Chapter 9
Braking system

Contents

Degrees of difficulty

Easy, suitable for novice with little experience 

Fairly easy, suitable for beginner with some experience 

Fairly difficult, suitable for competent DIY mechanic 

Difficult, suitable for experienced DIY mechanic 

Very difficult, suitable for expert DIY or professional 

Specifications

Front brakes

Type	Solid or ventilated disc, with single-piston sliding calipers
Disc diameter	240.0 mm
Disc thickness:	
Solid disc	10.0 mm
Ventilated disc	20.0 mm
Minimum disc thickness:	
Solid disc	8.0 mm
Ventilated disc	18.0 mm
Maximum disc run-out (disc fitted)	0.1 mm
Minimum brake pad thickness	1.5 mm

Rear brakes

Type	Drum with leading and trailing shoes and automatic adjusters
Nominal drum diameter:	
All except XR2i and ABS equipped models	180 mm
XR2i and ABS equipped models	203 mm
Maximum drum diameter	1.0 mm above nominal diameter
Wheel cylinder bore diameter:	
All except XR2i and ABS equipped models	17.5 mm
XR2i models with conventional braking system	19.0 mm
All ABS equipped models	22.0 mm
Minimum brake shoe lining thickness	1.0 mm

Torque wrench settings	Nm	lbf ft
Master cylinder to servo	20 to 25	15 to 18
Servo to mounting bracket	35 to 45	26 to 33
Pedal-to-servo cross-link brackets to bulkhead	20 to 25	15 to 18
Rear drum/hub to axle flange bolts*	56 to 76	41 to 56
Caliper-to-spindle carrier (anchor bracket) bolts	50 to 66	37 to 49
Caliper piston housing retaining bolts	20 to 25	15 to 18
Load-apportioning valves to bracket	20 to 25	15 to 18
Load-apportioning valve bracket to vehicle	21 to 28	15 to 21
Load-apportioning valve adjustment screw	12 to 16	9 to 12
Load-apportioning valve-to-axle beam link rod nut	21 to 28	15 to 21
Modulator pivot and adjusting clamp bolts	22 to 28	16 to 21
Modulator drivebelt cover	8 to 12	6 to 9
Roadwheel nuts	70 to 110	52 to 74

**Applies to all models except Courier. No figures are quoted by the manufacturers for Courier models.*

1 General information

The braking system is of the diagonally split, dual-circuit hydraulic type, with servo assistance to the front disc brakes and rear drum brakes. The dual-circuit hydraulic system is a safety feature - in the event of a malfunction somewhere in one of the hydraulic circuits, the other circuit continues to operate, providing at least some braking effort. Under normal circumstances, both brake circuits operate in unison, to provide efficient braking.

The master cylinder (and the vacuum servo unit to which it is bolted) is located on the left-hand side of the bulkhead in the engine compartment. On all right-hand drive variants, they are jointly operated via a transverse cross-link from the brake pedal.

Brake pressure control valves are fitted in-line to each rear brake circuit, their function being to regulate the braking force available at each rear wheel, reducing the possibility of the rear wheels locking up under heavy braking. Courier models also have a "light-laden" valve incorporated into the rear braking circuits for the same reason.

The front brake discs are of the ventilated type on XR2i and ABS-equipped models, with solid discs fitted on all other models. The front brake calipers are of single sliding piston type mounted on the front spindle carriers each side.

Each rear brake shoe assembly is operated by a twin-piston wheel cylinder. The leading brake shoe in each brake unit has a thicker lining than the trailing shoe, so that they wear proportionally. To take up the brake adjustment as the linings wear, each rear brake assembly incorporates an automatic adjuster mechanism.

The cable-operated handbrake acts on both rear brakes, to provide an independent means of brake operation.

An anti-lock braking system (ABS) is available on some models, and has many of the components in common with the conventional braking system. Further details on ABS can be found later in this Chapter.

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 Ford replacement parts, or at least those of known good quality. Note the warnings given in "Safety first" and at relevant points in this Chapter concerning the dangers of asbestos dust and hydraulic fluid.*

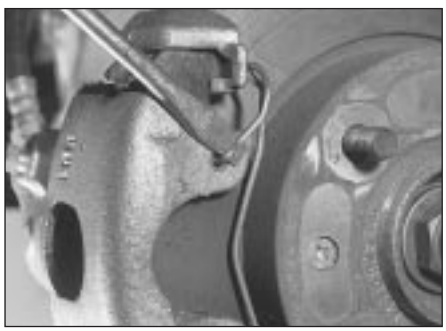
2 Front brake pads - renewal

Warning: Disc brake pads MUST be renewed on both front wheels at the same time - NEVER renew the pads on only one wheel, as uneven braking may result. The front brake calipers will be of Bendix or Teves manufacture, and if they or their component parts require renewal, ensure that the correct type is fitted. Dust created by wear of the pads may contain asbestos, which is a health hazard. Never blow it out with compressed air, and do not inhale any of it. DO NOT use petroleum-based solvents to clean brake parts - use brake cleaner or methylated spirit only. DO NOT allow any brake fluid, oil or grease to contact the brake pads or disc. Also refer to the warning in Section 13 concerning the dangers of hydraulic fluid.

1 Chock the rear wheels then jack up the front of the car and support it on axle stands (see *"Jacking and Vehicle Support"*). Remove the front roadwheels.

2 Hold the caliper support spring with a pair of pliers, and prise it out of its location in the caliper housing using a screwdriver **(see illustration)**.

3 Prise free the blanking plugs from the caliper upper and lower mounting bolts. Unscrew the bolts, then withdraw the caliper from the anchor bracket **(see illustrations)**. Suitably support the caliper to avoid straining the brake hose.



2.2 Prise out the caliper support spring with a screwdriver

2.3a Remove the rubber blanking plugs for access to the caliper mounting bolts . . .

2.3b . . . unscrew the bolts then withdraw the caliper from the anchor bracket

4 Withdraw the pads from the caliper piston housing or anchor bracket. The outer pad will normally remain in position in the anchor bracket, but the inner pad will stay attached to the piston in the caliper, and may need to be carefully prised free. If the old pads are to be refitted, ensure that they are identified so that they can be returned to their original positions.

5 Brush the dust and dirt from the caliper and piston, but *do not inhale it, as it is a health hazard*. Inspect the dust cover around the piston for damage and for evidence of fluid leaks, which if found will necessitate caliper overhaul as described in Section 3.

6 If new brake pads are to be fitted, the caliper piston will need to be pushed back into its housing, to allow for the extra pad thickness - use a C-clamp to do this. Note that, as the piston is pressed back into the bore, it will displace the fluid in the system, causing the fluid level in the brake master cylinder reservoir to rise and possibly overflow. To avoid this possibility, a small quantity of fluid should be removed from the reservoir. If any brake fluid is spilt onto the bodywork, hoses or adjacent components in the engine compartment, wipe it clean without delay.

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An ideal way to remove fluid from the master cylinder reservoir is to use a clean syringe or an old poultry baster.

7 Prior to refitting, check that the pads and the disc are clean. Where new pads are to be installed, peel the protective backing paper from them. If the old pads are to be refitted, ensure that they are correctly located as noted during their removal.

8 Locate the inner and outer brake pad into position in the caliper. Relocate the caliper into position on the anchor bracket, and insert the mounting bolts.

9 Tighten the mounting bolts to the specified torque, and refit the blanking plugs. Relocate the caliper support spring.

10 Repeat the procedure on the opposite front brake.

11 Before lowering the vehicle, check that the fluid level in the brake master cylinder reservoir is up to the "Maximum level" mark, and top-up with the specified fluid type if required (see *"Weekly Checks"*). Depress the brake pedal a few times to position the pads against the disc, then recheck the fluid level in the reservoir and further top-up if necessary.

12 Refit the roadwheels, then lower the vehicle to the ground. Tighten the roadwheel retaining nuts to the specified torque.

13 To allow the new brake pads to bed-in and reach full efficiency, a running-in period of approximately 100 miles or so should be observed before hard use and heavy braking.

3 Front brake caliper - removal, overhaul and refitting

Note: *Before starting work, refer to the warning at the beginning of Section 13 concerning the dangers of hydraulic fluid, and to the warning at the beginning of Section 2 concerning the dangers of asbestos dust.*

Removal

1 Chock the rear wheels then jack up the front of the car and support it on axle stands (see *"Jacking and Vehicle Support"*). Remove the front roadwheels.

2 Fit a brake hose clamp to the flexible brake hose leading to the front brake caliper. This will minimise brake fluid loss during subsequent operations.

3 Loosen by half a turn, the union on the caliper end of the flexible brake hose.

4 Remove the front brake pads as described in Section 2.

5 Support the caliper in one hand, and prevent the brake hose from turning with a spanner in the other hand. Unscrew the caliper from the hose, making sure that the hose is not twisted unduly or strained **(see illustration)**. Once the caliper is detached, cover or plug the open hydraulic unions to keep them clean.

6 If required, the caliper anchor bracket can be unbolted and removed from the spindle carrier **(see illustration)**.

Overhaul

7 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*.

8 Remove the piston from its bore by applying low air pressure (from a foot pump, for example) into the caliper hydraulic fluid hose port. In the event of a high-pressure air hose being used, keep the pressure as low as possible, to enable the piston to be extracted, but to avoid the piston being ejected too quickly and being damaged. Position a suitable piece of wood between the caliper frame and the piston to prevent this possibility. Any fluid remaining in the caliper will probably be ejected with the piston.

9 Using a suitable hooked tool, carefully extract the dust cover from its groove in the piston and the seal from its groove in the caliper bore, but take care not to scratch or damage the piston and/or the bore in the caliper.

10 Clean all the parts in methylated spirit or clean brake fluid, and wipe dry using a clean lint-free cloth **(see illustration)**. Inspect the piston and caliper bore for signs of damage, scuffing or corrosion. If these conditions are evident, renew the caliper body assembly.

11 If the components are in satisfactory condition, a repair kit which includes a new seal and dust cover must be obtained.

12 Lubricate the piston bore in the caliper and the seal with clean brake fluid. Carefully fit the seal in the caliper bore, using fingers only (no tools) to manipulate it into position in its groove. When in position, check that it is not distorted or twisted.

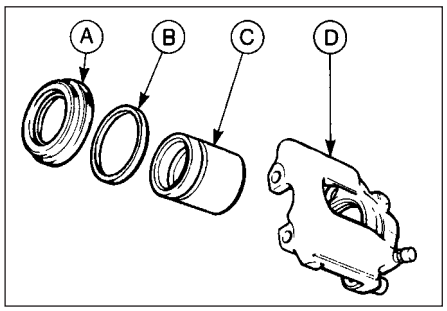
13 Locate the dust cover over the piston so that its inner diameter is engaged in the piston groove. Smear the area behind the piston groove with the special lubricating grease supplied in the repair kit, then insert the piston into the caliper. Push the piston into position in the bore, and simultaneously press the dust cover into the piston housing so that it is seated correctly. Take particular care not to distort or damage the seal or cover as they are fitted.

Refitting

14 If the anchor bracket was removed, fit it into position on the spindle carrier, and tighten the retaining bolts to the specified torque.

3.5 Hold the brake hose with a spanner and unscrew the caliper from the hose

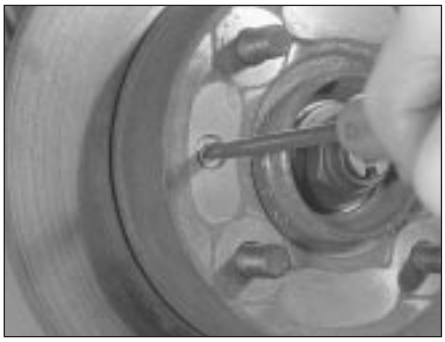
3.6 Undoing a brake caliper anchor bracket bolt



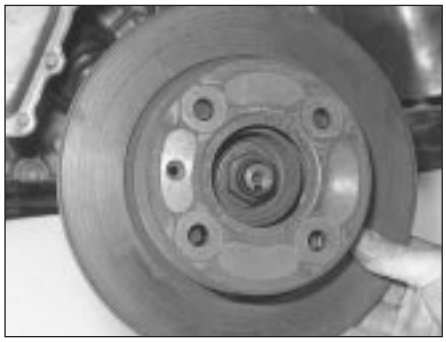
3.10 Brake caliper and piston components

A Dust cover
B Piston seal
C Piston
D Brake caliper

4.4 Checking brake disc run-out using a dial gauge



4.8a Extract the brake disc securing screw . . .



4.8b . . . and remove the disc from the hub

15 Unplug the hydraulic hose, and check that the unions are clean. Reconnect the caliper to the hose so that the hose is not twisted or strained. The hose union connection can be fully tightened when the caliper is refitted.
16 Refit the brake pads as described in Section 2.
17 The brake hydraulic hose can now be fully tightened. When secured, turn the steering from lock-to-lock to ensure that the hose does not foul on the wheel housing or suspension components.
18 Bleed the brake hydraulic system as described in Section 13 or 14 according to type. Providing suitable precautions were taken to minimise loss of fluid, it should only be necessary to bleed the relevant front brake.
19 Refit the roadwheel, lower the vehicle to the ground, then tighten the wheel nuts to the specified torque.

4 Front brake disc - inspection, removal and refitting

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

Inspection

Note: *If a disc requires renewal, BOTH front discs should be renewed or reground at the same time to ensure even and consistent braking. New brake pads should also be fitted.*
1 Chock the rear wheels then jack up the front of the car and support it on axle stands (see *"Jacking and Vehicle Support"*). Remove the appropriate front roadwheel.
2 Temporarily refit two of the wheel nuts to diagonally-opposite studs, with the flat sides of the nuts against the disc. Tighten the nuts progressively, to hold the disc firmly.
3 Scrape any corrosion from the disc. Rotate the disc, and examine it for deep scoring, grooving or cracks. Using a micrometer, measure the thickness of the disc in several places. Light wear and scoring is normal, but if excessive, the disc should be removed, and either reground by a specialist, or renewed. If regrinding is undertaken, at least the minimum thickness must be maintained. Obviously, if the disc is cracked, it must be renewed.
4 Using a dial gauge, check that the disc run-out, measured at a point 10.0 mm from the outer edge of the disc, does not exceed the limit given in the Specifications. To do this, fix the measuring equipment, and rotate the disc, noting the variation in measurement as the disc is rotated **(see illustration)**. The difference between the minimum and maximum measurements recorded is the disc run-out.

HAYNES HiNT ***If a dial gauge is not available, check the run-out by positioning a fixed pointer near the outer edge, in contact with the disc face. Rotate the disc and measure the maximum displacement of the pointer with feeler blades.***

5 If the run-out is greater than the specified amount, check for variations of the disc thickness as follows. Mark the disc at eight positions 45° apart, then using a micrometer, measure the disc thickness at the eight positions, 15.0 mm in from the outer edge. If the variation between the minimum and maximum readings is greater than the specified amount, the disc should be renewed.

Removal

6 Remove the caliper and its anchor bracket with reference to Section 3, but do not disconnect the hydraulic brake hose. Suspend the caliper assembly from the front suspension coil spring, taking care to avoid straining the brake hose.
7 Remove the wheel nuts which were temporarily refitted in paragraph 2.
8 Unscrew the screw securing the disc to the hub, and withdraw the disc **(see illustrations)**. If it is tight, lightly tap its rear face with a hide or plastic mallet.

Refitting

9 Refit the disc in a reversal of the removal sequence. If new discs are being fitted, first remove their protective coating. Ensure complete cleanliness of the hub and disc mating faces and tighten the screw securely.
10 Refit the caliper/anchor bracket with reference to Section 3.
11 Refit the roadwheel, lower the vehicle to the ground, and tighten the wheel nuts to the specified torque.

5 Rear brake drum - removal, inspection and refitting

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

Removal

1 Chock the front wheels then jack up the rear of the car and support it on axle stands (see *"Jacking and Vehicle Support"*). Remove the appropriate rear roadwheel, and release the handbrake.
2 Undo the four bolts securing the drum/hub and stub axle assembly to the rear axle flange, then withdraw the drum/hub from the axle. If the brake drum is stuck on the shoes, remove the rubber access plug from the rear of the brake backplate, and release the automatic brake adjuster by levering the release catch on the adjuster pawl through the backplate **(see illustration)**.
3 With the brake drum removed, brush or wipe the dust from the drum, brake shoes,

5.2 Removing the rubber access plug from the rear of the brake backplate

6.3 Depress and turn the cups securing the brake shoes

wheel cylinder and backplate. *Take great care not to inhale the dust, as it may contain asbestos.*

4 If required, remove the hub from the drum as described in Chapter 10.

Inspection

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

5 Clean the inside surfaces of the brake drum and hub, then examine the internal surface of the brake drum for signs of scoring or cracks. If any deterioration of the friction surface is evident, renewal of the drum is necessary. To detach the hub from the drum, refer to Chapter 10.

Refitting

6 Check that the automatic brake adjuster is fully retracted, then refit the drum/hub to the axle. Tighten the retaining bolts to the specified torque.

7 With the brake drum refitted, refit the roadwheel. Fully depress the brake pedal several times, to actuate the rear brake adjuster and take up the adjustment. Check that the rear wheels spin freely when the brakes are released, then apply the handbrake, lower the vehicle and tighten the wheel nuts to the specified torque.

6.4a Detach the lower pull-off spring

6 Rear brake shoes - renewal

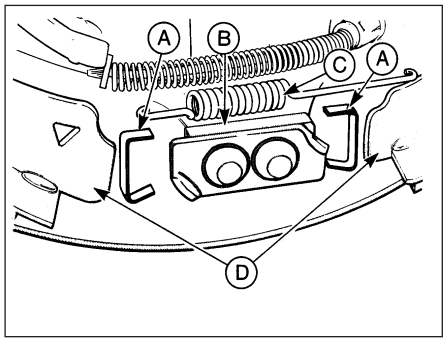
Warning: Drum brake shoes MUST be renewed on both rear wheels at the same time - NEVER renew the shoes on only one wheel, as uneven braking may result. Also, the dust created by wear of the shoes may contain asbestos, which is a health hazard. Never blow it out with compressed air, and don't inhale any of it. An approved filtering mask should be worn when working on the brakes. DO NOT use petroleum-based solvents to clean brake parts - use brake cleaner or methylated spirit only.

1 Remove the rear brake drum with reference to Section 5.

2 Note the fitted positions of the springs and the adjuster strut.

3 Depress the cups holding the brake shoes in position and rotate them through 90° to release them from the locking pins **(see illustration)**. Carefully remove the cups and springs, then withdraw the locking pins from the rear of the brake backplate.

4 Lift the shoes from their lower pivot and remove the lower pull-off spring **(see illustration)**. Note that on some models anti-rattle shims may be fitted between the brake shoe and the lower pivot **(see illustration)**. If



6.4b Arrangement of brake shoe anti-rattle shims - where fitted

A Shims
B Lower pivot
C Lower pull-off spring
D Brake shoes

fitted, remove the shims and store them safely.

5 With the shoe assembly pulled away from the wheel cylinder, disengage the handbrake cable from its operating lever on the trailing shoe **(see illustration)**.

6 Remove the upper pull-off spring, noting the method of location.

7 Release the automatic brake adjuster cam and pawl, then remove the adjuster strut which is held in position by spring tension **(see illustrations)**.

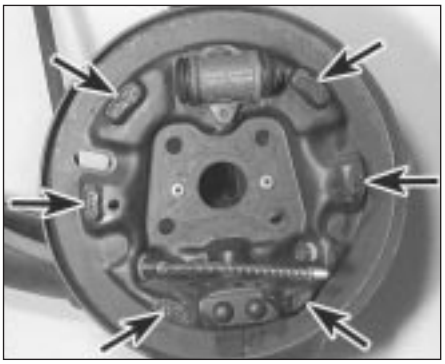
8 Using a screwdriver, lever off the spring clip securing the handbrake operating lever to the trailing shoe and separate the assembly **(see illustration)**.

6.5 Disengage the handbrake cable from its operating lever on the trailing shoe

6.7a Release the automatic brake adjuster cam and pawl

6.7b Detach the adjuster strut

6.8 Lever off the spring clip securing the handbrake operating lever to the trailing shoe



6.11 Brake shoe contact points on brake backplate (arrowed)

9 Detach the automatic brake adjuster cam in a similar manner to that described in the previous paragraph, noting its orientation.
10 Clean the adjuster strut and its associated components.
11 Clean the backplate, then apply a little high-melting-point grease to the shoe contact points on the backplate and the lower anchor plate **(see illustration)**. On models so equipped, refit the anti-rattle shims to the brake shoe lower pivot on the backplate ensuring that they are securely located.
12 Fit the handbrake operating lever to the trailing shoe, using a new spring clip.
13 Fit the automatic brake adjuster cam to the leading shoe, using a new spring clip.
14 Apply a small amount of high-melting-point grease to the automatic brake adjuster cam and pawl contact faces, and where the cam and handbrake operating lever sweep across their respective brake shoes. Do not over-apply, as this may result in lining contamination in use - a thin smear will suffice. Take care not to allow any grease to contact the brake linings.
15 Fit the adjuster strut to the trailing shoe, securing with its spring, then connect the free end of the strut to the automatic brake adjuster cam. Fit the upper pull-off spring between the tops of the two brake shoes.
16 Reconnect the handbrake cable to its operating lever.
17 Position the brake shoes onto the backplate so that their upper leading edges rest against the wheel cylinder pistons, and their lower leading edges engage either side of the lower pivot. Fit the lower pull-off spring into its locating slots at the bottom end of each brake shoe.
18 Insert the brake shoe locking pins through the rear of the backplate, then relocate the springs and cups. Depress and turn the cups through 90° to secure.
19 Check that the brake shoes and their associated components are correctly refitted, then refit the brake drum with reference to Section 5.
20 Repeat the procedure on the remaining rear brake.

7 Rear wheel cylinder - removal, overhaul and refitting

Note: *Before starting work, refer to the warning at the beginning of Section 13 concerning the dangers of hydraulic fluid.*

Removal

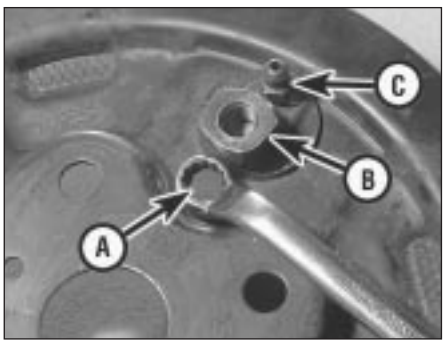
1 Remove the brake drum as described in Section 5.
2 Using a suitable hose clamp, isolate the relevant rear brake unit by clamping its flexible brake hose.
3 Disconnect the brake pipe at the wheel cylinder union, and fit a blanking plug to the brake pipe to prevent dirt ingress.
4 On all models except Courier, drill out the pop-rivets securing the brake backplate to the axle flange, and withdraw the backplate assembly with the brake shoes in situ. Note that it is not possible to remove the backplate completely as the handbrake cable will still be attached to the brake shoes.
5 Expand the brake shoes by pulling their tops away from the wheel cylinder. The automatic brake adjuster will hold the shoes clear of the wheel cylinder for ease of removal.
6 Remove the single bolt securing the wheel cylinder to the brake backplate, and withdraw the wheel cylinder **(see illustration)**.

Overhaul

7 Clean any heavy dirt or grease deposits from the external surfaces of the wheel cylinder, then pull off the dust-excluding covers **(see illustration)**.
8 The pistons and seals will probably shake out. If they do not, apply air pressure from a foot-operated tyre pump to the brake pipe connection to eject them.
9 Examine the surfaces of the pistons and the cylinder bores for scoring or signs of metal-to-metal rubbing. If evident, renew the complete cylinder assembly.
10 If the cylinder is to be renewed, note that three sizes are used across the Fiesta range, dependent on specification. Ensure that the new cylinder obtained is of the correct size to maintain the rear braking balance.
11 Where the pistons and cylinder bores are in good condition, discard the rubber seals and dust excluders and obtain a repair kit.
12 Any cleaning of the components should be done using clean hydraulic fluid or methylated spirit - nothing else.
13 Reassemble by dipping the first piston in clean hydraulic fluid, then manipulate its seal into position using fingers only. Ensure that the seal is fitted correctly with its raised lip facing away from the brake shoe bearing face of the piston.
14 Insert the first piston into the wheel cylinder from the opposite end of the cylinder body. With it located in position, fit a dust-excluding cover to it.
15 Fit the seal to the second piston, as described in paragraph 13, then insert the spring to the wheel cylinder, followed by the second piston. Take care not to damage the lip of the seal when fitting to the wheel cylinder - additional lubrication with clean hydraulic fluid and a slight twisting action may help. Once again, only fingers should be used.
16 Fit the dust excluding cover to the second piston.

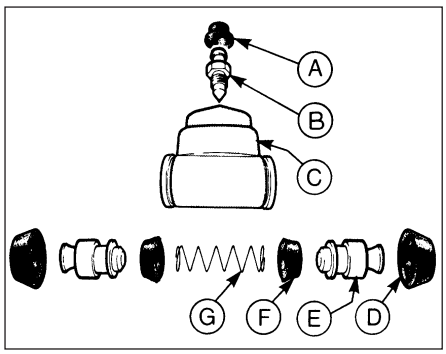
Refitting

17 Refitting is the reverse sequence to removal. When refitting the backplate, locate it in position and temporarily insert the hub/drum retaining bolts to ensure correct alignment. Now secure the brake backplate using new pop rivets. Release the automatic brake adjuster so that the brake shoes are brought into contact with the wheel cylinder, before refitting the hub/drum assembly as described in Section 5.
18 On completion, bleed the brake hydraulic system as described in Section 13 or 14 (as applicable).



7.6 Rear view of brake backplate

A Wheel cylinder-to-brake backplate retaining bolt
B Wheel cylinder brake pipe connection
C Bleed screw

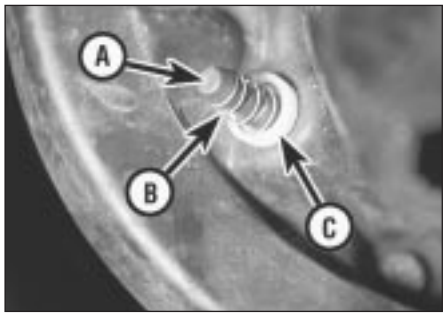


7 .7 Exploded view of rear wheel cylinder components

A Dust cap
B Bleed screw
C Wheel cylinder
D Dust-excluding cover
E Piston
F Seal
G Spring

8.3 Compress the retaining lugs (arrowed), and release the handbrake cable from the backplate

8.6 Drilling out a pop-rivet securing the brake backplate to the axle flange



8.8 Handbrake adjustment plunger

A Plunger B Spring C Collar

8 Rear brake backplate - removal and refitting

Removal

1 Remove the brake drum/hub assembly as described in Section 5.
2 Remove the rear brake shoes as described in Section 6.
3 Compress the three retaining lugs, and release the handbrake cable from the backplate by pushing it back through the plate **(see illustration)**.
4 Using a suitable hose clamp, isolate the relevant rear brake unit by clamping its flexible brake hose.
5 Disconnect the brake pipe at the wheel cylinder union, and fit blanking plugs to prevent dirt ingress.
6 Drill out the pop-rivets securing the backplate to the rear axle, and remove the backplate **(see illustration)**.
7 Remove the single bolt securing the wheel cylinder to the brake carrier plate, and withdraw the wheel cylinder.
8 If required, remove the handbrake adjustment plunger from the backplate by gently prising the spring off, over the plunger abutment, then withdraw the plunger from the brake shoe side **(see illustration)**. Remove the plunger collar from the rear of the backplate.

Refitting

9 Locate the wheel cylinder in positionand securely tighten the retaining bolt.
10 If removed, refit the handbrake adjustment plunger to the backplate.
11 Place the backplate in position and temporarily insert the hub/drum retaining bolts to ensure correct alignment. Now secure the brake backplate using new pop rivets
12 Refit the handbrake cable, and ensure that the retaining lugs are secure.
13 Connect the brake pipe to the wheel cylinder and remove the brake hose clamp.
14 Refit the rear brake shoes as described in Section 6.
15 Refit the brake drum/hub as described in Section 5.
16 On completion, bleed the brake hydraulic system as described in Section 13 or 14 (as applicable).

9 Master cylinder - removal, overhaul and refitting

Note: *Before starting work, refer to the warning at the beginning of Section 13 concerning the dangers of hydraulic fluid.*

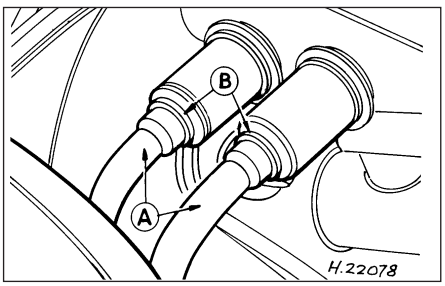
Removal

1 Disconnect the wiring multi-plug from the fluid level warning indicator in the reservoir filler cap, then remove the filler cap from the reservoir. Note that the filler cap must not be inverted. The brake fluid should now be removed from the reservoir.
2 Identify each brake pipe and its connection to the master cylinder. Unscrew the fluid pipe to master cylinder union nuts and disconnect the pipes. On models equipped with anti-lock brakes, disconnect the modulator return hoses from the brake fluid reservoir, collecting fluid spillage from the hoses in a suitable tray **(see illustration)**. The modulator return hose unions should be disconnected by first pushing the hose into the reservoir, then retaining the collar against the reservoir body whilst withdrawing the hose. Note that the modulator return hoses are colour coded - the left-hand modulator has a black return hose and connector, and should be fitted to the forward section of the reservoir, whilst the right-hand modulator has a grey return hose and connector, and should be fitted to the rear section of the reservoir.
3 Unscrew the mounting nuts and withdraw the master cylinder from the servo unit.

HAYNES HiNT ***An ideal way to remove fluid from the master cylinder reservoir is to use a clean syringe or an old poultry baster.***

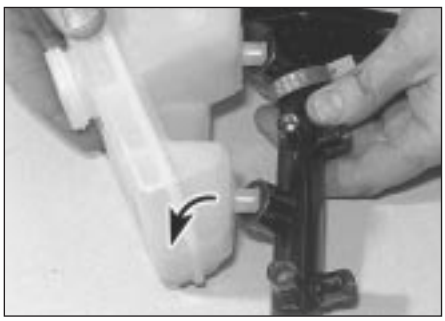
Overhaul

4 With the master cylinder removed, empty any remaining fluid from it, and clean it externally.
5 Withdraw the brake fluid reservoir from the top of the master cylinder by pulling and rocking it free from its retaining seals **(see illustration)**.
6 Extract the reservoir seals from the top face of the master cylinder **(see illustration)**.



9.2 Modulator return hose connections at the brake fluid reservoir

A Return hoses B Collars



9.5 Removing the brake fluid reservoir from its seals in the master cylinder

9.6 Brake fluid reservoir seal

9.7 Removing the secondary piston retaining pin

9.8a Removing the primary piston assembly from the master cylinder . . .

9.8b . . . followed by the secondary piston assembly

7 Using a suitable socket, firmly press the primary piston into the master cylinder until the secondary piston retaining pin becomes visible through the secondary piston reservoir opening. Remove the retaining pin using needle-nosed pliers or similar tool **(see illustration)**.

8 Remove the primary and secondary pistons by shaking or gently tapping the master cylinder **(see illustrations)**.

9 Examine the piston and cylinder bore surfaces for scoring or signs of metal-to-metal rubbing. If evident, renew the master cylinder assembly as a complete unit.

10 Cleaning of components should be done using clean brake hydraulic fluid or methylated spirit - nothing else.

11 Obtain a master cylinder repair kit, and brake fluid reservoir seals.

12 Having dipped the secondary piston assembly in clean hydraulic fluid, insert it into the master cylinder. Note that the seals on the secondary piston have raised lips which face away from each other, towards the extremities of the piston **(see illustration)**. A slight twisting action will assist insertion.

13 Using a suitable socket bar extension, or similar tool, press the secondary piston into the master cylinder to enable fitting of the secondary piston retaining pin.

14 Dip the primary piston assembly in clean hydraulic fluid and, using a similar twisting action to that used for the secondary piston, insert it into the master cylinder. Note that both the seals fitted to the primary piston have raised lips that face the same way - towards its captive spring.

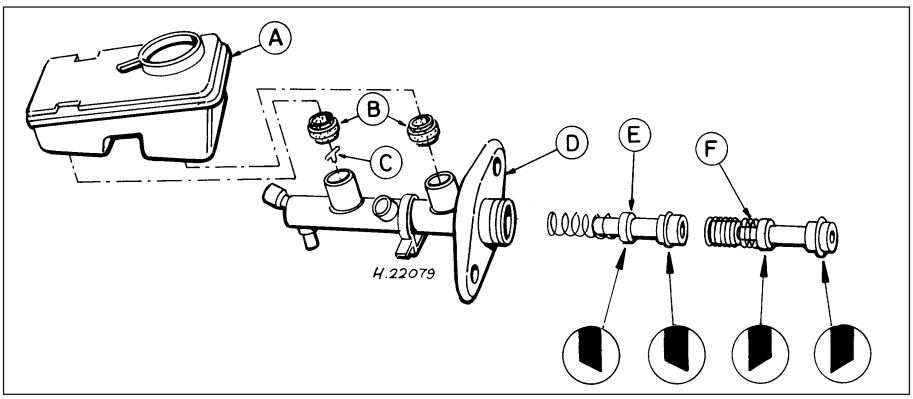
15 Insert new brake fluid reservoir seals to the master cylinder then, using a similar rolling action to that used to remove it, fit the reservoir to the master cylinder.

16 It is recommended that a small quantity of fluid is now poured into the reservoir and the pistons depressed several times to prime the unit.

Refitting

17 Locate the master cylinder to the servo unit, having fitted a new dust cover as applicable. Refit the two spring washers and nuts, then tighten to the specified torque.

18 Remove the blanking plugs fitted on removal of the unit, then reconnect the brake pipes, tightening the unions securely. Additionally, on vehicles equipped with anti-lock brakes, reconnect the modulator return hoses to the brake fluid reservoir in accordance with their colour coding (see paragraph 2), pushing the hoses firmly into the reservoir body then levering out the collars to retain.



9 .12 Exploded view of master cylinder components

A Brake fluid reservoir
B Reservoir seals
C Secondary piston retaining pin
D Master cylinder
E Secondary piston
F Primary piston

19 Refill the brake fluid reservoir with fresh fluid of the specified type, then bleed the braking system in accordance with Section 13 or 14, as applicable.

20 On completion, ensure that the brake fluid level is up to the MAX mark on the reservoir before refitting the reservoir cap and the warning indicator wiring multi-plug.

10 Brake pedal - removal and refitting

Removal

1 Disconnect the battery negative (earth) lead (refer to Chapter 5A, Section 1).

2 Remove the clip securing the brake servo operating link pushrod to the brake pedal, noting the bush fitted in the pedal, and disconnect the brake stop light switch wiring connector. Release the brake stop light switch in a clockwise direction, and extract it from the pedal bracket.

3 Remove the C-clip from its pedal shaft location, at the right-hand side of the brake pedal, to allow the shaft to be withdrawn towards the centre of the vehicle.

4 As the pedal shaft is withdrawn, remove the brake pedal from the servo operating link pushrod. The brake pedal spacer can now be slid off the shaft if required, and the brake rod bush removed.

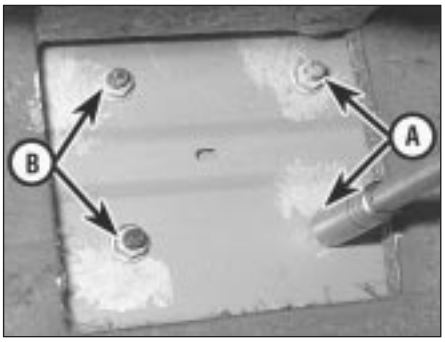
5 Prise the bushes out from both sides of the brake pedal, and renew as necessary.

Refitting

6 Prior to refitting, apply a small amount of molybdenum disulphide grease to the pedal shaft.

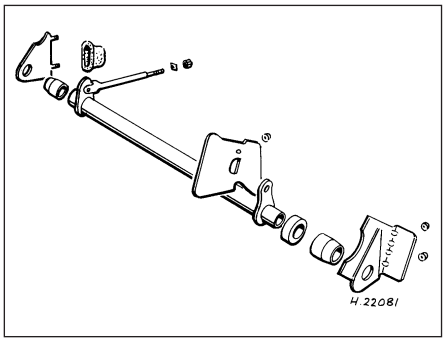
7 Refitting is the reverse sequence to removal, ensuring that the brake rod bush is located correctly, and that the pedal shaft “D” section locates into the pedal box right-hand support.

8 When refitting the stop light switch, insert the switch into its retainer, press it lightly against the brake pedal until all free play is just taken up, then turn the switch clockwise to secure. Reconnect the switch wiring connector.

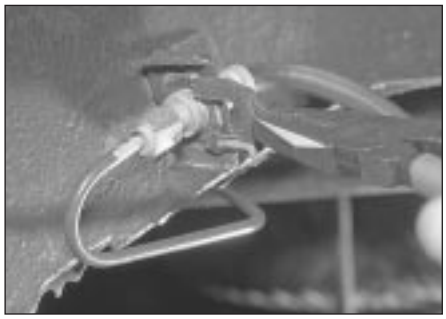


11.6 Servo mounting bracket retaining nuts

A Inner section retaining nuts
B Outer section retaining nuts



11.10 Exploded view of brake pedal-to-servo cross link and its retaining brackets



12.2 Prising out a spring retaining clip from a rigid pipe/flexible hose support bracket

11 Brake pedal-to-servo cross-link - removal and refitting

Removal

1 Disconnect the battery negative (earth) lead (refer to Chapter 5A, Section 1).
2 Disconnect the cross link pushrod from its brake pedal location by removing the retaining clip on the brake pedal, noting the bush fitted in the pedal.
3 Disconnect the wiring multi-plug from the fluid level warning indicator in the master cylinder reservoir filler cap, then remove the filler cap. Note that the filler cap must not be inverted. The brake fluid should now be removed from the reservoir.

> **HAYNES HiNT** ***An ideal way to remove fluid from the master cylinder reservoir is to use a clean syringe or an old poultry baster.***

4 Identify each brake pipe and its connection to the master cylinder. Unscrew the fluid pipe to master cylinder union nuts and disconnect the pipes. On models equipped with anti-lock brakes, disconnect the modulator return hoses from the brake fluid reservoir, collecting fluid spillage from the hoses in a suitable tray. The modulator return hose unions should be disconnected by first pushing the hose into the reservoir, then retaining the collar against the reservoir body whilst withdrawing the hose. Note that the modulator return hoses are colour coded - the left-hand modulator has a black return hose and connector, and should be fitted to the forward section of the reservoir, whilst the right-hand modulator has a grey return hose and connector, and should be fitted to the rear section of the reservoir.
5 Disconnect the vacuum hose from the servo unit by carefully levering between the hose connector and the servo housing collar with a screwdriver.
6 Lift up the flap of sound insulation on the bulkhead, in the passenger side footwell, to expose the servo mounting bracket retaining nuts, and remove them **(see illustration)**.
7 Remove the four nuts securing the servo unit to its mounting bracket assembly.
8 Pull the servo/master cylinder assembly forward and remove the inner servo support bracket.
9 Remove the spring clip and clevis pin securing the servo actuating rod to the cross link, then lift out the servo/master cylinder assembly.
10 Remove the two nuts on the right-hand side of the pedal box assembly to free the cross link right-hand support bracket, then withdraw the link from the vehicle **(see illustration)**.

Refitting

11 Refitting is the reverse procedure to removal, ensuring that the brake pedal pushrod grommet is seated correctly in the bulkhead and that the pushrod itself locates through the brake pedal before securing the servo operating link support brackets. Ensure correct location of the pushrod bush in the brake pedal.
12 Bleed the complete brake hydraulic system in accordance with Section 13 or 14 (as applicable).

12 Hydraulic pipes and hoses - renewal

Note: *Before starting work, refer to the warning at the beginning of Section 13 concerning the dangers of hydraulic fluid.*
1 If any pipe or hose is to be renewed, minimise hydraulic fluid loss by disconnecting the wiring multi-plug from the fluid level warning indicator in the master cylinder reservoir filler cap, then remove the filler cap. Note that the filler cap must not be inverted. Place a piece of plastic film over the reservoir and seal it with an elastic band. 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 **(see illustration)**. Where the other end of the hose is connected directly to the brake caliper, disconnect it by unscrewing it from its tapped hole.
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 component 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 Ford dealers. All that is then necessary is to bend it to shape, following the line of the original, before fitting it to the car. 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 Before refitting, blow through the new pipe or hose with dry compressed air. Do not overtighten the union nuts. It is not necessary to exercise brute force to obtain a sound joint.
6 If flexible rubber hoses are renewed, ensure that the pipes and hoses are correctly routed, with no kinks or twists, and that they are secured in the clips or brackets provided.
7 After fitting, bleed the hydraulic system as described in Section 13 or 14 (as applicable), wash off any spilt fluid, and check carefully for fluid leaks.

13 Hydraulic system - bleeding (conventional braking system)

Note: *For vehicles equipped with an anti-lock braking system, refer to Section 14.*

Warning: Hydraulic fluid is poisonous; wash off immediately and thoroughly in the case of skin contact, and seek immediate medical advice if any fluid is swallowed or gets into the eyes. Certain types of hydraulic fluid are inflammable, and may ignite when allowed into contact with hot components; when servicing any hydraulic system, it is safest to assume that the fluid IS inflammable, and to take precautions against the risk of fire as though it is petrol that is being handled. Hydraulic fluid is also an effective paint stripper, and will attack plastics; if any is spilt, it should be washed off immediately, using copious quantities of clean water. Finally, it is hygroscopic (it absorbs moisture from the air). The more moisture is absorbed by the fluid, the lower its boiling point becomes, leading to a dangerous loss of braking under hard use. Old fluid may be contaminated and unfit for further use. When topping-up or renewing the fluid, always use the recommended type, and ensure that it comes from a freshly-opened sealed container.

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, and apply the handbrake. Switch off the engine, then (where applicable) depress the brake pedal several times to dissipate the vacuum from the servo unit. **Note:** *When bleeding the system, the vehicle must maintain a level attitude, ie not tilted in any manner, to ensure that air is not trapped within the pressure control valves. During certain operations in this manual, instructions are given to bleed the brake hydraulic system with the front or the rear of the vehicle raised. In such cases raise the rest of the vehicle so that it maintains a level attitude, but only if it is safe to do so. If it is not possible to achieve this safely, complete the remainder of the operation and bleed the brake hydraulic system with the vehicle on its wheels.*

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 Disconnect the wiring multi-plug from the fluid level warning indicator in the master cylinder reservoir filler cap, then remove the filler cap. Note that the filler cap must not be inverted. Top-up the reservoir with the specified fluid to the "Maximum" level (see *"Weekly Checks"*). *Remember to maintain the fluid level at least above the "Minimum" 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 is suggested that you work in the following sequence:

a) Right-hand front wheel.
b) Left-hand rear wheel.
c) Left-hand front wheel.
d) Right-hand rear wheel.

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 "Minimum" level throughout the procedure.

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

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 at least 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 **(see illustration)**. 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 "Minimum" level at all times.

13.22 Bleeding the hydraulic system using a one-way valve kit

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.
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.

14 **Hydraulic system** - bleeding (anti-lock braking system)

Note: *Before starting work, refer to the warning at the beginning of Section 13 concerning the dangers of hydraulic fluid.*
1 On vehicles equipped with the anti-lock braking system there are two bleed procedures possible, depending on which part of the brake hydraulic system has been disturbed.
2 If any one of the following conditions are present, bleed procedure A should be adopted:

a) A modulator has been removed.
b) A modulator return hose (between modulator and brake fluid reservoir) has been drained.
c) The rigid brake pipes have been disconnected from a modulator.

3 If any one of the following conditions are present, bleed procedure B should be adopted:

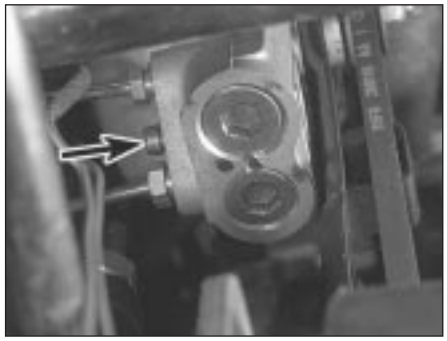
a) Any condition where the master cylinder has been removed or drained, providing that the modulator return hoses have not lost their head of fluid.
b) Removal or disconnection of any of the basic braking system components ie, brake caliper, flexible hose or rigid pipe, wheel cylinder, or load-apportioning valve.

Bleed procedure A

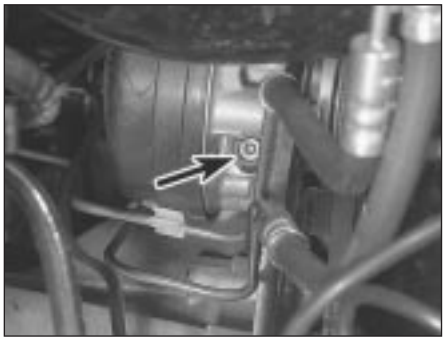
4 Raise the vehicle on ramps, or drive it over an inspection pit, so that working clearance may be obtained with the full weight of the vehicle on its roadwheels. Remove the one-piece undertray, as applicable, by turning its bayonet-type fasteners and, on XR2i models, remove the front suspension crossmember (see Chapter 10).
5 Disconnect the wiring multi-plug from the fluid level warning indicator in the master cylinder reservoir filler cap, then remove the filler cap. Note that the filler cap must not be inverted. Top-up the brake fluid reservoir to the MAX mark using fresh fluid of the specified type (see *"Weekly Checks"*), and keep it topped up throughout the bleeding procedure.
6 Slacken the modulator bypass valve Torx screw, located between the two rigid brake pipe connections on the modulator body, and unscrew it two full turns **(see illustration)**.
7 Fully depress the auto-bleed plunger on the modulator and hold it down so that the plunger circlip contacts the modulator body **(see illustration)**. With the plunger depressed, have an assistant steadily pump the brake pedal at least twenty times whilst you observe the fluid returning to the brake fluid reservoir. Continue this operation until the returning fluid is free from air bubbles.
8 Release the auto-bleed plunger, ensuring that it returns to its normal operational position - pull it out by hand if necessary.
9 Tighten the modulator bypass valve Torx screw.
10 Repeat the operation on the other modulator, if applicable, then refit the one-piece undertray and the front suspension crossmember if removed.
11 Now carry out bleed procedure B.

Bleed procedure B

12 This procedure is the same as for conventional braking systems, and reference should be made to Section 13. Note, however, that all the weight of the vehicle must be on the roadwheels, otherwise the load-apportioning valves will not bleed. If problems are encountered whereby the rear brakes will not bleed satisfactorily, ensure that the load-apportioning valves are correctly adjusted (see Section 25). As with the conventional braking system, the brake fluid level must be kept topped up during bleeding.



14.6 Modulator bypass valve Torx screw (arrowed)



14.7 Modulator auto-bleed plunger (arrowed)

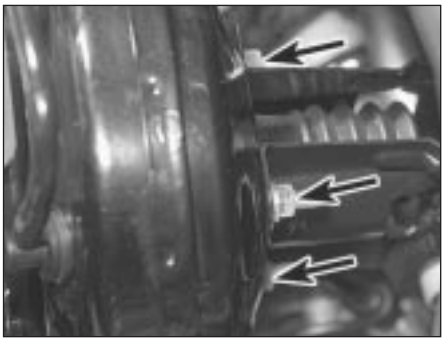
15 **Vacuum servo unit** - testing, removal and refitting

Testing

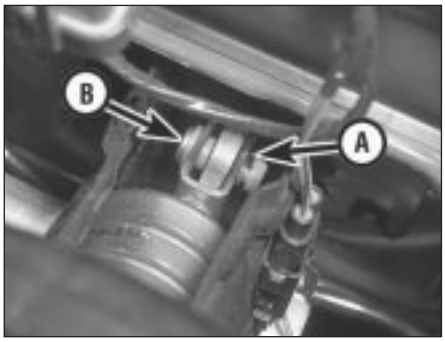
1 To test the operation of the servo, depress the footbrake four or five times to exhaust the vacuum, then start the engine while keeping the footbrake depressed. As the engine starts, there should be a noticeable "give" in the brake pedal as vacuum builds up. Allow the engine to run for at least two minutes, and then switch it off. If the brake pedal is depressed again, it should be possible to detect a hiss from the servo when the pedal is depressed. After about four or five applications, no further hissing will be heard, and the pedal will feel considerably firmer.
2 Before assuming that a problem exists in the servo itself, check the non-return valve as described in the next Section.

Removal

3 Refer to Section 9 and remove the master cylinder.
4 Disconnect the vacuum hose at the servo non-return valve by pulling it free. If it is reluctant to move, assist it by prising it free using a screwdriver with its blade inserted under the elbow flange.
5 Lift up the flap of sound insulation on the bulkhead, in the passenger side footwell, to expose the servo mounting bracket retaining nuts **(see illustration 11.6)**. Remove the two innermost nuts to free the inner section of the servo mounting bracket from its bulkhead



15.6 Nuts securing servo unit to its mounting bracket assembly (arrowed)



15.7 Spring clip (A) and clevis pin (B) securing servo pushrod to the cross link

location. Slacken the other two nuts or remove them, as necessary.

6 Remove the four nuts securing the servo unit to its mounting bracket assembly, then pull the servo forward to remove the inner servo support bracket **(see illustration)**.

7 Remove the spring clip and clevis pin securing the servo pushrod to the cross link, then lift out the servo unit **(see illustration)**.

8 Note that the servo unit cannot be dismantled for repair or overhaul and, if faulty, must be renewed.

Refitting

9 Refitting is a reversal of removal. Refer to Section 9 for details of refitting the master cylinder.

16 Vacuum servo unit vacuum hose and non-return valve - removal, testing and refitting

Removal

1 Depress the brake pedal three or four times to exhaust any remaining vacuum from the servo unit.

2 Carefully pull free and detach the servo vacuum hose from the servo unit. If the hose is reluctant to move, prise it free with the aid of a screwdriver, inserting its blade under the flange of the elbow.

3 Detach the vacuum hose from its inlet manifold connection. Depending on the fixing, undo the union nut and withdraw the hose, or press the hose and its retaining collar inwards, then holding the collar in, withdraw the hose.

4 If the hose or the fixings are damaged or in poor condition, they must be renewed.

Non-return valve testing

5 Examine the non-return valve for damage and signs of deterioration, and renew it if necessary. The valve may be tested by blowing through its connecting hoses in both directions. It should only be possible to blow from the servo end to the manifold end.

Refitting

6 Refitting is a reversal of removal. If fitting a new non-return valve, ensure that it is fitted the correct way round.

17 Handbrake lever - removal and refitting

Removal

1 Disconnect the battery negative (earth) lead (refer to Chapter 5A, Section 1), then chock the wheels to secure the vehicle.

2 Undo the bolts securing the front seats to the floorpan, and remove both seats from the vehicle (see Chapter 11). Move the seats on their slide mechanisms to expose the mounting bolts, as necessary.

3 Remove the screws securing the rear seat cushion, then raise the cushion to obtain access to the carpet retaining screws. Remove the carpet retaining screws.

4 Undo the bolt securing the seat belt clips to the centre of the floorpan, then remove the clip assembly.

5 Remove the seat belt lower anchor bracket bolt from its location at the base of the B-pillar behind the driver's seat.

6 Remove the screws securing the sill scuff plate to the driver's side of the vehicle, then carefully pull the sill scuff plate away from its location so that the carpet is released.

7 Fold the carpet forwards, at the same time carefully easing it out from under the sill scuff plate. Lift the carpet over the handbrake lever.

8 Lift out the noise insulation for access to the lever mounting bolts and the primary cable fixing.

9 Fully release the handbrake lever, then remove the handbrake primary cable clevis pin securing clip **(see illustration)**. Remove the clevis pin and withdraw the primary cable from the handbrake lever assembly.

10 Remove the cover **(see illustration)**, then disconnect the handbrake warning light switch wiring connection, and undo the two screws securing the switch to the handbrake lever assembly.

11 Undo the handbrake lever mounting bolts, then withdraw the handbrake lever assembly from the vehicle.

Refitting

12 Refitting is the reverse procedure to removal, ensuring that the handbrake warning light wiring is routed away from the lever ratchet. The loom should be secured to the floorpan with tape.

13 Check the handbrake adjustment as described in Chapter 1 to complete.

18 Handbrake primary cable - removal and refitting

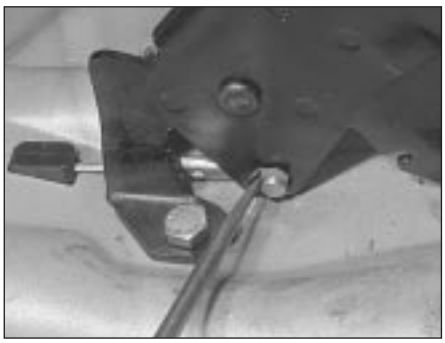
Removal

1 Release the primary cable from the handbrake lever, as described in the previous Section.

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

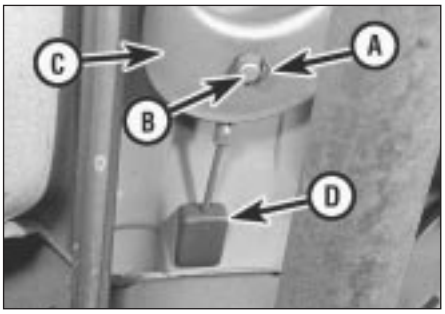
3 Where applicable, detach the exhaust system and remove the heat shields from the underside floorpan to allow access to the primary cable connections underneath the vehicle (see Chapter 4E).

4 Release the spring clip securing the pin, and extract the equaliser/cable pin. Detach



17.9 Removing the handbrake primary cable clevis pin securing clip

17.10 Removing the cover from the handbrake warning light switch



18.4 Handbrake equaliser yoke arrangement

A Clevis pin securing clip
B Clevis pin
C Equaliser yoke
D Primary cable guide

the equaliser from the primary cable **(see illustration)**.
5 Remove the primary cable guide by drifting it out rearwards, through the floorpan, from the inside of the vehicle.

Refitting

6 Refit in the reverse order of removal. Ensure that the cable guide is secured in the floorpan, and lubricate the pivot pin with a liberal amount of high-melting-point grease.
7 Refit the exhaust system and heat shields with reference to Chapter 4E (where applicable).
8 Refer to Chapter 1 for details, and adjust the handbrake as required before lowering the vehicle to the ground.

19 Handbrake rear cable - removal and refitting

Removal

1 Chock the front wheels then jack up the rear of the car and support it on axle stands (see *"Jacking and Vehicle Support"*). Fully release the handbrake lever and remove the rear roadwheels.
2 Refer to the previous Section for details, and disconnect the handbrake primary cable from the equaliser.
3 Disconnect the handbrake cable from its adjuster body location and its fixed body

19.3 Handbrake rear cable fixed body location

location **(see illustration)**, then remove it from its retaining clips.
4 Remove the rear brake drum(s) and brake shoes as described in Sections 5 and 6 respectively.
5 Compress the handbrake cable retainer lugs and release the cable from the backplate, then pull the cable through. Release the cable from the underbody fixings, and remove it from the vehicle.

Refitting

6 Refitting is a reversal of the removal procedure. Refer to Sections 6 and 5 respectively for details on the refitting of the brake shoes and drums.
7 When the cable is fully refitted (but before lowering the vehicle rear wheels to the ground) check and adjust the handbrake as described in Chapter 1.

20 Brake pressure control valves - removal and refitting

Note: *Before starting work, refer to the warning at the beginning of Section 13 concerning the dangers of hydraulic fluid.*

Removal

1 The pressure control valves are located in the engine compartment, fixed to the left-hand inner wing panel or screwed directly into the master cylinder fluid outlet ports **(see illustrations)**.
2 Minimise hydraulic fluid loss by disconnecting the wiring multi-plug from the fluid level warning indicator in the master cylinder reservoir filler cap, then remove the filler cap. Note that the filler cap must not be inverted. Place a piece of plastic film over the reservoir and seal it with an elastic band. Detach the rigid brake pipes from the valves. As the pipes are disconnected, tape over the exposed ends, or fit plugs, to prevent the ingress of dirt and excessive fluid loss.
3 To remove the inner wing panel mounted assembly, remove the two screws securing the valve assembly mounting bracket to the inner wing panel, and withdraw the valve assembly from the vehicle. To remove the valves from the bracket, slide free the retaining clips and detach the valve(s).
4 To remove the master cylinder mounted valves, unscrew them from the master cylinder body.

Refitting

5 Refitting is a reversal of the removal procedure.
6 On completion, bleed the complete hydraulic system as described in Section 13.

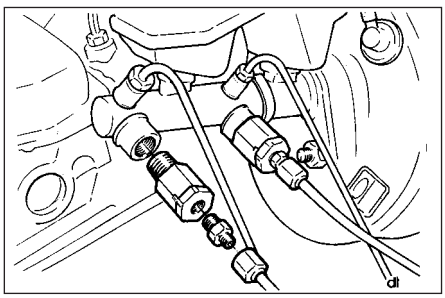
21 Light-laden valve (Courier models) - removal and refitting

Note: *Before starting work, refer to the warning at the beginning of Section 13 concerning the dangers of hydraulic fluid.*

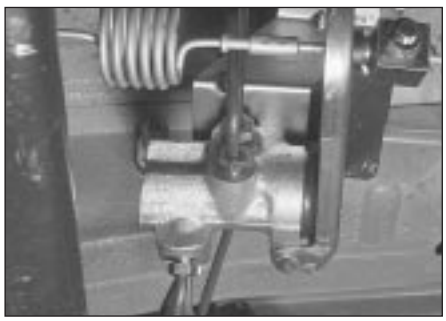
Removal

1 For this operation, the vehicle must be raised for access underneath at the rear, but must still be resting on its wheels. Suitable ramps (or an inspection pit) will therefore be required. If positioning the vehicle on a pair of ramps, chock the front roadwheels.
2 Minimise hydraulic fluid loss by disconnecting the wiring multi-plug from the fluid level warning indicator in the master cylinder reservoir filler cap, then remove the filler cap. Note that the filler cap must not be inverted. Place a piece of plastic film over the reservoir and seal it with an elastic band.
3 Disconnect the four brake pipes from the valve, and drain any escaping fluid into a suitable container for disposal **(see illustration)**. Due to its location, care will be

20.1a Pressure control valves located on left-hand inner wing panel



20.1b Pressure control valves and pipe connections at the master cylinder - later models



21.3 Hydraulic pipe and linkage attachments at the light-laden valve

needed not to spill the fluid onto the hands - wear suitable protective gloves. Plug or cap the disconnected pipes and valve openings, to prevent dirt ingress and further fluid loss.

4 Unbolt the valve from its mounting bracket, unhook the linkage from the rear axle, then withdraw the valve **(see illustration)**. The intermediate bracket may be unbolted if required.

Refitting

5 Refitting is the reverse of the removal procedure; adjust the valve as described in Section 22, then bleed the complete hydraulic system as described in Section 13. Check the operation of the brakes before taking the vehicle out on the road.

22 Light-laden valve (Courier models) - adjustment

Note: *To adjust the valve accurately, the vehicle must be at a known rear axle loading - owners who cannot determine the loading with sufficient accuracy must have this check made by a Ford dealer or similar expert.*

1 For this operation, the vehicle must be raised for access underneath at the rear, but must be standing on its wheels. Suitable ramps (or an inspection pit) will therefore be required. If positioning the vehicle on a pair of ramps, chock the front roadwheels.

2 Measure the distance between the inner radius of the linkage's hooked end and the first shoulder **(see illustration)**. If the dimension is not as specified for the axle loading, adjustment is required.

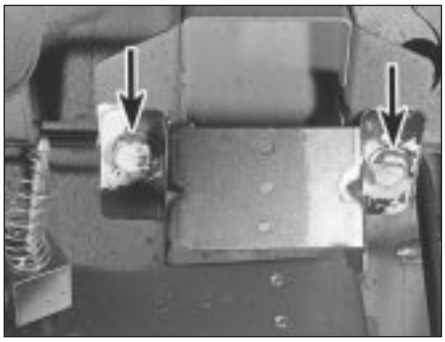
3 To adjust the setting, slacken the locknut on the valve linkage, move the rod until the setting is correct, then tighten the locknut securely **(see illustration)**. Check the operation of the brakes before taking the vehicle out on the road.

23 Anti-lock braking system (ABS) - general information

A mechanically-driven, two-channel anti-lock braking system is available as a factory-fitted option on certain model variants within the Fiesta range.

The system comprises four main components; two modulators, one for each brake circuit, and two rear axle load-apportioning valves, again, one for each brake circuit. Apart from the additional hydraulic piping, the remainder of the braking system is the same as for conventional models.

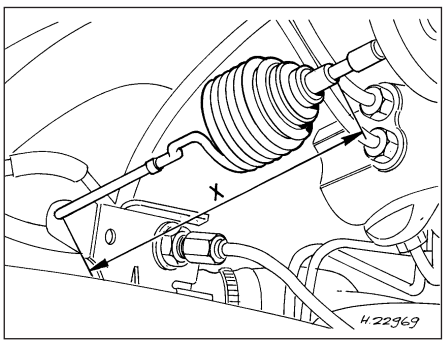
The modulators are located in the engine compartment with one mounted on each side of the transmission, directly above the driveshaft inner constant velocity joints. Each modulator contains a shaft which actuates a flywheel by means of a ball and ramp clutch.



21.4 Light-laden valve mounting bolts (arrowed)

A rubber toothed belt is used to drive the modulator shaft from the driveshaft inner constant velocity joint.

During driving and under normal braking the modulator shaft and the flywheel rotate together and at the same speed through the engagement of a ball and ramp clutch. In this condition hydraulic pressure from the master cylinder passes to the modulators and then to each brake in the conventional way. In the event of a front wheel locking the modulator shaft rotation will be less than that of the flywheel and the flywheel will overrun the ball and ramp clutch. This causes the flywheel to slide on the modulator shaft, move inward and operate a lever which in turn opens a dump valve. Hydraulic pressure to the locked brake is released via a de-boost piston allowing the wheel to once again revolve. Fluid passed through the dump valve is returned to the master cylinder reservoir via the modulator return hoses. At the same time hydraulic pressure from the master cylinder causes a pump piston to contact an eccentric cam on the modulator shaft. The flywheel is then decelerated at a controlled rate by the flywheel friction clutch. When the speed of the modulator shaft and flywheel are once again equal the dump valve closes and the cycle repeats. This complete operation takes place many times a second until the vehicle stops or the brakes are released.



22.2 Light-laden valve adjustment details

With rear axle load at 400 kg,
"X" should be 147 mm
With rear axle load at 850 kg,
"X" should be 166 mm

The load-apportioning valves are mounted on a common bracket attached to the rear body, just above the rear axle twist beam location, and are actuated by linkages attached to the axle beam. The valves regulate hydraulic pressure to the rear brakes, in accordance with vehicle load and attitude, so that the braking force available at the rear brakes will always be lower than that available at the front.

A belt-break warning switch is fitted to the cover which surrounds each modulator drivebelt. The switch contains an arm which is in contact with the drivebelt at all times. If the belt should break, or if the adjustment of the belt is too slack, the arm will move out closing the switch contacts and informing the driver via an instrument panel warning light.

24 Anti-lock braking system (ABS) components - removal and refitting

Modulator

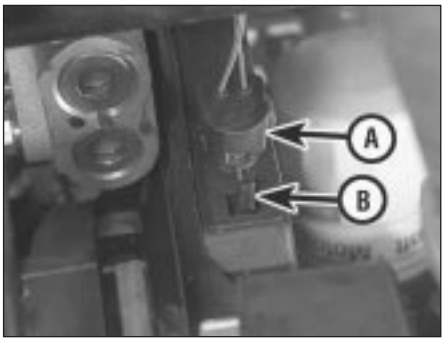
Note: *Before starting work, refer to the warning at the beginning of Section 13 concerning the dangers of hydraulic fluid.*

1 Disconnect the battery negative (earth) lead (refer to Chapter 5A, Section 1).

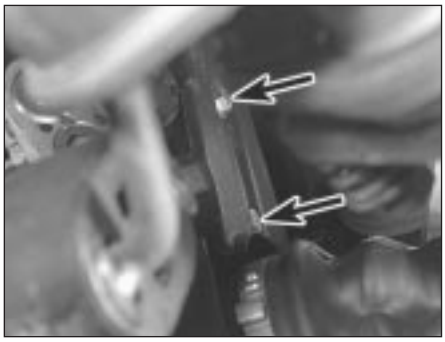
2 Minimise hydraulic fluid loss by disconnecting the wiring multi-plug from the fluid level warning indicator in the master cylinder reservoir filler cap, then remove the filler cap. Note that the filler cap must not be inverted. Place a piece of plastic film over the reservoir and seal it with an elastic band.

3 Disconnect the modulator return hoses from the master cylinder reservoir, collecting any fluid spillage from the hoses in a suitable tray. The modulator return hose unions should be disconnected by first pushing the hose into the reservoir, then retaining the collar against the reservoir body whilst withdrawing the hose. Note that the hoses are colour coded - the left-hand modulator has a black return hose and connector, and should be fitted to the forward section of the reservoir, whilst the right-hand modulator has a grey return hose and connector, and should be fitted to the rear section of the reservoir.

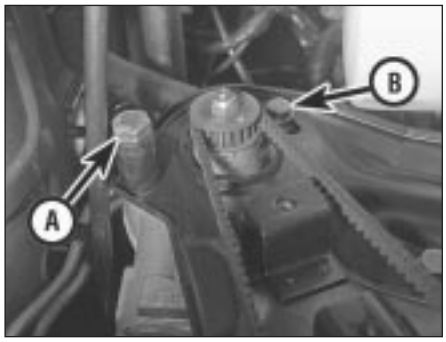
22.3 Light-laden valve linkage adjustment locknut (arrowed)



24.6 Belt-break switch in drivebelt cover
A Main switch body B Release lever



24.7 Modulator drivebelt cover to mounting bracket securing bolts (arrowed)



24.9 Modulator pivot bolt (A) and adjuster bolt (B)

Right-hand side

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

5 Remove the one-piece undertray where fitted, by turning the bayonet type fasteners, and on XR2i models, remove the front suspension crossmember (see Chapter 10).

6 From underneath, remove the belt-break switch from the right-hand drivebelt cover by squeezing its release lever towards the main body of the switch **(see illustration)**, then carefully withdraw, ensuring that the belt contact arm does not catch on the drivebelt cover.

7 Remove the two bolts securing the modulator drivebelt cover to the modulator mounting bracket, and withdraw the cover **(see illustration)**.

8 Disconnect the rigid brake pipes from the modulator, fitting blanking plugs to prevent excessive fluid loss and dirt ingress.

9 Remove the modulator pivot bolt and adjuster bolt **(see illustration)**, then slip the drivebelt from its pulley, and withdraw the modulator unit from the vehicle. Ensure that the modulator return hose does not become kinked as the modulator unit is withdrawn.

10 Disconnect the modulator return hose from the modulator unit, and fit a blanking plug to prevent dirt ingress. Allow for residual fluid spillage as the hose is disconnected.

11 If a new modulator is to be fitted, note that these units are not interchangeable from side to side, and the correct replacement must be obtained. The modulator units are colour-coded, and must be fitted with the arrows on top of the casings pointing towards the front of the vehicle.

12 To refit, first connect the modulator return hose to the return outlet on the modulator unit.

13 Locate the modulator unit to its bracket and fit the pivot bolt, having applied a thin smear of anti-seize compound to the bolt, but do not fully tighten at this stage. Take care not to damage the modulator return hose as it is manoeuvred into position.

14 Fit the drivebelt to its modulator pulley location, ensuring that it sits correctly over the driveshaft pulley, then refit the adjuster bolt but do not fully tighten at this stage.

15 Adjust the tension of the drivebelt by moving the modulator unit, until a belt deflection of 5.0 mm is obtained under firm finger pressure. Check this using a ruler at a point midway between the two pulleys.

16 With the drivebelt tensioned correctly, tighten the pivot and adjuster bolts to the specified torque. Re-check the tension of the drivebelt after tightening the bolts.

17 Reconnect the rigid brake pipes to the modulator, tightening the unions securely.

18 Refit the modulator drivebelt cover to the modulator mounting bracket, and secure with its two retaining bolts.

19 Refit the belt-break switch to the modulator drivebelt cover, taking care not to damage the belt contact arm as it passes through the cover.

20 Reconnect the modulator return hose by pushing the hose firmly into its brake fluid reservoir location, then lever out the collar to retain it.

21 Refit the front suspension crossmember and the one-piece undertray, as applicable.

22 Lower the vehicle to the ground.

23 Top-up the brake fluid reservoir using fresh fluid of the specified type (see "*Weekly checks*"), then bleed the brake hydraulic system in accordance with Section 14. Refit the reservoir filler cap and warning indicator wiring multi-plug on completion.

24 Reconnect the battery negative lead.

Left-hand side

25 Repeat the procedures given in paragraphs 1 to 3.

26 Chock the rear wheels then jack up the front of the car and support it on axle stands (see *"Jacking and Vehicle Support"*). Remove the front roadwheels.

27 Remove the one-piece undertray where fitted, by turning the bayonet type fasteners, and on XR2i models, remove the front suspension crossmember (see Chapter 10).

28 Remove the belt-break switch from the left-hand drivebelt cover in a similar manner to that described in paragraph 6, this time from the engine compartment.

29 Remove the two bolts securing the modulator drivebelt cover to the modulator mounting bracket, then ease the lower portion of the cover over the driveshaft taking care not to damage the driveshaft CV joint gaiter. Withdraw the cover through the engine compartment, manoeuvring it to clear obstructions.

30 Disconnect the rigid brake pipes from the modulator, fitting blanking plugs to prevent excessive fluid loss and dirt ingress.

31 Slacken the modulator pivot and adjuster bolts, then swing the modulator downwards to release the drivebelt tension before slipping the drivebelt from its modulator pulley location.

32 Remove the modulator pivot and adjuster bolts, withdraw the modulator upwards through the engine compartment. Ensure that the modulator return hose does not become kinked as the modulator unit is withdrawn.

33 Disconnect the modulator return hose from the modulator unit, and fit a blanking plug to prevent dirt ingress. Allow for residual fluid spillage as the hose is disconnected.

34 If a new modulator is to be fitted, note that these units are not interchangeable from side to side, and the correct replacement must be obtained. The modulator units are colour-coded, and must be fitted with the arrows on top of the casings pointing towards the front of the vehicle.

35 To refit, first connect the modulator return hose to the return outlet on the modulator unit.

36 Locate the modulator unit to its mounting bracket and fit the pivot bolt, having applied a thin smear of anti-seize compound to the bolt, but do not fully tighten at this stage. Take care not to damage the modulator return hose as it is manoeuvred into position.

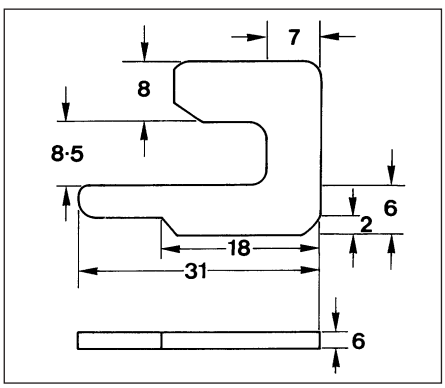
37 Fit the drivebelt to its modulator pulley location, ensuring that it sits correctly over the driveshaft pulley, then refit the adjuster bolt but do not fully tighten at this stage.

38 Adjust the tension of the drivebelt by moving the modulator unit, until a belt deflection of 5.0 mm is obtained under firm finger pressure. Check this using a ruler at a point midway between the two pulleys.

39 With the drivebelt tensioned correctly, tighten the pivot and adjuster bolts to the specified torque. Re-check the tension of the drivebelt after tightening the bolts.
40 Reconnect the rigid brake pipes to the modulator, tightening the unions to seal the system.
41 Refit the modulator drivebelt cover and secure with its two retaining bolts. Take care not to damage the driveshaft CV joint gaiter as the cover is eased into position.
42 Refit the belt-break switch to the modulator drivebelt cover, taking care not to damage the belt contact arm as it passes through the cover.
43 Reconnect the modulator return hose by pushing the hose firmly into its brake fluid reservoir location, then lever out the collar to retain it.
44 Refit the front suspension crossmember and the one-piece undertray, as applicable.
45 Refit the roadwheels, then remove the axle stands and lower the vehicle to the ground. Tighten the wheel nuts to the specified torque.
46 Top-up the brake fluid reservoir using fresh fluid of the specified type (see "*Weekly checks*"), then bleed the brake hydraulic system in accordance with Section 14. Refit the reservoir filler cap and the warning indicator wiring multi-plug on completion.
47 Reconnect the battery negative lead.

Modulator drivebelt

48 Disconnect the battery negative (earth) lead (refer to Chapter 5A, Section 1).
49 Chock the rear wheels then jack up the front of the car and support it on axle stands (see *"Jacking and Vehicle Support"*). Remove the relevant front roadwheel.
50 Remove the one-piece undertray where fitted, by turning its bayonet-type fasteners, and on XR2i models, remove the front suspension crossmember (see Chapter 10).
51 Remove the belt-break switch from the relevant drivebelt cover, then remove the drivebelt cover, as described in the previous sub-Section.
52 Slacken the modulator pivot and adjuster bolts to release drivebelt tension, then slip the drivebelt from the modulator.
53 Remove the track rod end balljoint from the steering arm on the spindle carrier (see Chapter 10).
54 Disconnect the anti-roll bar connecting link (where applicable) and release the brake hose from their locations on the suspension strut.
55 Remove the pinch bolt and nut securing the lower suspension arm balljoint to the spindle carrier, and separate the balljoint from the spindle carrier assembly.
56 To release the driveshaft inner CV joint from the differential, have an assistant pull the spindle carrier away from the centre of the vehicle whilst you insert a lever between the inner CV joint and the transmission casing, then firmly strike the lever with the flat of the hand, but be careful not to damage adjacent components. Make provision for escaping transmission oil, if possible plugging the opening to prevent excessive loss. Do not allow the CV joints to bend more than 20° from the horizontal or internal damage may occur. If both driveshafts are to be removed, immobilise the differential by inserting an old joint or suitable shaft, before the other driveshaft is removed.
57 Slide the drivebelt off the driveshaft.
58 Remove the snap-ring from the groove in the splines of the inner CV joint. *This snap-ring must be renewed every time the driveshaft is withdrawn from the differential.*
59 With the drivebelt removed, closely examine the condition of the belt over its entire length. Renew the belt if any cracks are noticed in the fabric at the roots of the teeth, if there is any abrasion of the fabric facing material, or if there are any tears starting from the edge of the belt.
60 If, since the drivebelts were last renewed, a vehicle has covered more than 30 000 miles (48 000 km) or a period of more than two years has elapsed, the drivebelts should be renewed as a matter of course.
61 Prior to refitting the drivebelt, thoroughly clean its CV joint pulley location.
62 Fit the drivebelt over the driveshaft then, with a new snap-ring fitted to the inner CV joint splines, lubricate the splines with transmission oil. Remove the temporary plug and insert the inner CV joint to its transmission casing location. Press against the spindle carrier so that the snap-ring engages fully to hold the CV joint splines in the differential.
63 Refitting is now a reversal of the removal procedure, tensioning the drivebelt as described in the previous sub-Section. Ensure that the pinch-bolt securing the lower suspension arm balljoint to the spindle carrier locates in the annular groove on the balljoint spindle. Secure the track rod and balljoint, using a new split pin. Tighten the suspension components to their specified torque (see Chapter 10).
64 Check the level of the transmission oil, and top-up as required (see Chapter 1).



25.1 Load-apportioning valve adjustment tool (dimensions given in mm)

Modulator belt-break switch

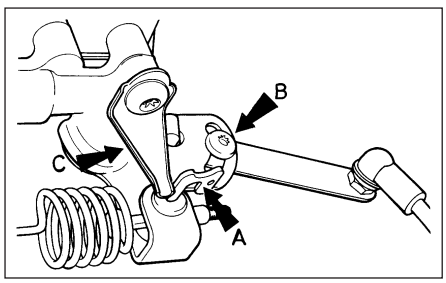
65 Modulator belt-break switches are fitted to each of the two drivebelt covers, and clip into position. To remove, gently squeeze the protruding lever on the switch towards the main switch body and lift out, ensuring that the belt contact arm does not catch on the drivebelt cover.

25 Load-apportioning valve (ABS models) - adjustment

1 Before attempting to adjust the load-apportioning valves, the vehicle must be at its kerb weight, ie with approximately half a tank of fuel and carrying no load. Note that a special setting tool will be required to adjust the valves - this can be fabricated, to the dimensions shown **(see illustration)**.
2 Raise the vehicle on ramps or drive it over an inspection pit, so that working clearance is obtained with the full weight of the vehicle resting on its roadwheels. Remove the spare wheel and its carrier.
3 To check adjustment, insert the load-apportioning valve setting tool into the nylon sleeve without pre-loading the valve. If unable to insert the tool, carry out the following adjustment procedure.
4 Slacken the operating link adjustment fixing screw then insert the setting tool into the nylon sleeve, applying light pressure to the operating link upper arm, so that the setting tool fully locates. With the setting tool just resting up against the adjustment post, tighten the operating link adjustment fixing screw to the specified torque **(see illustration)**.
5 Repeat the procedure on the other valve.
6 Refit the spare wheel on completion.

26 Load-apportioning valve (ABS models) - removal and refitting

1 Minimise hydraulic fluid loss by disconnecting the wiring multi-plug from the fluid level warning indicator in the master



25.4 Load-apportioning valve adjustment

A Setting tool
B Operating link adjustment fixing screw
C Adjustment post

cylinder reservoir filler cap, then remove the filler cap. Note that the filler cap must not be inverted. Place a piece of plastic film over the reservoir and seal it with an elastic band.

2 Raise the vehicle on ramps, or drive it over an inspection pit, so that working clearance may be obtained with the full weight of the vehicle on its roadwheels.

3 Remove the spare wheel and its carrier for access to the load-apportioning valves **(see illustration)**.

4 Disconnect the load-apportioning valve operating links from the rear axle twist beam, by undoing the nuts securing them.

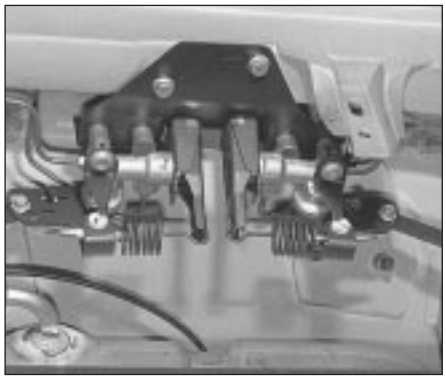
5 Disconnect the rigid brake pipes from the load-apportioning valves, and fit blanking plugs to prevent dirt ingress. Make provision for escaping fluid as the pipes are disconnected.

6 Remove the bolts securing the valve assembly mounting bracket to the vehicle body, then carefully lower from the vehicle.

7 The valves can now be individually removed from the mounting bracket, as required, by undoing the fixings securing them from the other side of the bracket.

8 Refitting is the reverse sequence to removal, adjusting the load-apportioning valves, as described in the previous Section, before refitting the spare wheel. When fitting a new valve, the plastic tie must be cut off before attempting any adjustment, and the setting tool must be used as described in the previous Section.

9 Bleed the brake hydraulic system in accordance with Section 14.



26.3 General view of load-apportioning valve arrangement (spare wheel and carrier removed for access)

Notes