

# Chapter 9

## Braking system

### Contents

|                                                       |                          |                                                       |                      |
|-------------------------------------------------------|--------------------------|-------------------------------------------------------|----------------------|
| Brake disc - inspection, removal and refitting        | 4                        | Handbrake cables - removal and refitting              | 10                   |
| Brake fluid level check                               | See <i>Weekly checks</i> | Hydraulic pipes and hoses - renewal                   | 13                   |
| Brake fluid renewal                                   | See Chapter 1A or 1B     | Hydraulic system - bleeding                           | 11                   |
| Brake warning lamp check                              | See Chapter 1A or 1B     | Master cylinder - removal and refitting               | 12                   |
| Front brake caliper - removal, overhaul and refitting | 3                        | Rear brake shoe check                                 | See Chapter 1A or 1B |
| Front brake pad check                                 | See Chapter 1A or 1B     | Rear brake shoes - renewal                            | 5                    |
| Front brake pads - renewal                            | 2                        | Rear brake drums - removal, inspection and refitting  | 6                    |
| General information                                   | 1                        | Rear wheel cylinder - removal, overhaul and refitting | 7                    |
| Handbrake - checking and adjustment                   | 9                        | Stop-light switch - adjustment, removal and refitting | 8                    |

### 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

#### Front disc brakes

|                                               |                                          |
|-----------------------------------------------|------------------------------------------|
| Type                                          | Disc with single-piston sliding calipers |
| Disc diameter:                                |                                          |
| Petrol models with single-point injection     | 240.0 mm                                 |
| Petrol models with multi-point injection      | 257.0 mm                                 |
| Non-turbo diesel models                       | 240.0 mm                                 |
| Turbo diesel models                           | 257.0 mm                                 |
| Disc thickness (new):                         |                                          |
| Petrol models with single-point injection     | 10.80 to 11.10 mm                        |
| Petrol models with multi-point injection      | 11.80 to 12.10 mm                        |
| Non-turbo diesel models                       | 10.80 to 11.10 mm                        |
| Turbo diesel models                           | 11.80 to 12.10 mm                        |
| Minimum disc thickness (wear limit):          |                                          |
| Petrol models with single-point injection     | 9.20 mm                                  |
| Petrol models with multi-point injection      | 10.20 mm                                 |
| Non-turbo diesel models                       | 9.20 mm                                  |
| Turbo diesel models                           | 10.20 mm                                 |
| Maximum disc runout                           | 0.15 mm                                  |
| Brake pad friction material minimum thickness | 1.5 mm                                   |

#### Rear drum brakes

|                                     |                    |
|-------------------------------------|--------------------|
| Drum inner diameter (new)           | 180.0 to 180.25 mm |
| Maximum drum diameter (wear limit)  | 181.35 mm          |
| Minimum brake shoe lining thickness | 2.0 mm             |

#### Torque wrench settings

|                                                     | Nm | lbf ft |
|-----------------------------------------------------|----|--------|
| Bleed screw                                         | 6  | 4      |
| Brake disc locating studs                           | 12 | 9      |
| Brake drum locating studs                           | 12 | 9      |
| Brake pipe and hose unions                          | 14 | 10     |
| Front caliper mounting bracket-to-hub carrier bolts | 53 | 39     |
| Front caliper-to-caliper bracket guide pin bolts    | 12 | 9      |
| Rear wheel cylinder mounting bolts                  | 10 | 7      |
| Roadwheel bolts                                     | 85 | 63     |



2.3a Release the locking clip ...



2.3b ... and remove the pad wear indicator wiring and brake fluid line from the suspension strut

## 1 General information

The braking system is of the vacuum servo-assisted, dual-circuit hydraulic type. The arrangement of the hydraulic system is such that each circuit operates one front and one rear brake from a tandem master cylinder. Under normal circumstances, both circuits operate in unison. However, in the event of hydraulic failure in one circuit, full braking force will still be available at two diagonally-opposite wheels.

All models covered in this manual are fitted with front disc brakes and rear drum brakes.

The front disc brakes are actuated by single-piston sliding type calipers, which ensure that equal pressure is applied to each brake pad.

The rear drum brakes incorporate leading and trailing shoes, which are actuated by twin-piston wheel cylinders. A self-adjust mechanism is incorporated, to automatically compensate for brake shoe wear. As the brake shoe linings wear, the footbrake operation automatically operates the adjuster mechanism, which effectively lengthens the shoe strut and repositions the brake shoes, to remove the lining-to-drum clearance.

The mechanical handbrake linkage operates the brake shoes via a lever attached to the trailing brake shoe.

Load sensitive proportioning valves operate on the rear brake hydraulic circuits, to prevent the possibility of the rear wheels locking before the front wheels under heavy braking.

**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 Fiat 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.

### Models with anti-lock braking system (ABS)

Available as an option on certain models, the anti-lock braking system prevents skidding which not only optimises stopping distances but allows full steering control to be maintained under maximum braking.

By electronically monitoring the speed of each roadwheel in relation to the other wheels, the system can detect when a wheel is about to lock-up, before control is actually lost. The brake fluid pressure applied to that wheel's brake caliper is then decreased and restored (or modulated) several times a second until control is regained.

The system components comprise an Electronic Control Unit (ECU), four wheel speed sensors, a hydraulic unit, brake lines and dashboard mounted warning lamps.

The hydraulic unit incorporates a tandem master cylinder, a valve block which modulates the pressure in the brake hydraulic circuits during ABS operation, an accumulator which provides a supply of highly pressurised brake fluid, a hydraulic pump to charge the accumulator and an integral electronic control unit (ECU).

The four wheel sensors are mounted on the wheel hubs. The ECU uses the signals produced by the sensors to calculate the rotational speed of each wheel.

The ECU has a self-diagnostic capability and will inhibit the operation of the ABS if a fault is detected, lighting the dashboard mounted warning lamp. The braking system will then revert to conventional, non-ABS operation. If the nature of the fault is not immediately obvious upon inspection, the vehicle must be taken to a Fiat dealer, who will have the diagnostic equipment required to interrogate the ABS ECU electronically and pin-point the problem.

## 2 Front brake pads - renewal



**Warning:** Renew **BOTH** sets of front brake pads at the same time - NEVER renew the pads on only one wheel, as uneven braking may result.



**Warning:** Note that the dust created by wear of the pads may contain asbestos, which is a health hazard. Never blow it out with compressed air, and don't inhale any of it. An approved filtering mask should be worn when working on the brakes. DO NOT use petrol or petroleum-based solvents to clean brake parts; use proprietary brake cleaner or methylated spirit only.

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

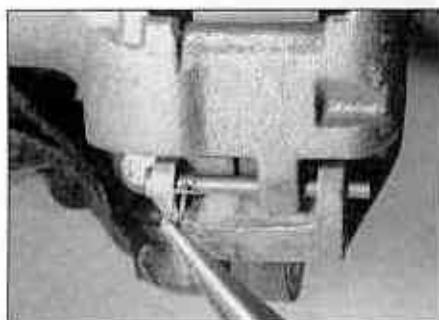
2 Working on one side of the vehicle, push the caliper piston into its bore by pulling the caliper outwards. If necessary, press the piston back into its bore using a large G-clamp or a piston retraction tool. Keep a careful eye on the level of brake fluid in the reservoir as you do this - ensure that the level does not rise above the MAX marking.

3 Where applicable, release the locking clip and remove the pad wear indicator wiring and brake fluid line from the bracket at the base of the suspension strut (see illustrations).

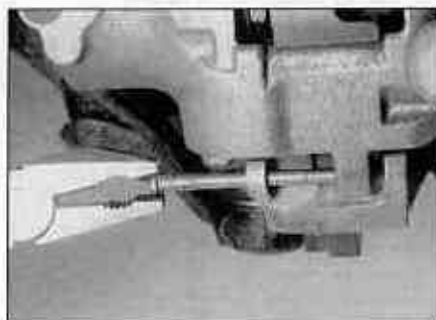
### Petrol models without ABS

4 Remove the locking clip and extract the lower guide pin from the caliper (see illustrations)

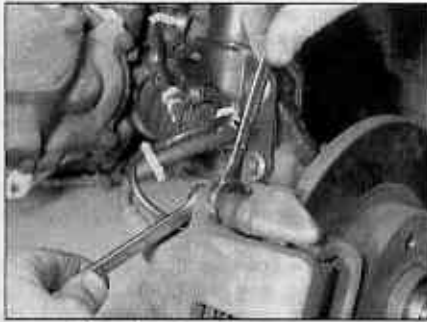
5 Pivot the caliper body upwards and support in position with a length of wire or a cable-tie. Avoid straining the hydraulic hose.



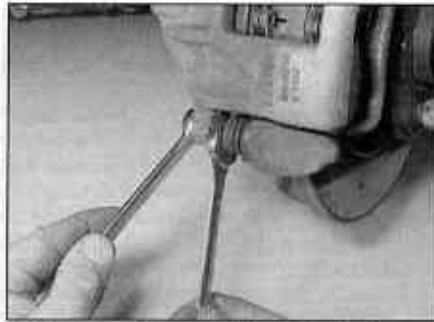
2.4a Remove the locking clip ...



2.4b ... and extract the lower guide pin from the caliper (petrol models without ABS)



2.6a Unscrew the upper ...



2.6b ... and lower guide pin bolts (petrol models with ABS and diesel models)



2.7 Lift the caliper from the hub/disc assembly

### Petrol models with ABS and diesel models

6 Unscrew the upper and lower caliper guide pin bolts, using a slim open-ended spanner to counterhold the head of the guide pin (see illustrations). Discard the guide pin bolts - new items must be fitted on reassembly.

7 Lift the caliper from the hub/disc assembly (see illustration). Suspend it from a suitable point on the suspension using a length of wire or a cable-tie, to avoid straining the hydraulic hose.

### All models

**Caution:** Do not depress the brake pedal until the caliper is refitted, or the piston will be pushed out of its bore.

8 Withdraw the brake pads from the caliper bracket (see illustrations).

9 Measure the thickness of each brake pad's friction material. If either pad is worn at any point to the specified minimum thickness or less, all four pads must be renewed. Also, the pads should be renewed if any are fouled with oil or grease; there is no satisfactory way of degreasing friction material, once contaminated. If any of the brake pads are worn unevenly, or are fouled with oil or grease, trace and rectify the cause before reassembly.



**Warning:** Do not be tempted to swap brake pads over to compensate for uneven wear.

10 If the brake pads are still serviceable, carefully clean them using a clean, fine wire brush or similar and brake cleaning fluid. Pay particular attention to the sides and back of the metal backing. Where applicable, clean out the grooves in the friction material, and pick out any large embedded particles of dirt or debris.

11 Clean the surfaces of the brake pad contact points in the caliper body and caliper mounting bracket.

12 Prior to fitting the pads, check that the guide pins can slide freely in the caliper body, and check that the rubber guide pin gaiters are undamaged. Brush the dust and dirt from the caliper and piston, but do not inhale it, as it may contain asbestos.

13 Inspect the dust seal and the area around the piston for signs of damage, corrosion or

brake fluid leaks. If evident, refer to Section 3 and overhaul the caliper assembly.

14 If new brake pads are to be fitted, the caliper piston must be pushed back into the cylinder, to allow for the extra depth of the friction material. Either use a G-clamp or similar tool, or use suitable pieces of wood as levers. Provided that the master cylinder reservoir has not been overfilled with hydraulic fluid, there should be no spillage, but keep a careful watch on the fluid level while retracting the piston. If the fluid level rises above the MAX level line at any time, the surplus should be siphoned off.



**Warning:** Do not syphon the fluid by mouth, as it is poisonous; use a syringe or an old poultry baster.

15 Apply a little high temperature brake grease to the contact surfaces of the pad backing plates; take great care not to allow any grease onto the pad friction linings. Similarly, apply brake grease to the pad contact points on the caliper bracket - again take care not to apply excess grease, which may contaminate the pads.

16 Place the brake pads in position on the caliper bracket, with the friction material facing the surfaces of the brake disc. Feed the wear indicator cable through the caliper body aperture.

### Petrol models without ABS

17 Pivot the caliper body down over the brake pads, then refit the guide pin and clip.



2.8a Withdraw the outboard ...



2.8b ... and inboard brake pads from the caliper bracket

### Petrol models with ABS and diesel models

18 Fit the caliper body in position on the caliper bracket, then fit the new guide pin bolts and tighten them to the specified torque.

### All models

19 Check that the caliper body can slide freely on the guide pins. Ensure that the flexible hydraulic hose is not twisted or kinked in any way. Turn the steering from lock to lock and check that the hose does not chafe against the suspension or steering gear.

20 Where applicable, reconnect the pad wear indicator wiring and press it into the retaining clips on the suspension.

21 Repeat the above procedure on the remaining front caliper.

22 With both sets of front brake pads fitted, depress the brake pedal repeatedly until the pads are pressed into firm contact with the brake disc, and normal pedal pressure is restored. Any sponginess felt when depressing the pedal is most probably due to air trapped inside the hydraulic system - refer to Section 11 and bleed the braking system before progressing any further.

23 Refit the roadwheels, and lower the vehicle to the ground.

24 Check the hydraulic fluid level as described in *Weekly checks*.

25 Check the operation of the braking system thoroughly.





3.5 Unscrew the caliper upper guide pin bolt and remove the caliper body from the bracket

### 3 Front brake caliper - removal, overhaul and refitting

**Warning:** Before starting work, refer to the warnings at the beginning of Sections 2 and 11 concerning the dangers of handling asbestos dust and hydraulic fluid.

#### Removal

1 Chock the rear wheels, apply the handbrake, then jack up the front of the vehicle and support it on axle stands (see *Jacking and vehicle support*). Remove the appropriate front roadwheel.

2 Remove the brake pads as described in Section 2.

3 To minimise fluid loss during the following operations, remove the master cylinder reservoir cap, then tighten it down onto a piece of polythene, to obtain an airtight seal. Alternatively, use a brake hose clamp to seal off the flexible hose running to the caliper.

**Warning:** Do not use an ordinary G-clamp or mole grips for this purpose, as these can easily damage the hydraulic hose internally, possibly leading to failure.

4 Clean the area surrounding the brake hose union, then slacken it using a ring spanner. It won't be possible to separate the union completely without twisting the hose at this stage.



3.7 Unscrew the two securing bolts (arrowed) and remove the caliper mounting bracket from the hub carrier

5 On petrol models without ABS, unscrew the caliper upper guide pin bolt using a hex bit or Allen key and remove the caliper body from the bracket (see illustration).

6 Hold the brake hose and rotate the caliper to unscrew the hose union from the caliper body. Cover the open ends of the union and the caliper fluid inlet, to prevent dirt ingress. Alternatively, the flexible brake hose may be separated from the rigid brake pipe, at the bracket mounted on the inner wheel arch.

7 If desired, the caliper mounting bracket can be removed from the hub carrier after unscrewing the two securing bolts (see illustration) but note that locking compound must be applied to the bolt threads on refitting.

#### Overhaul

**Note:** Before commencing work, ensure that the appropriate caliper overhaul kit is obtained.

8 With the caliper on the bench, wipe away all traces of dust and dirt, but avoid inhaling the dust, as it is a health hazard.

9 Place a small block of wood between the caliper body and the piston, to act as padding. Remove the piston by applying a jet of low pressure compressed air (such as that produced by a tyre foot pump) to the fluid inlet port.

**Warning:** Protect your hands and eyes when using compressed air in this manner - brake fluid may be ejected under pressure when the piston pops out of its bore.

10 Peel the dust seal from the piston, then use a soft, blunt instrument (ie not a screwdriver) to extract the piston seal from the caliper bore.

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

12 The caliper piston seal, the dust seal and the bleed nipple dust cap, are only available as part of a seal kit. Since the manufacturers recommend that the piston seal and dust seal are renewed whenever they are disturbed, all of these components should be discarded on disassembly and new ones fitted on reassembly as a matter of course.

13 Carefully examine all parts of the caliper assembly, looking for signs of wear or damage. In particular, the cylinder bore and piston must be free from any signs of scratches, corrosion or wear. If there is any doubt about the condition of any part of the caliper, the relevant part should be renewed. Note that the piston surface is plated, and must not be polished with emery or similar abrasives to remove corrosion or scratches. In addition, the pistons are matched to the caliper bores and can only be renewed as a part of a complete caliper assembly.

14 Check that the threads in the caliper body and the mounting bracket are in good condition. Check that both guide pins are

undamaged, and (when cleaned) a reasonably tight sliding fit in the mounting bracket bores.

15 Use compressed air to blow clear the fluid passages.



**Warning:** Wear eye protection when using compressed air.

16 Before commencing reassembly, ensure that all components are spotlessly clean and dry.

17 Soak the new piston seal in clean hydraulic fluid, and fit it to the groove in the cylinder bore, using your fingers only (no tools) to manipulate it into place.

18 Fit the new dust seal inner lip to the cylinder groove, smear clean hydraulic fluid over the piston and caliper cylinder bore, and twist the piston into the dust seal. Press the piston squarely into the cylinder, then slide the dust seal outer lip to the groove in the piston.

#### Refitting

19 Where applicable, refit the caliper mounting bracket to the hub carrier. Coat the threads of the mounting bolts with locking compound, then tighten them to the specified torque.

20 Hold the brake hose and rotate the caliper to screw the hose union back into the caliper body.

21 On petrol models without ABS, place the caliper in position on the bracket and tighten the caliper upper guide pin bolt to the specified torque.

22 Refit the brake pads as described in Section 2.

23 On all models, tighten the brake hose-to-caliper union securely.

24 Check that the caliper slides smoothly on its guide pins.

25 Where applicable, remove the polythene from the master cylinder reservoir cap, or remove the clamp from the fluid hose, as applicable.

26 Bleed the hydraulic fluid circuit as described in Section 11. Note that if no other part of the system has been disturbed, it should only be necessary to bleed the relevant front circuit.

27 Depress the brake pedal repeatedly to bring the pads into contact with the brake disc, and ensure that normal pedal pressure is restored.

28 Refit the roadwheel, and lower the vehicle to the ground.

### 4 Brake disc - inspection, removal and refitting

#### Inspection

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



2 Rotate the brake disc by hand and examine the whole of the surface area swept by the brake pads, on both sides of the disc. **Note:** It will be necessary to remove the front brake pads to allow an adequate inspection of the disc's rear surface; refer to Section 2 for details.

3 Typically, the disc surface will have a polished appearance and should be free from heavy scoring. Smooth rippling is produced by normal operation and does not indicate excessive wear. Deep scoring and cracks, however, are indications of more serious damage in need of correction.

4 If deep scoring is discovered, it may be possible to have the disc reground to restore the surface, depending on the extent of the damage. To determine whether this is a feasible course of action, it will be necessary to measure the thickness of the disc, as described later.

5 Check the whole surface of the disc for cracks, particularly around the roadwheel bolt holes. A cracked disc must be renewed.

6 A ridge of rust and brake dust at the inner and outer edges of the disc, beyond the pad contact area is normal - this can be scraped away quite easily.

7 Raised ridges caused by the brake pads eroding the disc material, however, are an indication of excessive wear. If close examination reveals such ridges, the thickness of the disc must be measured, to assess whether it is still fit for use.

8 To measure the thickness of the disc, take readings at several points on the surface using a micrometer, in the area swept by the brake pads (see illustration). Include any points where the disc has been scored; align the jaws of the micrometer with the deepest area of scoring, to get a true indication of the extent of the wear. Compare these measurements with the limits listed in the Specifications. If the disc has worn below its minimum thickness, at any point, it must be renewed.

9 If the discs are suspected of causing brake judder, check the disc runout, using one of the following methods:

#### Runout measurement - DTI gauge method

10 Refit the four roadwheel bolts, together with one M14 plain washer per stud - this will ensure adequate disc to hub contact. Tighten the studs to 5 Nm (4 lbf ft).

11 Clamp the DTI gauge to a stand and attach the stand, preferably via a magnetic base, to the strut mounting bracket. Align the gauge so that its pointer rests upon the area of the disc swept by the brake pads, on an arc 2 mm from the outer edge of the disc (see illustration).

12 Zero the gauge and slowly rotate the disc through one revolution, observing the pointer movement. Note the maximum deflection recorded and compare the figure with that listed in Specifications.



4.8 Measuring brake disc thickness with a micrometer

#### Runout measurement - feeler blade method

13 Use the feeler blades to measure the clearance between the disc and a convenient fixed point, such as the disc backplate. Rotate the disc and measure the variation in clearance at several points around the disc. Compare the maximum figure with that listed in Specifications.

14 If the disc runout is outside of its specified tolerance, first check that the hub is not worn (see *Steering and suspension* check in Chapter 1A or 1B). If the hub is in good condition, remove the disc (as described later in this Section), rotate it through 180° and refit it. This may improve the seating and eradicate the excessive runout.

15 If the runout is still unacceptable, then it may be possible to restore the disc by regrounding; consult your Fiat dealer or a machine shop for a professional opinion - it may prove more economical to purchase a new disc. If the disc cannot be reground, then it must be renewed.

#### Removal

16 Mark the relationship between the disc and the hub with chalk or a marker pen, to allow correct refitting.

17 To allow the disc to be removed, undo the two bolts securing the brake caliper mounting bracket to the hub carrier (see illustration 3.7). Withdraw the brake caliper and mounting bracket assembly, complete with brake pads, from the hub carrier, and hang it from a rigid point on the suspension, using wire or a



4.18a Slacken and remove the disc locating studs ...



4.11 Brake disc runout measurement - DTI gauge method

cable-tie. Do not allow it to dangle freely as this will strain the brake hose.

18 Slacken and remove the disc locating stud(s). Support the disc as you do this and lift it off as it becomes free (see illustrations).

19 Remove the polished glaze from the surface of the disc with sand/emery paper. Use small, circular motions to avoid producing a directional finish on the surface.

#### Refitting

20 If a new disc is being fitted, remove the protective coating from the surface using an appropriate solvent.

21 Locate the disc on the hub so that the roadwheel bolt and locating stud holes are all correctly lined up; use the alignment marks made during removal. If the disc is being removed in an attempt to improve seating and hence runout, turn the disc through 180° and then refit it.

22 Refit the locating stud and retaining screw, tightening them securely.

23 Re-check the disc runout, using one of the methods described earlier in this Section.

24 Refit the brake caliper and mounting bracket assembly to the hub carrier. Coat the threads of the mounting bolts with locking compound, then tighten them to the specified torque.

25 Depress the brake pedal several times to bring the brake pads into contact with the disc.

26 Refit the roadwheel and lower the vehicle to the ground. Tighten the roadwheel bolts to the specified torque.

27 Check the hydraulic fluid level as described in *Weekly checks*.



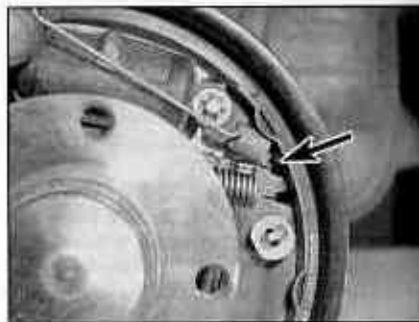
4.18b ... and lift off the disc as it becomes free



5.4a Detaching the lower return spring



5.4b Detaching the upper return spring from the leading ...



5.4c ... and trailing brake shoes

## 5 Rear brake shoes - renewal

**Warning:** Renew **BOTH** sets of rear brake shoes at the same time - NEVER renew the shoes on only one wheel, as uneven braking may result.

**Warning:** Before starting work, refer to the warning given at the beginning of Section 2, concerning the dangers of asbestos dust.

1 Remove the rear brake drums, as described in Section 6.

2 Working on one side of the vehicle, brush the dirt and dust from the brake backplate and drum. Avoid inhaling the dust, as it may contain asbestos, which is a health hazard.

3 Note the position of each shoe, and the location of the return and steady springs. Also

make a note of the adjuster component locations, to aid refitting later. It is advisable, at this stage to wrap a stout rubber band or a cable-tie over the wheel cylinder, to prevent the pistons from being accidentally ejected.

4 Detach the upper and lower return springs from both brake shoes (see illustrations).

5 Unhook the self-adjuster mechanism return spring from the leading brake shoe (see illustration). Remove the hold-down cup and spring from the leading shoe. The spring cups are a bayonet-style fit - use a large pair of pliers to depress and then turn the cup through 90°, while holding the pin from behind the backplate. Remove the pin.

6 Carefully pull the leading brake shoe away from the backplate and remove it (see illustration).

7 Using a suitable pair of pliers, unhook the self-adjuster mechanism from the trailing shoe and remove it (see illustrations).

8 Remove the hold-down cup and spring from the trailing shoe, using a large pair of pliers, as described for the leading shoe. Remove the pin. Lift the trailing shoe away from the backplate and disconnect the handbrake cable from the brake shoe lever (see illustration).

9 Thoroughly clean the surface of the backplate using brake component cleaner to remove all traces of dust and old lubricant. Examine all components for signs of corrosion.

10 Apply brake grease sparingly to the shoe contact surfaces of the brake backplate (see illustration).

11 Connect the handbrake cable to the lever on the trailing brake shoe, locate the trailing shoe on the backplate and secure in position with the pin, hold down spring and cup. Using pliers, turn the cup through 90° and then release it, to lock it in position.



5.5 Unhook the self-adjuster mechanism return spring from the leading brake shoe



5.6 Carefully pull the leading brake shoe away from the backplate and remove it



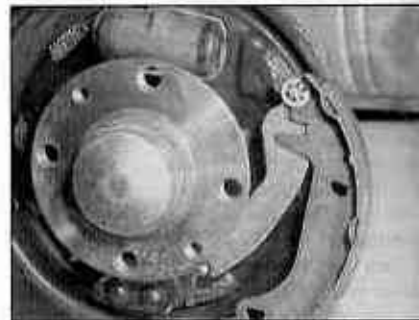
5.7a Unhook the self-adjuster mechanism from the trailing shoe ...



5.7b ... and remove it



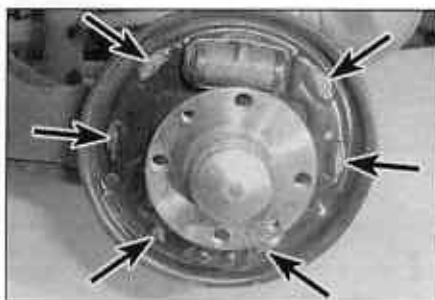
5.8a Remove the hold-down cup and spring from the trailing shoe



5.8b Lift the trailing shoe away from the backplate ...



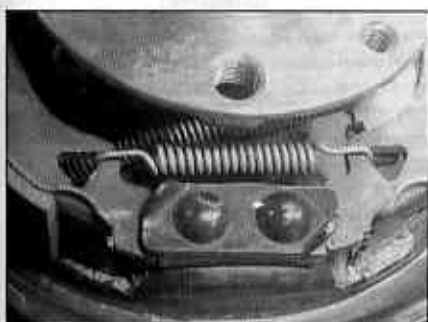
5.8c ... and disconnect the handbrake cable from the brake shoe lever



5.10 Apply brake grease sparingly to the shoe contact surfaces (arrowed) of the brake backplate



5.12 Fit the self-adjuster mechanism into the recess (arrowed) in the trailing brake shoe



5.14a Lower return spring fitted in place



5.14b Correct location of upper return spring in leading shoe ...



5.14c ... and trailing shoe

12 Fit the self-adjuster mechanism into the recess in the trailing brake shoe and anchor the retaining spring in the slot provided in the shoe (see illustration).

13 Fit the leading shoe in position on the backplate and secure it with the hold down pin, spring and cup as described for the trailing shoe. Engage the end of the self-adjuster mechanism with the recess in the leading brake shoe. Hook the retaining spring into the slot provided.

14 Fit the upper and lower shoe return springs, engaging them with the slots in the shoes as shown (see illustrations). Remove the elastic band from the wheel cylinder.

15 Turn the serrated wheel at the end of the self-adjuster mechanism, to retract the brake shoes - this will give additional clearance to allow the drum to pass over the shoes during refitting.

16 Repeat the procedure on the remaining side of the vehicle.

17 Refit the brake drums as described in Section 6. Check and if necessary adjust the operation of the handbrake, as described in Section 9.

18 Apply the brake pedal and handbrake lever several times to settle the self-adjusting mechanism. With both rear roadwheels refitted and the rear of the vehicle still raised, turn the wheels by hand to check that the brake shoes are not binding.

19 Lower the vehicle to the ground and thoroughly check the operation of the braking system.

## 6 Rear brake drums - removal, inspection and refitting

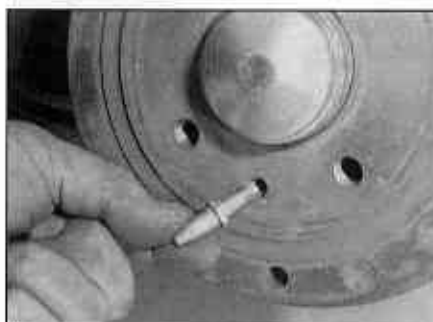


**Warning:** Before starting work, refer to the warning at the beginning of Section 2 concerning the dangers of asbestos dust.

### Removal

1 Chock the front wheels, then jack up the rear of the vehicle and support it on axle stands (see *Jacking and vehicle support*). Remove the appropriate rear roadwheel. Fully release the handbrake.

2 If the original drum is to be refitted, mark the relationship between the drum and the hub. Slacken and remove the two locating studs and pull the drum from the hub (see illustration).



6.2 Slacken and remove the two drum locating studs

3 If the drum is binding on the brake shoes, it can be drawn off as follows. Hold the drum still and turn the hub so that the drum and hub flange bolt holes no longer line up. Screw two bolts into the locating stud threaded holes in the drum, and progressively tighten them against the hub flange to push the drum from the hub (see illustration).

### Inspection

**Note:** If either drum requires renewal, BOTH should be renewed at the same time, to ensure even and consistent braking. New brake shoes should also be fitted.

4 Working carefully, remove all traces of brake dust from the drum, but avoid inhaling the dust, as it is a health hazard.

5 Clean the outside of the drum, and check it for obvious signs of wear or damage, such as cracks around the roadwheel stud holes; renew the drum if necessary.



6.3 Using two bolts to draw the drum off the brake shoes



6 Carefully examine the inside of the drum. Light scoring of the friction surface is normal, but if heavy scoring is found, the drum must be renewed.

7 It is usual to find a lip on the drum's inboard edge which consists of a mixture of rust and brake dust; this should be carefully scraped away, to leave a smooth surface which can be polished with fine (120 to 150-grade) emery paper. If, however, the lip is due to the friction surface being recessed by excessive wear, then the drum must be renewed.

8 If the drum is thought to be excessively worn, or oval, its internal diameter must be measured at several points using an internal micrometer. Take measurements in pairs, the second at right-angles to the first, and compare the two, to check for signs of ovality. Provided that it does not enlarge the drum to beyond the specified maximum diameter, it may be possible to have the drum refinished by skimming or grinding; if this is not possible, the drums on both sides must be renewed. Note that if the drum is to be skimmed, BOTH drums must be refinished, to maintain a consistent internal diameter on both sides.

### Refitting

9 If a new brake drum is to be installed, use a suitable solvent to remove any preservative coating that may have been applied to its internal friction surfaces. Note that it may also be necessary to shorten the adjuster strut length, by rotating the serrated strut wheel, to allow the drum to pass over the brake shoes - see Section 5 for details.

10 If the original drum is being refitted, align the marks made on the drum and hub before removal, then fit the drum over the hub. Refit the locating studs and tighten them to the specified torque.

11 Depress the footbrake repeatedly to expand the brake shoes against the drum, and ensure that normal pedal pressure is restored.

12 Check and if necessary adjust the handbrake cable as described in Section 9.

13 Refit the roadwheels, and lower the vehicle to the ground.

## 7 Rear wheel cylinder - removal, overhaul and refitting

**Warning:** Before starting work, refer to the warnings at the beginning of Sections 2 and 11 concerning the dangers of handling asbestos dust and hydraulic fluid.

### Removal

1 Remove the brake drum (see Section 6).

2 Remove the brake shoes (see Section 5).

3 To minimise fluid loss during the following operations, remove the master cylinder reservoir cap, then tighten it down onto a piece of polythene, to obtain an airtight seal.



7.4 Unscrew the union nut and disconnect the hydraulic pipe from the rear of the wheel cylinder

4 Clean the brake backplate around the wheel cylinder mounting bolts and the hydraulic pipe union, then unscrew the union nut and disconnect the hydraulic pipe (see illustration). Cover the open ends of the pipe and the master cylinder to prevent dirt ingress.

5 Remove the securing bolts, then withdraw the wheel cylinder from the backplate (see illustration).

### Overhaul

**Note:** Before commencing work, ensure that the appropriate wheel cylinder overhaul kit is obtained.

6 Clean the assembly thoroughly, using only methylated spirit or clean brake fluid.

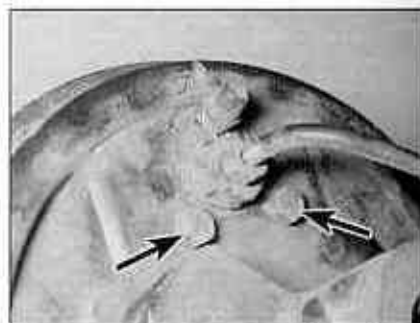
7 Peel off both rubber dust covers, then use paint or similar to mark one of the pistons so that the pistons are not interchanged on reassembly.

8 Withdraw both pistons and the spring.

9 Discard the rubber piston cups and the dust covers. These components should be renewed as a matter of course, and are available as part of an overhaul kit, which also includes the bleed nipple dust cap.

10 Check the condition of the cylinder bore and the pistons - the surfaces must be perfect and free from scratches, scoring and corrosion. It is advisable to renew the complete wheel cylinder if there is any doubt as to the condition of the cylinder bore or pistons.

11 Ensure that all components are clean and dry. The pistons, spring and cups should be



7.5 Remove the securing bolts then withdraw the wheel cylinder from the backplate

fitted wet, using hydraulic fluid as a lubricant - soak them in clean fluid before installation.

12 Fit the cups to the pistons, ensuring that they are the correct way round. Use only your fingers (no tools) to manipulate the cups into position.

13 Fit the first piston to the cylinder, taking care not to distort the cup. If the original pistons are being re-used, the marks made on dismantling should be used to ensure that the pistons are refitted to their original bores.

14 Refit the spring and the second piston.

15 Apply a smear of rubber grease to the exposed end of each piston and to the dust cover sealing lips, then fit the dust covers to each end of the wheel cylinder.

### Refitting

16 Refitting is a reversal of removal, bearing in mind the following points:

- Tighten the mounting bolts to the specified torque.
- Refit the brake shoes as described in Section 5, and refit the brake drum as described in Section 6.
- Before refitting the roadwheel and lowering the vehicle to the ground, remove the polythene from the fluid reservoir, and bleed the hydraulic system as described in Section 11. Note that if no other part of the system has been disturbed, it should only be necessary to bleed the relevant rear circuit.

## 8 Stop-light switch - adjustment, removal and refitting

### Adjustment

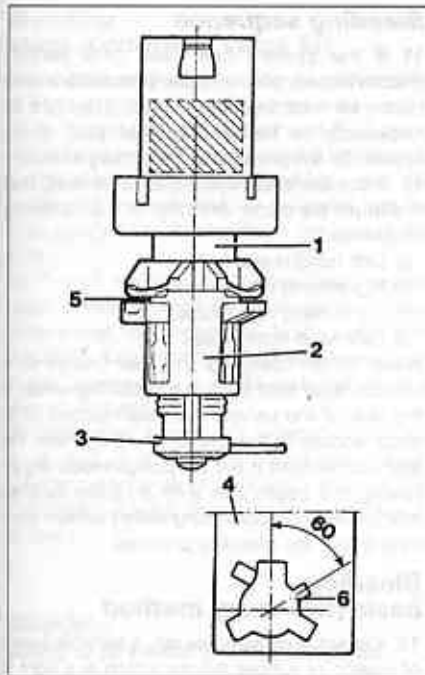
- The switch plunger operates on a ratchet.
- If adjustment is required, pull the plunger fully out - the switch then self-adjusts as the brake pedal is applied and released.

### Removal

- Ensure that the ignition is switched to OFF.
- For improved access, remove the driver's side lower fascia panel, as described in Chapter 11 (see illustration).
- Disconnect the wiring plug from the switch.



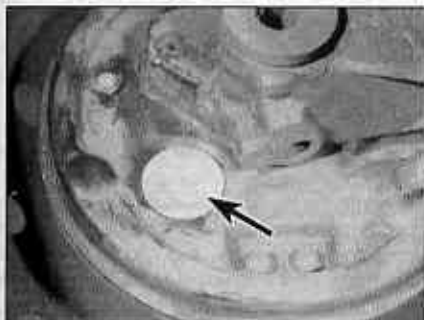
8.4 Location of brake light switch - LHD model shown



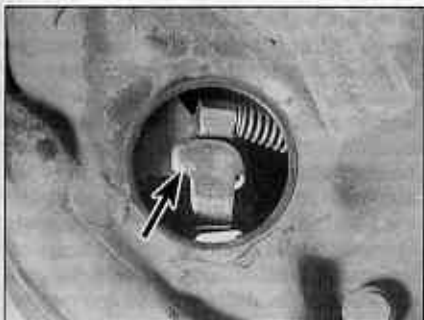
8.8 Brake light switch assembly

- |                     |                    |
|---------------------|--------------------|
| 1 Hexagonal section | 3 Spacer           |
| 2 Bush              | 4 Mounting bracket |
|                     | 5 Locating lug     |

6 Twist the switch anti-clockwise through about half a turn, and withdraw the switch from the pedal bracket. Note the position of the spacer and fitting bush.



10.3a Prise the bung (arrowed) from the access hatch in the rear of the relevant brake backplate



10.3b Unhook the cable end from the brake shoe lever (arrowed)

## Refitting

7 Depress the brake pedal and hold it in this position.

8 Fit the bush and spacer over the end of the switch, then insert the switch into its mounting bracket. Rotate the switch body clockwise through 60° until the locating lug is felt to engage in its recess (see illustration).

9 Release the brake pedal and allow it to rest against the switch spacer tab - this adjusts the position of the switch body inside the bush.

10 Now depress the brake pedal again - this has the effect of breaking off the spacer tab and fixes the position of the switch inside the bush.

11 Restore the wiring at the connector, then refit the fascia lower trim panel.

12 Switch on the ignition and test the operation of the brake lights.

## 9 Handbrake - checking and adjustment

### Checking

1 Apply the handbrake by pulling it through three to four clicks of the ratchet mechanism and check that this locks the rear wheels, holding the vehicle stationary on an incline. In this position, there should be sufficient reserve travel in the handbrake lever to allow for brake shoe wear and cable stretching. If not, the handbrake mechanism is need of adjustment.

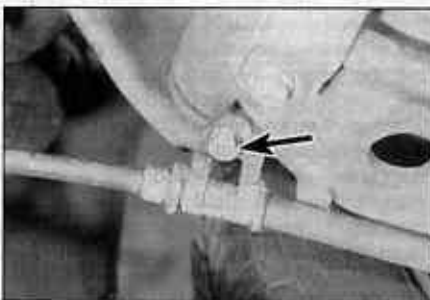
### Adjustment

2 Remove the securing screws and lift off the handbrake lever trim cover - refer to Chapter 11, Section 19, for details.

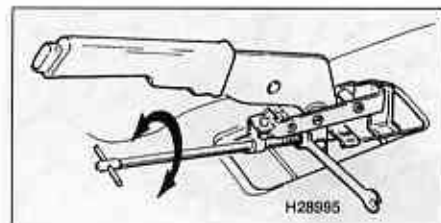
3 Pull the handbrake lever through three clicks of the ratchet mechanism and leave it in this position.

4 The adjustment mechanism is underneath the handbrake lever. Hold the locknut with a ring spanner, then rotate the adjustment screw through one turn anticlockwise, so that the adjustment mechanism tensions the handbrake cable draw bar (see illustration).

5 Release the handbrake lever, then re-apply



10.5a Unscrew the bolts (arrowed) securing the handbrake cable bracket to the suspension lower arm



9.4 Method of adjusting the operation of the handbrake

it and check the operation of the handbrake as described in paragraph 1. Repeat the adjustment procedure as necessary.

6 Chock the front wheels then jack up the rear of the car and support it on axle stands (see *Jacking and Vehicle Support*). Release the handbrake lever and check that the rear wheels are free to rotate without binding. Re-adjust the cable if the brakes appear to be binding.

7 On completion, tighten the cable locknut and refit the handbrake lever trim cover. Lower the car to the ground.

## 10 Handbrake cables - removal and refitting

### Removal

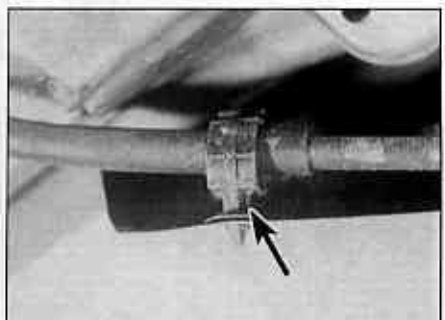
1 There are two rear handbrake cables, one on each side of the vehicle. To renew either rear cable, proceed as follows.

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

3 Working under the rear of the car, prise the bung from the access hatch in the rear of the relevant brake backplate. Using pointed-nose pliers, compress the cable spring and release the cable end from the brake shoe lever (see illustrations).

4 Extract the handbrake outer cable from the brake backplate, then withdraw the end of the cable from the brake assembly.

5 Unscrew the nuts and bolts securing the handbrake cable bracket to the suspension lower arm. Release the cable from the clips on the floorpan heatshield (see illustrations).



10.5b Release the cable from the clips (arrowed) on the floorpan heatshield





10.6 Disconnect the relevant handbrake inner cable (arrowed) from the draw bar

6 Working inside the vehicle, remove the screws and lift off the handbrake lever trim panel (refer to Section 9 for more detail). At the base of the handbrake lever, fully slacken off the handbrake adjusting screw and locknut, to remove all tension from the cable draw bar, then disconnect the relevant handbrake inner cable from the cable draw bar (see illustration)

7 Release the cable grommet from the floorpan, then withdraw the cable from the vehicle.

### Refitting

8 Refitting is a reversal of removal, bearing in mind the following points:

- Ensure that the cables are securely fastened in the clips on the floorpan heatshield and lower suspension arm.
- On completion, check the handbrake adjustment, as described in Section 9.

### 11 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



11.17 Bleeding a rear brake line

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 spilled, it should be washed off immediately, using copious quantities of fresh water. Finally, it is hygroscopic (it absorbs moisture from the air) - 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 operation of any hydraulic system is only possible after removing all air from the components and circuit; and this is achieved by bleeding the system.

2 During the bleeding procedure, add only clean, unused hydraulic fluid of the recommended 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 already in the system, the brake components and circuit must be flushed completely with uncontaminated, correct fluid, and new seals should be fitted throughout the system.

4 If hydraulic fluid has been lost from the system, or air has entered because of a leak, ensure that the fault is cured before proceeding further.

5 Park the vehicle on level ground, switch off the engine and select first or reverse gear (or P), 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 (where applicable), and clean any dirt from around the bleed screws.

7 Unscrew the master cylinder reservoir cap, and top the master cylinder reservoir up to the MAX level line; refit the cap loosely. Remember to maintain the fluid level at least above the MIN level line 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 whenever 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, the basic (two-man) method must be used, which is described in detail below.

9 If a kit is to be used, prepare the vehicle 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 below in the relevant sub-section.

10 Whichever method is used, the same sequence must be followed (paragraphs 11 and 12) to ensure the removal of all air from the system.

### Bleeding sequence

11 If the system has been only partially disconnected, and suitable precautions were taken to minimise fluid loss, it should be necessary to bleed only that part of the system (ie the primary or secondary circuit).

12 If the complete system is to be bled, then it should be done working in the following sequence:

- Left-hand rear wheel.
- Right-hand front wheel.
- Right-hand rear wheel.
- Left-hand front wheel.

**Note:** When bleeding the rear brakes on a vehicle fitted with load proportioning valves: if the rear of the vehicle has been jacked up to allow access to the brake wheel cylinder, the rear suspension must be compressed (eg by raising the beam axle with a trolley jack) so that the load proportioning valves remain open throughout the bleeding process.

### Bleeding - basic (two-man) method

13 Collect a clean glass jar, a suitable length of plastic or rubber tubing which is a tight fit over the bleed screw, and a ring spanner to fit the screw. The help of an assistant will also be required.

14 Remove the dust cap from the first screw in the sequence if not already done. Fit a suitable spanner and tube to the screw, place the other end of the tube in the jar, and pour in sufficient fluid to cover the end of the tube.

15 Ensure that the master cylinder reservoir fluid level is maintained at least above the MIN level line throughout the procedure.

16 Have the assistant fully depress the brake pedal several times to build up pressure, then maintain it on the final downstroke.

17 While pedal pressure is maintained, unscrew the bleed screw (approximately one turn) and allow the compressed fluid and air to flow into the jar. The assistant should maintain pedal pressure, following the pedal down to the floor if necessary, and should not release the pedal until instructed to do so. When the flow stops, tighten the bleed screw again, have the assistant release the pedal slowly, and recheck the reservoir fluid level (see illustration).

18 Repeat the steps given in paragraphs 16 and 17 until the fluid emerging from the bleed screw is free from air bubbles. If the master cylinder has been drained and refilled, and air is being bled from the first screw in the sequence, allow approximately five seconds between cycles for the master cylinder passages to refill.

19 When no more air bubbles appear, tighten the bleed screw securely, remove the tube and spanner, and refit the dust cap (where applicable). Do not overtighten the bleed screw.

20 Repeat the procedure on the remaining screws in the sequence, until all air is removed from the system, and the brake pedal feels firm again.



### Bleeding - using a one-way valve kit

21 As their name implies, these kits consist of a length of tubing with a one-way valve fitted, to prevent expelled air and fluid being drawn back into the system; some kits include a translucent container, which can be positioned so that the air bubbles can be more easily seen flowing from the end of the tube.

22 The kit is connected to the bleed screw, which is then opened. The user returns to the driver's seat, depresses the brake pedal with a smooth, steady stroke, and slowly releases it; this is repeated until the expelled fluid is clear of air bubbles.

23 Note that these kits simplify work so much that it is easy to forget the master cylinder reservoir fluid level; ensure that this is maintained at least above the MIN level line at all times.

### Bleeding - using a pressure-bleeding kit

24 These kits are usually operated by the reservoir of pressurised air contained in the spare tyre. However, note that it will probably be necessary to reduce the pressure to a lower level than normal; refer to the instructions supplied with the kit.

25 By connecting a pressurised, fluid-filled container to the master cylinder reservoir, bleeding can be carried out simply by opening each screw in turn (in the specified sequence), and allowing the fluid to flow out until no more air bubbles can be seen in the expelled fluid.

26 This method has the advantage that the large reservoir of fluid provides an additional safeguard against air being drawn into the system during bleeding.

27 Pressure-bleeding is particularly effective when bleeding 'difficult' systems, or when bleeding the complete system at the time of routine fluid renewal.

### All methods

28 When bleeding is complete, and firm pedal feel is restored, wash off any spilt fluid, tighten the bleed screws securely, and refit their dust caps (where applicable).

29 Check the hydraulic fluid level in the master cylinder reservoir, and top-up if necessary.

30 Discard any hydraulic fluid that has been bled from the system; it will not be fit for re-use.

31 Check the feel of the brake pedal. If it feels at all spongy, air must still be present in the system, and further bleeding is required. Failure to bleed satisfactorily after a reasonable repetition of the bleeding procedure may be due to worn master cylinder seals.

## 12 Master cylinder - removal and refitting



**Warning:** Before starting work, refer to the warning at the beginning of Section 11 concerning the dangers of hydraulic fluid.

### Removal

1 Remove the master cylinder fluid reservoir cap, and syphon the hydraulic fluid from the reservoir. **Note:** Do not syphon the fluid by mouth, as it is poisonous; use a syringe or an old poultry baster. Alternatively, open any convenient bleed screw in the system, and gently pump the brake pedal to expel the fluid through a tube connected to the screw (see Section 11). Disconnect the wiring connector from the brake fluid level sender unit.

2 Carefully prise the fluid reservoir from the seals and release it from the top of the master cylinder.

3 Wipe clean the area around the brake pipe unions on the side of the master cylinder, and place absorbent rags beneath the pipe unions to catch any surplus fluid. Make a note of the correct fitted positions of the unions, then unscrew the union nuts and carefully withdraw the pipes. Plug or tape over the pipe ends and master cylinder orifices, to minimise the loss of brake fluid, and to prevent the entry of dirt into the system. Wash off any spilt fluid immediately with cold water.



**Cut the finger tips from an old rubber glove and secure them over the open ends of the brake pipes with elastic bands - this will help to minimise fluid loss and prevent the ingress of contaminants.**

4 Slacken and remove the nuts securing the master cylinder to the vacuum servo unit, then withdraw the unit from the engine compartment.

5 Where applicable, recover the seals from the rear of the master cylinder, and discard them; new items must be used on refitting.

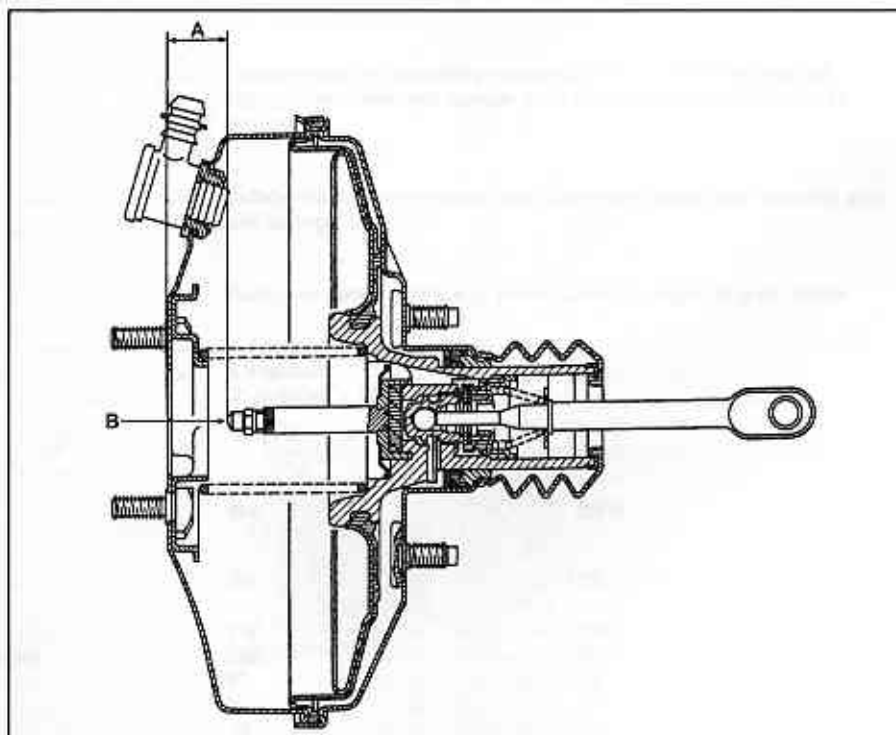
6 With the master cylinder removed, check that the distance between the end of the vacuum servo unit pushrod and the master cylinder mating surface is as shown in the diagram. If necessary, the distance may be adjusted by turning the nut at the end of the servo unit pushrod (see illustration).

### Refitting

7 Fit new rubber seals and then press the fluid reservoir into the ports at the top of the master cylinder.

8 Remove all traces of dirt from the master cylinder and servo unit mating surfaces, and where applicable, fit a new seal between the master cylinder body and the servo.

9 Fit the master cylinder to the servo unit, ensuring that the servo unit pushrod enters the master cylinder bore centrally. Refit the



12.6 Cross-sectional view of vacuum servo unit

A 22.45 to 22.65 mm

B Adjustment nut

master cylinder mounting nuts, and tighten them securely.

10 Wipe clean the brake pipe unions, then refit them to the correct master cylinder ports, as noted before removal, and tighten the union nuts securely.

11 Refill the master cylinder reservoir with new fluid, and bleed the complete hydraulic system as described in Section 11.

12 Check the operation of the braking system thoroughly.

### 13 Hydraulic pipes and hoses - renewal



**Warning:** Before starting work, refer to the warning at the beginning of Section 11 concerning the dangers of hydraulic fluid.

1 If any pipe or hose is to be renewed, minimise fluid loss by first removing the master cylinder reservoir cap, then tighten the cap down onto a piece of polythene to obtain

an airtight seal. Alternatively, flexible hoses can be sealed, if required, using a proprietary brake hose clamp; metal brake pipe unions can be plugged (if care is taken not to allow dirt into the system) or capped immediately they are disconnected. Place a wad of rag under any union that is to be disconnected, to catch any spilt fluid.

2 If a flexible hose is to be disconnected, unscrew the brake pipe union nut before removing the spring clip which secures the hose to its mounting bracket.

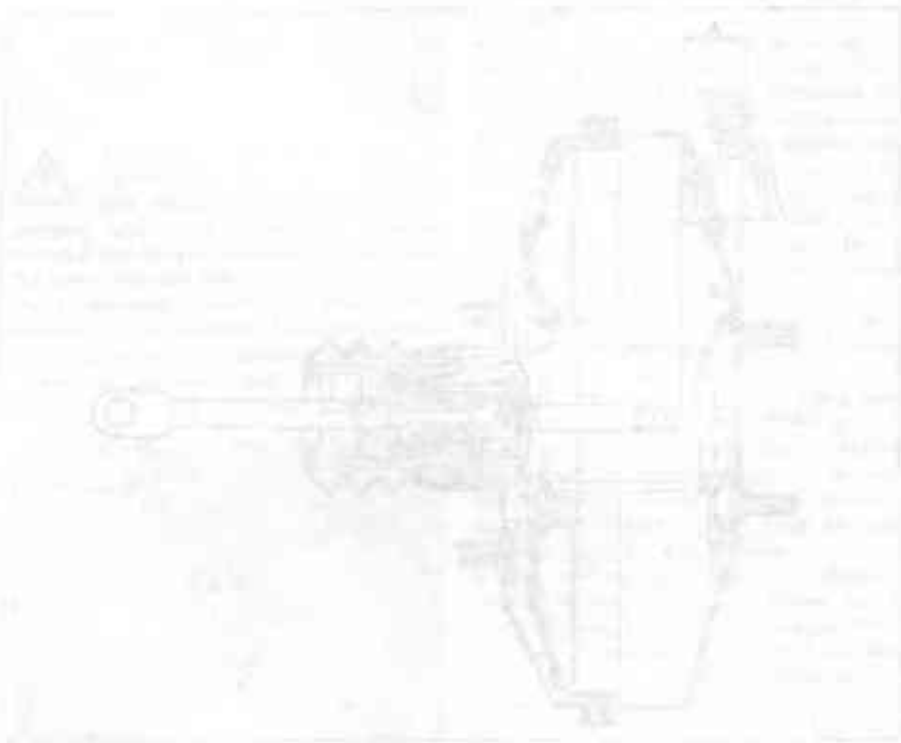
3 To unscrew the union nuts, it is preferable to obtain a brake pipe spanner of the correct size; these are available from most large motor accessory shops. Failing this, a close-fitting open-ended spanner will be required, though if the nuts are tight or corroded, their flats may be rounded-off if the spanner slips. In such a case, a self-locking wrench is often the only way to unscrew a stubborn union, but it follows that the pipe and the damaged nuts must be renewed on reassembly. Always clean a union and surrounding area before disconnecting it. If disconnecting a compo-

nent with more than one union, make a careful note of the connections before disturbing any of them.

4 If a brake pipe is to be renewed, it can be obtained, cut to length and with the union nuts and end flares in place, from Fiat dealers. All that is then necessary is to bend it to shape, following the line of the original, before fitting it to the vehicle. Alternatively, most motor accessory shops can make up brake pipes from kits, but this requires very careful measurement of the original, to ensure that the replacement is of the correct length. The safest answer is usually to take the original to the shop as a pattern.

5 On refitting, do not overtighten the union nuts. It is not necessary to exercise brute force to obtain a sound joint.

6 Ensure that the pipes and hoses are correctly routed, with no kinks, and that they are secured in the clips or brackets provided. After fitting, remove the polythene from the reservoir, and bleed the hydraulic system as described in Section 11. Wash off any spilt fluid, and check carefully for fluid leaks.



# Chapter 10

## Suspension and steering

### Contents

|                                                                 |                   |                                                             |                      |
|-----------------------------------------------------------------|-------------------|-------------------------------------------------------------|----------------------|
| Front hub bearings - renewal                                    | 2                 | Power steering pump - removal and refitting                 | 16                   |
| Front suspension anti-roll bar - removal and refitting          | 6                 | Rear hub bearings - renewal                                 | 7                    |
| Front suspension lower arm - removal and refitting              | 4                 | Rear suspension components- removal, overhaul and refitting | 8                    |
| Front suspension lower arm balljoint - renewal                  | 5                 | Steering and suspension check                               | See Chapter 1A or 1B |
| Front suspension strut - removal, overhaul and refitting        | 3                 | Steering column - removal, overhaul and refitting           | 11                   |
| General information                                             | 1                 | Steering gear rubber gaiters - renewal                      | 14                   |
| Ignition switch/steering column lock - removal and refitting    | 10                | Steering wheel - removal and refitting                      | 9                    |
| Manual steering gear assembly - removal, overhaul and refitting | 12                | Track-rod end - removal and refitting                       | 17                   |
| Power steering fluid level check                                | See Weekly checks | Wheel alignment and steering angles - general information   | 18                   |
| Power steering gear assembly - removal and refitting            | 13                | Wheel and tyre maintenance and tyre pressure checks         | See Weekly checks    |
| Power steering hydraulic system - bleeding                      | 15                |                                                             |                      |

### Degrees of difficulty

|                                                          |                                                                                   |                                                                 |                                                                                   |                                                               |                                                                                   |                                                          |                                                                                     |                                                                 |                                                                                     |
|----------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------|-----------------------------------------------------------------------------------|---------------------------------------------------------------|-----------------------------------------------------------------------------------|----------------------------------------------------------|-------------------------------------------------------------------------------------|-----------------------------------------------------------------|-------------------------------------------------------------------------------------|
| <b>Easy</b> , suitable for novice with little experience |  | <b>Fairly easy</b> , suitable for beginner with some experience |  | <b>Fairly difficult</b> , suitable for competent DIY mechanic |  | <b>Difficult</b> , suitable for experienced DIY mechanic |  | <b>Very difficult</b> , suitable for expert DIY or professional |  |
|----------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------|-----------------------------------------------------------------------------------|---------------------------------------------------------------|-----------------------------------------------------------------------------------|----------------------------------------------------------|-------------------------------------------------------------------------------------|-----------------------------------------------------------------|-------------------------------------------------------------------------------------|

### Specifications

#### Front suspension

|      |                                                                                                                                               |
|------|-----------------------------------------------------------------------------------------------------------------------------------------------|
| Type | Independent, incorporating transverse lower wishbones and coil spring-over-telescopic damper strut units. Anti-roll bar fitted to all models. |
|------|-----------------------------------------------------------------------------------------------------------------------------------------------|

#### Rear suspension

|      |                                                                                    |
|------|------------------------------------------------------------------------------------|
| Type | Independent, incorporating trailing arms with telescopic dampers and coil springs. |
|------|------------------------------------------------------------------------------------|

#### Steering

|                     |                                                               |
|---------------------|---------------------------------------------------------------|
| Type                | Rack-and-pinion, manual or power assisted, depending on model |
| Turns lock-to-lock: |                                                               |
| Manual              | 4.4 approx.                                                   |
| Power assisted      | 2.9 approx.                                                   |
| Toe setting (front) | 0° (parallel) $\pm$ 1°                                        |

#### Roadwheels and tyres

See Weekly checks

#### Torque wrench settings

|                                                    | Nm  | lbf ft |
|----------------------------------------------------|-----|--------|
| <b>Front suspension</b>                            |     |        |
| Anti-roll bar bush bracket bolts                   | 30  | 22     |
| Driveshaft nut:                                    |     |        |
| All models except turbo diesel (M22 plain)         | 240 | 177    |
| Turbo diesel (M24 with staking and captive washer) | 280 | 207    |
| Lower arm balljoint to hub carrier                 | 30  | 22     |
| Lower arm front bush securing bolt                 | 95  | 70     |
| Lower arm rear bush securing bolt                  | 70  | 52     |
| Suspension strut damper nut                        | 60  | 44     |
| Suspension strut to hub carrier                    | 70  | 52     |
| Suspension strut to inner wing                     | 50  | 37     |



## Torque wrench settings (continued)

|                                                        | Nm  | lbf ft |
|--------------------------------------------------------|-----|--------|
| <b>Rear suspension</b>                                 |     |        |
| Damper lower securing bolt                             | 95  | 70     |
| Damper upper securing bolt                             | 60  | 44     |
| Handbrake cable support bracket-to-trailing arm screws | 15  | 11     |
| Hub nut                                                | 280 | 207    |
| Trailing arm securing bolt                             | 150 | 111    |
| <b>Steering</b>                                        |     |        |
| Ignition switch/steering column lock securing bolts    | 4   | 3      |
| Steering column mounting bolts                         | 55  | 41     |
| Steering gear mounting bolts                           | 70  | 52     |
| Steering wheel nut*                                    | 50  | 37     |
| Subframe-to-body bolts                                 | 110 | 81     |
| Track-rod end to hub carrier                           | 40  | 30     |
| Universal joint clamp bolts                            | 20  | 15     |
| <b>Roadwheels</b>                                      |     |        |
| Roadwheel bolts                                        | 85  | 63     |

\* Use a new nut

## 1 General information

## Front suspension

The front suspension is independent, comprising transverse lower wishbones, coil spring-over-damper strut units and an anti-roll bar. The hub carriers are bolted to the base of the strut units and are linked to the lower arms by means of balljoints. The entire front suspension assembly is mounted on a subframe, which is in turn bolted to the vehicle body.

## Rear suspension

The rear suspension incorporates a torsion beam axle, trailing arms, coil springs and separate telescopic dampers. In addition, a rear anti-roll bar is fitted to certain models. The components form a discrete sub-assembly which can be unbolted from the underside of the vehicle separately or as a complete unit.

## Steering

The two-piece steering shaft runs in a tubular column assembly, which is bolted to a bracket mounted on the vehicle's bulkhead. The shaft is articulated at its lower end by means of a universal joint, which is clamped to the steering shaft and the steering gear pinion by means of clamp bolts.

The steering gear is mounted on the engine compartment bulkhead, and is connected to the steering arms projecting rearwards from the hub carriers. The track-rod ends are fitted with balljoints at their inner and outer ends, to allow for suspension movement, and are threaded to facilitate adjustment.

Hydraulically-assisted power steering is fitted to some models. The hydraulic system is powered by a belt-driven servo pump, which is driven from the crankshaft pulley.

Certain models are fitted with an airbag system. Sensors built into the vehicle body are triggered in the event of a front end collision and prompt an Electronic Control Unit (ECU) to activate the airbag, mounted in the centre of the steering wheel and the fascia. This reduces the risk of the front seat occupants striking the steering wheel, windscreen or fascia during an accident.



**Warning:** For safety reasons, owners are strongly advised to entrust to an authorised Fiat dealer any work which involves disturbing the airbag system components. The airbag inflation devices contain explosive material and legislation exists to control their handling and storage. In addition, specialised test equipment is needed to check that the airbag system is fully operational following reassembly.

## 2 Front hub bearings - renewal



**Note:** A balljoint separator tool, and a press or suitable alternative tools (see text) will be required for this operation. The bearing will be destroyed during the removal procedure.

## Removal

1 Chock the rear wheels, apply the handbrake, then jack up the front of the vehicle and support on axle stands (see *Jacking and vehicle support*). Remove the appropriate roadwheel.

2 Remove the brake disc and caliper, with reference to Chapter 9. Note that the caliper body can remain bolted to its bracket: there is no need to disconnect the brake fluid hose from the caliper.

3 With reference to Chapter 8, slacken and remove the driveshaft hub nut.

4 On models with ABS, unbolt the ABS wheel sensor, and remove the screw securing the

ABS sensor wiring to the hub carrier. Suspend the sensor away from the working area, to avoid the possibility of damage.

5 With reference to Section 17, separate the track-rod end from the hub carrier, using a suitable balljoint splitter.

6 Remove the two nuts from the bolts securing the hub carrier to the base of the suspension strut (refer to Section 3). Withdraw the bolts and separate the top of hub carrier from the strut.

7 Disconnect the outboard end of the driveshaft from the hub, as described during the driveshaft removal and refitting procedure in Chapter 8. **Note:** There is no need to disconnect the inboard end of the driveshaft from the transmission.

**Caution:** Do not allow the end of the driveshaft to hang down under its own weight, as this places strain on the CV joints; support the end of the shaft using wire or string.

8 Slacken and remove the nut and clamp bolt, then push the lower arm down and separate the balljoint from the base of the hub carrier (see illustrations).

9 At this stage, it is recommended that the hub carrier be taken to a engineering workshop, as the hub and bearing should ideally be removed from the hub carrier using a hydraulic press.



2.8a ... Slacken and remove the nut ...



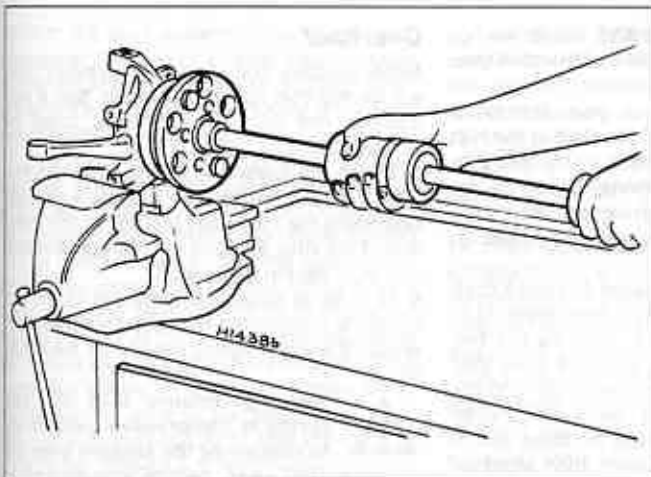
2.8b ... and clamp bolt ...



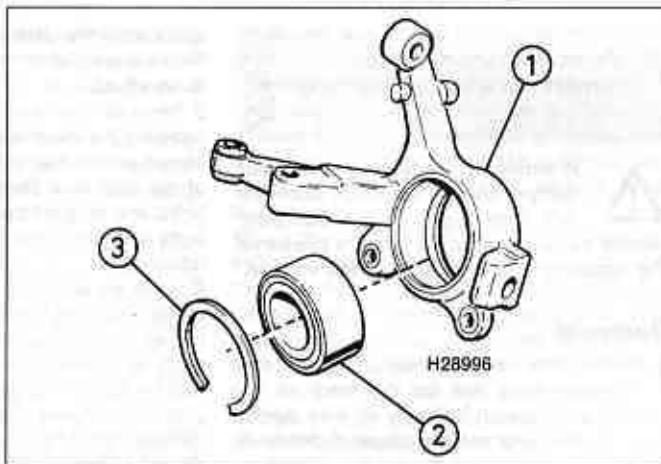
2.8c ... then push the lower arm down and separate the balljoint from the base of the hub carrier



2.8d View of front suspension components with hub carrier removed



2.10 Using a slide hammer to extract the hub



2.11 Wheel bearing components

1 Hub carrier

2 Wheel bearing

3 Circlip

Owners wishing to attempt the work themselves should proceed as follows.

10 Mount the hub carrier firmly in a bench vice. Attach a slide hammer to the hub flange and extract the hub, together with the inner bearing race, if it has remained attached to the hub. Unbolt and remove the heat shield (see illustration).

11 Mount the hub carrier horizontally in the vice, then remove the bearing retaining circlip. Using a suitable length of tubing as a drift, drive the bearing outer race from the carrier (see illustration). Note that a flange on the outboard side of the carrier means that the bearing can only be driven out in one direction.

12 Support the inner bearing race, if it has remained attached to the hub, then press or drive the hub from the race. Alternatively, pull the bearing race from the hub using a suitable two or three-legged puller.

13 Before installing the new bearing, thoroughly clean the bearing location in the hub carrier.

14 Fit the new bearing from the inboard side the hub; press or drive the bearing into position, applying pressure only to the bearing outer race. Do not lubricate the mating surface of the bearing in an attempt to ease installation.

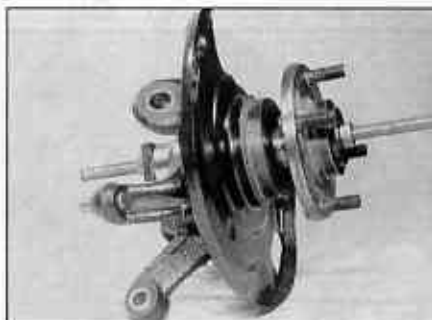
15 Fit the bearing retaining circlip to its groove in the hub carrier, then refit the heat

shield and tighten the retaining screw securely.

16 Support the outer face of the hub carrier across the jaws of a bench vice.

17 Carefully press or draw the hub into the bearing, noting that the bearing inner race must be supported during this operation, to prevent it from being separated from the outer race. This can be achieved using a suitable socket, threaded rod, washers and a length of bar (see illustration).

18 On completion, check that the hub rotates freely in the hub carrier without resistance or roughness.



2.17 Typical method of drawing the hub into the wheel bearing using improvised tools

### Refitting

19 Reconnect the outboard end of the driveshaft to the hub as described in Chapter 8. Ensure that the driveshaft nut is tightened to the correct torque and adequately staked. Ideally, for safety reasons due to the very high torque of the driveshaft nut, carry out final tightening and staking of the nut after refitting the roadwheel and lowering the car to the ground.

20 Reconnect the hub carrier to the lower arm balljoint, then fit a new clamp bolt nut. Tighten the nut to the specified torque.

21 Engage the hub carrier with the suspension strut, then refit the securing bolts and nuts, tightening them to the specified torque.

22 Reconnect the steering track-rod balljoint to the hub carrier steering arm. Use a new nut and tighten it to the specified torque.

23 Refer to Chapter 9 and refit the brake disc and caliper.

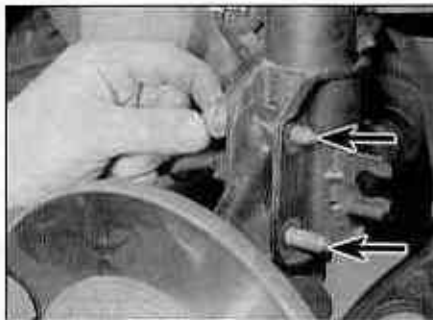
24 Where applicable, fit the ABS wheel sensor into its mounting hole and tighten the securing screw.

25 Refit the roadwheel, and lower the vehicle to the ground.

26 Have the front wheel alignment checked by a Flat dealer or a tyre specialist at the earliest opportunity.



3.2 Release the brake fluid line (and where applicable, the pad wear/ABS sensor wiring) from the strut



3.3a Remove the two bolts (arrowed) . . .



3.3b . . . and detach the lower end of the strut from the hub carrier

### 3 Front suspension strut - removal, overhaul and refitting



**Warning:** If renewing the strut damper during overhaul, both the left and right hand dampers should be renewed as a pair, to preserve the handling characteristics of the vehicle.

#### Removal

1 Chock the rear wheels, apply the handbrake, then jack up the front of the vehicle and support securely on axle stands (see *Jacking and vehicle support*). Remove the relevant roadwheel.

2 Release the brake fluid line (and where

applicable, the pad wear/ABS sensor wiring) from the bracket on the base of the strut (see illustration).

3 Remove the two nuts from the bolts securing the lower end of the strut to the hub carrier, noting that the nuts fit on the rear side of the strut (see illustrations). Withdraw the bolts, and support the hub carrier. Discard the bolts and nuts - new ones should be used on refitting.

4 Have an assistant support the strut from underneath the wheel arch then, working in the engine compartment, unscrew the two bolts and release the two stud clips that secure the strut upper mounting plate to the suspension turret. *Do not unscrew the centre damper rod nut yet.* Release the lower end of the strut from the hub carrier, then withdraw the assembly from under the wheel arch.

#### Overhaul

**Note:** Suitable coil spring compressor tools will be required for this operation, and a new damper rod top nut must be used on reassembly.

5 Clamp the lower end of the strut in a vice fitted with jaw protectors - take care to avoid deforming the mounting bracket at the lower end of the strut. Remove the protective plastic cap from the top of the strut.

6 Fit suitable spring compressors to the coil spring, and compress the spring sufficiently to enable the upper spring seat to be turned by hand.

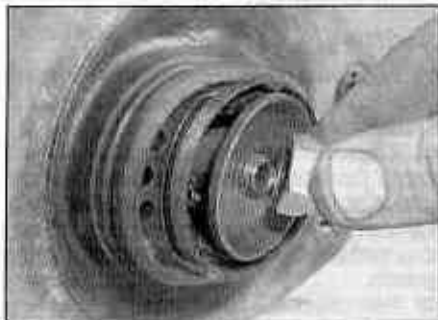


**Warning:** Ensure that the coil spring is compressed sufficiently to remove all the tension from the upper spring seat, before attempting to remove the damper rod nut.

7 Fully unscrew and remove the damper rod top nut. Counterhold the damper rod, using a suitable Allen key or hex bit, as the nut is unscrewed - do not allow the rod to rotate inside the damper (see illustration). Discard the nut - a new one must be used on reassembly.

8 Withdraw the washer, bush, upper mounting plate and upper spring seat - make a careful note of the order of assembly (see illustrations).

9 Withdraw the spring, complete with the compressors, then withdraw the dust cover, bump rubber and the lower spring seat rubber (where fitted) (see illustrations).



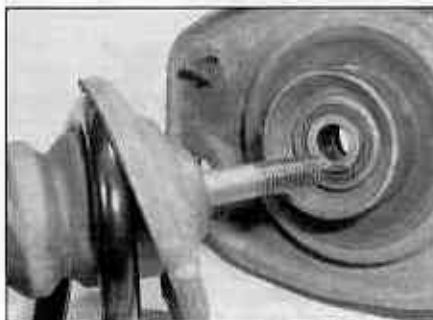
3.7 Fully unscrew and remove the damper rod top nut



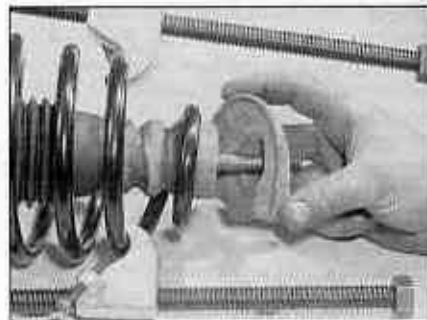
3.8a Withdraw the washer . . .



3.8b . . . bush . . .

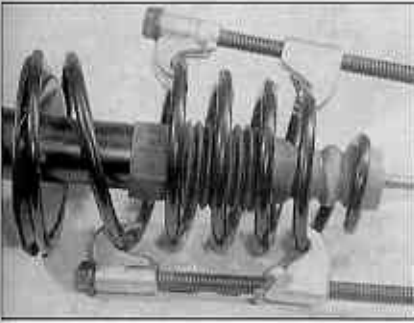


3.8c . . . upper mounting plate . . .



3.8d . . . and upper spring seat

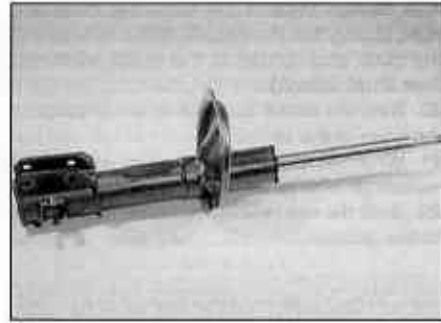




3.9a Withdraw the coil spring, complete with the compressors . . .



3.9b . . . then withdraw the dust cover and bump rubber



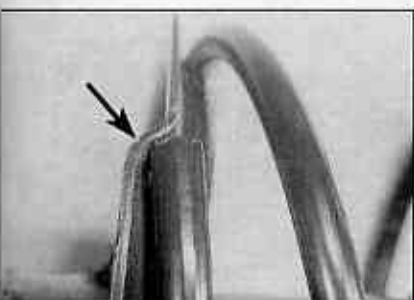
3.9c Fully dismantled strut

10 With the strut assembly now dismantled, examine all the components for wear, damage or deformation. Check the rubber components for deterioration. Renew any of the components as necessary.

11 Examine the damper for signs of fluid leakage. Check the damper rod for signs of pitting along its entire length, and check the strut body for signs of damage. While holding it in an upright position, test the operation of the strut by moving the damper rod through a full stroke, and then through short strokes of 50 to 100 mm. In both cases, the resistance felt should be smooth and continuous. If the resistance is jerky, or uneven, or if there is any visible sign of wear or damage to the strut, renewal is necessary. Note that the damper cannot be renewed independently, and if leakage, damage or corrosion is evident, the complete strut/damper assembly must be renewed (in which case, the spring, upper mounting components, bushes, and associated components can be transferred to the new strut).

12 If any doubt exists about the condition of the coil spring, carefully remove the spring compressors, and check the spring for distortion and signs of cracking. Renew the spring if it is damaged or distorted, or if there is any doubt about its condition.

**Warning:** Coil springs are classified by their height when under load - this is indicated by a coloured paint marking on the side of the



3.14 Ensure that the lower end of the spring is correctly located in the recess (arrowed) on the lower spring seat

coil windings (either green or yellow). All coil springs fitted to the vehicle must be of the same classification to ensure the correct ride height.

13 Clamp the strut body in a vice, as during dismantling, then refit the lower spring seat rubber (where fitted), dust cover and bump rubber.

14 Ensure that the coil spring is compressed sufficiently to enable the upper mounting components to be fitted, then fit the spring over the damper rod, ensuring that the lower end of the spring is correctly located in the recess on the lower spring seat (see illustration).

15 Refit the upper spring seat and upper mounting plate ensuring that the top end of

the spring is correctly located on the upper spring seat. Note that when the strut is reassembled, the orientation marking on the upper rubber mounting must be positioned in relation to the metal section of the upper mounting plate as shown, to maintain the correct front wheel castor setting (see illustration).

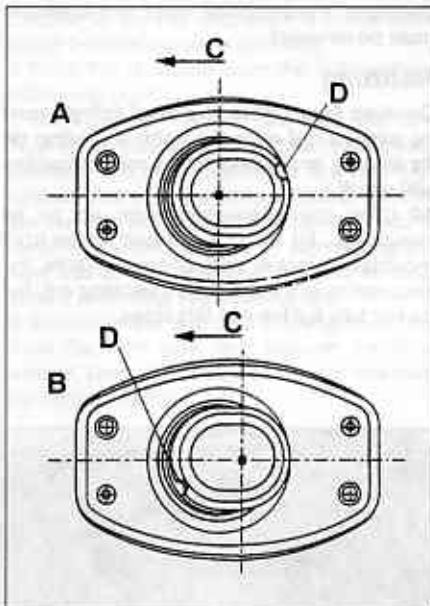
16 Fit the new damper rod top nut together with its washer and bush, then tighten the nut to the specified torque, counterholding the damper rod in a manner similar to that used during dismantling. Note that a suitable crows-foot adapter will be required to tighten the damper rod top nut to the specified torque.

17 Remove the spring compressors. Where applicable, refit the protective plastic cap over the damper rod top nut.

### Refitting

18 Manoeuvre the strut assembly into position under the wheel arch, passing the locating stud clip through the holes in the body turret. Note that when the strut is refitted, the orientation marking on the upper mounting plate rubber mounting must be positioned in relation to the vehicle as shown, to maintain the correct front wheel castor setting - refer to illustration 3.15. Fit the upper mounting bolts, and tighten them to the specified torque (see illustration).

19 Engage the lower end of the strut with the



3.15 Correct positioning of the suspension strut upper mounting components

- A Left hand mounting for vehicles with manual steering
- B Left hand mounting for vehicles with power-assisted steering
- C To front of vehicle
- D Orientation marking



3.18 Fit the strut upper mounting bolts, and tighten them to the specified torque

hub carrier, then fit the securing bolts and nuts, noting that the nuts fit on the rear side of the strut, and tighten to the specified torque (see illustrations).

20 Refit the brake fluid line to the bracket on the base of the strut.

21 Where applicable, press the ABS wheel sensor wiring into its retaining bracket.

22 Refit the roadwheel, and lower the vehicle to the ground.

#### 4 Front suspension lower arm - removal and refitting

##### Removal

1 Chock the rear wheels, apply the handbrake, then jack up the front of the vehicle and support securely on axle stands (see *Jacking and vehicle support*). Remove the relevant roadwheel.

2 Unscrew the bolts securing the anti-roll bar mountings to the suspension lower arms on either side of the vehicle. Similarly, unscrew the bolts securing the anti-roll bar mountings to the suspension sub-frame (see illustrations). Allow the ends of the anti-roll bar to pivot away from the suspension lower arms.

3 With reference to Section 2, unscrew the nut, withdraw the clamp bolt and lever the end of the suspension lower arm down to release it from the base of the hub carrier.



4.2a Unscrew the bolts (arrowed) securing the anti-roll bar mountings to the suspension lower arms ...



4.2b ... and the suspension sub-frame (arrowed)



3.19a Fit the securing bolts, noting that the nuts fit on the rear side of the strut ...



3.19b ... and tighten them to the specified torque

4 Unscrew the two bolts and detach the suspension arm rear mounting bracket from the subframe (see illustration).

5 Slacken and remove the nut from the through-bolt at the lower arm front mounting (see illustration). Withdraw the bolt.

6 Withdraw the suspension lower arm from under the vehicle.

7 With the lower arm removed, examine the lower arm itself, and the mounting bushes, for wear, cracks or damage.

8 Check the balljoint for wear, excessive play, or stiffness. Also check the balljoint dust boot for cracks or damage.

9 The mounting bushes and balljoint assembly are integral with the lower arm, and cannot be renewed independently. If either the bushes or the balljoint are worn or damaged, the complete lower arm assembly must be renewed.

##### Refitting

**Caution:** Final tightening of all fixings must be carried out with the vehicle resting on its wheels, or damage to the rubber bushes will result.

10 Offer the suspension arm up to its mountings. Fit the through-bolt to the front mounting bracket and engage it with the suspension arm bush. Fit the securing nut, but do not fully tighten it at this stage.



4.4 Unscrew the two bolts (arrowed) and detach the suspension arm rear mounting bracket from the subframe

11 Bolt the rear mounting bracket to the subframe, but do not fully tighten the bolts at this stage.

12 Engage the lower arm balljoint with the hub carrier, then refit the balljoint clamp bolt and nut. Do not fully tighten the nut at this stage.

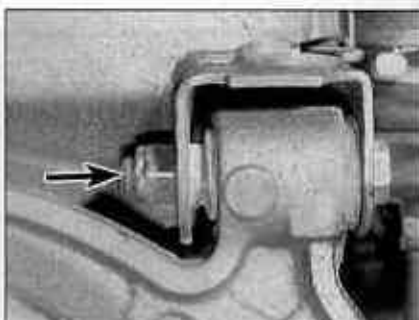
13 Raise the anti-roll bar into position, then bolt the mounting brackets to the subframe. The anti-roll bar must be pre-loaded before its outer mounting brackets can be bolted to the suspension arms. Do this by raising the ends of the anti-roll bar with a trolley jack and holding them in this position whilst the bracket mounting bolts are inserted and hand tightened. Do not fully tighten the bolts at this stage. Line up the holes at the ends of the anti-roll bar with those on the suspension lower arm.

14 Refit the roadwheel, and lower the vehicle to the ground.

15 Make sure that the vehicle is parked on level ground, then release the handbrake. Roll the vehicle backwards and forwards, and bounce the front of the vehicle to settle the suspension components.

16 Chock the wheels, then tighten all the anti-roll bar and suspension arm mounting nuts and bolts to the specified torque.

17 On completion the front wheel alignment should be checked by a Fiat dealer.



4.5 Slacken and remove the nut (arrowed) from the through-bolt at the lower arm front mounting

## 5 Front suspension lower arm balljoint - renewal



The balljoint is integral with the suspension lower arm (see illustration). If the balljoint is worn or damaged, the complete lower arm must be renewed as described in Section 4.

## 6 Front suspension anti-roll bar - removal and refitting



### Removal

- 1 Chock the rear wheels, apply the handbrake, then jack up the front of the vehicle and support securely on axle stands (see *Jacking and vehicle support*). If required, remove the relevant roadwheels.
- 2 Refer to the Chapter 4D and unbolt the front section of the exhaust pipe.
- 3 Unscrew the bolts securing the anti-roll bar mountings to the suspension lower arms on either side of the vehicle. Similarly, unscrew the bolts securing the anti-roll bar mountings to the suspension sub-frame (refer to the illustrations in Section 4).
- 4 Lower the anti-roll bar away from the underside of the vehicle.
- 5 Inspect the rubber bushes for cracks or deterioration. If renewal is necessary, slide the old bushes from the bar, and fit the new items, using soapy water as a lubricant. Do not apply grease or oil as this will attack the rubber.
- 6 Check the anti-roll bar for signs of damage, wear or serious corrosion.

### Refitting

- 7 Refitting is a reversal of removal, bearing in mind the following points:
  - a) Line up the holes at the ends of the anti-roll bar with those on the suspension lower arm.
  - b) Tighten all fixings to the specified torque, but do not do this until the vehicle is resting on its roadwheels, and the suspension has been settled, or damage to the bushes may result.



5.1 Front suspension lower arm balljoint

## 7 Rear hub bearings - renewal



**Note:** The bearing will be destroyed during the removal operation, and a new rear hub/bearing assembly must be used on refitting - the old hub cannot be re-used. A new rear hub nut must be used on refitting.

- 1 The rear hub bearings are integral with the hubs themselves, and cannot be renewed separately. If the bearings require renewal, the complete hub assembly must be renewed as follows.
  - 2 Chock the front wheels, then jack up the rear of the vehicle and support securely on axle stands (see *Jacking and vehicle support*). Remove the appropriate rear roadwheel.
  - 3 Remove the brake drum as described in Chapter 9. Do not depress the brake pedal whilst the brake drum is removed.
  - 4 Prise the dust cap from the hub, using a mallet and punch.
  - 5 Slacken and remove the hub nut and recover the washer/spacers (see illustration).
- Caution:** The nut is tightened to a very high torque. Use a long extension bar to remove the nut and ensure that you have access to torque wrench capable of tightening the new nut to the specified torque setting, before removing the existing nut.
- 6 Withdraw the hub and bearing assembly from the stub axle, and recover the inner washer. Discard the hub nut - a new one must be used on refitting.

7 Thoroughly clean the stub axle, then slide the inner washer and new hub assembly into position.

8 Fit the outer washer, then thread a new hub nut onto the end of the stub axle by hand - do not fully tighten the nut at this stage.

9 Refit the brake drum (Chapter 9).

10 Tighten the hub nut to the specified torque, then check that the hub spins smoothly and freely. Carefully tap the dust cap into position over the nut.

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

## 8 Rear suspension components - removal, overhaul and refitting



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

### Damper

#### Removal

- 2 Using a trolley jack positioned under the trailing arm, raise the trailing arm to take the strain from the damper.
- 3 Slacken and withdraw the damper lower retaining bolt (see illustration).
- 4 Lower the jack and allow the damper to separate from the trailing arm. Take care to avoid displacing the coil spring.
- 5 Slacken and withdraw the damper upper retaining bolt (see illustration).
- 6 Lower the damper away from the suspension subframe.

#### Refitting

7 Refitting is a reversal of removal. Tighten the damper upper and lower retaining bolts to the specified torque, but delay this operation until the full weight vehicle is resting on the roadwheels - this prevents the damper bushes from being strained.

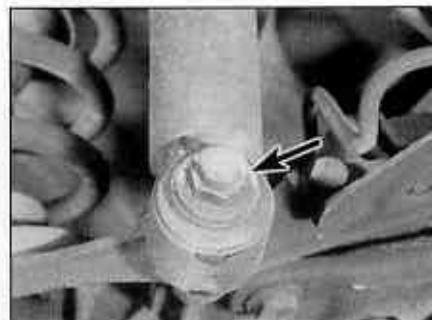
### Coil spring

#### Removal

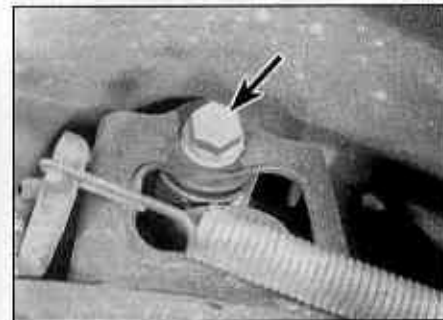
8 With reference to the previous sub-Section,



7.5 Slacken and remove the rear hub nut



8.3 Slacken and withdraw the damper lower retaining bolt (arrowed)



8.5 Slacken and withdraw the damper upper retaining bolt (arrowed)





9.1 Prise the horn centre pad from the steering wheel hub

unbolt the lower end of the damper from the trailing arm.

9 Lower the trailing arm gradually using a trolley jack, until the coil spring is released from its lower seat on the trailing arm and its upper seat on the subframe. Make a note of the orientation of the coil spring, to aid correct refitting later.

#### Refitting

10 Refitting is a reversal of removal. Tighten the damper lower retaining bolt to the specified torque.

#### Trailing arm

**Note:** The rear stub axles are integral with the trailing arm assemblies and cannot be renewed separately.

#### Removal

11 With reference to Chapter 9, carry out the following:

- Remove the brake drum, shoes and adjuster assembly.
- Unbolt the brake hose union from the rear of the wheel cylinder.
- Unbolt the brake pipe mounting bracket from the trailing arm.

12 Refer to Section 7 and remove the rear hub and bearing assembly.

13 With reference to the relevant sub-Section, unbolt the lower end of the damper from the trailing arm.

14 Raise the trailing arm using a trolley jack so that the coil spring is compressed, then slacken and withdraw the trailing arm front mounting bolt.

15 With reference to the previous sub-Section, gradually lower the trailing arm using a trolley jack and remove the coil spring.

16 Allow the trailing arm to hang down, then pull the leading edge of the arm down from its mounting bracket.

#### Refitting

17 Refitting is a reversal of removal. Tighten all suspension fixings to the specified torque settings, but delay this operation until the full weight vehicle is resting on the roadwheels - this prevents the damper and trailing arm bushes from being strained.

18 On completion, bleed the brake hydraulic system and adjust the operation of the handbrake, with reference to Chapter 9.



9.2 Unplug the wiring from the centre pad at the connector(s)

### 9 Steering wheel - removal and refitting

**Note:** This procedure does not apply to vehicles fitted with an airbag

**Warning:** For safety reasons, owners are strongly advised to entrust to an authorised Fiat dealer any work which involves disturbing the airbag system components. The airbag inflation devices contain explosive material and legislation exists to control their handling and storage. In addition, specialised test equipment is needed to check that the airbag system is fully operational following reassembly.

#### Removal

1 Ensure that the ignition is switched off, then prise the horn centre pad from the steering wheel hub. Use the blade of a screwdriver, padded with PVC tape to protect the steering wheel (see illustration)

2 Unplug the horn and (where applicable) radio/cassette control switch wiring from the centre pad at the connector(s) (see illustration).

3 Turn the steering wheel to its centre position, so that the roadwheels are pointing straight ahead.

4 Make alignment marks between the steering wheel and the end of the steering column shaft, to aid correct refitting later.

5 Relieve the staking and then slacken and remove the steering wheel securing nut (see



9.5 Slacken and remove the steering wheel securing nut

illustration). Discard the nut as a new item must be used on refitting.

6 Lift the steering wheel off the column splines. If it is tight, tap it near the centre, using the palm of your hand, or twist it from side to side, whilst pulling upwards to release it from the shaft splines. If the wheel is particularly tight, a suitable puller should be used.

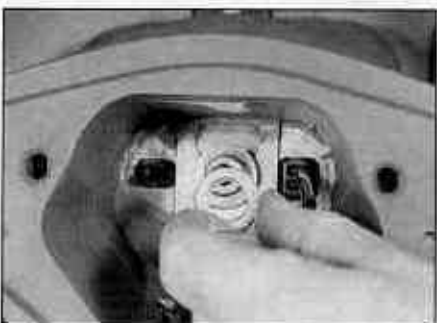
#### Refitting

7 Before commencing refitting, lightly coat the surfaces of the direction indicator cancelling mechanism with grease.

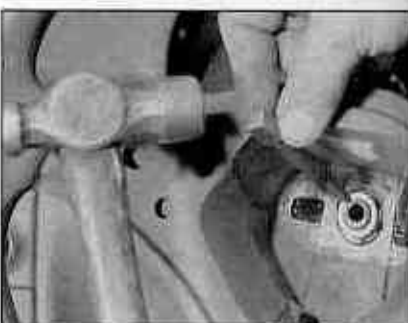
8 Refitting is a reversal of removal, bearing in mind the following points:

- Use a new steering wheel securing nut and tighten it to the specified torque. Ensure that its outer collar is adequately staked to the column shaft using a hammer and punch (see illustrations).
- Ensure that the direction indicator switch is in the central (cancelled/off) position, otherwise the switch may be damaged as the wheel is refitted.
- Align the marks made on the wheel and the steering column shaft during removal.

9 Note that if necessary, the position of the steering wheel on the column shaft can be altered in order to centralise the wheel (ensure that the front roadwheels are pointing in the straight-ahead position), by moving the wheel the required number of splines on the shaft. Fine adjustment can be carried out by adjusting the length of both track-rod simultaneously, but this operation is best entrusted to a Fiat dealer or tyre specialist.



9.8a Fit a new steering wheel securing nut...



9.8b ... and stake it to the steering column shaft using a hammer and punch



10.3 Unplug the multi-way wiring connector from the rear of the lock assembly

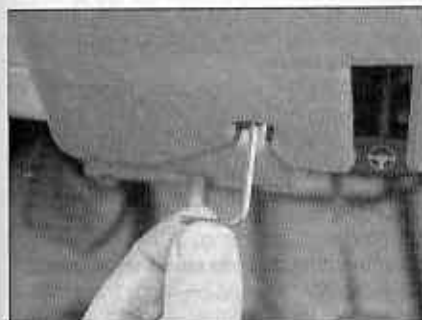
## 10 Ignition switch/steering column lock - removal and refitting



**Caution:** The ignition switch/steering column lock has an integral anti-theft mechanism. Any attempt to rotate the lock shaft using tools (ie without using the correct key) results in the steering column being locked and irreparable damage to the lock mechanism. This renders the vehicle unusable until the lock assembly is renewed.

### Removal

- 1 Disconnect the battery negative terminal (refer to *Disconnecting the battery* in the Reference Section of this manual).
- 2 Remove the lower section of the steering column shroud.



11.3a Unscrew the fixings using an Allen key ...



11.3b ... and remove the upper and lower halves of the plastic shroud from the steering column



10.4 On vehicles fitted with a Fiat immobiliser, unclip the receiver ring from the lock cylinder

- 3 Unplug the multi-way wiring connector from the rear of the lock assembly (see illustration).
- 4 On vehicles fitted with a Fiat immobiliser, unclip the receiver ring from the lock cylinder (see illustration). Insert the key into the ignition switch and turn it to the ON position.
- 5 Working underneath the steering column, insert a small flat bladed screwdriver into the access slot in the base of the lock assembly bracket. Depress the release button and withdraw the lock assembly from its bracket, complete with the key (see illustrations).

### Refitting

- 6 To refit the lock, first insert the key and turn it to the ON position. Depress the release button slide the assembly into the retaining bracket until the release button clicks into the access slot.
- 7 Turn the key back to the OFF position, then reconnect the wiring connector.
- 8 Refit the steering column lower shroud.
- 9 Reconnect the negative cable to the battery terminal.

## 11 Steering column - removal, overhaul and refitting



### Removal

- 1 Disconnect the battery negative terminal (refer to *Disconnecting the battery* in the Reference Section of this manual).
- 2 Remove the steering wheel (Section 9).



11.6 Slacken the nut (arrowed) and clamp bolt on the lower half of the universal joint

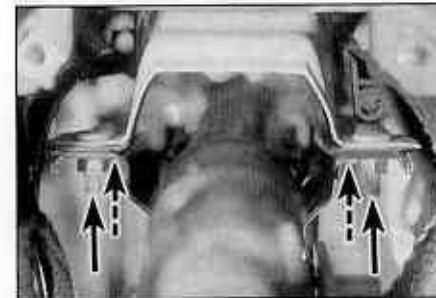


10.5a Insert a small, flat-bladed screwdriver into the access slot in the base of the lock assembly bracket

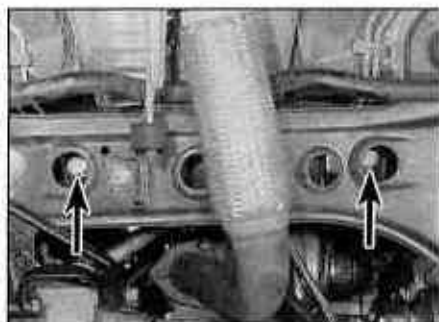


10.5b Depress the release button and withdraw the lock cylinder

- 3 Unscrew the fixings using an Allen key and remove the upper and lower halves of the plastic shroud from the steering column (see illustrations).
- 4 Working as described in Chapter 12, Section 14, remove the column stalk switch assembly.
- 5 Unplug the wiring from the rear of the ignition switch/column lock at the multi-way connector - refer to Section 10 for details.
- 6 Working in the drivers footwell, peel back the carpet trim to gain access to the base of the steering column. Slacken the nut and clamp bolt on the lower half of the universal joint (see illustration).
- 7 Remove the nuts from the four upper steering column mounting bolts and lower the assembly away from the bulkhead bracket (see illustration).



11.7 Remove the nuts from the four upper steering column mounting bolts (two arrowed, two concealed)



**12.8** Slacken and remove the two steering gear-to-subframe bolts (arrowed)

8 Disconnect the universal joint at the base of the steering column from the steering gear pinion. Note the position of the safety clip - this must be refitted in the same position on reassembly.

9 Remove the steering column from the vehicle.

### Overhaul

10 The height adjustment mechanism can be removed by removing the nut from the end of the pivot shaft and withdrawing it.

11 The upper and lower bushes are held in position by staking at the ends of the column tube. Relieve the staking using a mallet and punch to extract the bushes.

12 Check for excessive radial and axial play in the universal joints at both ends of the lower steering column. The lower section of the steering column may be renewed separately if required, by slackening the clamp bolt and detaching it from the upper section.

13 If the vehicle has been involved in an accident, check for deformation in all of the steering column components, particularly the mounting bracket and centre tube. Renew as required.

### Refitting

14 Refitting the steering column is by following the removal procedure in reverse. Tighten all fixings to the specified torque setting.

## 12 Manual steering gear assembly - removal, overhaul and refitting

### Removal

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

2 Disconnect the battery negative terminal (refer to *Disconnecting the battery* in the Reference Section of this manual).

3 With reference to Section 11, slacken the clamp bolt at the base of steering column lower universal joint, to separate it from the steering gear pinion.



**12.9** Unbolt the rear engine mounting-to-subframe bolts (arrowed)

4 Remove the safety clip from the steering gear pinion, noting its fitted position to aid correct refitting later. Lift off the sound insulating pad.

5 Refer to Section 17 and detach the track-rod end balljoints from the hub carriers, using a balljoint splitter.

6 Working underneath the vehicle, remove the clips and detach the gear selection cable and the reverse gear inhibitor cable from the steering gear.

7 Detach the gear selector rod from the top of the steering gear.

8 Slacken and remove the two steering gear-to-subframe bolts (see illustration).

9 Support the underside of the transmission using a trolley jack, then unbolt the rear engine mounting-to-subframe bolts (see illustration).

10 With reference to Chapter 4D, unbolt the front section of the exhaust pipe from the catalytic converter.

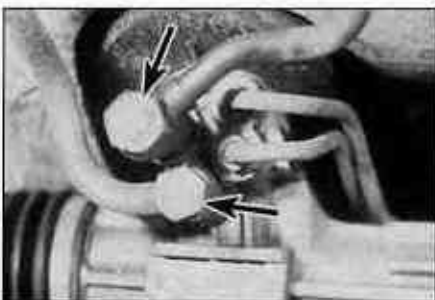
11 Unclip the plastic steering gear pinion cup from the bulkhead.

12 Withdraw the steering gear through the wheel arch.

### Refitting

13 Refitting is a reversal of removal, noting the following:

- Tighten all fixings to the specified torque settings.
- On completion, have the front wheel alignment checked at the earliest opportunity by a Fiat dealer or a tyre specialist.



**13.10** Disconnect the fluid delivery and return pipes (arrowed) from the power steering gear

## 13 Power steering gear assembly - removal and refitting

### Removal

1 Chock the rear wheels, apply the handbrake, then jack up the front of the vehicle and support securely on axle stands (see *Jacking and vehicle support*). Remove both front roadwheels to improve access.

2 Disconnect the battery negative terminal (refer to *Disconnecting the battery* in the Reference Section of this manual).

3 With reference to Section 11, slacken the clamp bolt at the base of steering column lower universal joint, to separate it from the steering gear pinion.

4 Remove the safety clip from the steering gear pinion, noting its fitted position to aid correct refitting later. Lift off the sound insulating pad.

5 Refer to Section 17 and detach the track-rod end balljoints from the hub carriers, using a balljoint splitter.

6 Working underneath the vehicle, remove the clips and detach the power steering fluid pipe from the steering gear casing.

7 With reference to Chapter 4D, unbolt the front section of the exhaust pipe from the manifold and catalytic converter/intermediate silencer (as applicable).

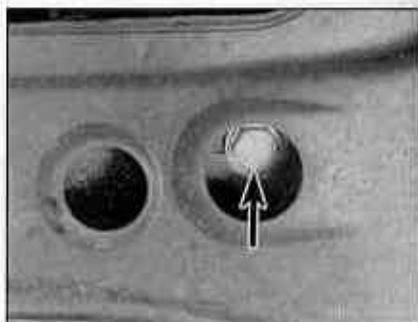
8 Refer to Chapter 7A and disconnect the gear selector rod from the relay rod. Disconnect the relay rod from the mounting on the top of the steering gear casing.

9 Drain as much fluid as possible from the power steering reservoir, using a pipette or an old poultry baster.

10 Slacken the unions and disconnect the fluid delivery and return pipes from the power steering gear. Be prepared for an amount of fluid loss - position a container underneath the unions and pad the surrounding area with absorbent rags (see illustration).

11 Slacken and remove the two steering gear-to-subframe bolts (see illustrations).

12 Support the engine and transmission assembly using either blocks of wood positioned under the transmission casing, or a lifting beam positioned across the engine bay



**13.11a** Slacken and remove the right-hand ...





13.11b ... and left-hand steering gear-to-subframe bolts

hooked onto the engine lifting eyelet on the cylinder head. Working underneath the vehicle, unbolt and remove the transmission-to-subframe rear mounting bracket.

13 Position a trolley jack under the right hand side of the subframe crossmember. Raise the jack to take the weight of the crossmember and the attached components.

14 With reference to Section 4, slacken and remove the two bolts that secure the suspension lower arm rear bush to the subframe. Slacken and withdraw the subframe-to-bodywork bolt, located adjacent to the rear of the suspension lower arm. Thread two flange head bolts of the same thread size, but approximately 25 mm longer into the vacated holes, then carefully lower the trolley jack and allow the subframe to rest on the heads of the temporary bolts (see illustration).

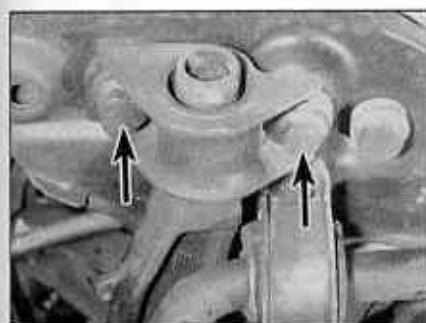
15 Repeat the operations in paragraphs 13 and 14 at the left-hand side of the vehicle. On completion, the subframe should be resting at a height approximately 25 mm lower than normal.

16 The additional clearance will now permit the steering gear pinion to be lowered away from the bulkhead. When the end of the pinion has cleared the aperture, manoeuvre the entire steering gear assembly through the wheelarch.

### Refitting

17 Refitting is a reversal of removal, noting the following points:

- a) Remove the temporary bolts and refit the original length fixings.



13.14 Slacken and remove the subframe-to-bodywork bolts (arrowed)

- b) Tighten all fixings to the specified torque settings.
- c) Refill the hydraulic system with the specified grade and quantity of power steering fluid (see Lubricants and fluids in Weekly checks), then thoroughly bleed the system as described in Section 15.
- d) On completion, have the front wheel alignment checked at the earliest opportunity by a Fiat dealer or a tyre specialist.

### 14 Steering gear rubber gaiters - renewal

**Note:** New gaiter retaining clips should be used on refitting.

1 Remove the relevant track-rod end as described in Section 17.

2 If not already done, unscrew the track-rod end locknut from the end of the track-rod.

3 Mark the correct fitted position of the gaiter on the track-rod, then release the gaiter securing clips. Slide the gaiter from the steering gear, and off the end of the track-rod.

4 Thoroughly clean the track-rod and the steering gear housing, using fine abrasive paper to polish off any corrosion, burrs or sharp edges, which might damage the new gaiter sealing lips on installation. Scrape off all the grease from the old gaiter, and apply it to the track-rod inner balljoint. (This assumes that grease has not been lost or contaminated as a result of damage to the old gaiter. Use fresh grease if in doubt.)

5 Carefully slide the new gaiter onto the track-rod, and locate it on the steering gear housing. Align the outer edge of the gaiter with the mark made on the track-rod prior to removal, then secure it in position with new retaining clips.

6 Screw the track-rod end locknut onto the end of the track-rod.

7 Refit the track-rod end as described in Section 17.

### 15 Power steering hydraulic system - bleeding

#### General

1 The following symptoms indicate that there is air present in the power steering hydraulic system:

- a) Generation of air bubbles in fluid reservoir.
- b) Clicking noises from power steering pump.
- c) Excessive buzzing or groaning from power steering pump.

2 Note that when the vehicle is stationary, or while moving the steering wheel slowly, a hissing noise may be produced in the steering gear or the fluid pump. This noise is inherent in the system, and does not indicate any cause for concern.

### Bleeding

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

4 Check the fluid level in the power steering fluid reservoir (bear in mind that the vehicle will be tilted, so the level cannot be read accurately), and if necessary top-up to just above the relevant level mark.

5 Have an assistant turn the steering quickly from lock to lock, and observe the fluid level. If the fluid level drops, add more fluid, and repeat the operation until the fluid level no longer drops. Failure to achieve this within a reasonable period may indicate a leak in the system.

6 Start the engine and repeat the procedure described in the previous paragraph.

7 Once the fluid level has stabilised, and all air has been bled from the system, lower the vehicle to the ground.

### 16 Power steering pump - removal and refitting

#### Removal

1 Drain as much fluid as possible from the power steering reservoir, using a pipette or an old poultry baster.

2 Remove the clip and disconnect the rubber fluid supply hose from the port on the top of the power steering pump. Be prepared for an amount of fluid loss - position a container underneath the port and pad the surrounding area with absorbent rags.

3 Slacken the union and disconnect the fluid delivery hose from the side of the power steering pump. Again, be prepared for an amount of fluid loss.

4 Unscrew the clamp bolt and through-bolt at either end of the drivebelt guard, then detach the guard from the power steering pump (see illustrations).

5 Partially unscrew the two power steering pump mounting bolts then rotate the pump towards the engine slightly, to release the tension from the belt. Carefully ease the drivebelt from the pump pulley.



16.4a Unscrew the clamp bolt ...



16.4b ... and through-bolt ...



16.4c ... then detach the guard from the power steering pump



16.6a Power steering pump front ...

6 Remove the two pump mounting bolts (see illustrations) that were slackened earlier, then remove the pump from the engine.

### Refitting

7 Refitting is a reversal, noting the following points:

- On completion, check and if necessary adjust the drivebelt tension as described in Chapter 1A or 1B.
- Refill the hydraulic system with the specified grade and quantity of power steering fluid (see lubricants and fluids in Weekly checks), then thoroughly bleed the system as described in Section 15.
- Tighten all fixings to the specified torque setting.

### 17 Track-rod end - removal and refitting



### Removal

**Note:** A balljoint separator tool will be required for this operation. A new track-rod end nut split pin should be used on refitting.

1 Chock the rear wheels, apply the handbrake, then jack up the front of the vehicle and support on axle stands (see Jacking and vehicle support). Remove the relevant front roadwheel.

2 Partially unscrew the nut securing the track-rod end to the steering arm. Using a

balljoint separator tool, separate the track-rod end from the steering arm (see illustrations).

3 Counterhold the track-rod end using the flats provided, then loosen the track-rod end locknut (see illustration).

4 Unscrew the track-rod end from the track-rod, counting the exact number of turns required to do so. Alternatively, mark the relationship between the track-rod end and the track-rod using a dab of paint.

### Refitting

5 Carefully clean the track-rod end and the track-rod threads.

6 Renew the track-rod end if the rubber dust cover is cracked, split or perished, or if the movement of the balljoint is either sloppy or too stiff. Also check for other signs of damage such as worn threads.

7 Screw the track-rod end onto the track-rod by the number of turns noted before removal. Tighten the locknut temporarily.

8 Ensure that the balljoint taper is clean, then engage the taper with the steering arm on the hub carrier.

9 Refit the balljoint nut, and tighten to the specified torque.

10 Refit the roadwheel, and lower the vehicle to the ground.

11 Have the front wheel alignment checked by a Fiat dealer or tyre specialist at the earliest opportunity. **Note:** If the vehicle has to be driven to have the wheel alignment checked, the track-rod end locknut should be tightened before driving the vehicle.



16.6b ... and rear mounting bolts

### 18 Wheel alignment and steering angles - general information

#### General information

1 A car's steering and suspension geometry is defined in four basic settings - with the exception of toe setting, all angles are expressed in degrees; the relevant settings are camber, castor, steering axis inclination, and toe-setting. With the exception of toe-setting, none of these settings are adjustable.

#### Front wheel toe setting

#### Checking

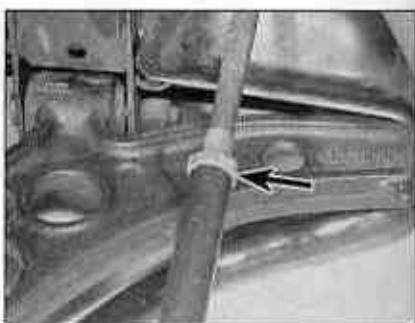
2 Due to the special measuring equipment necessary to check the wheel alignment, and



17.2a Balljoint separator tool in use on the track-rod end



17.2b Separate the track-rod end from the steering arm



17.3 Counterhold the track-rod end, then loosen the locknut (arrowed)

the skill required to use it properly, the checking and adjustment of these settings is best left to a Fiat dealer or similar expert. Most tyre-fitting shops now possess sophisticated checking equipment.

3 For accurate checking, the vehicle must be at the kerb weight specified in *Dimensions and weights*.

4 Before starting work, check first that the tyre sizes and types are as specified (see *Tyre pressures in Weekly checks*), then check tyre pressures and tread wear. Also check roadwheel run-out, the condition of the hub bearings, the steering wheel free play and the condition of the front suspension components (*Steering and suspension check* in Chapter 1A or 1B). Correct any faults found.

5 Park the vehicle on level ground, with the front roadwheels in the straight-ahead position. Rock the rear and front ends to settle the suspension. Release the handbrake and roll the vehicle backwards approximately 1 metre, then forwards again, to relieve any stresses in the steering and suspension components.

6 Two methods are available to the home mechanic for checking the front wheel toe setting. One method is to use a gauge to measure the distance between the front and rear inside edges of the roadwheels. The other method is to use a scuff plate, in which each front wheel is rolled across a movable plate which records any deviation, or scuff, of the tyre from the straight-ahead position as it moves across the plate. Such gauges are available in relatively-inexpensive form from accessory outlets. It is up to the owner to decide whether the expense is justified, in view of the small amount of use such equipment would normally receive.

7 Prepare the vehicle as described in paragraphs 3 to 5 above.

8 If the measurement procedure is being used, carefully measure the distance between the front edges of the roadwheel rims and the rear edges of the rims. Subtract the front measurement from the rear measurement, and check that the result is within the specified range. If not, adjust the toe setting as described in paragraph 10.

9 If scuff plates are to be used, roll the vehicle backwards, check that the roadwheels are in the straight-ahead position, then roll it across the scuff plates so that each front roadwheel passes squarely over the centre of its respective plate. Note the angle recorded by the scuff plates. To ensure accuracy, repeat the check three times, and take the average of the three readings. If the roadwheels are running parallel, there will of course be no angle recorded; if a deviation value is shown on the scuff plates, compare the reading obtained for each wheel with that supplied by the scuff plate manufacturers. If the value recorded is outside the specified tolerance, the toe setting is incorrect, and must be adjusted as follows.

#### Adjustment

10 Apply the handbrake, then jack up the front of the vehicle and support it securely on axle stands (see *Jacking and vehicle support*). Turn the steering wheel onto full-left lock, and record the number of exposed threads on the right-hand track-rod. Now turn the steering wheel onto full-right lock, and record the number of threads on the left-hand side. If there are the same number of threads visible on both sides, then subsequent adjustment should be made equally on both sides. If there are more threads visible on one side than the other, it will be necessary to compensate for this during adjustment. **Note:** It is important to ensure that, after adjustment, the same number of threads are visible on the end of each track-rod.

11 First clean the track-rod threads; if they are corroded, apply penetrating fluid before starting adjustment. Release the steering gear rubber gaiter outboard clips, then peel back the gaiters and apply a smear of grease, so that both gaiters are free and will not be twisted or strained as their respective track-rods are rotated.

12 Use a straight-edge and a scribe or similar to mark the relationship of each track-rod to the track-rod end. Working on each track-rod end in turn, unscrew its locking nut.

13 Alter the length of the track-rods, bearing in mind the note in paragraph 10, by screwing them into or out of the track-rod ends. Rotate the track-rod using an open-ended spanner fitted to the flats provided. If necessary, counterhold the track-rod end using a second spanner. Shortening the track-rods (screwing them into their track-rod ends) will reduce toe-in and increase toe-out.

14 When the setting is correct, hold the track-rods and securely tighten the locking nuts. Check that the balljoints are seated correctly in their sockets, and count the exposed threads on the ends of the track-rods. If the number of threads exposed is not the same on both sides, then the adjustment has not been made equally, and problems will be encountered with tyre scrubbing in turns; also, the steering wheel spokes will no longer be horizontal when the wheels are in the straight-ahead position.

15 When the track-rod lengths are the same, lower the vehicle to the ground and re-check the toe setting; readjust if necessary. When the setting is correct, tighten the locking nuts. Ensure that the steering gear rubber gaiters are seated correctly and are not twisted or strained, then secure them in position with new retaining clips.