VAUXHALL/OPEL VECTRA

Haynes 3930

Mar 1999 to May 2002 (**T** registration onwards) Petrol & Diesel

Haynes **Service and Repair Manual**

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

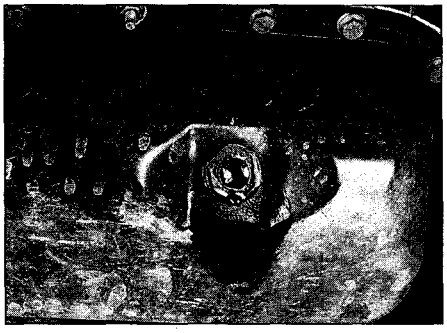
Identifying leaks

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

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

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

Sump oil

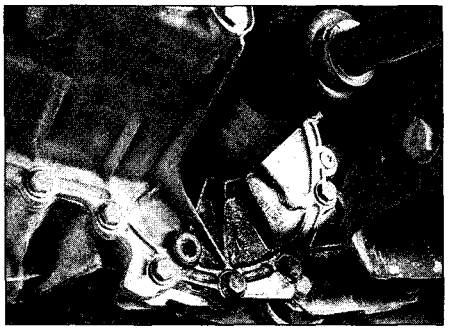


Engine oil may leak from the drain plug...

Oil from filter

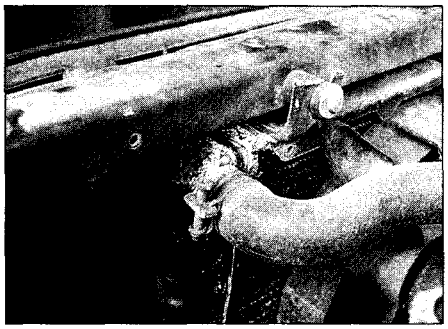
...or from the base of the oil filter.

Gearbox oil



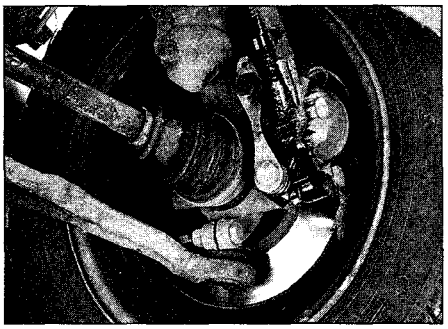
Gearbox oil can leak from the seals at the inboard ends of the driveshafts.

Antifreeze



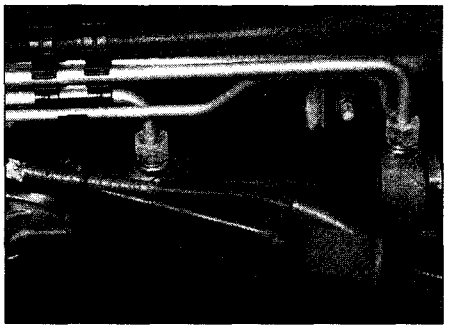
Leaking antifreeze often leaves a crystalline deposit like this.

Brake fluid



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

Power steering fluid



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

Towing

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

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

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

☐ Only attach the tow-rope to the towing eyes provided.

☐ Before being towed, release the handbrake and select neutral on the transmission. On models with automatic transmission, special precautions apply. If in doubt, do not tow, or transmission damage may result.

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

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

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

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

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

☐ A towing eye is provided with the warning triangle and first aid kit in the luggage compartment.

☐ To fit the towing eye, prise the cover from the front bumper, then screw in the towing eye anti-clockwise as far as it will go using the handle of the wheel brace to turn the eye. **Note that the towing eye has a left-hand thread.** A rear towing eye is provided beneath the rear of the vehicle.

Tyre pressures (cold)

Note: *Pressures apply to original-equipment tyres, and may vary if any other make or type of tyre is fitted; check with the tyre manufacturer or supplier for correct pressures if necessary. The pressures are also given on the inside of the fuel filler flap.*

	Front	Rear
Saloon/Hatch models with 1.6 and 1.8 litre petrol engines		
195/65R15:		
Up to 3 persons	28 psi (1.9 bar)	28 psi (1.9 bar)
Full load	30 psi (2.1 bar)	39 psi (2.7 bar)
205/60R15:		
Up to 3 persons	28 psi (1.9 bar)	28 psi (1.9 bar)
Full load	30 psi (2.1 bar)	39 psi (2.7 bar)
205/55R16:		
Up to 3 persons	28 psi (1.9 bar)	28 psi (1.9 bar)
Full load	30 psi (2.1 bar)	39 psi (2.7 bar)
215/45ZR17:		
Up to 3 persons	30 psi (2.1 bar)	33 psi (2.3 bar)
Full load	33 psi (2.3 bar)	42 psi (2.9 bar)
Saloon/Hatch models with 2.2 litre petrol engine		
195/65R15:		
Up to 3 persons	32 psi (2.2 bar)	32 psi (2.2 bar)
Full load	33 psi (2.3 bar)	42 psi (2.9 bar)
205/60R15:		
Up to 3 persons	32 psi (2.2 bar)	32 psi (2.2 bar)
Full load	33 psi (2.3 bar)	42 psi (2.9 bar)
205/55R16:		
Up to 3 persons	32 psi (2.2 bar)	32 psi (2.2 bar)
Full load	33 psi (2.3 bar)	42 psi (2.9 bar)
215/45ZR17:		
Up to 3 persons	33 psi (2.3 bar)	38 psi (2.6 bar)
Full load	36 psi (2.5 bar)	45 psi (3.1 bar)
Saloon/Hatch models with 2.0 litre and 2.2 litre diesel engines		
195/65R15, 205/60R15 and 205/55R16:		
Up to 3 persons	32 psi (2.2 bar)	32 psi (2.2 bar)
Full load	33 psi (2.3 bar)	42 psi (2.9 bar)
215/45ZR17:		
Up to 3 persons	35 psi (2.4 bar)	38 psi (2.6 bar)
Full load	36 psi (2.5 bar)	45 psi (3.1 bar)
Estate models with 1.8 litre petrol engine		
195/65R15:		
Up to 3 persons	28 psi (1.9 bar)	28 psi (1.9 bar)
Full load	29 psi (2.0 bar)	42 psi (2.9 bar)
205/60R15:		
Up to 3 persons	28 psi (1.9 bar)	28 psi (1.9 bar)
Full load	29 psi (2.0 bar)	42 psi (2.9 bar)
205/55R16:		
Up to 3 persons	28 psi (1.9 bar)	28 psi (1.9 bar)
Full load	29 psi (2.0 bar)	42 psi (2.9 bar)
215/45ZR17:		
Up to 3 persons	30 psi (2.1 bar)	33 psi (2.3 bar)
Full load	32 psi (2.2 bar)	45 psi (3.1 bar)
Estate models with 2.2 litre petrol engine		
195/65R15:		
Up to 3 persons	32 psi (2.2 bar)	32 psi (2.2 bar)
Full load	32 psi (2.2 bar)	45 psi (3.1 bar)
205/60R15:		
Up to 3 persons	32 psi (2.2 bar)	32 psi (2.2 bar)
Full load	32 psi (2.2 bar)	45 psi (3.1 bar)
205/55R16:		
Up to 3 persons	32 psi (2.2 bar)	32 psi (2.2 bar)
Full load	32 psi (2.2 bar)	45 psi (3.1 bar)
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Full load	36 psi (2.5 bar)	49 psi (3.4 bar)
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195/65R15, 205/60R15 and 205/55R16:		
Up to 3 persons	32 psi (2.2 bar)	32 psi (2.2 bar)
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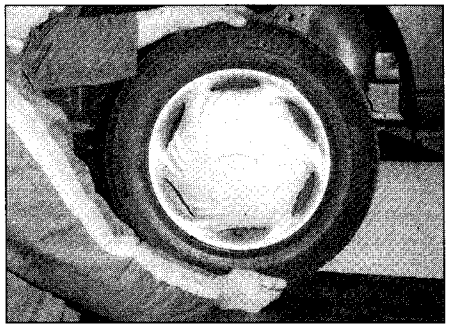
Full load	36 psi (2.5 bar)	49 psi (3.4 bar)



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

7 Rear brake shoe check

Note: *This Section applies only to models fitted with rear drum brakes.*

Refer to Chapter 9.

8 Suspension and steering check

Front suspension and steering

1 Raise the front of the vehicle, and securely support it on axle stands (see *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 deterioration of the balljoints or steering gear.

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

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

5 Now grasp the wheel at the 9 o'clock and 3 o'clock positions, and try to rock it as before. Any movement felt now may again be caused by wear in the hub bearings or the steering track rod balljoints. If the outer balljoint is worn, the visual movement will be obvious. If the inner joint is suspect, it can be felt by placing a hand over the rack-and-pinion rubber gaiter and gripping the track rod. If the wheel is now rocked, movement will be felt at the inner joint if wear has taken place.

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

7 With the 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. In addition, check the steering column universal joints for wear, and also check the rack-and-pinion steering gear itself.

Rear suspension

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

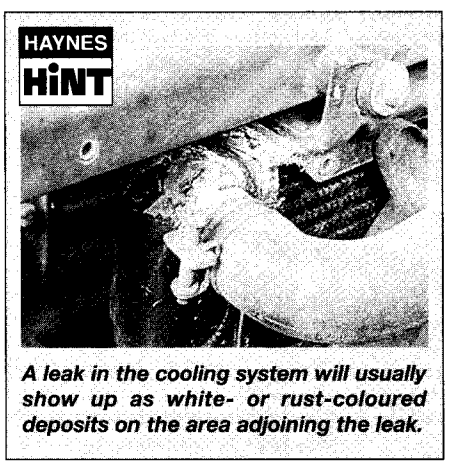
9 Working as described previously for the front suspension, check the rear hub bearings, the suspension bushes and the strut or shock absorber mountings (as applicable) for wear.

Shock absorber

10 Check for any signs of fluid leakage around the shock absorber body, or from the rubber gaiter around the piston rod. Should any fluid be noticed, the shock absorber is defective internally, and should be renewed.

Note: *Shock absorbers should always be renewed in pairs on the same axle.*

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



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

9 Rear suspension level control system check

Where fitted on Estate models, check that the rear suspension self-levelling control system operates correctly. In the event of a suspected fault, have the system checked by a Vauxhall/Opel dealer.

10 Body corrosion check

This work should be carried out by a Vauxhall/Opel dealer in order to validate the vehicle warranty. The work includes a thorough inspection of the vehicle paintwork and underbody for damage and corrosion.

11 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 cylinder head cover, cylinder head, oil filter and sump joint faces. Bear in mind that, over a period of time, some very slight seepage from these areas is to be expected – what you are really looking for is any indication of a serious leak. Should a leak be found, renew the offending gasket or oil seal by referring to the appropriate Chapters in this manual. Similarly, check for leaks around the transmission casing.

2 Also check the security and condition of all the engine-related pipes and hoses, and all braking system pipes and hoses, and fuel lines. Ensure that all cable ties or securing clips are in place, and in good condition. Clips which 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 which 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. If the crimped-type hose clips are used, it may be a good idea to replace them with standard worm-drive clips.

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

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

6 With the vehicle raised, inspect the fuel tank and filler neck for punctures, cracks and other damage. The connection between the

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 us for vehicles driven daily. If you wish to keep your vehicle in peak condition at all times, you may wish to perform some of these procedures more often. We encourage frequent maintenance, because it enhances the efficiency, performance and resale value of your vehicle.

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

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

Every 10 000 miles (15 000 km) or 6 months, whichever comes first

- ☐ Renew the engine oil and filter (Section 3)

Note: *Vauxhall recommend that the engine oil and filter are changed every 20 000 miles (30 000 km) or 12 months. However, oil and filter changes are good for the engine and we recommend that the oil and filter are renewed more frequently, especially if the vehicle is used on a lot of short journeys.*

Every 20 000 miles (30 000 km) or 12 months, whichever comes first

- ☐ Check the condition of the auxiliary drivebelts and tensioner (Section 4)
- ☐ Check the front/rear brake pads and discs for wear (Section 5)
- ☐ Check and adjust the handbrake (Section 6)
- ☐ Check the rear brake shoes for wear (Section 7)
- ☐ Check the steering and suspension components for condition and security (Section 8)
- ☐ Check the rear suspension level control system (where applicable) (Section 9)
- ☐ Check the body and underbody for corrosion protection (Section 10)
- ☐ Check all components, pipes and hoses for fluid leaks (Section 11)
- ☐ Check the condition of the driveshaft gaiters (Section 12)
- ☐ Check and if necessary adjust the headlight beam alignment (Section 13)
- ☐ Check the roadwheel bolts are tightened to the specified torque (Section 14)
- ☐ Lubricate all door locks and hinges, door stops, bonnet lock and release, and tailgate lock and hinges (Section 15)
- ☐ Check the operation of all electrical systems (Section 16)
- ☐ Carry out a road test (Section 17)

Every 12 months, regardless of mileage

- ☐ Drain water from the fuel filter (Section 18)

Every 20 000 miles (30 000 km) or 2 years, whichever comes first

- ☐ Renew the pollen filter element (Section 19)

Note: *If the vehicle is used in dusty conditions, the pollen filter should be renewed more frequently.*

Every 40 000 miles (60 000 km) or 2 years, whichever comes first

- ☐ Renew the remote control batteries (Section 20)

Every 2 years, regardless of mileage

- ☐ Renew the hydraulic fluid (Section 21)
- ☐ Renew the coolant (Section 22)
- ☐ Exhaust emission test (Section 23)

Every 40 000 miles (60 000 km) or 4 years, whichever comes first

- ☐ Renew the air cleaner element (Section 24)
- ☐ Renew the timing belt and tensioner roller (Section 25)
- ☐ Renew the fuel filter (Section 26)
- ☐ Check the rear brake drums for wear (Section 27)

Chapter 2 Part A:
1.6 litre SOHC petrol engine in-car repair procedures

Contents

Degrees of difficulty

Easy, suitable for novice with little experience 

Fairly easy, suitable for beginner with some experience 

Fairly difficult, suitable for competent DIY mechanic 

Difficult, suitable for experienced DIY mechanic 

Very difficult, suitable for expert DIY or professional 

Specifications

General

Engine type	Four-cylinder, in-line, water-cooled. Single overhead camshaft, belt-driven, acting on hydraulic tappets
Manufacturer's engine code	X16SZR
Bore	79.0 mm
Stroke	81.5 mm
Capacity	1598 cc
Firing order	1-3-4-2 (No 1 cylinder at timing belt end)
Direction of crankshaft rotation	Clockwise (viewed from timing belt end of engine)
Compression ratio	9.6:1
Maximum power	55 kW at 5200 rpm
Maximum torque	128 Nm at 2800 rpm

Compression pressures

Standard	12 to 15 bar (174 to 218 psi)
Maximum difference between any two cylinders	1 bar (14.5 psi)

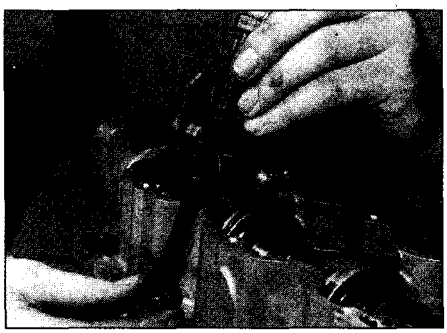
Camshaft

Endfloat	0.09 to 0.21 mm
Maximum permissible radial run-out	0.040 mm
Cam lift:	
Inlet valve	5.61 mm
Exhaust valve	6.12 mm

Lubrication system

Oil pump type	Gear type, driven directly from crankshaft
Minimum permissible oil pressure at idle speed, with engine at operating temperature (oil temperature of at least 80°C)	1.5 bar (22 psi)
Oil pump clearances:	
Gear teeth clearance	0.08 to 0.15 mm
Gear endfloat	0.10 to 0.20 mm

12.25 Apply sealant to the cylinder head upper mating surface then refit the camshaft housing



12.28 Fit the washers to the new cylinder head bolts and screw the bolts into position

26 Ensure the two locating dowels are in position then lubricate the camshaft followers with clean engine oil.

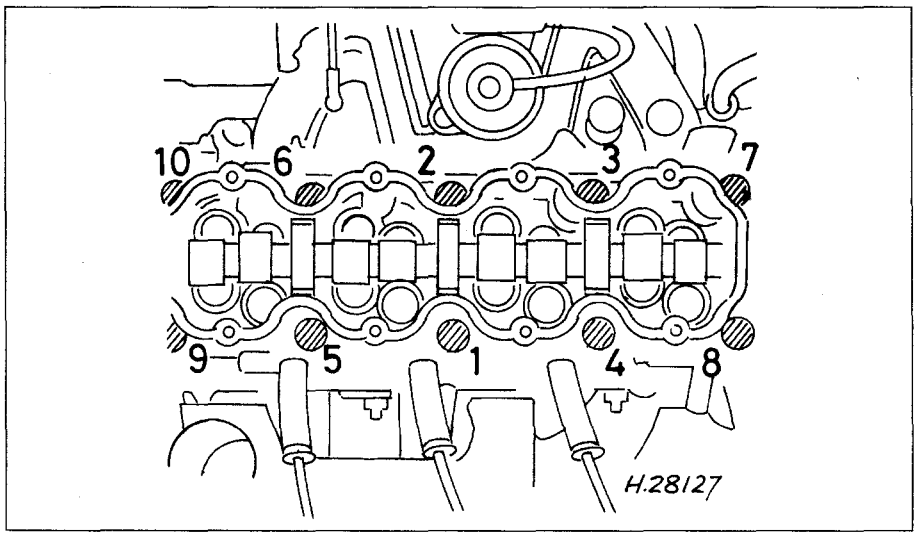
27 Carefully lower the camshaft housing assembly into position, locating it on the dowels.

28 Fit the washers to the new cylinder head bolts then carefully insert them into position (**do not drop**), tightening them finger-tight only at this stage **(see illustration)**.

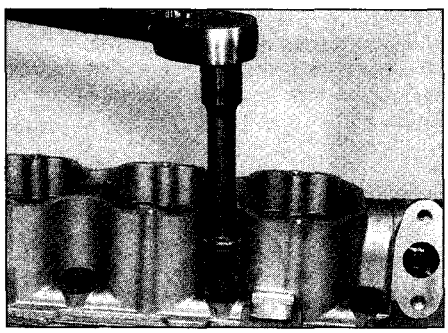
29 Working progressively and in the sequence shown, first tighten all the cylinder head bolts to the Stage 1 torque setting **(see illustrations)**.

30 Once all bolts have been tightened to the Stage 1 torque, again working in the sequence shown, tighten each bolt through its specified Stage 2 angle, using a socket and extension bar. It is recommended that an angle-measuring gauge is used during this stage of the tightening, to ensure accuracy **(see illustration)**.

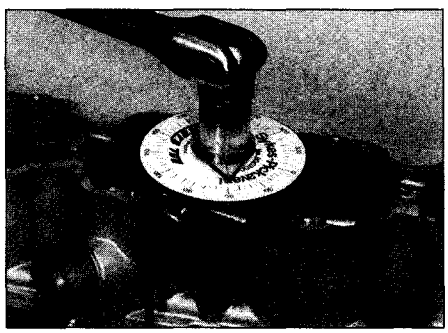
31 Working in the specified sequence, go around again and tighten all bolts through the specified Stage 3 angle.



12.29a Cylinder head bolt tightening sequence



12.29b Working in the specified sequence, tighten the cylinder head bolts to the specified Stage 1 torque setting . . .



12.30 . . . and then through the various specified angles (see text)

32 Finally go around in the specified sequence again and tighten all bolts through the specified Stage 4 angle.

33 Refit the bolts securing the timing belt rear cover to the camshaft housing and tighten them to the specified torque.

34 Refit the camshaft sprocket as described in Section 8 then fit the timing belt as described in Section 7.

35 Reconnect the wiring connectors to the cylinder head components, ensuring all wiring is correctly routed, and secure it in position with the necessary clips.

36 Reconnect the coolant hose to the thermostat housing and securely tighten its retaining clip.

37 Refit/reconnect the manifolds as described in Chapter 4A (as applicable).

38 Refit the roadwheel then lower the vehicle to the floor and tighten the wheel bolts to the specified torque.

39 Ensure all pipes and hoses are securely reconnected then refill the cooling system and refit the spark plugs as described in Chapter 1A.

40 Reconnect the battery then start the engine and check for signs of leaks.

13 Sump – removal and refitting

Removal

1 Disconnect the battery negative terminal.

2 Firmly apply the handbrake then jack up the front of the car and support it on axle stands.

3 Drain the engine oil as described in Chapter 1A, then fit a new sealing washer and refit the drain plug, tightening it to the specified torque.

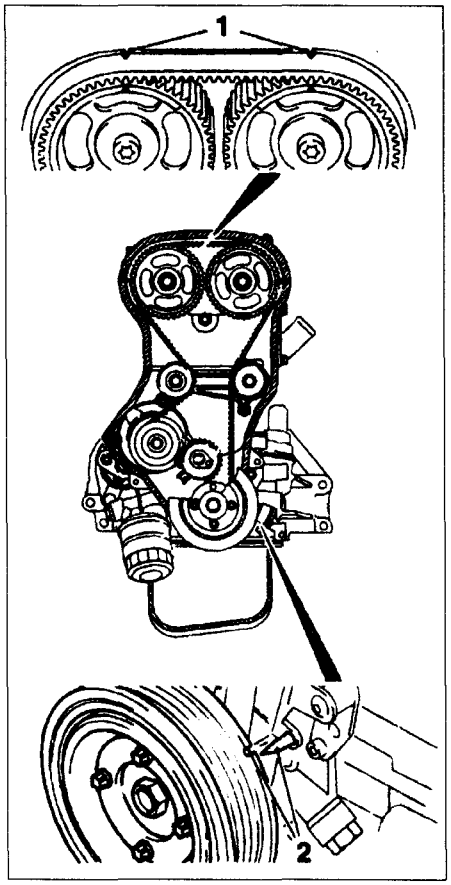
4 Remove the exhaust system front pipe as described in Chapter 4A.

5 Where necessary, disconnect the wiring connector from the oil level sender unit on the sump.

No air conditioning (steel sump)

6 Slacken and remove the flywheel/driveplate lower cover retaining bolts and remove the cover from the base of the transmission unit **(see illustration)**.

13.6 Removing the flywheel/driveplate lower cover plate – models without air conditioning



3.7 Align the camshaft sprocket timing marks with the marks (1) on the cylinder head cover, and the crankshaft pulley notch with the pointer (2) to position No 1 cylinder at TDC on its compression stroke

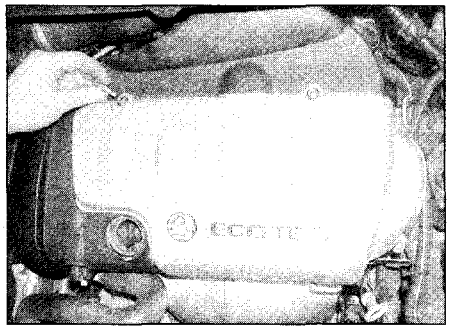
camshaft cover. With the camshaft sprocket marks correctly positioned, align the notch on the crankshaft pulley rim with the pointer on the cover **(see illustration)**. The engine is now positioned with No 1 piston at TDC.

4 Camshaft cover – removal and refitting

X16XEL and Z16XE

Removal

1 Remove the oil filler cap. Undo the retaining screws, disengage the engine cover from the locating lugs at the front of the camshaft cover, and remove the cover from the engine compartment **(see illustration)**.
2 Disconnect the wiring plug, remove the retaining screws, and remove the ignition module. If necessary, refer to Chapter 5B.
3 Release the retaining clips and disconnect the breather hoses from the left-hand end of the camshaft cover **(see illustration)**.
4 Evenly and progressively slacken and remove the camshaft cover retaining bolts.

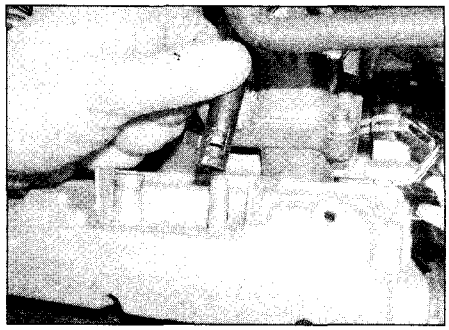


4.1 Undo the two screws and disengage the locating lugs to remove the engine cover

5 Lift the camshaft cover away from the cylinder head and recover the cover's seals and the sealing rings which are fitted to each of the retaining bolt holes **(see illustration)**. Examine the seals and sealing rings for signs of wear or damage and renew if necessary.

Refitting

6 Ensure the cover and cylinder head surfaces are clean and dry then fit the camshaft seals securely to the cover grooves. Fit the sealing rings to the recesses around each retaining bolt hole, holding them in position with a smear of grease **(see illustrations)**.
7 Apply a smear of suitable sealant to areas of the cylinder head surface around the right-hand end inlet and exhaust camshaft bearing caps and also to the semi-circular cut-outs on the left-hand end of the head.
8 Carefully manoeuvre the camshaft cover into position, taking great care to ensure all the sealing rings remain correctly seated. Refit the cover retaining bolts and tighten the retaining bolts to the specified torque, working in a spiral pattern from the centre outwards.
9 Reconnect the breather hoses, securing them in position with the retaining clips.
10 Refit the ignition module with reference to Chapter 5B.
11 Refit the engine cover.

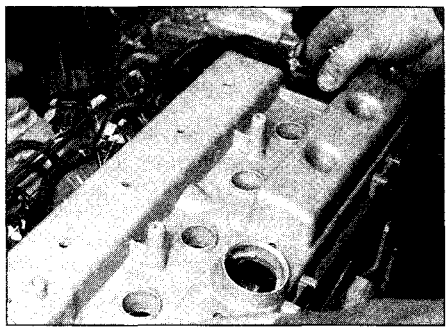


4.3 Disconnect the breather hoses

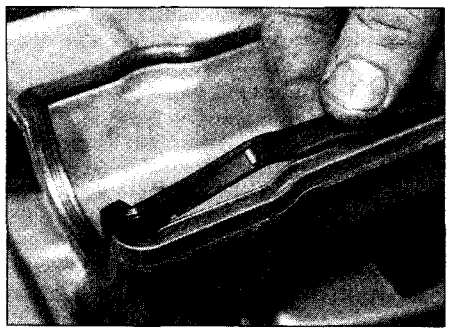
X18XE1 and Z18XE

Removal

12 Remove the engine cover as described in paragraph 1.
13 Slacken the retaining clips and disconnect the breather hoses from the left-hand rear of the cover **(see illustration)**.
14 Disconnect the wiring plug, undo the retaining screws, and remove the ignition module. Refer to Chapter 5B if necessary.

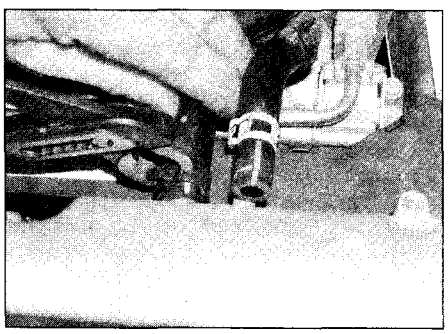


4.5 Lift the camshaft cover away from the engine



4.6a Ensure the seals are correctly seated in the cover recesses . . .

4.6b . . . and fit the sealing rings to the recess around each retaining bolt hole



4.13 Disconnect the breather hoses

11 Cylinder head – removal and refitting

Note: *The engine must be cold when removing the cylinder head. New cylinder head bolts must be used on refitting.*

Removal

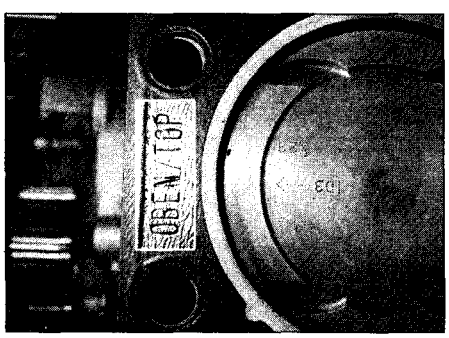
1 Depressurise the fuel system as described in Chapter 4A then disconnect the battery negative lead.
2 Drain the cooling system and remove the spark plugs as described in Chapter 1A.
3 Prior to releasing the timing belt tension and removing the belt, rotate the crankshaft **backwards** by approximately 60° (4 teeth of movement); this will position the camshafts so that the valve spring pressure is evenly exerted along the complete length of the shafts, preventing the shafts turning and reducing the risk of the valves contacting the pistons **(see illustration 10.1)**. Remove the timing belt as described in Section 7. Proceed as described under the relevant sub-heading.

X16XEL, Z16XE, X18XE1 and Z18XE

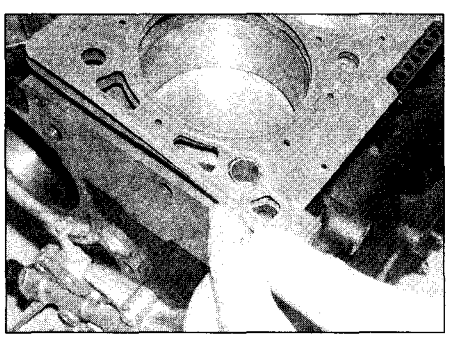
4 Remove the complete inlet manifold as described in Chapter 4A. Remove the exhaust manifold as described in Chapter 4A. If no work is to be carried out on the cylinder head, the head can be removed complete with the manifold once the following operations have been carried out (see Chapter 4A).
a) Unbolt the exhaust front pipe from manifold.
b) Disconnect the oxygen sensor wiring connector.
c) Disconnect the air hose and vacuum hose from the air injection valve.
5 Remove the camshaft cover as described in Section 4.
6 Remove the camshaft sprockets and the timing belt idler pulleys as described in Section 8.
7 Undo the retaining bolts securing the timing belt rear cover to the cylinder head.
8 Referring to Chapter 10, unbolt the power steering pump and position it clear of the cylinder head.
9 Disconnect the wiring connectors from the DIS module and the coolant temperature sender units on the cylinder head. Free the wiring from its retaining clips, noting its correct routing, and position it clear of the cylinder head.
10 Release the retaining clips then disconnect and remove the upper coolant hose linking the cylinder head to the radiator. Release the retaining clip and disconnect the cylinder head coolant hose from the expansion tank.
11 Referring to Chapter 3, unclip the coolant hoses from the heater matrix unions on the engine compartment bulkhead to drain the coolant from the cylinder block. Once the flow of coolant has stopped, reconnect both hoses and mop up any spilt coolant.
12 Make a final check to ensure that all relevant hoses, pipes and wires, etc, have been disconnected.
13 Working in the **reverse** of the tightening sequence **(see illustration 11.32a)**, progressively slacken the cylinder head bolts by a third of a turn at a time until all bolts can be unscrewed by hand. Remove each bolt in turn, along with its washer.
14 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 the fitted positions of the two locating dowels, and remove them for safe-keeping if they are loose.
15 Recover the cylinder head gasket, and discard it.

X18XE and X20XEV

16 Remove the inlet and exhaust manifolds as described in Chapter 4A. If no work is to be carried out on the cylinder head, the head can be removed complete with manifolds once all the hoses/wiring, etc, have been disconnected (see Chapter 4A).
17 Remove the camshaft cover as described in Section 4.
18 Remove the camshaft sprockets as described in Section 8.
19 Unbolt the torque support rod bracket from the end of the cylinder head.
20 Undo the retaining bolts securing the timing belt rear cover to the cylinder head.
21 Remove the cylinder head as described in paragraphs 10 to 15.



11.29a Ensure the head gasket is fitted with its OBEN/TOP marking uppermost . . .



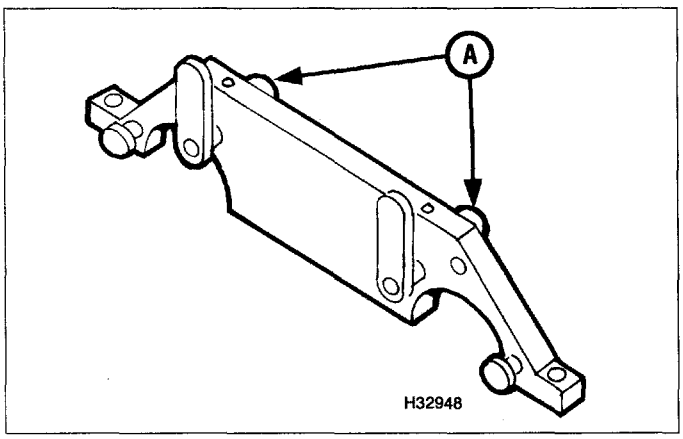
11.29b . . . over the locating dowels

Preparation for refitting

22 The mating faces of the cylinder head and block must be perfectly clean before refitting the head. Use a scraper to remove all traces of gasket and carbon, and also clean the tops of the pistons. Take particular care with the aluminium surfaces, as the soft metal is damaged easily. Also, make sure that debris is not allowed to enter the oil and water channels – this is particularly important for the oil circuit, as carbon could block the oil supply to the camshaft or crankshaft bearings. Using adhesive tape and paper, seal the water, oil and bolt holes in the cylinder block. To prevent carbon entering the gap between the pistons and bores, smear a little grease in the gap. After cleaning the piston, rotate the crankshaft so that the piston moves down the bore, then wipe out the grease and carbon with a cloth rag. Clean the other piston crowns in the same way.
23 Check the block and head for nicks, deep scratches and other damage. If slight, they may be removed carefully with a file. More serious damage may be repaired by machining, but this is a specialist job.
24 If warpage of the cylinder head is suspected, use a straight-edge to check it for distortion. Refer to Chapter 2E if necessary.
25 Ensure that the cylinder head bolt holes in the crankcase are clean and free of oil. Syringe or soak up any oil left in the bolt holes. This is most important in order that the correct bolt tightening torque can be applied and to prevent the possibility of the block being cracked by hydraulic pressure when the bolts are tightened.
26 Renew the cylinder head bolts regardless of their apparent condition.

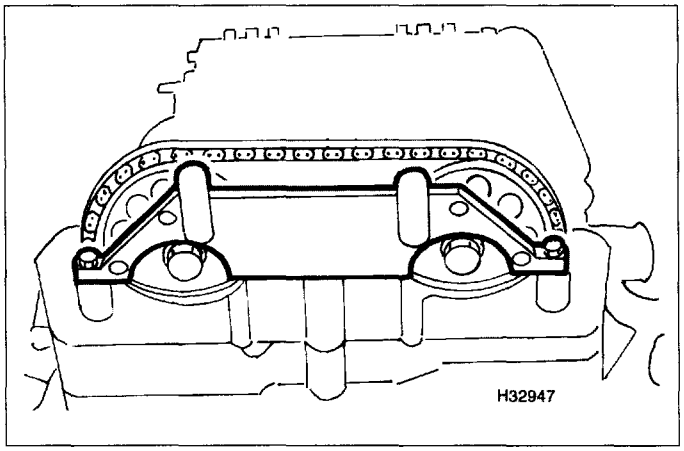
Refitting

27 Ensure the crankshaft is positioned approximately 60° BTDC and wipe clean the mating faces of the head and block.
28 Ensure that the two locating dowels are in position at each end of the cylinder block/crankcase surface.
29 Fit the new cylinder head gasket to the block, making sure it is fitted with the correct way up with its OBEN/TOP mark uppermost **(see illustrations)**.
30 Carefully refit the cylinder head, locating it on the dowels.
31 Fit the washers to the new cylinder head bolts then carefully insert them into position (**do not drop**), tightening them finger-tight only at this stage **(see illustration)**.
32 Working progressively and in the sequence shown, first tighten all the cylinder head bolts to the Stage 1 torque setting **(see illustrations)**.
33 Once all bolts have been tightened to the Stage 1 torque, again working in the sequence shown, tighten each bolt through its specified Stage 2 angle, using a socket and extension bar. It is recommended that an angle-measuring gauge is used during this



4.0 Vauxhall camshaft locking tool (KM-6148)

A Camshaft sprocket locating pins



4.3 Locking the camshaft sprockets in position using the Vauxhall tool KM-6148

4 Valve timing – checking and adjustment

Note: *To check the valve timing, it will be necessary to use the following Vauxhall special tool (or suitable equivalent); the camshaft locking tool number is KM-6148* ***(see illustration)****. If access to this tool cannot be gained, this task must be entrusted to a Vauxhall dealer. The camshaft locking tool (pictured) has locating pins that locate in the holes in the camshaft sprockets, to ensures that the camshafts remain correctly positioned.*

1 Remove the camshaft cover as described in Section 5.

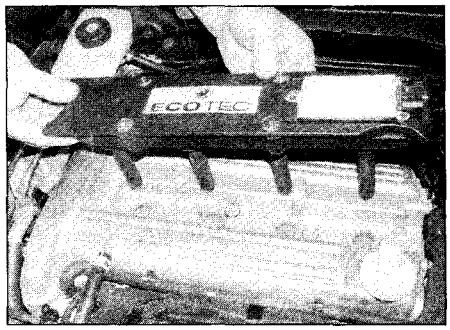
2 Position No 1 cylinder at TDC as described in Section 3, ensuring the crankshaft pulley notch is correctly aligned with the timing mark on the timing chain cover.

3 With the crankshaft in position, insert the camshaft locking tool into position on the right-hand end of the camshaft sprockets **(see illustration)**.

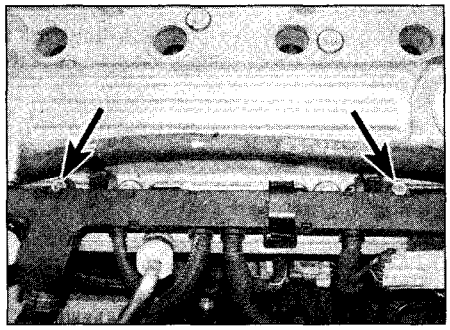
4 If the locking tool can be correctly fitted the valve timing is correctly set and no adjustment is necessary.

5 Refit the camshaft cover as described In Section 5

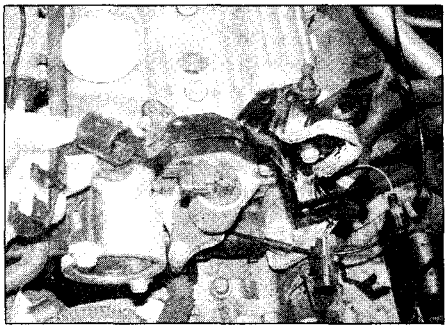
6 If the camshaft tool cannot be inserted correctly into the camshaft sprockets, the timing will need to be reset. See Section 9 for the removal, inspection and refitting of the timing chain and sprockets.



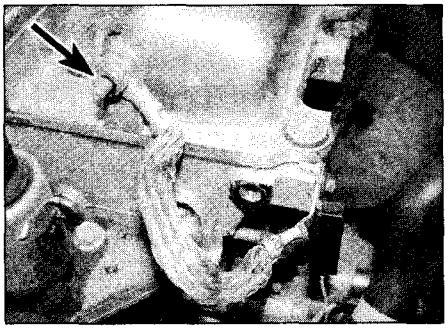
5.3 Removing the ignition module assembly from the spark plugs



5.8 Undo the two retaining nuts (arrowed) to remove the wiring trough



5.9a Remove the bracket from the left-hand end of the cam cover . . .



5.9b . . . then undo the earth strap retaining nut (arrowed)

5 Camshaft cover – removal and refitting

Removal

1 Unclip and remove the plastic cover from the top of the engine.

2 Release the securing clip from the wiring plug on the ignition module and disconnect.

3 Undo the four retaining bolts from the ignition module assembly and lift upwards to release from the spark plugs **(see illustration)**.

4 Disconnect the breather hose from the front of the camshaft cover.

5 Unclip the wiring harness from along the front edge and left-hand side of the camshaft cover.

6 Disconnect the wiring plug from the EGR (exhaust gas recirculation) valve.

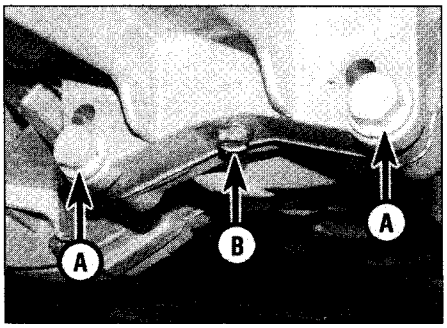
7 Unclip the brake servo vacuum pipe and coolant expansion tank hose from the wiring brackets along the front edge and left-hand side of the camshaft cover.

8 Undo the two retaining nuts and lift off the wiring trough from along the front of the camshaft cover **(see illustration)**.

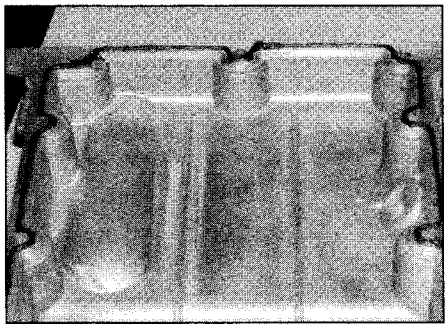
9 Undo the two retaining nuts and remove the wiring bracket from the left-hand side of the camshaft cover. With the bracket removed, undo the right-hand stud to release the earth strap**(see illustrations)**.

10 On vehicles with air conditioning, undo the two retaining nuts from the timing chain end of the camshaft cover to release the refrigerant lines **(see illustration)**. Also unclip the fuel pipes from the bracket.

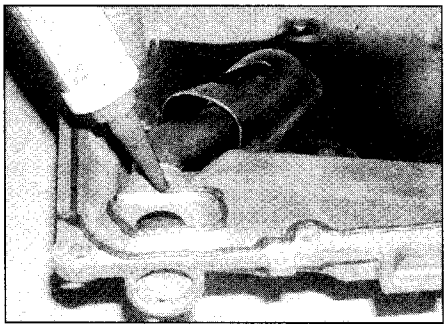
11 Slacken and remove the camshaft cover retaining bolts along with their sealing washers then lift the camshaft cover and



12.7 Undo the two sump to transmission bolts (A) and also the sump-to-lower cylinder block bolt (B)



12.11a Apply a continuous bead of silicone sealer around the sump . . .



12.11b . . . and also around the oil intake pipe area

12 Sump – removal and refitting

Removal

1 Disconnect the battery negative terminal (see Chapter 5A).

2 Firmly apply the handbrake then jack up the front of the car and support it on axle stands. Where necessary, undo the retaining clips/screws and remove the engine undertray and right-hand wheelarch cover.

3 Drain the engine oil as described in Chapter 1A, then fit a new sealing washer and refit the drain plug, tightening it to the specified torque.

4 Where fitted, disconnect the wiring connector from the oil level sensor (see Chapter 5A).

5 Mark the running direction of the auxiliary belt, then slacken the tensioner and remove the belt as described in Chapter 1A.

6 Remove the lower mounting bolt for the air conditioning compressor. Slacken (do not remove) the upper two mounting bolts and use a block of wood (or similar) to wedge the compressor away from the sump. **Note:** *Take care not to damage the bolts or alloy mounting point when inserting the wedge; do not use excessive force.*

7 Slacken and remove the bolts securing the sump flange to the transmission housing **(see illustration)**.

8 Progressively slacken and remove the bolts securing the sump to the base of the cylinder block lower casing (there is one long bolt at the transmission end of the sump – **see illustration 12.7)**. To break the sump joint it may be necessary to cut the silicone sealer using a suitable knife, taking care not to damage any surfaces. Lower the sump away from the engine.

9 While the sump is removed, take the opportunity to check the oil pump pick-up/strainer (if possible) for signs of clogging or splitting. **Note:** *The pick-up/strainer cannot be removed from the sump as it is riveted in position.*

Refitting

10 Remove all traces of silicone sealer and oil from the mating surfaces of the sump and cylinder block.

11 Apply a continuous bead of silicone sealing compound (available from your Vauxhall dealer) at approximately 1.0 mm from the inner edge of the sump. The bead of sealant should be between 2.0 and 2.5 mm in diameter. Also apply a bead of sealant (2.0 to 2.5 mm) around the oil intake pipe area of the sump mating surface **(see illustrations)**.

12 Offer up the sump to the cylinder block and loosely refit all the retaining bolts.

13 Working out from the centre in a diagonal sequence, progressively tighten the bolts securing the sump to the cylinder block lower casing. Tighten all the bolts to their specified torque setting.

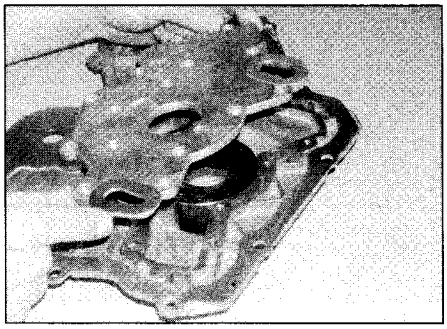
14 Tighten the bolts securing the sump flange to the transmission housing to their specified torque settings.

15 Remove the wedge-shaped block from the air conditioning compressor and refit the lower mounting bolt. Tighten the three compressor mounting bolts to their specified torque (Chapter 3).

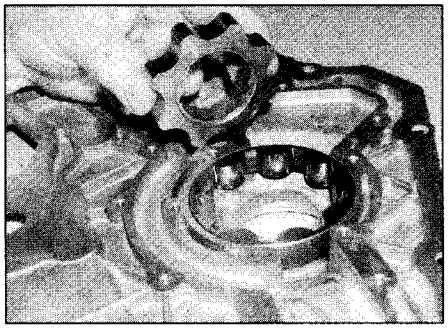
16 Refit the auxiliary drivebelt (see Chapter 1A).

17 Reconnect the oil level sensor wiring connector (as applicable). Where necessary refit the engine undertray and wheelarch cover.

18 Lower the vehicle to the ground then fill the engine with fresh engine oil (see Chapter 1A).



13.2 Undo the retaining screws and remove the pump cover plate



13.4 Removing the inner and outer rotors

13 Oil pump – removal, inspection and refitting

Note: *The oil pump pressure control valve can be removed with the timing chain cover in position on the engine (see paragraph 5 below).*

Removal

1 The oil pump assembly is built into the timing chain cover. Removal and refitting of the cover is as described in Section 7.

Inspection

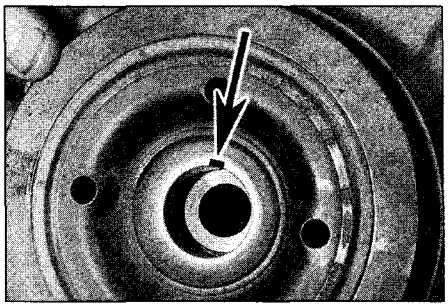
2 Undo the retaining screws and lift off the pump cover plate from the inside of the timing chain cover **(see illustration)**.

3 Note any marks identifying the outer faces of the pump rotors. If none can be seen, use a suitable marker pen and mark the surface of both the pump inner and outer rotors; the marks can then be used to ensure the rotors are refitted the correct way around.

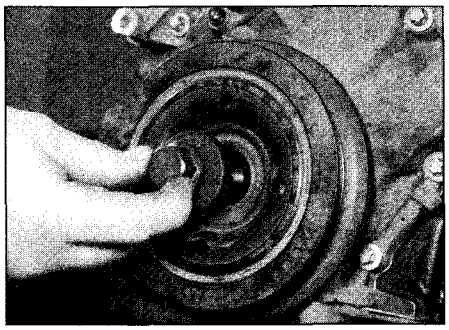
4 Lift out the inner and outer rotors from the cover **(see illustration)**.

5 Unscrew the oil pressure control valve plug from the timing chain cover and withdraw the spring and plunger, noting which way around the plunger is fitted. Remove the sealing ring from the valve bolt **(see illustrations)**.

6 Clean the components, and carefully examine the rotors, pump body and valve plungers for any signs of scoring or wear.



6.5a Slide the crankshaft pulley carefully into position engaging its slot (arrowed) with the Woodruff key . . .



6.5b . . . then fit the retaining bolt and washer

Remove the right-hand roadwheel. Where applicable, undo the retaining screws/clips and remove the engine undertray.

2 Remove the auxiliary drivebelt as described in Chapter 1B. Prior to removal, mark the direction of rotation on the belt to ensure the belt is refitted the same way around.

3 Slacken the crankshaft pulley retaining bolt. To prevent crankshaft rotation whilst the retaining bolt is slackened, have an assistant select top gear and apply the brakes firmly; if the engine is removed from the vehicle it will be necessary to lock the flywheel (see Section 16).

4 Unscrew the retaining bolt and washer and remove the crankshaft pulley from the end of the crankshaft. Whilst the pulley is removed check the oil seal for signs of wear or damage and, if necessary, renew as described in Section 15.

Refitting

5 Carefully locate the crankshaft pulley on the crankshaft end, aligning the pulley slot with the crankshaft key. Slide the pulley fully into position, taking great care not to damage the oil seal, then fit the washer and new retaining bolt **(see illustrations)**.

6 Lock the crankshaft by the method used on removal, and tighten the pulley retaining bolt to the specified Stage 1 torque setting then angle-tighten the bolt through the specified Stage 2 angle, using a socket and extension bar, and finally through the specified Stage 3 angle. It is recommended that an angle-measuring gauge is used during the final stages of the tightening, to ensure accuracy **(see illustration)**. If a gauge is not available, use white paint to make alignment marks between the bolt head and pulley prior to tightening; the marks can then be used to check that the bolt has been rotated through the correct angle.

7 Refit the auxiliary drivebelt as described in Chapter 1B using the mark made prior to removal to ensure the belt is fitted the correct way around.

8 Refit the roadwheel and engine undertray, then lower the car to the ground and tighten the wheel bolts to the specified torque.

7 Timing chain cover – removal and refitting

Removal

1 Remove the upper timing chain and sprockets as described in Section 9.

2 Remove the cylinder head as described in Section 11. **Note:** *In theory it is possible to remove the timing chain cover without disturbing the cylinder head. However, this procedure carries a high risk of damaging the head gasket, resulting in oil/coolant leakage once the cover is refitted. If you wish to attempt this, leave the cylinder head in position and just undo the retaining bolts securing the head to the top of the timing chain cover. Be warned though that, after refitting, you may find the head gasket will need renewing, meaning that the cylinder head will have to be removed after all. The decision is yours as to whether this is a chance worth taking.*

3 Remove the coolant pump as described in Chapter 3.

4 Remove the crankshaft pulley as described in Section 6. Prior to slackening the pulley bolt, temporarily remove the locking pin from the crankshaft to prevent damage. Refit the pin once the bolt is loose.

5 Remove the sump as described in Section 12.

6 Remove the alternator as described in Chapter 5A.

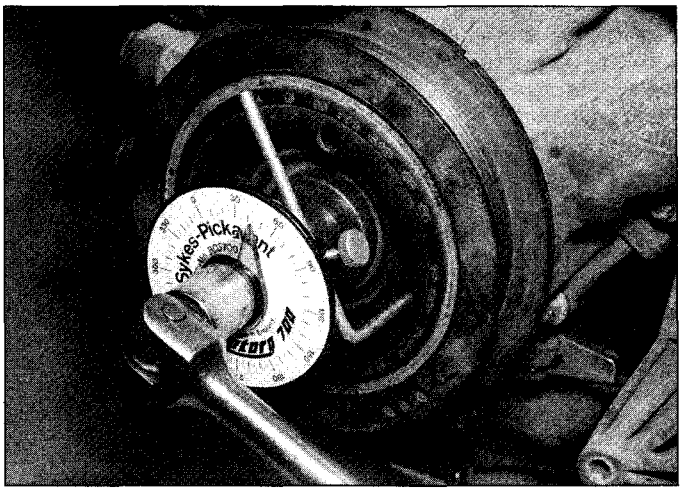
7 Remove the power steering pump as described in Chapter 10.

8 Unscrew the lower timing chain tensioner cap from the rear of the timing chain cover and remove the tensioner plunger, noting which way around it is fitted. Remove the sealing ring from the cap and discard it, a new one should be used on refitting.

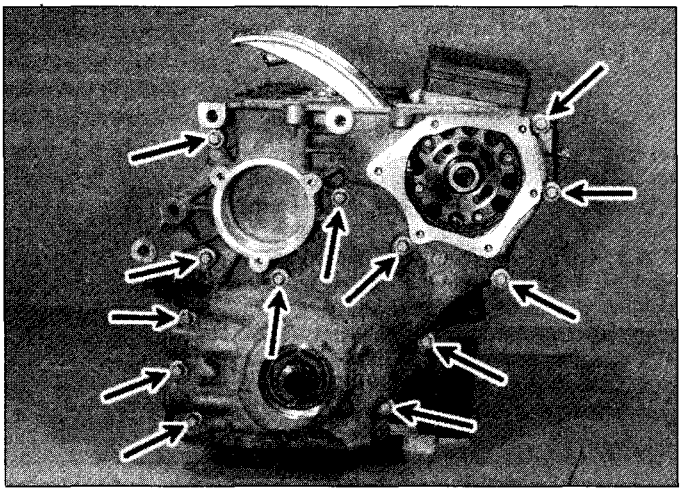
9 Noting each bolt's correct fitted location (the bolts are not all the same length), slacken and remove all the bolts securing the timing chain cover to the cylinder block **(see illustration)**.

10 Carefully ease the timing cover squarely away from the cylinder block and manoeuvre it out of position, noting the correct fitted positions of its locating dowels. If the locating dowels are a loose fit, remove them and store with the cover for safe-keeping.

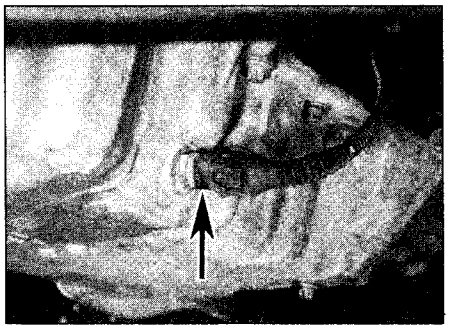
11 Undo the pivot bolt and remove the upper and lower timing chain tensioner blades from the cylinder block **(see illustration)**.



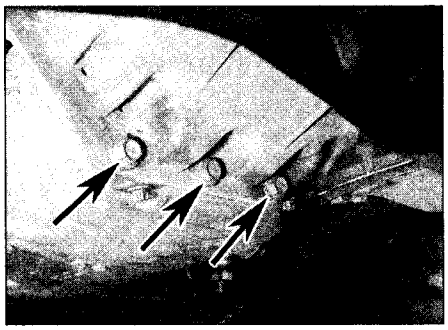
6.6 Lock the crankshaft then tighten the pulley retaining bolt



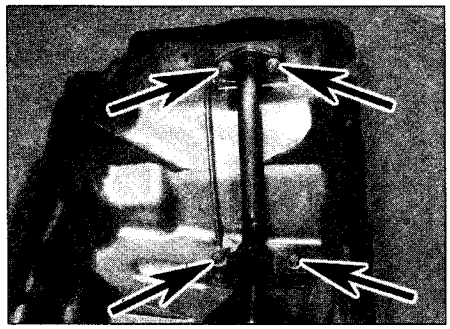
7.9 Timing chain cover retaining bolt locations (arrowed)



12.4 Disconnect the wiring connector from the oil temperature sensor (arrowed)



12.5 Slacken and remove the bolts securing the sump flange to the transmission housing (lower bolts arrowed)



12.7 Oil pump pick-up/strainer retaining bolts (arrowed)

33 Pivot the alternator back into position and tighten its upper mounting bolt to the specified torque (Chapter 5A).
34 Reconnect the coolant hoses to the cylinder head and secure them in position with the retaining clips.
35 Refit/reconnect the inlet and exhaust manifolds and associated components as described in Chapter 4B.
36 Refit the camshaft sprocket to the camshaft as described in paragraphs 27 to 37 of Section 10.
37 Position a new sealing washer on each side of the injection pump fuel hose unions then refit both union bolts and tighten them to the specified torque (Chapter 4B).
38 On completion refill the cooling system as described in Chapter 1B.

12 Sump – removal and refitting

Removal

1 Disconnect the battery negative terminal (see Chapter 5A).
2 Firmly apply the handbrake then jack up the front of the car and support it on axle stands. Where necessary, undo the retaining screws and remove the undercover from beneath the engine/transmission unit.
3 Drain the engine oil as described in Chapter 1B, then fit a new sealing washer and refit the drain plug, tightening it to the specified torque.
4 Disconnect the wiring connector(s) from the oil temperature sensor and (where fitted) the oil level sensor **(see illustration)**.
5 Slacken and remove the bolts securing the sump flange to the transmission housing **(see illustration)**.
6 Progressively slacken and remove the bolts securing the sump to the base of the cylinder block/oil pump. Break the sump joint by striking the sump with the palm of the hand, then lower the sump away from the engine and withdraw it. Remove the gasket and discard it.
7 While the sump is removed, take the opportunity to check the oil pump pick-up/strainer for signs of clogging or splitting. If necessary, unbolt the pick-up/strainer and remove it from the sump along with its sealing ring **(see illustration)**. The strainer can then be cleaned easily in solvent or renewed.

Refitting

8 Remove all traces of dirt and oil from the mating surfaces of the sump and cylinder block and (where removed) the pick-up/strainer.
9 Where necessary, position a new sealing ring on the oil pump pick-up/strainer flange and fit the strainer to the sump, tightening its retaining bolts to the specified torque.
10 Apply a smear of suitable sealant to the areas of the cylinder block mating surface around the oil pump housing and rear main bearing cap joints **(see illustrations)**.
11 Fit a new gasket to the sump then offer up the sump to the cylinder block and loosely refit all the retaining bolts **(see illustration)**.
12 Working out from the centre in a diagonal sequence, progressively tighten the bolts securing the sump to the cylinder block/oil pump to their specified torque setting.
13 Tighten the bolts securing the sump flange to the transmission housing to their specified torque settings.
14 Reconnect the oil temperature/level sensor wiring connector(s) (as applicable). Where necessary refit the undercover.
15 Lower the vehicle to the ground then fill the engine with fresh oil (see Chapter 1B).

13 Oil pump – removal, inspection and refitting

Note: *The oil pump safety valve can be removed with the timing chain cover in position on the engine and the pressure relief valve can be removed once the sump has been removed (see below).*

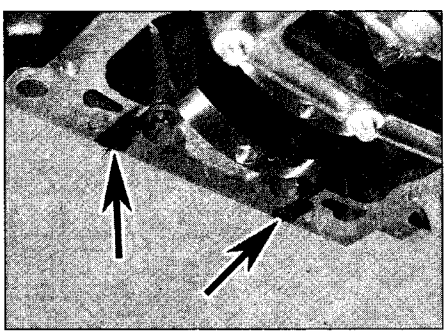
Removal

1 The oil pump assembly is built into the timing chain cover. Removal and refitting is as described in Section 7.

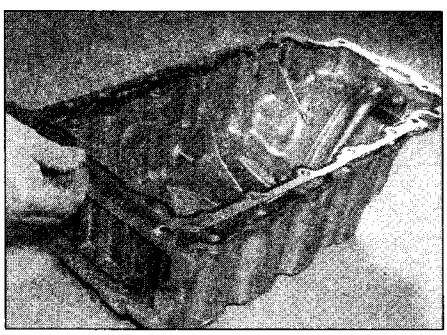
Inspection

2 Undo the retaining screws and lift off the

12.10a Apply a smear of sealant to the areas of the cylinder block/timing chain cover joints . . .



12.10b . . . and the rear main bearing cap/cylinder block joints



12.11 Fit a new gasket to the sump and manoeuvre it up into position

1.8 litre DOHC petrol engine (X18XE1 and Z18XE) (continued)

Valves and guides (continued)

Installation height of valve guide	10.70 to 11.00 mm	
Installation height of valves	N/A	
Stem-to-guide clearance:		
Inlet	0.03 to 0.06 mm	
Exhaust	0.04 to 0.07 mm	
Valve length*:	**Inlet**	**Exhaust**
Standard	101.20 to 101.60	100.56 to 100.96
1st oversize – 0.075 mm (K1)	N/A	N/A
2nd oversize – 0.150 mm (K2)	N/A	N/A
Valve stem diameter*:	**Inlet**	**Exhaust**
Standard	4.955 to 4.970 mm	4.935 to 4.950 mm
1st oversize – 0.075 mm (K1)	N/A	N/A
2nd oversize – 0.150 mm (K2)	N/A	N/A
Valve head diameter:		
Inlet	31.2 mm	
Exhaust	27.5 mm	

Gudgeon pins

Diameter	17.997 to 18.000 mm
Length	55 mm
Gudgeon pin clearance:	
In connecting rod (shrunk fit)	0.0 mm
In piston	0.09 to 0.015 mm

Crankshaft

Endfloat	0.100 to 0.202 mm
Main bearing journal diameter:	
Standard	54.980 to 54.997 mm
1st undersize – 0.25 mm	54.730 to 54.747 mm
2nd undersize – 0.50 mm	54.482 to 54.495 mm
Big-end bearing journal (crankpin) diameter:	
Standard	42.971 to 42.987 mm
1st undersize – 0.25 mm	42.721 to 42.737 mm
2nd undersize – 0.50 mm	42.471 to 42.487 mm
Big-end bearing journal shell thickness*:	
Standard (264N)	1.485 to 1.497 mm
1st undersize – 0.25 mm (blue – 265A)	1.610 to 1.622 mm
2nd undersize – 0.50 mm (white – 266B)	1.735 to 1.747 mm
Main bearing shell thickness (Nos 1, 2, 4 and 5)*:	
Standard (brown – 256N)	1.987 to 1.993 mm
Standard (green – 257N)	1.993 to 1.999 mm
1st undersize – 0.25 mm (brown/blue – 258A)	2.112 to 2.118 mm
1st undersize – 0.25 mm (green/blue – 259A)	2.118 to 2.124 mm
2nd undersize – 0.50 mm (brown/white – 260B)	2.237 to 2.243 mm
2nd undersize – 0.50 mm (green/white – 261B)	2.243 to 2.249 mm
Main bearing/thrust shell thickness (No 3)*:	
Standard (brown – 859N)	1.987 to 1.993 mm
Standard (green – 860N)	1.993 to 1.999 mm
1st undersize – 0.25 mm (brown/blue – 861A)	2.112 to 2.118 mm
1st undersize – 0.25 mm (green/blue – 862A)	2.118 to 2.124 mm
2nd undersize – 0.50 mm (brown/white – 863B)	2.237 to 2.243 mm
2nd undersize – 0.50 mm (green/white – 864B)	2.243 to 2.249 mm
Main bearing/thrust shell width (No 3)*:	
Standard (green/brown)	25.850 to 25.900 mm
1st undersize – 0.25 mm (brown/blue)	26.050 to 26.100 mm
2nd undersize – 0.50 mm (brown/white)	26.250 to 26.300 mm
Journal out-of round	0.04 mm
Journal taper	N/A
Crankshaft run-out	Less than 0.03 mm
Main bearing running clearance	0.013 to 0.043 mm
Big-end bearing (crankpin) running clearance	0.019 to 0.071 mm

8 With the engine securely supported, remove the front suspension subframe assembly as described in Chapter 10.
9 Referring to Chapter 8, free the driveshaft inner constant velocity joints from the transmission unit and position them clear. Note that it is not necessary to remove the driveshafts, they can be left attached to the hub assemblies. **Note:** *Do not allow the shafts to hang down under their own weight as this could damage the constant velocity joints/gaiters.*
10 Make a final check that any components which would prevent the removal of the engine/transmission from the car have been removed or disconnected. Ensure that components such as the driveshafts are secured so that they cannot be damaged on removal.
11 Undo the retaining nuts and remove the bracket securing the right-hand engine mounting to the cylinder head.
12 If available, a low trolley should be placed under the engine/transmission assembly, to facilitate its easy removal from under the vehicle. Lower the engine/transmission assembly, making sure that nothing is trapped, taking great care not to damage the radiator/cooling fan assembly **(see illustration)**. Enlist the help of an assistant during this procedure, as it may be necessary to tilt the assembly slightly to clear the body panels. Great care must be taken to ensure that no components are trapped and damaged during the removal procedure.
13 Detach the hoist and withdraw the engine/transmission unit from under the vehicle.

Separation

14 Refer to Section 4.

Refitting

15 If the engine and transmission have been separated, perform the operations described below in paragraphs 16 to 18. If not, proceed as described from paragraph 19 onwards.
16 Ensure the locating dowels are correctly positioned then carefully offer the transmission to the engine, until the locating dowels are engaged. Ensure that the weight of the transmission is not allowed to hang on the input shaft as it is engaged with the clutch friction disc.
17 Refit the transmission housing-to-engine bolts, ensuring that all the necessary brackets are correctly positioned, and tighten them to the specified torque setting.
18 Refit the starter motor and tighten its mounting bolts to the specified torque (see Chapter 5A).
19 Slide the engine/transmission unit into position and reconnect the hoist and lifting tackle to the engine lifting brackets.
20 With the aid of an assistant, carefully lift the assembly into position the engine compartment, manipulating the hoist and lifting tackle as necessary, taking great care not to trap any components.
21 Align the engine with the right-hand mounting then refit the mounting bracket, tightening its nuts by hand only at this stage.
22 Renew the driveshaft oil seals (see Chapter 7A) then carefully engage the driveshaft inner constant velocity joints with the transmission (see Chapter 8).
23 Refit the front suspension subframe as described in Chapter 10.
24 With the subframe assembly correctly installed, tighten the right-hand mounting bracket nuts to the specified torque.
25 The remainder of the refitting procedure is a direct reversal of the removal sequence, noting the following points:

a) Ensure that all wiring is correctly routed and retained by all the relevant retaining clips and that all connectors are correctly and securely reconnected.

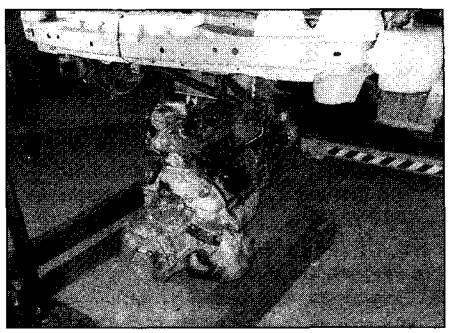
b) Ensure that all disturbed hoses are correctly reconnected, and securely retained by their retaining clips.
c) Fit new sealing washers to the injection pump fuel hose unions and tighten the union bolts to the specified torque (see Chapter 4B).

d) Fit a new sealing ring to the clutch fitting on the transmission unit and reconnect the end fitting, ensuring it is securely retained by the clip. On completion, check the bleed the hydraulic system as described in Chapter 6.

e) Refit the gearchange linkage to the transmission and adjust as described in Chapter 7A.

f) Refill the transmission with correct quantity and type of oil, as described in Chapter 7A. If the oil was not drained, top-up the level as described in Chapter 7A.

g) Refill the engine with oil as described in Chapter 1B and also refill the cooling system.



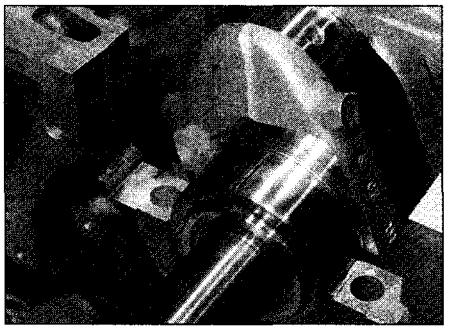
5.12 Ensure all components are disconnected then carefully lower the engine/transmission unit and manoeuvre it out from underneath the vehicle

6 Engine overhaul – dismantling sequence

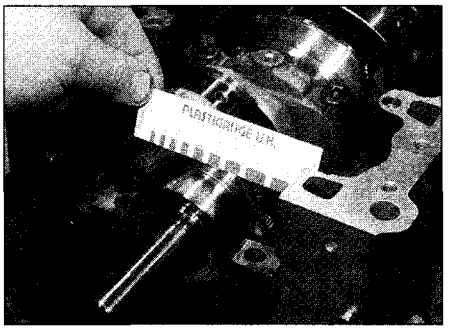
1 It is much easier to dismantle and work on the engine if it is mounted on a portable engine stand. These stands can often be hired from a tool hire shop. Before the engine is mounted on a stand, the flywheel/driveplate should be removed, so that the stand bolts can be tightened into the end of the cylinder block.
2 If a stand is not available, it is possible to dismantle the engine with it blocked up on a sturdy workbench, or on the floor. Be extra-careful not to tip or drop the engine when working without a stand.
3 If you are going to obtain a reconditioned engine, all the external components must be removed first, to be transferred to the replacement engine (just as they will if you are doing a complete engine overhaul yourself). These components include the following:
a) Inlet and exhaust manifolds (Chapter 4).
b) Alternator/power steering pump/air conditioning compressor bracket(s) (as applicable).
c) Coolant pump (Chapter 3).
d) Fuel system components (Chapter 4).
e) Wiring harness and all electrical switches and sensors.
f) Oil filter (Chapter 1).
g) Flywheel/driveplate (relevant Part of this Chapter).

Note: *When removing the external components from the engine, pay close attention to details that may be helpful or important during refitting. Note the fitted position of gaskets, seals, spacers, pins, washers, bolts, and other small items.*
4 If you are obtaining a 'short' engine (which consists of the engine cylinder block, crankshaft, pistons and connecting rods all assembled), then the cylinder head, sump, oil pump, and timing belt/chains (as applicable) will have to be removed also.
5 If you are planning a complete overhaul, the engine can be dismantled, and the internal components removed, in the order given below, referring to the relevant Part of this Chapter unless otherwise stated.
a) Inlet and exhaust manifolds (Chapter 4).
b) Timing belt, sprockets and tensioner – all models except 2.2 litre petrol and all diesel engines.
c) Cylinder head.
d) Flywheel/driveplate.
e) Sump.
f) Oil pump.
g) Timing chains and sprockets – 2.2 litre petrol and all diesel engines.
h) Piston/connecting rod assemblies.
i) Crankshaft.

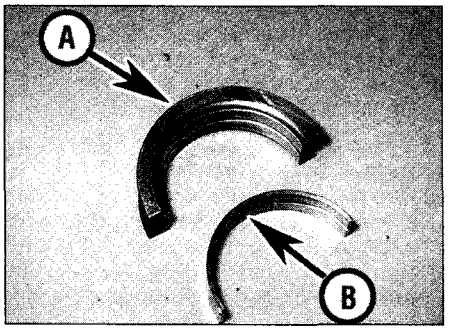
6 Before beginning the dismantling and overhaul procedures, make sure that you have all of the correct tools necessary. Refer to the *Tools and working facilities* Section of this manual for further information.



18.7 Plastigauge in place on a crankshaft main bearing journal



18.9 Measure the width of the deformed Plastigauge using the scale on the card



18.15 No 2 main bearing shell incorporates the thrust flanges (A) on the 2.2 petrol engine and No 3 main bearing shell on all other models – all the other shells are plain (B)

shells. If the diameter of each corresponding crankshaft journal is measured and then subtracted from the bearing internal diameter, the result will be the main bearing running clearance.

5 The second (and more accurate) method is to use a product known as Plastigauge. This consists of a fine thread of perfectly-round plastic which is compressed between the bearing shell and the journal. When the shell is removed, the plastic is deformed and can be measured with a special card gauge supplied with the kit. The running clearance is determined from this gauge. Plastigauge is sometimes difficult to obtain but enquiries at one of the larger specialist quality motor factors should produce the name of a stockist in your area. The procedure for using Plastigauge is as follows.

6 With the main bearing upper shells in place, carefully lay the crankshaft in position. Do not use any lubricant; the crankshaft journals and bearing shells must be perfectly clean and dry.

7 Cut several lengths of the appropriate size Plastigauge (they should be slightly shorter than the width of the main bearings) and place one length on each crankshaft journal axis **(see illustration)**.

8 With the main bearing lower shells in position, refit the main bearing caps, using the identification marks to ensure each one is correctly positioned. Refit the original retaining bolts and tighten them to the specified Stage 1 torque and then through the Stage 2 and 3 angles (see paragraphs 20 to 22). Take care not to disturb the Plastigauge and **do not** rotate the crankshaft at any time during this operation. Evenly and progressively slacken and remove the main bearing cap bolts then lift off the caps again taking great care not to disturb the Plastigauge or rotate the crankshaft.

9 Compare the width of the crushed Plastigauge on each journal to the scale printed on the Plastigauge envelope to obtain the main bearing running clearance **(see illustration)**. Compare the clearance measured with that given in the Specifications at the start of this Chapter.

10 If the clearance is significantly different from that expected, the bearing shells may be the wrong size (or excessively worn if the original shells are being re-used). Before deciding that the crankshaft is worn, make sure that no dirt or oil was trapped between the bearing shells and the caps or block when the clearance was measured. If the Plastigauge was wider at one end than at the other, the crankshaft journal may be tapered.

11 Before condemning the components concerned, seek the advice of your Vauxhall dealer or suitable engine repair specialist. They will also be able to inform as to the best course of action or whether renewal will be necessary.

12 Where necessary, obtain the correct size of bearing shell and repeat the running clearance checking procedure as described above.

13 On completion, carefully scrape away all traces of the Plastigauge material from the crankshaft and bearing shells using a fingernail or other object which is unlikely to score the bearing surfaces.

Final crankshaft refitting

1.6 litre petrol engine

14 Carefully lift the crankshaft out of the cylinder block.

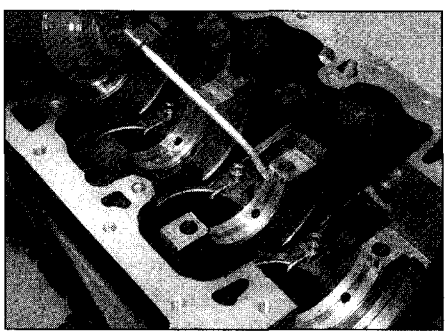
15 Place the bearing shells in their locations as described above in paragraphs 2 and 3 **(see illustration)**. If new shells are being fitted, ensure that all traces of the protective grease are cleaned off using paraffin. Wipe dry the shells and caps with a lint-free cloth.

16 Lubricate the upper shells with clean engine oil then lower the crankshaft into position **(see illustration)**.

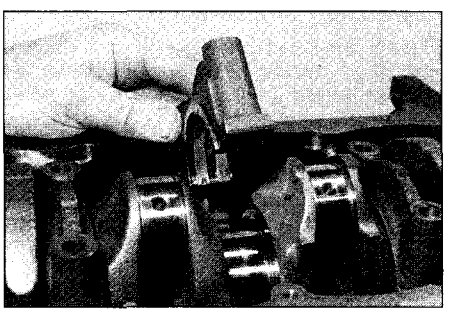
17 Ensure the crankshaft is correctly seated then check the endfloat as described in Section 14.

18 On models with separate main bearing caps, ensure the bearing shells are correctly located in the caps and refit the caps to the cylinder block **(see illustration)**. Ensure the caps are fitted in their correct locations, with number 1 cap at the timing belt end, and are fitted the correct way around so that all the numbers are the correct way up when read from the rear of the cylinder block.

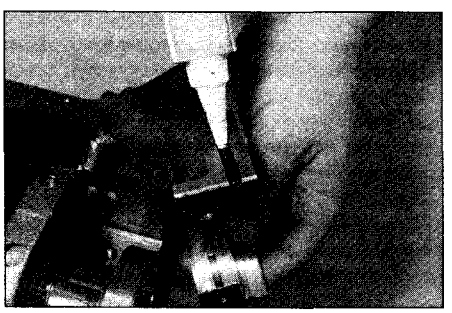
19 Ensure the rear (No 5) bearing cap is clean and dry then fill the groove on each side of the cap with sealing compound (Vauxhall recommend the use of sealant, part no 90485251, available from your Vauxhall dealer) **(see illustration)**. Fit the bearing cap to the engine, ensuring it is fitted the correct way around.



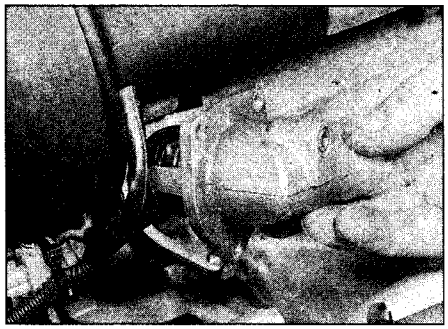
18.16 Lubricate the upper bearing shells with clean engine oil then fit the crankshaft



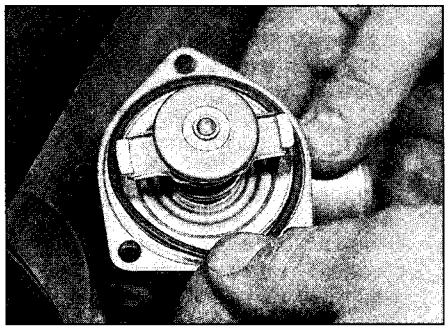
18.18 Lubricate the crankshaft journals then refit bearing caps Nos 1 to 4, ensuring each one is fitted in its original location



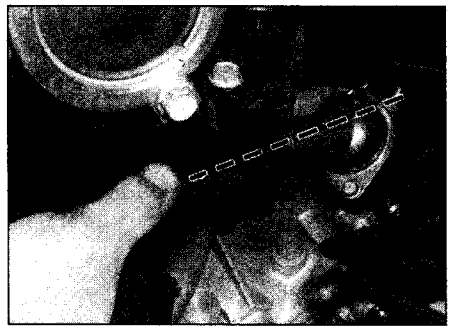
18.19 Fill the side grooves of the rear (No 5) bearing cap with sealant prior to refitting it to the engine



4.22a Removing the thermostat and cover on the 1.6 litre engine



4.22b Removing the sealing ring on the 1.6 litre engine



4.46 The top hose has a cut-out to locate on the thermostat cover lug

unscrewing the mounting bolts. Clean all remains of the gasket from the contact surfaces and obtain a new one.

Testing

24 A rough test of the thermostat's operation 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 **(see illustration 4.7)**.

25 The opening temperature is usually marked on the thermostat. If a thermometer is available, the precise opening temperature of the thermostat may be determined, and compared with the value marked on the thermostat.

26 A thermostat which fails to close as the water cools must also be renewed.

Refitting

27 Refitting is a reversal of removal, but fit a new seal to the thermostat, and where removed fit a new gasket to the housing. Refill the cooling system as described in Chapter 1A.

X18XE and X20XEV

Removal

28 The thermostat is located on the right-hand front of the cylinder head and is integral with the housing. First, disconnect the battery negative (earth) lead (see Chapter 5A).

29 Drain the cooling system as described in Chapter 1A by disconnecting the bottom hose from the radiator.

30 Loosen the clip and disconnect the top hose from the thermostat housing.

31 Progressively unscrew the mounting bolts and remove the thermostat housing from the cylinder head. Clean all remains of the seal from the contact surfaces and obtain a new seal.

Testing

32 Refer to paragraphs 7 to 9.

Refitting

33 Refitting is a reversal of removal, but fit a new seal and tighten the mounting bolts to the specified torque. Refill the cooling system as described in Chapter 1A.

Z18XE and X18XE1

Removal

34 The thermostat is located on the right-hand front of the cylinder head, and it is integral with its housing. First, disconnect the battery negative (earth) lead (see Chapter 5A).

35 Apply the handbrake, then jack up the front of the vehicle and support it on axle stands (see *Jacking and vehicle support*). Remove the engine compartment undertray. Also remove the top cover from the engine.

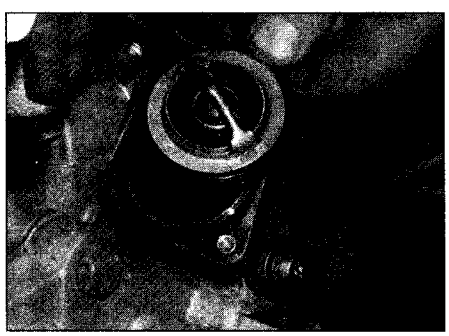
36 Drain the cooling system as described in Chapter 1A by disconnecting the bottom hose from the radiator.

37 Loosen the clips and disconnect the top hose and expansion tank hose from the thermostat housing.

38 Disconnect the wiring from the coolant temperature sensor on the housing.

39 Unbolt and remove the housing from the cylinder head, then remove the gasket.

4.47 Removing the thermostat housing cover



4.48 Removing the thermostat from the housing

Thoroughly clean the contact surfaces of the housing and cylinder head.

Testing

40 Refer to paragraphs 7 to 9.

Refitting

41 Refitting is a reversal of removal, but fit a new gasket and tighten the mounting bolts securely. Refill the cooling system as described in Chapter 1A.

Z22SE

Removal

42 The thermostat is located on the left-hand rear of the cylinder head, over the transmission. First, disconnect the battery negative (earth) lead (see Chapter 5A).

43 Apply the handbrake, then jack up the front of the vehicle and support it on axle stands (see *Jacking and vehicle support*). Remove the engine compartment undertray.

44 Drain the cooling system as described in Chapter 1A. The drain plug is located in the bottom of the coolant pump.

45 Release the relay box from the ABS hydraulic modulator in the left-hand rear corner of the engine compartment, and position the box to one side.

46 Loosen the clip and disconnect the top hose from the thermostat cover. Note that the end of the hose has a cut-out which locates with a lug on the cover **(see illustration)**.

47 Where applicable, unclip the coolant temperature sensor wiring from the cover, then unscrew the bolts and remove the cover from the thermostat housing **(see illustration)**.

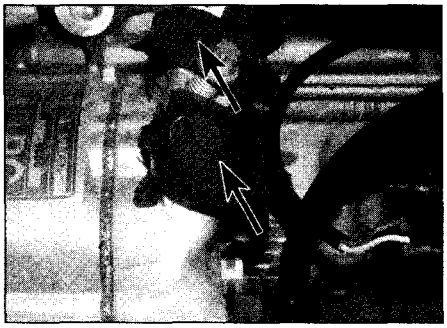
48 Lift the thermostat from the housing **(see illustration)**. Remove the seal from the rim of the thermostat and discard it. Obtain a new one. Clean the contact surfaces of the cover and housing.

Testing

49 Refer to paragraphs 7 to 9.

Refitting

50 Refitting is a reversal of removal, but fit a new seal and tighten the cover bolts to the specified torque. Refill the cooling system as described in Chapter 1A.



12.6 Seal the refrigerant inlet and outlet ports on the compressor

before the panel's lower end is pressed into place.

e) When reassembly is complete, synchronise the servomotors by switching on the ignition and depressing simultaneously the 'Auto On' and 'Auto Off' controls for approximately 5 seconds.

ECC air temperature sensor

Removal

59 Remove the climate control unit as described earlier.

60 Disconnect the wiring plug from the air outlet temperature sensor.

61 Twist the temperature sensor anti-clockwise and remove from the housing.

Refitting

62 Refitting is a reversal of removal.

ECC fan regulator

Removal

63 Remove the left-hand side footwell air duct.

64 Remove the cover from the side of the heater assembly.

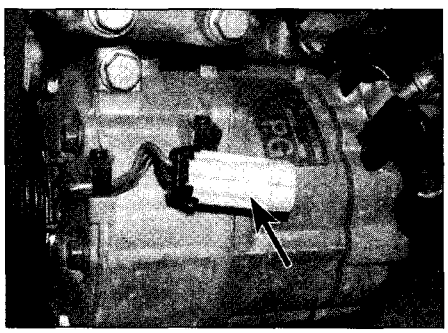
65 On left-hand drive models, remove the accelerator pedal.

66 Unscrew the fan regulator retaining bolts.

67 Withdraw the fan regulator from the heater housing.

Refitting

68 Refitting is a reversal of removal.



12.7 Wiring plug on the compressor

ECC sun sensor

Removal

69 Carefully prise out the sensor from the top of the air duct panel taking care not to damage the panel. Use a wad of cloth when levering as a precaution.

70 Tape or clip the wiring to the facia to prevent it dropping inside.

71 Disconnect the wiring and remove the sensor.

Refitting

72 Refitting is a reversal of removal.

11 Air conditioning system – general information and precautions

General information

Air conditioning is standard on top of the range models, and optional on certain other models. It enables the temperature of incoming air to be lowered, and also dehumidifies the air, which makes for rapid demisting and increased comfort.

The cooling side of the system works in the same way as a domestic refrigerator. Refrigerant gas is drawn into a belt-driven compressor, and passes into a condenser mounted in front of the radiator, where it loses heat and becomes liquid. The liquid passes through an expansion valve to an evaporator, where it changes from liquid under high pressure to gas under low pressure. This change is accompanied by a drop in temperature, which cools the evaporator. The refrigerant returns to the compressor, and the cycle begins again.

Air blown through the evaporator passes to the heater assembly, where it is mixed with hot air blown through the heater matrix, to achieve the desired temperature in the passenger compartment.

The heating side of the system works in the same way as on models without air conditioning (see Section 10).

The operation of the system is controlled electronically. Any problems with the system should be referred to a Vauxhall/Opel dealer or an air conditioning specialist.

Precautions

It is necessary to observe special precautions whenever dealing with any part of the system, its associated components, and any items which necessitate disconnection of the system.

Warning: The refrigeration circuit contains a liquid refrigerant (Freon). This refrigerant is potentially dangerous, and should only be handled by qualified persons. If it is splashed onto the skin, it can cause frostbite. It is not itself poisonous, but in the presence of a naked flame it forms a poisonous gas; inhalation of the vapour through a lighted cigarette could prove fatal. Uncontrolled discharging of the refrigerant is dangerous, and potentially damaging to the environment. It is therefore dangerous to disconnect any part of the system without specialised knowledge and equipment. If for any reason the system must be disconnected, entrust this task to an authorised dealer or an air conditioning specialist.

Caution: Do not operate the air conditioning system if it is known to be short of refrigerant, as this may damage the compressor.

12 Air conditioning system components – removal and refitting

Warning: Read the precautions given in Section 11, and have the system discharged by a Vauxhall/Opel dealer or an air conditioning specialist. Do not carry out the following work unless the system has been discharged.

Compressor

Removal

1 Have the air conditioning system evacuated by a qualified engineer. Seal the refrigerant circuit with suitable plugs.

2 Where necessary, remove the air filter housing as described in the appropriate part of Chapter 4.

3 Remove the auxiliary drivebelt as described in Chapter 1A or 1B.

4 Apply the handbrake, then jack up the front of the vehicle and support it on axle stands (see *Jacking and vehicle support*). Remove the splash guard from under the engine compartment.

5 On petrol engine models, remove the front exhaust downpipe as described in Chapter 4A.

6 Disconnect the refrigerant lines from the compressor, then tape over or plug the lines **(see illustration)**.

7 Disconnect the wiring plug from the compressor **(see illustration)**.

8 On models with the X20DTL diesel engine, disconnect the wiring plug at the sump.

9 Unscrew the mounting bolts and withdraw the compressor from the engine.

Refitting

10 Refitting is a reversal of removal but tighten the mounting bolts to the specified torque and tension the auxiliary drivebelt with reference to Chapter 1A or 1B. On completion, have the refrigerant engineer charge the system and fit new O-rings to the line connections. If a new compressor is being fitted, make sure that the oil level is checked and topped-up before fitting it, and initially run

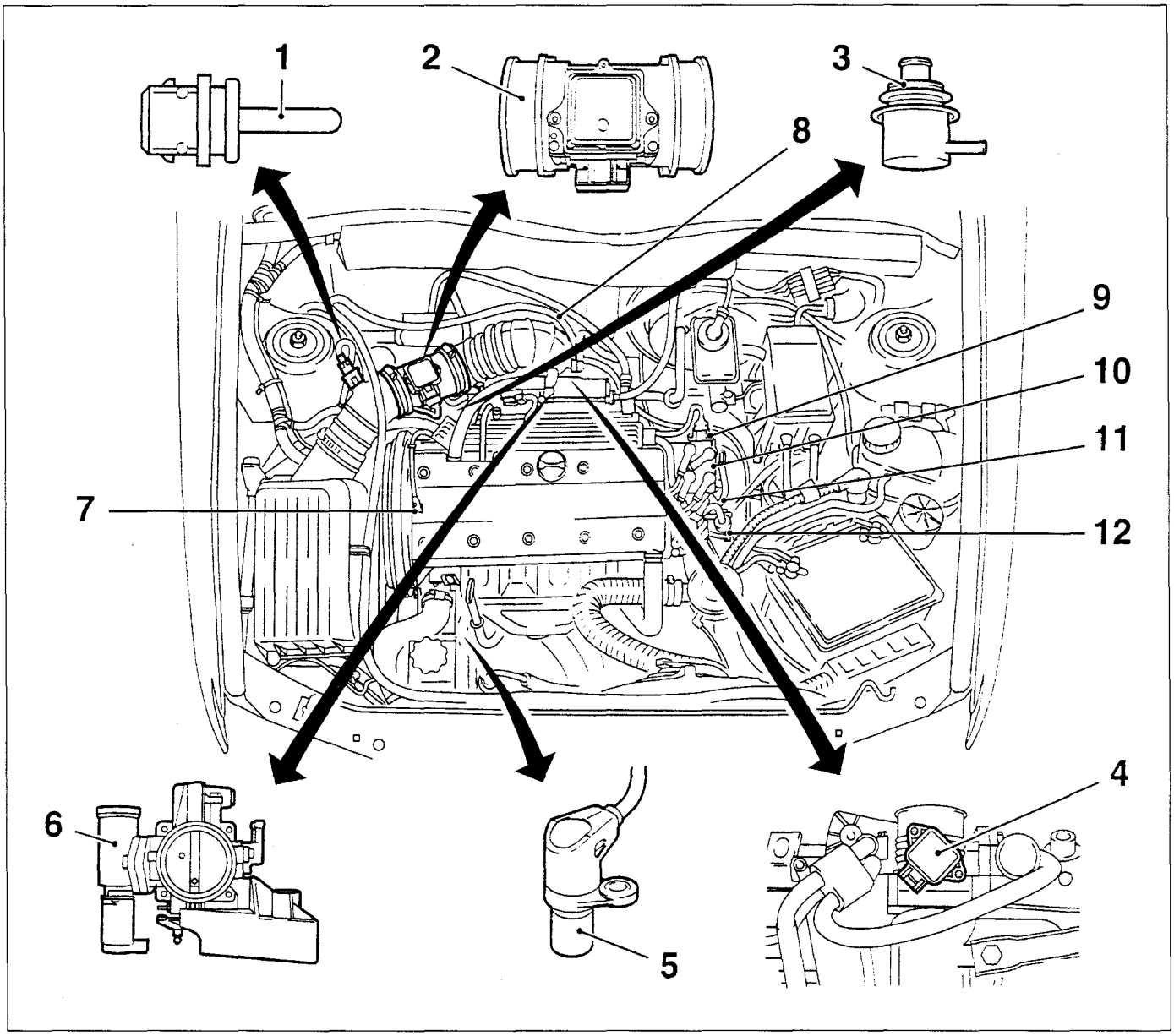
for cranking, starting (with either a hot or cold engine), warm-up, idle, cruising, and acceleration. The Multec S system is a 'sequential' fuel injection system. This means that each of the four injectors is triggered individually just before the inlet valve of the relevant cylinder is about to open.

13 On early models, the ECU also has full control over the engine idle speed, via a stepper motor which is fitted to the throttle housing. The motor controls the opening of an air passage which bypasses the throttle valve. When the throttle valve is closed (accelerator pedal released), the ECU uses the motor to vary the amount of air entering the engine and so controls the idle speed.

14 On later models (Z16XE, Z18XE and Z22SE), the system has an electronic accelerator (no accelerator cable), this consists of an accelerator pedal module and a throttle valve module. Each module has two potentiometers (sensors) which determine the position of the pedal, which then transmitts a signal to the ECU. Also the crankshaft sensor has been moved to the cylinder block, where it picks up the signal from an increment disc on number eight web on the crankshaft.

15 The ECU also controls the exhaust and evaporative emission control systems, which are described in detail in Part C of this Chapter.

16 If there is an abnormality in any of the readings obtained from any sensor, the ECU enters its back-up mode. In this event, the ECU ignores the abnormal sensor signal, and assumes a preprogrammed value which will allow the engine to continue running (albeit at reduced efficiency). If the ECU enters this back-up mode, the warning light on the instrument panel will come on, and the relevant fault code will be stored in the ECU memory.



7.18a Simtec 56.5 and 70 multi-point fuel injection system components (X18XE, X18XE1 and X20XEV)

1 *Intake air temperature sensor*
2 *Hot film mass airflow meter*
3 *Fuel pressure regulator*
4 *Throttle potentiometer*
5 *Crankshaft sensor*
6 *Idle speed control stepper motor*
7 *Camshaft position sensor*
8 *Knock sensor (on rear of the cylinder block)*
9 *Evaporative emission system purge valve*
10 *Ignition module*
11 *Coolant temperature sensor*
12 *Exhaust gas recirculation (EGR) valve*

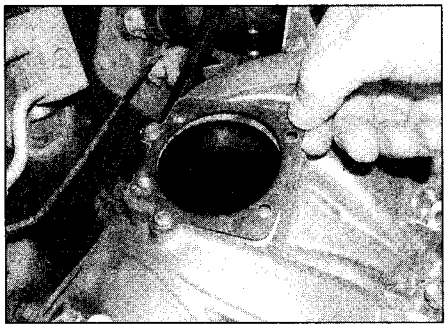
37 Where applicable, disconnect the vacuum/breather hoses from the throttle body, noting their correct fitted locations, then undo the retaining nuts and remove the housing from the manifold. Remove the gasket and discard it, a new one should be used on refitting **(see illustration)**.

38 Refitting is the reverse of removal, bearing in mind the following points.

a) Ensure the mating surfaces are clean and dry then fit a new gasket and tighten the housing nuts to the specified torque.

b) Ensure all hoses are correctly and securely reconnected.

c) On completion adjust the accelerator cable as described in Section 4 (where applicable).



12.37 Renew the throttle body-to-manifold gasket

13 Fuel injection system – testing and adjustment

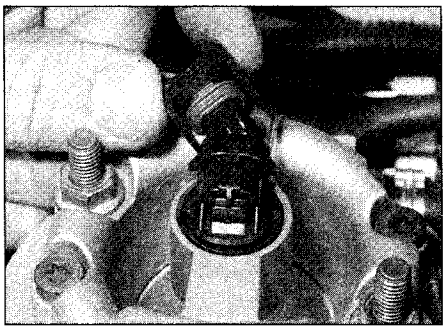
Testing

1 If a fault appears in the fuel injection system, first ensure that all the system wiring connectors are securely connected and free of corrosion. Ensure that the fault is not due to poor maintenance; ie, check that the air cleaner filter element is clean, the spark plugs are in good condition and correctly gapped, the cylinder compression pressures are correct, and that the engine breather hoses are clear and undamaged, referring to the appropriate part of Chapters 1, 2 and 5 for further information (as applicable).

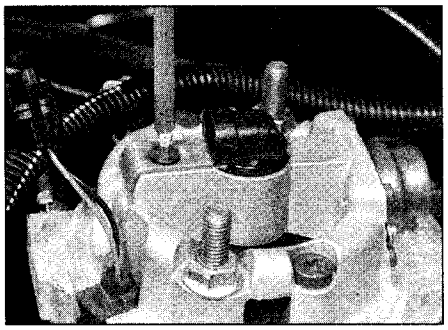
2 If these checks fail to reveal the cause of the problem, the vehicle should be taken to a suitably-equipped Vauxhall dealer for testing. A wiring block connector is incorporated in the engine management circuit, into which a special electronic diagnostic tester can be plugged (see Section 7). The tester will locate the fault quickly and simply, alleviating the need to test all the system components individually, which is a time-consuming operation that carries a risk of damaging the ECU.

Adjustment

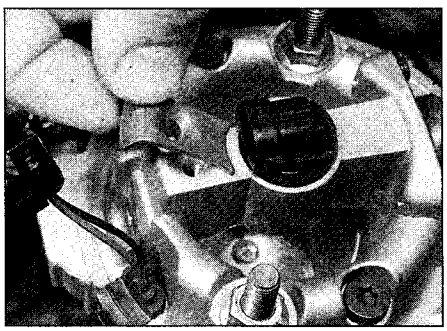
3 Experienced home mechanics with a considerable amount of skill and equipment (including a tachometer and an accurately calibrated exhaust gas analyser) may be able to check the exhaust CO level and the idle speed. However, if these are found to be in need of adjustment, the car will have to be taken to a suitably-equipped Vauxhall dealer who has access to the necessary diagnostic equipment required to test and adjust the settings.



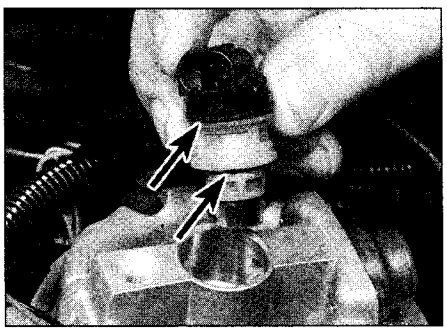
14.3 Disconnect the wiring connector from the fuel injector . . .



14.4a . . . then undo the retaining screw . . .



14.4b . . . and remove the injector retaining plate



14.5 Remove the injector from the throttle body, noting the sealing rings (arrowed)

14 Multec single-point injection system components – removal and refitting

Warning: Refer to the warning note in Section 1 before proceeding.

Fuel injector

Note: *Before condemning an injector, if a faulty injector is suspected, it is worth trying the effect of one of the proprietary injector-cleaning treatments.*

1 Depressurise the fuel system as described in Section 8 then disconnect the battery negative terminal.

2 Slacken the retaining clip and disconnect the air intake duct from the throttle body cover. Disconnect the vacuum and breather hoses from the cover then undo the retaining screws and remove the cover and sealing ring from the top of the throttle body.

3 Release the retaining clips and disconnect the wiring connector from the injector **(see illustration)**.

4 Undo the retaining screw and remove the injector retaining plate **(see illustrations)**.

5 Ease the injector out from the throttle body along with its sealing rings **(see illustration)**. Discard the sealing rings, they must be renewed whenever the injector is disturbed.

6 Refitting is a reversal of the removal procedure using new injector sealing rings. When refitting the retaining clip, ensure it is correctly engaged with the injector and securely tighten its retaining screw.

Fuel pressure regulator

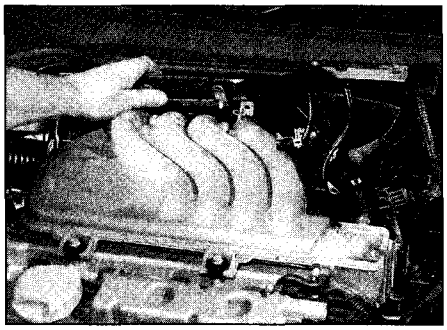
Note: *At the time of writing it appears that the regulator assembly is not available separately; if it is faulty the complete throttle body upper section must be renewed. Although the unit can be dismantled for cleaning, if required, it should not be disturbed unless absolutely necessary.*

7 Depressurise the fuel system as described in Section 8 then disconnect the battery negative terminal.

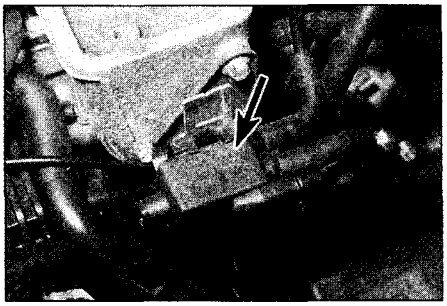
8 Slacken the retaining clip and disconnect the air intake duct from the throttle body cover. Disconnect the vacuum and breather hoses from the cover then undo the retaining screws and remove the cover and sealing ring from the top of the throttle body.

9 Using a marker pen, make alignment marks between the regulator cover and throttle body, then slacken and remove the cover retaining screws **(see illustration)**.

10 Lift off the cover, then remove the spring seat and spring then withdraw the diaphragm, noting its correct fitted orientation **(see**



18.16 Free the wiring harness from the rear of the manifold (X16XEL)



18.17 Unclip the purge valve (arrowed) from the left-hand end of the manifold (X16XEL)

retaining screws and lift off the cover from the top of the engine. Refit the oil filler cap. Drain the coolant system with reference to Chapter 1A.

16 Slacken and remove the bolts securing the wiring harness plastic tray to the rear of the inlet manifold. Starting at the front and working back, disconnect the wiring connectors from the oxygen sensor, DIS module, purge valve and the various connectors on the left-hand side of the manifold. Undo the nuts securing the earth leads to the cylinder head and manifold then unclip the plastic tray and position it clear of the manifold **(see illustration)**.

17 Unclip the evaporative emission system purge valve from the left-hand end of the manifold and disconnect the valve hose from the manifold **(see illustration)**.

18 Slacken the union nut and disconnect the braking system vacuum servo hose from the manifold. Also disconnect the breather/ vacuum hoses which are situated next to the servo unit union. On X16XEL models, disconnect the vacuum hose from the fuel pressure regulator.

19 Release the retaining clips and disconnect the coolant pipes from the throttle housing.

20 Slacken and remove the retaining nuts and bolts from the front and rear of the manifold upper section **(see illustration)**. Lift the manifold section out of position, freeing it from the connecting hose, and recover the gasket from the lower section.

21 To remove the lower section of the manifold, first depressurise the fuel system as described in Section 8.

22 Slacken the unions nuts and disconnect the fuel hoses from the fuel rail. Whilst slackening the nuts, retain the fuel rail adapters with an open-ended spanner.

23 Slacken the lower retaining clip and remove the connecting piece from the throttle housing.

24 Disconnect the crankshaft sensor wiring connector and free it from the manifold, noting its correct routing.

25 On X16XEL models, free the accelerator cable from the throttle housing and mounting bracket (see Section 4). On X16XEL and Z16XE models, disconnect the wiring connector(s) from the throttle valve body.

26 Undo the retaining bolts and remove the throttle housing from the its mounting flange. Recover the housing gasket and discard.

27 Unbolt the throttle housing mounting flange and remove it from the side of the manifold. Note each bolt's fitted location as they are different lengths.

28 Remove the auxiliary drivebelt (see Chapter 1A) then undo the retaining bolts and remove the alternator mounting bracket from the right-hand end of the manifold.

29 Release the retaining clip and disconnect the coolant hose from the base of the manifold.

30 Slacken and remove the retaining nuts then manoeuvre the lower section of the manifold away from the cylinder head and out of the engine compartment.

31 Unbolt the coolant housing from the right-hand end of the cylinder head then remove the manifold gasket and discard it.

32 Refitting is the reverse of removal bearing in mind the following points.

a) Prior to refitting, check the manifold studs and renew any that are worn or damaged.
b) Ensure the manifold and cylinder mating surfaces are clean and dry and fit the new gasket. Fit the manifold and coolant housing and tighten the retaining nuts and bolts evenly and progressively to the specified torque.
c) Fit the throttle housing using a new gasket and tighten its retaining bolts to the specified torque.
d) Ensure that all relevant hoses are reconnected to their original positions, and are securely held (where necessary) by their retaining clips.
e) Tighten the fuel hose and vacuum servo hose union nuts to their specified torque settings.
f) Refill the cooling system as described in Chapter 1A.
g) On completion, adjust the accelerator cable as described in Section 4.

1.8 and 2.0 litre engine

33 Remove the auxiliary drivebelt as described in Chapter 1A.

34 Depressurise the fuel system as described in Section 8 then disconnect the battery negative terminal.

35 Carry out the operations described in paragraphs 30 to 37 of Section 12 noting that it is not necessary to unbolt the throttle housing from the manifold.

36 Slacken the unions nuts and disconnect the fuel hoses from the fuel rail. Whilst slackening the nuts, retain the fuel rail adapters with an open-ended spanner.

37 Disconnect the wiring connectors from the DIS module, the purge valve, the manifold valve switchover solenoid, the coolant temperature sensor, the EGR valve and the oxygen sensor.

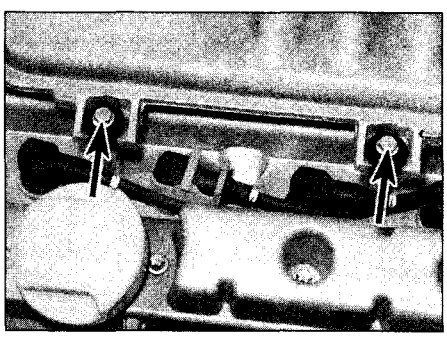
38 Carefully release the retaining clips and lift the wiring cover assembly squarely away from rear of the cylinder head. Disconnect the crankshaft sensor and knock sensor wiring connectors from the base of the cover then position the cover and wiring clear of the manifold.

39 Unscrew the union nut and disconnect the braking system servo unit hose from the manifold. Disconnect all remaining vacuum/ breather hoses from the manifold, noting each ones correct fitted location.

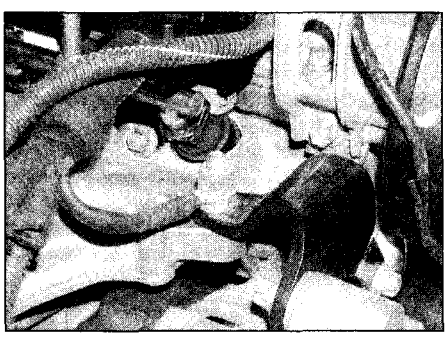
40 Undo the retaining bolts and remove the alternator mounting brackets from the right-hand side of the inlet manifold **(see illustration)**.

41 Undo the retaining bolts and remove the support bracket from the base of the manifold **(see illustration)**.

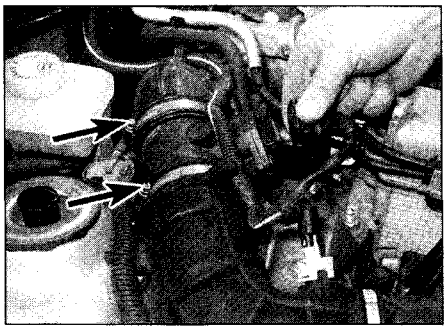
42 Slacken and remove the retaining nuts and bolts and manoeuvre the manifold assembly away from the engine. Remove the gasket and discard it. **Note:** *The manifold assembly must be treated as a sealed unit; do not attempt to dismantle it as no components, other than the switchover diaphragm and solenoid, are available separately.*



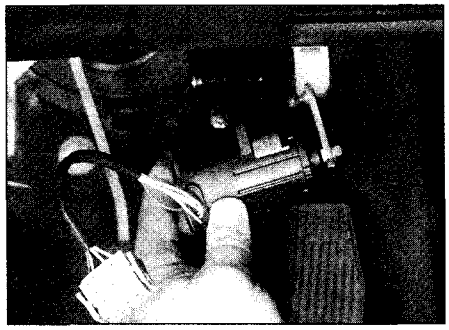
18.20 Manifold upper section-to-camshaft cover bolts (arrowed)



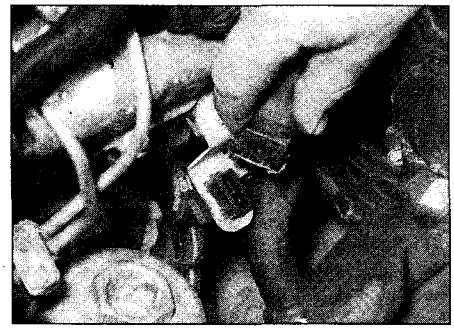
18.40 Alternator support bracket (X18XE1) – note the earth connection



8.1 Disconnect the wiring connector then slacken the retaining clips (arrowed) and remove the airflow meter



8.9 Removing the accelerator pedal position sensor



8.13 Disconnect the wiring connector . . .

2 Slacken the retaining clips then free the airflow meter from the intake ducts and remove it from the engine compartment.
3 Refitting is the reverse of removal, ensuring the intake ducts are correctly seated and their retaining clips are securely tightened.

Intake air temperature sensor

Note: *On high-pressure turbo models, the air temperature sensor is built into the airflow meter.*

Low-pressure turbo models

4 Ensure the ignition is switched off, then disconnect the wiring connector and carefully ease the sensor out from the intake duct.
5 Refitting is the reverse of removal ensuring the sensor is correctly located in the duct.

Accelerator pedal position sensor

6 From inside the vehicle, unscrew the fasteners and remove the lower trim panel from underneath the driver's side of the facia to gain access to the accelerator pedal.
7 Disconnect the wiring connector from the sensor which is mounted onto the top of the accelerator pedal.
8 Remove the retaining clip from the link rod ball joint then unclip the rod from the sensor.
9 Undo the retaining screws and remove the sensor from the pedal bracket **(see illustration)**.
10 Refitting is the reverse of removal.

Crankshaft sensor

11 Undo the retaining screws and remove the plastic cover from the top of the cylinder head.
12 To gain access to the sensor from below, firmly apply the handbrake then jack up the front of the vehicle and support it on axle stands. Where necessary, undo the retaining bolts and remove the undercover from beneath the engine/transmission unit.
13 Trace the wiring back from the crankshaft sensor to its wiring connector then free the connector from its bracket and disconnect it from the main harness **(see illustration)**.
14 Wipe clean the area around the crankshaft sensor then slacken and remove the retaining bolt. Remove the sensor from the front of the cylinder block and recover the sealing ring **(see illustration)**.
15 Refitting is the reverse of removal, using a new sealing ring. Tighten the sensor retaining bolt to the specified torque.

Coolant temperature sensor

16 The coolant temperature sensor is screwed into the front of the cylinder head, at the right-hand end. Refer to Chapter 3, Section 7, for removal and refitting details.

Charge (boost) pressure sensor

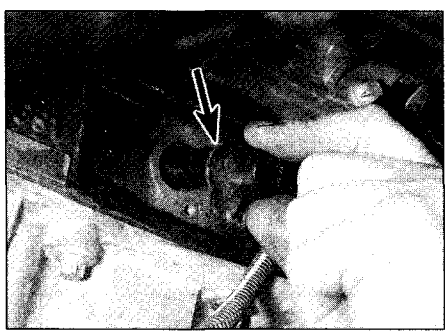
17 Undo the retaining screws and remove the plastic cover from the top of the cylinder head.
18 Slacken and remove the screws securing the wiring harness tray to the top of the inlet manifold and disconnect the wiring connector from the charge pressure sensor **(see illustration)**.
19 Undo the retaining bolt and remove the sensor from the top of the inlet manifold, noting the sealing ring fitted to the sensor shaft.
20 Refitting is the reverse of removal, using a new sealing ring and tightening the retaining bolt to the specified torque.

Oil temperature sensor

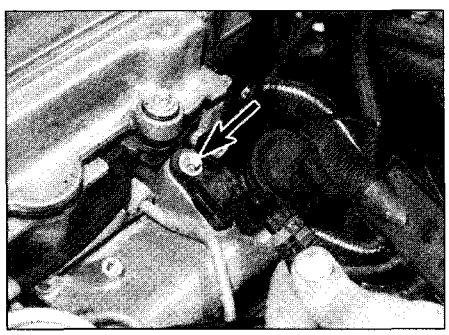
21 Firmly apply the handbrake then jack up the front of the vehicle and support it on axle stands. Where necessary, undo the retaining bolts and remove the undercover from beneath the engine/transmission unit.
22 Drain the engine oil as described in Chapter 1B. Once the oil has finished draining, fit a new sealing ring then refit the drain plug and tighten it to the specified torque.
23 Disconnect the wiring connector then unscrew the sensor from the front of the sump **(see illustration)**.
24 On refitting is the reverse of removal, refilling the engine with oil as described in Chapter 1B.

Electronic control unit (ECU)

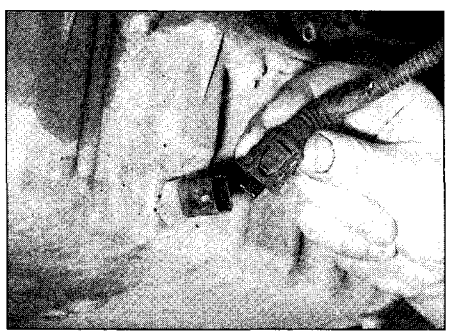
25 Remove the windscreen wiper arms as described in Chapter 12 then disconnect the battery negative terminal.



8.14 . . . then undo the retaining screw and remove the crankshaft sensor from the front of the cylinder block (sealing ring arrowed)



8.18 Disconnect the wiring connector then undo the retaining bolt (arrowed) and remove the charge pressure sensor



8.23 Disconnect the oil temperature sensor wiring connector

1 General information

1 All petrol engine models use unleaded petrol and also have various other features built into the fuel system to help minimise harmful emissions. All models are equipped with a crankcase emission control system, a catalytic converter, an exhaust gas recirculation (EGR) system and an evaporative emission control system to keep fuel vapour/exhaust gas emissions down to a minimum.

2 All diesel engine models are also designed to meet strict emission requirements. All models are fitted with a crankcase emission control system and a catalytic converter to keep exhaust emissions down to a minimum. All models are also fitted with an exhaust gas recirculation (EGR) system to further decrease exhaust emissions.

3 The emission control systems function as follows.

Petrol models

Crankcase emission control

4 To reduce the emission of unburned hydrocarbons from the crankcase into the atmosphere, the engine is sealed and the blow-by gases and oil vapour are drawn from inside the crankcase, through a wire mesh oil separator, into the inlet tract to be burned by the engine during normal combustion.

5 Under all conditions the gases are forced out of the crankcase by the (relatively) higher crankcase pressure; if the engine is worn, the raised crankcase pressure (due to increased blow-by) will cause some of the flow to return under all manifold conditions.

Exhaust emission control

6 To minimise the amount of pollutants which escape into the atmosphere, all models are fitted with a catalytic converter in the exhaust system. The system is of the closed-loop type, in which a oxygen sensor(s) in the exhaust system provides the fuel injection/ignition system ECU with constant feedback, enabling the ECU to adjust the mixture to provide the best possible conditions for the converter to operate.

7 On Z16XE, Z18XE and Z22SE engines there are two heated oxygen sensors fitted to the exhaust system **(see illustrations)**. The sensor nearest the engine (before the catalytic converter) determines the residual oxygen content of the exhaust gasses for mixture correction. The sensor in the exhaust front pipe (after the catalytic converter) monitors the function of the catalytic converter to give the driver a warning signal if there is a fault.

8 The oxygen sensor's tip is sensitive to oxygen and sends the ECU a varying voltage depending on the amount of oxygen in the exhaust gases; if the intake air/fuel mixture is too rich, the exhaust gases are low in oxygen so the sensor sends a low-voltage signal, the voltage rising as the mixture weakens and the amount of oxygen rises in the exhaust gases. Peak conversion efficiency of all major pollutants occurs if the intake air/fuel mixture is maintained at the chemically-correct ratio for the complete combustion of petrol of 14.7 parts (by weight) of air to 1 part of fuel (the 'stoichiometric' ratio). The sensor output voltage alters in a large step at this point, the ECU using the signal change as a reference point and correcting the intake air/fuel mixture accordingly by altering the fuel injector pulse width.

Evaporative emission control

9 To minimise the escape into the atmosphere of unburned hydrocarbons, an evaporative emissions control system is also fitted to all models. The fuel tank filler cap is sealed and a charcoal canister is mounted behind the right-hand front wing. The canister collects the petrol vapours generated in the tank when the car is parked and stores them until they can be cleared from the canister (under the control of the fuel injection/ignition system ECU) via the purge valve into the inlet tract to be burned by the engine during normal combustion.

10 To ensure that the engine runs correctly when it is cold and/or idling and to protect the catalytic converter from the effects of an over-rich mixture, the purge control valve is not opened by the ECU until the engine has warmed-up, and the engine is under load; the valve solenoid is then modulated on and off to allow the stored vapour to pass into the inlet tract.

Exhaust gas recirculation (EGR) system

11 This system is designed to recirculate small quantities of exhaust gas into the inlet tract, and therefore into the combustion process. This process reduces the level of unburnt hydrocarbons present in the exhaust gas before it reaches the catalytic converter. The system is controlled by the fuel injection/ignition ECU, using the information from its various sensors, via the EGR valve.

12 On 1.6 litre models the EGR valve is an electrically-operated valve mounted on the inlet manifold.

13 On 1.8, 2.0 and 2.2 litre models the EGR valve assembly is mounted on the left-hand end of the cylinder head. The valve assembly contains the vacuum-operated valve and the electrical solenoid valve which is used to switch the valve on and off.

Secondary air injection system

14 The purpose of the secondary air injection system is to decrease exhaust gas emissions when the engine is cold. The system achieves this by raising the temperature of the exhaust gases which has the effect of quickly warming the catalytic converter up to its normal operating temperature. Once the catalytic converter is up to temperature the air injection system is switched off.

15 The system consists of the pump, air cleaner, the air valve and the solenoid valve and is controlled by the fuel injection/ignition ECU. When the engine is cold, the solenoid valve switches the air valve to open and the pump injects a controlled amount of air into the cylinder head exhaust ports. The air then mixes with the exhaust gases, causing any unburned particles of the fuel in the mixture to be burnt in the exhaust port/manifold which effectively raises the temperature of the exhaust gases. Once the catalytic converter is up to temperature, the solenoid valve closes the air valve and the pump is switched off. A non-return valve prevents the exhaust gases passing through the air valve.

Diesel models

Crankcase emission control

16 Refer to paragraphs 4 and 5.

Exhaust emission control

17 To minimise the level of exhaust pollutants released into the atmosphere, a catalytic converter is fitted in the exhaust system.

18 The catalytic converter consists of a canister containing a fine mesh impregnated with a catalyst material, over which the hot exhaust gases pass. The catalyst speeds up the oxidation of harmful carbon monoxide, unburned hydrocarbons and soot, effectively reducing the quantity of harmful products released into the atmosphere via the exhaust gases.

Exhaust gas recirculation (EGR) system

19 This system is designed to recirculate small quantities of exhaust gas into the inlet tract, and therefore into the combustion process. This process reduces the level of unburnt hydrocarbons present in the exhaust gas before it reaches the catalytic converter. The system is controlled by the injection system ECU, using the information from its various sensors, via the EGR valve on the upper section of the inlet manifold. The EGR valve is vacuum operated and is switched on and off by an electrical solenoid valve.

2 Petrol engine emission control systems – testing and component renewal

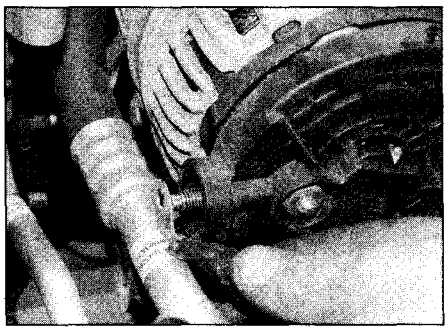
Crankcase emission control

1 The components of this system require no attention other than to check that the hose(s) are clear and undamaged at regular intervals.

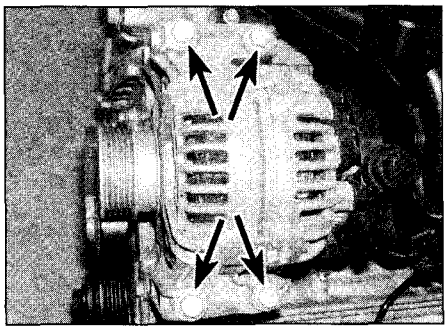
Evaporative emission control system

Testing

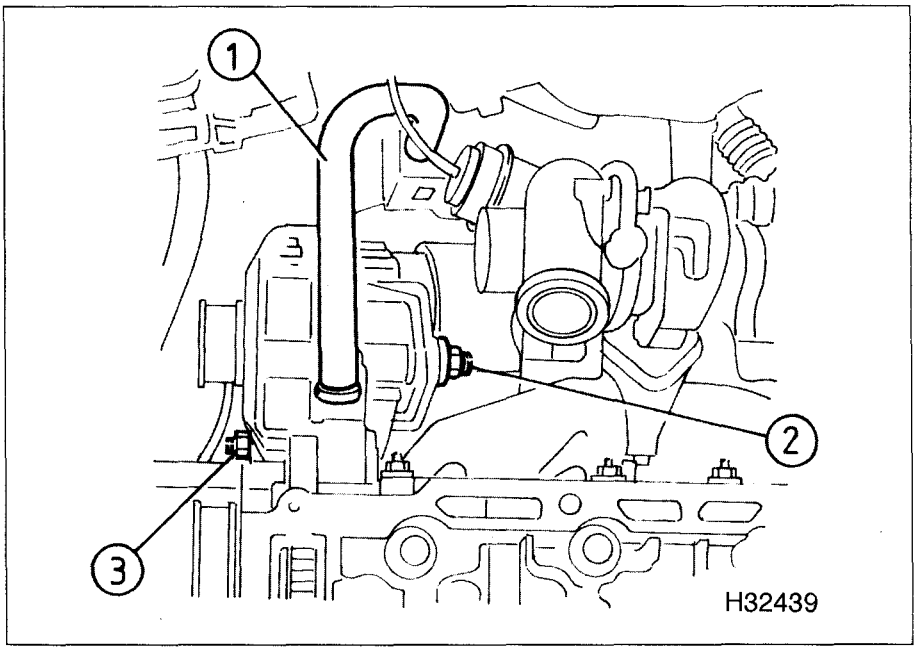
2 If the system is thought to be faulty, disconnect the hoses from the charcoal canister and purge control valve and check



8.28b . . . and disconnect the wiring terminal



8.29 Alternator mounting bracket bolts arrowed (Z22SE)



8.32 Lower alternator mounting bolt (3), upper mounting bolt (2), and coolant hose (1)

29 Slacken and remove the four alternator mounting bolts, and manoeuvre the alternator out of position **(see illustration)**.

Diesel engines

30 With reference to Chapter 4B if necessary, remove the intake ducting complete with hot film mass airflow meter.

31 Unscrew the three bolts securing the rear wiring trough, and disconnect the wiring connections from the alternator.

32 Remove the starter motor and turbocharger heat shields, and slacken the lower alternator retaining bolt **(see illustration)**.

33 Disconnect the vacuum pipe and wiring plug, and remove the turbocharger wastegate solenoid valve as described in Chapter 4B, Section 8.

34 Unscrew the nut and remove the upper alternator retaining bolt **(see illustration 8.32)**.

35 Drain the cooling system as described in Chapter 1B, or be prepared for coolant spillage. Disconnect the coolant flange from the right-hand end of the cylinder head.

36 Remove the lower retaining bolt, and remove the alternator upwards and out of the engine compartment.

Refitting

37 Refitting is the reverse of removal tightening all mounting bolts to their specified torque settings (where given). Ensure the drivebelt is correctly refitted and tensioned as described in the appropriate part of Chapter 1.

9 Alternator – brush renewal

Note: *If the alternator is thought to be suspect, it can 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 and availability of parts before proceeding as it may prove more economical to obtain a new or exchange alternator.*

Procedure for a typical alternator

1 Remove the alternator, as described in Section 8.

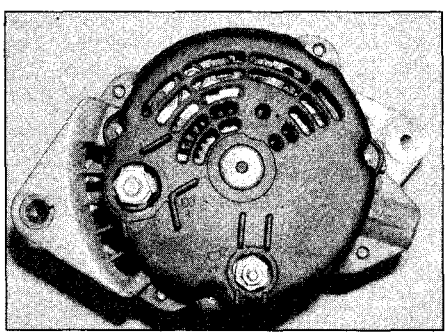
2 Place the alternator on a clean work surface, with the pulley facing down.

3 Undo the retaining screws, and lift away the outer plastic cover **(see illustration)**.

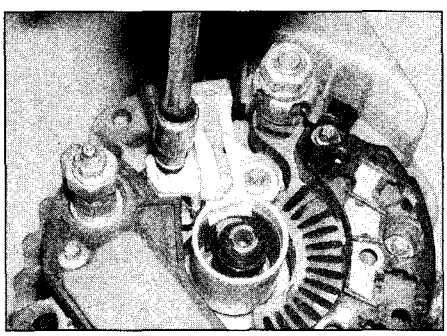
4 Unscrew the two retaining screws and ease the wire from the connector **(see illustrations)**.

5 If the brushes are damaged or excessively worn, the brush pack must be renewed.

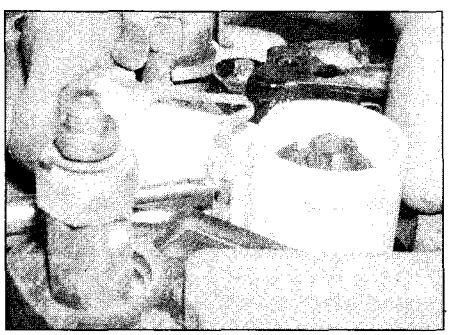
6 Clean and inspect the surfaces of the slip-rings, at the end of the alternator shaft. If they are excessively worn, or damaged, the alternator must be renewed.



9.3 Undo the screws and lift away the cover



9.4a Unscrew the brush pack screws . . .



9.4b . . . and ease the connector apart

1 General information

1 The clutch consists of a friction disc, a pressure plate assembly, and the hydraulic release cylinder (which incorporates the release bearing); all of these components are contained in the large cast-aluminium alloy bellhousing, sandwiched between the engine and the transmission **(see illustration)**.

2 The friction disc is fitted between the engine flywheel and the clutch pressure plate, and is allowed to slide on the transmission input shaft splines.

3 The pressure plate assembly is bolted to the engine flywheel. When the engine is running, drive is transmitted from the crank-shaft, via the flywheel, to the friction disc (these components being clamped securely together by the pressure plate assembly) and from the friction disc to the transmission input shaft.

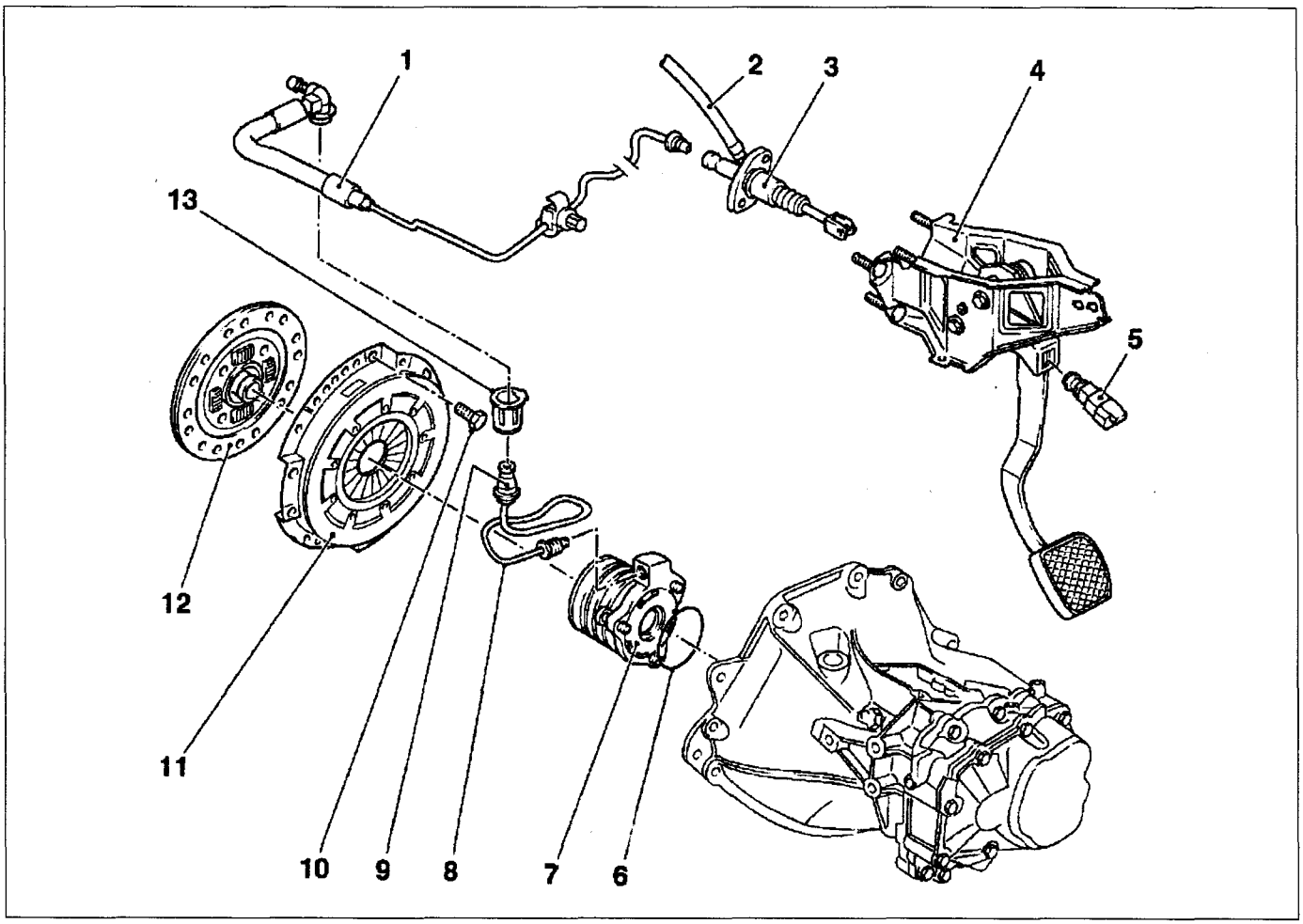
4 To interrupt the drive, the spring pressure must be relaxed. This is achieved using a hydraulic release mechanism which consists of the master cylinder, the release cylinder and the pipe/hose linking the two components. Depressing the pedal pushes on the master cylinder pushrod which hydraulically forces the release cylinder piston against the pressure plate spring fingers. This causes the springs to deform and releases the clamping force on the friction disc.

5 The clutch is self-adjusting and requires no manual adjustment.

6 The clutch pedal support and clutch pedal are one assembly and must be renewed as a complete unit. In the event of a frontal collision, the clutch pedal is released from its bearing in the support bracket to prevent injury to the driver's feet and legs (this also applies to the brake pedal). If an airbag has been deployed, inspect the clutch pedal assembly and if necessary renew the complete unit.

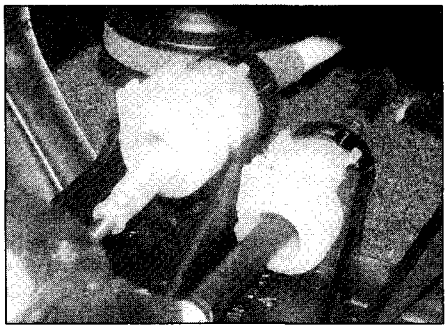
2 Clutch hydraulic system – bleeding

Warning: Hydraulic fluid is poisonous; wash off immediately and thoroughly in the case of skin contact, and seek immediate medical advice if any fluid is swallowed or gets into the eyes. Certain types of hydraulic fluid are flammable, and may ignite when allowed into contact with hot components; when servicing any hydraulic system, it is safest to assume that the fluid is flammable, and to take precautions against the risk of fire as though it is petrol that is being handled. Hydraulic fluid is also an effective paint stripper, and will attack plastics; if any is spilt, it should be washed off immediately, using copious quantities of fresh water. Finally, it is hygroscopic (it absorbs moisture from the

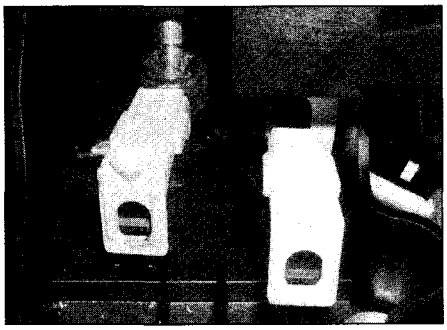


1.1 Clutch components

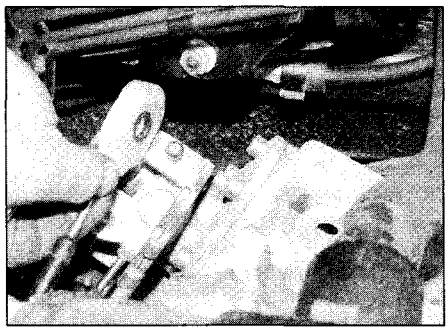
1 *Pressure line*
2 *Supply hose*
3 *Master cylinder*
4 *Clutch pedal assembly*
5 *Clutch control switch (where fitted)*
6 *O-ring*
7 *Release cylinder*
8 *Release cylinder pressure line*
9 *Sealing ring*
10 *Pressure plate bolt*
11 *Pressure plate*
12 *Clutch (friction) disc*
13 *Fastening sleeve*



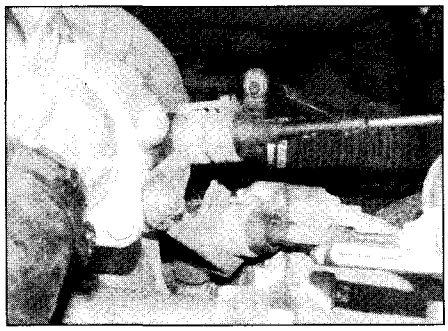
4.26 Unclip the outer cable from the gear lever assembly



4.29 The clamping pieces are attached to the bottom of the gear lever assembly by a ball and socket arrangement



4.42 Prise the gear linkage cables off the selector on the transmission

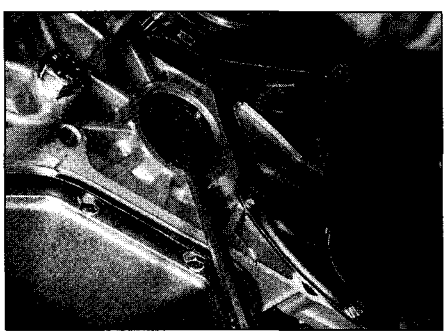


4.43 Unclip the outer cables from the bracket on the transmission casing

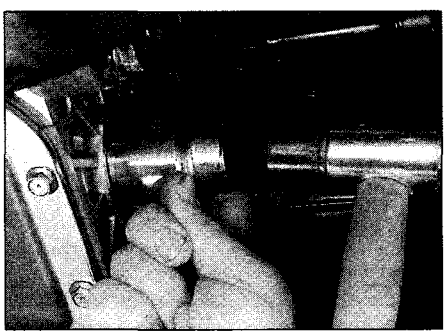
26 Note the fitted locations of the cables, then prise the ends of the cables from the gear lever assembly **(see illustration)**.
27 Slide the inner cables from the cable clamping pieces at the front of the gear-change assembly.
28 Undo the four retaining bolts and lift the gear lever assembly from the floor.
29 If required, the cable clamping pieces attached to the gear lever can be prised from their position. No further dismantling of the assembly is recommended **(see illustration)**.
30 If previously removed, attached the cable end fittings to the base of the lever using a pair of pliers.
31 Position the gear lever assembly on the floor, insert the securing bolts and tighten to the specified torque.
32 Refit the cable clamping pieces into the front of the gear lever housing. Do not lock the clamping pieces at this stage.
33 Reconnect the ends of the cables to the cable end fittings attached to the base of the gear lever.
34 Carry out the *Gearchange mechanism adjustment* procedure, as described in the previous Section.
35 Refit the centre console.

Selector cables

36 With reference to Chapter 11, remove the centre console.
37 Using a small screwdriver, open the selector cables clamping pieces as far as the notch. Opening them any further may damage the clamping pieces **(see illustrations 3.10 and 4.25)**.
38 Note the fitted locations of the cables, then prise the ends of the cables from the gear lever assembly **(see illustrations 4.26)**.
39 Slide the inner cables from the cable clamping pieces at the front of the gear-change assembly.
40 Disconnect the battery.
41 Support the engine/transmission and remove the rear engine/transmission mounting as described in the appropriate part of Chapter 2.
42 Note the fitted locations of the cables, then prise the ends of the cables from the selector linkage assembly above/behind the transmission **(see illustration)**.
43 Release the outer cables from the linkage assembly bracket **(see illustration)**.
44 Pull the cables (complete with grommet) out of the bulkhead and into the engine compartment.
45 Push the selector cables through the bulkhead passage from the engine compartment.
46 Refit the outer cables to the retaining bracket at the transmission end.
47 Engage the cable end fittings with the selector linkage assembly, squeezing them together with pliers if necessary.
48 Check the cables are routed as noted during removal, and refit the outer cable clamping pieces with corresponding cut-outs in the front of the gear lever housing. Do not lock the clamping pieces at this stage.
49 Reconnect the cables to the end fittings attached to the base of the gear lever.
50 Carry out the *Gearchange mechanism adjustment* procedure, as described in the previous Section.
51 Refit the air distribution duct and centre console.



5.4 Prising out a driveshaft oil seal



5.5 Fitting a new driveshaft oil seal using a socket as a tubular drift

5 Oil seals – renewal

Driveshaft oil seals

1 Chock the rear wheels, apply the handbrake, then jack up the front of the car and support it on axle stands. Remove the appropriate front roadwheel.
2 Drain the transmission oil as described in Section 2 or be prepared for oil loss as the seal is changed.
3 Remove the driveshaft as described in Chapter 8.
4 Note the correct fitted depth of the seal in its housing then carefully prise it out of position using a large flat-bladed screwdriver **(see illustration)**.
5 Remove all traces of dirt from the area around the oil seal aperture, then apply a smear of grease to the outer lip of the new oil seal. Ensure the seal is correctly positioned, with its sealing lip facing inwards, and tap it squarely into position, using a suitable tubular drift (such as a socket) which bears only on the hard outer edge of the seal **(see illustration)**. Ensure the seal is fitted at the same depth in its housing that the original was.

14 Place a jack with a block of wood beneath the transmission, and raise the jack to take the weight of the transmission.

15 With the jack positioned beneath the transmission taking the weight, slacken and remove the upper and lower bolts securing the transmission housing to the engine. Note the correct fitted positions of each bolt, and the necessary brackets, as they are removed, to use as a reference on refitting. Make a final check that all components have been disconnected, and are positioned clear of the transmission so that they will not hinder the removal procedure.

16 With all the bolts removed, move the trolley jack and transmission to the right, to free it from its locating dowels. Once the transmission is free, lower the jack and manoeuvre the unit out from under the car, taking care to ensure that the torque converter does not fall off. Remove the locating dowels from the transmission or engine if they are loose, and keep them in a safe place.

Refitting

17 The transmission is refitted by a reversal of the removal procedure, bearing in mind the following points.

a) Prior to refitting, remove all traces of old locking compound from the torque converter threads by running a tap of the correct thread diameter and pitch down the holes. In the absence of a suitable tap, use one of the old bolts with slots cut in its threads.

b) Prior to refitting, ensure the engine/transmission locating dowels are correctly positioned and apply a smear of molybdenum disulphide grease to the torque converter locating pin and its centering bush in the crankshaft end.

c) Once the transmission and engine are correctly joined, refit the securing bolts, tightening them to the specified torque setting.

d) Fit the new torque converter to driveplate bolts and tighten them lightly only to start then go around and tighten them to the specified torque setting in a diagonal sequence.

e) Tighten all nuts and bolts to the specified torque (where given).

f) Renew the driveshaft oil seals (see Chapter 7A) and refit the driveshafts to the transmission as described in Chapter 8.

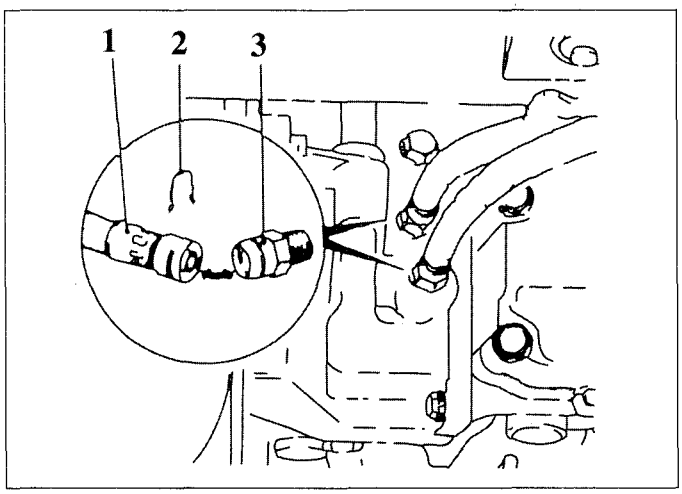
g) Fit new sealing rings to the fluid cooler hose unions and ensure both unions are securely retained by their clips.

h) On completion, refill the transmission with the specified type and quantity of fluid as described in Section 2 and adjust the selector cable as described in Section 3.

10 Automatic transmission overhaul – general information

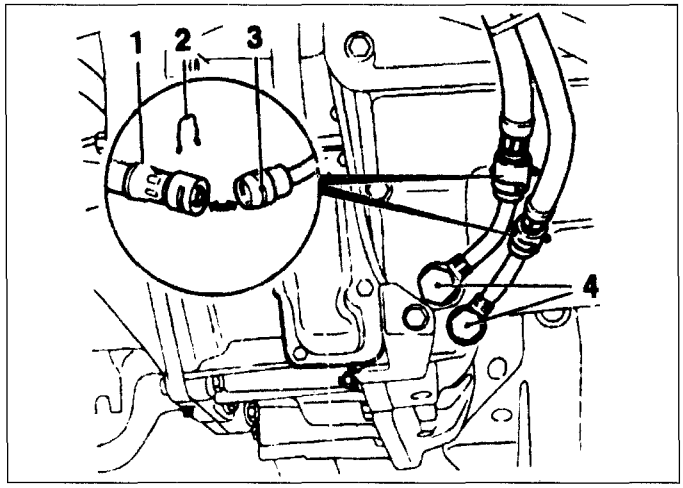
1 In the event of a fault occurring with the transmission, it is first necessary to determine whether it is of a mechanical or hydraulic nature, and to do this, special test equipment is required. It is therefore essential to have the work carried out by a Vauxhall dealer if a transmission fault is suspected.

2 Do not remove the transmission from the car for possible repair before professional fault diagnosis has been carried out, since most tests require the transmission to be in the vehicle.



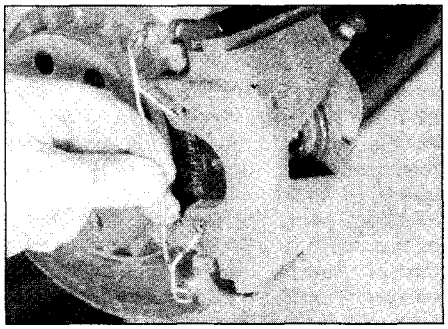
9.8a Transmission fluid cooler hose connections – Type 1

1 Hose end fitting
2 Retaining clip
3 Transmission union

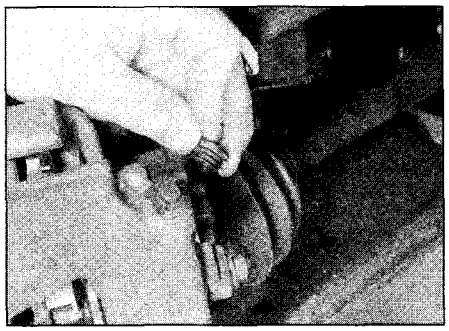


9.8b Transmission fluid cooler hose connections – Type 2

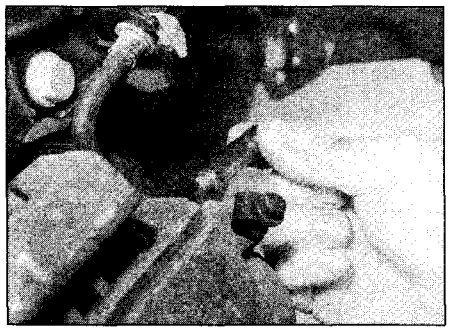
1 Hose end fitting
2 Retaining clip
3 Pipe end fitting
4 Transmission unions



4.3 Removing the retaining spring from the front caliper



4.4 Remove the dust caps . . .



4.5a . . . then unscrew the guide bolts . . .

4 Front brake pads – renewal

Warning: Renew BOTH sets of front brake pads at the same time – NEVER renew the pads on only one wheel, as uneven braking may result. Note that the dust created by wear of the pads may contain asbestos, which is a health hazard. Never blow it out with compressed air, and do not inhale any of it. An approved filtering mask should be worn when working on the brakes. DO NOT use petroleum-based solvents to clean brake parts – use brake cleaner or methylated spirit only.

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

2 Using a screwdriver lever out the brake pad warning sensor and unclip it from the retainer.

3 Prise the retaining spring from the outer edge of the caliper, noting its correct fitted position **(see illustration)**.

4 Remove the dust caps from the inner ends of the guide bolts **(see illustration)**.

5 Unscrew the guide bolts from the caliper, and lift the caliper and inner pad away from the mounting bracket. Tie the caliper to the suspension strut using a suitable piece of wire **(see illustrations)**. Do not allow the caliper to hang unsupported on the flexible brake hose.

6 Remove the inner pad from the caliper piston, noting that it is retained by a spring clip attached to the pad backing plate, and recover the outer pad from the mounting bracket **(see illustration)**.

7 Brush the dirt and dust from the caliper, but take care not to inhale it. Carefully remove any rust from the edge of the brake disc.

8 Measure the thickness of each brake pad (friction material and backing plate) **(see illustration)**. If either pad is worn at any point to the specified minimum thickness or less, all four pads must be renewed. The pads should also be renewed if any are fouled with oil or grease; there is no satisfactory way of degreasing friction material, once contaminated. If any of the brake pads are worn unevenly, or fouled with oil or grease, trace and rectify the cause before reassembly.

9 If the brake pads are still serviceable, carefully clean them using a clean, fine wire brush or similar, paying particular attention to the sides and back of the metal backing. Clean out the grooves in the friction material, and pick out any large embedded particles of dirt or debris. Carefully clean the pad locations in the caliper body/mounting bracket.

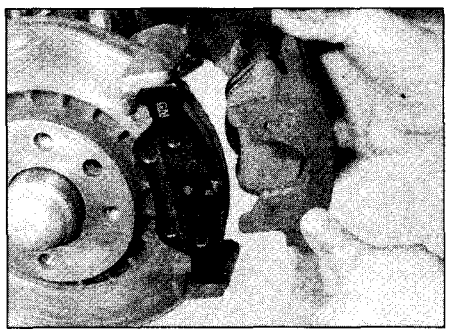
10 Prior to fitting the pads, check that the guide bolts are a snug fit in the caliper bushes. Brush the dust and dirt from the caliper and piston. Apply a little high melting-point copper brake grease to the areas on the pad backing plates which contact the caliper and piston. Inspect the dust seal around the piston for damage, and the piston for evidence of fluid leaks, corrosion or damage. If attention to any of these components is necessary, refer to Section 10.

11 If new brake pads are to be fitted, the caliper piston must be pushed back into the cylinder to make room for them. We recommend that the caliper bleed screw is loosened and the excess fluid drained into a container, rather than forcing the fluid through the circuit into the reservoir. This method will prevent any sediment being forced back into the master cylinder. Either use a G-clamp or similar tool, or use suitable pieces of wood as levers to move the piston fully into the caliper bore. Tighten the bleed screw.

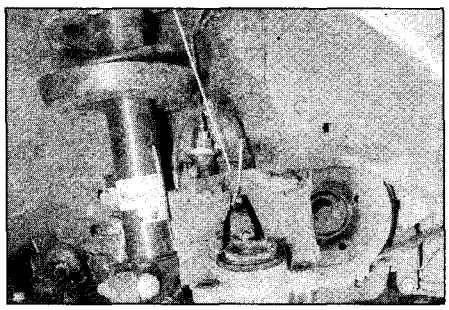
12 Check that the cutaway recesses on the caliper piston are correctly positioned **(see illustration)**. If necessary, carefully turn the piston to its correct position.

13 Fit the inner pad to the caliper, ensuring that its clip is correctly located in the caliper piston **(see illustration)**.

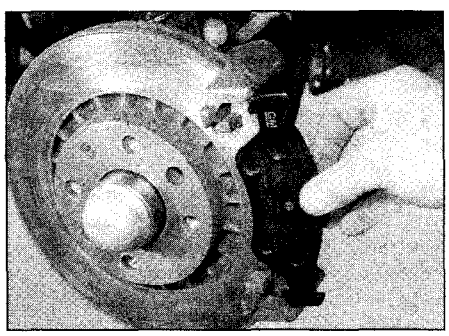
14 Fit the outer pad to the caliper mounting bracket, ensuring that its friction material is facing the brake disc.



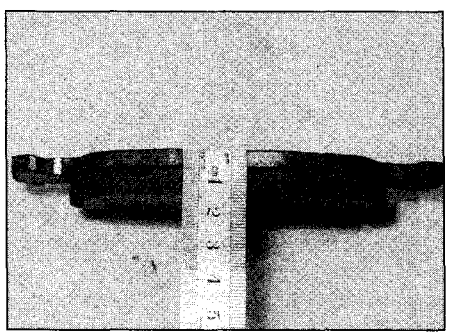
4.5b . . . and lift the caliper and inner pad away from the mounting bracket



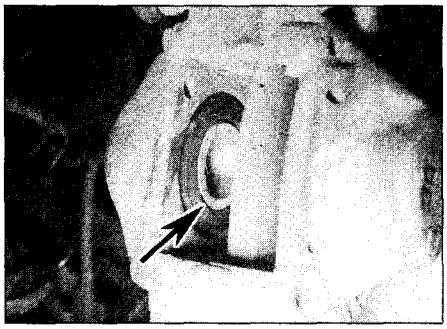
4.5c Tie the caliper to the suspension strut, to avoid placing any strain on the hydraulic brake hose



4.6 Removing the outer pad from the mounting bracket



4.8 Measuring the brake pad thickness



11.18 Check that the piston (arrowed) is correctly positioned before refitting the rear brake caliper

11 Thoroughly clean all components, using only methylated spirit or clean hydraulic fluid. Never use mineral-based solvents such as petrol or paraffin, which will attack the rubber components of the hydraulic system.

12 Dry the components using compressed air or a clean, lint-free cloth. If available, use compressed air to blow clear the fluid passages.

Warning: Wear eye protection when using compressed air.

13 Check all components, and renew any that are worn or damaged. If the pistons and/or cylinder bores are worn excessively, renew the complete caliper body.

14 If the caliper is fit for further use, obtain the necessary components from your Vauxhall/Opel dealer. Renew the caliper seals and dust covers as a matter of course; these should never be re-used.

15 On reassembly, ensure that all components are absolutely clean and dry.

16 Working on one piston at a time, dip the piston and the new piston seal in clean hydraulic fluid, and smear clean fluid on the cylinder bore surface.

17 Locate the new seal in the cylinder bore groove, using only the fingers to manipulate it into position.

18 Fit the new dust seal to the piston, then insert the piston into the cylinder bore using a twisting motion to ensure it enters the seal correctly. Make sure the piston enters squarely into the bore with the raised sectors positioned as described in Section 5 **(see illustration)**. Locate the dust seal in the body groove, and push the piston fully into the caliper bore. Press the dust seal lock collar into the caliper body.

Refitting

19 Locate the caliper over the disc, then insert the hydraulic line and screw in the union nut. Do not fully tighten the nut at this stage.

20 Apply a little locking fluid to the threads of the mounting bolts, then refit them and tighten to the specified torque.

21 Refit the brake pads as described in Section 5.

22 Fully tighten the hydraulic union nut.

23 Remove the dummy cap or hose clamp, and bleed the hydraulic system as described in Section 2. Note that, providing the precautions described were taken to minimise brake fluid loss, it should only be necessary to bleed the relevant rear brake circuit.

24 Refit the roadwheel, then lower the vehicle to the ground and tighten the roadwheel bolts to the specified torque.

12 Rear wheel cylinder – removal, overhaul and refitting

Note: *Before starting work, refer to the note at the beginning of Section 2 concerning the dangers of hydraulic fluid, and to the warning at the beginning of Section 6 concerning the dangers of asbestos dust.*

Removal

1 Remove the brake drum as described in Section 9.

2 Minimise fluid loss by first removing the master cylinder reservoir cap, then fitting a dummy cap without a vent hole, to obtain an airtight seal. Alternatively, use a brake hose clamp to clamp the flexible hose at the nearest convenient point to the wheel cylinder.

3 Carefully unhook the brake shoe upper return spring, and remove it from both brake shoes. Pull the upper ends of the shoes away from the wheel cylinder to disengage them from the pistons.

4 Wipe away all traces of dirt around the brake pipe union nut at the rear of the wheel cylinder, and unscrew the nut. Carefully ease the pipe out of the wheel cylinder, and plug or tape over its end to prevent dirt entry. Wipe off any spilt fluid immediately.

5 Unscrew the retaining bolt from the rear of the backplate, and remove the wheel cylinder, taking care not to allow surplus hydraulic fluid to contaminate the brake shoe linings.

Overhaul

6 Brush the dust and dirt from the wheel cylinder, but take care not to inhale it.

7 Pull the rubber dust seals from the ends of the cylinder body **(see illustration)**.

8 The pistons will normally be ejected by the pressure of the coil spring, but if they are not, tap the end of the cylinder body on a piece of wood, or apply low air pressure (eg, from a foot pump) to the hydraulic fluid union hole to eject the pistons from their bores. Remove the seals.

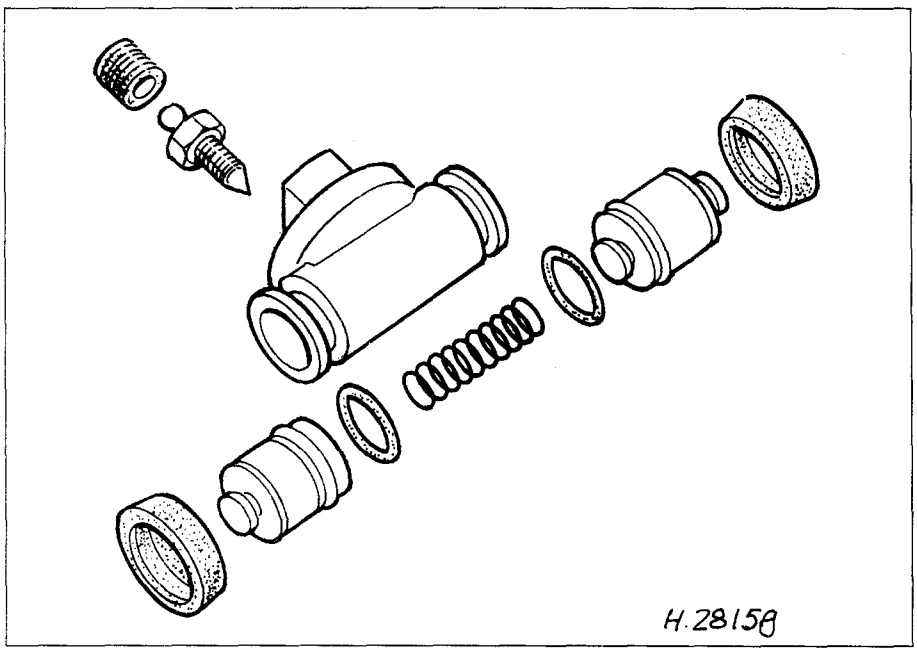
9 Thoroughly clean all components, using only methylated spirit or clean hydraulic fluid. Never use mineral-based solvents such as petrol or paraffin, which will attack the rubber components of the hydraulic system. Dry the components using compressed air or a clean, lint-free cloth. If available, use compressed air to blow clear the fluid passages.

10 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. 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.

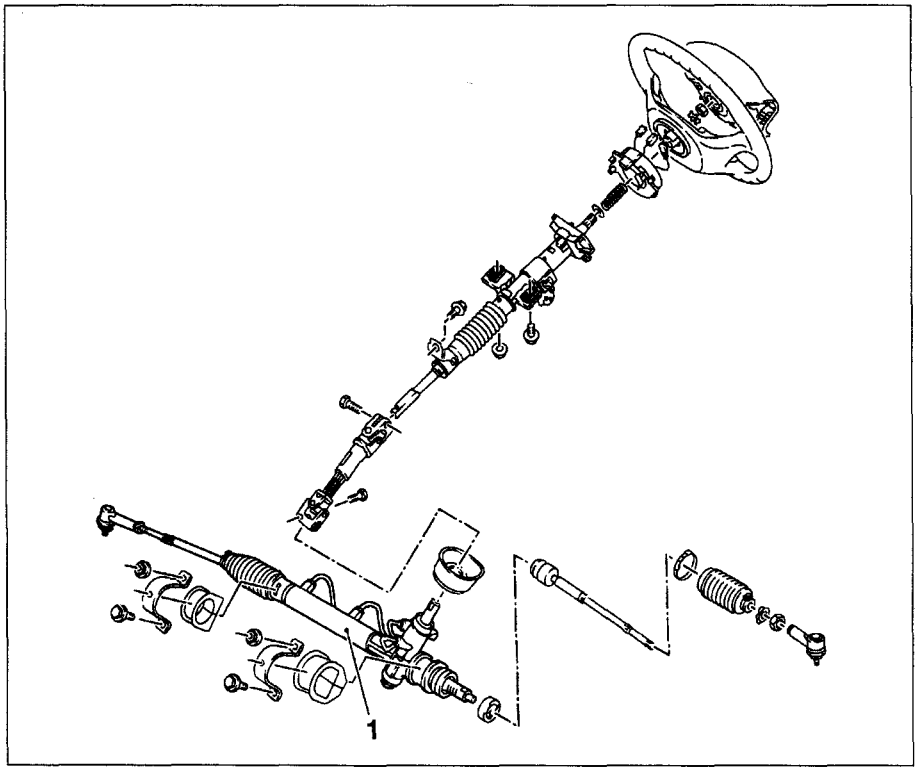
11 Lubricate the piston seals with clean brake fluid, and insert them into the cylinder bores, with the spring between them, using finger pressure only.

12 Dip the pistons in clean brake fluid, and insert them into the cylinder bores.

13 Fit the dust seals, and check that the pistons can move freely in their bores.



12.7 Exploded view of the rear brake wheel cylinder

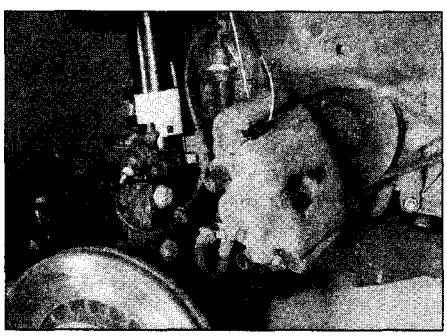


1.3 Steering gear and column components

The steering is of conventional rack-and-pinion type, incorporating a collapsible safety column **(see illustration)**. The column is joined to the steering gear by an intermediate shaft incorporating two universal joints. The upper section of the column includes an outer slip coupling into which the steering lock engages. With the steering lock engaged, the coupling allows the column to turn at torques above 200 Nm (147 lbf ft) only, so making it impossible to break the steering lock shear pin. However, at this torque it is not possible to control the vehicle. The steering gear is mounted on the front suspension subframe. The steering gear track rods are attached to the steering arms on the hub carriers by track rod ends.

All models are fitted with power-assisted steering. On all engines except the Z22SE, the power steering pump is belt-driven from the crankshaft pulley; on the Z22SE it is driven from the left-hand end of the camshaft. The fluid reservoir is either incorporated in the pump or located remotely according to model.

As from June 1999, models with alloy wheels have 5-stud fixing, however all other models remain with 4-stud wheels.



2.5 Tie the brake caliper to the coil spring while removing the front hub carrier

Precautions

An airbag is fitted to the steering wheel. To ensure it operates correctly should it ever be needed, and to avoid the risk of personal injury from it being accidentally triggered, the following precautions must be observed. Also refer to Chapter 12 for more information:

a) Before carrying out any operations on the airbag system, disconnect the battery negative terminal, and wait at least 1 minute to ensure that the system capacitor has been discharged.

b) Note that the airbag must not be subjected to temperatures in excess of 80°C (176°F). When the airbag is removed, ensure that it is stored with the pad facing upwards.

c) Do not allow any solvents or cleaning agents to contact the airbag assembly. The unit must be cleaned using only a damp cloth.

d) The airbag and control unit are both sensitive to impact. If either is dropped from a height of more than 50 cm (20 in), they must be renewed.

e) Disconnect the airbag control unit wiring plug prior to using arc-welding equipment on the vehicle.

*f) On vehicles fitted with a passenger 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.*

2 Front hub carrier – removal and refitting

Note: *It is recommended that all mounting nuts and bolts are renewed. A balljoint separator tool will be required for this operation.*
Caution: The front wheel camber setting is controlled by the bolts securing the hub carrier to the front suspension strut. Before removing the bolts, mark the hub carrier in relation to the strut accurately. On completion, the camber setting must be checked and adjusted by a suitably-equipped garage.

Removal

1 Apply the handbrake, then jack up the front of the vehicle and support it on axle stands (see *Jacking and vehicle support*). Remove the relevant front wheel.

2 Unscrew the nut securing the track rod end to the steering arm on the hub carrier. Using a balljoint separator, separate the track rod end from the steering arm.

3 Unscrew and remove the clamp bolt securing the front suspension lower arm balljoint in the hub carrier, noting which way round it is fitted.

4 Using a suitable lever, push down the lower arm and separate it from the hub carrier. When releasing the lower arm, take care not to damage the balljoint rubber boot on the bottom of the hub carrier; if necessary protect it with a piece of card or plastic. **Note:** *If the balljoint stub is tight in the hub carrier, use a screwdriver or cold chisel as a wedge to force the clamp apart.*

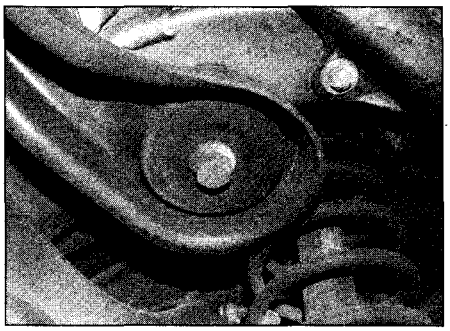
5 Remove the brake caliper with reference to Chapter 9, however, do not disconnect the hydraulic line from it. Tie the caliper to the coil on the front suspension strut using a length of wire or string **(see illustration)**.

6 Unscrew the mounting bolt and remove the wheel speed sensor from the top of the hub carrier. Tie it to one side.

7 Carefully tap the protective cap from the centre of the hub, then extract the split pin and unscrew the driveshaft retaining nut while holding the hub stationary with a bar positioned between two wheel bolts temporarily refitted to the hub. **Note:** *The nut is tightened to a high torque.* Remove the nut and spacer.

8 Pull the hub carrier out while pressing the driveshaft through the hub. If it is tight use a suitable puller.

9 Mark the position of the strut on the hub carrier. **Note:** *This is important to maintain the camber setting.*



16.10 Rear suspension crossmember mounting

8 Using a trolley jack, support the weight of the crossmember. If necessary, use a length of wood positioned beneath the crossmember.
9 Unscrew the bolts securing the bottom of the struts to the trailing arms on each side.
10 With the help of an assistant, unscrew the four mounting bolts and carefully lower the crossmember to the floor **(see illustration)**.
11 Remove the upper and lower arms from the crossmember together with the trailing arms and rear hubs, with reference to Sections 13 and 14.
12 Remove the anti-roll bar from the crossmember with reference to Section 12.

Refitting

13 Refitting is a reversal of removal, but note the following points.

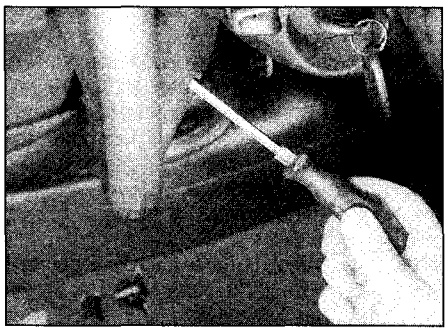
a) Before lifting the crossmember into position, check the condition of the captive mounting nuts in the underbody and renew them if necessary.
b) Delay fully tightening the upper and lower arm inner bolts until the weight of the vehicle is on the suspension.
c) Bleed the brake hydraulic system as described in Chapter 9.
d) Have the rear wheel toe-in setting checked and if necessary adjusted at the earliest opportunity.

17 Steering wheel – removal and refitting

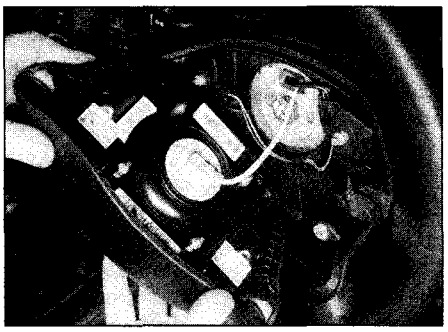
Note: *A puller will be required to draw the steering wheel off the column splines. A new retaining nut lockwasher will be required when refitting.*

Models without an airbag

1 Disconnect the battery negative (earth) lead (see Chapter 5A).
2 Set the front wheels in the straight-ahead position, then remove the ignition key and lock the column by turning the steering wheel as required. Unlike earlier models which locked in the straight-ahead position, models from 1999 Model Year lock in a different position due to a modified intermediate shaft. Right-hand drive models lock with the steering wheel approximately 5° anti-clockwise, and left-hand drive models lock with the steering wheel approximately 45° clockwise.
3 Carefully ease the horn button out from the steering wheel, and disconnect its wiring.

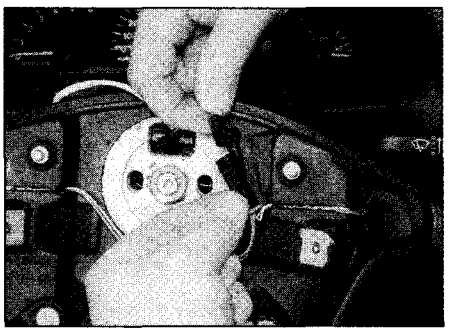


17.16a Remove the screws from the steering wheel . . .



17.16b . . . then remove the airbag/horn-push . . .

17.16c . . . and disconnect the wiring



17.17 Disconnect the wiring from the radio control switches

4 Using a screwdriver, prise back the tabs on the retaining nut lockwasher.
5 Unscrew the retaining nut, and lift off the lockwasher. Discard the lockwasher; a new one should be used on refitting.
6 Make alignment marks between the steering wheel and steering column shaft.
7 A two-legged puller will now be required to free the steering wheel from its splines. Locate the legs of the puller in the holes in the centre of the wheel, and draw the steering wheel off the column splines. Lift off the steering wheel, and remove the spring from the column shaft.
8 Check that the indicator cancelling lug/horn button contact pad fitted to the rear of steering wheel is in good condition, and if necessary renew it. To release the pad, depress the two clips located inside the steering wheel. Apply a little copper grease to the contact pad before refitting it.
9 Ensure that the indicator switch stalk is in its central (OFF) position. Failure to do this could lead to the steering wheel lug breaking the switch tab as the steering wheel is refitted.
10 Fit the spring to the column, then locate the wheel on the column splines, aligning the marks made on removal.
11 Fit the new lockwasher, and screw on the retaining nut. Tighten the retaining nut to the specified torque, and secure it in position with the lockwasher tabs.
12 Reconnect the wiring connectors to the horn button, and refit the button in the centre of the steering wheel.
13 Reconnect the battery, and check the operation of the horn.

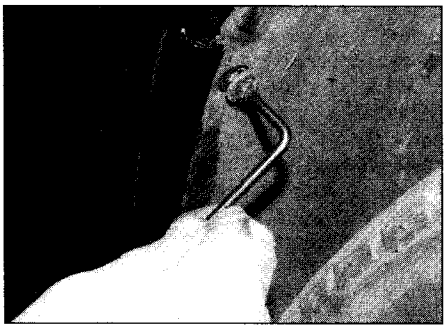
Models with an airbag

Warning: Before removing the steering wheel, observe the safety precautions given in Chapter 12 and in Section 1 of this Chapter.

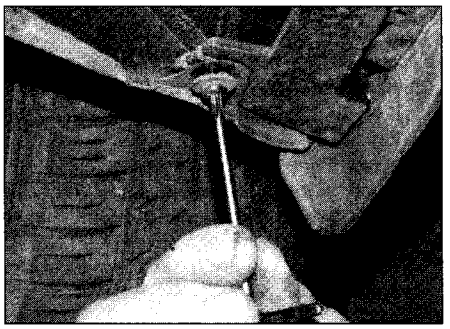
14 Disconnect the battery negative (earth) lead (see Chapter 5A).

Caution: Wait at least one minute before proceeding. This is necessary to allow the airbag condenser to fully discharge.

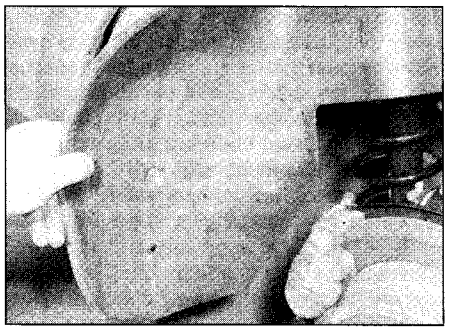
15 Set the front wheels in the straight-ahead position, then remove the ignition key and lock the column by turning the steering wheel as required. Unlike earlier models which locked in the straight-ahead position, models from 1999 Model Year lock in a different position due to a modified intermediate shaft. Right-hand drive models lock with the steering wheel approximately 5° anti-clockwise, and left-hand drive models lock with the steering wheel approximately 45° clockwise.
16 Unscrew and remove the two screws from the rear of the steering wheel and carefully lift the airbag/horn-push from the steering wheel. Disconnect the wiring from the airbag **(see illustrations)**. Position the airbag in a safe place where it cannot be tampered with, making sure that the padded side is facing upwards.
17 Where fitted, disconnect the wiring from the radio control switches **(see illustration)**.



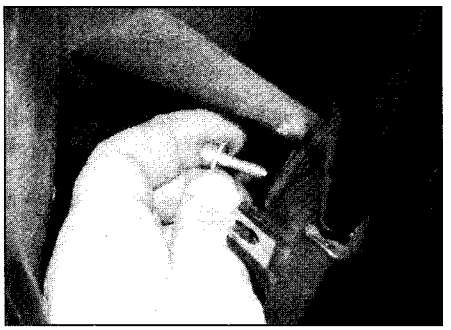
6.2a Removing the side . . .



6.2b . . . and bottom Torx screws from the wheelarch liners



6.2c Removing the complete wheelarch liner



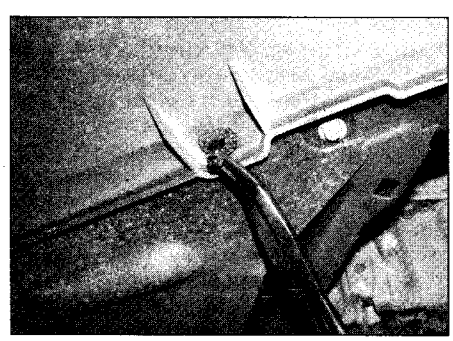
6.2d Removing the front bumper side mounting screws

Plastic components

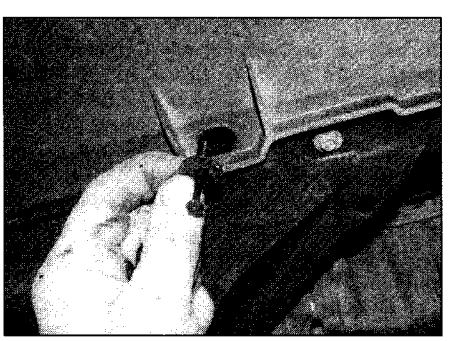
With the use of more and more plastic body components by the vehicle manufacturers (eg bumpers. spoilers, and in some cases major body panels), rectification of more serious damage to such items has become a matter of either entrusting repair work to a specialist in this field, or renewing complete components. Repair of such damage by the DIY owner is not really 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, 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 (eg 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. Once mixed in equal, 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 be left with the problem of finding a suitable 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 encountered in body component applications. Standard paints, generally speaking, will not bond to plastic or rubber satisfactorily, but suitable paints 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 which consists of a pre-primer treatment, a primer and coloured top coat. Full instructions are normally supplied with a kit, but basically, 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.



6.3a Use a pair of pliers to pull out the centre pins . . .



6.3b . . . then pull the plastic clips from the bottom of the front bumper

5 Major body damage – repair

Where serious damage has occurred, or large areas need renewal due to neglect, it means that complete new panels will need welding-in, and this is best left to professionals. If the damage is due to impact, it will also be necessary to check completely the alignment of the bodyshell, and this can only be carried out accurately by a Vauxhall/Opel dealer using special jigs. If the body is left misaligned, it is primarily dangerous, as the car will not handle properly, and secondly, uneven stresses will be imposed on the steering, suspension and possibly transmission, causing abnormal wear, or complete failure, particularly to such items as the tyres.

6 Bumpers – removal and refitting

Front bumper

Removal

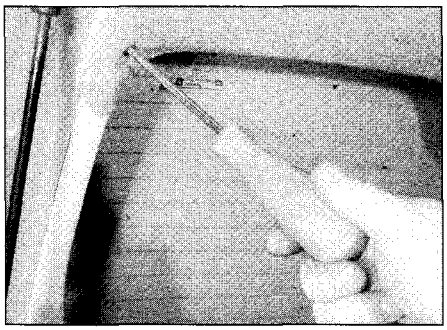
1 Remove the radiator grille as described in Section 7.

2 Working beneath the front wheelarches, use a Torx key to remove the screws, then pull back the liners for access to the front bumper side mounting screws. If preferred, the liners can be completely removed by releasing the plastic retainers (press the centre pins through the clips). Unscrew and remove the bumper side mounting screws **(see illustrations)**.

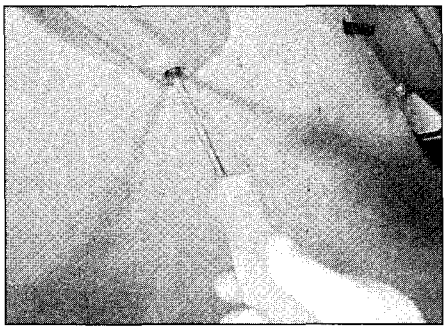
3 Remove the plastic clips securing the bottom of the front bumper to the front valance. To do this, pull out the centre pins using a pair of pliers **(see illustrations)**.

4 Unscrew and remove the upper mounting bolts, then carefully withdraw the front bumper from the front of the vehicle **(see illustrations)**.

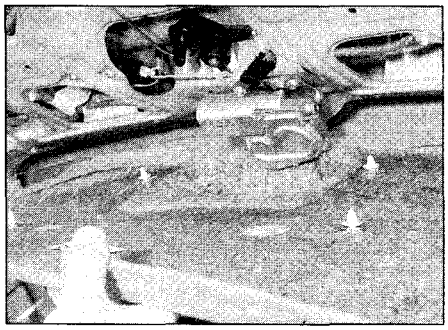
5 Where a spoiler is fitted, prise off the special clips then compress the lugs and separate the



19.8a Undo the upper screws . . .



19.8b . . . and lower screws . . .



19.8c . . . then prise the trim panel from the inside of the tailgate (Estate models)

prising out the spring clips with a small screwdriver. Lower the struts to the body.

5 Extract the clips from the hinge pivot pins, then drive out the pins with a suitable drift while the assistant supports the tailgate. Withdraw the tailgate from the body.

Refitting

6 Refitting is a reversal of removal, but apply a little grease to the pivot pins, and check that when closed the tailgate is positioned centrally within the body aperture and flush with the surrounding bodywork. If necessary, remove the trim from the rear of the roof headlining and loosen the hinge mounting bolts. Reposition the tailgate then tighten the bolts and refit the trim. If necessary, adjust the position of the rubber supports so that the tailgate is flush with the surrounding bodywork. After making adjustments, check that the striker enters the lock centrally and if necessary loosen the striker bolts to reposition it. Tighten the bolts on completion.

Tailgate (Estate models)

Removal

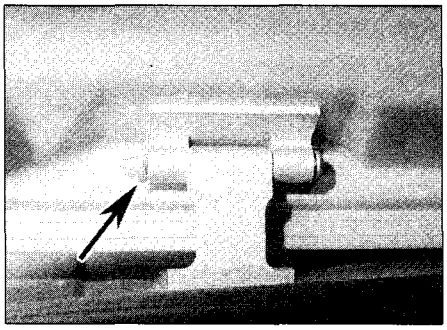
7 Disconnect the battery negative (earth) lead (see Chapter 5A).

8 Open the tailgate then remove the trim panel by removing the screws and carefully prising the panel free from the clips **(see illustrations)**.

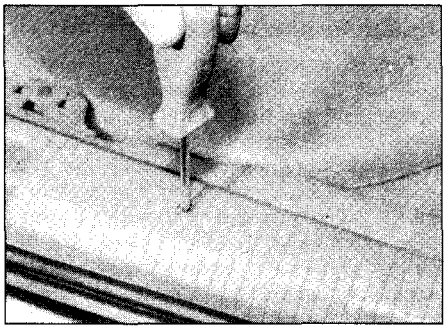
9 Disconnect the wiring at the connector just below the tailgate glass.

10 Release the cable ties and unbolt the earth cable.

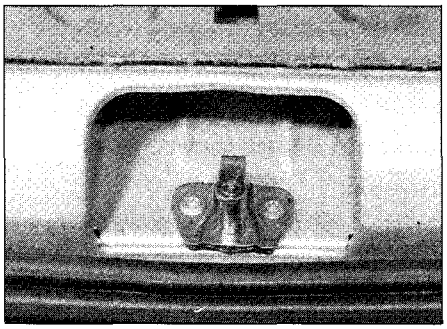
11 Disconnect the wiring from the heated rear screen, interior light switch, number plate lamp, wiper motor, central door locking drive and anti-theft warning system switch.



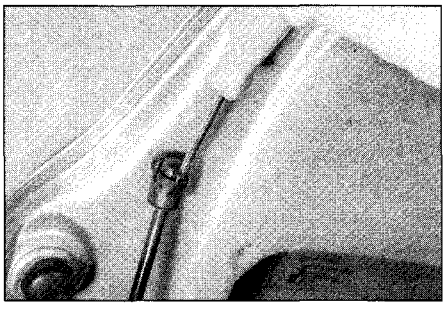
19.15 Location of clip securing the tailgate hinge pin (Estate models)



19.16a Undo the screws and remove the rear trim panel . . .



19.16b . . . for access to the tailgate lock striker



19.18 Use a screwdriver to prise out the spring clip from the top of the tailgate support strut

12 Attach a piece of string to the end of the wiring harness, then withdraw it from the top of the tailgate. Untie the string and leave it in position inside the tailgate to aid refitting.

13 Disconnect the tailgate washer hose.

14 Have an assistant support the tailgate, then disconnect the tops of the support struts by prising out the spring clips with a small screwdriver. Lower the struts to the body.

15 Extract the clips from the hinge pivot pins, then drive out the pins with a suitable drift while the assistant supports the tailgate. Withdraw the tailgate from the body **(see illustration)**.

Refitting

16 Refitting is a reversal of removal, but apply a little grease to the pivot pins, and check that when closed the tailgate is positioned centrally within the body aperture and flush with the surrounding bodywork. If necessary, remove the trim from the rear of the roof headlining and loosen the hinge mounting bolts. Reposition the tailgate then tighten the bolts and refit the trim. If necessary, adjust the position of the rubber supports so that the tailgate is flush with the surrounding bodywork. After making adjustments, check that the striker enters the lock centrally and if necessary loosen the striker bolts to reposition it. Remove the rear trim panel where necessary. Tighten the bolts and refit the trim on completion **(see illustrations)**.

Support struts

Removal

17 Open the tailgate and note which way round the struts are fitted. Have an assistant support the tailgate in its open position.

18 Using a small screwdriver, prise the spring clip from the top of the strut and disconnect it from the ball on the tailgate **(see illustration)**.

19 Similarly prise the spring clip from the bottom of the strut and disconnect it from the ball on the body. Withdraw the strut.

Refitting

20 Refitting is a reversal of removal but make sure that the exposed rod is at the top of the strut.

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 5A.

1 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. The speedometer is of the electrical type, and uses the ABS wheel sensors or a speed sensor on the transmission to monitor the vehicle speed. There is no speedometer cable.

2 This Chapter covers repair and service procedures for the various electrical components not associated with the engine. Information on the battery, alternator and starter motor can be found in Chapter 5A.

3 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.

4 At regular intervals, check the routing of the wiring harness, ensuring that it is correctly secured by the clips or ties to prevent it chafing against other components. If evidence of chafing is found, 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, refer to 'Radio/cassette unit anti-theft system' 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.*

General

1 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.

2 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.

3 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.

4 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.

5 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.

6 Apart from problems due to poor connections, two basic types of fault can occur in an electrical circuit – open-circuit and short-circuit.

7 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.

8 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

9 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.

10 Connect the other lead to a connector in the circuit being tested, preferably nearest to the battery or fuse.

11 Switch on the circuit, remembering that some circuits are live only when the ignition switch is moved to a particular position.

12 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.

13 Continue to check the remainder of the circuit in the same fashion.

14 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

15 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).

16 Remove the relevant fuse from the circuit, and connect a circuit tester or voltmeter to the fuse connections.

17 Switch on the circuit, remembering that some circuits are live only when the ignition switch is moved to a particular position.

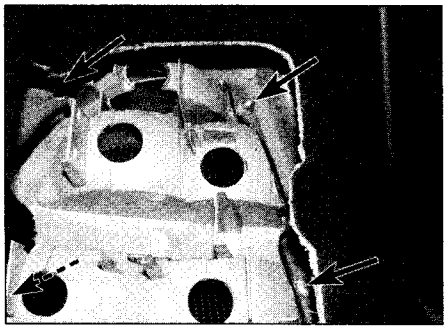
18 If voltage is present (indicated either by the tester bulb lighting or a voltmeter reading, as applicable), this means that there is a short-circuit.

19 If no voltage is present, but the fuse still blows with the load(s) connected, this indicates an internal fault in the load(s).

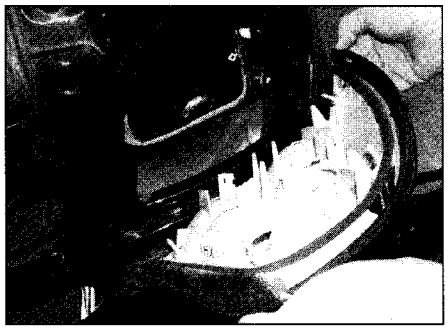
Finding an earth fault

20 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 (eg, 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-to-metal contact between components, due to flexible rubber mountings, etc.

21 To check whether a component is



7.17a Unscrew the mounting nuts . . .



7.17b . . . and remove the rear light cluster

Refitting

10 Refitting is a reversal of removal, with reference to the headlight sub-section earlier.

Front foglight

Removal

11 Remove the front bumper as described in Chapter 11.

12 Unscrew the three mounting bolts and remove the foglight, then disconnect the wiring.

Refitting

13 Refitting is a reversal of removal.

Direction indicator side repeater

14 The procedure is described in Section 5.

Rear light cluster

Removal

15 In the luggage compartment, remove the side trim cover. If working on the right-hand side, remove the first aid kit and warning triangle. On Estate models, the left-hand cover is removed by twisting the fastener.

16 Depress the retaining lug in the middle of the rear light cluster, and withdraw the bulbholder from the rear light.

17 Unscrew the mounting nuts and withdraw the light cluster from the rear of the vehicle **(see illustrations)**. Take care not to damage the vehicle paintwork.

Refitting

18 Refitting is a reversal of removal.

Rear number plate light

19 The procedure is described in Section 5.

High-level stop-light

20 The procedure is described in Section 5.

8 Headlight beam alignment – general information

1 Accurate adjustment of the headlight beam is only possible using optical beam-setting equipment, and this work should therefore be carried out by a Vauxhall/Opel dealer or suitably-equipped workshop.

2 For reference, the headlights can be adjusted using the adjuster assemblies fitted to the front upper outer mounting and to the rear inner mounting. The inner screw is for horizontal adjustment and the outer one for vertical adjustment.

3 All models have an electrically-operated headlight beam adjustment range system, controlled via a switch in the facia. The recommended settings are as follows.

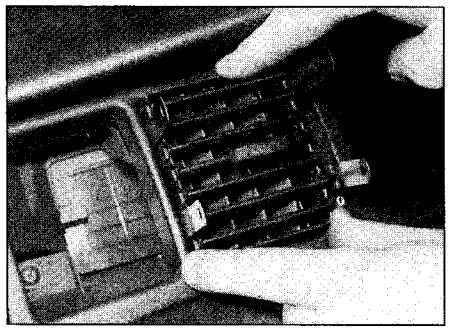
0 Front seat(s) occupied.
1 All seats occupied.
2 All seats occupied, and load in luggage compartment.
3 Driver's seat occupied and load in the luggage compartment.

Note: *When adjusting the headlight aim, ensure that the switch is set to position 0.*

4 On Estate models with automatic self-levelling control, the headlight range adjustment should be reduced by one setting after completing approximately 3 km (1.8 miles).

5 Some models fitted with Xenon headlights may have an automatic range adjustment system. If a fault occurs in the system, a warning symbol lights up on the instrument display unit.

9 Instrument panel – removal and refitting



9.2 Using feeler blades to remove the centre air vents

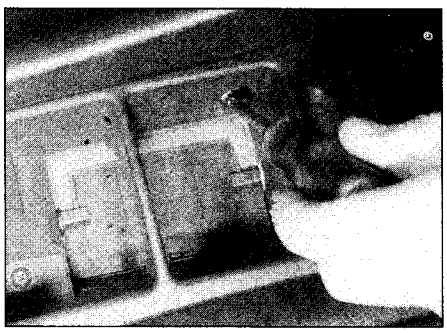
Removal

1 Remove the steering column shrouds. To do this, first remove the steering wheel. Alternatively, the steering wheel may remain in position, but it will have to turned for access to the end face screws of the shrouds. Unscrew the tilt steering lever, then remove the two screws from the end face and three screws from the bottom shroud. Remove the shrouds and recover the ignition key position indicator from the ignition switch.

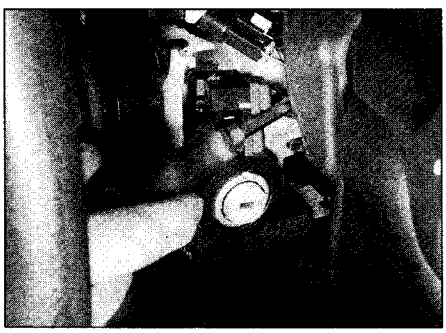
2 Carefully prise the centre and driver's side air vents and housings from the facia, using a small screwdriver or alternatively feeler blades to depress the side clips **(see illustration)**. Where applicable, place a wad of cloth beneath the screwdriver to prevent damage.

3 Remove the light switch as described in Section 4.

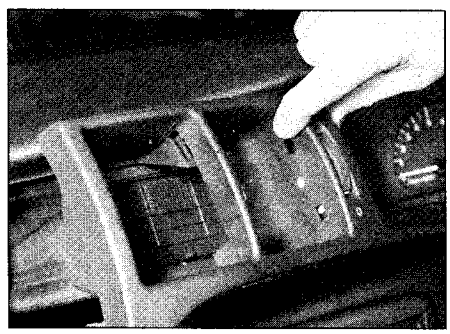
4 Undo the mounting screws and remove the centre surround and side surround/light switch housing from the facia. Disconnect the wiring **(see illustrations)**.



9.4a Undo the inner screws . . .



9.4b . . . and the outer screws . . .



9.4c . . . then remove the surround

Diagram 2

Wire colours

Bn	Brown	**Rd**	Red
Bu	Blue	**Bk**	Black
Ye	Yellow	**Wh**	White
Gn	Green	**Vt**	Violet
Gy	Grey	**Vi**	Mauve
Og	Orange	**DBu**	Dark blue
Pu	Purple	**LBu**	Light blue
Pk	Pink		

Key to items

1 Battery
2 Starter motor
3 Alternator
4 Ignition switch
5 Diagnostic socket
6 Light switch
a = side/headlight
7 Combined indicator switch
a = parking light
8 Filament failure module
9 Number plate light
10 LH parking light
11 RH parking light
12 LH tail light
13 RH tail light
14 Automatic transmission switch

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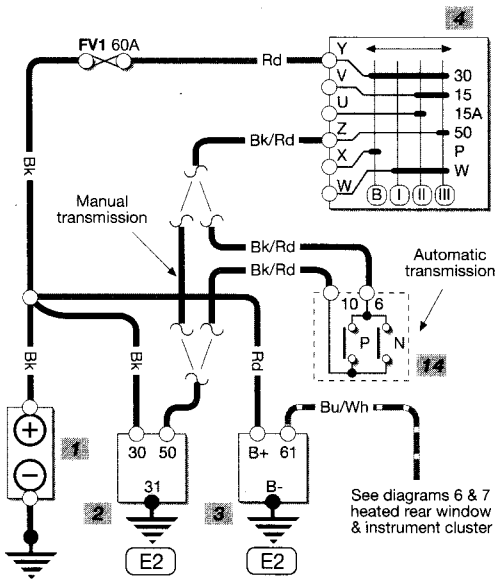
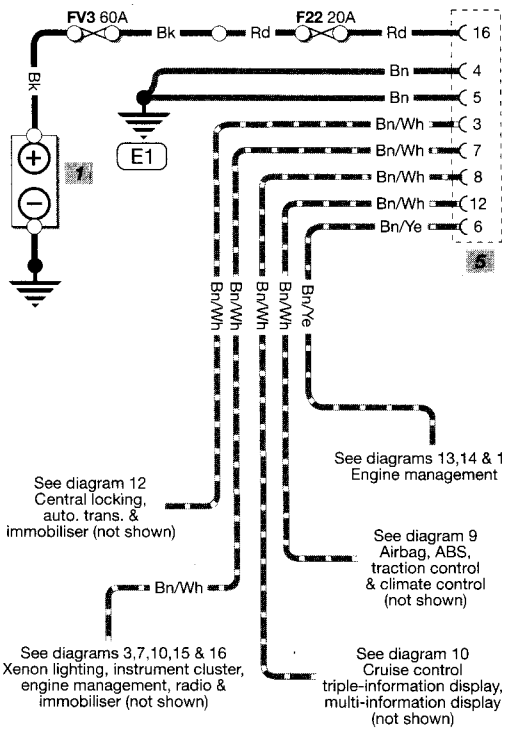
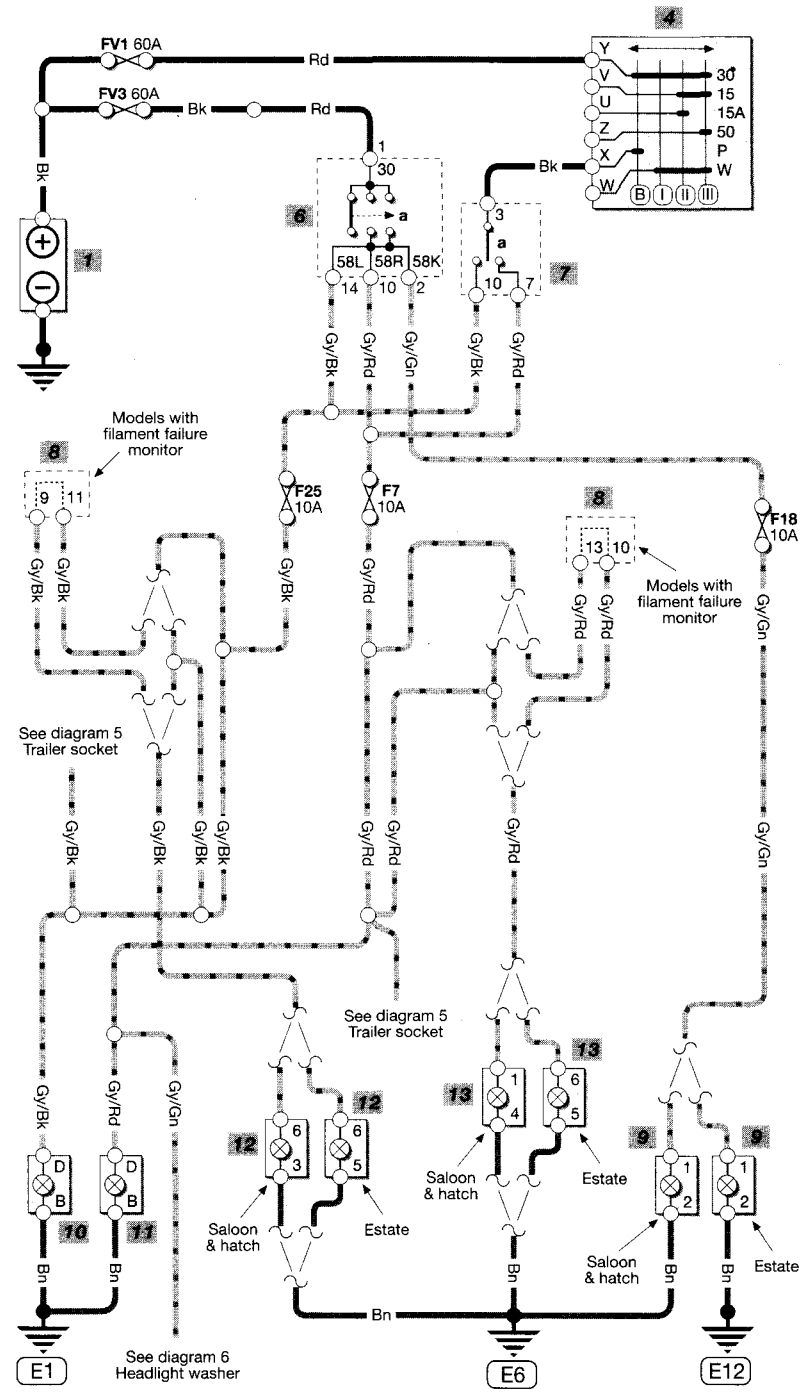
Starting & charging system



Diagnostic socket



Parking, tail & number plate lights



Wire colours

Bn	Brown	**Rd**	Red
Bu	Blue	**Bk**	Black
Ye	Yellow	**Wh**	White
Gn	Green	**Vt**	Violet
Gy	Grey	**Vi**	Mauve
Og	Orange	**DBu**	Dark blue
Pu	Purple	**LBu**	Light blue
Pk	Pink		

Key to items

1 Battery
4 Ignition switch
40 Multitimer unit
60 Heater blower motor/resistor pack
170 Central locking/alarm control unit
171 RH front door lock assembly
a = door locking switch
b = door locking motor
172 Tailgate locking motor
173 Fuel filler flap locking motor
174 LH front door locking motor
175 LH rear door locking motor
176 RH rear door locking motor
177 Blower/air cond. switch
a = temperature lever limit switch
b = defrost lever limit switch
178 Air cond. relay
179 Coolant solenoid valve
180 Recirculation switch
181 Recirculation solenoid
182 Air cond. switch
183 Air cond. pressure switch
184 Air cond. pressure relay
185 Blower relay
186 Compressor relay
187 Compressor clutch
188 Compressor clutch doide

Diagram 12

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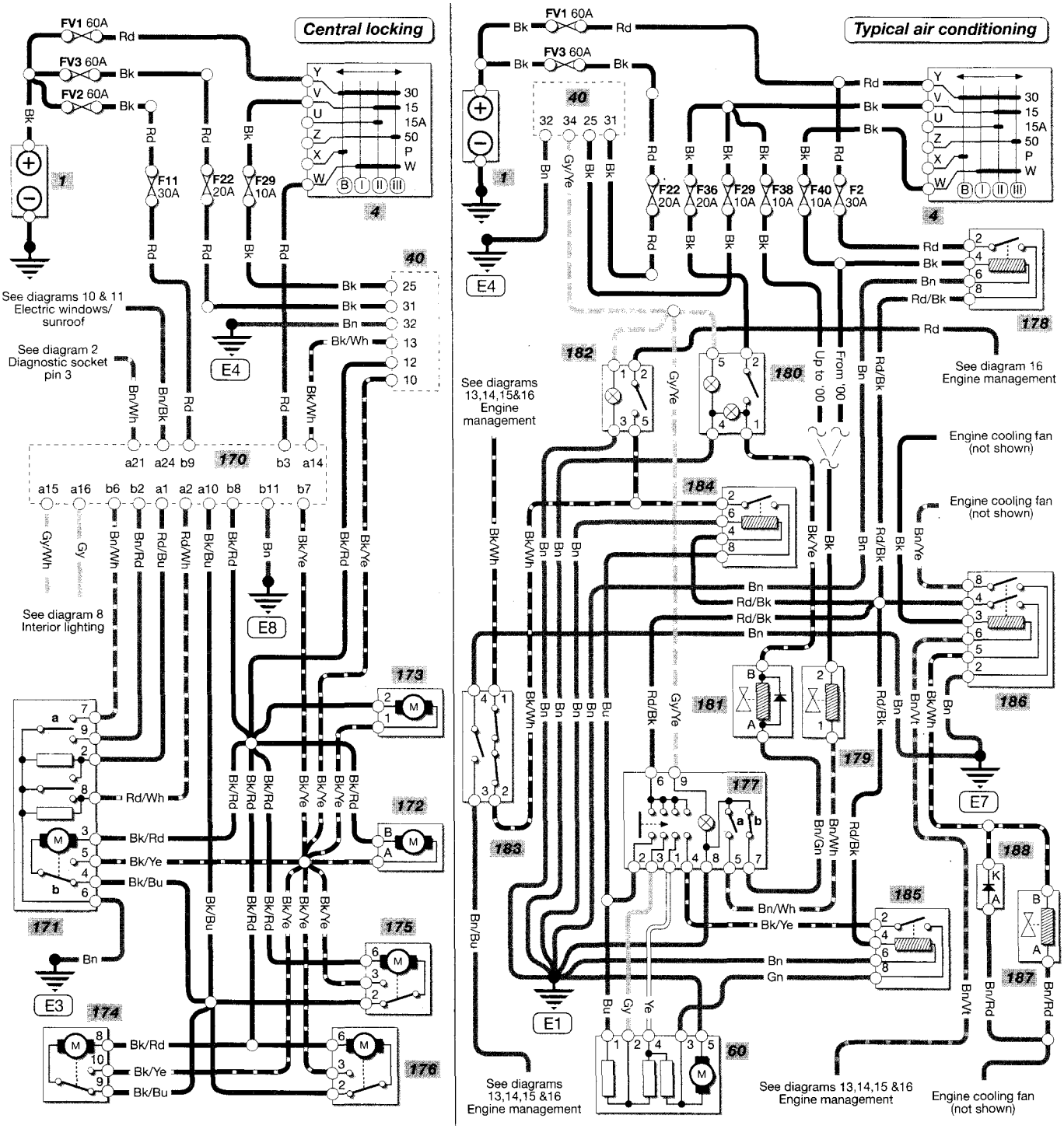


Conversion factors

Length (distance)

Inches (in)	x 25.4	=	Millimetres (mm)	x 0.0394	=	Inches (in)
Feet (ft)	x 0.305	=	Metres (m)	x 3.281	=	Feet (ft)
Miles	x 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, Imperial (mpg)	x 0.354	=	Kilometres per litre (km/l)	x 2.825	=	Miles per gallon, Imperial (mpg)
Miles per gallon, US (mpg)	x 0.425	=	Kilometres per litre (km/l)	x 2.352	=	Miles per gallon, US (mpg)

Temperature

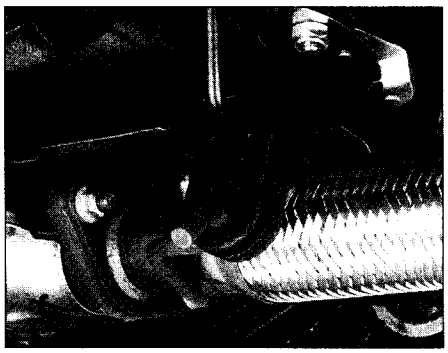
Degrees Fahrenheit = (°C x 1.8) + 32

Degrees Celsius (Degrees Centigrade; °C) = (°F - 32) x 0.56

** It is common practice to convert from miles per gallon (mpg) to litres/100 kilometres (l/100km), where mpg x l/100 km = 282*

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

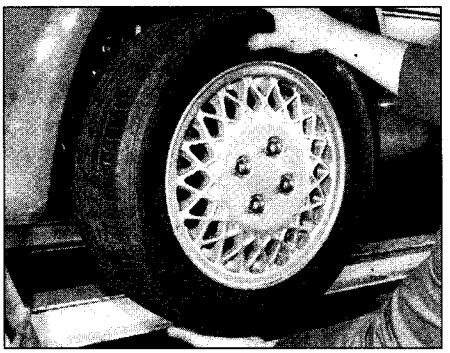
☐ Have your assistant turn the steering from lock to lock. Check that the steering turns smoothly, and that no part of the steering mechanism, including a wheel or tyre, fouls any brake hose or pipe or any part of the body structure.

☐ 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.

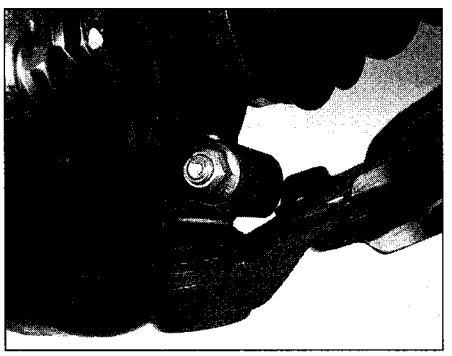
Front and rear suspension and wheel bearings

☐ Starting at the front right-hand side, grasp the roadwheel at the 3 o'clock and 9 o'clock positions and rock gently but firmly. 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.

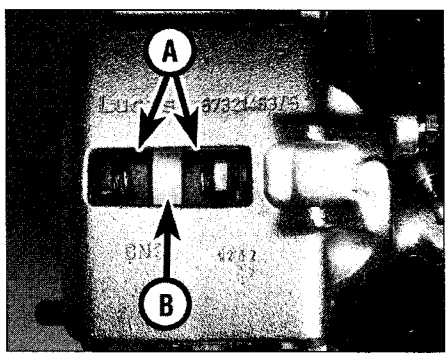
☐ Inspect the shock absorbers for signs of serious fluid leakage. Check for wear of the mounting bushes or attachments, or damage to the body of the unit.

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.

Steering and suspension

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 (see *Weekly checks*).
- ☐ Excessive wear in suspension or steering components (Chapters 1 and 10).
- ☐ Incorrect front wheel alignment (Chapter 10).
- ☐ Accident damage to steering or suspension components (Chapters 1 and 10).

Wheel wobble and vibration

- ☐ Front roadwheels out of balance (vibration felt mainly through the steering wheel) (Chapter 10).
- ☐ Rear roadwheels out of balance (vibration felt throughout the vehicle) (Chapter 10).
- ☐ Roadwheels damaged or distorted (Chapter 10).
- ☐ Faulty or damaged tyre (*Weekly Checks*).
- ☐ Worn steering or suspension joints, bushes or components (Chapters 1 and 10).
- ☐ Wheel bolts loose (Chapter 1 and 10).

Excessive pitching and/or rolling around corners, or during braking

- ☐ Defective shock absorbers (Chapters 1 and 10).
- ☐ Broken or weak coil 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 (Chapter 10).
- ☐ Faulty or damaged tyre (*Weekly Checks*).
- ☐ Wheel bolts loose (Chapter 10).
- ☐ Defective shock absorbers (Chapters 1 and 10).

Excessively-stiff steering

- ☐ Seized track rod end balljoint or suspension balljoint (Chapters 1 and 10).
- ☐ Broken or incorrectly adjusted auxiliary drivebelt (Chapter 1).
- ☐ Incorrect front wheel alignment (Chapter 10).
- ☐ Steering gear damaged (Chapter 10).

Excessive play in steering

- ☐ Worn steering column universal joint(s) (Chapter 10).
- ☐ Worn steering track rod end balljoints (Chapters 1 and 10).
- ☐ Worn 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 (*Weekly Checks*).
- ☐ Restriction in power steering fluid hoses (Chapter 10).
- ☐ Faulty power steering pump (Chapter 10).
- ☐ Faulty steering gear (Chapter 10).

Tyre wear excessive

Tyres worn on inside or outside edges

- ☐ Tyres under-inflated (wear on both edges) (*Weekly Checks*).
- ☐ 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 (*Weekly Checks*).

Tyres worn on inside and outside edges

- ☐ Tyres under-inflated (*Weekly Checks*).
- ☐ Worn shock absorbers (Chapter 10).

Tyres worn unevenly

- ☐ Tyres/wheels out of balance (*Weekly Checks*).
- ☐ Excessive wheel or tyre run-out (Chapter 10).
- ☐ Worn shock absorbers (Chapters 1 and 10).
- ☐ Faulty tyre (*Weekly Checks*).