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90

SERVICE MANUAL

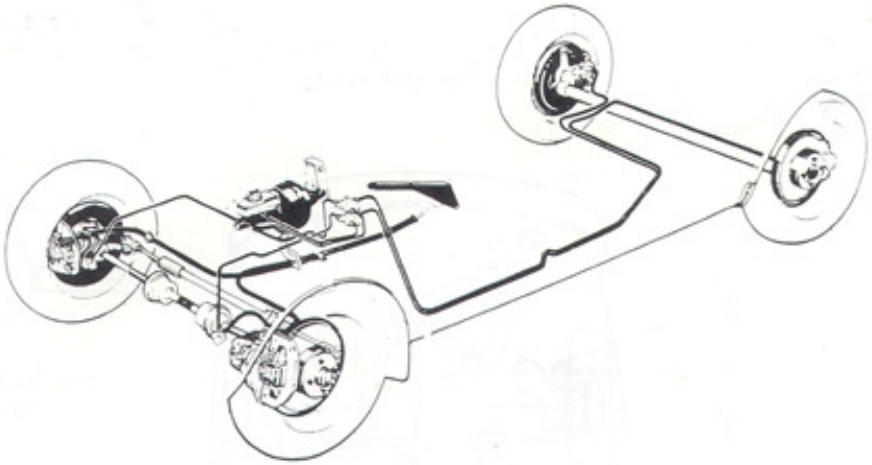
5 Brakes

M 1985–

5 Brakes

M 1985-

Specifications



Front brakes

Make	Girling
Type	Disc with floating yoke
Outside diameter of disc	276 mm
Thickness of new disc	12.7 mm
Minimum thickness of disc after grinding	11.7 mm
Maximum permissible grinding depth per side	0.5 mm
Maximum lateral throw of fitted disc	0.10 mm
Maximum permissible variation in thickness	0.015 mm
Lining thickness, new brake pad	8.8 mm
Minimum lining thickness	1 mm
Pad friction area	29 cm^2

Rear brakes

Make	ATE
Type	Disc with fixed yoke
Outside diameter of disc	267.5 mm
Thickness of new disc	10.5 mm
Minimum thickness of disc after grinding	9.5 mm
Maximum permissible grinding depth per side	0.5 mm
Maximum lateral throw of fitted disc	0.10 mm
Lining thickness, new brake pad	8.5 mm
Minimum lining thickness	1 mm
Pad friction area	20 cm^2

Brake fluid

Specification	DOT4
Brake system capacity	0.58 l (approx.)

Master cylinder

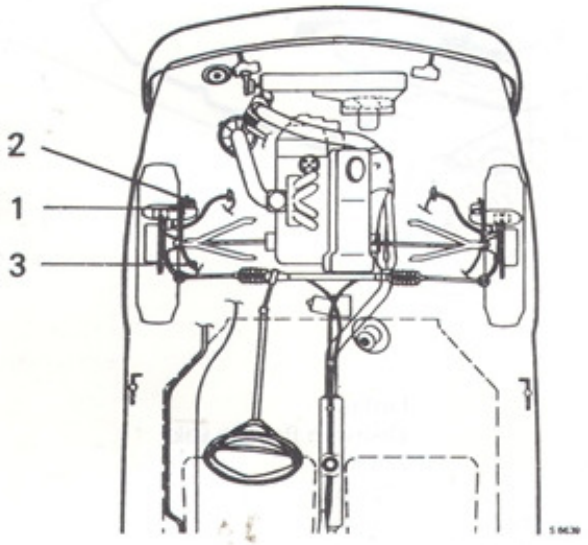
Type	Tandem cylinder
Make	Girling
Diameter	7/8 in. (22.23 mm)

Brake servo unit

Make	Girling
Diameter	9 in
Power multiplication	3.5:1 at a pedal force of 25 kgf

Tightening torques

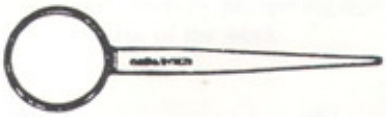
Front brake yoke bolts	110–130 Nm (11–13 kgf m)
Rear brake yoke bolts	70–90 Nm (7–9 kgf m)



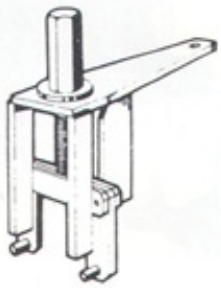
Item	Lubricating point	Lubricant
1	Front brake yoke sliding surfaces	Gleitmo 540
2	Automatic front brake adjusting mechanism	Girling Special Grease
3	Handbrake cables (protective sheath)	Chassis grease

Tools, service

89 96 043 *Key, brake, piston*

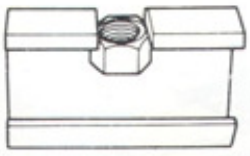


89 95 607 *Tool, removal and installation of brake spring*

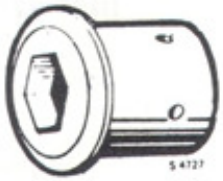


89 95 771 *Removing tool, brake pad*

83 90 270 *Tapping-out hammer*



89 96 175 *Removing tool, pad retaining pin*



89 95 805 *Sleeve, wheel nut*

89 96 191 *Grinding set, brake disc*

89 95 367 *Piston pliers, rear brake piston*

(45)30 08 612 *Grease, brake yoke*
89 94 782 *Grease, handbrake mechanism*

89 95 342 *Template*

General

The car has two independent brake systems: the footbrake or driving brake, which is hydraulic and acts on all four wheels, and the handbrake or parking brake, which is mechanical and acts on the front wheels.

Important

We recommend that you use the wet method when working on the brakes. For this you will need a spray flask containing water, which can be used to keep the components moist, thereby preventing dust from rising during the course of the work.

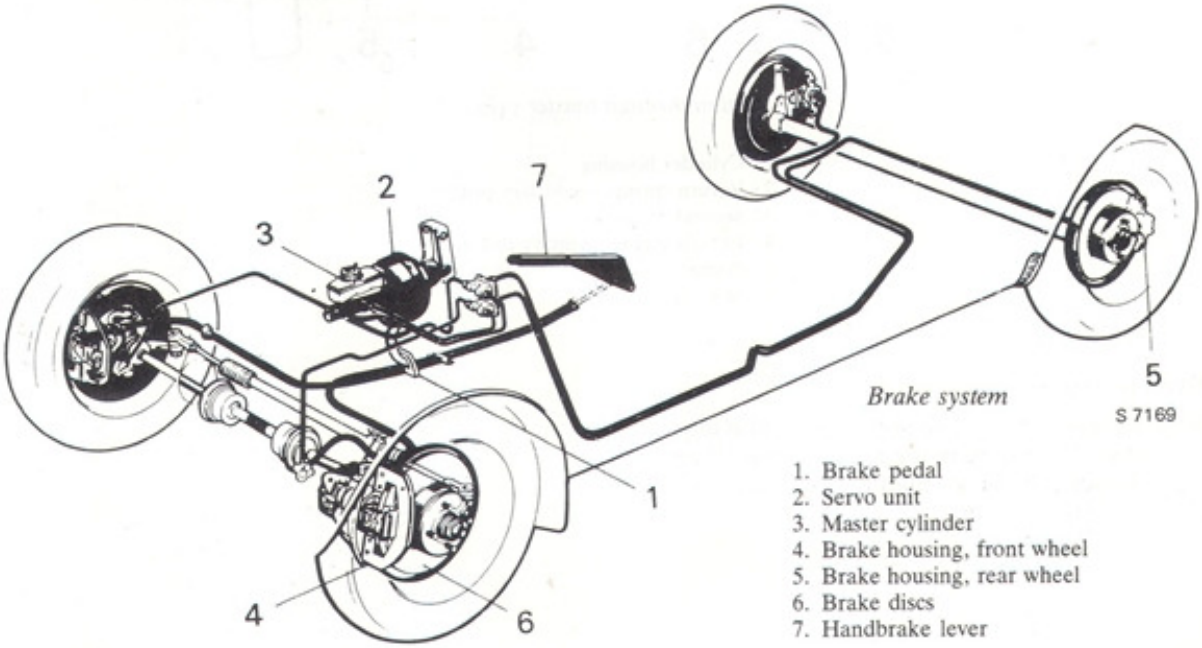
Footbrake system

When the brake pedal (1) is depressed, it acts on two pistons in the master cylinder (3) via the servo unit (2); the latter increases the pedal pressure and transmits the motion to the master cylinder which acts simultaneously but independently on two hydraulic circuits to the front (4) and rear (5) wheel brakes. Each circuit acts on a diagonally opposed pair of wheels, i.e. right front and left rear, and left front and right rear.

The pressure is transmitted through the brake lines and hoses to the wheel cylinders, where the pistons force the brake pads against the discs (6). The braking effort is greater on the front wheels, and this reduces the risk of the rear wheels locking. If there is a leak in the system, braking effort will be lost on one diagonal pair of wheels only, the other pair being unaffected. A float in the fluid reservoir senses the level of the fluid in the master cylinder. In the event of leakage, a contact in the float chamber cover will close, and the brake warning light will come on.

Handbrake system

The action of the handbrake lever (7) is transmitted mechanically by a link mechanism and two wires to the front wheel brakes (4) where a push rod acts mechanically on the pistons, which force the brake pads against the discs.



Brake system

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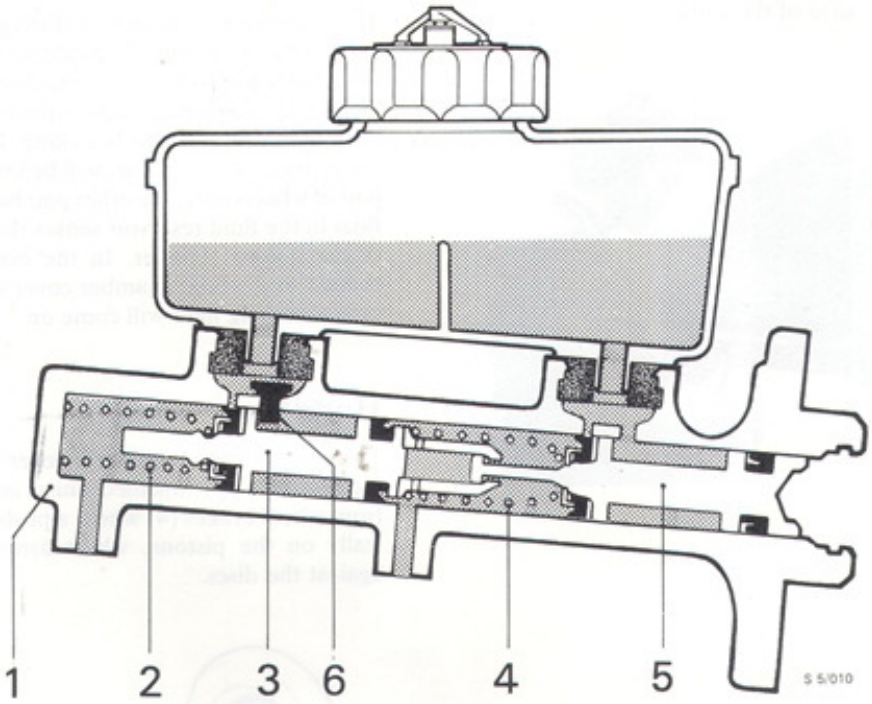
1. Brake pedal
2. Servo unit
3. Master cylinder
4. Brake housing, front wheel
5. Brake housing, rear wheel
6. Brake discs
7. Handbrake lever

Master cylinder

The master cylinder comprises a cylinder housing in which two pistons, one for each brake circuit, transmit the force from the push rod hydraulically. The leakage warning system consists of a float mechanism in the cover of the brake fluid reservoir, which senses the level of the fluid. Should the level drop below a preset limit, the movement of the float will actuate a switch in the cover, whereupon the brake warning light will come on.



Section through master cylinder

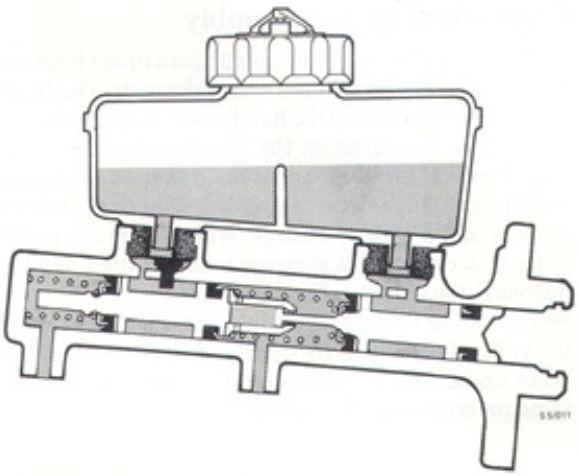
1. Cylinder housing
2. Return spring, secondary piston
3. Secondary piston
4. Return spring, primary piston
5. Primary piston
6. Stop pin

Rest position

In the rest position, the two pistons are held at the rear end of travel by means of the return spring. The passages between the brake fluid reservoir and the two brake circuits are open.

Braking

When the brake pedal is depressed, the primary piston is pushed forward by the push rod. This movement closes the passage between the fluid reservoir and the cylinder and the fluid pressure in front of the piston rises. The increased pressure results in the secondary piston being pushed forward. The same pressure acts on the front of both pistons and the pressure is transmitted to the brake.



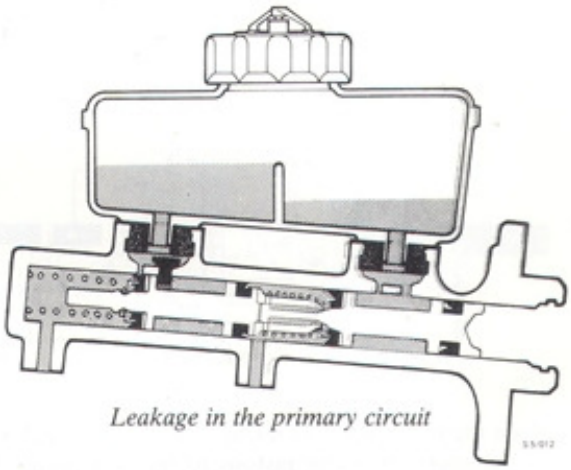
Failure of a brake circuit

In the event of a leakage occurring, for example, in the primary circuit, the primary piston spring is compressed until the piston acts on the secondary piston, and the brakes in the secondary circuit function normally.

In the event of leakage in the secondary circuit, the secondary piston is pushed forward until it bottoms in the cylinder. The primary circuit is unaffected. The float will drop as the fluid level sinks, whereupon the switch in the cover will close the circuit to the brake warning light.

The brake fluid reservoir comprises two mutually independent compartments. In the event of leakage in one circuit, only one of the compartments will therefore be emptied.

The fluid remaining in the undamaged circuit is sufficient to drive the car safely to a workshop. As the two brake circuits act diagonally, about half of the braking effect always remains in the event of leakage in one of the circuits. This also provides greater safety in steering the car as one front and one rear wheel always run free and do not lock.

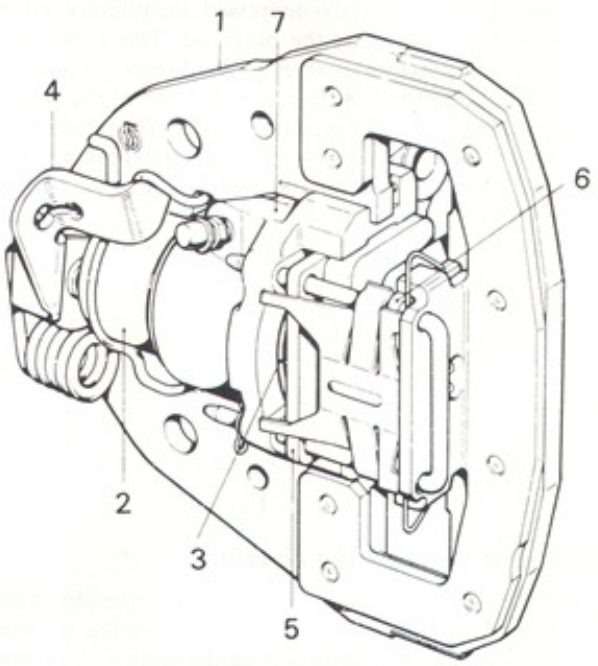


Leakage in the primary circuit

Wheel brakes

Front wheel brake assembly

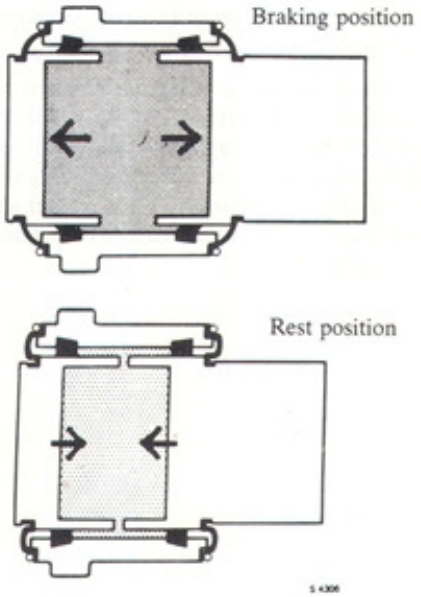
Each wheel brake assembly comprises a brake housing with two pistons, a yoke and two brake pads. The front brake housings contain the handbrake mechanism and are securely mounted on the steering knuckle housings. The rear brake housings are mounted to special mounting points on the rear axle. The yokes slide in grooves in the brake housings. When the brake pedal is depressed, the fluid pressure is transmitted to both pistons in the cylinder. One of the pistons acts directly on one of the brake pads, while the other presses on the yoke which indirectly transfers the pressure to the other brake pad. In this way, the pressure will be the same on both sides of the disc.



Front wheel brake assembly, left

1. Yoke
2. Piston (indirect)
3. Piston (direct)
4. Handbrake lever
5. Brake pad (inner)
6. Brake pad (outer)
7. Cylinder housing

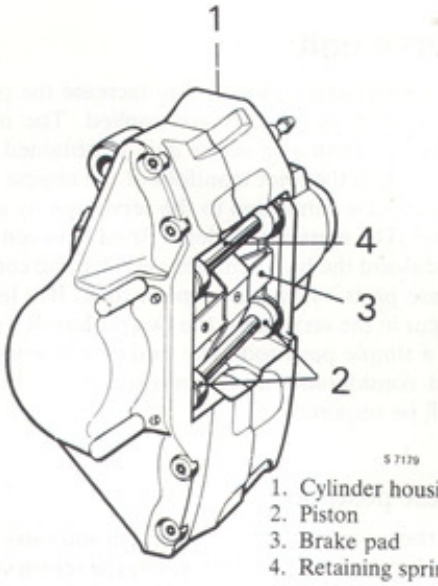
When the brake pedal is released, the piston seals in the cylinder return the pistons to the rest position. Adjustment as a result of brake pad wear is thus automatic.



Piston seals, position at rest and during braking

Rear wheel brake assembly

Each wheel brake assembly consists of a brake housing comprising two parts which are bolted together. Each half is equipped with a brake cylinder. When the brake pedal is depressed, both pistons act directly on the brake pads, pushing them against the disc.



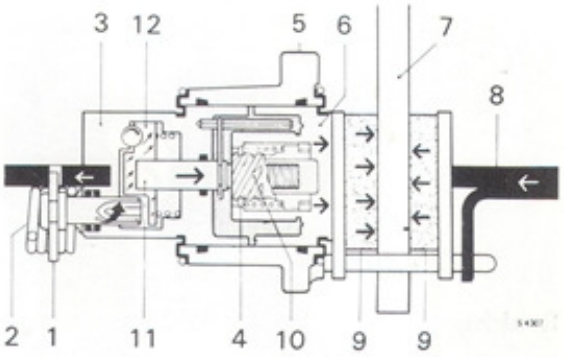
1. Cylinder housing
2. Piston
3. Brake pad
4. Retaining spring

Rear wheel brake assembly, left

Handbrake mechanism

The handbrake mechanisms and their automatic adjustment devices are combined with two brake pistons. The handbrake lever acts on a thrust plate which mechanically actuates the two pistons by means of a push rod. The automatic adjustment devi ce is built into the direct piston and consists of a sleeve with internal and external threads. The push rod is screwed into the internal thread and a drive ring fitted to a conical hole in the brake piston runs on the external thread which is specially designed with a coarse pitch.

When the brake is applied, the increase in hydraulic pressure between the pistons acts on the threaded end of the push rod. As the other end of the push rod is not affected by the pressure, the push rod and the direct piston will be forced apart. The play between the push rod thread and the internal thread of the sleeve evens out and the same applies to the external thread of the sleeve and the drive ring. The pressure of the drive ring against the conical hole increases and, as a result of its special shape, the sleeve turns in relation to the indirect piston and the push rod. As the brake is released, the brake pistons are returned in the cylinder as a result of the seals. The sleeve and push rod are returned by spring washers, the drive ring makes contact with the other side of the thread on the sleeve and the pressure against the conical seating is reduced, with the result that the drive ring revolves on the external thread of the sleeve. When the pistons are pressed further apart in the cylinder as a result of wear on the brake pads, rotation of the sleeve in relation to the push rod results in the latter being fed out, and this ensures constant adjustment.



Adjustment device, handbrake mechanism

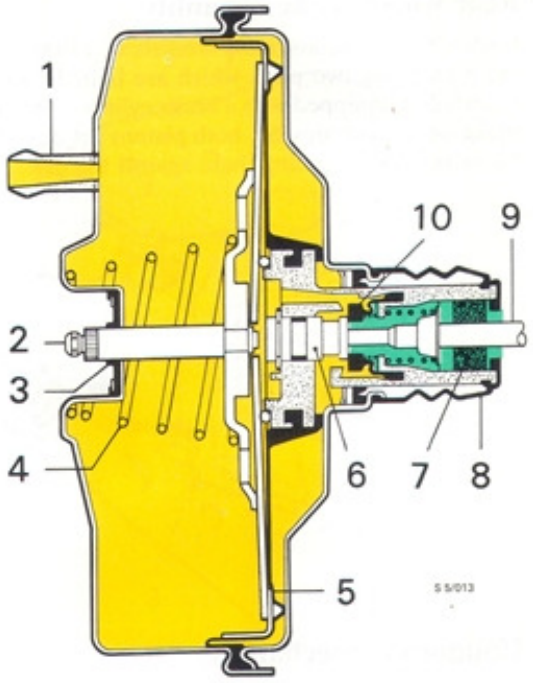
1. Handbrake lever
2. Return spring
3. Brake piston (indirect)
4. Drive ring
5. Brake cylinder housing
6. Brake piston (direct)
7. Brake disc
8. Yoke
9. Brake pad
10. Sleeve
11. Push rod
12. Thrust plate

Servo unit

The servo unit is designed to increase the pedal pressure when the brakes are applied. The increase in pressure from the servo unit is obtained from the vacuum in the inlet manifold of the engine. The inlet manifold is connected to the servo unit by means of a hose. The master cylinder is fitted between the brake pedal and the brake master cylinder and connected to these parts by means of push rods. If a leak should occur in the servo unit, the two push rods will then act as a simple push rod. The brakes will work as usual, but considerably more pressure on the brake pedal will be required.

Rest position

In the rest position the diaphragm and valve piston are held at the rear limit of travel by the return spring. The same vacuum acts on both sides of the diaphragm since the by-pass passage in the diaphragm is open.



Servo unit, rest position

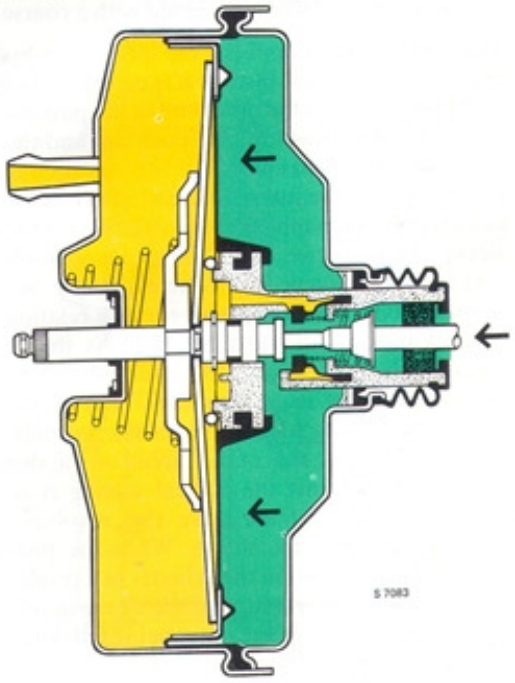
1. Non-return valve
2. Push rod (master cylinder)
3. Seal
4. Return spring
5. Diaphragm
6. Valve piston
7. Filter
8. Dust cover
9. Push rod (brake pedal)
10. By-pass valve

Braking

When the brake pedal is depressed, the push rod pushes the valve piston and diaphragm forward, closing the by-pass passage. The valve piston then opens a passage which enables air at atmospheric pressure to flow through the filter and to the rear of the diaphragm.

The power boost is derived from the difference between the vacuum in front of the diaphragm and the atmospheric pressure behind it.

When the brake pedal is released, the by-pass passage opens immediately and the air flows from behind the diaphragm to the front and on through the non-return valve to the inlet manifold. The atmospheric passage simultaneously closes and the return spring returns the diaphragm, valve piston, and push rod to the brake pedal, to the rest position. The non-return valve prevents air at atmospheric pressure from being drawn from the inlet manifold to the servo unit. The valve opens only when the vacuum in the inlet manifold is greater than that in the servo cylinder.



Servo unit, braking

Brake discs

The condition of the discs should be inspected when the thickness of the brake pad linings is checked. Small scores will be present on the brake discs after normal use and should be ignored.

Intermittent and irregular braking action as a result of lateral throw or variations in disc thickness should be rectified by grinding with sanding blocks (refer to the separate section on this).

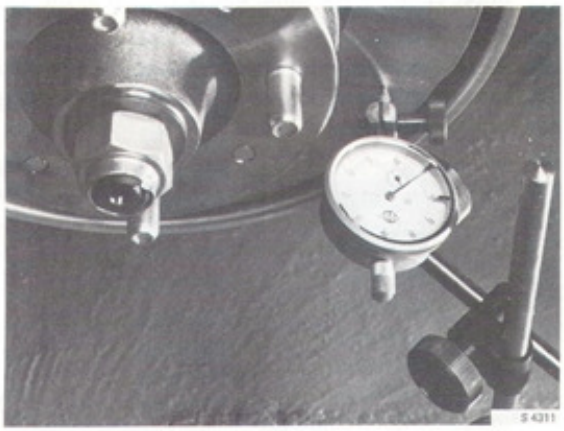
In more severe cases, turning in a special machine or replacement of the disc must be considered. Consideration must then be given to the amount of wear on the disc, which implies that check measurements must first be made.

Corrosion and signs of wear on the edge of the disc can be removed by a scraper (refer to the section on sanding blocks).

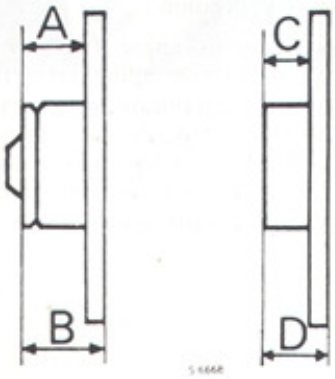
Check measurements

Use a dial indicator to measure the lateral throw of the brake disc. The maximum permissible throw is 0.004 in.(0.10 mm). The amount of wear of the disc can be measured with the disc in position or removed from the car. If measuring is to be carried out with the disc fitted in situ, the brake assembly must be slackened and any corrosion or signs of wear on the disc scraped off. Vernier calipers and a straightedge should be used to make the measurements. The following dimensions should be checked.

Brake disc with hub:	
Dimension A	
New brake disc	2.075 in. (52.7 mm)
Maximum after grinding	2.095 in. (53.2 mm)
Worn brake disc	2.102 in. (53.4 mm)
Dimension B	
New brake disc	2.575 in. (65.4 mm)
Minimum after grinding	2.555 in. (64.9 mm)
Worn brake disc	2.547 in. (64.7 mm)
Brake disc removed from car:	
Dimension C	
New brake disc	1.366 in. (34.7 mm)
Maximum after grinding	1.386 in. (35.2 mm)
Worn brake disc	1.394 in. (35.4 mm)
Dimension D	
New brake disc	1.866 in. (47.4 mm)
Minimum after grinding	1.846 in. (46.9 mm)
Worn brake disc	1.838 in. (46.7 mm)



Measuring the brake disc throw



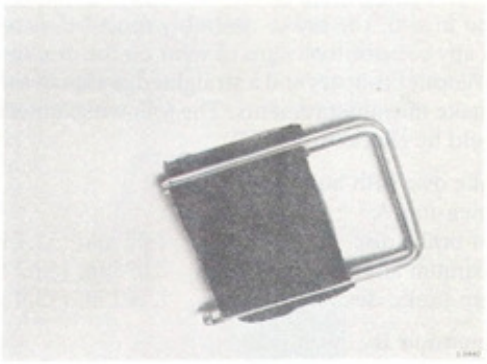
Brake disc with hub *Brake disc*

Dimensions for grinding and replacing of brake discs

Thickness, new brake discs	0.500 in. (12.7 mm)
Minimum thickness, worn brake discs	0.441 in. (11.2 mm)
Maximum wear per side (See check measurements)	0.028 in. (0.7 mm)
Grinding of brake discs, minimum thickness	0.461 in. (11.7 mm)
Maximum grinding cut per side (See check measurements)	0.020 in. (0.5 mm)

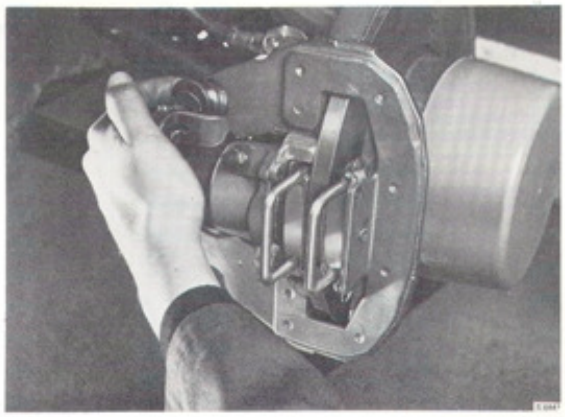
Grinding with sanding blocks

1. Lift the front suspension and remove the wheels. The front assembly must be kept level, so that lubrication of the differential will not be adversely affected.
2. Remove the brake pads and disconnect the handbrake cable on the same side of the car as the disc to be ground. Refer to Section 517.
3. Reset the automatic adjustment mechanism for the handbrake by screwing back the direct-acting brake piston.
4. Fit a piece of No. 50 grain emery cloth to each of the sanding blocks included in grinding kit 89 96 191. Clamp the emery cloth to the block by means of a pad retaining pin, as shown in the illustration.
5. Fit the sanding blocks with the deeper groove up and press the hub cover onto the wheel studs.
6. Lock the wheel on the opposite side of the car by applying the handbrake.
7. Set the automatic handbrake adjusting mechanism, on the same side as the disc to be ground, in the operating position.
8. Start the engine and engage first gear. Adjust the idling speed using the idling screw. Because the grinding effect deteriorates with the speed of rotation of the disc, have the disc rotate as slowly as possible. The speed will have to be slightly higher if the car has automatic transmission, to obviate slipping in the transmission.



9. Grind the disc by pressing on the handbrake lever.

Note
Apply enough pressure to cause the brake assembly to oscillate up and down. This indicates that the thickest part of the disc is being ground. Excessive pressure on the handbrake lever will reduce the grinding effect.



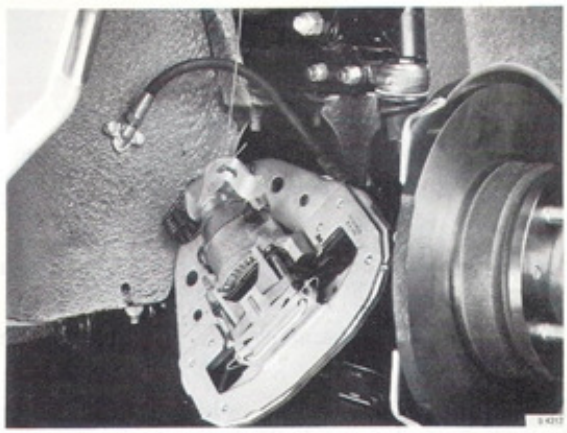
10. After about 30 seconds of grinding, withdraw the sanding blocks to clear them of grindings and then return them.
11. Repeat the procedure until the oscillating movement of the brake assembly has ceased.
12. Fit the brake pads and reset the footbrake and handbrake (refer to section 517).

Removal

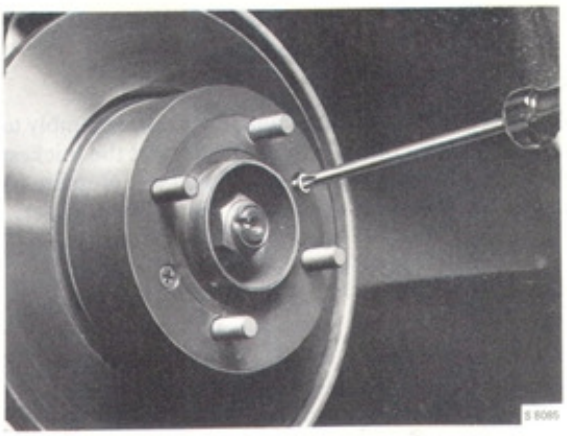
Front brake discs

Removal of brake disc

1. Remove the brake pads (see section 517).
2. Separate the brake housing from the steering knuckle housing vertical link and suspend it on a length of wire to avoid the brake hose being damaged or stretched.

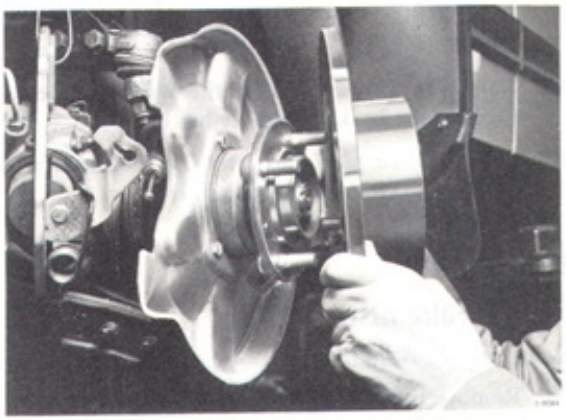


3. Remove the Phillips screws holding the disc to the hub.



4. Remove the brake disc from the hub.

   Refit in the reverse order. Always use new locking plates for the bolts in the brake housing. Tighten with a torque of 110–130 Nm (11–13 kgf m).



Rear brake discs

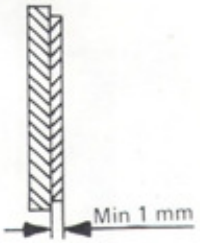
1. Disconnect the brake hose at the brake housing.
2. Remove the two bolts holding the brake housing to the rear axle.
3. Lift off the brake housing and suspend it by a length of wire.
4. Unscrew both retaining screws and remove the disc.

Refit the disc in the reverse order. Always use new locking plates for the bolts in the brake housing. Tighten with a torque of 70–90 Nm (7–9 kgf m).

Brake pads

Checking

Because both the footbrake and handbrake are self-adjusting, it is not possible to judge by the pedal stroke or by the lever movement whether the brake linings are worn. It is therefore most important to remove the wheels at the interval stated in the service program to check the thickness of the linings. The brake pads must be replaced before the thickness of the lining is less than 0.039 in. (1.0 mm).



The following friction lining thicknesses may be used as a recommendation for assessing whether or not the brake pads must be replaced in conjunction with service.

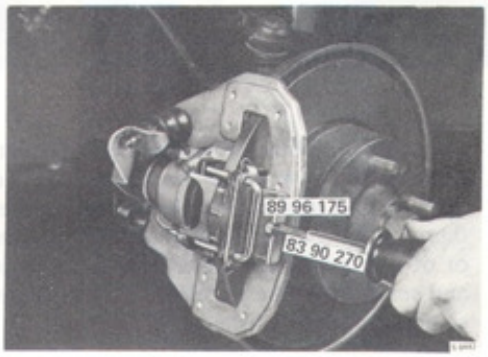
Front: 4 mm (0.157 in.)
Rear: 3 mm (0.118 in.)

If the friction material is thicker than the above values, it will be good for a further 15000 km (9000 miles) under normal motoring conditions.

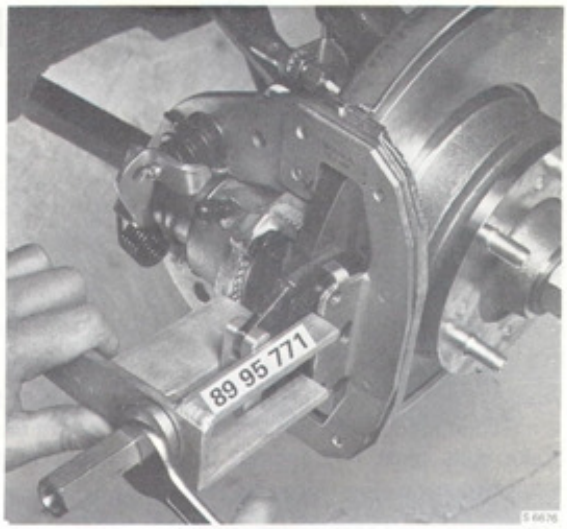
Brake assembly, front

Removal

1. Clean the brake housing.
2. Rotate the brake disc so that one of the recesses in the edge of the disc is in line with the brake pads.
3. Remove the damper spring, pin retaining clip and pad retaining pin. If the pad retaining pin is difficult to remove, use tapping-out tool 83 90 270 and removal tool 89 96 175.



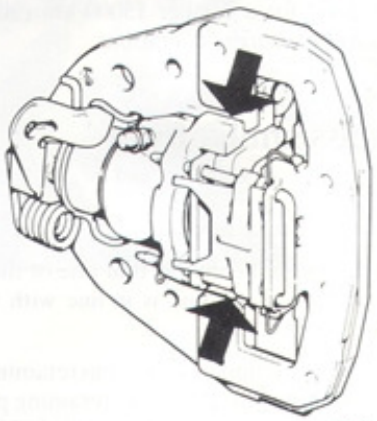
4. Withdraw the brake pads. If the pads are seated firmly, extractor 89 95 771 can be used.



Assembly

1. Lubricate the brake yoke's bearings by moving the yoke backwards and forwards against the yoke spring and applying the lubricant to the sliding surfaces (see illustration).

   Lubricant Gleitmo 540 Part No. (45) 3008612.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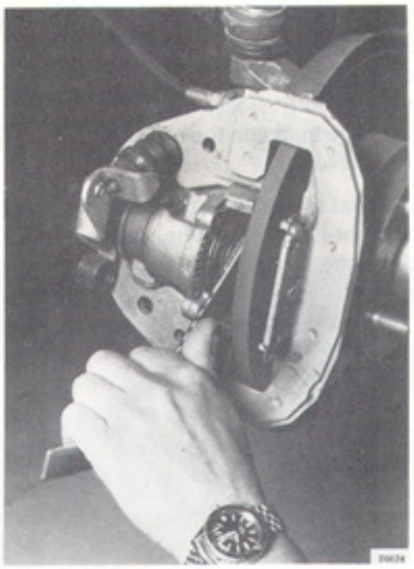
2. Check that the dust cover retainer is properly in position and is in good condition. Loose damaged or split dust covers should be replaced. If there are signs of dirt having entered the cylinders or of the pistons having corroded, new pistons and seals should be installed. Corroded pistons should never be polished.

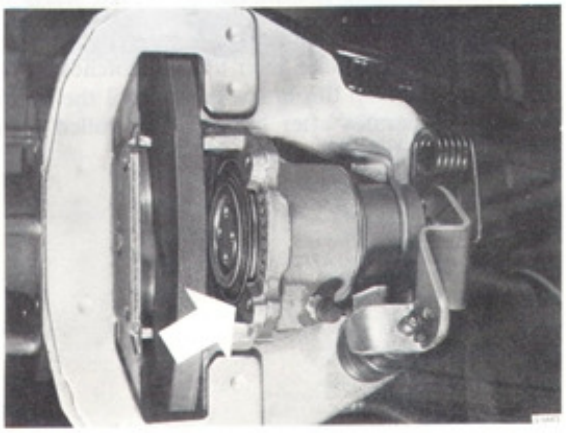
3. To fit new brake pads the brake pistons must be pushed back in the cylinder. On the front wheel brake, this can be done by rotating the direct piston by means of tool 89 96 043 at the same time as the piston is pressed into the cylinder.

   In this way, the automatic handbrake adjustment is reset.

   When the brake pistons are pushed back into the cylinder, the level in the brake fluid reservoir will rise. If the reservoir is full, some of the fluid must therefore be siphoned off before the pistons are screwed into the cylinder housing.



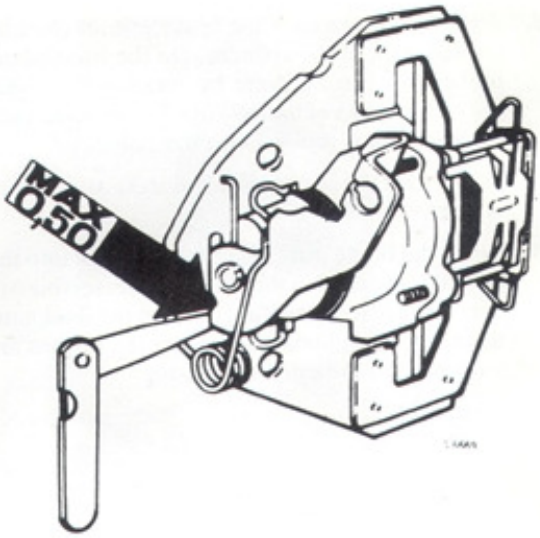
Caution
The piston seal can be damaged if the direct piston is inserted too far. Consequently, do not push the piston past the point where it is in line with the plane of the hole for the pad retaining pin in the brake housing (see illustration).



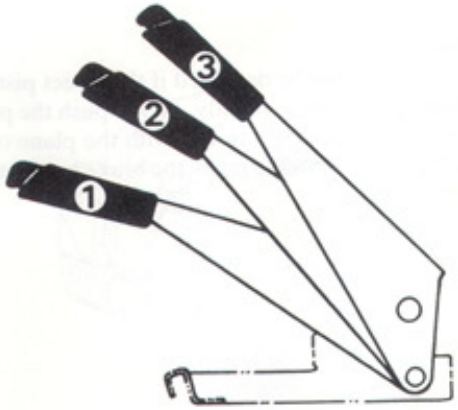
4. Check that the position of the pistons has not displaced the dust cover and that the yoke moves easily in the groove on the brake housing. Remove any rust or burred edges from the edge of the disc.
5. Fit the new brake pads together with the pad retaining pin, pin retaining clip and the damper spring.

6. Check the adjustment of the handbrake cable. Check the distance between the lever and the yoke. Clearance should be 0.5 mm max. (0.019 in.) on both sides. Adjustment, if required, should be made on the adjusting nut on the handbrake lever.

   Note that the cables cross over, which implies that the right-hand adjusting nut should be used to adjust the left-hand brake mechanism and vice versa.



7. With the engine switched off, pump the brake pedal repeatedly until the footbrake starts to operate.
8. Pull the handbrake lever up five notches. Continue to pump the brake pedal until the handbrake operates after having been pulled up a further two to four notches.



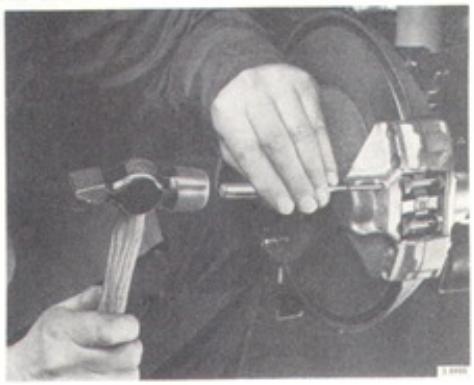
Handbrake lever

1. Neutral position (brake off)
2. Adjustment position (5 notches)
3. Full braking effort (7–9 notches)

Brake assembly, rear

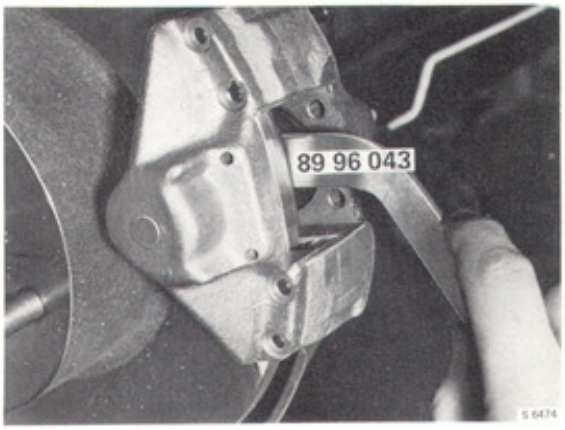
Removal

1. Clean the brake housing.
2. Tap out the brake pad retaining pins using a 2.5 mm (0.11 in.) drift. Save retaining spring.
3. Withdraw the brake pads. If they are difficult to remove, use extractor 89 95 771.



Fitting new pads

1. Check that the dust cover retainer is properly in position and that the cover is in good condition. Loose, damaged or split covers should be replaced. If there are signs of dirt having entered or of pistons having corroded new pistons and seals should be used. Corroded pistons should never be polished.
2. To provide sufficient space for the new brake pads to be fitted, the brake pistons must be pushed back in the cylinder bore. Use the handle to wrench 89 96 043 and push the pistons back no further than is necessary to enable the new pads to be fitted.



Caution
When the brake pistons are pressed into the cylinder, the level of the brake fluid in the reservoir will rise. Consequently, if the reservoir is full, some of the fluid will have to be siphoned off.

3. Fit the pad retaining pins and pin retaining clip. Repeat the procedure on the opposite wheel and then top up the brake fluid reservoir as necessary.
4. To put the brake in the operating position, lightly pump the brake pedal.

Hydraulic footbrake system

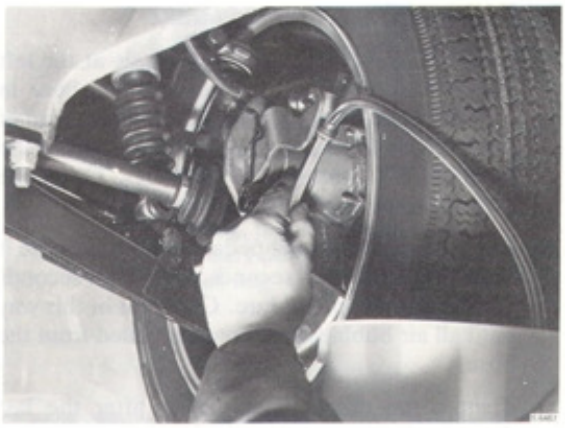
General instructions

Scrupulous cleanliness is essential when the brake system or any part of it is dismantled. Clean any dismantled parts in brake fluid or in a special cleaning solution for hydraulic brake components. Wipe the parts with a clean, lint-free cloth. All rubber parts and seals, etc., are available in repair kits and should be replaced. Before a unit is installed, all components should be dipped in clean brake fluid of the recommended specification.

Changing the brake fluid

All brake fluids deteriorate with time through oxidation and water absorption. The boiling point is lowered and a build-up of vapour is possible after repeated hard braking and this may result in brake failure. The brake fluid should therefore be changed every other year or every 50000 km (30000 miles).

1. Open the bleeder nipples for the secondary circuit (right front wheel and left rear wheel) one turn and connect suitable hoses to them, placing the other ends in a container.



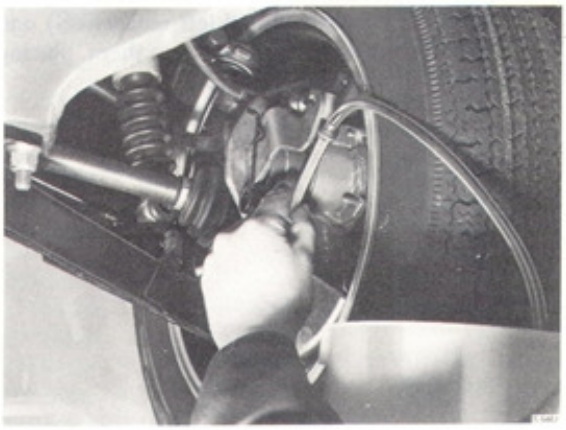
2. Pump the brake pedal until the front half of the fluid reservoir is nearly empty.
3. Top up with new fluid and continue pumping until the reservoir is nearly empty.
4. Top up the reservoir once again and close the bleeder nipples.
5. Repeat the same procedure for the primary circuit (left-hand front and right-hand rear).
6. Bleed the brake system

Bleeding

If air has entered the system, this can be detected by any sponginess being felt in the brake pedal, the need to press the pedal several times before the brake grips or by a lack of resistance. Checking should be carried out with the engine switched off and with no assistance from the servo unit. If small quantities of air are present in one of the circuits, this may result in uneven braking of the car but without sponginess in the brake pedal. Bleeding must be carried out after any component in the system has been removed. It is usually sufficient to bleed the brake housing or the circuit in which work has been carried out. A bleeder nipple is fitted to each brake housing. The best and fastest results are achieved with bleeding equipment, in which case the manufacturer's instructions should be followed.

1. Place chocks under the wheels and release the handbrake.
2. Make sure that the brake fluid reservoir is well filled and that the vent holes in the cap are not blocked.
3. Pump the brake pedal repeatedly.
4. Connect a hose to the bleeder nipple at the left rear wheel. Place the free end of the hose in container part filled with brake fluid. The end of the hose must be kept below the surface of the liquid in the container at all times. Open the bleeder screw one to two turns.
5. Fully depress the brake pedal, and then release it after a pause of a few seconds. Wait a few seconds then repeat the procedure. Continue in this way until all air bubbles have been expelled from the hose.

   Tighten the nipple immediately after the last downward stroke of the pedal.



6. Repeat the procedure described in points 4 and 5 with the right front wheel. Then change to the primary circuit by bleeding first the right rear wheel and then the left front wheel.
7. Top up the fluid reservoir.

Caution
New clean brake fluid of the recommended specification should always be used for topping up the brake fluid reservoir.

The brake fluid which has been pumped out during bleeding should never be reused.

Master cylinder

General instructions

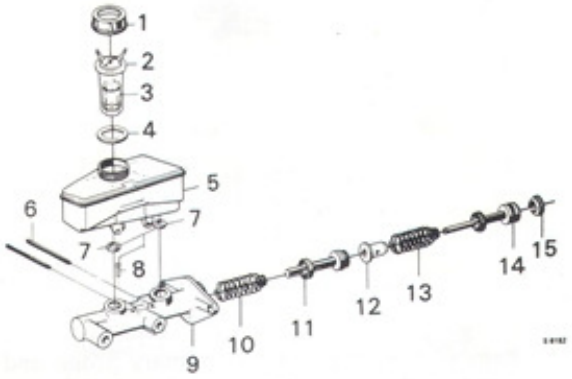
Scrupulous cleanliness is essential when the brake system or any part of it is dismantled. Clean any dismantled parts in brake fluid or in a special cleaning solution for hydraulic brake components. Wipe the parts with a clean, lint-free cloth. All rubber parts and seals, etc., are available in repair kits and should be replaced. Before a unit is installed, all components should be dipped in clean brake fluid of the recommended specification.

Removal

1. Cover the wing and place rags under the master cylinder to obviate damage to the paintwork in case the brake fluid should be spilt.
2. Disconnect the electric cable to the filler cap.
3. Disconnect the hose from the clutch master cylinder to the fluid reservoir. Insert a plastic stopper in the nipple of the reservoir.
4. Disconnect the two brake lines at the master cylinder.
5. Remove the two nuts which hold the master cylinder to the servo unit and remove the master cylinder.

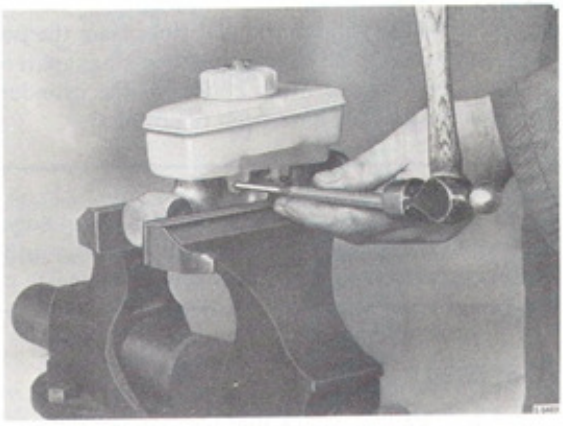
Dismantling

1. Empty the brake fluid reservoir and mount the master cylinder in a vice.
2. Tap out the tubular pins by means of a drift.



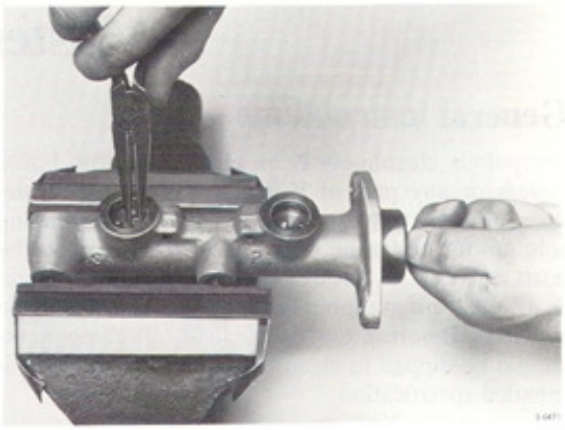
Master cylinder, exploded view, as from 1978 models

1. Cap
2. Fluid level switch
3. Float
4. Sealing ring
5. Brake fluid reservoir
6. Pin
7. Sealing ring
8. Stop pin
9. Cylinder housing
10. Spring, secondary piston
11. Secondary piston
12. Sleeve
13. Spring, primary piston
14. Primary piston
15. Lock ring

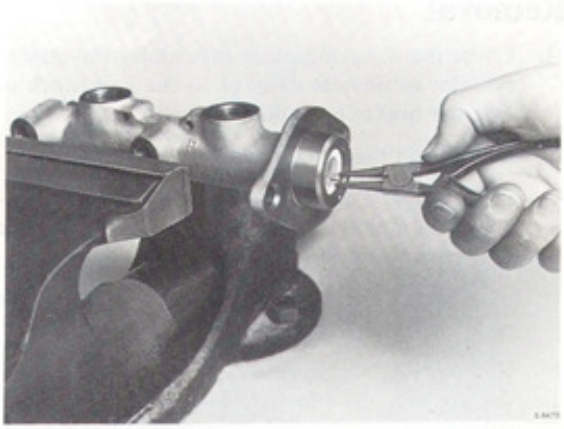


3. Remove the reservoir and using a small screwdriver remove the rubber seals from the hole for the fluid reservoir.

4. Push the primary piston into the master cylinder and withdraw the stop pin on the secondary piston.



5. Remove the circlip on the primary piston and withdraw the primary piston.



6. Remove the cylinder housing from the vice and knock it carefully against a wooden surface so that the secondary piston falls out. Alternatively, the secondary piston can be forced out with compressed air.
7. Remove the springs and seal rings from the two pistons. Keep the pistons and their rings apart so that they can be fitted back into the cylinders from which they have been removed.

Caution
Never attempt to extract the seals with sharp-edged tools which may scratch the pistons. If necessary, use a small screwdriver with smoothly rounded edges.

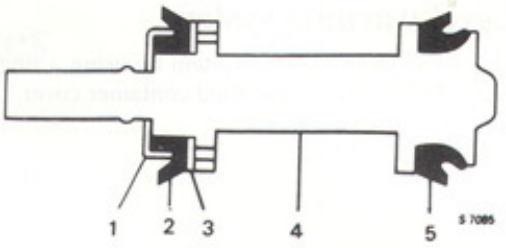
Assembly

1. After cleaning, check that the cylinder bore and pistons are free from scratches and corrosion. Worn or damaged parts should be replaced.

2. Fit new piston seals to the secondary and primary piston. This is made easier if the piston and seals are first dipped in brake fluid. Check that the seals are the right way round.

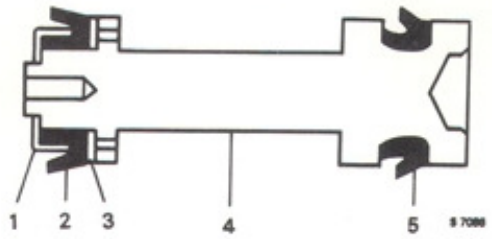
3. Grip the master cylinder in a vice. Lubricate the cylinder bore and carefully insert the complete secondary piston with the spring. Great care must be taken to avoid damage to the piston seals. Push in the secondary piston by means of a clean screwdriver and insert the stop pin.

4. Insert the complete primary piston in the same way and fit the circlip.



Secondary piston with seals

1. Spring seat
2. Piston seal
3. Washer
4. Piston
5. Piston seal

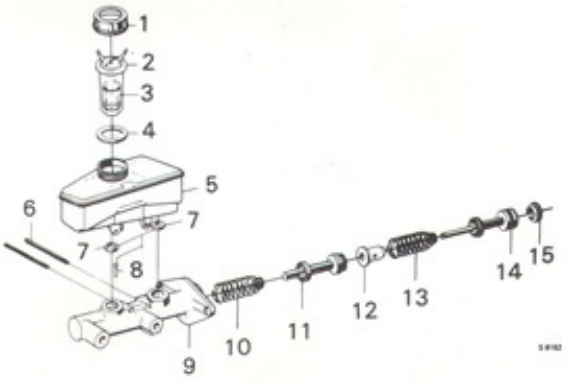


Primary piston with seals

1. Spring seat
2. Piston seal
3. Washer
4. Primary piston
5. Piston seals

Fitting

1. Secure the nuts holding the master cylinder to the servo unit.
2. Connect the brake line connections, the pipe from the clutch master cylinder and the electric cables for the brake warning switch.
3. Bleed the brake system.

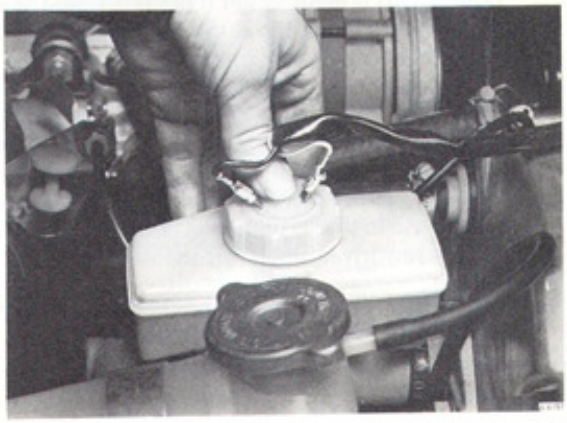


Master cylinder, exploded view, as from 1978 models

1. Cap
2. Fluid level switch
3. Float
4. Sealing ring
5. Brake fluid reservoir
6. Pin
7. Sealing ring
8. Stop pin
9. Cylinder housing
10. Spring, secondary piston
11. Secondary piston
12. Sleeve
13. Spring, primary piston
14. Primary piston
15. Lock ring

Level warning system

Check the level warning system by using a finger to depress the switch in the fluid container cover.



Brake lines

Inspection

For reasons of safety, all pipes, rubber hoses, connections, etc., in the brake line system must always be kept in first class condition. It is therefore essential that these parts be checked regularly in conjunction with the service programme. Brake pipes fitted to the body by means of clips must not be corroded or fitted in such a way that they can chafe against other parts; nor should they show any visible signs of damage. All hoses and connection should be secure and free from leaks. Damaged parts should be replaced.

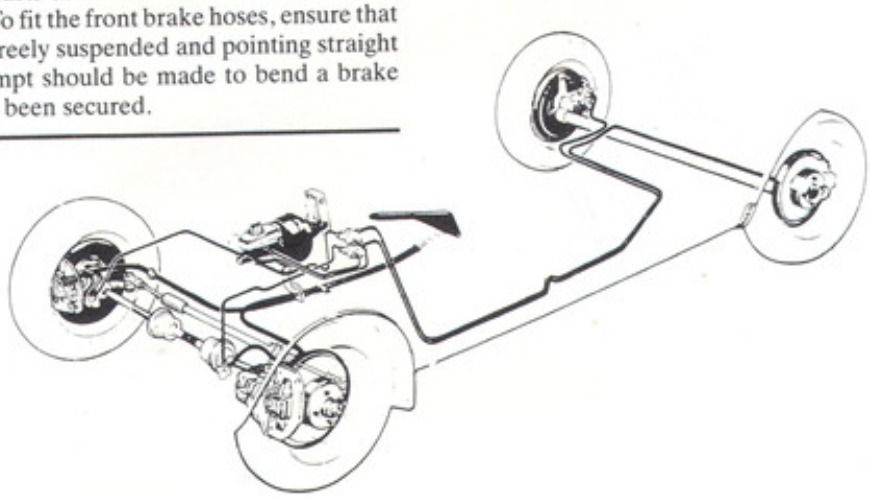
Removal

1. Clean all connections to the damaged pipe.
2. Unscrew the connecting nuts on the pipe together with any clips.
3. Insert plastic stoppers in the open ends and then remove the damaged pipe.

Fitting

1. Clean a new brake pipe internally by blowing clean, moisture-free compressed air through it.
2. Position the pipe, remove the plastic stoppers and tighten the connecting nuts.
3. Bleed the brake system.

Caution
When fitting brake hoses, it is highly important to position them correctly, thereby ensuring that steering or suspension movements do not bring them into contact with other parts of the car. The brake hoses must not be twisted. To fit the front brake hoses, ensure that the wheels are freely suspended and pointing straight ahead. No attempt should be made to bend a brake pipe once it has been secured.



Wheel cylinders and brake housing

General instructions

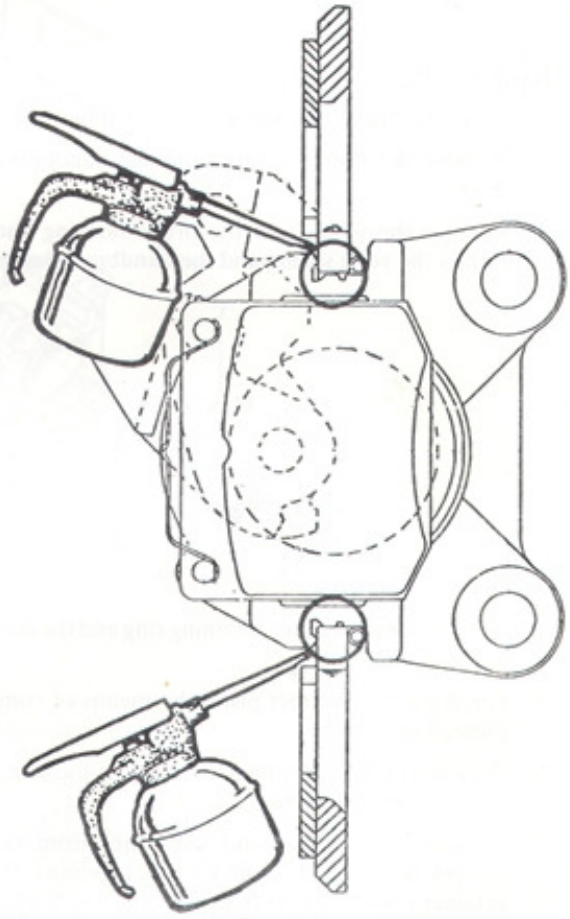
Scrupulous cleanliness is essential when the brake system or any part of it is dismantled. Clean any dismantled parts in brake fluid or in a special cleaning solution for hydraulic brake components. Wipe the parts with a clean, lint-free cloth. All rubber parts and seals, etc., are available in repair kits and should be replaced. Before a unit is installed, all components should be dipped in clean brake fluid of the recommended specification.

Front brake housing

Lubrication

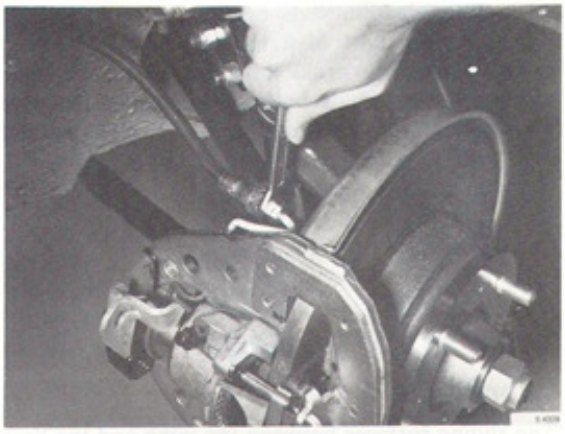
The sliding surfaces between the yoke and the brake housing should be lubricated in accordance with the service inspection programme and whenever work is carried out on the front brake assemblies. Lubrication can be carried out without removing the assemblies or brake pads.

1. Scrape away any dirt around the sliding surfaces of the yoke on the brake housing.
2. Apply drops of Gleitmo 540, Part No. (45) 30 08 612, to the sliding surfaces, sliding the yoke back and forth simultaneously.



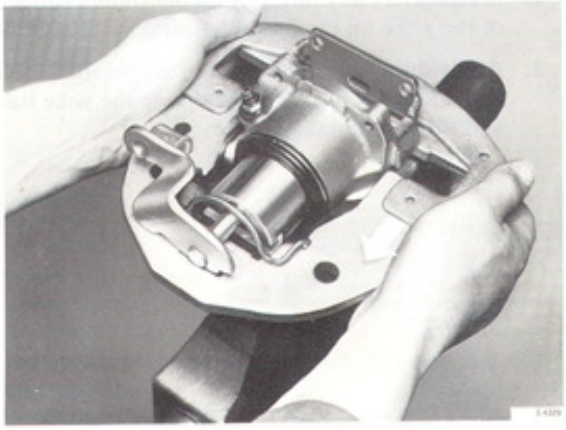
Removal

1. Remove the brake pads. See Section 517.
2. Disconnect the handbrake cable from the brake housing.
3. Unscrew the brake pipes to the brake housing at the hose connection (see illustration). Insert a rubber stopper in the connection to obviate spillage from the pipe.
4. Remove the two bolts which hold the brake housing to the steering knuckle housing.

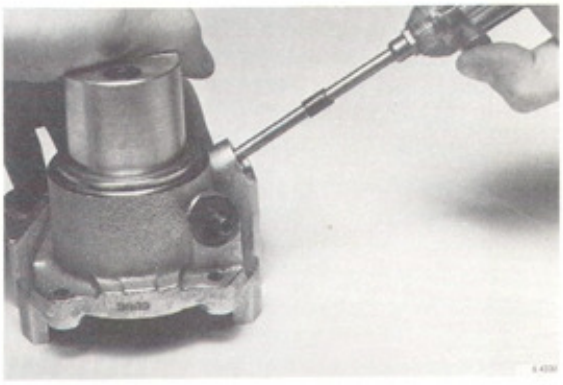


Dismantling

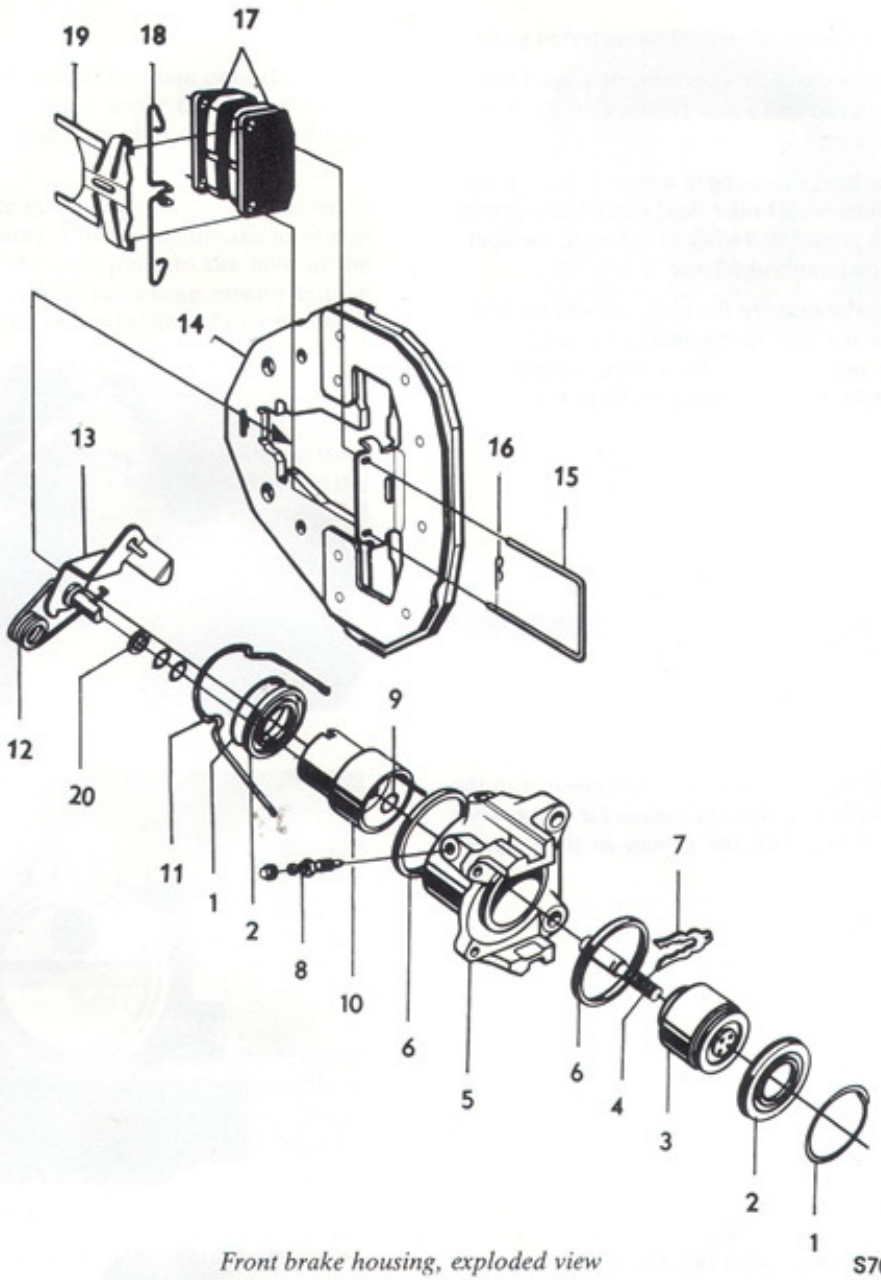
1. Clean the brake housing and mount it in a vice.
2. Remove the return spring from the handbrake lever.
3. Remove the yoke from the brake housing and extract the yoke spring and the handbrake lever.



4. Remove the dust cover retaining ring and the dust cover.
5. Force out the indirect piston by means of compressed air.
6. Press the push rod by hand to separate the direct piston from the cylinder.
7. Remove the O-rings and seal rings from the pistons and from the cylinder bore. Remove the retainer (two O-rings) from the aperture for the handbrake lever, to enable a new one to be fitted.



Note
The indirect piston and internal parts comprise an integral unit and must not be rinsed in brake fluid or any other cleaning fluid but should only be wiped clean; the lubricating grease for the handbrake mechanism will otherwise be washed off.

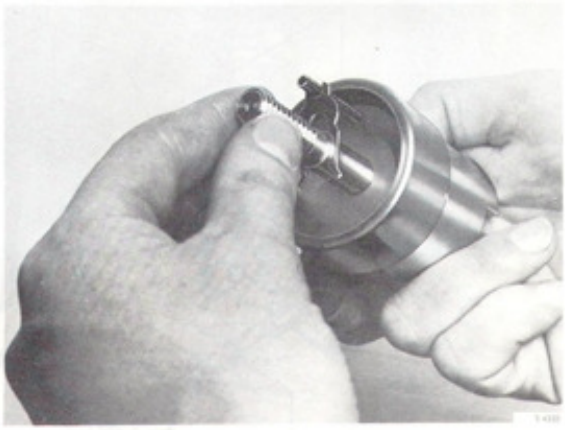


Front brake housing, exploded view

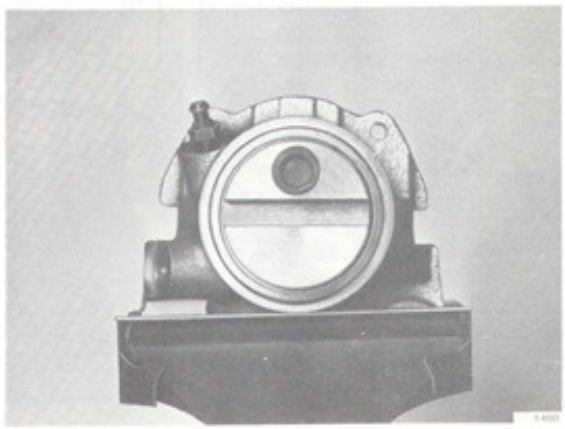
1. Dust cover holder
2. Dust cover
3. Piston (direct)
4. Push rod
5. Brake housing
6. Piston seal
7. Guide clip
8. Bleeder nipple
9. O-ring
10. Piston
11. Yoke spring
12. Spring (handbrake lever)
13. Handbrake lever
14. Yoke
15. Pad retaining pin
16. Lock clip
17. Brake pad
18. Spring
19. Damper spring
20. Retainer (two O-rings)

Assembly

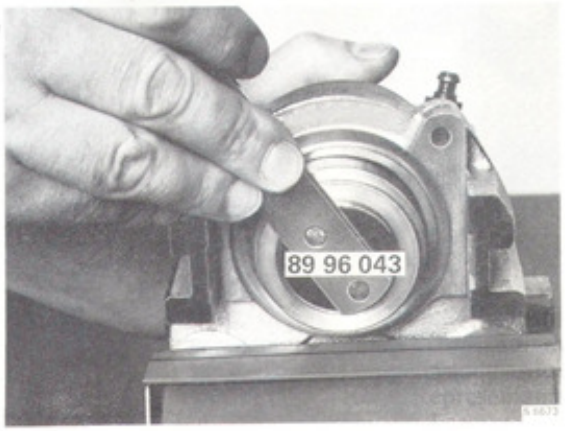
1. Replace any worn, damaged or corroded parts.
2. In the case of the indirect piston, fit a new O-ring on the push rod and a new retainer for the handbrake lever.
3. Mount the brake housing in a vice. Lubricate the cylinder bore with brake fluid and fit new piston seals. Use grease 89 94 782 to lubricate the aperture for the handbrake lever.
4. Fit the anchor plate to the push rod and push the latter into the hole in the indirect piston. Make sure that the recess in the anchor plate comes immediately over the spring in the piston.



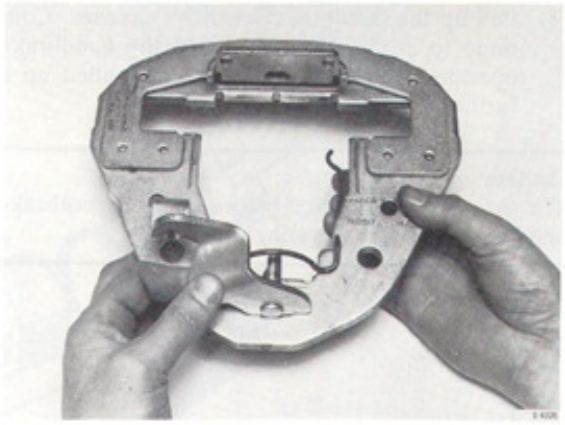
5. Lubricate the indirect piston and insert it in the brake housing so that the recess for the yoke is directly in line with the groove in the cylinder housing.



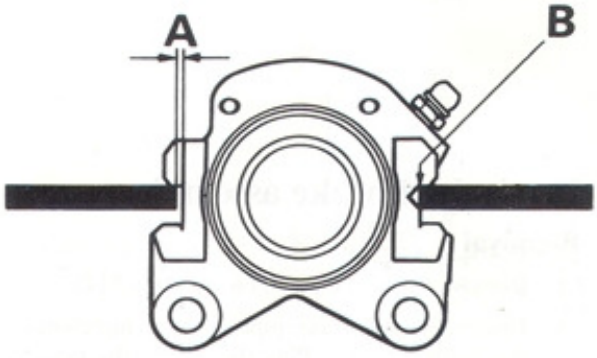
6. In the same way, push the direct piston into the cylinder and, by means of tool 89 96 043, screw together the piston and push rod. Screw and push in the two pistons until the edges of the dust cover grooves are flush with the brake housing.
7. Fit new dust covers and retaining rings.



8. Fit the yoke spring and the handbrake lever to the yoke.
9. Brush the recommended grease onto the yoke's sliding surfaces. Also apply the grease to the seating of the pad retaining disc in the brake housing.
10. Align the yoke guide edges with the grooves in the brake housing. Lift the handbrake lever and fit the end of the axle pin into the hole in the indirect piston. At the same time, ensure that the yoke fits into the recess in the indirect piston.
11. Fit the handbrake lever return spring.



12. Check the clearance between the sliding surfaces of the yoke and the brake housing as shown in the diagram. Greater play can result in vibration and noise when the brake is applied.



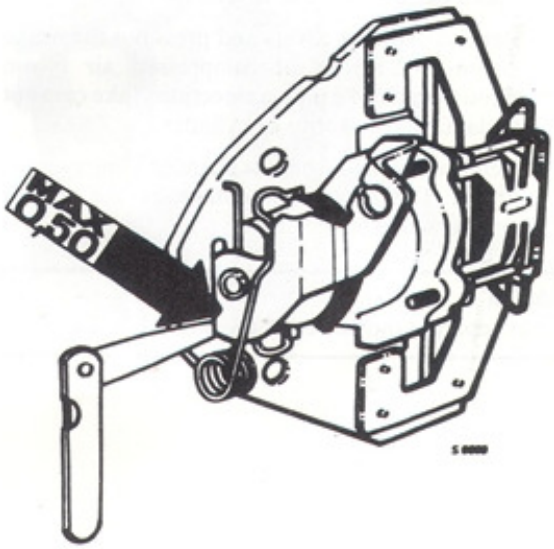
Clearance between brake housing and brake yoke, front wheel brake

A = 0.006–0.012 in.(0.15–0.30 mm)
B = No clearance

Fitting

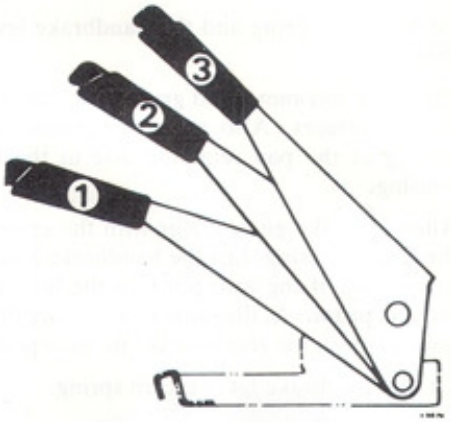
1. Check that the dust cover has not slipped out of position. Bolt the complete brake assembly to the steering knuckle housing. Use a new locking plate. Tighten with a torque of 110–130 Nm (11–13 kgf m).
2. Connect the brake lines.
3. Connect the handbrake cable. Pull the lever several times.
4. Check that the distance between the yoke and lever is 0.5 mm (0.019 in.). Adjust at the lever, if necessary.

   N.B.
   The cables are crossed.
5. Fit the brake pads.
6. Top up the brake fluid, bleed the system and check all connections for leakage.
7. With the engine switched off, return the brakes to their operating position by repeated pumping of the brake pedal. Continue pumping until the footbrake just starts to operate.



8. Pull up the handbrake lever five notches. Continue to pump the pedal until the handbrake operates after the lever has been pulled up a further two to four notches.

Caution
The car must not be used before both the footbrake and handbrake are operating properly.



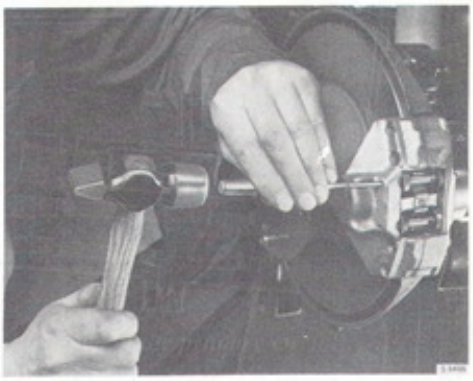
Handbrake lever

1. Neutral position
2. Adjustment poisition (5 notches)
3. Full braking effort (7–9 notches)

Rear-wheel brake assembly

Removal

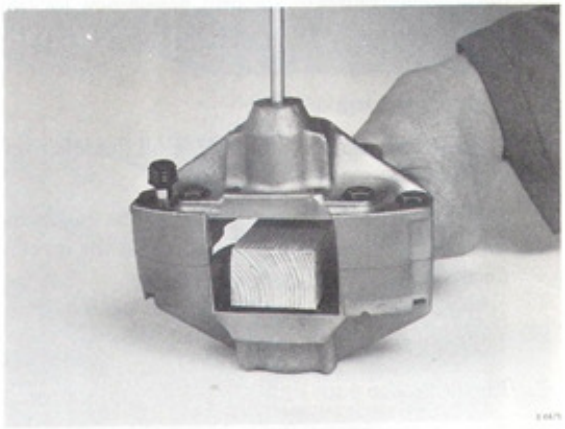
1. Remove the brake pads, (see section 517).
2. Disconnect the brake pipe at the connection to the brake housing. Plug the end of the pipe to prevent fluid leaking from the brake system.
3. Remove the two bolts securing the brake housing to the end assembly of the rear axle.

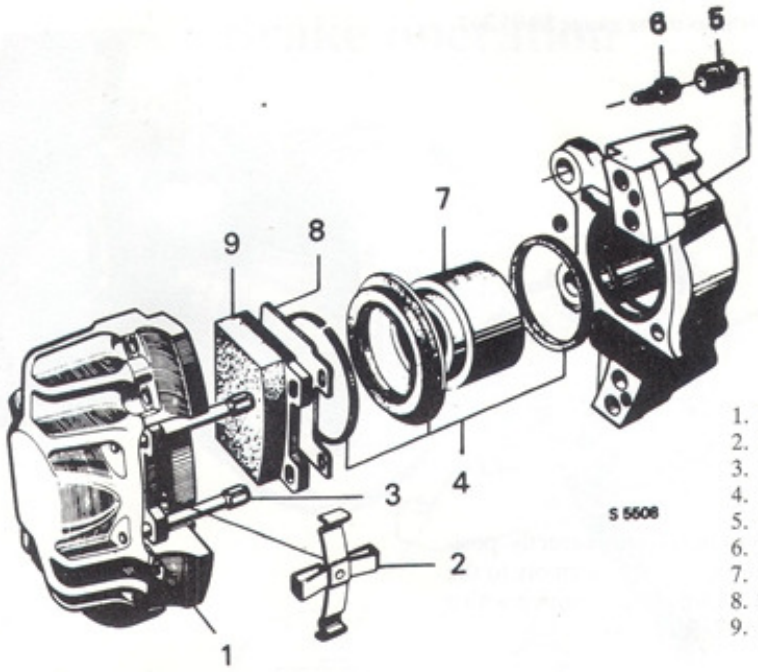


Dismantling

1. Clean the wheel brake assembly.
2. Remove the dust covers and press out the brake pistons by means of compressed air blown through the brake pipe connection. Take care not to damage the groove or cylinder.
3. Remove the seals from the cylinder using a screwdriver. Take care not to damage the sealing groove and cylinder bore.

Caution
Never separate the halves of the brake housing.



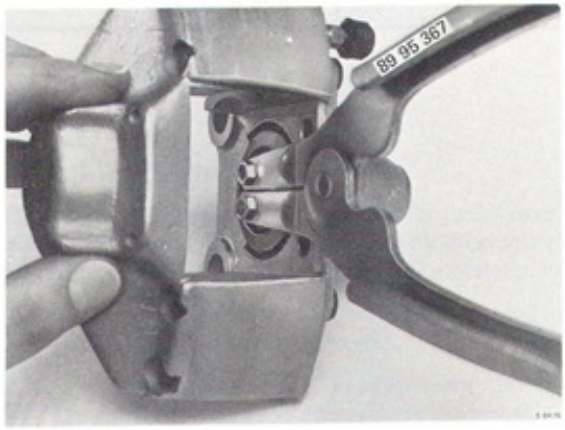


1. Brake housing
2. Damper spring
3. Lock pin
4. Piston seal
5. Rubber cap
6. Bleeder nipple
7. Piston
8. Twist stop
9. Brake pad

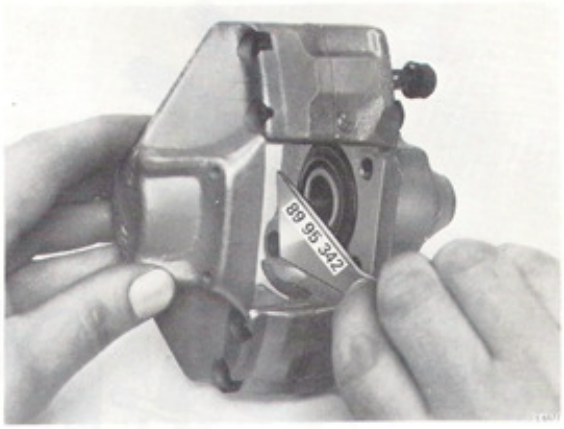
Rear brake housing, exploded view

Assembly

1. Replace any worn, damaged or seriously corroded parts.
2. Lubricate the cylinder bore with brake fluid and fit new seals.
3. Lubricate the pistons with brake fluid and insert them carefully into the cylinder.
4. Fit new dust covers and press the pistons fully home.
5. Using tool 89 95 367, rotate the pistons so that the recesses are in the right position.



6. Check the piston positions using gauge 89 95 342.

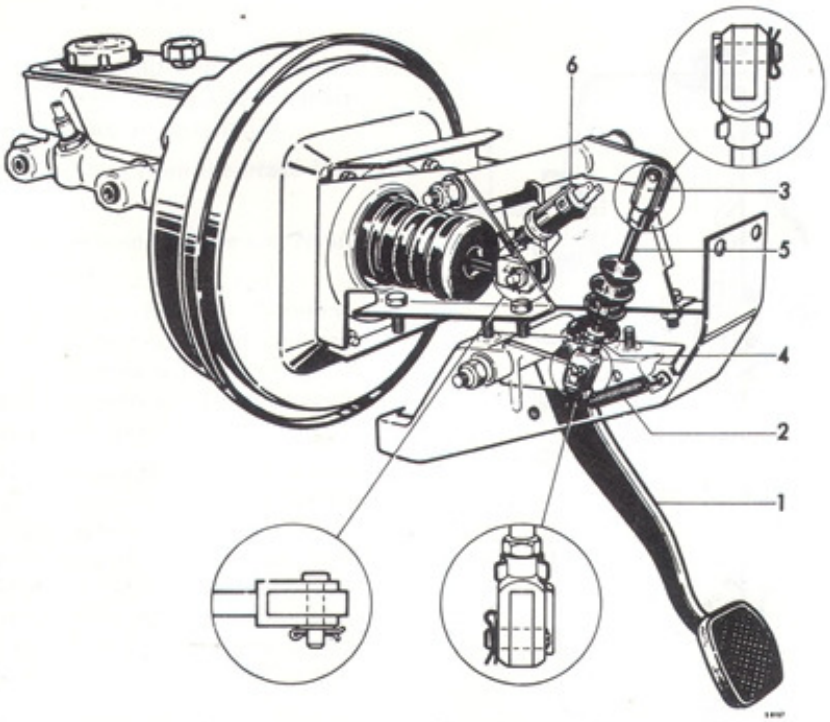


Refitting

1. Check that the dust covers are correctly positioned. Bolt the complete brake assembly to the rear axle. Use new locking plates. Tighten with a torque of 70–90 Nm (7–9 kgf m).
2. Connect the brake line.
3. Fit the brake pads. The stamped areas of the backing plates should be turned to coincide with the recess in the pistons.
4. Top up the brake fluid, bleed the system and check that there are no leakages at the brake line connections.
5. Return the brakes to the operating position by lightly pumping the brake pedal.

Caution
The car must not be used before both the footbrake and handbrake are operating properly.

Brake operation



Brake pedal (with pedal and push rod)

1. Brake pedal
2. Return spring
3. Fork end
4. Locknut
5. Pull rod
6. Brake light switch

Brake pedal

Removal

1. Remove the pedal-return spring.
2. Disconnect the lower fork end of the brake pedal pull rod.
3. Remove the locknut from the end of the pedal pin and push out the latter.
4. If the bushes are worn these can be pressed out and replaced with new ones. New bushes must be carefully greased with ball bearing grease.

Assembly

Assembly is carried out in th reverse order.

Pedal adjustment

Adjustment of the position of the brake pedal in relation to the clutch pedal is carried out by shortening or lengthening the pull rod from the brake pedal.

1. Disconnect the lower fork end of the pull rod and the return spring on the pedal.
2. Pull the rubber bellows away from the hole through the bulkhead and remove the locknut on the push rod. The rubber bellows and locknuts can be reached from the engine compartment.
3. Rotate the lower fork of the pull rod to obtain the required length.
4. After completed adjustment, tighten the locknut and reconnect the pull rod and return spring.

Servo system

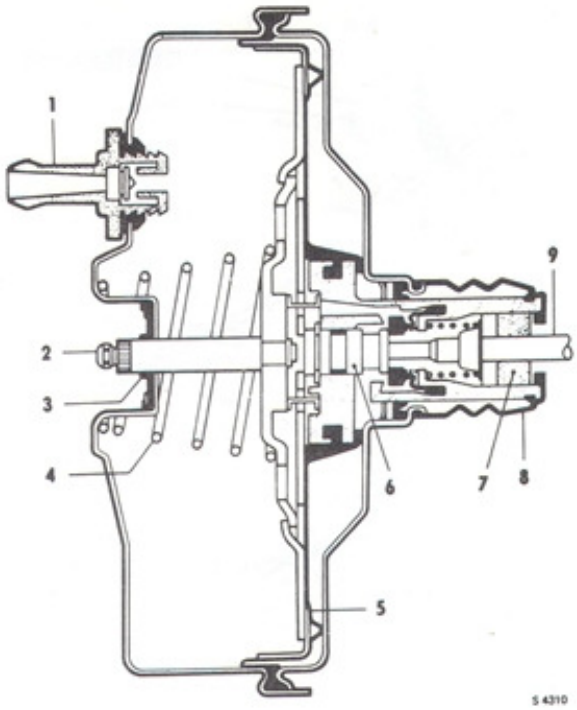
Removal

1. Disconnect the upper fork end of the brake pedal pull rod (accessible from the engine compartment). See the illustration in section 524.
2. Disconnect the two cables from the brake-light switch.
3. Disconnect the vacuum hose from the non-return valve on the servo unit.
4. Disconnect the brake pipes from the master cylinder, and the cables to the brake warning switch, and then disconnect the hose to the clutch master cylinder from the fluid reservoir. Plug the lines to prevent brake fluid escaping.
5. Remove the servo unit complete with master cylinder and bracket. Four bolts secure the bracket to the bulkhead. The nuts to three of the bolts are accessible from underneath inside the car, after the padding and part of the bulkhead lining have been removed from under the instrument panel. The fourth nut is accessible from inside the engine compartment.
6. Unbolt the master cylinder and bracket from the servo unit.

The servo unit comprises one complete unit and cannot be taken apart. Only the non-return valve, dust cover, filter and one seal ring can be removed and replaced.

To fit new air filters these must be slit with a knife to enable them to fit over the input push rod.

Note
The dome nut on the output push rod is correctly set by the manufacturer and must never be adjusted.



Servo unit

1. Non-return valve
2. Push rod (master cylinder)
3. Sealing ring
4. Return spring
5. Diaphragm
6. Valve piston
7. Filter
8. Dust cover
9. Pull rod (brake pedal)

Installation

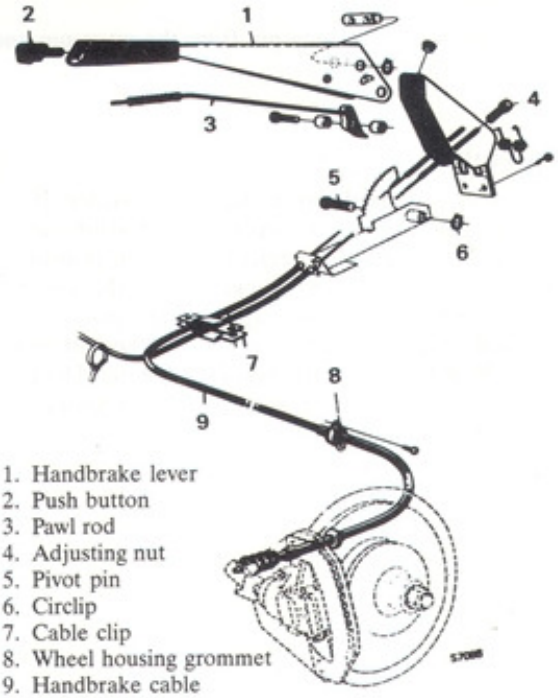
1. Bolt the master cylinder and bracket to the servo unit.
2. Refit the servo unit, complete with the bracket and master cylinder, to the car.
3. Connect the brake pipes and cables at the master cylinder and the hose from the clutch master cylinder to the fluid reservoir.
4. Connect the vacuum hose.
5. Connect the cables to the brake warning switch and connect the upper fork end of the brake pedal pull rod.
6. Bleed the brakes

Handbrake system

Handbrake cable

Removal

1. Remove the driver's seat. Remove the scuff plates and fold the carpet to provide access to the heater ducts.
2. Remove the gear lever cover. Take care not to damage the ignition switch light.
3. Remove the cover plate and then the air ducts.
4. Disconnect the cable from the adjustment nut on the handbrake lever.
5. Remove the clip holding the two cables to the floor.
6. Remove the rubber bush in the side of the wheel housing and disconnect the cable from the handbrake lever at the brake cylinder housing.
7. Pull out the cable. The simplest method is to withdraw either end of the cable from underneath in the engine compartment.

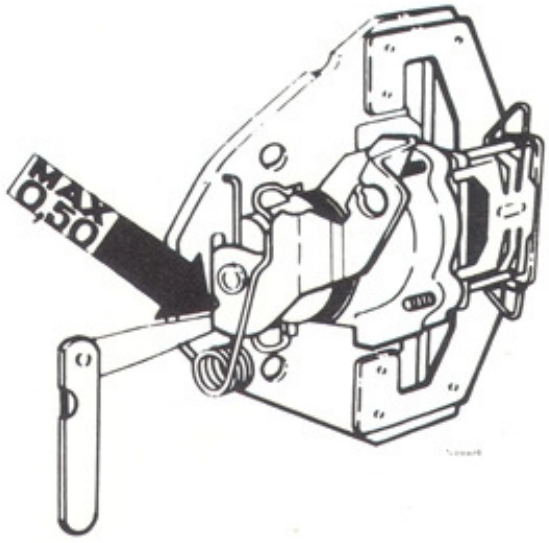


1. Handbrake lever
2. Push button
3. Pawl rod
4. Adjusting nut
5. Pivot pin
6. Circlip
7. Cable clip
8. Wheel housing grommet
9. Handbrake cable

Handbrake operation

Fitting

1. Fitting is carried out in the reverse order. The cables should cross each other on the floor of the passenger compartment.
2. After the new cable has been fitted, apply the handbrake lever a few times to stretch the cable. Use the adjusting nut on the handbrake lever inside the car to adjust the cable such that it will give a maximum clearance between the handbrake lever (at the brake housing) and the yoke of 0.5 mm (0.19 in.), as shown in the illustration. The clearance should be the same on both sides.



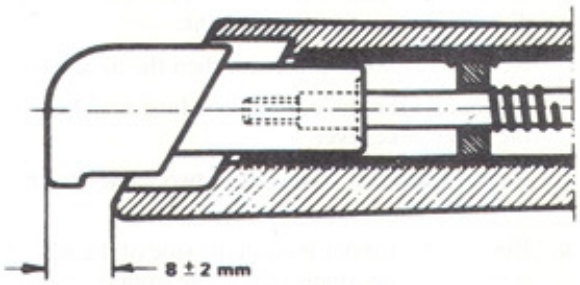
Handbrake lever

Removal

1. Disconnect the two cables from the adjusting nuts.
2. Remove the locking pin from the pivot pin and pull out the latter.

Assembly

Assembly is carried out in the reverse order. If the pawl button, pawl rod or any other part contained in the handbrake lever has been removed, the position of the pawl button must be checked. After the lever has been fitted and the brake applied, the distance between the top edge of the button and the handbrake lever should be 0.32 ± 0.08 in.(8 ± 2 mm). The pawl button can be adjusted by screwing or unscrewing it on the push rod.



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