Chapter 9 Braking system

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Degrees of difficulty

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

Front brakes

Type ................................................................. Ventilated disc, with single-piston floating caliper
Disc diameter .................................................. 260.0 mm
Disc thickness:
  New ........................................................................ 24.15 mm
  Minimum ................................................................ 22.20 mm
Maximum disc run-out (fitted) ................................ 0.15 mm
Maximum disc thickness variation .......................... 0.015 mm
Front hub face maximum run-out .......................... 0.05 mm

Rear drum brakes

Type ................................................................. Leading and trailing shoes, with automatic adjusters
Drum diameter:
  New:
    1.6 Saloon/Hatchback ........................................ 203.0 mm
    1.8 and 2.0 Saloon/Hatchback .......................... 228.6 mm
    Estate ......................................................... 228.6 mm
  Maximum diameter:
    1.6 Saloon/Hatchback ........................................ 204.2 mm
    1.8 and 2.0 Saloon/Hatchback .......................... 229.6 mm
    Estate ......................................................... 229.6 mm

Rear disc brakes

Type ................................................................. Solid disc, with single-piston floating caliper
Disc diameter .................................................. 252.0 mm
Disc thickness:
  New ........................................................................ 20.0 mm
  Minimum ................................................................ 18.0 mm
Maximum disc run-out (fitted) ............................ 0.15 mm
Maximum disc thickness variation .......................... 0.015 mm
Rear hub face maximum run-out .......................... 0.05 mm
1 General information

The braking system is of diagonally-split, dual-circuit design, with ventilated discs at the front, and drum or disc brakes (according to model) at the rear. The front calipers are of floating single-piston design, using asbestos-free pads. The rear drum brakes are of the leading and trailing shoe type. They are self-adjusting during footbrake operation. The rear brake shoe linings are of different thicknesses, in order to allow for the different proportional rates of wear.

Pressure-control relief (PCR) valves are fitted to the rear brakes, to prevent rear wheel lock-up under hard braking. The valves are sometimes referred to as pressure-conscious reducing valves. On non-ABS models, they are fitted in the master cylinder rear brake outlet ports; on ABS models, they are located on the ABS unit.

When rear disc brakes are fitted, the rear brake caliper is located on the front of the knuckle on Saloon and Hatchback models, and on the rear of the knuckle on Estate models (see illustration).

The handbrake is cable-operated, and acts on the rear brakes. On rear drum brake models, the cables operate on the rear trailing brake shoe operating levers, and on rear disc brake models, they operate on levers on the rear calipers. The handbrake lever incorporates an automatic adjuster, which removes any slack from the cables when the lever is disengaged (see illustration). Handbrake lever movement remains consistent at all times, and no adjustment is necessary or possible.

Where fitted, the anti-lock braking system (ABS) is of the four-channel low-pressure type (see illustration). It uses the basic conventional brake system, together with a Bendix ABS hydraulic unit fitted between the master cylinder and the four wheel brakes. The hydraulic unit consists of a hydraulic actuator, an ABS brake pressure pump, an ABS module with built-in relay box, and two pressure-control relief valves. Braking at each of the four wheels is controlled by separate solenoid valves in the hydraulic actuator. If wheel lock-up is detected on a wheel when the vehicle speed is above 3 mph, the valve opens, releasing pressure to the relevant brake, until the wheel regains a rotational speed corresponding to the speed of the vehicle. The cycle can be repeated many times a second. In the event of a fault in the ABS system, the conventional braking system is not affected. Diagnosis of a fault in the ABS system requires the use of special equipment, and this work should therefore be left to a Ford dealer. Diagnostic connectors are located on the side of the left-hand front suspension turret.

The traction control system (TCS) is fitted as an option to some models, and uses the
basic ABS system, with an additional pump and valves fitted to the hydraulic actuator (see illustration). If wheelspin is detected at a speed below 30 mph, one of the valves opens, to allow the pump to pressurise the relevant brake, until the spinning wheel slows to a rotational speed corresponding to the speed of the vehicle. This has the effect of transferring torque to the wheel with most traction. At the same time, the throttle plate is closed slightly, to reduce the torque from the engine. At speeds above 30 mph, the TCS operates by throttle plate adjustment only.

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. Although genuine Ford linings are asbestos-free, the dust created by wear of non-genuine pads may contain asbestos, which is a health hazard. Never blow it out with compressed air, and don’t 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 at the start of Section 15 concerning brake fluid.

1 Apply the handbrake. Loosen the front wheel nuts, jack up the front of the vehicle and support it on axle stands.
2 Remove the front wheels. Work on one brake assembly at a time, using the assembled brake for reference if necessary.
3 Follow the accompanying photos, beginning with illustration 2.3A, for the pad removal procedure. Be sure to stay in order, and read the caption under each illustration.
4 Inspect the front brake disc for scoring and cracks. If a detailed inspection is necessary, refer to Section 4.
5 The piston must be pushed back into the caliper. Hold it with a pair of pliers, to avoid personal injury. On models fitted with pad wear sensors, it will be necessary to disconnect the wiring.

2 Front brake pads - renewal

1 Apply the handbrake. Loosen the front wheel nuts, jack up the front of the vehicle and support it on axle stands.
2 Remove the front wheels. Work on one brake assembly at a time, using the assembled brake for reference if necessary.
3 Follow the accompanying photos, beginning with illustration 2.3A, for the pad removal procedure. Be sure to stay in order, and read the caption under each illustration.
4 Inspect the front brake disc for scoring and cracks. If a detailed inspection is necessary, refer to Section 4.
5 The piston must be pushed back into the caliper. Hold it with a pair of pliers, to avoid personal injury. On models fitted with pad wear sensors, it will be necessary to disconnect the wiring.

2.3A Prise the retaining clip from the caliper. Hold it with a pair of pliers, to avoid personal injury. On models fitted with pad wear sensors, it will be necessary to disconnect the wiring.
9.4 Braking system

2.3B Prise the plastic covers from the ends of the two guide pins

2.3C Using a 7 mm Allen key, unscrew...

2.3D ...and remove the guide bolts securing the caliper to the carrier bracket

2.3E Withdraw the caliper from the disc, and support it on an axle stand to avoid straining the hydraulic hose. The outer pad will normally remain in position against the disc, but the inner pad will stay attached to the piston in the caliper.

caliper bore, to provide room for the new brake pads. A C-clamp can be used to accomplish this. As the piston is depressed to the bottom of the caliper bore, the fluid in the master cylinder will rise slightly. Make sure that there is sufficient space in the brake fluid reservoir to accept the displaced fluid, and if necessary, syphon some off first.

6 Fit the new pads using a reversal of the removal procedure, but tighten the guide bolts to the torque wrench setting given in the Specifications at the beginning of this Chapter.

7 On completion, firmly depress the brake pedal a few times, to bring the pads to their normal working position. Check the level of the brake fluid in the reservoir, and top-up if necessary.

8 Give the vehicle a short road test, to make sure that the brakes are functioning correctly, and to bed-in the new linings to the contours of the disc. New linings will not provide maximum braking efficiency until they have bedded-in; avoid heavy braking as far as possible for the first hundred miles or so.

3 Front brake caliper - removal, overhaul and refitting

Note: Refer to the warning at the beginning of the previous Section before proceeding.

3.2 Brake hose clamp fitted to the front flexible brake hose

3.3 Loosening the flexible brake hose at the caliper

3.6 Removing the caliper carrier bracket

Removal

1 Apply the handbrake. Loosen the front wheel nuts, jack up the front of the vehicle and support it on axle stands. Remove the appropriate front wheel.

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

3 Loosen (but do not completely unscrew) the union on the caliper end of the flexible brake hose (see illustration).

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

2.3F Pull the inner pad from the piston in the caliper

2.3G Remove the outer pad from the caliper frame. Brush all dust and dirt from the caliper, pads and disc, but do not inhale it, as it may be harmful to health. Scrape any corrosion from the disc.
5 Support the caliper in one hand, and prevent the hydraulic hose from turning with the other hand. Unscrew the caliper from the hose, making sure that the hose is not twisted unduly or strained. Once the caliper is detached, plug the open hydraulic unions in the caliper and hose, to keep out dust and dirt.

6 If required, the caliper carrier bracket can be unbolted and removed from the steering knuckle (see illustration).

**Overhaul**

7 With the caliper on the bench, brush away all traces of dust and dirt, but take care not to inhale any dust, as it may be injurious to health.

8 Pull the dust-excluding rubber seal from the end of the piston.

9 Apply low air pressure to the fluid inlet union, and eject the piston. Only low air pressure is required for this, such as is produced by a foot-operated tyre pump.

**Caution:** The piston may be ejected with some force.

10 Using a suitable blunt instrument (for instance a knitting needle or a crochet hook), prise the piston seal from the groove in the cylinder bore. Take care not to scratch the surface of the bore.

11 Clean the piston and caliper body with methylated spirit, and allow to dry. Examine the surfaces of the piston and cylinder bore for wear, damage and corrosion. If the piston alone is unserviceable, a new piston must be obtained, along with seals. If the cylinder bore is unserviceable, the complete caliper must be renewed. The seals must be renewed, regardless of the condition of the other components.

12 Coat the piston and seals with clean brake fluid, then manipulate the piston seal into the groove in the cylinder bore.

**Refitting**

13 Push the piston squarely into its bore.

14 Fit the dust-excluding rubber seal onto the piston and caliper, then depress the piston fully.

**Note:** To prevent uneven braking, BOTH front brake discs should be renewed or reground at the same time.

**Refitting**

15 Refit the caliper, and where applicable the carrier bracket, by reversing the removal operations. Make sure that the flexible brake hose is not twisted. Tighten the mounting bolts and wheel nuts to the specified torque (see illustration).

16 Bleed the brake circuit according to the procedure given in Section 15, remembering to remove the brake hose clamp from the flexible hose. Make sure there are no leaks from the hose connections. Test the brakes carefully before returning the vehicle to normal service.

**Caution:** The piston may be ejected with some force.

**Haynes Hint** Position a thin piece of wood between the piston and the caliper body, to prevent damage to the end face of the piston, in the event of it being ejected suddenly.

4.4A Using a micrometer to measure the thickness of the front brake disc

4.4B Disc minimum thickness marking

**4 Front brake disc - inspection, removal and refitting**

**Note:** To prevent uneven braking, BOTH front brake discs should be renewed or reground at the same time.

**Inspection**

1 Apply the handbrake. Loosen the relevant wheel nuts, jack up the front of the vehicle and support it on axle stands. Remove the wheel.

2 Remove the front brake caliper and carrier bracket with reference to Section 3, but do not disconnect the flexible hose. Support the caliper on an axle stand, or suspend it on axle stands. Remove the wheel.

3 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.

4 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. The minimum thickness is stamped on the disc hub (see illustrations). 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, the minimum thickness must be maintained. Obviously, if the disc is cracked, it must be renewed.

5 Using a dial gauge or a flat metal block and feeler gauges, check that the disc run-out 10 mm from the outer edge 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.

6 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 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.

7 The hub face run-out can also be checked in a similar way. First remove the disc as described later in this Section, fix the measuring equipment, then slowly rotate the hub, and check that the run-out does not exceed the amount given in the Specifications. If the hub face run-out is excessive, this should be corrected (by renewing the hub bearings - see Chapter 10) before rechecking the disc run-out.
Removal

8 With the wheel and caliper removed, remove the wheel nuts which were temporarily refitted in paragraph 3.
9 Mark the disc in relation to the hub, if it is to be refitted.
10 Remove the two special washers (where fitted), and withdraw the disc over the wheel studs (see illustrations).

Refitting

11 Make sure that the disc and hub mating surfaces are clean, then locate the disc on the wheel studs. Align the previously-made marks if the original disc is being refitted.
12 Refit the two special washers, where fitted.
13 Refit the brake caliper and carrier bracket with reference to Section 3.
14 Refit the wheel, and lower the vehicle to the ground.
15 Test the brakes carefully before returning the vehicle to normal service.

5 Rear brake drum - removal, inspection and refitting

Note: To prevent uneven braking, BOTH rear brake drums should be renewed at the same time.

Removal

1 Chock the front wheels, release the handbrake and engage 1st gear (or “P”).

Loosen the relevant wheel nuts, jack up the rear of the vehicle and support it on axle stands. Remove the wheel.
2 Remove the two special clips (where fitted), and withdraw the brake drum over the wheel studs. If the drum will not pass over the shoes, it is possible to release the automatic adjuster mechanism by prising out the small rubber grommet near the centre of the backplate, and inserting a screwdriver through the small hole. The self-adjusting ratchet can then be rotated, so that the brake shoes move to their lowest setting (see illustrations). Refit the rubber grommet before proceeding.
3 With the brake drum removed, clean the dust from the drum, brake shoes, wheel cylinder and backplate, using brake cleaner or methylated spirit. Take care not to inhale the dust, as it may contain asbestos.

Inspection

4 Clean the inside surfaces of the brake drum, then examine the internal friction surface for signs of scoring or cracks. If it is cracked, deeply scored, or has worn to a diameter greater than the maximum given in the Specifications, then it should be renewed, together with the drum on the other side.
5 Regrinding of the brake drum is not recommended.

Refitting

6 Locate the brake drum over the wheel studs, and (where fitted) refit the special clips.
7 Refit the wheel, then check the remaining rear drum.
8 Lower the vehicle to the ground, and tighten the wheel nuts to the specified torque. Depress the brake pedal several times, in order to operate the self-adjusting mechanism and set the shoes at their normal operating position.
9 Test the brakes carefully before returning the vehicle to normal service.

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 drums as described in Section 5. Work on one brake assembly at a time, using the assembled brake for reference if necessary.
2 Follow the accompanying illustrations for the brake shoe renewal procedure (see illustrations 6.2A to 6.2O). Be sure to stay in order, and read the caption under each illustration.
3 If the wheel cylinder shows signs of fluid leakage, or if there is any reason to suspect it of being defective, inspect it now, as described in the next Section.
4 Fit the new brake shoes using a reversal of the removal procedure, but set the eccentric cam at its lowest position before assembling it to the trailing shoe.
5 Before refitting the brake drum, it should be checked as described in Section 5.
6.2B Remove the two shoe hold-down springs, using a pair of pliers to depress the upper ends so that they can be withdrawn downwards off the pins.

6.2C Remove the hold-down pins from the backplate.

6.2D Pull the bottom end of the leading (front) brake shoe from the bottom anchor (use pliers or an adjustable spanner over the edge of the shoe to lever it away).

6.2E Release the trailing (rear) brake shoe from the anchor, then move the bottom ends of both shoes towards each other.

6.2F Unhook the lower return spring from the shoes, noting the location holes.

6.2G Move the bottom ends of the brake shoes together, and disconnect the top ends of the shoes from the wheel cylinder, taking care not to damage the rubber boots.

6.2H Unhook the upper return spring from the shoes . . .

6.2I . . . and withdraw the leading shoe from the backplate.

6.2J To prevent the wheel cylinder pistons from being accidentally ejected, fit a suitable elastic band or wire lengthwise over the cylinder/pistons. Don’t press the brake pedal while the shoes are removed.

6.2K Pull the handbrake cable spring back from the operating lever on the rear of the trailing shoe. Unhook the cable end from the cut-out in the lever, and remove the shoe.

6.2L Unhook the automatic adjustment strut from the trailing brake shoe . . .

6.2M . . . and remove the small spring.
6.2N Clean the backplate, and apply small amounts of high-melting-point brake grease to the brake shoe contact points. Be careful not to get grease on any friction surfaces.

6 With the drum in position, refit the wheel, then carry out the renewal procedure on the remaining rear brake.

7 Lower the vehicle to the ground, and tighten the wheel nuts.

8 Depress the brake pedal several times, in order to operate the self-adjusting mechanism and set the shoes at their normal operating position.

9 Make several forward and reverse stops, and operate the handbrake fully two or three times. Give the vehicle a road test, to make sure that the shoes are functioning correctly, and to bed-in the new linings to the contours of the disc. Remember that the new linings will not give full braking efficiency until they have bedded-in.

7 Rear wheel cylinder - removal, overhaul and refitting

Note: Before starting work, check on the availability of parts (overhaul kit of seals). Also bear in mind that if the brake shoes have been contaminated by fluid leaking from the wheel cylinder, they must be renewed. In principle, the shoes on BOTH sides of the vehicle must be renewed, even if they are only contaminated on one side.

Removal

1 Remove the brake drum as described in Section 5.

2 Minimise fluid loss either by removing the master cylinder reservoir cap, and then tightening it down onto a piece of polythene to obtain an airtight seal, or by using a brake hose clamp, a G-clamp, or similar tool, to clamp the flexible hose at the nearest convenient point to the wheel cylinder.

3 Pull the brake shoes apart at their top ends, so that they are just clear of the wheel cylinder. The automatic adjuster will hold the shoes in this position, so that the cylinder can be withdrawn.

4 Wipe away all traces of dirt around the hydraulic union at the rear of the wheel cylinder, then undo the union nut.

5 Unscrew the two bolts securing the wheel cylinder to the backplate (see illustration).

6 Withdraw the wheel cylinder from the backplate so that it is clear of the brake shoes. Plug the open hydraulic unions, to prevent the entry of dirt, and to minimise further fluid loss whilst the cylinder is detached.

Overhaul

7 Clean the external surfaces of the cylinder, and unscrew the bleed screw.

8 Carefully prise off the dust cover from each end of the cylinder.

9 Tap the wheel cylinder on a block of wood to eject the pistons and seals, keeping them identified for location. Finally remove the spring.

10 Clean the pistons and the cylinder by washing in methylated spirit or fresh hydraulic fluid. Do not use petrol, paraffin or any other mineral-based fluid. Remove and discard the old seals, noting which way round they are fitted.

11 Examine the surfaces of the pistons and the cylinder bores, and look for any signs of rust or scoring. If such damage is evident, the complete wheel cylinder must be renewed.

12 Reassemble by lubricating the first piston in clean hydraulic fluid, then manipulating a new seal into position, so that its raised lip faces away from the brake shoe bearing face of the piston.

13 Insert the piston into the cylinder. As the seal enters the bore, twist the piston back and forth so that the seal lip is not trapped.

14 Insert the spring, then refit the remaining piston and seal, again making sure that the seal lip is not trapped as it enters the bore.

15 Fit new dust covers to the grooves in the pistons and wheel cylinder body.

16 Refit the bleed screw.

Refitting

17 Wipe clean the backplate, and remove the plug from the end of the hydraulic pipe. Fit the cylinder onto the backplate, and screw in the hydraulic union nut by hand, being careful not to cross-thread it.

18 Tighten the mounting bolts, then fully tighten the hydraulic union nut.

19 Retract the automatic brake adjuster mechanism, so that the brake shoes engage with the pistons of the wheel cylinder. To do this, prise the shoes apart slightly, turn the automatic adjuster to its minimum position, and release the shoes.

20 Remove the clamp from the flexible brake hose, or the polythene from the master cylinder (as applicable).

21 Refit the brake drum with reference to Section 5.

22 Bleed the brake hydraulic system as described in Section 15. Providing suitable precautions were taken to minimise loss of fluid, it should only be necessary to bleed the relevant rear brake.

23 Test the brakes carefully before returning the vehicle to normal service.

8 Rear brake pads - renewal

Warning: Disc brake pads must be renewed on BOTH rear wheels at the same time - never renew the pads on only one wheel, as uneven braking may result. Although genuine Ford linings are asbestos-free, the dust created by wear of non-genuine pads may contain asbestos, which is a health hazard. Never blow it out with compressed air, and don't 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.

1 Check the front wheels, and engage 1st gear (or "P"). Loosen the rear wheel nuts, jack up the rear of the vehicle and support it on axle stands.

2 Remove the rear wheels. Work on one brake assembly at a time, using the assembled brake for reference if necessary.

3 Inspect the rear brake disc as described in Section 10.

4 Extract the spring clip, and pull out the retaining pin securing the caliper to the carrier.
bracket. Note that on Saloon and Hatchback models, the pin is at the bottom of the caliper, whereas on Estate models, it is at the top.

5 Swivel the caliper away from the carrier bracket, to expose the brake pads (see illustrations).

6 Disconnect the pad wear warning light wire (when fitted) at the connector. Also unbolt the brake hose bracket from the rear suspension strut, to avoid straining the flexible hose.

7 If necessary, the caliper may be completely removed by prising off the cap and unscrewing the pivot guide bolt. Support the caliper on an axle stand, or tie it to one side with wire.

8 Remove the pads from the carrier bracket.

9 Brush all dust and dirt from the caliper, pads and disc, but do not inhale it, as it may be harmful to health. Scrape any corrosion from the disc.

10 Before fitting the new pads, screw the caliper piston fully into its bore, at the same time pressing the piston fully to the bottom of the bore. Proprietary tools are available for this operation - at a pinch, it may be possible to use long-nosed pliers engaged with the cut-outs in the piston. Brake fluid will be displaced into the master cylinder reservoir, so check first that there is enough space to accept the fluid. If necessary, syphon off some of the fluid.

11 Fit the new pads using a reversal of the removal procedure. On completion, firmly depress the brake pedal a few times, to bring the pads to their normal working position. Check the level of the brake fluid in the reservoir, and top-up if necessary.

12 Give the vehicle a road test, to make sure that the brakes are functioning correctly, and to bed-in the new linings to the contours of the disc. Remember that full braking efficiency will not be obtained until the new linings have bedded-in.

**Removal**

1 Chock the front wheels, and engage 1st gear (or “P”). Loosen the rear wheel nuts, jack up the rear of the vehicle and support it on axle stands. Remove the appropriate rear wheel.

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

3 Loosen (but do not completely unscrew) the union on the caliper end of the flexible hose.

4 Remove the rear brake pads, and free the caliper as described in Section B.

5 Disconnect the handbrake cable from the caliper. On Saloon and Hatchback models, the handbrake lever faces away from the caliper, whereas on Estate models, it faces towards the caliper (see illustrations).

**Overhaul**

8 No overhaul procedures were available at the time of writing, so check availability of spares before dismantling the caliper. In principle, the overhaul information given for the front brake caliper will apply, noting that it will be necessary to unscrew the piston from the handbrake mechanism (see Section 8, paragraph 10) before being able to expel the piston from the caliper. On reassembly, push the piston fully into the caliper, and screw it back onto the handbrake mechanism. Do not attempt to dismantle the handbrake mechanism; if the mechanism is faulty, the complete caliper assembly must be renewed.

**Refitting**

9 Refit the caliper, and where applicable the carrier bracket, by reversing the removal operations. Tighten the mounting bolts and wheel nuts to the specified torque, and do not forget to remove the brake hose clamp from the flexible brake hose.
10 Bleed the brake circuit according to the procedure given in Section 15. Make sure there are no leaks from the hose connections. Test the brakes carefully before returning the vehicle to normal service.

**10 Rear brake disc - inspection, removal and refitting**

Refer to Section 4 (front disc inspection). Once the rear caliper is removed, the procedure is the same.

**11 Master cylinder - removal and refitting**

**Removal**

1. Disconnect the low fluid level warning light multi-plug from the fluid reservoir filler cap (see illustration). Unscrew and remove the cap (note that the filler cap should not be inverted). Draw off the hydraulic fluid from the reservoir, using an old battery hydrometer or a poultry baster. Do not syphon the fluid by mouth; it is poisonous. Any brake fluid spilt on paintwork should be washed off with clean water, without delay - brake fluid is also a highly-effective paint-stripper!
2. Identify the locations of each brake pipe on the master cylinder. On non-ABS models, there are four pipes; the two rear brake pipes are attached to PCR (pressure-conscious relief) valves on the master cylinder. On ABS models, there are only two pipes, which lead to the ABS hydraulic unit (see illustration).
3. Place rags beneath the master cylinder to catch spilt hydraulic fluid.
4. Clean around the hydraulic union nuts. Unscrew the nuts, and disconnect the hydraulic lines from the master cylinder.
5. Unscrew the mounting nuts, and withdraw the master cylinder from the studs on the front of the servo unit. If the nuts are tight, a split ring spanner should be used in preference to an open-ended spanner. Plug or cap open unions, to keep dust and dirt out.
6. Recover the gasket from the master cylinder.
7. If the master cylinder is faulty, it must be renewed. At the time of writing, no overhaul kits were available.

**Refitting**

8. Clean the contact surfaces of the master cylinder and servo.
9. Locate a new gasket on the master cylinder.
10. Position the master cylinder on the studs on the servo unit. Refit and tighten the nuts to the specified torque.
11. Carefully insert the hydraulic lines in the apertures in the master cylinder, then tighten the union nuts. Make sure that the nuts enter their threads correctly.
12. Fill the reservoir with fresh brake fluid.
13. Bleed the hydraulic system as described in Section 15.
14. Refit the reservoir filler cap, and reconnect the multi-plug for the low fluid level warning light.
15. Test the brakes carefully before returning the vehicle to normal service.

**12 Brake pedal - removal and refitting**

**Removal**

1. Working inside the vehicle, move the driver’s seat fully to the rear, to allow maximum working area.
2. Remove the ashtray, then unscrew the screws and remove the lower facia panel.
3. Prise the hairpin clip from the right-hand end of the pedal pivot shaft, and remove the washer (see illustration).
4. Unscrew the nut securing the pedal trunnion to the pushrod. The nut is located near the top of the pedal (see illustrations).
5 Press the pedal pivot shaft to the left, through the mounting bracket, just far enough to allow the pedal to be withdrawn. On manual transmission models, leave the blue nylon spacer (located between the clutch and brake pedals) on the pivot shaft (see illustration). On automatic transmission models, the shaft can be removed completely (see illustration).
6 With the pedal removed, prise out the bushes from each side. If necessary, also remove the pushrod trunnion and the rubber pad. Renew the components as necessary (see illustrations).

Refitting
7 Prior to refitting the pedal, apply a little grease to the pivot shaft, pedal bushes and trunnion.
8 Refitting is a reversal of the removal procedure, but make sure that the pedal bushes are correctly located, and that the pedal shaft "D" section locates in the right-hand side of the pedal bracket. Also make sure that the hairpin clip is correctly located.

Removal
1 Disconnect the battery negative (earth) lead (Chapter 5, Section 1).
2 Remove the master cylinder and the vacuum servo unit as described in Sections 11 and 16. If wished, the master cylinder may be left attached to the servo unit.
3 Working inside the passenger compartment, fold down the covering from the front of both front footwells.
4 Have an assistant support the cross-link assembly from inside the engine compartment.
5 Unscrew and remove the nuts and bolts on each side of the bulkhead, and remove the link assembly from inside the engine compartment. If necessary, have the assistant

Inspection
1 Jack up the front and rear of the vehicle, and support on axle stands.
2 Check for signs of leakage at the pipe unions, then examine the flexible hoses for signs of cracking, chafing and fraying.
3 The brake pipes should be examined carefully for signs of dents, corrosion or other damage. Corrosion should be scraped off, and if the depth of pitting is significant, the pipes renewed. This is particularly likely in those areas underneath the vehicle body where the pipes are exposed and unprotected.
4 Renew any defective brake pipes and/or hoses.

6 If a section of pipe or hose is to be removed, loss of brake fluid can be reduced by unscrewing the filler cap, and completely sealing the top of the reservoir with cling film or adhesive tape. Alternatively, the reservoir can be emptied (see Section 11).

Removal
5 If any brake fluid is spilt onto the bodywork, it must be washed off without delay - brake fluid is also a highly-effective paint-stripper!
6 To remove a section of pipe, hold the adjoining hose union nut with a spanner to prevent it from turning, then unscrew the union nut at the end of the pipe, and release it.
Releasing the brake pipe

1. Disconnect the brake hose from the master cylinder or brake caliper.
2. Loosen the nut securing the brake pipe union to the body, using a spanner.
3. Remove the brake pipe union nut, then release the pipe by pulling it out.
4. Repeat the procedure on the other end of the pipe.

Refitting the brake pipe

1. Clean the area around the brake pipe union.
2. Lubricate the brake pipe union with a suitable sealant.
3. Insert the brake pipe union into the body, making sure it is fully seated.
4. Torque the brake pipe union nut to the specified torque setting.
5. Reconnect the brake hose to the master cylinder or brake caliper.

Hydraulic system - bleeding

Warning: Brake fluid is poisonous. Take care to keep it off bare skin, and in particular not to get splashes in your eyes.

The fluid also attacks paintwork - wash off spillages immediately with cold water.

1. If the master cylinder has been disconnected and reconnected, then the complete system (both circuits) must be bled of air. If a component of one circuit has been disturbed, then only that particular circuit need be bled.
2. Bleeding should commence on one front brake, followed by the diagonally-opposite rear brake. The remaining front brake should then be bled, followed by its diagonally-opposite rear brake.
3. There are a variety of do-it-yourself “one-man” brake bleeding kits available from motor accessory shops, and it is recommended that one of these kits be used wherever possible, as they greatly simplify the brake bleeding operation. Follow the kit manufacturer’s instructions in conjunction with the following procedure. If a pressure-bleeding kit is obtained, then it will not be necessary to depress the brake pedal in the following procedure.
4. During the bleeding operation, do not allow the brake fluid level in the reservoir to drop below the minimum mark. If the level is allowed to fall so far that air is drawn in, the whole procedure will have to be started again from scratch. Only use new fluid for topping-up, preferably from a freshly-opened container. Never re-use fluid bled from the system.
5. Before starting, check that all rigid pipes and flexible hoses are in good condition, and that all hydraulic unions are tight. Take great care not to allow hydraulic fluid to come into contact with the vehicle paintwork, otherwise the finish will be seriously damaged. Wash off any spill fluid immediately with cold water.
6. If a brake bleeding kit is not being used, gather together a clean jar, a length of plastic or rubber tubing which is a tight fit over the bleed screw, and a new can of the specified brake fluid (see Chapter 1 Specifications). The help of an assistant will also be required.
7. Clean the area around the bleed screw on the front brake unit to be bled. It is important that no dirt be allowed to enter the hydraulic system, and remove the dust cap. Connect one end of the tubing to the bleed screw, and immerse the other end in the jar, which should be filled with sufficient brake fluid to keep the end of the tube submerged.
8. Open the bleed screw by one or two turns, and have the assistant depress the brake pedal to the floor. Tighten the bleed screw at the end of the downstroke, then have the assistant release the pedal. Continue this procedure until clean brake fluid, free from air bubbles, can be seen flowing into the jar. Finally tighten the bleed screw with the pedal in the fully-depressed position.
9. Remove the tube, and refit the dust cap. Top-up the master cylinder reservoir if necessary, then repeat the procedure on the diagonally-opposite rear brake.
10. Repeat the procedure on the remaining circuit, starting with the front brake, and followed by the diagonally-opposite rear brake.
11. Check the feel of the brake pedal - it should be firm. If it is spongy, there is still some air in the system, and the bleeding procedure should be repeated.
12. When bleeding is complete, top-up the master cylinder reservoir and refit the cap.

Vacuum servo unit - testing, removal and refitting

Testing

1. To test the operation of the servo unit, depress the footbrake four or five times to dissipate 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 now depressed again, it should be possible to hear a hiss from the servo when the pedal is depressed. After four or five applications, no further hissing should be heard, and the pedal should feel harder.
2. Before assuming that a problem exists in the servo unit itself, inspect the non-return valve as described in the next Section.

Removal

3. Refer to Section 11 and remove the master cylinder.
4. Disconnect the vacuum hose adaptor at the servo unit by pulling it free from the rubber grommet. If it is reluctant to move, prise it free, using a screwdriver with its blade inserted under the flange.
5. Unscrew the four nuts securing the servo unit to the mounting brackets on the bulkhead in the engine compartment.
6. On right-hand drive models, withdraw the servo unit so that its studs are just clear of the brackets. Have an assistant hold the brake pedal depressed, then extract the spring clip.
and remove the clevis pin securing the servo unit pushrod to the pedal cross-link arm.
7 On left-hand drive models, unscrew the nut securing the pedal trunion to the servo unit pushrod inside the passenger compartment. The nut is located near the top of the pedal, and is accessible through an access hole. For improved access, remove the lower fascia panel first.
8 Withdraw the servo unit from the bulkhead, and remove it from the engine compartment. On left-hand drive models, take care not to damage the bulkhead rubber grommet as the pushrod passes through it.
9 Note that the servo unit cannot be dismantled for repair or overhaul and, if faulty, must be renewed.

Refitting
10 Refitting is a reversal of the removal procedure. Refer to Section 11 for details of refitting the master cylinder.

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

Removal
1 Depress the brake pedal four or five times, to dissipate any remaining vacuum from the servo unit.
2 Disconnect the vacuum hose adaptor at the servo unit, by pulling it free from the rubber grommet (see illustration). If it is reluctant to move, prise it free, using a screwdriver with its blade inserted under the flange.
3 Detach the vacuum hose from the inlet manifold connection, pressing in the collar to disengage the tabs, then withdrawing the collar slowly.
4 If the hose or the fixings are damaged or in poor condition, they must be renewed.

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 towards the inlet manifold.

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

18 Pressure-control relief valve (non-ABS models) - removal and refitting

Removal
1 On non-ABS models, the two pressure-control relief valves (sometimes referred to as pressure-conscious reducing valves) are located on the master cylinder outlets to the rear brake line circuits.
2 Unscrew and remove the fluid reservoir filler cap, and draw off the fluid - see Section 11.
3 Position some rags beneath the master cylinder, to catch any spilled fluid.
4 Clean around the valve to be removed. Hold the PCR valve stationary with one spanner, and unscrew the hydraulic pipe union nut with another spanner. Pull out the pipe, and bend it slightly away from the valve.
5 Unscrew the PCR valve from the master cylinder.
6 Note that the primary and secondary PCR valves have different thread diameters, to prevent incorrect fitment. The primary valve has a 12 mm diameter thread (see illustration).

Refitting
7 Refitting is a reversal of the removal procedure. On completion, bleed the hydraulic system as described in Section 15.

19 Pressure-control relief valve (ABS models) - removal and refitting

Removal
1 On ABS models, the pressure-control relief valves are located on the ABS hydraulic unit (see illustration).
2 Disconnect the battery negative (earth) lead (Chapter 5, Section 1).
3 Remove the air cleaner assembly as described in Chapter 4.
4 Remove the engine air inlet duct and air plenum chamber.
5 Disconnect the low fluid level warning multi-plug from the brake fluid reservoir.
6 Unscrew and remove the brake fluid reservoir filler cap, and completely seal the top of the reservoir using cling film or adhesive tape. This will reduce loss of fluid when the PCR valve is removed.
7 Unscrew the master cylinder mounting nuts, and carefully withdraw the cylinder from the servo unit, leaving the brake pipes still connected to it. Move the master cylinder over to the left-hand side of the engine.

Refitting
12 Refitting is a reversal of the removal procedure. On completion, bleed the hydraulic system as described in Section 15.

18.6 Pressure-control relief valve locations
1 Primary PCR valve (12 mm)
2 Secondary PCR valve (10 mm)

On left-hand drive models, unscrew the servo unit mounting nuts, and move the unit to one side.
9 Position some rags beneath the ABS unit, to catch spilled fluid.
10 Clean around the valve to be removed. Hold the PCR valve stationary with one spanner, and unscrew the hydraulic pipe union nut with another spanner. Pull out the pipe, and bend it slightly away from the valve.
11 Unscrew the PCR valve from the ABS unit.

Refitting
12 Refitting is a reversal of the removal procedure. On completion, bleed the hydraulic system as described in Section 15.
20 ABS hydraulic unit - removal and refitting

Note: If any part of the ABS hydraulic unit is defective, it must be renewed as an assembly. Apart from the relay box (Section 22), individual spare parts are not available.

Removal
1 Remove both pressure-control relief valves as described in Section 19.
2 Identify the location of the remaining brake hydraulic pipes on the ABS hydraulic unit, then unscrew the union nuts and pull out the pipes. Carefully bend the pipes away from the hydraulic unit, to allow the unit to be removed.
3 Disconnect the multi-plugs from the hydraulic unit. To disconnect the main 22-pin multi-plug, push the locktab, then swivel the multi-plug outwards and unhook it.

Right-hand drive models
4 Have an assistant hold the brake pedal depressed, then extract the spring clip and remove the clevis pin securing the servo unit pushrod to the pedal cross-link arm.
5 Remove the vacuum servo unit from the engine compartment.

Left-hand drive models
6 Unscrew the nut securing the pedal trunnion to the servo unit pushrod inside the passenger compartment. The nut is located near the top of the pedal, and is accessible through an access hole. For improved access, remove the lower facia panel first.
7 Remove the vacuum servo unit, together with the pushrod, from the engine compartment. Take care not to damage the rubber grommet in the bulkhead.

All models
8 Unscrew the pump mounting nut.
9 Raise the left-hand side of the ABS hydraulic unit, then swivel the unit out of the right-hand mounting. Take care not to lose the bracket studs and insulator ring.

Refitting
10 Locate the insulator ring on the pump end, and fit the stud cap to the insulator ring.
11 Lower the ABS hydraulic unit into position, right-hand end first.
12 Fit the right-hand bracket studs onto the insulators.
13 Lower the left-hand end of the ABS hydraulic unit onto the bracket, then fit and tighten the pump mounting nut.

Left-hand drive models
14 Locate the vacuum servo unit and pushrod on the bulkhead bracket, taking care not to damage the rubber grommet.
15 Insert the pushrod in the pedal trunnion, and tighten the nut.
16 Refit the lower facia panel if it was removed.

21 ABS wheel sensor - testing, removal and refitting

Testing
1 Checking of the sensors is done before removal, connecting a voltmeter to the disconnected sensor multi-plug. Using an analogue (moving coil) meter is not practical, since the meter does not respond quickly enough. A digital meter having an AC facility may be used to check that the sensor is operating correctly. To do this, raise the relevant wheel then disconnect the wiring to the ABS sensor and connect the meter to it. Spin the wheel and check that the output voltage is between 1.5 and 2.0 volts, depending on how fast the wheel is spun. Alternatively, an oscilloscope may be used to check the output of the sensor - an alternating current will be traced on the screen, of magnitude depending on the speed of the rotating wheel.
2 If the sensor output is low or zero, renew the sensor.

Removal
Front wheel sensor
3 Apply the handbrake, jack up the front of the vehicle and support it on axle stands. Remove the relevant wheel.
4 Unscrew the sensor mounting bolt located on the steering knuckle, and withdraw the sensor (see illustrations).
5 Remove the sensor wiring loom from the support brackets on the front suspension strut and wheel arch.
6 Prise out the stud clips, and remove the Torx screws and screw clips holding the wheel arch liner in position. Withdraw the liner.
7 Disconnect the multi-plug, and withdraw the sensor and wiring loom.

Rear wheel sensor
8 Chock the front wheels, and engage 1st gear (or "P"). Jack up the rear of the vehicle and support it on axle stands. Remove the relevant wheel.
9 Unscrew the sensor mounting bolt, located on the brake backplate (drum brakes) or rear suspension knuckle (disc brakes), and withdraw the sensor.
10 On disc brake models, prise out the stud clips, and remove the Torx screws and screw clips holding the wheel arch liner in position. Withdraw the liner.
11 Disconnect the sensor wiring loom from the supports on the rear suspension strut (or knuckle) and wheel arch.
12 Working inside the vehicle, lift the rear seat cushion, then disconnect the multi-plug for the sensor wiring loom (see illustration).
13 Withdraw the sensor and wiring loom through the rubber grommet in the rear floor.

Refitting
Front and rear wheel sensors
14 Refitting is a reversal of the removal procedure.

22 ABS relay box - removal and refitting

Removal
1 Disconnect the battery negative (earth) lead (Chapter 5, Section 1).
2 Detach the vacuum hose from the inlet manifold connection, pressing in the collar to disengage the tabs, then withdrawing the collar slowly.
3 To improve access, free the heater hose from its retaining clips, and position it clear of the relay box.
4 Disconnect the wiring connector(s) from the relay box and, where necessary, the speed sender unit.
5 Slacken and remove the four Torx retaining screws, and withdraw the relay box from the hydraulic unit (see illustration).

Refitting
6 Refitting is a reversal of the removal procedure. Do not overtighten the relay box retaining screws, as the plastic is easily cracked.

23 TCS inhibitor switch - removal and refitting

Removal
1 Disconnect the battery negative (earth) lead (Chapter 5, Section 1).
2 Using a small screwdriver and a suitable pad (to protect the facia), prise out the TCS inhibitor switch from the facia.

Refitting
4 Refitting is a reversal of the removal procedure.

24 TCS throttle actuator - removal and refitting

Removal
1 The TCS throttle actuator is located in the front right-hand corner of the engine compartment. First disconnect the battery negative (earth) lead (Chapter 5, Section 1).
2 Disconnect the wiring multi-plug at the TCS actuator (see illustration).
3 Disconnect the multi-plug from the switch, and withdraw the switch.
4 Turn the upper throttle control segment, to provide some play in the accelerator cable leading to the throttle housing, then disconnect the cable by unhooking the end stop. Release the cable from the motor housing support (see illustrations).
5 Turn the lower accelerator control segment, to provide play in the accelerator cable from the accelerator pedal, then disconnect the cable by unhooking the end stop. Release the cable from the motor housing support (see illustration).
6 Unscrew the mounting bolts, and lift out the TCS throttle actuator (see illustration).

Refitting
7 Refitting is a reversal of the removal procedure. Adjust the accelerator cables as described in Chapter 4.

25 Stop-light switch - removal and refitting

Removal
1 Disconnect the battery negative (earth) lead (Chapter 5, Section 1).
2 Remove the lower facia panel, with reference to Chapter 11.
3 Disconnect the wiring multi-plug from the switch.
4 Rotate the switch anti-clockwise by a quarter-turn, and withdraw it from the pedal bracket (see illustration).
Refitting and adjustment

5. With the switch removed, reset it by fully extending its plunger.

6. Depress the brake pedal until the distance between the pedal and mounting bracket is as shown (see illustration).

7. Hold the pedal in this position, and refit the stop-light switch to the mounting bracket.

8. With the switch securely clipped in position, release the brake pedal, and gently pull it fully back to the at-rest position. This will automatically set the adjustment of the stop-light switch.

9. Reconnect the wiring connector and the battery, and check the operation of the switch prior to refitting the lower facia panel (Chapter 11).

Removal

26 Handbrake lever removal and refitting

1. Raise the front and rear of the vehicle, and support it on axle stands. Fully release the handbrake lever.

2. Remove the centre console as described in Chapter 11.

3. Working beneath the vehicle, release the exhaust system from the rubber mountings. Lower the exhaust system as far as possible, supporting it on blocks or more axle stands.

4. Detach the exhaust heat shield from the underbody.

5. Unhook the secondary (rear) handbrake cables from the equaliser bar.

6. Working inside the vehicle, unscrew and remove the two mounting bolts securing the handbrake lever to the floor (see illustration).

7. Turn the handbrake lever upside-down, then disconnect the primary cable end from the segment.

8. Withdraw the handbrake from inside the vehicle.

Refitting

9. Refitting is a reversal of the removal procedure, making sure that the primary cable is correctly located in the segment. Check the operation of the handbrake before returning the vehicle to normal service.

27 Handbrake cables removal and refitting

Removal

Primary (front)

1. Remove the handbrake lever as described in Section 26.

2. Prise the grommet from the underbody, and withdraw the cable from beneath the vehicle.

Secondary (rear)

3. Chock the front wheels, and engage 1st gear (or “P”). Jack up the rear of the vehicle and support it on axle stands. Fully release the handbrake lever.

4. Remove the relevant rear wheel.

5. Working beneath the vehicle, release the exhaust system from the rubber mountings. Lower the exhaust system as far as possible, supporting it on blocks or more axle stands.

6. Unbolt the exhaust heat shield from the underbody.

7. Unhook the relevant cable from the equaliser bar.

8. On drum brake models, remove the rear brake shoes on the relevant side as described in Section 6, then remove the outer cable from the backplate by compressing the three retaining lugs (use a suitable ring spanner) and pushing the cable through (see illustration).

9. On disc brake models, unhook the end of the cable from the handbrake operating arm on the rear caliper.

10. Release the lugs securing the outer cable to the underbody brackets, then release the cable from the clips, and withdraw it from under the vehicle (see illustrations).

Refitting

All cables

11. Refitting is a reversal of the removal procedure, but make sure that the cable end fittings are correctly located. Check the operation of the handbrake before returning the vehicle to normal service.