refitting by fitting new seals to both ends of each fuel injector **(see illustration)**. Even if only one injector has been removed, new seals should be fitted to all four injectors.
10 Refitting is a reversal of removal, ensuring that all hoses, pipes and wires are correctly reconnected.
11 On completion, where applicable, check and if necessary adjust the idle mixture, as described in Section 20.

DOHC models

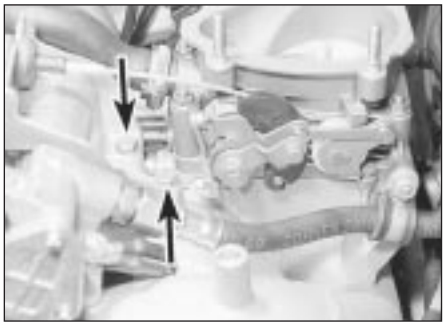
Removal

12 Disconnect the battery negative lead.
13 Loosen the clamp screw securing the air trunking to the left-hand end of the air mass meter.
14 Using an Allen key or hexagon bit, unscrew the four bolts securing the air box to the throttle body. Lift the air box from the throttle body, and disconnect the hose from the base of the air box, then withdraw the air box.
15 Position a wad of rag beneath one of the fuel hose unions on the fuel rail, to absorb the fuel that will be released as the union is disconnected.
16 Slowly loosen the fuel hose union to relieve the pressure in the fuel line, then disconnect the hose from the fuel rail. Be prepared for fuel spillage, and take adequate fire precautions. Plug the end of the fuel hose, to prevent dirt ingress and further fuel leakage.
17 Repeat paragraphs 15 and 16 for the remaining fuel hose-to-fuel rail union.
18 Disconnect the two breather hoses from the rear of the camshaft cover. Disconnect the larger hose from the throttle body, and remove the hose completely.
19 Disconnect the vacuum pipe from the top of the fuel pressure regulator.
20 Disconnect the wiring plug from the air mass meter. Recover the sealing ring.
21 Disconnect the wiring plug from the throttle position sensor.
22 Slide the end of the throttle cable from the throttle valve lever on the throttle body, then unbolt the cable bracket from the inlet manifold, and move it to one side **(see illustration)**.

28.7A Withdraw the securing clip . . .

28.7B . . . then pull the injector from the fuel rail - SOHC model

28.9 Fit new seals to the injectors



28.22 Throttle cable bracket securing bolts (arrowed) - DOHC model

28.24 Earth leads secured to fuel rail stud (arrowed) - DOHC model

23 Disconnect the wiring harness housing from the fuel injectors, and move it to one side, taking care not to strain the wiring. Pull up on the wiring harness housing, and compress the wiring plug retaining clips to release the housing from the injectors.

24 Unscrew and remove the two fuel rail securing nuts, and withdraw the fuel rail complete with fuel injectors from the inlet manifold. Note the position of the earth leads on the fuel rail securing studs **(see illustration)**.

25 To remove an injector from the fuel rail, prise out the metal securing clip using a screwdriver, then pull the injector from the fuel rail

Refitting

26 Refitting is as described in paragraphs 8 to 11 inclusive.

29 Fuel injector (Multec system) - removal and refitting

Removal

1 Depressurise the fuel system (see Section 8).

2 Remove the air box (see Section 5).

3 Disconnect the battery earth lead.

4 Disconnect the wiring plug from the fuel injector **(see illustration)**.

5 Undo the Torx-type screw (size TX 20) securing the fuel injector retainer to the top of the throttle body, remove the retainer and lift out the injector **(see illustration)**. Remove and discard the injector sealing rings.

29.6 Renew injector sealing rings (arrowed)

29.4 Disconnecting the fuel injector wiring plug - Multec systems

Refitting

6 Refitting is the reverse of the removal procedure, noting the following points.

*a) Always renew both sealing rings; apply a smear of grease to each to ease injector refitting **(see illustration)**.*

b) Refit the injector so that its wiring terminals point to the rear of the vehicle; locate the edge of the retainer securely in the groove at the top of the injector.

c) Apply a few drops of a thread-locking compound to the screw threads, then tighten it carefully to the specified torque wrench setting.

d) Switch on the ignition and check carefully for signs of fuel leaks; if any signs of leakage are detected, the problem must be rectified before the engine is started.

30 Fuel injector (Multec system) - testing

1 A simple test of the injector's windings is possible for those who have a multi-meter of sufficient sensitivity. First disconnect the injector wiring plug as described in Section 29, then connect the meter (set to the appropriate resistance scale) across the injector's terminals and note the reading obtained.

2 On C18 NZ engines, the reading should be within the specified tolerance; similar results can be expected on C16NZ, C16NZ2, and X16 SZ engines.

3 If the reading differs significantly from the specified value, indicating either shorted or open circuit windings, the injector must be renewed.

4 Note that this is only a test of the injector's electrical condition; it does not test its spray pattern or performance. If the injector is thought to be faulty it is always worth trying a well known injector-cleaning treatment. If this fails, the vehicle must be taken to a Vauxhall dealer for full testing on the special test equipment.

29.5 Unscrewing the injector retainer Torx screw

31 Throttle body (except Multec system) - removal and refitting

Note: *Refer to Section 2 before proceeding. A new throttle body gasket must be used on refitting*

SOHC

Removal

1 Disconnect the battery negative lead.

2 Loosen the clamp screws securing the air trunking to the throttle body and the airflow meter, then withdraw the air trunking.

3 Loosen the clamp screw, and disconnect the idle speed adjuster hose from the throttle body.

4 Disconnect the camshaft cover breather hose from the throttle body.

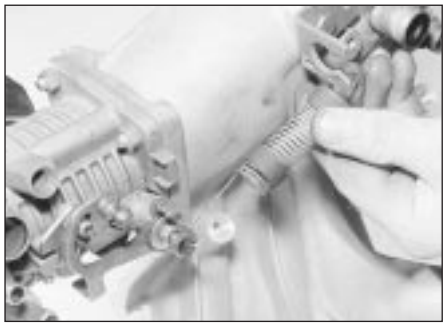
5 Disconnect the coolant hoses from the throttle body. Be prepared for coolant spillage, and clamp or plug the open ends of the hoses, to prevent further coolant loss.

6 Disconnect the wiring plug from the throttle position sensor.

7 Release the securing clip, then disconnect the throttle cable end balljoint from the throttle valve lever.

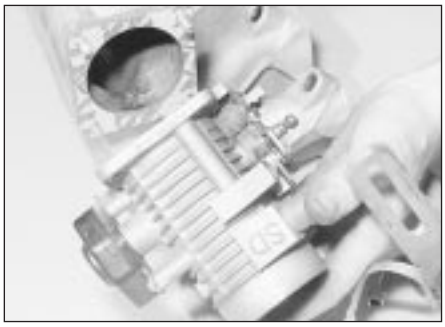
8 Slide the throttle cable grommet from the bracket on the inlet manifold, then unhook the throttle return spring from the bracket **(see illustration)**.

9 Make a final check to ensure that all relevant hoses and wires have been disconnected and moved clear of the throttle body.



31.8 Unhook the throttle return spring from the bracket on the inlet manifold (inlet manifold removed for clarity)

31.10A Unscrew the securing nuts . . .



31.10B. . . and withdraw the throttle body (inlet manifold removed for clarity) - SOHC models

10 Unscrew the four securing nuts, and withdraw the throttle body from the inlet manifold **(see illustrations)**. Access to the lower nuts is difficult and it may be necessary to move the two fuel hoses to one side for improved access. Take care not to strain the hoses.
11 Recover the gasket.
12 If desired, the throttle position sensor can be removed from the throttle body, with reference to Section 23.

Refitting

13 Refitting is a reversal of removal, remembering the following points.
14 Where applicable, refit the throttle position sensor, as described in Section 23.
15 Refit the throttle body, using a new gasket **(see illustration)**.
16 Ensure that all hoses and wires are correctly reconnected and routed.
17 Check and if necessary top-up the coolant level, as described in Chapter 3.
18 Check and if necessary adjust the throttle cable free play, as described in Section 19.

DOHC

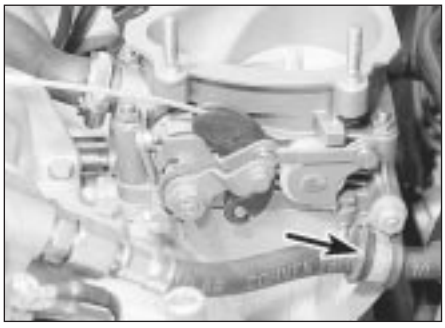
Removal

19 Disconnect the battery negative lead.
20 Loosen the clamp screw securing the air trunking to the left-hand side of the air mass meter.
21 Using an Allen key or hexagon bit, unscrew the four bolts securing the air box to the throttle body. Lift the air box from the throttle body, and disconnect the hose from the base of the air box, then withdraw the air box.
22 Disconnect the wiring plug from the throttle position sensor.
23 Unscrew the retaining nut, and remove the fuel hose bracket from the left-hand side of the throttle body **(see illustration)**.
24 Slide the throttle cable end from the throttle valve lever.
25 Disconnect the breather hose from the front of the throttle body.
26 Disconnect the vacuum pipe from the top of the fuel pressure regulator.
27 Make a final check to ensure that all relevant hoses, pipes and wires have been disconnected and moved clear of the throttle body.
28 Unscrew the four securing nuts, and withdraw the throttle body from the inlet manifold. Recover the gasket.
29 If desired, the throttle position sensor can be removed from the throttle body, referring to Section 31, if necessary.
30 Do not under any circumstances attempt to adjust the throttle valve linkage. If the throttle valve linkage is faulty, refer the problem to a Vauxhall dealer.

Refitting

31 Refitting is a reversal of removal, remembering the following points.
32 Where applicable, refit the throttle position sensor, as described in Section 23.
33 Refit the throttle body, using a new gasket.
34 Ensure that all hoses, pipes and wires are correctly reconnected and routed.
35 On completion, check and if necessary adjust the throttle cable free play, as described in Section 19.

31.15 Refit the throttle body, using a new gasket



31.23 Remove the fuel hose bracket (arrowed) from the throttle body - DOHC models

32 Throttle body (Multec system) - removal and refitting

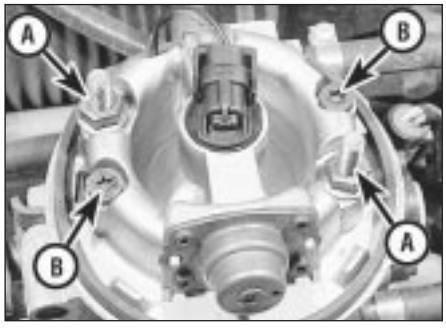
Removal

1 Depressurise the fuel system (Section 8).
2 Remove the air box (see above).
3 Disconnect the battery negative lead.
4 Disconnect the wiring plugs from the fuel injector (pressing out the wiring rubber grommet), from the idle air control stepper motor and from the potentiometer.
5 Disconnect the fuel hoses from their unions and plug them to prevent loss of fuel and the entry of dirt; label them to ensure correct refitting. Be prepared for fuel spillage and take safety precautions.
6 Disconnect the vacuum hoses and pipes from the body unions.
7 Disconnect the throttle valve operating linkage at the throttle body.
8 Undo the two nuts securing the throttle body to the inlet manifold and withdraw the body assembly; peel off and discard the gasket **(see illustration)**.
9 If required, the throttle body's upper and lower sections may be separated by removing the two Torx-type securing screws; note that a new gasket must be fitted on reassembly. The fuel inlet and return unions may also be unscrewed, but note that new sealing rings must be fitted on reassembly, and the unions must be tightened securely.

Refitting

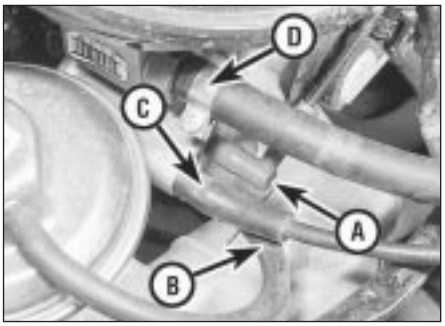
10 Refitting is the reverse of the removal procedure, noting the following points **(see illustration)**.

a) Renew all gaskets and seals, and use thread-locking compound where applicable.



32.8 Throttle body - Multec systems

A Mounting nuts
B Upper-to-lower section Torx screws



32.10 Intake air temperature control - Multec systems

A Vacuum pipe
B Exhaust gas recirculation valve hose
C Charcoal canister control pipe
D Fuel return hose

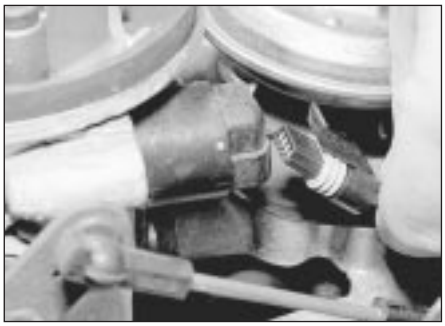
b) Check the throttle cable operation and adjustment (see above).
c) When reconnecting the vacuum hoses and pipes, ensure that they are connected to the front unions as shown in the accompanying photograph.
d) As no fuel vapour trap is fitted, it is essential that the manifold absolute pressure sensor vacuum hose is routed so that it falls steadily from the sensor to the throttle body. This precaution will prevent any fuel droplets being trapped in the sensor or hose and allowing them to drain into the inlet port.
e) Ensure that the fuel hoses are correctly reconnected; the feed hose is on the injector end of the throttle body.
f) Switch on the ignition and check for signs of fuel leaks from all disturbed unions; if any signs of leakage are detected, the problem must be rectified before the engine is started.

33 Idle air control stepper motor - removal and refitting

Removal

1 Remove the air box (see Section 5).
2 Disconnect the battery earth lead.

34.2 Disconnecting the throttle potentiometer wiring plug - note the mounting screws (arrowed)



33.3 Disconnecting the idle air control stepper motor wiring plug

3 Disconnect the wiring plug from the stepper motor **(see illustration)**.
4 Undo its two screws, then withdraw the stepper motor. Remove and discard the sealing ring **(see illustrations)**.

Refitting

5 Refitting is the reverse of the removal procedure, noting the following points.
a) Fit a new sealing ring, greasing it lightly to ease installation.
b) To prevent the risk of damage, either to the throttle body or to the stepper motor, if the motor's plunger tip projects more than 28 mm (1.1 in) beyond the motor's mating surface, carefully press the plunger in until its stop is reached. The stepper motor will then be reset by the ECU when the engine is restarted.
c) Apply a few drops of a thread-locking compound to their threads, then carefully tighten the screws to the specified torque wrench setting.

34 Throttle potentiometer - removal and refitting

Removal

1 Disconnect the battery negative lead.
2 Disconnect the wiring plug from the potentiometer **(see illustration)**.
3 Unscrew the two Torx-type securing screws (size TX 25) and withdraw the potentiometer.

35.3 Withdrawing the fuel injection/ignition system ECU

33.4A Unscrew retaining screws (second screw arrowed) . . .

33.4B . . . to remove the stepper motor - renew sealing ring (arrowed)

Refitting

4 Refitting is the reverse of the removal procedure, noting the following points.
a) Install the potentiometer when the throttle valve is fully closed, and ensure that its adapter seats correctly on the throttle valve spindle.
b) Tighten the screws carefully to the specified torque.

35 Electronic Control Unit (ECU) - removal and refitting

Removal

1 Disconnect the battery negative lead.
2 Remove the driver's footwell side trim panel (Chapter 11).
3 Release the unit from its mountings and withdraw it until the wiring plugs' locking lugs can be released and the plugs can be disconnected **(see illustration)**.
4 Note that the unit consists of two parts the basic control unit and the Programmable Read Only Memory (PROM). While it is possible to renew them separately, do not attempt to separate them. Faults requiring this degree of attention can be diagnosed only by an experienced mechanic using the special Vauxhall test equipment. A previously sound ECU could be seriously damaged by careless handling of the contacts between the two sub-units.

Refitting

5 Refitting is a reversal of the removal procedure, ensuring that the wiring plugs are correctly reconnected and that the unit is located securely.

36 Knock sensor and module (X16 SZ models) - removal and refitting

Removal

1 The knock sensor fitted to the X16 SZ engine is located on the cylinder block below the inlet manifold, between cylinders 2 and 3.
2 Disconnect the battery negative lead.
3 Remove the wiring and unscrew the unit from the block.
4 The module and control unit are located on the left-hand side of the engine compartment behind the battery. To remove, disconnect the wiring multiplug and remove the retaining bolts **(see illustration)**.
5 There is no provision for testing the knock sensor or module without dedicated Vauxhall test equipment. Check for external damage and replace if necessary.

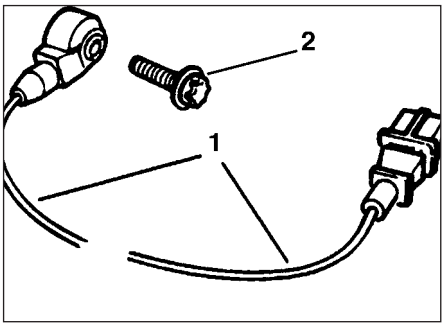
Refitting

6 Refitting is a reversal of the removal procedure, ensuring that the wiring plugs are correctly reconnected and that the units are located securely.

37 Knock sensor (Simtec system) - removal and refitting

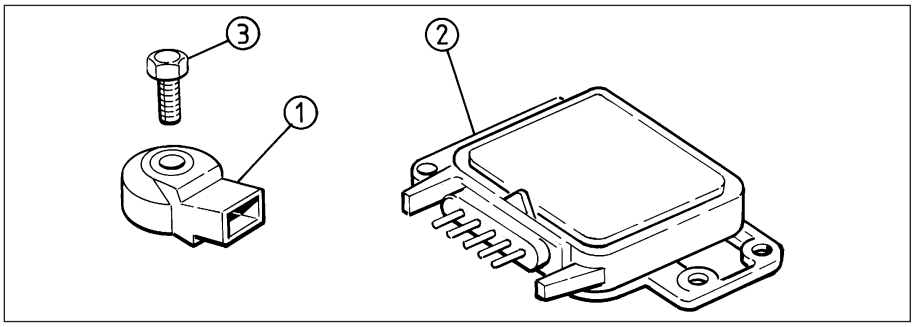
Removal

1 Disconnect the battery negative lead.
2 Disconnect wiring harness plug, from inlet air temperature sensor and wiring harness plug, from hot mass air flow meter.
3 Remove crankcase ventilation hoses.
4 Remove coolant hoses from air inlet hoses, hot film mass air flow meter complete with air inlet hoses, from upper part of air cleaner and throttle body.



37.8 Knock sensor and wiring (Simtec system)

1 Sensor *2 Securing bolt*



36.4 Knock sensor and module (X16 SZ models)

1 Sensor *2 Module* *3 Sensor securing bolt*

5 Press retaining clip for 1st and 4th cylinder injectors in plug strip (with screwdriver) towards fuel distributor pipe - lifting plug strip at the same time. On the underside of the plug strip there are a total of 6 plug connections, 4 of which are for the injectors.
6 Disconnect wiring harness plug for knock sensor from the plug strip.
7 Connect a 1 metre length of separate cable to knock sensor wiring harness plug (note routing).
8 Remove knock sensor from cylinder block **(see illustration)**.
9 Disconnect knock sensor cable from separately attached cable, separate cable remains in engine compartment.

Refitting

10 Refitting is a reversal of removal, but note the following.
11 Before refitting ensure that the sensor is spotlessly clean. Clean the entire contact surface of the sensor must lie directly on the cylinder block. Do not use any form of washers.
12 Carefully refit sensor into the block. Tighten to the correct torque.
13 Guide knock sensor cable between ridges on inlet manifold using separate cable - ensure correct routing.
14 Remove the cable.
15 Insert the wiring harness plug for the knock sensor, into the plug strip.
16 Correctly align the spring clips for the injectors as they may prevent engagement of the plug strip. Correct contact between the plug strip and the injector is essential.
17 When connecting plug strip, an audible 'click' should be heard.
18 Ensure that hoses are in good condition and installed securely with the two clamps.

38.5 Disconnecting the brake servo vacuum hose - SOHC models

38 Inlet manifold (SOHC without Multec) - removal and refitting

Note: *Refer to warning in Section 2, before proceeding. Use a new gaskets when refitting.*

Removal

1 Disconnect the battery negative lead.
2 Remove the idle speed adjuster and its hoses, referring to Section 22, if necessary.
3 Release the securing clip, then disconnect the throttle cable and balljoint from the throttle valve lever. Slide the throttle cable grommet from the bracket on the inlet manifold, and move the throttle cable to one side out of the way.
4 Loosen the clamp screw and disconnect the air trunking from the throttle body.
5 Unscrew the union nut and disconnect the brake servo vacuum hose from the inlet manifold **(see illustration).**
6 Disconnect the camshaft cover breather hose from the throttle body.
7 Disconnect the coolant hoses from the throttle body. Be prepared for coolant spillage, and clamp or plug the open ends of the hoses, to prevent further coolant loss.
8 Disconnect the wiring plug from the throttle position sensor.
9 Disconnect the vacuum pipe from the top of the fuel pressure regulator.
10 Disconnect the wiring harness housing from the fuel injectors and move it to one side, taking care not to strain the wiring. Pull up on the wiring harness housing, and compress the wiring plug retaining clips to release the harness housing from the injectors.
11 Disconnect the fuel hoses from the fuel rail. Be prepared for fuel spillage, and take adequate fire precautions. Clamp or plug the open ends of the hoses, to prevent dirt ingress and further fuel leakage.

12 Unscrew and remove the top alternator mounting nut and bolt.
13 Make a final check to ensure that all relevant hoses, pipes and wires have been disconnected.
14 Unscrew the securing nuts, and withdraw the manifold from the cylinder head. Recover the gasket **(see illustrations).**
15 It is possible that some of the manifold studs may be unscrewed from the cylinder head when the manifold securing nuts are unscrewed. In this event, the studs should be screwed back into the cylinder head once the manifold has been removed, using two manifold nuts locked together.
16 If desired, the ancillary components can be removed from the manifold, referring to the relevant Chapter.

Refitting

17 Refitting is a reversal of removal, remembering the following points.
18 Where applicable refit any ancillary components to the manifold, with reference to relevant Sections of Chapters 4A or 4B.
19 If the alternator mounting bracket has been unbolted from the manifold, refit it before refitting the manifold, as access to the securing bolt is extremely limited once the manifold is in place.
20 Refit the manifold using a new gasket, and tighten the securing nuts to the specified torque.
21 Ensure that all relevant hoses, pipes and wires are correctly reconnected.
22 On completion, check and if necessary top-up the coolant level, (Chapter 3).
23 Check and if necessary adjust the throttle cable free play, as described in Chapters 4A or 4B, as applicable.
24 If any of the fuel system components have been disturbed or renewed, check and if necessary adjust the idle mixture, as described in Chapters 4A or 4B, as applicable.

39 Inlet manifold (SOHC with Multec) - removal and refitting

Removal

1 Depressurise the fuel system Section 8).
2 Remove the air box (see Section 5).
3 Disconnect the battery negative lead.
4 Either remove the throttle body assembly (see Section 32), or disconnect the throttle cable, wiring, fuel and vacuum hoses and pipes to allow the manifold to be removed with the throttle body.
5 Drain the cooling system (see Chapter 3).
6 Continue as described in Chapter 4A, Section 26, paragraph 4 onwards.

Refitting

7 Refitting is the reverse of the removal procedure; renew all gaskets and seals disturbed.

38.14A Unscrew the securing nuts

38.14B ...and withdraw the inlet manifold - SOHC models

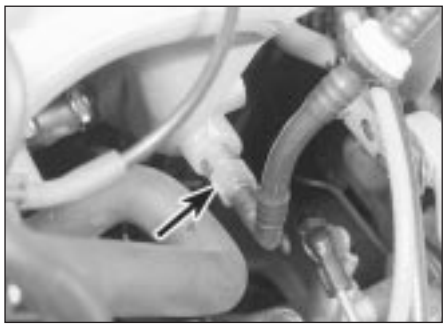
40 Inlet manifold (DOHC models) - removal and refitting

Removal

1 Disconnect the battery negative lead.
2 Disconnect the wiring plug from the air mass meter. Recover the sealing ring.
3 Loosen the clamp screw securing the air trunking to the right-hand end of the air mass meter.
4 Using an Allen key or hexagon bit, unscrew the four bolts securing the air box to the throttle body. Lift the air box from the throttle body, and disconnect the hose from the base of the air box then withdraw the air box/air mass meter assembly.
5 Disconnect the wiring plug from the throttle position sensor.
6 Slide the throttle cable end from the throttle valve lever. Then pull the cable end grommet from the bracket on the inlet manifold and move the throttle cable to one side out of the way.
7 Disconnect the two breather hoses from the rear of the camshaft cover. Disconnect the larger hose from the throttle body, and remove the hose completely.
8 Position a wad of rag beneath one of the fuel hose unions on the fuel rail, to absorb the fuel that will be released as the union is disconnected.
9 Slowly loosen the fuel hose union, to gradually relieve the pressure in the fuel feed line, then disconnect the hose from the fuel rail. Be prepared for fuel spillage, and take adequate fire precautions. Plug the end of the fuel hose, to prevent dirt ingress and further fuel leakage.
10 Repeat paragraphs 9 and 10 for the remaining fuel hose-to-fuel rail union.
11 Disconnect the vacuum pipe from the top of the fuel pressure regulator.
12 Disconnect the wiring harness housing from the fuel injectors and move it to one side, taking care not to strain the wiring. Pull up on the wiring harness housing, and compress the wiring plug retaining clips to release the housing from the injectors.
13 Unscrew the union nut, and disconnect the brake servo vacuum hose from the left-hand side of the inlet manifold **(see illustration)**.
14 Unscrew the retaining nut, and remove the fuel hose bracket from the left-hand side of the throttle body.
15 Unscrew the securing nuts, and disconnect the earth leads from the fuel rail securing studs at either end of the fuel rail.
16 Unscrew the securing bolt, and remove the cable/hose bracket from the left-hand end of the inlet manifold.
17 Remove the idle speed adjuster, as described in Section 22.
18 Unscrew and remove the top alternator mounting nut and bolt.
19 Make a final check to ensure that all relevant hoses, pipes and wires have been disconnected.
20 Unscrew the securing nuts, and withdraw the manifold from the cylinder head. Recover the gasket.
21 It is possible that some of the manifold studs may be unscrewed from the cylinder head when the manifold securing nuts are unscrewed. In this event, the studs should be screwed back into the cylinder head once the manifold has been removed, using two manifold nuts locked together.
22 If desired, the ancillary components can be removed from the manifold, with reference to the relevant Sections of Chapters 4A or 4B.

Refitting

23 Refitting is a reversal of the removal procedure.



40.13 Brake servo vacuum hose connection at inlet manifold (arrowed) - DOHC models

Chapter 4 Part C:
Fuel and exhaust systems - exhaust and emissions

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

Torque wrench settings	Nm	lbf ft
AIR non-return valve to pipe	30	22
AIR pipe support bracket to manifold	8	6
AIR pipe to manifold	20	15
AIR pipe to support bracket	8	6
AIR pump bracket to protective shield	10	7
AIR pump to wheel arch	20	15
AIR pump to insulator	10	7
AIR valves to bracket	4	3
Carbon canister	4	3
EGR valve	20	15
Heat shield	8	6
Oxygen sensor	30	22

1 Emissions control systems - general

General

Multec system

1 An evaporative emissions control system is fitted to minimise the escape into the atmosphere of unburned hydrocarbons.

2 The fuel tank filler cap is sealed and a charcoal canister is mounted under the right-hand front wing to collect the petrol vapours generated in the tank when the vehicle is parked. It stores them until they can be purged from the canister into the inlet tract to be burned by the engine during normal combustion. The canister's control valve (on the top of the canister) is opened by a vacuum pipe from the front of the throttle body on C16 NZ, C16 NZ2 and C18 NZ engines. On X16 SZ it's opened by an electronically activated purge valve, mounted on the camshaft housing.

Motronic system

3 The system is as described in Chapter 4B, except that the charcoal canister is purged under the control of the fuel injection/ignition system module through the fuel tank vent valve. 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 valve is not opened by the module until the engine is under partial or full load. The valve solenoid is then modulated on and off to allow the stored vapour to pass into the inlet tract.

4 Canister removal and refitting is as described in Section 11.

5 On C20 NE engines, the vent valve is mounted above the injectors for cylinders 2 and 4. To remove it, disconnect the battery negative lead and the valve wiring plug, then disconnect the two vent hoses having made note of their connections. Either remove the valve from its mounting bracket, or unbolt the bracket, as required.

6 On C20 XE engines, the vent valve is mounted on the left-hand end of the engine, underneath the end of the fuel injector wiring harness housing **(see illustration)**. Removal and refitting is as described in the previous paragraph.

Simtec system

7 For information refer to "General description", in Chapter 4B. Note that "AIR", is an abbreviation for the secondary Air Injection Reactor system used on this model.

1.6 Disconnecting the fuel tank vent valve wiring

2 Exhaust gas recirculation (EGR) system - general

The system reintroduces small amounts of exhaust gas into the combustion cycle to reduce the generation of oxides of nitrogen (NOx).

On C16 NZ, C16 NZ2 and C18 NZ engines, the volume of exhaust gas reintroduced is governed by manifold vacuum, through the EGR valve mounted on the inlet manifold. When the valve is opened small amounts of exhaust gas are allowed to enter the inlet tract, passing through ports in the cylinder head.

On X16 SZ engines the EGR valve is operated by an EGR module, mounted on the left-hand side of the engine compartment behind the battery. This module amplifies signals received from the fuel system ECU and operates the EGR valve electronically providing precise control of exhaust gas recirculation under all engine conditions.

3 EGR valve (Multec system models) - testing, removal and refitting

Testing

1 On C16 NZ, C16 NZ2 and C18 NZ engines, it is recommended that the system is checked annually, by checking the movement of the valve's diaphragm carrier plate as follows. Note that the carrier plate is visible only through the apertures in the underside of the valve, so a battery-operated torch and small mirror may be useful. On X16 SZ engines, Vauxhall test equipment is necessary to check the EGR system.

2 With the engine fully warmed up to normal operating temperature and idling, briefly open and close the throttle. The carrier plate should move upwards as the manifold vacuum changes. When the engine is idling smoothly again, press the carrier plate upwards (do this very carefully, so that the plate is not distorted or the diaphragm damaged). The idle speed should drop significantly (approximately 100 rpm).

3 If the valve does not respond as described, it must be cleaned.

Removal

4 Pull off the hose from the valve, then unbolt the valve and remove it **(see illustrations)**. Clean away all carbon using a wire brush and a pointed tool, but take care not to damage the valve seat. Renew the valve gasket to prevent induction leaks.

Refitting

5 Refit the valve and reconnect the hose, then recheck the system's performance; if there is no improvement, the valve must be renewed.

3.4 Disconnecting the vacuum hose from the exhaust gas recirculation valve

3.4B Withdrawing the exhaust gas recirculation valve

4 EGR valve (Simtec system) - testing, removal and refitting

Note: *A new gasket will be required when refitting the valve.*

Removal

1 Disconnect the battery negative lead.

2 Remove wiring harness and vacuum hose.

3 Mark position of the valve, to ensure correct relocation.

4 Undo the 3 bolts, and remove the valve from the dual spark ignition coil's coolant flange.

Refitting

5 Clean the sealing surfaces of the valve and flange.

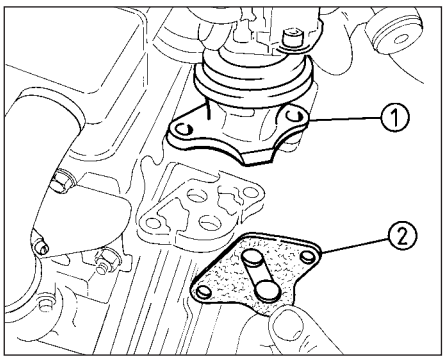
6 Refit the valve with a new gasket and line up the marks made before removal **(see illustration)**.

5 EGR module (X16 SZ models) - removal and refitting

Removal

1 Disconnect the knock module from its bracket (refer to Chapter 4B, if necessary), and place to one side.

2 Remove wiring plug from module. Remove module from bracket.



4.6 EGR valve
1 Valve 2 Gasket

Refitting

3 Refitting is a reversal of removal.

6 AIR pump assembly (Simtec system) - removal and refitting

Removal

1 Chock the rear wheels, jack up the front of the vehicle and support it on axle stands placed under the body side members (see "*Jacking and Vehicle Support*")

2 Remove the left hand front wheel and inner wheel arch lining.

3 Loosen the hose clamp and remove the air duct hose from the pump.

4 Disconnect the battery negative lead.

5 Undo the securing nuts and remove the pump assembly from its location. Disconnect the wiring plug.

6 Remove the wiring plug from the pump's bracket.

7 Mark the position of the pump on it's bracket before separating.

8 Remove the fixing bolts and disconnect the pump from it's insulator.

9 The insulator can also be checked by removing the 3 nuts, securing the protective shield. Before removing, mark the shield and insulator. Replace if necessary.

10 Check the pump's air cleaner for damage.

Refitting

11 Refitting is a reversal of removal. Ensure correct alignment of the components.

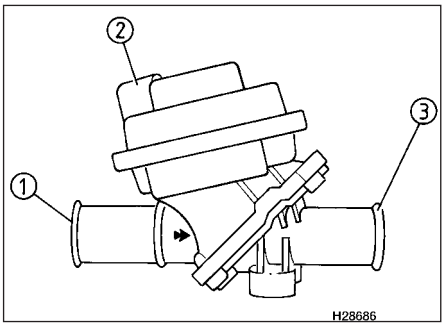
7 AIR cut-off valve - removal, testing and refitting

Removal

1 Before removal, mark on the cut-off valve, the direction of flow towards the non-return valve **(see illustration)**.

2 Disconnect and remove the air duct and vacuum hoses.

3 Undo the switchover valve's bolts and move to one side.



7.1 AIR cut-off valve

1 Connection to AIR pump
2 Connection to AIR switchover valve
3 Connection to AIR non-return valve

4 The cut-off valve can now be removed from the bracket.

Testing

5 To test the cut-off valve a vacuum hand pump with gauge will be required. If available, connect to the cut-off valve and ensure that air through-flow aperture is fully open.

Refitting

6 Refitting is a reversal of removal. Ensure valve is fitted in the correct direction.

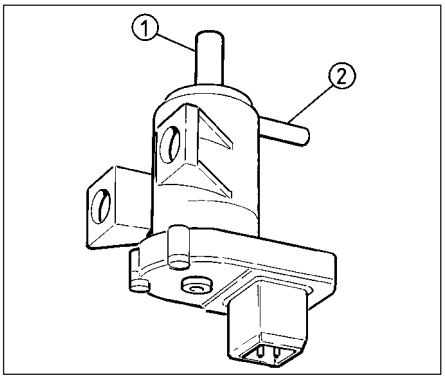
8 AIR switchover valve - removal and refitting

Removal

1 Disconnect the battery negative lead.
2 Disconnect wiring plug from the valve.
3 Mark the location of the vacuum hoses before removing them from the valve.
4 After disconnecting the hoses undo the two bolts, and remove them from its bracket.

Refitting

5 Refitting is a reversal of removal. Ensure hoses are fitted correctly **(see illustration).**



8.5 AIR switchover valve

1 Connection to brake servo vacuum hose
2 Connection to cut-off valve

9 AIR pipe and non-return valve - removal and refitting

Note: *New air pipe washers will be required when refitting.*

Removal

1 Remove the non-return valve air duct hose.
2 Undo the bolts engine lifting eye bracket, and turn the bracket on to its left hand side.
3 Remove the pipe support bracket by releasing its three bolts.
4 Remove the heat shield that is secured by two bolts.
5 The air pipe can now be removed by releasing the two securing bolts.
6 If necessary the non-return valve can now be disconnected.
7 Carefully clamp the pipe using a vice with protective jaws. Unbolt the valve from the pipe, clean and inspect for damage.

Refitting

8 Before refitting, coat the threads of the non-return valve with sealing compound (i.e. Vauxhall part no. 90094714).
9 Use new washers when refitting the pipe, (take care as the washers have sharp edges). Coat the pipe mounting bolts with assembly paste (i.e. Vauxhall part no. 90513210), before refitting.
10 Refitting is a reversal of removal. Retighten to correct torque as shown in Specifications.

10 Catalytic converter - description, general and precautions

Note: *The catalytic converter is not a filter. It creates a chemical reaction, but it is not affected by that reaction.*

Description

1 Certain models are available with a catalytic converter, to reduce exhaust emissions. These models can be identified by a 'C' or 'X', prefixing the engine code.
2 The purpose of the catalytic converter is to change potentially harmful hydrocarbon and carbon monoxide exhaust gases into harmless gases and water vapour. The converter consists of a stainless steel canister containing a catalyst-coated honeycomb ceramic. The catalyst is a mixture of three precious metals, platinum, palladium and rhodium.

10.9 The catalytic converter is protected by heat shields

3 The exhaust gases pass freely through the honeycomb, where the catalyst speeds up the chemical change of the exhaust gases, without being permanently altered itself.
4 To avoid damage to the catalyst, the engine must be kept properly tuned, and unleaded petrol must always be used. Normal leaded petrol will "poison" the catalyst, and must not be used.
5 To enable the Motronic engine management system to achieve complete combustion of the fuel mixture, and thus to minimise exhaust emissions, an oxygen sensor is fitted in the exhaust gas stream. The sensor monitors the oxygen level in the exhaust gas, and sends a signal to the Motronic module. The module constantly alters the fuel/air mixture within a narrow band to reduce emissions, and to allow the catalytic converter to operate at maximum efficiency. No adjustment of idle mixture is therefore possible on models fitted with a catalytic converter.

General

6 Ninety-nine per cent of exhaust gases, from a petrol engine (however efficient or well tuned), consists of nitrogen (N_2), carbon dioxide (CO_2), oxygen (O_2), other inert gases and water vapour (H_2O). The remaining 1% is made up of the noxious materials that are currently seen (except CO_2), as the major polluters of the environment. Carbon monoxide (CO), unburned hydrocarbons (HC), oxides of nitrogen (NOx) and some solid matter, including a small lead content.
7 The device most commonly used to clean up vehicle exhausts is the catalytic converter. It is fitted into the vehicle's exhaust system and uses precious metals (platinum and palladium or rhodium) as catalysts to speed up the reaction between the pollutants and the oxygen in the exhaust gases. CO and HC being oxidised to form H_2O and CO_2 and (in the three-way type of catalytic converter) NOx being reduced to N_2.
8 The converter consists of an element of ceramic honeycomb, coated with a combination of precious metals in such a way as to produce a vast surface area over which the exhaust gases must flow. The three-way closed-loop type converter fitted to these models can remove over 90% of pollutants.
9 The catalytic converter is a reliable and simple device that needs no maintenance. However there are some facts that an owner should be aware if the converter is to function properly for its full service life **(see illustration)**.

a) DO NOT use leaded petrol in a vehicle 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 according to the manufacturers schedule (see "Routine maintenance" and the relevant Chapter). In particular, ensure that the air cleaner filter element, the fuel filter and the spark plugs are renewed at the correct intervals. If the inlet air/fuel mixture is allowed to become too rich due to neglect, the unburned surplus will enter and burn in the catalytic converter, overheating the element and eventually destroying the converter.

c) If the engine develops a misfire, do not drive the vehicle at all (or at least as little as possible) until the fault is cured. The misfire will allow unburned fuel to enter the converter, which will result in its overheating, as noted above.

d) The engine control indicator (the outline of an engine with a lightning symbol superimposed), will light when the ignition is switched on and the engine is started, then it will go out. While it may light briefly while the engine is running, it should go out again immediately and stays unlit. If it lights and stays on while the engine is running, seek the advice of a Vauxhall dealer as soon as possible. A fault has occurred in the fuel injection/ignition system that, apart from increasing fuel consumption and impairing the engine's performance, may damage the catalytic converter.

e) DO NOT push or tow-start the vehicle. This will soak the catalytic converter in unburned fuel causing it to overheat when the engine does start see (b) above.

f) DO NOT switch off the ignition at high engine speeds. If the ignition is switched off at anything above idle speed, unburned fuel will enter the (very hot) catalytic converter, with the possible risk of its igniting on the element and damaging the converter.

g) DO NOT use fuel or engine oil additives. These may contain substances harmful to the catalytic converter.

h) DO NOT continue to use the vehicle if the engine burns oil to the extent of leaving a visible trail of blue smoke. The unburned carbon deposits will clog the converter passages and reduce its efficiency; in severe cases the element will overheat.

i) Remember that the catalytic converter operates at very high temperatures hence the heat shields on the vehicle's under-body and the casing will become hot enough to ignite combustible materials that brush against it. DO NOT, therefore, park the vehicle in dry undergrowth, over long grass or over piles of dead leaves.

j) Remember that the catalytic converter is FRAGILE. Do not strike it with tools during servicing work. Take great care when working on the exhaust system. Ensure that the converter is well clear of any jacks or other lifting gear used to raise the vehicle. Do not drive the vehicle over rough ground, road humps, etc., in such a way as to ground the exhaust system.

k) In some cases, particularly when the vehicle is new and/or is used for stop/start driving, a sulphurous smell (like that of rotten eggs) may be noticed from the exhaust. This is common to many catalytic converter-equipped vehicles and seems to be due to the small amount of sulphur found in some petrol's reacting with hydrogen in the exhaust to produce hydrogen sulphide (CS) gas. While this gas is toxic, it is not produced in sufficient amounts to be a problem. Once the vehicle has covered a few thousand miles the problem should disappear. In the meanwhile a change of driving style or of the brand of petrol may effect a solution.

l) The catalytic converter, used on a well-maintained and well-driven vehicle, should last for between 50 000 and 100 000 miles. From this point on, careful checks should be made at all specified service intervals of the CO level to ensure that the converter is still operating efficiently. If the converter is no longer effective it must be renewed.

11 Carbon canister - removal and refitting

Removal

1 Apply the handbrake, then jack up the front of the vehicle, and support securely on axle stands placed under the body side members (see "*Jacking and Vehicle Support*").

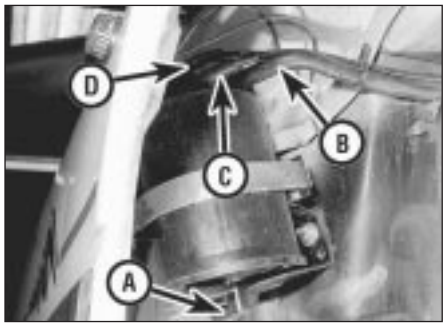
2 Remove the front right hand wheel and wheel arch liner.

3 Note the hose and pipe connections to the canister, or label them, to ensure that they are reconnected to their original unions, then disconnect them **(see illustration)**. Unscrew the two nuts securing the canister mounting bracket to the vehicle body.

Refitting

4 Refitting is a reversal of removal, however ensure correct fitment of hose and pipes.

12.6 Oxygen sensor location in front section of exhaust system - DOHC models



11.3 Charcoal canister

A Vent to atmosphere
B Vapour feed hose from filler pipe
C Vapour exhaust hose to inlet tract
D Control valve vacuum pipe from throttle body

12 Oxygen sensor (catalytic converter models) - removal and refitting

Note: *This sensor is also known as a Lambda sensor.*

Removal

1 Disconnect the battery negative lead.

2 Disconnect the oxygen sensor wiring plug, which is located behind the coolant expansion tank.

3 Apply the handbrake, then jack up the front of the vehicle, and support securely on axle stands placed under the body side members.

4 On DOHC models, remove the engine undershield, as described in Chapter 11.

5 On models fitted with Multec injection system, the sensor is screwed into the exhaust manifold. Trace the wiring from the sensor itself to the connector (either clipped to the radiator cooling fan shroud or behind the coolant expansion tank). Release it from any clips or ties; disconnect the wiring before unscrewing the sensor.

6 On other models, unscrew the oxygen sensor from the front section of the exhaust system **(see illustration)**. It is advisable to wear gloves, as the exhaust system will be extremely hot.

7 Withdraw the oxygen sensor and its wiring, taking care not to burn the wiring on the exhaust system. If the sensor is to be re-used, take care that the sealing ring is not lost, and that the sensor is not dropped.

Refitting

8 If a new sensor is being fitted, it will be supplied with the threads coated in a special grease to prevent it seizing in the exhaust system.

9 If the original sensor is being refitted, ensure that the screw thread is clean. Coat the thread with a lithium based copper grease (i.e. Vauxhall Part No. 90295397).

10 Refitting is a reversal of removal. Check the exhaust system for leakage when the engine is re-started.

13.7 Unscrewing an exhaust manifold securing nut - SOHC models

14.9 Exhaust front section flexible joint - SOHC models

14.10 Exhaust front section support bracket - SOHC models

13 Exhaust manifold - removal and refitting

Note: *New manifold-to-cylinder head, and manifold-to-downpipe, gaskets must be used on refitting. Exhaust manifolds on DOHC models are of tubular design, which form part of the front section of the exhaust.*

Removal

1 Disconnect the battery negative lead.
2 Disconnect the HT leads from the spark plugs, if necessary labelling them to ensure refitting to the correct cylinders.
3 Loosen the clamp screw and disconnect the air cleaner hot air tube from the shroud on the manifold, if fitted. Remove the securing screws and withdraw the hot air shroud from the manifold.
4 Working under the manifold, unscrew and remove the four bolts securing the exhaust downpipe to the manifold.
5 If fitted, disconnect the oxygen sensor wiring
6 Separate the downpipe from the manifold, and support with wire or string. Do not allow the front section of the exhaust system to hang under its own weight. Recover the gasket.
7 Unscrew the securing nuts, and withdraw the manifold from the cylinder head **(see illustration)**. Recover the gasket.
8 It is possible that some of the manifold studs may be unscrewed from the cylinder head when the manifold securing nuts are unscrewed. In this event, the studs should be screwed back into the cylinder head once the manifold has been removed, using two manifold nuts locked together.

Refitting

9 Refit the manifold using a new gasket, and tighten the securing nuts to the specified torque.
10 Reconnect the exhaust downpipe to the manifold, using a new gasket and tighten the securing bolts to the specified torque.
11 Further refitting is a reversal of removal.

14 Exhaust system - checking, removal and refitting

Note: *All relevant gaskets and/or sealing rings should be renewed on refitting*

Checking

1 Periodically, the exhaust system should be checked for signs of leaks or damage. Also inspect the exhaust system rubber mountings, and renew if necessary.
2 Small holes or cracks can be repaired using proprietary exhaust repair products, but where more serious corrosion or damage is evident, renewal will be necessary.

Removal

3 The original factory-fitted exhaust system consists of four separate sections, all of which can be renewed individually.
4 On models fitted with a catalytic converter, an oxygen sensor is fitted to the front section of the exhaust. The catalytic converter is fitted in place of the front expansion box in the conventional exhaust system. The manufacturers do not specify any renewal intervals for the catalytic converter.
5 Before renewing an individual section of the exhaust system, it is wise to inspect the remaining sections. If corrosion or damage is evident on more than one section of the system, it may prove more economical to renew the entire system.
6 Individual sections of the exhaust system can be removed as follows.

Front section - SOHC models

7 On models with a catalytic converter, disconnect the battery negative lead, and disconnect the oxygen sensor wiring plug, which is located behind the coolant expansion tank.
8 Raise the vehicle, and support securely on axle stands placed under the body side members (see "*Jacking and Vehicle Support*").
9 Unscrew the two securing bolts, and disconnect the exhaust front section from the front expansion box or catalytic converter (as applicable) at the flexible joint. Recover the sealing ring and the springs **(see illustration)**.
10 Unbolt the exhaust front section from the bracket on the cylinder block **(see illustration)**.
11 Unscrew and remove the four bolts securing the downpipe to the exhaust manifold, and withdraw the exhaust front section **(see illustration)**. Recover the downpipe-to-manifold gasket.

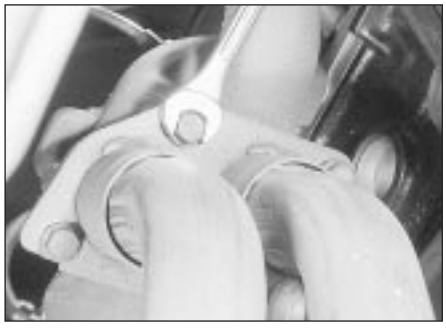
Refitting

12 Refitting is a reversal of removal, but use a new gasket when reconnecting the downpipe to the manifold, and a new sealing ring when connecting the flexible joint. Tighten all fixings to the specified torque.

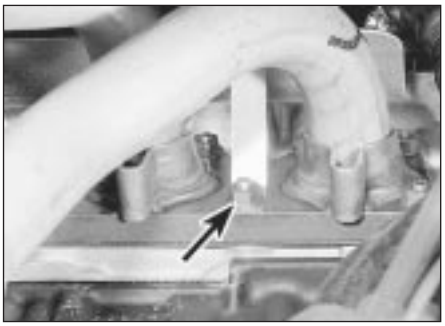
Front section - DOHC models

Removal

13 Proceed as described in paragraphs 7 and 8.
14 Remove the engine undershield, as described in Chapter 11.
15 Proceed as described in paragraphs 9 and 10.
16 Working in the engine compartment, remove the bolts securing the exhaust manifold heat shield to the cylinder head.
17 Unscrew the two lower exhaust manifold securing nuts that also secure the heat shield brackets, and withdraw the heat shield **(see illustration)**.
18 Unscrew the remaining manifold securing nuts, then withdraw the manifold/exhaust front section from the vehicle. Recover the manifold gasket.



14.11 Unscrewing a downpipe-to-exhaust manifold bolt - SOHC models



14.17 Exhaust manifold nut (arrowed) securing exhaust heat shield - DOHC models

19 It is possible that some of the manifold studs may be unscrewed from the cylinder head when the manifold securing nuts are unscrewed. In this event, the studs should be screwed back into the cylinder head once the manifold has been removed, using two manifold nuts locked together.

Refitting

20 Refitting is a reversal of removal, but use a new manifold gasket, and use a new sealing ring when reconnecting the flexible joint. Tighten all fixings to the specified torque.

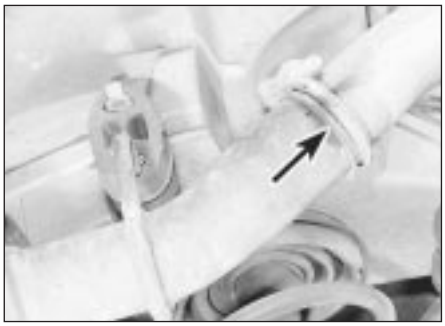
Front expansion box/catalytic converter

Removal

21 Proceed as described in paragraphs 8 and 9.

22 Unscrew the three securing nuts and bolts, and disconnect the expansion box/catalytic converter from the exhaust centre section flanged joint. Recover the gasket.

23 Withdraw the expansion box/catalytic converter from the vehicle.



14.26 Exhaust centre section-to-rear section clamp (arrowed) - SOHC model

Refitting

24 Refitting is a reversal of removal, but use a new sealing ring when reconnecting the flexible joint, and a new gasket when reconnecting the flanged joint. Tighten all fixings to the specified torque.

Centre section

Removal

25 Raise the vehicle, and support securely on axle stands placed under the body side members.

26 Unscrew the clamp bolt, and disconnect the exhaust centre section from the rear section **(see illustration)**. If necessary, tap around the joint with a hammer to break the seal, and gently prise the two sections apart. Note that the end of the centre section fits inside the rear section, to form a sleeve joint.

27 Proceed as described in paragraph 22.

28 Release the exhaust centre section from its rubber mountings on the underbody, and withdraw it from the vehicle **(see illustration)**.

14.28 Exhaust centre section forward rubber mountings - DOHC models

Refitting

29 Refitting is a reversal of removal, but use a new gasket when reconnecting the flanged joint, and lubricate the pipes with exhaust assembly paste when connecting the centre section to the rear section. Tighten all fixings to the specified torque.

Rear section

Removal

30 Proceed as described in paragraphs 25 and 26.

31 Release the exhaust rear section from its rubber mountings on the underbody, and withdraw it from the vehicle.

Refitting

32 Refitting is a reversal of removal, but lubricate the pipes with exhaust assembly paste when connecting the rear section to the centre section. Tighten the clamp bolt to the specified torque.

Chapter 5
Engine electrical 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

System type	12 volt, negative earth
Battery capacity	36, 44, 55 or 66 Ah

Alternator

Type	Bosch or Delco-Remy
Output	55 or 70 A, depending upon model
Minimum brush length:	
Bosch type alternator	5.0 mm protrusion
Delco-Remy type alternator	11.0 mm overall length

Starter motor

Type	Pre-engaged, Bosch or Delco-Remy
Minimum brush length:	
Bosch DF type starter motor	11.5 mm
Bosch DM type starter motor	3.0 mm
Bosch DW type starter motor	4.5 mm
Delco-Remy type starter motor	4.0 mm

System type

14 NV	HEI (High Energy Ignition) system
16 SV and 18 SV	MSTS-i (Microprocessor Spark Timing System)
C16 NZ, C16 NZ2 and C18 NZ	Multec, with MSTS-i
X16 SZ	Multec, with DIS (Direct Ignition System)
20 NE, C20 NE and 20 SEH, (up to 1990)	Motronic M4.1
20 NE, C20 NE and 20 SEH, (from 1990)	Motronic M1.5
20 XEJ and C20 XE, (up to 1993)	Motronic M2.5
C20 XE (from 1993)	Motronic M2.8
X20 XEV	Simtec 56.1

Coil

Output	16.0 to 20.0 kilovolts
Primary winding resistance (DOHC models only)	0.2 to 0.34 ohms
Secondary winding resistance (DOHC models only)	7.2 to 8.2 ohms

Distributor

Direction of rotor arm rotation	Anti-clockwise (viewed from cap)
Firing order	1-3-4-2 (No 1 cylinder at timing belt end of engine)
Dwell angle	Automatically controlled by electronic module (not adjustable)

Ignition timing

14 NV	5° BTDC
16 SV, X 16 SZ, C 16 NZ, C 16 NZ2 and C 18 NZ	10° BTDC *
18 SV and 2.0 litres models	8 to 12° BTDC *

** Ignition timing electronically controlled no adjustment possible*

Spark plugs ..... See Chapter 1 Specifications

Torque wrench setting

	Nm	lbf ft
Alternator mounting	25	18
Camshaft phase sensor disc	8	6
Camshaft phase sensor	15	11
'Compact' series alternator lower mounting bolt	35	26
'Compact' series alternator upper mounting bolts	20	15
DIS module	7	5
Inductive pulse pick-up to block	8	6
Spark plugs	25	18
Starter motor mounting bracket-to-cylinder block	25	18
Starter motor mounting:		
1.4 and 1.6 litre models	25	18
1.8 and 2.0 litre models:		
Engine side	45	33
Transmission side	75	55

1 Electrical system - general

Caution: Before carrying out any work on the vehicle electrical system, read through the precautions given in the "Safety first!" Section at the beginning of this manual, and in Section 3 of this Chapter.

1 The electrical system is of the 12 volt negative earth type, and consists of a 12 volt battery, alternator with integral voltage regulator, starter motor, and related electrical accessories, components and wiring.

2 The battery is of the maintenance-free "sealed for life" type, and is charged by an alternator, which is belt-driven from the crankshaft pulley. The starter motor is of the pre-engaged type, incorporating an integral solenoid. On starting, the solenoid moves the drive pinion into engagement with the flywheel ring gear before the starter motor is energised. Once the engine has started, a one-way clutch prevents the motor armature being driven by the engine until the pinion disengages from the flywheel.

3 It is necessary to take extra care when working on the electrical system, to avoid damage to semi-conductor devices (diodes and transistors), and to avoid the risk of personal injury. Along with the precautions given in the *"Safety first!"* Section at the beginning of this manual, take note of the following points when working on the system.

4 *Always remove rings, watches, etc. before working on the electrical system.* Even with the battery disconnected, discharge could occur if a component live terminal is earthed through a metal object. This could cause a shock or nasty burn.

5 *Do not reverse the battery connections.* Components such as the alternator, or any other component having semi-conductor circuitry, could be irreparably damaged.

6 If the engine is being started using jump leads and a slave battery, connect the batteries *positive to positive* and *negative to negative.* This also applies when connecting a battery charger.

7 Never disconnect the battery terminals, or alternator multi-plug connector, when the engine is running.

8 The battery leads and alternator wiring must be disconnected before carrying out any electric welding on the vehicle.

9 Never use an ohmmeter of the type incorporating a hand-cranked generator for circuit or continuity testing.

2 Ignition system - general

1 The ignition system is responsible for igniting the air/fuel mixture in each cylinder at the correct moment, in relation to engine speed and load. A number of different types of ignition systems are fitted to models within the range. Ranging from a basic breakerless electronic system, to a fully integrated engine management system controlling both ignition and fuel injection systems. Each system is described in further detail later in this Section.

2 The ignition system is based on feeding low tension voltage from the battery to the coil, where it is converted to high tension voltage. The high tension voltage is powerful enough to jump the spark plug gap in the cylinders many times a second under high compression pressures, providing that the system is in good condition. The low tension (or primary) circuit consists of the battery, the lead to the ignition switch. The lead from the ignition switch to the low tension coil windings and the supply terminal on the electronic module. The lead from the low tension coil windings to the control terminal on the electronic module. The high tension (or secondary) circuit consists of the high tension coil windings, the HT (high tension) lead from the coil to the distributor cap, the rotor arm, the HT leads to the spark plugs, and the spark plugs.

3 The system functions in the following manner. Current flowing through the low tension coil windings produces a magnetic field around the high tension windings. As the engine rotates, a sensor produces an electrical impulse that is amplified in the electronic module and used to switch off the low tension circuit.

4 The subsequent collapse of the magnetic field over the high tension windings produces a high tension voltage, which is then fed to the relevant spark plug through the distributor cap and rotor arm. The low tension circuit is automatically switched on again by the electronic module, to allow the magnetic field to build up again before the firing of the next spark plug. The ignition is advanced and retarded automatically, to ensure that the spark occurs at the correct instant with the engine speed and load.

HEI (High Energy Ignition) system

5 This comprises of a breakerless distributor and an electronic switching/amplifier module along with the coil and spark plugs.

6 The electrical impulse that is required to switch off the low tension circuit is generated by a magnetic trigger coil in the distributor. A trigger wheel rotates within a magnetic stator, the magnetic field being provided by a permanent magnet. The magnetic field across the two poles (stator arm and trigger wheel) is dependent on the air gap between the two poles. When the air gap is at its minimum, the trigger wheel arm is directly opposite the stator arm, and this is the trigger point. As the magnetic flux between the stator arm and trigger wheel varies, a voltage is induced in the trigger coil mounted below the trigger wheel. This voltage is sensed and then amplified by the electronic module, and used to switch off the low tension circuit. There is one trigger arm and one stator arm for each cylinder.

7 The ignition advance is a function of the distributor, and is controlled both mechanically and by a vacuum-operated system. The mechanical governor mechanism consists of two weights that move out from the distributor shaft due to centrifugal force as the engine speed rises. As the weights move outwards, they rotate the trigger wheel relative to the distributor shaft and so advance the spark. The weights are held in position by two light springs, and it is the tension of the springs that is largely responsible for correct spark advancement.

8 The vacuum control consists of a diaphragm, one side of which is connected by way of a small-bore hose to the carburettor, and the other side to the distributor. Depression in the inlet manifold and carburettor, which varies with engine speed and throttle position, causes the diaphragm to move, so moving the baseplate and advancing or retarding the spark. A fine degree of control is achieved by a spring in the diaphragm assembly.

MSTS-i (Microprocessor-controlled Spark Timing System)

9 This system comprises a "Hall-effect" distributor (or a crankshaft speed/position sensor on X 16 SZ models), a manifold pressure sensor, an oil temperature sensor, and a module, along with the coil and spark plugs.

10 On 1.6 litre models, the electrical impulse that is required to switch off the low tension circuit is generated by a sensor in the distributor. A trigger vane rotates in the gap between a permanent magnet and the sensor. The trigger vane has four cut-outs, one for each cylinder. When one of the trigger vane cut-outs is in line with the sensor, magnetic flux can pass between the magnet and the sensor. When a trigger vane segment is in line with the sensor, the magnetic flux is diverted through the trigger vane away from the sensor. The sensor senses the change in magnetic flux, and sends an impulse to the MSTS-i module, which switches off the low tension circuit.

11 On 1.8 litre models, the electrical impulse that is required to switch off the low tension circuit is generated by a crankshaft speed/position sensor, which is activated by a toothed wheel on the crankshaft. The toothed wheel has 35 equally spaced teeth, with a gap in the 36th position. The gap is used by the sensor to determine the crankshaft position relative to TDC (top dead centre) of No 1 piston.

12 Engine load information is supplied to the MSTS-i module by a pressure sensor, which is connected to the carburettor by a vacuum pipe. Additional information is supplied by an oil temperature sensor. The module selects the optimum ignition advance setting based on the information received from the sensors. The degree of advance can thus be constantly varied to suit the prevailing engine conditions.

Multec, with MSTS-i

13 The ignition system is fully electronic in operation and incorporates the Electronic Control Unit (ECU) mounted in the driver's footwell. A distributor (driven off the camshaft left-hand end and incorporating the amplifier module) as well as the octane coding plug, the spark plugs, HT leads, ignition HT coil and associated wiring.

14 The ECU controls both the ignition system and the fuel injection system, integrating the two in a complete engine management system. Refer to Chapters 4B and 4C for further information that is not detailed here.

15 For ignition the ECU receives information in the form of electrical impulses or signals from the distributor (giving it the engine speed and crankshaft position), from the coolant temperature sensor (giving it the engine temperature) and from the manifold absolute pressure sensor (giving it the load on the engine). In addition, the ECU receives input from the octane coding plug (to provide ignition timing appropriate to the grade of fuel used) and from, where fitted, the automatic transmission control unit (to smooth gear changing by retarding the ignition as changes are made).

16 All these signals are compared by the ECU with set values pre-programmed (mapped) into its memory. Considering this information, the ECU selects the ignition timing appropriate to those values and controls the ignition HT coil by way of the amplifier module accordingly.

17 The system is so sensitive that, at idle speed, the ignition timing may be constantly changing; this should be remembered if trying to check the ignition timing.

18 The system fitted to C18 NZ models, is similar to that described above, except that the amplifier module is separate. The ECU determines engine speed and crankshaft position using a sensor mounted in the right-hand front end of the engine's cylinder block; this registers with a 58-toothed disc mounted on the crankshaft so that the gap left by the missing two teeth provides a reference point, so enabling the ECU to recognise TDC.

19 Note that this simplifies the distributor's function, which is merely to distribute the HT pulse to the appropriate spark plug; it has no effect whatsoever on the ignition timing.

DIS (Direct Ignition System)

20 On all X16 SZ engines, and on C20 XE (DOHC) engines from 1993-on, a DIS (Direct Ignition System) module is used in place of the distributor and coil. On the X16 SZ engine the DIS module is attached to the camshaft housing in the position normally occupied by the distributor. On the C20 XE engine, a camshaft phase sensor is attached to the cylinder head at the non-driven end of the exhaust camshaft, in the position normally occupied by the distributor. The DIS module is attached, by a bracket, to the cylinder head at the non-driven end of the inlet camshaft.

21 The DIS module consists of two ignition coils and an electronic control module housed in a cast casing. Each ignition coil supplies two spark plugs with HT voltage. One spark is provided in a cylinder with its piston on the compression stroke, and one spark is provided to a cylinder with its piston on the exhaust stroke. This means that a "wasted spark" is supplied to one cylinder during each ignition cycle, but this has no detrimental effect. This system has the advantage that there are no moving parts (therefore there is no wear), and the system is largely maintenance-free.

Motronic M4.1 and M1.5

22 This system controls both the ignition and the fuel injection systems.

23 The Motronic module receives information from a crankshaft speed/position sensor, an engine coolant temperature sensor mounted in the thermostat housing. A throttle position sensor, an airflow meter, and on models fitted with a catalytic converter, an oxygen sensor mounted in the exhaust system (Chapter 4C).

24 The module provides outputs to control the fuel pump, fuel injectors, idle speed and ignition circuit. Using the inputs from the various sensors, the module computes the optimum ignition advance, and fuel injector pulse duration, to suit the prevailing engine conditions. This system gives very accurate control of the engine under all conditions, improving fuel consumption and driveability, and reducing exhaust gas emissions.

25 Further details of the fuel injection system components are given in Chapter 4B.

Motronic M2.5 and M2.8

26 The system is similar to that described for SOHC models, with the following differences.

27 Along with the crankshaft speed/position sensor, a "Hall-effect" distributor is used (similar to that described in this Section, with the MSTS-i system).

28 The system also incorporates a separate ignition amplifier module that transmits amplified signals from the main system module to trigger the HT pulse from the ignition coil. The module is mounted on the ignition coil's bracket/baseplate.
29 Additionally, the Motronic module receives information from a cylinder block-mounted knock sensor, which senses "knocking" (or pre-ignition) just as it begins to occur, enabling the module to retard the ignition timing, thus preventing engine damage.

Simtec 56.1

30 This system uses increased amount of electronic components instead of mechanical parts as sensors and actuators with the Simtec engine management system. This provides more precise operating data as well as greater problem free motoring.
31 The control unit is equipped with electronic ignition control. Called 'Microprocessor Spark Timing System, inductive triggered', (or MSTS-i), and means that the mechanical high voltage distributor is no longer needed. It is located behind the trim panel, on the right-hand side footwell (door pillar).
32 The ignition coil is replaced by a dual spark ignition coil, which is switched directly by the output stages in the control unit.
33 A camshaft sensor will maintain emergency operation, should the crankshaft inductive pulse pick-up, malfunction. These sense TDC ('Top Dead Centre'), crankshaft angle and engine speed. The signals are used by the control unit to calculate ignition point and for fuel injection.
34 The 'hot film airflow meter' determines the mass of air taken in by the engine. The system uses this information to calculate the correct amount of fuel needed for injection in the engine.
35 The air inlet temperature sensor (NTC), is fitted in the air inlet duct between the air cleaner and the hot mass air flow meter.
36 A controlled canister purge valve is actuated by the system. The tank ventilation is monitored closely with the Lambda control (or oxygen sensor) and adaptation by the computer within the control unit.
37 A knock control system is also fitted. This eliminates the need for octane number adjustment, as it is performed automatically through the control unit.

3 Electrical system - precautions

Warning: The HT voltage generated by an electronic ignition system is extremely high and, in certain circumstances, could prove fatal. Take care to avoid receiving electric shocks from the HT side of the ignition system. Do not handle HT leads, or touch the distributor or coil, when the engine is running. If tracing faults in the HT circuit, use well-insulated tools to manipulate live leads

1 It is necessary to take extra care when working on the electrical system, to avoid damage to semi-conductor devices (diodes and transistors), and to avoid the risk of personal injury. Along with the precautions given in the *"Safety first!"* Section at the beginning of this manual, take note of the following points when working on the system.
2 *Always remove rings, watches, etc. before working on the electrical system.* Even with the battery disconnected, discharge could occur if a component live terminal is earthed through a metal object. This could cause a shock or nasty burn.
3 *Do not reverse the battery connections.* Components such as the alternator, or any other component having semi-conductor circuitry, could be irreparably damaged.
4 If the engine is being started using jump leads and a slave battery, connect the batteries *positive to positive* and *negative to negative.* This also applies when connecting a battery charger.
5 Never disconnect the battery terminals, or alternator multi-plug connector, when the engine is running.
6 The battery leads and alternator wiring must be disconnected before carrying out any electric welding on the vehicle.
7 Never use an ohmmeter of the type incorporating a hand-cranked generator for circuit or continuity testing.
8 Engine management modules are very sensitive components, and certain precautions must be taken, to avoid damage to the module when working on a vehicle equipped with an engine management system, as follows.
9 When carrying out welding operations on the vehicle using electric welding equipment, the battery and alternator should be disconnected.
10 Although underbonnet-mounted modules will tolerate normal underbonnet conditions, they can be adversely affected by excess heat or moisture. If using welding equipment or pressure washing equipment near the module, take care not to direct heat, or jets of water or steam, at the module. If this cannot be avoided, remove the module from the vehicle, and protect its wiring plug with a plastic bag.
11 Before disconnecting any wiring, or removing components, always ensure that the ignition is switched off.
12 Do not attempt to improvise fault diagnosis procedures using a test lamp or multimeter, as irreparable damage could be caused to the module.
13 After working on ignition/engine management system components, ensure that all wiring is correctly reconnected before reconnecting the battery or switching on the ignition.
14 Any ignition system that uses a "Hall-effect" generator in the distributor, **cannot** be tested. Test equipment that uses its own power source (e.g. an ohmmeter), when connected to the distributor or the "Hall-effect" generator, will be damaged.

4 Ignition system testing - general

Note: *Refer to Section 3 before proceeding. Always switch off the ignition before disconnecting or connecting any component and when using a multi-meter to check resistances. Any voltmeter or multi-meter used to test ignition system components must have an impedance of 10 meg ohms or greater*
1 Electronic ignition system components are normally very reliable. Most faults are far more likely to be due to loose or dirty connections, or to "tracking" of HT voltage due to dirt, dampness or damaged insulation than to component failure. Always check all wiring thoroughly before condemning an electrical component and work methodically to eliminate all other possibilities before deciding that a particular component is faulty.
2 The old practice of checking for a spark by holding the live end of a HT lead a short distance away from the engine is not recommended. Not only is there a high risk of a powerful electric shock, but the ignition coil or amplifier module will be damaged. Similarly, never try to "diagnose" misfires by pulling off one HT lead at a time. Note also that the ECU is at risk if the system is triggered with an open (i.e., not properly earthed) HT circuit; ECU's are very expensive to replace, so take care!
3 If you are in any doubt as to your skill and ability to test an ignition system component or if you do not have the required equipment, take the vehicle to a suitably equipped Vauxhall dealer. It is better to pay the labour charges involved in having the vehicle checked by an expert than to risk damage to the system or to yourself.
4 If the engine either will not turn over at all, or only turns very slowly, check the battery and starter motor. Connect a voltmeter across the battery terminals (meter positive probe to battery positive terminal) and disconnect the ignition coil HT lead from the distributor cap and earth. Note the voltage reading obtained while turning over the engine on the starter for (no more than) ten seconds. If the reading obtained is less than approximately 9.5 volts, check the battery, battery connections, starter motor and charging system.

5 If the engine turns over at normal speed but will not start, check the HT circuit by connecting a timing light and turning the engine over on the starter motor. If the light flashes, voltage is reaching the spark plugs, so these should be checked first. If the light does not flash, check the HT leads themselves followed by the distributor cap, carbon brush and rotor arm.
6 If there is a spark, check the fuel system for faults as far as possible (Chapters 4A or 4B).
7 If there is still no spark, check the voltage at the ignition coil "+" or "15" terminal; it should be the same as the battery voltage (i.e., at least 11.7 volts). If the voltage at the coil is more than 1 volt less than that at the battery, check the connections back through the ignition switch to the battery and its earth until the fault is found. Note, however, that the ECU controls the coil's feed; do not attempt to "test" the ECU with anything other than the correct test equipment, which will be available only to a Vauxhall dealer. If any of the wires are to be checked which lead to the ECU, always first unplug the relevant connector from the ECU so that there is no risk of the ECU being damaged by the application of incorrect voltages from test equipment.
8 If the feed to the ignition coil is sound, check the coil's primary and secondary windings (refer to Section 16). Renew the coil if faulty, but check the condition of the LT connections themselves before doing so, to ensure that the fault is not due to dirty or poorly fastened connectors.
9 If the ignition coil is in good condition, the fault may be within the amplifier module or the distributor on the C16 NZ and C16 NZ2 engines, or the amplifier or the crankshaft speed/position sensor on the C18 NZ engine. A quick check of these components can be made by connecting a low-wattage bulb across the ignition coil's (disconnected) LT terminals. If the bulb flickers or flashes when the engine is turned over, the amplifier and distributor (C16 NZ and C16 NZ2 engines), or amplifier and crankshaft speed/position sensor (C18 NZ engine), are sound.
10 If this is the case, the entire LT circuit is in good condition; the fault, if it lies in the ignition system, must be in the HT circuit components. These should be checked carefully, as outlined above.
11 If the indicator or bulb does not flash, the fault is in either the amplifier or the distributor (C16 NZ and C16 NZ2 engines), or the amplifier or crankshaft speed/position sensor (C18 NZ engine). Owners should note, however, that by far the commonest cause of "failure" of either of these is a poor connection, either between the components themselves or in the LT circuit wiring connections. If such a fault is suspected, the vehicle must be taken to a suitably equipped Vauxhall dealer for testing; no information is available to eliminate these components by other means.
12 An irregular misfire suggests either a loose connection or intermittent fault on the primary circuit, or a HT fault on the coil side of the rotor arm.
13 With the ignition switched off, check carefully through the system ensuring that all connections are clean and securely fastened. If the equipment is available, check the LT circuit as described in paragraphs 7 to 11 above.
14 Check that the HT coil, the distributor cap and the HT leads are clean and dry. Check the leads and the spark plugs (by substitution, if necessary), then check the distributor cap, carbon brush and rotor arm.
15 Regular misfiring is almost certainly due to a fault in the distributor cap, HT leads or spark plugs. Use a timing light (paragraph 5, above) to check whether HT voltage is present at all leads.
16 If HT voltage is not present on any particular lead, the fault will be in that lead or in the distributor cap. If HT is present on all leads, the fault will be in the spark plugs; check and renew them if there is any doubt about their condition.
17 If no HT voltage is present, check the ignition coil; its secondary windings may be breaking down under load.
18 If all components have been checked for signs of obvious faults but the system is still thought to be faulty, take the vehicle to a Vauxhall dealer for testing on special equipment.

5 **Battery** - testing and charging

Note: *Refer to Section 3 before proceeding.*

Testing

1 Topping-up and testing of the electrolyte in each cell is not possible. The condition of the battery can therefore only be tested by observing the battery condition indicator.
2 The battery condition indicator is fitted in the top of the battery casing, and indicates the condition of the battery from its colour. If the indicator shows green, then the battery is in a good state of charge. If the indicator turns darker, eventually to black, then the battery requires charging, as described later in this Section. If the indicator shows clear/yellow, then the electrolyte level in the battery is too low to allow further use, and the battery should be renewed.

Charging

3 Do not attempt to charge, load or jump start a battery when the indicator shows clear/yellow. If the battery is to be charged, remove it from the vehicle and charge it as follows.
4 The maintenance-free type battery takes considerably longer to fully recharge than the standard type, the time taken being dependent on the extent of discharge.
5 A constant-voltage type charger is required, to be set, when connected, to 13.9 to 14.9 volts with a charger current below 25 amps.
6 If the battery is to be charged from a fully discharged state (less than 12.2 volts output), have it recharged by a Vauxhall dealer or battery specialist, as the charge rate will be high and constant supervision during charging is necessary.

6 **Battery** - removal and refitting

Note: *Refer to Section 3 before proceeding.*

Removal

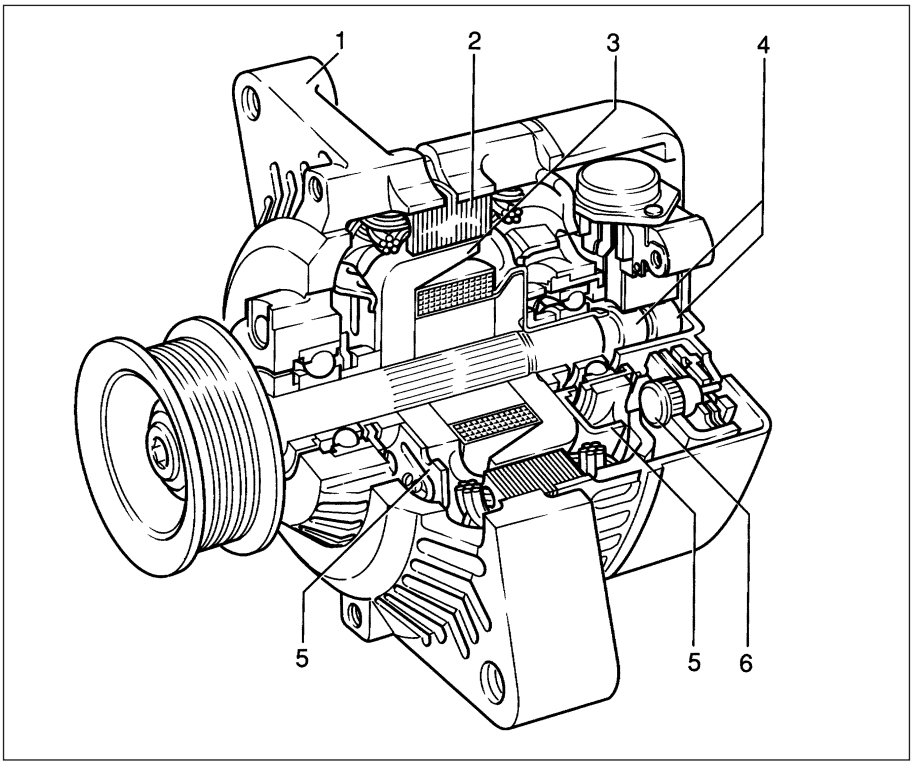
1 The battery is located at the left-hand front corner of the engine compartment.
2 Disconnect the lead(s) at the negative (earth) terminal by unscrewing the retaining nut and removing the terminal clamp.
3 Disconnect the positive terminal lead(s) in the same way.
4 Unscrew the clamp bolt sufficiently to enable the battery to be lifted from its location. Keep the battery in an upright position, to avoid spilling electrolyte on the bodywork.

Refitting

5 Refitting is a reversal of removal, but smear petroleum jelly on the terminals when reconnecting the leads, and always connect the positive lead first and the negative lead last.

7 **Alternator** - description

1 A Delco-Remy or Bosch alternator may be fitted, depending on model and engine capacity. The maximum output of the alternator varies accordingly.
2 The alternator is belt-driven from the crankshaft pulley. Cooling is provided by a fan, mounted outside the casing on the end of the rotor shaft. An integral voltage regulator is incorporated, to control the output voltage.
3 The alternator provides a charge to the battery even at very low engine speed, and consists of a coil-wound stator in which a rotor rotates. The rotor shaft is supported in ball-bearings, and slip rings are used to conduct current to and from the field coils through the carbon brushes.
4 The alternator generates ac (alternating current), which is rectified by an internal diode circuit to dc (direct current) for supply to the battery.
5 Later models are fitted with a Delco-Remy, 'compact' series alternators **(see illustration).** They use a ribbed V-belt type drivebelt with automatic tensioner. They are rigidly mounted to the engine.



7.5 Sectional view of the Delco-Remy "compact" series alternator

1 Drive end bracket
2 Stator
3 Rotor
4 Slip rings
5 Fan
6 Rectifier

8 Alternator drivebelt - removal, refitting and adjusting

V-belt type (not-ribbed)

Removal

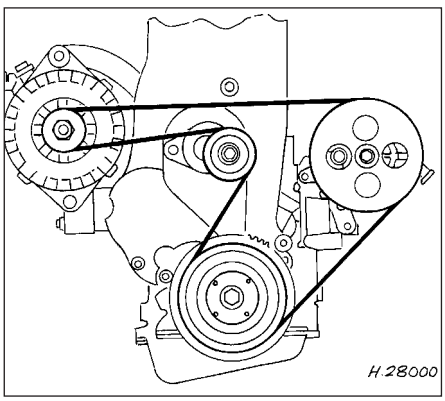
1 Disconnect the air inlet trunking from the air cleaner, and the air box or throttle body, as applicable, and remove it for improved access.
2 Correct tensioning of the drivebelt will ensure that it has a long life. Beware, however, of overtightening, as this can cause excessive wear in the alternator.
3 The belt should be inspected regularly, and if it is found to be worn, frayed or cracked, it should be renewed as a precaution against breakage in service. It is advisable to carry a spare drivebelt of the correct type in the vehicle always.
4 On models with power steering, the alternator drivebelt also drives the power steering pump.
5 To remove the belt, on 1.8 and 2.0 litre models first remove the power steering pump drivebelt, as described in Chapter 10.
6 Loosen the two alternator mounting nuts and bolts sufficiently to allow the alternator to be pivoted in towards the engine.
7 Slide the belt from the pulleys.

Refitting

8 Ensure that the correct type of belt is used, if it is being renewed. Fit the belt around the pulleys. Take up the slack in the belt by swinging the alternator away from the engine and lightly tightening the mounting nuts and bolts.

Adjusting

9 Although special tools are available for measuring the belt tension, a good approximation can be achieved if the belt is tensioned so that there is approximately 13.0 mm (0.5 in) of free movement under firm thumb pressure at the mid-point of the longest run between pulleys.
10 With the mounting bolts just holding the unit, lever the alternator away from the engine using a wooden lever at the mounting bracket end until the correct tension is achieved. Then tighten the mounting nuts and bolts. On no account lever at the free end of the alternator, as serious internal damage could be caused.



8.23 Correct routing of the ribbed V-belt

11 Where applicable, refit and tension the power steering pump drivebelt, as described in Chapter 10.
12 Refit the air inlet trunking.
13 When a new belt has been fitted, it will probably stretch slightly when it is first run, and the tension should be rechecked and if necessary adjusted after approximately 250 miles (400 km).

Ribbed V-belt type

General

14 Later models equipped with power steering are fitted with a ribbed V-belt type drivebelt in conjunction with an automatic tensioning roller. Once the belt is installed, no further adjustment is necessary as the correct tension is maintained by the automatic tensioning roller. Removal and refitting procedures are as follows.

Removal

15 For improved access, remove the air cleaner assembly and air inlet trunking.
16 If the original drivebelt is to be refitted, mark the rotational direction on the belt with chalk.
17 Using a spanner or socket on the automatic tensioning roller hexagon, turn the tensioning roller clockwise (as viewed from the right-hand side of the car) and hold it in this position. With the drivebelt tension released, slip the drivebelt off the pulleys, then allow the tensioner to return to its original position.
18 Support the engine under the sump with a jack and interposed block of wood.
19 From under the car, unbolt the right-hand engine mounting block from the body.
20 Lower the engine support jack just sufficiently to allow the drivebelt to be withdrawn from between the mounting block and the body.

Refitting

21 Slip the new drivebelt between the mounting block and body then raise the engine, by means of the jack, to its original position.
22 Clean the threads of the mounting block retaining bolts, apply locking fluid, and refit the bolts. Tighten the bolts to the specified torque (see Chapter 2A).
23 Rotate the automatic tensioner roller anti-clockwise and route the drivebelt around the pulleys as shown **(see illustration)**. With the belt correctly positioned, release the tensioner that will automatically apply the correct tension to the belt.
24 On completion, refit the air cleaner assembly and the air inlet trunking.

9.3 Disconnecting the wires from the terminals on the rear of the alternator - Delco-Remy alternator

9 Alternator- removal and refitting

Note: *Refer to Section 3 before proceeding*

Except 'compact' series alternators

Removal

1 Disconnect the battery leads.
2 Disconnect the air trunking from the air cleaner, and the air box or throttle body, as applicable, and remove it for improved access.
3 Disconnect the wiring plug, or disconnect the wires from their terminals on the rear of the alternator, noting their locations **(see illustration)**.
4 Remove the drivebelt, (Section 8).
5 Unscrew the two mounting bolts and nuts and recover any washers and insulating bushes, noting their locations. Note the earth strap attached to the top mounting bolt **(see illustration)**.
6 Withdraw the alternator, taking care not to knock or drop it, as this can cause irreparable damage.

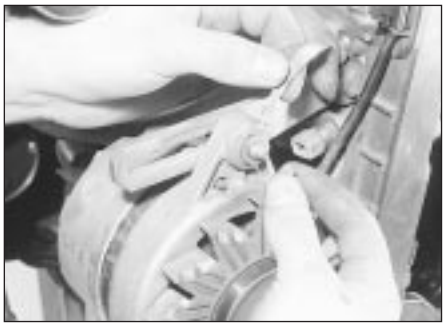
Refitting

7 Refitting is a reversal of removal, remembering the following points.
8 Ensure that the earth lead is in place on the top mounting bolt.
9 Refit and tension the drivebelt, (Section 8).

'Compact' series alternators

Removal

10 Disconnect the battery negative lead.
11 Remove the air inlet trunking and, if necessary for improved access, the air cleaner assembly.
12 Mark the rotational direction on the alternator drivebelt with chalk.
13 Using a spanner or socket on the automatic tensioning roller hexagon turn the tensioning roller clockwise (as viewed from the right-hand side of the car) and hold it in this position. With the drivebelt tension released, slip the drivebelt off the alternator pulley, then allow the tensioner to return to its original position.



9.5 Disconnecting the earth lead from the top alternator mounting bolt

14 Disconnect the electrical cable connections at the rear of the alternator.
15 Undo and remove the alternator lower mounting bolt, and slacken both upper bolts that secure the alternator mounting brackets to the engine.
16 Undo and remove both bolts that secure the alternator to its mounting brackets, noting the location of the different length bolts. Swing the brackets clear and remove the alternator from the engine.

Refitting

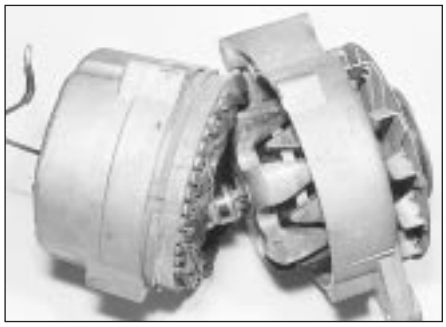
17 Refitting is a reversal of removal. Tighten the mounting bolts to the specified torque, and refit the drivebelt as described in Section 8.

10 Alternator - testing

Due to the specialist knowledge and equipment required to test or service an alternator, it is recommended that if a fault is suspected, the vehicle is taken to a dealer or a specialist. Information is limited to the inspection and renewal of the brushes. Should the alternator not charge, or the system be suspect, the following points may be checked before seeking further assistance:

a) Check the drivebelt tension, as described in Section 8
b) Check the condition of the battery and its connections - see Section 5

11.4 Alternator slip rings (arrowed) - Delco-Remy alternator



11.3 Separating the drive end housing from the slip ring end housing - Delco-Remy alternator

c) Inspect all electrical cables and connections for condition and security

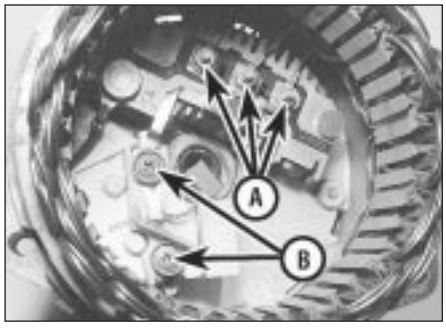
Note that if the alternator is found to be faulty, it may prove more economical to buy a factory-reconditioned unit, rather than having the existing unit overhauled.

11 Alternator brushes - removal, inspection and refitting

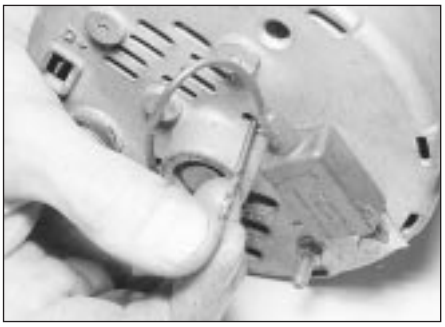
Removal

Delco-Remy type (except 'compact' series)

1 Remove the alternator, as described in Section 9
2 Scribe a line across the drive end housing and the slip ring end housing, to ensure correct alignment when reassembling.
3 Unscrew the three through-bolts, and prise the drive end housing and rotor away from the slip ring end housing and stator **(see illustration)**.
4 Check the condition of the slip rings, and if necessary clean with a rag or very fine glass paper **(see illustration)**.
5 Remove the three nuts and washers securing the stator leads to the rectifier, and lift away the stator assembly **(see illustration)**.

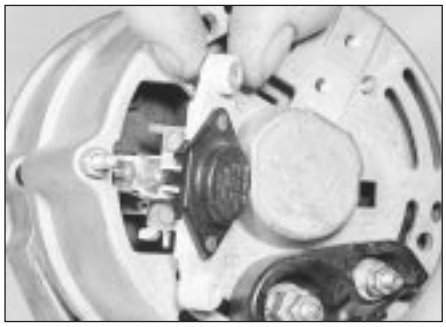


11.5 Delco-Remy alternator
A Stator lead securing nuts
B Brush holder/voltage regulator securing screws



11.15 Withdrawing the twist drill used to retain the brushes - Delco-Remy alternator

11.20A Remove the securing screws . . .



11.20B . . .and withdraw the brush holder/voltage regulator assembly - Bosch alternator

6 Remove the terminal screw and lift out the diode assembly.
7 Extract the two screws securing the brush holder and voltage regulator to the slip ring end housing, and remove the brush holder assembly. Note the insulation washers under the screw heads.
8 Check that the brushes move freely in their guides, and that the brush lengths are within the limits given in the Specifications. If any doubt exists regarding the condition of the brushes, the best policy is to renew them.
9 To fit new brushes, unsolder the old brush leads from the brush holder, and solder on the new leads in exactly the same place.
10 Check that the new brushes move freely in the guides.

Refitting

11 Before refitting the brush holder assembly, retain the brushes in the retracted position using a stiff piece of wire or a twist drill.
12 Refit the brush holder assembly so that the wire or drill protrudes through the slot in the slip ring end housing, and tighten the securing screws.
13 Refit the diode assembly and the stator assembly to the housing, ensuring that the stator leads are in their correct positions, and refit the terminal screw and nuts.
14 Assemble the drive end housing and rotor to the slip ring end housing, ensuring that the previously made marks are aligned. Insert and tighten the three through-bolts.
15 Pull the wire or drill, as applicable, from the slot in the slip ring end housing so that the brushes rest on the rotor slip rings **(see illustration)**.
16 Refit the alternator, as described in Section 9

Bosch type alternator

Removal

17 Disconnect the air trunking from the air cleaner, and the air box or throttle body, as applicable, and remove it for improved access.
18 Disconnect the battery leads.
19 If desired, to improve access further, the alternator can be removed, as described in Section 9
20 Remove the two securing screws, and withdraw the brush holder/voltage regulator assembly **(see illustrations)**.
21 Check that the brushes move freely in their guides, and that the brush lengths are within the limits given in the Specifications **(see illustration)**. If any doubt exists regarding the condition of the brushes, the best policy is to renew them as follows.
22 Hold the brush wire with a pair of pliers, and unsolder it from the brush holder. Lift away the brush. Repeat for the remaining brush.

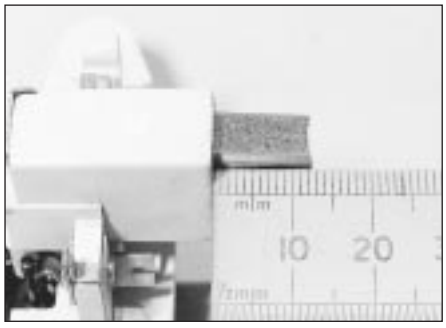
Refitting

23 Note that whenever new brushes are fitted, new brush springs should also be fitted.
24 With the new springs fitted to the brush holder, insert the new brushes, and check that they move freely in their guides. If they bind, lightly polish with a very fine file or glass paper.
25 Solder the brush wire ends to the brush holder, taking care not to allow solder to pass to the stranded wire.
26 Check the condition of the slip rings, and if necessary clean with a rag or very fine glass paper **(see illustration)**.
27 Refit the brush holder/voltage regulator assembly, and tighten the securing screws.
28 Where applicable, refit the alternator, as described in Section 9
29 Reconnect the battery leads.
30 Refit the air trunking.

Delco-Remy "compact" series

Removal

31 Remove the alternator as described in Section 9.
32 Remove the plastic cover from the rear of the alternator.
33 Undo the two bolts securing the brush holder to the rear of the alternator, noting that one of the bolts also secures the suppression capacitor.
34 Remove the suppression capacitor then withdraw the brush holder, noting the flat plug on the side.
35 Check that the brushes move freely in their holder and that the brush lengths are within the limits given in the Specifications. If any doubt exists regarding the condition of the brushes, the best policy is to renew them.



11.21 Measuring the length of an alternator brush - Bosch alternator

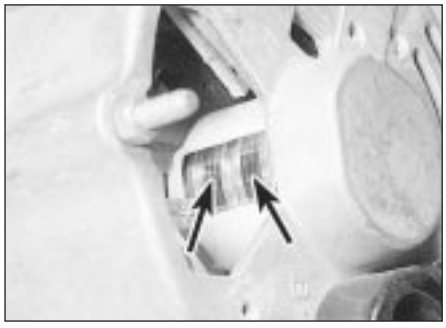
36 Check the condition of the slip rings, and if necessary clean with a rag or very fine glass paper.

Refitting

37 Refitting the brushes is a reversal of removal.

12 Starter motor - general

1 The starter motor is mounted at the rear of the cylinder block, and may be of either Delco-Remy or Bosch manufacture. Both makes are of the pre-engaged type, i.e. the drive pinion is brought into mesh with the starter ring gear on the flywheel before the main current is applied.



11.26 Alternator slip rings (arrowed) - Bosch alternator

2 When the starter switch is operated, current flows from the battery to the solenoid that is mounted on the starter body. The plunger in the solenoid moves inwards, so causing a centrally pivoted lever to push the drive pinion into mesh with the starter ring gear. When the solenoid plunger reaches the end of its travel, it closes an internal contact and full starting current flows to the starter field coils. The armature is then able to rotate the crankshaft, so starting the engine.
3 A special freewheel clutch is fitted to the starter driven pinion, so that when the engine fires and starts to operate on its own it does not drive the starter motor.
4 When the starter switch is released, the solenoid is de-energised, and a spring moves the plunger back to its rest position. This operates the pivoted lever to the withdraw the drive pinion from engagement with the starter ring.

13 Starter motor - testing

Note: *Refer to Section 3 before proceeding*

Testing

1 If the starter motor fails to turn the engine when the switch is operated, and engine seizure is not the problem, there are several other possible reasons:

a) The battery is faulty
b) The electrical connections between the switch, solenoid battery and starter motor are somewhere failing to pass the necessary current from the battery through the starter to earth
c) The solenoid switch is faulty
d) The starter motor is mechanically or electrically defective
e) The starter motor pinion and/or flywheel ring gear is badly worn, and in need of replacement

2 To check the battery, switch on the headlamps. If they dim after a few seconds, then the battery is in a discharged state. If the lamps glow brightly, operate the starter switch and see what happens to the lamps. If they dim, then power is reaching the motor, but failing to turn it. If the starter turns slowly, go on to the next check.
3 If, when the starter switch is operated, the lamps stay bright, then insufficient power is reaching the motor. Disconnect the battery and the starter/solenoid power connections, and the engine earth strap, then thoroughly clean them and refit them. Smear petroleum jelly around the battery connections to prevent corrosion. Corroded connections are the most frequent cause of electrical system malfunctions.
4 If the preceding checks and cleaning tasks have been carried out without success, a clicking noise will probably have been heard each time the starter switch was operated. This indicates that the solenoid switch was operating, but it does not necessarily follow that the main contacts were closing properly (if no clicking has been heard from the solenoid, it is certainly defective). The solenoid can be checked by connecting a voltmeter across the main cable connection on the solenoid and earth. When the switch is operated, these should be a reading on the voltmeter. If there is no reading, the solenoid unit is faulty, and should be renewed.
5 If the starter motor operates, but does not turn the engine, then it is likely that the starter pinion and/or flywheel ring gear are badly worn. If this is the case, the starter motor will normally be noisy in operation.
6 Finally, if it is established that the solenoid is not faulty, and 12 volts are reaching the starter, then the motor itself is faulty, and should be removed for inspection.

14 Starter motor - removal and refitting

Note: *Refer to Section 3 before proceeding*

Removal

1 Disconnect the battery negative lead.
2 Apply the handbrake, then jack up the front of the vehicle, and support securely on axle stands (see "*Jacking and Vehicle Support*") positioned under the body side members.
3 On DOHC models, remove the engine undershield, as described in Chapter 11.
4 Note the wiring connections on the solenoid, then disconnect them **(see illustration)**.
5 Where applicable, unscrew the bolt securing the exhaust bracket and the starter motor mounting bracket to the cylinder block **(see illustration)**.
6 Unscrew the two starter motor mounting bolts. Note that the top bolt on some models are fitted from the transmission side, and secures a wiring harness bracket **(see illustration)**.
7 Withdraw the starter motor.

Refitting

8 Refitting is a reversal of removal, but where applicable, ensure that the wiring harness bracket is in place on the top mounting bolt, and tighten all bolts to the specified torque.

15 Starter motor - overhaul

If the starter motor is thought to be suspect, it should be removed from the vehicle and taken to an auto-electrician for testing. Most auto-electricians will be able to supply and fit brushes at a reasonable cost. However, check on the cost of repairs before continuing as it may prove more economical to obtain a new or exchange motor.

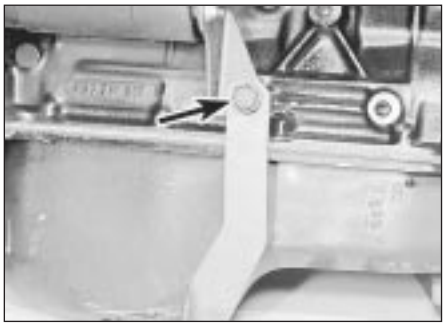
16 Ignition coil - removal, testing and refitting

Note: *Refer to Section 3 before proceeding. An ohmmeter will be required to test the coil*

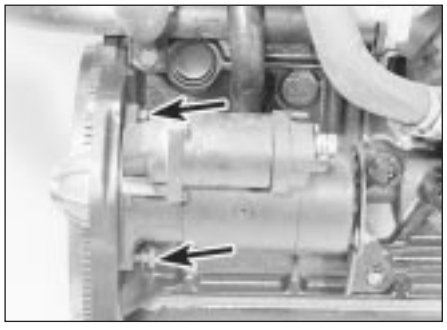
Removal

1 The ignition coil is either a cylindrical metal canister or a moulded plastic unit. It is clamped or bolted to the left-hand inner wing panel, near the suspension strut top mounting (under the power steering fluid reservoir, on

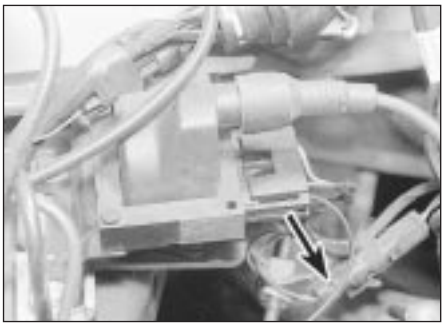
14.4 Starter motor and solenoid viewed from underneath the vehicle. Solenoid wiring connections arrowed



14.5 Starter motor mounting bracket/exhaust bracket securing bolt (arrowed) - 1.6 litre model



14.6 Starter motor securing bolts (arrowed) - 1.6 litre model (engine removed)



16.1 Ignition coil - 1.6 litre models - note ignition timing basic adjustment coding plug (arrowed)

16.3 Disconnecting the coil LT wiring plug - 2.0 litre model

models so equipped). On 14 NV, 16 SV and 18 SV models, the ignition amplifier module is mounted on the coil's bracket or baseplate **(see illustration)**.

2 Disconnect the battery negative lead.

3 Carefully note the LT wiring connections before disconnecting them **(see illustration)**.

4 Note that on models with power steering, one of the coil securing bolts also secures the power steering fluid reservoir bracket.

5 Remove the coil.

6 On models with a cylindrical type coil, the mounting clamp can be removed from the coil by loosening the clamp nut.

Testing

7 To test the coil, first disconnect the LT wiring and the HT lead. Test the coil's primary windings by connecting a multi-meter across the LT terminals ("+" or "15" and "-" or "1"). Then the secondary windings by testing across the HT terminal ("4") and one of the LT terminals (usually the "-/1" terminal, although in some cases, either terminal may serve). On 20 XEJ models, results should closely approximate the specified values. On all other models, typical primary resistances are less than 1 ohm, while secondary resistances can be expected to be in the 4000 to 12 000 ohms range.

8 If the results obtained differ significantly from those given, showing windings that are shorted or open circuit, the coil must be renewed.

Refitting

9 Refitting is a reversal of removal, however ensure correct connections. Usually they are physically different to prevent incorrect refitting. If not, use the terminal marks or numbers in conjunction with the relevant wiring diagram at the back of this manual to ensure that the connections are correctly remade. If the connections are reversed, so will the coil's polarity be. While the engine may still run, spark plug life will be reduced and poor starting and/or misfiring may follow.

10 Where applicable, ensure that the coil suppresser is in position before refitting the coil securing bolts.

17 Distributor cap and rotor arm - removal and refitting

Note: *Refer to Section 3 before proceeding*

Removal

14 NV and 16 SV models

1 Disconnect the battery negative lead.

2 Identify each HT lead for position, so that the leads can be refitted to their correct cylinders, then disconnect the leads from the spark plugs by pulling on the connectors, not the leads. Similarly, disconnect the HT lead from the coil. Pull the leads from the clips on the camshaft cover.

3 On the Bosch distributor, prise away the two spring clips with a screwdriver, and lift off the distributor cap. On the Lucas distributor, unscrew the two small bolts and lift off the cap **(see illustrations)**.

4 The rotor arm is a push fit on the end of the distributor shaft.

5 If needed, on the Bosch distributor, the plastic shield can be pulled from the end of the distributor, to allow examination of the distributor components **(see illustration)**.

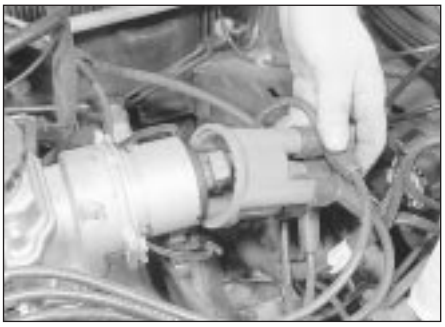
Other models, where applicable

6 Proceed as described in paragraphs 1 and 2.

7 On DOHC models (except X20 XEV), unscrew the two securing bolts and withdraw the spark plug cover from the camshaft cover.

8 Using a Torx socket, unscrew the three captive securing screws and withdraw the distributor cap **(see illustration)**.

9 Withdraw the plastic shield from the rotor arm housing. The shield is fitted in the housing, with an O-ring seal located in a groove in its periphery. Ease out the shield, taking care not to damage the rotor arm **(see illustration)**.



17.3A Removing the distributor cap - 1.6 litre model (Bosch distributor) . . .

17.3B . . .and 1.6 litre models (Lucas distributor)

17.5 Removing the rotor arm and plastic shield - 1.6 litre model (Bosch distributor)

17.8 Unscrewing a distributor cap securing screw - 2.0 litre model

17.9 Removing the plastic shield from the rotor arm housing - 2.0 litre model

10 Using an Allen key or hexagon bit, extract the two securing screws and withdraw the rotor arm, leaving the metal rotor hub in the housing **(see illustrations)**.
11 Examine the O-ring on the plastic shield, and renew if necessary.

Refitting

12 Refitting is a reversal of removal, noting that the rotor arm can only be fitted in one position. If necessary, turn the metal rotor hub so that the screw holes align with those in the rotor arm and the end of the camshaft. Ensure that the HT leads are correctly reconnected.

18 Distributor (SOHC models) - removal and refitting

Note: *Refer to Section 3 before proceeding. A tachometer and a timing light will be required to check the ignition timing on completion 14 NV and 16 SV*

Removal

1 Disconnect the battery negative lead.
2 Remove the distributor cap, as described in Section 17.
3 Disconnect the distributor wiring plug **(see illustrations)**.
4 On 14 NV models, disconnect the vacuum pipe from the diaphragm unit on the side of the distributor.
5 If the original distributor is to be refitted, make alignment marks between the distributor body and the camshaft housing, so that the distributor can be refitted in its original position.
6 Turn the crankshaft. This can be done by either using a socket or spanner on the crankshaft pulley bolt, or by engaging top gear and pushing the vehicle backwards or forwards. Bring No 1 cylinder to the firing point. No 1 cylinder is at the firing point when:

a) The relevant timing marks are aligned. On 14 NV models, the pointer on the rear timing belt cover should be aligned halfway between the two notches in the crankshaft pulley. On 16 NV models, the pointer on the rear timing belt cover should be aligned with the notch in the crankshaft pulley
b) The tip of the rotor arm is pointing to the position occupied by the No 1 cylinder HT lead terminal in the distributor cap
c) On the Bosch distributor, the rotor arm is aligned with the notch in the distributor body (remove the rotor arm and plastic shield, then refit the rotor arm to check the alignment with the notch). On the Lucas distributor, the rotor arm is approximately aligned with the **TDC** *arrow stamped in the distributor body* ***(see illustration).***

7 Unscrew the clamp nut and remove the clamp plate, then withdraw the distributor from the camshaft housing **(see illustrations)**.
8 If desired, the distributor can be dismantled, as described in Section 20.
9 Check the condition of the O-ring on the rear of the distributor body, and renew if necessary.

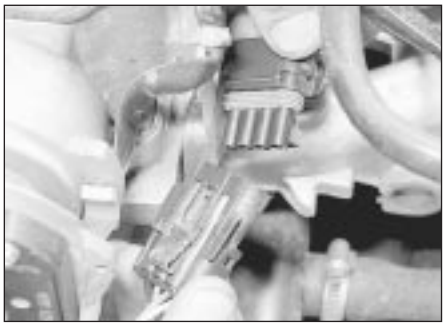
Refitting

10 Begin refitting by checking that No 1 cylinder is still at the firing point. The relevant timing marks should be aligned. If the engine has been turned whilst the distributor has

17.10A Extract the two securing screws . . .

17.10B . . .and withdraw the rotor arm - 2.0 litre model

18.3A Disconnecting the distributor wiring plug - 1.6 litre model (Bosch distributor)



18.3B Disconnecting the distributor wiring on the C16 NZ engine

18.6 TDC arrow on the Lucas distributor body

18.7A Unscrew the clamp nut . . .

18.7B . . .remove the clamp plate . . .

18.7C . . .and withdraw the distributor

been removed, check that No 1 cylinder is on its firing stroke by removing No 1 cylinder spark plug and placing a finger over the plug hole. Turn the crankshaft until compression can be felt, which indicates that No 1 piston is rising on its compression stroke. Continue turning the crankshaft until the relevant timing marks are in alignment.

11 Turn the rotor arm to the position noted in paragraph 6c, and hold the rotor arm in this position as the distributor is fitted. Note that the distributor driveshaft will only engage with the camshaft in one position. If the original distributor is being refitted, align the marks made on the distributor body and camshaft housing before removal.

12 Refit the clamp plate and nut, but do not fully tighten the nut at this stage.

13 On the Bosch distributor, remove the rotor arm, then refit the plastic shield and the rotor arm.

14 On 14 NV models, reconnect the vacuum pipe to the diaphragm unit.

15 Reconnect the distributor wiring plug.

16 Refit the distributor cap as described in Section 17.

17 Reconnect the battery negative lead.

18 Check and if necessary adjust the ignition timing, as described in Section 21.

19 Distributor (DOHC models), where applicable - removal and refitting

Removal

1 Disconnect the battery negative lead.

2 Remove the distributor cap, as described in Section 17.

3 Disconnect the distributor wiring plug.

4 Unscrew the two securing bolts, and remove the distributor from the cylinder head.

5 Examine the O-ring on the rear of the distributor, and renew if necessary.

Refitting

6 Refitting is a reversal of removal. However, note that the distributor should be fitted so that the wiring plug is positioned on the upper left-hand side of the distributor body, when viewed from the distributor cap end.

20 Distributor - dismantling, inspection and reassembly

Note: *Before contemplating dismantling of a distributor, check the cost and availability of replacement parts. It may prove more economical to renew the complete distributor assembly*

14 NV models

Dismantling

1 With the distributor removed as described in Section 18, continue as follows.

2 Pull off the rotor arm, and remove the plastic shield.

3 The top bearing plate can be removed after unscrewing the two securing screws, however (other than the vacuum diaphragm unit), no spares are available for the distributor and no adjustments are required.

4 If desired, the vacuum diaphragm unit can be removed by extracting the two securing screws and unhooking the operating arm from the distributor baseplate. Note that the screws are of differing lengths, the longer screw also secures one of the distributor cap clips.

Inspection

5 The vacuum unit can be tested by applying suction to the vacuum port, and checking that the operating rod moves into the unit as suction is applied. Remove the suction, and check that the operating rod returns to its original position. If the operating rod does not move as described, renew the vacuum unit.

6 Check the distributor cap for corrosion of the segments, and for signs of tracking, indicated by a thin black line between the segments. Make sure that the carbon brush in the centre of the cap moves freely and stands proud of the surface of the cap. Renew the cap if necessary.

7 If the metal portion of the rotor arm is badly burnt or loose, renew it. If slightly burnt or corroded; it may be cleaned with a fine file.

8 Examine the seal ring at the rear of the distributor body, and renew if necessary.

Reassembly

9 Reassembly is a reversal of dismantling, ensuring that the vacuum unit operating arm is correctly engaged with the peg on the baseplate, several attempts may be required to reconnect it.

10 Refit the distributor as described in Section 18, and then check and if necessary adjust the ignition timing, as described in Section 21.

16 SV models

Dismantling

11 With the distributor removed as described in Section 18, pull off the rotor arm and, on the Bosch distributor, remove the plastic shield.

12 Using a pin punch, carefully drive out the roll pin securing the plastic drive collar to the rear of the distributor shaft **(see illustration)**.

13 Lift off the drive collar, and remove the thrustwashers from the end of the shaft **(see illustration)**.

14 Withdraw the shaft, complete with the trigger vane, from the distributor body, and recover the thrustwashers from the shaft **(see illustration)**.

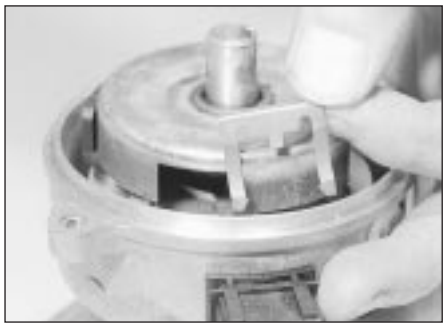
15 On the Lucas distributor, extract the spring clip from inside the body, then withdraw the terminal block. Pull the small wiring plug from inside the terminal block **(see illustrations)**.

16 Remove the screws, and lift the sensor plate from the distributor body **(see illustrations)**.

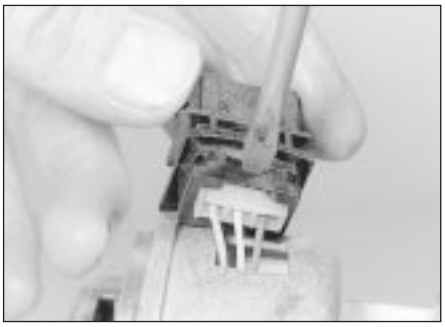
20.12 Removing the drive collar roll pin - 1.6 litre models (Bosch distributor)

20.13 Removing the thrustwashers

20.14 Recovering the thrustwashers from the shaft - 1.6 litre (Bosch distributor)

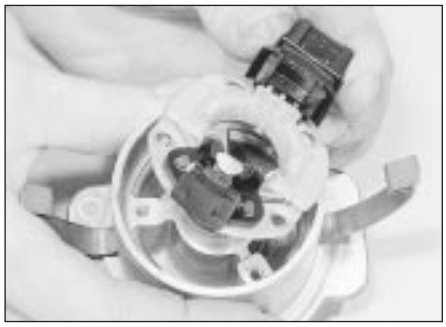


20.15A Removing the spring clip . . .



20.15B . . .and disconnecting the small wiring plug - 1.6 litre (Lucas distributor)

20.16A Remove the securing screws . . .



20.16B . . .and withdraw the sensor plate - 1.6 litre (Bosch distributor)

Inspection

17 Examine the distributor cap and rotor arm, as described in paragraphs 6 and 7. Examine the O-rings at the rear of the distributor body, and on the rear of the shaft, and renew if necessary.

Reassembly

18 Reassembly is a reversal of dismantling, ensuring that the thrustwashers are correctly located. Note that the drive collar should be refitted so that the drive peg on the collar is aligned with the groove in the top of the distributor shaft (it is possible to fit the drive collar 180° out of position).

19 Refit the distributor as described in Section 18, and then check and if necessary adjust the ignition timing, as described in Section 21.

DOHC models (where applicable)

20 The distributor cap and rotor arm can be examined as described in paragraphs 6 and 7.

21 Ignition timing - checking and adjustment

Note: *Refer to Section 3 before proceeding. A tachometer and a timing light will be required during this procedure. For details of ignition timing adjustment required to operate vehicles on unleaded petrol, refer to Section 22.*

14 NV and 16 SV models

Checking

1 Start the engine and run it until it reaches normal operating temperature, then switch off.

2 On 14 NV models, disconnect the vacuum pipe from the distributor vacuum diaphragm unit.

3 On all models use a spanner applied to the crankshaft pulley bolt to rotate the crankshaft clockwise until the notch in the pulley's inboard rim aligns with the pointer protruding from the oil pump housing. On 14 NV models, where two notches (indicating 10° and 5° BTDC respectively) are found, rotate the crankshaft until the second notch (in the direction of rotation - i.e. 5° BTDC) aligns. Use white paint or similar to emphasise the pointer and notch, to make them easier to see.

4 Connect a timing light to No 1 cylinder (nearest the timing belt end of the engine) HT lead, also a tachometer; follow the equipment manufacturer's instructions for connection.

5 Start the engine and allow it to idle - the speed should be between 700 and 1000 rpm.

6 On 14 NV models, aim the timing light at the pointer and check that it is aligned with the crankshaft pulley notch.

7 On early 16 SV models, disconnect the ignition timing basic adjustment coding plug. This can be identified by a length of Black wire joining Brown/Red and Brown/Yellow wires in a connector plug clipped to the wiring or heater/cooling system hoses beneath the battery/ignition coil (see illustration, 16.1). This causes the MSTS-i module to adopt its basic adjustment mode, sending a constant firing signal corresponding to 10° BTDC and eliminating any advance below 2000 rpm. Aim the timing light at the pointer and check that it is aligned with the crankshaft pulley notch.

8 On later 16 SV, C 16 NZ and C 16 NZ2 models, the coding plugs are no longer fitted. For accurate checking, special Vauxhall test equipment must be used which causes the MSTS module to adopt its basic adjustment mode.

9 Without access to such equipment, it is possible to check and adjust the ignition timing, accurate results cannot be guaranteed. Owners are therefore advised to have this work carried out by a suitably equipped Vauxhall dealer; at the very least, make the initial setting yourself and then have it checked as soon as possible.

10 If you do attempt to check the ignition timing yourself, note that the fixed reference mark is now an extended line embossed on the timing belt lower outer cover.

Adjustment

11 If the notch and pointer are not aligned, loosen the distributor clamp nut and turn the distributor body slightly in the required direction to align.

12 Tighten the distributor clamp nut, and check that the notch and pointer are still aligned.

20.16C Sensor plate screw (arrowed) - 1.6 litre (Lucas distributor)

13 Stop the engine, and disconnect the timing light and tachometer.

14 On 16 SV models, reconnect the basic adjustment coding plug. On 14 NV models, reconnect the vacuum pipe to the distributor vacuum diaphragm unit.

Other models

15 No adjustment of the ignition timing is possible on 1.8 and 2.0 litre models, as the adjustment is carried out automatically by the electronic control module.

16 The ignition timing can be checked by a Vauxhall dealer using specialist dedicated test equipment, if a fault is suspected.

22 Ignition timing - adjustment for use with unleaded petrol

14 NV models

1 All models with the 14 NV engine have the ignition timing adjusted for use with 95 RON unleaded petrol before they leave the factory, and no further adjustment is required.

2 Leaded petrol (98 RON) can be used if desired, with no adverse effects.

1.6, 1.8 and 2.0 SOHC models

Note: *Models equipped with a catalytic converter must be operated on 95 R0N unleaded petrol at all times, and although an octane coding plug may be fitted, it should* **not** *be tampered with*

3 Models, other than 14 NV, are equipped with an octane coding plug, which is located

22.3 Octane coding plug (arrowed) - 2.0 litre model

in a clip at the left-hand rear of the engine compartment **(see illustration)**.

4 The plug is reversible in its connector, and is marked either "A" or "98" on one side, which corresponds to the position for use with 98 RON leaded petrol. On the other side either "B" or "95", which corresponds to the position to use with 95 RON unleaded petrol. All vehicles are set for use with 95 RON unleaded petrol before they leave the factory.

5 To change the coding for use with a different type of petrol, first allow the fuel tank to become practically empty.

6 Fill the fuel tank with the required type of petrol.

7 Ensure that the ignition is switched off, then remove the coding plug from its clip and disconnect the wiring connector.

8 Rotate the plug through 180°, so that the appropriate octane mark is uppermost (see paragraph 4), then reconnect the wiring connector and refit the plug to its clip.

9 Note that using petrol with a higher octane rating than that set will not cause damage, but petrol with a lower octane rating than that set must not be used.

20 XE, C20 XE and X20 XEV models

10 The ignition coding plug found on these models is **not** an octane coding plug (although its method of operation is similar) and must not be altered from its factory setting. Its purpose is to ensure that the Motronic module uses the correct information, pre-programmed (or "mapped") into its memory, to enable the vehicle to comply with the relevant national noise and exhaust emission legislation.

11 On these models, the knock sensor circuit allows the Motronic module to compensate for differences in the octane value of the petrol used, without the need for manual intervention. Remember, however, that all catalytic converter-equipped vehicles must use unleaded petrol only. This means that these models can use any grade of unleaded petrol on sale in the UK without the need for adjustment.

23 Electronic modules - removal and refitting

Note: *Refer to Section 3 for precautions to be observed when working with electronic modules. Heat sink compound must be used when refitting the module.*

HEI module (14 NV models)

Removal

1 The module is mounted on a metal plate, beneath the ignition coil, on the left-hand side of the engine compartment.

2 Remove the ignition coil as described in Section 16, and slide the coil from its clamp.

3 The module can be removed from the mounting plate by unscrewing the two securing screws.

4 Before refitting the module, heat sink compound should be applied to the mounting plate to improve heat dissipation. If a new module is being fitted, it should be supplied with heat sink compound. Similar compounds can be bought from DIY electrical shops.

Refitting

5 Refitting is a reversal of removal.

MSTS-i module (1.6 and 1.8 litre models)

Removal

6 The module is mounted on the engine compartment bulkhead, above the steering rack **(see illustration)**.

7 Disconnect the battery negative lead.

8 If desired, for improved access, remove the air box from the top of the carburettor.

9 Disconnect the wiring plug from the module.

10 Unscrew the two securing nuts, and withdraw the module from the bulkhead.

Refitting

11 Refitting is a reversal of removal.

Motronic module

Removal

12 The module is mounted in the driver's footwell, behind the side trim panel.

23.15 Lowering the Motronic module from the footwell - 2.0 litre model

23.6 MSTS-i module location - 1.6 litre model

13 Disconnect the battery negative lead.

14 Remove the driver's footwell side trim panel, as described in Chapter 11.

15 Unscrew the three module securing screws, two at the top of the module, and a single screw at the bottom, and lower the module from the footwell **(see illustration)**.

16 Release the retaining clip, and disconnect the module wiring plug **(see illustration)**.

17 Withdraw the module, noting the plastic insulating sheet on its rear face.

Refitting

18 Refitting is a reversal of removal, but ensure that the insulating sheet is in place on the rear face of the module.

24 MSTS-i components - removal and refitting

Note: *Refer to Section 3 before proceeding. Procedures for removal and refitting of the ignition system components and electronic module are given elsewhere in the relevant Sections of this Chapter*

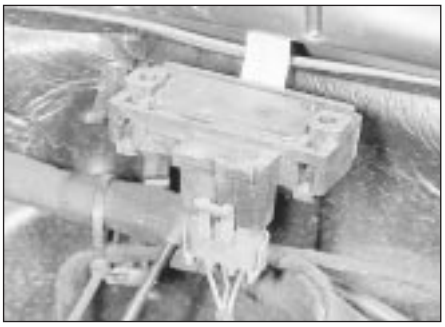
Manifold pressure sensor

Removal

1 The sensor is located on the engine compartment bulkhead, to the left of the MSTS-i module, under the edge of the windscreen cowl panel **(see illustration)**.

2 Disconnect the battery negative lead.

23.16 Releasing the Motronic module wiring plug clip - 2.0 litre model



24.1 MSTS-i manifold pressure sensor - 1.6 litre model

3 Lift up the edge of the windscreen cowl panel for access to the sensor.
4 Disconnect the sensor wiring plug, and the vacuum pipe.
5 Pull the pressure sensor upwards to release it from its bracket, and withdraw it from the vehicle.

Refitting

6 Refitting is a reversal of removal. However, on Multec models no fuel vapour trap is fitted. It is therefore essential that the sensor vacuum hose is routed so that it falls steadily from the sensor to the throttle body. This precaution prevents any fuel droplets being trapped in the sensor or hose, and allows them to drain into the inlet port.

Oil temperature sensor

Removal

7 The sensor is screwed into the inlet manifold side of the cylinder block, next to the starter motor's right-hand end.
8 The sensor can be reached quite easily from above, but if it is to be removed from beneath, ensure that the handbrake is applied, and that the vehicle is securely supported on axle stands (see "*Jacking and Vehicle Support*").
9 Disconnect the battery negative lead.
10 Disconnect the sensor wiring plug.
11 Using a spanner, unscrew the sensor and remove it **(see illustration)**. Be prepared for oil spillage, and plug the hole in the cylinder block to prevent dirt ingress and further oil loss.

24.18 Examine the crankshaft speed/position sensor sealing ring - 1.8 litre model

24.11 Unscrewing the MSTS-i oil temperature sensor - 1.6 litre model (engine removed)

Refitting

12 Refitting is a reversal of removal.

Crankshaft speed/position sensor (1.8 litre models)

Removal

13 The sensor is located on the exhaust manifold side of the engine, in the lower cylinder block behind the oil pump.
14 Disconnect the battery negative lead.
15 Release the relevant outer timing belt cover securing clips, and unclip the sensor wiring from the timing belt cover.
16 Disconnect the sensor wiring connector, noting its location.
17 Unscrew the securing bolt, and withdraw the sensor from the cylinder block **(see illustration)**.
18 Examine the sensor sealing ring, and renew if necessary **(see illustration)**.

Refitting

19 Refitting is a reversal of removal, ensuring that the sensor wiring is correctly located on the timing belt cover, and that the wiring connector is correctly located.

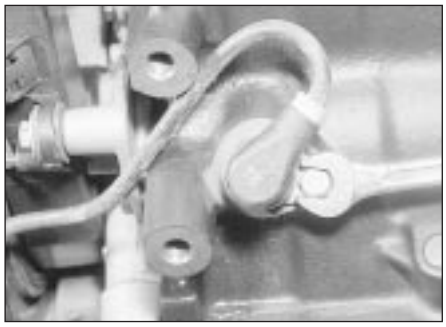
25 Motronic system components - removal and refitting

Note: *Refer to Section 3 before proceeding. Procedures for removal and refitting of the ignition system components and electronic module are given elsewhere in the relevant Sections of this Chapter. Removal and refitting procedures for all fuel injection system components are given in Chapter 4B*

Coolant temperature sensor

Removal

1 On all except 20 XEJ models, the sensor is located in the end of the thermostat housing, on the inlet manifold side of the engine.
2 On 20 XEJ models, the sensor is located in the thermostat housing, on the exhaust manifold side of the engine.
3 Disconnect the battery negative lead.
4 Partially drain the cooling system, as described in Chapter 3.



24.17 Unscrewing the crankshaft speed/position sensor securing bolt - 1.8 litre model

5 Disconnect the sensor wiring plug **(see illustration)**.
6 Using a spanner, unscrew the sensor and withdraw it from the thermostat housing.

Refitting

7 Refitting is a reversal of removal.
8 On completion, top-up the cooling system, as described in Chapter 3.

Knock sensor (DOHC models)

Removal

9 The sensor is located at the lower inlet manifold side of the cylinder block, below the idle speed adjuster, and is only accessible from below the vehicle.
10 Disconnect the battery negative lead.
11 Apply the handbrake, then jack up the front of the vehicle, and support securely on axle stands (see "*Jacking and Vehicle Support*") placed under the body side members.
12 Remove the engine undershield, as described in Chapter 11.
13 Disconnect the sensor wiring plug.
14 Unscrew the securing bolt, and withdraw the sensor from the cylinder block.

Refitting

15 Refitting is a reversal of removal, but note that the mating faces of the sensor and cylinder block must be cleaned thoroughly before fitting the sensor.

25.5 Disconnecting the coolant temperature sensor wiring plug - 2.0 litre model (alternator removed)

26 DIS module - removal and refitting

Note: *Refer to Section 3 before proceeding.*

Removal

1 Disconnect the battery negative lead.
2 Disconnect the HT leads from the module terminals noting their locations to ensure correct refitting. Note that the HT lead cylinder numbers are stamped on the module, next to each terminal, and similar numbers appear on each HT lead.
3 Disconnect the module wiring plug.
4 On X16 SZ engines, undo the three screws and remove the module from the camshaft housing. On C20 XE engines, undo the bolts securing the DIS module mounting bracket to the cylinder head and remove the module and bracket. Note the installed position of DIS module on its mounting bracket, undo the four securing screws and separate the module from the bracket.

Refitting

5 Refitting is a reversal of removal.

27 Camshaft phase sensor (C20 XE engine) - removal and refitting

Note: *Refer to Section 3 before proceeding.*

Removal

1 The camshaft phase sensor is mounted on the end of the cylinder head in the position normally occupied by the distributor.
2 Disconnect the battery negative lead.
3 Disconnect the wiring plug then undo the phase sensor securing bolts.
4 Withdraw the phase sensor from the cylinder head, then undo the bolt and remove the phase sensor disc from the end of the camshaft.

Refitting

5 Refitting is a reversal of removal.

Chapter 9
Braking system

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

Models without ABS:	
1.4, 1.6 and 1.8 litre models	Front discs and rear drums, with vacuum servo assistance, dual hydraulic circuit split diagonally, pressure-proportioning valves in rear hydraulic circuit. Cable-operated handbrake on rear wheels
2.0 litre models	Front and rear discs, with vacuum servo assistance, dual hydraulic circuit split diagonally, pressure-proportioning valves in rear hydraulic circuit. Cable-operated handbrake on rear wheels
All models with Anti-lock Braking System (ABS)	Front and rear discs, with vacuum servo assistance, operated via hydraulic modulator, dual hydraulic circuit split front/rear, pressure-proportioning valves in rear hydraulic circuit. Cable-operated handbrake on rear wheels

Front discs

Type:	
1.4, 1.6 and 1.8 litre models	Solid or ventilated (as from 10/91)
2.0 litre models	Ventilated
Diameter:	
1.4, 1.6 and early 1.8 litre models	236 mm
Late (as from 10/91) 1.8 and 2.0 litre models	256 mm
Maximum disc run-out (all models)	0.1 mm
Minimum pad friction material thickness (including backing plate):	
All models	7.0 mm
Minimum disc thickness after machining: *	
1.4, 1.6 and 1.8 litre models (with solid discs)	10.7 mm
1.4, 1.6 and 1.8 litre models (with vented discs)	18.0 mm
2.0 litre models	22.0 mm

** When this dimension is reached, only one further new set of brake pads is permissible, then renew the discs*

Rear discs

Type (all models)	Solid
Diameter (all models)	260 mm
Maximum disc run-out (all models)	0.1 mm
Minimum pad friction material thickness (including backing plate):	
All models	7.0 mm
Minimum disc thickness after machining (all models) *	8.0 mm

** When this dimension is reached, only one further new set of disc pads is permissible, then renew the discs*

Minimum handbrake shoe friction material thickness (lining only)	
All models	1.0 mm

Rear drums

Internal diameter (all models)	200 mm
Minimum shoe friction material thickness (all models)	0.5 mm above rivet heads

Brake fluid type/specification:

All models	See *Lubricants and fluids* in "*Weekly checks*"

Torque wrench settings

	Nm	lbf ft
ABS hydraulic modulator mounting	8	6
ABS wheel sensor mounting	8	6
ABS control unit	1.5	1
Brake fluid line unions	16	12
Caliper and wheel cylinder bleed screws	9	7
Front brake disc securing screw	4	3
Front brake fluid hose to caliper union	40	30
Front caliper bracket to hub carrier	95	70
Front caliper guide	30	22
Front caliper mounting (solid disc models)	95	70
Front caliper to mounting bracket (vented disc models)	30	22
Handbrake lever securing	20	15
Master cylinder mounting	22	16
Master cylinder stop screw (ATE type)	6	4
Pressure proportioning valve to master cylinder:		
ATE type	12	9
GMF type	40	30
Rear brake backplate/stub axle spring:		
Stage 1	50	37
Stage 2	Angle-tighten a further 30º	
Stage 3	Angle-tighten a further 15º	
Rear brake disc securing screw	8	6
Rear caliper mounting	80	59
Rear drum securing screw	4	3
Rear wheel cylinder mounting	9	7
Vacuum servo support bracket to bulkhead	22	16
Vacuum servo to support bracket	20	15

1 General description

The foot brake operates on all four wheels. Solid or ventilated disc brakes are fitted at the front, and self-adjusting drum or solid disc brakes are fitted at the rear, depending on model. Actuation is hydraulic, with vacuum servo assistance. The handbrake is cable-operated, and acts on the rear wheels only.

The hydraulic system is split into two circuits. On non-ABS models, the system is split diagonally, and on ABS models, the system is split front and rear. If there is a hydraulic fluid leak in one circuit, the remaining circuit will still function, so that some braking capability remains.

The hydraulic fluid supply to the rear brakes is regulated so that the front brakes always lock first under heavy braking. The fluid pressure to the rear brakes is controlled by two valves, one for each brake, which are either screwed into the master cylinder or mounted on the rear underbody of the vehicle, depending on model.

The brake servo is of the direct-acting type, fitted between the pedal and the master cylinder. The servo is powered by vacuum developed in the inlet manifold. Should the servo fail, the brakes will still operate, but increased pedal pressure will be required.

2 Anti-lock braking system (ABS) - general

1 ABS is available as an option for all models. When the ignition is switched on, an 'ABS' symbol illuminates in the instrument panel for a short time.

2 The system comprises an electronic control unit, roadwheel sensors, hydraulic modulator, and the necessary valves and relays. Disc brakes are fitted to all four wheels. The purpose of the system is to stop wheel(s) locking during heavy brake applications. This is achieved by automatic release of the brake on the locked wheel, followed by re-application of the brake. This procedure is carried out several times a second by the hydraulic modulator.

3 The modulator is controlled by the electronic control unit, which itself receives signals from the wheel sensors, which monitor the locked or unlocked state of the wheels. The two front brakes are modulated separately, but the two rear brakes are modulated together.

4 The ABS unit is fitted between the brake master cylinder and the brakes, the vacuum servo and master cylinder being of similar type for both non-ABS and ABS models.

5 If the 'ABS' symbol, in the instrument panel stays lit after approximately 4 seconds, or if it comes on sporadically or stays on whilst driving, there is a fault in the system. Should this occur, it is recommended that a complete test is carried out by a Vauxhall dealer, who will have the necessary specialist diagnostic equipment. Due to the special equipment required, it is not practical for the DIY mechanic to carry out the test procedure.
6 To prevent possible damage to the electronic control unit, always disconnect the control unit wiring plug before carrying out electrical welding work.
7 It is recommended that the control unit is removed if the vehicle is being subjected to high temperatures, like for instance, during certain paint-drying processes.
8 If using steam cleaning equipment, do not aim the water/steam jet directly at the control unit.
9 Do not disconnect the control unit wiring plug with the ignition switched on.
10 Do not use a battery booster to start the engine.
11 After working on the ABS components, ensure that all wiring plugs are correctly reconnected, and have the complete system tested by a Vauxhall dealer, at the earliest opportunity.
12 All models up to 1991 that were fitted with ABS, used the ABS-2E system. From 1992 onwards an ABS-2EH system was fitted, which can be identified by the location of the electronic control module, which is bolted to the hydraulic modulator.
13 The main differences between the two systems are in the electrical components and circuits, the most obvious of these being omission of the surge arrester relay on the 2EH system.

3 Hydraulic system - bleeding

HAYNES HiNT ***If brake fluid is spilt on the paintwork, the affected area must be washed down with cold water immediately. Brake fluid is an effective paint stripper!***

General

1 If any of the hydraulic components in the braking system have been removed or disconnected, or if the fluid level in the reservoir has been allowed to fall appreciably, it is certain that air will have entered into the system. The removal of all this air from the hydraulic system is essential if the brakes are to function correctly, and the process of removing it is known as bleeding.
2 Where an operation has only affected one circuit of the hydraulic system (the system is split diagonally on non-ABS models, and front and rear on ABS models), then it will only be necessary to bleed the relevant circuit. If the master cylinder has been disconnected and reconnected, or the fluid level has been allowed to fall appreciably, then the complete system must be bled.
3 One of three methods can be used to bleed the system, although Vauxhall recommend the use of a pressure bleeding kit.

Bleeding - two-man method

4 Obtain a clean jar, and a length of rubber or plastic bleed tubing that will fit the bleed screws tightly. The help of an assistant will be required.
5 Remove the dust cap and clean around the bleed screw on the relevant caliper of wheel cylinder **(see illustration)**, then attach the bleed tube to the screw. If the complete system is being bled, start at the front of the vehicle. When bleeding the complete system on models with ABS, the front brakes must be bled before the rears.
6 Check that the fluid reservoir is topped up, and then destroy the vacuum in the brake servo by giving several applications of the brake pedal.
7 Immerse the open end of the bleed tube in the jar, which should contain two or three inches of hydraulic fluid. The jar should be positioned about 300 mm (12.0 in) above the bleed screw to prevent any possibility of air entering the system down the threads of the bleed screw when it is slackened.
8 Open the bleed screw half a turn, and have the assistant depress the brake pedal slowly to the floor. With the brake pedal still depressed, retighten the bleed screw, and then have the assistant quickly release the pedal. Repeat the procedure.
9 Observe the submerged end of the tube in the jar. When air bubbles cease to appear, tighten the bleed screw when the pedal is being held fully down by the assistant.
10 Top-up the fluid reservoir. It must be kept topped up throughout the bleeding operations. If the connecting holes to the master cylinder are exposed at any time due to low fluid level, the air will be drawn into the system, and the whole bleeding process will have to start again.
11 If the complete system is being bled, the procedure should be repeated on the diagonally opposite rear brake. Then on the front and rear brakes of the other circuit on non-ABS models, or on the remaining front brake and then on the rear brakes on ABS models.
12 On completion, remove the bleed tube, and discard the fluid that has been bled from the system, unless it is required to make up the level in the bleed jar. Never re-use old fluid.
13 On completion of bleeding, top-up the fluid level in the reservoir. Check the action of the brake pedal, which should be firm, and free from any "sponginess" that would indicate that air is still present in the system.

3.5 Removing the dust cap from a rear caliper bleed screw - models with ventilated discs

Bleeding - with one-way valve

14 There are a number of one-man brake bleeding kits currently available from motor accessory shops. It is recommended that one of these kits should be used whenever possible, as they greatly simplify the bleeding operations. They also reduce the risk of expelled air or fluid being drawn back into the system.
15 Proceed as described in paragraphs 5 and 6.
16 Open the bleed screw half a turn, then depress the brake pedal to the floor, and slowly release it. The one-way valve in the bleeder device will prevent expelled air from returning to the system at the completion of each stroke. Repeat the operation until clear hydraulic fluid, free from air bubbles, can be seen coming through the tube. Tighten the bleed screw.
17 Proceed as described in paragraphs 11 to 13 inclusive.

Bleeding - with pressure bleeding kit

18 These are also available from motor accessory shops, and are usually operated by air pressure from the spare tyre.
19 By connecting a pressurised container to the master cylinder fluid reservoir, bleeding is then carried out by simply opening each bleed screw in turn and allowing the fluid to run out. Like turning on a tap, until no air bubbles are visible in the fluid being expelled.
20 Using this method, the large reserve of fluid provides a safeguard against air being drawn into the master cylinder during the bleeding operations.
21 This method of bleeding is recommended by Vauxhall.
22 Begin bleeding with reference to paragraphs 5 and 6, and continue as described in paragraphs 11 to 13 inclusive.

4 Front disc pads - inspection, removal and refitting

Note: *When working on the brake components, take care not to disperse brake dust into the air, or to inhale it, since it may contain asbestos, which can damage your health.*

Inspection

1 Where applicable, remove the wheel trims, then loosen the front roadwheel bolts and apply the handbrake. Jack up the front of the vehicle, and support on axle stands (see "*Jacking and Vehicle Support*") positioned under the body side members.
2 Remove the roadwheels. Turn the steering to full right-hand lock, and check the wear of the friction material on the right-hand brake pads. Check that the thickness of the friction material (including the backing plate) is not less than the minimum given in the Specifications.
3 Turn the steering to full left-hand lock, and check the left-hand brake pads in the same way.
4 If any brake pad is worn below the specified minimum thickness, renew all the front pads as a set.
5 If the pads require renewal, continue as follows according to model.

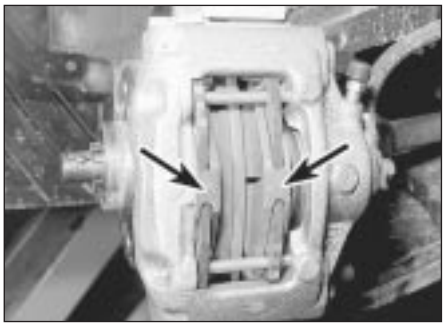
Removal

1.4, 1.6 and 1.8 litre models

6 Note how the anti-rattle springs are located **(see illustration)**, then drive the upper and lower pad retaining pins out from the inboard side of the caliper, using a pin punch.
7 Remove the anti-rattle springs **(see illustration)**.
8 Push the pads away from the disc slightly, then using a pair of pliers, withdraw the outboard pad **(see illustration)**.
9 Withdraw the inboard pad, and the shim that fits between the pad and the caliper piston **(see illustration)**.

Refitting

10 Brush the dust and dirt from the caliper, but take care not to inhale it. Carefully remove any rust from the edge of the brake disc.



4.6 Front disc pad anti-rattle springs (arrowed) - models with solid discs

11 To accommodate the new thicker pads, the caliper piston must be depressed fully into its cylinder bore, using a flat bar of metal such as a tyre lever. The action of depressing the piston will cause the fluid level in the reservoir to rise, so to avoid spillage, syphon out some fluid using an old hydrometer or a teat pipette. Refer to the note at the beginning of Section 3. Do not lever between the piston and disc to depress the piston.
12 Check that the cutaway recesses in the piston are positioned vertically. If necessary, carefully turn the piston to its correct position.
13 Apply a little brake grease to the top and bottom edges of the backplates on the new brake pads.
14 Locate the new pads in the caliper, ensuring that the shim is in place between the inboard pad and the piston. Ensure that the friction material faces the disc, and check that the pads are free to move slightly.
15 Locate the anti-rattle springs on the pads, then insert the pad retaining pins from the outboard side of the caliper, while depressing the springs. Tap the pins firmly into the caliper **(see illustration)**.
16 Repeat the operations on the remaining side of the vehicle.
17 Refit the roadwheels and lower the vehicle to the ground. Do not fully tighten the roadwheel bolts until the vehicle is resting on its wheels.
18 Apply the footbrake hard several times to position the pads against the discs.
19 Check and if necessary top-up the brake fluid level.

4.7 Removing an anti-rattle spring - models with solid discs

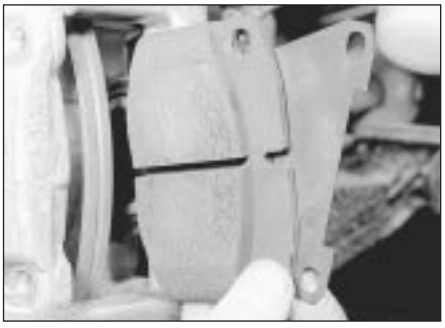
4.8 Withdrawing the outboard disc pad - models with solid discs

20 New brake pads should be carefully bedded in and, where possible, heavy braking should be avoided during the first 100 miles (160 km) or so after fitting new pads.

2.0 litre models

Removal

21 Where applicable, pull the pad wear sensor from the inboard pad, and disconnect the wiring at the connector under the wheel arch, next to the suspension strut **(see illustration)**. Note the wire routing.
22 Using a screwdriver, prise the pad retaining clip from the outboard edge of the caliper, noting how it is located **(see illustration)**.
23 Prise out the two guide bolt dust caps from the inboard edge of the caliper, then using a Allen key or hexagon bit, unscrew the

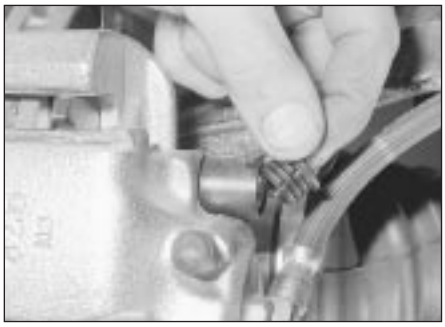


4.9 Withdrawing the inboard disc pad and shim - models with solid discs

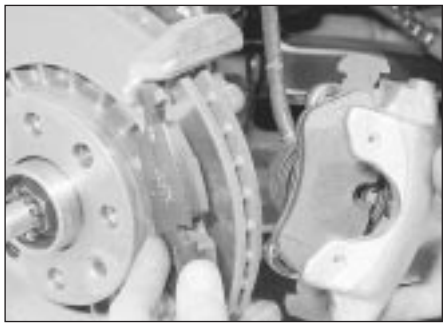
4.15 Fitting a disc pad retaining pin - models with solid discs

4.21 Withdrawing the pad wear sensor from the inboard pad - DOHC model

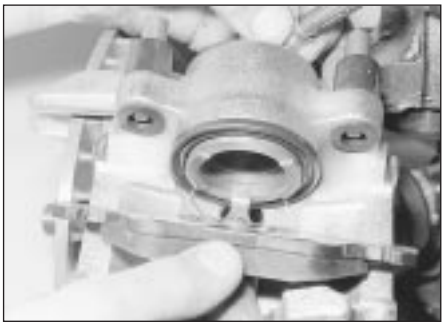
4.22 Prising out the disc pad retaining clip - models with ventilated discs



4.23A Removing a caliper guide bolt dust cap - models with ventilated discs



4.23B Withdrawing the caliper, inboard and outboard pad - models with ventilated discs



4.24 Removing the inboard pad from the caliper piston - models with ventilated discs

4.25 Caliper piston cutaway recess (arrowed) correctly positioned - models with ventilated discs

4.29 Tightening a caliper guide bolt - models with ventilated discs

guide bolts, and lift the caliper and inboard pad from the bracket. Recover the outboard brake pad **(see illustrations)**. Suspend the caliper body with wire or string, to avoid straining the brake fluid hose.

24 Pull the inboard pad from the caliper piston, noting that it is retained by a clip attached to the pad backing plate **(see illustration)**.

Refitting

25 Proceed as described in paragraphs 10 to 12 inclusive **(see illustration)**.

26 Apply a little brake grease to the contact surfaces of the new brake pads.

27 Fit the new inboard pad to the caliper piston, ensuring that the piston is correctly located.

28 Locate the outboard pad on the caliper bracket, with the friction material facing the disc.

29 Refit the caliper to the bracket, and tighten the guide bolts to the specified torque **(see illustration)**.

30 Refit the guide bolt dust caps.

31 Refit the pad retaining clip, locating it as noted before removal.

32 Where applicable, fit a new pad wear sensor to the inboard pad, and connect the wiring at the connector under the wheel arch. Route the wiring as noted during removal.

33 Repeat the operations on the remaining side of the vehicle.

34 Proceed as described in paragraphs 17 to 20 inclusive.

5 Rear disc pads - inspection, removal and refitting

Note: *When working on the brake components, take care not to disperse brake dust into the air, or to inhale it, since it may contain asbestos, which can damage your health.*

Inspection

1 Where applicable, remove the wheel trims, then loosen the rear roadwheel bolts and chock the front wheels. Jack up the rear of the vehicle, and support on axle stands (see "*Jacking and Vehicle Support*") positioned under the body side members. Remove the roadwheels.

2 Check the wear of the friction material on the brake pads, on both sides of the vehicle. Check that the thickness of the friction material (including the backing plate) is not less than the minimum given in the Specifications.

3 If any brake pad is worn below the specified minimum thickness, renew all the rear pads as a set as follows.

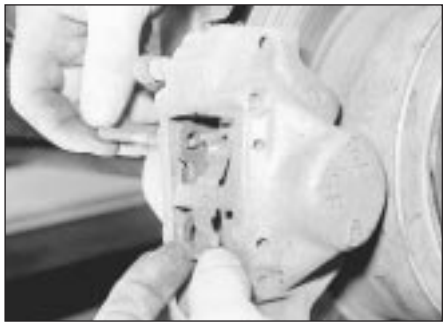
Removal

4 Note how the anti-rattle spring is located, then drive out the upper and lower pad retaining pins from the outside of the caliper using a pin punch **(see illustration)**.

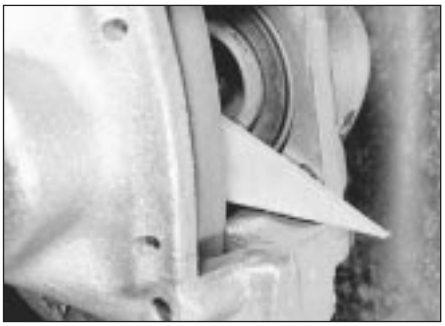
5 Remove the anti-rattle spring **(see illustration)**.

6 Push the pads away from the disc slightly, then using a pair of pliers, withdraw the

5.4 Driving out a rear disc pad retaining pin



5.5 Removing a rear disc pad retaining pin anti-rattle spring



5.9 Checking a rear caliper piston cut away recess angle with a card template

outboard pad and anti-squeal shim that fits between the pad and the caliper body.
7 Withdraw the inboard pad and anti-squeal shim.

Refitting

8 Proceed as described in Section 4, paragraphs 10 and 11.
9 Check that the cutaway recesses in the pistons are positioned downwards, at approximately 23° to the horizontal. A template made of card may be used to check the setting **(see illustration)**. If necessary, carefully turn the pistons to their correct positions.
10 Apply a little brake grease to the top and bottom edges of the backplates on the new brake pads.
11 Locate the new pads and the anti-squeal shims in the caliper. Ensure that the friction material faces the disc, and check that the pads are free to move slightly.
12 Locate the anti-rattle spring on the pads, then insert the pad retaining pins from the inside edge of the caliper, while depressing the spring. Tap the pins firmly into the caliper.
13 Repeat the operations on the remaining side of the vehicle.
14 Proceed as described in Section 4, paragraphs 17 to 20 inclusive.

6 Rear brake shoes (drum brakes) - inspection, removal and refitting

Note: *When working on the brake components, take care not to disperse brake dust into the air, or to inhale it, since it may contain asbestos, which can damage your health.*

Inspection

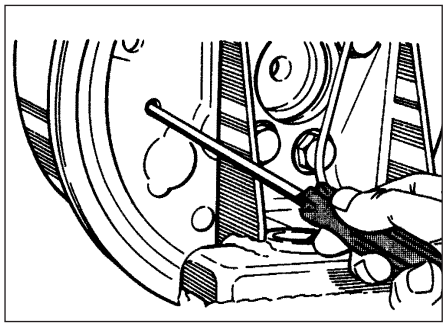
1 It is recommended that the brake shoes are inspected when necessary by removing the drums. This will enable a proper inspection of the linings to be made, and additionally, the wheel cylinders can be inspected for leaks. If preferred, however, a provisional inspection of the state of wear of the rear shoe linings can be made by removing the plugs from the inspection holes in the brake backplates.

6.6A Extracting a brake drum securing screw

2 Use a torch or inspection lamp, and if necessary a mirror, to check that the friction material has not worn down to less than the specified minimum.
3 If any one of the shoes has worn below the specified limit, all four rear brake shoes must be renewed as a set, as follows.

Removal

4 Where applicable, remove the wheel trims, then loosen the rear roadwheel bolts and chock the front wheels. Jack up the rear of the vehicle, and support on axle stands (see "*Jacking and Vehicle Support*") positioned under the body side members. Remove the roadwheels.
5 Fully release the handbrake.
6 Extract the drum securing screw and remove the drum. If the drum is tight, remove the plug from the inspection hole in the brake backplate, and push the handbrake operating lever towards the brake shoe to move the shoes away from the drum. If necessary, slacken the handbrake cable adjuster **(see illustrations)**.
7 Note the location and orientation of all components before dismantling, as an aid to reassembly.
8 Clean the dust and dirt from the drum and shoes, but take care not to inhale it.
9 Remove the shoe hold-down pins, springs and cups by depressing the cups and turning them through 90° using a pair of pliers **(see illustrations)**. Note that the hold-down pins are removed through the rear of the brake backplate.
10 Disconnect the handbrake cable from the operating lever.

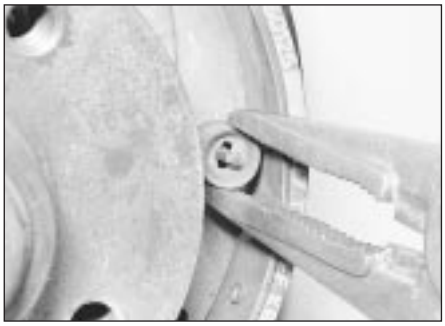


6.6B Push the handbrake operating lever to move the shoes away from the drum

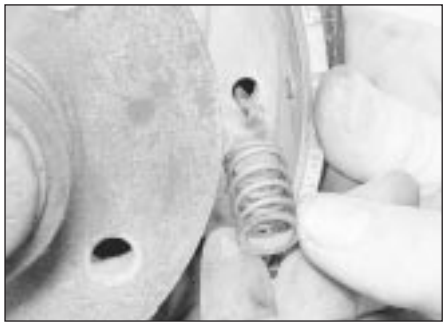
11 The upper and lower return springs may now be unhooked and the shoes removed separately, or the assembly of shoes, adjuster strut and springs may be removed together. Remove the hub, refer to Chapter 10, if necessary. Take care not to damage the wheel cylinder rubber boots. Before removing the return springs, note the position and orientation of the springs and adjuster strut.
12 If the shoes are to be removed for some time, fit a stout rubber band or a spring clip to the wheel cylinder, to prevent the pistons from being pushed out of their bores. In any event, do not press the brake pedal while the drum is removed.

Refitting

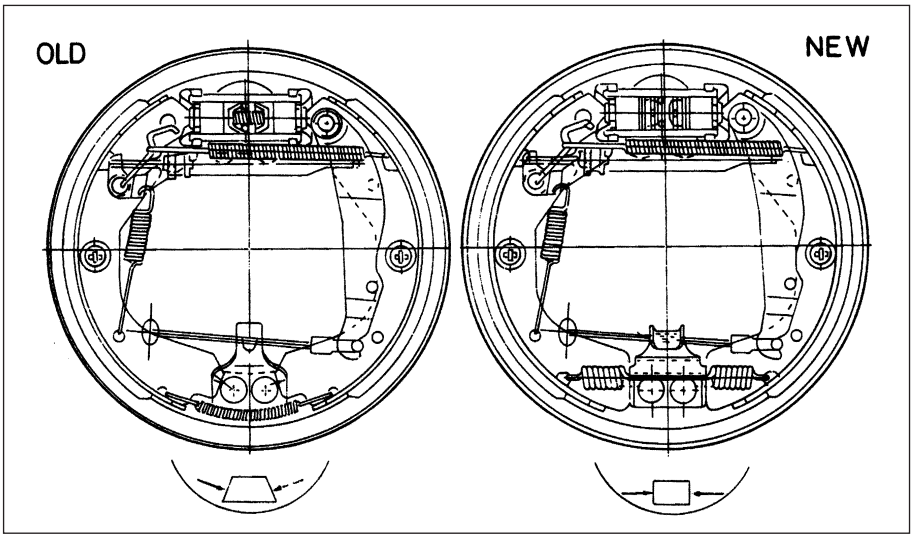
13 Clean the dust and dirt from the brake backplate, but take care not to inhale it.
14 Apply a small amount of brake grease to the shoe rubbing areas on the backplate.
15 Investigate and rectify any source of contamination of the linings (wheel cylinder or hub bearing oil seal leaking).
16 Although linings are available separately (without shoes), renewal of the shoes complete with linings is to be preferred, unless the reader has the necessary skills and equipment to fit new linings to the old shoes.
17 If not already done, dismantle the shoes, strut and springs. Note the position and orientation of the components. On later models (1992-on), the brake shoe lower anchorage has been modified so that it is now rectangular, necessitating modified brake shoes and a modified lower return spring **(see illustration)**.



6.9A Release the shoe hold-down cup . . .



6.9B . . . then withdraw the cup and spring



6.17 Modified rear brake shoe lower anchorage - 1992-on models

18 If both brake assemblies are dismantled at the same time, take care not to mix up the components. Note that the left-hand and right-hand adjuster components are marked. The threaded rod is marked "L" or "R", and the other "handed" components are colour-coded black for the left-hand side, and silver for the right-hand side.

19 Dismantle and clean the adjuster strut. Apply a smear of silicone-based grease to the adjuster threads.

20 Examine the return springs. If they are distorted, or if they have seen extensive service, renewal is advisable. Weak springs may cause the brakes to bind.

21 If a new handbrake operating lever was not supplied with the new shoes (where applicable), transfer the lever from the old shoes. The lever may be secured with a pin and circlip, or by a rivet, which will have to be drilled out.

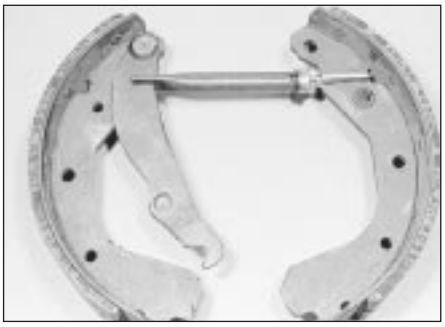
22 If the components are to be refitted as an assembly, assemble the new shoes, springs and adjuster components. Expand the adjuster strut to ease fitting **(see illustrations)**.

23 Offer the shoes to the brake backplate. Be careful not to damage the wheel cylinder boots, or to displace the pistons. Remember to remove the rubber band or spring clip from the wheel cylinder, where applicable.

24 When the shoes are in position, insert the hold-down pins and secure them with the springs and cups **(see illustration)**.

25 Reconnect the handbrake cable, then refit the hub, and adjust the bearing if the hub was removed.

26 Fitting the shoes and springs together as an assembly may be too difficult. It is possible to fit the shoes and secure them with the hold-down pins and then fit the adjuster strut, the return springs and adjuster.



6.22A Right-hand adjuster strut correctly fitted to shoes

6.22B Fitting the upper return spring to the shoes

6.22C Adjuster lever spring fitted to leading shoe

27 Back off the adjuster wheel to reduce the length of the strut, until the brake drum will pass over the shoes.

28 Make sure that the handbrake operating lever is correctly positioned, with the pin on the edge of the shoe web, not riding on top of it, then refit and secure the brake drum.

29 Repeat the operations on the remaining side of the vehicle.

30 Adjust the brakes by operating the footbrake at least fifteen times. A clicking noise will be heard at the drums, as the automatic adjusters operate. When the clicking stops, adjustment is complete.

31 Check the handbrake adjustment, as described in Section 26.

32 Refit the roadwheels, and lower the vehicle to the ground. Do not fully tighten the roadwheel bolts until the vehicle is resting on its wheels.

33 New brake linings should be carefully bedded-in and, where possible, heavy braking should be avoided during the first 100 miles (160 km) or so after fitting new linings.

7 Handbrake shoes (rear disc brakes) - inspection, removal and refitting

Note: *When working on the brake components, take care not to disperse brake dust into the air, or to inhale it, since it may contain asbestos, which can damage your health.*

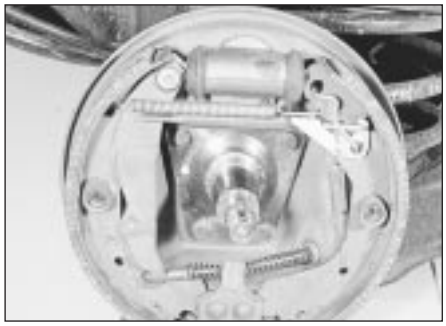
Inspection

1 Although 2.0 litre models are fitted with rear disc brakes, the handbrake operates independently of the footbrake, using brake shoes on the inside of the disc in a similar way to rear drum brake models.

2 To inspect the handbrake shoes on all SOHC models, it is necessary to remove the hub/disc, as described in Chapter 10.

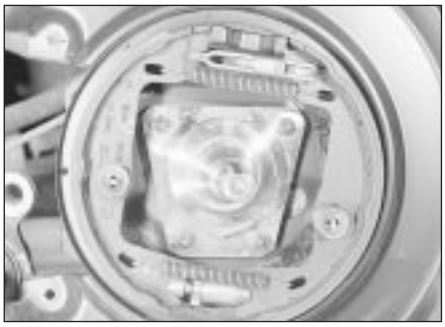
3 To inspect the handbrake shoes on DOHC models it will be necessary to remove the brake disc, as described in Section 10.

4 With the hub/disc or the disc (as applicable) removed, check that the friction material has not worn down to less than the specified minimum.



6.24 Rear brake components correctly assembled (hub removed for clarity)

7.16A Fitting the lower shoe return spring - SOHC models



7.16B Handbrake shoe components correctly assembled - SOHC models

5 If any one of the shoes has worn below the specified limit, all four handbrake shoes must be renewed as a set, as follows.

SOHC models

Removal

6 Clean the dust and dirt from the various components, but take care not to inhale it.
7 Disconnect the handbrake cable and the return spring from the handbrake operating lever at the brake backplate. If necessary, slacken the handbrake cable adjustment, with reference to Section 26.
8 Remove the shoe hold-down pins, springs and cups by depressing the cups and turning them through 90° using a pair of pliers. Note that the hold-down pins are removed through the rear of the brake backplate.
9 The shoes, adjuster, handbrake operating lever and return springs can now be removed together as an assembly.
10 Note the position and orientation of all components, then unhook the upper and lower return springs from the shoes, and recover the handbrake operating lever and the adjuster.

Refitting

11 Apply a little brake grease to the threads of the adjuster, then screw it together to its minimum length. Also apply a little brake grease to the shoe rubbing areas on the lockplate.
12 Fit one of the new brake shoes, and secure it to the backplate with the hold-down pin, spring and cup.
13 Fit the handbrake operating lever in position.
14 Fit the remaining brake shoe, and secure with the hold-down pin, spring and cup.
15 Hook the upper return spring onto the shoes.
16 Fit the adjuster between the lower ends of the shoes, as noted before dismantling, then fit the lower return spring **(see illustrations)**.
17 Reconnect the handbrake cable and the return spring to the handbrake operating lever.
18 Refit the hub/disc, and adjust the wheel bearing play, as described in Chapter 10, but do not refit the roadwheel at this stage.
19 Repeat the operations on the remaining side of the vehicle.
20 Check the handbrake cable adjustment, as described in Section 26.
21 Refit the roadwheels and lower the vehicle to the ground. Do not fully tighten the roadwheel bolts until the vehicle is resting on its wheels.

DOHC models

Removal

22 Proceed as described in paragraphs 6 and 7.
23 Remove the shoe hold-down pins, springs and cups by turning the cups through using a screwdriver. Note that the hold-down pins are removed through the rear of the brake backplate. Note also the position and orientation of all components, then unhook the upper and lower return springs from the shoes, and recover the handbrake operating lever and the adjuster.

Refitting

24 Proceed as described in paragraphs 11 to 14 inclusive.
25 Hook the lower return spring onto the shoes.
26 Fit the adjuster between the upper ends of the shoes, as noted before dismantling, then fit the upper return spring **(see illustration)**.
27 Reconnect the handbrake cable and the return spring to the handbrake operating lever.
28 Refit the brake disc as described in Section 10, but do not refit the roadwheel at this stage.
29 Proceed as described in paragraphs 19 to 21 inclusive.

7.26 Handbrake shoe adjuster and upper return spring correctly fitted - DOHC models

8 Front disc caliper - removal, overhaul and refitting

Note: *Refer to the note at the beginning of Section 3 before proceeding. Before dismantling a caliper, check that replacement parts can be obtained, and retain the old components to compare them with the new ones. New sealing rings must be used on the fluid hose union bolt on refitting*

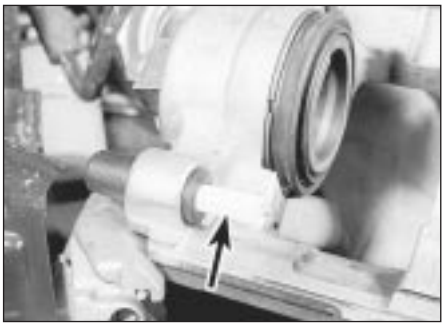
Models with solid discs

Removal

1 Where applicable, remove the wheel trims, then loosen the relevant front roadwheel bolts and apply the handbrake. Jack up the front of the vehicle, and support securely on axle stands (see "*Jacking and Vehicle Support*") positioned under the body side members. Remove the roadwheel.
2 Remove the brake disc pads, as described in Section 4.
3 Working under the bonnet, remove the brake fluid reservoir cap, and secure a piece of polythene over the filler neck with a rubber band, or by refitting the cap. This will reduce the loss of fluid during the following procedure.
4 Unscrew the brake fluid hose union bolt from the rear of the caliper, and disconnect the hose. Recover the two sealing rings from the union bolt (one either side of the hose end fitting). Be prepared for fluid spillage, and plug the open ends to prevent dirt ingress and further fluid loss.
5 Prise out the two caliper bracket mounting bolt dust caps from the inboard edge of the caliper bracket, then using an Allen key or hexagon bit, unscrew the mounting bolts, and withdraw the caliper assembly from the vehicle.

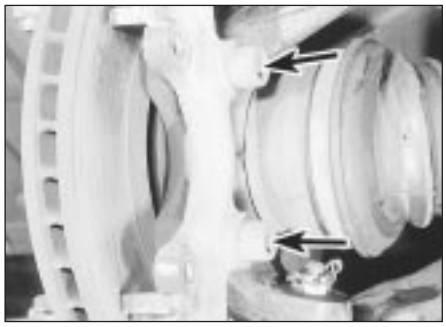
Overhaul

6 If desired, the caliper can be overhauled as follows. Otherwise, go on to paragraph 24 for details of refitting.
7 Brush the dirt and dust from the caliper, but take care not to inhale it.
8 Mount the caliper bracket in a soft-jawed vice. Then separate the caliper body from the mounting bracket by pressing the front face of the caliper body downwards and simultaneously sliding the caliper body from the locating pins on the bracket. Recover the guide springs from the bracket, noting their orientation.
9 Using a screwdriver, prise the dust seal retaining clip from the piston dust seal, then carefully prise off the dust seal.
10 Place a thin piece of wood in front of the piston to prevent it from falling out of its bore and sustaining damage. Then apply low air pressure - e.g. from a foot pump - to the hydraulic fluid union hole in the rear of the caliper body, to eject the piston from its bore.



8.20A Extract the nylon compression sleeve (arrowed) . . .

8.20B . . . then withdraw the caliper locating pin rubber - model with solid discs



8.31 Caliper bracket securing bolts (arrowed) - model with ventilated discs

11 Remove the wood and carefully withdraw the piston.
12 Carefully prise the seal from the groove in the caliper piston bore, using a plastic or wooden instrument.
13 Inspect the surfaces of the piston and its bore in the caliper for scoring, or evidence of metal-to-metal contact. If evident, renew the complete caliper assembly.
14 If the piston and bore are in good condition, discard the seals and obtain a repair kit, which will contain all the necessary renewable items.
15 Clean the piston and cylinder bore with brake fluid or methylated spirit, nothing else!
16 Begin reassembly by fitting the seal into the caliper bore.
17 Locate the dust seal in its groove in the piston. Dip the piston in clean brake fluid and insert it squarely into the cylinder. Check that the cutaway recesses in the piston are positioned horizontally. If necessary, carefully turn the piston to its correct position.
18 When the piston has been partially depressed, engage the dust seal with the rim of the caliper bore, and fit the retaining clip.
19 Push the piston further into its bore, but not as far as the stop, ensuring that it does not jam.
20 If desired, the caliper body locating pin rubbers can be renewed. Extract the nylon compression sleeve from within each rubber, then carefully compress the rubber shoulder, and push the rubber through the hole in the caliper body to remove it from the inboard end **(see illustrations)**.
21 Fit the new rubbers using a reversal of the removal procedure.
22 Secure the caliper bracket in a soft-jawed vice, and refit the guide springs in the positions noted before removal.
23 Engage the caliper body with the locating pins on the bracket, then press the caliper body into position until the locating pin rubbers in the caliper body rest against the bracket.

Refitting

24 Refit the caliper bracket to the hub carrier, and tighten the securing bolts to the specified torque. Refit the dust caps to the bolts.
25 Reconnect the brake fluid hose union, using new sealing rings on the union bolt.
26 Refit the disc pads, as described in Section 4.
27 Remove the polythene from the brake fluid reservoir filler neck, and bleed the relevant brake hydraulic circuit, as described in Section 3.
28 Refit the roadwheel and lower the vehicle to the ground. Do not fully tighten the roadwheel bolts until the vehicle is resting on its wheels.

Models with ventilated discs

Removal

29 Proceed as described in paragraphs 1 to 4 inclusive.
30 Withdraw the caliper body from the vehicle.
31 If desired, the caliper bracket can be removed from the hub carrier by unscrewing the two securing bolts **(see illustration)**.

Overhaul

32 To overhaul the caliper, continue as follows. Otherwise, go on to paragraph 42 for details of refitting.
33 Brush the dirt and dust from the caliper, but take care not to inhale it.
34 Using a screwdriver, carefully prise the dust seal from the end of the piston and the caliper body, and remove it.
35 Proceed as described in paragraphs 10 to 15 inclusive.
36 Begin reassembly by fitting the seal into the caliper bore.
37 Locate the dust seal in its groove in the piston. Dip the piston in clean brake fluid and insert it squarely into the cylinder. Check that the cutaway recesses in the piston are positioned vertically. If necessary, carefully turn the piston to its correct position.
38 When the piston has been partially depressed, engage the dust seal with the rim of the caliper bore.
39 Push the piston further into its bore, but not as far as the stop, ensuring that it does not jam.
40 If desired, the guide bolt sleeves can be renewed. Extract the nylon compression sleeve from within each rubber, then carefully compress the rubber shoulder, and push the rubber through the hole in the caliper body to remove it from the inboard end.
41 Fit the new sleeves using a reversal of the removal procedure.

Refitting

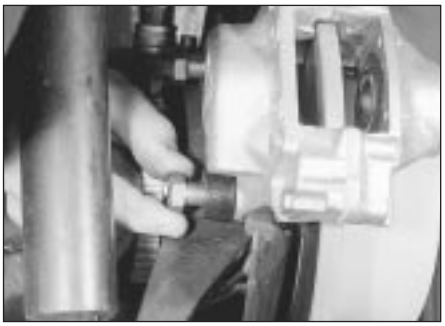
42 Where applicable, refit the caliper bracket to the hub carrier, and tighten the securing bolts to the specified torque.
43 Proceed as described in paragraphs 25 to 28 inclusive.

9 Rear disc caliper - removal, overhaul and refitting

Note: *Refer to the note at the beginning of Section 3 before proceeding. Before dismantling a caliper, check that replacement parts can be obtained, and retain the old components to compare them with the new ones*

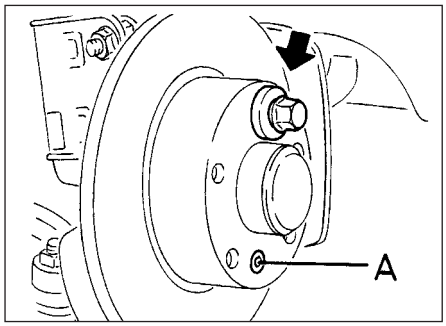
Removal

1 Where applicable, remove the wheel trim, then loosen the relevant rear roadwheel bolts and check the front wheels. Jack up the rear of the vehicle, and support on axle stands (see "*Jacking and Vehicle Support*") positioned under the body side members. Remove the roadwheel.
2 Remove the disc pads, as described in Section 5.
3 Working under the bonnet, remove the brake fluid reservoir cap and secure a piece of polythene over the filler neck with a rubber band, or by refitting the cap. This will reduce the loss of fluid during the following procedure.
4 Unscrew the brake fluid pipe union nut from the rear of the caliper, and disconnect the pipe. Take care not to strain the pipe. Be prepared for fluid spillage, and plug the open ends to prevent dirt ingress and further fluid loss.
5 Unscrew the two mounting bolts and withdraw the caliper from the vehicle, noting that on DOHC models, the caliper securing bolts also secure the ABS sensor bracket **(see illustrations)**. Take care not to strain the ABS sensor wiring, where applicable.



9.5A Withdrawing a rear caliper mounting bolt . . .

9.5B . . . which also secures the ABS sensor bracket - DOHC model



10.2 Refit a wheel bolt and spacer (arrowed) opposite the disc securing screw (A) before checking brake disc run-out

Overhaul

6 If desired, the caliper can be overhauled as follows. Otherwise, go on to paragraph 20 for details of refitting.
7 Brush the dirt and dust from the caliper, but take care not to inhale it.
8 Note that no attempt must be made to separate the two halves of the caliper.
9 Using a screwdriver, prise the dust seal retaining clips from the piston dust seals, then carefully prise off the dust seals.
10 Using a clamp, secure one of the pistons in its fully retracted position. Then apply low air pressure (e.g. from a foot pump), to the hydraulic fluid union hole in the rear of the caliper body, to eject the remaining piston from its bore. Take care not to drop the piston, which may result in damage.
11 Temporarily close off the bore of the removed piston, using a flat piece of wood or similar improvised tool. Then remove the clamp from the remaining piston, and again apply air pressure to the caliper union to eject the piston.
12 Carefully prise the seals from the grooves in the caliper piston bores, using a plastic or wooden instrument.
13 Inspect the surfaces of the pistons and their bores in the caliper for scoring, or evidence of metal-to-metal contact. If evident, renew the complete caliper assembly.
14 If the pistons and bores are in good condition, discard the seals and obtain a repair kit, which will contain all the necessary renewable items. Also obtain a tube of brake cylinder paste.
15 Clean the piston and cylinder bore with brake fluid or methylated spirit - nothing else!
16 Apply a little brake cylinder paste to the pistons, cylinder bores and piston seals.
17 Begin reassembly by fitting the seals to the grooves in the caliper bores.
18 Locate the dust seals in their grooves in the pistons, then insert the pistons carefully into their bores until they enter the seals. It may be necessary to rotate the pistons to prevent them from jamming in the seals.
19 When the pistons have been partially depressed, engage the dust seals with the rims of the caliper bores, and fit the retaining clips.

Refitting

20 Refit the caliper and tighten the securing bolts to the specified torque, ensuring that the ABS sensor bracket is in position, where applicable.
21 Reconnect the brake fluid pipe to the caliper, and tighten the union nut.
22 Refit the disc pads, as described in Section 5.
23 Remove the polythene from the brake fluid reservoir filler neck and bleed the relevant brake hydraulic circuit, as described in Section 3.
24 Refit the roadwheel and lower the vehicle to the ground. Do not fully tighten the roadwheel bolts until the vehicle is resting on its wheels.

10 Brake disc - inspection, removal and refitting

Inspection

1 Where applicable, remove the wheel trim, then loosen the relevant roadwheel bolts. If checking a front disc, apply the handbrake, and if checking a rear disc, chock the front wheels, then jack up the relevant end of the vehicle and support on axle stands (see "*Jacking and Vehicle Support*") positioned under the body side members. Remove the roadwheel.
2 Where applicable, check that the brake disc securing screw is tight. Then fit a spacer approximately 10.0 mm (0.4 in) thick to one of the roadwheel bolts, and refit and tighten the bolt in the hole opposite the disc securing screw **(see illustration).**
3 Rotate the brake disc, and examine it for deep scoring or grooving. Light scoring is normal, but if excessive, the disc should be removed and either renewed or machined (within the specified limits) by an engineering works.
4 Using a dial gauge, or a flat metal block and feeler blades, check that the disc run-out does not exceed the figure given in the Specifications. Measure the run-out 10.0 mm (0.4 in) in from the outer edge of the disc.
5 On all SOHC models, if the rear disc run-out is excessive, check the rear wheel bearing adjustment, as described in Chapter 10.
6 If the front disc run-out (all models), or the rear disc run-out (DOHC models), is excessive, remove the disc as described later in this Section. Check that the disc-to-hub surfaces are perfectly clean. Refit the disc and check the run-out again.
7 If the run-out is still excessive, the disc should be renewed.
8 To remove a disc, continue as follows.

Front disc

Removal

9 Where applicable, remove the roadwheel bolt and spacer used when checking the disc.
10 Remove the disc pads, (Section 4).
11 On 2.0 litre models, unscrew the two securing bolts and remove the caliper bracket.
12 Remove the securing screw and withdraw the disc from the hub, where applicable tilting it to clear the brake caliper **(see illustration)**.

Refitting

13 Refitting is a reversal of removal, but make sure that the mating faces of the disc and hub are perfectly clean, and apply a little locking fluid to the threads of the securing screw. Refit the disc pads, (Section 4).

Rear disc - SOHC models

14 On these models, the disc is integral with the rear hub, and removal and refitting is described in Chapter 10.

10.12 Removing a disc securing screw - SOHC model

10.18 Withdrawing the rear brake disc - DOHC model

Rear disc - DOHC models

Removal

15 Where applicable, remove the roadwheel bolt and spacer used when checking the disc.
16 Remove the disc pads, as described in Section 5.
17 Remove the brake caliper with reference to Section 9, but leave the hydraulic fluid pipe connected. Move the caliper to one side, and suspend it using wire or string to avoid straining the pipe.
18 Remove the securing screw and withdraw the disc from the hub **(see illustration)**. If the disc is tight, collapse the handbrake shoes by inserting a screwdriver through the adjuster hole in the disc and turning the adjuster wheel.

Refitting

19 Refitting is a reversal of removal, but make sure that the mating faces of the disc and hub are perfectly clean, and apply a little locking fluid to the threads of the securing screw. Refit the disc pads, as described in Section 5.

11 Brake drum - removal, inspection and refitting

Note: *When working on the brake components, take care not to disperse brake dust into the air, or to inhale it, since it may contain asbestos, which can damage your health.*

Removal

1 Where applicable, remove the wheel trim, then loosen the relevant rear roadwheel bolts and chock the front wheels. Jack up the rear of the vehicle, and support on axle stands (see "*Jacking and Vehicle Support*") positioned under the body side members. Remove the roadwheel.
2 Fully release the handbrake.
3 Extract the drum securing screw and remove the drum. If the drum is tight, remove the plug from the inspection hole in the brake backplate, and push the handbrake operating lever towards the brake shoe to move the shoes away from the drums. If necessary, slacken the handbrake cable adjuster.

Inspection

4 Brush the dirt and dust from the drum, taking care not to inhale it.
5 Examine the internal friction surface of the drum. If they are deeply scored, or so worn that the drum has become ridged to the width of the shoes, then both drums must be renewed.
6 Regrinding of the friction surface is not recommended, since the internal diameter of the drum will no longer be compatible with the shoe friction material contact diameter.

Refitting

7 Refit the brake drum and tighten the securing screw. If necessary, back off the adjuster wheel until the drum will pass over the shoes.
8 Adjust the brakes by operating the footbrake a number of times. A clicking noise will be heard at the drum as the automatic adjuster operates. When the clicking stops, adjustment is complete.
9 Refit the roadwheel and lower the vehicle to the ground. Do not fully tighten the roadwheel bolts until the vehicle is resting on its wheels.

12 Rear wheel cylinder (drum brakes) - removal, overhaul and refitting

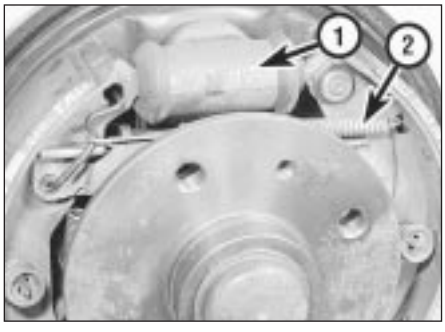
Note: *Refer to the notes* at *the beginning of Sections 3 and 11 before proceeding. Before dismantling a wheel cylinder, check that replacement parts can be obtained, and retain the old components to compare them with the new ones*

Removal

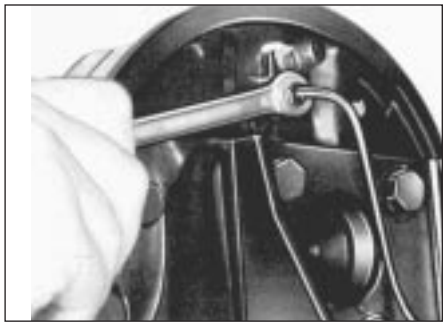
1 Where applicable, remove the wheel trim, then loosen the relevant rear roadwheel bolts and chock the front wheels. Jack up the rear of the vehicle and support on axle stands (see "*Jacking and Vehicle Support*") positioned under the body side members. Remove the roadwheel.
2 Fully release the handbrake.
3 Extract the drum securing screw and remove the drum. If the drum is tight, remove the plug from the inspection hole in the brake backplate, and push the handbrake operating lever towards the brake shoe to move the shoes away from the drum. If necessary, slacken the handbrake cable adjuster.
4 Using a pair of pliers, unhook the upper return spring from the brake shoes, noting its orientation, then push the upper ends of the shoes apart until they are clear of the wheel cylinder **(see illustration)**.
5 Working under the bonnet, remove the brake fluid reservoir cap and secure a piece of polythene over the filler neck with a rubber band, or by refitting the cap. This will reduce the loss of fluid during the following procedure.
6 Unscrew the brake fluid pipe union nut from the rear of the wheel cylinder, and disconnect the pipe **(see illustration)**. Take care not to strain the pipe. Be prepared for fluid spillage, and plug the open ends to prevent dirt ingress and further fluid loss.
7 Unscrew the two securing bolts from the rear of the brake backplate, and withdraw the wheel cylinder.

Overhaul

8 If desired, the wheel cylinder can be overhauled as follows. Otherwise, go on to paragraph 17 for details of refitting.
9 Brush the dirt and dust from the wheel cylinder, but take care not to inhale it.
10 Pull the rubber dust seals from the ends of the cylinder body.
11 The pistons will normally be ejected by the pressure of the coil spring. If they are not, tap the end of the cylinder body on a piece of wood, or apply low air pressure (e.g. from a foot pump), to the hydraulic fluid union hole in the rear of the cylinder body, to eject the pistons from their bores.
12 Inspect the surfaces of the pistons and their bores in the cylinder body for scoring, or evidence of metal-to-metal contact. If evident, renew the complete wheel cylinder assembly. Note that the later type of wheel cylinder can be used to replace the early type as a complete unit.



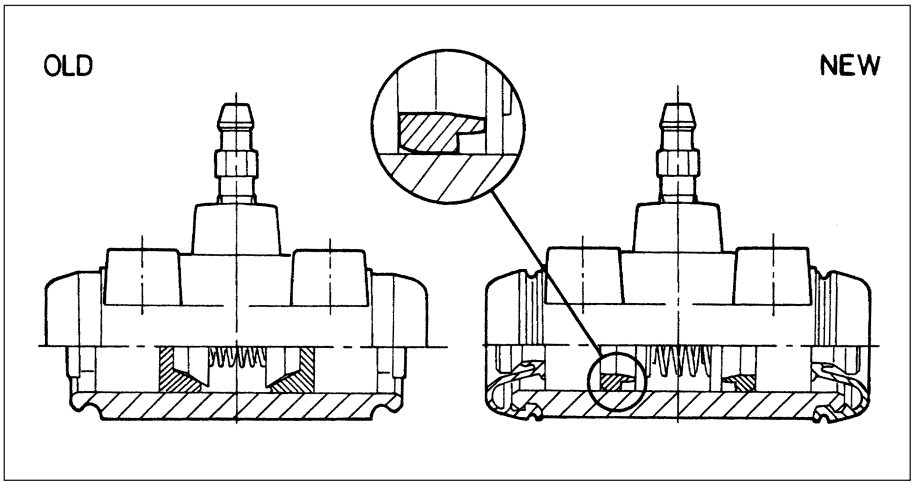
12.4 Rear brake assembly
1 Wheel cylinder
2 Upper shoe return spring (note orientation)



12.6 Unscrewing rear wheel cylinder brake fluid pipe union

12.13A Exploded view of a rear brake wheel cylinder

1 Dust cap
2 Bleed screw
3 Cylinder body
4 Dust seal
5 Piston
6 Piston seal
7 Spring



12.13B Modified rear wheel cylinders - 1992-on models

13 If the pistons and bores are in good condition, discard the seals and obtain a repair kit, which will contain all the necessary renewable items. Later models (1992-on), are fitted with L-shaped piston seals **(see illustrations).** Ensure that the correct repair kit is obtained when overhauling a wheel cylinder, as the early and later components are not interchangeable.
14 Lubricate the piston seals with clean brake fluid, and insert them into the cylinder bores with the spring between them, using finger pressure only.
15 Dip the pistons in clean brake fluid, and insert them into the cylinder bores.
16 Fit the dust seals, and check that the pistons can move freely in their bores.

Refitting

17 Refit the wheel cylinder to the backplate, and tighten the securing bolts.
18 Reconnect the brake fluid pipe to the cylinder, and tighten the union nut.
19 Push the brake shoes against the pistons, then refit the upper return spring as noted before removal.
20 Refit the brake drum and tighten the securing screw. If necessary, back off the adjuster wheel until the drum will pass over the shoes.
21 Remove the polythene from the brake fluid reservoir filler neck, and bleed the relevant brake hydraulic circuit, as described in Section 3.
22 Adjust the brakes by operating the footbrake a number of times. A clicking noise will be heard at the drum as the automatic adjuster operates. When the clicking stops, adjustment is complete.
23 Refit the roadwheel and lower the vehicle to the ground. Do not fully tighten the roadwheel bolts until the vehicle is resting on its wheels.

13 Rear brake backplate - removal and refitting

Models with rear drum brakes

Removal

1 Where applicable, remove the wheel trim, then loosen the relevant rear roadwheel bolts and chock the front wheels. Jack up the rear of the vehicle, and support on axle stands (see "*Jacking and Vehicle Support*") positioned under the body side members. Remove the roadwheel.
2 Remove the brake drum with reference to Section 11.
3 Remove the rear hub, (Chapter 10).
4 Remove the brake shoes, (Section 6).
5 Remove the brake wheel cylinder, as described in Section 12.
6 Using a screwdriver, prise out the lockplate that secures the handbrake cable in the backplate.
7 Unscrew the four securing bolts, and withdraw the stub axle and backplate.

Refitting

8 Refitting is a reversal of removal, remembering the following points.
9 Coat the rear face of the stub axle flange with a little lithium-based grease.
10 Tighten the brake backplate/stub axle securing bolts to the specified torque, in the three stages given in the Specifications.
11 Refit the brake wheel cylinder, as described in Section 12.
12 Refit the brake shoes, as described in Section 6.
13 Refit the rear hub, as described in Chapter 10.
14 Refit the brake drum with reference to Section 11.
15 Before refitting the roadwheel and lowering the vehicle to the ground, check and if necessary adjust the handbrake, as described in Section 26.

Models with rear disc brakes (SOHC models)

Removal

16 Proceed as described in paragraphs 1 to 7.
17 Remove the rear hub/disc, (Chapter 10).
18 Remove the handbrake shoes, (Section 7).
19 Unscrew the four securing bolts, and withdraw the stub axle and lockplate.

Refitting

20 Refitting is a reversal of removal, remembering the following points.
21 Coat the rear face of the stub axle flange with a little lithium-based grease.
22 Tighten the brake backplate/stub axle securing bolts to the specified torque, in the three stages given in the Specifications.
23 Refit the handbrake shoes, as described in Section 7.
24 Refit the rear hub/disc, (Chapter 10).
25 Before refitting the roadwheel and lowering the vehicle to the ground, check and if necessary adjust the handbrake, as described in Section 26.

DOHC models

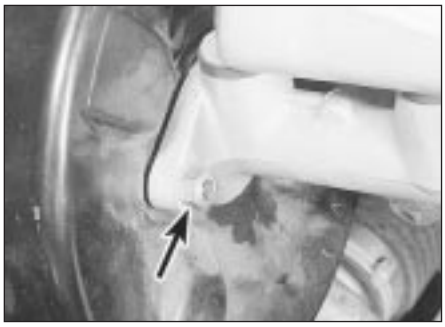
Removal

26 Proceed as described in paragraphs 1 to 7.
27 Remove the brake disc (Section 10).
28 Remove the rear hub, (Chapter 10).
29 Remove the handbrake shoes, (Section 7).
30 Using a splined key, unscrew the four securing bolts and withdraw the backplate.

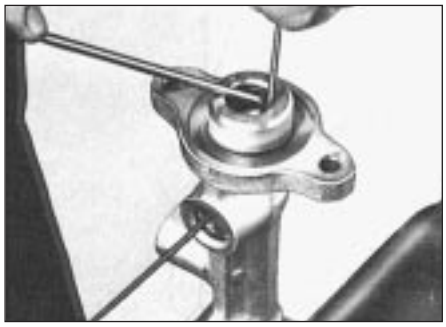
Refitting

31 Refitting is a reversal of removal, remembering the following points.
32 Refit the handbrake shoes, (Section 7).
33 Refit the rear hub, (Chapter 10).
34 Refit the brake disc (Section 10).
35 Before refitting the roadwheel and lowering the vehicle to the ground, check and if necessary adjust the handbrake, as described in Section 26.

14.4 Cutting a section of metal from a new front brake disc shield prior to fitting



15.7 Master cylinder securing nut (arrowed)



16.5 Holding the primary piston depressed while extracting the circlip from the cylinder body - GMF type master cylinder

14 Front brake disc shield - removal and refitting

Removal

1 Where applicable, remove the wheel trim, then loosen the relevant front roadwheel bolts and apply the handbrake. Jack up the front of the vehicle, and support on axle stands (see "*Jacking and Vehicle Support*") positioned under the body side members. Remove the roadwheel.
2 Remove the brake disc, as described in Section 10.
3 Using a screwdriver inserted through the holes in the hub flange, extract the three screws securing the disc shield to the hub carrier.
4 Using plate shears or an alternative tool, cut a section of metal from the rear edge of the shield to enable the shield to be withdrawn over the hub, then remove the shield **(see illustration)**.

Refitting

5 If a new shield is to be fitted, cut out a section of metal, as during removal of the old shield, to enable the shield to be fitted. Smooth the cut edges, and coat them with anti-corrosion paint.
6 Further refitting is a reversal of removal, remembering the following points.
7 Refit the brake disc, as described in Section 10.
8 Do not fully tighten the roadwheel bolts until the vehicle is resting on its wheels.

15 Master cylinder - removal and refitting

Note: *Refer to the note at the beginning of Section 3 before proceeding*

Removal

1 Disconnect the battery negative lead.
2 Depress the footbrake pedal several times to dissipate the vacuum in the servo unit.
3 Disconnect the wiring plug from the brake fluid level sensor in the reservoir filler cap.
4 If possible, use a teat pipette or an old hydrometer to remove the brake fluid from the reservoir. This will reduce the loss of fluid later in the procedure.
5 Locate a container beneath the master cylinder, to catch the brake fluid that will be released.
6 Identify the brake fluid pipes for position, then unscrew the union nuts and disconnect the pipes from the master cylinder.
7 Unscrew the two securing nuts, and withdraw the master cylinder from the studs on the vacuum servo unit **(see illustration)**.
8 Clean the external surfaces of the cylinder, then using a screwdriver carefully prise the fluid reservoir and its seals from the top of the cylinder.
9 If desired, on models without ABS, the master cylinder can be overhauled, as described in Section 16.
10 No overhaul of the master cylinder is possible on models with ABS, see Section 17.

Refitting

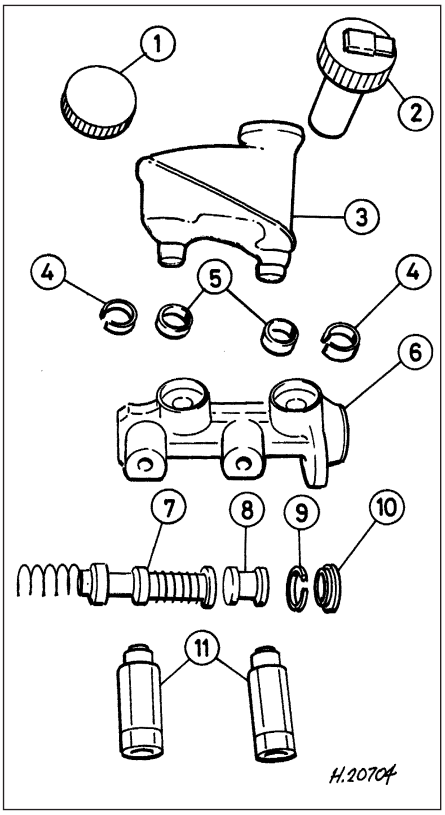
11 Refitting is a reversal of removal, but use new seals when fitting the brake fluid reservoir, and on completion, bleed the complete brake hydraulic system, as described in Section 3.

16 Master cylinder (non-ABS) - overhaul

Note: *Before dismantling the master cylinder, check that replacement parts can be obtained and retain the old components to compare them with the new ones*
1 With the master cylinder removed as described in Section 15, continue as follows, according to type.

GMF type master cylinder

2 Clamp the master cylinder in a soft-jawed vice.
3 Where applicable, unscrew the pressure-proportioning valves from the base of the cylinder.
4 Carefully prise out the sealing ring from the end of the cylinder bore.
5 Depress the primary piston slightly using a piece of wood or plastic. Then hold the piston in the depressed position by inserting a smooth pin or rod of 3.0 mm (0.12 in) diameter through the primary fluid reservoir port in the cylinder **(see illustration)**.
6 Extract the circlip from the end of the cylinder bore using a screwdriver. Take care not to damage the piston or cylinder bore.
7 Withdraw the pin or rod retaining the piston.
8 Withdraw the primary piston assembly from the cylinder, if necessary tapping the cylinder on a wooden block to free the piston from the bore.
9 Apply low air pressure - e.g. from a foot pump - to the front fluid reservoir port in the cylinder, to eject the secondary piston assembly.
10 Clean all the components, in clean brake fluid or methylated spirit only, and examine them for wear and damage. In particular, check the surfaces of the pistons and cylinder bore for scoring and corrosion. If the bore shows signs of wear, renew the complete master cylinder assembly **(see illustration)**.
11 If the cylinder bore is in good condition, obtain a repair kit, which will contain all the necessary renewable items. A Vauxhall dealer will supply a pre-assembled kit of parts, which should be fitted as follows.
12 Lubricate the cylinder bore with clean brake fluid or brake grease, then clamp the cylinder in a soft-jawed vice, with the bore horizontal.
13 Remove the plug from the end of the assembly tube, and insert the short part of the tube into the cylinder bore as far as the shoulder on the tube.
14 Use a piece of wood or plastic to push the components out of the tube and into the cylinder bore. Then hold the primary piston in the depressed position by inserting the pin or rod used during dismantling through the cylinder primary fluid reservoir port.
15 Fit a new circlip to the end of the cylinder bore, ensuring that it seats correctly, and that the piston is free to move.
16 Depress the primary piston, and withdraw the pin or rod from the fluid reservoir port.



16.10 Exploded view of GMF type master cylinder

1 Filler cap (standard)
2 Filler cap (with fluid level sensor)
3 Fluid reservoir
4 Fluid reservoir retaining clips
5 Fluid reservoir seals
6 Cylinder body
7 Secondary piston and springs
8 Primary piston
9 Circlip
10 Sealing ring
11 Pressure-proportioning valves

17 Fit a new sealing ring to the end of the cylinder bore.
18 Where applicable, screw the pressure-proportioning valves into the base of the cylinder.
19 Refit the master cylinder, as described in Section 15.

ATE type master cylinder

20 Clamp the master cylinder in a soft-jawed vice.
21 Where applicable, unscrew the pressure-proportioning valves from the base of the cylinder.
22 Carefully prise out the sealing ring from the end of the cylinder bore.
23 Depress the primary piston slightly using a piece of wood or plastic, then extract the circlip from the end of the cylinder bore.
24 Withdraw the primary piston assembly, noting the location of the stop washers.
25 Depress the secondary piston, again using a piece of wood or plastic, and withdraw the stop screw from the cylinder body **(see illustration)**.
26 Withdraw the secondary piston assembly from the cylinder, if necessary tapping the cylinder on a wooden block to free the piston from the bore.
27 Clean all the components, in clean brake fluid or methylated spirit only, and examine them for wear and damage. In particular, check the surfaces of the pistons and cylinder bores for scoring and corrosion. If the bore shows signs of wear, renew the complete master cylinder assembly **(see illustration)**.

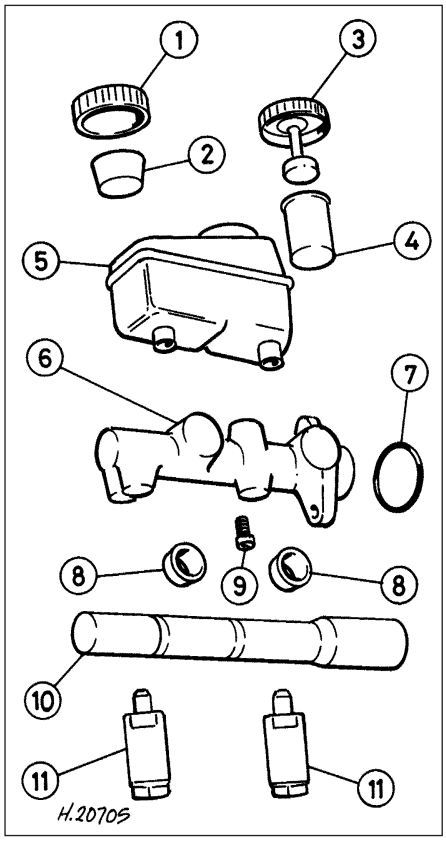
28 If the cylinder bore is in good condition, obtain a repair kit, which will contain all the necessary renewable items. A Vauxhall dealer will supply a complete kit of parts, which should be fitted as follows.
29 Lubricate the cylinder bore with clean brake fluid or brake grease, then clamp the cylinder in a soft-jawed vice, with the bore horizontal.
30 Fit a new sealing ring to the stop screw, then screw it into the cylinder body a little way, but not so far that it protrudes into the bore.
31 Remove the plugs from the ends of the assembly tube, then remove all the components from the short part of the tube, and push the short part into the long part until they are flush.
32 Insert the assembly tube into the cylinder bore as far as the collar on the short sleeve. Then use a piece of wood or plastic to push the secondary piston assembly into the bore until it contacts the end of the cylinder.
33 Lightly tighten the stop screw, then withdraw the piece of wood or plastic and the assembly tube, and fully tighten the stop screw.
34 Reposition the master cylinder in the vice, with the bore facing upwards.
35 Smear the primary piston skirt and the seal grooves with the special grease provided in the repair kit. Fit the stop washer to the piston.
36 Adjust the assembly tube so that the end of the long part is flush with the inner shoulder of the short part.

16.27 Exploded view of ATE type master cylinder

1 Filler cap (standard)
2 Strainer
3 Filler cap (with fluid level sensor)
4 Guide sleeve for float
5 Fluid reservoir
6 Cylinder body
7 Sealing ring
8 Fluid reservoir seals
9 Stop screw
10 Repair kit assembly tube
11 Pressure-proportioning valves

16.25 Depressing the secondary piston while extracting the stop screw - ATE type master cylinder

37 Fit the front seal to the primary piston, with the open end of the seal facing the front of the master cylinder.
38 Place the assembly tube over the cylinder to compress the seal, insert the piston and tube part way into the bore, and withdraw the tube.
39 Place the intermediate ring on the primary piston, then fit the remaining seal using the assembly tube as described previously.
40 Place the stop washer as the primary piston, then depress the piston slightly using a piece of wood or plastic, and fit a new circlip to the end of the cylinder bore. Ensure that the circlip is correctly seated, and that the piston is free to move.
41 Fit a new sealing ring to the end of the cylinder bore.



42 Where applicable, screw the pressure-proportioning valves into the base of the cylinder.
43 Refit the master cylinder, as described in Section 15.

17 Master cylinder (ABS) - general

The master cylinder fitted to models with ABS cannot be dismantled, and no attempt should be made at overhaul.

If faulty, the complete unit must be renewed, as described in Section 15.

18 Vacuum servo - description and testing

Description

1 The vacuum servo is fitted between the brake pedal and the master cylinder, and provides assistance to the driver when the pedal is depressed, reducing the effort required to operate the brakes. The unit is operated by vacuum from the inlet manifold. With the brake pedal released, vacuum is channelled to both sides of the internal diaphragm. However, when the pedal is depressed, one side of the diaphragm is opened to atmosphere, resulting in assistance to the pedal effort. Should the vacuum servo develop a fault, the hydraulic system is not affected, but greater effort will be required at the pedal.

Testing

2 The operation of the servo can be checked as follows.
3 With the engine stopped, destroy the vacuum in the servo by depressing the brake pedal several times.
4 Hold the brake pedal depressed and start the engine. The pedal should sink slightly as the engine is started.
5 If the pedal does not sink, check the servo vacuum hose for leaks.
6 If no defects are found in the vacuum hose, the fault must lie in the servo itself.

19.10A Remove the plugs . . .

19.10B . . . to expose the servo securing bolts

7 No overhaul of the servo is possible, and if faulty, the complete unit must be renewed.

19 Vacuum servo - removal and refitting

Note: *During the 1989 model year, some vehicles were produced with the brake pedal height incorrectly set, resulting in the brake pedal resting approximately 15.0 mm (0.6 in) above the clutch pedal instead of 4.0 mm (0.16 in below). The correct pedal height can be set by adjusting the vacuum servo operating fork dimension, as described in paragraphs 15 and 16*

Removal

1 Disconnect the battery negative lead.
2 Working inside the vehicle, remove the lower trim panel from the driver's footwell.
3 Disconnect the wiring plug from the brake lamp switch, then twist the switch anti-clockwise and remove it from its bracket.
4 Pull the spring clip from the right-hand end of the servo fork-to-pedal pivot pin.
5 Using a pair of pliers, pull back the end of the pedal return spring from the pedal, to enable the servo fork-to-pedal pivot pin to be removed. Withdraw the pivot pin.
6 Remove the windscreen cowl panel, as described in Chapter 11, then remove the windscreen wiper motor and linkage as described in Chapter 12.
7 Remove the coolant expansion tank as described in Chapter 3.
8 Pull the vacuum pipe from the brake servo.
9 Unscrew the two securing nuts, and carefully withdraw the brake master cylinder from the studs on the servo. Move the master cylinder forwards slightly, taking care not to strain the brake pipes.
10 Remove the two plugs covering the servo securing bolts from the cowl panel **(see illustrations)**.
11 Using a Allen key or hexagon bit, unscrew the servo securing bolts and remove them completely, then lift the servo from the bulkhead **(see illustrations)**.
12 If desired, the mounting bracket can be removed from the servo by unscrewing the four securing nuts. Note that the bracket will stick to the servo, as it is fitted with sealing compound.
13 The servo cannot be overhauled, and if faulty, the complete unit must be renewed.

Refitting

14 Before refitting the servo, check that the operating fork dimension is correct as follows.
15 Measure the distance from the end face of the servo casing to the centre of the pivot pin hole in the end of the operating fork. The distance should be 144.0 mm (5.6 in). To make accurate measurement easier, insert a bolt or bar of similar diameter through the pivot pin hole, and measure to the centre of the bolt or bar **(see illustration)**.

19.11A Unscrew the securing bolts . . .

19.11B . . . and withdraw the servo

19.15 Measuring the servo operating fork dimension using a bolt inserted through the pivot pin hole

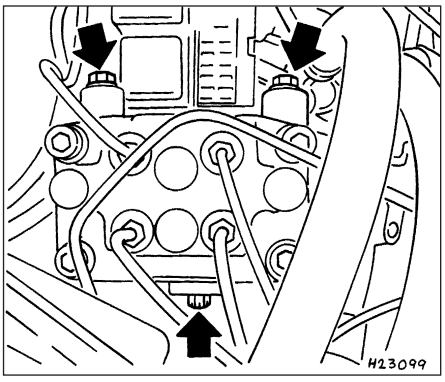
16 If adjustment is necessary, slacken the locknut, turn the fork to give the specified dimension, then tighten the locknut.
17 Where applicable, coat the contact faces of the servo and the mounting bracket with sealing compound, then refit the bracket to the servo, and tighten the securing nuts to the specified torque.
18 Coat the threads of the servo securing bolts with locking fluid, then fit the servo to the bulkhead and tighten the securing bolts.
19 Refit the securing bolt cover plugs to the cowl panel.
20 Refit the master cylinder to the servo, and tighten the securing nuts to the specified torque.
21 Reconnect the vacuum pipe to the servo.
22 Refit the coolant expansion tank, as described in Chapter 3.
23 Refit the windscreen wiper motor and linkage as described in Chapter 12, then refit the windscreen cowl panel.
24 Further refitting is a reversal of removal. On completion, test the operation of the servo, as described in Section 18.

20 ABS hydraulic modulator - removal and refitting

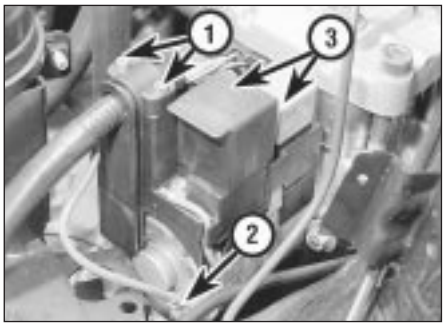
Note: *Refer to Section 2, and the note at the beginning of Section 3, before proceeding*

Removal

1 Disconnect the battery negative lead.
2 Remove the brake fluid reservoir cap, and secure a piece of polythene over the filler neck with a rubber band, or by refitting the cap. This will reduce the loss of fluid during the following procedure.
3 Remove the securing screw, and withdraw the plastic cover from the hydraulic modulator.
4 Remove the two clamp screws, and lift off the modulator wiring harness clamp **(see illustration)**.
5 Disconnect the modulator wiring plug, levering it from the socket with a screwdriver if necessary.



20.7 ABS hydraulic modulator securing screws (arrowed)



20.4 ABS hydraulic modulator (cover removed)

1 Wiring harness clamp screws
2 Earth lead
3 Relays

6 Unscrew the brake fluid pipe union nuts, and disconnect the pipes from the modulator. Be prepared for fluid spillage, and plug the open ends to prevent dirt ingress and further fluid loss. Move the pipes just clear of the modulator, taking care not to strain them.
7 Unscrew the three modulator securing nuts **(see illustration)**, then tilt the modulator slightly, and withdraw it upwards from its bracket, sufficiently to gain access to the earth lead securing nut at the front lower edge of the modulator.
8 Unscrew the securing nut and disconnect the earth lead, then withdraw the modulator from the vehicle, taking care not to spill brake fluid on the vehicle paintwork.
9 If a new modulator is to be fitted, pull the two relays from the top of the old modulator, and transfer them to the new unit. No attempt must be made to dismantle the modulator.

Refitting

10 Before refitting the modulator, check that the bolts securing the mounting bracket to the body panel are tight, and that the modulator rubber mountings are in good condition. Renew the rubber mountings if necessary.
11 Refitting is a reversal of removal, remembering the following points.
12 Make sure that the earth lead is reconnected before fitting the modulator to its mounting bracket.
13 On completion, remove the polythene sheet from the brake fluid reservoir filler neck, and bleed the complete brake hydraulic system, as described in Section 3.
14 Check that the ABS warning lamp extinguishes when first starting the engine after the modulator has been removed. At the earliest opportunity, take the vehicle to a Vauxhall dealer, and have the complete system tested, using the dedicated ABS test equipment.

21 ABS wheel sensors - removal and refitting

Note: *Refer to Section 2 before proceeding*

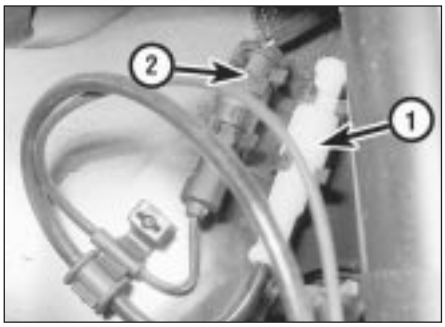
Front wheel sensor

Removal

1 Disconnect the battery negative lead.
2 Where applicable, remove the wheel trim, then loosen the relevant front roadwheel bolts and apply the handbrake. Jack up the front of the vehicle, and support on axle stands (see "*Jacking and Vehicle Support*") positioned under the body side members. Remove the roadwheel.
3 Unclip the sensor wiring connector from the retaining clip under the wheel arch, then separate the two halves of the wiring connector, prising them apart with a screwdriver if necessary **(see illustration)**.
4 Using a Allen key or hexagon bit, unscrew the bolt securing the wheel sensor to its mounting bracket, then carefully lever the sensor from the bracket using a screwdriver **(see illustration)**. Recover the seal ring.

Refitting

5 Examine the condition of the seal ring, and renew if necessary.
6 Refitting is a reversal of removal, remembering the following points.
7 Smear a little grease on the sensor casing before fitting it to the bracket.
8 Do not fully tighten the roadwheel bolts until the vehicle is resting on its wheels.
9 Check that the ABS warning lamp extinguishes when first starting the engine after a wheel sensor has been removed. At



21.3 Front wheel sensor wiring under wheelarch - DOHC model

1 ABS sensor connector
2 Disc pad wear sensor wiring connector

21.4 ABS front wheel sensor securing bolt (arrowed) - DOHC model

the earliest opportunity, take the vehicle to a Vauxhall dealer, and have the complete system tested, using the dedicated ABS test equipment.

Rear wheel sensor

Removal

10 Disconnect the battery negative lead.
11 Where applicable, remove the wheel trim, then loosen the relevant rear roadwheel bolts and chock the front wheels. Jack up the rear of the vehicle, and support on axle stands (see "*Jacking and Vehicle Support*") positioned under the body side members. Remove the roadwheel.
12 Unclip the sensor wiring connector from the retaining clip on the rear underbody, then separate the two halves of the wiring connector, prising them apart with a screwdriver if necessary **(see illustration)**.
13 Note the routing of the sensor wiring, and, where applicable, release it from the clips on the underbody.
14 Using a Allen key or hexagon bit, unscrew the bolt securing the wheel sensor to the trailing arm (or the mounting bracket on DOHC models), then carefully lever the sensor from its location using a screwdriver **(see illustration)**. Recover the seal ring.

Refitting

15 Proceed as described in paragraphs 5 to 9 inclusive.

22 ABS electronic control module - removal and refitting

Note: *Refer to Section 2 before proceeding*

ABS-2E systems

Removal

1 Ensure that the ignition is switched off, then disconnect the battery negative lead.
2 The control module is located under a cover in the passenger sill, to the left-hand side of the seat.
3 Extract the three securing screws, and lift the cover from the control module. Note that two of the screws are covered by plastic trim plugs.

21.12 ABS rear wheel sensor wiring connectors (arrowed) on rear underbody - DOHC model`

4 Lift the control module from its recess, then release the retaining clip and disconnect the module wiring plug. Withdraw the module **(see illustrations)**.

Refitting

5 Refitting is a reversal of removal.
6 Check that the ABS warning lamp extinguishes when first starting the engine after the module has been removed. At the earliest opportunity, take the vehicle to a Vauxhall dealer, and have the complete system tested, using the dedicated ABS test equipment.

ABS-2EH systems

Removal

7 Ensure that the ignition is switched off, then disconnect the battery negative lead.
8 Remove the cover from the hydraulic modulator.
9 Disconnect both the wiring harness and solenoid valve connectors.
10 Relays can only be removed from control units that have slanted covers **(see illustration).** The relays for the solenoid valve and pump motor, if removable, can now be removed. If the unit has a flat cover, and is faulty, the whole unit will have to be replaced.
11 Undo fixing bolts and remove the control unit.

Refitting

12 Refitting is a reversal of removal. Refer also to paragraph 6.

21.14 ABS rear wheel sensor (arrowed) - DOHC model

23 ABS relays (ABS-2E systems only) - removal and refitting

Note: *Refer to Section 2 before proceeding. For ABS-2EH system relays, refer to paragraphs 7 to 12, in Section 22.*

Solenoid valve and pump motor relays

Removal

1 The solenoid valve and pump motor relays are mounted on the hydraulic modulator.
2 Disconnect the battery negative lead.
3 Remove the securing screw and withdraw the plastic cover from the hydraulic modulator.
4 Pull out the appropriate relay. The small relay is for the solenoid valve, and the large relay is for the pump motor.

Refitting

5 Refitting is a reversal of removal.
6 Check that the ABS warning lamp extinguishes when first starting the engine after a relay has been removed. At the earliest opportunity, take the vehicle to a Vauxhall dealer, and have the complete system tested, using the dedicated ABS test equipment.

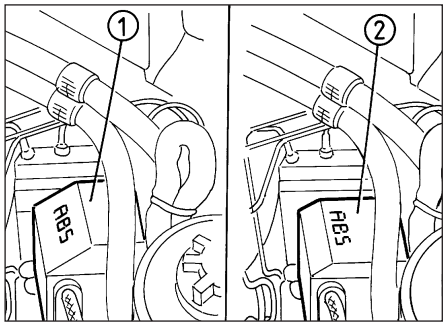
Surge arrester relay

Removal

7 The surge arrester relay is located in the relay box at the left rear of the engine compartment.

22.4A Lift out the ABS control module . . .

22.4B . . . and release the wiring plug retaining clip - ABS-2E system



22.10 ABS-2EH control unit
1 Slanted cover type 2 Flat cover type

8 Disconnect the battery negative lead.
9 Unclip the lid and open the relay box, then pull out the relay **(see illustration)**.

Refitting

10 Refitting is a reversal of removal, with reference to paragraph 6.

24 Rear brake pressure-proportioning valves - removal and refitting

Note: *Refer to the note at the beginning of Section 3 before proceeding. Note also that the valve must only be renewed in pairs, and both valves must be of the same calibration. Ensure that correct type of valves are fitted. The bodies have been stamped for easier identification.*

Master cylinder-mounted valves

Removal

1 Remove the brake fluid reservoir cap, and secure a piece of polythene over the filler neck with a rubber band, or by refitting the cap. This will reduce the loss of fluid during the following procedure.
2 Locate a container beneath the master cylinder, to catch the brake fluid that will be released.
3 Identify the two lower brake pipes for position, then unscrew the union nuts and disconnect the pipes from the proportioning valves in the base of the master cylinder. Plug the open ends of the pipes to prevent dirt ingress.
4 Unscrew the proportioning valves from the master cylinder, and plug the open ends of the cylinder to prevent dirt ingress.

Refitting

5 Refitting is a reversal of removal, but on completion, remove the polythene from the brake fluid reservoir filler neck, and bleed the complete hydraulic system, as described in Section 3.

Rear underbody-mounted valves

Removal

6 Proceed as described in paragraph 1.
7 Chock the front wheels, then jack up the rear of the vehicle, and support securely on axle stands (see "*Jacking and Vehicle Support*") positioned under the body side members.
8 Working under the rear of the vehicle, unscrew the union nut and disconnect the brake pipe from one of the valves. Be prepared for fluid spillage, and plug the open end of the pipe to prevent dirt ingress and further fluid spillage.
9 Similarly, disconnect the flexible hose from the valve.
10 Pull the valve retaining clip from the bracket on the underbody, noting that on certain models, the retaining clip also secures the ABS sensor wiring, and withdraw the valve **(see illustration)**.
11 Repeat the procedure for the other valve.

23.9 ABS surge arrester relay (arrowed)

Refitting

12 Proceed as described in paragraph 5.

25 Brake fluid pipes and hoses - general, removal and refitting

Note: *Refer to the note at the beginning of Section 3, before proceeding.*

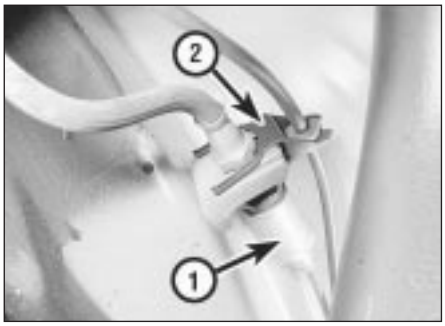
General

1 When checking the condition of the system's pipes and/or hoses, carefully check that they do not foul other components such as the power steering gear pipes (where applicable), so that there is no risk of the pipes chafing. If necessary use clips or ties to secure braking system pipes and hoses well clear of other components.

Rigid pipes

Removal

2 Some of the commonly used brake pipes can be obtained from Vauxhall parts dealers, ready-formed and complete with unions, but other brake pipes must be prepared using 4.75 mm (0.19 in) diameter brake pipe. Kits for making the brake pipes can be obtained from certain motor accessory shops.
3 Before removing a brake pipe, remove the brake fluid reservoir cap, and secure a piece of polythene over the filler neck with a rubber band, or by refitting the cap. This will reduce the loss of fluid when the pipe is disconnected.



24.10 Brake pressure-proportioning valve on rear underbody - DOHC model
1 Valve 2 Retaining clip

4 Jack up the vehicle, and support securely on axle stands (see "*Jacking and Vehicle Support*") positioned under the body side members.
5 To remove a brake pipe, unscrew the unions at each end, and release the pipe from the retaining clips.

Refitting

6 Refitting is a reversal of removal, taking care not to overtighten the unions.
7 On completion, remove the polythene from the brake fluid reservoir filler neck, and bleed the relevant hydraulic circuit(s), as described in Section 3.

Flexible hoses

Removal

8 Proceed as described previously for the rigid pipes, but note that a flexible pipe must never be installed twisted, although a slight "set" is permissible to give it clearance from adjacent components.

Refitting

9 When reconnecting a flexible hose to a front brake caliper, note that the sealing rings on the union bolt must be renewed.

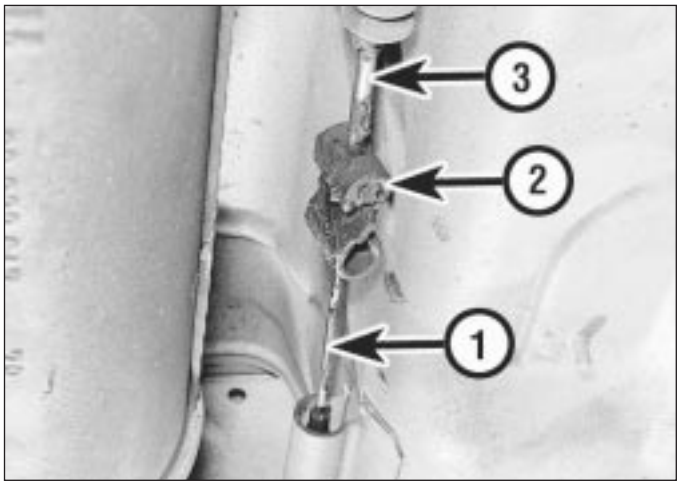
26 Handbrake - adjustment

Models with rear drum brakes

1 The handbrake will normally be kept in correct adjustment by the self-adjusting action of the rear brake shoes. However, due to cable stretch over a period of time, the travel of the handbrake lever may become excessive, in which case the following operations should be carried out.
2 Chock the front wheels, jack up the rear of the vehicle, and support securely on axle stands (see "*Jacking and Vehicle Support*") positioned under the body side members.
3 Fully release the handbrake.
4 Turn the knurled nut on the cable adjuster (mounted on the torsion beam), until the brake shoes can just be heard to rub when the rear wheels are turned by hand in the normal direction of rotation **(see illustration)**.

26.4 Handbrake cable adjuster. Knurled nut arrowed - all SOHC models

26.14 Using a screwdriver to turn the handbrake adjuster wheel - model with rear disc brakes



27.6 Handbrake cable connection to handbrake lever operating rod

1 Handbrake cable
2 Connecting link
3 Handbrake lever operating rod

5 Loosen the adjuster nut until the wheels are just free to turn.
6 The handbrake must start to operate with the lever on the second notch of the ratchet.
7 On completion of adjustment, check the handbrake cables for free movement, and apply a little grease to the adjuster threads to prevent corrosion.
8 Lower the vehicle to the ground.

Models with rear disc brakes

9 Where applicable, remove the wheel trims, then loosen the rear roadwheel bolts and chock the front wheels. Jack up the rear of the vehicle, and support securely on axle stands (see "*Jacking and Vehicle Support*") positioned under the body side members. Remove the roadwheels.
10 Pull the handbrake lever as far as the second notch on the ratchet.
11 On DOHC models fitted with a catalytic converter, unscrew the four securing nuts and withdraw the exhaust centre box heat shield by carefully sliding it round the centre box.
12 On all SOHC models, loosen the knurled nut on the cable adjuster (mounted on the torsion beam).
13 On DOHC models, loosen the nut securing the cable equaliser yoke to the handbrake lever operating rod.
14 Using a screwdriver inserted through the adjuster hole in one of the discs/hubs **(see illustration)**, turn the adjuster wheel until the brake shoes can just be heard to rub when the disc/hub is turned by hand in the normal direction of rotation.
15 Turn the adjuster wheel back until the disc/hub is just free to turn.
16 Repeat paragraphs 14 and 15 on the remaining side of the vehicle.
17 Tighten the nut on the cable adjuster or the equaliser, as applicable, until the brake shoes just begin to operate. Check that the shoes operate equally on both wheels.
18 Fully release the handbrake, then apply it again.
19 The discs/hubs must lock when the handbrake lever reaches the sixth notch on the ratchet. If necessary, turn the nut on the cable adjuster or equaliser, as applicable, to achieve this.
20 Where applicable, refit the exhaust heat shield.
21 Refit the roadwheels and lower the vehicle to the ground. Do not fully tighten the roadwheel bolts until the vehicle is resting on its wheels.

27 Handbrake cable - removal and refitting

Models with rear drum brakes

Removal

1 The handbrake cable is in two sections. The longer section runs from the handbrake operating rod, through the adjuster, to the right-hand brake assembly. The shorter section runs from the adjuster to the left-hand brake assembly. The two sections of the cable can be renewed independently.
2 Where applicable, remove the wheel trim(s), then loosen the relevant rear roadwheel bolts. Chock the front wheels, jack up the rear of the vehicle, and support securely on axle stands (see "*Jacking and Vehicle Support*") positioned under the body side members. Remove the roadwheel(s).
3 Note the routing of the handbrake cable(s), as an aid to refitting.
4 Remove the relevant brake drum(s), with reference to Section 11.

Longer cable

Removal

5 Note the length of exposed thread at the handbrake cable adjuster on the torsion beam, then unscrew the adjuster nut from the threaded rod.
6 Disconnect the cable from the handbrake lever operating rod on the vehicle underbody **(see illustration)**.
7 Detach the cable from the guides on the underbody. Note that the cable can be fed through certain guides, but in some cases, the guide brackets must be bent away from the underbody to allow the cable to be withdrawn.
8 Detach the cable from the adjuster on the torsion beam.
9 Unhook the cable end from the lever on the brake shoe, then using a screwdriver, prise out the lockplate that secures the handbrake cable in the backplate.
10 Withdraw the cable from the vehicle, releasing it from the guide on the torsion beam.

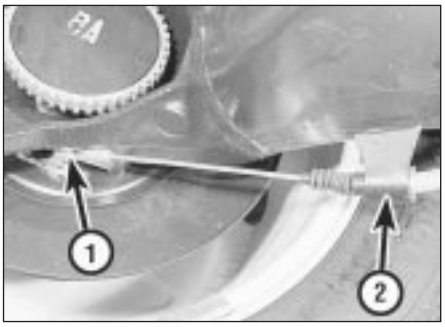
Refitting

11 Refitting is a reversal of removal, remembering the following points.
12 Screw the adjuster nut onto the threaded rod to the position noted before removal.
13 Ensure that the handbrake cable is routed as noted before removal.
14 Refit the brake drum, (Section 11).
15 Before refitting the roadwheel(s) and lowering the vehicle to the ground, adjust the handbrake, as described in Section 26.

Shorter cable

Removal

16 Note the length of exposed thread at the handbrake cable adjuster on the torsion beam, then unscrew the adjuster nut from the threaded rod. Continue as described in paragraphs 8 to 10.



27.27 Handbrake cable end fitting at brake shoe - DOHC model

1 Operating lever
2 Cable bracket on semi-trailing arm

Refitting

17 Proceed as described in paragraphs 11 to 15 inclusive.

Models with rear disc brakes (SOHC)

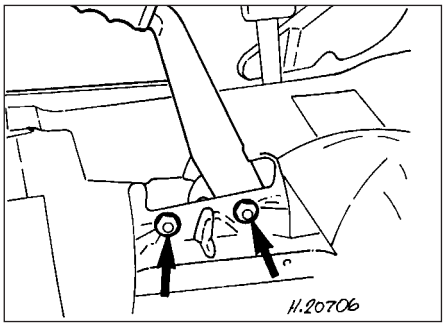
General

18 The procedure is as described for models with rear drum brakes, remembering the following points.
19 Ignore the references to removal and refitting of the brake drum.
20 Note that there is no lockplate securing the handbrake cable to the brake backplate, but the return spring must be unhooked from the cable end.
21 On models with a catalytic converter, when removing the longer cable, unscrew the four securing nuts and withdraw the exhaust centre box heat shield by carefully sliding it round the centre box.

DOHC models

Removal

22 The left and right-hand handbrake cables, and the equaliser yoke, are removed as an assembly on DOHC models.
23 Loosen the rear roadwheel bolts, then chock the front wheels, jack up the rear of the vehicle, and support securely on axle stands (see "*Jacking and Vehicle Support*") positioned under the body side members. Remove the roadwheels.
24 Note the routing of the handbrake cables, as an aid to refitting.
25 On models with a catalytic converter, unscrew the four securing nuts and withdraw the exhaust centre box heat shield by carefully sliding it round the centre box.
26 Note the length of exposed thread at the cable equaliser yoke, then unscrew the securing nut and disconnect the equaliser yoke from the handbrake lever operating rod.
27 Unhook the cable ends from the brake shoe operating levers and the return springs **(see illustration)**.
28 Detach the cable from the guides on the underbody and the semi-trailing arms. Note that the cables can be fed through certain guides, but in some cases, the guide brackets may have to be bent away from the underbody to allow the cables to be withdrawn.
29 Withdraw the cables and equaliser assembly from the vehicle.



28.9 Handbrake lever securing bolts (arrowed)

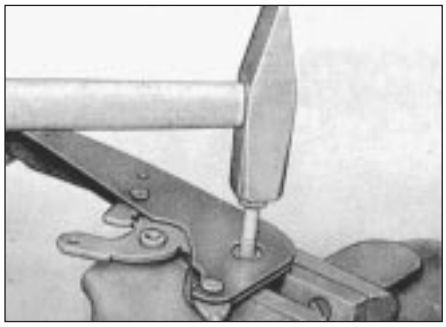
Refitting

30 Refitting is a reversal of removal, remembering the following points.
31 Use a new self-locking nut to secure the equaliser yoke to the handbrake lever operating rod, and screw the nut onto the rod to the position noted before removal.
32 Ensure that the cables are routed as noted before removal.
33 Before refitting the roadwheels and lowering the vehicle to the ground, adjust the handbrake, as described in Section 26.

28 Handbrake lever - removal and refitting

Removal

1 Disconnect the battery negative lead.
2 Jack up the vehicle, and support on axle stands (see "*Jacking and Vehicle Support*") positioned securely under the body side members.
3 On models with a catalytic converter, unscrew the four securing nuts and withdraw the exhaust centre box heat shield by carefully sliding it round the centre box.
4 On all SOHC models, note the length of exposed thread at the handbrake cable adjuster on the torsion beam, then slacken the adjuster to enable the cable to be disconnected from the handbrake lever operating rod. Disconnect the cable from the operating rod and slide the rubber sealing grommet from the underbody and operating rod.
5 On DOHC models, note the length of exposed thread at the handbrake cable equaliser yoke, then unscrew the securing nut and disconnect the equaliser yoke from the handbrake lever operating rod. Slide the rubber sealing grommet from the underbody and operating rod.
6 Remove the front passenger seat, as described in Chapter 11.

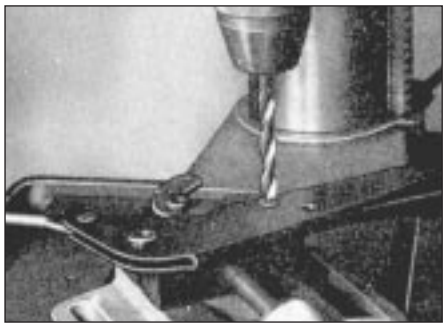


28.11 Driving out the handbrake lever ratchet segment securing sleeve

7 Remove the rear section of the centre console, as described in Chapter 11.
8 Access to the handbrake lever-to-floor mounting bolts is provided by slits in the carpet. If no slits are provided, either carefully cut some, or release and fold back the carpet.
9 Unscrew the mounting bolts, and withdraw the handbrake lever sufficiently to disconnect the handbrake "on" warning lamp switch wiring **(see illustration)**.
10 Disconnect the wiring and withdraw the handbrake lever and operating rod from the vehicle.
11 A worn ratchet segment can be renewed by driving the securing sleeve from the handbrake lever, using a metal rod or a bolt of similar diameter **(see illustration)**.
12 Drive the new sleeve supplied with the new segment into the lever to permit a little play between the segment and lever.
13 If desired, a new pawl can be fitted if the original pivot rivet is drilled out **(see illustration)**.
14 Rivet the new pawl so that the pawl is still free to move.
15 The handbrake "on" warning lamp switch can be removed from the lever assembly after unscrewing the securing bolt.

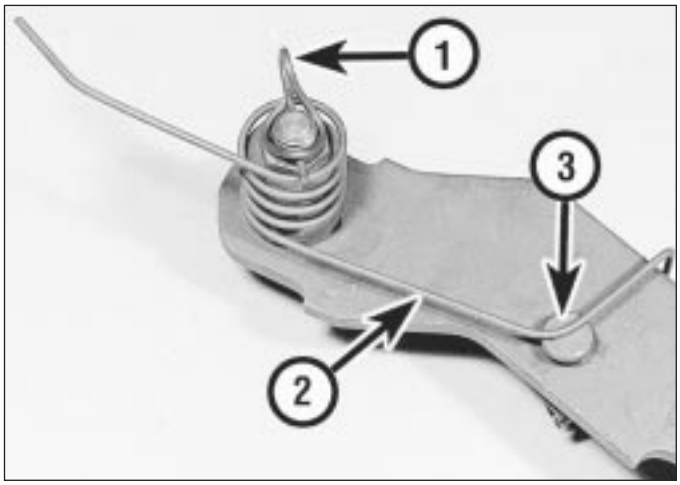
Refitting

16 Refitting is a reversal of removal, remembering the following points.
17 Refit the rear section of the centre console, as described in Chapter 11.
18 Refit the front passenger seat, as described in Chapter 11.



28.13 Drilling out the handbrake lever pawl pivot pin

29.4 Brake servo fork-to-pedal pivot pin spring clip (arrowed)



29.5 Brake pedal assembly removed from vehicle
1 Locking clip 2 Pedal return spring 3 Pedal pivot pin

19 On DOHC models, use a new self-locking nut to secure the equaliser yoke to the handbrake lever operating rod, and screw the nut onto the rod to the position noted before removal.
20 On SOHC models, tighten the cable adjuster to expose the length of thread noted before removal.
21 Before lowering the vehicle to the ground, adjust the handbrake, (Section 26).

29 Brake pedal - removal and refitting

Removal

1 Disconnect the battery negative lead.
2 Remove the lower trim panel from the driver's footwell.
3 Disconnect the wiring plug from the brake lamp switch, then twist the switch anti-clockwise and remove it from its bracket.
4 Pull the spring clip from the right-hand end of the servo fork-to-pedal pivot pin **(see illustration)**.
5 Using a pair of pliers, pull back the end of the pedal return spring from the pedal, to enable the servo fork-to-pedal pivot pin to be removed. Withdraw the pivot pin **(see illustration)**.
6 Pull the locking clip from the left-hand end of the pedal pivot pin.
7 Unscrew the nut from the left-hand end of the pivot pin, then slide the pivot pin from the right-hand end of the pedal mounting bracket. If necessary, tap the end of the pivot pin with a soft-faced hammer to free the splines from the mounting bracket. Recover any washers that may be positioned on the pivot pin, noting their locations.
8 Withdraw the pedal and return spring.

Refitting

9 Refitting is a reversal of removal, remembering the following points.
10 Ensure that the pedal return spring is correctly located on the pedal before refitting.
11 Coat the pedal pivot pin with a little molybdenum disulphide grease.
12 Ensure that any washers on the pedal pivot pin are positioned as noted before removal.

Chapter 10
Suspension and steering

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

Front suspension type (all models)	Independent, with MacPherson struts and anti-roll bar
Rear suspension type:	
SOHC models	Semi-independent torsion beam, with trailing arms, coil springs and telescopic shock absorbers. Anti-roll bar on some models. Manual level control system standard on some models, optional on others
DOHC models	Fully independent, with semi-trailing arms, coil springs, telescopic shock absorbers and anti-roll bar
Steering type (all models)	Rack and pinion. Power steering standard on selected models, optional on others
Vehicle condition for “laden” measurements:	
All models	70 kg in each front seat, fuel tank half full
Front suspension (laden):	
Camber	-40’ ± 40’
Castor	+2° ± 1°
Toe in	+15’ ± 10’
Toe out on turns	1° 30’ ± 45’
Max. deviation between wheels on toe out	40’

Vehicle condition for “laden” measurements (continued):	
Rear suspension (laden, after depressing rear of vehicle several times):	
DOHC models:	
Camber	-2° 10’ ± 40’
Toe in	+25’ + 30’/-20’
SOHC models:	
Camber	-1°40’ ± 30’
Toe in	+10’ ± 30’/-20’

Steering

Ratio:	
Manual steering	22 : 1 or 24.5 : 1
Power steering	18 : 1
Power steering fluid type	See Chapter 1 Specifications
Power steering drivebelt tension (measured with Vauxhall gauge):	
New belt	250 to 300 N
Used belt	450 N

Wheels and tyres

Wheel size	5½J x 13, 5½J x 14 or 6J x 15
Tyre size:	
5½J x 13 wheels	165 R13-82T
5½J x 14 wheels	175/70 R14-82T, 195/60 R14-85H, or 195/60 R14-85V
6J x 15 wheels	195/60 R15-87V or 205/55 R15-87V

Torque wrench settings

	Nm	lbf ft
Front suspension - all models		
Anti-roll bar to subframe	20	15
Balljoint to lower arm	60	44
Lower arm to suspension strut balljoint *	70	52
Lower arm to subframe front (horizontal) pivot: *		
Stage 1	100	74
Stage 2	Angle-tighten a further 60°	
Stage 3	Angle-tighten a further 15°	
Lower arm damper weight (where applicable)	20	15
Subframe to underbody bolts: *		
Front	115	85
Centre	170	125
Rear:		
Stage 1	100	74
Stage 2	Angle-tighten a further 75°	
Stage 3	Angle-tighten a further 15°	
Suspension strut upper mounting	55	41
Suspension strut piston rod	55	41
Suspension strut ring	200	148
Rear suspension - SOHC models		
Anti-roll bar	30	22
Rear hub unit (maintenance free type) securing: *		
Stage 1	50	37
Stage 2	Angle-tighten a further 30° to 45°	
Rear hub nut (see Section 10)	25	18
Shock absorber lower mounting	70	52
Shock absorber upper mounting	20	15
Stub axle to trailing arm: *		
Stage 1	50	37
Stage 2	Angle-tighten a further 30° to 45°	
Trailing arm to underbody	105	77
Rear suspension - DOHC models		
Anti-roll bar	22	16
Crossmember mounting bracing bracket to underbody	65	48
Crossmember rear tube to body	60	44
Forward crossmember to body	125	92
Rear hub *	300	221
Semi-trailing arm to crossmember	100	74
Shock absorber lower mounting	110	81
Shock absorber upper mounting	20	15

* = *Use new nuts/locking pins or bolts (as applicable)*

Torque wrench settings (continued)	Nm	lbf ft
Steering		
Steering gear mounting (to bulkhead)	22	16
Steering wheel retaining	25	18
Tie-rod to steering gear	95	70
Tie-rod end clamp	20	15
Tie-rod end to suspension strut balljoint	60	44
Steering shaft to flexible coupling	22	16
Steering gear pinion to flexible coupling	22	16
Steering gear pinion	40	30
Steering gear damper adjuster	60	44
Fluid pipe to power steering gear unions	42	31
Fluid pipe to power steering pump union	28	21
Fluid pipe to pipe and pipe to hose unions	28	21
Power steering pump mounting:		
1.6 litre models (up to 1992)	30	23
1.8 and 2.0 litre models (up to 1992):		
Bolts “A” and “C” (refer to text)	25	18
Bolts “B” (refer to text)	40	30
SOHC models (from 1993)	20	15
DOHC models (from 1993):		
Bolts “1” and “2” (refer to text)	25	18
Bolts “3” and “4” (refer to text)	18	13
Power steering pump pulley (1.6 litre models)	25	18
Steering column to dashboard mounting bracket	22	16
Steering column upper right hand mounting	22	16
Roadwheels		
Roadwheel	110	81

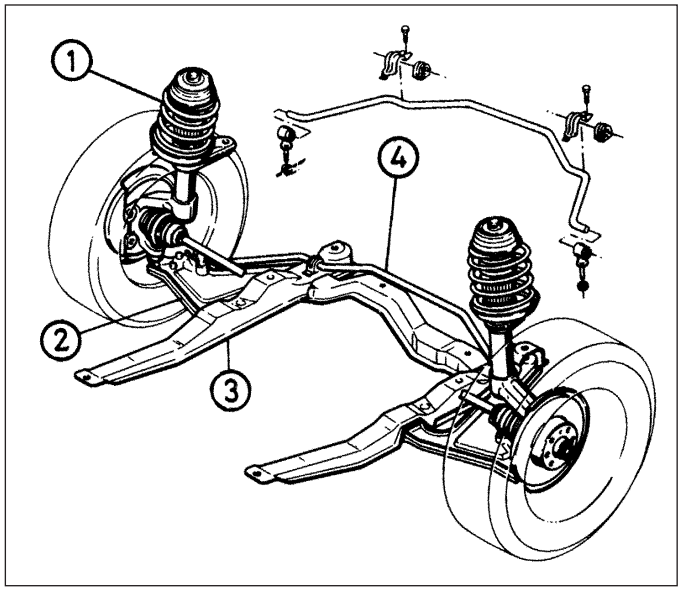
1 General description

1 The front suspension consists of MacPherson struts, lower arms, and an anti-roll bar. The lower arms and the anti-roll bar are mounted on a detachable U-shaped front subframe, which also carried the rear engine/transmission mounting **(see illustration)**.

2 Each lower arm is attached to the subframe by a horizontal front bush and a vertical rear bush. In conjunction with the steering geometry, this arrangement allows the front wheels to steer themselves against any imbalance in the braking forces. This would maintain stability when braking with one side of the vehicle on a slippery surface, and the other on dry tarmac.

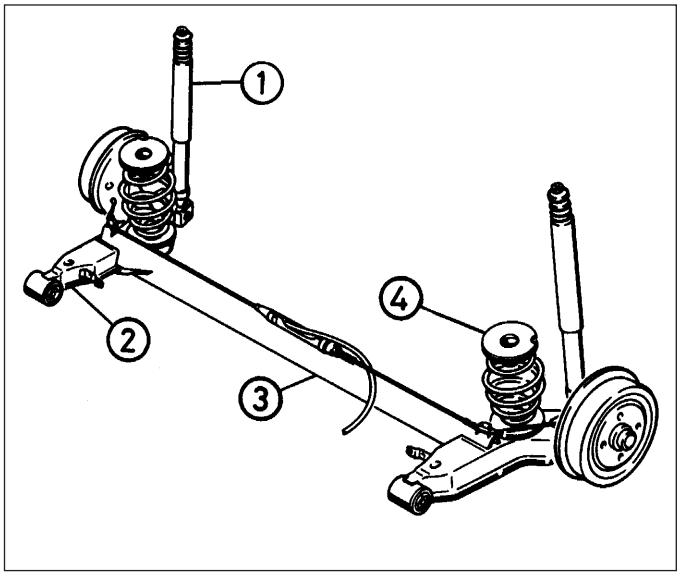
3 The hub carriers are mounted between the lower ends of the MacPherson struts, and the lower arms, and carry the double row ball type wheel bearings and the brake assemblies.

4 The rear suspension on SOHC models is of semi-independent type, consisting of a torsion beam and trailing arms with double-conical coil springs and telescopic shock absorbers. The front ends of the trailing arms are attached to the vehicle underbody by horizontal bushes, and the rear ends are located by the shock absorbers, which are bolted to the underbody at their upper ends.



1.1 Front suspension layout - all models

1 MacPherson strut
2 Lower arm
3 Subframe
4 Anti-roll bar



1.4 Rear suspension layout - SOHC model (model with rear drum brakes shown)

1 Shock absorber
2 Trailing arm
3 Torsion beam
4 Coil spring

The coil springs are mounted independently of the shock absorbers, and act directly between the trailing arms and the underbody. Certain models are fitted with an anti-roll bar, which is mounted between the torsion beam and the rear ends of the trailing arms **(see illustration)**.

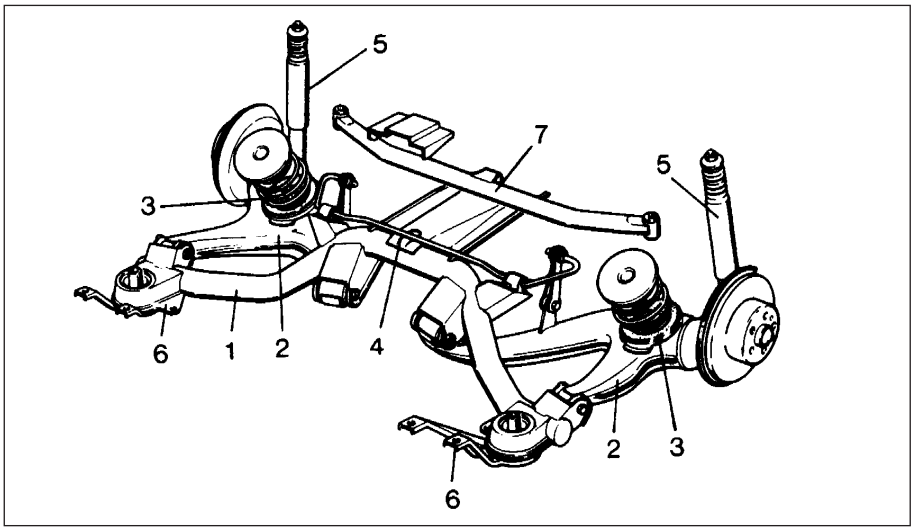
5 A manual rear suspension level control system is available as standard equipment on some models, and as an optional extra on others. The system operates using compressed air filled shock absorbers. The rear suspension level is adjusted by altering the air pressure in the shock absorbers, through a valve located in the luggage compartment.

6 The rear suspension on DOHC models is of fully independent type, consisting of semi-trailing arms, with double-conical coil springs, telescopic shock absorbers and an anti-roll bar. The front end of each semi-trailing arm is attached to a suspension crossmember by two horizontal bushes, and the rear ends are located by the shock absorbers, which are bolted to the underbody at their upper ends. The coil springs are mounted independently of the shock absorbers, and act directly between the semi-trailing arms and the underbody. The anti-roll bar is located on the suspension crossmember, and is attached to each semi-trailing arm by a vertical link. The suspension crossmember is bolted directly to the vehicle underbody at its forward end **(see illustration)**.

7 The steering gear is of rack-and-pinion type. Movement is transmitted to the front wheels through tie-rods, which are connected to the rack through a sliding sleeve at their inner ends, and to the suspension struts through balljoints at their outer ends.

8 The steering column consists of an outer column that incorporates a collapsible section, and a shaft connected to a flexible coupling at its lower end.

9 Power steering is fitted as standard to certain models and is available as an option on others. The power steering is hydraulically operated, and pressure is supplied by a fluid pump driven by way of a drivebelt from the engine crankshaft. On 1.8 and 2.0 Litre models, fluid cooler pipes are mounted beneath the radiator to keep the temperature of the hydraulic fluid within operating limits.



1.6 Rear suspension layout - DOHC model

1 Crossmember
2 Semi-trailing arm
3 Coil springs
4 Anti-roll bar
5 Shock absorber
6 Crossmember mounting bracing bracket
7 Crossmember rear tube

2 Front wheel bearing - renewal

HAYNES HiNT ***The bearing will probably be destroyed during the removal operation. The use of a puller will greatly ease the procedure***

Removal

1 Remove the relevant suspension strut/hub carrier assembly, as described in Section 4.

2 Unscrew the securing screw, and remove the brake disc from the hub.

3 Support the hub carrier on two metal bars positioned as shown **(see illustration)**, then using a metal bar or tube of similar diameter, press or drive the hub from the wheel bearing. Alternatively, screw two roadwheel bolts into the hub and, using progressively thicker packing pieces, tighten the bolts to force the hub from the bearing. Note that one half of the inner bearing race will remain on the hub.

4 Using a puller, pull the half inner bearing race from the hub. Alternatively, support the bearing race on suitably thin metal bars, and press or drive the hub from the bearing race **(see illustration)**.

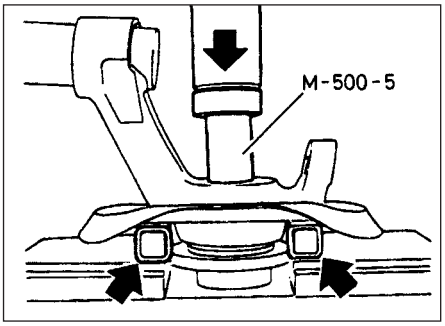
5 Remove the three securing screws, and lift the brake disc shield from the hub carrier **(see illustration)**.

6 Extract the inner and outer bearing retaining circlips **(see illustration)**.

7 Using a puller, pull the bearing from the hub carrier, applying pressure to the outer race. Alternatively, support the hub carrier, and press or drive out the bearing.

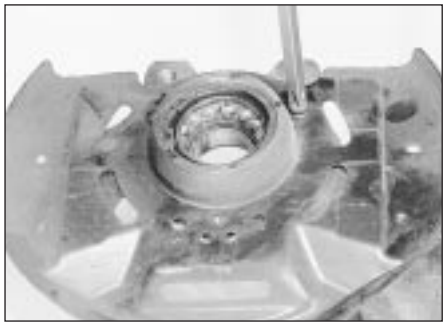
Refitting

8 Before installing the new bearing, thoroughly clean the bearing location in the hub carrier, and fit the outer bearing retaining circlip, "A" **(see illustration)**. Note that the circlip tabs should be positioned towards the bottom of the hub carrier.



2.3 Pressing the front hub from the wheel bearing

2.4 Removing the half inner bearing race from the hub



2.5 Removing a brake disc shield securing screw

2.6 Extracting the outer bearing retaining circlip

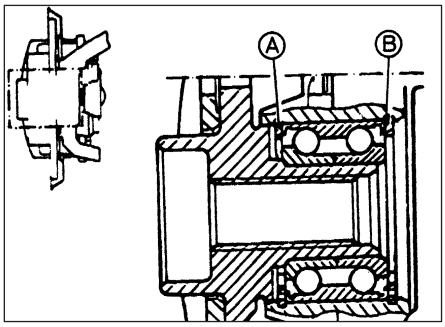
9 Press or drive the new bearing into position until it contacts the outer circlip, applying pressure to the outer race **(see illustration)**.
10 Fit the inner bearing retaining circlip, with the tabs positioned towards the bottom of the hub carrier.
11 Fit the brake disc shield.
12 Press or draw the hub into the bearing. The bearing inner track must be supported during this operation. This can be achieved using a socket, long bolt, washers and a length of bar as shown **(see illustration)**.
13 Refit the brake disc.
14 Refit the suspension strut/hub carrier assembly, as described in Section 4.

3 Front subframe - removal and refitting

Note: *Suitable equipment will be required to support the engine during this procedure. A balljoint separator tool will be required. The lower arm to suspension strut balljoint nut locking pins must be renewed on refitting*

Removal

1 The subframe is removed complete with the lower arms and the anti-roll bar as an assembly.
2 Before removing the subframe, the engine must be supported from its left hand lifting bracket. Ideally, the engine should be supported using a strong wooden or metal beam resting on blocks positioned securely in the channels at the sides of the engine compartment. The Vauxhall special tool designed specifically for this purpose is shown in Chapter 7A. Alternatively, the engine can be supported using a hoist and lifting tackle. However in this case, the hoist must be of such a design as to enable the engine to be supported with the vehicle raised off the ground, leaving sufficient clearance to withdraw the subframe from under the front of the vehicle.
3 Where applicable, remove the wheel trims, then loosen the front roadwheel bolts on both sides of the vehicle. Apply the handbrake, then jack up the front of the vehicle, and support securely on axle stands (see "*Jacking and Vehicle Support*") positioned under the body side members. Remove the front roadwheels.



2.8 Cross sectional view of front wheel bearing/hub assembly
A Outer bearing retaining circlip
B Inner bearing retaining circlip

4 Remove the front section of the exhaust system, with reference to Chapter 4C. On DOHC models, unbolt the oil cooler hose bracket from the right hand side of the subframe.
5 Working on one side of the vehicle, extract the locking pin, then unscrew the castellated nut from the lower arm to suspension strut balljoint.
6 Using a balljoint separator tool, disconnect the lower arm to suspension strut balljoint.
7 Repeat paragraphs 5 and 6 for remaining lower arm.
8 Ensure that the engine is adequately supported, then unscrew and remove the two nuts and washers securing the rear engine/transmission mounting to the subframe.
9 Support the subframe on a trolley jack, with an interposed wooden beam to prevent the subframe from tipping as it is withdrawn.
10 Unscrew and remove the six bolts securing the subframe to the vehicle underbody. Note that the rear bolts also secure the lower arms to the subframe **(see illustrations)**. The bolts are very tight, and an extension bar will probably be required to loosen them.
11 Lower the jack supporting the subframe, and withdraw the assembly from under the front of the vehicle.
12 If desired, the anti-roll bar and/or the lower arms can be removed from the subframe, with reference to Sections 8 and 5 respectively.

2.9 Fitting a new front wheel bearing using a socket, nut, bolt, washers, and length of bar

2.12 Drawing the hub into the bearing using improvised tools

Refitting

13 Refitting is a reversal of removal, remembering the following points.
14 If the anti-roll bar and/or the lower arms have been removed from the subframe, refit them with reference to Section 8 and/or 5, as applicable.
15 Tighten all nuts and bolts to the specified torques, noting that the rear subframe to underbody bolts must be tightened in stages see Specifications.
16 Secure the lower arm to suspension strut balljoint nuts with new locking pins.
17 Refit the front section of the exhaust system, with reference to Chapter 4C. On DOHC models, refit the oil cooler hose bracket to the right hand side of the subframe.
18 Finally tighten the roadwheel bolts when the vehicle has been lowered to the ground, and where applicable, refit the wheel trims.

3.10A Front subframe front securing bolt

3.10B Front subframe rear securing bolt which also secures rear end of lower arm

4.7 Unscrewing the suspension strut top mounting nut

4.8 Withdrawing a suspension strut

4.13A Lift off the strut upper mounting rubber . . .

4 Front suspension strut - removal, overhaul and refitting

Note: *A balljoint separator tool will be required during this procedure, and a spring compressor tool will be required if the strut is to be overhauled. The tie-rod end balljoint self-locking nut, the driveshaft retaining snap ring, and the hub nut must be renewed on refitting*

Removal

1 Where applicable, remove the wheel trim, then loosen the relevant front roadwheel bolts. Apply the handbrake, then jack up the front of the vehicle, and support securely on axle stands (see "*Jacking and Vehicle Support*") positioned under the body side members. Remove the relevant front roadwheel.

2 Where applicable, remove the ABS wheel sensor from the hub carrier, referring to Chapter 9, if necessary, and disconnect the wiring from the strut.

3 Remove the brake caliper from the hub carrier, as described in Chapter 9. The caliper can be suspended out of the way, using wire or string, to avoid the need to disconnect the hydraulic fluid hose.

4 Unscrew and remove the self-locking nut from the tie-rod end to suspension strut balljoint.

5 Using a balljoint separator, disconnect the tie-rod end to suspension strut balljoint.

6 Disconnect the outboard end of the driveshaft from the hub carrier, as described in Chapter 8. Support the driveshaft by suspending with wire or string. Do not allow the driveshaft to hang down under its own weight.

7 Working in the engine compartment, unscrew the nut securing the suspension strut to the suspension turret. To unscrew the nut, it will be necessary to counterhold the suspension strut piston rod using a splined key **(see illustration)**. Support the suspension strut as the nut is unscrewed, as once the nut has been removed, the strut is free to drop from the vehicle.

8 Withdraw the suspension strut/hub carrier assembly from the vehicle **(see illustration)**.

9 If desired, the suspension strut can be overhauled as follows, otherwise go on to paragraph 30 for details of the refitting procedure.

Overhaul

10 The hub, wheel bearing and brake disc shield can be removed, as described in Section 2.

11 With the suspension strut resting on a bench or clamped in a vice, fit a spring compressor tool, and compress the coil spring to relieve the pressure on the upper spring seat. Ensure that the compressor tool is securely located on the spring, according to the tool manufacturer's instructions.

12 Hold the strut piston rod with the splined key used during strut removal, and unscrew the piston rod nut.

13 Lift off the strut upper mounting rubber and the bearing **(see illustrations)**.

4.13B . . . and the bearing

14 Lift off the upper spring seat and damper ring, then carefully release the spring compressor and remove the spring **(see illustration)**. Note which way up the spring is fitted.

15 Slide the bellows and the rubber buffer that fits inside the bellows from the strut **(see illustration)**.

16 To remove the shock absorber cartridge, the ring nut must be unscrewed from the top of the strut tube. This nut is extremely tight. One method that can be used to unscrew the nut is to invert the strut and clamp the nut in a vice, then lever the strut round using a long bar and a bolt passed through the tie-rod bracket.

17 With the ring nut removed, the shock absorber cartridge can be withdrawn **(see illustrations)**.

18 The shock absorber can be tested by clamping the lower end in a vice, then fully extending and contracting the shock absorber several times. Any evidence of jerky

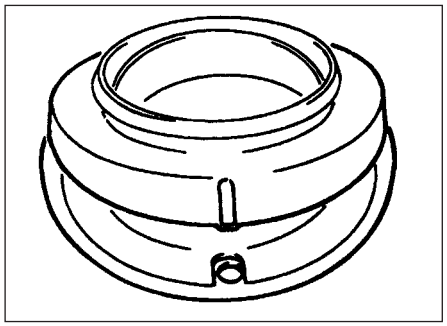
4.14 Lift off the upper spring seat and damper ring

4.15 Slide off the bellows and the rubber buffer

4.17A Remove the ring nut . . .

4.17B . . . and withdraw the shock absorber cartridge

4.22 Lower end of spring rests against lug (arrowed) on lower spring seat



4.24 Mark on suspension strut damper ring aligned with hole in spring seat

movement or lack of resistance indicates the need for renewal.

19 Examine all components for wear or damage and renew as necessary. Pay particular attention to the mounting rubber and the bearing.

20 Begin reassembly by sliding the shock absorber cartridge into the strut, and refitting the ring nut.

21 Clamp the strut in a vice, and tighten the ring nut to the specified torque, using a suitably large long reach socket.

22 Refit and compress the coil spring, ensuring that the lower end of the spring rests against the lug on the lower spring seat **(see illustration)**.

23 Refit the rubber buffer and the bellows.

24 Refit the upper spring seat and the damper ring, ensuring that the mark on the damper ring is aligned with the hole in the spring seat, as shown **(see illustration)**. The spring seat should be positioned with the hole at right angles to (i.e. 90° away from) the end of the spring.

25 Lubricate the bearing with a little grease, then refit it with the visible part of the bearing race uppermost.

26 Refit the strut upper mounting rubber.

27 Counterhold the strut piston rod, and tighten the piston rod nut to the specified torque. This can be achieved by holding the piston rod using the splined key fitted to a torque wrench, and tightening the nut using a spanner until the specified torque is reached **(see illustration)**.

28 Carefully release and remove the spring compressor tool, ensuring that the spring seats correctly at top and bottom. Ensure that the lower end of the spring still rests against the lug on the lower spring seat.

29 The strut can now be refitted to the vehicle as follows.

Refitting

30 Locate the top end of the strut in the suspension turret, then refit the securing nut and tighten it to the specified torque using the method described in paragraph 27.

31 Reconnect the outboard end of the driveshaft to the hub carrier (see Chapter 8).

32 Reconnect the tie-rod end balljoint to the suspension strut, and tighten a new self locking nut to the specified torque.

33 Refit the brake caliper to the hub carrier, as described in Chapter 9.

34 Where applicable, refit the ABS wheel sensor to the hub carrier, with reference to Chapter 9, and reconnect the wiring to the strut.

35 Refit the roadwheel, and lower the vehicle to the ground. Finally tighten the roadwheel bolts with the vehicle resting on its wheels, and where applicable, refit the wheel trim.

36 Check and if necessary adjust the front wheel alignment, as described in Section 45.

5 Front suspension lower arm - removal and refitting

Note 1: *A new lower arm to suspension strut balljoint nut locking pin, and (where applicable) a new anti-roll bar to lower arm nylock nut must be used on refitting.*

Note 2: *Regular inspection of the front suspension lower arms is recommended in order to detect damage or distortion which could eventually lead to failure. Any sign of cracking, creasing or other damage should be investigated and the arm renewed if necessary. If in doubt, consult your Vauxhall/Opel dealer for advice.*

Removal

1 Where applicable, remove the wheel trim, then loosen the relevant front roadwheel bolts. Apply the handbrake, then jack up the front of the vehicle, and support securely on axle stands (see "*Jacking and Vehicle Support*") positioned under the body side members. Remove the relevant front roadwheel.

2 Unscrew and remove the nut securing the end of the anti-roll bar to the lower arm. Recover the dished washers and mounting rubbers.

3 Extract the locking pin, then unscrew the castellated nut from the lower arm to suspension strut balljoint.

4 Using a balljoint separator tool, disconnect the lower arm to suspension strut balljoint.

5 Unscrew and remove the two pivot bolts securing the lower arm to the subframe **(see illustration)**. Note that the rear pivot bolt also secures the subframe to the underbody. Both

4.27 Tightening the piston rod nut

bolts are very tight, and an extension bar will probably be required to loosen them.

6 Pull the lower arm from the subframe, and withdraw it from the vehicle.

7 Note that certain 2.0 litre models have a damper weight bolted to the right hand lower arm. If the right hand lower arm is to be renewed on such a vehicle, it is important to ensure that the damper weight is transferred to the new arm.

8 Note that the metal sleeves in the rear mounting bush can be discarded when refitting the lower arm.

9 If any sign of damage or distortion of the front suspension lower arm around the front pivot bolt is evident, a modified and strengthened arm is available from Vauxhall dealers.

10 The modified lower arm, which can be identified by the strengthening flange along the seam on the forward facing side of the arm, will be fitted in production from mid-1993 on **(see illustration)**.

5.5 Lower arm front pivot bolt

11 The modified lower arm is fully interchangeable with the earlier version. Note also that if the modified arm is replacing an earlier version that incorporates a damper weight, as described earlier. The damper weight should not be fitted to the modified lower arm.

Refitting

12 Start refitting by pushing the lower arm into position in the subframe.
13 Fit the two pivot bolts, then hold the lower arm in a horizontal position, and tighten the bolts to the specified torque. Note that the rear bolt must be tightened in stages, see Specifications.
14 Reconnect the lower arm to suspension strut balljoint, and tighten the castellated nut to the specified torque. Secure the nut with a new locking pin.
15 Reconnect the end of the anti-roll bar to the lower arm, noting that the dished washer that retain the mounting rubbers should be fitted with their concave sides facing towards the lower arm. Note that on certain models, nylock type nuts are used to secure the anti-roll bar to the lower arms, these nuts should be renewed on refitting.
16 Tighten the anti-roll bar to lower arm nuts to give the specified rubber bush compression shown **(see illustration)**. If necessary, renew the rubber bushes.
17 Refit the roadwheel and lower the vehicle to the ground. Finally tighten the roadwheel bolts with the vehicle resting on its wheels, and where applicable, refit the wheel trim.
18 Check and if necessary adjust the front wheel alignment, as described in Section 45.

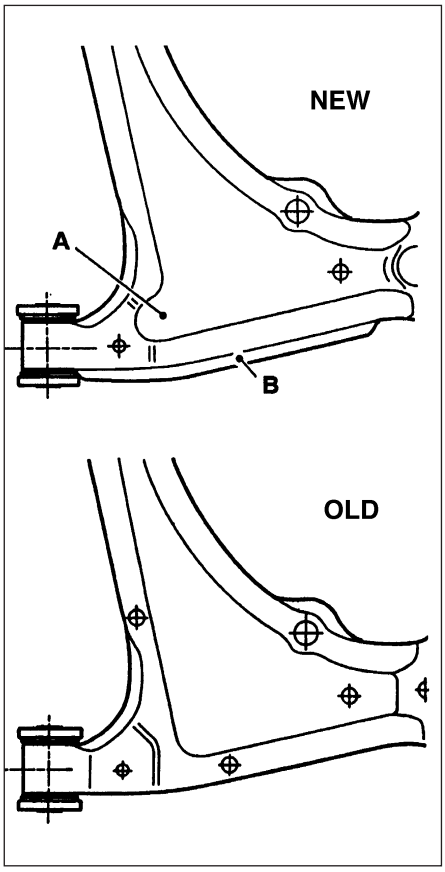
6 Front suspension lower arm bushes - renewal

Removal

1 Remove the lower arm, (Section 5).
2 The bushes are a tight fit in the lower arm, and must be pressed out.
3 If a press is not available, the bushes can be drawn out using a long bolt, nut, washers and a socket or length of metal tubing.
4 The vertical bush should be pressed out through the top of the lower arm, from below, and the horizontal bush should be pressed out towards the front of the lower arm, from the rear.

Refitting

5 Lubricate the new bushes using soapy water, then fit them to the lower arm, reversing the method described in paragraph 3.
6 The new vertical bush should be pressed into the lower arm from below, and the new horizontal bush should be pressed into the lower arm from front to rear. The horizontal bush should project from the lower arm equally at both ends.
7 Refit the lower arm, as described in Section 5.



5.10 Modified front suspension lower arm

A Modified inner profile
B Strengthening flange along seam

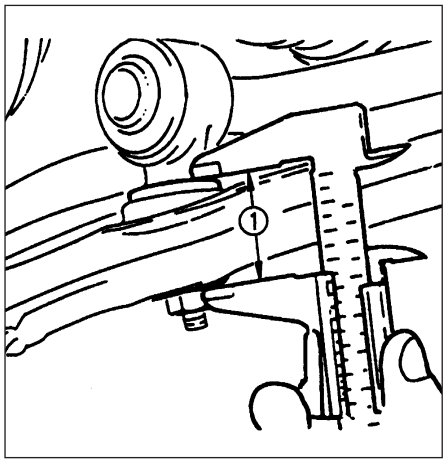
7 Front suspension lower arm balljoint - removal and refitting

Removal

1 Remove the lower arm, as described in Section 5.
2 Mount the lower arm in a vice, then drill the heads from the three rivets that secure the balljoint to the lower arm, using a 12.0 mm (0.47 in) diameter drill.
3 If necessary, tap the rivets from the lower arm, then remove the balljoint.

Refitting

4 The new balljoint should be fitted using three special bolts, spring washers and nuts, available from a Vauxhall parts centre.
5 Ensure that the balljoint is fitted the correct way up, noting that the securing nuts should be positioned on the underside of the lower arm.
6 Tighten the balljoint to lower arm nuts to the specified torque.
7 Refit the lower arm, as described in Section 5.



5.16 Front anti-roll bar rubber bush compression

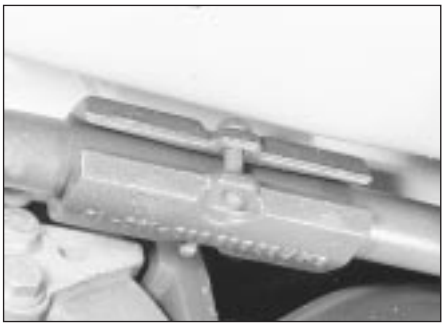
1 38.0 to 39.0 mm

8 Front anti-roll bar - removal and refitting

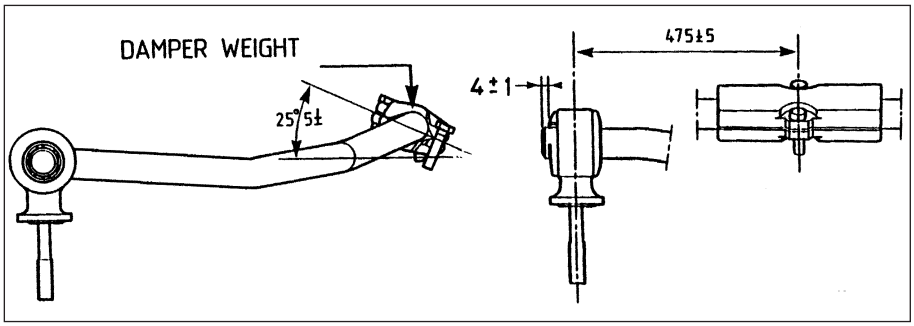
Note: *Where applicable, the nylock type nuts securing the anti-roll bar to the lower arms must be renewed on refitting*

Removal

1 Support the engine, and raise the vehicle as described in Section 3, paragraph's 2 and 3.
2 If desired, remove the front section of the exhaust system, with reference to Chapter 4C.
3 Working under the vehicle, unscrew and remove the locknuts securing the ends of the anti-roll bar to the lower arms. Recover the dished washers and mounting rubbers.
4 Ensure that the engine is adequately supported, then unscrew and remove the two nuts and washers securing the engine/transmission rear mounting to the subframe.
5 Support the subframe on a trolley jack, with an interposed wooden beam to spread the load.
6 Unscrew and remove the two rear and two centre bolts securing the subframe to the vehicle underbody. Note that the rear bolts also secure the lower arms to the subframe. The bolts are very tight, and an extension bar will probably be required to loosen them.
7 Loosen, but do not remove the two front subframe to underbody securing bolts.
8 Carefully lower the subframe until the anti-roll bar to subframe bolts are accessible, then unscrew and remove the bolts.
9 Lift the anti-roll bar from the subframe and the lower arms, and withdraw it from the vehicle.



8.10A Front anti-roll bar damper weight



8.10B Correct position of front anti-roll bar damper weight
(All dimensions in mm)

Refitting

10 Note that on certain models, a damper weight is fitted to the centre of the anti-roll bar **(see illustration)**. If the anti-roll bar is to be renewed, the damper weight (where applicable) must be transferred to the new component, and positioned as shown **(see illustration)**.

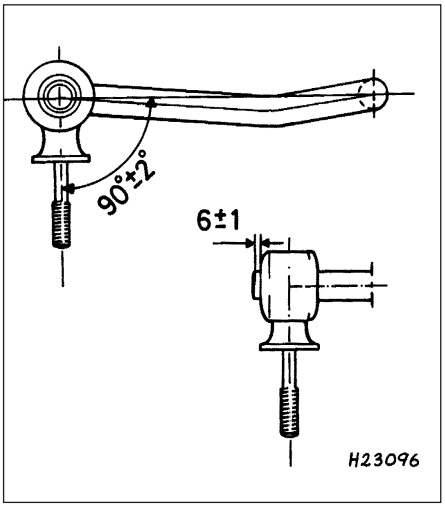
11 If desired, the anti-roll bar mounting bushes can be renewed, (Section 9).

12 Refitting is a reversal of removal, remembering the following points.

13 Reconnect the ends of the anti-roll bar to the lower arm, noting that the dished washers that retain the mounting rubbers should be fitted with their concave sides facing towards the lower arm. Note that on certain models, nylock type nuts are used to secure the anti-roll bar to the lower arms, these nuts should be renewed on refitting.

14 Tighten the anti-roll bar to lower arm nuts to give the specified rubber bush compression, as described in Section 5, paragraph 16. If necessary, renew the rubber bushes.

15 Tighten all nuts and bolts to the specified torques, noting that the rear subframe to underbody bolts must be tightened in stages, see Specifications.



9.7 Correct position of end link on front anti-roll bar
(Dimensions in mm)

16 Where applicable, refit the front section of the exhaust with reference to Chapter 4C.

17 Finally tighten the roadwheel bolts when the vehicle is resting on its wheels, and where applicable, refit the wheel trims.

9 Front anti-roll bar bushes - renewal

1 Remove the anti-roll bar, (Section 8).

2 To renew an anti-roll bar end mounting bush, mount the anti-roll bar in a vice, then light hammer blows on a drift, drive the end link from the anti-roll bar.

3 The bush can now be prised from the end link, using a screwdriver or similar tool.

4 Lubricate the new bush with a little soapy water to aid fitting, then press it into place in the end link.

5 If necessary, repeat the procedure on the remaining end link.

6 With either end link removed, the anti-roll bar to subframe mounting bushes can be renewed if desired, by sliding the bushes along the bar and manipulating them until they can be withdrawn from the end of the bar. Fit the new bushes in the same way.

7 Press or drive the end link(s) onto the anti-roll bar to the position shown **(see illustration)**.

8 Before refitting the anti-roll bar, examine the anti-roll bar to lower arm bushes, and renew if necessary.

9 Refit the anti-roll bar, (Section 8).

10.2 Removing the dust cover from the rear hub - model with rear disc brakes

10 Rear wheel bearing (SOHC models) - adjustment

Note: *A new split pin must be used to secure the hub nut on completion of adjustment*

1 Where applicable, remove the wheel trim, then loosen the rear roadwheel bolts on the relevant side of the vehicle. Chock the front wheels, then jack up the rear of the vehicle, and support securely on axle stands (see "*Jacking and Vehicle Support*") positioned under the body side members. Remove the roadwheel.

2 Prise the dust cover from the centre of the hub **(see illustration)**.

3 Extract the split pin from the end of the stub axle, then loosen the hub nut.

4 Tighten the hub nut to a torque of 25 Nm (18 lbf ft), whilst simultaneously turning the hub.

5 Gradually loosen the hub nut until the spacer washer under the nut can just be moved with a screwdriver, without levering on the hub **(see illustration)**.

6 If the split pin hole in the stub axle is not aligned with any of the slots in the hub nut, tighten the nut until the nearest slots align. Then check that the spacer washer can still be moved as described in paragraph 5. If the washer cannot be moved, slacken the nut until the nearest slots in the nut align with the split pin hole.

7 Secure the hub nut using a new split pin, then refit the dust cover to the centre of the hub.

10.5 Loosen rear hub nut until spacer washer can be moved with a screwdriver - model with rear disc brakes

8 Refit the roadwheel and lower the vehicle to the ground. Finally tighten the roadwheel bolts with the vehicle resting on its wheels, and where applicable, refit the wheel trim.

11 Rear wheel bearing (SOHC models, up to mid-1993) - renewal

Note: *The rear hub oil seal must be renewed on reassembly*

1 If wear in the bearings is evident, indicated by a rumbling sound when the wheel is spun, or a noticeable roughness if the wheel is turned slowly, then the bearings should be renewed as follows. Note that each hub runs on two taper roller bearings, and both the inner and outer bearing should be renewed if wear is evident.

2 Remove the hub, (Section 13).

3 If the outer bearing inner race is still in the hub, prise it out using a screwdriver.

4 Prise the oil seal from the inner end of the hub, and extract the inner bearing inner race **(see illustration)**.

5 Support the hub on blocks or in a vice, then press or drive out the bearing outer races.

6 Thoroughly clean the internal bore of the hub with paraffin or a solvent.

7 Before fitting the new bearings, remove any burrs that may be present in the bore of the hub, using a fine file or scraper.

8 Fit the new bearing outer races, with the larger internal diameters of the races facing outwards from the centre of the hub. Press or tap the races into position, using a metal tube. Take care to keep the races square in the hub bore as they are installed, otherwise they may jam and crack.

9 Pack the bearing races with lithium based grease, and apply a liberal quantity of grease to the space in the hub between the bearing races.

10 Place the inner bearing inner race in position, lubricate the lip of a new oil seal, and tap the seal squarely into place, using a tube or a piece of wood.

11 Refit the hub, and adjust the wheel bearing play, as described in Sections 13 and 10 respectively.

12 Rear hub and wheel bearings (from mid-1993) - removal and refitting

Note: *The hub unit securing nuts must be renewed on refitting*

Removal

1 From 1993-on, all Cavalier models are fitted with a maintenance free rear hub and wheel bearing assembly **(see illustration)**.

2 On these models, the stub axle, hub and wheel bearing are all one assembly. No adjustment is required as the bearing is sealed for life.

11.4 Prise the oil seal from the inner end of the hub - model with rear disc brakes

3 To remove the rear hub, remove the wheel trim, where applicable, then loosen the relevant rear roadwheel bolts and chock the front wheels. Jack up the rear of the vehicle and support on axle stands (see "*Jacking and Vehicle Support*") positioned under the body side members. Remove the roadwheel.

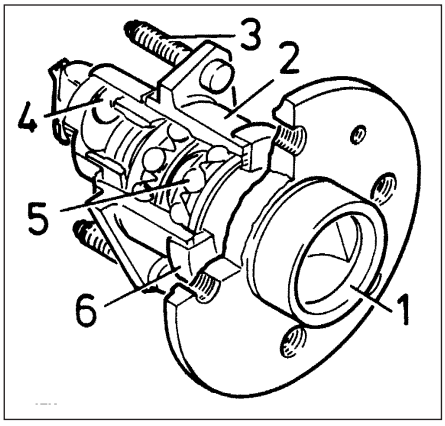
4 Remove the rear disc caliper as described in Chapter 9. The caliper can be suspended out of the way, using wire or string, to avoid the need to disconnect the hydraulic fluid pipe.

5 Disconnect the return spring from the handbrake shoe lever and the brake backplate.

6 Undo the retaining screw and lift off the brake disc.

7 Disconnect the ABS sensor wiring plug at the rear of the hub assembly.

8 Unscrew the four securing nuts and withdraw the hub assembly complete with backplate. Detach the handbrake cable from the handbrake shoe lever as the hub assembly is withdrawn.



12.1 Maintenance-free hub and wheel bearing assembly - later models with ABS

1 Hub
2 Stub axle
3 Threaded bolt
4 Dust cap with integral ABS wheel speed sensor
5 Bearings
6 Oil seal

Refitting

9 Refitting is a reversal of removal, remembering the following points.

10 New hub assembly securing nuts must be used, and they must be tightened in the stages given in the Specifications. Note that a socket extension and a universal joint may be required to enable the use of a torque angle gauge.

11 Make sure that the handbrake cable and return spring are correctly reconnected.

12 With the brake disc in place, refit the disc caliper as described in Chapter 8.

13 Before refitting the roadwheel and lowering the vehicle to the ground, check the handbrake cable adjustment as described in Chapter 9.

13 Rear hub (SOHC models) - removal and refitting

Note: *A new split pin must be used to secure the hub nut on refitting*

Models with rear drum brakes

Removal

1 Where applicable, remove the wheel trim, then loosen the rear roadwheel bolts on the relevant side of the vehicle. Chock the front wheels, then jack up the rear of the vehicle, and support securely on axle stands (see "*Jacking and Vehicle Support*") positioned under the body side members. Remove the roadwheel.

2 Remove the brake drum, with reference to Chapter 9.

3 Prise the dust cover from the centre of the hub.

4 Extract the split pin from the end of the stub axle, then unscrew the hub nut. If the hub nut is tight, counterhold the hub by refitting two roadwheel bolts and inserting a long screwdriver or similar tool between them, although this should not prove necessary unless the nut has been overtightened.

5 Remove the hub nut and the thrustwasher from the stub axle, then withdraw the hub. Be prepared to catch the outer wheel bearing inner race, which may drop out of the hub as it is removed.

Refitting

6 Begin refitting by placing the hub and the outer wheel bearing inner race on the stub axle. Take care not to damage the oil seal at the inner end of the hub.

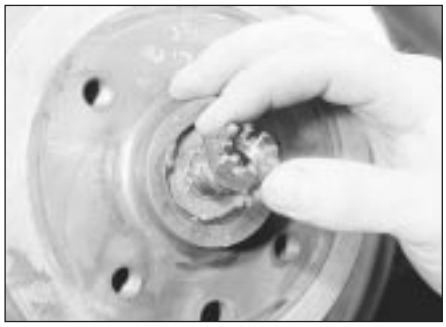
7 Fit the thrustwasher and the hub nut, then adjust the wheel bearing play, as described in Section 10, paragraphs 4 to 6 inclusive.

8 Secure the hub nut using a new split pin, then refit the dust cover to the centre of the hub.

9 Refit the brake drum, with reference to Chapter 9, and check the handbrake adjustment, as described in Chapter 9.

13.16 Refit the hub/disc . . .

13.17A . . . the thrustwasher . . .



13.17B . . . and the hub nut - model with rear disc brakes

10 Finally tighten the roadwheel bolts when the vehicle has been lowered to the ground, and where applicable, refit the wheel trim.

Models with rear disc brakes

Removal

11 On models with rear disc brakes, the hub is integral with the brake disc.
12 Proceed as described in paragraph 1.
13 Remove the brake caliper, as described in Chapter 9, but leave the hydraulic fluid pipe connected. Move the caliper to one side, and suspend it using wire or string to avoid straining the pipe.
14 Proceed as described in paragraphs 3 and 4.
15 Remove the hub nut and the spacer washer from the stub axle, then withdraw the hub/disc. If the hub/disc is tight, collapse the handbrake shoes, by inserting a screwdriver through the adjuster hole in the hub/disc and turning the adjuster wheel. Be prepared to catch the outer wheel bearing inner race, which may drop out of the hub/disc as it is removed.

Refitting

16 Begin refitting by placing the hub/disc and the outer wheel bearing inner race on the stub axle **(see illustration)**. Take care not to damage the oil seal at the inner end of the hub/disc. If necessary, slacken off the brake shoe adjuster wheel, to allow the hub/disc to pass over the brake shoes.
17 Proceed as described in paragraphs 7 and 8 **(see illustrations)**.

14.4 Unscrewing a rear shock absorber top mounting nut - Hatchback model

18 Check the handbrake adjustment, as described in Chapter 9, then refit the brake caliper, as described in Chapter 9.
19 Finally tighten the roadwheel bolts when the vehicle has been lowered to the ground, and where applicable, refit the wheel trim.

14 Rear shock absorber - removal and refitting

Removal

1 On SOHC models, it is important to note that only one shock absorber should be removed at a time. Note that shock absorbers should be renewed in pairs.
2 On models with manual rear suspension level control, depressurise the system, by releasing the air through the valve in the luggage compartment.
3 Working in the luggage compartment, prise off the cap that covers the shock absorber top mounting. On Hatchback models, pull back the flap covering the first aid kit and warning triangle storage compartment for access to the right hand shock absorber.
4 Counterhold the shock absorber piston rod, and unscrew the shock absorber top mounting nut **(see illustration)**. Remove the washer and the upper mounting rubber.
5 Drive the rear wheels up onto ramps, and chock the front wheels. Alternatively, chock the front wheels, then jack up the rear of the vehicle, and support securely on axle stands (see "*Jacking and Vehicle Support*") placed under the body side members. If the vehicle is jacked up, the relevant trailing arm (semi-trailing arm DOHC models) must be supported with a jack as the vehicle is raised.
6 Working under the rear of the vehicle, where applicable, disconnect the manual suspension level control air line from the shock absorber.
7 Unscrew and remove the bolt and washer securing the lower end of the shock absorber to the trailing arm (semi-trailing arm on DOHC models), **(see illustration)**.
8 On SOHC models, compress the shock absorber by hand, if necessary prising the lower end to free it from the trailing arm.
9 Withdraw the shock absorber from under the vehicle, and recover the lower mounting rubber and cup from the top of the shock absorber.
10 The shock absorber can be tested by clamping the lower mounting eye in a vice, then fully extracting and contracting the shock absorber several times. Any evidence of jerky movement or lack of resistance indicates the need for renewal.

Refitting

11 Before refitting the shock absorber, examine the mounting rubbers for wear or damage, and renew if necessary.
12 Refitting is a reversal of removal, remembering the following points.
13 Where applicable, ensure that the shock absorber is fitted with the air line union facing the correct way round.
14 Tighten the shock absorber lower mounting bolt to the specified torque.
15 On models with manual rear suspension level control, pressurise the system to 0.8 bar (12.0 lbf/in^2), and check for air leaks.

15 Rear shock absorber mounting rubbers - renewal

1 The shock absorber top mounting rubbers can be renewed without removing the shock absorber as follows. On SOHC models, it is important to note that, due to the design of the rear suspension, only one shock absorber should be disconnected at a time.

14.7 Unscrewing a rear shock absorber lower mounting bolt - SOHC models

2 Proceed as described in Section 14, paragraphs 2 to 4 inclusive.
3 Keeping the roadwheels resting on the ground, jack up the rear of the vehicle slightly, to enable the shock absorber to be compressed sufficiently by hand to release the top mounting from the body.
4 Remove the lower mounting rubber from the top of the shock absorber.
5 Fit the new mounting rubbers using a reversal of the removal procedure.
6 On models with manual rear suspension level control, pressurise the system to 0.8 bar (12.0 lbf/) on completion.

16 Rear suspension coil spring (SOHC models) - removal and refitting

Removal

1 Due to the design of the rear suspension, it is important to note that only one coil spring should be removed at a time. Note that rear springs should be renewed in pairs, and if the springs are to be renewed, it is advisable to renew the spring damping rubbers at the same time.
2 On models with manual rear suspension level control, depressurise the system by releasing the air through the valve in the luggage compartment.
3 Chock the front wheels, then jack up the rear of the vehicle, and support securely on axle stands (see "*Jacking and Vehicle Support*") placed under the body side members.
4 Raise the relevant trailing arm slightly ,using a jack.
5 Unscrew and remove the bolt and washer securing the lower end of the shock absorbers to the trailing arm, and free the lower end of the shock absorber.
6 Carefully lower the jack supporting the trailing arm, and remove the coil spring and its damping rubbers. Lever the trailing arm downwards slightly if necessary to remove the spring.

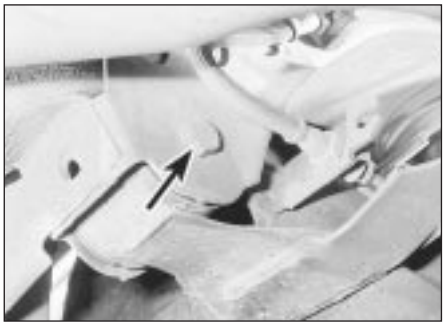
Refitting

7 Refitting is a reversal of removal, ensuring that the spring locates correctly on the trailing arm and the underbody.
8 Tighten the shock absorber lower mounting bolt to the specified torque.
9 If the springs are being renewed, repeat the procedure on the remaining side of the vehicle.
10 On models with manual rear suspension level control, pressurise the system to 0.8 bar on completion.

17 Rear suspension trailing arms assembly (SOHC models) - removal and refitting

Removal

1 Where applicable, remove the wheel trims, then loosen the rear roadwheel bolts on both sides of the vehicle. Chock the front wheels, then jack up the rear of the vehicle, and support securely on axle stands (see "*Jacking and Vehicle Support*") positioned under the body side members. Remove the rear roadwheels.
2 On models with manual rear suspension level control, depressurise the system by releasing the air through the valve in the luggage compartment.
3 On models with a catalytic converter, unbolt and remove the exhaust heat shield.
4 Measure the length of the thread projecting from the handbrake cable adjuster on the torsion beam, then loosen the adjuster nut to slacken the cable.
5 Disconnect the rear section of the handbrake cable from the underbody cable joiner bracket, and unclip the cable from the underbody.
6 Working in the engine compartment, remove the filler cap from the brake hydraulic fluid reservoir, then place a piece of polythene across the top of the reservoir filler hole, and refit the filler cap. This will minimise fluid loss when the brake lines are disconnected.
7 Disconnect the flexible hoses from the rigid brake pipes at the front edge of each trailing arm. Be prepared for fluid loss, and plug the open ends of the pipes and hoses, to prevent ingress of dirt and further fluid loss.
8 Where applicable, unbolt the ABS sensor brackets, and release the wiring from the brackets on the trailing arms. Support the sensor bracket by suspending with wire or string from the vehicle underbody.
9 Loosen, but do not remove, the nuts and bolts securing the front ends of the trailing arms to the vehicle underbody **(see illustration)**.
10 Support the torsion beam with a trolley jack and interposed block of wood. Position the jack securely under the centre of the torsion beam.

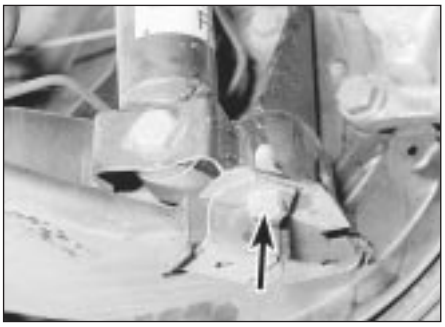


17.9 Trailing arm securing bolt (arrowed)

11 Unscrew and remove the bolts securing the lower ends of the shock absorbers to the trailing arms, then gently lower the jack supporting the torsion beam.
12 Remove the coil springs, referring to Section 16, if necessary.
13 Ensure that the torsion beam is adequately supported, then remove the nuts and bolts securing the front ends of the trailing arms to the vehicle underbody. The help of an assistant will greatly ease this task. Ensure that the torsion beam does not slip off the jack.
14 Withdraw the torsion beam/trailing arms assembly from under the rear of the vehicle.
15 If desired, the brake components can be removed from the trailing arms. The stub axles can be removed with reference to Section 20, and where applicable, the anti-roll bar can be removed with reference to Section 18.
16 If necessary, the trailing arm bushes can be renewed, with reference to Section 19.

Refitting

17 Begin reassembly by refitting any components that were removed from the torsion beam/trailing arms assembly, with reference to the relevant Sections of this Chapter and/or Chapter 9, as applicable.
18 Support the torsion beam/trailing arms assembly on the trolley jack, and position the assembly under the rear of the vehicle.
19 Raise the jack, and fit the bolts and nuts that secure the front ends of the trailing arms to the underbody. Do not fully tighten the fixings at this stage.
20 Refit the coil springs, referring to Section 16 if necessary.
21 Raise the rear ends of the trailing arms, and refit the bolts securing the lower ends of the shock absorbers. Tighten the bolts to the specified torque. Withdraw the jack from under the rear of the vehicle.
22 Where applicable, refit the ABS sensor brackets, and refit the wiring to the brackets on the trailing arms.
23 Remove the plugs from the brake pipes and hoses, and reconnect the unions.
24 Reconnect the handbrake cable to the underbody cable joiner bracket, and refit the cable to the underbody clip(s).
25 Tighten the handbrake cable adjuster nut to expose the length of thread measured during removal, then adjust the handbrake cable, as described in Chapter 9.
26 On models with a catalytic converter, refit the exhaust heat shield.
27 Refit the rear roadwheels, then lower the vehicle to the ground and finally tighten the roadwheel bolts. Where applicable, refit the wheel trims, and remove the chocks from the front wheels.
28 On models with manual rear suspension level control, pressurise the system to 0.8 bar.
29 Ensure that the vehicle is parked on level ground, then with the equivalent of a load of 70.0 kg in each front seat, "bounce" the vehicle to settle the suspension.



18.2 Rear anti-roll bar to trailing arm securing bolt (arrowed)

18.3 Rear anti-roll bar clamp

30 Without disturbing the position of the vehicle, place chocks at the front and rear edges of the front wheels, to prevent the vehicle from moving.
31 Working under the rear of the vehicle, tighten the fixings securing the front ends of the trailing arms to the underbody to the specified torque.
32 Finally, recheck the handbrake cable adjustment, then remove the polythene from beneath the brake hydraulic fluid reservoir cap, and bleed the brake hydraulic system, as described in Chapter 9.

18 Rear anti-roll bar (SOHC models) - removal and refitting

Removal

1 Chock the front wheels, then jack up the rear of the vehicle, and support securely on axle stands (see "*Jacking and Vehicle Support*") placed under the body side members.
2 Unscrew and remove the nuts and bolts securing the ends of the anti-roll bar to the trailing arms **(see illustration)**.
3 Unscrew and remove the nuts and bolts securing the anti-roll bar clamps to the torsion beam, and withdraw the anti-roll bar from the vehicle **(see illustration)**.
4 Examine the anti-roll bar mounting bushes for wear or damage, and renew as necessary.
5 To renew the bushes, slide them from the ends of the anti-roll bar.

Refitting

6 Refitting is a reversal of removal.
7 Tighten all fixings to the specified torque.

19 Rear suspension trailing arm bushes (SOHC models) - renewal

1 The trailing arm bushes can be renewed without removing the torsion beam/trailing arms assembly from the vehicle, as follows.
2 Proceed as described in Section 17, paragraphs 1 and 2.
3 Unclip the flexible hoses and the rear ends of the rigid brake pipes from the vehicle underbody.
4 Support the torsion beam with a trolley jack and interposed block of wood. Position the jack under the centre of the torsion beam.
5 Unscrew and remove the nuts and bolts securing the trailing arms to the underbody.
6 Gently lower the jack until the trailing arm bushes are accessible, then support the torsion beam on axle stands. Take care not to strain the brake pipes.
7 A special Vauxhall tool is available for removal and fitting of the bushes, but an alternative can be improvised using a long bolt, nut, washers, and a length metal tubing or a socket.
8 Before removing a bush, cut the flange from the inner end of the bush using a sharp knife, **(see illustration)**.
9 Removal of the bush will be made easier if the bush housing in the trailing arm is heated to approximately 70°C (158°F) using a heat gun or a hair dryer. Do not use a naked flame, due to the proximity of the fuel tank.
10 Draw the bush from the trailing arm, using the tool described in paragraph 7.
11 Lubricate the new bush with a little soapy water, then draw it into position, ensuring that the mouldings in the end of the bush are positioned as shown **(see illustration)**.
12 Repeat the procedure on the remaining trailing arm. The bushes should always be renewed in pairs.
13 Raise the torsion beam using the jack, and fit the bolts and nuts that secure the front ends of the trailing arms to the underbody. Do not fully tighten the fixings at this stage. Withdraw the axle stands.
14 Clip the rigid brake pipes and the flexible hoses to the vehicle underbody.
15 Proceed as described in Section 17, paragraphs 27 to 31 inclusive.

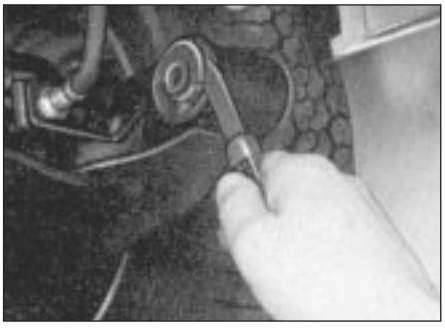
20 Rear stub axle (SOHC models) - removal and refitting

Removal

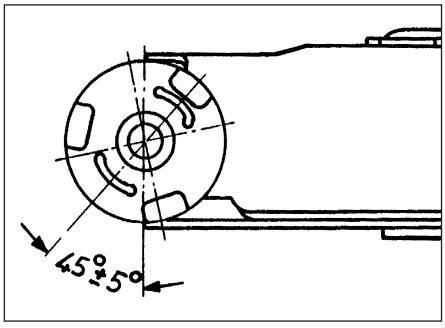
1 Remove the relevant rear hub, as described in Section 13.
2 Working behind the brake backplate, unscrew and remove the four bolts securing the stub axle and the brake backplate to the trailing arm **(see illustration)**. Support the backplate as the bolts are removed, and once the stub axle is free, refit the bolts to locate the backplate, thus avoiding unnecessary strain on the brake fluid pipe.

Refitting

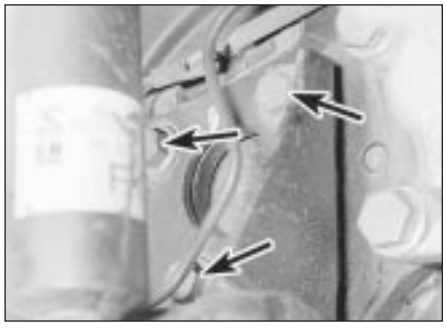
3 Refitting is a reversal of removal, but coat the rear face of the stub axle flange where it contacts the brake backplate with a little lithium based grease, and refit the rear hub as described in Section 13.
4 Tighten the stub axle/brake backplate securing bolts to the specified torque in the stages given in the Specifications.



19.8 Cutting inner flange from trailing arm bush - SOHC models



19.11 Trailing arm bush positioning - SOHC models



20.2 Three of the four stub axle to trailing arm securing bolts (arrowed)

21 Rear suspension level control system - adjustment

1 With the vehicle unladen, use a tyre pressure gauge on the air valve to check that the system pressure is 0.8 bar. Adjust if necessary.
2 With the vehicle standing on a level surface, measure the distance from the centre of the rear bumper to the ground. Subtract 50.0 mm (2.0 in) from the distance measured, and note the new value.
3 Load the vehicle, and if necessary the pressure in the system until the noted value for the bumper height is reached. Do not exceed a pressure of 5.0 bar.
4 After unloading the vehicle, depressurise the system to restore the originally measured bumper height, observing the minimum permissible pressure of 0.8 bar.
5 Do not drive an unladen vehicle with the system fully inflated.

22 Rear suspension level control system components - removal and refitting

Air valve

Removal

1 Working in the luggage compartment, pull back the floor covering for access to the air valve.
2 Fully depressurise the system.
3 Remove the cap and the retaining sleeve from the valve, then compress the retaining lugs and push the valve downwards, taking care not to damage the air lines.
4 Unscrew the air line unions from the valve, and then withdraw the valve from the vehicle.

Refitting

5 Refitting is a reversal of removal, but on completion, pressurise the system and check for air leaks.

Air lines

Removal

6 To remove an air line, first fully depressurise the system.
7 Unscrew the unions at the shock absorber and air valve, then release the air line from the clips on the vehicle underbody.

Refitting

8 Refitting is a reversal of removal, but on completion, pressurise the system and check for air leaks.

Shock absorber

9 Removal and refitting of the shock absorbers is covered in Section 14.

23.6A Prise out the plastic cover (arrowed) . . .

23.6B . . . for access to the rear hub nut - DOHC models

23 Rear wheel bearing (DOHC models) - renewal

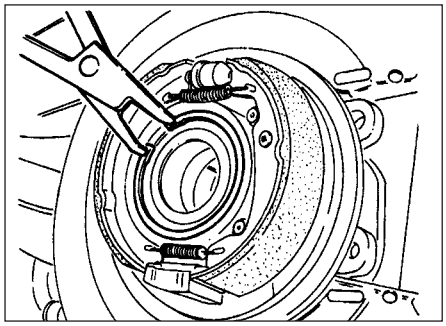
Note: *This is a difficult operation, and it is suggested that this Section is read carefully before beginning work. A torque wrench capable of measuring the high torque of the rear hub nut and a puller will be required. A new hub nut and locking collar must be used on reassembly*

Removal

1 Loosen the relevant rear roadwheel bolts, chock the front wheels, then jack up the rear of the vehicle, and support securely on axle stands (see "*Jacking and Vehicle Support*") positioned under the body side members. Remove the roadwheels.
2 Remove the locking clip and release the brake fluid line from the bracket on the semi-trailing arm. Note that the locking clip also supports the ABS sensor wire.
3 Unscrew the securing bolts, and withdraw the brake caliper and the ABS sensor bracket from the brake backplate. Support the caliper and the ABS sensor bracket out of the way, by suspending with string or wire from the vehicle underbody.
4 Remove the securing screw and withdraw the brake disc. If necessary, retract the handbrake shoes to enable the disc to be removed, by turning the adjuster with a screwdriver inserted through one of the unthreaded holes in the disc, see Chapter 9.
5 Using a splined key inserted through one of the unthreaded holes in the hub flange, unscrew the four brake backplate securing bolts. Note that the upper bolts are shorter than the lower bolts, and are fitted with locking plates.
6 Prise out the plastic cover from the rear of the ABS toothed sensor wheel, to expose the rear hub nut **(see illustrations)**.
7 Relieve the staking on the hub nut locking collar, then prise the locking collar from the ABS sensor wheel.
8 Screw two wheel bolts into the hub flange, and use a long metal bar between the bolts to hold the hub stationary, then unscrew the hub nut using a socket and extension bar. Note that the hub nut is extremely tight.
9 Pull the ABS sensor wheel from the hub, if necessary using a three legged puller.
10 Press the rear hub outwards from the bearing, using a puller attached to the semi-trailing arm. Note that the inner bearing track may stay on the hub as it is removed.
11 Extract the bearing retaining circlip from the outer edge of the semi-trailing arm **(see illustration)**. Then press or drive out the bearing, applying pressure to the bearing outer race. If desired, the bearing can be removed in the same way as the rear hub using a puller, again noting that pressure must be applied to the bearing outer race.
12 If the inner bearing race has remained on the hub, remove it using a puller.

Refitting

13 Clean all components, and examine them for wear and damage.
14 Begin reassembly by pressing the new bearing into the semi-trailing arm, using pressure on the bearing outer track. If necessary, a tube or socket with a long bolt, nut and washers may be used to draw the bearing into position. Press the bearing into the semi-trailing arm until it rests against the shoulder.
15 Fit the bearing retaining circlip, ensuring that it seats correctly in its groove.
16 Have an assistant support the bearing inner track at the inner end of the semi-trailing arm using a metal tube, then carefully drive in the rear hub from outside. Do not use excessively sharp blows, as the bearing is easily damaged.



23.11 Extracting the rear hub bearing retaining circlip - DOHC models

17 Fit the ABS sensor wheel to the inner end of the hub. If necessary, have an assistant support the outer end of the hub, and drive the sensor wheel fully home from the inside. Take care not to damage the teeth on the sensor wheel.
18 Fit a new hub nut and tighten it to the specified torque, holding the hub stationary as during removal.
19 Fit a new locking collar to the hub nut, and stake it to the ABS sensor wheel.
20 Refit the plastic cover to the rear of the ABS sensor wheel.
21 Refit the brake backplate securing bolts, and tighten them to the specified torque. Ensure that the shorter bolts are fitted to the top of the plate, and make sure that the locking plates are fitted.
22 Refit the brake disc and tighten its securing screw, then operate the handbrake several times to operate the adjuster mechanism and bring the shoes to their correct seat position.
23 Refit the brake caliper and the ABS sensor bracket to the bracket backplate, and tighten the securing bolts to the specified torque.
24 Reconnect the brake fluid line to its bracket on the semi-trailing arm, and secure with the locking clip.
25 Refit the roadwheel, then lower the vehicle to the ground. Finally tighten the roadwheel bolts with the vehicle resting on its wheels.

24 Rear hub (DOHC models) - removal and refitting

Removal

1 Removal and refitting of the rear hub is described in Section 23, as part of the wheel bearing renewal procedure.
2 Note that the wheel bearing will almost certainly be destroyed during removal of the hub, and must therefore be renewed.

Refitting

3 Refer to the note at the beginning of Section 23 before proceeding.

25 Rear suspension coil spring (DOHC models) - removal and refitting

Removal

1 Note that the rear springs should be renewed in pairs, and if the springs are to be renewed, it is advisable to renew the spring damping rubbers at the same time.
2 Chock the front wheels, jack up the rear of the vehicle, and support securely on axle stands positioned under the body side members.
3 Working under the rear of the vehicle, remove the locking clips and release the brake fluid lines from their brackets on either side of the vehicle underbody. Note that the locking clips also support the ABS sensor wires.
4 Working on each side of the vehicle in turn, support the semi-trailing arm with a trolley jack, then unscrew and remove the bolt and washer securing the lower end of the shock absorber to the semi-trailing arm. Carefully lower the trolley jack, and withdraw it once the shock absorber as been disconnected from the semi-trailing arm.
5 Disconnect the fuel outlet hose from the fuel filter, located on the right hand side of the underbody in front of the fuel tank. Be prepared for fuel spillage, and take adequate fire precautions. Plug the open ends of the filter and hose, to prevent further fuel spillage and dirt ingress.
6 Support the rear plate of the rear suspension crossmember with a trolley jack, then unscrew and remove the two securing bolts from the crossmember rear tube.
7 Carefully lower the trolley jack supporting the crossmember rear plate, taking care not to strain any of the hoses, pipes or wires, until the coil springs and their rubber dampers can be withdrawn. Note the orientation of the springs as they are removed.

Refitting

8 Begin refitting by positioning the springs and their seats between the semi-trailing arms and the underbody as noted during removal.
9 Carefully raise the jack supporting the crossmember rear plate, then refit the crossmember rear tube to underbody bolts, and tighten them to the specified torque.
10 Reconnect the fuel outlet hose to the fuel filter, and tighten the clamp screw.
11 Reconnect the shock absorbers to the semi-trailing arms, support the semi-trailing arms with a trolley jack as during removal. Tighten the securing bolts to the specified torque.
12 Refit the brake lines to the brackets on the underbody, and secure with the locking clips.
13 Lower the vehicle to the ground.

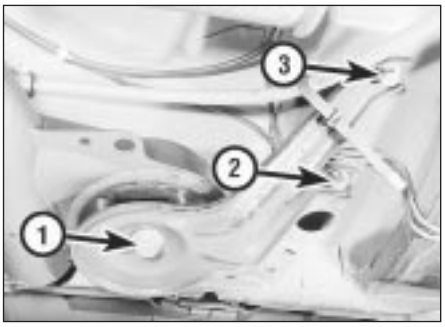
26 Rear suspension assembly (DOHC models) - removal and refitting

Removal

1 Loosen the rear roadwheel bolts, chock the front wheels, then jack up the rear of the vehicle, and support securely on axle stands (see "*Jacking and Vehicle Support*") positioned under the body side members. Remove the roadwheels.
2 Remove the rear half of the exhaust system (from the front expansion box rearwards), as described in Chapter 3.
3 Disconnect the handbrake cables and their return springs from the handbrake operating levers, with reference to Chapter 9.
4 Withdraw the handbrake cables from the brackets on the semi-trailing arms.
5 Remove the locking clips and release the brake fluid lines from their brackets on the semi-trailing arms. Note that the locking clips also support the ABS sensor wires **(see illustration)**.
6 Unscrew the securing bolts, and withdraw the brake calipers and the ABS sensor brackets from the brake backplates. Support the calipers and the ABS sensor brackets out of the way by suspending with string or wire from the vehicle underbody.
7 Working on each side of the vehicle in turn, support the semi-trailing arm with a trolley jack, then unscrew and remove the bolt and washer securing the lower end of the shock absorber to the semi-trailing arm. Carefully lower the trolley jack, and withdraw it once the shock absorber has been disconnected from the semi-trailing arm.
8 Disconnect the fuel outlet hose from the fuel filter, located on the right hand side of the underbody in front of the fuel tank. Be prepared for fuel spillage, and take adequate fire precautions. Plug the open ends of the filter and hose, to prevent further fuel spillage and dirt ingress.
9 Support the rear plate of the rear suspension crossmember with a trolley jack, then unscrew and remove the two securing bolts from the crossmember rear tube **(see illustration)**.

26.5 Brake fluid line/ABS sensor wire bracket and locking clip on semi-trailing arm - DOHC model

26.9 Rear suspension crossmember rear tube securing bolt - DOHC model



26.13 Forward crossmember fixings - DOHC model

1 Securing bolt
2 and 3 Crossmember mounting bracing bracket bolts

10 Carefully lower the trolley jack supporting the crossmember rear plate, until the coil springs and their rubber dampers can be withdrawn. Note the orientation of the springs as they are removed.
11 Make a check to ensure that all relevant hoses, pipes, cables and wires are clear of the rear suspension assembly.
12 With the weight of the rear suspension assembly supported on the trolley jack positioned under the crossmember rear plate, unscrew and remove the two forward crossmember securing bolts. Note that the bolts also pass through the crossmember mounting bracing brackets.
13 Unscrew and remove the two bolts in each case securing the crossmember mounting bracing brackets to the underbody. Then with the help of an assistant, carefully lower the rear suspension assembly and withdraw it from under the vehicle **(see illustration)**.
14 If desired, the assembly can be dismantled with reference to the relevant Sections of this Chapter.
15 The crossmember front mounting bushes can be renewed using a tube or socket, nut, bolt, washers and distance pieces as necessary to draw out the old bushes and fit the new ones. Lubricate the rear bushes with a little soapy water to aid fitting.

Refitting

16 Begin refitting by positioning the rear suspension assembly under the rear of the vehicle, and raising it (with the aid of an assistant) using a trolley jack positioned under the crossmember rear plate as during removal.
17 Refit the two forward crossmember securing bolts, ensuring that they also pass through the crossmember mounting bracing brackets, but do not fully tighten them at this stage.
18 Refit the crossmember mounting bracing bracket to underbody bolts and tighten them to the specified torque, then tighten the two forward crossmember securing bolts to the specified torque.
19 If necessary, lower the trolley jack supporting the crossmember rear plate, and refit the coil springs and their dampers between the semi-trailing arms and the underbody, as noted during removal.
20 Carefully raise the trolley jack supporting the crossmember rear plate, then fit the two crossmember rear tube securing bolts, and tighten them to the specified torque. Withdraw the trolley jack.
21 Reconnect the fuel outlet hose to the fuel filter, and tighten the clamp screw.
22 Working on each side of the vehicle in turn, raise the semi-trailing arm with a trolley jack to allow the lower shock absorber securing bolt and washer to be fitted. Tighten the bolts to the specified torque, then withdraw the trolley jack.
23 Refit the brake calipers and the ABS sensor brackets to the brake backplates, and tighten the securing bolts to the specified torque.
24 Reconnect the brake fluid lines to their brackets on the semi-trailing arms, and secure with the locking clips.
25 Refit the handbrake cables to their brackets on the semi-trailing arms, and reconnect the cable ends and return springs to the handbrake operating levers, then check the handbrake cable adjustment, as described in Chapter 9.
26 Refit the rear half of the exhaust system, with reference to Chapter 3.
27 Refit the roadwheels and lower the vehicle to the ground. Finally tighten the roadwheel bolts with the vehicle resting on its wheels.

27 Rear suspension semi-trailing arm (DOHC models) - removal and refitting

Removal

1 Loosen the relevant rear roadwheel bolts, chock the front wheels, then jack up the rear of the vehicle, and support securely on axle stands positioned under the body side members. Remove the roadwheel.
2 Working under the rear of the vehicle, remove the locking clip and release the brake fluid line from its bracket on the semi-trailing arm. Note that the locking clip also supports the ABS sensor wire.
3 Unscrew the two securing bolts, and withdraw the brake caliper and the ABS sensor bracket from the brake backplate. Support the caliper and the ABS sensor bracket out of the way by suspending with string or wire from the vehicle underbody.
4 Disconnect the handbrake cable and its return spring from the handbrake operating lever, with reference to Chapter 9.
5 Withdraw the handbrake cable from the bracket on the semi-trailing arm.
6 Disconnect the anti-roll bar end link from the semi-trailing arm, by unscrewing the single securing nut and bolt. Recover the rubber bush and the spacer sleeve.
7 Support the semi-trailing arm with a trolley jack, then unscrew and remove the bolt and washer securing the lower end of the shock absorber to the semi-trailing arm.
8 Carefully lower the trolley jack sufficiently to enable the coil spring and its rubber dampers to be withdrawn. Note the orientation of the spring as it is removed. Once the spring has been removed, withdraw the jack.
9 Check that all relevant hoses, pipes, cables and wires have been positioned clear of the semi-trailing arm.
10 Unscrew and remove the two self locking nuts and bolts securing the forward end of the semi-trailing arm to the suspension crossmember, then withdraw the semi-trailing arm from under the vehicle.
11 Refer to Section 23 for details of removal and refitting of the rear hub components.
12 The semi-trailing arm mounting bushes can be renewed using a tube or socket, nut, bolt, washers and distance pieces as necessary to draw out the old bushes and fit the new ones. To aid removal of the old bushes, the protruding ends of the bushes can be cut off using a sharp knife. Lubricate the new bushes with a little soapy water to aid fitting.

Refitting

13 Begin refitting by manipulating the forward end of the semi-trailing arm into position in the suspension crossmember brackets.
14 Fit the semi-trailing arm securing bolts, with new self-locking nuts, but do not fully tighten them at this stage. Note that the bolt heads must face each other.
15 Support the semi-trailing arm with a trolley jack, then refit the coil spring and its rubber dampers as noted during removal.
16 Carefully raise the trolley jack to allow the lower shock absorber securing bolt and washer to be fitted. Tighten the bolt to the specified torque then withdraw the trolley jack.
17 Refit the rubber bush and the spacer sleeve, and reconnect the anti-roll bar end link to the semi-trailing arm. Tighten the securing nut to the specified torque while counter-holding the bolt using a spanner.
18 Refit the handbrake cable to the bracket on the semi-trailing arm, and reconnect the cable end and return spring to the handbrake operating lever, then check the handbrake cable adjustment, as described in Chapter 9.
19 Refit the brake caliper and the ABS sensor bracket to the brake backplate, and tighten the securing bolts to the specified torque.
20 Reconnect the brake fluid line to its bracket on the semi-trailing arm, and secure with the locking clip.
21 Refit the roadwheel, then lower the vehicle to the ground. Finally tighten the roadwheel bolts with the vehicle resting on its wheels.
22 With the vehicle resting on its wheels, release the handbrake, and “bounce” the rear of the car to settle the suspension components.

23 Chock the front wheels, and load each front seat with the equivalent of 70 kg. Working under the rear of the vehicle, tighten the semi-trailing arm securing nuts (self-locking) to the specified torque, while counter-holding the bolts using a spanner.

28 Rear suspension crossmember (DOHC models) - removal and refitting

Removal and refitting of the rear suspension crossmember is described in Section 26, where the crossmember is removed as part of the complete rear suspension assembly.

The relevant components can then be removed from the crossmember, with reference to the relevant Sections of this Chapter.

29 Rear anti-roll bar (DOHC models) - removal and refitting

Removal

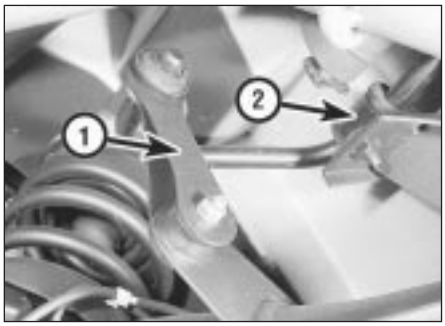
1 Chock the front wheels, then jack up the rear of the vehicle, and support securely on axle stands positioned under the body side members.

2 Working under the rear of the vehicle, remove the locking clips and release the brake fluid lines from their brackets on either side of the vehicle underbody. Note that the locking clips also support the ABS sensor wires.

3 Disconnect the fuel outlet hose from the fuel filter, located on the right hand side of the underbody in front of the fuel tank. Be prepared for fuel spillage, and take adequate fire precautions. Plug the open ends of the filter and hose, to prevent further fuel loss and dirt ingress.

4 Support the rear plate of the rear suspension crossmember using a trolley jack, then unscrew and remove the two securing bolts from the crossmember rear tube.

5 Carefully lower the trolley jack, taking care not to strain any of the hoses, pipes or wires, to allow access to the anti-roll bar to crossmember securing brackets.



29.7 Rear anti-roll bar fixings - DOHC model
1 End link 2 Clamp bracket

6 Disconnect the anti-roll bar end links from the semi-trailing arms by unscrewing the single securing nut and bolt in each case. Recover the rubber bushes and the spacer sleeves.

7 Unscrew and remove the two bolts securing the anti-roll bar clamp brackets to the suspension crossmember, and withdraw the anti-roll bar from the vehicle **(see illustration)**.

8 With the anti-roll bar removed from the vehicle, the end links can be removed by sliding them from the ends of the bar.

9 Examine the anti-roll bar mounting bushes for wear or damage, and renew as necessary.

10 If desired, the rubber bushes can be removed from the end links for renewal by pressing them out using a length of bar, or tube, nut, bolt and washers.

11 The mounting bushes that locate in the clamp brackets can be slid from the end of the anti-roll bar, after removal of one of the end links.

12 Lubricate the new bushes with soapy water to aid fitting.

13 Where applicable, refit the end links to the anti-roll bar.

Refitting

14 Begin refitting by positioning the anti-roll bar under the rear of the vehicle, and securing the end links. Use new rubber bushes and spacer sleeves, and tighten the nuts to the specified torque while counter-holding the bolts using a spanner.

15 Refit the clamps securing the anti-roll bar to the suspension crossmember, and tighten the securing bolts to the specified torque.

16 Carefully raise the jack supporting the crossmember, then refit the bolts securing the crossmember rear tube to the underbody, and tighten them to the specified torque.

17 Reconnect the fuel outlet hose to the fuel filter, and tighten the clamp screw.

18 Reconnect the brake lines to their brackets on the underbody, and secure with the locking clips.

19 Lower the vehicle to the ground.

30 Steering wheel - removal and refitting

Note: *A two legged puller will be required for this operation.*

Warning: If an airbag is fitted, read the warning in Chapter 12, before starting work.

Removal

1 Disconnect the battery negative lead.

2 Set the front wheels in the straight ahead position, and unless unavoidable, do not move them until the steering wheel has been refitted.

3 Prise the horn push pad from the centre of the steering wheel, and disconnect the wiring **(see illustration)**.

4 Using a screwdriver, prise back the tabs on the lockwasher securing the steering wheel retaining nut **(see illustration)**.

5 Unscrew and remove the steering wheel retaining nut and the lockwasher.

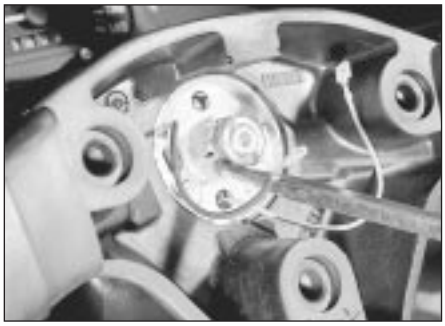
6 Make alignment marks between the steering wheel and the end of the column shaft.

7 A small two legged puller must now be fitted to the steering wheel to pull it from the column shaft **(see illustration)**. Note that the steering wheel is a very tight fit on the shaft.

Refitting

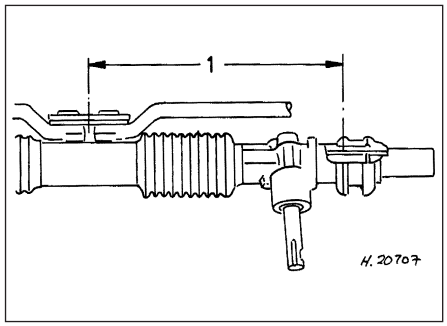
8 Begin refitting by gently tapping the steering wheel into position on the column shaft, using a metal tube or socket, and ensuring that the marks made during removal are aligned. Before tapping the wheel fully home, check the centralisation, as described in Section 31.

30.3 Disconnecting the horn push pad wiring



30.4 Prising back the tabs on the steering wheel retaining nut lockwasher

30.7 Two legged puller fitted to remove steering wheel



31.1A Steering centralised for setting of steering wheel straight ahead position
1 = 325.0 mm (12.8 in)

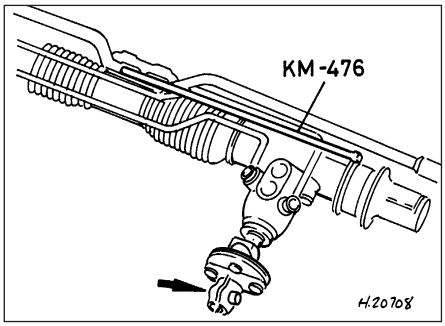
9 Refit the lockwasher and the steering wheel retaining nut, and tighten the nut to the specified torque. Bend up the lockwasher tabs to secure the nut.
10 Refit the horn push pad, ensuring that the wiring is securely connected, and reconnect the battery negative lead.

31 Steering wheel - centralising

1 The steering straight ahead position is achieved when the reference dimension between the centre of the tie-rod to steering gear bolt locking plate(s), and the centre of the rib on the right hand steering gear mounting clamp, is as shown **(see illustration)**. In this position, the flexible rubber coupling upper pinch bolt should lie horizontally on top of the steering shaft **(see illustration)**.
2 Check that the steering wheel is centralised.
3 If the steering wheel is off centre by more than 5°, it should be removed, then moved the required number of splines on the column shaft to achieve centralisation, and refitted as described in Section 30.

32 Steering shaft flexible rubber coupling - renewal

1 Position the front roadwheels in the straight ahead position.
2 Working in the engine compartment, loosen the steering gear mounting bolts.
3 Working in the driver's footwell, remove the lower trim panel by releasing the retaining clips.
4 Unscrew and remove the two pinch bolts from the flexible coupling **(see illustration)**.
5 Push the coupling upwards, remove it from the steering gear pinion shaft, then tilt it and withdraw it from the steering shaft.
6 Before refitting, ensure that the steering gear and the steering wheel are centralised, with reference to Section 31.



31.1B Flexible coupling upper pinch-bolt alignment (arrowed) with steering gear centralised

7 Fit the coupling, and refit the pinch bolts, but do not tighten them at this stage.
8 Push downwards on the coupling, and tighten the lower pinch bolt.
9 Tighten the steering gear mounting bolts to the specified torque.
10 Pull the steering shaft upwards until it contacts the bearing stop, then tighten the coupling upper pinch bolt.
11 Refit the driver's footwell lower trim panel.

33 Steering column - removal and refitting

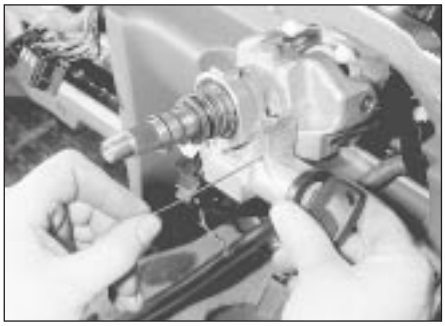
Note: *A bolt extractor will be required during this operation. A new shear head bolt and (where applicable) a new self-locking nut must be used to secure the column on refitting. When removing and refitting the steering column on models equipped with an air bag, read the contents of the following Sections carefully and follow the instructions implicitly. Note that two additional bracing struts, to cater for the additional weight of the air bag assembly, are bolted between the column and centre floor tunnel.*

Removal

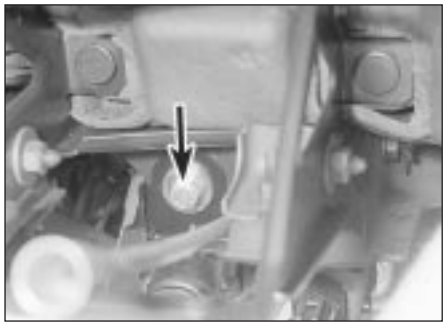
1 Disconnect the battery negative lead.
2 Set the front wheels in the straight ahead position.
3 Working in the driver's footwell, remove the lower trim panel by releasing the retaining clips.

32.4 Steering shaft flexible rubber coupling. Upper pinch-bolt arrowed

4 On models with an adjustable tilt steering column, move the column to its fully raised position, then unscrew the adjuster lever.
5 Remove the steering wheel, as described in Section 30, for improved access.
6 Prise out the screw covers from the front face of the steering column shrouds, then remove the two column shroud securing screws.
7 Remove the three securing screws from the underside of the lower column shroud, then remove both the upper and lower shrouds.
8 Disconnect the wiring plugs from the ignition switch and the indicator and wiper switches, and where applicable, disconnect the horn push wires from the switch housing.
9 On models with a fixed steering column, depress the indicator switch and wiper switch retaining clips and withdraw the switches. On models with an adjustable tilt steering column, unscrew the two Torx screws securing the indicator/wiper switch assembly to the steering column, and remove the switch assembly.
10 Insert the ignition key into the ignition switch, and turn it to position "II".
11 Insert a thin rod into the hole in the lock housing, then press the rod to release the detent spring, and pull out the lock cylinder using the key **(see illustration)**.
12 Working at the lower end of the steering shaft, unscrew and remove the upper pinch bolt securing the steering shaft to the flexible rubber coupling.
13 Unscrew and remove the bolt securing the column to the dashboard mounting bracket **(see illustration)**.



33.11 Removing the lock cylinder - adjustable tilt steering column



33.13 Steering column to dashboard mounting bracket bolt (arrowed)

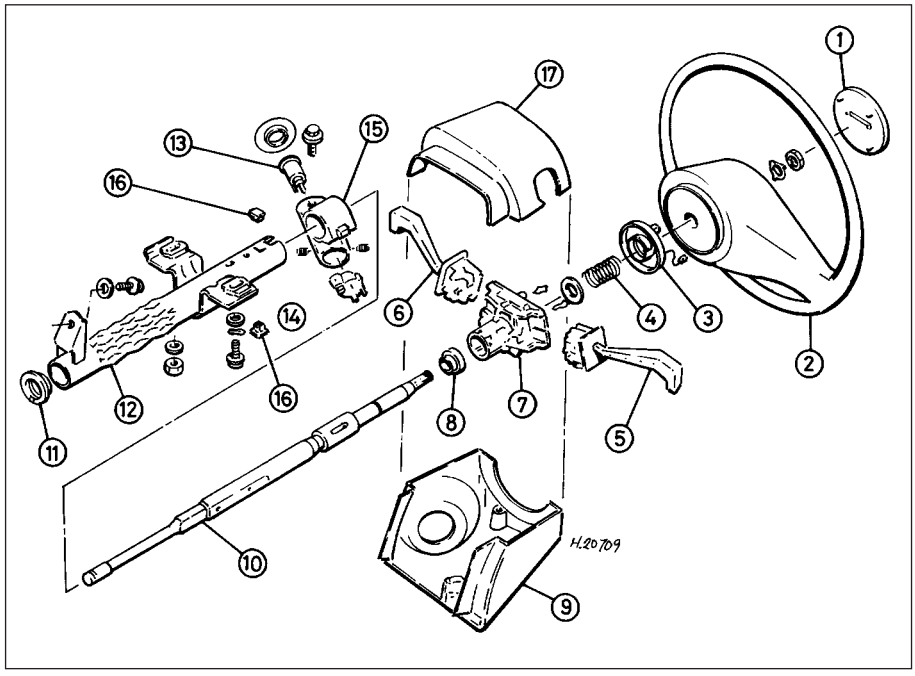
14 Two fixings must now be extracted from the column upper mounting bracket. The right hand bolt is of the shear head type, and must be centre punched, drilled and removed using a bolt extractor **(see illustration)**. A conventional bolt, or a self-locking nut, is used on the left hand side.
15 Withdraw the column assembly into the vehicle interior, and then remove it from the vehicle. Handle the column carefully, avoiding knocks or impact of any kind, which may damage the collapsible section of the column.
16 If desired, the column can be overhauled, as described in Section 34.

Refitting

17 Start refitting by ensuring that the roadwheels are still in the straight ahead position, and that the flexible coupling is positioned so that the upper pinch bolt will be horizontal on top of the steering shaft.
18 If a new column assembly is to be fitted, a large plastic washer will be found at the base of column tube. This washer is used to centre the shaft in the tube, and should be removed when fitting is complete.
19 Offer the column into position, and reconnect the flexible coupling. Refit the pinch bolt, but do not fully tighten it at this stage.
20 Loosely fit the upper mounting fixings, using a new shear head bolt, and (where applicable) a new self-locking nut.

33.14 Column upper mounting shear head bolt (arrowed)

21 Refit the bolt securing the column to the dashboard mounting bracket, and tighten the bolt to the specified torque.
22 Tighten the upper mounting fixings. The shear head bolt should be tightened until the head breaks off, and the conventional bolt or self-locking nut, as applicable, should be tightened to the specified torque.
23 Pull upwards on the steering shaft until the shaft contacts the bearing stop, then tighten the flexible coupling upper pinch bolt.
24 Prise the plastic centring washer from the base of the column tube and remove it from the steering shaft.
25 Further refitting is a reversal of the removal procedure. Refit the steering wheel, as described in Section 30.



34.2 Exploded view of fixed type steering column and associated components

1 Horn push pad
2 Steering wheel
3 Cam assembly
4 Spring
5 Lighting switch
6 Wash/wipe switch
7 Switch housing
8 Bearing
9 Lower column shroud
10 Steering shaft
11 Centralising plastic discs
12 Column tube
13 Lock barrel
14 Ignition switch
15 Lock housing
16 Switch housing safety plugs
17 Upper column shroud

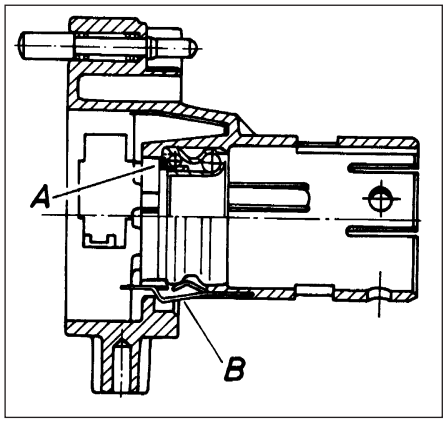
26 On completion, carry out a test drive along a route with several corners, and check that the steering mechanism operates smoothly.

34 Steering column - overhaul

Fixed steering column

Overhaul

1 If the steering column is in position in the vehicle, continue as described in Section 33, paragraphs 1 to 11 inclusive.
2 Prise out the ignition switch housing safety plugs **(see illustration)**, then turn the housing anti-clockwise, and pull it from the steering column.
3 The bearing can be removed from the ignition switch housing by prising apart the two bearing fixing catches, and pressing or driving out the bearing with a piece of tubing on the bearing outer race. When pressing in the new bearing, make sure that the thrustwasher and contact springs are correctly located **(see illustration)**.
4 The ignition switch is secured to the steering lock housing by two grub screws. Remove the screws to extract the switch. It is recommended that the switch and the lock cylinder are not both removed at the same time, so that their mutual alignment is not lost.
5 If the steering column is in position in the vehicle, unscrew and remove the upper pinch bolt from the steering shaft flexible rubber coupling in the driver's footwell.
6 Withdraw the steering shaft from the steering column tube.
7 Begin reassembly by fitting the temporary plastic centring washer, which will be supplied with a new column or steering shaft, into the base of the column tube.
8 Insert the shaft into the column tube. If the column is in position in the vehicle, engage the bottom end of the shaft with the flexible coupling and refit the upper pinch bolt, but do not tighten it at this stage.



34.3 Sectional view of ignition switch housing
A Thrustwasher B Contact springs

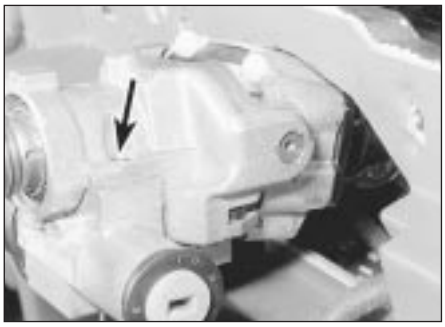
9 Where applicable, refit the ignition switch, and tighten the grub screws.
10 Refit the ignition switch housing, using new safety plugs.
11 If the column is in position in the vehicle, pull upwards on the steering shaft until the shaft contacts the bearing stop, then tighten the flexible coupling upper pinch bolt. Ensure that the roadwheels are still in the straight ahead position, and that the flexible coupling is positioned so that the upper pinch bolt is horizontal on top of the steering shaft.
12 Where applicable, further reassembly is a reversal of dismantling. Refit the steering wheel, as described in Section 30.
13 On completion, carry out a test drive along a route with several corners, and check that the steering mechanism operates smoothly.

Adjustable tilt steering column

Note: *New shear head bolts must be used to secure the lock housing on reassembly*

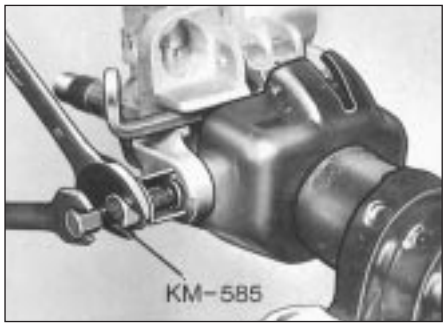
Overhaul

14 If the steering column is in position in the vehicle, continue as described in Section 33, paragraphs 1 to 11 inclusive.
15 The tilt adjuster spring can be removed by simply prising it free using a screwdriver. Be careful, as the spring may fly out.
16 The ignition switch is secured to the lock housing by two grub screws. Access to the "hidden" grub screw is virtually impossible with the steering column installed. For this, and further dismantling, the column must therefore be removed, as described in Section 33.
17 The lock housing is secured to the bearing housing by two shearhead bolts, which must be centre punched, drilled and removed using a bolt extractor, if the two housings are to be separated **(see illustration)**.



34.17 Lock housing shear head bolt location (arrowed) - adjustable tilt steering column

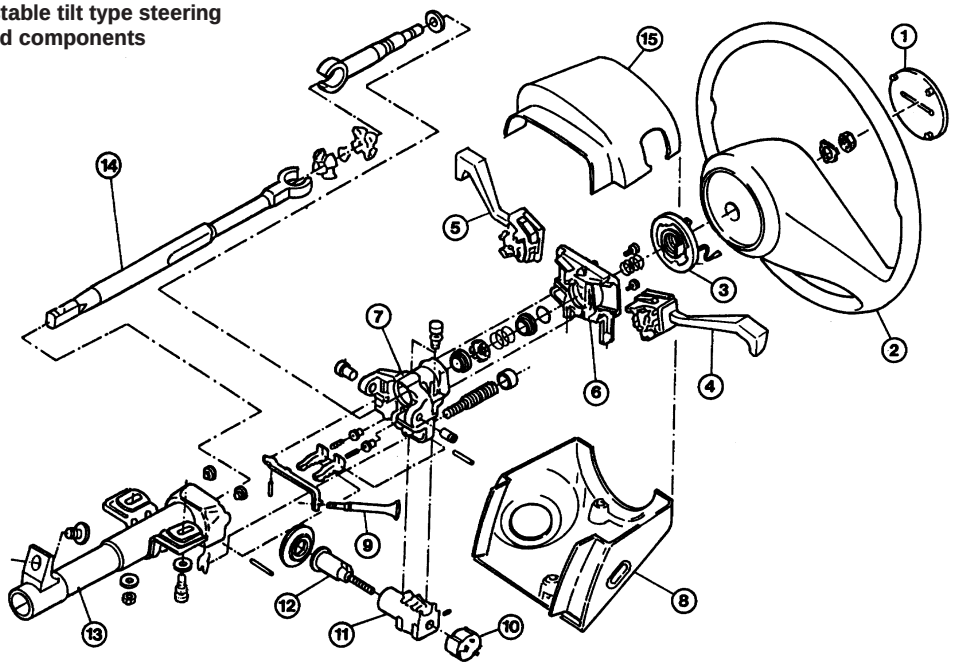
18 The column bearing upper race can be renewed after removing the retaining ring, pressure rings and spring. Note that it may be necessary to compress the spring to remove the retaining ring. Take care, as the spring may fly out as the retaining ring is removed.
19 To remove the bearing housing from the column, the fulcrum pins must be extracted, using a nut and bolt to draw them out. Vauxhall special tool KM-585 is available for this purpose **(see illustration)**.



34.19 Extracting the bearing housing fulcrum pins using special tool KM-585 - adjustable tilt type steering column

20 The column bearing lower race can be driven from the upper shaft using a hammer and a drift or chisel. Press or drive the new race onto the shaft.
21 The column bearings themselves can only be renewed complete with the housing.
22 The shaft universal joint and the tilt mechanism detent components can be dismantled for component renewal if necessary.
23 Reassembly is a reversal of dismantling, noting the following points **(see illustration)**.
24 When reconnecting the steering shaft universal joint, note that the spring clips should be located in the recesses of each half of the joint **(see illustration)**.
25 If the lock housing and bearing housing have been separated, clean out the securing bolt holes with a tap. Apply thread locking compound to new shear head bolts, and tighten the bolts until their heads break off.
26 After fitting the bearing housing fulcrum pins, stake them both in three equidistant places.
27 If the bearings have been renewed, the gaps between the bearing housing and the buffers that limit the movement in the upper position should be checked to ensure that they are equal. Check the gap with a feeler blade. A kit containing different thicknesses of buffer, with instructions, is available if required.

34.23 Exploded view of adjustable tilt type steering column and associated components



1 Horn push pad
2 Steering wheel
3 Cam assembly
4 Lighting switch
5 Wash/wipe switch
6 Switch housing
7 Bearing housing
8 Lower column shroud
9 Tilt adjuster lever
10 Ignition switch
11 Lock housing
12 Lock barrel
13 Column tube
14 Steering shaft
15 Upper column shroud

35 Steering damper - removal and refitting

Removal

1 Certain models are equipped with a steering damper, which is fitted between the rack and the rack housing.
2 Remove the securing nut from the moving end of the damper, and recover the washer.
3 Unbolt the clamp assembly from the rack housing, and withdraw the damper from its tube. Take care not to lose the rubbers and washer from the end of the damper.

Refitting

4 When refitting, secure the clamp assembly to the rack housing first, then tighten the securing nut at the moving end of the damper, to obtain a dimension "A", as shown **(see illustration)**.

36 Steering gear bellows - renewal

Note: *New bellows securing clips will be required for refitting*
1 Remove the steering gear, as described in Section 37 or 39, as applicable.
2 Remove the mounting clamp and rubber from the left hand end of the steering gear.
3 On power steering gear, disconnect the fluid pipe unions from the left hand end of the steering gear.
4 Remove the outer bellows securing clips from each end of the steering gear, then slide off the bellows/tube assembly.
5 Remove the inner bellows securing clips, and separate the bellows from the tube.
6 Fit the new bellows to the tube, using new clips. The clips should be positioned so that when the steering gear is fitted to the vehicle, the ends of the clips point upwards.
7 Fit the bellows/tube assembly to the steering gear, and secure with new clips, again positioned with the ends of the clips pointing upwards. Ensure that the bellows are not twisted.
8 On power steering gear, reconnect the fluid pipe unions, using new O-rings.

34.24 Steering shaft universal joint, adjustable tilt type steering column
Inset Spring clip location

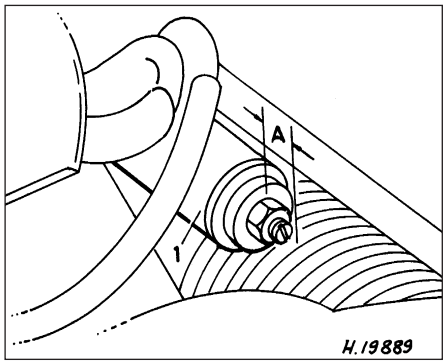
9 Refit the mounting clamp and rubber, then refit the steering gear, (Section 37).

37 Steering gear assembly (manual) - removal, overhaul and refitting

Note: *New steering gear clamp to bulkhead bolts, and new tie-rod to steering gear bolt locking plates, must be used on refitting*

Removal

1 Disconnect the battery negative lead.
2 On carburettor models, for improved access, remove the air cleaner casing from the top of the carburettor. Unbolt and move the brake servo to gain access to the right hand steering gear mounting clamp. It may also be necessary to unbolt the coolant expansion tank and/or the brake master cylinder.
3 Set the front wheels in the straight ahead position.
4 Prise the locking plate(s) from the tie-rod to steering gear bolts, then unscrew and remove the bolts and recover the washers and spacer plate **(see illustrations)**.
5 If a steering damper is fitted, unbolt the clamp assembly from the steering gear, and remove the damper.
6 Working in the driver's footwell, remove the lower trim panel by releasing the retaining clips.
7 On models with an adjustable tilt steering column, move the column to its fully raised position.



35.4 Steering damper securing nut setting
1 Damper tube
A = 12.5 top 13.5 mm

8 Unscrew and remove the upper pinch bolt securing the steering shaft to the flexible rubber coupling.
9 Working in the engine compartment, unbolt the two clamps securing the steering gear to the bulkhead, then manipulate the steering gear out from the left hand side of the engine compartment **(see illustration)**. The help of an assistant may be required to release the flexible rubber coupling from the steering shaft as the steering gear is withdrawn. Note that on some models, various wires and hoses may be secured to the steering gear with cable-ties. Ensure that, where applicable, all wires and hoses are free before the steering gear is removed.

Overhaul

10 Examine the steering gear assembly for signs of wear or damage. Check that the rack moves freely throughout the full length of its travel, with no signs of roughness or excessive free play between the steering gear pinion and rack. It is possible to overhaul the steering gear assembly housing components, but this task should be entrusted to a Vauxhall dealer.
11 The only components that can be renewed easily by the home mechanic are the steering gear gaiters, the track rod balljoints and the track rods. Tie-rod, tie-rod end and steering gear gaiter renewal procedures are covered in Sections 36, 43 and 44.

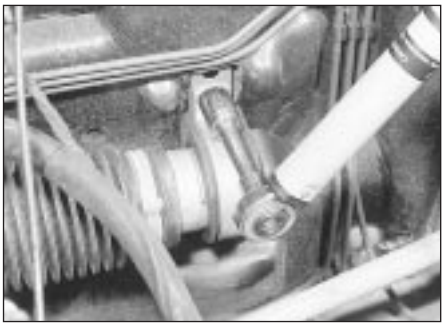
Refitting

12 Refitting is a reversal of removal, remembering the following points.

37.4A Prise off the locking plate . . .

37.4B . . . then unscrew and remove the tie-rod to steering gear bolts

37.9 Removing the steering gear



37.13 Tightening a steering gear mounting bolt

13 Use new mounting bolts to secure the steering gear clamps to the bulkhead **(see illustration)**.
14 The tie-rod to steering gear bolt locking plate(s) must be renewed on refitting.
15 On completion, check the steering wheel centralisation, as described in Section 31.

38 Steering gear assembly (power assisted) - removal, overhaul and refitting

Note: *New steering gear mounting bolts, and new tie-rod to steering gear bolt locking plates, must be used on refitting. New O-rings should be used when reconnecting fluid pipe unions*

Removal

1 Proceed as described in Section 37, paragraphs 1 to 3 inclusive.
2 Disconnect the fluid hoses from the pipes at the left hand end of the steering gear. Be prepared for fluid spillage, and plug the open ends of the pipes and hoses, to prevent dirt ingress and further fluid loss.
3 Where applicable, to provide space for the steering gear to be withdrawn, remove the relay box from the left hand side of the engine compartment, referring to Chapter 12, if necessary.
4 Proceed as described in Section 37, paragraphs 4 to 9 inclusive.

Overhaul

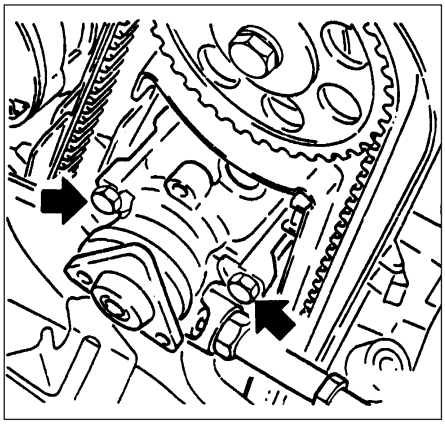
5 Overhaul of the power steering gear is not recommended by the manufacturers.
6 Fluid leaks from the hydraulic fluid pipe unions can normally be corrected by renewing the unions seals with the rack installed.
7 Bellows renewal is covered in Section 36.
8 Adjustment of the power steering gear should not be attempted.
9 Any faults with the steering gear should be referred to a Vauxhall dealer, although renewal of the complete assembly will probably be the only course of action available.

Refitting

10 Refitting is a reversal of removal, remembering the following points.
11 Before refitting, centralise the steering gear by counting the number of turns of the pinion shaft required to move the rack from lock to lock. Then set the rack by turning the pinion shaft from the full lock position through half the number of turns counted. Note that fluid may be ejected from the steering gear pipes as the rack is turned, and it may be necessary to remove the plugs from the ends of the pipes to allow the rack to turn.
12 Use new mounting bolts to secure the steering gear clamps to the bulkhead.
13 The tie-rod to steering gear bolt locking plate(s) must be renewed on refitting.
14 Reconnect the flexible rubber coupling to the steering shaft (with the rack and steering wheel centralised) so that the upper pinch bolt lies horizontally on top of the steering shaft, as described in Section 31, paragraph 1.
15 Renew the O-ring when reconnecting the fluid hose to pipe union.
16 On completion, top-up the fluid level, and bleed the fluid circuit as described in Chapter 1.

39 Power steering fluid circuit - bleeding

1 With the engine stopped, initially fill the reservoir to the level of "MAX" mark on the dipstick attached to the reservoir filler cap.
2 Start the engine, and immediately top-up the fluid level to the "MIN" mark on the dipstick. Do not allow the reservoir to run dry at any time. The help of an assistant will ease this operation.
3 With the engine running at idle speed, turn the steering wheel slowly two or three times approximately 45° left and right of the centre, then turn the wheel twice from lock to lock. Do not hold the wheel on either lock, as this imposes strain on the hydraulic system.
4 Stop the engine, and check the fluid level. With the fluid at operating temperature (80°/176°F) the level should be on the "MAX" mark, and with the fluid cold (20°C/68°F), the level should be on the "MIN" mark. Top-up if necessary.



40.6 Power steering pump mounting bolts (arrowed) - 1.6 litre models, up to 1992

40 Power steering pump - removal and refitting

Note: *A new fluid pipe union O-ring must be used on refitting*

1.6 litre models (up to 1992)

Removal

1 Remove the air cleaner casing from the right hand front wing, as described in Chapters 4A or 4B.
2 Remove the alternator/power steering pump drivebelt, with reference to Chapter 1.
3 Unscrew the three securing bolts, and remove the power steering pump pulley.
4 Unclip and remove the outer timing belt cover.
5 Disconnect the fluid pipe union and the hose from the pump. Be prepared for fluid spillage, and plug the open ends of the pump and the pipes, to prevent dirt ingress and further fluid spillage.
6 Unscrew the two pump securing bolts, and withdraw the pump from the cylinder block towards the alternator **(see illustration)**.
7 No overhaul of the pump is possible, and if faulty, a new unit must be fitted.

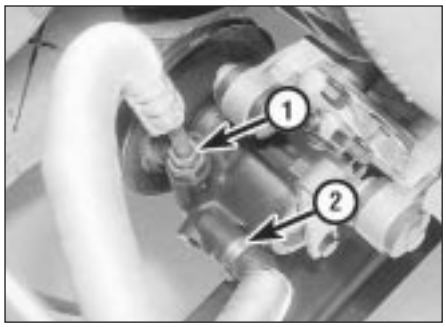
Refitting

8 Refitting is a reversal of removal, but renew the O-ring when reconnecting the fluid pipe union, and tension the alternator/power steering pump drivebelt, (Chapter 1).
9 On completion, top-up the fluid level, and bleed the fluid circuit as described in Chapter 1.

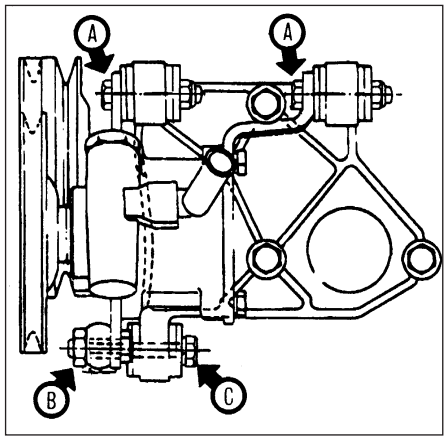
1.6 (from 1993), 1.8 and 2.0 litre models

Removal

10 Remove the power steering pump drivebelt, as described in Chapter 1.
11 Disconnect the fluid pipe union and the flexible fluid hose from the pump **(see illustration)**. Be prepared for fluid spillage, and plug the open ends of the pump, pipe and hose, to prevent dirt ingress and further fluid loss.



40.11 Power steering pump connections - 2.0 litre models
1 Fluid pipe union
2 Flexible hose connection



40.15A Mounting and adjuster bolts (arrowed) must be loosened to adjust drivebelt tension - 1.8 and 2.0 litre models, up to 1992

For A, B and C see "Torque wrench settings" in Specifications

12 Unscrew and remove the four mounting bolts. Recover the nuts, and take care not to lose the rubber insulators that fit into the mounting bracket.
13 Withdraw the pump from the vehicle.
14 No overhaul of the pump is possible, and if faulty, a new unit must be fitted.

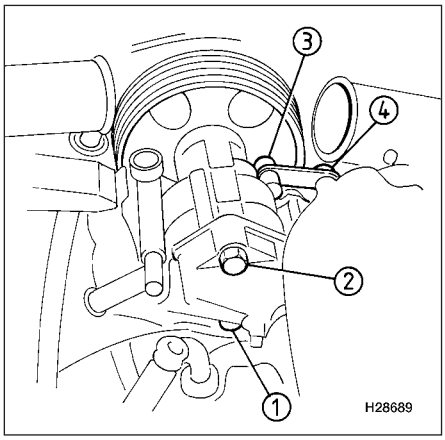
Refitting

15 Refitting is a reversal of removal, but renew the O-ring when reconnecting the fluid pipe union. Tension the drivebelt, as described in Chapter 1. Note the different tightening torque settings for the pump mountings **(see illustrations)**.
16 On completion, top-up the fluid level, and bleed the fluid circuit (Chapter 1).

41 Power steering fluid reservoir - removal and refitting

Removal

1 The reservoir can be removed for the mounting bracket by unscrewing the clamp screw and removing the clamp.



40.15B Power steering pump mounting (tightening torques shown in Specifications) - DOHC models

1 Pump to support
2 Pump to support
3 Shackle to pump
4 Shackle to engine

2 Have a container ready to catch the fluid, then disconnect the fluid hoses from the reservoir and drain the fluid. Plug the open ends of the hoses, to prevent dirt ingress and further fluid loss.
3 If desired, the mounting bracket can be unbolted from the body panel, but note that on certain models, the bolts securing the bracket also secure the ignition coil and suppressor, refer to Chapter 5. Where applicable, unclip the brake fluid pipes and any wiring from the bracket before removal.

Refitting

4 Refitting is a reversal of removal, but on completion, bleed the fluid circuit (Section 39).

42 Power steering fluid cooler pipes (where fitted) - removal and refitting

Note: *New fluid pipe union O-rings must be used on refitting.*

Removal

1 Remove the radiator, (Chapter 3).
2 Working at the left hand side of the engine compartment, disconnect the fluid cooler pipe unions **(see illustration)**. Be prepared for fluid spillage, and plug the open ends of the pipes to prevent dirt ingress and further fluid loss.
3 Release the three plastic clips securing the pipes to the lower body panel, then manipulate the pipes from the engine compartment **(see illustration)**.

Removal

4 Refitting is a reversal of removal, but renew the O-rings when reconnecting the fluid pipe unions, and refit the radiator as described in Chapter 3.
5 On completion, top-up the fluid level, and bleed the fluid circuit as described in Section 39.

43 Tie-rod end - removal and refitting

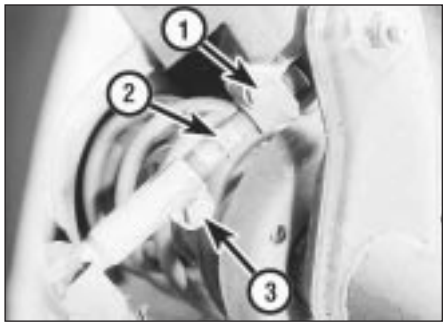
Note: *A balljoint separator tool will be required for this operation. A new tie-rod end balljoint self-locking nut must be used on refitting.*

Removal

1 Where applicable, remove the wheel trim, then loosen the relevant front roadwheel bolts. Apply the handbrake, then jack up the front of the vehicle, and support securely on axle stands (see "*Jacking and Vehicle Support*") positioned under the body side members. Remove the relevant front roadwheel.
2 Loosen the tie-rod end clamp bolt, which secures the tie-rod end to the threaded adjuster pin on the tie-rod **(see illustration)**.
3 Unscrew the self-locking nut from the tie-rod end to suspension strut balljoint.
4 Using a balljoint separator, disconnect the tie-rod end to suspension strut balljoint **(see illustration)**.
5 Note the position of the tie-rod end on the adjuster pin, either by marking the pin with paint or tape, or by counting the number of threads exposed, then unscrew the tie-rod end from the tie-rod.
6 Note that the tie-rod ends are handed. The right hand tie-rod end is marked "R" but the left hand tie-rod end has no marking.

42.2 Power steering fluid cooler pipe unions in engine compartment - 2.0 litre SOHC model

42.03 Removing the power steering fluid cooler pipes - 2.0 litre SOHC model



43.2 Tie-rod end viewed from underneath

1 Tie-rod end clamp bolt
2 Threaded adjuster pin
3 Tie-rod clamp bolt

Refitting

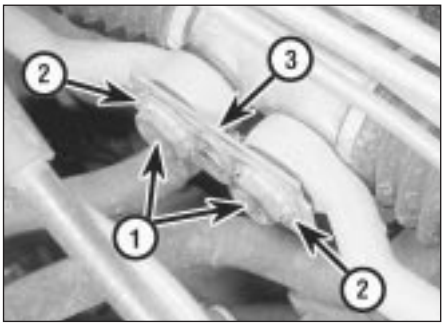
7 Start refitting by screwing the tie-rod end onto the adjuster pin to approximately the same position as was noted during removal.
8 Reconnect the tie-rod end balljoint to the suspension strut, and tighten a new self-locking nut to the specified torque.
9 Tighten the tie-rod end clamp bolt.
10 Refit the roadwheel, and lower the vehicle to the ground. Finally tighten the roadwheel bolts with the vehicle resting on its wheels, and where applicable, refit the wheel trim.
11 Check the front wheel alignment, as described in Section 45, and adjust if necessary. No harm will result from driving the vehicle a short distance to have the alignment checked.

44 Tie-rod - removal and refitting

Note: *A new tie-rod to steering gear bolt locking plate, and where applicable, a new tie-rod end balljoint self-locking nut, must be used on refitting. If the tie-rod is to be removed complete with the tie-rod end, a balljoint separator tool will be required*

Removal

1 The tie-rod can either be removed leaving the tie-rod end in place, or as an assembly with the tie-rod end.
2 Proceed as described in Section 43, paragraph 1.
3 If the tie-rod is to be removed complete with the tie-rod end, continue as described in Section 43, paragraphs 3 and 4.
4 If the tie-rod is to be removed independently of the tie-rod end, loosen the tie-rod clamp bolt, which secures the tie-rod to the threaded adjuster pin on the tie-rod end.
5 Prise the locking plate(s) from the tie-rod to steering gear bolts, then unscrew and remove the bolts, and recover the washers and spacer plate **(see illustration)**.
6 If the tie-rod is being removed complete with the tie-rod end, the assembly can now be withdrawn from the vehicle.
7 If the tie-rod is to be removed independently of the tie-rod end, note the position of the tie-rod end on the adjuster pin.



44.05 Tie-rod to steering gear fixings
1 Fixing bolts 3 Spacer plate
2 Locking plates

43.04 Disconnecting the tie-rod end to suspension strut balljoint

Do this either by marking the pin with paint or tape, or by counting the number of threads exposed, then unscrew the tie-rod from the tie-rod end and withdraw it from the vehicle.

Refitting

8 Refitting is a reversal of removal, remembering the following points.
9 The tie-rod to steering gear bolt locking plate(s) must be renewed on refitting.
10 If the tie-rod is being refitted complete with the tie-rod end, reconnect the tie-rod end balljoint to the suspension strut, and tighten a new self-locking nut to the specified torque.
11 If the tie-rod is being refitted with the tie-rod end already in place on the vehicle, screw the tie-rod onto the adjuster pin to approximately the same position as noted during removal, and tighten the clamp bolt.
12 Finally tighten the roadwheel bolts with the vehicle resting on its wheels, and where applicable, refit the wheel trim.
13 On completion, check the front wheel alignment, as described in Section 45 and adjust if necessary. No harm will result from driving the vehicle a short distance to have the alignment checked.

45 Front wheel alignment - general

1 Accurate front wheel alignment is essential for precise steering and handling, and for even tyre wear. Before carrying out any checking or adjusting operations, make sure that the tyres are correctly inflated. Check also that all steering and suspension joints and linkages are in sound condition and that the wheels are not buckled or distorted, particularly around the rims. It will also be necessary to have the car positioned on flat level ground, with enough space to push the car backwards and forwards through about half its length.
2 Front wheel alignment consists of four factors:

a) Camber is the angle at which the roadwheels are set from the vertical when viewed from the front or rear of the vehicle. Positive camber is the angle (in degrees) that the wheels are tilted outwards at the top from the vertical.
b) Castor is the angle between the steering axis and a vertical line when viewed from each side of the vehicle. Positive castor is indicated when the steering axis is inclined towards the rear of the vehicle at its upper end.
c) Steering axis inclination is the angle, when viewed from the front or rear of the vehicle, between the vertical and an imaginary line drawn between the upper and lower front suspension strut mountings.
d) Toe setting is the amount by which the distance between the front inside edges of the roadwheels differs from that between the rear inside edges, when measured at hub height. If the distance between the front edges is less than that at the rear, the wheels are said to "toe-in". If it is greater than at the rear, the wheels "toe-out."

3 Camber, castor and steering axis inclination are set during manufacture, and are not adjustable. Unless the vehicle has suffered accident damage, or there is gross wear in the suspension mountings or joints, it can be assumed that these settings are correct. If for any reason it is believed that they are not correct, the task of checking them should be left to a Vauxhall dealer, who will have the necessary special equipment needed to measure the small angles involved.
4 It is, however, within the scope of the home mechanic to check and adjust the front wheel toe setting. To do this, a tracking gauge must first be obtained. Two types of gauges are available, and can be obtained from motor accessory shops. The first type measures the distance between the front and rear inside edges of the roadwheels, as previously described, with the car stationary. The second type, known as a scuff plate, measures the actual position of the contact surface of the tyre, in relation to the road surface, with the vehicle in motion. This is achieved by pushing or driving the front tyre over a plate, which then moves slightly according to the scuff of the tyre, and shows this movement on a scale. Both types have their advantages and disadvantages, but either can give satisfactory results if used correctly and carefully. Alternatively, a tracking gauge can be fabricated from a length of steel tubing, suitably cranked to clear the sump and clutch bellhousing, with a set-screw and a locknut at one end.
5 Many tyre specialists will also check toe settings free, or for a nominal charge.
6 Make sure that the steering is in the straight ahead position when making measurements.
7 If adjustment is found to be necessary, clean the ends of the tie-rods in the area of the adjustment pin and clamp bolts.
8 Slacken the clamp bolts (one on each tie-rod balljoint and one on each tie-rod), and turn the adjustment pin on each tie-rod by the same amount in the same direction. Only turn each pin by a quarter turn at a time before rechecking.
9 When adjustment is correct, tighten the clamp bolts to the specified torque. Check that the tie-rod lengths are equal to within 5 mm (0.2 in), and that the steering wheel spokes are in the correct straight ahead position.

Chapter 11
Bodywork and fittings

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

Torque wrench setting	Nm	lbf ft
Front seat rails to floor	20	15
Seat belt fixings	35	26

1 General description

The bodyshell and floorpan are of pressed steel, and form an integral part of the vehicle's structure, without the need for a separate chassis.

Various areas are strengthened, to provide for suspension, steering and engine mounting points, and load distribution.

Extensive corrosion protection is applied to all new vehicles. Various anti-corrosion preparations are used, including galvanising and PVC under-sealing. Protective wax is injected into the box sections and other hollow cavities.

Extensive use is made of plastic for peripheral components, such as the radiator grille, bumpers and wheel trims, and for much of the interior trim.

Interior fittings are to a high standard on all models, and a wide range of optional equipment is available throughout the range.

Except for the rear quarter windows, all fixed glass is bonded in position, using a special adhesive. Any work in this area should be entrusted to a Vauxhall dealer or glass replacement specialist.

2 Bodywork and underframe - maintenance 

The general condition of a vehicle's bodywork is the one thing that significantly affects its value. Maintenance is easy but needs to be regular. Neglect, particularly after minor damage, can lead quickly to further deterioration and costly repair bills. It is important also to keep watch on those parts of the vehicle not immediately visible, for instance the underside, inside all the wheel arches and the lower part of the engine compartment.

The basic maintenance routine for the bodywork is washing preferably with a lot of water, from a hose. This will remove all the loose solids that may have stuck to the vehicle. It is important to flush these off in such a way as to prevent grit from scratching the finish. The wheel arches and underframe need washing in the same way to remove any accumulated mud that will retain moisture and tend to encourage rust. Oddly enough, the best time to clean the underframe and wheel arches is in wet weather when the mud is thoroughly wet and soft. In very wet weather the underframe is usually cleaned of large accumulations automatically and this is a good time for inspection.

Periodically, except on vehicles with a

wax-based underbody protective coating, it is a good idea to have the whole of the underframe of the vehicle steam cleaned, engine compartment included, so that a thorough inspection can be carried out to see what minor repairs and renovations are necessary. Steam cleaning is available at many garages and is necessary for removal of the accumulation of oily grime that sometimes is allowed to become thick in certain areas. The dirt can then be simply hosed off. Note that these methods should not be used on vehicles with wax-based underbody protective coating or the coating will be removed. Such vehicles should be inspected annually, preferably just before winter, when the underbody should be washed down and any damage to the wax coating repaired. Ideally, a completely fresh coat should be applied. It would also be worth considering the use of such wax-based protection for injection into door panels, sills, box sections, etc., as an additional safeguard against rust damage where such protection is not provided by the vehicle manufacturer.

After washing paintwork, wipe off with a chamois leather to give an unspotted clear finish. A coat of clear protective wax polish, will give added protection against chemical pollutants in the air. If the paintwork sheen has dulled or oxidised, use a cleaner/polisher combination to restore the brilliance of the shine. This requires a little effort, but such dulling is usually caused because regular washing has been neglected. Care needs to be taken with metallic paintwork, as special non-abrasive cleaner/polisher is required to avoid damage to the finish.

Always check that the door and ventilator opening drain holes and pipes are completely clear so that water can be drained out. Bright work should be treated in the same way as paint work. Windscreens and windows can be kept clear of the smeary film that often appears, by using a glass cleaner. Never use any form of wax or other body or chromium polish on glass.

3 Upholstery and carpets - maintenance

Mats and carpets should be brushed or vacuum cleaned regularly to keep them free of grit. If they are badly stained remove them from the vehicle for scrubbing or sponging and make quite sure they are dry before refitting. Seats and interior trim panels can be kept clean by wiping with a damp cloth. If they do become stained (which can be more apparent on light coloured upholstery) use a little liquid detergent and a soft nail brush to scour the grime out of the grain of the material. Do not forget to keep the headlining clean in the same way as the upholstery. When using liquid cleaners inside the vehicle do not over-wet the surfaces being cleaned. Excessive damp could get into the seams and padded interior causing stains, offensive odours or even rot. If the inside of the vehicle gets wet accidentally it is worthwhile taking some trouble to dry it out properly, particularly where carpets are involved. Do not leave oil or electric heaters inside the vehicle for this purpose.

4 Minor body damage - repair

Repairs of minor scratches in bodywork

If the scratch is very superficial, and does not penetrate to the metal of the bodywork, repair is very simple. Lightly rub the area of the scratch with a paintwork renovator, to remove loose paint from the scratch and to clear the surrounding bodywork of wax polish. Rinse the area with clean water.

Apply touch-up paint to the scratch using a fine paint brush; continue to apply fine layers of paint until the surface of the paint in the scratch is level with the surrounding paintwork. Allow the new paint at least two weeks to harden: then blend it into the surrounding paintwork by rubbing the scratch area with a paintwork renovator or a very fine cutting paste and apply wax polish.

Where the scratch has penetrated right through to the metal of the bodywork, causing the metal to rust, a different repair technique is required. Remove any loose rust from the bottom of the scratch with a penknife, then apply rust inhibiting paint, to prevent the formation of rust in the future. Using a rubber or nylon applicator fill the scratch with bodystopper paste. If required, this paste can be mixed with cellulose thinners to provide a very thin paste that is ideal for filling narrow scratches. Before the stopper-paste in the scratch hardens, wrap a piece of smooth cotton rag around the top of a finger. Dip the finger in cellulose thinners and then quickly sweep it across the surface of the stopper-paste in the scratch; this will ensure that the surface of the stopper-paste is slightly hollowed. The scratch can now be painted over as described earlier in this Section.

Repair of dents in bodywork

When deep denting of the vehicle's bodywork has taken place, the first task is to pull the dent out, until the affected bodywork almost attains its original shape. There is little point in trying to restore the original shape completely, as the metal in the damaged area will have stretched on impact and cannot be reshaped fully to its original contour. It is better to bring the level of the dent up to a point that is about 8 in (3 mm) below the level of the surrounding bodywork. In cases where the dent is very shallow anyway, it is not worth trying to pull it out at all. If the underside of the dent is accessible, it can be hammered out gently from behind, using a mallet with a wooden or plastic head. Whilst doing this, hold a block of wood firmly against the outside of the panel to absorb the impact from the hammer blows and thus prevent a large area of the bodywork from being "belled-out".

Should the dent be in a section of the bodywork that has a double skin or some other factor making it inaccessible from behind, a different technique is called for. Drill several small holes through the metal inside the area particularly in the deeper section. Then screw long self-tapping screws into the holes just sufficiently for them to gain a good purchase in the metal. Now the dent can be pulled out by pulling on the protruding heads of the screws with a pair of pliers.

The next stage of the repair is the removal of the paint from the damaged area, and from an inch or so of the surrounding "sound" bodywork. This is accomplished most easily by using a wire brush or abrasive pad on a power drill, although it can be done just as effectively by hand using sheets of abrasive paper. To complete the preparation for filling, score the surface of the bare metal with a screwdriver or the tang of a file, or alternatively, drill small holes in the affected area. This will provide a good "key" for the filler paste.

To complete the repair see the Section on filling and re-spraying.

Repair of rust holes or gashes in bodywork

Remove all paint from the affected area and from an inch or so of the surrounding "sound" bodywork, using an abrasive pad or a wire brush on a power drill. If these are not available a few sheets of abrasive paper will do the job just as effectively. With the paint removed you will be able to gauge the severity of the corrosion and therefore decide whether to renew the whole panel (if this is possible) or to repair the affected area. New body panels are not as expensive as most people think and it is often quicker and more satisfactory to fit a new panel than to attempt to repair large areas of corrosion.

Remove all fittings from the affected area except those which will act as a guide to the original shape of the damaged bodywork (e.g. headlamp shells, etc.). Then, using tin snips or a hacksaw blade, remove all loose metal and any other metal badly affected by corrosion. Hammer the edges of the hole inwards to create a slight depression for the filler paste.

Wire brush the affected area to remove the powdery rust from the surface of the remaining metal. Paint the affected area with rust inhibiting paint. If the back of the rusted area is accessible treat this also.

Before filling can take place it will be necessary to block the hole in some way. This can be achieved by using aluminium or plastic mesh, or aluminium tape.

Aluminium or plastic mesh, or glass fibre matting, is probably the best material to use for a large hole. Cut a piece to the approximate size and shape of the hole to be filled, then position it in the hole so that its edges are below the level of the surrounding bodywork. It can be retained in position by several blobs of filler paste around its periphery.

Aluminium tape should be used for small or very narrow holes. Pull a piece off the roll and trim it to the approximate size and shape required. Then pull off the backing paper (if used) and stick the tape over the hole. It can be overlapped if the thickness of one piece is insufficient. Burnish down the edges of the tape with the handle of a screwdriver or similar, to ensure that the tape is securely attached to the metal underneath.

Bodywork repairs filling and re-spraying

Before using this Section, see the Sections on dent, deep scratch, rust holes and gash repairs.

Many types of bodyfiller are available, but generally those proprietary kits that contain a tin of filler paste and a tube of resin hardener are best for this type of repair. These can be used directly from the tube. A wide, flexible plastic or nylon applicator will be found invaluable for imparting a smooth and well-contoured finish to the surface of the filler.

Mix up a little filler on a clean piece of card or board - measure the hardener carefully (follow the maker's instructions on the pack) otherwise the filler will set too rapidly or too slowly. Using the applicator apply the filler paste to the prepared area; draw the applicator across the surface of the filler to achieve the correct contour and to level the filler surface. When a contour that approximates to the correct one is achieved, stop working the paste - if you carry on too long the paste will become sticky and begin to "pick up" on the applicator. Continue to add thin layers of filler paste at twenty-minute intervals until the level of the filler is just proud of the surrounding bodywork.

Once the filler has hardened, excess can be removed using a metal plane or file. From then on, progressively finer grades of abrasive paper should be used, starting with a 40 grade production paper and finishing with 400 grade wet-and-dry paper. Always wrap the abrasive paper around a flat rubber, cork, or wooden block otherwise the surface of the filler will not be completely flat. During the smoothing of the filler surface the wet-and-dry paper should be periodically rinsed in water. This will ensure that a very smooth finish is imparted to the filler at the final stage.

At this stage the "dent" should be surrounded by a ring of bare metal, which in turn should be encircled by the finely "feathered" edge of the good paintwork. Rinse the repair area with clean water, until all the dust produced by the rubbing-down operation has gone.

Spray the whole repair area with a light coat of primer. This will show up any imperfections in the surface of the filler. Repair these imperfections with fresh filler paste or bodystopper, and again smooth the surface with abrasive paper. If bodystopper is used, it can be mixed with cellulose thinners to form a thin paste that is ideal for filling small holes. Repeat this spray and repair procedure until you are satisfied that the surface of the filler, and the feathered edge of the paintwork are perfect. Clean the repair area with clean water and allow to dry fully.

The repair area is now ready for final spraying. Paint spraying must be carried out in a warm, dry, windless and dust free atmosphere. This condition can be created artificially if you have access to a large indoor working area, but if you are forced to work in the open, you will have to pick your day very carefully. If you are working indoors, dousing the floor in the work area with water will help to settle the dust that would otherwise be in the atmosphere. If the repair area is confined to one body panel, mask off the surrounding panels; this will help to minimise the effects of a slight miss-match in paint colours. Bodywork fittings (e.g. chrome strips, door handles, etc.), will also need to be masked off. Use genuine masking tape and several thicknesses of newspaper for the masking operations.

Before beginning to spray, agitate the aerosol can thoroughly, then spray a test area (an old tin, or similar) until the technique is mastered. Cover the repair area with a thick coat of primer; the thickness should be built up using several thin layers of paint rather than one thick one. Using 400 grade wet-and-dry paper, rub down the surface of the primer until it is smooth. While doing this, the work area should be thoroughly doused with water, and the wet-and-dry paper periodically rinsed in water. Allow to dry before spraying on more paint.

Spray on the top coat, again building up the thickness by using several thin layers of paint. Start spraying in the centre of the repair area and then work outwards, with a side-to-side motion, until the whole repair area and about 2 inches of the surrounding original paintwork is covered. Remove all masking material 10 to 15 minutes after spraying on the final coat of paint.

Allow the new paint at least two weeks to harden, then using a paintwork renovator or a very fine cutting paste, blend the edges of the paint into the existing paintwork. Finally, apply wax polish.

Plastic components

With the use of more and more plastic body components (e.g. bumpers, spoilers, and in some cases major body panels), repair of more serious damage to such items has become a matter of either entrusting repair work to a specialist in this field, or renewing complete components. Repair of such damage by the DIY owner is not feasible owing to the cost of the equipment and materials required for effecting such repairs. The basic technique involves making a groove along the line of the crack in the plastic using a rotary burr in a power drill. The damaged part is then welded back together by using a hot air gun to heat up and fuse a plastic filler rod into the groove. Any excess plastic is then removed and the area rubbed down to a smooth finish. It is important that a filler rod of the correct plastic is used, as body components can be made of a variety of different types (e.g. polycarbonate, ABS, polypropylene).

Damage of a less serious nature (abrasions, minor cracks, etc.), can be repaired by the DIY owner using a two-part epoxy filler repair material. Once mixed in equal proportions this is used in similar fashion to the bodywork filler used on metal panels. The filler is usually cured in twenty to thirty minutes, ready for sanding and painting.

If the owner is renewing a complete component himself, or if he has repaired it with epoxy filler, he will have a problem of finding a paint for finishing which is compatible with the type of plastic used. At one time the use of a universal paint was not possible owing to the complex range of plastics come across in body component applications. Standard paints, generally, will not bond to plastic or rubber satisfactorily, but special paints are available to match any plastic or rubber finish can be obtained from dealers. However, it is now possible to obtain a plastic body parts finishing kit that consists of a pre-primer treatment, a primer and coloured top coat. Full instructions are normally supplied with a kit, but the method of use is to first apply the pre-primer to the component concerned and allow it to dry for up to 30 minutes. Then the primer is applied and left to dry for about an hour before finally applying the special coloured top coat. The result is a correctly coloured component where the paint will flex with the plastic or rubber, a property that standard paint does not normally possess.

5 **Major body damage** - repair

Major impact or rust damage should only be repaired by a Vauxhall dealer or other competent specialist. Alignment jigs are needed for successful completion of such work, superficially effective repairs may leave dangerous weaknesses in the structure. Distorted components can also impose severe stresses on steering and suspension components with consequent premature failure.

6.5 Lifting the bonnet from the vehicle

6 Bonnet - removal and refitting

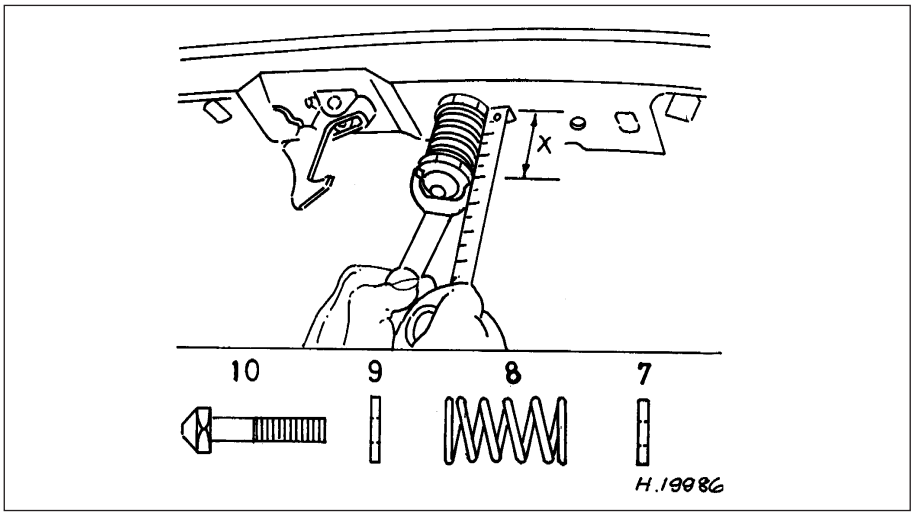
HAYNES HiNT ***To aid refitting mark the position of the bonnet before removal.***

Removal

1 Open the bonnet, and support it in the fully open position.
2 On models fitted with an underbonnet lamp, disconnect the battery negative lead, then prise the lamp from the bonnet and disconnect the wiring. If the bonnet is to be refitted, to aid routing of the wiring on refitting, tie a length of string to the end of the wiring. Then withdraw the wiring through the bonnet and untie the string, leaving it in position in the bonnet.
3 Similarly, disconnect the windscreen washer fluid hose from the connector in the bonnet, but tie the string to the connector, to prevent it from slipping into an inaccessible position in the bonnet.
4 Mark the position of the hinges on the bonnet.
5 With the help of an assistant, support the weight of the bonnet, then unscrew the securing bolts from the hinges, and lift the bonnet from the vehicle **(see illustration)**. If the bonnet is to be refitted, rest it carefully on rags or cardboard, to avoid damaging the paint.
6 If a new bonnet is to be fitted, transfer all the serviceable fittings (rubber buffers, lock striker, etc.), to it.
7 If desired, the bonnet hinges can be removed from the vehicle, after unscrewing the three bolts in each case securing them to the upper flanges of the front wings.

Refitting

8 Refitting is a reversal of removal, remembering the following points.
9 Align the hinges with the previously made marks on the bonnet.



6.11 Bonnet lock striker adjustment

7 Locknut 8 Spring 9 Washer 10 Striker pin

X = 40.0 to 45.0 mm (1.57 to 1.77 in) measured from bonnet panel to washer (9)

10 If the original bonnet is being refitted, draw the windscreen washer fluid hose, and where applicable, the underbonnet lamp wiring, through the bonnet using the string.
11 If the lock striker has been disturbed, adjust it to the dimension shown **(see illustration)**, then tighten the locknut.
12 If necessary, adjust the hinge bolts and the front rubber buffers until a good fit is obtained with the bonnet shut.

7 Bonnet lock components - removal and refitting

Removal

1 Open the bonnet, and support it in the fully open position.
2 The bonnet lock hook is riveted to the bonnet, and removal involves drilling out the rivet. Secure the hook assembly with a new rivet when refitting.
3 To remove the bonnet lock striker from the bonnet, loosen the locknut, then unscrew the striker and recover the washers and spring. When refitting, adjust the striker dimension as described in Section 6, paragraph 11, before tightening the locknut.
4 To remove the locking spring, disconnect the end of the bonnet release cable from the spring. Then unhook the end of the spring from the slot in the front body panel, and manipulate the spring out through the top of the panel, taking care not to damage the paint.

Refitting

5 Refitting is a reversal of removal.
6 On completion, close the bonnet and check that the lock and the bonnet release mechanism operate satisfactorily.

8 Bonnet lock release cable - removal and refitting

Removal

1 Open the bonnet, and support it in the fully open position.
2 Unscrew the release cable clip from the front body panel.
3 Disconnect the end of the release cable from the locking spring under the front body panel.
4 Disconnect the release cable from the release handle in the driver's footwell. If necessary, remove the release handle from its retainer for access to the cable end.
5 Pull the cable assembly through the grommet in the engine compartment bulkhead into the engine compartment.
6 Release the cable from any remaining clips and cable-ties, and withdraw it from the engine compartment.

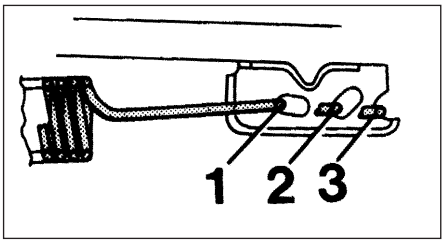
Refitting

7 Refitting is a reversal of removal, but ensure that the cable is correctly routed, and on completion check the release mechanism for satisfactory operation.

9 Boot lid (Saloon models) - removal and refitting

Removal

1 Open the bonnet lid fully.
2 On models with central locking, disconnect the battery negative lead then disconnect the wiring from the lock solenoid. If the boot lid is



9.6 Boot lid hinge counterbalance spring locations - Saloon models

1 Position for basic boot lid
2 Position for boot lid with outer plastic trim panel or spoiler
3 Position for boot lid with outer plastic trim panel and spoiler

to be refitted, tie a length of string to the end of the wiring. Then feed the wiring through the boot lid and untie the string, leaving it in position in the boot lid to assist refitting.

3 Mark the position of the hinges on the boot lid.

4 With the help of an assistant, support the weight of the boot lid, then unscrew the securing bolts from the hinges, and lift the boot lid from the vehicle. If the boot lid is to be refitted, rest it carefully on rags or cardboard, to avoid damaging the paint.

5 If a new boot lid is to be fitted, transfer all the serviceable fittings (rubber buffers, lock mechanism, etc.), to it.

6 If desired, the boot lid hinge counterbalance springs can be removed, but before unhooking them from the vehicle body, note their position so that they can be refitted in their original positions **(see illustration)**. Use a lever to unhook the springs.

Refitting

7 Refitting is a reversal of removal, remembering the following points.

8 Align the hinges with the precisely made marks on the boot lid.

9 Where applicable, draw the central locking solenoid wiring through the boot lid, using the string.

10 If necessary, adjust the hinge bolts and the rubber buffer until a good fit is obtained with the boot lid shut.

11 If necessary, adjust the position of the lock striker on the body, to achieve satisfactory lock operation.

12.6A Prise off the rear roof trim panel . . .

12.6B . . . for access to the tailgate hinge screws

10 Boot lid lock (Saloon models) - removal and refitting

Removal

1 Open the boot lid fully.

2 Unscrew the two securing screws, then withdraw the lock and disconnect the operating rod.

Refitting

3 Refitting is a reversal of removal, but if necessary adjust the position of the lock striker on the body, to achieve satisfactory lock operation.

11 Boot lid lock cylinder (Saloon models) - removal and refitting

Removal

1 Open the boot lid fully.

2 Unscrew the two securing nuts, then withdraw the lock cylinder complete with the housing, and disconnect the operating rods(s).

3 To remove the lock cylinder from the housing, insert the key into the lock, then extract the circlip and the operating lever assembly from the end of the lock cylinder, and withdraw the cylinder from the housing.

Refitting

4 Refitting is a reversal of removal, but check the operations of the lock on completion **(see illustration)**.

12 Tailgate (Hatchback models) - removal and refitting

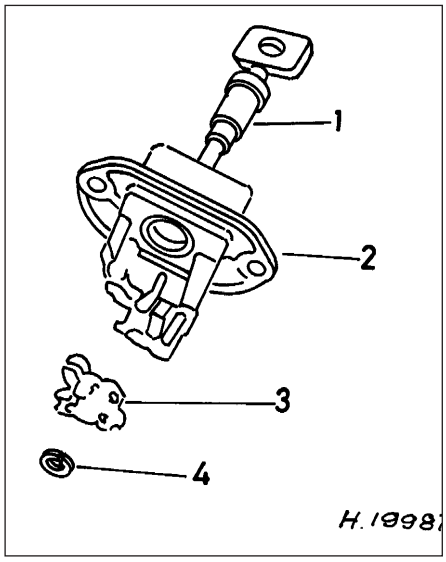
Removal

1 Open the tailgate fully.

2 Disconnect the battery negative lead.

3 Remove the securing screws, and withdraw the tailgate trim panels.

4 Disconnect all the relevant wiring now exposed, and disconnect the washer fluid hose.



11.4 Boot lid/tailgate lock cylinder components

1 Lock cylinder
2 Housing
3 Operating lever assembly
4 Circlip

5 If the original tailgate is to be refitted, tie string to the ends of all the relevant wires, and if necessary the washer fluid hose, then feed the wiring and the hose through the top edge of the tailgate. Untie the string, leaving it in position in the tailgate to assist refitting.

6 Prise off the rear roof trim panel, taking care not to break the securing clips, and lower the rear of the headlining slightly for access to the tailgate hinge securing screws **(see illustrations)**. Mark the hinge positions on the body.

7 Have an assistant support the weight of the tailgate, then disconnect the tailgate struts from their mounting balljoints, with reference to Section 15.

8 Ensure that the tailgate is adequately supported, then remove the hinge securing screws and withdraw the tailgate from the vehicle. If the tailgate is to be refitted, rest it carefully on rags or cardboard, to avoid damaging the paint.

9 If desired, the hinges can be removed from the tailgate by driving out the hinge pins.

10 If the tailgate can be moved up and down on its hinges due to wear in the hinge pins or their holes, it may be possible to drill out the holes and fit slightly oversize pins. Consult a Vauxhall dealer for further advice.

11 If a new tailgate is to be fitted, transfer all serviceable components to it.

Refitting

12 Refitting is a reversal of removal, remembering the following points.

13 Align the hinges with the previously made marks on the body.

13.1 Tailgate lock (trim panel removed)

14 If the original tailgate is being refitted, draw the wiring and washer fluid hose (where applicable) through the tailgate, using the string.
15 If necessary, adjust the hinge bolts and the rubber buffers, to obtain a good fit when the tailgate is shut.
16 If necessary, adjust the position of the lock striker on the body, to achieve satisfactory lock operation.

13 Tailgate lock (Hatchback models) - removal and refitting

Proceed as described in Section 10, but note that for access to the lock, the rear tailgate trim panel must be removed, after unscrewing the securing screws. Note also that the lock is secured by three screws **(see illustration)**.

14 Tailgate lock cylinder (Hatchback models) - removal and refitting

Proceed as described in Section 11, but note that for access to the lock cylinder, the rear tailgate trim panel must be removed after unscrewing the securing screws **(see illustration)**.

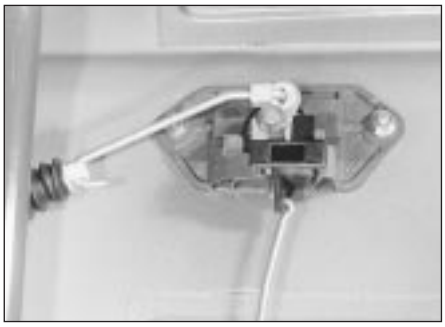
15 Tailgate strut (Hatchback models) - removal and refitting

Removal

1 Open the tailgate fully, and have an assistant support it.
2 Release the strut from its mounting balljoints by prising the spring clips a little way out **(see illustration)**, and pulling the strut off the balljoints. If the strut is to be re-used, do not remove the spring clips completely, and do not prise them out further than 6.0 mm (0.24 in).

Refitting

3 Refitting is a reversal of removal.



14.1 Tailgate lock cylinder housing - with central locking (trim panel removed)

16 Door - removal and refitting

Front door

Removal

1 The door hinges are welded onto the door-frame and the body pillar, so that there is no provision for adjustment or alignment.
2 To remove a door, open it fully and support it under its lower edge on blocks covered with pads of rag.
3 Where applicable, disconnect the battery negative lead, and disconnect the wiring connector from the front edge of the door. To release the connector, twist the locking collar, then pull the connector from the socket in the door **(see illustration)**.
4 Using a punch, drive the large roll pin from the door check arm pivot.
5 Remove the plastic covers from the hinge pins, then drive out the pins using a punch. Have an assistant support the door as the pins are driven out, then withdraw the door from the vehicle.

Refitting

6 Refitting is a reversal of removal, using a new check link roll pin.
7 If the door can be moved up and down on its hinges due to wear in the hinge pins or their holes, it may be possible to drill out the holes and fit slightly oversize pins. Consult a Vauxhall dealer for further advice.

16.3 Disconnect the wiring connector from the front edge of the door

15.2 Prising the spring clip from a tailgate strut balljoint

8 Door closure may be adjusted by altering the position of the lock striker on the body pillar, using an Allen key or hexagon bit.

Rear door

9 The removal and refitting procedure for rear doors is as described for front doors. Note that on models with central locking or electric windows, it will be necessary to remove the door inner trim panel, as described in Section 17, disconnect the wiring harness and feed it through the front edge of the door.

17 Door inner trim panel - removal and refitting

Front door

Removal

1 Prise the trim plate from the door lock button in the top rear edge of the door, then pull the lock button from the lock operating rod.
2 On models with manually operated windows, release the securing clip and remove the window regulator handle. To release the securing clip, insert a length of wire with a hooked end between the handle and the trim bezel on the door trim panel, and manipulate it to free the securing clip from the handle **(see illustration)**. Take care not to damage the door trim panel.
3 Prise the plastic surround from the door interior handle **(see illustration)**.

17.2 Window regulator handle securing clip

17.3 Remove the plastic surround from the door interior handle

4 Remove the seven trim panel securing screws that are located along the bottom edge of the door, and around the bottom edge of the armrest/hand grip. Release the door pocket clip, which is located below and to the rear of the door pocket, out of view.
5 The remaining nine plastic clips securing the trim panel to the door must now be released. This can be done using a screwdriver, but it is preferable to use a forked tool, to minimise the possibility of damage to the trim panel and the clips. The clips are located around the outer edge of the trim panel.
6 Once the clips have been released, pull the trim panel away from the door, and push the large clip at the rear of the door pocket rearwards to allow the trim panel to be withdrawn.
7 When working on the driver's door of models with electric door mirrors, it will be necessary to disconnect the mirror switch wiring connectors as the trim panel is withdrawn. Disconnect the battery negative lead before disconnecting the connector, and note the position of the connector in the bracket at the top of the door **(see illustration)**.
8 Similarly on models with door-mounted kerb lights, prise out the lamp and disconnect the wiring.
9 The plastic insulating sheet can be removed from the door after removing the loudspeaker (referring to Chapter 12 if necessary), and the door trim panel rear securing clip, which is attached to the door by a single screw. Take care not to damage the sheet.

17.7 Mirror switch wiring connector in bracket at top of door

10 The door pocket can be removed from the door trim panel by the three securing screws that are accessible from the rear of the trim panel, and releasing the single clip.
11 If desired, the door assist handle can be prised free from the door trim panel. Take care not to damage the securing clips.

Refitting

12 Refitting is a reversal of removal, remembering the following points.
13 If the plastic insulating sheet has been removed from the door make sure that it is refitted intact, and securely glued to the door. If the sheet is damaged or detached, rainwater may leak into the vehicle or damage the door trim.
14 Where applicable, ensure that the door mirror switch wiring connector is correctly positioned in its bracket before refitting the trim panel.
15 Ensure that all the trim panel securing clips engage as the panel is refitted, and if any of the clips were broken during removal, renew them on refitting.

Rear door

Removal

16 Proceed as described in paragraphs 1 to 3 inclusive.
17 On models with a door-mounted electric window operating switch, disconnect the battery negative lead, then carefully prise the switch from the door trim panel and disconnect the wiring plug.
18 Remove the three trim panel securing screws. Two are located under the interior handle surround, and the third is situated at the base of the door assist handle.
19 Proceed as described in paragraph 5.
20 Once the securing clips have been released, pull the trim panel away from the door **(see illustration)**.
21 If desired, the plastic insulating sheet can be removed from the door by peeling it back from the door skin. Take care not to damage the sheet.
22 If desired, the door assist handle can be prised free from the door trim panel. Take care not to damage the securing clips.

Refitting

23 Refitting is a reversal of removal, remembering the following points.

17.20 Removing a rear door inner trim panel

24 If the plastic insulating sheet has been removed from the door, make sure that it is refitted intact, and securely glued to the door. If the sheet is damaged or detached, rainwater may leak into the vehicle or damage the door trim.
25 Where applicable, ensure that the electric window switch wiring is routed so that it does not foul the window regulator mechanism.
26 Ensure that all the trim panel securing clips engage as the panel is refitted, and if any of the clips were broken during removal, renew them on refitting.

18 Door interior handle - removal and refitting

Removal

1 Remove the door inner trim panel, as described in Section 17.
2 Slide the handle assembly rearwards to free it from the door, then unhook the operating rod, and withdraw the assembly.

Refitting

3 Refitting is a reversal of removal, but check the mechanism for satisfactory operation before refitting the door inner trim panel, then refit the trim panel with reference to Section 17.

19 Door exterior handle - removal and refitting

Front door

Removal

1 Remove the door inner trim panel, as described in Section 17.
2 Peel back the plastic insulating sheet sufficiently to gain access to the exterior handle.
3 Unscrew the two nuts securing the exterior handle to the door.
4 When working on the driver's door of models with central locking, unclip the microswitch from the rear edge of the exterior handle assembly.
5 Release the two lower retaining clips, then manipulate the exterior handle assembly through the outside of the door, and disconnect the operating rods.

Refitting

6 Refitting is a reversal of removal, but check the operation of the mechanism before refitting the door inner trim panel, and refit the trim panel with reference to Section 17.

Rear door

Removal

7 Fully lower the window, then continue as described in paragraphs 1 and 2.

20.2 Extract the circlip from the end of the lock cylinder . . .

20.3A . . . then withdraw the lock cylinder using the key . . .

20.3B . . . and recover the lever assembly

8 Pull the weatherstrip from the rear edge of the window aperture, then unscrew the now exposed window rear guide rail securing screw. Note that the screw is of the Torx type.
9 Unscrew the remaining window rear guide rail securing screw (Torx type) which is accessible through the inner door skin, then withdraw the guide rail from the door. The weatherstrip can be left attached to the guide rail, in which case position the guide rail to one side out of the way, taking care not to damage the vehicle paintwork.
10 Reach in through the aperture in the rear of the door, and unclip the plastic shield from the door lock.
11 Unscrew the three Torx type lock securing bolts from the rear edge of the door, and lower the lock assembly inside the door.
12 Unscrew the two nuts securing the exterior handle to the door.
13 Release the two lower retaining clips, then manipulate the exterior handle through the outside of the door, and disconnect the operating rods.

Refitting

14 Refitting is a reversal of removal, but check the operation of the door lock, handle and window regulator mechanisms before refitting the door trim panel, and refit the trim panel with reference to Section 17.

20 Door lock barrel - removal and refitting

Removal

1 Remove the door exterior handle, as described in Section 19.
2 Insert the key into the lock, then extract the circlip from the end of the lock cylinder **(see illustration)**.
3 Withdraw the lock cylinder using the key, and recover the lever assembly **(see illustrations)**.

Refitting

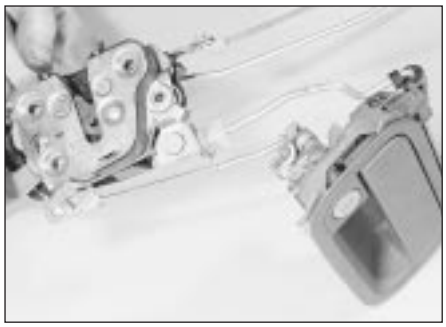
4 Refitting is a reversal of removal, but check the operation of the door lock, handle and window regulator mechanisms before refitting the door trim panel, and refit the trim panel with reference to Section 17.

21 Door lock - removal and refitting

Front door

Removal

1 Remove the door inner trim panel, as described in Section 17.
2 Unscrew the door trim panel rear securing clip, and peel the plastic insulating sheet back from the rear end of the door. Take care not to damage the sheet.
3 Working through the apertures in the door, disconnect the operating rods from the interior and exterior handles, and release the clips on the door, where applicable **(see illustration)**.
4 Reach in through the lower door aperture and unclip the plastic shield from the lock.
5 On models with central locking, lower the window half way. Disconnect the battery negative lead and working through the lower aperture in the door, disconnect the wiring plug from the central locking motor. Note that a clip must be depressed to release the wiring plug.
6 Unscrew the three Torx bolts securing the lock assembly to the rear edge of the door. Then manipulate the lock assembly (complete with central locking motor, where applicable, and operating rods), around the window regulator mechanism and out through the lower door aperture **(see illustration)**.



21.3 View of removed door lock and exterior handle assembly, showing operating rod attachments

Refitting

7 Refitting is a reversal of removal, but check the operation of the door lock, handle, and window regulator mechanisms before refitting the door trim panel, and refit the trim panel with reference to Section 17. If the lock operation is not satisfactory, note that the exterior handle operating rod can be adjusted by turning the knurled plastic adjuster wheel at the end of the rod **(see illustration)**.

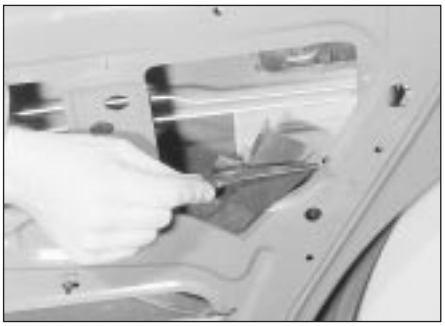
Rear door

Removal

8 Fully lower the window, then remove the door inner trim panel and the plastic insulating sheet, as described in Section 17.
9 Working through the apertures in the door, disconnect the operating rods from the interior and exterior handles, and from the lock button bellcrank.

21.6 Removing the lock assembly - model with central locking

21.7 Exterior handle operating rod adjuster wheel (arrowed) at lock end of rod



21.12 Unclip the plastic shield from the lock

10 Pull the weatherstrips from the rear edge of the window aperture, then unscrew the now-exposed window rear guide rail securing screw. Note that the screw is of the Torx type.
11 Unscrew the remaining window rear guide rail securing screw (Torx type), which is accessible through the inner door skin, then withdraw the guide rail from the door. The weatherstrip can be left attached to the guide rail, in which case position the guide rail to one side out of the way, taking care not to damage the vehicle paintwork.
12 Reach in through the aperture in the rear of the door, and unclip the plastic shield from the lock **(see illustration)**.
13 On models with central locking, disconnect the battery negative lead (if not already done) and disconnect the wiring plug from the central locking motor. Note that a clip must be depressed to release the wiring plug.
14 Unscrew the three Torx bolts securing the lock assembly to the rear edge of the door. Then manipulate the lock assembly (complete with central locking motor, where applicable, and operating rods), around the window regulator mechanism and out through the lower door aperture.

Refitting

15 Proceed as described in paragraph 7.

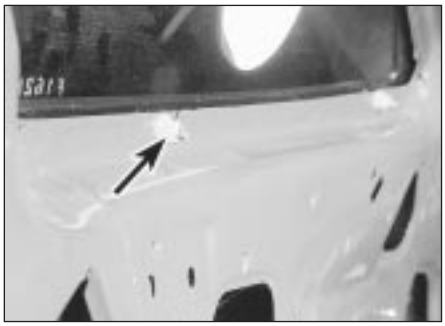
22 Door check arm - removal and refitting

Removal

1 Open the door fully, then using a punch, drive the roll pin from the door check arm pivot.
2 Remove the door inner trim panel, as described in Section 17.
3 Working at the front edge of the door, unscrew the two bolts securing the check arm to the door, then withdraw the check arm through the inside of the door.

Refitting

4 Refitting is a reversal of removal, but use a new roll pin to secure the check arm to the pivot.



24.2 Upper rear quarter trim panel removed, exposing rear quarter window securing nut (arrowed)

23 Windscreen and rear window - removal and refitting

1 Except for the rear quarter windows, all fixed glass is bonded in position, using a special adhesive.
2 Special tools, adhesives and expertise are required for successful removal and refitting of glass fixed by this method. Such work must therefore be entrusted to a Vauxhall dealer or a windscreen specialist.
3 The same remarks apply if sealing of the windscreen or other glass surround is necessary.

24 Rear quarter windows - removal and refitting

Removal

1 Remove the upper rear quarter trim panel, as described in Section 36.
2 Have an assistant support the quarter window from outside the vehicle, then unscrew the plastic securing nuts, and push the window from the body **(see illustration)**.

Refitting

3 Refitting is a reversal of removal, but ensure that the seal on the rear of the glass is seated correctly against the body as the window is fitted.

25.4 Window upper guide rail plastic end stop (arrowed)

25 Door window - removal and refitting

Front door

Removal

1 Fully lower the window, then remove the door inner trim panel and the plastic insulating sheet, as described in Section 17.
2 Unscrew the window rear guide rail securing bolt from the rear edge of the door, then manipulate the guide rail out through the lower aperture in the door.
3 Pull the weatherstrips from the inside and outside lower edge of the window aperture.
4 Pull the plastic end stop from the window upper guide rail **(see illustration)**.
5 Remove the two screws securing the lower guide rail to the door, and lower the guide rail **(see illustration)**.
6 Manipulate the window regulator mechanism as necessary, and tilt the window glass forwards until it can be withdrawn from outside the door through the window aperture.

Refitting

7 Refitting is a reversal of removal, but adjust the angle of the lower guide rail by means of the two securing screws until smooth operation of the window is achieved. Refit the door inner trim panel with reference to Section 17.
8 On models with electric windows, on completion, the electronic control system must be programmed as follows.
9 Close all the doors, and switch on the ignition.
10 Close each window in turn, using the relevant switch, and when each window has fully closed, continue to keep the switch depressed for at least five seconds.

Rear door

Removal

11 Fully lower the window, then remove the door inner trim panel and the plastic insulating sheet, as described in Section 17.

25.5 Window lower guide rail securing screws (arrowed)

25.12 Unscrewing the window rear guide securing screw

25.13A Remove the remaining securing screw . . .

25.13B . . . then withdraw the guide rail from the door

12 Pull the weatherstrip from the rear edge of the window aperture, then unscrew the now exposed window rear guide rail securing screw **(see illustration)**. Note that the screw is of the Torx type.

13 Unscrew the remaining window rear guide rail securing screw (Torx type), which is accessible through the inner door skin, then withdraw the guide rail from the door **(see illustrations)**. The weatherstrip can be left attached to the guide rail, in which case position the guide rail to one side out of the way, taking care not to damage the vehicle paintwork.

14 Pull the weatherstrips from the inside and outside lower edge of the window aperture **(see illustration)**.

15 Manipulate the window regulator mechanism as necessary, and tilt the window glass forwards until it can be withdrawn from outside the door through the window aperture **(see illustration)**.

Refitting

16 Refitting is a reversal of removal, but refit the door inner trim panel with reference to Section 17.

17 On models with electric windows, on completion the electronic control system must be programmed, as described in paragraphs 9 and 10.

26 Door window regulator - removal and refitting

Front door

Removal

1 Lower the window halfway, then remove the door inner trim panel and the plastic insulating sheet, as described in Section 17.

2 Support the window in the half-open position by placing a wooden prop under it, ensuring that the prop is clear of the regulator mechanism.

3 Drill out the rivets securing the regulator mechanism to the door, using an 8.5 mm (0.34 in) diameter drill. Take care not to damage the door panel.

4 Pull the plastic end stop from the window upper guide rail.

25.14 Pulling the inside weatherstrip from the window aperture

25.15 Withdrawing the window glass from the door

5 Remove the two screws securing the lower guide rail to the door, and lower the guide rail.

6 On models with electric windows, disconnect the battery negative lead (if not already done), then disconnect the wiring plug from the central locking motor.

7 Carefully manipulate the window regulator assembly out through the lower aperture in the door.

Refitting

8 Refitting is a reversal of removal, remembering the following points.

9 Ensure that the regulator arms are correctly positioned in the guide rails before securing the regulator assembly to the door **(see illustration)**.

10 Secure the regulator assembly to the door, using new rivets.

11 Adjust the angle of the lower guide rail by means of the two securing screws, until smooth operation of the window is achieved.

12 Refit the door inner trim panel with reference to Section 17.

13 On models with electric windows, on completion, the electronic control system must be programmed, as described in Section 25, paragraphs 9 and 10.

Rear door

Removal

14 Proceed as described in paragraphs 1 to 3 inclusive, and paragraphs 6 and 7.

Refitting

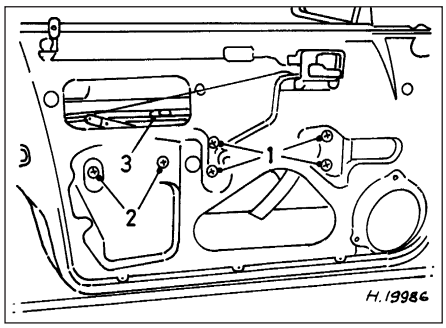
15 Refitting is a reversal of removal, remembering the following points.

16 Ensure that the regulator arm is correctly positioned in the guide rail before securing the regulator assembly to the door.

17 Secure the regulator assembly to the door, using new rivets.

18 Check the regulator mechanism for satisfactory operation before refitting the door trim panel, then refit the panel with reference to Section 17.

19 On models with electric windows, on completion, the electronic control system must be programmed, as described in Section 25, paragraphs 9 and 10.



26.9 Front door window regulator and guide components

1 Regulator mechanism securing rivets
2 Lower guide rail securing screws
3 Upper guide rail and stop

27.2 Removing the mirror glass - electric mirror (mirror removed)

27.6 Removing the mirror trim panel . . .

27.7A . . . for access to the mirror securing screws

27.7B Withdraw the mirror and disconnect the wiring plug

27.8 Locating the weather seal on the mirror housing

27 Door mirror - removal, overhaul and refitting

Glass renewal

1 If desired, the mirror glass can be removed for renewal without removing the mirror. On models with electric mirrors, disconnect the battery negative lead.
2 Carefully prise the glass from its balljoints using a screwdriver, and where applicable, disconnect the heater wires from the glass. Take care, as the glass is easily broken if forced **(see illustration)**.
3 To refit, simply push the glass onto the balljoints, ensuring that the heater wires are connected (where applicable).

27.10 Mirror motor securing screws (arrowed)

Mirror - removal and refitting

4 On models with electric mirrors, disconnect the battery negative lead.
5 On models with manually adjustable mirrors, pull off the interior adjuster lever.
6 Prise the mirror trim panel from the inside front edge of the door **(see illustration)**.
7 Extract the three now-exposed securing screws, and withdraw the mirror assembly from the door. On models with electric mirrors, disconnect the wiring plug **(see illustrations)**.
8 Refitting is a reversal of removal, but ensure that the rubber weather seal is correctly located on the mirror housing **(see illustration)**.

Electric motor removal and refitting

Removal

9 Remove the mirror glass, as described previously in this Section.
10 Extract the three motor securing screws, and disconnect the wiring plug, then withdraw the motor **(see illustration)**.

Refitting

11 Refitting is a reversal of removal, but ensure that the wiring is routed behind the motor, to avoid interfering with the adjustment mechanism.

28 Bumpers - removal and refitting

Front bumper

Removal

1 Remove both headlamps, as described in Chapter 12.
2 The bumper is removed as a complete assembly with the front trim panel, therefore on models with front foglamps, disconnect the foglamp wiring plugs. On DOHC and 1993-on models remove the radiator grille panel, as described in Section 29. Also remove the water deflector if fitted.
3 The bumper is secured by a single bolt at each end, and by clips. It is possible to unscrew the right-hand securing bolt with the air cleaner assembly in place. Using an open-ended spanner, but if desired the air cleaner assembly can be removed for improved access, as described in Chapters 4A or 4B, as applicable.
4 Remove the left and right-hand bumper securing bolts from the body side panels behind the headlamp apertures **(see illustration)**.
5 Release the bumper retaining clips from the body by pushing each end of the bumper towards the front of the vehicle, then pulling the end of the bumper out from the wing **(see illustration)**.

28.4 Unscrewing the right-hand front bumper securing bolt (air cleaner removed)

28.5 Front bumper retaining clips released from body

28.8A Remove the trim panel . . .

28.8B . . . to expose the bumper securing nuts

6 Carefully withdraw the bumper from the vehicle.

Refitting

7 Refitting is a reversal of removal.

Rear bumper

Removal

8 Remove the rear trim panel from the luggage compartment by prising up the top edge to release the clips, then lift the panel upwards to free it from the lower locating tags. The bumper retaining nuts are now exposed **(see illustrations)**.

9 Note that the bumper is removed as a complete assembly with its lower trim panel.

10 Disconnect the battery negative lead, then prise the number plate lamp from the bumper, and disconnect the wiring.

11 Unscrew the bumper retaining nuts, and recover the washers. On DOHC models, the bumper securing nuts are accessible from underneath the vehicle.

12 Where fitted, remove the special locking rivets, one each side, securing the bumper to the wheel arch.

13 Additional clips may be present on the underside of the bumper which must also be removed.

14 Release the bumper retaining clips at the front edges of the bumper by tapping the centre pin through the expanding clip, using a pin punch or similar. The pin will drop out as it is pushed through - recover it for refitting.

15 Push each end of the bumper towards the rear of the vehicle, then pull the end of the bumper from the rear wing.

29.1 Freeing a radiator grille panel retaining clip using a screwdriver

16 Carefully withdraw the bumper from the vehicle, taking care not to strain the number plate lamp wiring.

Refitting

17 Refitting is a reversal of removal. The expanding clips at the front edges of the bumper are secured by pushing the pin into the clip until flush.

29 Radiator grille panel - removal and refitting

All SOHC models

Removal

1 With the bonnet fully open and supported, pull the upper edge of the grille panel forwards and free the retaining clips using a screwdriver. Then lift the panel to release the lower locating lugs from their grommets in the lower body front panel **(see illustration)**.

Refitting

2 Refitting is a reversal of removal, but ensure that the lower locating lugs seat correctly in their grommets, and take care not to push the grommets from their holes in the body front panel.

DOHC and 1993-on models

Removal

3 Extract the three screws securing the grille panel to the body front panel, then lift the grille panel to release the lower locating lugs from their grommets in the lower body front panel.

Refitting

4 Refitting is a reversal of removal, with reference to paragraph 2.

30 Windscreen cowl panel - removal and refitting

Removal

1 Remove the wiper arms, referring to Chapter 12, if necessary.

2 Disconnect the washer fluid hose from the reservoir, and feed it through the cowl panel, noting its routing as a guide to refitting. Be prepared for fluid spillage.

3 Where applicable, disconnect the battery negative lead, then disconnect the underbonnet lamp wiring plug and feed it through the cowl panel, noting its routing as a guide to refitting.

4 Working from one end of the cowl panel, carefully prise the panel from the body. Care must be taken, as the panel is easily damaged.

Refitting

5 Refitting is a reversal of removal, ensuring that the panel is correctly seated along its length, and that the washer fluid hose, and where applicable the underbonnet lamp wiring, is correctly routed.

31 Wheel arch liners - general

1 The plastic wheel arch liners are secured by a combination of self-tapping screws and plastic clips. Removal and refitting is self explanatory, remembering the following points **(see illustration)**.

2 Some of the securing clips may be held in place using a central pin, which must be tapped out to release the clip.

3 The clips are easily broken during removal, and it is advisable to obtain a few spare clips for possible use when refitting.

31.1 Removing a wheel arch liner

34.2A Extract the four securing screws . . .

34.2B . . . and withdraw the guide rail plastic surround

34.4 Prising a plastic trim strip from the guide rail

4 Certain models may have additional underbody shields and splashguards fitted, which may be attached to the wheel arch liners.

32 Engine undershield (DOHC models) - removal and refitting

Removal

1 Apply the handbrake, then jack up the front of the vehicle, and support on axle stands (see "*Jacking and Vehicle Support*").
2 Extract the two securing screws, and remove the oil filter access panel.
3 Working around the edges of the splash shield, remove the self tapping screws that secure the shield to the body, noting that some of the screws also secure the wheel arch liners.
4 With the help of an assistant, pull the shield from the vehicle, and place it to one side to avoid damage.

Refitting

5 Refitting is a reversal of removal.

33 Fuel filler flap - removal and refitting

Removal

1 Open the flap for access to the four screws securing the flap to the rear wing.

34.6 Lifting the glass panel from the roof aperture

2 Remove the securing screws, and withdraw the flap.

Refitting

3 Refitting is a reversal of removal.

34 Sunroof components - removal and refitting

Note: *The sunroof is a complex piece of equipment consisting of a large number of components. It is strongly recommended that the sunroof mechanism is not disturbed unless necessary. If the sunroof mechanism is faulty, or requires overhaul, consult a dealer for advice.*

Glass panel

Removal

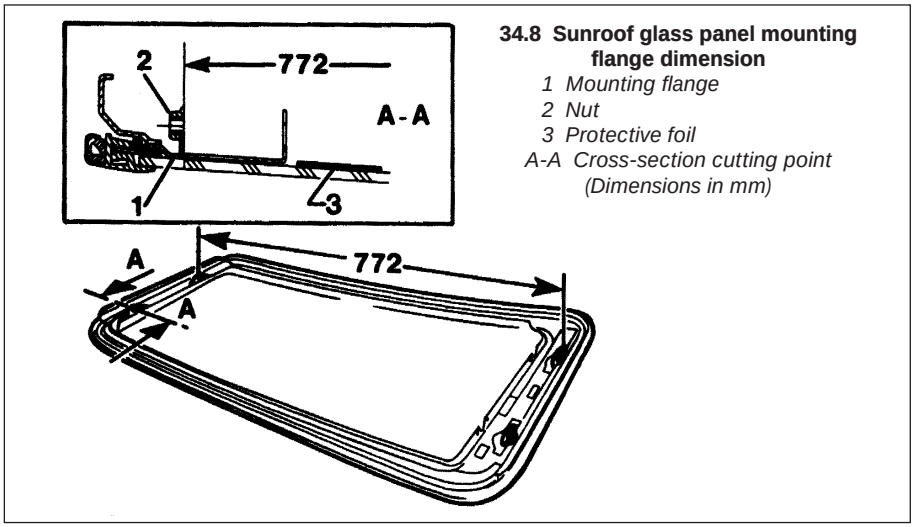
1 Push the sunshade fully rearwards, and open the glass panel halfway.
2 Extract the four securing screws from the front edge of the guide rail plastic surround, and withdraw the surround down through the sunroof aperture **(see illustrations)**.
3 Move the glass panel forward, and open it to its tilt position.
4 Prise the plastic trim strips from the guide rails, to expose the glass panel securing screws **(see illustration)**.

34.5 Loosening a glass panel securing screw

5 Extract the three securing screws from each guide rail, and where applicable, recover the lockwashers **(see illustration)**.
6 Carefully lift the glass panel from the roof aperture, taking care not to damage the vehicle paintwork **(see illustration)**.

Refitting

7 Refitting is a reversal of removal, remembering the following points.
8 Before refitting the glass panel, measure the distance between the mounting flanges. Bend the flanges if necessary to achieve the desired dimension **(see illustration)**.



34.8 Sunroof glass panel mounting flange dimension

1 Mounting flange
2 Nut
3 Protective foil
A-A Cross-section cutting point
(Dimensions in mm)

9 Where applicable, ensure that the glass panel securing screw lockwashers engage with the locating pins on the guide rails.
10 Before fully tightening the glass panel securing screws, close the panel, and adjust its position to give the dimensions shown **(see illustration)**.
11 If a new glass panel has been fitted, peel off the protective foil on completion of adjustment.
12 Take care when refitting the guide rail plastic surround, as it is fragile. Adjust the open position of the glass panel as required to fit the surround without damaging it.

Gutter

Removal

13 Remove the glass panel, as described previously in this Section.
14 Extract the two securing screws (Allen or Torx type), then lift the gutter from the roof aperture.

Refitting

15 Refit the gutter to the roof aperture at an angle, pushing it up to the stop on both sides until the retaining lugs engage with the gutter guides.
16 Refit and tighten the securing screws, then refit and adjust the glass panel as described earlier in this Section.

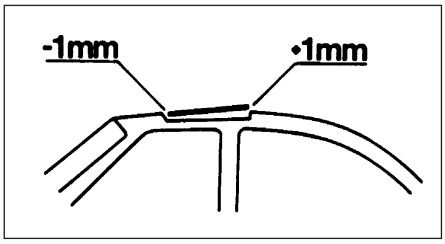
Sunshade

Removal

17 Remove the glass panel and the gutter, as described previously in this Section.

34.22A Extract the securing screws . . .

34.22B . . . then withdraw the trim panel from the roof . . .



34.10 Sunroof glass panel fitting position

18 Carefully prise the four sunshade spring clips out of the roof guides using a plastic or wooden implement to avoid damage, then withdraw the sunshade from the guides **(see illustration).**

Refitting

19 Refitting is a reversal of removal, but ensure that the spring clips engage correctly with the roof guides.

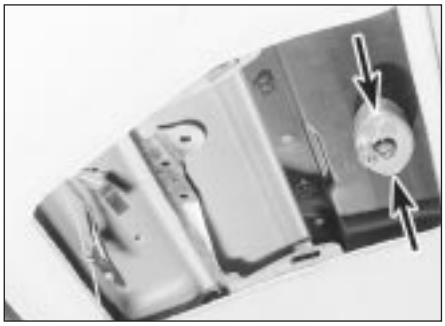
Crank drive

Removal

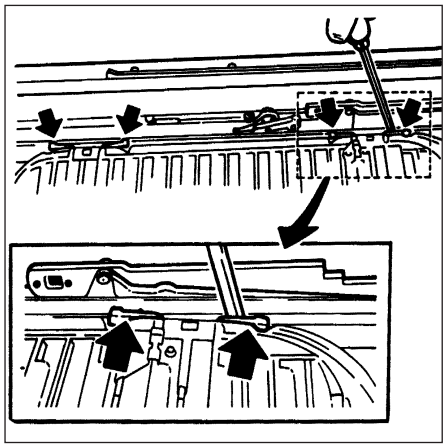
20 Prise out the trim and unscrew the crank handle securing screw. Prise the crank from the drive spindle.
21 Disconnect the battery negative lead, then prise the courtesy lamp from the roof trim panel, and disconnect the wiring.
22 Remove the two trim panel securing screws, and withdraw the trim panel from the roof **(see illustrations)**.
23 Extract the two securing screws, and remove the crank drive assembly **(see illustration)**.

Refitting

24 Refitting is a reversal of removal, remembering the following points.
25 Before finally refitting the crank handle, the crank drive must be adjusted as follows.
26 Temporarily refit the crank handle, and position it so that it faces forwards, then depress the locking button.
27 Remove the crank handle and turn the crank drive pinion anti-clockwise by hand as far as the stop.
28 Refit the crank handle so that it faces directly forwards, then tighten the securing screw and refit the trim.



34.23 . . . to expose the crank drive - securing screws arrowed



34.18 Sunshade spring clip locations (arrowed)

35 Interior trim panels - general

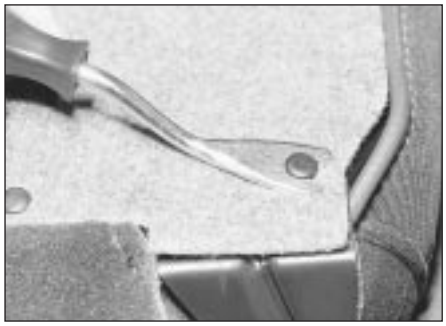
1 The various interior trim panels are secured by a variety of screws and plastic clips.
2 Where press-fit plastic fasteners are used, it is advisable to use a forked tool similar to that shown to remove them, to avoid damage to the clips and the trim panel **(see illustration)**.
3 Removal and refitting of most of the trim panels is self-explanatory but in all cases, care must be taken, as the panels are easily damaged by careless handling and the use of sharp instruments to release clips.

36 Interior trim panels - removal and refitting

Sill trim panel

Removal

1 When working on the passenger side of models fitted with ABS, extract the three securing screws and remove the cover from the ABS control module. Note that two of the screws are covered by plastic caps, which must be prised out to expose the screws.



35.2 Forked tool being used to remove clip from rear seat back trim

36.2 Sill trim panel removed to expose securing clips

2 The sill trim panel can be removed by simply prising it upwards to release the securing clips from the floor **(see illustration)**.

Refitting

3 Refitting is a reversal of removal, but ensure that the panel is correctly seated with its top edge located under the sill weatherstrip.

Footwell side trim panel

Removal

4 Release the front end of the sill trim panel from the floor, as described previously.
5 Prise the footwell side trim panel from the footwell **(see illustration)**. If necessary, pull the weatherstrip from the edge of the door aperture.

Refitting

6 Refitting is a reversal of removal, but ensure that the trim panels are correctly seated under the weatherstrip.

36.11 . . . then pull the lower trim panel from the pillar

36.5 Removing the driver's footwell side trim panel

Front body pillar trim panel

Removal

7 Prise the trim panel from the body pillar to release the six retaining clips. If necessary, pull the weatherstrip from the edge of the pillar.

Refitting

8 Refitting is a reversal of removal, but ensure that the trim panel is correctly seated under the weatherstrip.

Centre body pillar trim panels

Removal

9 Remove the sill trim panel, as described previously in this Section.
10 Prise the weatherstrips from the sides of the body pillar **(see illustration)**.
11 Pull the lower trim panel from the pillar to release the retaining clips **(see illustration)**.
12 With the lower trim panel removed, the upper trim panel can be withdrawn in the same way after unbolting the upper seat belt mounting. Prise off the trim to expose the upper seat belt mounting bolt, then unscrew the bolt and recover the spacer.

Refitting

13 Refitting is a reversal of removal, but ensure that the trim panels are seated correctly under the weatherstrips.

Rear quarter trim panels

14 Prise off the trim and unbolt the seat belt upper mounting from the body pillar. Recover the spacer.
15 Pull back the weatherstrip from the rear edge of the rear door aperture. On Hatchback models, remove the parcel shelf.

36.10 Pull the weatherstrip from the sides of the body pillar . . .

16 Remove the screws securing the upper rear quarter trim panel to the body. Note that all the screws are of the Torx type. When working on the right-hand side of Hatchback models, it will be necessary to open the first-aid kit/warning triangle cover flap in the luggage compartment for access to some of the screws.
17 Withdraw the upper seat quarter trim panel carefully, taking care not to damage surrounding panels **(see illustration)**. Where applicable, disconnect the wiring from the loudspeaker.
18 With the upper rear quarter trim panel removed, the lower trim panel can be removed.
19 The lower rear quarter trim panel is secured by a variety of screws, nuts and clips, depending upon model. Removal and refitting of the panel is self-explanatory, remembering the points made in Section 35. Note that the rubber stop must be removed from the seat catch before the trim panel can be withdrawn **(see illustrations)**.

Luggage compartment rear trim panel

20 Prise the trim panel from the rear of the luggage compartment to release the securing clips.
21 Refitting is a reversal of removal.

Tailgate trim panels (Hatchback models)

22 The tailgate trim panels are secured by screws, and removal and refitting are self-explanatory. Note that the lower side panel securing screws also secure the rear panel.

36.17 Withdrawing the upper rear quarter trim panel - Hatchback model

36.19A Removing the rubber stop from the seat catch

36.19B Withdrawing the lower rear quarter trim panel - Hatchback model

37.2 Releasing a footwell trim panel securing clip

37 Facia panels - removal and refitting

HAYNES HiNT ***Before removing any of the facia panels, the battery negative lead should be disconnected, as several permanently live feed wires are routed behind the facia.***

Footwell trim panels

Removal

1 The lower footwell trim panels on the driver's and passenger sides are secured by turnbuckle type plastic clips.

37.7 Removing the column adjuster lever

37.5A Remove the four securing screws from the fusebox aperture . . .

2 To remove a panel, use a screwdriver to turn the heads of the clips through 90° **(see illustration)**, then withdraw the panel from the facia.

Refitting

3 Refitting is a reversal of removal.

Driver's side lower facia panel

Removal

4 Open the flap covering the fusebox to expose the four lower facia panel securing screws.

5 Remove the four screws, then lower the panel and pull it towards the driver's door to release the two securing clips. Withdraw the panel from the facia **(see illustrations)**.

Refitting

6 Refitting is a reversal of removal.

37.9A Prise out the covers . . .

37.5B . . . then withdraw the lower facia panel

Steering column shrouds

Removal

7 On models with an adjustable tilt steering column, move the column to its fully raised position, then unscrew the adjuster lever **(see illustration)**.

8 Turn the steering wheel as necessary to expose one of the front steering column shroud securing screw covers.

9 Prise out the cover, and remove the column shroud securing screw, then turn the steering wheel to enable the remaining cover and screw to be removed **(see illustrations)**.

10 Remove the three securing screws from the underside of the lower column shroud, then remove the lower and upper shrouds **(see illustrations)**.

37.9B . . . then remove the front column shroud securing screws

37.10A Remove the three lower column shroud securing screws . . .

37.10B . . . then remove the lower . . .

37.10C . . . and upper shrouds (steering wheel removed)

37.13 Removing the instrument panel lower trim panel

Refitting

11 Refitting is a reversal of removal, but make sure that the column switch gaiters engage in the cut-outs in the upper shroud.

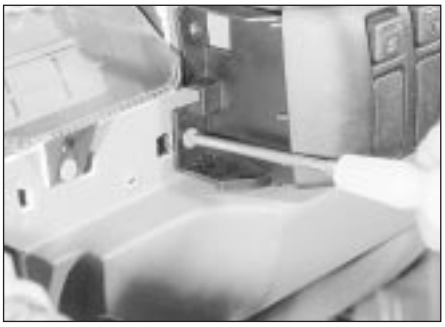
Instrument panel lower trim panel

Removal

12 Remove the steering column shrouds, as described previously in this Section.
13 The panel is secured by clips at either end, which must be released by pulling the ends of the panel from the facia **(see illustration)**. This is a tricky operation, as to release both ends, the panel must be bent slightly at its centre. Take great care, as the panel is easily broken.

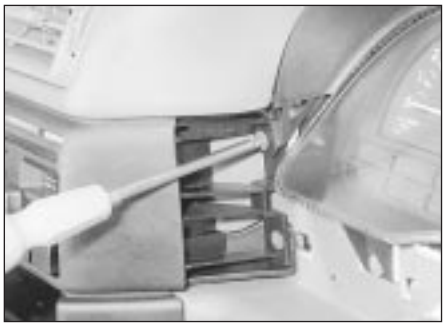
Refitting

14 Refitting is a reversal of removal.



37.20 Removing the lower left-hand lighting switch panel securing screw

37.22 Disconnecting the wiring plugs from the lighting switches



37.16 Unscrewing the left-hand instrument panel upper trim panel securing screw

Instrument panel upper trim panel

Removal

15 Remove the instrument panel lower trim panel, as described previously in this Section.
16 Extract the two now-exposed lower trim panel securing screws, one from each end of the panel, noting that the left-hand screw also secures the heater control panel **(see illustration)**.
17 Withdraw the panel from the facia **(see illustration)**.

Refitting

18 Refitting is a reversal of removal.

Lighting switch panel

Removal

19 Remove the instrument panel upper and lower trim panels, as described previously in this Section.
20 Remove the remaining securing screw from the left-hand side of the lighting switch panel **(see illustration)**.
21 Pull the lighting switch panel from the facia, to release the securing clips at the right-hand end.
22 Ensure that the battery negative lead has been disconnected, then disconnect the wiring plugs from the switches, and withdraw the switch panel **(see illustration)**.

Refitting

23 Refitting is a reversal of removal.

37.29A Right-hand securing lug (arrowed) behind heater control panel

37.17 Withdrawing the instrument panel upper trim panel

Radio/oddments tray panel

Removal

24 Remove the radio, as described in Chapter 12.
25 Remove the lower and upper instrument panel trim panels, as described previously in this Section.
26 Remove the lower securing screw from the right-hand side of the heater control panel.
27 Remove the clock or trip computer, as applicable, from the facia referring to Chapter 12, if necessary.
28 Remove the two now-exposed heater control panel securing screws from the clock/trip computer aperture.
29 Carefully manipulate the heater control panel forwards within the limits of the control cable travel, then manipulate the radio/oddments tray out from the facia. This is a tricky operation, as the radio/oddments tray securing lugs rest behind the heater control panel securing lugs **(see illustrations)**. Take care not to strain the heater control cables.
30 With the radio/oddments tray removed, the radio support tray can be removed if desired by unscrewing the two securing screws, then sliding the tray forwards to disconnect the wiring and aerial plugs **(see illustrations)**.

Refitting

31 Refitting is a reversal of removal, taking care not to damage the heater control components as the radio/oddments tray is manipulated into position.

37.29B Manipulating the radio/oddments tray from the facia

37.30A Slide the radio support tray from the facia . . .

37.30B . . . then disconnect the wiring and aerial plugs

37.32 Prise the side trim panels from the oddments tray . . .

37.33A . . . then release the lower retaining clips . . .

37.33B . . . and withdraw the oddments tray

37.34 Prise out the glovebox lamp and disconnect the wiring

37.35A Extract the upper . . .

37.35B . . . and lower glovebox securing screws . . .

37.35C . . . then withdraw the glovebox

Glovebox assembly

Warning: If an airbag is fitted, read the warning in Chapter 12, before starting work.

Removal

32 Carefully prise the side trim panels from the passenger's oddments tray, using a screwdriver **(see illustration)**.

33 Open the glovebox, then using a screwdriver, release the two lower retaining clips at the rear of the oddments tray, and withdraw the oddments tray from the facia **(see illustrations)**.

34 Where applicable, prise out the glovebox lamp, and disconnect the wiring **(see illustration)**.

35 Extract the two upper and two lower securing screws, then withdraw the glovebox assembly from the facia **(see illustrations)**.

Refitting

36 Refitting is a reversal of removal, but where applicable, feed the wiring through the glovebox lamp aperture as the assembly is offered into position.

38 Centre console - removal and refitting

Rear section

Removal

1 Prise the trim panel from the front of the rear centre console section to expose the front securing screw **(see illustration)**.

2 Extract the front securing screw **(see illustration)**.

3 Release the gaiter from the rear of the handbrake lever grip, then pull the grip from the front of the handbrake lever **(see illustration)**.

38.1 Prise the trim panel from the centre console . . .

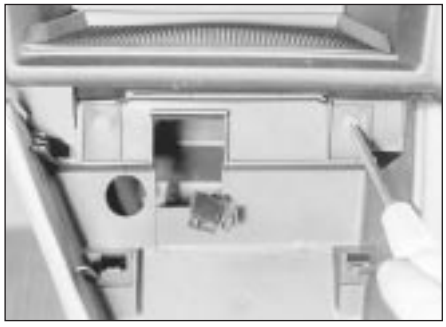
38.2 . . . then extract the front securing screw

38.3 Pull the grip from the handbrake lever

38.4 Pull the cassette storage box from the console . . .

38.5 . . . then extract the rear securing screw

38.11 Disconnecting the wiring plugs from the cigarette lighter



38.12 Extract the two centre console-to-facia securing screws

4 Pull the cassette storage box or the rubber mat, as applicable, from the rear of the centre console to expose the rear securing screw **(see illustration)**.
5 Extract the rear securing screw **(see illustration)**, then withdraw the rear centre console section upwards, feeding the gaiter over the handbrake lever.
6 Where applicable, ensure that the battery negative lead has been disconnected, then disconnect the wiring plug(s) from the electric window and/or trip computer switches.

Refitting

7 Refitting is a reversal of removal.

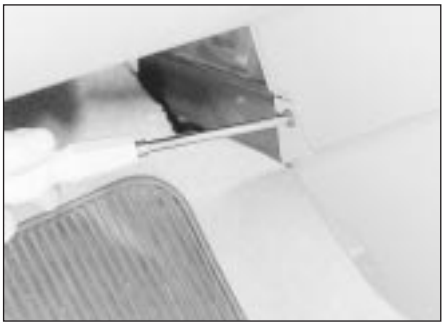
Front section

Removal

8 Remove the rear centre console section, as described previously in this Section.
9 Remove the gearchange lever, as described in Chapters 7A or 7B, as applicable.
10 Disconnect the battery negative lead, if not already done.
11 Pull the ashtray assembly from the centre console, and disconnect the wiring plugs from the cigarette lighter **(see illustration)**.
12 Extract the two now-exposed screws securing the centre console to the facia **(see illustration)**.
13 Working at either side of the centre console, remove the two lower centre console-to-facia securing screws, and the two centre console-to-floor bracket securing screws **(see illustration)**.
14 The front centre console section can now be withdrawn.

Refitting

15 Refitting is a reversal of removal, but feed the cigarette lighter wiring through the aperture in the centre console as the centre console is offered into position.



38.13 Unscrewing a side centre console-to-facia securing screw

39.2 Removing a grab handle securing screw

39 Headlining - removal and refitting

Removal

1 Where applicable, remove the sunroof crank drive, as described in Section 34.
2 Remove the grab handles from the sides of the roof **(see illustration)**.
3 Remove the sunvisors. On models with illuminated sunvisor vanity mirrors, disconnect the battery negative lead, then pull the lamp wiring from the roof as the sunvisor is withdrawn and disconnect the wiring plugs.
4 On models without a sunroof, disconnect the battery negative lead (if not already done), then prise the courtesy lamp and its trim panel from the roof and disconnect the wiring.
5 Open the doors, and prise the weatherstrips from the tops of the door apertures.
6 Remove the front body pillar and centre body pillar trim panels, as described in Section 36.
7 Loosen the upper edge of the rear quarter trim panels, referring to Section 36 if necessary.
8 On Hatchback models, open the tailgate, and prise the rear trim panel from the roof.
9 With the help of an assistant, lower the headlining from the roof, and withdraw it through the tailgate on Hatchback models or through one of the door apertures on Saloon models.

40.1 Withdrawing the outer seat rail trim

40.2 Remove the trim from the rear edge of the inner seat rail

40.3 Removing a front seat rail securing bolt, washer and backplate

Refitting

10 Refitting is a reversal of removal, but where applicable, refit the sunroof crank drive, as described in Section 34.

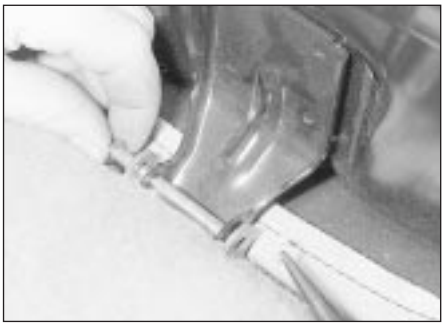
40 Seats (without tensioners) - removal and refitting

Warning: Refer to Section 43, if seat belt tensioners are fitted.

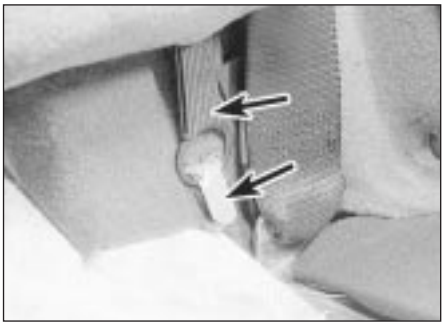
Front seats

Removal

1 Remove the single securing screw from the front edge of the outer seat rail trim, then withdraw the trim **(see illustration)**.



40.7 Removing a rear seat cushion hinge pin - SOHC models



40.19 Seat back-to-body panel securing strap and lug (arrowed)

2 Unclip the trim from the rear edge of the inner seat rail **(see illustration)**.
3 Remove the four bolts that secure the seat rails to the floor, then withdraw the seat, complete with rails. Recover the washers and backplates **(see illustration)**.
4 If desired, the seat can be separated from the rails for attention to the adjustment mechanism.

Refitting

5 Refitting is a reversal of removal. Note that the manufacturers recommend the use of new bolts to secure the seat rails to the floor.

Rear seat cushion (all SOHC models)

Removal

6 Fold the seat cushion forwards, to expose the hinge pins at the front edge of the cushion.
7 To remove a hinge pin, extract the circlip from the end of the pin, and withdraw the pin from the hinge **(see illustration)**.
8 With the hinge pins removed, the seat cushion can be withdrawn from the vehicle.

Refitting

9 Refitting is a reversal of removal.

Rear seat cushion (DOHC models)

Removal

10 Reach under the seat cushion, and pull the grab handles at either end to release the cushion from the catches on the vehicle floor.
11 Withdraw the complete cushion from the vehicle, through one of the rear doors.

40.21 Extracting a hinge-to-seat back securing screw

Refitting

12 Refitting is a reversal of removal. Push the seat cushion into position until the securing catches lock.

Rear seat back (one-piece type)

Removal

13 Fold forwards or remove the rear seat cushion, as applicable, then fold down the seat back.
14 Where applicable, bend up the lugs on the body panel, and disconnect the two rubber straps securing the ends of the seat back to the body panel.
15 Carefully remove the securing clips, and pull back the trim covering the hinges on the seat back.
16 Extract the screws securing the hinges to the seat back, then withdraw the seat back from the vehicle.

Refitting

17 Refitting is a reversal of removal, but ensure that, where applicable, the rubber strap securing lugs are bent back against the body panel, to avoid fouling the seat cushion.

Rear seat back (split type)

Removal

18 Fold forwards or remove the rear seat cushion, as applicable.
19 Where applicable, bend up the lug on the body panel, and disconnect the rubber strap securing the relevant section of the seat back to the body panel **(see illustration)**.
20 Carefully remove the securing clips, and pull back the trim covering the hinge on the seat back.
21 Extract the screws securing the hinge to the seat back **(see illustration)**.
22 Working at the central pivot of the two seat back sections, prise back the seat cushions from the centre bracket, to expose the securing nut and bolt. Note that the bolt passes through both seat back sections **(see illustration)**.
23 Unscrew and remove the nut and bolt, then carefully withdraw the seat back.

Refitting

24 Refitting is a reversal of removal, but ensure that, where applicable, the rubber strap securing lugs are bent back against the body panel, to avoid fouling the seat cushion.

40.22 Rear seat cushion pulled back to expose seat back hinge nut and bolt - split type rear seat back

41 Seat belts - removal and refitting

Note: *For details on mechanical seat belt tensioners, refer to Section 42.*

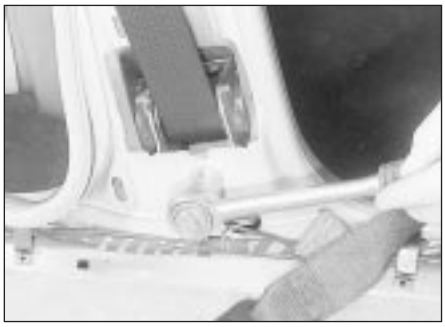
Front seat belt

Removal

1 Open both front and rear doors, and prise the weatherstrips from the edge of the centre body pillar.
2 Prise off the pillar lower trim panel to expose the inertia reel unit.
3 Unscrew the securing bolt, and tilt the inertia reel unit from the body pillar **(see illustration)**.
4 Prise off the trim and unbolt the seat belt upper mounting from the body pillar. Recover the spacer.
5 Similarly, unbolt the seat belt lower mounting, then withdraw the seat belt assembly from the vehicle.
6 If desired, the seat belt stalk can be unbolted from the seat frame, and the upper mounting height adjuster (where applicable) can be unbolted from the body pillar (Torx bolts), after prising off the pillar upper trim panel.

Refitting

7 Refitting is a reversal of removal, but note that, when refitting the height adjuster, the arrows should be uppermost, pointing towards the vehicle roof. Ensure that the belt is fitted untwisted.



41.3 Unscrewing a front seat belt inertia reel securing bolt

Rear seat belt

Removal

8 Fold the rear seat cushion forwards, or remove it, as applicable, for access to the seat belt lower mountings. Prise up the carpet to expose the mounting bolts, and unscrew the relevant bolt(s) from the floor **(see illustrations)**.
9 Prise off the trim, and unbolt the seat belt upper mounting from the body pillar. Recover the spacer **(see illustration)**.
10 Open the relevant rear door, and pull back the weatherstrip from the rear of the door aperture.
11 On Hatchback models, remove the screws securing the upper rear quarter trim panel to the body. Note that all the screws are of the Torx type, and when working on the right-hand side, it will be necessary to open the first-aid kit/warning triangle cover flap in the luggage compartment for access to some of the screws. Withdraw the trim panel carefully, taking care not to damage surrounding panels.
12 Detach the front edge of the lower rear quarter trim panel from the body. The panel is secured by clips on Saloon models, and by screws on Hatchback models.
13 Pull the lower rear quarter trim panel away from the body sufficiently to gain access to the seat belt inertia reel unit **(see illustration)**.

41.8 Rear seat belt lower side mounting - Hatchback model

14 Unscrew the securing bolt, and lift the inertia reel unit from the body panel, then withdraw the seat belt assembly from the vehicle.
15 If desired, the upper seat belt mounting height adjuster can be unbolted from the body pillar (Torx bolts), after removing the upper rear quarter trim panel **(see illustration)**.

Refitting

16 Refitting is a reversal of removal, but note that, when refitting the height adjuster (where applicable), the arrows should be uppermost, pointing towards the vehicle roof. Ensure that the belt is fitted untwisted.

42 Seat belt tensioners - general

1 All 1993-onwards Cavalier models are equipped with mechanical front seat belt tensioners which automatically tighten the front seat belts in the event of a head-on collision. The mechanically operated device ensures that the seat belt remains close to the body, thus preventing the wearer from sliding out, under the belt, during impact **(see illustration)**.
2 The tensioner system consists of a powerful preloaded spring, contained in a cylinder, which is released in the event of severe impact. The spring pulls back the seat belt by means of a bowden cable and fulcrum mechanism attached to the belt stalk, mounted on the seat frame.

41.9 Removing a rear seat belt upper mounting from the body pillar - Hatchback model

41.13 Rear seat belt inertia reel unit location - Hatchback model

41.15 Upper rear quarter trim panel removed, to expose upper seat belt mounting height adjuster

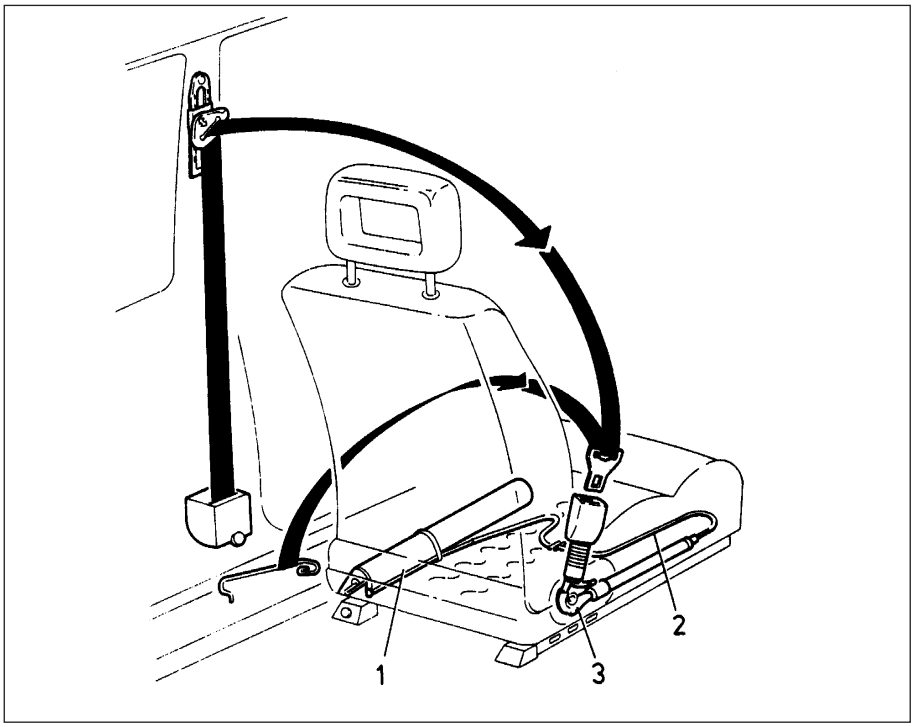
3 The tensioner assembly, fitted to the underside of the front seat, is maintenance free and, once triggered, must be replaced as a complete unit.
4 Due to the specialist safety related nature of the seat belt tensioner system, replacement must be entrusted to a suitably equipped Vauxhall dealer.

43 Front seats (with seat belt tensioners) - removal and refitting

Warning: The seat belt tensioners fitted to the front seat assemblies may cause injury if triggered inadvertently. Before carrying out any work on the front seats, a safety fork must be inserted into the seat belt tensioner cylinder, to prevent the possibility of the tensioner being triggered (see paragraphs 7 and 8 below). Seats should always be transported and installed with the safety fork in place. If a seat is to be disposed of, the tensioner must be triggered before the seat is removed from the vehicle, by inserting the safety fork, and striking the tensioner cylinder sharply with a hammer. If the tensioner has been triggered due to a sudden impact or accident, the unit must be renewed, as it cannot be reset. Due to safety considerations, tensioner renewal should be entrusted to a Vauxhall dealer.

Removal

1 Remove the single securing screw from the front edge of the outer seat rail trim, release the rear retaining lug and remove the trim rearwards.
2 Unclip the trim from the rear edge of the inner seat rail.



42.1 Mechanical seat belt tensioner system

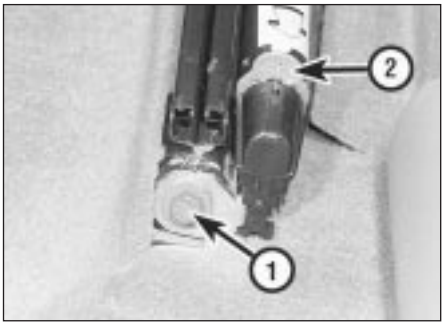
1 Spring *2 Bowden cable* *3 Fulcrum mechanism*

3 Locate the plastic safety fork for the seat belt tensioner, which is usually taped to the outside of the tensioner spring cylinder.
4 Insert the fork into the aperture provided at the rear of the spring cylinder, ensuring that the fork engages securely **(see illustration)**.
5 Remove the four bolts which secure the seat rails to the floor, then withdraw the seat complete with rails **(see illustration)**. Recover the washers and backplates.
6 Seek the advice of a Vauxhall dealer if there is any doubt about the condition of the seat belt tensioner assembly.

Refitting

7 Refitting is a reversal of removal. Note that the manufacturers recommend the use of new bolts to secure the seat rails to the floor. Tighten the bolts to the specified torque wrench settings (see Specifications) in the order - rear inner, front inner, rear outer, front outer.

43.4 Inserting the safety fork into the aperture in the seat belt tensioner spring cylinder



43.5 Front outer seat rail fixings
1 Securing bolt
2 Seat belt tensioner safety fork (inserted in the spring cylinder)

Chapter 12
Body electrical 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

Wiper blades

Type	19 ins. Champion X-4803

Fuses

Rating:

Red	10 A
Blue	15 A
Yellow	20 A
Green	30 A

Torque wrench settings

	Nm	lbf ft
Airbag unit to steering wheel	10	7
Airbag control	10	7
Brackets, passenger airbag	22	16
Passenger airbag to bracket	8	6
Steering to column	25	18

1 General information and precautions

Warning: Before carrying out any work on the electrical system, read through the precautions given in "Safety first!" at the beginning of this manual, and in Chapter 5.

The electrical system is of 12-volt negative earth type. Power for the lights and all electrical accessories is supplied by a lead/acid type battery, which is charged by the alternator.

This Chapter covers repair and service procedures for the various electrical components not associated with engine. Information on the battery, alternator and starter motor can be found in Chapter 5.

It should be noted that, before working on any component in the electrical system, the battery negative terminal should first be disconnected, to prevent the possibility of electrical short-circuits and/or fires.

Whenever the occasion arises, carefully check the routing of the wiring harness, ensuring that it is correctly secured by the clips or ties provided so that it cannot chafe against other components. Carefully check points such as the clutch cable bracket, clutch housing and harness support bracket, the inlet manifold, the horn mounting bracket, the starter motor terminals, and the rear bumper and number plate lamp.

If evidence is found of the harness having chafed against other components, repair the damage and ensure that the harness is secured or protected so that the problem cannot occur again.

Caution: **If the radio/cassette player fitted to the vehicle is one with an anti-theft security code, as the standard unit is, refer to *"Radio/cassette player anti-theft system - precaution"* in the Reference Section of this manual before disconnecting the battery.**

2 Electrical fault-finding - general information

Note: *Refer to the precautions given in "Safety first!" (at the beginning of this manual) and to Section 1 of this Chapter before starting work. The following tests relate to testing of the main electrical circuits, and should not be used to test delicate electronic circuits (such as anti-lock braking systems), particularly where an electronic control module is used.*

A typical electrical circuit consists of an electrical component, any switches, relays, motors, fuses, fusible links or circuit breakers related to that component, and the wiring and connectors that link the component to both the battery and the chassis. To help to pinpoint a problem in an electrical circuit, wiring diagrams are included at the end of this Chapter.

Before attempting to diagnose an electrical fault, first study the appropriate wiring diagram, to obtain a complete understanding of the components included in the particular circuit concerned. The possible sources of a fault can be narrowed down by noting whether other components related to the circuit are operating properly. If several components or circuits fail at one time, the problem is likely to be related to a shared fuse or earth connection.

Electrical problems usually stem from simple causes, such as loose or corroded connections, a faulty earth connection, a blown fuse, a melted fusible link, or a faulty relay (refer to Section 3 for details of testing relays). Visually inspect the condition of all fuses, wires and connections in a problem circuit before testing the components. Use the wiring diagrams to determine which terminal connections will need to be checked, to pinpoint the trouble-spot.

The basic tools required for electrical fault-finding include the following:

a) a circuit tester or voltmeter (a 12-volt bulb with a set of test leads can also be used for certain tests).
b) a self-powered test light (sometimes known as a continuity tester).
c) an ohmmeter (to measure resistance).
d) a battery.
e) a set of test leads.
f) a jumper wire, preferably with a circuit breaker or fuse incorporated, which can be used to bypass suspect wires or electrical components.

Before attempting to locate a problem with test instruments, use the wiring diagram to determine where to make the connections.

To find the source of an intermittent wiring fault (usually due to a poor or dirty connection, or damaged wiring insulation), a "wiggle" test can be performed on the wiring. This involves wiggling the wiring by hand, to see if the fault occurs as the wiring is moved. It should be possible to narrow down the source of the fault to a particular section of wiring. This method of testing can be used in conjunction with any of the tests described in the following sub-Sections.

Apart from problems due to poor connections, two basic types of fault can occur in an electrical circuit - open-circuit, or short-circuit.

Open-circuit faults are caused by a break somewhere in the circuit, which prevents current from flowing. An open-circuit fault will prevent a component from working, but will not cause the relevant circuit fuse to blow.

Short-circuit faults are caused by a "short" somewhere in the circuit, which allows the current flowing in the circuit to "escape" along an alternative route, usually to earth. Short-circuit faults are normally caused by a breakdown in wiring insulation, which allows a feed wire to touch either another wire, or an earthed component such as the bodyshell. A short-circuit fault will normally cause the relevant circuit fuse to blow.

Finding an open-circuit

To check for an open-circuit, connect one lead of a circuit tester or voltmeter to either the negative battery terminal or a known good earth.

Connect the other lead to a connector in the circuit being tested, preferably nearest to the battery or fuse.

Switch on the circuit, remembering that some circuits are live only when the ignition switch is moved to a particular position.

If voltage is present (indicated either by the tester bulb lighting or a voltmeter reading, as applicable), this means that the section of the circuit between the relevant connector and the battery is problem-free.

Continue to check the remainder of the circuit in the same fashion.

When a point is reached at which no voltage is present, the problem must lie between that point and the previous test point with voltage. Most problems can be traced to a broken, corroded or loose connection.

Finding a short-circuit

To check for a short-circuit, first disconnect the load(s) from the circuit (loads are the components that draw current from a circuit, such as bulbs, motors, heating elements, etc.).

Remove the relevant fuse from the circuit, and connect a circuit tester or voltmeter to the fuse connections.

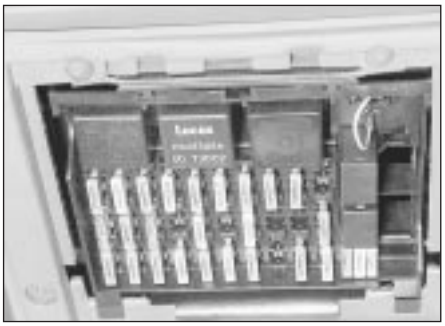
Switch on the circuit, remembering that some circuits are live only when the ignition switch is moved to a particular position.

If voltage is present (indicated either by the tester bulb lighting or a voltmeter reading, as applicable), this means that there is a short-circuit.

If no voltage is present, but the fuse still blows with the load(s) connected, this indicates an internal fault in the load(s).

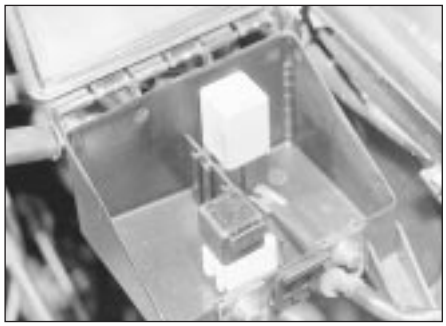
Finding an earth fault

The battery negative terminal is connected to "earth" (the metal of the engine/transmission and the car body), and most systems are wired so that they only receive a positive feed. The current returning through the metal of the car body. This means that the component mounting and the body form part of that circuit. Loose or corroded mountings can therefore cause a range of electrical faults, ranging from total failure of a circuit, to a puzzling partial fault. In particular, lights may shine dimly (especially when another circuit sharing the same earth point is in operation). Motors (e.g. wiper motors or the radiator cooling fan motor) may run slowly, and the operation of one circuit may have an affect on another. Note that on many vehicles, earth straps are used between certain components, such as the engine/transmission and the body, usually where there is no metal-



3.2 Main fuses and relays in facia panel - 2.0 litre SRi model shown

3.5 Removing a fuse - 2.0 litre model shown



3.11 Relays in engine compartment box - 2.0 litre SRi model shown

to-metal contact between components, due to flexible rubber mountings, etc.

To check whether a component is properly earthed, disconnect the battery, and connect one lead of an ohmmeter to a known good earth point. Connect the other lead to the wire or earth connection being tested. The resistance reading should be zero; if not, check the connection as follows.

If an earth connection is thought to be faulty, dismantle the connection, and clean back to bare metal both the bodyshell and the wire terminal or the component earth connection mating surface. Be careful to remove all traces of dirt and corrosion, then use a knife to trim away any paint, so that a clean metal-to-metal joint is made. On reassembly, tighten the joint fasteners securely; if a wire terminal is being refitted, use serrated washers between the terminal and the bodyshell, to ensure a clean and secure connection. When the connection is remade, prevent the onset of corrosion in the future by applying a coat of petroleum jelly or silicone-based grease.

3 Fuses and relays - general

Fuses

1 Fuses are designed to break a circuit when a predetermined current is reached, to protect the components and wiring which could be damaged by excessive current flow. Any excessive current flow will be due to a fault in the circuit, usually a short-circuit (Section 2).

2 The main fuses and relays are located in a panel at the lower right-hand side of the facia, under a hinged cover **(see illustration)**.

3 The circuits protected by the various fuses and relays are marked on the inside of the panel cover.

4 A blown fuse can be recognised from its melted or broken wire.

5 To remove a fuse, first ensure that the relevant circuit is switched off. Then open the cover and pull the relevant fuse or relay from the panel **(see illustration)**. If desired, the lower end of the panel can be tilted forwards, after releasing the retaining clips to improve access.

6 Before renewing a blown fuse, trace and rectify the cause, and always use a fuse of the correct rating. Never substitute a fuse of a higher rating, or make temporary repairs using wire or metal foil, as more serious damage or even fire could result.

7 Spare fuses are provided in the blank terminal positions in the fusebox.

8 Note that the fuses are colour-coded, see Specifications. Refer to the wiring diagrams for details of the fuse ratings and the circuits protected.

Relays

9 A relay is an electrically operated switch, which is used for the following reasons:

a) A relay can switch a heavy current remotely from the circuit in which the current is flowing, allowing the use of lighter-gauge wiring and switch contacts.

b) A relay can receive more than one control input, unlike a mechanical switch.

c) A relay can have a timer function - for example, the intermittent wiper relay.

10 Most of the relays are located at the rear of the main fusebox (remove the securing screws and pull the fusebox forwards to improve access). The rear wiper motor relay is located in the tailgate, behind the tailgate trim panel. On some models, additional engine-related relays are located in the relay box mounted on the left-hand side of the engine compartment.

11 On certain models, additional relays are located in a box at the left-hand rear of the engine compartment **(see illustration)**.

12 If a circuit or system controlled by a relay develops a fault, and the relay is suspect, operate the system. If the relay is functioning, it should be possible to hear it "click" as it is energised. If this is the case, the fault lies with the components or wiring of the system. If the relay is not being energised, then either the relay is not receiving a main supply or a switching voltage, or the relay itself is faulty. Testing is by the substitution of a known good unit, but be careful - while some relays are identical in appearance and in operation, others look similar but perform different functions.

13 To remove a relay, first ensure that the relevant circuit is switched off. The relay can then simply be pulled out from the socket, and pushed back into position.

4 Ignition switch and lock cylinder - removal and refitting

Removal

1 Disconnect the battery negative lead.

2 Turn the steering wheel as necessary to expose the two front steering column shroud securing screws, which are covered by plastic caps. Prise out the caps and remove the screws.

3 Remove the three securing screws from the underside of the lower column shroud, then remove both the upper and lower shrouds.

4 To remove the lock cylinder, insert the ignition key and turn it to position "II".

5 Insert a thin rod into the hole in the lock housing, then press the rod to release the detent spring, and pull out the lock cylinder using the key.

6 The ignition switch is secured to the steering lock housing by two grub screws. Disconnect the wiring plug, and remove the screws to extract the switch **(see illustration)**. Removal of the steering wheel, may aid removal. Refer to Chapter 10 or Section 57, as applicable. It is recommended that the switch and the lock cylinder are not both removed at the same time, so that their mutual alignment is not lost.

Refitting

7 Refitting is a reversal of removal.

4.6 Removing an ignition switch securing screw

5 Direction indicator/lighting switch - removal and refitting

Removal

1 Disconnect the battery negative lead.
2 Turn the steering wheel as necessary to expose the two front steering column shroud securing screws, which are covered by plastic caps. Prise out the caps and remove the screws.
3 Remove the three securing screws from the underside of the lower column shroud, then remove both the upper and lower shrouds.
4 Disconnect the wiring plug from the switch.
5 Depress the switch retaining clip, and withdraw the switch from the housing.

Refitting

6 Refitting is a reversal of removal.

6 Wash/wipe switch - removal and refitting

Proceed as described in Section 5.

7 Facia panel switches - removal and refitting

1 Disconnect the battery negative lead.

Lighting switch

Removal

2 Turn the switch to the "dipped beam on" position, then insert a small screwdriver or rod through the hole in the bottom of the switch knob to depress the knob retaining clip. Pull the knob from the switch **(see illustration)**.
3 Press the two now-exposed switch securing clips towards the switch spindle, then pull the switch from the facia and disconnect the wiring plug **(see illustrations)**.
4 Note that the switch assembly cannot be dismantled, and if any part of the switch is faulty, the complete assembly must be renewed.

7.6 Prising a push-button switch from the facia

7.2 Using a thin rod to depress the lightning switch knob retaining clip

Refitting

5 Refitting is a reversal of removal.

Push-button switches

Removal

6 First check beneath the switch, if there is a small hole in the facia, insert a slim screwdriver or metal rod into it. Release the switch retaining spring clip by pressing it upwards against the switch, then remove the switch and disconnect its wiring. If there is no hole, remove the switch by prising it out of the facia using a small screwdriver. Lever gently under the switch's lower edge (use adhesive tape or a piece of card to protect the facia's finish). Disconnect the switch wiring plug and withdraw the switch **(see illustration)**.

Refitting

7 Refitting is a reversal of removal.

Headlamp aim adjustment switch

8 The procedure is as described for push-button switches.

Hazard warning switch

Removal

9 Using a screwdriver, carefully prise the cap from the switch **(see illustration)**.
10 Using a screwdriver with a piece of card under the blade to avoid damage to the facia trim, prise the ventilation nozzle from the facia.
11 Prise the switch from the facia and disconnect the wiring **(see illustration)**.

7.9 Prising the cap from the hazard warning flasher switch

7.3A Press the switch securing clips towards the switch spindle . . .

7.3B . . . then pull the switch from the facia

Refitting

12 Refitting is a reversal of removal.

Heater blower motor switch

Removal

13 Remove the heater control panel, as described in Chapter 11.
14 Disconnect the wiring plug from the switch, if not already done.
15 Prise the switch out from the rear of the heater control panel.

Refitting

16 Refitting is a reversal of removal, but refer to Chapter 11, when refitting the heater control panel.

7.11 Withdrawing the hazard warning flasher switch from the facia

8 Electric door mirror switch - removal and refitting

Removal

1 Disconnect the battery negative lead.
2 Prise the plastic surround from the door interior handle.
3 Free the trim panel from the top edge of the door by releasing the securing clips. This can be done using a screwdriver, but it is preferable to use a forked tool, to minimise the possibility of damage to the trim panel and the clips.
4 Note the position of the mirror switch wiring connector in the bracket at the top of the door, then separate the two halves of the connector.
5 Prise the switch from the door trim panel, and feed the wiring through the panel.

Refitting

6 Refitting is a reversal of removal, but ensure that the wiring is correctly routed, so as not to foul the door interior handle mechanism.

9 Sunroof operating switch - removal and refitting

Removal

1 Disconnect the battery negative lead.
2 Prise the courtesy lamp from the roof trim panel, and disconnect the wiring.
3 Remove the two trim panel securing screws, and withdraw the trim panel from the roof, disconnecting the wiring from the sunroof operating switch.
4 Release the securing clips, then pull the switch from the rear face of the trim panel.

Refitting

5 Refitting is a reversal of removal.

10 Courtesy lamp switch - removal and refitting

HAYNES HiNT

Tape the wiring to the door pillar, to prevent if falling back into the door pillar. Alternatively, tie a piece of string to the wiring to retrieve it.

Removal

1 Disconnect the battery negative lead.
2 Open the door and remove the switch securing screw.
3 Withdraw the switch from the door pillar, and pull the wiring out sufficiently to prevent it from springing back into the pillar.
4 Disconnect the wiring and remove the switch.

Refitting

5 Refitting is a reversal of removal.

11 Luggage compartment lamp switch - removal and refitting

Removal

1 Disconnect the battery negative lead.
2 Open the boot lid or tailgate, as applicable, and remove the switch securing screw.
3 Withdraw the switch from the body panel, and pull the wiring out sufficiently to prevent it from springing back into the body.
4 Disconnect the wiring and remove the switch.

Refitting

5 Refitting is a reversal of removal.

12 Brake lamp switch - removal and refitting

Removal

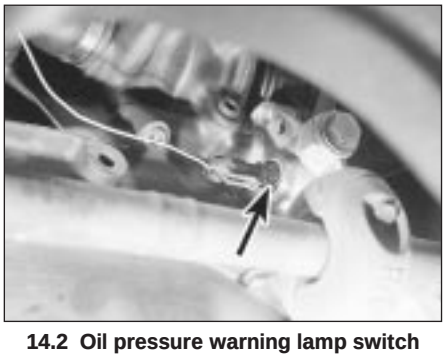
1 Disconnect the battery negative lead.
2 Remove the lower trim panel from the driver's footwell.
3 Disconnect the wiring plug from the brake lamp switch, then twist the switch anti-clockwise and remove it from its bracket.

Refitting

4 Refitting is a reversal of removal.

13 Handbrake "on" warning lamp switch - removal and refitting

For access to the switch, the handbrake lever must be removed. Removal and refitting of the switch is described as part of the handbrake lever removal and refitting procedure, in Chapter 9.



14.2 Oil pressure warning lamp switch (arrowed) viewed from underneath vehicle - SOHC model

14 Oil pressure warning lamp switch - removal and refitting

Removal

1 Disconnect the battery negative lead.
2 The switch is screwed into the oil pump, on the inlet manifold side of the engine. On 1.4 and 1.6 litre (except C16 NZ2), models the switch projects at right-angles to the crankshaft axis, while on C16 NZ2, 1.8 and 2.0 litre models it is parallel to the crankshaft **(see illustration)**.
3 In most cases the switch can be reached quite easily from above. However, on some models access will be easier if the front of the vehicle is jacked up and supported on axle stands (see "*Jacking and Vehicle Support*") (ensure that the handbrake is securely applied) and the front right-hand roadwheel is removed.
4 Disconnect the switch wire and use a spanner to unscrew the switch **(see illustration)**. As you withdraw the switch, swiftly plug the hole in the oil pump to minimise the loss of oil and to prevent the entry of dirt.

Refitting

5 Refitting is the reverse of the removal procedure; tighten the switch securely but do not overtighten it, reconnect its wire, then check and if necessary top-up the oil level, as described in Chapter 1. Wash off any spilt oil and check for leaks when the engine is restarted.

14.4 Unscrewing the oil pressure warning lamp switch - SOHC model (engine removed)

15 Cigarette lighter - removal and refitting

Removal

1 Disconnect the battery negative lead.
2 Slide the ashtray/cigarette lighter assembly from the facia, then disconnect the wiring and slide the illumination bulb from the cigarette lighter.

3 To remove the cigarette lighter assembly, simply pull it from the illumination ring assembly. If desired, the illumination ring assembly can be removed, by pulling it from the housing after depressing the retaining clips.

Refitting

4 Refitting is a reversal of removal.

16 Clock - removal and refitting

Removal

1 Disconnect the battery negative lead.
2 Using a thin-bladed screwdriver, carefully prise the clock from the facia panel.
3 Disconnect the wiring plugs and withdraw the clock **(see illustration)**.

Refitting

4 Refitting is a reversal of removal.

17 Heated front seats - general

Heating pads are fitted to the front seats of some models. Before attempting to remove a seat so equipped, disconnect the battery and the leads from the heating pad.

16.3 Disconnecting the wiring plugs from the clock

18 Instrument panel - removal and refitting

Removal

1 Disconnect the battery negative lead.
2 Remove the steering wheel, (Chapter 10).
3 Remove the steering column shrouds, and the instrument panel upper and lower trim panels, (Chapter 11).
4 Remove the single upper, and two lower, instrument panel securing screws **(see illustration)**.
5 Carefully withdraw the instrument panel, and disconnect the speedometer cable and the two wiring plugs. Note that the speedometer cable is retained by a clip, which must be pressed towards the speedometer to release the cable **(see illustration)**.

18.4 Unscrewing a lower instrument panel securing screw

18.5 Disconnecting an instrument panel wiring plug. Note speedometer cable retaining clip (arrowed)

6 If desired, the instrument panel can be dismantled, with reference to Section 19.

Refitting

7 Refitting is a reversal of removal, but ensure that the speedometer cable is not kinked or twisted between the instrument panel and the bulkhead as the panel is refitted.

19 Instrument panel components - removal and refitting

1 With the instrument panel removed, as described in Section 18, continue as follows.

Panel illumination and warning lamp bulbs

Removal

2 Twist the relevant bulbholder clockwise, and withdraw it from the printed circuit board on the rear of the instrument panel **(see illustration)**.
3 The bulbs are integral with the bulbholders, and must be renewed as a unit.

Refitting

4 Refitting is a reversal of removal.

Voltage stabiliser

Removal

5 Remove the single securing screw from the rear of the instrument panel, then pull the voltage stabiliser from the contacts on the printed circuit board **(see illustration)**.

Refitting

6 Refitting is a reversal of removal.

Fuel and temperature gauges - "low series" models

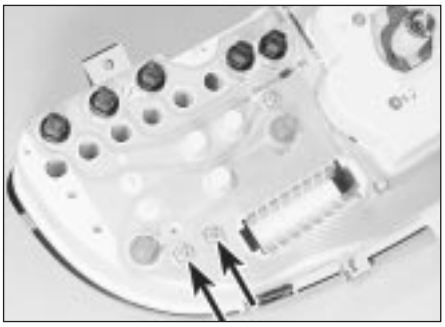
Removal

7 Pull the trip meter reset pin from the front of the panel.
8 Release the two retaining clips at the top of the panel, and remove the panel shroud **(see illustration)**.
9 Unscrew the two securing nuts, and withdraw the relevant gauge through the front of the instrument panel.

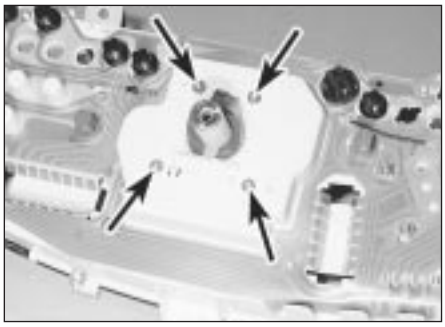
19.2 Withdrawing an instrument panel illumination lamp bulb

19.5 Instrument panel voltage stabiliser (arrowed)

19.8 Removing the instrument panel shroud



19.12 Tachometer securing nuts (arrowed)



19.14 Speedometer securing screws (arrowed)

Refitting

10 Refitting is a reversal of removal.

Fuel and temperature gauge assembly - "high series" models

11 The procedure is as described in paragraphs 7 to 10 inclusive, except that the gauge assembly is secured by four nuts.

Tachometer

12 The procedure is as described in paragraphs 7 to 10 inclusive except that the tachometer is secured by three nuts **(see illustration)**.

Speedometer

Removal

13 Proceed as described in paragraphs 7 and 8.
14 Extract the four securing screws from the rear of the panel **(see illustration)**.

Refitting

15 Refitting is a reversal of removal.

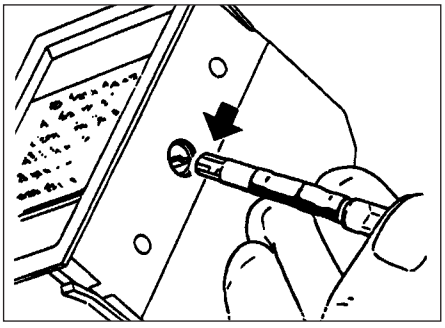
Printed circuit board

Removal

16 Remove all bulbs and instruments, and the voltage stabiliser, as described previously in this Section.
17 Carefully peel the printed circuit board from the instrument panel.

Refitting

18 Refitting is a reversal of removal, but ensure that the printed circuit board is seated correctly on the rear of the instrument panel.



20.6 Removing the trip computer display module illumination bulb

20 Trip computer components - removal and refitting

1 Disconnect the battery lead.

Display module

Removal

2 Using a thin-bladed screwdriver, carefully prise the module from the facia panel.
3 Disconnect the wiring plug and withdraw the module.

Refitting

4 Refitting is a reversal of removal.

Display module illumination bulb

Removal

5 Remove the display module, as described previously in this Section.
6 Using a length of rubber sleeving of similar diameter, or an alternator tool, extract the bulb by inserting the tool through the hole in the side of the display module **(see illustration)**.

Refitting

7 Refitting is a reversal of removal.

Operating switch

Removal

8 Remove the rear section of the centre console, as described in Chapter 11.
9 Release the wiring plug from the switch using a screwdriver.
10 Lift the switch, then pull it down and out from the centre console.

Refitting

11 Refitting is a reversal of removal.

Outside air temperature sensor

Removal

12 The sensor is located at the left-hand end of the front bumper **(see illustration)**.
13 Prise the cover cap from the bumper, then unclip the sensor, and disconnect the wiring plug.

Refitting

14 Refitting is a reversal of removal.

21 Check control system components - removal and refitting

1 Disconnect the battery negative lead.

Warning lamp bulbs

2 The warning lamp bulbs are located in the instrument panel, and removal and refitting are described in Section 19.

Control module

Removal

3 The control module is located behind the passenger side of the facia, above the glovebox.
4 Remove the glovebox assembly, as described in Chapter 11.
5 Disconnect the control module wiring plug, then release the control module from its mounting and withdraw the unit.

Refitting

6 Refitting is a reversal of removal.

Coolant level sensor

Removal

7 The coolant level sensor is integral with the coolant expansion tank cap.
8 Disconnect the wiring from the top of the cap, then unscrew the cap and withdraw it from the expansion tank.
9 If faulty, the complete cap assembly must be renewed.

Refitting

10 Refitting is a reversal of removal.

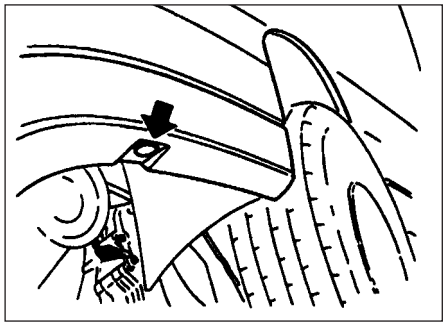
Washer fluid level sensor

Removal

11 The sensor is mounted in the side of the fluid reservoir.
12 Disconnect the wiring from the sensor, then unscrew the sensor from the fluid reservoir. If the fluid level is above the level of the sensor, be prepared for fluid spillage.

Refitting

13 Refitting is a reversal of removal.



20.12 Trip computer outside air temperature sensor location (arrowed)

21.18 Engine oil level sensor - DOHC model

22.5 Horn viewed from behind with radiator removed - single horned model

Brake fluid level sensor

14 The procedure is as described for the coolant level sensor in paragraphs 7 to 10 inclusive.

Engine oil level sensor

Removal

15 Apply the handbrake, jack up the front of the vehicle, and support securely on axle stands (see "*Jacking and Vehicle Support*") positioned under the body side members.
16 On DOHC models, remove the engine undershield, as described in Chapter 11.
17 Disconnect the sensor wiring plug.
18 Unscrew the three or four sensor securing screws, as applicable, and withdraw the sensor, manipulating the float through the hole in the sump **(see illustration)**. Recover the sealing ring. Be prepared for some oil spillage.
19 Examine the condition of the sealing ring, and renew if necessary.

Refitting

20 Refitting is a reversal of removal. On completion, check, and if necessary top-up, the engine oil level.

Bulb failure sensor

Removal

21 The bulb failure sensor is mounted behind the fuse/relay panel in the facia.
22 Release the retaining clips from the lower end of the fuse/relay panel, and tilt it forwards.

22.10 Horn mounting bracket securing bolt (arrowed) - twin horned model

23 Reach up behind the fuse/relay panel, and pull the sensor from its socket.

Refitting

24 Refitting is a reversal of removal.

22 Horn(s) - removal and refitting

1 On models with a single horn, the horn is located in front of the radiator. On models with twin horns, the horns are located beneath the washer fluid reservoir, at the left-hand end of the front bumper.

Single horn

Removal

2 Disconnect the battery negative lead.
3 Remove the radiator grille panel, with reference to Chapter 11.
4 Disconnect the wiring from the rear of the horn.
5 Reach up behind the mounting bracket, and unscrew the single nut securing the horn to the bracket **(see illustration)**. Withdraw the horn.

Refitting

6 Refitting is a reversal of removal.

Twin horns

Removal

7 Disconnect the battery negative lead.
8 Apply the handbrake, then jack up the front of the vehicle, and support securely on axle stands (see "*Jacking and Vehicle Support*") positioned under the body side members.
9 Remove the securing screws, and withdraw the plastic cover (where fitted) from the bumper/front wing to expose the horns.
10 Remove the bolt securing the horn mounting bracket to the bracket below the washer fluid reservoir **(see illustration)**.
11 Withdraw the horns and disconnect the wiring.
12 If desired, the horns can be unbolted from the bracket.

Refitting

13 Refitting is a reversal of removal.

23 Interior lamps - removal and refitting

Removal

1 Disconnect the battery negative lead.
2 Using a thin-bladed screwdriver, prise the lamp from its location and disconnect the wiring **(see illustration)**.

Refitting

3 Refitting is a reversal of removal.

24 Interior lamp bulbs - renewal

1 Disconnect the battery negative lead.

Courtesy lamp

Note: *Some later models are fitted with courtesy lamps for the rear seat passengers, as well as front.*

Removal

2 Using a thin-bladed screwdriver, prise the lamp from its location and disconnect the wiring.
3 On models fitted with a courtesy lamp with integral map reading lamps, the lens must be levered from the housing for access to the bulbs.

23.2 Withdrawing the courtesy lamp

24.10 Removing the underbonnet lamp bulb

4 Remove the courtesy lamp bulbs by carefully prising it from its location using a thin-bladed screwdriver. Where applicable, the map reading lamp bulbs are a push fit in the bulbholders.

Refitting

5 Refitting is a reversal of removal.

Glovebox lamp

Removal

6 Using a thin-bladed screwdriver, prise the lamp from its location and disconnect the wiring.
7 Carefully prise the bulb from the lamp.

Refitting

8 Refitting is a reversal of removal.

25.5A Unscrewing the lower headlamp securing screw

25.5B Unscrewing an upper headlamp securing screw

24.16 Removing the clock illumination lamp bulbholder

Luggage compartment, underbonnet and kerb lamps

Removal

9 Using a thin-bladed screwdriver, prise the lamp from its location; disconnect the wiring.
10 Carefully prise the bulb from the lamp **(see illustration)**.

Refitting

11 Refitting is a reversal of removal

Cigarette lighter illumination lamp

Removal

12 Slide the ashtray/cigarette lighter assembly from the facia, then disconnect the wiring and pull the bulbholder from the rear of the cigarette lighter housing.
13 The bulb is a push fit in the bulbholder.

Refitting

14 Refitting is a reversal of removal.

Clock illumination lamp

15 Remove the clock, (Section 16).
16 Twist the bulbholder and pull it from the rear of the clock **(see illustration)**.
17 The bulb is a push fit in the bulbholder.

Trip computer display module illumination lamp

18 Refer to Section 20.

Heater control panel illumination lamp

Removal

19 Remove the heater control panel, as described in Chapter 11.

25.5C Withdrawing a headlamp unit

24.20 Heater control panel illumination lamp bulbholder withdrawn

20 Pull the bulbholder from the rear of the control panel **(see illustration)**.
21 The bulb is a push fit in the bulbholder.

Refitting

22 Refitting is a reversal of removal.

Facia panel switch illumination lamp

23 If a bulb fails in one of the facia panel switches, the complete switch assembly must be renewed, as described in Section 7, as no individual spare parts are available.

Vanity mirror illumination lamp

Removal

24 Lower the sunvisor and, using a thin-bladed screwdriver, prise out the mirror and diffuser assembly. Pull the bulb(s) from the spring contacts.

Refitting

25 Refitting is a reversal of removal.

25 Headlamp unit - removal and refitting

Removal

1 Remove the radiator grille panel, as described in Chapter 11.
2 Remove the front indicator lamp unit, as described in Section 29.
3 Remove the cover from the rear of the headlamp unit, and disconnect the wiring plugs from the bulbs.
4 If applicable, disconnect the wiring plug from the headlamp aim adjustment motor.
5 Remove the three securing screws, and withdraw the headlamp unit **(see illustrations)**. Feed the wiring through the headlamp casing as it is removed.
6 If required, the headlamp lens can be removed by releasing the spring clips around its edge.

Refitting

7 Refitting is a reversal of removal.
8 On completion, have the headlamp alignment checked, with reference to Section 27.

26 Headlamp aim adjustment motor - removal and refitting

Removal

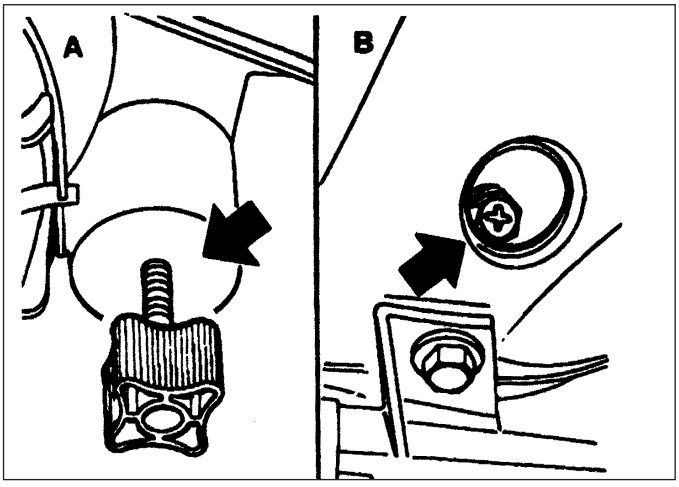
1 Remove the headlamp, (Section 25).
2 Twist the motor clockwise to release it from the headlamp, then carefully disconnect the motor from the balljoint **(see illustrations)**.

Refitting

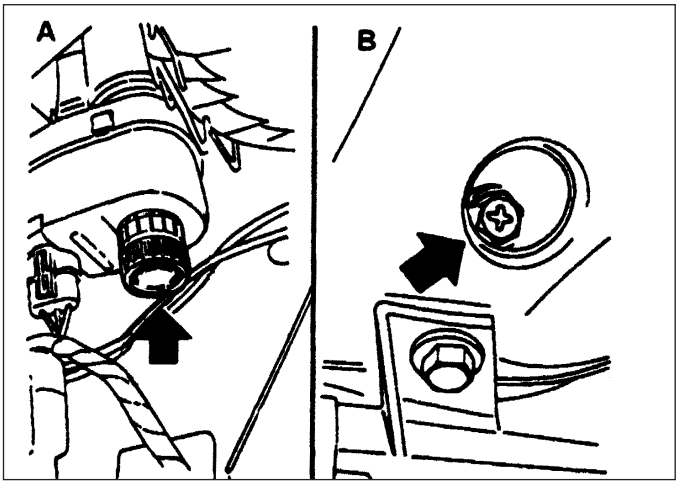
3 Refitting is a reversal of removal, but ensure that the motor is correctly engaged with the balljoint.

26.2A Headlamp aim adjustment motor (headlamp removed)

26.2B Headlamp aim adjuster balljoint (arrowed)



27.3A Headlamp alignment adjustment screws - models without electric aim adjustment
A Vertical adjustment screw B Horizontal adjustment screw



27.3B Headlamp alignment adjustment screws - models with electric aim adjustment
A Vertical adjustment screw B Horizontal adjustment screw

27 Headlamps - alignment

1 Correct alignment of the headlamp beams is most important, not only to ensure good vision for the driver, but also to protect other drivers from being dazzled.
2 Accurate alignment should be carried out using optical beam setting equipment.
3 In an emergency, adjustments may be made by turning the adjustment screws shown **(see illustrations)**. If an adjustment is made, the alignment should be checked using beam setting equipment at the earliest opportunity.
4 All 1992-on models are fitted with the headlamp aim adjustment system, operated through the facia-mounted switch **(see illustration)**.

a) Position '0', is for correct alignment if just the driving seat is occupied.
b) Position '1', if all seats are occupied.
c) Position '2', if all seats occupied and luggage.
d) Position '3', for just driver and luggage.

28 Headlamp dim-dip system - general, removal and refitting

General

1 The system (where fitted) is governed by the dim-dip control unit mounted either behind and above the glovebox (early models), or behind the main fuse panel (later models).
2 The control unit uses the oil pressure warning lamp circuit to ensure that, when the engine is running and the sidelamps are switched on, reduced current is fed to the headlamp dipped-beam circuits. This lights the headlamps with approximately one-sixth of their normal power so that the vehicle cannot be driven using sidelamps alone.
3 To locate the dim-dip control unit, open the main fuse panel covering flap and unclip it from its bottom and top mountings (Section 3). Then use a torch to see whether the unit is fastened to the plastic bracket behind the facia and fuse panel. The unit is usually rectangular, of black plastic, and can be identified by the colours of the five wires leading to it (see applicable wiring diagram).

27.4 The headlamp aim adjustment switch - 1992-on models

Removal

4 If the unit can be seen, remove the driver's side lower facia and footwell trim panels (Chapter 11), then unscrew the four retaining screws and lower the plastic bracket until the control unit can be detached.
5 If the unit cannot be seen, remove the glovebox assembly (Chapter 11). The unit will be fastened to the underside of the facia top surface.

Refitting

6 Refitting is the reverse of the removal procedure.

29 Front indicator lamp unit - removal and refitting

Removal

1 Disconnect the battery negative lead.
2 Remove the single indicator lamp unit securing screw, which is accessible through the hole in the upper body panel **(see illustration)**.
3 Pull the lamp unit forwards to release it from the body, then disconnect the wiring plug **(see illustration)**.

Refitting

4 Refitting is a reversal of removal.

30 Side repeater lamp - removal and refitting

Removal

1 Disconnect the battery negative lead.
2 Remove the wheel arch liner, as described in Chapter 11.
3 Working in the engine compartment, disconnect the wiring plug, and detach the earth lead from the body panel.
4 Working under the wheel arch, depress the retaining tabs and manipulate the lamp through the outside of the wing, pulling the wiring and the grommet from the inner wing panel.
5 The lens can be removed from the lamp by twisting it to release the retaining clips.
6 Check the condition of the rubber sealing ring, and renew if necessary.

Refitting

7 Refitting is a reversal of removal.

31 Front foglamp - removal, refitting and adjustment

Removal

1 Disconnect the battery negative lead.
2 Removing (if necessary) the radiator grille panel, as described in Chapter 11, disconnect the appropriate foglamp wiring plug.
3 Apply the handbrake, jack up the front of the vehicle and support it securely on axle stands (see "*Jacking and Vehicle Support*") positioned under the body side members.
4 If removing the driver's side foglamp, remove the securing screws and withdraw the plastic cover from the bumper/front wing to expose the lamp mountings.
5 Unscrew the three securing bolts and withdraw the lamp and wiring, the two bottom bolts are obvious, but the third is well hidden at the top of the lamp.

29.2 Unscrewing the front indicator lamp unit securing screw

29.3 Disconnecting the front indicator lamp unit wiring plug

Refitting

6 Refitting is a reversal of removal, but on completion check the foglamp adjustment.

Adjustment

7 The vertical aim of the foglamps can be adjusted by turning the adjuster screw at the rear of the lamp in the required direction. It will be necessary to remove the plastic cover (driver's side only) from the bumper/front wing to expose the adjuster screw **(see illustration)**.

32 Rear lamp unit - removal and refitting

Removal

1 Disconnect the battery negative lead.
2 Working in the luggage compartment, remove the cover from the rear of the lamp.
3 Release the top and bottom retaining clips, and pull the bulbholder from the lamp. Disconnect the wiring plug.
4 Remove the securing screws, and withdraw the lamp unit from outside the vehicle.
5 Note that the lens cannot be renewed separately, and if damaged, the complete lamp unit must be renewed.

Refitting

6 Refitting is a reversal of removal.

31.7 Foglamp aim adjustment screw (arrowed)

33 Number plate lamp - removal and refitting

Removal

1 Disconnect the battery negative lead.
2 Using a thin-bladed screwdriver, carefully prise the lamp surround from the bumper.
3 Pull the lamp from the bumper, and disconnect the wiring.

Refitting

4 Refitting is a reversal of removal.

34 Exterior lamp bulbs - renewal

Note: *The glass envelopes of the headlamp and foglamp bulbs must not be touched with the fingers. If the glass is accidentally touched, it should be washed with methylated spirits and dried with a soft cloth. Failure to observe this procedure may result in premature bulb failure*
1 Disconnect the battery negative lead.

Headlamps

Removal

2 Working in the engine compartment, release the retaining clip, and remove the cover from the rear of the headlamp **(see illustration)**.

34.2 Removing the cover from the rear of the headlamp

34.3A Release the spring clip . . .

34.3B . . . and withdraw the headlamp bulb

34.6 Pull the sidelamp bulbholder from the headlamp . . .

3 Pull the wiring plug from the base of the bulb, then release the spring clip, grasp the bulb by its contacts and carefully withdraw it **(see illustrations)**. Do not touch the bulb glass.

Refitting

4 Refitting is a reversal of removal.

Sidelamps

Removal

5 Working in the engine compartment, release the retaining clip, and remove the cover from the rear of the headlamp.
6 Pull the wiring plug from the bulbholder, then pull the bulbholder from the headlamp **(see illustration)**.
7 The bulb is a push fit in the bulbholder **(see illustration)**.

Refitting

8 Refitting is a reversal of removal.

Front indicator lamp

Removal

9 Working in the engine compartment, disconnect the wiring plug from the bulbholder.
10 Twist the bulbholder anti-clockwise, and pull it from the lamp unit **(see illustration)**.
11 The bulb is a bayonet fit in the bulbholder **(see illustration)**.

Refitting

12 Refitting is a reversal of removal.

Front indicator side repeater lamp

Removal

13 Twist the lamp lens anti-clockwise, and pull it from the lamp.
14 The bulb is a push fit in the lamp **(see illustration)**.

Refitting

15 Refitting is a reversal of removal, but ensure that the rubber sealing ring is correctly seated between the lens and the body panel.

Front foglamp

Removal

16 To improve access, apply the handbrake, jack up the front of the vehicle, and support securely on axle stands (see "*Jacking and Vehicle Support*") positioned under the body side members.
17 Remove the securing screws, and withdraw the plastic cover (driver's side only) from the bumper/front wing to expose the foglamp.
18 Remove the security screw, and withdraw the cover from the base of the lamp **(see illustration)**.
19 Release the spring clip, using a screwdriver if necessary, then grasp the bulb by its contacts and carefully withdraw it. Do not touch the bulb glass **(see illustration)**.
20 Pull the wiring plug from the base of the bulb.

Refitting

21 Refitting is a reversal of removal.

Rear lamp unit

Removal

22 Working in the luggage compartment, remove the cover from the rear of the lamp.
23 Release the top and bottom retaining clips, and pull the bulbholder from the lamp,

34.07 . . . then pull the bulb from the bulbholder

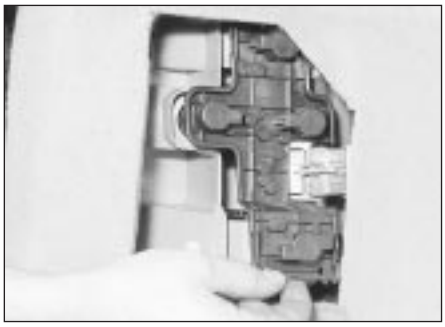
34.10 Withdraw the front indicator lamp bulbholder (lamp removed) . . .

34.11 . . . then remove the bulb

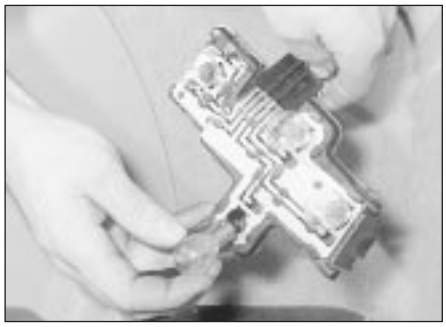
34.14 Removing a front indicator side repeater lamp bulb

34.18 Removing a front foglamp cover securing screw

34.19 Withdrawing a foglamp bulb



34.23 Release the rear lamp unit bulbholder retaining clips . . .



34.24 . . . then remove the relevant bulb

34.27 Unclip the lens from the rear number plate lamp . . .

34.28 . . . then remove the bulb

taking care not to strain the wiring **(see illustration)**.

24 The bulbs are a bayonet fit in the bulbholder **(see illustration)**. Note that the brake/tail lamp bulb has offset bayonet pins so that it can only be fitted in one position; ensure that the correct type of replacement is obtained.

Refitting

25 Refitting is a reversal of removal.

Rear number plate lamp

Removal

26 Using a thin-bladed screwdriver, carefully prise the lamp surround from the bumper.

27 Pull the lamp from the bumper, taking care not to strain the wiring, and unclip the lens **(see illustration)**.

28 The bulb is a bayonet fit in the lamp **(see illustration)**.

Refitting

29 Refitting is a reversal of removal.

35 Wiper blades - renewal

Removal

1 The wiper blades should be renewed when they no longer clean the glass effectively.

2 Lift the wiper arm away from the glass. On some models it may be more convenient to do this with the bonnet open.

3 With the blade at 90° to the arm, depress the spring clip and slide the blade from the hook **(see illustration)**.

4 If necessary, extract the two metal inserts and unhook the wiper rubber.

35.3 Removing a wiper blade

36.4 Windscreen wiper arms - 1992-on models

Refitting

5 Refitting is a reversal of removal, but where applicable, make sure that the cut-outs in the metal inserts securing the rubber to the blade face each other.

36 Wiper arms - removal and refitting

Windscreen and rear window wipers

Removal

1 The wiper motor should be in its parked position before removing the wiper arm. Mark the position of the blade on the glass with adhesive tape as a guide to refitting.

2 Lift the hinged covers, and remove the nuts and washers securing the arms to the spindles.

3 Prise the arms from the spindles, using a screwdriver if necessary. Take care not to damage the paintwork.

Refitting

4 Refitting is a reversal of removal. Note that the passenger side wiper arm is longer than that fitted to the driver's side. Ensure that the arms are fitted to their correct locations, as incorrect installation can cause the blades to foul one another when being used **(see illustration)**.

Headlamp wipers

5 The procedure is as described in paragraphs 1 to 4, but the washer hose must be disconnected from the stub on the body panel.

37 Washer nozzles - removal and refitting

Models up to 1990

Removal

1 To remove a nozzle, carefully prise it from its location using a thin-bladed screwdriver. Take care not to damage the paintwork.

2 Disconnect the washer hose and withdraw the nozzle.

Refitting

3 To refit, reconnect the washer hose to the nozzle, and push the nozzle into its locating hole.
4 The nozzles can be adjusted by inserting a pin into the jet, and swivelling it to the required position.

1991-on models

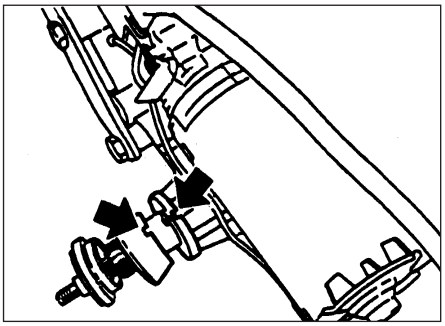
5 The nozzles on all later models are fitted with twin jets.
6 On some later models, the nozzles are heated; the circuit is fed through fuse 29 and is live whenever the ignition is switched on. Current is regulated by a Positive Temperature Coefficient (PTC) resistor that takes outside temperature into account.

38 Windscreen wiper motor and linkage - removal and refitting

Removal

1 Disconnect the battery negative lead.
2 Remove the wiper arms, as described in Section 36.
3 Remove the windscreen cowl panel, as described in Chapter 11.
4 Disconnect the wiring plug from the motor **(see illustration)**.

39.5 Tailgate wiper motor assembly. Note earth leads under heads of securing bolts



39.7 Cut-out in tailgate wiper motor drive spindle rubber seal must engage with notch in drive spindle

38.4 Disconnecting the windscreen wiper motor wiring plug

5 Unscrew the three bolts securing the motor/linkage assembly to the body, then withdraw the assembly **(see illustrations)**.
6 If desired, the motor can be removed from the linkage by unscrewing the three securing bolts. Do not attempt to dismantle the linkage.

Refitting

7 Refitting is a reversal of removal.

39 Tailgate wiper motor - removal and refitting

Removal

1 Disconnect the battery negative lead.
2 Remove the wiper arm, as described in Section 36.
3 Extract the securing screws, and remove the rear tailgate trim panel.
4 Disconnect the motor wiring plug.
5 Unscrew the two motor securing bolts, noting the earth leads under the bolt heads **(see illustration)**.
6 Manipulate the motor assembly from the tailgate.

Refitting

7 Refitting is a reversal of removal, ensuring that the cut-out in the drive spindle rubber seal engages with the notch in the drive spindle **(see illustration)**.

40.5A Unscrew the headlamp wiper motor securing bolts . . .

38.5A Unscrew the windscreen wiper motor/linkage assembly securing bolts . .

38.5B . . . then withdraw the assembly

40 Headlamp wiper motor - removal and refitting

Removal

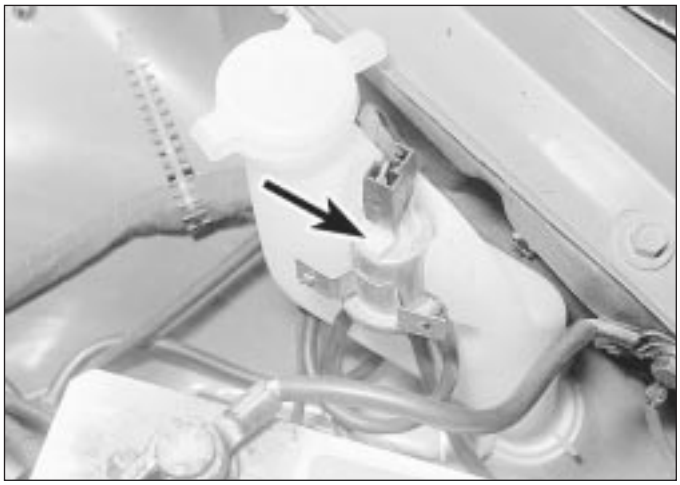
1 Disconnect the battery negative lead.
2 Remove the wiper arm, as described in Section 36.
3 Remove the headlamp, as described in Section 25.
4 Disconnect the motor wiring plug.
5 Unscrew the two bolts securing the motor mounting bracket to the body panel, then withdraw the motor **(see illustrations)**.

Refitting

6 Refitting is a reversal of removal.

40.5B . . . and withdraw the motor

41.17 Horn/washer fluid reservoir support bracket securing bolt (arrowed) - model with headlamp wash



43.1 Headlamp washer fluid non-return valve (arrowed)

41 Washer fluid reservoir - removal and refitting

1 Disconnect the battery negative lead.

Models without headlamp wash

Removal

2 Disconnect the wiring from the washer pump.
3 Disconnect the washer fluid hose from the pump. Be prepared for fluid spillage.
4 Remove the screw(s) securing the reservoir to the body, and withdraw the reservoir.

Refitting

5 Refitting is a reversal of removal.

Models with headlamp wash

Removal

6 On models with headlamp wash, the reservoir is in two sections, the upper section, which can be removed from the engine compartment, and the lower section, which must be removed from under the wheel arch.
7 Disconnect the wiring from the headlamp wash non-return valve in the top of the reservoir.
8 Disconnect the washer fluid hoses from the non-return valve. Be prepared for fluid spillage.
9 Remove the screw securing the upper section of the reservoir to the wing panel.
10 Loosen the plastic collar securing the upper section of the reservoir to the lower section, then withdraw the upper section of the reservoir from the engine compartment.
11 To remove the lower section of the reservoir, continue as follows.
12 Apply the handbrake, then jack up the front of the vehicle, and support on axle stands (see "*Jacking and Vehicle Support*") positioned under the body side members.
13 Remove the securing screws, and withdraw the plastic cover from the bumper/front wing to expose the lower section of the reservoir.
14 Remove the horns, (Section 22).
15 Remove the wheel arch liner, (Chapter 11).
16 Disconnect the wiring and the fluid hoses from the washer pump. Be prepared for fluid spillage.
17 Unscrew the bolts securing the horn/reservoir support bracket and the reservoir to the body, then withdraw the bracket and the reservoir **(see illustration)**.

Refitting

18 Refitting is a reversal of removal.

42 Washer pump - removal and refitting

1 Disconnect the battery negative lead.

Models without headlamp wash

Removal

2 Disconnect the wiring and the fluid hose from the pump. Be prepared for fluid spillage.
3 Pull the pump from the reservoir, being prepared for fluid spillage if the reservoir still contains fluid.
4 Examine the condition of the sealing grommet, and renew if necessary, and clean the gauze filter at the end of the pump pick-up tube.

Refitting

5 Refitting is a reversal of removal.

Models with headlamp wash

6 Apply the handbrake, then jack up the front of the vehicle, and support on axle stands positioned under the body side members.
7 Remove the securing screws, and withdraw the plastic cover from the bumper/front wing to expose the lower section of the fluid reservoir.
8 Remove the wheel arch liner, (Chapter 11).
9 Proceed as described in paragraphs 2 to 5 inclusive.

43 Headlamp washer fluid non-return valve - removal and refitting

Removal

1 The valve is located on a bracket attached to the upper section of the washer fluid reservoir **(see illustration)**.
2 Disconnect the battery negative lead.
3 Disconnect the wiring and the fluid hoses from the valve. Be prepared for fluid spillage.
4 Remove the screw securing the valve bracket to the reservoir, and withdraw the valve.

Refitting

5 Refitting is a reversal of removal.

44 Electric window components - removal and refitting

Note: *Whenever any of the electric window components are removed, after refitting the components, the electric window controls must be programmed, as described in Section 45.*
1 Disconnect the battery negative lead.

Rear door-mounted switches

Removal

2 Prise the plastic surround from the door interior handle.
3 Carefully prise the switch from its location, and disconnect the wiring plug.

Refitting

4 Refitting is a reversal of removal, but make sure that the wiring is routed so that it does not foul the electric window or lock operating components.

Centre console-mounted switches

Removal

5 The switches must be removed as a complete assembly, and cannot be dismantled. If one of the switches is faulty, the complete assembly must be renewed.
6 Remove the rear section of the centre console, as described in Chapter 11.
7 Release the securing clips, and withdraw the switch assembly through the top of the centre console.

Refitting

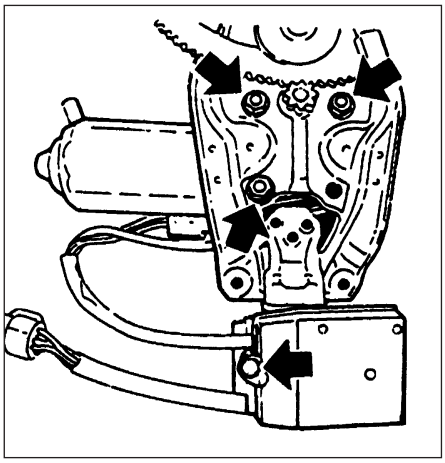
8 Refitting is a reversal of removal.

Operating motors

9 Remove the door window regulator, as described in Chapter 11.
10 To remove the motor assembly from the front door window regulator, unscrew the three motor securing nuts, and the single screw securing the pulse pick-up unit to the regulator assembly. Withdraw the motor, complete with the pulse pick-up unit. Note that if the motor or pick-up unit is/are faulty, the two components must be renewed as an assembly, as no spare parts are available **(see illustration)**.
11 The motor assembly fitted to the rear door window regulator is an integral part of the regulator, and no attempt should be made at dismantling. If faulty, the complete motor/regulator assembly must be renewed, as no spares are available.

45 Electric window controls - programming

1 Whenever the battery is disconnected, or any of the electric window components are removed, on completion of work, the electric window controls must be programmed as follows.
2 Close all doors, and switch on the ignition.
3 Close one of the windows by pressing the relevant operating switch. Press and hold the switch for a further five seconds after the relevant window has fully closed.



44.10 Front door electric window motor securing nuts and pulse pick-up securing screw (arrowed)

4 Repeat the procedure for the remaining window(s).

46 Central door locking components - removal and refitting

1 Disconnect the battery negative lead.

Electronic control module

Removal

2 The module is mounted in the driver's footwell, behind the side trim panel.
3 Remove the driver's footwell side trim panel, as described in Chapter 11.
4 Unscrew the two securing nuts, and lift the module from the body panel **(see illustration)**.
5 Depress the retaining clip to release the wiring plug, then withdraw the module.

Refitting

6 Refitting is a reversal of removal.

Operating switch

Removal

7 The operating switch takes the form of a microswitch, mounted inside the door at the rear of the exterior handle assembly.
8 Remove the door inner trim panel, as described in Chapter 11.
9 Peel back the plastic insulating sheet sufficiently to gain access to the exterior handle.
10 Unclip the microswitch from the rear edge of the exterior handle assembly, and disconnect the switch wiring plug from the door wiring harness, then withdraw the switch **(see illustration)**.

Refitting

11 Refitting is a reversal of removal.

Door lock operating motor

Removal

12 Remove the door lock, as described in Chapter 11.
13 Disconnect the lock operating rod from the motor.
14 Remove the two securing screws, and withdraw the motor from the lock assembly.

Refitting

15 Refitting is a reversal of removal.

Tailgate/boot lid lock operating motor

Removal

16 On Hatchback models, extract the securing screws and remove the rear tailgate trim panel.
17 Remove the two securing screws, and manipulate the motor to disconnect the lock operating rod.
18 Withdraw the motor and disconnect the wiring plug **(see illustration)**.

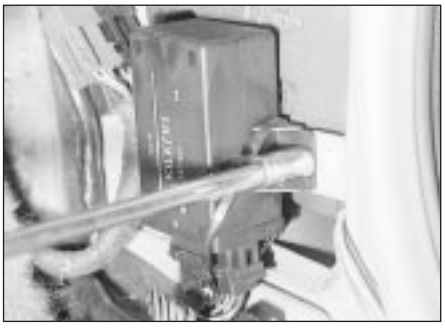
Refitting

19 Refitting is a reversal of removal.

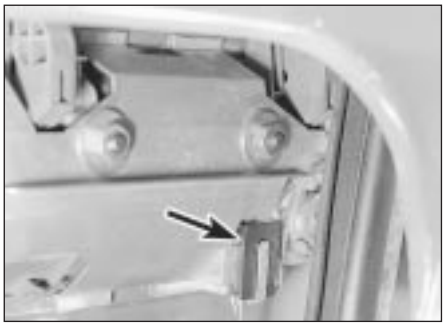
Fuel filler flap lock operating motor

Removal

20 Remove the right-hand rear quarter trim panels, as described in Chapter 11.
21 Disconnect the wiring plug from the rear of the motor **(see illustration)**.



46.4 Unscrewing a central door locking control module securing nut



46.10 Central door locking operating microswitch (arrowed) in driver's door

46.18 Disconnecting the wiring plug from the tailgate lock operating motor - Hatchback model

22 Unscrew the two screws securing the motor to the mounting bracket, then manipulate the motor to disconnect the lock operating rod. Withdraw the motor.

Refitting

23 Refitting is a reversal of removal.

47 Aerial - removal and refitting

HAYNES HiNT

Always clean the aerial mast in an upwards direction. This should minimise dirt being forced down, into the mast sections.

Removal

1 On models with an electric aerial, disconnect the battery negative lead.
2 Remove the left-hand rear quarter trim panel, as described in Chapter 11.
3 Remove the screw securing the earth lead(s) to the body panel **(see illustration)**.
4 Remove the screw securing the aerial bracket to the body panel, then ensure that the aerial is fully retracted, and pull it through the grommet in the bodywork into the luggage compartment. Disconnect the wiring plug on models with an electric aerial, and disconnect the aerial lead **(see illustrations)**.

47.4A Unscrewing the radio aerial bracket securing screws - electric aerial

47.4B Disconnecting the aerial lead - electric aerial

46.21 Disconnecting the wiring plug from the fuel filler flap operating motor - Hatchback model

Refitting

5 Refitting is a reversal of removal, but ensure that the rubber grommet is correctly seated in the bodywork.

48 Aerial mast, electric - removal and refitting

HAYNES HiNT

Always clean the aerial mast in an upwards direction. This should minimise dirt being forced down, into the mast sections.

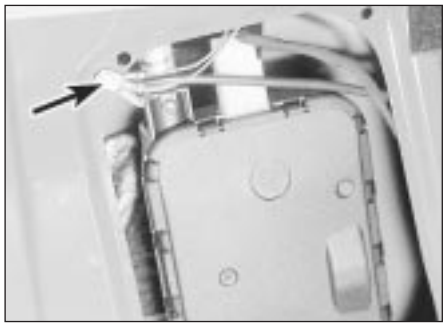
Removal

1 The mast on "factory fitted", fully automatic electric aerials, can be replaced separately.
2 Extend the aerial as far as possible, by switching on the radio.
3 Unscrew the mounting nut.
4 Pull the sprung sleeve upwards and clear of its base.
5 The assembly can now be removed from the clutch mechanism, by pulling the assembly upwards.

Refitting

6 Insert the ball end of the mast assembly into the base.

48.7 Push the mast assembly down, until it engages in the clutch mechanism



47.3 Radio aerial earth lead securing screw (arrowed) - electric aerial

7 Carefully push the mast assembly down as far as possible, until it engages into the clutch mechanism **(see illustration)**.
8 Switch the radio off to retract the aerial.
9 If the aerial does not fully retract into its base, guide the remaining mast into the base by hand.
10 Insert the sprung sleeve into the base and tighten the mounting nut.
11 Check the aerial works properly by turning the radio on and off a few times.

49 Speakers - removal and refitting

1 Disconnect the battery negative lead.

Facia-mounted speaker

Removal

2 Using a thin-bladed screwdriver, carefully prise the speaker from the top of the facia panel. Take care not to damage the facia trim **(see illustration)**
3 Disconnect the wiring and withdraw the speaker. If desired, the plastic trim panel can be unclipped from the top of the speaker.

Refitting

4 Refitting is a reversal of removal.

Front door-mounted speaker

Removal

5 Remove the door inner trim panel, as described in Chapter 11.

49.2 Removing a facia-mounted speaker (viewed through windscreen)

49.6 Withdrawing a front door-mounted speaker - wiring plug arrowed

6 Remove the three securing screws, and withdraw the speaker from the door. Disconnect the wiring plug **(see illustration)**.

Refitting

7 Refitting is a reversal of removal, but note that the speaker can only be fitted one way up, so that the lug on the bottom of the speaker rim engages with the corresponding hole in the door skin.

Rear speaker - Hatchback models

Removal

8 Remove the upper rear quarter trim panel, as described in Chapter 11.
9 Remove the four securing screws, and withdraw the speaker.

Refitting

10 Refitting is a reversal of removal.

Rear speaker Saloon models

Removal

11 Carefully prise the trim cover from the parcel shelf, to expose the speaker.
12 Remove the four securing screws, withdraw the speaker and disconnect the wiring.

Refitting

13 Refitting is a reversal of removal.

50 Radio/cassette player - removal and refitting

Removal

1 All the radio/cassette players fitted to the Cavalier range have DIN standard fixings. Two special tools, obtainable from in-car entertainment specialists, are required for removal.
2 Disconnect the battery negative lead.
3 Unscrew the four grub screws from the corners of the radio cassette player, using an Allen key or hexagon bit **(see illustration)**.
4 Insert the tools into the holes exposed by removal of the grub screws, and push them until they snap into place. Pull the tools outwards to release the unit **(see illustration)**.
5 Pull the unit forwards, and withdraw it from the facia.

Refitting

6 To refit the radio/cassette player, simply push the unit into the facia until the retaining lugs snap into place, then refit the grub screws.

51 Sunroof motor - removal and refitting

Removal

1 Ensure that the sunroof is fully closed.
2 Disconnect the battery negative lead.
3 Prise the courtesy lamp from the roof trim panel, and disconnect the wiring.
4 Remove the two trim panel securing screws, and withdraw the trim panel from the roof, disconnecting the wiring from the sunroof operating switch.
5 Disconnect the wiring plugs from the motor.
6 Unscrew the securing nut, and withdraw the motor assembly.

50.3 Unscrew the grub screws . . .

Refitting

7 Refitting is a reversal of removal.

52 Speedometer cable - removal and refitting

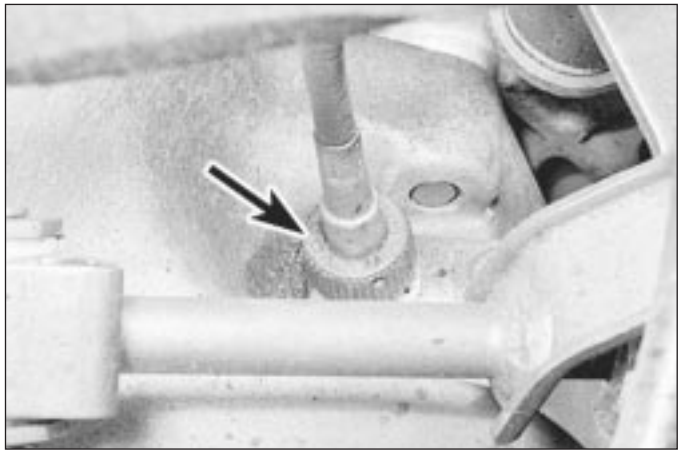
Removal

1 Remove the instrument panel, as described in Section 18.
2 Pull the cable through the bulkhead into the engine compartment, noting its routing.
3 Working in the engine compartment, unscrew the securing sleeve and disconnect the speedometer cable from the top of the transmission **(see illustration)**.
4 The cable can now be withdrawn from the vehicle, noting its routing so that it can be refitted in the same position.

Refitting

5 Refitting is a reversal of removal, ensuring that the cable is correctly routed. Make sure that the cable is not kinked or twisted between the instrument panel and the bulkhead as the instrument panel is refitted. Note that the cable should be routed to the right of the steering column support bracket.

50.4 . . . and withdraw the radio/cassette player using the special tools



52.3 Speedometer cable securing sleeve (arrowed) at transmission - SOHC model

53 Anti-theft alarm - general

1 Certain models are fitted with an anti-theft alarm as standard equipment.
2 The alarm system is triggered by door, bonnet and boot lid/tailgate mounted switches, and by ultrasonic sensors mounted inside the passenger compartment **(see illustration)**.
3 The alarm features a self-diagnostic function, and any faults should be referred to a Vauxhall dealer, who will have access to the necessary specialist diagnostic equipment.

54 Anti-theft alarm system components - removal and refitting

Control unit

Removal

1 Disconnect the battery negative lead.
2 Remove the driver's side lower facia panel as described in Chapter 11.
3 If necessary, remove the footwell side trim panel as described in Chapter 11.
4 Undo the control unit retaining bolt, disconnect the wiring plug and remove the unit from its location.

Refitting

5 Refitting is a reversal of removal.

Ultrasonic sensor

6 Disconnect the battery negative lead.
7 Remove the centre body pillar trim panel as described in Chapter 11.
8 Carefully release the ultrasonic sensor trim panel and withdraw it downwards.
9 Release the ultrasonic sensor from its location, disconnect the wiring plug and remove the unit from the car.

Refitting

10 Refitting is a reversal of removal.

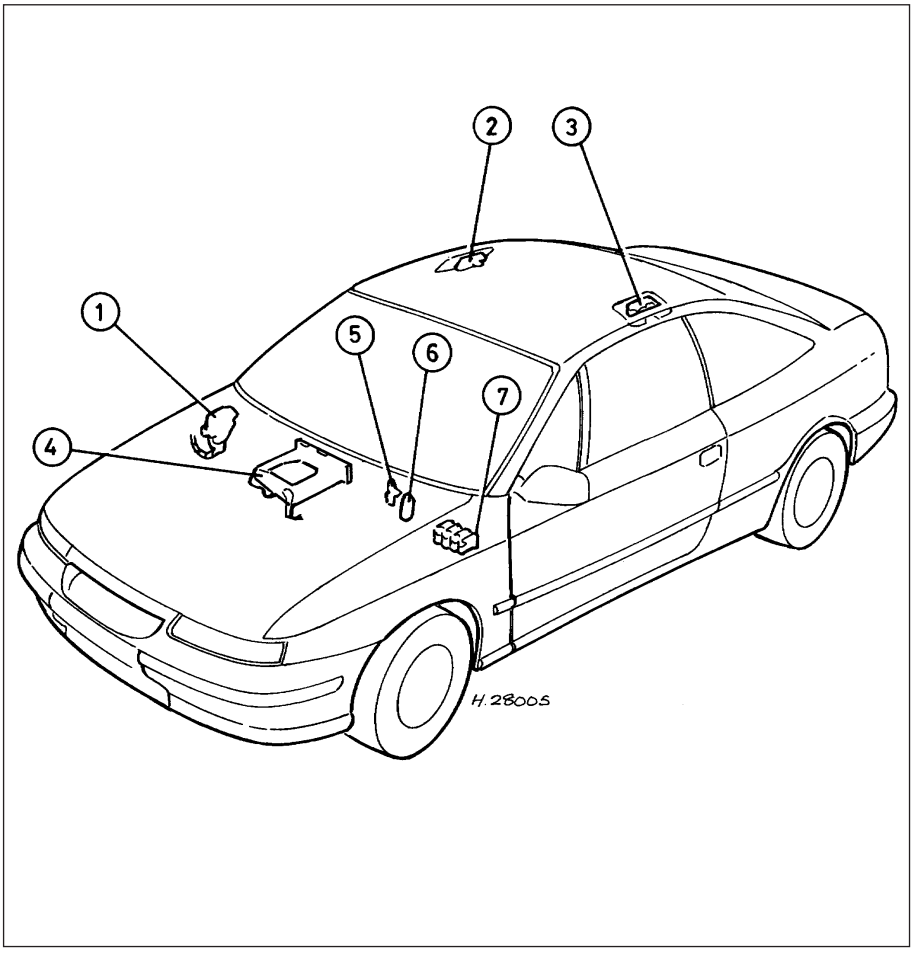
Bonnet contact unit

Removal

11 Disconnect the battery negative lead.
12 Using a screwdriver, depress the catch at the base of the contact unit and withdraw the contact from its location.
13 Disconnect the contact wiring and remove the unit.

Refitting

14 Refitting is a reversal of removal.



53.2 Anti-theft alarm system component locations
(Calibra model shown - component locations identical on Cavalier)

1 Control unit
2 Ultrasonic sensor with LED
3 Ultrasonic sensor with probe
4 Radio contact
5 Bonnet contact unit
6 Horn
7 Relay

55 Airbag - general

Warning: Before starting any work on airbag or related components, disconnect the battery. Cover the battery's terminals and wait a minimum of 1 minutes as a precaution against accidental firing of the airbag unit. This period ensures that any stored energy in the back-up capacitor is dissipated. Handle the airbag unit with extreme care as a precaution against personal injury, and always hold it with the cover facing away from the body. If in doubt concerning any proposed work involving the airbag unit or its control circuitry, consult a Vauxhall dealer or other qualified specialist.

All 1993 Cavalier models are available with an airbag that is designed to prevent serious chest and head injuries to the driver during an accident. A similar bag for the front seat passenger is also available on certain models. Sensors in the centre of the car measure the vehicle deceleration rate and pass these signals to a microprocessor. This unit analyses the sensor data and compares the information with pre-programmed values stored in its memory, triggering the airbag if the deceleration is severe. The airbag is inflated in 50 milliseconds by a gas generator that forces the bag out of the module cover in the centre of the steering wheel.

No repairs are possible on the airbag unit or its associated parts. The contents of the following Sections are confined to removal and refitting of the airbag, purely for access to other non-related components.

Should a fault be suspected on the airbag unit, indicated by the warning light on the instrument panel, or if the car has been involved in an accident, however minor, consult a Vauxhall dealer immediately. Do not attempt to dismantle any of the airbag components or carry out any work whatsoever, other than the procedures described in the following Sections.

On vehicles fitted with a passenger side airbag, **do not** fit accessories in the airbag zone. Items like telephones, cassette storage boxes, additional mirrors, etc., can be ripped off and cause serious injury, if the airbag inflates.

56 Airbag unit, drivers side - removal and refitting

Warning: Read warning at the beginning of Section 55, before starting work.

Note: *On power steering models in particular, it will be advantageous to jack up the front of the car and support it on axle stands placed under the body side members, so that the steering wheel can be turned more easily.*

Removal

1 Disconnect the battery negative lead and cover the battery terminal. Wait a minimum of 1 minute.
2 With the steering wheel positioned in the straight-ahead position, turn it 90° clockwise so that the left-hand spoke is accessible from the rear.
3 Using a Torx type socket, undo the first airbag retaining bolt from the rear of the steering wheel **(see illustration)**.
4 Turn the steering wheel 180° anti-clockwise so that the right-hand spoke is accessible from the rear.
5 Undo the second retaining bolt from the rear of the steering wheel.
6 Return the steering wheel to the straight-ahead position then carefully lift up the airbag unit.
7 Disconnect the wiring plug and remove the airbag from the car.

Warning: Stand the unit with the cover uppermost and do not expose it to heat sources in excess of 100ºC. Do not attempt to open or repair the airbag unit, or apply any voltage to it. Do not use any airbag unit that is visibly damaged or has been tampered with.

Refitting

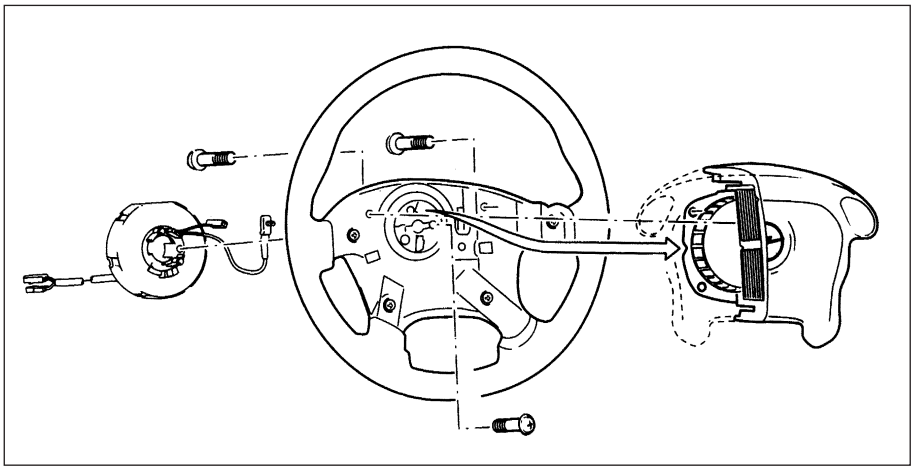
8 Refitting is a reversal of removal.

57 Steering wheel (with airbag) - removal and refitting

Note: *Read warning at the beginning of Section 55, before starting work. A two-legged puller will be required for this operation. Note also that the steering wheel is a very tight fit on the shaft.*

Removal

1 Remove the airbag unit as described previously.
2 Ensure that the steering wheel is in the straight ahead position.
3 From the centre of the steering wheel unscrew the two screws securing the airbag contact unit.

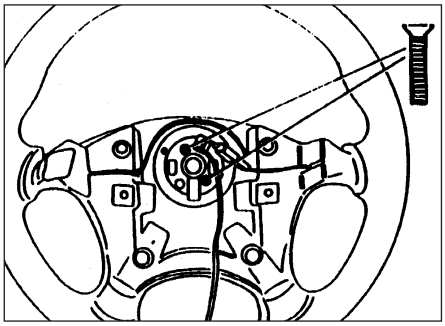


56.3 Airbag, steering wheel and contact unit details

4 Using a screwdriver, prise back the tabs on the lockwasher securing the steering wheel retaining nut.
5 Unscrew and remove the steering wheel retaining nut and the lockwasher.
6 Make alignment marks between the steering wheel and the end of the column shaft.
7 A suitably small two-legged puller must now be fitted to the steering wheel in order to pull it from the column shaft.
8 Once the steering wheel has been released from the column shaft, disconnect the horn wiring and remove the steering wheel.

Refitting

9 Begin refitting by positioning the steering wheel on the column shaft, ensuring that the marks made on removal are aligned, and that the wheel correctly engages with the airbag contact unit. It may be necessary to tap the steering wheel fully home on the column shaft using a metal tube and socket.
10 Reconnect the horn wiring.
11 Refit the lockwasher and the steering wheel retaining nut, and tighten the nut to the specified torque. Bend up the lockwasher to secure.
12 Refit the two screws securing the airbag contact unit.
13 Refit the airbag as described previously.



58.3 Airbag contact unit retaining screws

58 Airbag contact unit - removal and refitting

Note: *Read warning at the beginning of Section 55, before starting work.*

Removal

1 Remove the airbag and the steering wheel as described previously.
2 Remove the steering column upper and lower shrouds, referring to Chapter 10, if necessary.
3 Disconnect the contact unit wiring plug below the steering column and withdraw the contact unit from the column, noting its fitted position as a guide to reassembly **(see illustration)**.

Refitting

4 Before refitting the contact unit, ensure that the front wheels are in the straight-ahead position.
5 Place the contact unit on the column in the correct position as noted during removal.
6 Route the wiring harness under the steering column lock/ignition switch and connect the wiring plug.
7 Refit the steering column shrouds.
8 Refit the steering wheel and airbag as described previously.

59 Airbag unit, passengers side - removal and refitting

Note: *Read warning at the beginning of Section 55, before starting work.*

Removal

1 Disconnect the battery, cover the terminals and wait at least 1 minute.
2 Remove the glovebox assembly. Refer to Chapter 11, for further details if necessary.
3 Remove the right hand ventilation air duct.

4 Disconnect the plug connections.
5 Unbolt the six M6 nuts from the two side brackets.
6 Remove the airbag unit **(see illustration).**

Refitting

4 Refitting is a reversal of removal.

60 Bracket, passenger airbag unit - removal and refitting

Note: *Read warning at the beginning of Section 55, before starting work. This process involves removal of the windscreen, refer to Chapter 11, before starting work.*

Removal

1 Remove the passenger side airbag unit as described in Section 59.
2 Remove the airbag unit cover.
3 Remove the water deflector from in front of the windscreen.
4 Remove the windscreen.
5 The brackets can now be unbolted.

Refitting

4 Refitting is a reversal of removal.

61 Airbag control unit - removal and refitting

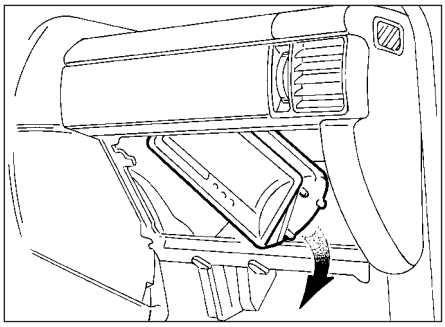
Note: *Read warning at the beginning of Section 55, before starting work.*

Removal

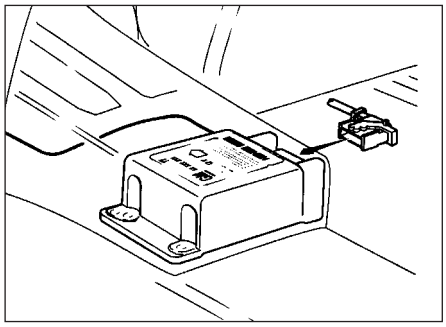
1 Disconnect the battery negative lead and cover the battery terminal to prevent accidental reconnection.
2 Remove the centre console rear section as described in Chapter 11.
3 Disconnect the control unit wiring plug, then undo the three nuts and remove the unit from the car **(see illustration)**.

Refitting

4 Refitting is a reversal of removal.



59.6 Removing the passenger side airbag



61.3 Airbag control unit details

62 Wiring diagrams - general

1 The wiring diagrams are of the current flow type, each circuit being shown in the simplest possible fashion. Note that since the diagrams were originally written in German (to the DIN standard), all wire colours and abbreviations used on the diagrams themselves are in German. Refer to the information given overleaf for clarification.
2 The bottom line of the diagram represents the "earth" or negative connection; the numbers below this line are track numbers, enabling circuits and components to be located using the key.
3 The lines at the top of the diagram represent "live feed" or positive connection points. The line marked "30" is live at all times, that marked "15" is live only when the ignition is switched on.
4 Numbers on the diagram that are framed in square boxes at the end of a wire show the track reference number in which that wire is continued. At the point indicated will be another framed number referring back to the circuit just left.
5 As an example of how to use the diagrams, trace with the help of the following text the reversing lamp switch circuit located between track reference numbers 496 and 498 on the 1991 model year diagram on page 12•40.
6 Starting at the top of track 497, the supply for the circuit comes from the line "15", showing that the circuit is fed only when the ignition is switched on, through fuse 22 (F22, rated at 10 amps). Note that this fuse can also protect the feed for several other circuits, some of which may not be applicable to the vehicle being worked on.
7 If the vehicle in question has a manual transmission (MT), the circuit continues along a black wire of 0.75 mm cross-section (as shown by "SW 0.75" in the wire path), through terminal 12 of connector X5 to the reversing lamp switch S7. From the switch the circuit continues along a white wire, with a black tracer and of 0.75 mm cross-section (WSSW 0.75), through terminal 2 of connector X5 and terminal 1 of connector X6, to the reversing lamp bulbs (E17 and E18). The circuit is completed by a brown wire from each bulbholder to earth; in this case the "earth" wire simply attaches the component to the nearest piece of metal bodywork, but in other cases earthing is achieved by the component mounting and no wire is needed. The diagram shows, as simply as possible, that when the switch contacts (which are normally open) are closed by the driver selecting reverse gear, current is allowed to flow to earth through the switch and bulbs causing the reversing lamps to light.
8 If the vehicle in question has automatic transmission (AT), the circuit differs in that the "live feed" goes from fuse 22 to terminal "F" of the transmission selector lever position switch connector X46 (track reference number 773). When position "R" is selected, terminals "F" and "G" are connected so that the circuit feed continues (back to track reference number 496, the "RFS/reversing lamp" circuit) along the same route described above for manual transmission models.

Explanations of abbreviations used in wiring diagrams

ABS	Anti-lock braking system
AC	Air conditioning
AZV	Trailer hitch
AT	Automatic transmission
ATC	Automatic temperature control
BR	Trip (on-board) computer
CC	Check control system
CRC	Cruise control
D	Diesel
DS	Theft protection
DT	Turbo Diesel
DWA	Anti-theft warning system
DZM	Tachometer
EFC	Electric folding roof (Convertible)
EKS	Pinch guard (electric windows)
EMP	Radio
EUR	Euronorm (emission control standard) engine
EZ + EI	Plus ignition system (with self-diagnosis)
EZV	Ecotronic
FH	Electric windows
GB	Great Britain
HS	Heated rear window
HW	Rear window wiper
HZG	Heating
HRL	Luggage compartment lamp
INS	Instrument panel
IRL	Courtesy lamps
KAT	Catalytic converter
KBS	Wiring harness
KV	Contact breaker distributor
L3.1	Bosch Jetronic fuel injection system
LCD	Liquid crystal display (LCD) instruments
LHD	Left-hand drive
4WD	Four-wheel-drive
LWR	Headlamp aim adjustment
M1.5	Bosch Motronic M1.5 engine management system
M2.5	Bosch Motronic M2.5 engine management system
MOT	Motronic (general)
MT	Manual gearbox
MUL	Multec fuel injection system
N	Norway
NS	Front foglamps
NSL	Rear foglamps
OEL	Oil level/pressure check system
OPT	Optional equipment
PBSL	Park and brake shift block (automatic transmission, selector lever in position ‘P’)
P/N	Park/neutral (automatic transmission)
POT	Potentiometer
RC	Rear suspension level control system
RFS	Reversing lamps
RHD	Right-hand drive
S	Sweden
SD	Sunroof
SH	Heated seats
SRA	Headlamp washers and wipers
TANK	Fuel level sender unit
TD	Turbo Diesel
TEMP	Temperature gauge
TFL	Daytime driving lamps
TKS	Courtesy lamp (door pillar) switches
TSZI	Transistorised ignition (inductive-triggered) system
VGS	Carburettor
WEG	Odometer frequency/roadspeed sensor
WHR	Rear suspension level control system
WS	Warning buzzer
ZV	Central locking
ZYL	Cylinder

Colour codes

BL	Blue	RT	Red
HBL	Light blue	WS	White
BR	Brown	SW	Black
GE	Yellow	LI	Lilac
GR	Grey	VI	Violet
GN	Green		

Wiring identification

Example: GEWS 1.5

GE - Wire basic colour
WS - Wire tracer colour
1.5 - Wire cross-section in mm^2

Note: *Not all items shown are fitted to all models. Refer to Section 62 (Chapter 12) for details of diagram usage.*

Key to wiring diagrams for 1989 models

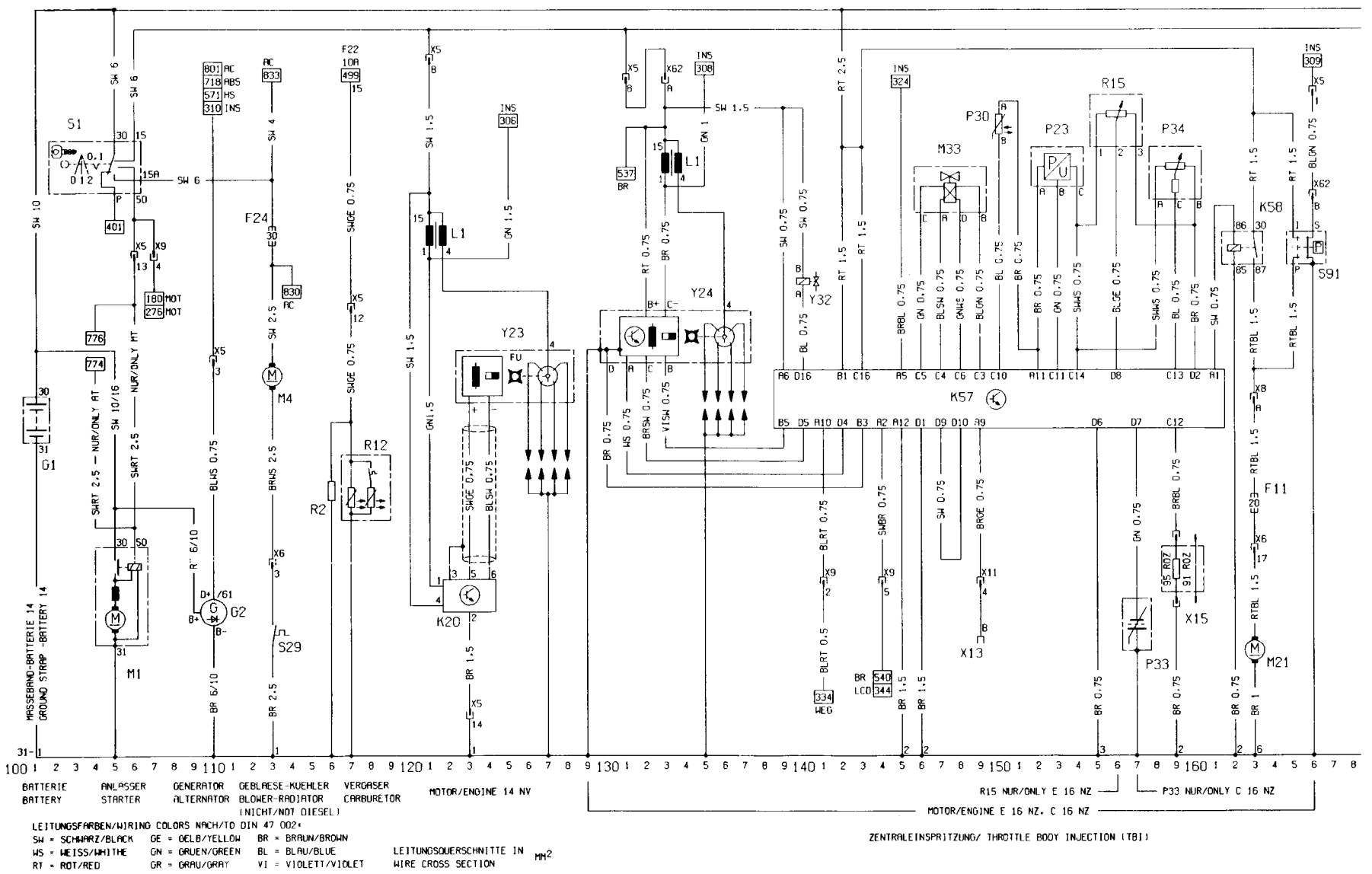
No	Description	Track
E1	Sidelamp - left	406
E2	Tail lamp - left	302, 380, 407
E3	Number plate lamp	413
E4	Side lamp right	409
E5	Tail lamp right	382, 410
E6	Engine compartment lamp	416
E7	Headlamp main beam - left	437
E8	Headlampmain beam - right	438
E9	Headlampdipped beam - left	384, 439
E10	Headlamp dipped beam - right	386, 440
E11	Instrument illumination lamps	328 to 329
E12	Gear selector lever illumination lamp (automatics)	799
E13	Luggage compartment lamp	485
E14	Courtesy lamp	487
E15	Glovebox lamp	599
E16	Cigarette lighter illumination lamp	598
E17	Reversing lamp - left	497
E18	Reversing lamp - right	498
E19	Heated rearwindow	572
E20	Front foglamp - left	448
E21	Front foglamp - right	447
E24	Rear foglamp - left	454
E25	Seat heater - front left	575
E30	Seat heater - front right	579
E32	Clock illumination lamp	552
E38	Trip computer illumination lamp	539
E39	Rear foglamp - right	455
E41	Courtesy lamp (with delay)	488 to 490
E50	Kerb lamp - driver's door	635
E51	Kerb lamp - passenger door	653
F1 to F30	Fuse (in fusebox)	Various
F32	Fuse - mixture preheating (not UK)	232
F33	Fuse - electronic carburettor (not UK)	201
F34	Fuse (in relay box, engine compartment)	834
F35	Voltage stabiliser	302
F36	Fuse - fuel filter heating (Diesel models)	866
G1	Battery	101
G2	Alternator	110
G3	Battery - Diesel models	846
G6	Alternator - Diesel models	850 to 852
H2	Horn	591
H3	Direction indicator warning lamp	318, 320
H4	Oil pressure warning lamp	310
H5	Brake fluid level warning lamp	313
H6	Hazard warning flasher warning lamp	470
H7	Alternator charge warning lamp	310
H8	Headlamp main beam warning lamp	322
H9	Brake lamp - left	388
H10	Brake lamp - right	390
H11	Direction indicator lamp - front left	472
H12	Direction indicatorlamp - rear left	473
H13	Direction indicator lamp - front right	481
H14	Direction indicator lamp - rear right	482
H16	Glow plug warning lamp (Diesel models)	323
H17	Trailer direction indicator warning lamp	321
H18	Horns (twin)	592, 593
H19	Headlamps-on warning buzzer	494, 495
H21	Handbrake-on warning lamp	315
H23	Radio/cassette player	585, 586
H25	Door mirror heater warning lamp	678
H26	ABS warning lamp	319
H30	Engine fault warning lamp	324
H33	Direction indicator side repeater lamp - left	476
H34	Direction indicator side repeater lamp - right	478
H42	Automatic transmission warning lamp	325
H45	Four-wheel-drive warning lamp	327
H46	Catalytic converter temperature warning lamp (not UK)	329
K1	Relay-heated rear window	571 to 572
K5	Relay - front foglamps	448 to 450
K6	Relay - air conditioning (not UK)	801 to 802
K7	Relay - air conditioning blower (not UK)	808 to 809
K8	Relay - intermittent windscreen wipe	503 to 506
K9	Relay - headlamp wash	522 to 523
K10	Relay - direction indicator/hazard warning flashers	467 to 469
K20	HEI ignition control unit	122 to 124
K25	Relay - glow plugs (Diesel models)	856 to 859
K30	Relay - intermittent rear window wipe	515 to 517
K35	Relay - door mirror heater	683 to 685
K37	Central locking control unit	606 to 612
K45	Relay - mixture preheating (not UK)	231 to 232
K47	Relay - surge arrester (ABS)	702 to 703
K50	ABS control unit	707 to 721
K51	Relay - cooling fan	830 to 831
K54	Electronic carburettor control unit (not UK)	203 to 226
K55	Relay - electronic carburettor (not UK)	203 to 206
K57	Fuel injection control unit (not UK)	139 to 161
K58	Relay - fuel pump (not UK)	162 to 163
K59	Relay - daytime running lamps (not UK)	420 to 426
K61	Motronic M4.1 control unit	170 to 194
K62	Dim-dip control unit	428 to 432
K63	Relay - horn	593 to 594
K64	Relay - air conditioning blower (not UK)	802 to 803
K67	Relay - cooling fan	827 to 828
K68	Relay - fuel injection system	294 to 299, 196 to 199
K69	Motronic M2.5 control unit	267 to 297
K71	Ride control unit (not UK)	739 to 754
K80	Relay - fuel filter heater (Diesel models)	865 to 866
K82	Relay - engine revolution	862 to 863
K83	Four-wheel-drive control unit	725 to 731

Key to wiring diagrams for 1989 models (continued)

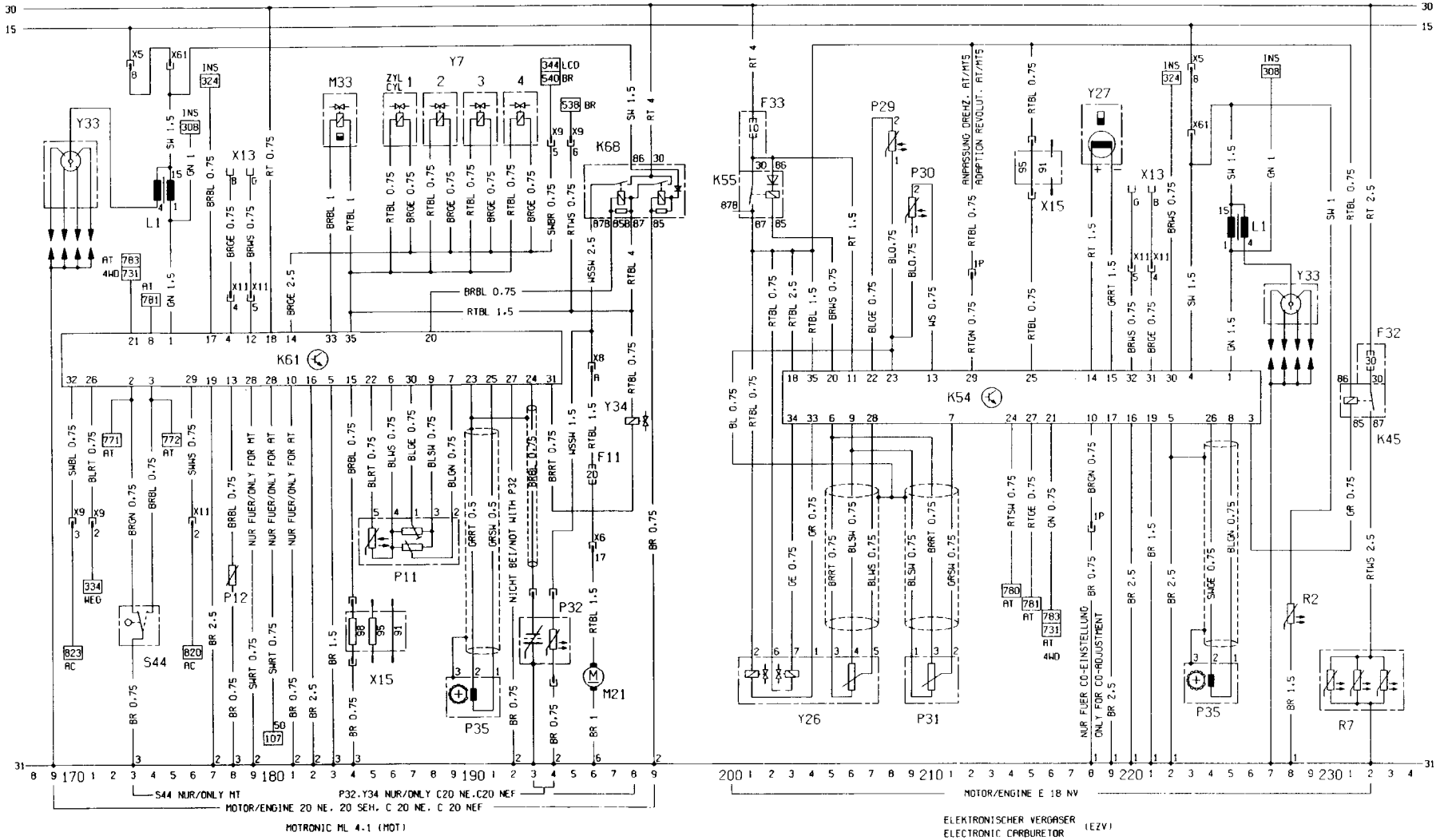
No	Description	Track
K84	MSTS ignition control unit	247 to 256
K85	Automatic transmission control unit	771 to 797
K86	Check control unit	370 to 392
K87	Relay - auxiliary cooling fan	833 to 834
K88	Catalytic converter temperature control unit (not UK)	760 to 762
K89	Relay - rear fog lamps	444 to 447
K90	Relay - air conditioning compressor (not UK)	820 to 821
K93	Relay - air conditioning compressor (not UK)	821 to 822
L1	Ignition coil	121 to 122, 133 to 134, 174 to 175, 225 to 226, 243 to 244, 261 to 262
M1	Starter motor	105 to 106
M2	Windscreen wiper motor	501 to 504
M4	Cooling fan motor	113
M6	Headlamp wiper motor - left	525 to 527
M7	Headlamp wiper motor - right	529 to 531
M8	Rear window wiper motor	513 to 515
M13	Sunroof motor	692 to 694
M18	Central locking motor - driver's door	607 to 610
M19	Central locking motor - left rear door	622 to 624
M20	Central locking motor - right rear door	626 to 628
M21	Fuel pump	163, 196, 299
M26	Electric aerial motor	584 to 585
M30	Door mirror motor and heater - driver's door	674 to 676
M31	Door mirror motor and heater - passenger door	680 to 682
M32	Central locking motor - passengerdoor	614to617
M33	Idle speed adjuster	146 to 149, 183 to 184, 277 to 278
M37	Central locking motor - boot lid/tailgate	618 to 621
M39	Headlamp aim adjustment motor - left	557 to 560
M40	Headlamp aim adjustment motor - right	561 to 564
M41	Central locking motor - fuel filler flap	623 to 625
M43	Ride control actuator - front left (not UK)	739 to 741
M44	Ride control actuator - front right (not UK)	743 to 745
M45	Ride control actuator - rear left (not UK)	747 to 749
M46	Ride control actuator - rear right (not UK)	751 to 753
M47	Electric window motor - front left	636 to 640
M48	Electric window motor - front right	654 to 658
M49	Electric window motor - rear left	642 to 646
M50	Electric window motor - rear right	660 to 664
M55	Washer fluid pump	518 to 519
P1	Fuel gauge	304
P2	Coolant temperature gauge	306
P3	Clock	551
P4	Fuel level sender unit	304
P5	Coolant temperature sensor	306
P7	Tachometer	308
P8	Oil pressure gauge	341
P9	Voltmeter	339
P10	Oil pressure sensor	341
P11	Airflow meter (Motronic M4.1)	185 to 189
P12	Coolant temperature sensor	178, 272
P13	Trip computer outside air temperature sensor	542 to 543
P14	Distance sensor (not UK)	336 to 337
P17	ABS wheel sensor - front left	707
P18	ABS wheel sensor - front right	710
P19	ABS wheel sensor - rear left	712
P20	ABS wheel sensor - rear right	714
P21	Speedometer frequency sensor (not UK)	332
P23	Pressure sensor	249 to 250
P24	Oil temperature sensor	251
P24	Automatic transmission fluid temperature sensor	795
P27	Brake pad wear sensor - front left	375
P28	Brake pad wear sensor - front right	375
P29	Inlet manifold temperature sensor (not UK)	207 to 208
P30	Coolant temperature sensor	209 to 210, 150
P31	Throttle position sensor (not UK)	209 to 211
P32	Oxygen sensor - heated (not UK)	193 to 194, 291 to 292
P33	Oxygen sensor	157
P34	Throttle position sensor	158 to 160, 780
P35	Crankshaft speed/position sensor	189 to 191, 223 to 225, 281 to 282
P39	Trailer bulb failure sensor	392 to 394
P43	Electronic speedometer	336
P44	Air mass meter (Motronic M2.5)	294 to 296
P45	Automatic transmission input speed sensor	787 to 788
P46	Knock sensor	284 to 285
P47	Distributor 'Hall-effect' sensor (Motronic M2.5)	287 to 288
P48	Automatic transmission distance sensor	785 to 786
P50	Catalytic converter temperature sensor (not UK)	761 to 762
R2	Carburettor preheating	116, 228
R3	Cigarette lighter	596 to 597
R5	Glow plugs (Diesel models)	858 to 859
R7	Mixture preheating (not UK)	232
R12	Automatic choke	117
R15	Mixture adjustment potentiometer (not UK)	155 to 157
R19	Cooling fan motor resistor	828, 848
S1	Ignition switch	102 to 106, 851 to 852
S2.1	Lighting switch	404 to 407
S2.2	Courtesy lamp switch	487
S2.3	Instrument illumination lamp dimmer	328
S3	Heater blower switch	837 to 844
S4	Heated rear window switch	570 to 571
S5.2	Dipped beam switch	438, 439
S5.3	Direction indicator switch	480 to 482
S5.4	Sidelamp switch	401 to 402
S7	Reversing lamp switch	497
S8	Brake lamp switch	462
S9.2	Windscreen wiper switch	501 to 504
S9.5	Rear window wash/wiper switch	516 to 518
S10	Automatic transmission switch	770 to 776
S11	Brake fluid level warning sensor	313
S13	Handbrake-on warning switch	315
S14	Oil pressure switch	310
S15	Luggage compartment lamp switch	485
S17	Passenger door courtesy lamp switch	490

Key to wiring diagrams for 1989 models (continued)

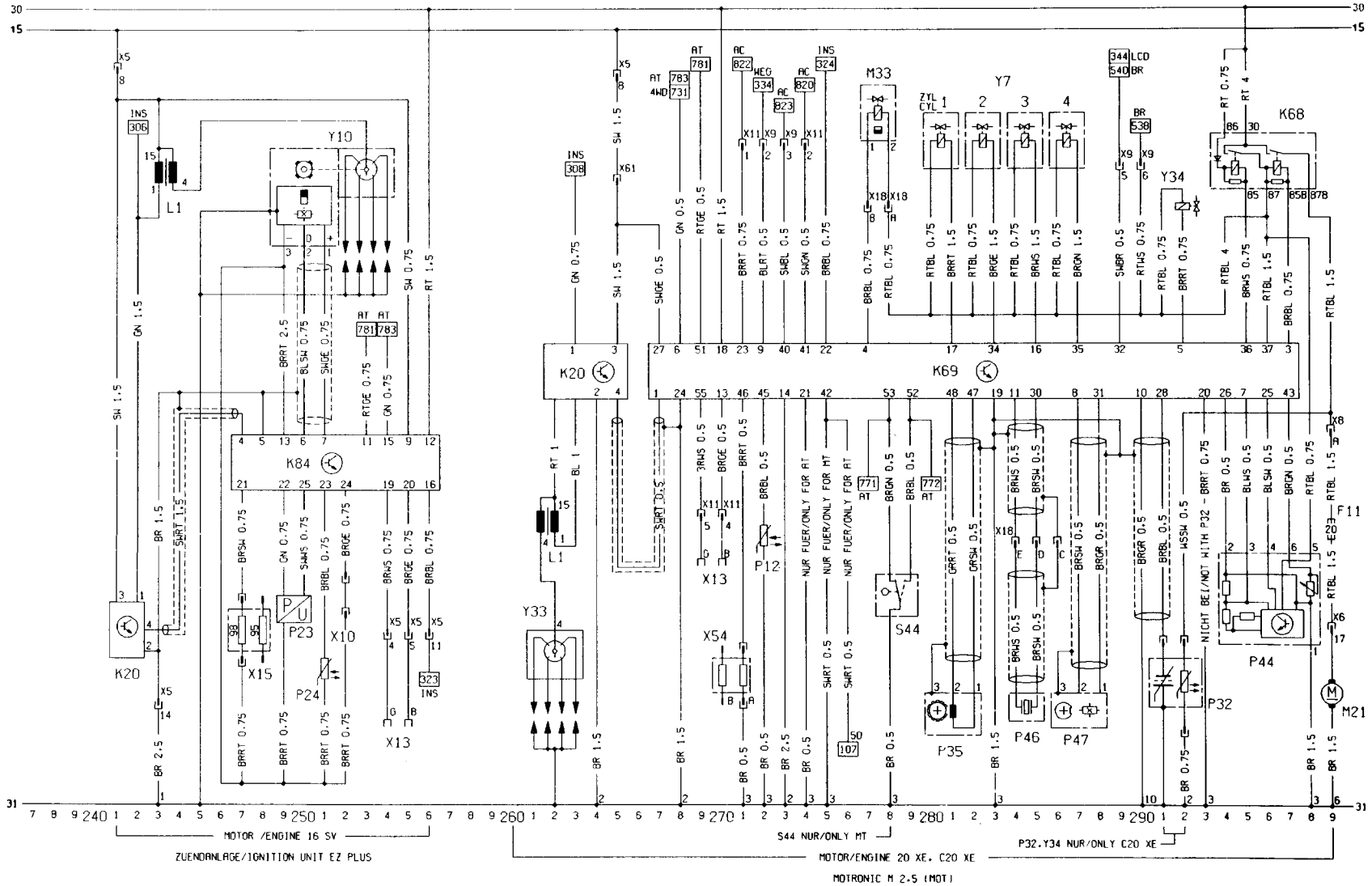
No	Description	Track
S21	Front foglamp switch	450 to 452
S22	Rear foglamp switch	455 to 457
S27	Air conditioning compressor low-pressure switch (not UK)	821
S28	Air conditioning compressor high-pressure switch (not UK)	821
S29	Cooling fan switch	113
S30	Seat heater switch - front left	575 to 577
S31	Rear door courtesy lamp switch - left	491
S32	Rear door courtesy lamp switch - right	492
S35	Sunroof travel microswitch	692
S36	Sunroof travel microswitch	694
S37	Electric windows switch assembly	637 to 663
S37.1	Electric window switch - front left	637 to 639
S37.2	Electric window switch - front right	655 to 657
S37.3	Electric window switch - rear left	643 to 645
S37.4	Electric window switch - rear right	661 to 663
S37.5	Electric windows safety cut-out switch	641 to 642
S37.6	Electric windows anti-jam switch	659
S37.7	Electric windows automatic control	646 to 651
S39	Electric windows switch - rear left door	647 to 649
S40	Electric windows switch - rear right door	665 to 667
S41	Central locking switch driver'sdoor	601 to 603
S42	Central locking switch passenger door	605
S44	Throttle position sensor	173 to 174, 278 to 279
S47	Driver's door courtesy lamp switch	493 to 494
S51	Cooling fan switch (not UK models)	825 to 827
S52	Hazard warning flasher switch	469 to 474
S55	Seat heater switch - front right	579 to 581
S57	Sunroof switch	690 to 696
S63.1	Trip computer function reset switch	543
S63.2	Trip computer clock hours adjustment switch	544
S63.3	Trip computer function select switch	545
S63.5	Trip computer clock minutes adjustment switch	546
S64	Horn switch	591 to 594
S68.1	Door mirror adjustment switch	672 to 677
S68.2	Door mirror heater switch	679 to 680
S68.3	Door mirror left/right selector switch	673 to 677
S76	Air conditioning compressor switch - high-pressure, cooling fan (not UK)	832
S82	Washer pump switch	371
S91	Oil pressure switch (not UK models)	165 to 166
S93	Coolant level sensor	372
S95	Oil level sensor	373
S98	Headlamp aim adjustment switch	556 to 558
S99	Electric windows switch - driver's door	634
S100	Electric windows switch - passenger door	652
S104	Kickdown switch (automatics)	792
S105	Start-up assistance switch (automatics)	796 to 798
S106	Economy/power programme switch (automatics)	791
S107	Throttle position sensor	771 to 776
S108	Cooling fan switch (Diesel models)	847 to 848
S109	Air conditioning compressor switch (not UK)	817
S110	Ride control switch (not UK)	738 to 743
S115	Automatic transmission fluid temperature sensor	793
S116	Brake lamp switch	464 to 465
S117	Four-wheel-drive hydraulic pressure switch	729
S118	Air conditioning refrigerant temperature switch (not UK)	829
U2	Trip computer	538 to 548
U4	ABS hydraulic modulator assembly	705 to 718
U4.1	ABS hydraulic pump relay	706 to 709
U4.2	ABS solenoid valves relay	715 to 718
U4.3	ABS hydraulic pump	705
U4.4	ABS diode	717
U4.5	ABS solenoid valve - front left	710
U4.6	ABS solenoid valve - front right	711
U4.7	ABS solenoid valve - rear left	712
U4.8	ABS solenoid valve - rear right	713
U5.1	Check control tail lamp and dipped beam bulb failure warning lamp	362
U5.2	Check control brake lamp bulb failure warning lamp	363
U5.3	Check control coolant oil level warning lamp	360
U5.5	Check control brake pad wear warning lamp	364
U5.6	Check control washer fluid level warning lamp	359
U5.7	Check control coolant level warning lamp	361
U7	Air conditioning control unit (not UK)	806 to 824
U7.6	Air conditioning blower switch (not UK)	806 to 811
U7.8	Air conditioning switch (not UK)	813 to 824
U12.1	Temperature switch (Diesel models)	865
U12.2	Fuel filter heater (Diesel models)	866
U13.1	Automatic transmission solenoid valve - shift 1	784
U13.2	Automatic transmission solenoid valve - shift 2	785
U13.3	Automatic transmission solenoid valve - lock-up control	786
U13.4	Automatic transmission solenoid valve - pressure control	787
V1	Brake fluid level warning lamp test diode (not UK)	312
V8	Air conditioning compressor diode (not UK)	820
X1	Trailer electrical socket	453 ,458 to 460
X2	Accessory electrical connectors	587
X5 to X62	Wiring connectors	Various
Y1	Air conditioning compressor clutch (not UK)	821
Y4	Headlamp washer solenoid valve	523
Y5	Fuel solenoid valve (Diesel models)	860
Y7	Fuel injectors	186 to 193, 280 to 287
Y10	Distributor (Hall-effect)	249 to 253
Y23	Distributor (Inductive discharge)	123 to 127
Y24	Distributor (Inductive discharge) (not UK)	129 to 136
Y26	Throttle valve positioner (not UK)	201 to 207
Y27	Pre-throttle valve (not UK)	218 to 219
Y30	Cold start valve (Diesel models)	863
Y32	Fuel injector (not UK)	140
Y33	Distributor	170, 262
Y34	Fuel tank ventilation valve (not UK)	198, 292
Y43	Air conditioning vacuum control (not UK)	815 to 818
Y44	Four-wheel-drive solenoid valve	731



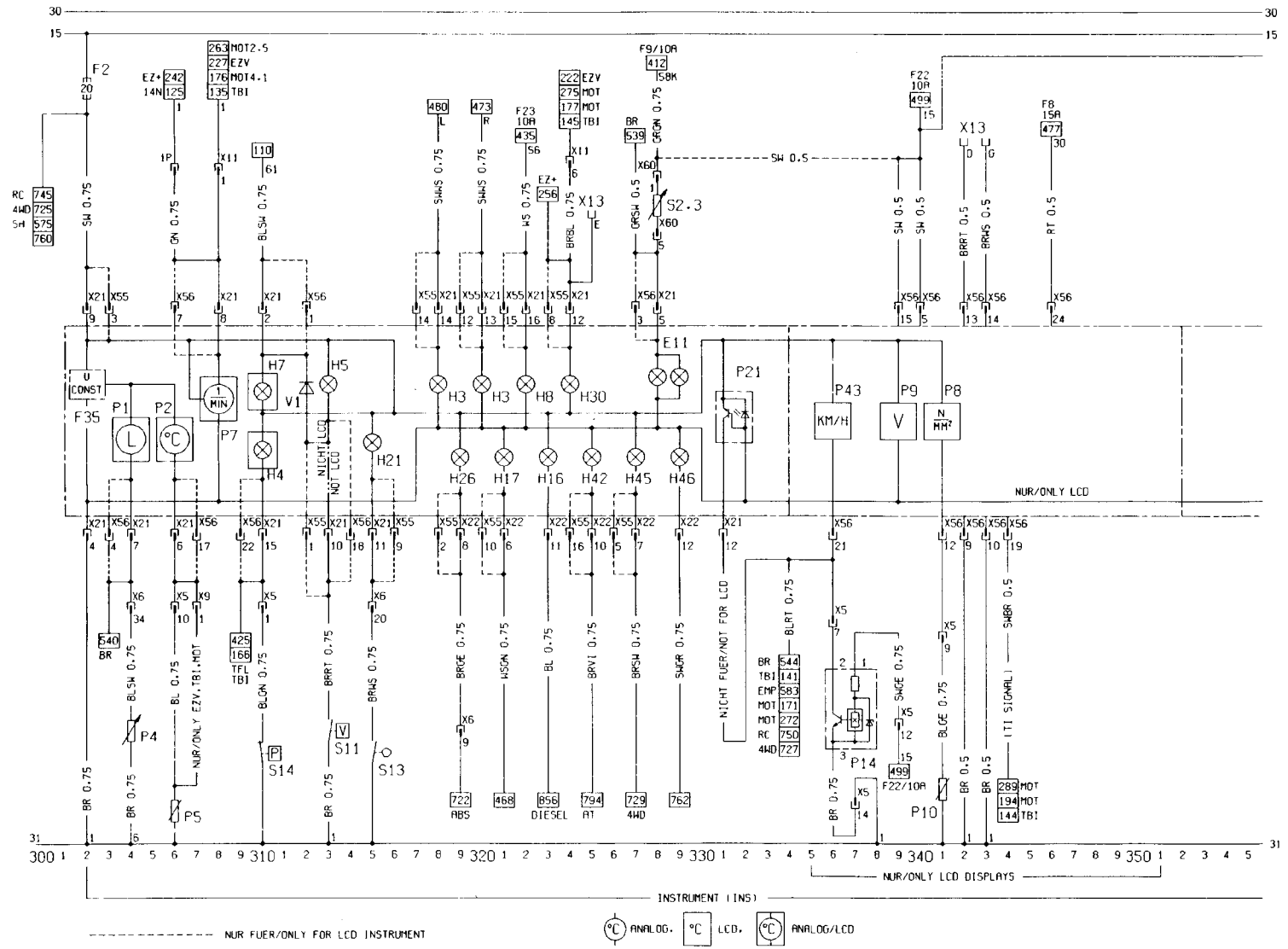
Wiring diagram for 1989 models



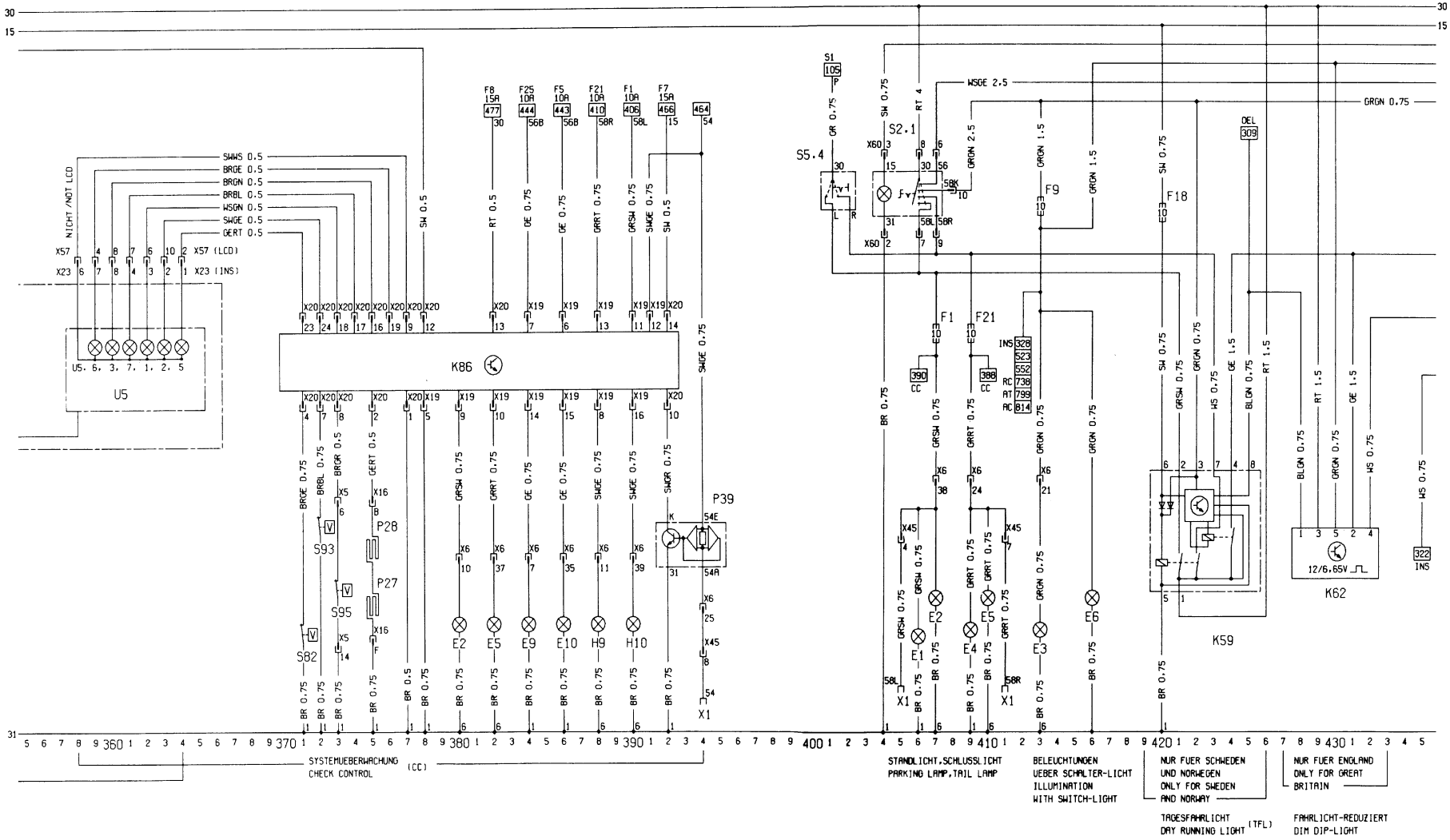
Wiring diagram for 1989 models (continued)



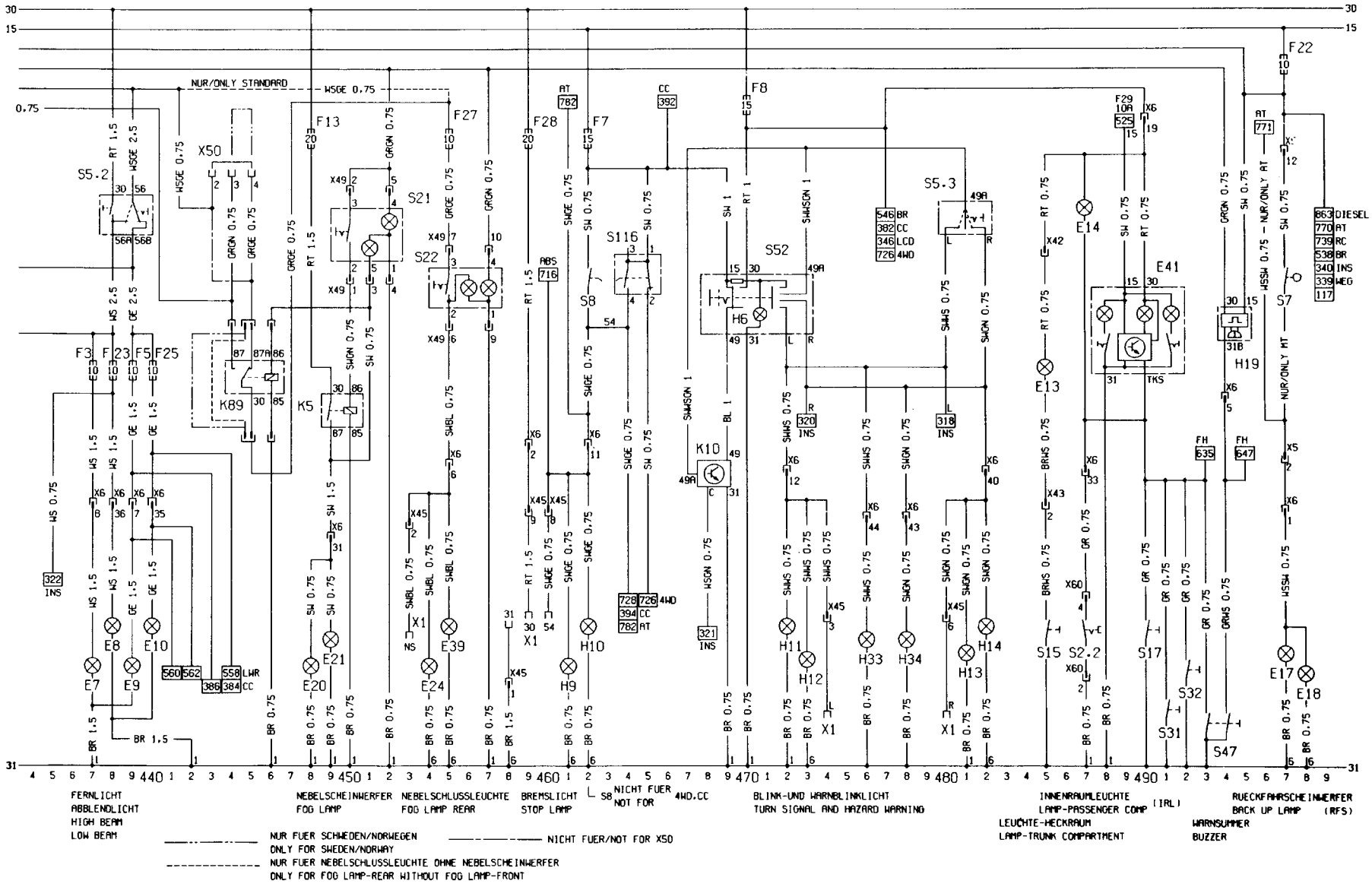
Wiring diagram for 1989 models (continued)



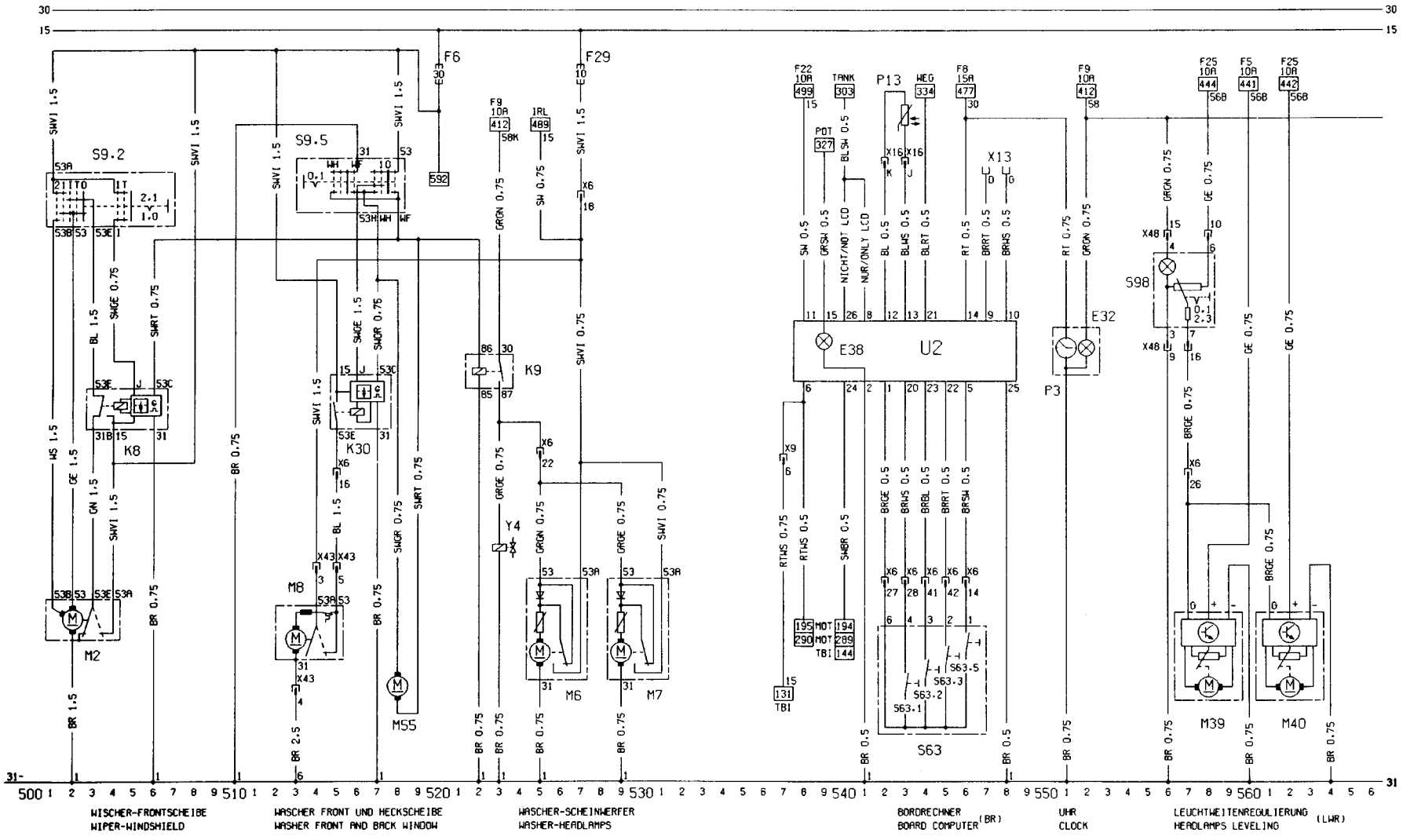
Wiring diagram for 1989 models (continued)



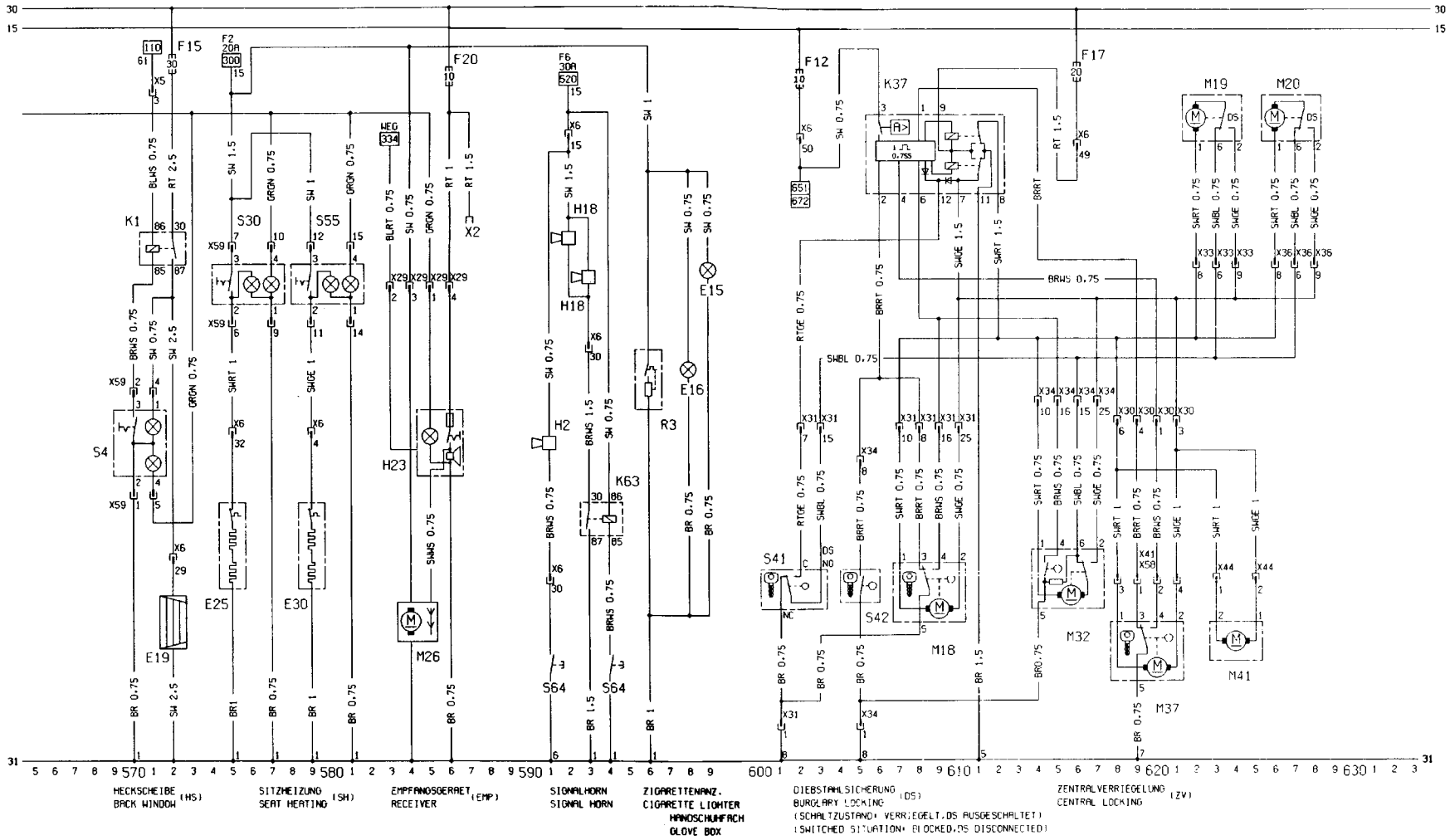
Wiring diagram for 1989 models (continued)



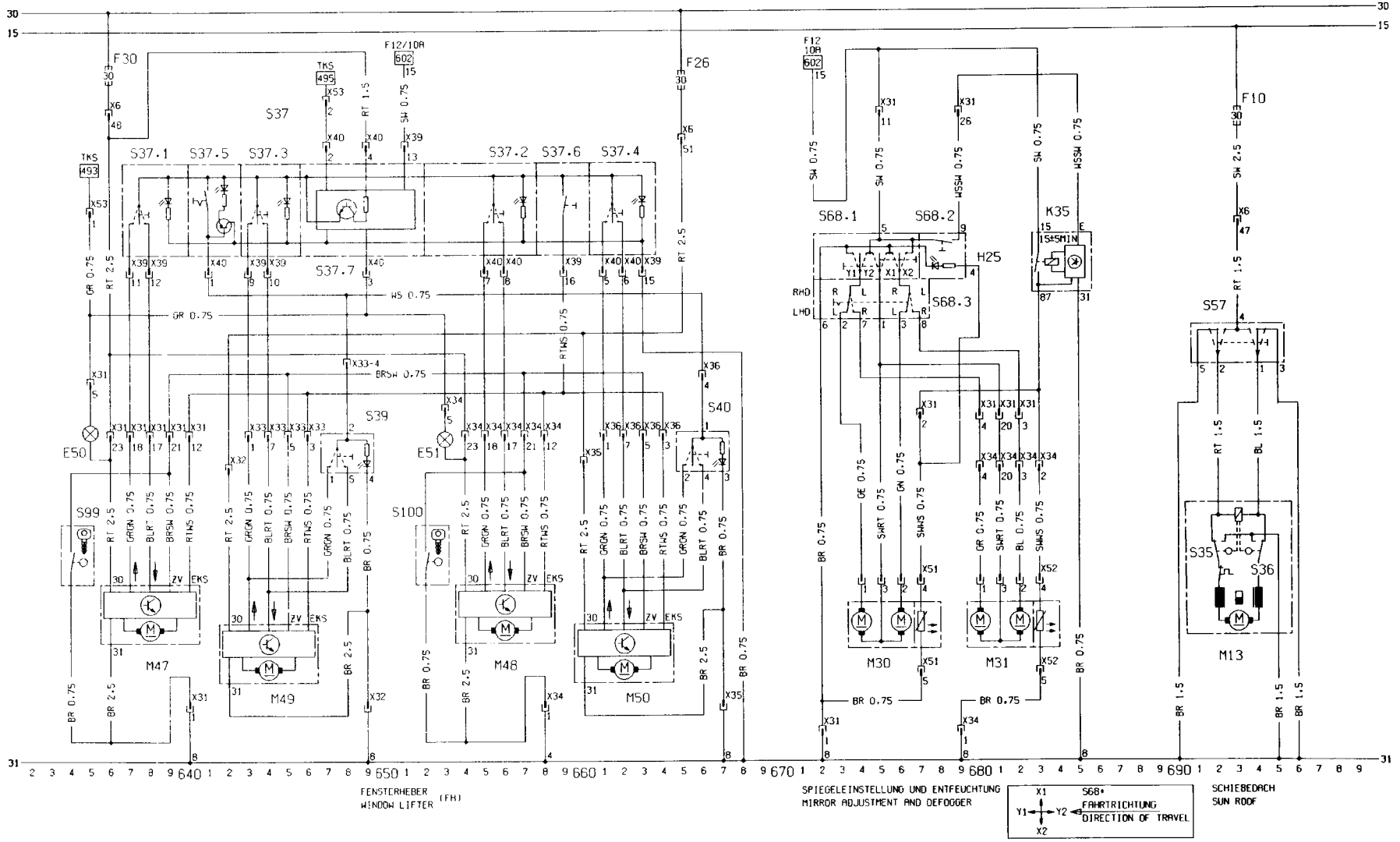
Wiring diagram for 1989 models (continued)



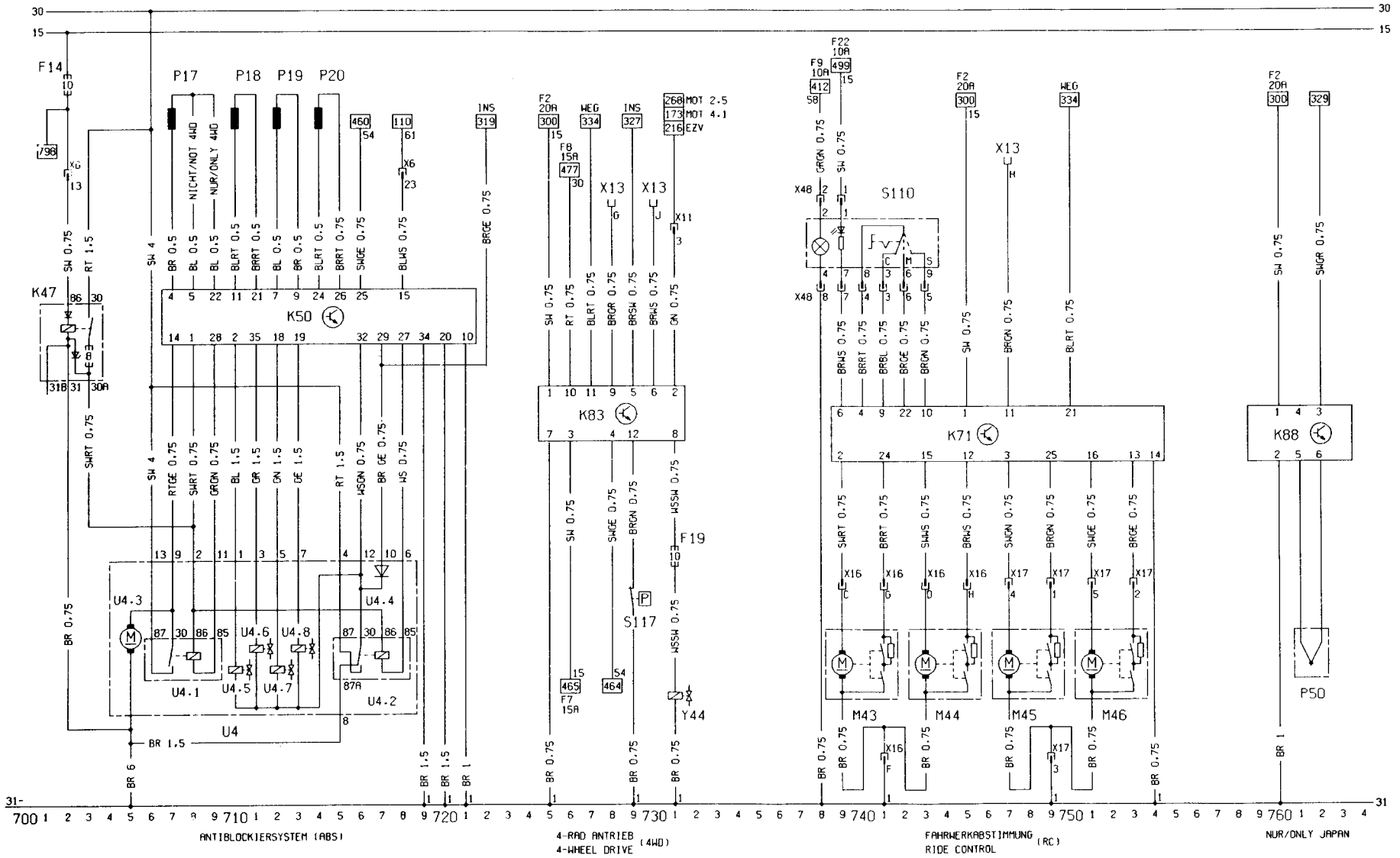
Wiring diagram for 1989 models (continued)



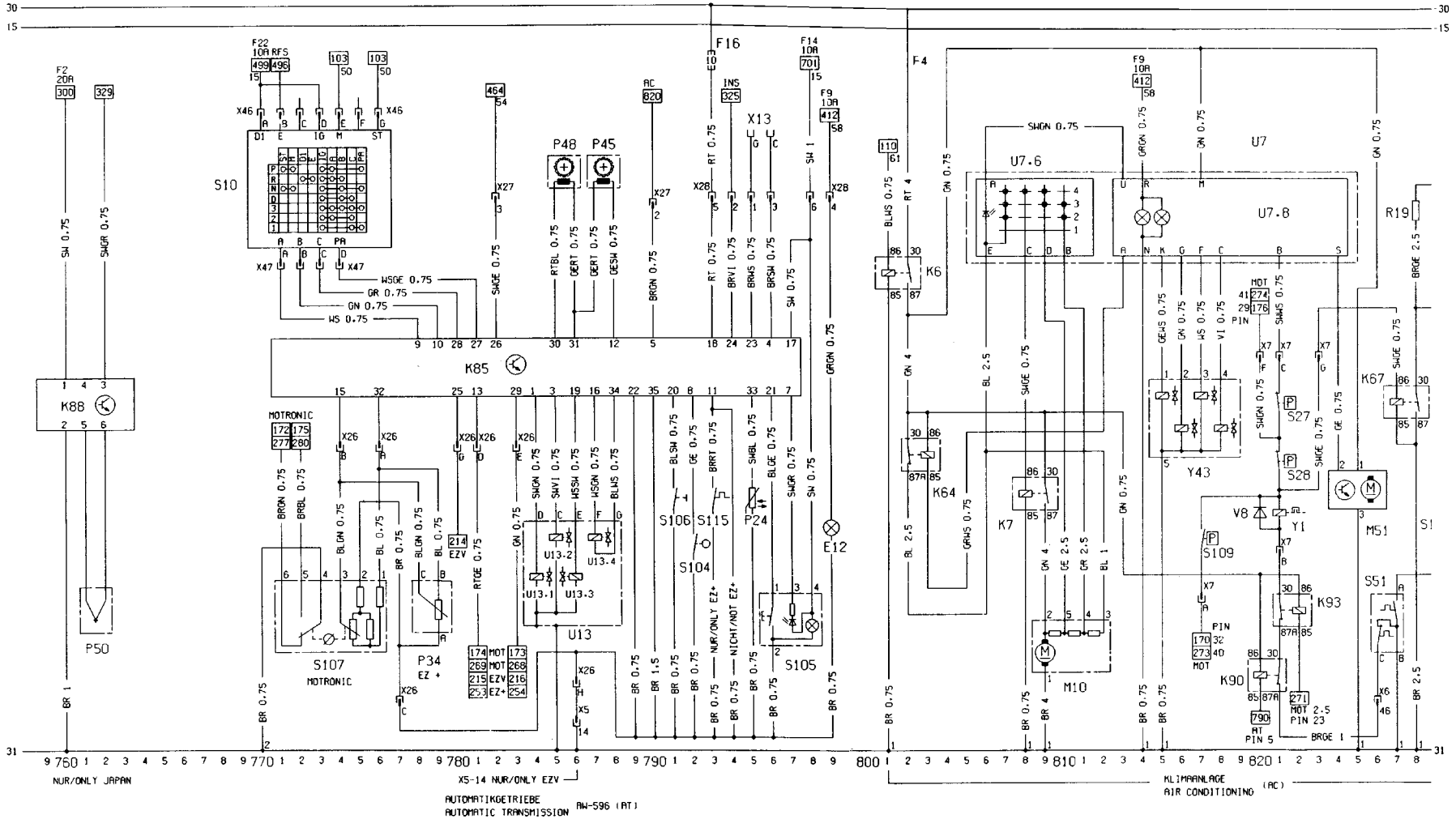
Wiring diagram for 1989 models (continued)



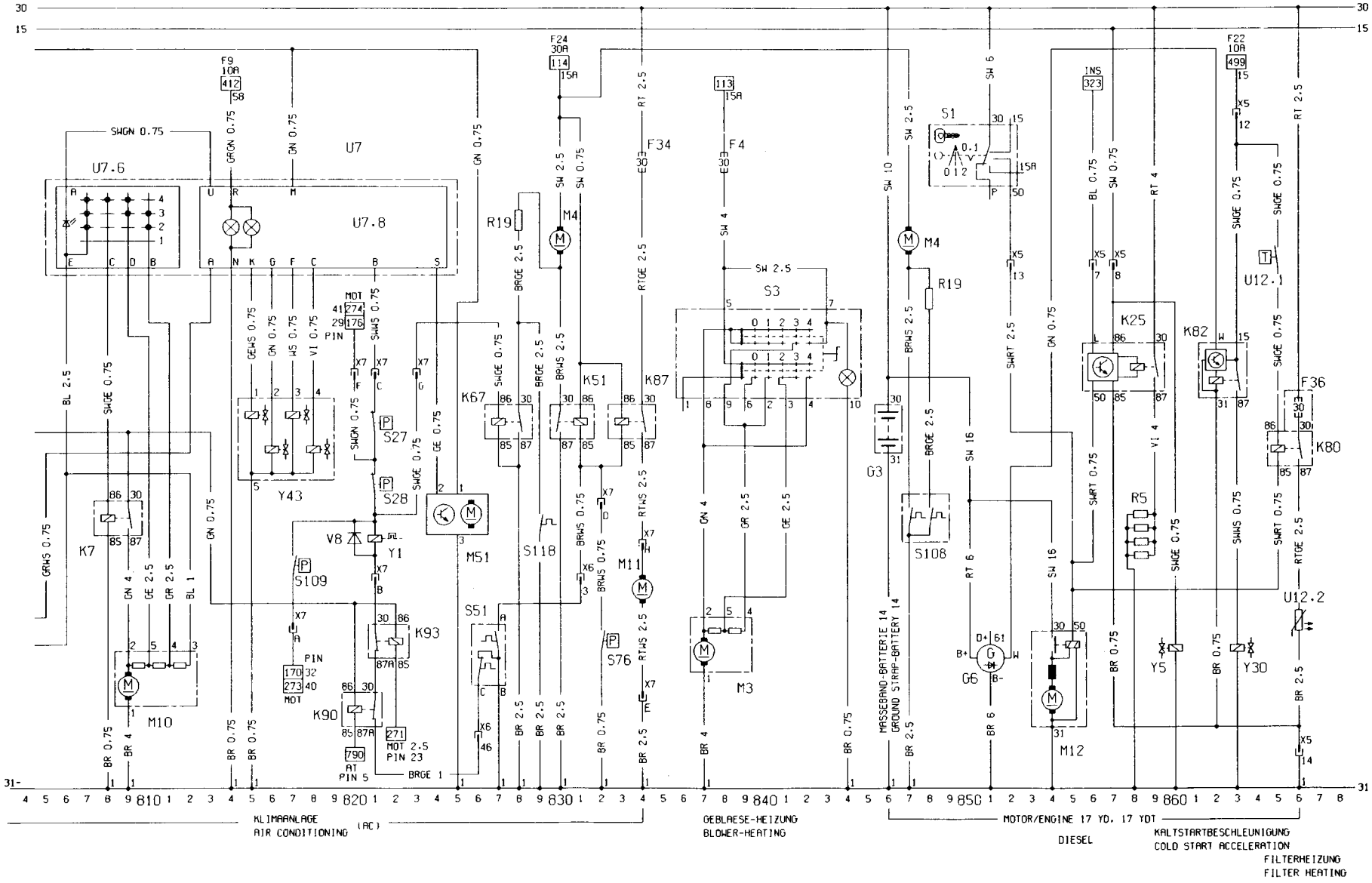
Wiring diagram for 1989 models (continued)



Wiring diagram for 1989 models (continued)



Wiring diagram for 1989 models (continued)



Wiring diagram for 1989 models (continued)

Wiring diagrams for 1991 models

Location of applicable circuits	Track
Air conditioning system	800 to 850
Alternator	111
Anti-lock braking system (ABS)	701 to 722
Anti-theft alarm system	633 to 647
Automatic transmission control system	773 to 799
Battery	100
Brake lamps	461 to 462
Carburettor	118 to 121
Central locking system	600 to 627
Check control system	347 to 371
Cigarette lighter	597 to 598
Clock	661 to 663
Courtesy lamps - front	487 to 494
Courtesy lamps - rear	569 to 573
Direction indicator and hazard warning lamps	467 to 482
Door mirrors	536 to 548
Electric windows	665 to 699
Engine compartment lamp	415
Foglamps - front	444 to 452
Foglamps - rear	444 to 457
Fuel injection and ignition (Multec) - C16 NZ engine	129 to 164
Fuel injection and ignition (Multec) - C18 NZ engine	972 to 997
Fuel injection/ignition (Motronic M1.5) - 2.0 litre sohc	168 to 199
Fuel injection/ignition (Motronic M2.5) - 2.0 litre dohc	261 to 299
Glovebox lamp	599
Headlamp aim adjustment system	758 to 766
Headlamp dim-dip	427 to 431
Headlamp washers	519 to 532
Headlamps	437 to 442
Headlamps “ON” warning buzzer	493 to 495
Heated front seats	560 to 566
Heated rear window	549 to 556
Heater blower motor	853 to 862
Horn(s)	592 to 596
Ignition (HEI) - 14 NV engine	121 to 128
Ignition (MSTS/EZ+) - 16 SV, 18 SV engines	236 to 256
Instruments	301 to 344
Luggage compartment lamp	485
Radiator cooling fan	113, 115
Radio/cassette player	586 to 591
Rear number plate lamp	413
Reversing lamps	496 to 498
Side and tail lamps	401 to 410
Starter motor	102 to 110
Sunroof	863 to 870
Tailgate wiper	510 to 516
Trip computer	650 to 662
Windscreen and tailgate washers	511 to 529
Windscreen wipers	501 to 506

Key to wiring diagrams for 1991 models

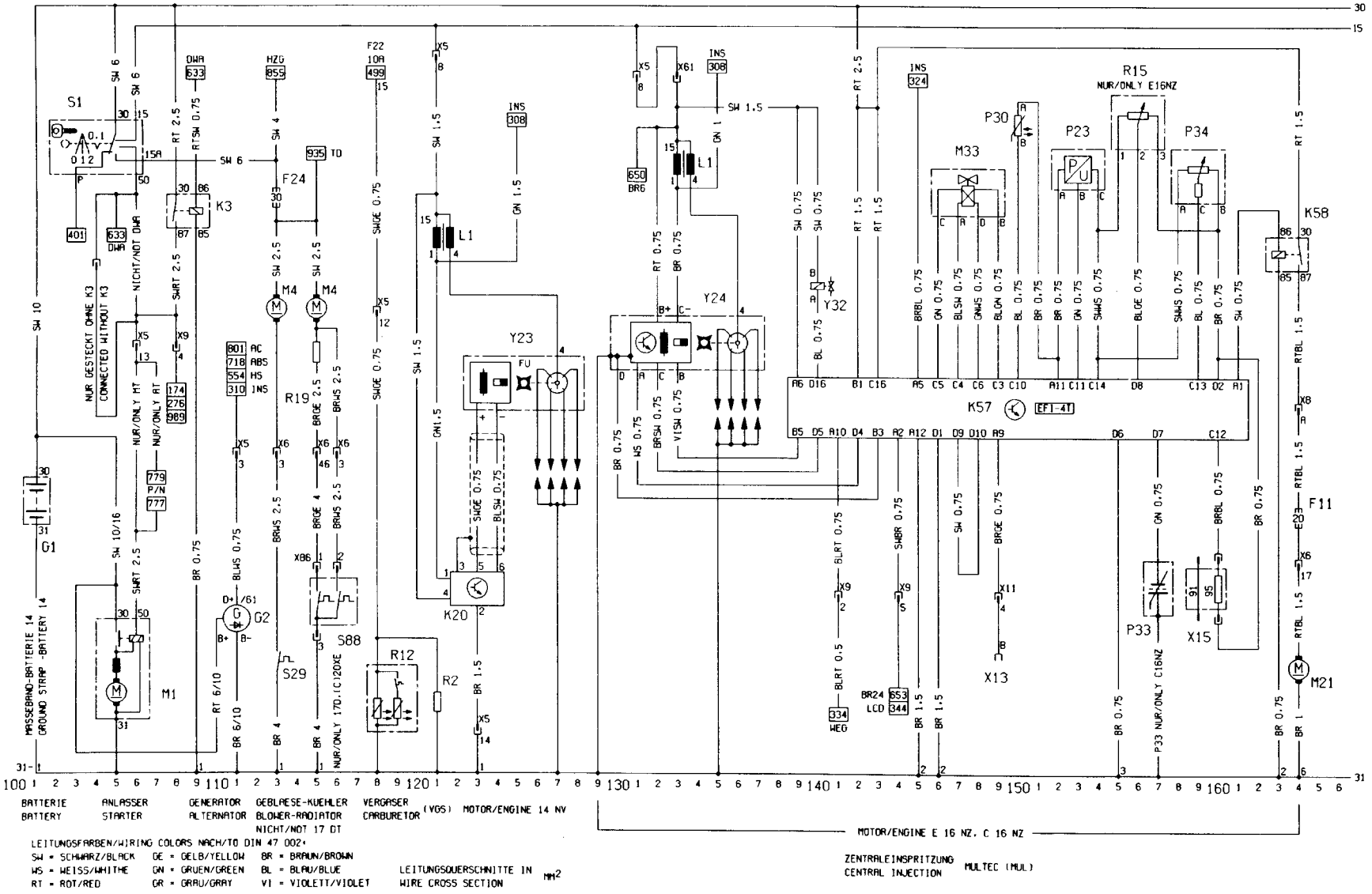
No	Description	Track
E1	Side lamp - left	406
E2	Tail lamp - left	356, 374, 407
E3	Number plate lamp	413
E4	Side lamp - right	409
E5	Tail lamp - right	358, 376, 410
E6	Engine compartment lamp	415
E7	Headlamp main beam - left	437
E8	Headlamp main beam - right	438
E9	Headlamp dipped beam - left	360, 378, 439
E10	Headlamp dipped beam - right	362, 380, 440
E11	Instrument illumination lamps	328 to 329
E12	Selector lever illumination lamp (automatic transmission)	799
E13	Luggage compartment lamp	485
E14	Courtesy lamp	487
E15	Glovebox lamp	599
E16	Cigarette lighter illumination lamp	596
E17	Reversing lamp - left	497
E18	Reversing lamp - right	498
E19	Heated rear window	552
E20	Front foglamp - left	448
E21	Front foglamp - right	447
E24	Rear foglamp - left	454
E25	Driver’s seat heater	580
E27	Courtesy lamp - rear left	569 to 570
E28	Courtesy lamp - rear right	572 to 573
E30	Passenger front seat heater	564
E32	Clock illumination lamp	663
E38	Trip computer illumination lamp	654
E39	Rear foglamp - right	455
E41	Courtesy lamp (with delay)	488 to 490
E50	Kerb lamp - driver’s door	666
E51	Kerb lamp - passenger door	684
F1 on	Fuses	Various
G1	Battery	101
G2	Alternator	111
G3	Battery - (Diesel models)	882, 901
G6	Alternator - (Diesel models)	884 to 886, 909 to 911
H1	Radio/cassette player	589 to 590, 634
H2	Horn	592
H3	Direction indicator warning lamp	315 to 320
H4	Oil pressure warning lamp	310
H5	Brake fluid level warning lamp	313
H6	Hazard warning flasher lamp	470
H7	Alternator charge warning lamp	310
H8	Headlamp main beam warning lamp	322
H9	Brake lamp - left	364, 382, 461
H10	Brake lamp - right	366, 384, 462
H11	Direction indicator lamp - front left	472
H12	Direction indicator lamp - rear left	473
H13	Direction indicator lamp - front right	461
H14	Direction indicator lamp - rear right	482
H15	Fuel level warning lamp	305
H16	Glow plug warning lamp (Diesel models)	323
H17	Trailer direction indicator warning lamp	321
H18	Horn	593
H19	Headlamps-on warning buzzer	494 to 495
H21	Handbrake-on warning lamp	315
H25	Door mirror warning lamp	542, 952
H26	ABS warning lamp	319
H30	Engine fault warning lamp	324
H33	Direction indicator side repeater lamp - left	476
H34	Direction indicator side repeater lamp - right	478
H42	Automatic transmission warning lamp	325
H45	Four-wheel-drive warning lamp	327
H46	Catalytic converter temperature warning lamp	329
H47	Anti-theft alarm horn	638
H48	Horn	594
K3	Relay - starter motor (anti-theft alarm)	109 to 110
K5	Relay - front foglamps	448 to 450
K6	Relay - air conditioning	801 to 802
K7	Relay - air conditioning blower	804 to 805
K8	Relay - intermittent windscreen wipe	503 to 506
K9	Relay - headlamp wash	519 to 520
K10	Relay - direction indicator/hazard warning flashers	467 to 469

Key to wiring diagrams for 1991 models (continued)

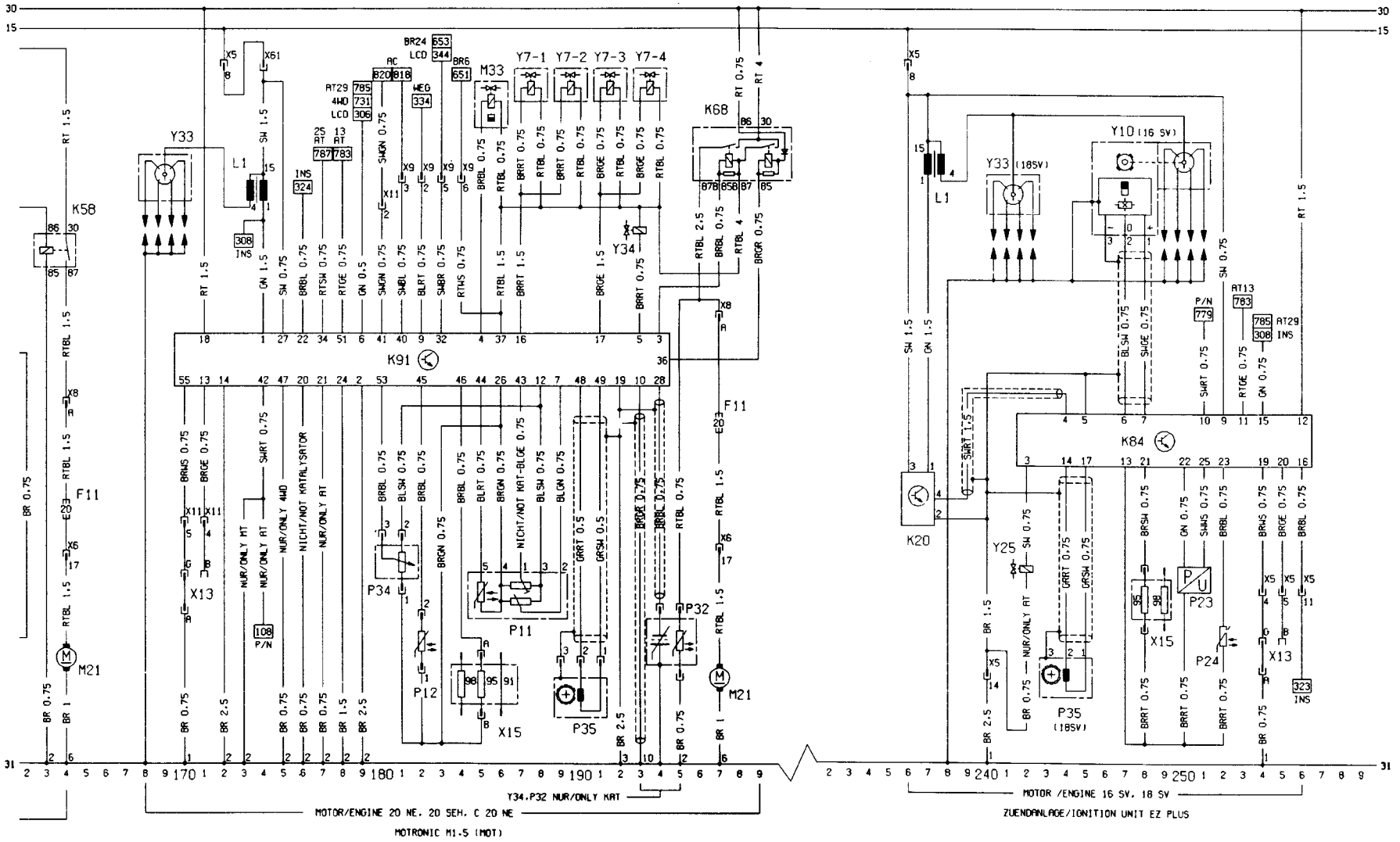
No	Description	Track
K20	Ignition amplifier module	122 to 124, 236 to 237, 975 to 976
K25	Relay - glow plugs (Diesel models)	889 to 892
K30	Relay - intermittent rear window wipe	513 to 515
K35	Relay - door mirror heater	550 to 552
K37	Central locking control unit	606 to 612
K47	Relay - surge arrester (ABS)	702 to 703, 735 to 736
K50	ABS control unit	707 to 721, 740 to 754
K51	Relay - cooling fan	829 to 830, 842 to 843, 837 to 838
K57	Multec electronic control unit (ECU)	139 to 161
K58	Relay - fuel pump	163 to 164, 996 to 997
K59	Relay - daytime running lamps	420 to 426
K62	Dim-dip control unit	427 to 431
K63	Relay - horn	594 to 595
K64	Relay - air conditioning blower	802 to 803
K67	Relay - cooling fan	825 to 826, 849 to 850
K68	Relay - fuel injection system	196 to 199
K69	Motronic M2.5 module	267 to 297
K73	Relay - headlamp main beam relay (Calibra only)	432 to 433
K76	Glow plug control unit (Turbo diesel models)	916 to 921
K77	Relay - glow plugs (Turbo diesel models)	923 to 924
K78	Relay - preresistor (Turbo diesel models)	926 to 927
K79	Alternator charge warning lamp relay	911 to 913
K80	Relay - fuel filter heater (Diesel models)	898 to 899, 931 to 932
K82	Relay - engine revolution	895 to 896
K83	Four-wheel-drive control unit	725 to 731
K84	MSTS ignition module	242 to 256
K85	Automatic transmission control unit	774 to 797
K86	Check control unit	347 to 368
K87	Relay - auxiliary cooling fan	832 to 833, 839 to 840, 940 to 941
K88	Catalytic converter temp. control unit	758 to 760, 966 to 968
K89	Relay - rear foglamps	444 to 447
K90	Relay - air conditioning compressor	820 to 821
K91	Motronic M1.5 module	170 to 194
K94	Anti-theft alarm control unit	633 to 647
K97	Relay - headlamp washer pump time delay	530 to 532
K101	Relay - electric mirror parking position	961 to 964
K102	Parking brake control unit (automatic transmission)	769 to 771
K103	Relay - cooling fan	845 to 847
K107	Multec electronic control unit (ECU)	978 to 996
L1	Ignition coil	121 to 122, 133 to 134, 173, 174, 237 to 238, 974 to 975
M1	Starter motor	105 to 106
M2	Windscreen wiper motor	501 to 504
M3	Heater blower motor	854 to 856
M4	Radiator cooling fan motor	113, 115, 829, 847, 935
M6	Headlamp wiper motor - left	522 to 524
M7	Headlamp wiper motor - right	526 to 528
M8	Rear window wiper motor	511 to 513
M10	Air conditioning blower motor	805 to 808
M11	Cooling fan motor	840, 941
M12	Starter motor (Diesel models)	887 to 888, 905 to 906
M13	Sunroof motor assembly	865 to 869
M13.1	Sunroof motor	866 to 868
M13.2	Sunroof travel microswitch	866
M13.3	Sunroof travel microswitch	868
M18	Central locking motor - driver's door	607 to 610
M19	Central locking motor - left rear door	621 to 623
M20	Central locking motor - right rear door	625 to 627
M21	Fuel pump	164, 197, 229, 997
M24	Headlamp washer pump	532
M26	Electric aerial motor	588 to 589
M30	Door mirror motor and heater - driver's door	538 to 541
M31	Door mirror motor and heater - passenger door	544 to 547
M32	Central locking motor - passenger door	613 to 616
M33	Idle speed adjuster/idle air control stepper motor	146 to 149, 185 to 186, 277 to 278, 985 to 988
M39	Headlamp aim adjuster motor - driver's side	759 to 762
M40	Headlamp aim adjuster motor - passenger side	763 to 766
M41	Central locking motor - fuel filler	623 to 624
M47	Electric window motor - front left	667 to 671
M48	Electric window motor - front right	685 to 689
M49	Electric window motor - rear left	673 to 677
M50	Electric window motor - rear right	691 to 695
M55	Windscreen and rear window washer pump	516
M60	Central locking motor (Calibra models)	627 to 628
M61	Sunroof assembly (Calibra models)	872 to 880
M61.1	Sunroof motor (Calibra models)	873 to 876
M61.2	Relay 1 - sunroof motor (Calibra models)	872 to 873
M61.3	Relay 2 - sunroof motor (Calibra models)	878 to 880
M62	Door mirror motor - driver's door	947 to 953
M63	Door mirror motor - passenger door	956 to 962
P1	Fuel gauge	304
P2	Coolant temperature gauge	306
P3	Clock	662
P4	Fuel level sender unit	304
P5	Coolant temperature gauge sender	306
P7	Tachometer	308
P8	Oil pressure gauge	341
P9	Voltmeter	339
P10	Oil pressure sensor	341
P11	Airflow meter (Motronic M1.5)	185 to 189
P12	Coolant temperature sensor	182, 272
P13	Trip computer outside air temperature sensor	655 to 656
P14	Distance sensor	336 to 337, 915 to 916
P17	ABS wheel sensor - front left	707, 740
P18	ABS wheel sensor - front right	710, 742
P19	ABS wheel sensor - rear left	712, 744
P20	ABS wheel sensor - rear right	713, 746
P21	Speedometer frequency sensor	332
P23	Pressure sensor	152 to 154, 984 to 986
P24	Automatic transmission fluid temperature sensor	252, 795
P25	Bulb failure sensor	373 to 386
P27	Brake pad wear sensor - front left	351, 396
P28	Brake pad wear sensor - front right	351, 396
P30	Coolant temperature sensor	150, 982
P32	Oxygen sensor - heated	194 to 195, 291 to 292
P33	Oxygen sensor	157, 991
P34	Throttle position sensor/potentiometer	158 to 160, 180 to 181, 777 to 778, 987 to 989
P35	Crankshaft speed/position sensor	189 to 191, 281 to 282, 982 to 984
P39	Trailer bulb failure sensor	368 to 370, 387 to 389
P43	Electronic speedometer	336
P44	Air mass meter (Motronic M2.5)	294 to 298
P45	Automatic transmission input speed sensor	791 to 792
P46	Knock sensor	284 to 285
P47	Distributor "Hall-effect" sensor (Motronic M2.5)	287 to 288
P48	Automatic transmission output speed sensor	789 to 790
P50	Catalytic converter temperature sensor	759 to 760, 977 to 978
P53	Anti-theft alarm sensor - driver's side	639 to 642
P54	Anti-theft alarm sensor - passenger side	644 to 647
P55	Coolant temperature sensor (Turbo diesel models)	919
R2	Carburettor preheating	121
R3	Cigarette lighter	597
R5	Glow plugs (Diesel models)	891 to 892, 922 to 924
R12	Automatic choke	118
R13	Heated windscreen washer nozzle - left	526
R14	Heated windscreen washer nozzle - right	528
R15	Mixture adjustment potentiometer	155 to 157
R19	Cooling fan motor resistor	115, 832, 935
R22	Glow plugs resistor (Turbo diesel models)	927
S1	Ignition switch	105 to 106, 885 to 886, 905 to 906

Key to wiring diagrams for 1991 models (continued)

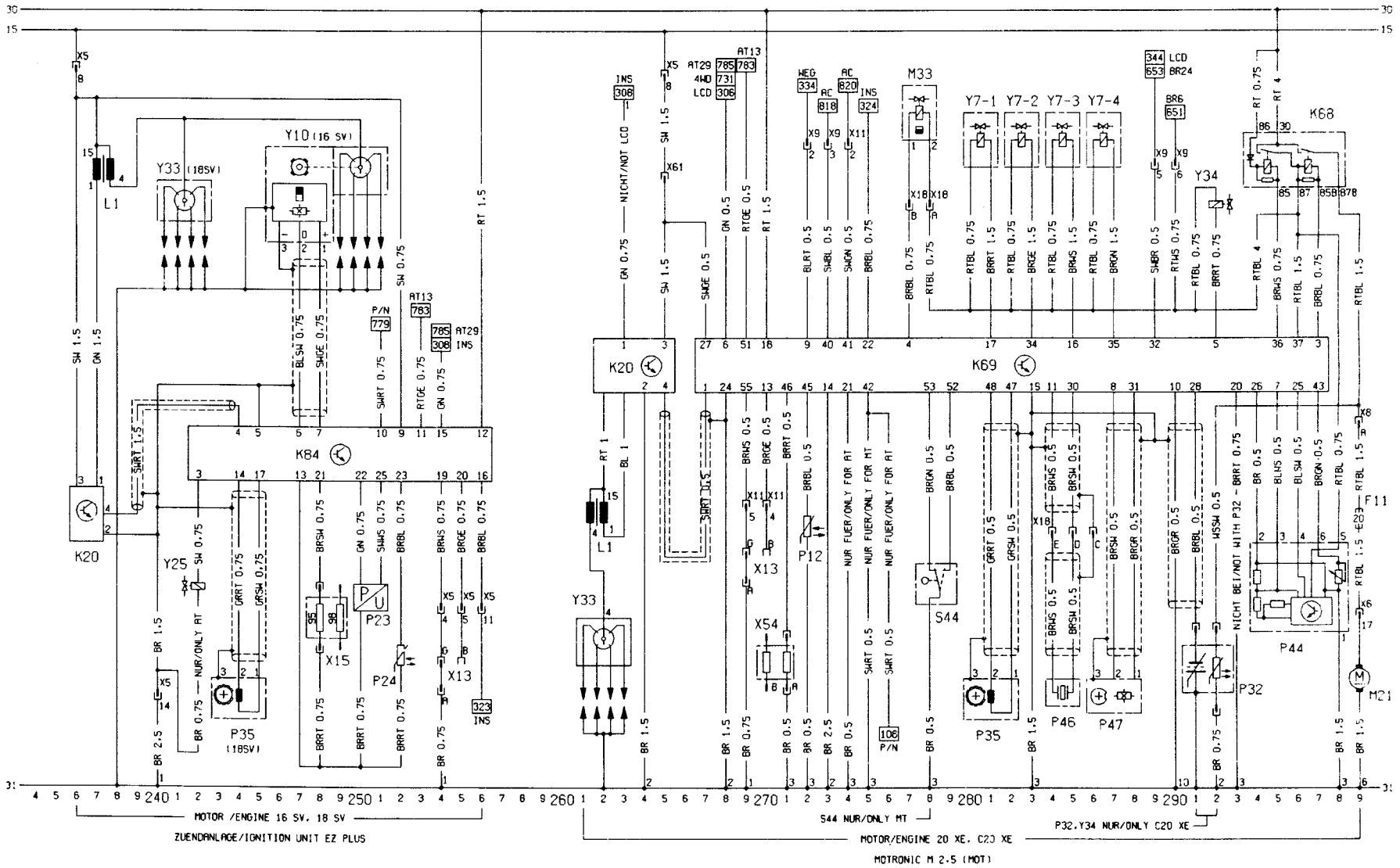
No	Description	Track
S1.2	Key contact switch	586
S2.1	Lighting switch	404 to 407
S2.2	Courtesy lamp switch	487
S2.3	Instrument illumination lamp dimmer	328
S3	Heater blower switch	853 to 860
S4	Heated rear window and mirror switch	554 to 556
S5.2	Dipped beam switch	438 to 439
S5.3	Direction indicator switch	480 to 482
S5.4	Sidelamp switch	401 to 402
S7	Reversing lamp switch	497
S8	Brake lamp switch	462
S9.2	Windscreen wiper interval switch	501 to 504
S9.5	Rear window washer/wiper switch	514 to 516
S10	Automatic transmission starter inhibitor switch	773 to 779
S11	Brake fluid level warning sensor	31
S13	Handbrake-on warning switch	315
S14	Oil pressure switch	310
S15	Luggage compartment lamp switch	485
S17	Passenger door courtesy lamp switch	490
S21	Front fog lamp switch	450 to 452
S22	Rear foglamp switch	455 to 457
S24	Air conditioning blower motor switch	804 to 811
S27	Air conditioning compressor low-pressure switch	821
S28	Air conditioning compressor high-pressure switch	821
S29	Cooling fan switch	113
S30	Driver's seat heater switch	560 to 562
S31	Rear door courtesy lamp switch - left	491
S32	Rear door courtesy lamp switch - right	491
S37	Driver's door electric window switch assembly	668 to 694
S37.1	Electric window switch - front left	668 to 670
S37.2	Electric window switch - front right	686 to 688
S37.3	Electric window switch - rear left	674 to 676
S37.4	Electric window switch - rear right	692 to 694
S37.5	Electric window safety cut-out switch	672 to 673
S37.6	Electric window anti-jam switch	690
S37.7	Electric window automatic control	677 to 682
S39	Electric window switch - rear left door	678 to 680
S40	Electric window switch - rear right door	696 to 698
S41	Central locking switch - driver's door	601 to 603
S42	Central locking switch - passenger door	605
S44	Throttle position sensor	278 to 279
S47	Driver's door courtesy lamp switch	493 to 494
S52	Hazard warning flasher switch	469 to 474
S55	Passenger seat heater switch	564 to 566
S57	Sunroof switch	864 to 869, 872 to 877
S63.1	Trip computer function reset switch	656
S63.2	Trip computer clock hours adjustment switch	657
S63.3	Trip computer function select switch	658
S63.5	Trip computer clock minutes adjustment switch	659
S64	Horn switch	592, 595
S68.1	Door mirror adjustment switch	538 to 540, 945 to 950
S68.3	Door mirror left/right selector switch	537 to 541, 946 to 950
S68.4	Door mirror parking position switch	952
S76	Air conditioning compressor switch - high-pressure fan	827
S82	Washer pump switch	347, 392
S88	Cooling fan switch	115 to 116, 935 to 936
S93	Coolant level sensor	348, 393
S95	Oil level sensor	349, 394
S98	Headlamp aim adjustment switch	758 to 760
S99	Electric window switch - driver's door	685
S100	Electric window switch - passenger door	683
S101	Air conditioning compressor switch	822 to 824
S102	Air conditioning circulation switch	816 to 818
S104	Automatic transmission kickdown switch	794
S105	Automatic transmission "Winter" mode button	796 to 798
S106	Automatic transmission "Economy/Sport" mode button	793
S109	Air conditioning compressor switch	818
S115	Automatic transmission coolant temperature switch	788 to 789
S116	Brake lamp switch	464 to 465
S117	Four-wheel-drive hydraulic pressure switch	729
S119	Air conditioning refrigerant temperature switch	829, 843
S120	Anti-theft alarm bonnet switch	635
S127	Central locking switch - tailgate (Calibra models)	630
S128	Air conditioning refrigerant temperature cooling switch	825 to 826
S131	Air conditioning defroster lever limit switch	815
U2	Trip computer	651 to 662
U4	ABS hydraulic modulator assembly	705 to 718, 738 to 751
U4.1	ABS hydraulic pump relay	706 to 709, 739 to 742
U4.2	ABS solenoid valves relay	715 to 718, 747 to 751
U4.3	ABS hydraulic pump	705, 738
U4.4	ABS diode	717
U4.5	ABS solenoid valve - front left	710, 743
U4.6	ABS solenoid valve - front right	711, 744
U4.7	ABS solenoid valve - rear left	712, 745
U4.8	ABS solenoid valve - rear right	713
U5	Check control display	347 to 355
U5.1	Check control washer fluid level warning lamp	352
U5.2	Check control oil level warning lamp	351
U5.3	Check control coolant level warning lamp	350
U5.4	Check control tail lamp and dipped beam bulb failure warning lamp	349
U5.5	Check control brake lamp bulb failure warning lamp	348
U5.6	Check control brake wear warning lamp	347
U6	LCD instruments	
U6.1	Check control washer fluid level warning lamp	392
U6.2	Check control oil level warning lamp	394
U6.3	Check control coolant level warning lamp	393
U6.4	Check control tail lamp and dipped beam bulb failure warning lamp	391
U6.5	Check control brake lamp bulb failure warning lamp	395
U6.6	Check control brake pad wear warning lamp	396
U12.1	Temperature switch (Diesel models)	898, 931
U12.2	Fuel filter heater (Diesel models)	899, 932
U13	AF 14/20 automatic transmission	782 to 786
U13.1	Solenoid - 1/2 and 3/4 shift up	782
U13.2	Solenoid - 2/3 shift up	783
U13.3	Solenoid - converter lock-up control	784
U13.4	Solenoid - main fluid pressure control	785
V1	Brake fluid level warning lamp test diode	312
V8	Air conditioning compressor diode	820
Y1	Air conditioning compressor clutch	821
Y4	Headlamp washer solenoid valve	520
Y5	Fuel solenoid valve (Diesel models)	893, 928
Y7	Fuel injectors	187 to 194, 280 to 287
Y10	Distributor (Hall-effect)	246 to 251
Y23	Distributor (inductive discharge)	123 to 127
Y24	Distributor (inductive discharge)	129 to 136
Y25	Idle-up solenoid valve (automatic transmission)	242
Y30	Cold start valve (Diesel models)	896
Y32	Fuel injector	140, 979
Y33	Distributor	170, 262, 972 to 974
Y34	Fuel tank vent valve	193, 292
Y35	Air conditioning circulation solenoid valve	816
Y44	Four-wheel-drive solenoid valve	731
Y47	Parking brake lock lifting magnet (automatic transmission)	769
X13	Diagnostic equipment connector	149, 170 to 171, 254 to 255, 269 to 270, 325, 339 to 340, 752 to 753, 774 to 775, 992 to 993
X15	Octane coding plug	160, 184 to 185, 248 to 249, 990 to 991
X54	Ignition coding plug	270 to 271
X1 on	Wiring connectors	Various



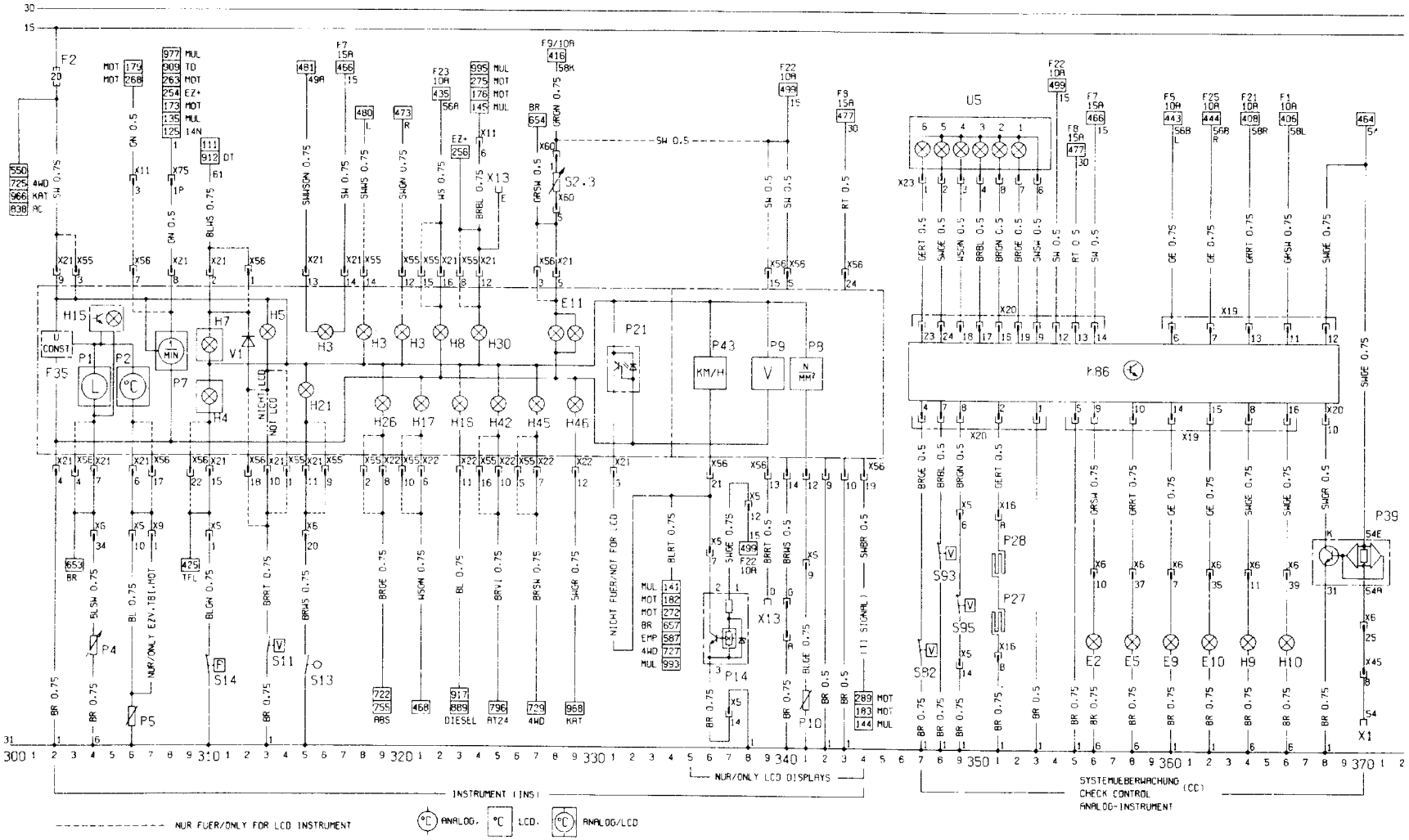
Wiring diagram for 1991 models



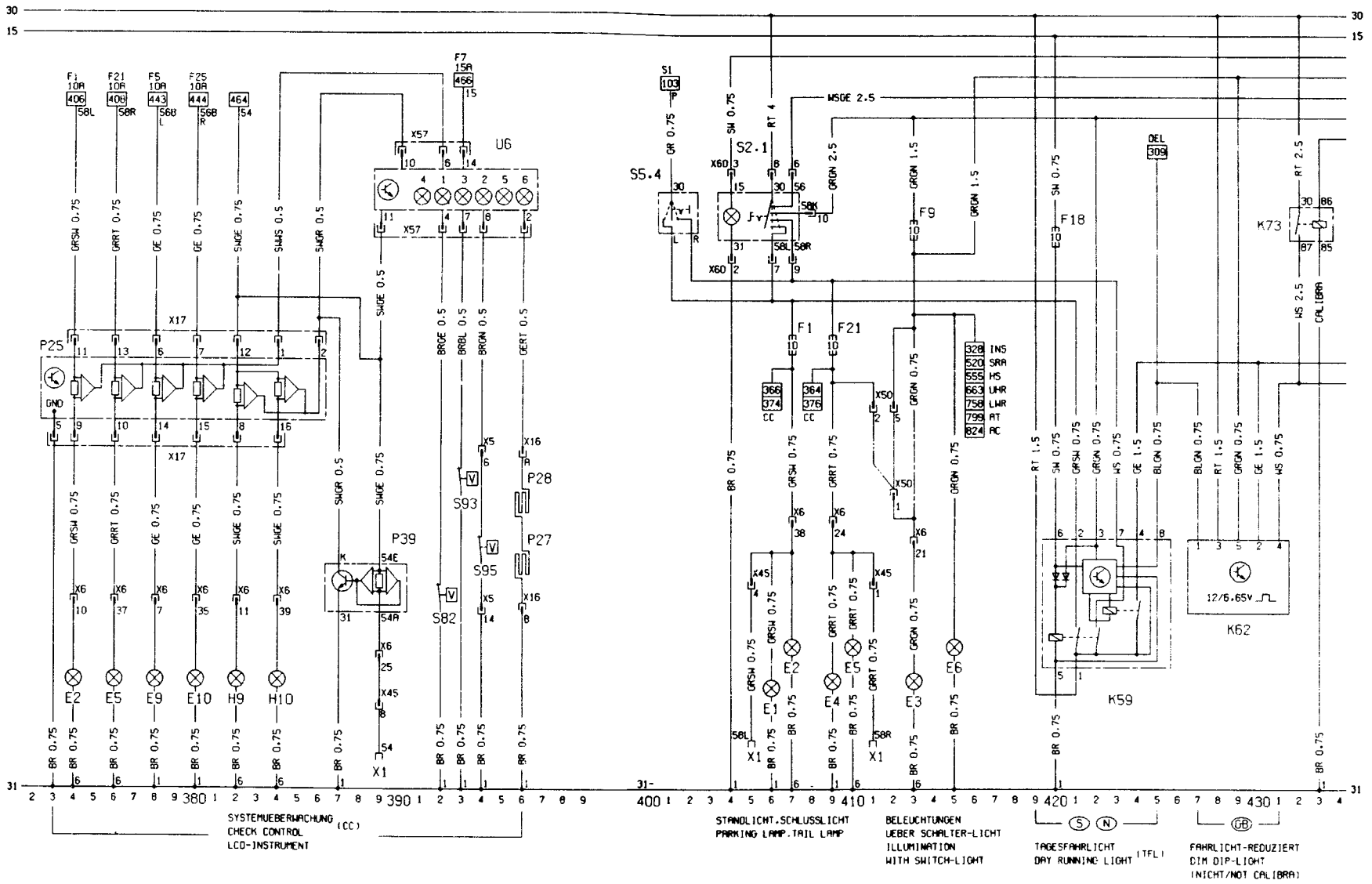
Wiring diagram for 1991 models (continued)



Wiring diagram for 1991 models (continued)

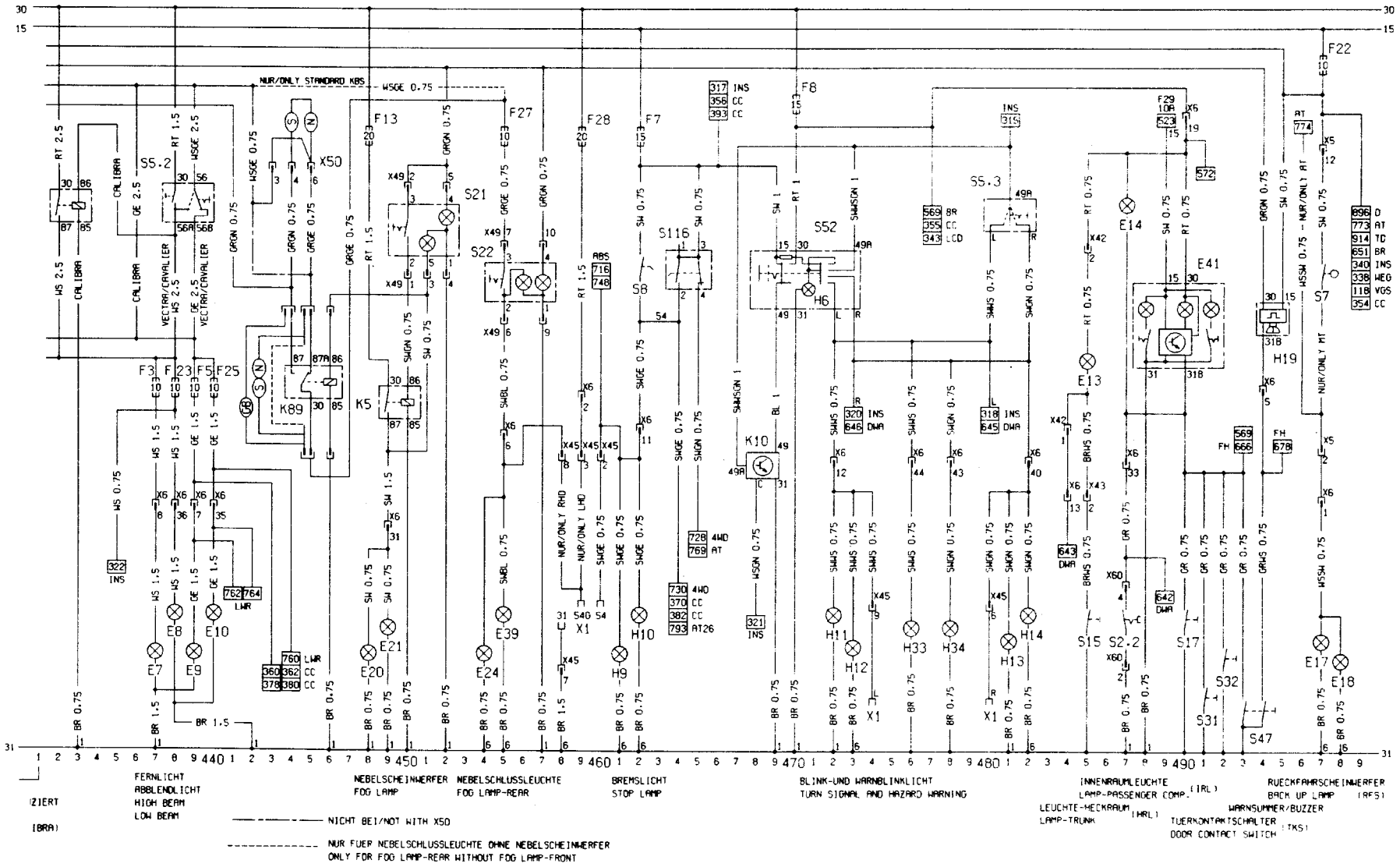


Wiring diagram for 1991 models (continued)

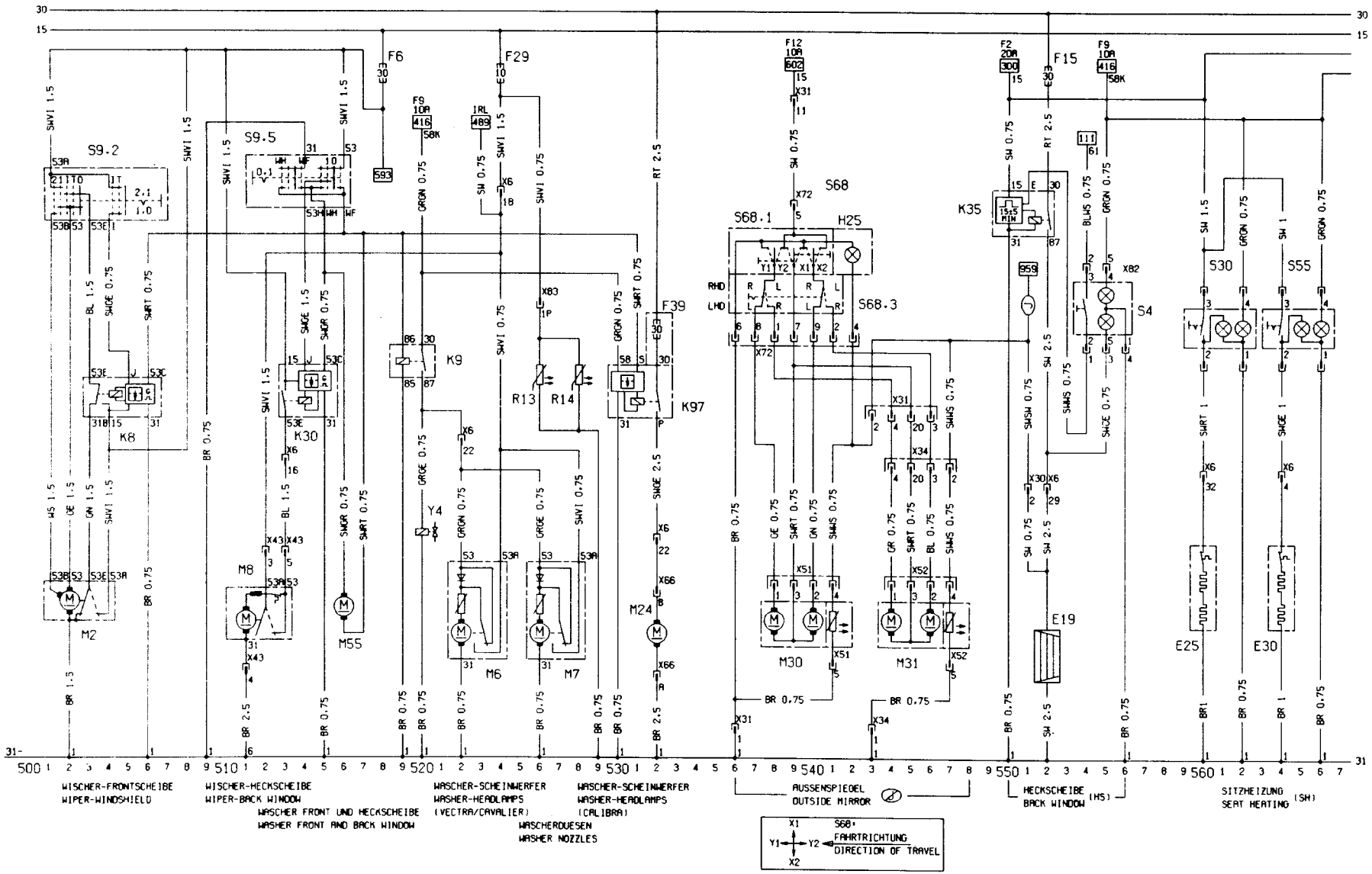


Wiring diagram for 1991 models (continued)

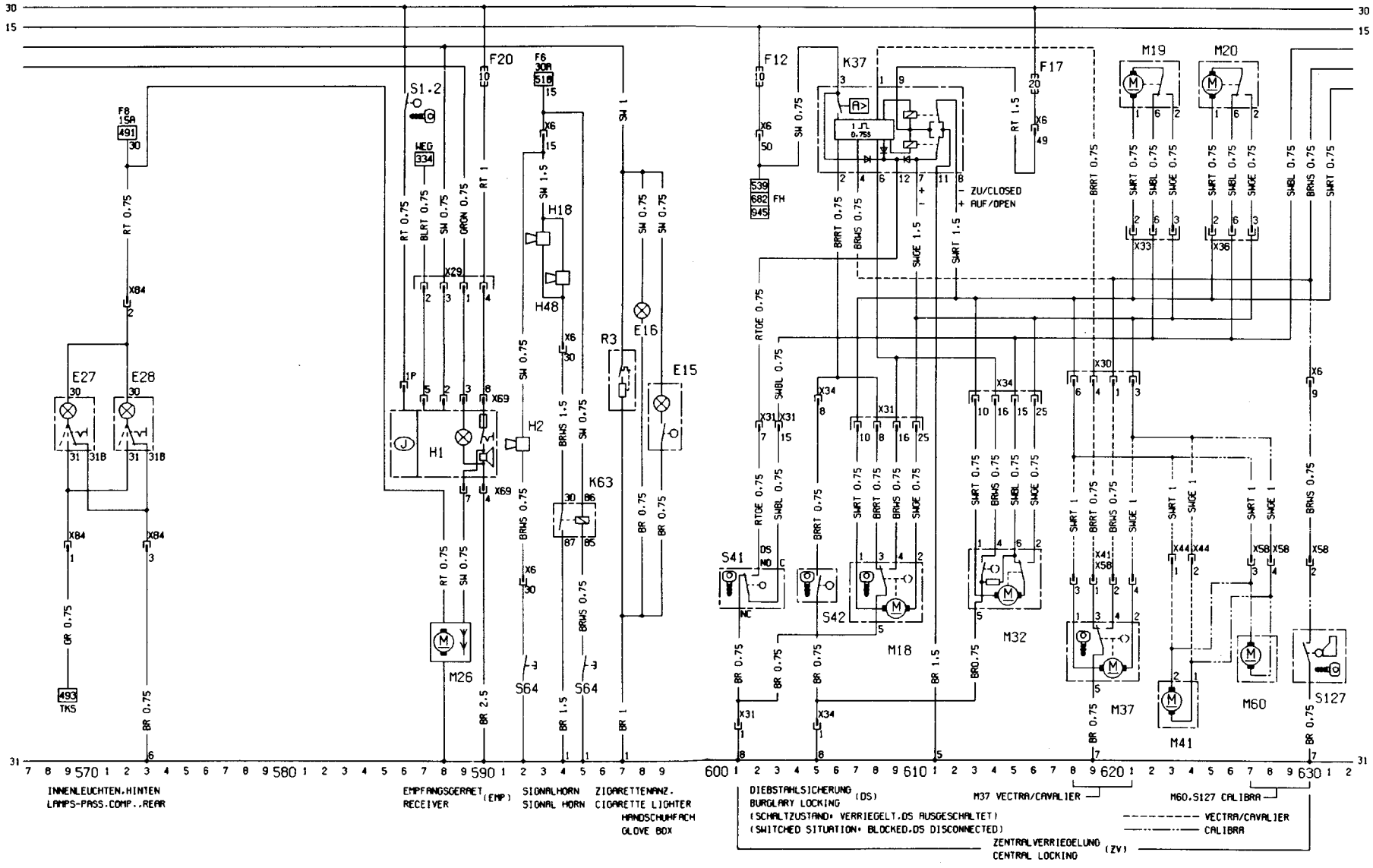
FULL MOTORES CHECK



Wiring diagram for 1991 models (continued)

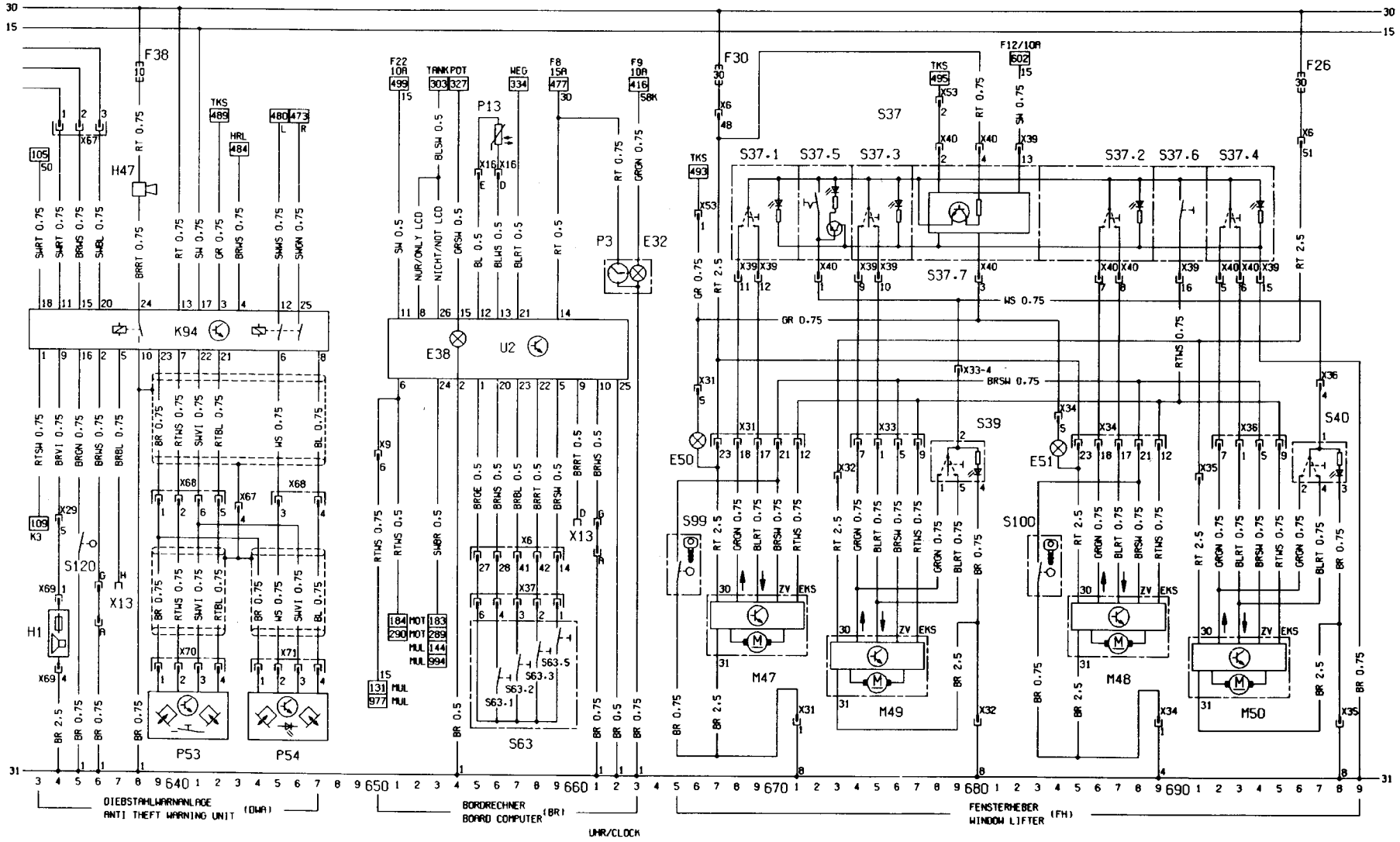


Wiring diagram for 1991 models (continued)

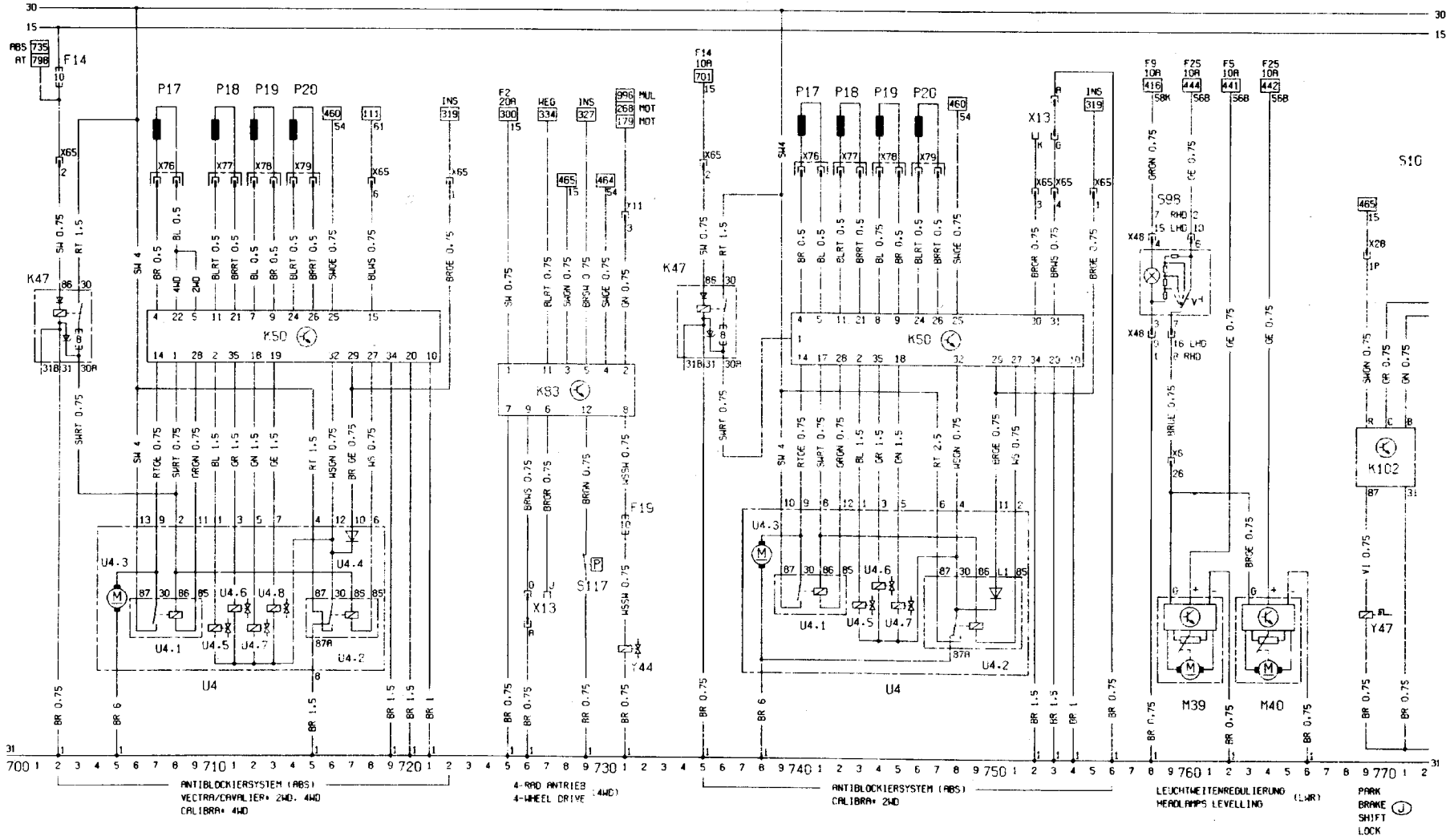


Wiring diagram for 1991 models (continued)

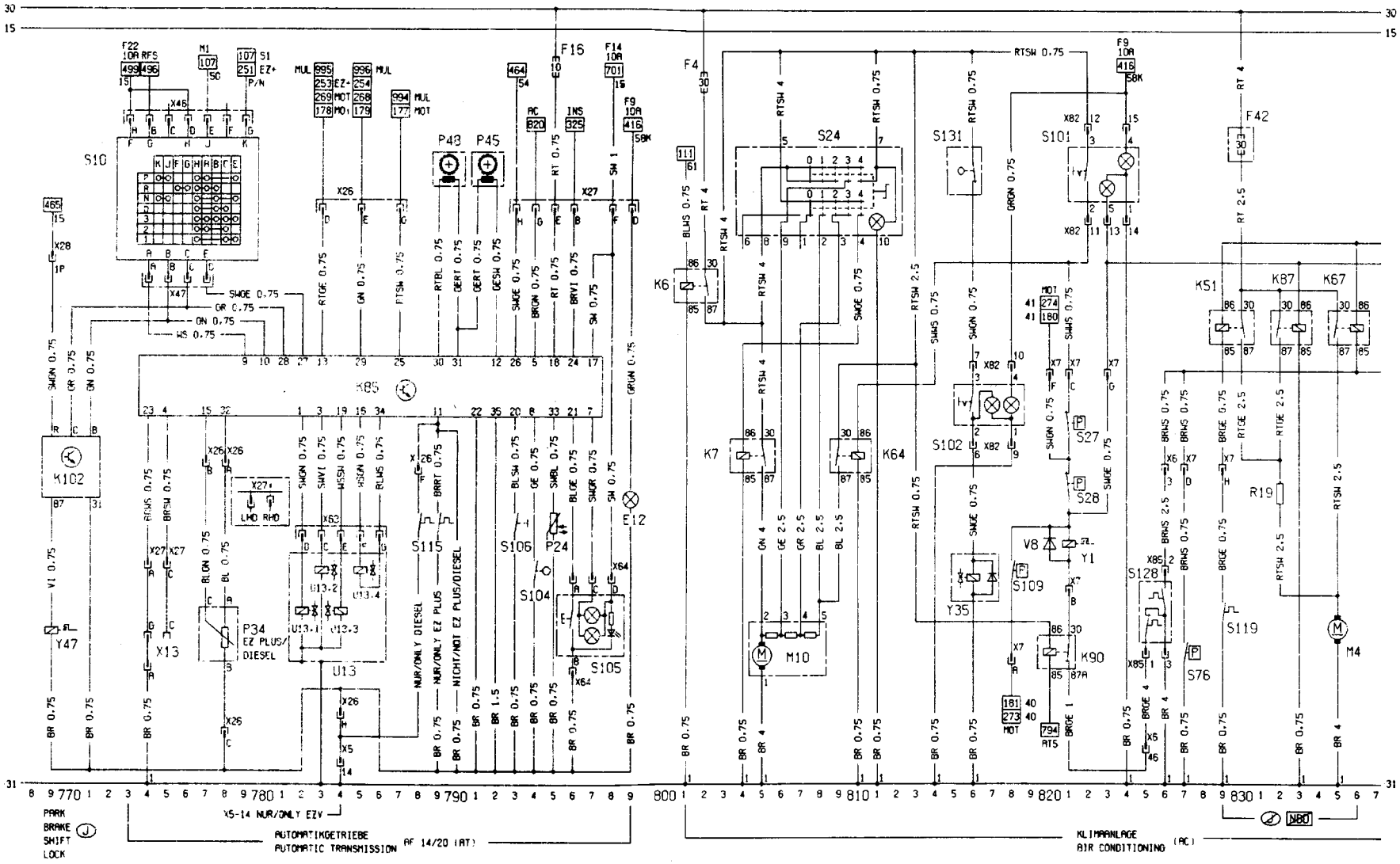
FULL MOTORES CHECK



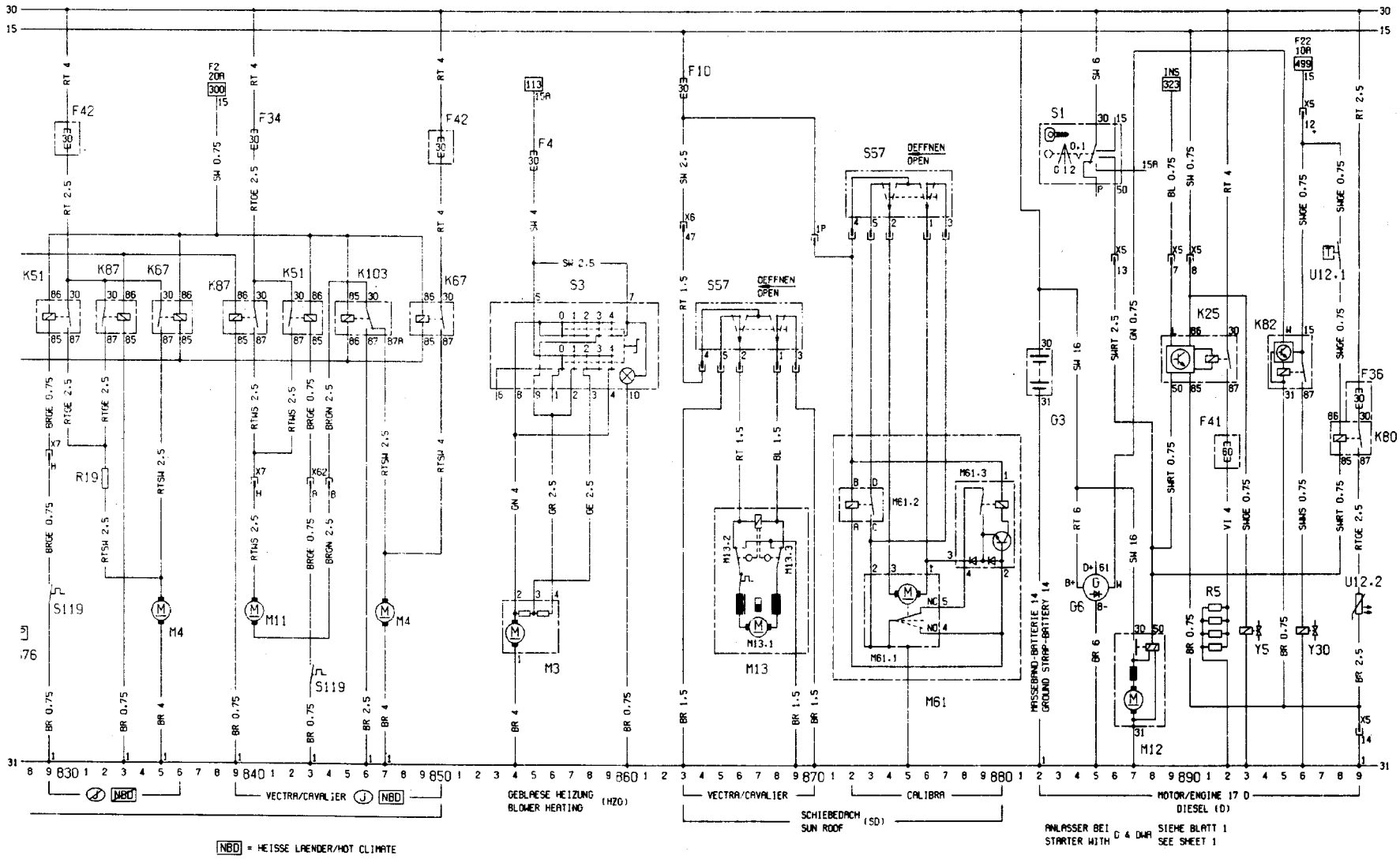
Wiring diagram for 1991 models (continued)



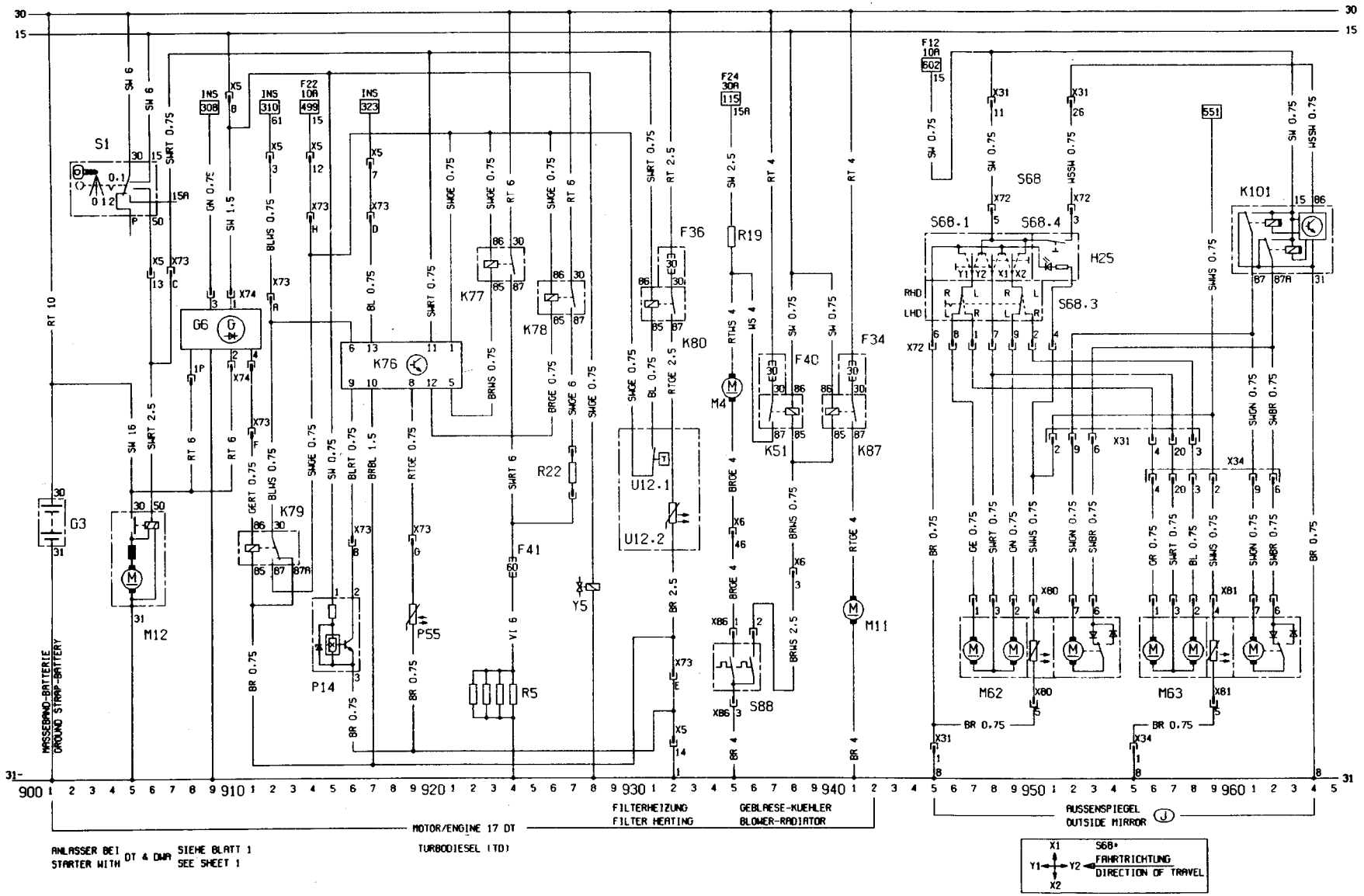
Wiring diagram for 1991 models (continued)



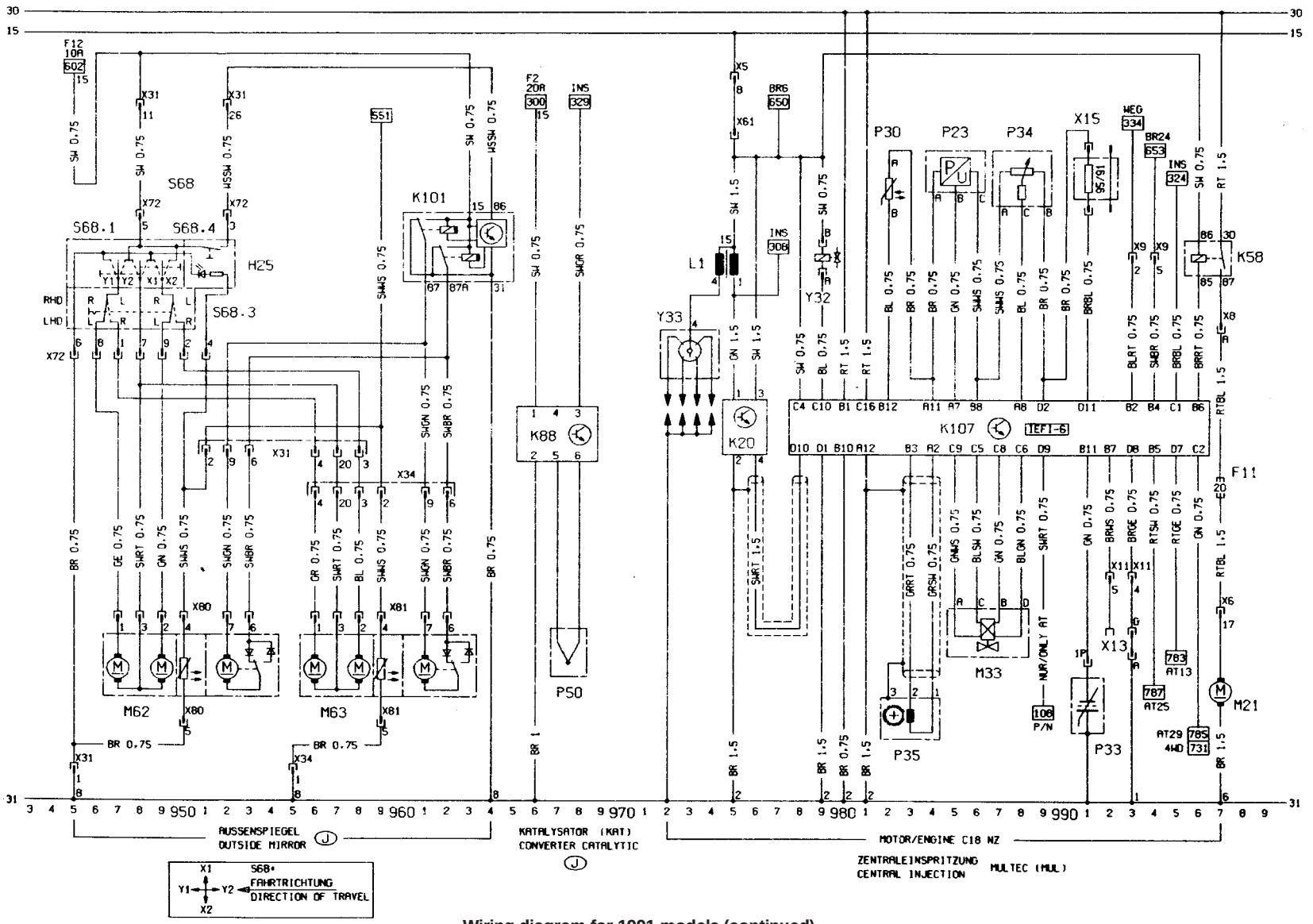
Wiring diagram for 1991 models (continued)



Wiring diagram for 1991 models (continued)



Wiring diagram for 1991 models (continued)



Wiring diagram for 1991 models (continued)

Key to wiring diagrams for 1992 and later models

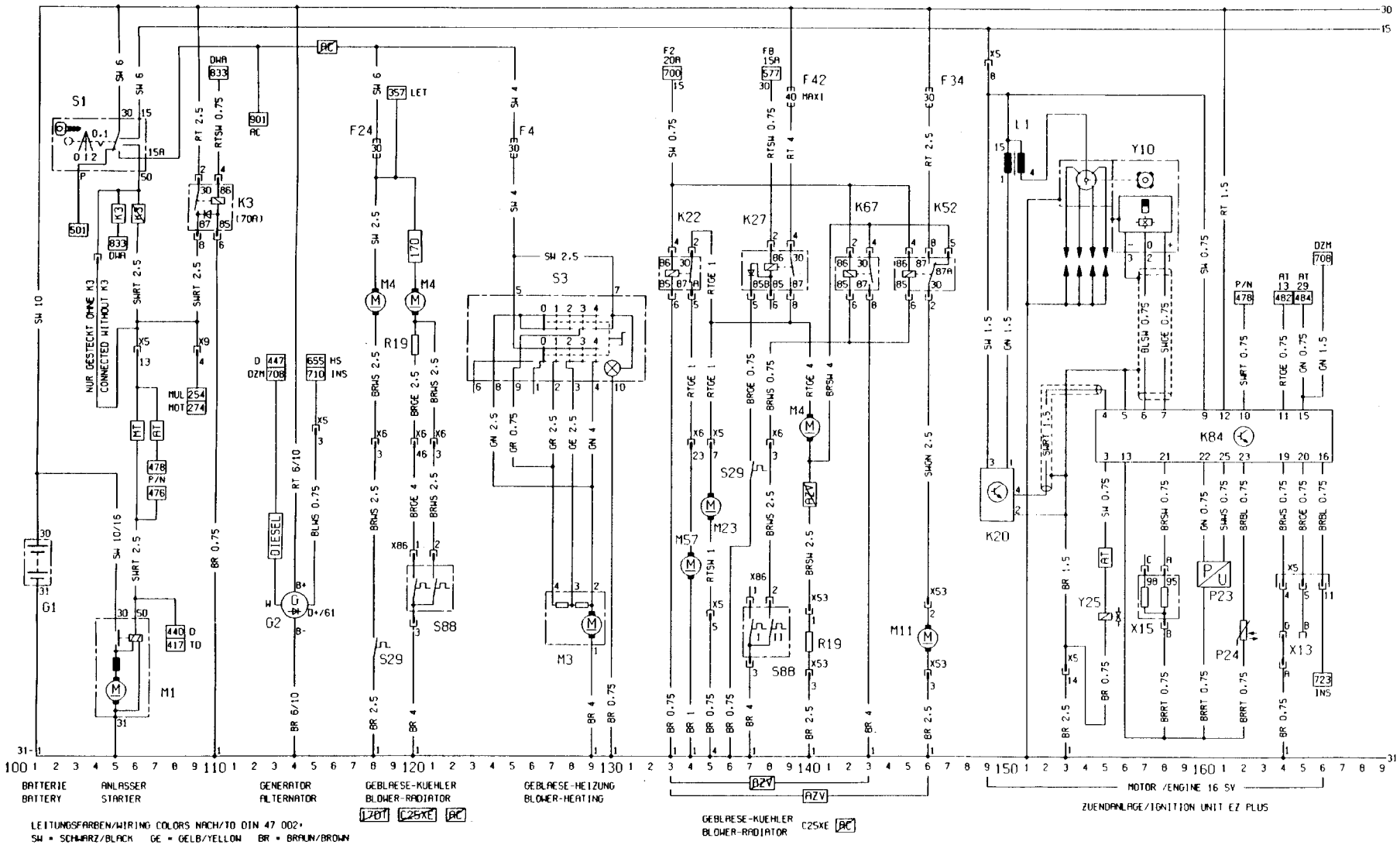
No	Description	Track
E1	Left parking lamp	506
E2	Left tail lamp	507, 745
E3	Licence plate lamp	513
E4	Right parking lamp	509
E5	Right tail lamp	510, 746
E6	Engine compartment lamp	515
E7	Left high beam	535
E8	Right high beam	536
E9	Left low beam	537, 747
E10	Right low beam	538, 748
E11	Instrument lights	728, 729
E12	Selector lever lamp	498, 499
E13	Boot lamp	585
E14	Passenger compartment lamp	587
E15	Glove box lamp	677
E16	Cigarette lighter lamp	676
E17	Left reversing lamp	597
E18	Right reversing lamp	598
E19	Heated back window	652
E20	Left fog lamp	553
E21	Right fog lamp	554
E24	Left rear fog lamp	548
E25	Left front heating mat	660
E27	Left rear reading lamp	680, 681
E28	Right rear reading lamp	683, 684
E30	Right front heating mat	664
E32	Clock lamp	863
E37	Left mirror make-up lamp	686
E38	Computer lamp	854
E39	Right rear foglamp	549
E40	Right mirror make-up lamp	688
E41	Passenger compartment delay lamp	588 to 590
E50	Driver door lamp	866
E51	Passenger door lamp	884
F1 on	Fuses	Various
F35	Voltage stabilizer	702
G1	Battery	101
G2	Alternator	114
G6	Diesel alternator	402 to 405
H1	Radio	784 to 798
H3	Turn signal lamp telltale	716, 718
H4	Oil pressure telltale	710
H5	Brake fluid telltale	712
H6	Telltale hazard warning system	570
H7	Charging indicator lamp	710
H8	High beam telltale	722
H9	Left stop lamp	561, 749
H10	Right stop lamp	562, 750
H11	Left front turn signal lamp	572
H12	Left rear turn signal lamp	573
H13	Right front turn signal lamp	581
H14	Right rear turn signal lamp	582
H15	Fuel telltale	705, 706
H16	Preheating time telltale	715
H17	Trailer turn signal lamp telltale	717
H18	Horn	670
H19	Headlamps on warning buzzer	594, 595
H21	Parking brake telltale	713
H23	Airbag telltale	719
H25	Heated back window & mirror telltale	642, 765
H26	ABS telltale	721
H27	Safety checking warning buzzer	996 to 998
H28	Seat belt warning telltale	723
H30	Engine telltale	724
H33	Left auxiliary turn signal lamp	576
H34	Right auxiliary turn signal lamp	578
H36	Additional stop lamp	563
H37	Left front loudspeaker	788 to 790
H38	Right front loudspeaker	794 to 796
H39	Left rear loudspeaker	788, 789
H40	Right rear loudspeaker	791, 792
H42	Automatic program power telltale	725
H45	Four wheel drive telltale	727
H46	Catalytic converter temperature telltale	729
H47	Anti-theft warning unit horn	838
H48	Horn	671
H51	Traction control telltale	720
H52	Left front tweeter	787 to 791
H53	Right front tweeter	793 to 797
K3	Starter relay anti-theft warning unit	109, 110
K5	Fog lamps relay	554 to 555
K6	Air conditioning relay	901, 902
K7	Four stage air conditioning blower relay	904, 905
K8	Windshield wiper interval relay	603 to 606
K9	Headlamps washer unit relay	619, 620
K10	Flasher unit	567 to 569
K20	Ignition coil module	149, 150, 171, 172, 241, 242, 302 to 305, 361 to 364, 1001 to 1005, 1055 to 1061
K22	Coolant pump relay	133, 134, 969, 970
K25	Glow time relay	440 to 443
K26	Radiator blower relays	972 to 974
K27	Radiator blower relay	137 to 139
K30	Back window wiper interval relay	613 to 615
K31	Airbag control unit	1191 to 1198
K34	Radiator blower time delay relay	356 to 358, 956 to 958
K35	Heated back window & mirror time delay relay	650 to 652
K37	Central locking control unit	805 to 812
K51	Radiator blower relay	430, 431, 942, 943, 956, 957
K52	Radiator blower relay	145 to 147, 433,435, 982 to 984, 960 to 962
K57	Multec unit control	211 to 230, 244 to 262
K58	Fuel pump relay	231, 232, 262, 263
K59	Running light relay	520 to 525
K60	Compressor relay	931,932
K61	Motronic control unit	270 to 294, 307 to 337, 366 to 396, 1007 to 1037, 1063 to 1096
K63	Horn relay	671, 672
K64	1 stage air conditioning blower relay	913, 914
K67	Radiator blower relay	142, 143, 436, 437, 948, 949, 964, 965, 986, 987
K68	Fuel injection unit relay	295 to 299, 393 to 397, 334 to 338, 1093 to 1097, 1034 to 1038
K73	High beam relay (Calibra)	530, 531
K76	Glow time control unit	413 to 417
K77	Glow plugs relay	419, 420
K78	Preresistor relay (70A)	422, 423
K79	Charge indicator relay	406 to 408
K80	Filter heating relay	426, 427, 452, 453
K82	Engine revolution relay	447, 448
K83	Four wheel drive unit control	342 to 349
K84	EZ Plus control unit	155 to 166, 177 to 191
K85	Automatic transmission control unit	473 to 496
K86	Check control unit	736 to 752
K87	Radiator blower relay	945, 946, 953, 954, 977, 978
K88	Catalytic converter temperature control unit	462 to 464
K89	Rear fog lamp relay	543 to 545
K90	Compressor relay (automatic transmission only)	930, 931
K94	Anti-theft warning unit control unit	833 to 847

Key to wiring diagrams for 1992 and later models (continued)

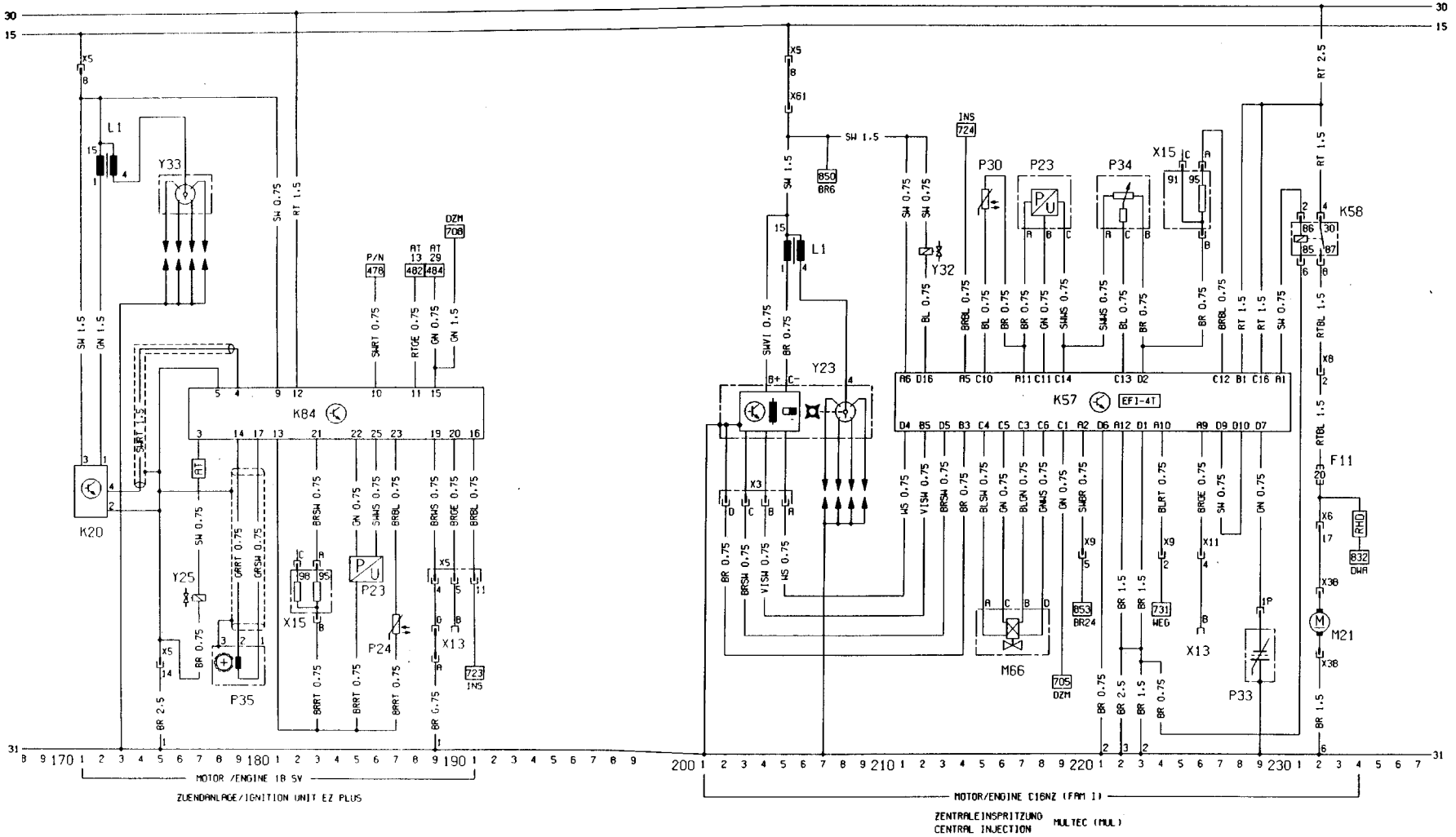
No	Description	Track
K95	Traction control control unit	1125 to 1140
K97	Headlamps washer pump time delay relay	630 to 632
K101	Parking position mirror relay	774 to 777
K102	Park brake shift lock control unit	469 to 471
L1	Ignition coil	150, 172, 205, 273, 241, 302, 361
L2	Ignition coil	1000 to 1004, 1054 to 1059
M1	Starter	105, 106
M2	Windshield wiper motor	601 to 604
M3	Heating blower motor	127 to 129
M4	Radiator blower motor	118, 120, 140, 356, 431, 948, 954, 980
M6	Left headlamp wiper motor	622 to 624
M7	Right headlamp wiper motor	626 to 628
M8	Back window wiper motor	611 to 613
M10	Air conditioning blower motor	905 to 908
M11	Radiator blower motor	136, 434, 962, 984
M13	Vectra/Cavalier sun roof motor	1172 to 1175
M13.1	Sun roof motor	1172, 1174
M13.2	Timing box microswitch	1172
M13.3	Timing box microswitch	1174
M18	Driver door central locking motor	807 to 810
M19	Left rear door central locking motor	821 to 823
M20	Right rear door central locking motor	825 to 827
M21	Fuel pump	232, 263, 297, 339, 399, 834, 1098, 1039
M23	Alternator blower motor	135, 974
M24	Headlamps washer pump	632
M26	Automatic antenna motor	798 to 799
M30	Driver side outside mirror	638 to 641
M31	Passenger side outside mirror	644 to 647
M32	Passenger door central locking motor	813 to 816
M33	Idle speed actuator	285, 286, 317, 318, 381, 382, 1019, 1020, 1075, 1076
M37	Tail gate/boot lid central locking motor	818 to 821
M39	Left headlamp levelling motor	692 to 695
M40	Right headlamp levelling motor	696 to 699
M41	Fuel filler door central locking motor	823, 824
M47	Driver door window lifter motor	867 to 871
M48	Passenger door window lifter motor	885 to 889
M49	Left rear window lifter motor	873 to 877
M50	Right rear window lifter motor	891 to 895
M55	Windshield and back window washer pump	617
M57	Coolant pump	134, 970
M60	Calibra tailgate central locking motor	827, 828
M61	Calibra sun roof motor	1178 to 1186
M61.1	Sun roof motor	1179 to 1182
M61.2	Relay 1	1178, 1179
M61.3	Relay 2	1184 to 1186
M62	Driver side outside mirror	760 to 767
M63	Passenger side outside mirror	769 to 776
M65	TC throttle valve actuator	1130 to 1134
M66	Idle air stepper motor	215 to 218, 250 to 253
P1	Fuel indicator	704
P2	Coolant temperature indicator	706
P3	Clock	862
P4	Fuel sensor	704
P5	Coolant temperature sensor	706
P7	Tachometer	708
P11	Airflow meter	285 to 289
P12	Coolant temperature sensor	282, 381
P13	Outside temperature sensor	856
P14	Distance sensor	412, 413
P17	Left front revolution sensor	1110, 1154
P18	Right front revolution sensor	1113, 1157
P19	Left rear revolution sensor	1116, 1160
P20	Right rear revolution sensor	1119, 1163
P21	Distance sensor	731
P23	Intake manifold absolute pressure sensor	160, 161, 185, 186, 217 to 219, 250 to 252
P24	Engine oil temperature sensor	162, 187
P27	Left front brake lining sensor	740
P28	Right front brake lining sensor	740
P29	Intake manifold temperature sensor	382, 1016, 1072
P30	Coolant temperature sensor	215, 248, 313, 1017, 1073
P32	Heated exhaust oxygen sensor	294, 295, 331, 332, 391, 392, 1034, 1035, 1093, 1094
P33	Exhaust oxygen sensor	229, 257
P34	Throttle valve potentiometer	221 to 223, 280, 281, 253 to 255, 383 to 385, 478, 479, 1018, 1019, 1074, 1075
P35	Crankshaft impulse sensor	178 to 180, 289 to 291, 248 to 250, 318 to 320, 373 to 375, 1025 to 1027, 1084 to 1086
P38	Transmission oil temperature sensor	494
P39	Trailer bulb test sensor	752 to 754
P43	Electronic speedometer	733
P44	Air mass meter	393 to 397, 334 to 338, 1037, 1038, 1096, 1097
P45	Transmission input revolution sensor	490, 491
P46	Knock control sensor	322, 323, 377, 378, 1022, 1023, 1078, 1079
P47	Cylinder identification hall sensor	325 to 327, 385 to 387, 1028 to 1030, 1087, 1089
P48	Automatic transmission distance sensor	488, 489
P50	Catalytic converter temperature sensor	463, 464
P53	Driver side anti-theft warning unit sensor	839 to 847
P54	Passenger side anti-theft warning unit sensor	839 to 847
P55	Engine coolant temperature sensor	415
P56	Knock control sensor II	1080, 1081
P57	Antenna	797
R3	Cigarette lighter	675
R5	Glow plugs	418 to 420, 441 to 443
R13	Left heated washer nozzle	626
R14	Right heated washer nozzle	628
R19	Radiator blower preresistor	120, 140, 945
R22	Glow plugs pre-resistor	423
R23	Driver airbag squib	1194
S1	Starter switch	103 to 106
S1.2	Key contact switch	783
S2	Light switch assy	
S2.1	Light switch	504 to 507
S2.2	Passenger compartment lamp switch	587
S2.3	Instrument lights dimmer	728
S3	Heating blower switch	123 to 130
S4	Heated back window & mirror switch	654 to 657
S5	Turn signal switch assy	
S5.2	Low beam switch	536, 537
S5.3	Turn signal switch	580 to 582
S5.4	Parking lamp switch	501, 502
S7	Back up lamp switch	597, 599
S8	Stop lamp switch	562
S9	Wiper unit switch	
S9.2	Interval windshield wiper switch	601 to 604
S9.5	Back window and washer unit wiper switch	614 to 616
S10	Automatic transmission switch	472 to 478
S11	Brake fluid control switch	712
S13	Parking brake switch	713
S14	Oil pressure switch	710
S15	Boot lamp switch	585
S17	Passenger door contact switch	590
S20	Pressure switch	
S20.1	Low pressure compressor switch	925

Key to wiring diagrams for 1992 and later models (continued)

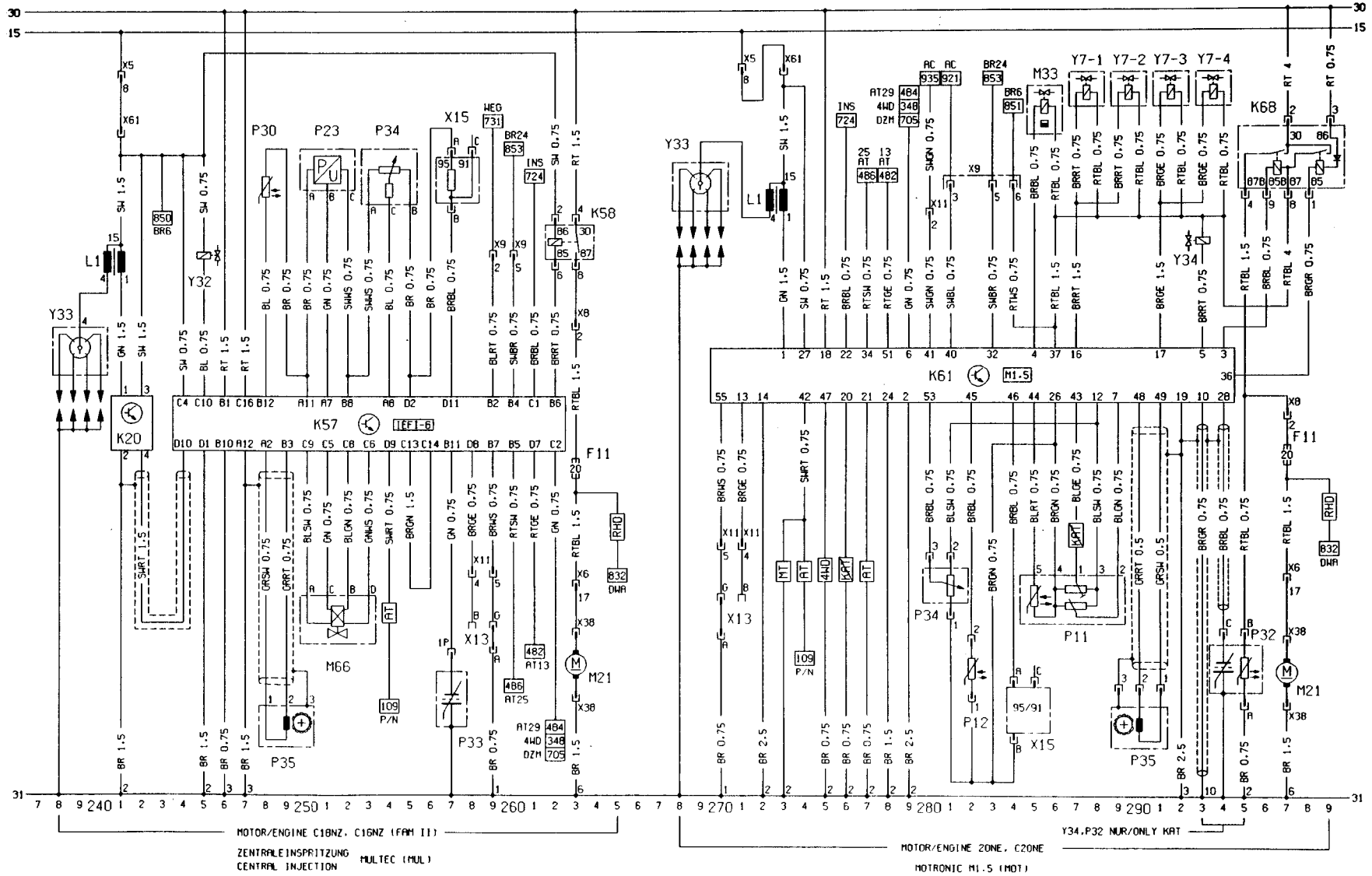
No	Description	Track
S20.2	High pressure compressor switch	925
S20.3	High pressure blower compressor switch	939
S21	Fog lamps switch	555 to 557
S22	Rear fog lamp switch	549 to 551
S24	Air conditioning blower switch	904 to 911
S29	Coolant temperature switch	118, 137, 357, 942, 957, 972
S30	Left front heating mat switch	660 to 662
S31	Rear left door contact switch	591
S32	Rear right door contact switch	592
S33	Traction control switch	1130, 1131
S37	Window lifter switch	868 to 894
S37.1	Left window lifter switch	868 to 870
S37.2	Right window lifter switch	886 to 888
S37.3	Left rear window lifter switch	874 to 876
S37.4	Right rear window lifter switch	892 to 894
S37.5	Safety switch	872, 873
S37.6	Window anti-jam off switch	890
S37.7	Automatic window lifter control	877 to 882
S39	Left rear door window lifter switch	878 to 880
S40	Right rear door window lifter switch	896 to 898
S41	Driver door burglary locking switch	800 to 802
S42	Passenger door central locking switch	805
S44	Throttle valve switch	316, 317
S47	Driver door contact switch	593, 594
S52	Hazard warning switch	569 to 573
S53	First gear identification switch	372
S55	Right front heating mat switch	664 to 666
S57	Sun roof switch	1170 to 1183
S63	Computer switch	
S63.1	Function reset switch	856
S63.2	Clock hours adjustment switch	857
S63.3	Function select switch	858
S63.4	Clock minute adjustment switch	859
S64	Horn switch	672
S68	Outside mirror switch assy	
S68.1	Outside mirror adjustment switch	638 to 640, 758 to 762
S68.3	Left/right outside mirror switch	637 to 641, 759 to 763
S68.4	Parking position switch	765
S82	Washer fluid minimum capacity control switch	736
S88	2 stage coolant temperature switch	120, 121, 137, 138, 430, 431
S89	Seat belt switch	998
S93	Coolant minimum capacity control switch	737
S95	Engine oil minuimum capacity control switch	738
S98	Headlamps levelling switch	691 to 693
S99	ZV driver door window lifter switch	865
S100	ZV passenger door window lifter switch	883
S101	Compressor switch	926 to 928
S102	Circulation switch	918 to 920
S103	Transmission temperature switch	350
S104	Kickdown switch	493
S105	Start-up assistance switch	495 to 497
S106	Economy power program switch	492
S109	Acceleration revolution pressure switch	921
S115	Coolant temperature switch	487, 488
S116	Stop lamp switch	564, 565
S117	Hydraulic pressure switch	346
S120	Engine compartment hood (anti-theft warning unit) switch	835
S127	Calibra tail gate central locking switch	831
S128	Coolant temperature switch	936,937
S131	Defroster lever limit switch	918
U2	Computer	851 to 862
U4	ABS hydroaggregate	1102 to 1122, 1146 to 1164
U4.1	Pump motor relay	1102, 1103, 1146, 1147
U4.2	Solenoid valves relay	1104, 1105, 1148, 1149
U4.3	Pump motor	1102,1146
U4.4	Diode	1105,1149
U4.5	Left front solenoid valve	1109,1153
U4.6	Right front solenoid valve	1111,1155
U4.7	Rear axle solenoid valve	1113,1157
U4.8	ABS control unit	1106 to 1122, 1150 to 1164
U4.9	Solenoid valves plug	1109 to 1113, 1153 to 1157
U5	Check control display	
U5.1	Washer fluid minimum capacity telltale	741
U5.2	Oil minimum capacity telltale	740
U5.3	Coolant minimum capacity telltale	739
U5.4	Tail light & low beam telltale	738
U5.5	Stop light failure telltale	737
U5.6	Front brake lining telltale	736
U12	Filter heater	
U12.1	Temperature switch	426, 452
U12.2	Filter heater	427, 453
U13	Automatic transmission	
U13.1	Solenoid valve (shift 1)	481
U13.2	Solenoid valve (shift 2)	482
U13.3	Solenoid valve (lock up control)	483
U13.4	Solenoid valve (pressure control)	484
U17	Roof antenna amplifier	795
V1	Brake fluid test bulb diode	712
V8	Air conditioning compressor diode	926
X1 on	Wiring connectors	Various
X10	Anti theft warning unit code	837
X13	Diagnostic link	164, 165, 189, 190, 226, 270, 271, 258, 259, 309, 310, 370, 371, 343, 344, 473, 474, 573, 725, 836, 837, 860, 861, 1012, 1013, 1069, 1070, 1118, 1119, 1136, 1162, 1163
X15	Octane number plug	157, 158, 182, 183, 225, 226, 257, 258, 284, 285
X54	Ignition coding plug	310, 311, 1014, 1070, 1071
Y1	Air conditioning compressor clutch	925
Y4	Headlamps washer solenoid valve	620
Y5	Fuel solenoid valve	410, 445
Y7	Fuel injection valves	287 to 294,320 to 327, 384 to 391,1025 to 1032,1078 to 1089
Y10	Hall sensor ignition distributor	153 to 158
Y11	Hot start solenoid valve	375, 376
Y12	Charging pressure control changeover valve	377, 378
Y18	Exhaust gas recirculation valve	1093
Y23	Inductive sensor distributor	201 to 208
Y24	Distributor (inductive discharge)	
Y25	Acceleration revolution solenoid valve	155, 177
Y30	Cold start acceleration solenoid valve	448
Y32	Fuel injection valve	212, 245
Y33	Ignition distributor	175 to 177, 268 to 270, 238 to 240, 301 to 303, 360 to 362
Y34	Tank ventilation valve	293, 331, 332, 379, 380, 1092, 1016, 1017,
Y35	Circulation solenoid valve	918
Y44	Four wheel drive solenoid valve	350
Y47	Park brake shift lock lifting magnet	469



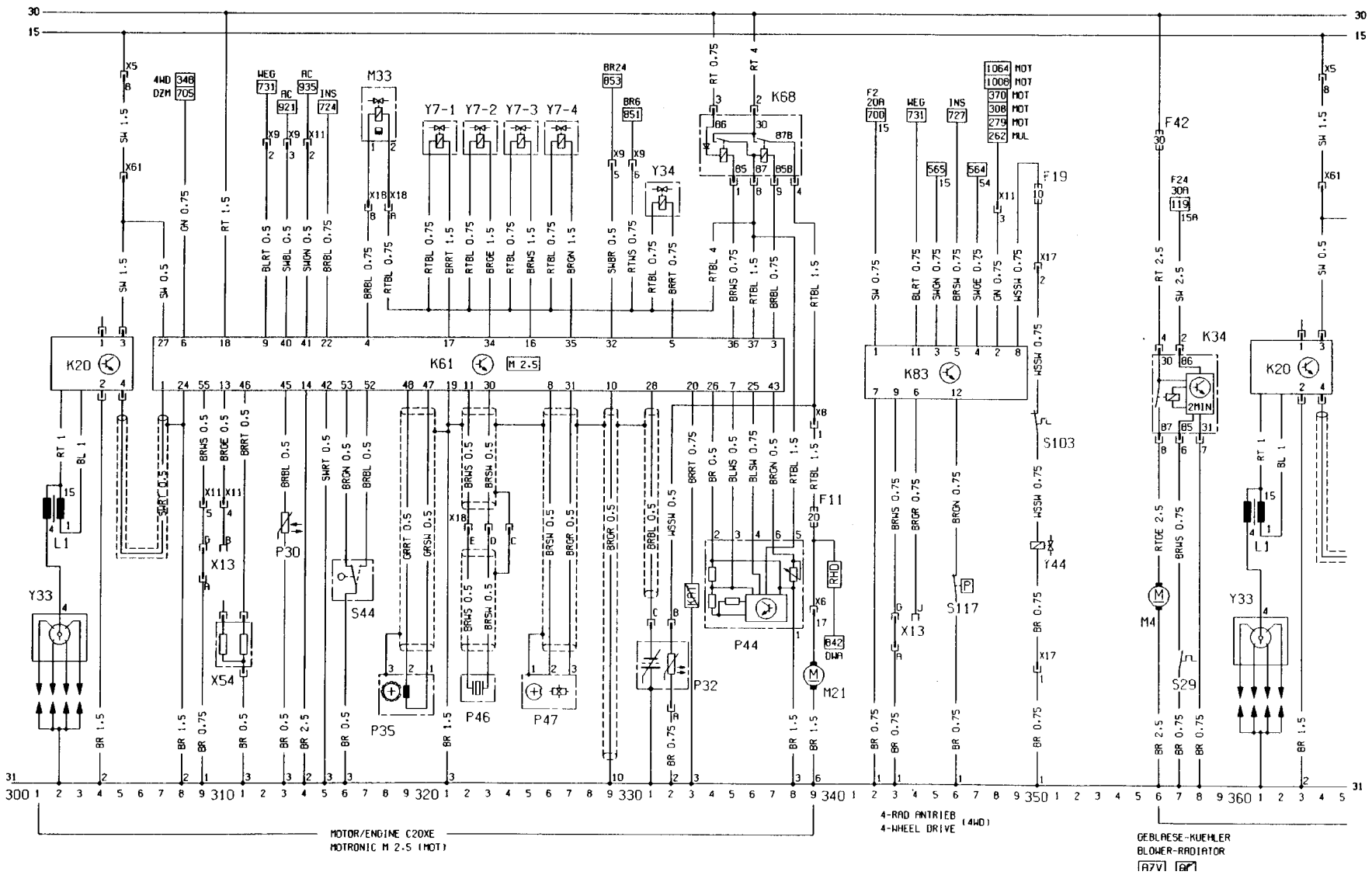
Wiring diagram for 1992-on models



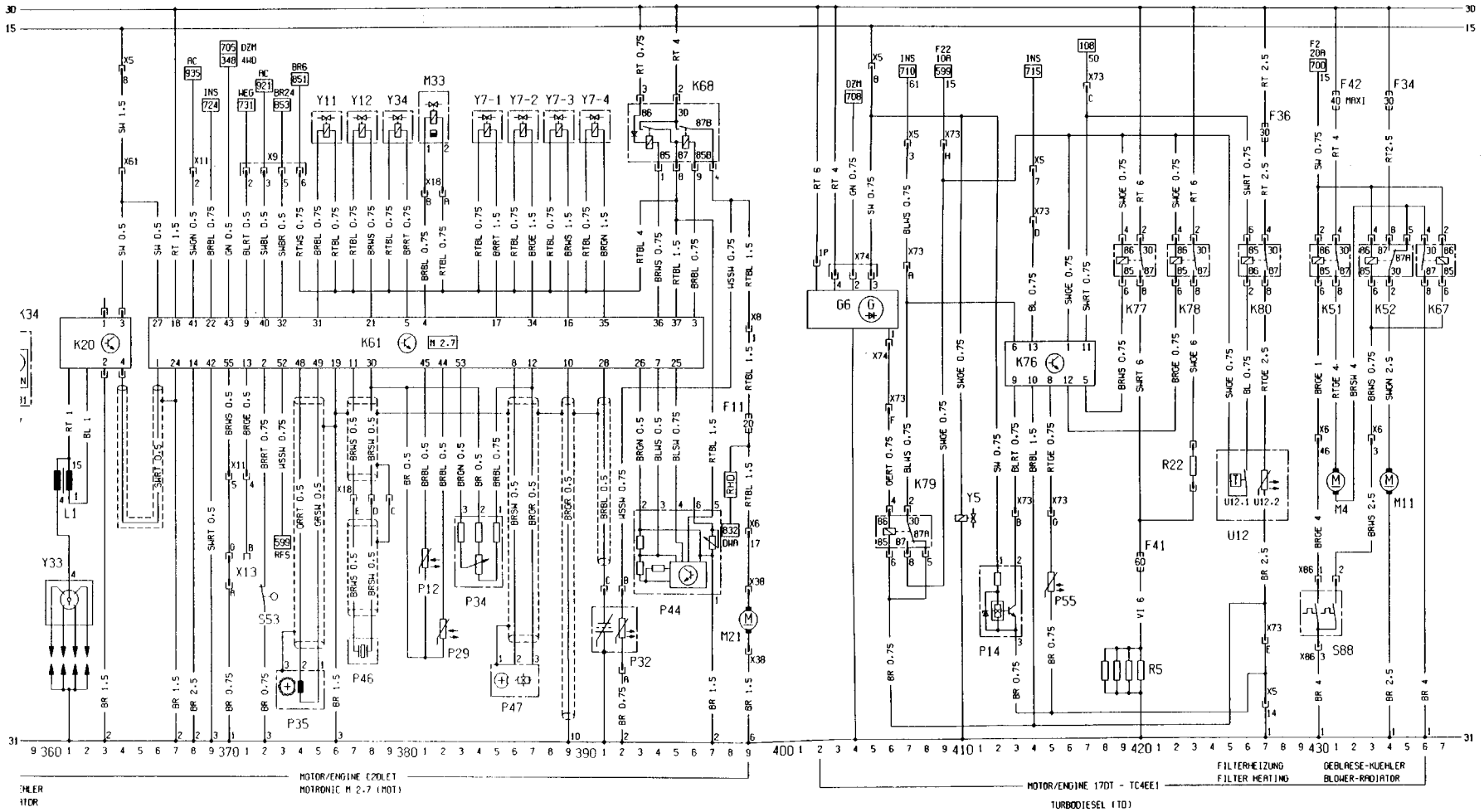
Wiring diagram for 1992-on models (continued)



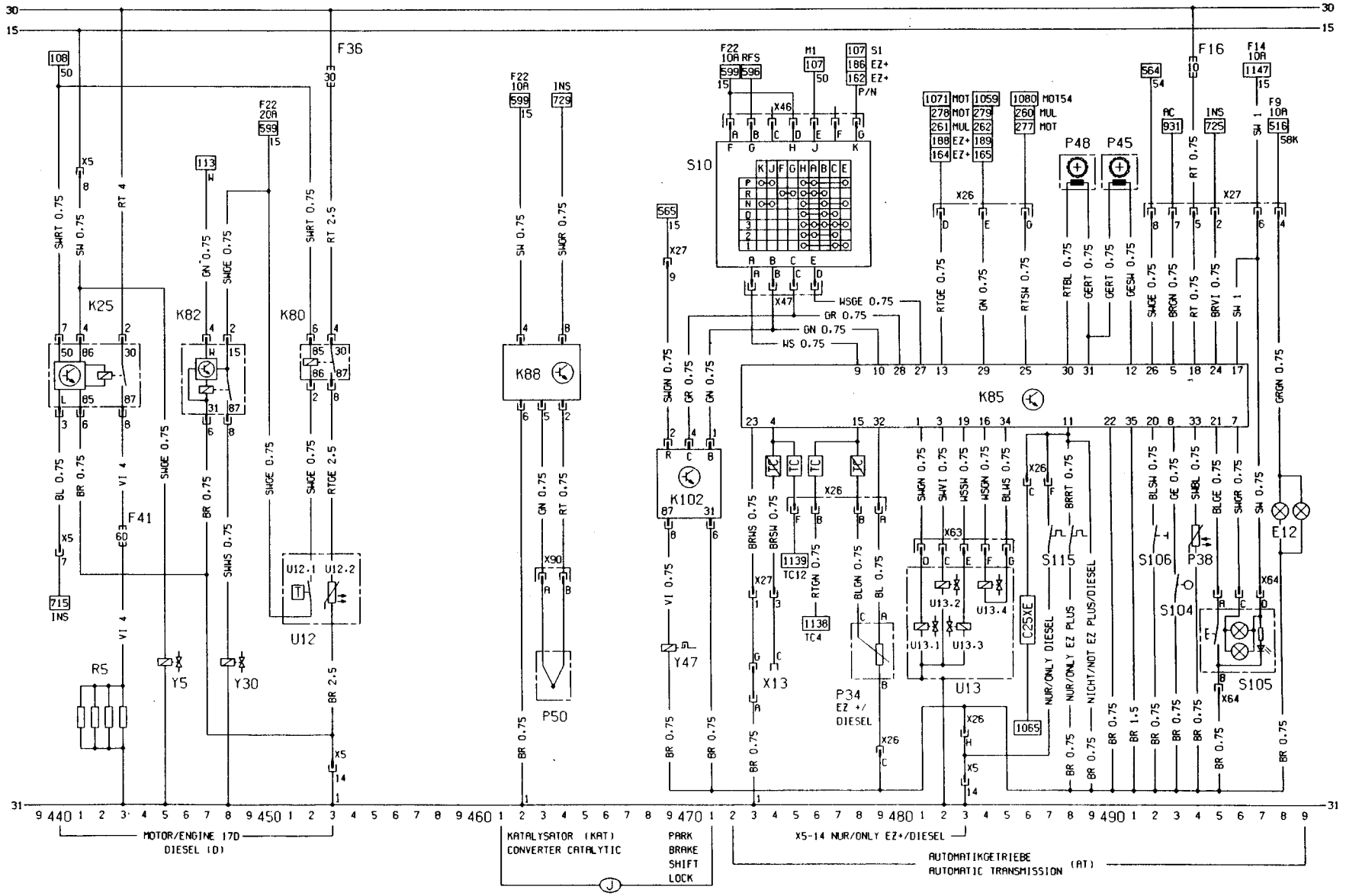
Wiring diagram for 1992-on models (continued)



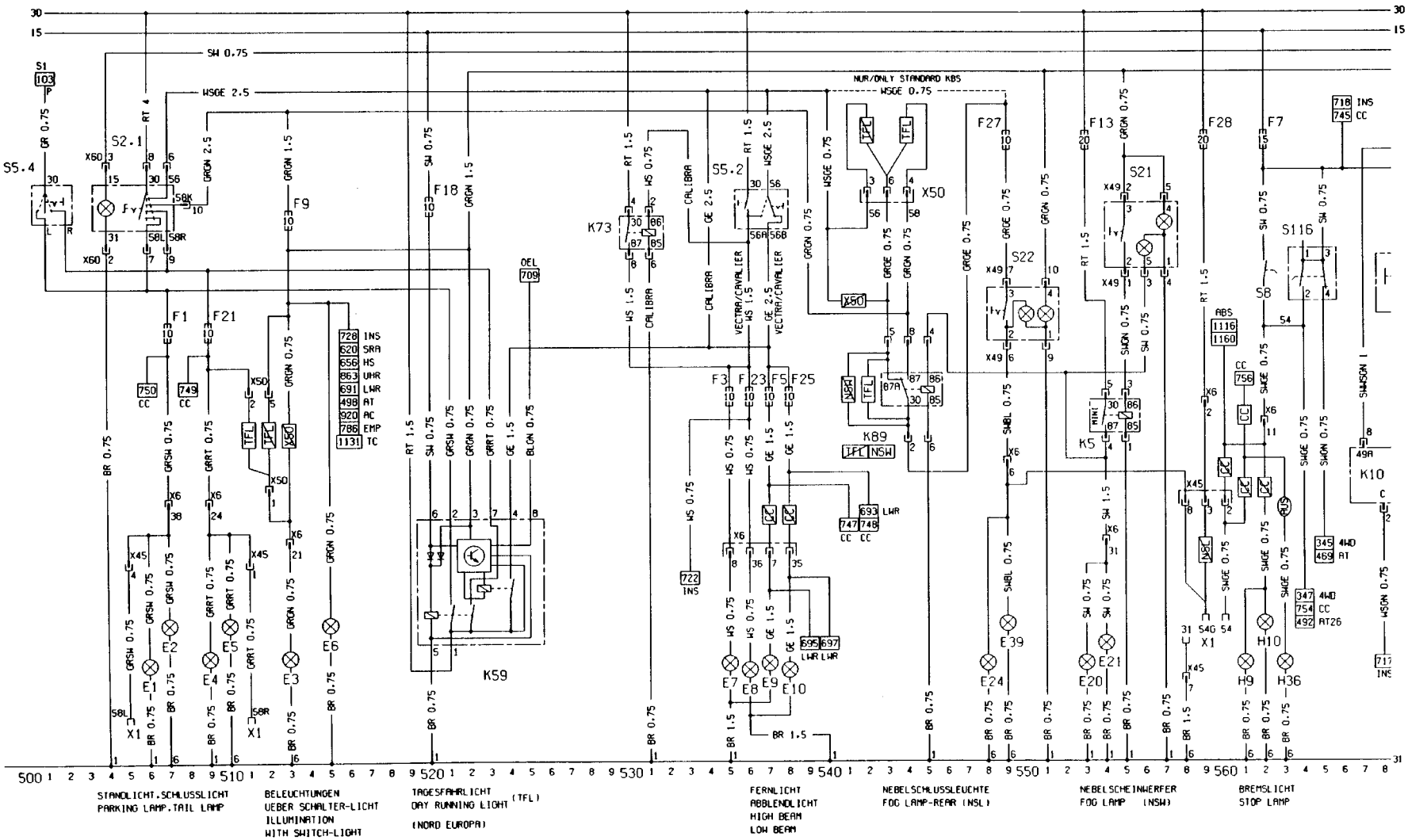
Wiring diagram for 1992-on models (continued)



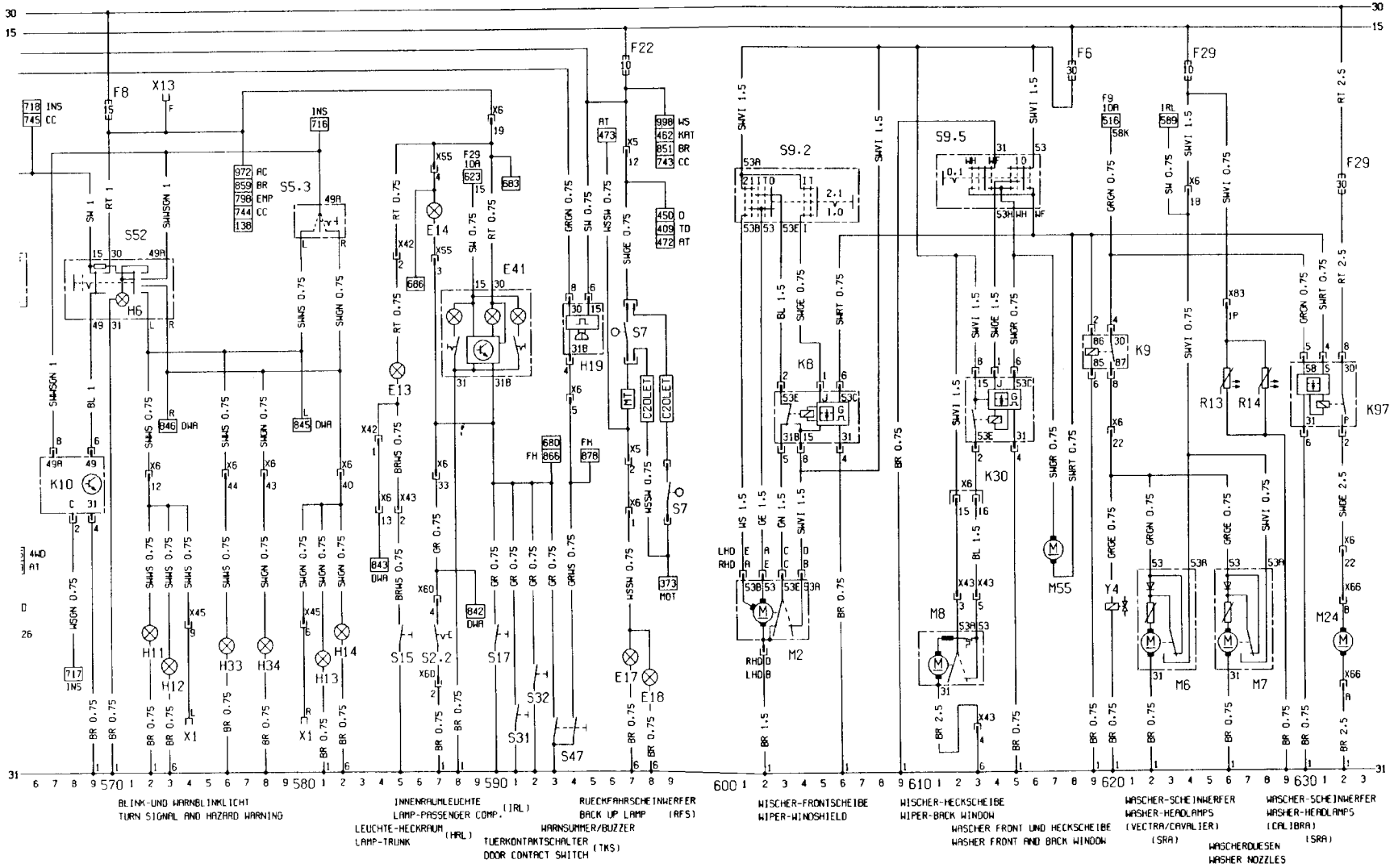
Wiring diagram for 1992-on models (continued)



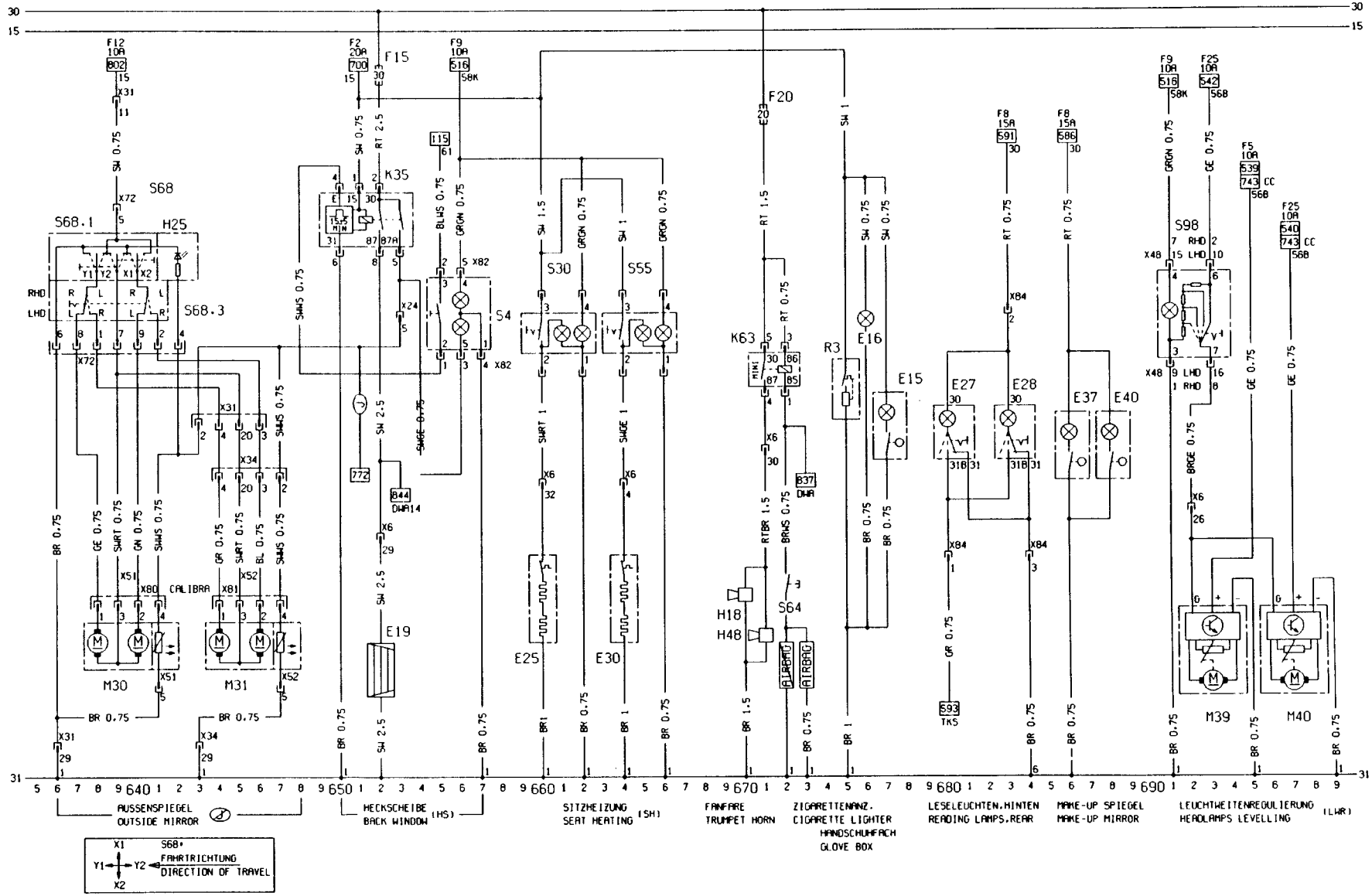
Wiring diagram for 1992-on models (continued)



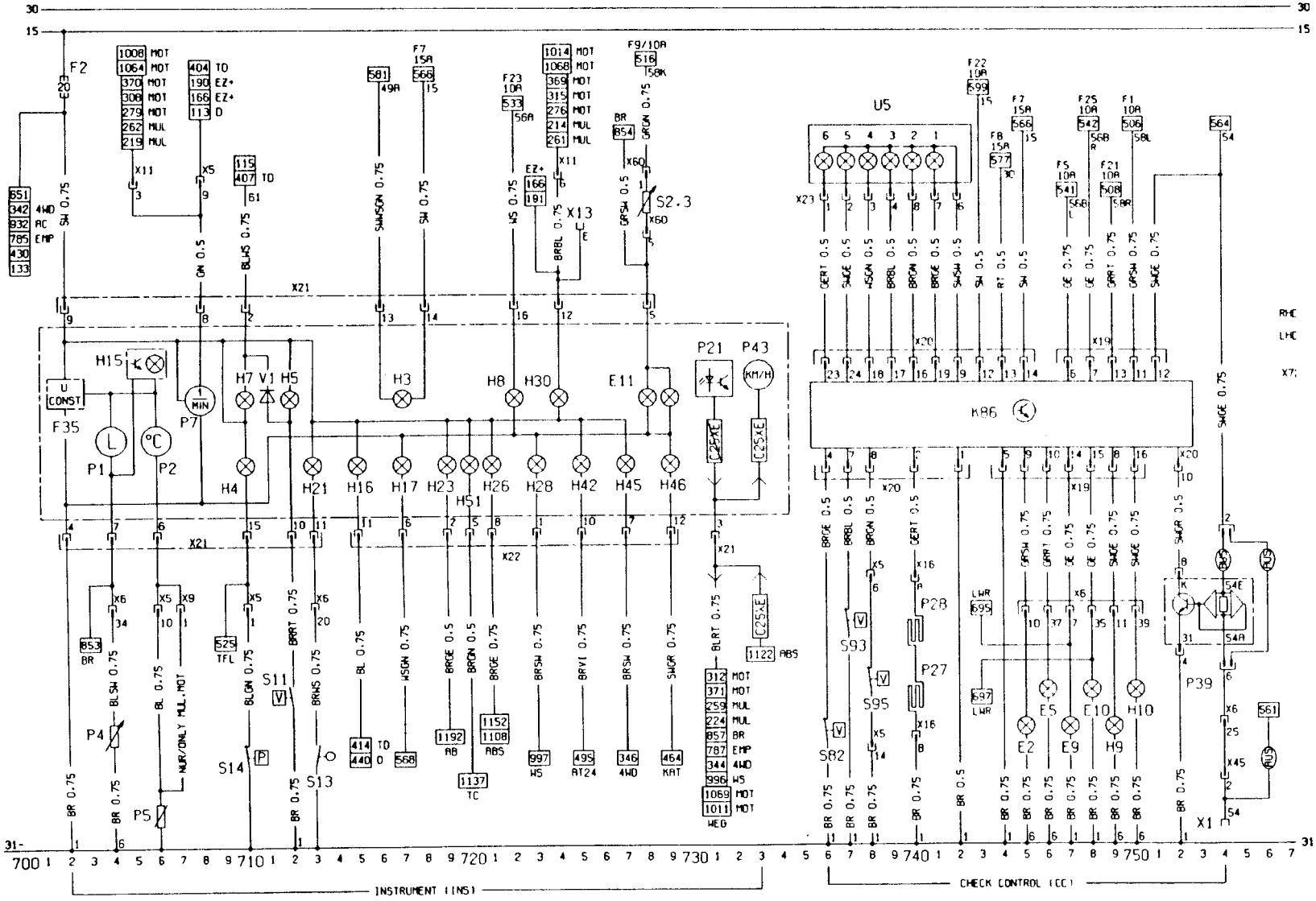
Wiring diagram for 1992-on models (continued)



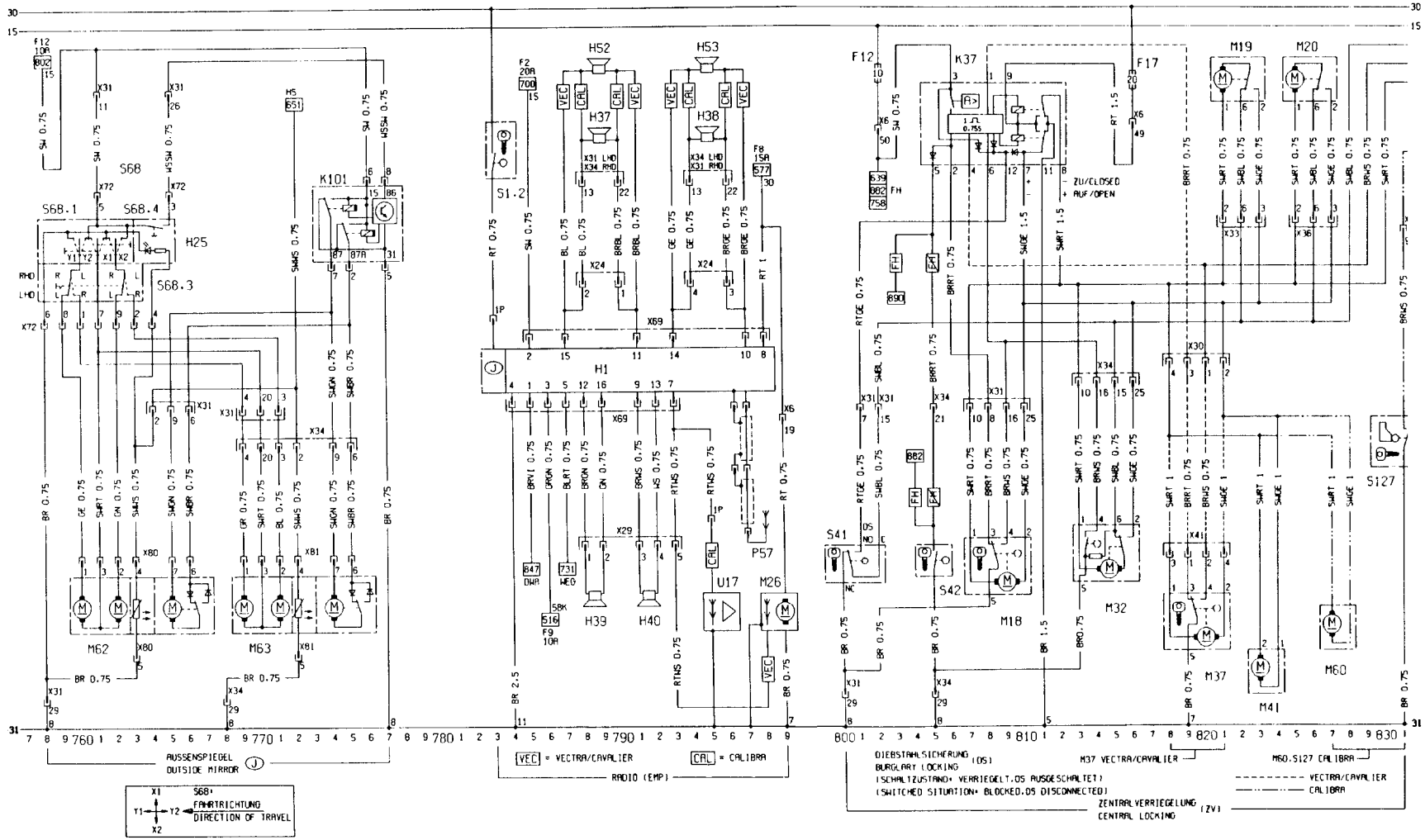
Wiring diagram for 1992-on models (continued)



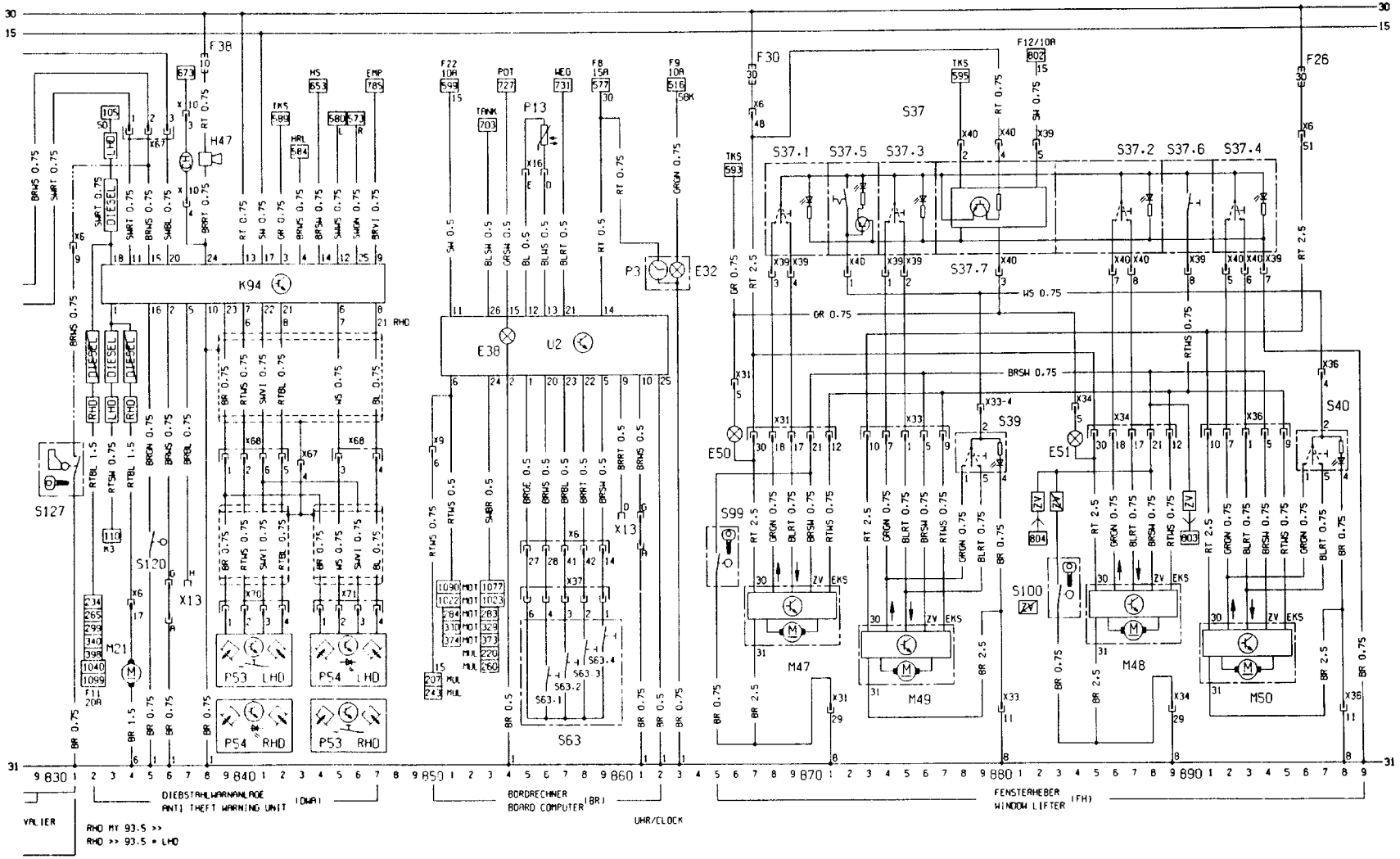
Wiring diagram for 1992-on models (continued)



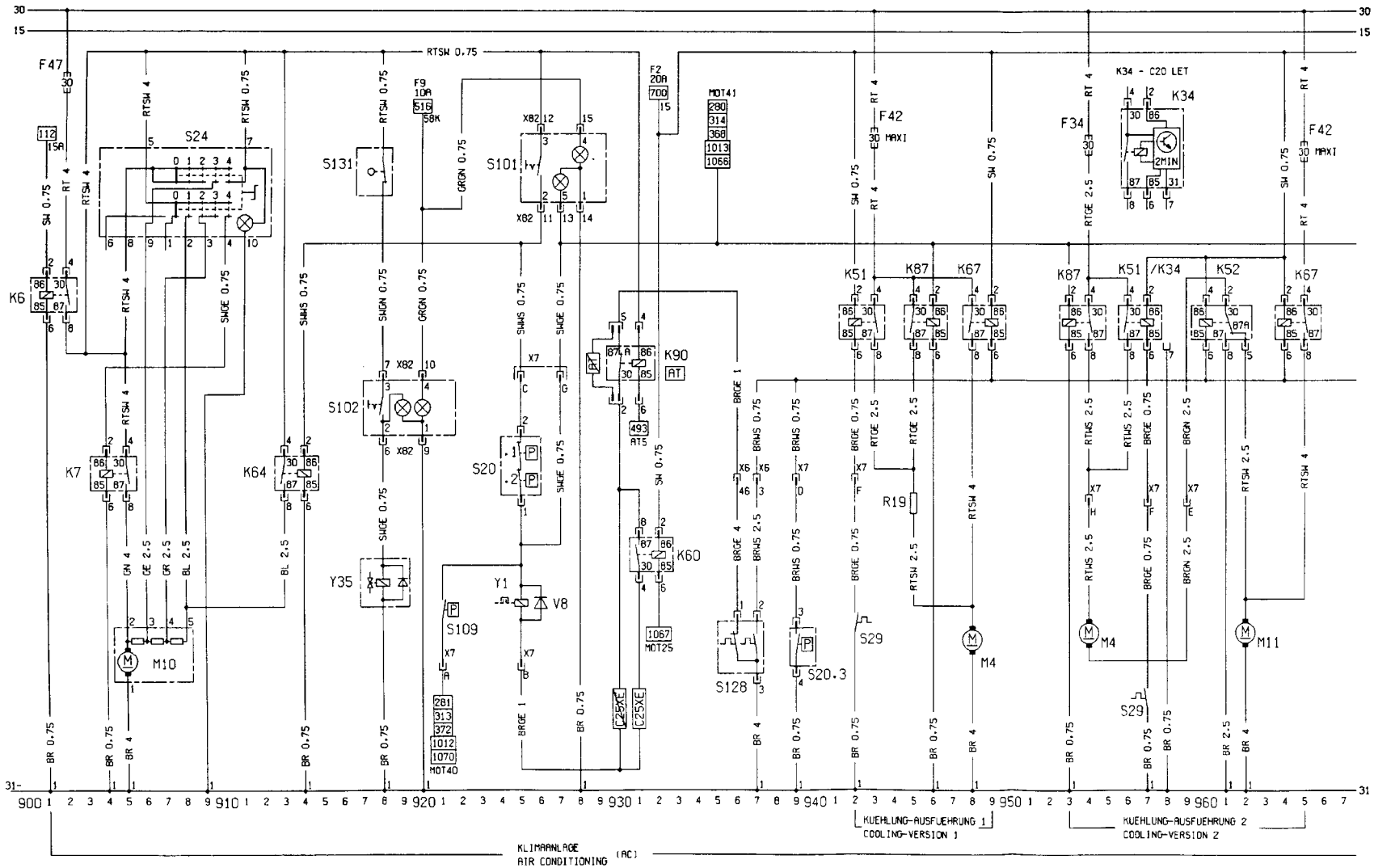
Wiring diagram for 1992-on models (continued)



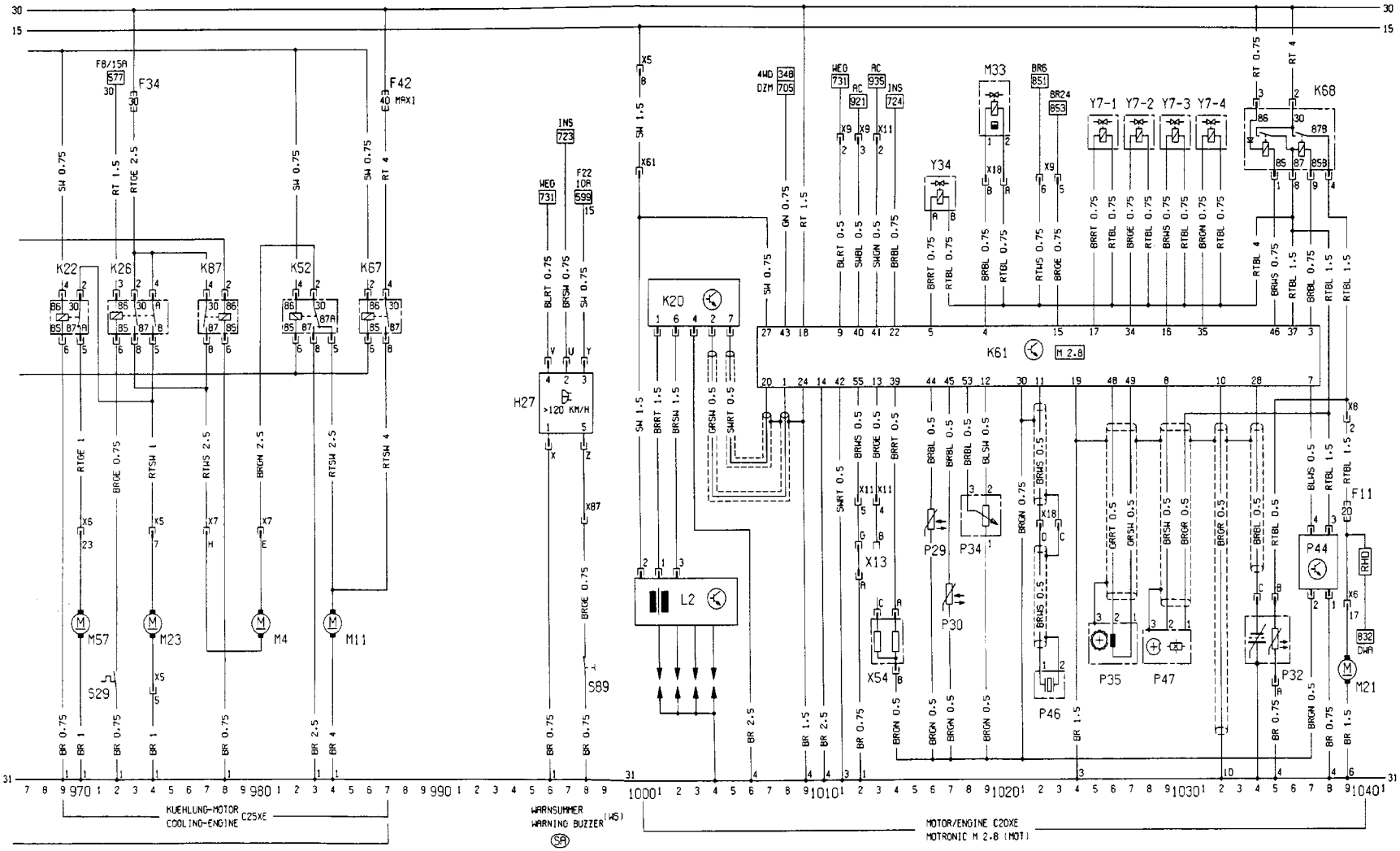
Wiring diagram for 1992-on models (continued)



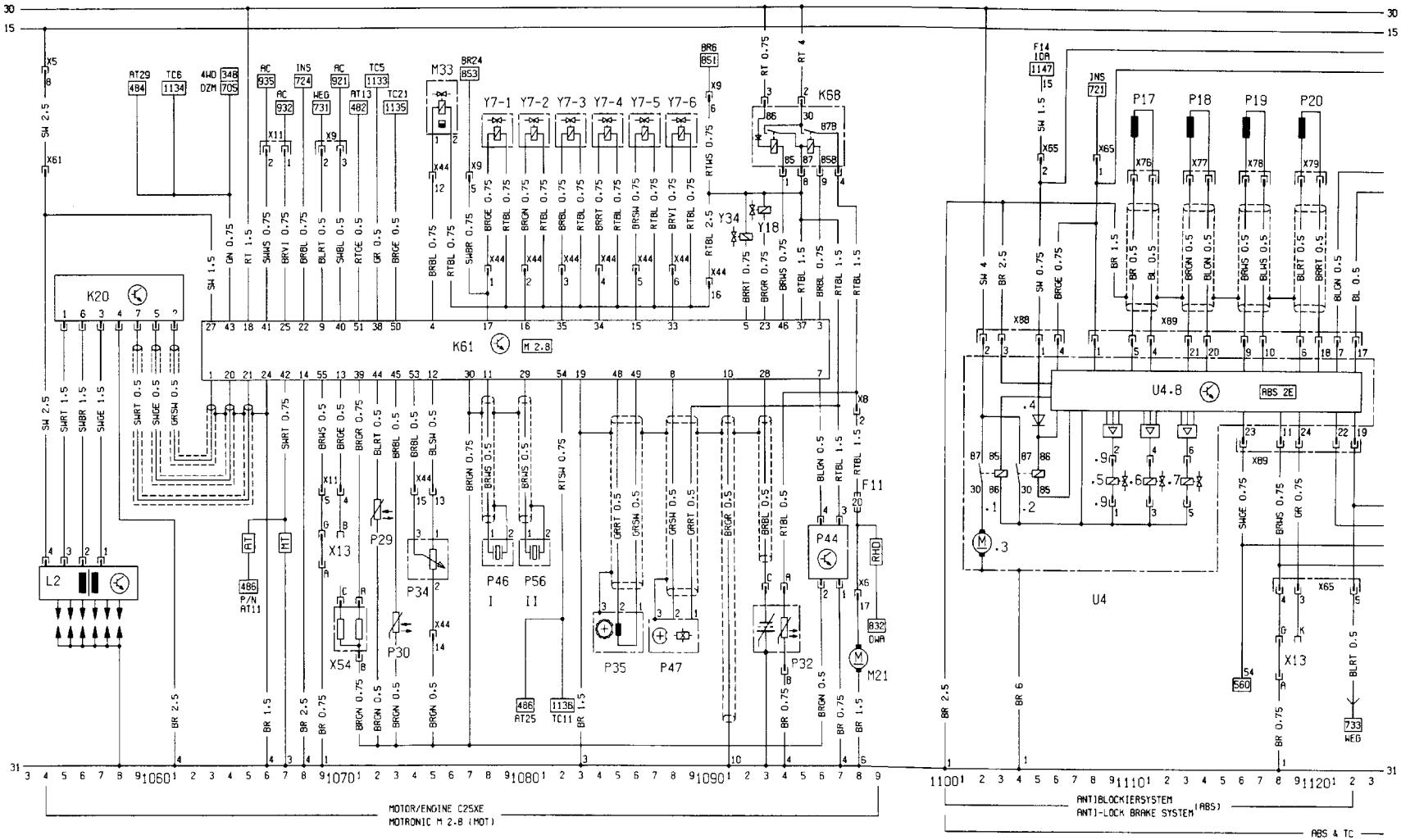
Wiring diagram for 1992-on models (continued)



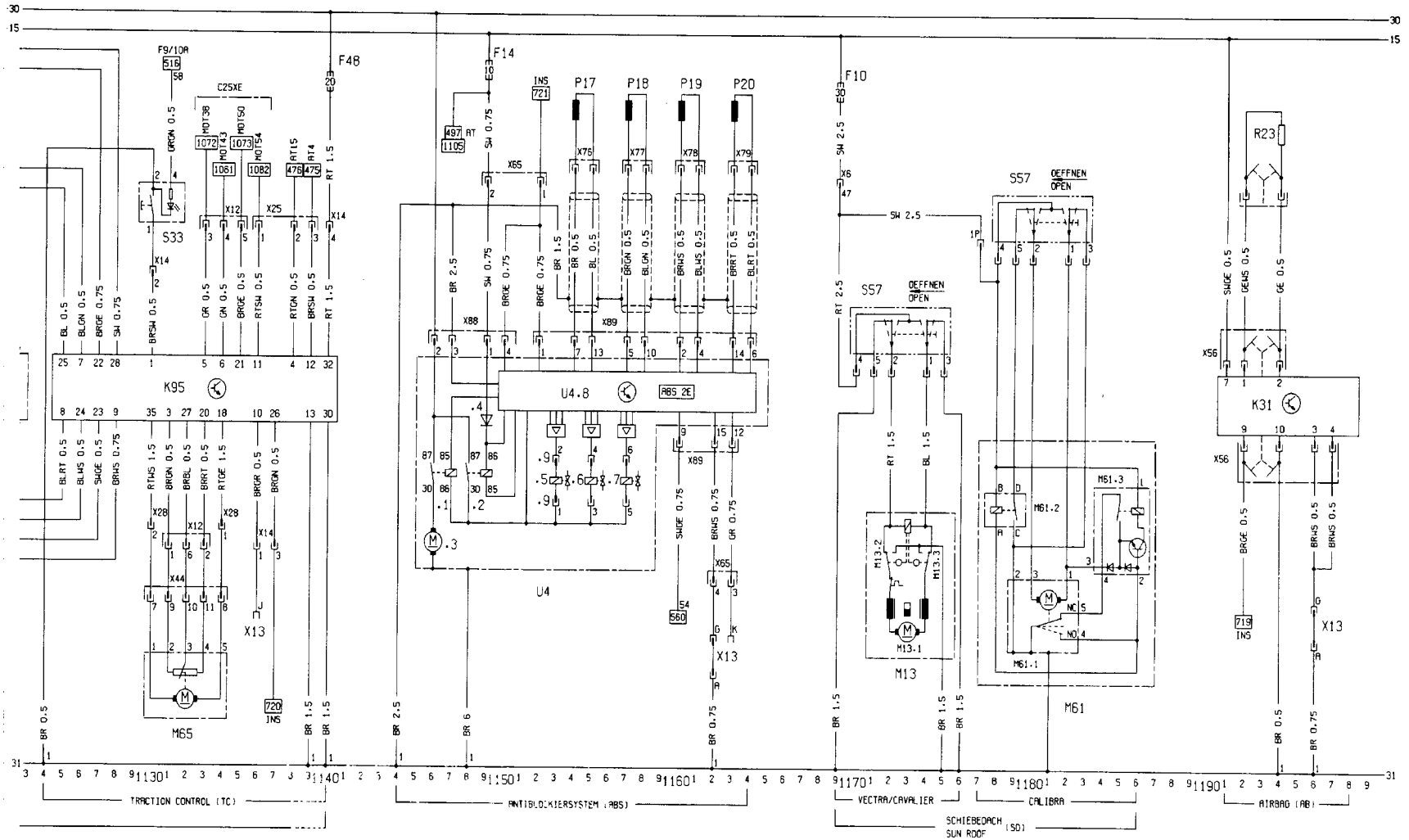
Wiring diagram for 1992-on models (continued)



Wiring diagram for 1992-on models (continued)



Wiring diagram for 1992-on models (continued)



Wiring diagram for 1992-on models (continued)

Dimensions and Weights

Overall length: *
Saloon models . . . . . 4432 mm
Hatchback models . . . . . 4352 mm

Overall width: *
All models . . . . . 1876 mm

Overall height (unladen): *
All models . . . . . 1400 mm

Wheelbase: *
All models . . . . . 2600 mm

Track:

Front: *
All models . . . . . 1426 mm

Rear: *
All models . . . . . 1423 mm

Ground clearance (minimum): *
All models . . . . . 120 mm

Weights

Kerb weight: *
Dependent on model . . . . . 1098 ± 101 kg

Maximum gross vehicle weight: *
All models . . . . . Refer to VIN plate

Maximum roof rack load: *
All models . . . . . 100 kg

Maximum towing hitch downward load: *
All models . . . . . 75 kg

Maximum towing weight: *
Trailer with brakes . . . . . 1175 ± 175 kg
Trailer without brakes . . . . . 550 ± 50 kg

* *Exact details depend upon model and specification. Refer to owners handbook.*

Conversion Factors

Length (distance)

Inches (in)	25.4	=	Millimetres (mm)	x 0.0394	=	Inches (in)
Feet (ft)	0.305	=	Metres (m)	x 3.281	=	Feet (ft)
Miles	1.609	=	Kilometres (km)	x 0.621	=	Miles

Volume (capacity)

Cubic inches (cu in; in^3)	x 16.387	=	Cubic centimetres (cc; cm^3)	x 0.061	=	Cubic inches (cu in; in^3)
Imperial pints (Imp pt)	x 0.568	=	Litres (l)	x 1.76	=	Imperial pints (Imp pt)
Imperial quarts (Imp qt)	x 1.137	=	Litres (l)	x 0.88	=	Imperial quarts (Imp qt)
Imperial quarts (Imp qt)	x 1.201	=	US quarts (US qt)	x 0.833	=	Imperial quarts (Imp qt)
US quarts (US qt)	x 0.946	=	Litres (l)	x 1.057	=	US quarts (US qt)
Imperial gallons (Imp gal)	x 4.546	=	Litres (l)	x 0.22	=	Imperial gallons (Imp gal)
Imperial gallons (Imp gal)	x 1.201	=	US gallons (US gal)	x 0.833	=	Imperial gallons (Imp gal)
US gallons (US gal)	x 3.785	=	Litres (l)	x 0.264	=	US gallons (US gal)

Mass (weight)

Ounces (oz)	x 28.35	=	Grams (g)	x 0.035	=	Ounces (oz)
Pounds (lb)	x 0.454	=	Kilograms (kg)	x 2.205	=	Pounds (lb)

Force

Ounces-force (ozf; oz)	x 0.278	=	Newtons (N)	x 3.6	=	Ounces-force (ozf; oz)
Pounds-force (lbf; lb)	x 4.448	=	Newtons (N)	x 0.225	=	Pounds-force (lbf; lb)
Newtons (N)	x 0.1	=	Kilograms-force (kgf; kg)	x 9.81	=	Newtons (N)

Pressure

Pounds-force per square inch (psi; lbf/in^2; lb/in^2)	x 0.070	=	Kilograms-force per square centimetre (kgf/cm^2; kg/cm^2)	x 14.223	=	Pounds-force per square inch (psi; lbf/in^2; lb/in^2)
Pounds-force per square inch (psi; lbf/in^2; lb/in^2)	x 0.068	=	Atmospheres (atm)	x 14.696	=	Pounds-force per square inch (psi; lbf/in^2; lb/in^2)
Pounds-force per square inch (psi; lbf/in^2; lb/in^2)	x 0.069	=	Bars	x 14.5	=	Pounds-force per square inch (psi; lbf/in^2; lb/in^2)
Pounds-force per square inch (psi; lbf/in^2; lb/in^2)	x 6.895	=	Kilopascals (kPa)	x 0.145	=	Pounds-force per square inch (psi; lbf/in^2; lb/in^2)
Kilopascals (kPa)	x 0.01	=	Kilograms-force per square centimetre (kgf/cm^2; kg/cm^2)	x 98.1	=	Kilopascals (kPa)
Millibar (mbar)	x 100	=	Pascals (Pa)	x 0.01	=	Millibar (mbar)
Millibar (mbar)	x 0.0145	=	Pounds-force per square inch (psi; lbf/in^2; lb/in^2)	x 68.947	=	Millibar (mbar)
Millibar (mbar)	x 0.75	=	Millimetres of mercury (mmHg)	x 1.333	=	Millibar (mbar)
Millibar (mbar)	x 0.401	=	Inches of water (inH_2O)	x 2.491	=	Millibar (mbar)
Millimetres of mercury (mmHg)	x 0.535	=	Inches of water (inH_2O)	x 1.868	=	Millimetres of mercury (mmHg)
Inches of water (inH_2O)	x 0.036	=	Pounds-force per square inch (psi; lbf/in^2; lb/in^2)	x 27.68	=	Inches of water (inH_2O)

Torque (moment of force)

Pounds-force inches (lbf in; lb in)	x 1.152	=	Kilograms-force centimetre (kgf cm; kg cm)	x 0.868	=	Pounds-force inches (lbf in; lb in)
Pounds-force inches (lbf in; lb in)	x 0.113	=	Newton metres (Nm)	x 8.85	=	Pounds-force inches (lbf in; lb in)
Pounds-force inches (lbf in; lb in)	x 0.083	=	Pounds-force feet (lbf ft; lb ft)	x 12	=	Pounds-force inches (lbf in; lb in)
Pounds-force feet (lbf ft; lb ft)	x 0.138	=	Kilograms-force metres (kgf m; kg m)	x 7.233	=	Pounds-force feet (lbf ft; lb ft)
Pounds-force feet (lbf ft; lb ft)	x 1.356	=	Newton metres (Nm)	x 0.738	=	Pounds-force feet (lbf ft; lb ft)
Newton metres (Nm)	x 0.102	=	Kilograms-force metres (kgf m; kg m)	x 9.804	=	Newton metres (Nm)

Power

Horsepower (hp)	x 745.7	=	Watts (W)	x 0.0013	=	Horsepower (hp)

Velocity (speed)

Miles per hour (miles/hr; mph)	x 1.609	=	Kilometres per hour (km/hr; kph)	x 0.621	=	Miles per hour (miles/hr; mph)

Fuel consumption*

Miles per gallon (mpg)	x 0.354	=	Kilometres per litre (km/l)	x 2.825	=	Miles per gallon (mpg)

** It is common practice to convert from miles per gallon (mpg) to litres/100 kilometres (l/100km), where mpg x l/100 km = 282*

Temperature

Degrees Fahrenheit = (°C x 1.8) + 32

Degrees Celsius (Degrees Centigrade; °C) = (°F - 32) x 0.56

Spare parts are available from many sources, for example: Vauxhall dealers, other garages and accessory shops, and motor factors. Our advice regarding spare part sources is as follows.

Officially appointed Vauxhall dealers

This is the best source of parts that are peculiar to your car and are otherwise not generally available (e.g. complete cylinder heads, transmission components, badges, interior trim, etc.). It is also the only place at which you should buy parts if your vehicle is still under warranty - use of non-Vauxhall components may invalidate the warranty. To be sure of obtaining the correct parts it will always be necessary to give the storeman your car's vehicle identification number, and if possible, to take the "old" parts along for positive identification. Remember that many parts are available on a factory exchange scheme - any parts returned should always be clean! It obviously makes good sense to go straight to the specialists on your car for this type of part for they are best equipped to supply you.

Other garages and accessory shops

These are often very good places to buy materials and components needed for the maintenance of your car (e.g. oil filters, spark plugs, bulbs, drivebelts, oils and greases, touch-up paint, filler paste, etc.). They also sell general accessories, usually have convenient opening hours, charge lower prices and can often be found not far from home.

Motor factors

Good factors will stock all the more important components that wear out relatively quickly (e.g. clutch components, pistons, valves, exhaust systems, brake cylinders/pipes/hoses/seals/shoes and pads, etc.). Motor factors will often provide new or reconditioned components on a part exchange basis - this can save considerable amount of money.

Vehicle Identification

Modifications are a continuing and unpublished process in vehicle manufacture, quite apart from major model changes. Spare parts manuals and lists are compiled upon a numerical basis, the individual vehicle numbers being essential to correct identification of the component required.

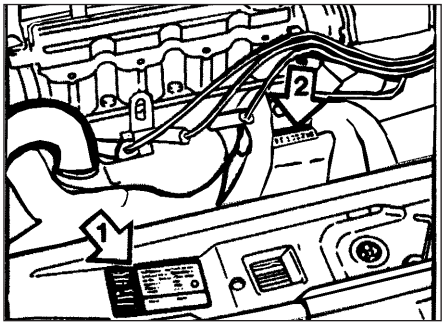
When ordering spare parts, always give as much information as possible. Quote the car model, year of manufacture and vehicle identification and/or engine numbers as appropriate.

The *vehicle identification plate* is riveted on top of the front body panel and includes the Vehicle Identification Number (VIN), vehicle weight information and paint and trim colour codes.

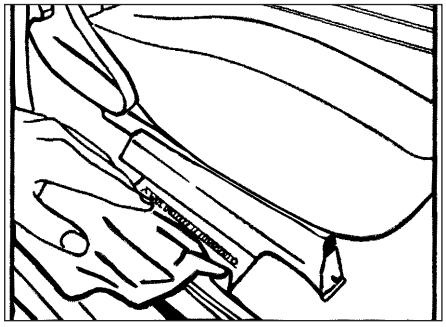
The *Vehicle Identification Number (VIN)* is given on the vehicle identification plate and is also stamped into the body floor panel between the driver's seat and the door sill panel; lift the flap in the carpet to see it.

The engine number is stamped on a horizontal flat located on the exhaust manifold side of the cylinder block, at the distributor end.

During 1995, Vauxhall introduced 'Car pass'. This is a card, which is issued to the customer when the car is first bought. It contains important information, e.g. VIN number, key number and radio code. It also includes a special code for diagnostic equipment, therefore it must be kept in a secure place and not in the vehicle.



The Vehicle Identification Number (VIN) plate (1) and engine number (2)



The VIN number is also stamped on the floor next to the drivers seat

Whenever servicing, repair or overhaul work is carried out on the car or its components, it is necessary to observe the following procedures and instructions. This will assist in carrying out the operation efficiently and to a professional standard of workmanship.

Joint mating faces and gaskets

When separating components at their mating faces, never insert screwdrivers or similar implements into the joint between the faces in order to prise them apart. This can cause severe damage which results in oil leaks, coolant leaks, etc upon reassembly. Separation is usually achieved by tapping along the joint with a soft-faced hammer in order to break the seal. However, note that this method may not be suitable where dowels are used for component location.

Where a gasket is used between the mating faces of two components, ensure that it is renewed on reassembly, and fit it dry unless otherwise stated in the repair procedure. Make sure that the mating faces are clean and dry, with all traces of old gasket removed. When cleaning a joint face, use a tool which is not likely to score or damage the face, and remove any burrs or nicks with an oilstone or fine file.

Make sure that tapped holes are cleaned with a pipe cleaner, and keep them free of jointing compound, if this is being used, unless specifically instructed otherwise.

Ensure that all orifices, channels or pipes are clear, and blow through them, preferably using compressed air.

Oil seals

Oil seals can be removed by levering them out with a wide flat-bladed screwdriver or similar implement. Alternatively, a number of self-tapping screws may be screwed into the seal, and these used as a purchase for pliers or some similar device in order to pull the seal free.

Whenever an oil seal is removed from its working location, either individually or as part of an assembly, it should be renewed.

The very fine sealing lip of the seal is easily damaged, and will not seal if the surface it contacts is not completely clean and free from scratches, nicks or grooves.

Protect the lips of the seal from any surface which may damage them in the course of fitting. Use tape or a conical sleeve where possible. Lubricate the seal lips with oil before fitting and, on dual-lipped seals, fill the space between the lips with grease.

Unless otherwise stated, oil seals must be fitted with their sealing lips toward the lubricant to be sealed.

Use a tubular drift or block of wood of the appropriate size to install the seal and, if the seal housing is shouldered, drive the seal down to the shoulder. If the seal housing is unshouldered, the seal should be fitted with its face flush with the housing top face (unless otherwise instructed).

Screw threads and fastenings

Seized nuts, bolts and screws are quite a common occurrence where corrosion has set in, and the use of penetrating oil or releasing fluid will often overcome this problem if the offending item is soaked for a while before attempting to release it. The use of an impact driver may also provide a means of releasing such stubborn fastening devices, when used in conjunction with the appropriate screwdriver bit or socket. If none of these methods works, it may be necessary to resort to the careful application of heat, or the use of a hacksaw or nut splitter device.

Studs are usually removed by locking two nuts together on the threaded part, and then using a spanner on the lower nut to unscrew the stud. Studs or bolts which have broken off below the surface of the component in which they are mounted can sometimes be removed using a proprietary stud extractor. Always ensure that a blind tapped hole is completely free from oil, grease, water or other fluid before installing the bolt or stud. Failure to do this could cause the housing to crack due to the hydraulic action of the bolt or stud as it is screwed in.

When tightening a castellated nut to accept a split pin, tighten the nut to the specified torque, where applicable, and then tighten further to the next split pin hole. Never slacken the nut to align the split pin hole, unless stated in the repair procedure.

When checking or retightening a nut or bolt to a specified torque setting, slacken the nut or bolt by a quarter of a turn, and then retighten to the specified setting. However, this should not be attempted where angular tightening has been used.

For some screw fastenings, notably cylinder head bolts or nuts, torque wrench settings are no longer specified for the latter stages of tightening, “angle-tightening” being called up instead. Typically, a fairly low torque wrench setting will be applied to the bolts/nuts in the correct sequence, followed by one or more stages of tightening through specified angles.

Locknuts, locktabs and washers

Any fastening which will rotate against a component or housing in the course of tightening should always have a washer between it and the relevant component or housing.

Spring or split washers should always be renewed when they are used to lock a critical component such as a big-end bearing retaining bolt or nut. Locktabs which are folded over to retain a nut or bolt should always be renewed.

Self-locking nuts can be re-used in non-critical areas, providing resistance can be felt when the locking portion passes over the bolt or stud thread. However, it should be noted that self-locking stiffnuts tend to lose their effectiveness after long periods of use, and in such cases should be renewed as a matter of course.

Split pins must always be replaced with new ones of the correct size for the hole.

When thread-locking compound is found on the threads of a fastener which is to be re-used, it should be cleaned off with a wire brush and solvent, and fresh compound applied on reassembly.

Special tools

Some repair procedures in this manual entail the use of special tools such as a press, two or three-legged pullers, spring compressors, etc. Wherever possible, suitable readily-available alternatives to the manufacturer’s special tools are described, and are shown in use. Unless you are highly-skilled and have a thorough understanding of the procedures described, never attempt to bypass the use of any special tool when the procedure described specifies its use. Not only is there a very great risk of personal injury, but expensive damage could be caused to the components involved.

Environmental considerations

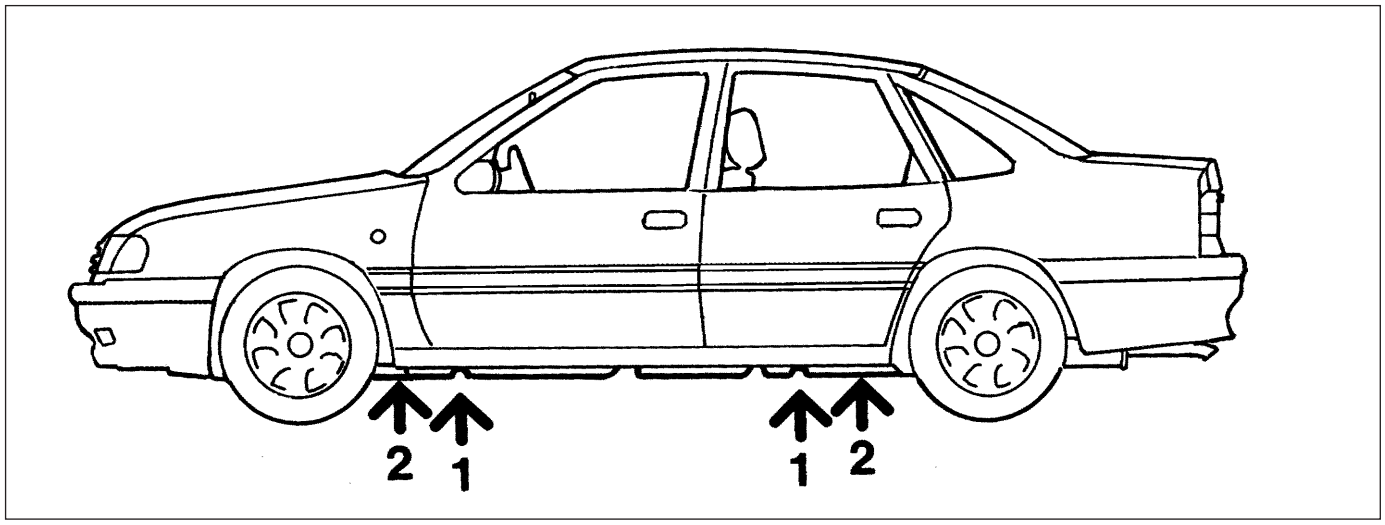
When disposing of used engine oil, brake fluid, antifreeze, etc, give due consideration to any detrimental environmental effects. Do not, for instance, pour any of the above liquids down drains into the general sewage system, or onto the ground to soak away. Many local council refuse tips provide a facility for waste oil disposal, as do some garages. If none of these facilities are available, consult your local Environmental Health Department for further advice.

With the universal tightening-up of legislation regarding the emission of environmentally-harmful substances from motor vehicles, most current vehicles have tamperproof devices fitted to the main adjustment points of the fuel system. These devices are primarily designed to prevent unqualified persons from adjusting the fuel/air mixture, with the chance of a consequent increase in toxic emissions. If such devices are encountered during servicing or overhaul, they should, wherever possible, be renewed or refitted in accordance with the vehicle manufacturer’s requirements or current legislation.

Note: It is antisocial and illegal to dump oil down the drain. To find the location of your local oil recycling bank, call this number free.

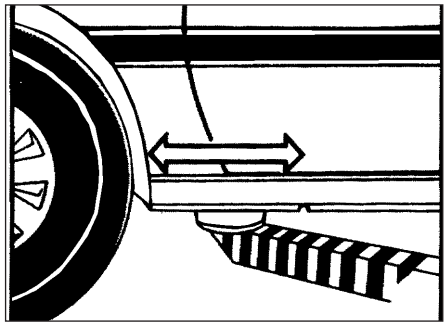
The jack supplied with the vehicle tool kit should only be used for changing roadwheels. When carrying out any other kind of work, raise the vehicle using a hydraulic jack, and always supplement the jack with axle stands positioned under the vehicle jacking points.

When jacking up the vehicle with a trolley jack, position the jack head under one of the relevant jacking points (note that the jacking points for use with a hydraulic jack are different to those for use with the vehicle jack). **Do not** jack the vehicle under the sump or any of the steering or suspension components. Supplement the jack using axle stands. The jacking points and axle stand positions are shown in the accompanying illustrations. **Never** *work under, around, or near a raised vehicle, unless it is adequately supported in at least two places.*

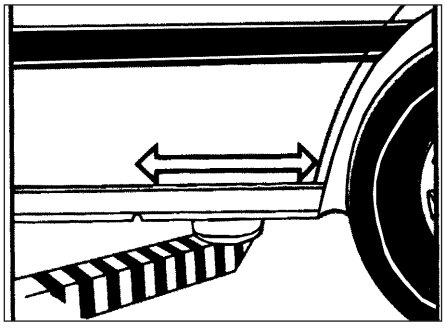


Location of jacking points

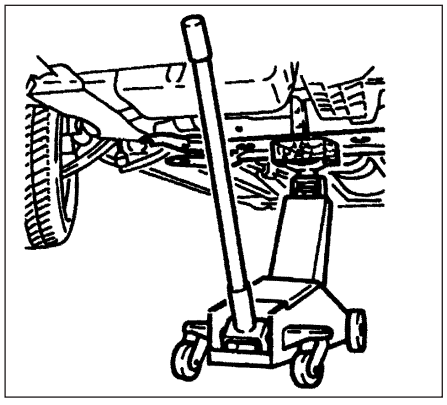
1 Jacking points for use with vehicle jack 2 Jacking points for use with hydraulic jack or axle stands



Front jacking point for hydraulic jack or axle stands



Rear jacking point for hydraulic jack or axle stands



When raising the front of the vehicle, locate the jack underneath the centre of the subframe. Note the use of the block of wood placed on the jack head

Radio/cassette unit Anti-theft System

The radio/cassette unit fitted as standard equipment by Vauxhall is equipped with a built-in security code, to deter thieves. If the power source to the unit is cut, the anti-theft system will activate. Even if the power source is immediately reconnected, the radio/cassette unit will not function until the correct security code has been entered. Therefore, if you do not know the correct security code for the radio/cassette unit, do not disconnect the battery negative terminal of the battery, or remove the radio/cassette unit from the vehicle.

Refer to the Audio handbook supplied in the owners handbook pack, for further details of how to use the code.

If you should loose or forget the code, seek the advice of your Vauxhall dealer. On presentation of proof of ownership, a Vauxhall dealer will be able to unlock the unit and provide you with a new security code.

Introduction

A selection of good tools is a fundamental requirement for anyone contemplating the maintenance and repair of a motor vehicle. For the owner who does not possess any, their purchase will prove a considerable expense, offsetting some of the savings made by doing-it-yourself. However, provided that the tools purchased meet the relevant national safety standards and are of good quality, they will last for many years and prove an extremely worthwhile investment.

To help the average owner to decide which tools are needed to carry out the various tasks detailed in this manual, we have compiled three lists of tools under the following headings: *Maintenance and minor repair, Repair and overhaul*, and *Special*. Newcomers to practical mechanics should start off with the *Maintenance and minor repair* tool kit, and confine themselves to the simpler jobs around the vehicle. Then, as confidence and experience grow, more difficult tasks can be undertaken, with extra tools being purchased as, and when, they are needed. In this way, a *Maintenance and minor repair* tool kit can be built up into a *Repair and overhaul* tool kit over a considerable period of time, without any major cash outlays. The experienced do-it-yourselfer will have a tool kit good enough for most repair and overhaul procedures, and will add tools from the *Special* category when it is felt that the expense is justified by the amount of use to which these tools will be put.

Maintenance and minor repair tool kit

The tools given in this list should be considered as a minimum requirement if routine maintenance, servicing and minor repair operations are to be undertaken. We recommend the purchase of combination spanners (ring one end, open-ended the other); although more expensive than open-ended ones, they do give the advantages of both types of spanner.

- ☐ *Combination spanners:*
  Metric - 8 to 19 mm inclusive
- ☐ *Adjustable spanner - 35 mm jaw (approx.)*
- ☐ *Spark plug spanner (with rubber insert) - petrol models*
- ☐ *Spark plug gap adjustment tool - petrol models*
- ☐ *Set of feeler gauges*
- ☐ *Brake bleed nipple spanner*
- ☐ *Screwdrivers:*
  Flat blade - 100 mm long x 6 mm dia
  Cross blade - 100 mm long x 6 mm dia
- ☐ *Combination pliers*
- ☐ *Hacksaw (junior)*
- ☐ *Tyre pump*
- ☐ *Tyre pressure gauge*
- ☐ *Oil can*
- ☐ *Oil filter removal tool*
- ☐ *Fine emery cloth*
- ☐ *Wire brush (small)*
- ☐ *Funnel (medium size)*

Repair and overhaul tool kit

These tools are virtually essential for anyone undertaking any major repairs to a motor vehicle, and are additional to those given in the *Maintenance and minor repair* list. Included in this list is a comprehensive set of sockets. Although these are expensive, they will be found invaluable as they are so versatile - particularly if various drives are included in the set. We recommend the half-inch square-drive type, as this can be used with most proprietary torque wrenches.

The tools in this list will sometimes need to be supplemented by tools from the *Special* list:

- ☐ *Sockets (or box spanners) to cover range in previous list (including Torx sockets)*
- ☐ *Reversible ratchet drive (for use with sockets)*
- ☐ *Extension piece, 250 mm (for use with sockets)*
- ☐ *Universal joint (for use with sockets)*
- ☐ *Torque wrench (for use with sockets)*
- ☐ *Self-locking grips*
- ☐ *Ball pein hammer*
- ☐ *Soft-faced mallet (plastic/aluminium or rubber)*
- ☐ *Screwdrivers:*
  Flat blade - long & sturdy, short (chubby), and narrow (electrician's) types
  Cross blade – Long & sturdy, and short (chubby) types
- ☐ *Pliers:*
  Long-nosed
  Side cutters (electrician's)
  Circlip (internal and external)
- ☐ *Cold chisel - 25 mm*
- ☐ *Scriber*
- ☐ *Scraper*
- ☐ *Centre-punch*
- ☐ *Pin punch*
- ☐ *Hacksaw*
- ☐ *Brake hose clamp*
- ☐ *Brake/clutch bleeding kit*
- ☐ *Selection of twist drills*
- ☐ *Steel rule/straight-edge*
- ☐ *Allen keys (inc. splined/Torx type)*
- ☐ *Selection of files*
- ☐ *Wire brush*
- ☐ *Axle stands*
- ☐ *Jack (strong trolley or hydraulic type)*
- ☐ *Light with extension lead*

Sockets and reversible ratchet drive

Valve spring compressor

Spline bit set

Piston ring compressor

Clutch plate alignment set

Special tools

The tools in this list are those which are not used regularly, are expensive to buy, or which need to be used in accordance with their manufacturers' instructions. Unless relatively difficult mechanical jobs are undertaken frequently, it will not be economic to buy many of these tools. Where this is the case, you could consider clubbing together with friends (or joining a motorists' club) to make a joint purchase, or borrowing the tools against a deposit from a local garage or tool hire specialist. It is worth noting that many of the larger DIY superstores now carry a large range of special tools for hire at modest rates.

The following list contains only those tools and instruments freely available to the public, and not those special tools produced by the vehicle manufacturer specifically for its dealer network. You will find occasional references to these manufacturers' special tools in the text of this manual. Generally, an alternative method of doing the job without the vehicle manufacturers' special tool is given. However, sometimes there is no alternative to using them. Where this is the case and the relevant tool cannot be bought or borrowed, you will have to entrust the work to a dealer.

☐ *Valve spring compressor*
☐ *Valve grinding tool*
☐ *Piston ring compressor*
☐ *Piston ring removal/installation tool*
☐ *Cylinder bore hone*
☐ *Balljoint separator*
☐ *Coil spring compressors (where applicable)*
☐ *Two/three-legged hub and bearing puller*
☐ *Impact screwdriver*
☐ *Micrometer and/or vernier calipers*
☐ *Dial gauge*
☐ *Stroboscopic timing light*
☐ *Dwell angle meter/tachometer*
☐ *Universal electrical multi-meter*
☐ *Cylinder compression gauge*
☐ *Hand-operated vacuum pump and gauge*
☐ *Clutch plate alignment set*
☐ *Brake shoe steady spring cup removal tool*
☐ *Bush and bearing removal/installation set*
☐ *Stud extractors*
☐ *Tap and die set*
☐ *Lifting tackle*
☐ *Trolley jack*

Buying tools

Reputable motor accessory shops and superstores often offer excellent quality tools at discount prices, so it pays to shop around.

Remember, you don't have to buy the most expensive items on the shelf, but it is always advisable to steer clear of the very cheap tools. Beware of 'bargains' offered on market stalls or at car boot sales. There are plenty of good tools around at reasonable prices, but always aim to purchase items which meet the relevant national safety standards. If in doubt, ask the proprietor or manager of the shop for advice before making a purchase.

Care and maintenance of tools

Having purchased a reasonable tool kit, it is necessary to keep the tools in a clean and serviceable condition. After use, always wipe off any dirt, grease and metal particles using a clean, dry cloth, before putting the tools away. Never leave them lying around after they have been used. A simple tool rack on the garage or workshop wall for items such as screwdrivers and pliers is a good idea. Store all normal spanners and sockets in a metal box. Any measuring instruments, gauges, meters, etc, must be carefully stored where they cannot be damaged or become rusty.

Take a little care when tools are used. Hammer heads inevitably become marked, and screwdrivers lose the keen edge on their blades from time to time. A little timely attention with emery cloth or a file will soon restore items like this to a good finish.

Working facilities

Not to be forgotten when discussing tools is the workshop itself. If anything more than routine maintenance is to be carried out, a suitable working area becomes essential.

It is appreciated that many an owner-mechanic is forced by circumstances to remove an engine or similar item without the benefit of a garage or workshop. Having done this, any repairs should always be done under the cover of a roof.

Wherever possible, any dismantling should be done on a clean, flat workbench or table at a suitable working height.

Any workbench needs a vice; one with a jaw opening of 100 mm is suitable for most jobs. As mentioned previously, some clean dry storage space is also required for tools, as well as for any lubricants, cleaning fluids, touch-up paints etc, which become necessary.

Another item which may be required, and which has a much more general usage, is an electric drill with a chuck capacity of at least 8 mm. This, together with a good range of twist drills, is virtually essential for fitting accessories.

Last, but not least, always keep a supply of old newspapers and clean, lint-free rags available, and try to keep any working area as clean as possible.

Micrometer set

Dial test indicator ("dial gauge")

Stroboscopic timing light

Compression tester

Stud extractor set

MOT Test Checks

This is a guide to getting your vehicle through the MOT test. Obviously it will not be possible to examine the vehicle to the same standard as the professional MOT tester. However, working through the following checks will enable you to identify any problem areas before submitting the vehicle for the test.

Where a testable component is in borderline condition, the tester has discretion in deciding whether to pass or fail it. The basis of such discretion is whether the tester would be happy for a close relative or friend to use the vehicle with the component in that condition. If the vehicle presented is clean and evidently well cared for, the tester may be more inclined to pass a borderline component than if the vehicle is scruffy and apparently neglected.

It has only been possible to summarise the test requirements here, based on the regulations in force at the time of printing. Test standards are becoming increasingly stringent, although there are some exemptions for older vehicles. For full details obtain a copy of the Haynes publication Pass the MOT! (available from stockists of Haynes manuals).

An assistant will be needed to help carry out some of these checks.

The checks have been sub-divided into four categories, as follows:

1 Checks carried out **FROM THE DRIVER'S SEAT**

2 Checks carried out **WITH THE VEHICLE ON THE GROUND**

3 Checks carried out **WITH THE VEHICLE RAISED AND THE WHEELS FREE TO TURN**

4 Checks carried out on **YOUR VEHICLE'S EXHAUST EMISSION SYSTEM**

1 Checks carried out FROM THE DRIVER'S SEAT

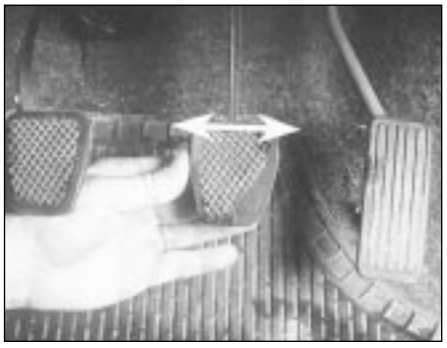
Handbrake

☐ Test the operation of the handbrake. Excessive travel (too many clicks) indicates incorrect brake or cable adjustment.

☐ Check that the handbrake cannot be released by tapping the lever sideways. Check the security of the lever mountings.

Footbrake

☐ Depress the brake pedal and check that it does not creep down to the floor, indicating a master cylinder fault. Release the pedal, wait a few seconds, then depress it again. If the pedal travels nearly to the floor before firm resistance is felt, brake adjustment or repair is necessary. If the pedal feels spongy, there is air in the hydraulic system which must be removed by bleeding.



☐ Check that the brake pedal is secure and in good condition. Check also for signs of fluid leaks on the pedal, floor or carpets, which would indicate failed seals in the brake master cylinder.

☐ Check the servo unit (when applicable) by operating the brake pedal several times, then keeping the pedal depressed and starting the engine. As the engine starts, the pedal will move down slightly. If not, the vacuum hose or the servo itself may be faulty.

Steering wheel and column

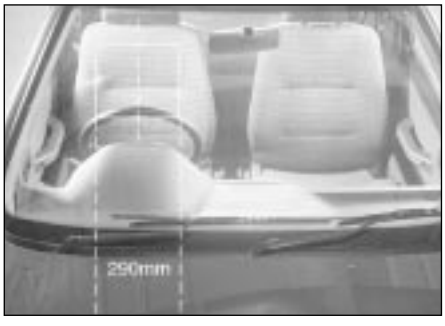
☐ Examine the steering wheel for fractures or looseness of the hub, spokes or rim.

☐ Move the steering wheel from side to side and then up and down. Check that the steering wheel is not loose on the column, indicating wear or a loose retaining nut. Continue moving the steering wheel as before, but also turn it slightly from left to right.

☐ Check that the steering wheel is not loose on the column, and that there is no abnormal movement of the steering wheel, indicating wear in the column support bearings or couplings.

Windscreen and mirrors

☐ The windscreen must be free of cracks or other significant damage within the driver's field of view. (Small stone chips are acceptable.) Rear view mirrors must be secure, intact, and capable of being adjusted.



Seat belts and seats

Note: *The following checks are applicable to all seat belts, front and rear.*

☐ Examine the webbing of all the belts (including rear belts if fitted) for cuts, serious fraying or deterioration. Fasten and unfasten each belt to check the buckles. If applicable, check the retracting mechanism. Check the security of all seat belt mountings accessible from inside the vehicle.
☐ The front seats themselves must be securely attached and the backrests must lock in the upright position.

Doors

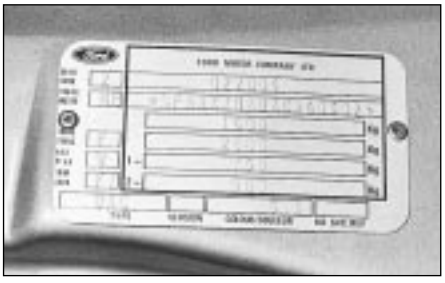
☐ Both front doors must be able to be opened and closed from outside and inside, and must latch securely when closed.

2 Checks carried out WITH THE VEHICLE ON THE GROUND

Vehicle identification

☐ Number plates must be in good condition, secure and legible, with letters and numbers correctly spaced – spacing at (A) should be twice that at (B).

☐ The VIN plate and/or homologation plate must be legible.



Electrical equipment

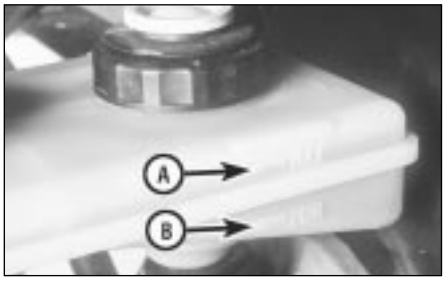
☐ Switch on the ignition and check the operation of the horn.
☐ Check the windscreen washers and wipers, examining the wiper blades; renew damaged or perished blades. Also check the operation of the stop-lights.

☐ Check the operation of the sidelights and number plate lights. The lenses and reflectors must be secure, clean and undamaged.
☐ Check the operation and alignment of the headlights. The headlight reflectors must not be tarnished and the lenses must be undamaged.
☐ Switch on the ignition and check the operation of the direction indicators (including the instrument panel tell-tale) and the hazard warning lights. Operation of the sidelights and stop-lights must not affect the indicators - if it does, the cause is usually a bad earth at the rear light cluster.
☐ Check the operation of the rear foglight(s), including the warning light on the instrument panel or in the switch.

Footbrake

☐ Examine the master cylinder, brake pipes and servo unit for leaks, loose mountings, corrosion or other damage.

☐ The fluid reservoir must be secure and the fluid level must be between the upper (**A**) and lower (**B**) markings.



☐ Inspect both front brake flexible hoses for cracks or deterioration of the rubber. Turn the steering from lock to lock, and ensure that the hoses do not contact the wheel, tyre, or any part of the steering or suspension mechanism. With the brake pedal firmly depressed, check the hoses for bulges or leaks under pressure.

Steering and suspension

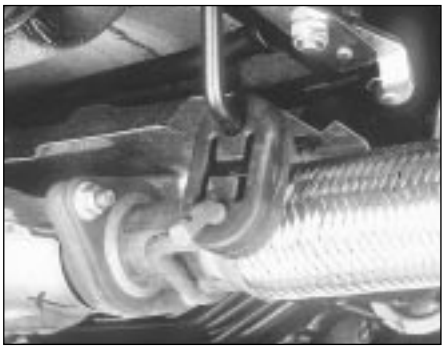
☐ Have your assistant turn the steering wheel from side to side slightly, up to the point where the steering gear just begins to transmit this movement to the roadwheels. Check for excessive free play between the steering wheel and the steering gear, indicating wear or insecurity of the steering column joints, the column-to-steering gear coupling, or the steering gear itself.
☐ Have your assistant turn the steering wheel more vigorously in each direction, so that the roadwheels just begin to turn. As this is done, examine all the steering joints, linkages, fittings and attachments. Renew any component that shows signs of wear or damage. On vehicles with power steering, check the security and condition of the steering pump, drivebelt and hoses.
☐ Check that the vehicle is standing level, and at approximately the correct ride height.

Shock absorbers

☐ Depress each corner of the vehicle in turn, then release it. The vehicle should rise and then settle in its normal position. If the vehicle continues to rise and fall, the shock absorber is defective. A shock absorber which has seized will also cause the vehicle to fail.

Exhaust system

☐ Start the engine. With your assistant holding a rag over the tailpipe, check the entire system for leaks. Repair or renew leaking sections.



3 Checks carried out **WITH THE VEHICLE RAISED AND THE WHEELS FREE TO TURN**

Jack up the front and rear of the vehicle, and securely support it on axle stands. Position the stands clear of the suspension assemblies. Ensure that the wheels are clear of the ground and that the steering can be turned from lock to lock.

Steering mechanism

☐ Have your assistant turn the steering from lock to lock. Check that the steering turns smoothly, and that no part of the steering mechanism, including a wheel or tyre, fouls any brake hose or pipe or any part of the body structure.

☐ Examine the steering rack rubber gaiters for damage or insecurity of the retaining clips. If power steering is fitted, check for signs of damage or leakage of the fluid hoses, pipes or connections. Also check for excessive stiffness or binding of the steering, a missing split pin or locking device, or severe corrosion of the body structure within 30 cm of any steering component attachment point.

Front and rear suspension and wheel bearings

☐ Starting at the front right-hand side, grasp the roadwheel at the 3 o'clock and 9 o'clock positions and shake it vigorously. Check for free play or insecurity at the wheel bearings, suspension balljoints, or suspension mountings, pivots and attachments.

☐ Now grasp the wheel at the 12 o'clock and 6 o'clock positions and repeat the previous inspection. Spin the wheel, and check for roughness or tightness of the front wheel bearing.

☐ If excess free play is suspected at a component pivot point, this can be confirmed by using a large screwdriver or similar tool and levering between the mounting and the component attachment. This will confirm whether the wear is in the pivot bush, its retaining bolt, or in the mounting itself (the bolt holes can often become elongated).

☐ Carry out all the above checks at the other front wheel, and then at both rear wheels.

Springs and shock absorbers

☐ Examine the suspension struts (when applicable) for serious fluid leakage, corrosion, or damage to the casing. Also check the security of the mounting points.

☐ If coil springs are fitted, check that the spring ends locate in their seats, and that the spring is not corroded, cracked or broken.

☐ If leaf springs are fitted, check that all leaves are intact, that the axle is securely attached to each spring, and that there is no deterioration of the spring eye mountings, bushes, and shackles.

☐ The same general checks apply to vehicles fitted with other suspension types, such as torsion bars, hydraulic displacer units, etc. Ensure that all mountings and attachments are secure, that there are no signs of excessive wear, corrosion or damage, and (on hydraulic types) that there are no fluid leaks or damaged pipes.

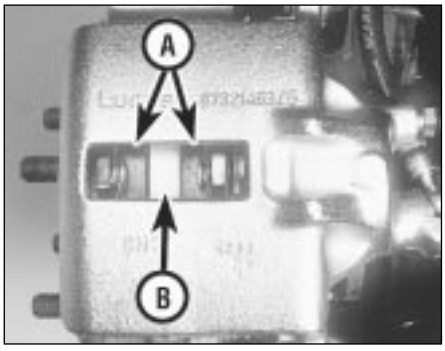
☐ Inspect the shock absorbers for signs of serious fluid leakage. Check for wear of the mounting bushes or attachments, or damage to the body of the unit.

Driveshafts (fwd vehicles only)

☐ Rotate each front wheel in turn and inspect the constant velocity joint gaiters for splits or damage. Also check that each driveshaft is straight and undamaged.

Braking system

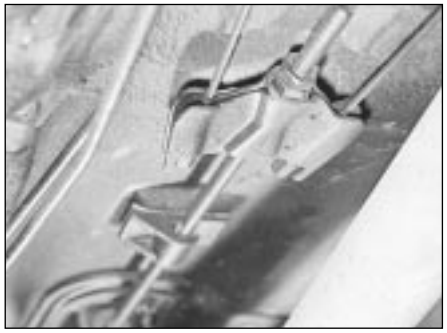
☐ If possible without dismantling, check brake pad wear and disc condition. Ensure that the friction lining material has not worn excessively, (A) and that the discs are not fractured, pitted, scored or badly worn (B).



☐ Examine all the rigid brake pipes underneath the vehicle, and the flexible hose(s) at the rear. Look for corrosion, chafing or insecurity of the pipes, and for signs of bulging under pressure, chafing, splits or deterioration of the flexible hoses.

☐ Look for signs of fluid leaks at the brake calipers or on the brake backplates. Repair or renew leaking components.

☐ Slowly spin each wheel, while your assistant depresses and releases the footbrake. Ensure that each brake is operating and does not bind when the pedal is released.



☐ Examine the handbrake mechanism, checking for frayed or broken cables, excessive corrosion, or wear or insecurity of the linkage. Check that the mechanism works on each relevant wheel, and releases fully, without binding.

☐ It is not possible to test brake efficiency without special equipment, but a road test can be carried out later to check that the vehicle pulls up in a straight line.

Fuel and exhaust systems

☐ Inspect the fuel tank (including the filler cap), fuel pipes, hoses and unions. All components must be secure and free from leaks.

☐ Examine the exhaust system over its entire length, checking for any damaged, broken or missing mountings, security of the retaining clamps and rust or corrosion.

Wheels and tyres

☐ Examine the sidewalls and tread area of each tyre in turn. Check for cuts, tears, lumps, bulges, separation of the tread, and exposure of the ply or cord due to wear or damage. Check that the tyre bead is correctly seated on the wheel rim, that the valve is sound and

properly seated, and that the wheel is not distorted or damaged.

☐ Check that the tyres are of the correct size for the vehicle, that they are of the same size and type on each axle, and that the pressures are correct.

☐ Check the tyre tread depth. The legal minimum at the time of writing is 1.6 mm over at least three-quarters of the tread width. Abnormal tread wear may indicate incorrect front wheel alignment.

Body corrosion

☐ Check the condition of the entire vehicle structure for signs of corrosion in load-bearing areas. (These include chassis box sections, side sills, cross-members, pillars, and all suspension, steering, braking system and seat belt mountings and anchorages.) Any corrosion which has seriously reduced the thickness of a load-bearing area is likely to cause the vehicle to fail. In this case professional repairs are likely to be needed.

☐ Damage or corrosion which causes sharp or otherwise dangerous edges to be exposed will also cause the vehicle to fail.

4 Checks carried out on YOUR VEHICLE'S EXHAUST EMISSION SYSTEM

Petrol models

☐ Have the engine at normal operating temperature, and make sure that it is in good tune (ignition system in good order, air filter element clean, etc).

☐ Before any measurements are carried out, raise the engine speed to around 2500 rpm, and hold it at this speed for 20 seconds. Allow the engine speed to return to idle, and watch for smoke emissions from the exhaust tailpipe. If the idle speed is obviously much too high, or if dense blue or clearly-visible black smoke comes from the tailpipe for more than 5 seconds, the vehicle will fail. As a rule of thumb, blue smoke signifies oil being burnt (engine wear) while black smoke signifies unburnt fuel (dirty air cleaner element, or other carburettor or fuel system fault).

☐ An exhaust gas analyser capable of measuring carbon monoxide (CO) and hydrocarbons (HC) is now needed. If such an instrument cannot be hired or borrowed, a local garage may agree to perform the check for a small fee.

CO emissions (mixture)

☐ At the time of writing, the maximum CO level at idle is 3.5% for vehicles first used after August 1986 and 4.5% for older vehicles. From January 1996 a much tighter limit (around 0.5%) applies to catalyst-equipped vehicles first used from August 1992. If the CO level cannot be reduced far enough to pass the test (and the fuel and ignition systems are otherwise in good condition) then the carburettor is badly worn, or there is some problem in the fuel injection system or catalytic converter (as applicable).

HC emissions

☐ With the CO emissions within limits, HC emissions must be no more than 1200 ppm (parts per million). If the vehicle fails this test at idle, it can be re-tested at around 2000 rpm; if the HC level is then 1200 ppm or less, this counts as a pass.

☐ Excessive HC emissions can be caused by oil being burnt, but they are more likely to be due to unburnt fuel.

Diesel models

☐ The only emission test applicable to Diesel engines is the measuring of exhaust smoke density. The test involves accelerating the engine several times to its maximum unloaded speed.

Note: *It is of the utmost importance that the engine timing belt is in good condition before the test is carried out.*

☐ Excessive smoke can be caused by a dirty air cleaner element. Otherwise, professional advice may be needed to find the cause.

Engine

- ☐ Engine fails to rotate when attempting to start
- ☐ Engine rotates, but will not start
- ☐ Engine difficult to start when cold
- ☐ Engine difficult to start when hot
- ☐ Starter motor noisy or excessively rough in engagement
- ☐ Engine starts, but stops immediately
- ☐ Engine idles erratically
- ☐ Engine misfires at idle speed
- ☐ Engine misfires throughout the driving speed range
- ☐ Engine hesitates on acceleration
- ☐ Engine stalls
- ☐ Engine lacks power
- ☐ Engine backfires
- ☐ Oil pressure warning light illuminated with engine running
- ☐ Engine runs-on after switching off
- ☐ Engine noises

Cooling system

- ☐ Overheating
- ☐ Overcooling
- ☐ External coolant leakage
- ☐ Internal coolant leakage
- ☐ Corrosion

Fuel and exhaust systems

- ☐ Excessive fuel consumption
- ☐ Fuel leakage and/or fuel odour
- ☐ Excessive noise or fumes from exhaust system

Clutch

- ☐ Pedal travels to floor - no pressure or very little resistance
- ☐ Clutch fails to disengage (unable to select gears)
- ☐ Clutch slips (engine speed increases, with no increase in vehicle speed)
- ☐ Judder as clutch is engaged
- ☐ Noise when depressing or releasing clutch pedal

Manual transmission

- ☐ Noisy in neutral with engine running
- ☐ Noisy in one particular gear
- ☐ Difficulty engaging gears
- ☐ Jumps out of gear
- ☐ Vibration
- ☐ Lubricant leaks

Automatic transmission

- ☐ Fluid leakage
- ☐ Transmission fluid brown, or has burned smell
- ☐ General gear selection problems
- ☐ Transmission will not downshift (kickdown) with accelerator fully depressed
- ☐ Engine will not start in any gear, or starts in gears other than Park or Neutral
- ☐ Transmission slips, shifts roughly, is noisy, or has no drive in forward or reverse gears

Driveshafts

- ☐ Clicking or knocking noise on turns (at slow speed on full-lock)
- ☐ Vibration when accelerating or decelerating

Braking system

- ☐ Vehicle pulls to one side under braking
- ☐ Noise (grinding or high-pitched squeal) when brakes applied
- ☐ Excessive brake pedal travel
- ☐ Brake pedal feels spongy when depressed
- ☐ Excessive brake pedal effort required to stop vehicle
- ☐ Judder felt through brake pedal or steering wheel when braking
- ☐ Brakes binding
- ☐ Rear wheels locking under normal braking

Suspension and steering systems

- ☐ Vehicle pulls to one side
- ☐ Wheel wobble and vibration
- ☐ Excessive pitching and/or rolling around corners, or during braking
- ☐ Wandering or general instability
- ☐ Excessively stiff steering
- ☐ Excessive play in steering
- ☐ Lack of power assistance
- ☐ Tyre wear excessive

Electrical system

- ☐ Battery will not hold a charge for more than a few days
- ☐ Ignition/no-charge warning light remains illuminated with engine running
- ☐ Ignition/no-charge warning light fails to come on
- ☐ Lights inoperative
- ☐ Instrument readings inaccurate or erratic
- ☐ Horn inoperative, or unsatisfactory in operation
- ☐ Windscreen/tailgate wipers inoperative, or unsatisfactory in operation
- ☐ Windscreen/tailgate washers inoperative, or unsatisfactory in operation
- ☐ Electric windows inoperative, or unsatisfactory in operation
- ☐ Central locking system inoperative, or unsatisfactory in operation

Introduction

The vehicle owner who does his or her own maintenance according to the recommended service schedules should not have to use this section of the manual very often. Modern component reliability is such that, provided those items subject to wear or deterioration are inspected or renewed at the specified intervals, sudden failure is comparatively rare. Faults do not usually just happen as a result of sudden failure, but develop over a period of time. Major mechanical failures in particular are usually preceded by characteristic symptoms over hundreds or even thousands of miles. Those components that do occasionally fail without warning are often small and easily carried in the vehicle.

With any fault-finding, the first step is to decide where to begin investigations. Sometimes this is obvious, but on other occasions, a little detective work will be necessary. The owner who makes half a dozen haphazard adjustments or replacements may be successful in curing a fault (or its symptoms). However, will be none the wiser if the fault recurs, and ultimately may have spent more time and money than was necessary. A calm and logical approach will be found to be more satisfactory in the long run. Always take into account any warning signs or abnormalities that may have been noticed in the period preceding the fault - power loss, high or low gauge readings, unusual smells, etc. - and remember that failure of components such as fuses or spark plugs may only be pointers to some underlying fault.

The pages that follow provide an easy-reference guide to the more common problems that may occur during the operation of the vehicle. These problems and their possible causes are grouped under headings denoting various components or systems, such as Engine, Cooling system, etc. The Chapter and/or Section that deals with the problem is also shown in brackets. Whatever the fault, certain basic principles apply. These are as follows:

Verify the fault. This is simply a matter of being sure that you know what the symptoms are before starting work. This is particularly important if you are investigating a fault for someone else, who may not have described it very accurately.

Do not overlook the obvious. For example, if the vehicle will not start, is there petrol in the tank? (Do not take anyone else's word on this particular point, and do not trust the fuel gauge either!) If an electrical fault is indicated, look for loose or broken wires before digging out the test gear.

Cure the disease, not the symptom. Substituting a flat battery with a fully charged one will get you off the hard shoulder, but if the underlying cause is not attended to, the new battery will go the same way. Similarly, changing oil-fouled spark plugs for a new set will get you moving again, but remember that the reason for the fouling (if it was not simply an incorrect grade of plug) will have to be established and corrected.

Do not take anything for granted. Particularly, do not forget that a "new" component may itself be defective (especially if it's been rattling around in the boot for months). Also do not leave components out of a fault diagnosis sequence just because they are new or recently fitted. When you do finally diagnose a difficult fault, you will probably realise that all the evidence was there from the start.

Engine

Engine fails to rotate when attempting to start

- ☐ Battery terminal connections loose or corroded (Chapter 1).
- ☐ Battery discharged or faulty (Chapter 5).
- ☐ Broken, loose or disconnected wiring in the starting circuit (Chapter 5).
- ☐ Defective starter solenoid or switch (Chapter 5).
- ☐ Defective starter motor (Chapter 5).
- ☐ Starter pinion or flywheel ring gear teeth loose or broken (Chapters 2A and 5).
- ☐ Engine earth strap broken or disconnected (Chapter 5).

Engine rotates, but will not start

- ☐ Fuel tank empty.
- ☐ Battery discharged (engine rotates slowly), (Chapter 5).
- ☐ Battery terminal connections loose or corroded (Chapter 1).
- ☐ Ignition components damp or damaged (Chapters 1 and 5).
- ☐ Broken, loose or disconnected wiring in the ignition circuit (Chapters 1 and 5).
- ☐ Worn, faulty or incorrectly gapped spark plugs (Chapter 1).
- ☐ Choke mechanism incorrectly adjusted, worn or sticking - carburettor models (Chapter 4A).
- ☐ Faulty fuel cut-off solenoid - carburettor models (Chapter 4A).
- ☐ Fuel injection system fault - fuel-injected models (Chapter 4B).
- ☐ Major mechanical failure (e.g. camshaft drive), (Chapter 2A or 2B).

Engine difficult to start when cold

- ☐ Battery discharged (Chapter 5).
- ☐ Battery terminal connections loose or corroded (Chapter 1).
- ☐ Worn, faulty or incorrectly gapped spark plugs (Chapter 1).
- ☐ Choke mechanism incorrectly adjusted, worn or sticking - carburettor models (Chapter 4A).
- ☐ Fuel injection system fault - fuel-injected models (Chapter 4B).
- ☐ Other ignition system fault (Chapters 1 and 5).
- ☐ Low cylinder compressions (Chapter 2A).

Engine difficult to start when hot

- ☐ Air filter element dirty or clogged (Chapter 1).
- ☐ Choke mechanism incorrectly adjusted, worn or sticking - carburettor models (Chapter 4A).
- ☐ Fuel injection system fault - fuel-injected models (Chapter 4B).
- ☐ Low cylinder compressions (Chapter 2A).

Starter motor noisy or excessively rough in engagement

- ☐ Starter pinion or flywheel ring gear teeth loose or broken (Chapters 2A and 5).
- ☐ Starter motor mounting bolts loose or missing (Chapter 5).
- ☐ Starter motor internal components worn or damaged (Chapter 5).

Engine starts, but stops immediately

- ☐ Loose or faulty electrical connections in the ignition circuit (Chapters 1 and 5B).
- ☐ Vacuum leak at the carburettor/throttle body or inlet manifold (Chapter 4A or 4B).
- ☐ Blocked carburettor jet(s) or internal passages - carburettor models (Chapter 4A).
- ☐ Blocked injector/fuel injection system fault - fuel-injected models (Chapter 4B).

Engine idles erratically

- ☐ Air filter element clogged (Chapter 1).
- ☐ Vacuum leak at the carburettor/throttle body, inlet manifold or associated hoses (Chapter 4A or 4B).
- ☐ Worn, faulty or incorrectly gapped spark plugs (Chapter 1).
- ☐ Uneven or low cylinder compressions (Chapter 2A).
- ☐ Camshaft lobes worn (Chapter 2A or 2B).
- ☐ Timing belt incorrectly tensioned (Chapter 2A or 2B).
- ☐ Blocked carburettor jet(s) or internal passages - carburettor models (Chapter 4A).
- ☐ Blocked injector/fuel injection system fault - fuel-injected models (Chapter 4B).

Engine misfires at idle speed

- ☐ Worn, faulty or incorrectly gapped spark plugs (Chapter 1).
- ☐ Faulty spark plug HT leads (Chapter 1).
- ☐ Vacuum leak at the carburettor/throttle body, inlet manifold or associated hoses (Chapter 4A or 4B).
- ☐ Blocked carburettor jet(s) or internal passages - carburettor models (Chapter 4A).
- ☐ Blocked injector/fuel injection system fault - fuel-injected models (Chapter 4B).
- ☐ Distributor cap cracked or tracking internally (where applicable), (Chapter 1).
- ☐ Uneven or low cylinder compressions (Chapter 2A).
- ☐ Disconnected, leaking, or perished crankcase ventilation hoses (Chapter 4C).

Engine misfires throughout the driving speed range

- ☐ Fuel filter choked (Chapter 1).
- ☐ Fuel pump faulty, or delivery pressure low (Chapter 4A or 4B).
- ☐ Fuel tank vent blocked, or fuel pipes restricted (Chapter 4A or 4B).
- ☐ Vacuum leak at the carburettor/throttle body, inlet manifold or associated hoses (Chapter 4A or 4B).
- ☐ Worn, faulty or incorrectly gapped spark plugs (Chapter 1).
- ☐ Faulty spark plug HT leads (Chapter 1).
- ☐ Distributor cap cracked or tracking internally (where applicable), (Chapter 1).

Engine (continued)

- ☐ Faulty ignition coil (Chapter 5).
- ☐ Uneven or low cylinder compressions (Chapter 2A).
- ☐ Blocked carburettor jet(s) or internal passages - carburettor models (Chapter 4A).
- ☐ Blocked injector/fuel injection system fault - fuel-injected models (Chapter 4B).

Engine hesitates on acceleration

- ☐ Worn, faulty or incorrectly gapped spark plugs (Chapter 1).
- ☐ Vacuum leak at the carburettor/throttle body, inlet manifold or associated hoses (Chapter 4A or 4B).
- ☐ Blocked carburettor jet(s) or internal passages - carburettor models (Chapter 4A).
- ☐ Blocked injector/fuel injection system fault - fuel-injected models (Chapter 4B).

Engine stalls

- ☐ Vacuum leak at the carburettor/throttle body, inlet manifold or associated hoses (Chapter 4A or 4B).
- ☐ Fuel filter choked (Chapter 1).
- ☐ Fuel pump faulty, or delivery pressure low (Chapter 4A or 4B).
- ☐ Fuel tank vent blocked, or fuel pipes restricted (Chapter 4A or 4B).
- ☐ Blocked carburettor jet(s) or internal passages - carburettor models (Chapter 4A).
- ☐ Blocked injector/fuel injection system fault - fuel-injected models (Chapter 4B).

Engine lacks power

- ☐ Timing belt incorrectly fitted or tensioned (Chapter 2A or 2B).
- ☐ Fuel filter choked (Chapter 1).
- ☐ Fuel pump faulty, or delivery pressure low (Chapter 4A or 4B).
- ☐ Uneven or low cylinder compressions (Chapter 2A).
- ☐ Worn, faulty or incorrectly gapped spark plugs (Chapter 1).
- ☐ Vacuum leak at the carburettor/throttle body, inlet manifold or associated hoses (Chapter 4A or 4B).
- ☐ Blocked carburettor jet(s) or internal passages - carburettor models (Chapter 4A).
- ☐ Blocked injector/fuel injection system fault - fuel-injected models (Chapter 4B).
- ☐ Brakes binding (Chapters 1 and 9).
- ☐ Clutch slipping (Chapter 6).

Engine backfires

- ☐ Timing belt incorrectly fitted or tensioned (Chapter 2A or 2B).
- ☐ Vacuum leak at the carburettor/throttle body, inlet manifold or associated hoses (Chapter 4A or 4B).
- ☐ Blocked carburettor jet(s) or internal passages - carburettor models (Chapter 4A).
- ☐ Blocked injector/fuel injection system fault - fuel-injected models (Chapter 4B).

Oil pressure warning light illuminated with engine running

- ☐ Low oil level, or incorrect oil grade (Chapter 1).
- ☐ Faulty oil pressure warning light switch (Chapter 12).
- ☐ Worn engine bearings and/or oil pump (Chapter 2A).
- ☐ High engine operating temperature (Chapter 3).
- ☐ Oil pressure relief valve defective (Chapter 2A).
- ☐ Oil pick-up strainer clogged (Chapter 2A).

Engine runs-on after switching off

- ☐ Excessive carbon build-up in engine (Chapter 2A).
- ☐ High engine operating temperature (Chapter 3).
- ☐ Faulty fuel cut-off solenoid - carburettor models (Chapter 4A).
- ☐ Fuel injection system fault - fuel-injected models (Chapter 4B).

Engine noises

Pre-ignition (pinking) or knocking during acceleration or under load

- ☐ Ignition timing incorrect/ignition system fault (Chapters 1 and 5).
- ☐ Incorrect grade of spark plug (Chapter 1).
- ☐ Incorrect grade of fuel (Chapter 1).
- ☐ Vacuum leak at the carburettor/throttle body, inlet manifold or associated hoses (Chapter 4A or 4B).
- ☐ Excessive carbon build-up in engine (Chapter 2A).
- ☐ Blocked carburettor jet(s) or internal passages - carburettor models (Chapter 4A).
- ☐ Blocked injector/fuel injection system fault - fuel-injected models (Chapter 4B).

Whistling or wheezing noises

- ☐ Leaking inlet manifold or carburettor/throttle body gasket (Chapter 4A or 4B).
- ☐ Leaking exhaust manifold gasket or pipe-to-manifold joint (Chapter 4C).
- ☐ Leaking vacuum hose (Chapters 4A, 4B, 4C, 5, 9 and 12).
- ☐ Blowing cylinder head gasket (Chapter 2A or 2B).

Tapping or rattling noises

- ☐ Worn valve gear or camshaft (Chapter 2A or 2B).
- ☐ Ancillary component fault (coolant pump, alternator, etc.) (Chapters 3, 5, etc.).

Knocking or thumping noises

- ☐ Worn big-end bearings (regular heavy knocking, perhaps less under load), (Chapter 2A or 2B).
- ☐ Worn main bearings (rumbling and knocking, perhaps worsening under load), (Chapter 2A or 2B).
- ☐ Piston slap (most noticeable when cold), (Chapter 2A).
- ☐ Ancillary component fault (coolant pump, alternator, etc.) (Chapters 3, 5, etc.).

Cooling system

Overheating

- ☐ Insufficient coolant in system (Chapter 1).
- ☐ Thermostat faulty (Chapter 3).
- ☐ Radiator core blocked, or grille restricted (Chapter 3).
- ☐ Electric cooling fan or thermoswitch faulty (Chapter 3).
- ☐ Pressure cap faulty (Chapter 3).
- ☐ Ignition timing incorrect/ignition system fault (Chapters 1 and 5).
- ☐ Inaccurate temperature gauge sender unit (Chapter 3).
- ☐ Airlock in cooling system (Chapter 1).

Overcooling

- ☐ Thermostat faulty (Chapter 3).
- ☐ Inaccurate temperature gauge sender unit (Chapter 3).

External coolant leakage

- ☐ Deteriorated or damaged hoses or hose clips (Chapter 1).
- ☐ Radiator core or heater matrix leaking (Chapter 3).
- ☐ Pressure cap faulty (Chapter 3).
- ☐ Water pump seal leaking (Chapter 3).
- ☐ Boiling due to overheating (Chapter 3).
- ☐ Core plug leaking (Chapter 2A).

Internal coolant leakage

- ☐ Leaking cylinder head gasket (Chapter 2A or 2B).
- ☐ Cracked cylinder head or cylinder bore (Chapter 2A or 2B).

Corrosion

- ☐ Infrequent draining and flushing (Chapter 1).
- ☐ Incorrect coolant mixture or inappropriate coolant type (Chapter 1).

Fuel and exhaust systems

Excessive fuel consumption

- ☐ Air filter element dirty or clogged (Chapter 1).
- ☐ Choke cable incorrectly adjusted, or choke sticking - carburettor models (Chapter 4A).
- ☐ Fuel injection system fault - fuel-injected models (Chapter 4B).
- ☐ Ignition timing incorrect/ignition system fault (Chapters 1 and 5).
- ☐ Tyres under-inflated (Chapter 1).

Fuel leakage and/or fuel odour

- ☐ Damaged or corroded fuel tank, pipes or connections (Chapter 4A or 4B).
- ☐ Carburettor float chamber flooding (float height incorrect) - carburettor models (Chapter 4A).

Excessive noise or fumes from exhaust system

- ☐ Leaking exhaust system or manifold joints (Chapters 1 and 4C).
- ☐ Leaking, corroded or damaged silencers or pipe (Chapters 1 and 4C).
- ☐ Broken mountings causing body or suspension contact (Chapter 1).

Clutch

Pedal travels to floor - no pressure or very little resistance

- ☐ Broken clutch cable (Chapter 6).
- ☐ Incorrect clutch cable adjustment (Chapter 6).
- ☐ Broken clutch release bearing or fork (Chapter 6).
- ☐ Broken diaphragm spring in clutch pressure plate (Chapter 6).

Clutch fails to disengage (unable to select gears).

- ☐ Incorrect clutch cable adjustment (Chapter 6).
- ☐ Clutch disc sticking on transmission input shaft splines (Chapter 6).
- ☐ Clutch disc sticking to flywheel or pressure plate (Chapter 6).
- ☐ Faulty pressure plate assembly (Chapter 6).
- ☐ Clutch release mechanism worn or incorrectly assembled (Chapter 6).

Clutch slips (engine speed increases, with no increase in vehicle speed).

- ☐ Incorrect clutch cable adjustment (Chapter 6).
- ☐ Clutch disc linings excessively worn (Chapter 6).
- ☐ Clutch disc linings contaminated with oil or grease (Chapter 6).
- ☐ Faulty pressure plate or weak diaphragm spring (Chapter 6).

Judder as clutch is engaged

- ☐ Clutch disc linings contaminated with oil or grease (Chapter 6).
- ☐ Clutch disc linings excessively worn (Chapter 6).
- ☐ Clutch cable sticking or frayed (Chapter 6).
- ☐ Faulty or distorted pressure plate or diaphragm spring (Chapter 6).
- ☐ Worn or loose engine or transmission mountings (Chapter 2A or 2B).
- ☐ Clutch disc hub or transmission input shaft splines worn (Chapter 6).

Noise when depressing or releasing clutch pedal

- ☐ Worn clutch release bearing (Chapter 6).
- ☐ Worn or dry clutch pedal bushes (Chapter 6).
- ☐ Faulty pressure plate assembly (Chapter 6).
- ☐ Pressure plate diaphragm spring broken (Chapter 6).
- ☐ Broken clutch disc cushioning springs (Chapter 6).

Manual transmission

Noisy in neutral with engine running

☐ Input shaft bearings worn (noise apparent with clutch pedal released, but not when depressed), (Chapter 7A).*
☐ Clutch release bearing worn (noise apparent with clutch pedal depressed, possibly less when released), (Chapter 6).

Noisy in one particular gear

☐ Worn, damaged or chipped gear teeth (Chapter 7A).*

Difficulty engaging gears

☐ Clutch fault (Chapter 6).
☐ Worn or damaged gear linkage (Chapter 7A).
☐ Incorrectly adjusted gear linkage (Chapter 7A).
☐ Worn synchroniser units (Chapter 7A).*

Jumps out of gear

☐ Worn or damaged gear linkage (Chapter 7A).
☐ Incorrectly adjusted gear linkage (Chapter 7A).
☐ Worn synchroniser units (Chapter 7A).*
☐ Worn selector forks (Chapter 7A).*

Vibration

☐ Lack of oil (Chapter 1).
☐ Worn bearings (Chapter 7A).*

Lubricant leaks

☐ Leaking differential output oil seal (Chapter 7A).
☐ Leaking housing joint (Chapter 7A).*
☐ Leaking input shaft oil seal (Chapter 7A).*

** Although the corrective action necessary to remedy the symptoms described is beyond the scope of the home mechanic, the above information should be helpful in isolating the cause of the condition. This should enable the owner can communicate clearly with a professional mechanic.*

Automatic transmission

Note: *Due to the complexity of the automatic transmission, it is difficult for the home mechanic to properly diagnose and service this unit. For problems other than the following, the vehicle should be taken to a dealer service department or automatic transmission specialist. Do not be too hasty in removing the transmission if a fault is suspected, as most of the testing is carried out with the unit still fitted.*

Fluid leakage

☐ Automatic transmission fluid is usually dark in colour. Fluid leaks should not be confused with engine oil, which can easily be blown onto the transmission by airflow.
☐ To determine the source of a leak, first remove all built-up dirt and grime from the transmission housing and surrounding areas using a degreasing agent, or by steam-cleaning. Drive the vehicle at low speed, so airflow will not blow the leak far from its source. Raise and support the vehicle, and determine where the leak is coming from. The following are common areas of leakage:

a) Fluid pan or "sump" (Chapter 1 and 7B).
b) Dipstick tube (Chapter 1 and 7B).
c) Transmission-to-fluid cooler pipes/unions (Chapter 7B).

Transmission fluid brown, or has burned smell

☐ Transmission fluid level low, or fluid in need of renewal (Chapter 1).

General gear selection problems

☐ Chapter 7B deals with checking and adjusting the selector cable on automatic transmissions. The following are common problems that may be caused by a poorly adjusted cable:

a) Engine starting in gears other than Park or Neutral.
b) Indicator panel indicating a gear other than the one actually being used.
c) Vehicle moves when in Park or Neutral.
d) Poor gear shift quality or erratic gear changes.

☐ Refer to Chapter 7B for the selector cable adjustment procedure.

Transmission will not downshift (kickdown) with accelerator pedal fully depressed

☐ Low transmission fluid level (Chapter 1).
☐ Incorrect selector cable adjustment (Chapter 7B).

Engine will not start in any gear, or starts in gears other than Park or Neutral

☐ Incorrect starter/inhibitor switch adjustment (Chapter 7B).
☐ Incorrect selector cable adjustment (Chapter 7B).

Transmission slips, shifts roughly, is noisy, or has no drive in forward or reverse gears

☐ There are many probable causes for the above problems, but the home mechanic should be concerned with only one possibility - fluid level. Before taking the vehicle to a dealer or transmission specialist, check the fluid level and condition of the fluid as described in Chapter 1. Correct the fluid level as necessary, or change the fluid and filter if needed. If the problem persists, professional help will be necessary.

Driveshafts

Clicking or knocking noise on turns (at slow speed on full-lock)

☐ Lack of constant velocity joint lubricant, possibly due to damaged gaiter (Chapter 8).
☐ Worn outer constant velocity joint (Chapter 8).

Vibration when accelerating or decelerating

☐ Worn inner constant velocity joint (Chapter 8).
☐ Bent or distorted driveshaft (Chapter 8).

Braking system

Note: *Before assuming that a brake problem exists, make sure that the tyres are in good condition and correctly inflated, that the front wheel alignment is correct, and that the vehicle is not loaded with weight in an unequal manner. Apart from checking the condition of all pipe and hose connections, any faults occurring on the anti-lock braking system should be referred to a Peugeot dealer for diagnosis.*

Vehicle pulls to one side under braking

- ☐ Worn, defective, damaged or contaminated brake pads/shoes on one side (Chapters 1 and 9).
- ☐ Seized or partially seized front brake caliper/wheel cylinder piston (Chapters 1 and 9).
- ☐ A mixture of brake pad/shoe lining materials fitted between sides (Chapters 1 and 9).
- ☐ Brake caliper or backplate mounting bolts loose (Chapter 9).
- ☐ Worn or damaged steering or suspension components (Chapters 1 and 10).

Noise (grinding or high-pitched squeal) when brakes applied

- ☐ Brake pad or shoe friction lining material worn down to metal backing (Chapters 1 and 9).
- ☐ Excessive corrosion of brake disc or drum. This may be apparent after the vehicle has been standing for some time (Chapters 1 and 9).
- ☐ Foreign object (stone chipping, etc.) trapped between brake disc and shield (Chapters 1 and 9).

Excessive brake pedal travel

- ☐ Inoperative rear brake self-adjust mechanism - drum brakes (Chapters 1 and 9).
- ☐ Faulty master cylinder (Chapter 9).
- ☐ Air in hydraulic system (Chapters 1 and 9).
- ☐ Faulty vacuum servo unit (Chapter 9).

Brake pedal feels spongy when depressed

- ☐ Air in hydraulic system (Chapters 1 and 9).
- ☐ Deteriorated flexible rubber brake hoses (Chapters 1 and 9).
- ☐ Master cylinder mounting nuts loose (Chapter 9).
- ☐ Faulty master cylinder (Chapter 9).

Excessive brake pedal effort required to stop vehicle

- ☐ Faulty vacuum servo unit (Chapter 9).
- ☐ Disconnected, damaged or insecure brake servo vacuum hose (Chapter 9).
- ☐ Primary or secondary hydraulic circuit failure (Chapter 9).
- ☐ Seized brake caliper or wheel cylinder piston(s) (Chapter 9).
- ☐ Brake pads or brake shoes incorrectly fitted (Chapters 1 and 9).
- ☐ Incorrect grade of brake pads or brake shoes fitted (Chapters 1 and 9).
- ☐ Brake pads or brake shoe linings contaminated (Chapters 1 and 9).

Judder felt through brake pedal or steering wheel when braking

- ☐ Excessive run-out or distortion of discs/drums (Chapters 1 and 9).
- ☐ Brake pad or brake shoe linings worn (Chapters 1 and 9).
- ☐ Brake caliper or brake backplate mounting bolts loose (Chapter 9).
- ☐ Wear in suspension or steering components or mountings (Chapters 1 and 10).

Brakes binding

- ☐ Seized brake caliper or wheel cylinder piston(s) (Chapter 9).
- ☐ Incorrectly adjusted handbrake mechanism (Chapter 9).
- ☐ Faulty master cylinder (Chapter 9).

Rear wheels locking under normal braking

- ☐ Rear brake shoe linings contaminated (Chapters 1 and 9).
- ☐ Faulty brake pressure regulator (Chapter 9).

Suspension and steering

Note: *Before diagnosing suspension or steering faults, be sure that the trouble is not due to incorrect tyre pressures, mixtures of tyre types, or binding brakes.*

Vehicle pulls to one side

- ☐ Defective tyre (Chapter 1).
- ☐ Excessive wear in suspension or steering components (Chapters 1 and 10).
- ☐ Incorrect front wheel alignment (Chapter 10).
- ☐ Accident damage to steering or suspension components (Chapter 1).

Wheel wobble and vibration

- ☐ Front roadwheels out of balance (vibration felt mainly through the steering wheel), (Chapters 1 and 10).
- ☐ Rear roadwheels out of balance (vibration felt throughout the vehicle), (Chapters 1 and 10).
- ☐ Roadwheels damaged or distorted (Chapters 1 and 10).
- ☐ Faulty or damaged tyre (Chapter 1).
- ☐ Worn steering or suspension joints, bushes or components (Chapters 1 and 10).
- ☐ Wheel bolts loose (Chapters 1 and 10).

Excessive pitching and/or rolling around corners, or during braking

- ☐ Defective shock absorbers (Chapters 1 and 10).
- ☐ Broken or weak spring and/or suspension component (Chapters 1 and 10).
- ☐ Worn or damaged anti-roll bar or mountings (Chapter 10).

Wandering or general instability

- ☐ Incorrect front wheel alignment (Chapter 10).
- ☐ Worn steering or suspension joints, bushes or components (Chapters 1 and 10).
- ☐ Roadwheels out of balance (Chapters 1 and 10).
- ☐ Faulty or damaged tyre (Chapter 1).
- ☐ Wheel bolts loose (Chapters 1 and 10).
- ☐ Defective shock absorbers (Chapters 1 and 10).

Excessively stiff steering

- ☐ Lack of steering gear lubricant (Chapter 10).
- ☐ Seized track rod end balljoint or suspension balljoint (Chapters 1 and 10).
- ☐ Broken or incorrectly adjusted auxiliary drivebelt - power steering (Chapter 1).

Suspension and steering (continued)

- ☐ Incorrect front wheel alignment (Chapter 10).
- ☐ Steering rack or column bent or damaged (Chapter 10).

Excessive play in steering

- ☐ Worn steering column intermediate shaft universal joint (Chapter 10).
- ☐ Worn steering track rod end balljoints (Chapters 1 and 10).
- ☐ Worn rack-and-pinion steering gear (Chapter 10).
- ☐ Worn steering or suspension joints, bushes or components (Chapters 1 and 10).

Lack of power assistance

- ☐ Broken or incorrectly adjusted auxiliary drivebelt (Chapter 1).
- ☐ Incorrect power steering fluid level (Chapter 1).
- ☐ Restriction in power steering fluid hoses (Chapter 1).
- ☐ Faulty power steering pump (Chapter 10).
- ☐ Faulty rack-and-pinion steering gear (Chapter 10).

Tyre wear excessive

Tyres worn on inside or outside edges

- ☐ Tyres under-inflated (wear on both edges), (Chapter 1).
- ☐ Incorrect camber or castor angles (wear on one edge only), (Chapter 10).
- ☐ Worn steering or suspension joints, bushes or components (Chapters 1 and 10).
- ☐ Excessively hard cornering.
- ☐ Accident damage.

Tyre treads exhibit feathered edges

- ☐ Incorrect toe setting (Chapter 10).

Tyres worn in centre of tread

- ☐ Tyres over-inflated (Chapter 1).

Tyres worn on inside and outside edges

- ☐ Tyres under-inflated (Chapter 1).

Tyres worn unevenly

- ☐ Tyres/wheels out of balance (Chapter 1).
- ☐ Excessive wheel or tyre run-out (Chapter 1).
- ☐ Worn shock absorbers (Chapters 1 and 10).
- ☐ Faulty tyre (Chapter 1).

Electrical system

Note: *For problems associated with the starting system, refer to the faults listed under "Engine" earlier in this Section.*

Battery will not hold a charge for more than a few days

- ☐ Battery defective internally (Chapter 5).
- ☐ Battery terminal connections loose or corroded (Chapter 1).
- ☐ Auxiliary drivebelt worn or incorrectly adjusted (Chapter 1).
- ☐ Alternator not charging at correct output (Chapter 5).
- ☐ Alternator or voltage regulator faulty (Chapter 5).
- ☐ Short-circuit causing continual battery drain (Chapters 5 and 12).

Ignition/no-charge warning light remains illuminated with engine running

- ☐ Auxiliary drivebelt broken, worn, or incorrectly adjusted (Chapter 1).
- ☐ Alternator brushes worn, sticking, or dirty (Chapter 5).
- ☐ Alternator brush springs weak or broken (Chapter 5).
- ☐ Internal fault in alternator or voltage regulator (Chapter 5).
- ☐ Broken, disconnected, or loose wiring in charging circuit (Chapter 5).

Ignition/no-charge warning light fails to come on

- ☐ Warning light bulb blown (Chapter 12).
- ☐ Broken, disconnected, or loose wiring in warning light circuit (Chapter 12).
- ☐ Alternator faulty (Chapter 5).

Lights inoperative

- ☐ Bulb blown (Chapter 12).
- ☐ Corrosion of bulb or bulbholder contacts (Chapter 12).
- ☐ Blown fuse (Chapter 12).
- ☐ Faulty relay (Chapter 12).
- ☐ Broken, loose, or disconnected wiring (Chapter 12).
- ☐ Faulty switch (Chapter 12).

Instrument readings inaccurate or erratic

Instrument readings increase with engine speed

- ☐ Faulty voltage regulator (Chapter 12).

Fuel or temperature gauges give no reading

- ☐ Faulty gauge sender unit (Chapters 3, 4A and 4B).
- ☐ Wiring open-circuit (Chapter 12).
- ☐ Faulty gauge (Chapter 12).

Fuel or temperature gauges give continuous maximum reading

- ☐ Faulty gauge sender unit (Chapters 3, 4A and 4B).
- ☐ Wiring short-circuit (Chapter 12).
- ☐ Faulty gauge (Chapter 12).

Electrical system (continued)

Horn inoperative, or unsatisfactory in operation

Horn operates all the time

- ☐ Horn push either earthed or stuck down (Chapter 12).
- ☐ Horn cable-to-horn push earthed (Chapter 12).

Horn fails to operate

- ☐ Blown fuse (Chapter 12).
- ☐ Cable or cable connections loose, broken or disconnected (Chapter 12).
- ☐ Faulty horn (Chapter 12).

Horn emits intermittent or unsatisfactory sound

- ☐ Cable connections loose (Chapter 12).
- ☐ Horn mountings loose (Chapter 12).
- ☐ Faulty horn (Chapter 12).

Windscreen/tailgate wipers inoperative, or unsatisfactory in operation

Wipers fail to operate, or operate very slowly

- ☐ Wiper blades stuck to screen, or linkage seized or binding (Chapters 1 and 12).
- ☐ Blown fuse (Chapter 12).
- ☐ Cable or cable connections loose, broken or disconnected (Chapter 12).
- ☐ Faulty relay (Chapter 12).
- ☐ Faulty wiper motor (Chapter 12).

Wiper blades sweep over too large or too small an area of the glass

- ☐ Wiper arms incorrectly positioned on spindles (Chapter 1).
- ☐ Excessive wear of wiper linkage (Chapter 12).
- ☐ Wiper motor or linkage mountings loose or insecure (Chapter 12).

Wiper blades fail to clean the glass effectively

- ☐ Wiper blade rubbers worn or perished (Chapter 1).
- ☐ Wiper arm tension springs broken, or arm pivots seized (Chapter 12).
- ☐ Insufficient windscreen washer additive to adequately remove road film (Chapter 1).

Windscreen/tailgate washers inoperative, or unsatisfactory in operation

One or more washer jets inoperative

- ☐ Blocked washer jet (Chapter 1).
- ☐ Disconnected, kinked or restricted fluid hose (Chapter 12).
- ☐ Insufficient fluid in washer reservoir (Chapter 1).

Washer pump fails to operate

- ☐ Broken or disconnected wiring or connections (Chapter 12).
- ☐ Blown fuse (Chapter 12).
- ☐ Faulty washer switch (Chapter 12).
- ☐ Faulty washer pump (Chapter 12).

Washer pump runs for some time before fluid is emitted from jets

- ☐ Faulty one-way valve in fluid supply hose (Chapter 12).

Electric windows inoperative, or unsatisfactory in operation

Window glass will only move in one direction

- ☐ Faulty switch (Chapter 12).

Window glass slow to move

- ☐ Regulator seized or damaged, or in need of lubrication (Chapter 11).
- ☐ Door internal components or trim fouling regulator (Chapter 11).
- ☐ Faulty motor (Chapter 12).

Window glass fails to move

- ☐ Blown fuse (Chapter 12).
- ☐ Faulty relay (Chapter 12).
- ☐ Broken or disconnected wiring or connections (Chapter 12).
- ☐ Faulty motor (Chapter 12).

Central locking system inoperative, or unsatisfactory in operation

Complete system failure

- ☐ Blown fuse (Chapter 12).
- ☐ Faulty relay (Chapter 12).
- ☐ Broken or disconnected wiring or connections (Chapter 12).
- ☐ Faulty control module (Chapter 12).

Latch locks but will not unlock, or unlocks but will not lock

- ☐ Faulty master switch (Chapter 12).
- ☐ Broken or disconnected latch operating rods or levers (Chapter 11).
- ☐ Faulty relay (Chapter 12).
- ☐ Faulty control module (Chapter 12).

One solenoid/motor fails to operate

- ☐ Broken or disconnected wiring or connections (Chapter 12).
- ☐ Faulty solenoid/motor (Chapter 12).
- ☐ Broken, binding or disconnected latch operating rods or levers (Chapter 11).
- ☐ Fault in door latch (Chapter 11).

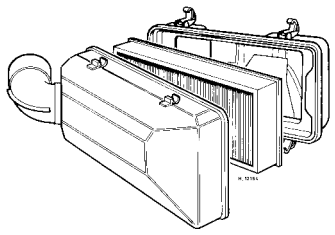
A

ABS (Anti-lock brake system) A system, usually electronically controlled, that senses incipient wheel lockup during braking and relieves hydraulic pressure at wheels that are about to skid.

Air bag An inflatable bag hidden in the steering wheel (driver's side) or the dash or glovebox (passenger side). In a head-on collision, the bags inflate, preventing the driver and front passenger from being thrown forward into the steering wheel or windscreen.

Air cleaner A metal or plastic housing, containing a filter element, which removes dust and dirt from the air being drawn into the engine.

Air filter element The actual filter in an air cleaner system, usually manufactured from pleated paper and requiring renewal at regular intervals.

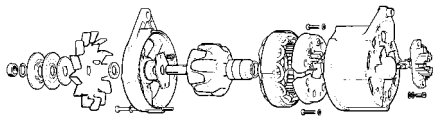


Air filter

Allen key A hexagonal wrench which fits into a recessed hexagonal hole.

Alligator clip A long-nosed spring-loaded metal clip with meshing teeth. Used to make temporary electrical connections.

Alternator A component in the electrical system which converts mechanical energy from a drivebelt into electrical energy to charge the battery and to operate the starting system, ignition system and electrical accessories.



Alternator (exploded view)

Ampere (amp) A unit of measurement for the flow of electric current. One amp is the amount of current produced by one volt acting through a resistance of one ohm.

Anaerobic sealer A substance used to prevent bolts and screws from loosening. Anaerobic means that it does not require oxygen for activation. The Loctite brand is widely used.

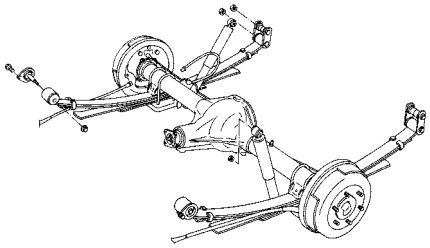
Antifreeze A substance (usually ethylene glycol) mixed with water, and added to a vehicle's cooling system, to prevent freezing of the coolant in winter. Antifreeze also contains chemicals to inhibit corrosion and the formation of rust and other deposits that would tend to clog the radiator and coolant passages and reduce cooling efficiency.

Anti-seize compound A coating that reduces the risk of seizing on fasteners that are subjected to high temperatures, such as exhaust manifold bolts and nuts.

Anti-seize compound

Asbestos A natural fibrous mineral with great heat resistance, commonly used in the composition of brake friction materials. Asbestos is a health hazard and the dust created by brake systems should never be inhaled or ingested.

Axle A shaft on which a wheel revolves, or which revolves with a wheel. Also, a solid beam that connects the two wheels at one end of the vehicle. An axle which also transmits power to the wheels is known as a live axle.



Axle assembly

Axleshaft A single rotating shaft, on either side of the differential, which delivers power from the final drive assembly to the drive wheels. Also called a driveshaft or a halfshaft.

B

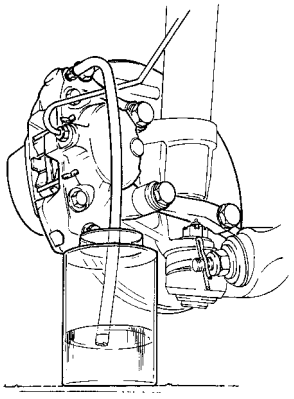
Ball bearing An anti-friction bearing consisting of a hardened inner and outer race with hardened steel balls between two races.

Bearing

Bearing The curved surface on a shaft or in a bore, or the part assembled into either, that permits relative motion between them with minimum wear and friction.

Big-end bearing The bearing in the end of the connecting rod that's attached to the crankshaft.

Bleed nipple A valve on a brake wheel cylinder, caliper or other hydraulic component that is opened to purge the hydraulic system of air. Also called a bleed screw.



Brake bleeding

Brake bleeding Procedure for removing air from lines of a hydraulic brake system.

Brake disc The component of a disc brake that rotates with the wheels.

Brake drum The component of a drum brake that rotates with the wheels.

Brake linings The friction material which contacts the brake disc or drum to retard the vehicle's speed. The linings are bonded or riveted to the brake pads or shoes.

Brake pads The replaceable friction pads that pinch the brake disc when the brakes are applied. Brake pads consist of a friction material bonded or riveted to a rigid backing plate.

Brake shoe The crescent-shaped carrier to which the brake linings are mounted and which forces the lining against the rotating drum during braking.

Braking systems For more information on braking systems, consult the *Haynes Automotive Brake Manual*.

Breaker bar A long socket wrench handle providing greater leverage.

Bulkhead The insulated partition between the engine and the passenger compartment.

C

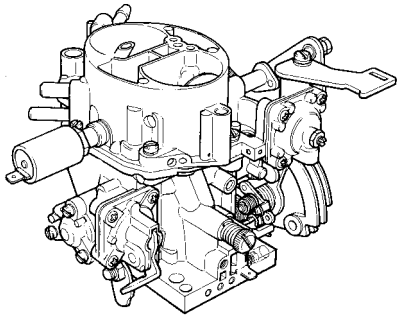
Caliper The non-rotating part of a disc-brake assembly that straddles the disc and carries the brake pads. The caliper also contains the hydraulic components that cause the pads to pinch the disc when the brakes are applied. A caliper is also a measuring tool that can be set to measure inside or outside dimensions of an object.

Camshaft A rotating shaft on which a series of cam lobes operate the valve mechanisms. The camshaft may be driven by gears, by sprockets and chain or by sprockets and a belt.

Canister A container in an evaporative emission control system; contains activated charcoal granules to trap vapours from the fuel system.

Canister

Carburettor A device which mixes fuel with air in the proper proportions to provide a desired power output from a spark ignition internal combustion engine.



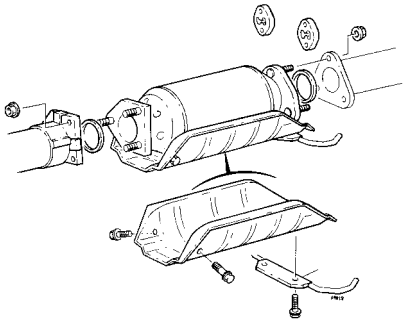
Carburettor

Castellated Resembling the parapets along the top of a castle wall. For example, a castellated balljoint stud nut.

Castellated nut

Castor In wheel alignment, the backward or forward tilt of the steering axis. Castor is positive when the steering axis is inclined rearward at the top.

Catalytic converter A silencer-like device in the exhaust system which converts certain pollutants in the exhaust gases into less harmful substances.



Catalytic converter

Circlip A ring-shaped clip used to prevent endwise movement of cylindrical parts and shafts. An internal circlip is installed in a groove in a housing; an external circlip fits into a groove on the outside of a cylindrical piece such as a shaft.

Clearance The amount of space between two parts. For example, between a piston and a cylinder, between a bearing and a journal, etc.

Coil spring A spiral of elastic steel found in various sizes throughout a vehicle, for example as a springing medium in the suspension and in the valve train.

Compression Reduction in volume, and increase in pressure and temperature, of a gas, caused by squeezing it into a smaller space.

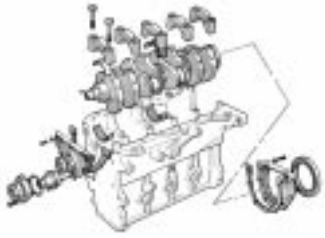
Compression ratio The relationship between cylinder volume when the piston is at top dead centre and cylinder volume when the piston is at bottom dead centre.

Constant velocity (CV) joint A type of universal joint that cancels out vibrations caused by driving power being transmitted through an angle.

Core plug A disc or cup-shaped metal device inserted in a hole in a casting through which core was removed when the casting was formed. Also known as a freeze plug or expansion plug.

Crankcase The lower part of the engine block in which the crankshaft rotates.

Crankshaft The main rotating member, or shaft, running the length of the crankcase, with offset “throws” to which the connecting rods are attached.



Crankshaft assembly

Crocodile clip See Alligator clip

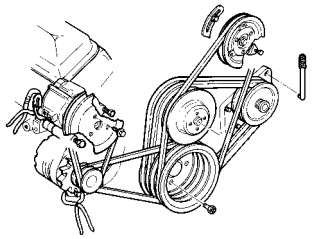
D

Diagnostic code Code numbers obtained by accessing the diagnostic mode of an engine management computer. This code can be used to determine the area in the system where a malfunction may be located.

Disc brake A brake design incorporating a rotating disc onto which brake pads are squeezed. The resulting friction converts the energy of a moving vehicle into heat.

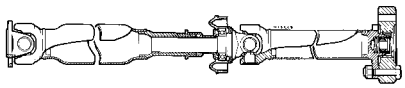
Double-overhead cam (DOHC) An engine that uses two overhead camshafts, usually one for the intake valves and one for the exhaust valves.

Drivebelt(s) The belt(s) used to drive accessories such as the alternator, water pump, power steering pump, air conditioning compressor, etc. off the crankshaft pulley.



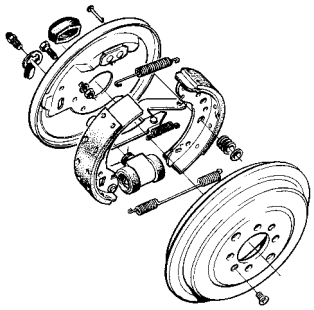
Accessory drivebelts

Driveshaft Any shaft used to transmit motion. Commonly used when referring to the axleshafts on a front wheel drive vehicle.



Driveshaft

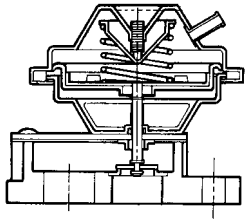
Drum brake A type of brake using a drum-shaped metal cylinder attached to the inner surface of the wheel. When the brake pedal is pressed, curved brake shoes with friction linings press against the inside of the drum to slow or stop the vehicle.



Drum brake assembly

E

EGR valve A valve used to introduce exhaust gases into the intake air stream.



EGR valve

Electronic control unit (ECU) A computer which controls (for instance) ignition and fuel injection systems, or an anti-lock braking system. For more information refer to the *Haynes Automotive Electrical and Electronic Systems Manual.*

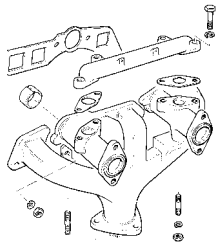
Electronic Fuel Injection (EFI) A computer controlled fuel system that distributes fuel through an injector located in each intake port of the engine.

Emergency brake A braking system, independent of the main hydraulic system, that can be used to slow or stop the vehicle if the primary brakes fail, or to hold the vehicle stationary even though the brake pedal isn't depressed. It usually consists of a hand lever that actuates either front or rear brakes mechanically through a series of cables and linkages. Also known as a handbrake or parking brake.

Endfloat The amount of lengthwise movement between two parts. As applied to a crankshaft, the distance that the crankshaft can move forward and back in the cylinder block.

Engine management system (EMS) A computer controlled system which manages the fuel injection and the ignition systems in an integrated fashion.

Exhaust manifold A part with several passages through which exhaust gases leave the engine combustion chambers and enter the exhaust pipe.



Exhaust manifold

F

Fan clutch A viscous (fluid) drive coupling device which permits variable engine fan speeds in relation to engine speeds.

Feeler blade A thin strip or blade of hardened steel, ground to an exact thickness, used to check or measure clearances between parts.

Feeler blade

Firing order The order in which the engine cylinders fire, or deliver their power strokes, beginning with the number one cylinder.

Flywheel A heavy spinning wheel in which energy is absorbed and stored by means of momentum. On cars, the flywheel is attached to the crankshaft to smooth out firing impulses.

Free play The amount of travel before any action takes place. The "looseness" in a linkage, or an assembly of parts, between the initial application of force and actual movement. For example, the distance the brake pedal moves before the pistons in the master cylinder are actuated.

Fuse An electrical device which protects a circuit against accidental overload. The typical fuse contains a soft piece of metal which is calibrated to melt at a predetermined current flow (expressed as amps) and break the circuit.

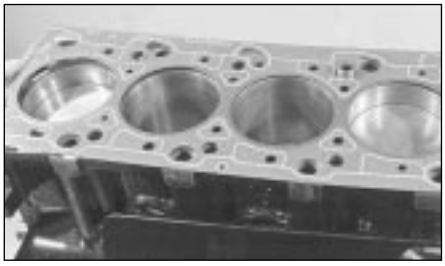
Fusible link A circuit protection device consisting of a conductor surrounded by heat-resistant insulation. The conductor is smaller than the wire it protects, so it acts as the weakest link in the circuit. Unlike a blown fuse, a failed fusible link must frequently be cut from the wire for replacement.

G

Gap The distance the spark must travel in jumping from the centre electrode to the side electrode in a spark plug. Also refers to the spacing between the points in a contact breaker assembly in a conventional points-type ignition, or to the distance between the reluctor or rotor and the pickup coil in an electronic ignition.

Adjusting spark plug gap

Gasket Any thin, soft material - usually cork, cardboard, asbestos or soft metal - installed between two metal surfaces to ensure a good seal. For instance, the cylinder head gasket seals the joint between the block and the cylinder head.



Gasket

Gauge An instrument panel display used to monitor engine conditions. A gauge with a movable pointer on a dial or a fixed scale is an analogue gauge. A gauge with a numerical readout is called a digital gauge.

H

Halfshaft A rotating shaft that transmits power from the final drive unit to a drive wheel, usually when referring to a live rear axle.

Harmonic balancer A device designed to reduce torsion or twisting vibration in the crankshaft. May be incorporated in the crankshaft pulley. Also known as a vibration damper.

Hone An abrasive tool for correcting small irregularities or differences in diameter in an engine cylinder, brake cylinder, etc.

Hydraulic tappet A tappet that utilises hydraulic pressure from the engine's lubrication system to maintain zero clearance (constant contact with both camshaft and valve stem). Automatically adjusts to variation in valve stem length. Hydraulic tappets also reduce valve noise.

I

Ignition timing The moment at which the spark plug fires, usually expressed in the number of crankshaft degrees before the piston reaches the top of its stroke.

Inlet manifold A tube or housing with passages through which flows the air-fuel mixture (carburettor vehicles and vehicles with throttle body injection) or air only (port fuel-injected vehicles) to the port openings in the cylinder head.

J

Jump start Starting the engine of a vehicle with a discharged or weak battery by attaching jump leads from the weak battery to a charged or helper battery.

L

Load Sensing Proportioning Valve (LSPV) A brake hydraulic system control valve that works like a proportioning valve, but also takes into consideration the amount of weight carried by the rear axle.
Locknut A nut used to lock an adjustment nut, or other threaded component, in place. For example, a locknut is employed to keep the adjusting nut on the rocker arm in position.
Lockwasher A form of washer designed to prevent an attaching nut from working loose.

M

MacPherson strut A type of front suspension system devised by Earle MacPherson at Ford of England. In its original form, a simple lateral link with the anti-roll bar creates the lower control arm. A long strut - an integral coil spring and shock absorber - is mounted between the body and the steering knuckle. Many modern so-called MacPherson strut systems use a conventional lower A-arm and don't rely on the anti-roll bar for location.
Multimeter An electrical test instrument with the capability to measure voltage, current and resistance.

N

NOx Oxides of Nitrogen. A common toxic pollutant emitted by petrol and diesel engines at higher temperatures.

O

Ohm The unit of electrical resistance. One volt applied to a resistance of one ohm will produce a current of one amp.
Ohmmeter An instrument for measuring electrical resistance.
O-ring A type of sealing ring made of a special rubber-like material; in use, the O-ring is compressed into a groove to provide the sealing action.

O-ring

Overhead cam (ohc) engine An engine with the camshaft(s) located on top of the cylinder head(s).
Overhead valve (ohv) engine An engine with the valves located in the cylinder head, but with the camshaft located in the engine block.
Oxygen sensor A device installed in the engine exhaust manifold, which senses the oxygen content in the exhaust and converts this information into an electric current. Also called a Lambda sensor.

P

Phillips screw A type of screw head having a cross instead of a slot for a corresponding type of screwdriver.
Plastigage A thin strip of plastic thread, available in different sizes, used for measuring clearances. For example, a strip of Plastigage is laid across a bearing journal. The parts are assembled and dismantled; the width of the crushed strip indicates the clearance between journal and bearing.

Plastigage

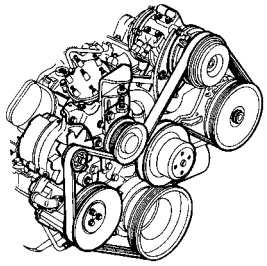
Propeller shaft The long hollow tube with universal joints at both ends that carries power from the transmission to the differential on front-engined rear wheel drive vehicles.
Proportioning valve A hydraulic control valve which limits the amount of pressure to the rear brakes during panic stops to prevent wheel lock-up.

R

Rack-and-pinion steering A steering system with a pinion gear on the end of the steering shaft that mates with a rack (think of a geared wheel opened up and laid flat). When the steering wheel is turned, the pinion turns, moving the rack to the left or right. This movement is transmitted through the track rods to the steering arms at the wheels.
Radiator A liquid-to-air heat transfer device designed to reduce the temperature of the coolant in an internal combustion engine cooling system.
Refrigerant Any substance used as a heat transfer agent in an air-conditioning system. R-12 has been the principle refrigerant for many years; recently, however, manufacturers have begun using R-134a, a non-CFC substance that is considered less harmful to the ozone in the upper atmosphere.
Rocker arm A lever arm that rocks on a shaft or pivots on a stud. In an overhead valve engine, the rocker arm converts the upward movement of the pushrod into a downward movement to open a valve.
Rotor In a distributor, the rotating device inside the cap that connects the centre electrode and the outer terminals as it turns, distributing the high voltage from the coil secondary winding to the proper spark plug. Also, that part of an alternator which rotates inside the stator. Also, the rotating assembly of a turbocharger, including the compressor wheel, shaft and turbine wheel.
Runout The amount of wobble (in-and-out movement) of a gear or wheel as it's rotated. The amount a shaft rotates "out-of-true." The out-of-round condition of a rotating part.

S

Sealant A liquid or paste used to prevent leakage at a joint. Sometimes used in conjunction with a gasket.
Sealed beam lamp An older headlight design which integrates the reflector, lens and filaments into a hermetically-sealed one-piece unit. When a filament burns out or the lens cracks, the entire unit is simply replaced.
Serpentine drivebelt A single, long, wide accessory drivebelt that's used on some newer vehicles to drive all the accessories, instead of a series of smaller, shorter belts. Serpentine drivebelts are usually tensioned by an automatic tensioner.



Serpentine drivebelt

Shim Thin spacer, commonly used to adjust the clearance or relative positions between two parts. For example, shims inserted into or under bucket tappets control valve clearances. Clearance is adjusted by changing the thickness of the shim.
Slide hammer A special puller that screws into or hooks onto a component such as a shaft or bearing; a heavy sliding handle on the shaft bottoms against the end of the shaft to knock the component free.
Sprocket A tooth or projection on the periphery of a wheel, shaped to engage with a chain or drivebelt. Commonly used to refer to the sprocket wheel itself.
Starter inhibitor switch On vehicles with an

automatic transmission, a switch that prevents starting if the vehicle is not in Neutral or Park.

Strut See MacPherson strut.

T

Tappet A cylindrical component which transmits motion from the cam to the valve stem, either directly or via a pushrod and rocker arm. Also called a cam follower.

Thermostat A heat-controlled valve that regulates the flow of coolant between the cylinder block and the radiator, so maintaining optimum engine operating temperature. A thermostat is also used in some air cleaners in which the temperature is regulated.

Thrust bearing The bearing in the clutch assembly that is moved in to the release levers by clutch pedal action to disengage the clutch. Also referred to as a release bearing.

Timing belt A toothed belt which drives the camshaft. Serious engine damage may result if it breaks in service.

Timing chain A chain which drives the camshaft.

Toe-in The amount the front wheels are closer together at the front than at the rear. On rear wheel drive vehicles, a slight amount of toe-in is usually specified to keep the front wheels running parallel on the road by offsetting other forces that tend to spread the wheels apart.

Toe-out The amount the front wheels are closer together at the rear than at the front. On front wheel drive vehicles, a slight amount of toe-out is usually specified.

Tools For full information on choosing and using tools, refer to the *Haynes Automotive Tools Manual.*

Tracer A stripe of a second colour applied to a wire insulator to distinguish that wire from another one with the same colour insulator.

Tune-up A process of accurate and careful adjustments and parts replacement to obtain the best possible engine performance.

Turbocharger A centrifugal device, driven by exhaust gases, that pressurises the intake air. Normally used to increase the power output from a given engine displacement, but can also be used primarily to reduce exhaust emissions (as on VW's "Umwelt" Diesel engine).

U

Universal joint or U-joint A double-pivoted connection for transmitting power from a driving to a driven shaft through an angle. A U-joint consists of two Y-shaped yokes and a cross-shaped member called the spider.

V

Valve A device through which the flow of liquid, gas, vacuum, or loose material in bulk may be started, stopped, or regulated by a movable part that opens, shuts, or partially obstructs one or more ports or passageways. A valve is also the movable part of such a device.

Valve clearance The clearance between the valve tip (the end of the valve stem) and the rocker arm or tappet. The valve clearance is measured when the valve is closed.

Vernier caliper A precision measuring instrument that measures inside and outside dimensions. Not quite as accurate as a micrometer, but more convenient.

Viscosity The thickness of a liquid or its resistance to flow.

Volt A unit for expressing electrical "pressure" in a circuit. One volt that will produce a current of one ampere through a resistance of one ohm.

W

Welding Various processes used to join metal items by heating the areas to be joined to a molten state and fusing them together. For more information refer to the *Haynes Automotive Welding Manual.*

Wiring diagram A drawing portraying the components and wires in a vehicle's electrical system, using standardised symbols. For more information refer to the *Haynes Automotive Electrical and Electronic Systems Manual.*

Note: *References throughout this index are in the form - "Chapter number" • "page number"*

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REF

Preserving Our Motoring Heritage

The Model J Duesenberg Derham Tourster. Only eight of these magnificent cars were ever built – this is the only example to be found outside the United States of America

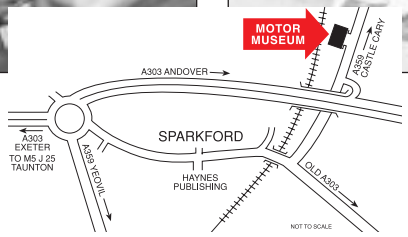
Almost every car you've ever loved, loathed or desired is gathered under one roof at the Haynes Motor Museum. Over 300 immaculately presented cars and motorbikes represent every aspect of our motoring heritage, from elegant reminders of bygone days, such as the superb Model J Duesenberg to curiosities like the bug-eyed BMW Isetta. There are also many old friends and flames. Perhaps you remember the 1959 Ford Popular that you did your courting in? The magnificent 'Red Collection' is a spectacle of classic sports cars including AC, Alfa Romeo, Austin Healey, Ferrari, Lamborghini, Maserati, MG, Riley, Porsche and Triumph.

A Perfect Day Out

Each and every vehicle at the Haynes Motor Museum has played its part in the history and culture of Motoring. Today, they make a wonderful spectacle and a great day out for all the family. Bring the kids, bring Mum and Dad, but above all bring your camera to capture those golden memories for ever. You will also find an impressive array of motoring memorabilia, a comfortable 70 seat video cinema and one of the most extensive transport book shops in Britain. The Pit Stop Cafe serves everything from a cup of tea to wholesome, home-made meals or, if you prefer, you can enjoy the large picnic area nestled in the beautiful rural surroundings of Somerset.

John Haynes O.B.E., Founder and Chairman of the museum at the wheel of a Haynes Light 12.

Graham Hill's Lola Cosworth Formula 1 car next to a 1934 Riley Sports.



The Museum is situated on the A359 Yeovil to Frome road at Sparkford, just off the A303 in Somerset. It is about 40 miles south of Bristol, and 25 minutes drive from the M5 intersection at Taunton.

Open 9.30am - 5.30pm (10.00am - 4.00pm Winter) 7 days a week, *except Christmas Day, Boxing Day and New Years Day*

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