# MINI

'59 to '69

All models □ 848 cc □ 970 cc
997 cc □ 998 cc □ 1071 cc □ 1275 cc

Haynes

THE BOOK

## Owners Workshop Manual


EVERY MANUAL BASED ON A STRIP DOWN AND REBUILD

movement disappears or becomes less severe, then the wheel hub bearings in the swivel hub are at fault. Any perceptible movement at all indicates wear in the hub bearings, and they should be renewed as described in Chapter 10.

### Swivel hub balljoints

**7** Wear of the swivel hub balljoints is fairly common on Minis and will be quite obvious on inspection because the whole swivel hub will appear to move in relation to the suspension arms as the wheel is rocked. If this is the case, the balljoints should be adjusted, or if badly worn, renewed; these procedures are contained in Chapter 10.

### Suspension arm mountings

**8** Check for wear of the lower arm inner mounting bushes where the arm is bolted to the subframe. If the bushes are worn, the arm will appear to move in and out as the wheel is rocked.

**9** The upper arm inner roller bearings cannot be inspected without partially dismantling the suspension because the rubber cone spring or displacer unit holds the arm in tension and any wear will not be evident. It can be removed for closer inspection if required as described in Chapter 10; however, wear of the upper arm and its bearings is uncommon.

**10** With the brakes still firmly applied, try to rotate the wheel back and forth. If any movement is now felt, examine the tie-bar between the lower suspension arm and subframe for wear or deterioration of the rubber bushes.

## *Rear suspension*

**11** To check the rear suspension for wear, chock the front wheels then jack up the rear of the car and support it on axle stands (see *"Jacking and vehicle support"*).

**12** Wear of the rear suspension components can often be felt when driving the car as a tendency for the rear of the vehicle to wander over uneven road surfaces or when cornering. To isolate the worn components, grasp the roadwheel at the 12 o'clock and 6 o'clock positions and try to rock it. If any movement is felt, it is likely to be in one of the following areas:

### Hub bearings

**13** Continue rocking the wheel while an assistant depresses the footbrake. If the movement disappears or becomes less pronounced, then the bearings in the rear hub are at fault. The bearings should be renewed if there is any appreciable movement whatsoever.

> **HAYNES HiNT** ***Wear in the rear hub bearings can often be confirmed by slowly turning the wheel with your hand on the tyre. Worn bearings usually exhibit a roughness which can be felt as the wheel is turned.***

### Radius arm bearings

**14** With the footbrake still applied, continue rocking the wheel and observe the front of the radius arm. If it can be seen to move appreciably up and down, then wear has taken place in the roller or plain bearing in the radius arm, or on the pivot shaft. If this is the case, the radius arm should be removed for overhaul as described in Chapter 10.

## 6 Underbody and fuel/brake line check

**1** With the vehicle raised and supported on axle stands (see *"Jacking and vehicle support"*), or over an inspection pit, thoroughly inspect the underbody and wheel arches for signs of damage and corrosion. In particular, examine the bottom of the side sills, and any concealed areas where mud can collect. Where corrosion and rust is evident, press and tap firmly on the panel with a screwdriver, and check for any serious corrosion which would necessitate repairs. If the panel is not seriously corroded, clean away the rust, and apply a new coating of underseal. Refer to Chapter 11 for more details of body repairs.

**2** At the same time, inspect the treated lower body panels for stone damage and general condition.

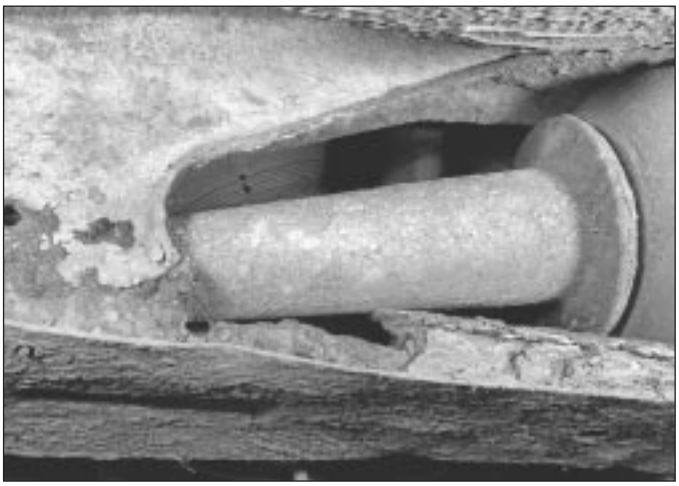
**3** Examine the subframes carefully, particularly the side members of the rear subframe. Corrosion here is a common occurrence on Minis, particularly older models, and is one of the main causes of MOT test failure on these cars **(see illustration)**. Where corrosion has reached an advanced stage, renewal of the subframe is the only satisfactory cure.

**4** Inspect all of the fuel and brake lines on the underbody for damage, rust, corrosion and leakage. Also make sure that they are correctly supported in their clips. The battery positive cable which runs under the car from front to rear is a common problem area as it is prone to damage or chafing if not properly routed or secured.

**5** Inspect the flexible brake hoses in the vicinity of the backplates or front calipers, where they are subjected to most movement **(see illustration)**. Bend them between the fingers (but do not actually bend them double, or the casing may be damaged) and check that this does not reveal previously hidden cracks, cuts or splits.

## 7 Exhaust system check

**1** With the engine cold (at least three hours after the vehicle has been driven), check the complete exhaust system, from its starting point at the engine to the end of the tailpipe. Ideally, this should be done on a hoist, where unrestricted access is available; if a hoist is not available, raise and support the vehicle on axle stands (see "*Jacking and vehicle support*").



**6.3 Advanced state of corrosion on rear subframe side member**

**6.5 Inspect the flexible brake hoses in the vicinity of the backplates**

### 34 Emission control equipment check

**1** Of the emission control systems that may be fitted, only the air pump drivebelt (where applicable), the crankcase ventilation system and the evaporative emission control systems require regular checking, and even then, the components of these systems require minimal attention.
**2** Checks and adjustment of the air pump drivebelt are contained in Section 9.
**3** The crankcase ventilation system filter in the oil filler cap should be renewed by simply renewing the cap (the new cap is supplied with filter inside). Checks of the other system components are contained in Chapter 4C.
**4** Should it be felt that the other systems are not functioning correctly, the advice of a dealer should be sought.

# Every 24 000 miles or 24 months

### 35 Coolant renewal

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

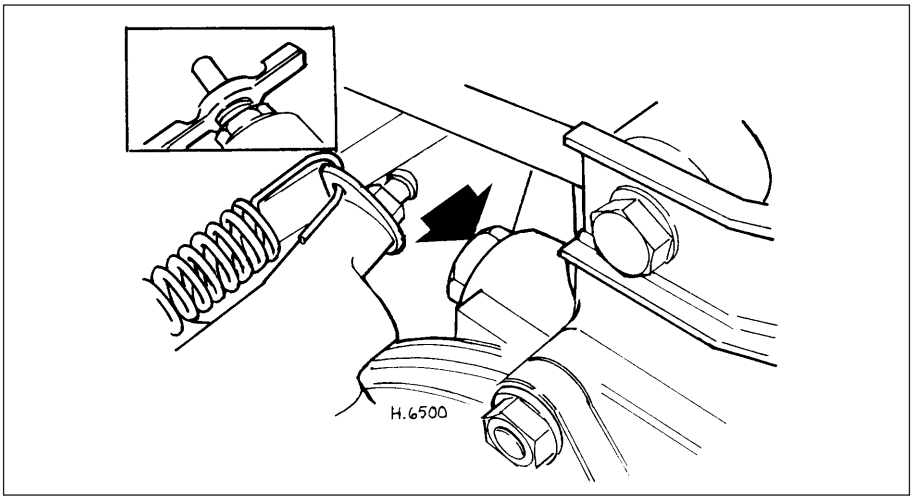
**Note:** *If coolant to Rover specification, in the correct ratio, has been continuously maintained in the system, then coolant renewal will not normally be necessary. However, to be absolutely sure about the integrity of the antifreeze and anti-corrosion properties of the coolant, periodic renewal is to be recommended.*

#### *Cooling system draining*

**1** To drain the system, first remove the expansion tank filler cap (see *"Weekly checks"*). Move the heater temperature control to the hot position.
**2** If there is anti-freeze in the system, place clean bowls beneath the radiator and at the rear of the engine to collect the coolant for re-use.
**3** Undo and remove the radiator drain plug and cylinder block drain plug, and allow the coolant to drain. If fitted, the radiator drain plug is located at the bottom of the radiator nearest the grille, and the cylinder block drain plug (if fitted) can be found at the rear of the block, beneath the engine tie-bar **(see illustration)**.
**4** On later models the radiator does not incorporate a drain plug, and it is therefore necessary to detach the bottom hose to drain the coolant. To do this slacken the bottom hose retaining clip and pull the hose off the radiator outlet. The hose clip is very inaccessible and a long thin screwdriver is quite useful here. If the hose proves difficult to remove from the radiator outlet, it is possible to gently push it off from the access hole under the wheel arch.
**5** When the coolant has stopped running, probe the orifices, particularly the cylinder block orifice, with a short piece of wire to dislodge any particles of rust or sediment which may be preventing the coolant from completely draining out.

#### *Cooling system flushing*

**6** With time, the cooling system may gradually lose its efficiency if the radiator core becomes choked with rust, scale deposits from the water, and other sediment. This is especially likely if an inferior grade of antifreeze has been used that has not been regularly renewed. To minimise this, as well as using only the specified type of antifreeze and clean soft water, the system should be flushed as follows whenever any part of it is disturbed, and/or when the coolant is renewed.
**7** With the coolant drained, close the drain taps and refill the system with fresh water. Refit the radiator cap, start the engine and warm it up to normal operating temperature, then stop it and (after allowing it to cool down completely) drain the system again. Repeat as necessary until only clean water can be seen to emerge, then refill finally with the specified coolant mixture.
**8** If only clean, soft water and good-quality antifreeze has been used, and the coolant has been renewed at the specified intervals, the above procedure will be sufficient to keep the system clean for a considerable length of time. If, however, the system has been neglected, a more thorough operation will be required, as follows.
**9** To flush the system first drain the coolant as described in the previous Section. Place a garden hose in the radiator filler cap neck and allow water to run through the system for ten to fifteen minutes.
**10** To flush the engine, remove the thermostat (see Chapter 3), insert the garden hose into the thermostat housing, and allow water to circulate until it runs clear from the bottom hose. If, after a reasonable period, the water still does not run clear, the radiator should be flushed with a good proprietary cleaning agent.
**11** In severe cases of contamination, reverse-flushing of the radiator may be necessary. To do this, remove the radiator (see Chapter 3), invert it, and insert the garden hose into the bottom outlet. Continue flushing until clear water runs from the top hose outlet. A similar procedure can be used to flush the heater matrix.
**12** The use of chemical cleaners should be necessary only as a last resort. Normally, regular renewal of the coolant will prevent excessive contamination of the system.




**35.3 Cylinder block coolant drain tap or plug location (arrowed)**

**8.19a Disconnect the two vacuum/ breather hoses from the left-hand end of the cylinder head . . .**

**8.19b . . . and the single hose from the right-hand end**

**8.20 Remove the nut and release the ignition coil bracket**

**32** Reconnect the wire to the temperature gauge sender unit.
**33** Refit the heater hose to the heater valve then tighten the heater hose and the bypass hose retaining clips.
**34** Refer to Chapter 4C and reconnect the exhaust front pipe and, on Cooper S models, the inlet and exhaust manifolds.
**35** Refit the radiator upper support bracket.
**36** Refit the ignition coil and bracket and reconnect the wiring.
**37** Refit and secure the radiator top hose.
**38** Refer to Chapter 4A and refit the carburettor(s).
**39** Refer to Section 4 and adjust the valve clearances then refit the rocker cover, HT leads and associated components.
**40** Reconnect the battery then refill the cooling system as described in Chapter 1. If removed, refit the bonnet, referring to Chapter 11 if necessary.

## 8 Cylinder head (fuel injection engines) - removal and refitting

**Note:** *Observe the precautions in Section 1 of Chapter 4B before working on any component in the fuel system.*

### Removal

**1** Disconnect the battery negative lead. For improved working clearance, remove the bonnet as described in Chapter 11.
**2** Drain the cooling system as described in Chapter 1.
**3** Release the fasteners and remove the ignition cover from the front of the engine.
**4** Refer to Chapter 4B and remove the air cleaner assembly.
**5** Chock the rear wheels then jack up the front of the car and support it on axle stands (see *"Jacking and vehicle support"*).
**6** Working from underneath the car, slacken and remove the single bolt securing the exhaust front pipe to its mounting bracket on the transmission. Undo the three nuts securing the front pipe to the manifold, then disconnect it and recover the gasket.
**7** Trace the wiring back from the exhaust system lambda sensor (which is screwed into the exhaust manifold), releasing it from any relevant cable-ties, and disconnect its wiring connector from the main harness.
**8** Lower the car to the ground.
**9** Undo the bolt and remove the retaining clip securing the injector housing fuel pipes to the bulkhead.
**10** Bearing in mind the information contained in Chapter 4B, Section 6 on depressurising the fuel system, using an open-ended spanner to retain each adapter, slacken the union nuts and disconnect the feed and return pipes from the throttle body assembly. Plug each pipe and adapter, to minimise the loss of fuel and prevent the entry of dirt into the system.
**11** Release the retaining clips and disconnect the wiring connectors from the injector housing, the throttle potentiometer and the stepper motor. Free the wiring from any relevant retaining clips, and position it clear of the throttle body assembly.
**12** Slacken the accelerator cable locknuts, and free the outer cable from its mounting bracket. Release the inner cable from the throttle cam, and position the cable clear of the throttle body.
**13** On automatic transmission models, disconnect the governor control rod from the throttle body linkage.
**14** Disconnect the two vacuum hoses from the rear of the inlet manifold, noting their correct fitted positions; note that the hoses are colour-coded for identification purposes.
**15** Undo the union bolt securing the brake servo vacuum hose to the inlet manifold, and recover the hose union sealing washers.
**16** Slacken the retaining clips and disconnect the coolant hoses from the left-hand side of the inlet manifold.
**17** Slacken the clips securing the radiator top hose to the thermostat housing and radiator, and remove the hose.
**18** Undo the radiator upper mounting bracket retaining bolts, and remove the bracket from the side of the cylinder head and radiator.
**19** Release the retaining clip(s), and disconnect the two vacuum/breather hoses from the left-hand end of the cylinder head, and the single hose from the right-hand end of the head **(see illustrations)**.
**20** Undo the nut securing the ignition coil to the front of the cylinder head, then release the coil from its mounting stud and position it clear of the cylinder head **(see illustration)**.
**21** Make a note of the correct fitted positions of the HT leads, and disconnect them from the spark plugs.
**22** Remove the cylinder head assembly as described in paragraphs 13 to 18 of Section 7, noting that it will be necessary to disconnect the wiring connectors from the PTC heater and coolant temperature sensor (situated on the underside of the inlet manifold) as they become accessible.

### *Preparation for refitting*

**23** Refer to Section 7, paragraphs 19 to 22.

### Refitting

**24** Refit the cylinder head as described in Section 7, not forgetting to reconnect the PTC heater and coolant temperature sensor wiring connectors as the head assembly is lowered into position on the cylinder block.
**25** The remainder of the refitting process is a direct reversal of the removal procedure, noting the following points:

*a) Ensure that all pipes/hoses are correctly reconnected, and (where necessary) are securely held in position by their retaining clips.*
*c) Tighten all nuts and bolts to the specified torque setting (where given).*
*d) Position a sealing washer on either side of the brake servo vacuum hose union, and tighten the union bolt securely.*
*e) Refill the cooling system as described in Chapter 1*
*f) On completion, reconnect the battery, and adjust the accelerator cable as described In Chapter 4B.*

## 9 Crankshaft oil seals - renewal

### *Front (timing cover) oil seal*

**1** Remove the timing cover as described in Section 5, paragraphs 1 to 6 and 8 to 11.
**2** Thoroughly clean the timing cover with

## 3 Engine/transmission - removal and refitting

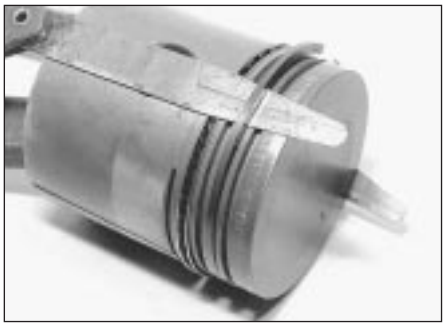
### Removal

**1** Disconnect the battery negative lead.
**2** Drain the cooling system and the engine/transmission oil as described in Chapter 1.
**3** Remove the bonnet and front grille as described in Chapter 11.
**4** On models equipped with an ignition shield mounted on the front of the engine, release the three retaining lugs and lift off the shield.
**5** On carburettor engines, refer to Chapter 4A and remove the air cleaner assembly and carburettor(s). On fuel injection engines, slacken the accelerator cable locknuts, and free the outer cable from its mounting bracket. Release the inner cable from the throttle cam, and position the cable clear of the throttle body.
**6** On fuel injection engines, remove the engine management ECU as described in Chapter 4B.
**7** Remove the starter motor and alternator as described in Chapter 5A.
**8** Where applicable, undo and remove the screws securing the starter solenoid to the inner wing panel and position the solenoid clear of the engine.
**9** On models equipped with a mechanical fuel pump, disconnect the fuel inlet hose and plug it with a suitable bolt or metal rod to prevent loss of fuel.
**10** On fuel injection engines, undo the bolt and remove the retaining clip securing the injector housing fuel pipes to the bulkhead. Bearing in mind the information contained in Chapter 4B, Section 6, concerning depressurisation of the fuel system, using an open-ended spanner to retain each adapter, slacken the union nuts and disconnect the feed and return pipes from the throttle body assembly. Plug each pipe and adapter, to minimise the loss of fuel and prevent the entry of dirt into the system.
**11** Where applicable, disconnect the cooling system hose from the expansion tank, which is located by the side of the radiator. Undo the retaining bolt and remove the expansion tank from the engine compartment.
**12** On carburettor engines, slacken the retaining clips and remove the two heater hoses. Also slacken the two securing screws and withdraw the heater control cable from the valve on the cylinder head (where applicable). On fuel injection engines, Undo the heater control coolant valve mounting bolt, then slacken the retaining clips and disconnect the coolant valve hoses from the manifold and thermostat housing. Slacken the clip and disconnect the heater unit hose from its union with the bottom radiator hose (situated directly below the coolant valve).
**13** If a fresh air heater/demister blower motor is mounted in the engine compartment, remove this unit as described in Chapter 3.
**14** Undo and remove the two nuts and bolts on the clamp, or the three flange nuts securing the exhaust front pipe to the manifold. Separate the front pipe from the manifold. **Note:** *On Cooper S models it will be necessary to remove the complete exhaust system as described in Chapter 4C.*
**15** If the horn is mounted on the front body panel, disconnect the electrical leads, undo and remove the mounting bolts and withdraw the horn.
**16** From beneath the right-hand front wing detach the heater fresh air ducting from the air inlet. Now withdraw the air inlet from the inner wing panel.
**17** Disconnect the wiring from the following locations, after identifying the leads or wiring plugs for subsequent reconnection:

*a) Leads to the temperature gauge transmitter and oil pressure switch (where fitted).*
*b) LT leads at the ignition coil.*
*c) HT leads from the spark plugs and ignition coil, and the crankshaft sensor wiring connector on fuel injection engines.*
*d) On fuel injection engines, disconnect the wiring connectors from the injector housing, the throttle potentiometer and the stepper motor. Free the wiring from any relevant retaining clips, and position it clear of the throttle body assembly. Trace the wiring back from the exhaust system lambda sensor (which is screwed into the exhaust manifold), releasing it from any relevant cable-ties, and disconnect its wiring connector from the main harness.*
*e) Wiring connectors from the auxiliary cooling fan switch (where fitted), which is situated at the front bottom corner of the radiator.*

**18** Spring back the distributor cap retaining clips, or undo the two screws and remove the cap and leads. Remove the rotor arm from the distributor shaft.
**19** On manual transmission models, release the clutch slave cylinder return spring from the clutch operating lever. Undo and remove the two securing bolts and lift the slave cylinder off the flywheel housing. Tie the cylinder out of the way from a convenient place on the engine bulkhead.
**20** If an oil pressure gauge is fitted, slacken the clamp screw and pull the rubber hose off the feed pipe at the rear of the engine.
**21** On fuel injection engines, release the retaining clip and disconnect the vacuum hose from the pipe situated just behind the thermostat housing. Disconnect the two vacuum hoses from the rear of the inlet manifold, noting their correct fitted positions; note that the hoses are colour-coded for identification purposes.
**22** On later models, disconnect the oil separator breather hose from the right-hand end of the cylinder head. Undo the two bolts securing the separator to the flywheel housing, and remove the separator and hose assembly from the engine, along with its gasket.
**23** Undo and remove the bolt securing the engine tie-bar to the side of the cylinder block. Slacken the tie-bar bulkhead mounting and move the bar back out of the way. Note that on later models the tie-bar retaining bolt also retains the engine earth strap.
**24** Where fitted, remove the oil cooler as described in Part A of this Chapter.
**25** On models fitted with a vacuum servo unit mounted in the engine compartment, refer to Chapter 9 and remove the servo and brake master cylinder. Unscrew the two union nuts securing the master cylinder brake pipes to the pressure-reducing valve, and remove both the pipes, noting their correct fitted positions. Plug the pressure reducing valve ports, to minimise fluid loss and prevent the entry of dirt into the system.
**26** Working under the front wheel arch undo and remove the screw securing the upper suspension arm rebound rubber to the subframe and withdraw the rubber. Place a solid wooden wedge of approximately the same thickness in its place. Repeat this procedure on the other side of the car.
**27** Chock the rear wheels then jack up the front of the car and support it on axle stands (see *"Jacking and vehicle support"*). Remove the front roadwheels.
**28** On manual transmission models fitted with a direct engagement gear lever, undo and remove the retaining screws and lift off the interior rubber boot retaining plate. Now slide the rubber boot up the gear lever slightly. From under the car, undo and remove the two bolts securing the gear lever retaining plate to the rear of the differential housing. Withdraw the gear lever into the car and lift out the anti-rattle spring and plunger from the gear lever housing.
**29** On manual transmission models fitted with the early type remote control extension housing, undo and remove the four shouldered bolts securing the housing to the mounting on the rear of the differential assembly. Pull the front of the extension housing downwards to disengage the linkage and then support the front of the housing on a block of wood.
**30** On manual transmission models fitted with the later rod-change type remote control extension housing, drift out the roll pin securing the collar of the remote control extension rod to the selector shaft. Undo and remove the bolt securing the fork of the steady rod to the differential housing. Release the extension rod and the steady rod from the rear of the transmission.
**31** On automatic transmission models, disconnect the gear selector cable from the transmission as described in Chapter 7B, Section 6.
**32** On early models undo and remove the bolt securing the engine earth strap to the flywheel/torque converter housing.

**11.3 Removing a connecting rod big-end cap**



**11.8 Using feeler blades to aid removal of the piston rings**

**11.16 Measuring the piston diameter**

## 11 Piston/connecting rod - removal, inspection, separation and reconnection

### *Removal*

**1** With the engine separated from the transmission and the cylinder head removed, the piston/connecting rod assemblies can be removed as follows.

**2** Knock back the locking tabs on the big-end bearing cap retaining bolts, using a small chisel and remove the bolts and locking tabs. The 1275 cc engine does not have locking tabs and the big-end caps are retained by bolts and special multi-sided nuts.

**3** Remove the big-end caps one at a time, taking care to keep them in the right order and the correct way round **(see illustration)**. Also ensure that the shell bearings are kept with their correct connecting rods and caps unless they are to be renewed. Normally, the numbers 1 to 4 are stamped on adjacent sides of the big-end caps and connecting rods, indicating which cap fits on which rod and which way round that cap fits. If no numbers or lines can be found then, with a sharp screwdriver, scratch mating marks across the joint from the rod to the cap. One line for connecting rod No 1, two for connecting rod No 2, and so on. This will ensure that there is no confusion later, as it is essential that the caps go back in the correct position on the connecting rods from which they were removed.

**4** If the big-end caps are difficult to remove they may be gently tapped with a soft mallet.

**5** To remove the shell bearings, press the bearing opposite the groove in both the connecting rod and the connecting rod caps, and the bearings will slide out easily.

**6** Withdraw the pistons and connecting rods upwards and ensure that they are kept in the correct order for refitting in the same bore. Refit the connecting rod caps and bearings to the rods if the bearings do not require renewal, to minimise the risk of getting the caps and rods muddled.

### *Inspection*

**7** Before the inspection process can begin, the piston/connecting rod assemblies must be cleaned, and the original piston rings removed from the pistons.

**8** Carefully expand the old rings over the top of the pistons. The use of two or three old feeler blades will be helpful in preventing the rings dropping into empty grooves **(see illustration)**. Be careful not to scratch the piston with the ends of the ring. The rings are brittle, and will snap if they are spread too far. They are also very sharp - protect your hands and fingers. Always remove the rings from the top of the piston. Keep each set of rings with its piston if the old rings are to be re-used.

**9** Scrape away all traces of carbon from the top of the piston. A hand-held wire brush (or a piece of fine emery cloth) can be used, once the majority of the deposits have been scraped away.

**10** Remove the carbon from the ring grooves in the piston, using an old ring. Break the ring in half to do this (be careful not to cut your fingers - piston rings are sharp). Be careful to remove only the carbon deposits - do not remove any metal, and do not nick or scratch the sides of the ring grooves.

**11** Once the deposits have been removed, clean the piston/connecting rod assembly with paraffin or a suitable solvent, and dry thoroughly. Make sure that the oil return holes in the ring grooves are clear.

**12** If the pistons and cylinder bores are not damaged or worn excessively, the original pistons can be refitted. Normal piston wear shows up as even vertical wear on the piston thrust surfaces, and slight looseness of the top ring in its groove. New piston rings should always be used when the engine is reassembled.

**13** Carefully inspect each piston for cracks around the skirt, around the gudgeon pin holes, and at the piston ring “lands” (between the ring grooves).

**14** Look for scoring and scuffing on the piston skirt, holes in the piston crown, and burned areas at the edge of the crown. If the skirt is scored or scuffed, the engine may have been suffering from overheating, and/or abnormal combustion which caused excessively high operating temperatures. The cooling and lubrication systems should be checked thoroughly. Scorch marks on the sides of the pistons show that blow-by has occurred. A hole in the piston crown, or burned areas at the edge of the piston crown, indicates that abnormal combustion (pre-ignition, knocking, or detonation) has been occurring. If any of the above problems exist, the causes must be investigated and corrected, or the damage will occur again. The causes may include incorrect ignition timing, or a carburettor or fuel injection system fault.

**15** Corrosion of the piston, in the form of pitting, indicates that coolant has been leaking into the combustion chamber and/or the crankcase. Again, the cause must be corrected, or the problem may persist in the rebuilt engine.

**16** Using a micrometer, measure the diameter of all four pistons at a point 10 mm from the bottom of the skirt, at right angles to the gudgeon pin axis **(see illustration)**. Record the measurements and use them to check the piston-to-bore clearance when the cylinder bores are measured later in this Chapter.

**17** Hold a new piston ring in the appropriate groove and measure the ring-to-groove clearance using a feeler blade **(see illustration)**. Note that the rings are of different types, so use the correct ring for the groove. Compare the measurements with those listed in the *Specifications*; if the clearances are outside the tolerance range, then the pistons must be renewed.

**18** When new pistons are to be fitted, take great care to be sure to fit the exact size best suited to the particular bore of your engine. Rover go one stage further than merely specifying one size piston for all standard

**11.17 Measuring the piston ring-to-groove clearance**

## 4 Radiator - removal and refitting

**Note:** *Refer to the warnings given in Section 1 of this Chapter before proceeding.*

HAYNES HINT

***If leakage is the reason for wanting to remove the radiator, bear in mind that minor leaks can often be cured using a radiator sealant with the radiator in situ.***

### *Removal*

**1** Drain the cooling system as described in Chapter 1.

**2** Refer to Chapter 11 and remove the bonnet.

**3** Slacken the two retaining clips and completely remove the radiator top hose.

**4** If the bottom hose was not removed for draining, slacken the retaining clip, using a long thin screwdriver, and pull the hose off the radiator outlet.

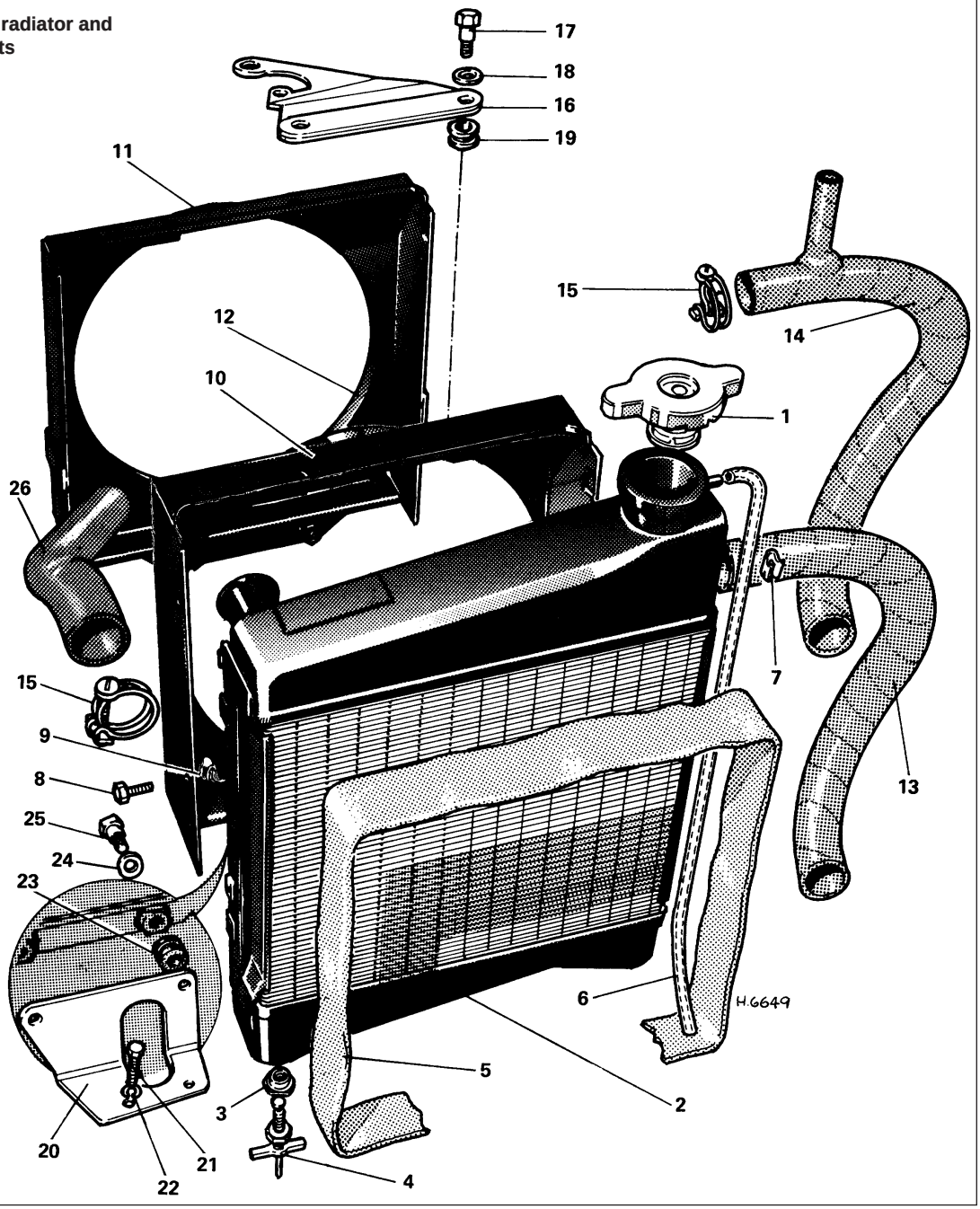
**5** Undo and remove the bolts and nuts securing the radiator upper support bracket to the fan cowling and thermostat housing. Lift away the bracket **(see illustration)**.

**6** On later 1275 cc engines (except carburettor engine Cooper models) disconnect the wiring connectors at the auxiliary cooling fan thermostatic switch in the bottom corner of the radiator.

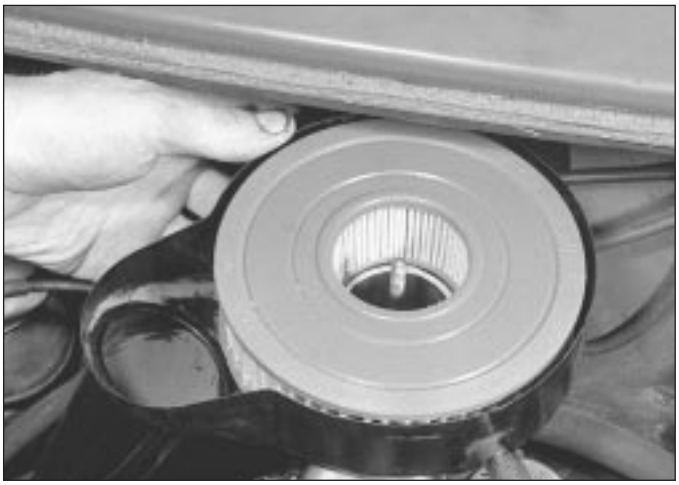
**7** At the base of the radiator undo and remove either the long through-bolt or the two short bolts (depending on model) that secure the lower support bracket to the engine mounting **(see illustration)**. If necessary remove the front grille panel as described in Chapter 11 to provide greater access.

**4.5 Exploded view of radiator and attachments**

*1 Filler cap*
*2 Radiator*
*3 Drain tap adapter*
*4 Drain tap or plug*
*5 Rubber surround*
*6 Overflow pipe*
*7 Retaining clip*
*8 Cowl fixing screw*
*9 Nut*
*10 Cowl (one piece type)*
*11 Cowl (upper - two piece type)*
*12 Cowl (lower - two-piece type)*
*13 Bottom hose (non-heater type)*
*14 Bottom hose (heater type)*
*15 Hose clip*
*16 Upper mounting*
*17 Bolt*
*18 Washer*
*19 Rubber grommet*
*20 Lower mounting*
*21 Bolt*
*22 Washer*
*23 Rubber grommet*
*24 Washer*
*25 Bolt*
*26 Top hose*



**2.1b . . . or the two wing bolts on later models**



**2.2a If the air cleaner is retained by a single wing nut, lift off the top cover and withdraw the air cleaner body from the carburettor**

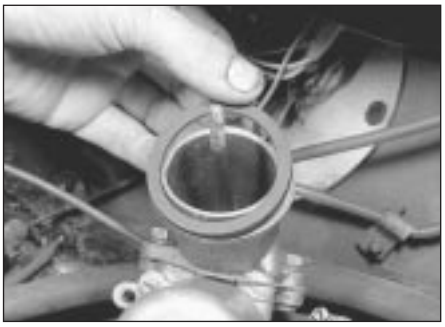
**3** If the air cleaner is retained by two wing bolts, detach the hot air duct (where fitted) and then lift the air cleaner body off the carburettor **(see illustrations)**.

**4** With the air cleaner removed from the engine, recover the rubber sealing ring if it stayed behind on the carburettor flange.

### Refitting

**5** Refitting the air cleaner is the reverse sequence to removal. Ensure also that the rubber sealing ring is in position before refitting the air cleaner.

**6** If the air cleaner body incorporates an adjustable air inlet spout, this should be positioned adjacent to the exhaust manifold in winter and away from it in summer.



**2.2b Recover the sealing ring**

**2.3a If the air cleaner is retained by two wing bolts detach the hot air duct . . .**

**2.3b . . . and lift off the air cleaner body . . .**

## *Cooper S Mk III models*

### Removal

**7** Undo and remove the two wing bolts and washers then disconnect the engine breather pipe and the throttle return spring. Lift off the air cleaner body and recover the two rubber sealing rings from the carburettor flanges.

### Refitting

**8** Refitting is the reverse sequence to removal but ensure that the rubber sealing rings are in position on the carburettor's flanges.

## *1990-on Cooper models*

### Removal

**9** Unscrew the two nuts securing the air inlet duct to the rocker cover studs, then release the clip and disconnect the duct from the air cleaner **(see illustration)**.

**10** Unscrew and remove the nuts and washers, then lift the air cleaner from the carburettor and disconnect the hot air hose. Remove the sealing ring from the carburettor flange.

### Refitting

**11** Refitting is the reverse sequence to removal but ensure that the rubber sealing ring is in position on the carburettors flange.

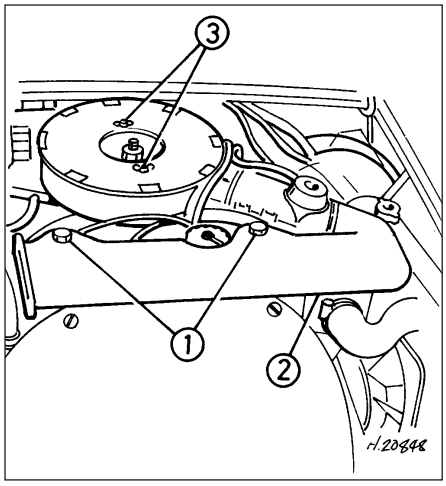
## *1992-on models with open-loop catalytic converter*

### Removal

**12** Unscrew the two wing nuts, and lift the air cleaner assembly away from the carburettor. Recover the sealing ring from the carburettor flange.

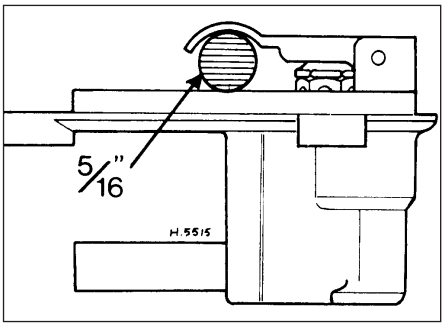
### Refitting

**13** Refitting is the reverse sequence to removal but ensure that the rubber sealing ring is in position on the carburettors flange.




**2.9 Air cleaner and intake duct fitted to 1990-on Cooper models**

*1 Intake duct retaining nuts*
*2 Intake duct*
*3 Air cleaner mounting nuts*




**13.46 Method of setting the correct clearance of the float lever – early carburettors**

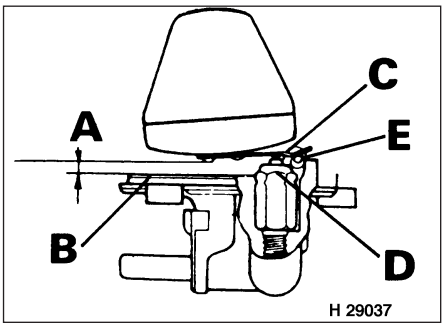
in the centre of the float chamber cover, without fouling the float. If the bar lifts the float or if the float stands clear of the bar, bend the float lever very slightly until the clearance is correct **(see illustration)**.

**47** Later carburettors fitted with plastic floats incorporate either a plain steel needle or a spring-loaded needle enclosed in a plastic sheath. The adjustment procedure for the plain steel needle type is the same as described in paragraph 46. Float level adjustment for spring-loaded needles is as follows.

**48** Invert the float chamber cover so that the needle valve is closed but the spring is not compressed. The gap between the float and the flange on the float chamber cover, at the centre of the cover, should be between 3.18 mm and 4.76 mm **(see illustration)**. If the gap is incorrect, bend the float lever slightly until the specified gap is obtained. In the case of floats having a moulded plastic hinge, increase or decrease the washer thickness under the needle seat to achieve the desired float level height.

**49** Place a new gasket in position on the float chamber, refit the cover and secure it with the three retaining screws.

**50** Fill the carburettor piston damper with the correct grade of oil, until the level is 13.0 mm




**13.48 Method of setting the correct clearance of the float lever – later carburettors**

*A 3.18 to 4.76 mm*
*B Machined lip*
*C Float lever adjustment point*
*D Float needle and seat assembly*
*E Lever hinge pin*

above the top of the hollow piston rod. Now refit the damper plunger.

**51** To obtain an initial jet setting and to allow the engine to be started, screw the jet adjusting nut up until the jet is flush with the bridge in the carburettor body. Now screw the nut down two complete turns on non-sealed carburettors and three complete turns on sealed units. **Note:** *The sealed type carburettors are identified by the throttle adjusting screw which is recessed within the carburettor body.*

**52** The carburettor can now be refitted to the car as described in Section 12 and the idle speed and mixture adjustments carried out as described in Section 15.

## 14 Carburettor (SU HIF44 and HIF38)) - fault diagnosis and overhaul

### *Fault diagnosis*

**1** Refer to Section 13.

### *Overhaul*

#### SU HIF44 carburettor

**2** Remove the carburettor from the car as described in Section 12, then clean the exterior surfaces thoroughly and wipe dry.

**3** Mark the float chamber cover in relation to the carburettor body. Remove the screws, and withdraw the cover and sealing ring **(see illustration)**.

**4** Unscrew and remove the mixture screw and spring, and withdraw the seal.

**5** Unscrew the jet retaining screw, and remove the spring.

**6** Withdraw the jet and bi-metal lever assembly. Disengage the lever from the jet.

**7** Unscrew and remove the float pivot and seal.

**8** Withdraw the float and the needle valve.

**9** Unscrew and remove the needle valve seat.

**10** Unscrew and remove the piston damper, and drain the oil.

**11** Mark the dashpot in relation to the carburettor body. Remove the screws and withdraw the dashpot together with the piston.

**12** Prise the clip from the top of the piston rod, then withdraw the piston and spring from the dashpot.

**13** Unscrew the needle retaining grub screw. Remove the needle, guide and spring from the piston.

**14** From underneath the main body, unscrew the jet bearing nut and withdraw the bearing.

**15** Note how the spring is attached to the fast idle cam lever, then bend back the locktabs, unscrew the nut and remove the washer.

**16** Hold the return spring against the main body, and use a screwdriver to prise the cam lever from the end of the cold start spindle. Remove the spring.

**17** Remove the end cover and spindle seat.

**18** Remove the two screws and withdraw the retaining plate, cold start body and gasket.

**19** Remove the O-ring from the end of the cold start spindle, and withdraw the spindle from the main body. Remove the cold start seal.

**20** Dismantling of the throttle spindle is not recommended, unless the components are damaged or excessively worn. If they are, first note how the return spring is attached to the throttle lever.

**21** Mark the throttle valve in relation to the spindle and main body.

**22** Remove the throttle valve screws while supporting the spindle with a block of wood if necessary.

**23** Open the throttle and withdraw the valve disc.

**24** Remove any burrs from the spindle screw holes with a fine file.

**25** Bend back the locktabs and unscrew the spindle nut. Remove the lockwasher, plain washer, throttle lever, and return spring.

**26** From the opposite end of the spindle, loosen the nut and bolt, and remove the throttle damper lever.

**27** Check the threaded end of the spindle and main body in relation to each other, then withdraw the spindle. Remove the two seals.

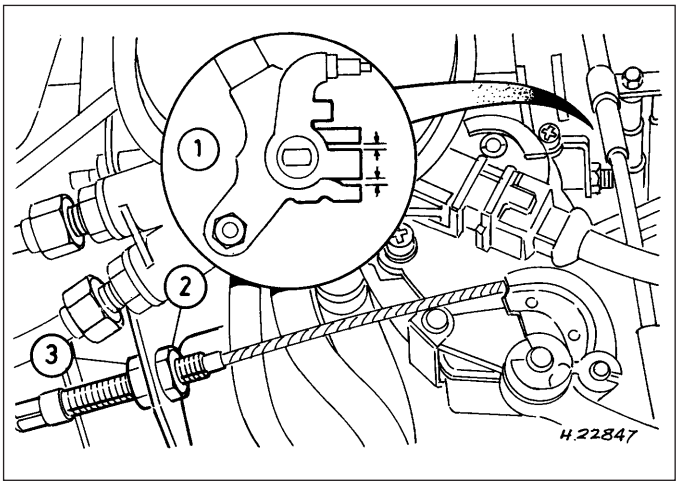
**28** Clean all the components dry thoroughly. Examine each item for damage and excessive wear. In particular, check the throttle spindle and bearings for wear. If excessive, renewal of the spindle may be sufficient, but if the bearings are worn, it may be necessary to renew the complete carburettor, as new bearings are not always available. Check the needle valve and seating for excessive ridging. Examine the main body for cracks, and for security of the brass fittings and piston key. Check the tapered needle, jet and jet bearing for wear. Shake the float, and listen for any trapped fuel which may have entered through a small crack or fracture. Renew the components as necessary, and obtain a complete set of gaskets and seals, and two new throttle valve screws if necessary.

**29** Clean the inside of the dashpot and the periphery of the piston with methylated spirit. Do not use any form of abrasive. Lubricate the piston rod with engine oil, and insert it into the dashpot. Hold the two components horizontal, and spin the piston in several positions. The piston must spin freely, without touching the sides of the dashpot.

**30** Commence reassembly by fitting the throttle spindle and two seals to the main body. The seals must be slightly recessed in their housings.

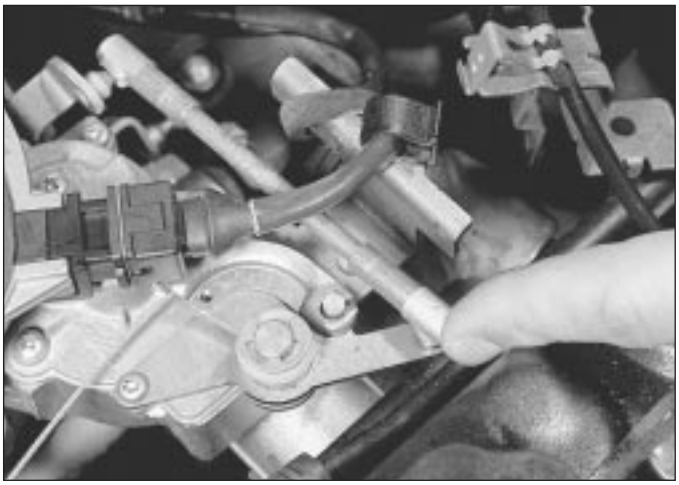
**31** Locate the return spring and throttle lever on the end of the spindle, and fit the plain washer, lockwasher, and nut. Tighten the nut while holding the lever, and bend over the locktabs to lock.

**32** Engage the return spring with the throttle lever and main body, and tension the spring.




**4.8 Accelerator cable adjustment - fuel-injected models**

*1 Throttle lever-to-lost motion link clearance should be equal on each side*
*2 Adjuster locknut*
*3 Adjuster nut*



**4.9 To adjust the accelerator cable, index the stepper motor . . .**

**6** Remove the accelerator cable retaining clip, then release the cable from the upper end of the accelerator pedal. Return to the engine compartment, and withdraw the cable from the bulkhead.

### *Refitting and adjustment*

**7** Refitting is the reverse sequence to removal, ensuring that the cable is correctly routed. Prior to tightening the cable locknuts, the cable should be adjusted as follows.

**8** With the pedal fully released, position the locknuts so that there is equal clearance present on each side of the throttle lever at the lost motion link and no slack in the cable **(see illustration)**. Have an assistant fully depress the pedal, and check that the throttle cam opens fully, then check that it returns to the at-rest position when released.

**9** To adjust the cable, switch on the ignition and position the stepper motor by moving the cam only to open, and fully close the throttle **(see illustration)**. Note that it is essential for accurate positioning of the stepper motor that the accelerator pedal switch contacts remain closed, so that the ECU recognises the throttle movement as a command, and indexes the stepper motor.

**10** Slacken the adjuster locknut, then tighten the adjuster nut until the clearance is equal on each side of the throttle lever at the lost motion link, tighten the locknut without disturbing this setting **(see illustration)**. Recheck the adjustment, and switch off the ignition.

## 5 Accelerator pedal - removal and refitting

Refer to Part A, Section 4.

## 6 Fuel system - depressurisation

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

***Warning: The following procedure will merely relieve the pressure in the fuel system - remember that fuel will still be present in the system components, and take precautions accordingly before disconnecting any of them.***

**1** The fuel system referred to in this Section is defined as the tank mounted fuel pump, the fuel filter, the fuel injector and the pressure regulator in the injector housing, and the metal pipes and flexible hoses of the fuel lines between these components. All these contain fuel which will be under pressure while the engine is running and/or while the ignition is switched on. The pressure will remain for some time after the ignition has been switched off, and must be relieved before any of these components are disturbed for servicing work.

**2** Disconnect the battery negative lead.

**4.10 . . . then adjust the locknut and adjuster nut as described in text**

**3** Place a suitable container beneath the relevant connection/union to be disconnected, and have a large rag ready to soak up any escaping fuel not being caught by the container.

**4** Loosen the connection or union nut (as applicable) slowly to avoid a sudden release of pressure, and position the rag around the connection to catch any fuel spray which may be expelled. Once the pressure is released, disconnect the fuel line, and insert suitable plugs to minimise fuel loss and prevent the entry of dirt into the fuel system.

## 7 Fuel system - pressure check

**Note:** *The following procedure is based on the use of the Rover pressure gauge and adapter (service tool number 18G1500).*

**1** Depressurise the fuel system as described in Section 6, then release the retaining clip and disconnect the flexible fuel feed hose at its union to the metal fuel pipe which is secured to the engine compartment bulkhead, just behind the throttle body assembly; the feed pipe is the lower of the two.

**2** Connect the gauge into the fuel line between the hose and pipe, and check that it is securely retained.

**3** Reconnect the battery and start the engine; the pressure should be steady at the specified regulated injection pressure. Stop the engine and watch the gauge; the pressure drop in the first minute should not exceed 0.7 bars.

**4** If the regulated pressure recorded was too high, the pressure regulator must be renewed; this means renewing the complete injector housing assembly.

**5** If the pressure first recorded was too low, or if it falls too quickly, check the system carefully for leaks. If no leaks are found, first

**8** Refitting is the reverse sequence to removal, but use a new manifold gasket.

### *Fuel injection models*

#### Removal

**9** Remove the inlet manifold as described in Part B of this Chapter.

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

**11** Working from underneath the vehicle, slacken and remove the single bolt securing the exhaust front pipe to its mounting bracket on the transmission. Undo the three nuts securing the front pipe to the exhaust manifold, and release the pipe from the manifold studs.

**12** Track the wiring back from the exhaust manifold Lambda sensor, releasing it from any relevant retaining clips, and disconnect it from the main wiring harness.

**13** Slacken and remove the three heat shield retaining bolts, and remove the heat shield from the manifold.

**14** Undo the two remaining exhaust manifold nuts, and slide the breather pipe off the manifold stud. Disengage the manifold from its mounting studs, and remove it from the engine compartment. Remove the manifold gasket, and discard it.

**15** Examine all the exhaust manifold studs for signs of damage and corrosion; remove all traces of corrosion, and repair or renew any damaged studs.

#### Refitting

**16** Refitting is the reverse sequence to removal, noting the following points:

*a) Ensure that the exhaust manifold and cylinder head mating surfaces are clean and free from corrosion, and fit a new gasket onto the manifold studs.*

*b) Tighten the manifold nuts to the specified torque, not forgetting to refit the breather pipe to the left-hand stud.*

*c) Fit a new gasket at the manifold to the front pipe flange joint, and securely tighten all other disturbed fasteners.*

## 5 Crankcase emission control system - checking and component renewal

The crankcase emission control system consists simply of a number of ventilation hoses, an oil separator on the left-hand cylinder block side cover, or on the timing chain cover, and a wire mesh filter in the engine oil filler cap.

The components of this system require no attention other than to check that the hoses are clear and undamaged and to renew the oil filler cap at regular intervals (see Chapter 1).

Component renewal is self-explanatory, but it may be necessary to detach surrounding components for improved access. Refer to the various Chapters of this manual as necessary if problems are encountered.

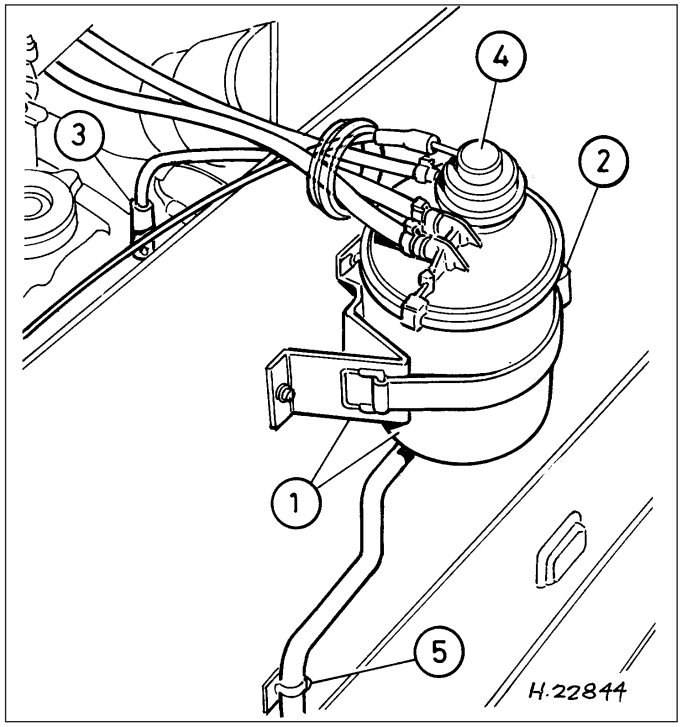
## 6 Evaporative emission control system - checking and component renewal

### *Checking*

**1** Poor idle, stalling and poor driveability can be caused by an inoperative canister purge valve, faulty thermostatic vacuum valve a damaged canister, split or cracked hoses, or hoses connected to the wrong fittings. Check the fuel filler cap for a damaged or deformed gasket.

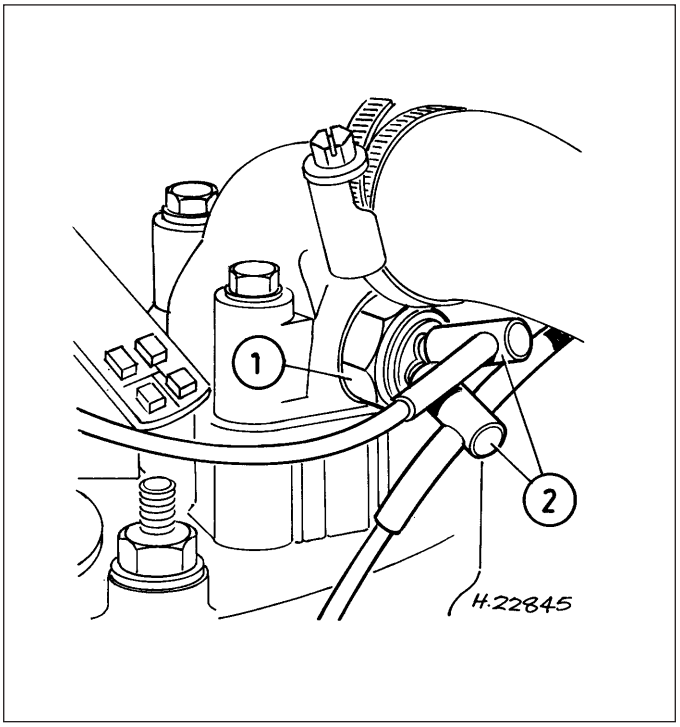
**2** Fuel loss or fuel odour can be caused by liquid fuel leaking from fuel lines, a cracked or damaged canister, an inoperative canister purge valve, and disconnected, misrouted, kinked or damaged vapour or control hoses.

**3** Inspect each hose attached to the canister for kinks, leaks and cracks along its entire length. If their condition is suspect, disconnect each hose in turn and blow through it to check for blockages. Repair or renew as necessary.




**6.13 Charcoal canister fitted to carburettor models with catalytic converter**

*1 Charcoal canister and mounting bracket*
*2 Rubber retaining strap*
*3 Fuel return pipe connection*
*4 Purge valve vacuum diaphragm*
*5 Vent hose*




**6.23 Thermostatic vacuum valve connections**

*1 Vacuum valve*
*2 Vacuum hoses*

## 12 Starting system - testing

**Note:** *Refer to the precautions given in "Safety first!" and in Section 1 of this Chapter before starting work.*

**1** If the starter motor fails to operate when the ignition key is turned to the appropriate position, the following possible causes may be to blame.

*a) The battery is faulty.*
*b) The electrical connections between the switch, solenoid, battery and starter motor are somewhere failing to pass the necessary current from the battery through the starter to earth.*
*c) The solenoid is faulty.*
*d) The starter motor drive pinion may be jammed in the flywheel ring gear teeth (inertia type starters).*
*e) The starter motor is mechanically or electrically defective.*

**2** To check the battery, switch on the headlights. If they dim after a few seconds, this indicates that the battery is discharged - recharge (see Section 3) or renew the battery. If the headlights glow brightly, operate the ignition switch and observe the lights. If they dim, then this indicates that current is reaching the starter motor, therefore the fault must lie in the starter motor. If an inertia type starter is fitted, check it is not jammed by placing the car in gear (manual transmission only) and rocking it to and fro. Alternatively, turn the armature with a small spanner on the square end protruding from the commutator end bracket. If the lights continue to glow brightly (and no clicking sound can be heard from the starter motor solenoid), this indicates that there is a fault in the circuit or solenoid - see following paragraphs. If the starter motor turns slowly when operated, but the battery is in good condition, then this indicates that either the starter motor is faulty, or there is considerable resistance somewhere in the circuit.

**3** If a fault in the circuit is suspected, disconnect the battery leads (including the earth connection to the body), the starter/solenoid wiring and the engine/transmission earth strap. Thoroughly clean the connections, and reconnect the leads and wiring, then use a voltmeter or test lamp to check that full battery voltage is available at the battery positive lead connection to the solenoid, and that the earth is sound.

**4** If the battery and all connections are in good condition, check the circuit by disconnecting the wire from the solenoid blade terminal. Connect a voltmeter or test lamp between the wire end and a good earth (such as the battery negative terminal), and check that the wire is live when the ignition switch is turned to the "start" position. If it is, then the circuit is sound - if not the circuit wiring can be checked as described in Chapter 12.

**HAYNES HiNT** ***Smear petroleum jelly around the battery terminals to prevent corrosion - corroded connections are amongst the most frequent causes of electrical system faults.***

**5** The solenoid contacts can be checked by connecting a voltmeter or test lamp between the battery positive feed connection on the starter side of the solenoid, and earth. When the ignition switch is turned to the "start" position, there should be a reading or lighted bulb, as applicable. If there is no reading or lighted bulb, the solenoid is faulty and should be renewed.

**6** If the circuit and solenoid are proved sound, the fault must lie in the starter motor. In this event, it may be possible to have the starter motor overhauled by a specialist, but check on the cost of spares before proceeding, as it may prove more economical to obtain a new or exchange motor.

## 13 Starter motor - removal and refitting

### Removal

**1** Disconnect the battery negative lead.

**2** If an ignition shield is fitted to the front of the engine, release the three retaining lugs and lift off the shield.

**3** For improved access if necessary, release the horn and horn bracket, and move them to one side.

**13.4a Unscrew the nut securing the starter motor cable**

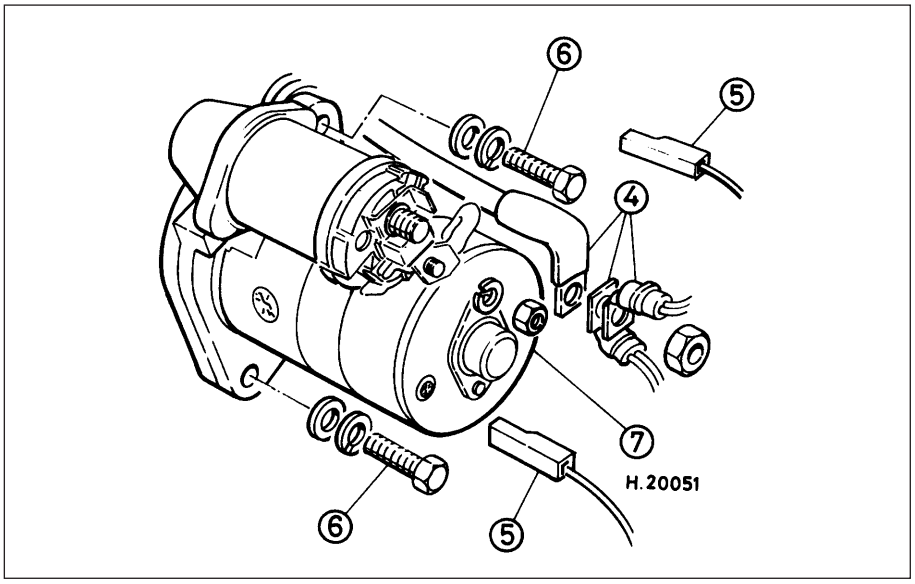
**4** On inertia type starters, undo and remove the nut and spring washer and then detach the starter motor cable from the terminal stud **(see illustration)**. On pre-engaged type starters, undo the nut, and disconnect the leads at the upper terminal on the solenoid. Disconnect the leads at the two solenoid spade terminals, after identifying their positions **(see illustration)**.

**5** If the ignition coil is mounted on a bracket secured to the cylinder head, undo and remove the nut securing the bracket to the head and place the coil to one side.

**6** Undo and remove the two bolts securing the starter motor to the flywheel housing, then lift the motor upwards and out of the engine compartment.

### Refitting

**7** Refitting is the reverse sequence to removal.




**13.4b Pre-engaged starter motor attachments**

*4 Solenoid upper terminal leads*
*5 Solenoid spade terminal leads*
*6 Retaining bolts*
*7 Starter motor*

**6.8 Lift off the rotor arm . . .**

**9** Using a short screwdriver, unscrew the single screw securing the adjustable contact breaker plate to the distributor baseplate. Lift off the screw and washer, taking care not to drop them inside the distributor.
**10** Lift the contact assembly off the baseplate and detach the tensioning arm from the insulator. Release the terminal containing the condenser and low tension leads from the end of the arm and then lift away the contact breaker points **(see illustrations)**.
**11** To refit the points first engage the terminal containing the condenser and low tension leads with the end of the tensioning arm. Make sure that the black lead is uppermost.
**12** Position the tensioning arm in the insulator, place the contact assembly on the baseplate and refit the retaining screw and washer.
**13** The contact breaker points gap should now be adjusted as described in the previous Section.

### *Ducellier*

**14** Remove the distributor cap as described in the previous Section then withdraw the rotor arm from the distributor spindle.
**15** Disconnect the contact breaker low tension lead at the connector.
**16** Using a small screwdriver or pointed-nose pliers, carefully extract the circlip securing the moving contact arm to the pivot post. Remove the washer and lift off the moving contact arm and low tension lead assembly.
**17** Unscrew the single screw securing the adjustable contact breaker plate to the baseplate. Lift off the screw and washer taking care not to drop them inside the distributor. Now lift away the breaker plate.
**18** To refit the points first position the adjustable contact breaker plate on the baseplate and refit the retaining screw and washer.
**19** Place the moving contact arm over the pivot post and engage the tensioning arm with the insulator. Refit the washer and circlip to the pivot post.
**20** Enter the grommet of the low tension lead into the slot on the side of the distributor and reconnect the lead.
**21** The contact breaker points gap should now be adjusted as described in the previous Section.

## 7 **Condenser** - testing, removal and refitting

**Note:** *Carburettor models without electronic ignition may be fitted with either a Lucas 23D4, 25D4, 45D4, 59D4 or Ducellier distributor. Identify the unit being worked on by referring to the illustrations accompanying Section 5, then proceed as described below according to distributor type.*

### *Testing*

**1** The purpose of the condenser (sometimes known as a capacitor) is to prevent excessive arcing of the contact breaker points, and to ensure that a rapid collapse of the magnetic field, created in the coil, and necessary if a healthy spark is to be produced at the plugs, is allowed to occur.
**2** The condenser is fitted in parallel with the contact breaker points. If it becomes faulty it will cause ignition failure, as the points will be prevented from cleanly interrupting the low tension circuit.
**3** If the engine becomes very difficult to start, or begins to miss after several miles of running, and the contact breaker points show signs of excessive burning, then the condition of the condenser must be suspect. When examining the contact breaker points, disregard any blue discoloration which may be apparent on their faces. This is due to the formation of tungsten oxide, and has no detrimental effect on ignition performance; it is not indicative of condenser failure. A further test can be made by separating the points by hand, with the ignition switched on. If this is accompanied by an excessively strong flash, it indicates that the condenser has failed.
**4** Without special test equipment, the only reliable way to diagnose condenser trouble is to renew the suspect unit and note if there is any improvement in performance.
**5** Removal and refitting of the condenser varies according to distributor type as follows.

### *Removal*

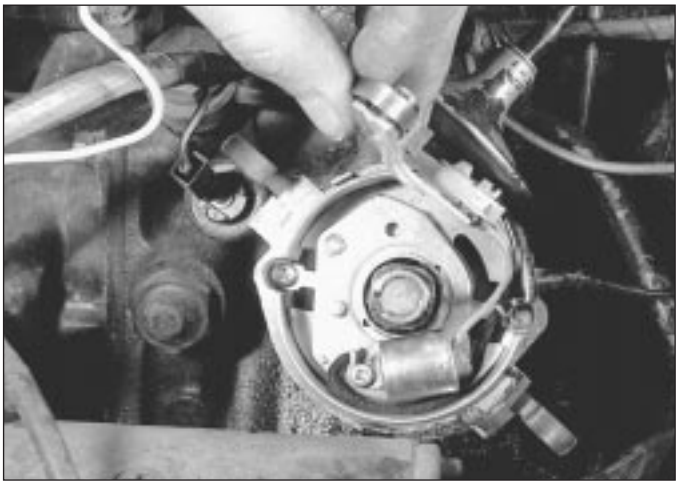
#### Lucas 23D4 and 25D4

**6** Remove the distributor cap and rotor arm, referring to Section 5 if necessary.
**7** Undo and remove the nut and washer (if fitted) from the contact breaker terminal post. Withdraw the flanged nylon insulator and release the condenser lead.
**8** Undo and remove the small screw securing the condenser to the distributor baseplate and lift the condenser away.

#### Lucas 45D4 and 59D4

**9** Remove the distributor cap and rotor arm, referring to Section 5 if necessary.
**10** Release the contact breaker points tensioning arm from the insulator and detach the condenser and low tension lead terminal from the end of the arm.
**11** Undo and remove the small screw securing the condenser to the distributor baseplate.





**6.10a . . . and with the retaining screw removed, lift the contact assembly off the baseplate**

**6.10b The LT terminal can then be detached from the tensioning arm**

## 1 General information

Drum brakes are fitted to the front and rear wheels on all early models except Cooper S and 1275 GT versions. These, and all later models have disc brakes at the front. The braking system is operated hydraulically by a master cylinder, which is actuated by the brake pedal. Disc brake models may also be servo assisted by a vacuum servo unit mounted in the engine compartment.

The hydraulic system on early models is of the single circuit type, whereby both the front and rear brakes are operated by the same hydraulic system from the master cylinder. On later models a dual circuit system is used, whereby the brakes at each pair of wheels are operated by a separate hydraulic system from a tandem master cylinder. In the event of hydraulic failure in one circuit, full braking force will still be available at two wheels. On early dual circuit systems a diagonal split is used, each circuit supplying one front and one diagonally opposite rear brake. Later versions employ a front-to-rear split whereby both front and both rear brakes are operated by a separate hydraulic circuit. A pressure differential warning actuator is fitted to certain models to inform the driver of a hydraulic circuit failure via an illuminated warning light, and also to restrict the flow of hydraulic fluid into the failed circuit. This unit is either mounted separately on the engine compartment bulkhead, or incorporated in the master cylinder. On single circuit and certain dual circuit systems, a pressure reducing valve is incorporated in the rear brake circuit. This valve reduces hydraulic fluid pressure to the rear brakes and prevents rear wheel lock-up due to forward weight transfer under heavy braking. On models not equipped with a pressure reducing valve, the same effect is achieved by reducing the rear wheel cylinder piston diameters. A low brake fluid warning light is also fitted to later models operated by a float-type switch in the master cylinder reservoir filler cap.

On models fitted with front drum brakes, the brake shoes are operated by two single piston wheel cylinders at each front wheel. Models with front disc brakes utilise a twin piston fixed type caliper at each front wheel. At the rear on all models, one twin piston wheel cylinder operates each wheel's leading and trailing brake shoes.

The handbrake provides an independent mechanical means of rear brake shoe application.

Adjustment of the drum brakes is provided by two adjusters on each front brake and a single adjuster on each rear brake. Periodic adjustment is necessary to compensate for wear on the brake shoe friction linings. The front disc brakes do not require adjustment, as the pistons in the caliper automatically compensate for brake pad wear.

**Note:** *When servicing any part of the system, work carefully and methodically; also observe scrupulous cleanliness when overhauling any part of the hydraulic system. Always renew components (in axle sets, where applicable) if in doubt about their condition, and use only genuine Rover replacement parts, or at least those of known good quality. Note the warnings given in "Safety first" and at relevant points in this Chapter concerning the dangers of asbestos dust and hydraulic fluid.*

## 2 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 inflammable, and may ignite when allowed into contact with hot components; when servicing any hydraulic system, it is safest to assume that the fluid IS inflammable, 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 clean water. Finally, it is hygroscopic (it absorbs moisture from the air). The more moisture is absorbed by the fluid, the lower its boiling point becomes, leading to a dangerous loss of braking under hard use. Old fluid may be contaminated and unfit for further use. When topping-up or renewing the fluid, always use the recommended type, and ensure that it comes from a freshly-opened sealed container.***

### General

**1** The correct functioning of the brake hydraulic system is only possible after removing all air from the components and circuit; this is achieved by bleeding the system.

**2** During the bleeding procedure, add only clean, fresh hydraulic fluid of the specified type; never re-use fluid that has already been bled from the system. Ensure that sufficient fluid is available before starting work.

**3** If there is any possibility of incorrect fluid being used in the system, the brake lines and components must be completely flushed with uncontaminated fluid and new seals fitted to the components.

**4** If brake fluid has been lost from the master cylinder due to a leak in the system, ensure that the cause is traced and rectified before proceeding further.

**5** Park the car on level ground, switch off the ignition and select first gear (manual transmission) or Park (automatic transmission) then chock the wheels and release the handbrake.

**6** Check that all pipes and hoses are secure, unions tight, and bleed screws closed. Remove the dust caps and clean any dirt from around the bleed screws.

**7** Unscrew the master cylinder reservoir cap, and top-up the reservoir. Refit the cap loosely, and remember to keep the reservoir topped up throughout the procedure, otherwise there is a risk of further air entering the system.

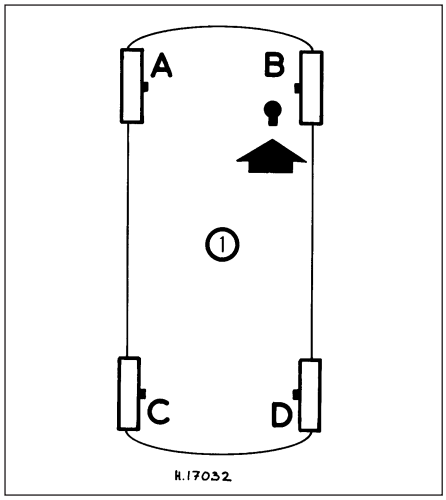
**8** There are a number of one-man, do-it-yourself, brake bleeding kits currently available from motor accessory shops. It is recommended that one of these kits is used wherever possible, as they greatly simplify the bleeding operation, and also reduce the risk of expelled air and fluid being drawn back into the system. If such a kit is not available, collect a clean glass jar of reasonable size and a suitable length of plastic or rubber tubing, which is a tight fit over the bleed screw.

**9** If a kit is to be used, prepare the car as described previously, and follow the kit manufacturer's instructions, as the procedure may vary slightly according to the type being used; generally, they are as outlined in the text below.

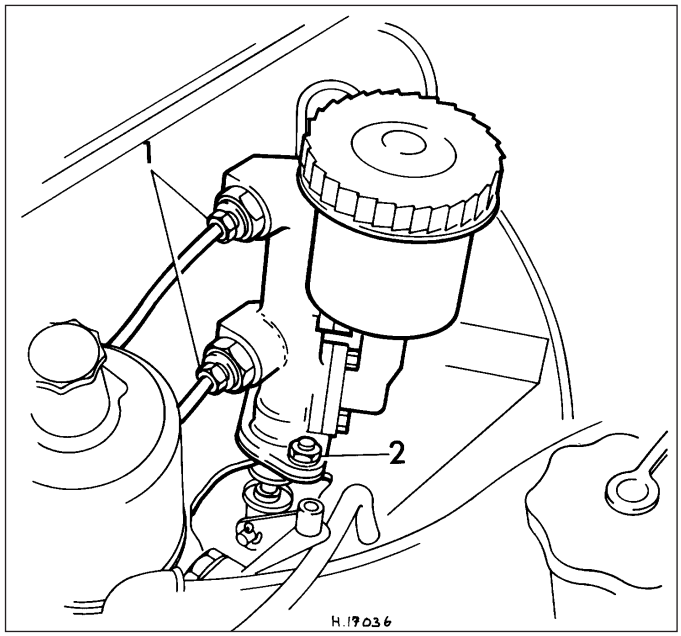
**10** The procedure for bleeding varies according to whether the car is equipped with a single or dual circuit braking system, and also with dual circuit systems, the type of master cylinder that is fitted. Identify the type of system being worked on by referring to the illustrations, and to Section 13, then proceed according to type.

### Single circuit system

**11** To bleed the system, clean the area around the bleed screw of the wheel to be bled. If the hydraulic system has only been partially disconnected, and suitable precautions were taken to prevent further loss of fluid, it should only be necessary to bleed that part of the system. However, if the entire system is to be bled, proceed in the sequence ABCD for right-hand drive cars, and BADC for left-hand drive vehicles **(see illustration)**.

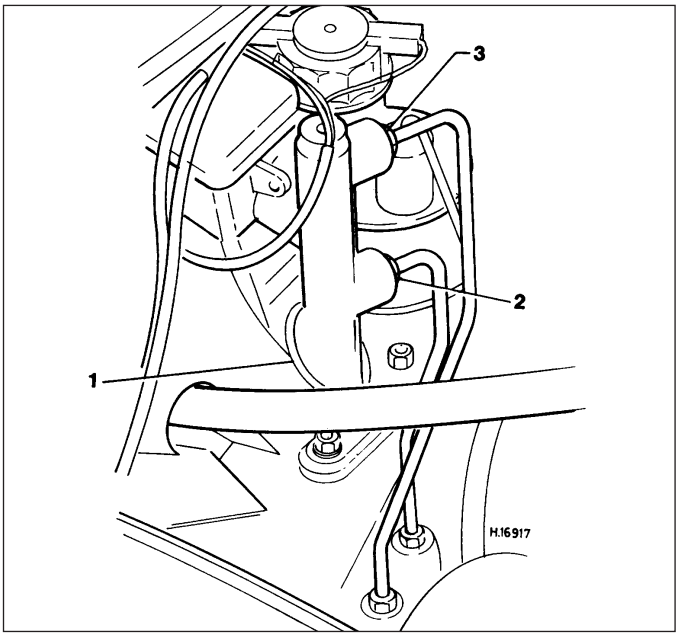



**2.11 Bleeding sequence for single circuit braking systems**



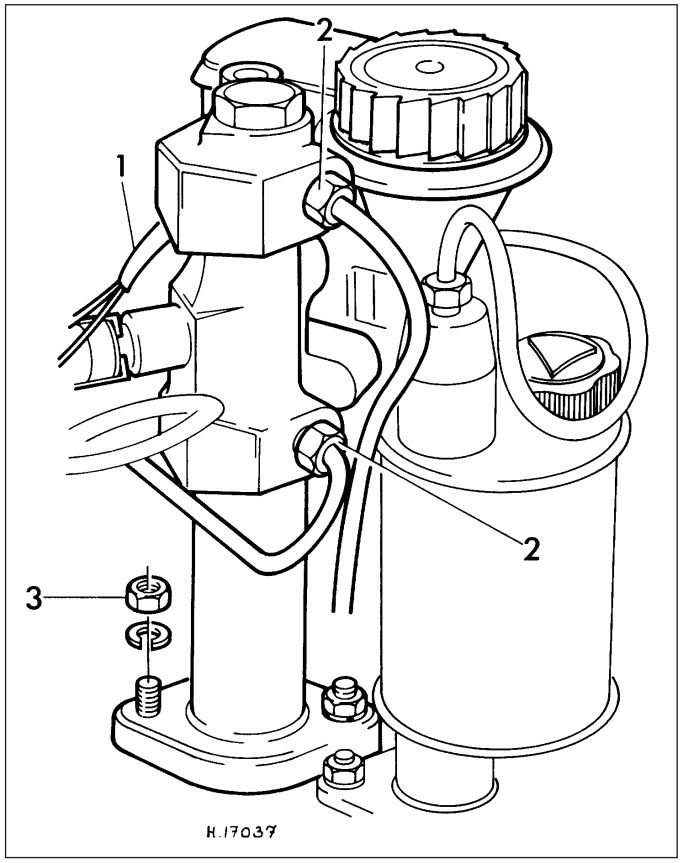

**13.2a Identification and removal of the type 1 tandem master cylinder**

*1 Hydraulic pipe unions 2 Retaining nuts*



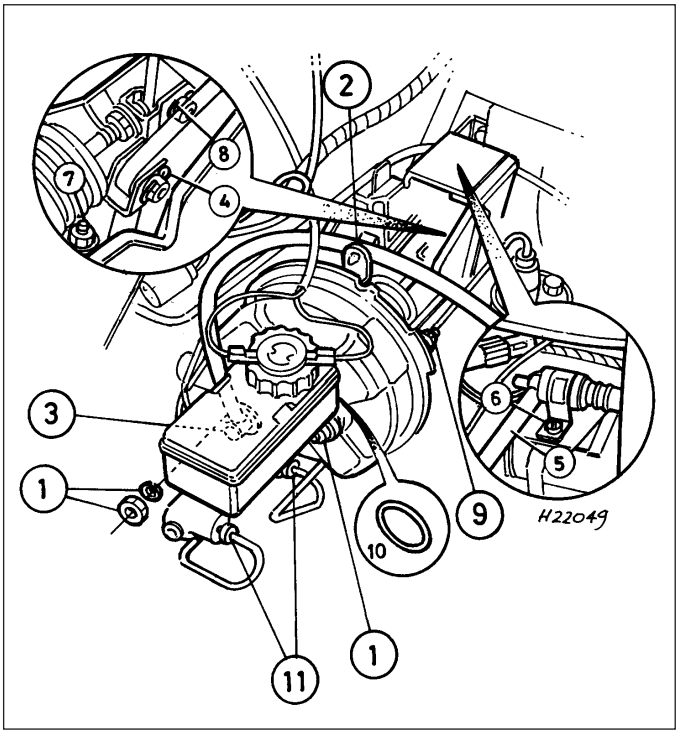

**13.2c Identification and removal of the type 3 tandem master cylinder**

*1 Yellow band 2 Larger pipe union 3 Smaller pipe union*




**13.2b Identification and removal of the type 2 tandem master cylinder**

*1 Electrical wiring to failure switch*
*2 Hydraulic pipe unions*
*3 Retaining nuts*




**13.2d Identification and removal of the type 4 tandem master cylinder**

*1 Master cylinder mounting nuts*
*2 Vacuum hose retaining clip*
*3 One-way vacuum valve*
*4 Brake pedal clevis pin*
*5 Anti-run-on valve hoses (where fitted)*
*6 Anti-run-on valve (where fitted)*
*7 Servo mounting bracket nuts*
*8 Servo pushrod clevis pin*
*9 Servo-to-mounting bracket nuts*
*10 O-ring*
*11 Brake pipe union nuts*

**3.5 Remove the steering tie-rod balljoint with a universal separator**

driveshaft nut. Note that on disc brake models, the driveshaft retaining nut is extremely tight and it may be beneficial to fabricate a home-made tool to prevent the hub rotating when undoing the nut (see Chapter 8, Section 2).

**4** On disc brake models, undo and remove the brake caliper retaining bolts. Lift off the caliper complete with brake pads, and tie it out of the way from a convenient place under the wheel arch. On models fitted with drum brakes, clamp the flexible brake hose with a proprietary brake hose clamp or a self-gripping wrench with its jaws suitably protected. Now slacken the brake hose union, at the wheel cylinder by half a turn.

**5** Undo and remove the steering tie-rod balljoint retaining locknut and then release the balljoint tapered shank from the steering arm using a universal balljoint separator **(see illustration)**.

**6** Undo and remove the nuts and spring washers securing the swivel hub balljoints to the upper and lower suspension arms **(see illustration)**.

**7** Using the method described in paragraph 5, separate the upper and lower suspension arms from the tapered shanks of the balljoints.

**8** Carefully lift the swivel hub assembly off the two suspension arms. At the same time, tap the centre of the driveshaft, using a soft-faced mallet, until the driveshaft can be withdrawn from the rear of the swivel hub assembly.

**9** On disc brake models, withdraw the swivel hub assembly and then lift off the driving flange and disc. On models with drum brakes, support the flexible brake hose to avoid stretching it and then rotate the complete swivel hub assembly anti-clockwise to unscrew it from the hose **(see illustration)**. The hub can now be lifted away and the end of the brake hose protected to prevent dirt ingress. Collect the copper sealing washer from the end of the hose as the hose is removed. Note that a new washer will be required for refitting.

## *Refitting*

### Models with drum brakes

**10** Refitting is the reverse sequence to removal, bearing in mind the following points:

*a) Ensure that the hub bearing water shield is in place on the driveshaft CV joint and positioned approximately 6 mm from the shoulder of the joint.*

*b) Use a new copper washer on the flexible brake hose and ensure that the hose is not twisted when refitting the swivel hub. Bleed the hydraulic system at the appropriate wheel on completion (see Chapter 9).*

*c) Tighten all nuts and bolts to the specified torque.*

*d) Tighten the driveshaft retaining nut to the specified torque, then tighten the nut further to align the split pin holes in the driveshaft and nut. Secure the nut with a new split pin.*

**TOOL TiP**

***An alternative method of releasing the balljoint tapered shank is to refit the locknut to the balljoint and screw it on two or three turns. Using a medium hammer, sharply strike the end of the steering arm until the shock separates the taper. Now remove the locknut and lift the joint off the arm.***

### Models with disc brakes

**11** Refitting is the reverse sequence to removal, bearing in mind points *a* and *c* detailed in paragraph 10. Additionally, the following procedure must be observed, otherwise it is possible that the split-collar fitted beneath the driveshaft retaining nut will become clamped to the shaft before the shaft is fully home in the hub bearings.

**12** Insert the driveshaft through the swivel hub, but do not fit the split collar. Obtain a plain washer of the dimensions shown **(see illustration)**. If necessary, make the washer from mild steel.

**3.9 Withdraw the swivel hub from the end of the driveshaft**

**3.6 Remove the lower swivel hub balljoint retaining nut**

**13** Fit the plain washer over the driveshaft end. Fit the driveshaft retaining nut and, using the same procedure as for removal to prevent the hub rotating, tighten the nut to the specified torque to seat the shaft in the hub bearings. Note that there are two different torque settings for the driveshaft nut; one for driveshafts with multiple split pin holes, and a higher setting for driveshafts with a single split pin hole. Now remove the nut and washer and smear engine oil over the driveshaft threads.

**14** Examine the split-collar, and renew it if damaged or worn. Fit the collar and driveshaft retaining nut, and once again tighten it to the specified torque. Tighten the nut further to align the split pin holes in the driveshaft and nut, then secure the nut with a new split pin.

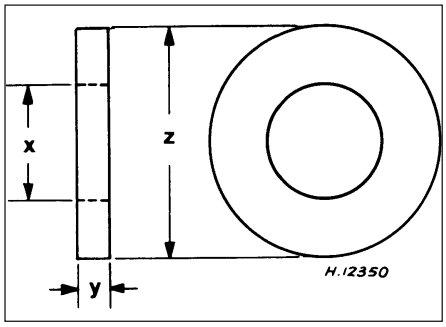
## 4 Front hub bearings - renewal

### *Drum brake models*

**1** Remove the swivel hub assembly as described in Section 3.

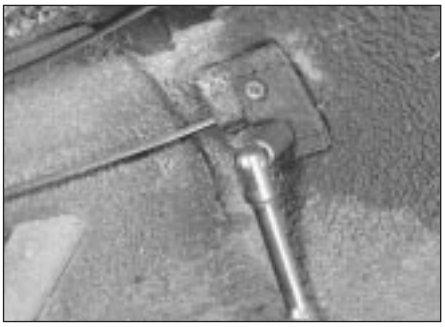
**2** With the assembly on the bench, slacken the brake adjusters, remove the two brake drum retaining screws and lift off the drum. If it is tight, tap it gently using a soft-faced mallet.

**3** Arrange two wooden blocks approximately 250 mm high, on the bench, far enough apart for the drive flange to lie freely between them,

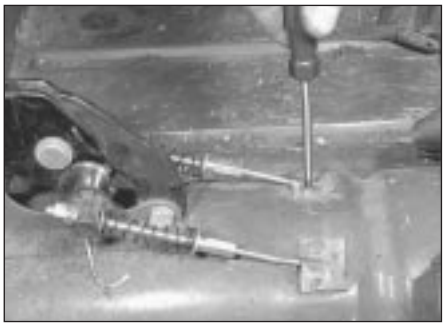



**3.12 Details of special washer required for fitting the driveshaft on disc brake models**

*X = 25 mm Y = 6.5 mm Z = 50 mm*



**21.5a Hold the cable guide retaining nuts from below . . .**



**21.5b . . . and unscrew from above**

the filler neck, then refit the cap. This will help prevent fluid loss when the rear pipes are disconnected.

**7** From underneath the rear of the car, undo and remove the brake hydraulic pipe union from the centre of the pressure regulating valve on early models. On models equipped with a dual circuit braking system, unscrew the pipe unions at the pipe connectors on each side of the subframe front crossmember. On later dual circuit systems unscrew the pipe union from the three-way connector on the rear subframe.

**8** Refer to Chapter 4C if necessary and remove the complete exhaust system from the car.

**9** If an electric fuel pump is fitted, disconnect the electrical leads, slacken the clips and detach the fuel inlet and outlet hoses from the pump.

***Warning: Refer to the precautions contained in Chapter 4A, Section 1 before carrying out any work on the fuel system.***

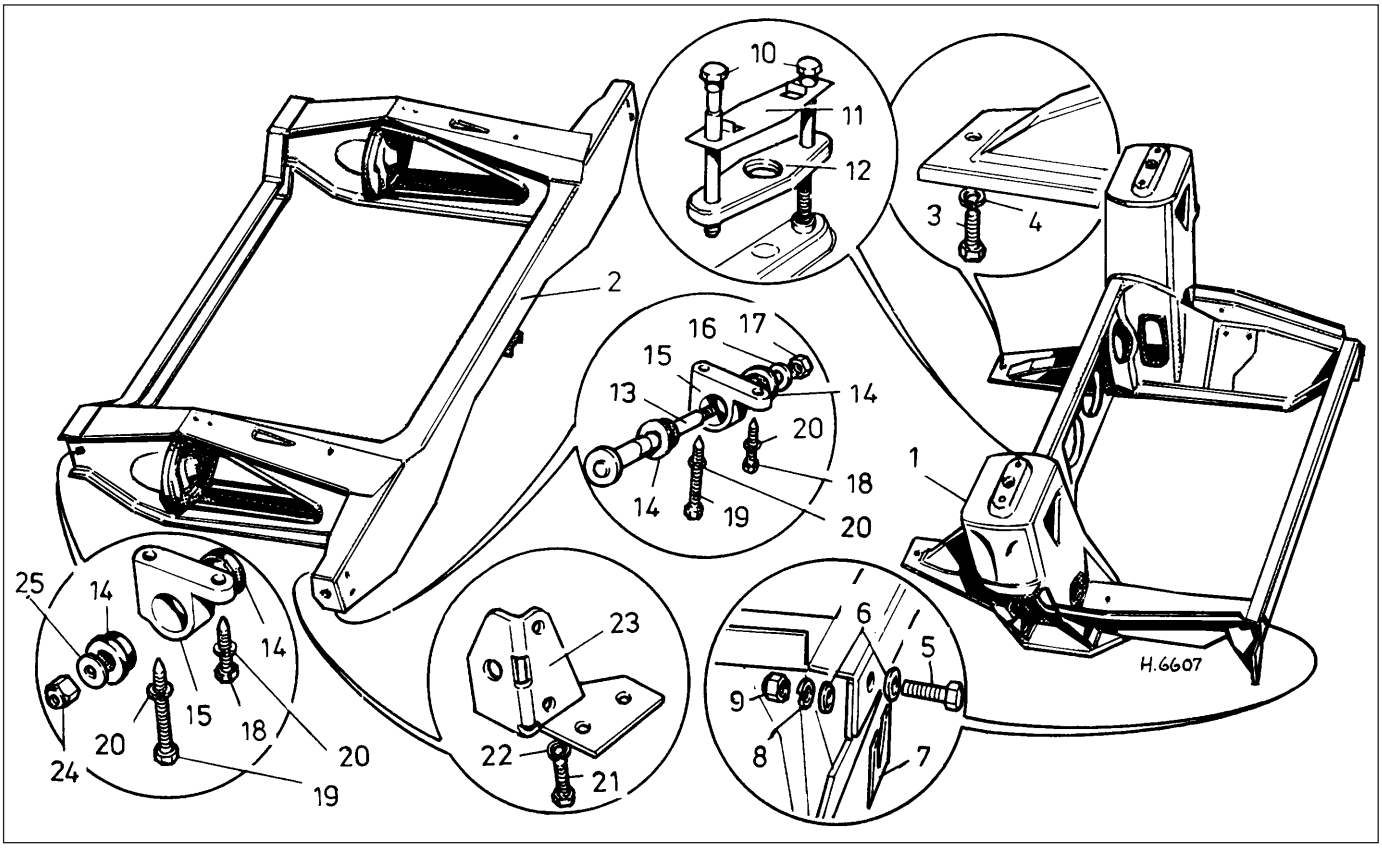
**Note**: *During this operation, clamp the hoses using a self-gripping wrench with suitably protected jaws to prevent loss of fuel. Plug both hoses with a bolt or suitable metal rod upon removal.*

**10** On models fitted with Hydrolastic suspension, undo and remove the transfer pipe unions from the pressure valves at the rear of the subframe.

**11** Place a block of wood under the rear wheels or jack up the radius arms slightly. From inside the car or luggage compartment, undo and remove the shock absorber upper mounting on models with rubber cone suspension, or the helper spring upper mounting on models with Hydrolastic suspension. On Saloon cars, it will be necessary to detach the fuel tank retaining strap and move the tank slightly to provide access to the left-hand mounting.

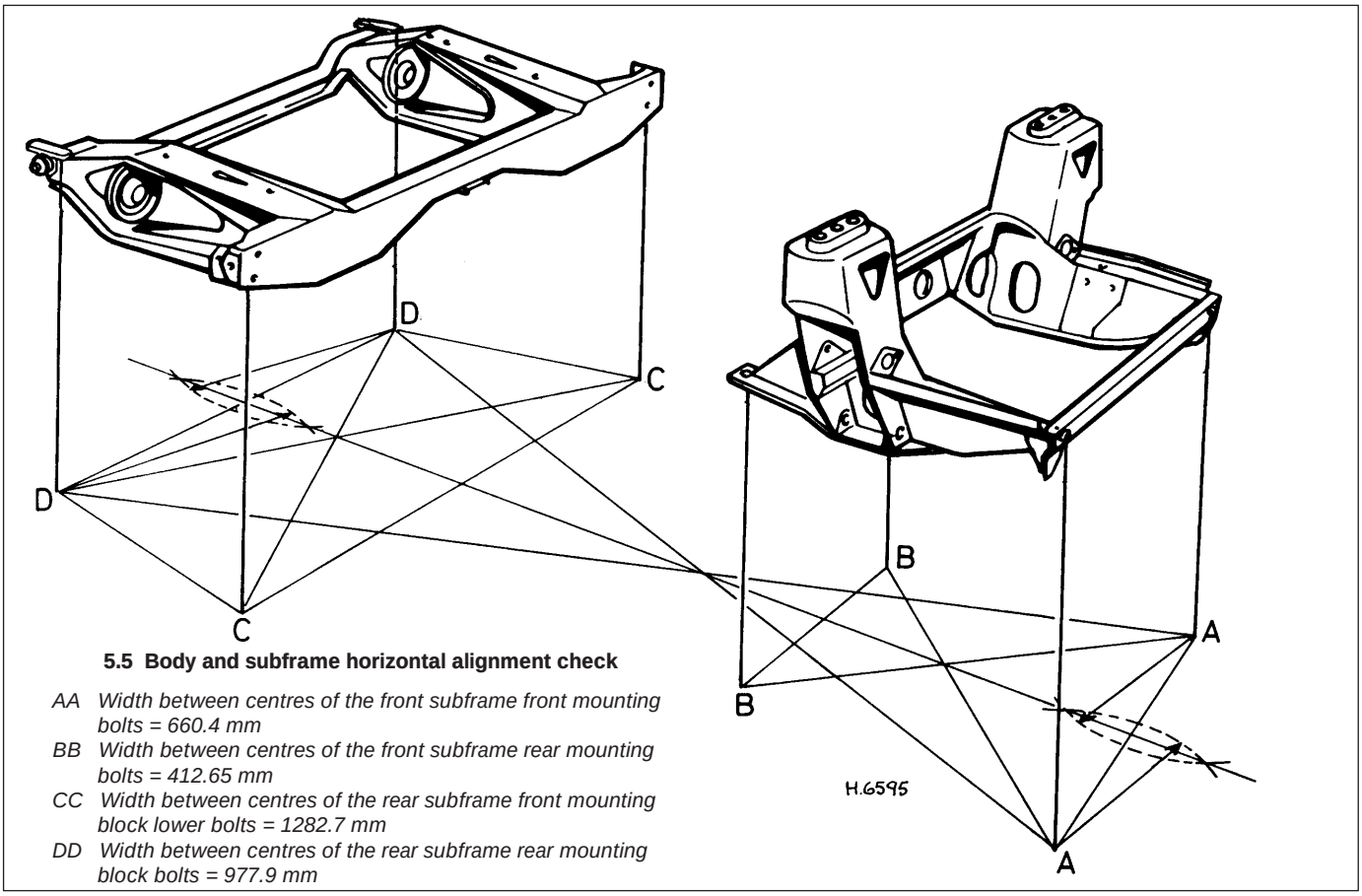
**12** Undo and remove the retaining screws and lift off the finisher panels from each end of the body side sills (where fitted).

**13** Place a jack under each side of the subframe, or a trolley jack in the centre, with a substantial plank of wood running transversely across the subframe, and just take the weight of the frame on the jacks.




**21.14 Exploded view of the front and rear subframe assemblies**

| | | | | |
|---|---|---|---|---|
| *1 Front subframe* | *6 Washer* | *11 Washer* | *16 Washer* | *21 Screw* |
| *2 Rear subframe* | *7 Packing piece* | *12 Pressure pad* | *17 Nut* | *22 Washer* |
| *3 Screw* | *8 Washer* | *13 Support pin* | *18 Screw* | *23 Bracket* |
| *4 Washer* | *9 Nut* | *14 Bush* | *19 Screw* | *24 Nut* |
| *5 Bolt* | *10 Screw* | *15 Mounting* | *20 Washer* | *25 Washer* |




**5.5 Body and subframe horizontal alignment check**

*AA Width between centres of the front subframe front mounting bolts = 660.4 mm*
*BB Width between centres of the front subframe rear mounting bolts = 412.65 mm*
*CC Width between centres of the rear subframe front mounting block lower bolts = 1282.7 mm*
*DD Width between centres of the rear subframe rear mounting block bolts = 977.9 mm*

each line. A line drawn on the floor starting at the front and finishing at the rear should be quite straight and pass through the centres of the other lines. Diagonal measurements can also be made as a check for squareness.

**6** On older Minis, rust or corrosion of the vehicle underframe is a common occurrence and, if the corrosion has reached an advanced state, may be grounds for failure of the annual MoT test.

**7** Where serious rust or corrosion has affected a load bearing area, it will be necessary to have this repaired immediately either by fitting a new body section or, in less serious cases, by plating over the affected area. The load bearing areas of the Mini consist of the subframe, the side sills (inner and outer) and any area of the vehicle structure within 305 mm of a suspension, steering, subframe, or seat belt anchorage point.

**8** Repairs of this nature are best left to a body repair specialist, as any new section or plating that may be necessary must be welded in place to restore the original structural rigidity of the bodyshell. The repair of corrosion to structural areas using fibreglass, body filler, or the retention of new sections with pop rivets, or screws, is not acceptable to legal requirements.

## 6 Front door interior trim panel (Saloon and Estate models) - removal and refitting

### *Removal*

**1** Undo and remove the two screws and lift off the interior pull handle **(see illustration)**.

**2** Undo and remove the retaining screws and lift away the door lock remote control handle followed by the window regulator handle and surround **(see illustrations)**. On later models, the screw securing the window regulator handle is covered with a trim cap, which must be carefully prised out for access to the screw.

**6.1 Remove the interior pull handle retaining screws and handle**

**6.2a Remove the door lock remote control handle . . .**

**6.2b . . . and the window regulator handle**

# Chapter 12
# Body electrical system

## Contents



## Degrees of difficulty

**Easy,** suitable for novice with little experience 

**Fairly easy,** suitable for beginner with some experience 

**Fairly difficult,** suitable for competent DIY mechanic 

**Difficult,** suitable for experienced DIY mechanic 

**Very difficult,** suitable for expert DIY or professional 

## Specifications

### General

| | |
|---|---|
| System type | 12-volt negative earth |

### Main fuses (two-fuse fuse block)

| Fuse connecting | Rating (amp) | Circuits protected |
|---|---|---|
| 1 and 2 | 35 | Interior light, horn and auxiliary units which operate with the ignition switched on or off |
| 3 and 4 | 35 | Direction indicators, windscreen wiper motor, heater blower, stop lights and auxiliary units which operate only when the ignition is switched on |

**Note:** *The fitting of additional accessories which are required to operate independently of the ignition circuit should be connected to the "2" terminal; accessories which are required to operate only when the ignition is switched on should be connected to the "4" terminal.*

### Line fuses (two-fuse fuse block)

| Rating (amp) | Circuits protected |
|---|---|
| 8 | Side and tail lights |
| 35 | Hazard flasher |

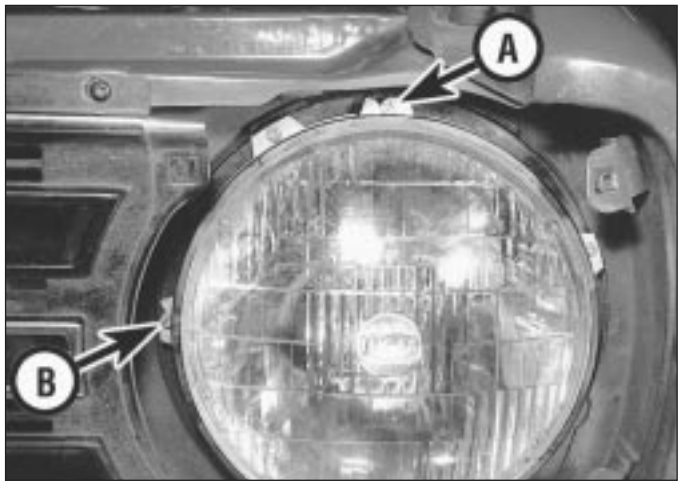
### Main fuses (four-fuse fuse block - early models)

| Fuse connecting | Rating (amp) | Circuits protected |
|---|---|---|
| 1 and 2 | 35 | Stop lights, reversing lights, direction indicators, heated rear window. These systems will only operate with the ignition switch at position II |
| 3 and 4 | 25 | Horn, headlight flasher, brake failure circuit. These systems operate independently of the ignition switch |
| 5 and 6 | 25 | Heater blower motor, windscreen wipers/ washers, radio. These systems will operate with the ignition switch at position I or II |
| 7 and 8 | 15 | Side and tail lights, instrument panel lights |

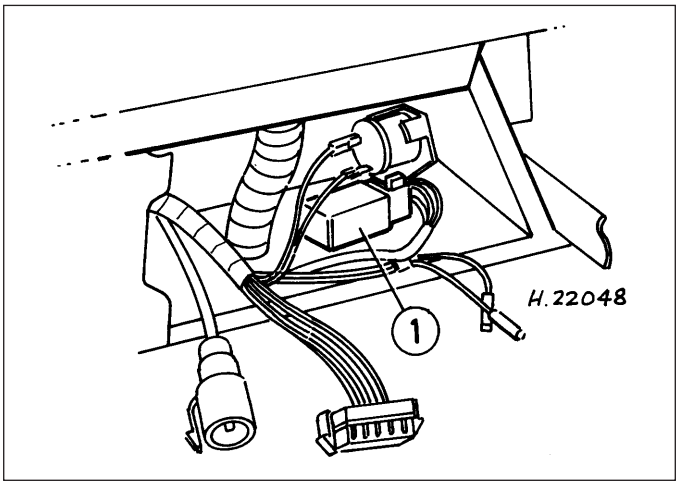
**Note:** *The fitting of additional accessories which are required to operate independently of the ignition circuit should be connected to the "4" terminal.*

### Line fuses (four-fuse fuse block - early models)

| Rating (amp) | Circuits protected |
|---|---|
| 15 | Hazard flashers, interior light |
| - | Radio (rating to be as specified by the manufacturer) |




**7.1 Headlight vertical position A and horizontal position B adjusting screws**




**8.2 Location of dim-dip lighting unit (1) behind the instrument panel**

horizontal position **(see illustration)**. On the alternative type headlight units, the two diametrically opposite screws are used for adjustment. The upper screw adjusts the horizontal setting and the lower screw adjusts the vertical setting.

**2** The lights should be set so that on full or high beam, the beams are set slightly below parallel with a level road surface. Do not forget that the beam position is affected by how the car is normally loaded for night driving, and set the beams with the car loaded to this position.

**3** Although this adjustment can be approximately set at home, it is recommended that beam alignment is be carried out by a Rover dealer or other specialist heaving the necessary optical alignment equipment.

## 8 Dim-dip lighting system components - removal and refitting

### *Dim-dip unit*

#### Removal

**1** Remove the instrument panel as described in Section 15.

**2** Disconnect the dim-dip unit from the wiring loom connector **(see illustration)**.

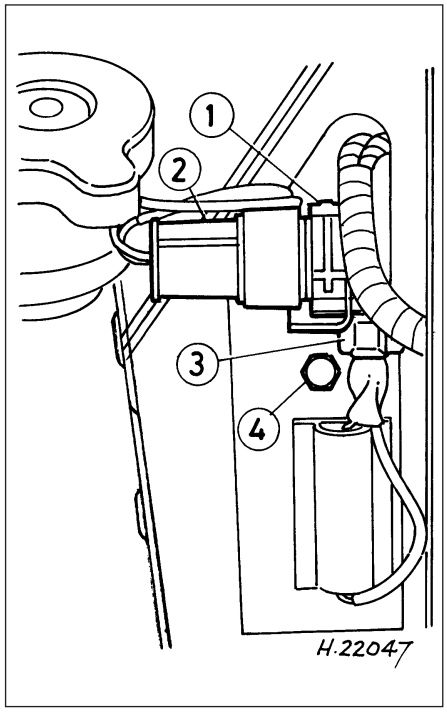
#### Refitting

**3** Refitting is the reverse sequence to removal.

### *Dim-dip resistor*

#### Removal

**4** Disconnect the battery negative lead.




**8.5 Location of dim-dip resistor**

*1 Wiring loom connector*
*2 Resistor plug*
*3 Wiring loom clip*
*4 Mounting plate bolt*

**9.1 Horn location showing electrical leads and mounting nuts**

**5** Open the bonnet, and unclip the wiring loom connector on the right-hand side of the engine compartment **(see illustration)**.

**6** Pull the resistor plug from the connector, and release the wiring loom.

**7** Unscrew the mounting bolt, and withdraw the resistor and mounting plate.

#### Refitting

**8** Refitting is the reverse sequence to removal.

## 9 Horn - removal, refitting and adjustment

### *Removal and refitting*

**1** The horn is located in the engine compartment and is attached to a bracket, which is in turn secured to the front body panel by two small nuts and bolts **(see illustration)**.

**2** To remove the unit, disconnect the horn wiring then undo the retaining bracket nuts and bolts. Remove the horn, complete with bracket, then remove the bracket. The horn is not repairable and should not be dismantled.

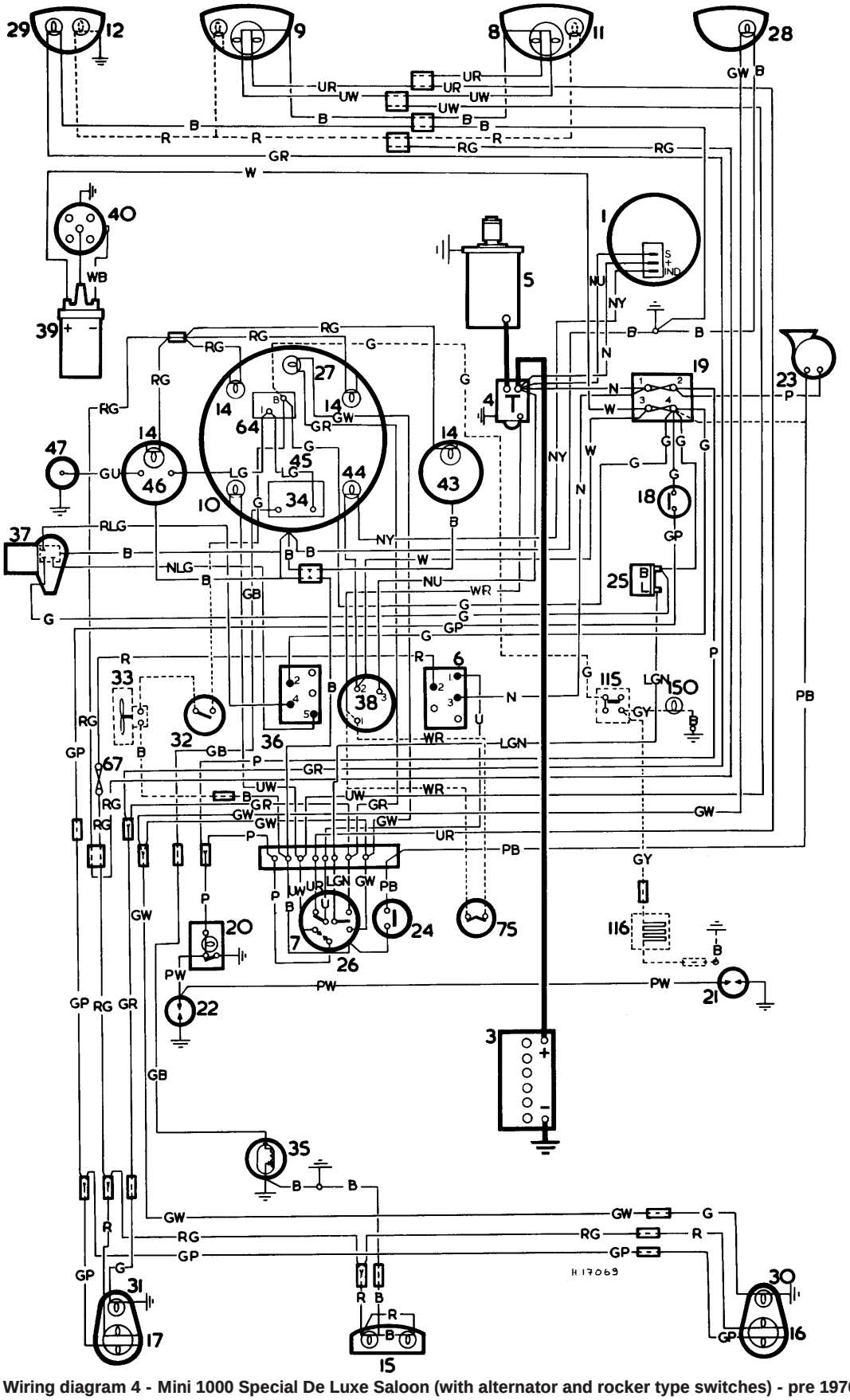
**3** Refitting is the reverse sequence to removal.

### *Adjustment*

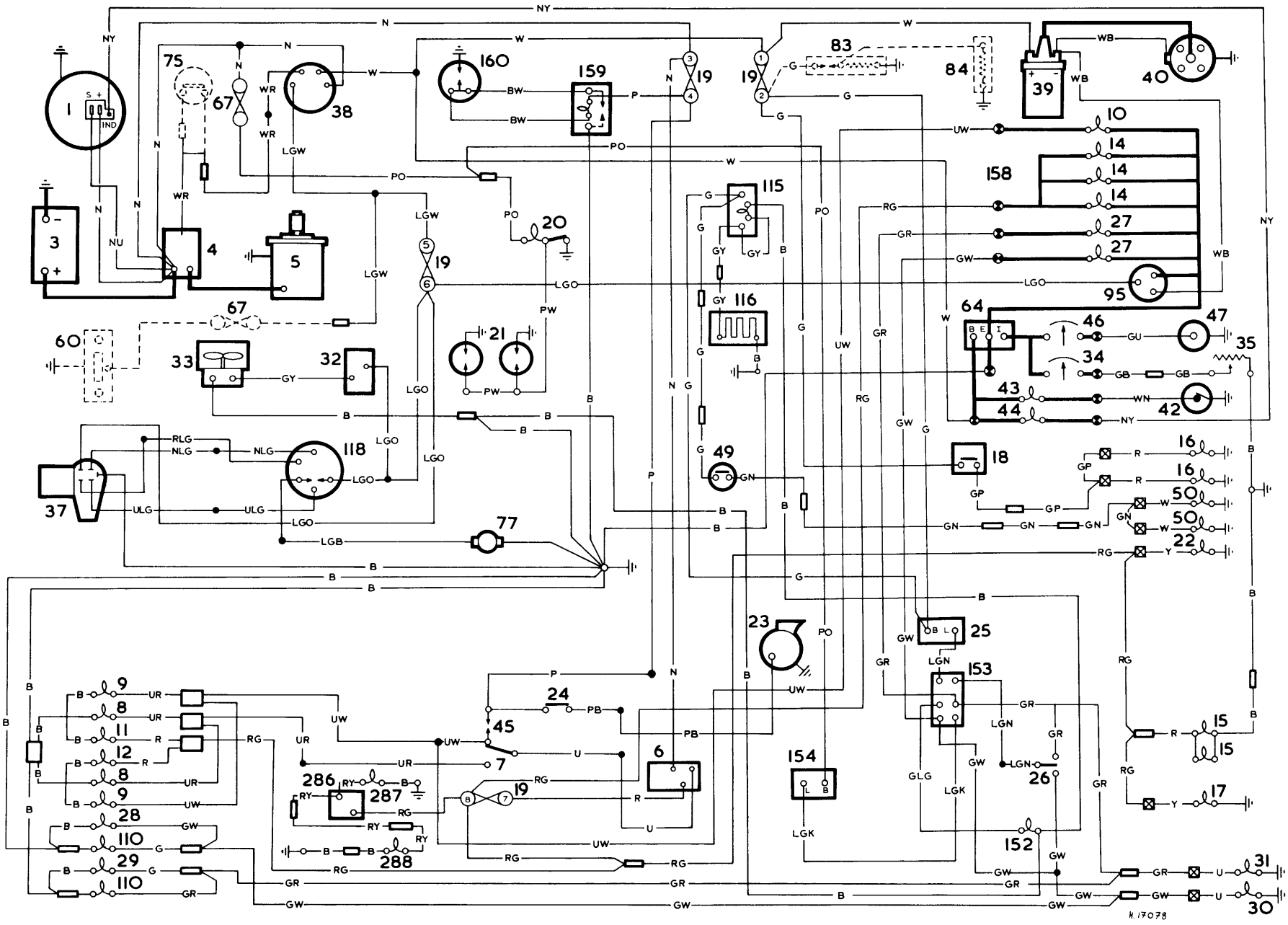
**4** On early type horns an adjustment is provided to compensate for wear of the moving parts.

**5** Adjustment is by means of a screw on the broad rim of the horn nearly opposite the two terminals. Do not confuse this with the large screw in the centre.

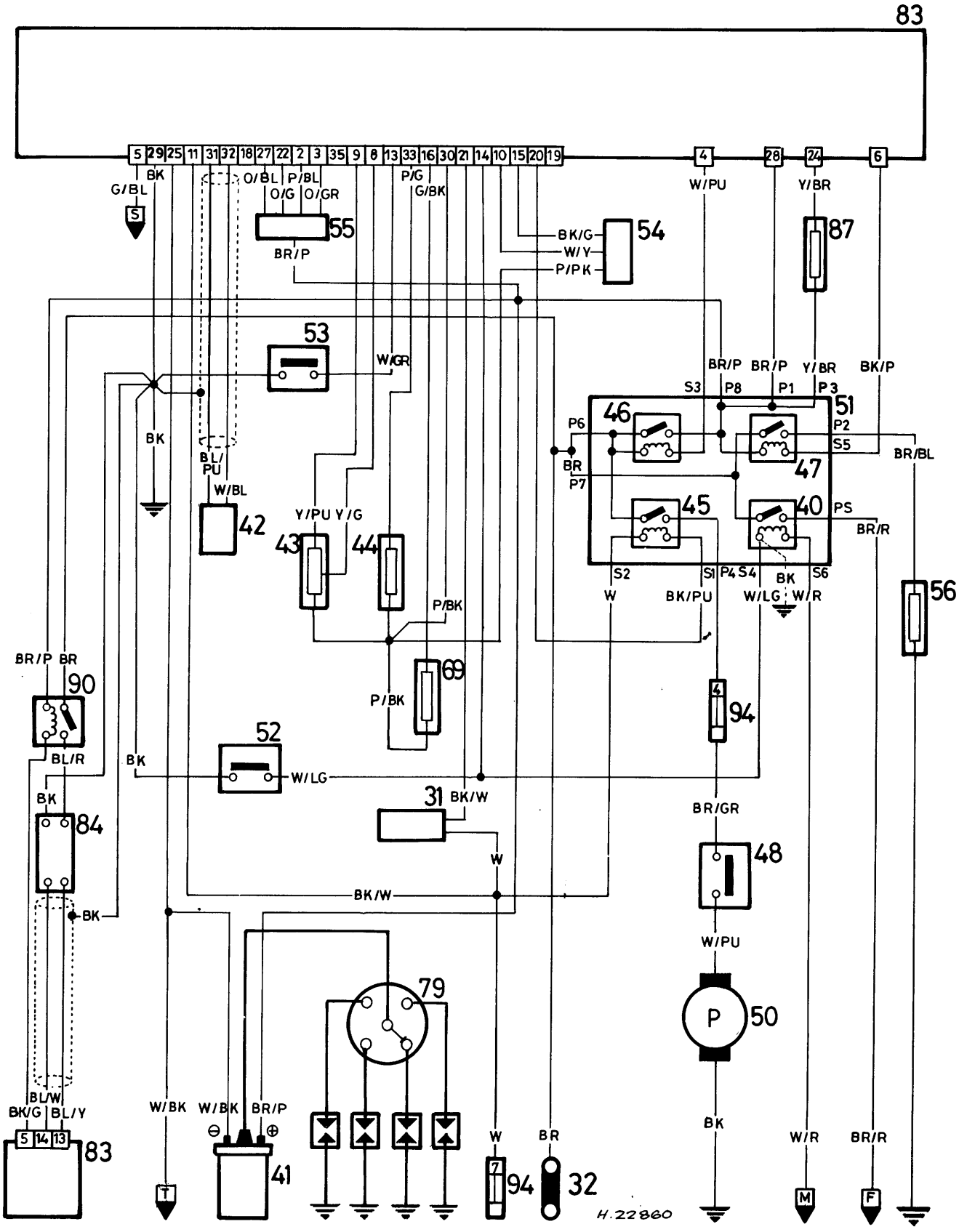
**6** Turn the adjustment screw anti-clockwise until the horn just fails to sound. Then turn the screw a quarter of a turn clockwise, which is the optimum setting.




**Wiring diagram 4 - Mini 1000 Special De Luxe Saloon (with alternator and rocker type switches) - pre 1976**




**Wiring diagram 13 - Mini Special - 1977 to 78**




**Wiring diagram 21 - Engine management circuit (fuel-injected models)**

F to Wiring diagram 20
M to Wiring diagram 20
S to Wiring diagram 22
T to Wiring diagram 22

## Special tools

The tools in this list are those which are not used regularly, are expensive to buy, or which need to be used in accordance with their manufacturers' instructions. Unless relatively difficult mechanical jobs are undertaken frequently, it will not be economic to buy many of these tools. Where this is the case, you could consider clubbing together with friends (or joining a motorists' club) to make a joint purchase, or borrowing the tools against a deposit from a local garage or tool hire specialist. It is worth noting that many of the larger DIY superstores now carry a large range of special tools for hire at modest rates.

The following list contains only those tools and instruments freely available to the public, and not those special tools produced by the vehicle manufacturer specifically for its dealer network. You will find occasional references to these manufacturers' special tools in the text of this manual. Generally, an alternative method of doing the job without the vehicle manufacturers' special tool is given. However, sometimes there is no alternative to using them. Where this is the case and the relevant tool cannot be bought or borrowed, you will have to entrust the work to a franchised garage.

- ☐ *Valve spring compressor*
- ☐ *Valve grinding tool*
- ☐ *Piston ring compressor*
- ☐ *Piston ring removal/installation tool*
- ☐ *Balljoint separator*
- ☐ *Coil spring compressors (where applicable)*
- ☐ *Two/three-legged hub and bearing puller*
- ☐ *Impact screwdriver*
- ☐ *Micrometer and/or vernier calipers*
- ☐ *Dial gauge*
- ☐ *Stroboscopic timing light*
- ☐ *Dwell angle meter/tachometer*
- ☐ *Universal electrical multi-meter*
- ☐ *Cylinder compression gauge*
- ☐ *Hand-operated vacuum pump and gauge*
- ☐ *Bush and bearing removal/installation set*
- ☐ *Stud extractors*
- ☐ *Tap and die set*
- ☐ *Lifting tackle*
- ☐ *Trolley jack*

## Buying tools

For practically all tools, a tool factor is the best source, since he will have a very comprehensive range compared with the average garage or accessory shop. Having said that, accessory shops often offer excellent quality tools at discount prices, so it pays to shop around.

Remember, you don't have to buy the most expensive items on the shelf, but it is always advisable to steer clear of the very cheap tools. There are plenty of good tools around at reasonable prices, but always aim to purchase items which meet the relevant national safety standards. If in doubt, ask the proprietor or manager of the shop for advice before making a purchase.

## Care and maintenance of tools

Having purchased a reasonable tool kit, it is necessary to keep the tools in a clean and serviceable condition. After use, always wipe off any dirt, grease and metal particles using a clean, dry cloth, before putting the tools away. Never leave them lying around after they have been used. A simple tool rack on the garage or workshop wall for items such as screwdrivers and pliers is a good idea. Store all normal spanners and sockets in a metal box. Any measuring instruments, gauges, meters, etc, must be carefully stored where they cannot be damaged or become rusty.

Take a little care when tools are used. Hammer heads inevitably become marked, and screwdrivers lose the keen edge on their blades from time to time. A little timely attention with emery cloth or a file will soon restore items like this to a good serviceable finish.

## Working facilities

Not to be forgotten when discussing tools is the workshop itself. If anything more than routine maintenance is to be carried out, some form of suitable working area becomes essential.

It is appreciated that many an owner-mechanic is forced by circumstances to remove an engine or similar item without the benefit of a garage or workshop. Having done this, any repairs should always be done under the cover of a roof.

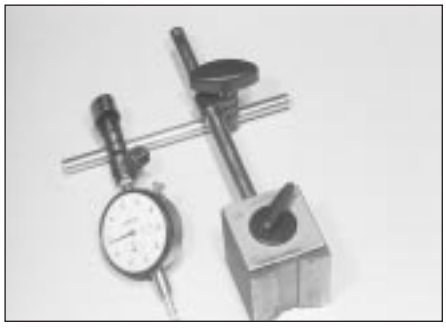
Wherever possible, any dismantling should be done on a clean, flat workbench or table at a suitable working height.

Any workbench needs a vice; one with a jaw opening of 100 mm is suitable for most jobs. As mentioned previously, some clean dry storage space is also required for tools, as well as for any lubricants, cleaning fluids, touch-up paints and so on, which become necessary.

Another item which may be required, and which has a much more general usage, is an electric drill with a chuck capacity of at least 8 mm. This, together with a good range of twist drills, is virtually essential for fitting accessories.

Last, but not least, always keep a supply of old newspapers and clean, lint-free rags available, and try to keep any working area as clean as possible.

**Micrometer set**



**Dial test indicator ("dial gauge")**

**Stroboscopic timing light**

**Compression tester**

**Stud extractor set**

# 8 Braking system

**Note:** *Before assuming that a brake problem exists, make sure that the tyres are in good condition and correctly inflated, that the front wheel alignment is correct, and that the vehicle is not loaded with weight in an unequal manner.*

### *Vehicle pulls to one side under braking*

- ☐ Worn, defective, damaged or contaminated brake shoes/pads on one side (Chapters 1 and 9).
- ☐ Seized or partially-seized front wheel cylinder piston or brake caliper piston (Chapters 1 and 9).
- ☐ A mixture of brake shoe/ pad lining materials fitted between sides (Chapters 1 and 9).
- ☐ Brake backplate or caliper mounting bolts loose (Chapter 9).
- ☐ Worn or damaged steering or suspension components (Chapters 1 and 10).

### *Noise (grinding or high-pitched squeal) when brakes applied*

- ☐ Brake shoe or pad friction lining material worn down to metal backing (Chapters 1 and 9).
- ☐ Excessive corrosion of brake drum or disc. (May be apparent after the vehicle has been standing for some time (Chapters 1 and 9).

### *Excessive brake pedal travel*

- ☐ Incorrect drum brake adjustment (Chapter 1).
- ☐ Faulty master cylinder (Chapter 9).
- ☐ Air in hydraulic system (Chapter 9).
- ☐ Faulty vacuum servo unit - where fitted (Chapter 9).

### *Brake pedal feels spongy when depressed*

- ☐ Air in hydraulic system (Chapter 9).
- ☐ Deteriorated flexible rubber brake hoses (Chapters 1 and 9).
- ☐ Master cylinder mounting nuts loose (Chapter 9).
- ☐ Faulty master cylinder (Chapter 9).

### *Excessive brake pedal effort required to stop vehicle*

- ☐ Faulty vacuum servo unit - where fitted (Chapter 9).
- ☐ Disconnected, damaged or insecure brake servo vacuum hose (Chapter 9).
- ☐ Primary or secondary hydraulic circuit failure (Chapter 9).
- ☐ Seized wheel cylinder or brake caliper piston(s) (Chapter 9).
- ☐ Brake shoes or pads incorrectly fitted (Chapters 1 and 9).
- ☐ Incorrect grade of brake shoes or pads fitted (Chapters 1 and 9).
- ☐ Brake shoe linings or pads contaminated (Chapters 1 and 9).

### *Judder felt through brake pedal or steering wheel when braking*

- ☐ Excessive run-out or distortion of drums/discs (Chapters 1 and 9).
- ☐ Brake shoe or pad linings worn (Chapters 1 and 9).
- ☐ Brake backplate or caliper mounting bolts loose (Chapter 9).
- ☐ Wear in suspension or steering components or mountings (Chapters 1 and 10).

### *Brakes binding*

- ☐ Incorrect drum brake adjustment (Chapter 1).
- ☐ Seized wheel cylinder or brake caliper piston(s) (Chapter 9).
- ☐ Incorrectly-adjusted handbrake mechanism (Chapter 9).
- ☐ Seized handbrake cable moving sectors (Chapter 9).
- ☐ Faulty master cylinder (Chapter 9).

### *Rear wheels locking under normal braking*

- ☐ Rear brake shoe linings contaminated (Chapters 1 and 9).
- ☐ Faulty brake pressure regulating valve or reducing valve (Chapter 9).

# 9 Suspension and steering systems

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

### *Wheel wobble and vibration*

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

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

- ☐ Defective shock absorbers - rubber cone suspension models (Chapter 10).
- ☐ Incorrect vehicle ride height - Hydrolastic suspension models (Chapter 10).
- ☐ Worn or damaged suspension component or mounting (Chapter 10).

### *Wandering or general instability*

- ☐ Incorrect front wheel alignment (Chapter 10).
- ☐ Worn steering or suspension joints, bushes or components (Chapters 1 and 10).
- ☐ Roadwheels out of balance (Chapters 1 and 10).
- ☐ Defective tyre (*"Weekly checks"*).
- ☐ Wheel nuts loose (Chapters 1 and 10).
- ☐ Defective shock absorbers - rubber cone suspension models (Chapter 10).
- ☐ Incorrect vehicle ride height - Hydrolastic suspension models (Chapter 10).

### *Excessively-stiff steering*

- ☐ Lack of steering gear lubricant (Chapter 10).
- ☐ Seized tie-rod or suspension balljoint (Chapters 1 and 10).
- ☐ Incorrect front wheel alignment (Chapter 10).
- ☐ Steering rack or column bent or damaged (Chapter 10).

### *Excessive play in steering*

- ☐ Worn steering tie-rod balljoints (Chapters 1 and 10).
- ☐ Loose steering column clamp bolt (Chapter 10).
- ☐ Worn rack-and-pinion steering gear (Chapter 10).
- ☐ Worn steering or suspension joints, bushes or components (Chapters 1 and 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).