

Part 5
BRAKES
(disc brakes)
P 120, P 1800

CARS

**SERVICE
MANUAL**

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DESCRIPTION

The P 120 and P 1800 are both equipped with two brake systems independent of each other. One of these, the footbrake system, is controlled by a brake pedal and operates on all four wheels through a hydraulic system. The other brake system, the handbrake, is operated by means of a brake lever and influences both the rear wheels mechanically.

has been discontinued. The standard type P 120 does not have the servo brake cylinder and vacuum tank, so that the brake line from the master cylinder is connected directly to the branch union (9). When the brake pedal (10) is depressed, this influences the plunger in the master cylinder (8) by means of a thrust rod. The hydraulic pressure in the master cylinder then rises and is transmitted through the brake fluid to the servo brake cylinder (4) where it is boosted. The pressure then moves out to the wheel unit cylinders (2 and 15) in which the plungers are pressed outwards and apply the brakes.

FOOTBRAKES

Fig. 1 shows the general arrangement of the footbrake system, in this case as on the early production P 1800. On late production, the vacuum tank (11)

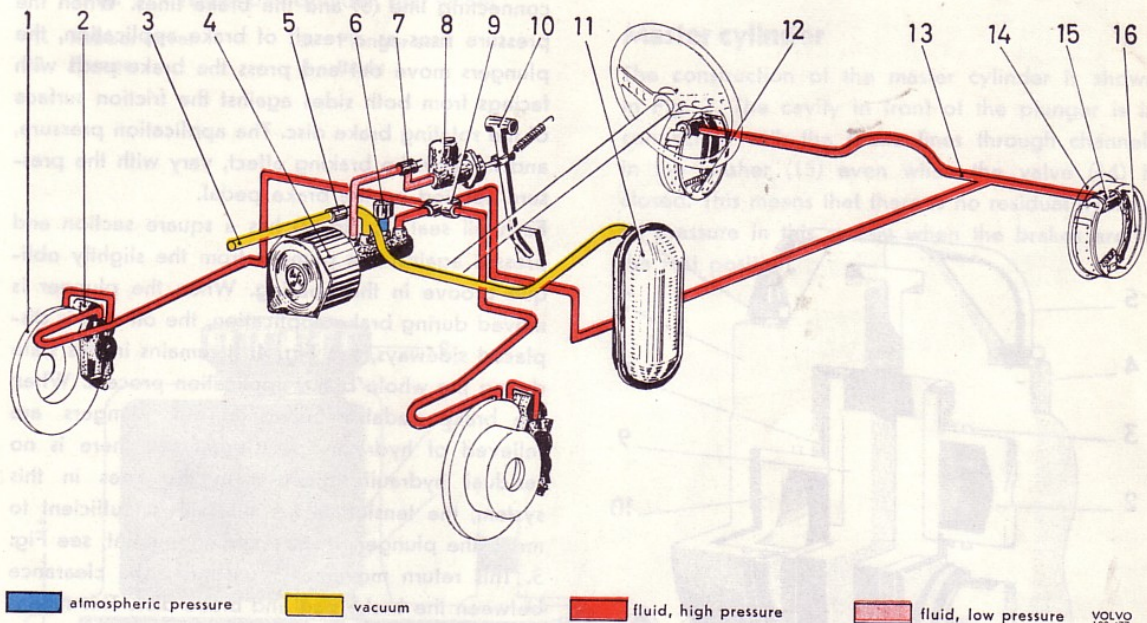


Fig. 1. Footbrakes system.

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|----------------------------|-------------------------|
| 1. Brake disc | 9. Branch union |
| 2. Front wheel brake unit | 10. Brake pedal |
| 3. Vacuum line from engine | 11. Vacuum tank |
| 4. Servo brake cylinder | 12. Adjusting device |
| 5. Check valve | 13. Brake line |
| 6. Air filter | 14. Brake drum |
| 7. Brake contact | 15. Wheel unit cylinder |
| 8. Master cylinder | 16. Brake shoe |

Front wheel brake units

The front wheel brakes are of the disc type. The discs (1, Fig. 1) are made of steel and are attached to the wheel hubs with which they rotate. Protecting plates prevent the discs from getting dirty.

On each stub axle there is a caliper containing the wheel unit cylinders and brake pads, see Fig. 2. This consists of two halves (4 and 7) joined together by bolts and located on either side of the brake disc. The plunger (10) and cylinder on the inner half are larger than those (2) on the outer half. The oil seals (3) prevent brake fluid from oozing out and rubber covers (8) prevent dirt from entering. The brake pads (9) are provided with moulded-in facings and are guided by means of guide pins (1).

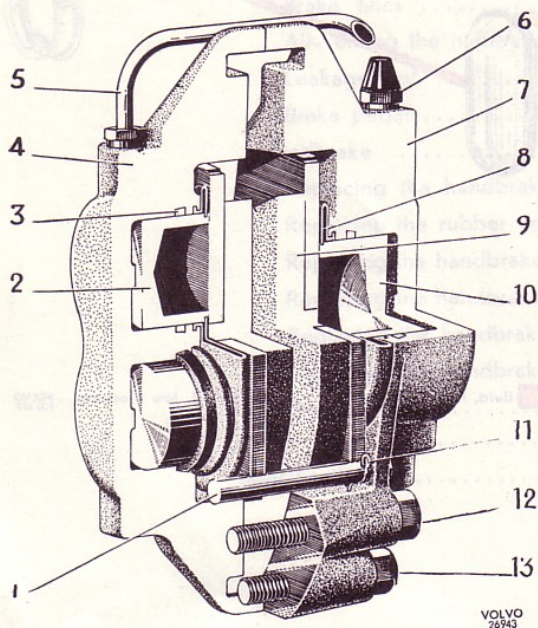


Fig. 2. Brake caliper.

- | | |
|----------------------------------|-------------------|
| 1. Guide pin | 7. Inner housing |
| 2. Outer plunger | 8. Rubber cover |
| 3. Oil seal | 9. Brake pad |
| 4. Outer housing | 10. Inner plunger |
| 5. Connecting line (early prod.) | 11. Locking clip |
| 6. Air-venting nipple | 12. Bolt |
| | 13. Bolt |

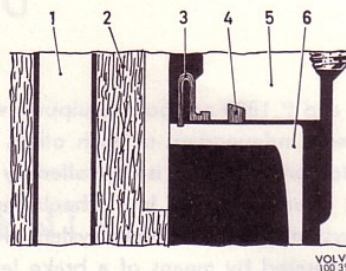


Fig. 3. Rest position.

- | | |
|-----------------|---------------------|
| 1. Brake disc | 4. Oil seal |
| 2. Brake pad | 5. Cylinder housing |
| 3. Rubber cover | 6. Plunger |

The cylinders are connected to the master cylinder by means of channels in the housings (4 and 7), the connecting line (5) and the brake lines. When the pressure rises as a result of brake application, the plungers move out and press the brake pads with facings from both sides against the friction surface of the rotating brake disc. The application pressure, and thereby the braking effect, vary with the pressure applied on the brake pedal.

Each oil seal (3, Fig. 2) has a square section and presses against the plunger from the slightly oblique groove in the housing. When the plunger is moved during brake application, the oil seal is displaced sideways, see Fig. 4. It remains in this state during the whole brake application process. When the brake pedal is released, the plungers are relieved of hydraulic pressure. Since there is no residual hydraulic pressure in the lines in this system, the tension in the oil seals is sufficient to move the plungers back a certain amount, see Fig. 3. This return movement constitutes the clearance between the brake pad and brake disc. This means that in the rest position the brake pads are always at a certain distance from the brake disc regardless of wear, so that the front wheel brake units are self adjusting.

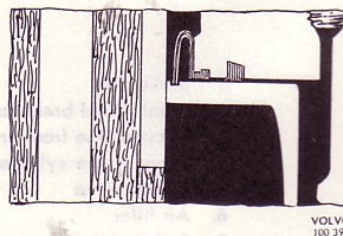


Fig. 4. Brake application.

Rear wheel brake units

The rear wheel brake units in this system consist of drum brakes of the Simplex type, see Fig. 25. Each wheel brake unit has a double-acting cylinder, (Fig. 5) and the lower ends of the brake shoes

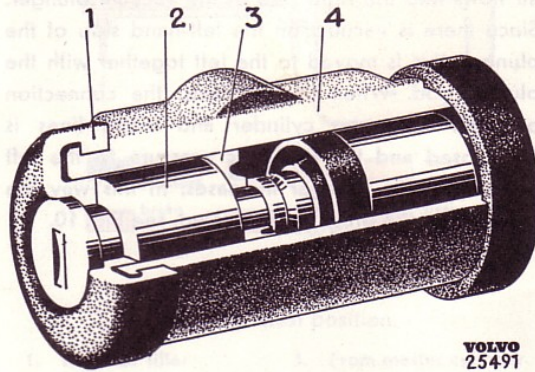


Fig. 5. Wheel unit cylinder, rear wheel.

- | | |
|-----------------|-----------------|
| 1. Rubber cover | 3. Plunger seal |
| 2. Plunger | 4. Body |

rest against an adjusting device (Fig. 6). This means that the servo effect is only obtained on the primary shoe, so that this type operates more directly than the other types on the P 120. The brake shoes are self-centring since they can be displaced radially at the support points.

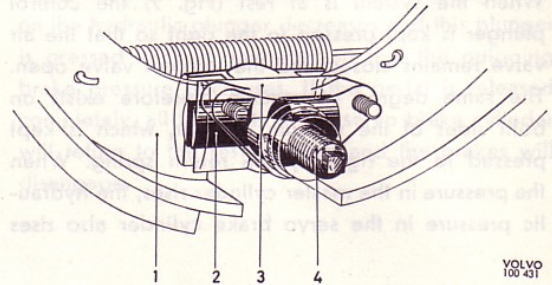


Fig. 6. Adjusting device.

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|---------------|--------------------|
| 1. Brake shoe | 3. Body |
| 2. Plunger | 4. Adjusting screw |

Master cylinder

The construction of the master cylinder is shown in Fig. 7. The cavity in front of the plunger is in connection with the brake lines through channels in the washer (15) even when the valve (14) is closed. This means that there is no residual hydraulic pressure in this system when the brakes are in the rest position.

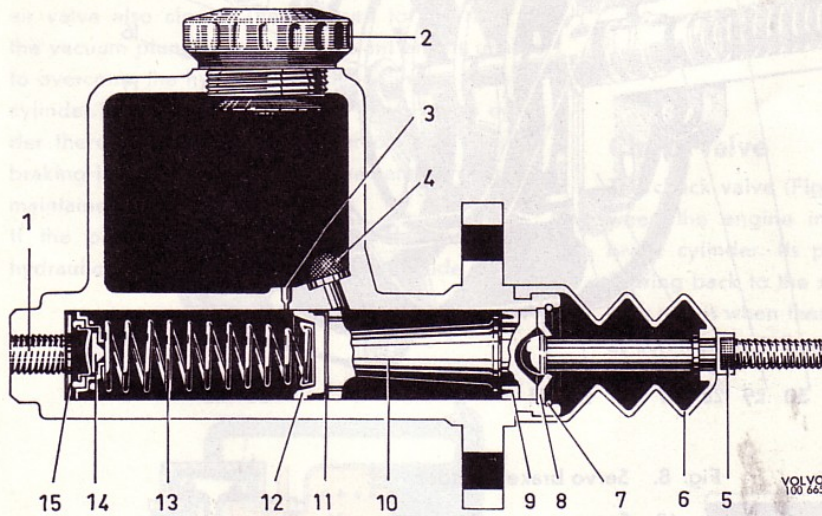


Fig. 7. Master cylinder.

- | | |
|-------------------------------|----------------|
| 1. Connection for brake line | 8. Stop washer |
| 2. Filter cap | 9. Seal |
| 3. Equalizing hole | 10. Plunger |
| 4. Strainer for overflow hole | 11. Washer |
| 5. Thrust rod | 12. Seal |
| 6. Rubber cover | 13. Spring |
| 7. Circlip | 14. Valve |
| | 15. Washer |

Servo brake cylinder

The construction of this is shown in Fig. 8. The servo brake cylinder functions as described below. Concerning the denomination and position of the parts, refer to Fig. 8, and to Fig. 9 for the significance of the colours on the figures.

When the system is at rest (Fig. 9) the control plunger is kept pressed to the right so that the air valve remains closed and the vacuum valve open. The same degree of vacuum therefore exists on both sides of the vacuum plunger, which is kept pressed to the right by the return spring. When the pressure in the master cylinder rises, the hydraulic pressure in the servo brake cylinder also rises

to the same extent. Since the right-hand pressure surface of the control plunger is larger than that on the left-hand side, the plunger is moved to the left. When this happens the valve arm also moves, the vacuum valve closes, the air valve opens and air flows into the right side of the vacuum plunger. Since there is vacuum on the left-hand side of the plunger, this is moved to the left together with the plunger rod. When this happens, the connection between the master cylinder and brake lines is first closed and the hydraulic pressure to the left of the pressure plunger increases. In this way the outgoing brake pressure is boosted, see Fig. 10.

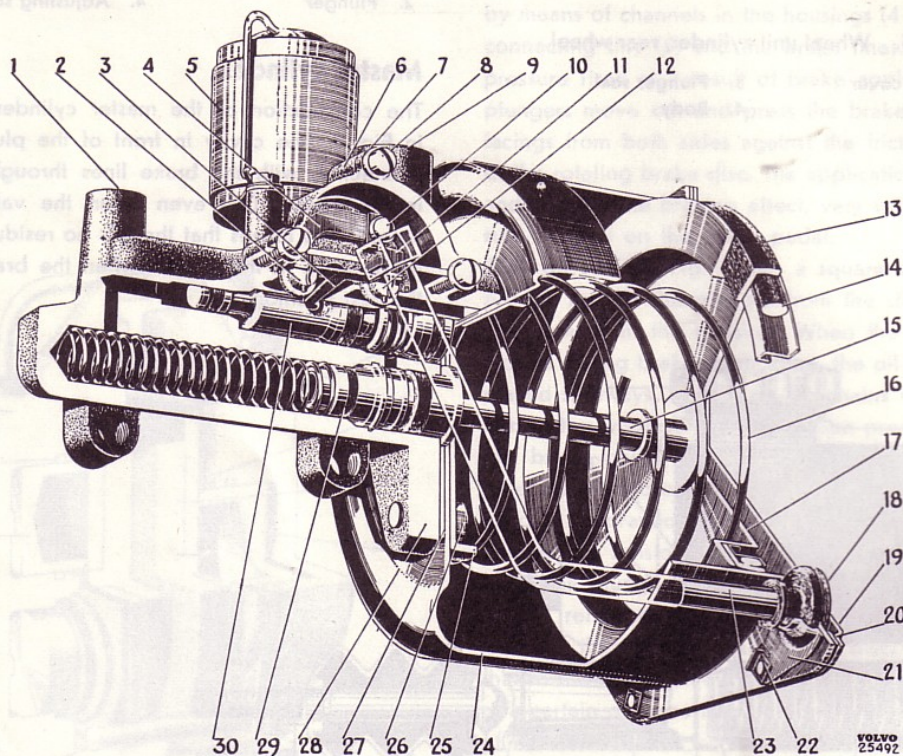


Fig. 8. Servo brake cylinder.

- | | | |
|--|--------------------|----------------------|
| 1. Connection for brake line | 10. Screw | 21. Plate |
| 2. Air valve | 11. Yoke | 22. Screw |
| 3. Valve arm | 12. Vacuum valve | 23. Connecting pipe |
| 4. Spring | 13. Plunger seal | 24. Vacuum cylinder |
| 5. Air filter body
(early production) | 14. Rubber ring | 25. Plate |
| 6. Valve body | 15. Plunger rod | 26. Bolt |
| 7. Cover | 16. Return spring | 27. Gasket |
| 8. Screw | 17. Vacuum plunger | 28. Body |
| 9. Vacuum connection | 18. Rubber bush | 29. Pressure plunger |
| | 19. Cover | 30. Control plunger |
| | 20. Gasket | |

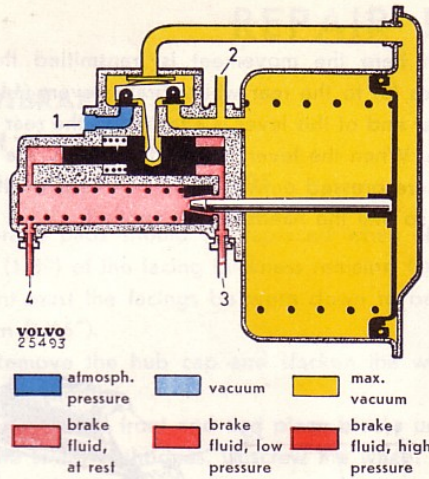


Fig. 9. Rest position.

- | | |
|---------------------|-------------------------|
| 1. From air filter | 3. From master cylinder |
| 2. From vacuum tank | 4. To wheel brake unit |

The outgoing hydraulic pressure and the pressure on the left-hand side of the control plunger increases as more air enters. If the pressure on the brake pedal, and therefore the hydraulic pressure on the large, right-hand side of the control plunger remains unaltered, this is finally overcome and the plunger is pressed to the right, see Fig. 11. When this happens the valve arm is influenced so that the air valve also closes. The pressure to the right of the vacuum plunger remains constant and is unable to overcome the hydraulic resistance in the pressure cylinder. The moving parts of the servo brake cylinder therefore remain in this position and constant braking is obtained as long as the same pressure is maintained on the pedal.

If the pressure on the pedal is decreased, the hydraulic pressure on the right-hand side of the

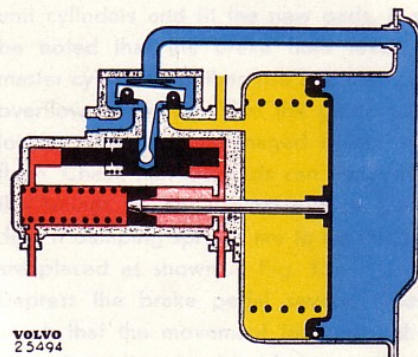


Fig. 10. Brake application.

control plunger is also decreased and the plunger is moved further to the right. The valve arm is then turned so that the vacuum valve opens. The cavities on both sides of the vacuum plunger thereby have a free passage between each other, the pressure equalizes and the plunger is moved to the right by spring pressure. The pressure of the plunger rod on the hydraulic plunger decreases and this plunger is pressed back to the right so that the outgoing brake pressure decreases. If the pedal is released completely, all the parts of the servo brake cylinder will return to the rest position and the brakes will disengage.

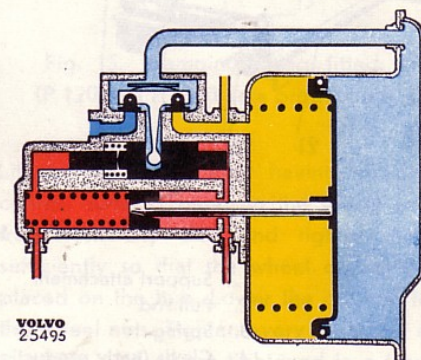


Fig. 11. Constant braking.

Check valve

The check valve (Fig. 12) is placed on the line between the engine intake manifold and the servo brake cylinder. Its purpose is to prevent air from flowing back to the servo brake cylinder. The valve only opens when there is a larger degree of vacuum at connection 1 than at connection 4.

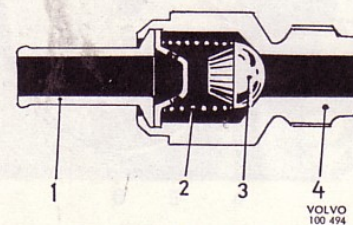


Fig. 12. Check valve.

- | | |
|-----------------------------------|--|
| 1. Connection for intake manifold | 3. Valve |
| 2. Return spring | 4. Connecting for servo brake cylinder |

HANDBRAKE

The arrangement of the handbrake system is shown in Fig. 13. On the P 120, however, the handbrake lever is attached directly to the shaft (21). The handbrake lever (5) is placed in the floor on the outside of the driving seat. The movement of the lever is transmitted via the pull rod (20), shaft (21) with arm and pull rod (2) to the clevis (4).

From here the movement is transmitted through cables (8) to the rear wheel brake levers (14). The upper end of this lever is attached to the rear brake shoe. When the lever is pulled forwards, the shoes (16) are pressed outwards with the help of the link (13) so that the handbrake is applied.

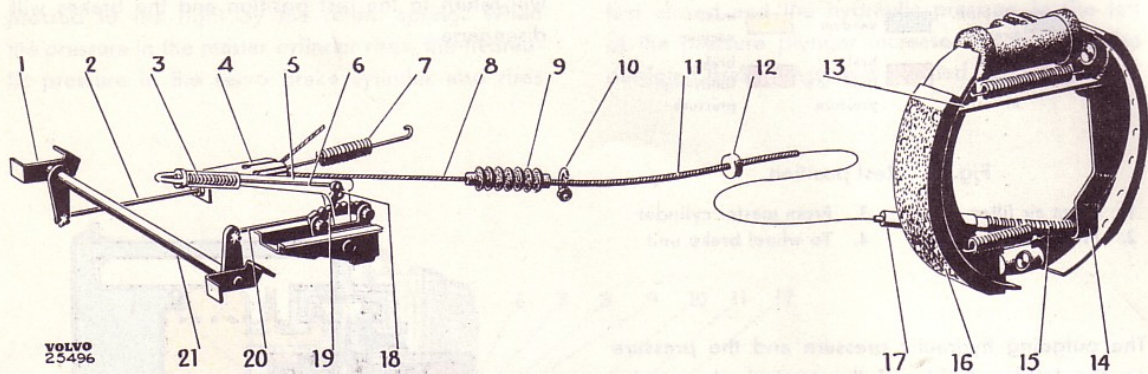


Fig. 13. Handbrake system.

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|---------------------------------|---------------------|
| 1. Support attachment | 11. Outer casing |
| 2. Pull rod | 12. Bush |
| 3. Spring | 13. Link |
| 4. Clevis (early production) | 14. Lever |
| 5. Handbrake lever | 15. Return springs |
| 6. Push rod | 16. Brake shoe |
| 7. Return spring | 17. Sleeve |
| 8. Handbrake cable | 18. Pawl |
| 9. Rubber cover | 19. Ratchet segment |
| 10. Attachment for outer casing | 20. Pull rod |
| | 21. Shaft |

REPAIR INSTRUCTIONS

FOOTBRAKES

Front wheel brake units

REPLACING THE BRAKE PADS

The brake pads should be replaced when about 3 mm (1/8") of the facing thickness remains. On no account must the facings be worn down to below 1.5 mm (1/16").

1. Remove the hub cap and slacken the wheel nuts slightly.
2. Jack up the front end and place blocks under the lower wishbones. Unscrew the wheel nuts and lift off the wheel.
3. Remove the hairpin-shaped locking clips and guide pins for the brake pads. Pull out the pads, see Fig. 14. Carefully clean out the cavity in which the pads fit. If the seal is damaged, remove the front wheel brake unit, see under "Reconditioning".

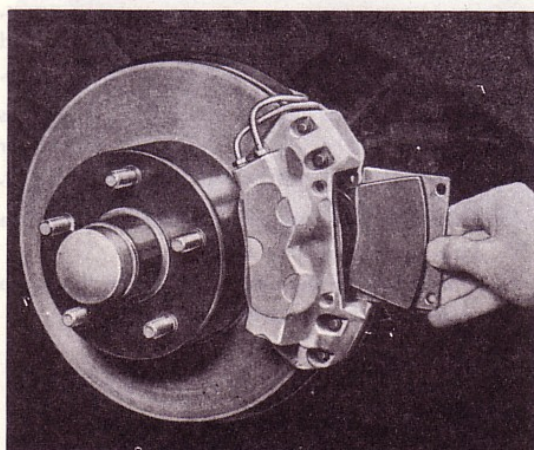
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Fig. 14. Removing the brake pads.

4. Carefully press the plungers into the wheel unit cylinders and fit the new pads. It should be noted that the brake fluid level in the master cylinder will then rise and may possibly overflow. Make sure that the guide pins and locking clips are undamaged before refitting them. Check that the pads can move and that the facings do not project outside the brake disc. If damping springs are to be fitted, these are placed as shown in Fig. 15.
5. Depress the brake pedal several times and check that the movement feels normal. As a rule, air-venting need not be carried out after replacing the brake pads.

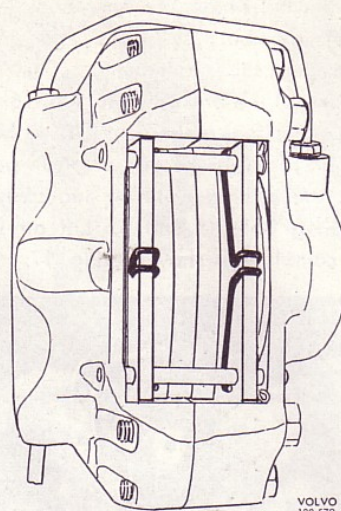
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Fig. 15. Damping springs fitted.
(P 120 and P 1800, late production)

6. Lift on the wheel after having cleaned the contact surfaces between the wheel and hub free from any dirt, and tighten the nuts sufficiently so that the wheel cannot be displaced on the hub. Lower the car and tighten the wheel nuts. Tighten every other nut a little at a time until all are tightened to a torque of 10—14 kgm (70—100 lb.ft.). Fit the hub cap.

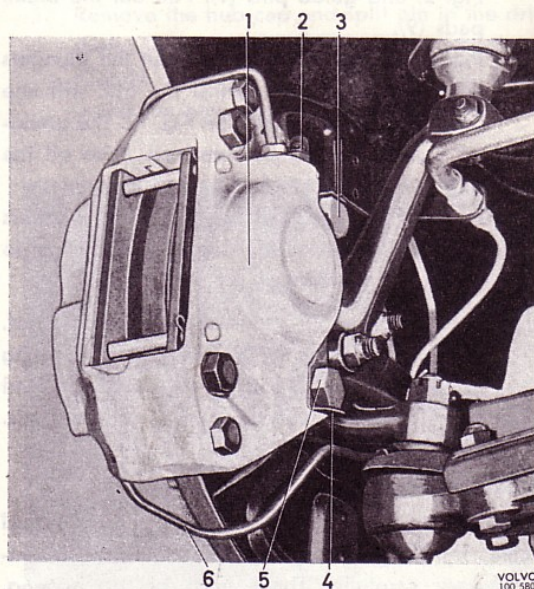
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Fig. 16. Front wheel brake unit.

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|-----------------------|-------------------|
| 1. Caliper | 4. Locking plate |
| 2. Air-venting nipple | 5. Attaching bolt |
| 3. Attaching bolt | 6. Brake line |

RECONDITIONING

Removing

1. Remove the wheel, see operations 1—2 under "Replacing the brake pads".
2. Clean the caliper externally.
3. Disconnect the brake line (6, Fig. 16) and plug the connection. Make sure that no brake fluid runs on to the brake disc or brake pads. Bend back the locking plate (4) and screw out the attaching bolts (3 and 5). Lift off the brake unit complete as shown in Fig. 17.

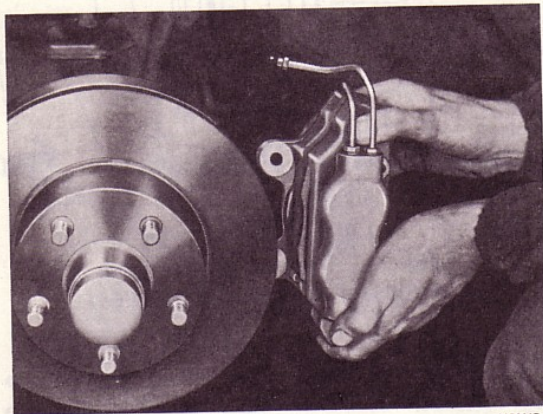


Fig. 17. Removing the front wheel brake unit.

Dismantling

1. Remove the hairpin-shaped locking clips (1, Fig. 2) and guide pins (1). Pull out the brake pads (9).
2. Place a piece of wood between the plungers and press these out against the disc with the help of compressed air, see Fig. 18. The plungers can then easily be removed. Prise off the rubber covers.
3. Remove the oil seals (3) from the cylinders with the help of a blunt tool. Be careful not to damage the edge of the grooves.

N.B. The brake caliper should not be taken apart. The reason for this is that pressure testing equipment is required when assembling and special locking fluid is required for the bolts.

Inspecting

Before inspecting wash all the parts in methylated spirit. The plungers and cylinders should be examined very carefully. There must be no scoring, scratches or rust on the polished surface. Damaged plungers should be replaced. If the cylinders are damaged, the complete front wheel brake assembly should be replaced.

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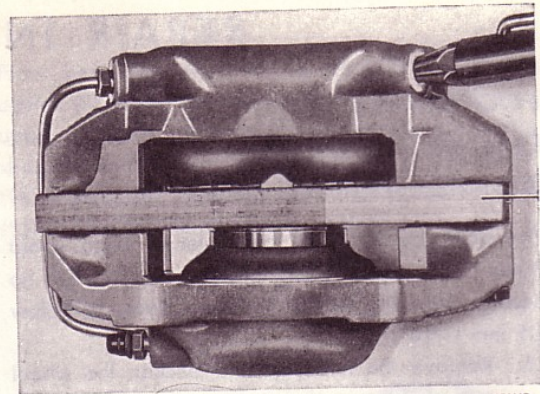


Fig. 18. Removing the plungers.

1. Piece of wood

Assembling

1. Coat the working surfaces of the plungers and cylinders with brake fluid.
2. Fit new oil seals (3, Fig. 2) in the cylinders. Place the rubber covers (8) in position and make sure that they enter the cylinder grooves.
3. Fit the plungers with the closed end first. Press the plungers in fully and see that the rubber covers enter the plunger grooves, see Fig. 19.
4. Place the brake pads in position. Fit the guide pins and the locking clips. If damping springs are to be fitted, these are placed as shown in Fig. 15.

Installing

Before the caliper is installed, check the brake disc, see under "Brake disc".

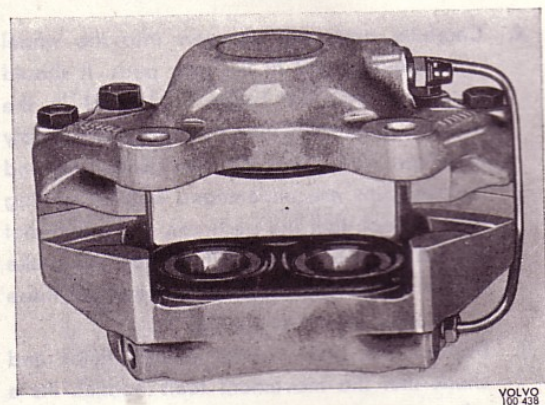


Fig. 19. Plungers fitted.

Before installing, check that the contact surfaces of the caliper and retainer are clean and undamaged since it is of vital importance that the caliper takes up the correct position in relation to the brake disc. Fit the caliper as shown in Fig. 16. Place on the locking plate (4) and tighten the attaching bolts (3 and 5) and lock them. Connect the brake line (6) and air-vent the wheel unit cylinders. On early production models the brake line arrangement is slightly different.

Check that the brake disc can rotate between the brake pads. Fit the wheel, see operation 6 under "Replacing the brake pads".

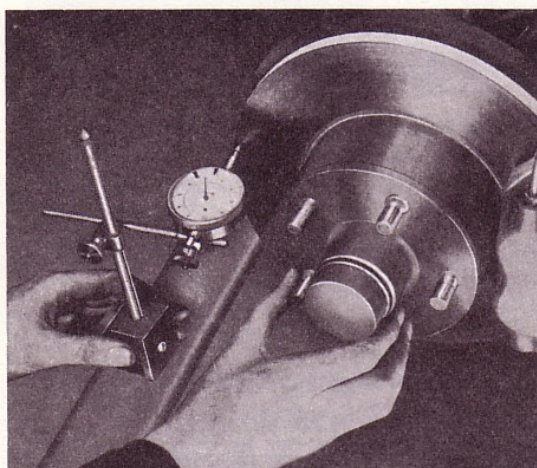
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Fig. 20. Checking the run-out.

Brake discs

The brake disc should be examined as regards the friction surface, run-out and thickness. There must be no rust or scoring on the friction surface. The run-out must not exceed 0.1 mm (0.004") and is measured as shown in Fig. 20. Check first that the wheel bearings are correctly adjusted and that the disc fits securely on the hub. The thickness should not vary more than 0.03 mm (0.0012") when the disc is rotated one turn, since this can cause a vibrating brake pedal.

The brake disc can be reconditioned by precision turning or grinding. Machining should be done together with the hub. The thickness of the disc after machining must not be less than 12.2 mm (0.48") and the surface texture should be max. 3 μ measured at a random diameter and max. 5 μ , measured radially. After reconditioning, the disc must not throw more than 0.10 mm (0.004") and its thickness must not vary more than 0.03 mm (0.0012").

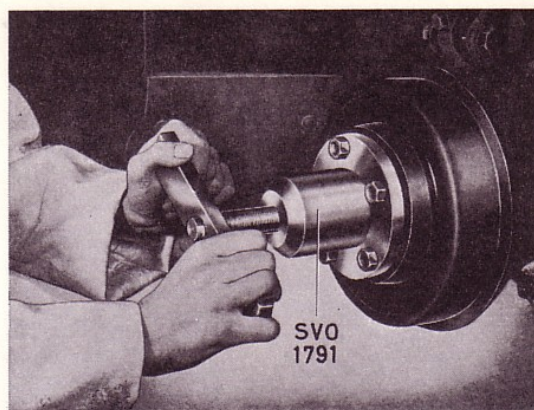
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Fig. 21. Removing the hub.

If the brake disc cannot be reconditioned as described above, or if it is cracked or damaged, it should be replaced together with the hub. Regarding the procedure for this, see under "Replacing or adjusting the front wheel bearings", Part 6.

When replacing the wheel studs, the old stud is pressed out, after which an oversize stud is fitted. The latter has a diameter of 16.3 mm (41/64"). The hole in the hub should therefore be 16.18—16.30 mm (0.637—0.642") (press fit) and in the brake disc 16.5—16.7 mm (0.650—0.658") (clearance fit).

Rear wheel brake units

DISMANTLING

1. Remove the hub cap and split pin in the drive shaft. Slacken the castle nut and wheel nuts slightly. Jack up the car and place blocks under the rear axle. Remove the wheel.

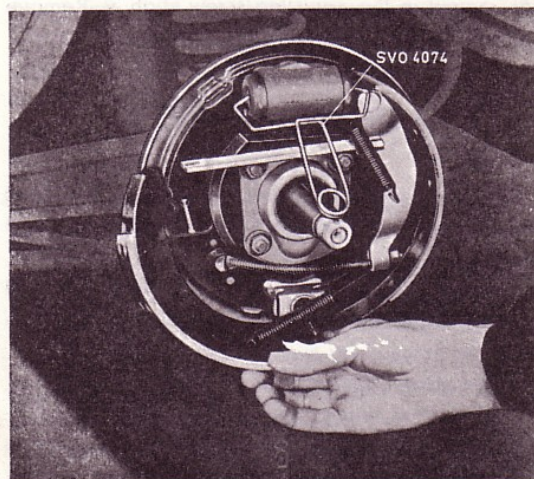
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Fig. 22. Removing the brake shoes.

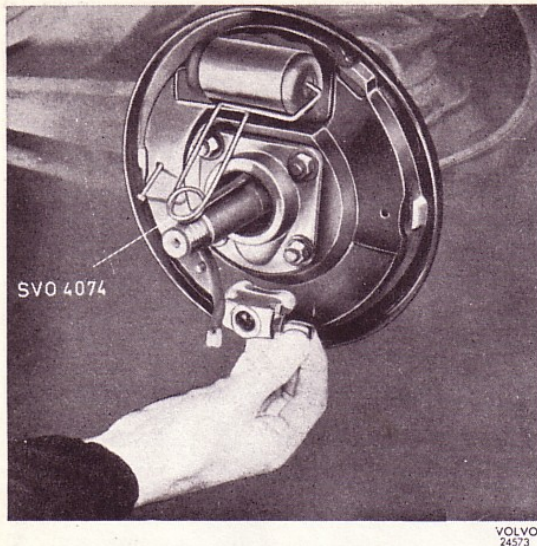


Fig. 23. Removing the adjusting plunger.

2. Release the handbrake. Pull off the hub with tool SVO 1791, see Fig. 21. Put on protecting sleeve SVO 2581 before fitting the puller. The sleeve protects the threads on the drive shaft.
3. Place clamp SVO 4074 over the wheel unit cylinder so that the plungers cannot be pressed out. Remove the upper return spring with the help of brake spring pliers. Pull down the front shoe into the groove in the brake backing plate, hold against the guide pin on the other side of the backing plate and turn and then remove the locking washer. Lift out the shoe, see Fig. 22.
4. Remove the rear shoe in a similar manner and disconnect it from the handbrake cable. Unhook the return spring and if necessary the handbrake link.
5. Screw in the adjusting screw slightly. Remove the adjusting plunger, see Fig. 23.

REPLACING THE BRAKE LININGS

Riveted type

The brake linings must be replaced at the latest when they have worn down level with the rivet heads.

1. Press out the rivets with the drift provided for the purpose in the rivet press. Then wash the shoes clean and wipe them.
2. Rivet on ready-made genuine Volvo linings. The front lining is placed towards the lower end of the shoe and the rear lining towards the upper end, see Fig. 25. Use rivets as shown in the specifications and a rivet press with suitable drifts. Begin riveting from the

middle and continue outwards to the ends. Check after riveting that the brake lining beds down properly along its entire length.

3. In order to obtain best results, the linings should be ground in a special grinding machine. Check that the linings have a radius of 0.4 mm (0.016") less than that of the brake drum.

Bonded type

Bonded linings are most simply replaced by fitting replacement shoes complete. The replacement set contains a complete set of shoes with ready-bonded linings for both rear wheels.

The procedure for bonding varies with different makes of oven and testing apparatus so that it is not possible to give a general description. Follow the instructions of the bonding compound manufacturer carefully. The position of the linings on the shoes is shown in Fig. 25. Only special bonding compound must be used which is specially manufactured to withstand the high temperatures which occur during prolonged braking.

RECONDITIONING THE WHEEL UNIT CYLINDER

Loosen the clip, pull off the rubber cover (1, Fig. 5) and take out the plunger (2) with seal (3). Wash all the parts in methylated spirit.

Examine the cylinder, see under inspecting the master cylinder, page 12.

The clearance between the plunger and cylinder must not exceed 0.25 mm (0.010") and is measured as shown in Fig. 24. If the clearance exceeds 0.25 mm.

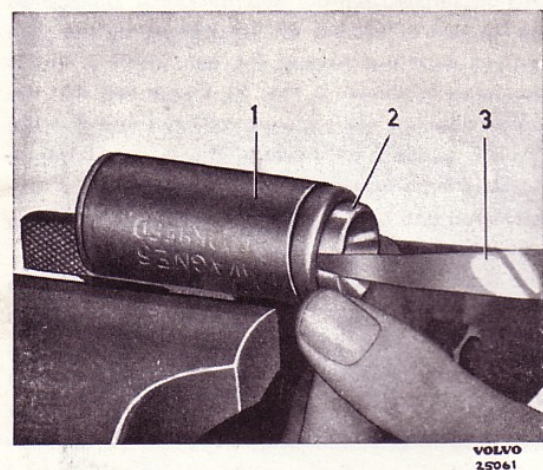


Fig. 24. Checking the clearance.

1. Wheel unit cylinder 2. Plunger 3. Feeler gauge

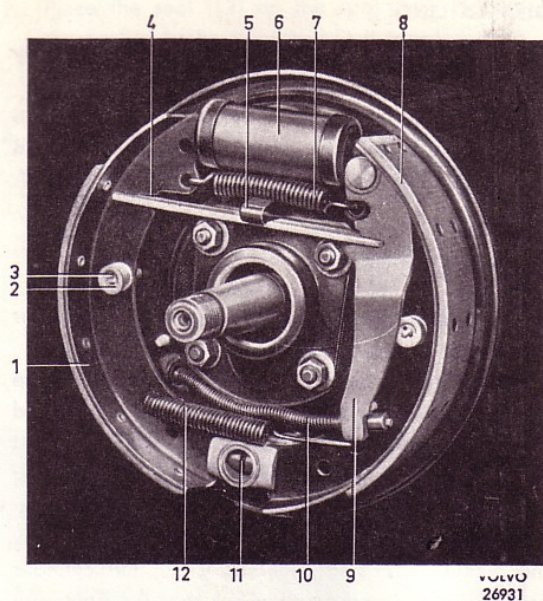


Fig. 25. Rear wheel brake unit.

- | | |
|------------------------|-----------------------------|
| 1. Front brake shoe | 7. Upper return spring |
| 2. Locking washer | 8. Rear brake shoe |
| 3. Guide pin | 9. Lever |
| 4. Link | 10. Return spring for lever |
| 5. Spring clip | 11. Adjusting device |
| 6. Wheel unit cylinder | 12. Lower return spring |

(0.010"), test with a new plunger. If this does not help, the wheel unit cylinder must be replaced.

Assemble the parts in the reverse order to dismantling. When doing this, dip the plungers and seals in brake fluid. The location of the parts is shown in Fig. 5.

BRAKE DRUMS

The friction surface and radial throw of the brake drums should be checked. The radial throw must not exceed 0.15 mm (0.006"). If the friction surface is concave, scored or cracked, the brake drum should be replaced. Minor rust spots can, however, be polished off or ground away in a machine.

ASSEMBLING

1. Screw back the adjusting screw and fit the adjusting plungers after having cleaned them and coated them lightly with heat-resistant grease. Check that the plungers move easily.
2. Fit the lever on the rear brake shoe. Hook on the handbrake cable and return springs. Place the shoe in position and fit the guide pin and locking clip. Make sure that the head of the guide pin enters the countersink of the clip.

3. Place the handbrake link in position, ensuring that it is turned correctly. Hook on the lower return spring and fit the front brake shoe with brake spring pliers. Remove tool SVO 4074. Fit the spring clip (5, Fig. 25).
4. Check that the springs and locking washers are properly in position and that the linings are free from burr, grease and dirt.
5. Check that the key fits properly in the drive shaft and fit the hub with brake drum. Place on the washer and tighten the castle nut. If the wheel unit cylinder has been removed, this should be air-vented, see under "Air-venting the hydraulic system". Lift on the wheel after having cleaned the contact surfaces between the wheel and hub free from dirt, and tighten up the nuts sufficiently so that the wheel cannot be displaced on the hub. Adjust the brakes, see under "Adjusting the wheel brake units". Lower the car and tighten the wheel nuts. Tighten every other nut a little at a time until all are tightened to a torque of 10—14 kgm (70—100 lb.ft.). Tighten the castle nut well and lock it with a split pin. Fit the hub cap.

N.B. Fouling of the servo cylinder air filter, as well as brake lining wear, depends to a large extent on the number of brakings carried out. As a rule, therefore, it is advisable to change the air filter element in connection with replacing the rear wheel brake linings.

Adjusting the wheel brake units

The front wheel disc brakes are designed so that the pad facings are always at a certain minimum distance from the brake disc, regardless of wear. The front wheel brakes are therefore self-adjusting and no manual adjustment of the position of the brake pads needs to be carried out.

When the brake pedal can be depressed too far down towards the floorboards, this usually means that the rear wheel brake linings are worn and that the brake shoes require adjusting. However, one reason can be excessive throw on the brake disc. If it is suspected that the linings are worn, the brake drum should be removed for checking this. The adjusting device permits adjustment even if the linings are worn down to the rivets, and such wear can lead to the rivets damaging the brake drums. The linings should be inspected regularly every 10,000 km (6000 miles). Adjusting is done as follows:

1. Jack up the rear end and place blocks under the rear axle. Release the handbrake.
2. Rotate the wheel while applying the brakes by turning the adjusting screw clockwise with the help of spanner SVO 2548, see Fig. 26. When the wheel can only just be turned round with one hand, stop turning the screw. Then ease off four "notches" and check that the brake drum can rotate freely with the adjusting screw in the locked position.
3. Adjust the other rear wheel in the same way. Lower the car.

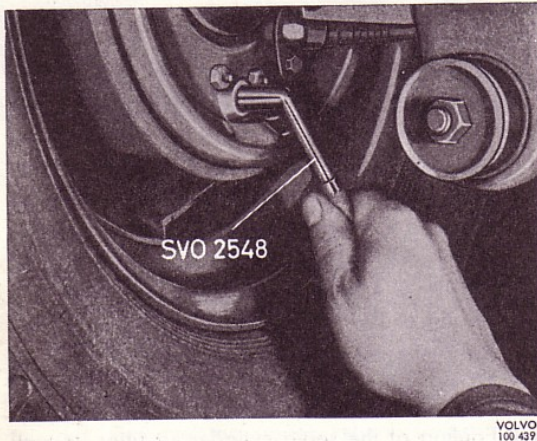


Fig. 26. Adjusting the wheel brake unit.

Master cylinder

Observe the utmost care when working on the hydraulic system. Wash the hands with soap and water before cleaning the internal parts. These should be cleaned with methylated spirit. Petrol (gasoline), paraffin (kerosene), trichlorethylene or any other spirit containing bensol must not be used. Only fill with a first-class brake fluid which fulfils the requirements of SAE 70 R 3. Fluids which only fulfil the requirements of SAE 70 R 1, or what is known as HD quality, must not be used. Avoid spilling brake fluid on the paintwork as this can cause damage.

REMOVING

1. Remove the split pin and bolt for the brake pedal. Unhook the return spring. Remove the rubber cover.
2. Remove the two attaching bolts for the master cylinder. Disconnect the brake line connection and take out the master cylinder carefully. Avoid spilling brake fluid on the paintwork as this can cause damage.

5—12

DISMANTLING

1. Screw off the cap (2, Fig. 7 and 27) and empty out the brake fluid.
2. Pull back the rubber cover (6) and remove the circlip (7), washer (8) and thrust rod (5). Shake out all the parts from the cylinder, see Fig. 27.

INSPECTING

Before inspecting, all parts of the master cylinder should be washed in methylated spirit.

Examine the cylinder carefully internally. There must be no scoring, scratches or rust on the polished surface. Such damage can as a rule be eliminated by honing the cylinder. The procedure for doing this varies with different makes of tool so that no general description can be given. Therefore follow the manufacturer's instructions. Clean the cylinder carefully after honing and check that the holes are clear.

The clearance between the plunger and cylinder must not exceed 0.20 mm (0.008"). If the clearance exceeds this value, test with a new plunger. If this does not help, the master cylinder must be replaced.

Replace both the plunger seals. Any other parts which are damaged or worn should be replaced.

ASSEMBLING

1. Fit the washer (15, Fig. 27) in the bottom of the cylinder.

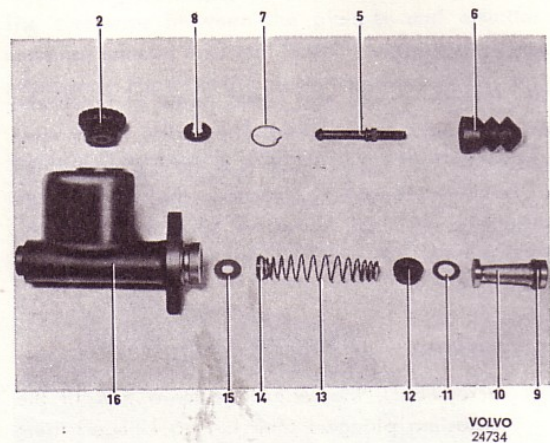


Fig. 27. Master cylinder.

- | | |
|-----------------|-------------------|
| 2. Filler cap | 11. Washer |
| 5. Thrust rod | 12. Seal |
| 6. Rubber cover | 13. Spring |
| 7. Circlip | 14. Valve |
| 8. Washer | 15. Washer |
| 9. Seal | 16. Cylinder body |
| 10. Plunger | |

2. Place the seal (12) on the spring guide. Dip the seal in brake fluid and fit it together with the spring and valve. Place the washer (11) in the cylinder.
3. Pull the seal (9) on to the plunger and turn it as shown in the figure. Dip the plunger in brake fluid and fit it. Be careful not to damage the seal (9) and make sure that it does not bend over. Preferably use a piece of tube-shaped brass foil as a guide for the seal, see Fig. 28. Compress the spring and fit the thrust rod (5), washer (8) and circlip (7).

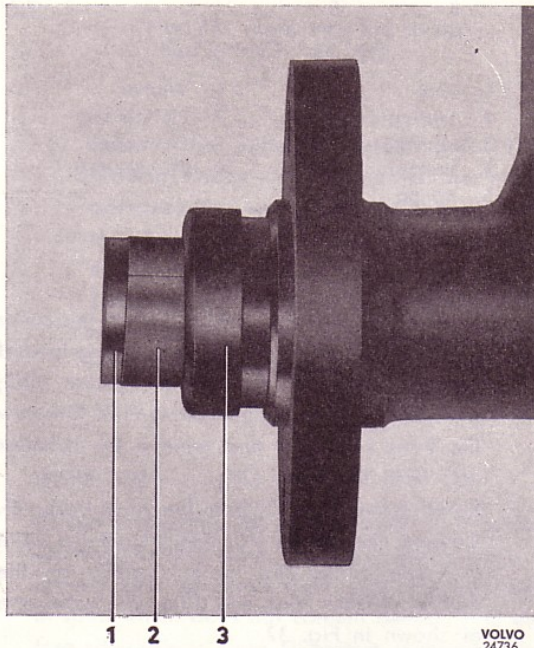


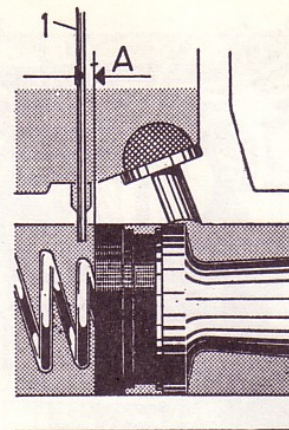
Fig. 28. Fitting the plunger.

1. Plunger
2. Brass foil
3. Master cylinder

4. Check that the equalizing hole is clear by inserting a 0.5 mm (25 s.w.g.) wire through the hole, see Fig. 29. It should then be possible to press the plunger in approx. 0.5 mm (0.020") before the wire is gripped. Take care not to damage the seal. Also check that there is clearance for the thrust rod (5).
5. Fit the rubber cover (6).

INSTALLING

Place the master cylinder in position and fit the attaching bolts and nuts. Pull the rubber cover on to the cylinder flange. Hook on the return spring and fit the yoke to the pedal. Do not forget the



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Fig. 29. Checking the equalizing hole.

1. 0.5 mm (25 s.w.g.) wire
- A=approx. 0.5 mm (0.020")

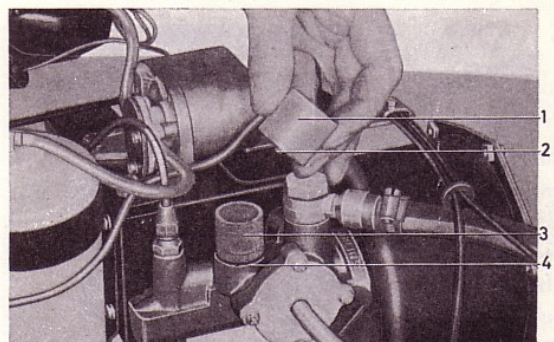
split pin. Connect the brake line. Fill up with brake fluid and air-vent in accordance with the instructions under "Air-venting the hydraulic system".

Servo brake cylinder

REPLACING THE AIR FILTER ELEMENT

Fouling of the servo cylinder air filter, as well as brake lining wear, depends to a large extent on the number of brakings carried out. As a rule, therefore, it is advisable to change the air filter element in connection with replacing the rear wheel brake linings.

The element is accessible after its cover has been removed. On early production filters this can be done after the clamp has been moved to one side and in late production (Fig. 30) the attaching bolt is screwed out. When replacing, the cover should be cleaned but the actual element must always be replaced with a new one. Tighten the attaching bolt (2) to a torque of 0.3—0.4 kgm (2—3 lb. ft.).



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Fig. 30. Replacing the filter element.

1. Cover
2. Attaching bolt
3. Element
4. Gasket

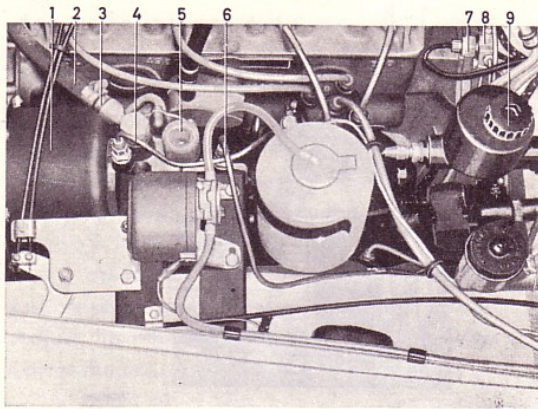


Fig. 31. Brake components, P 1800
(with effect from chassis No. 7000)

- | | |
|---------------------------|----------------------------|
| 1. Servo brake cylinder | 6. Outgoing hydraulic line |
| 2. Vacuum line | 7. Brake contact |
| 3. Check valve | 8. Branch union |
| 4. Ingoing hydraulic line | 9. Master cylinder |
| 5. Air filter | |

REMOVING

Disconnect the hydraulic lines and vacuum line from the servo brake cylinder. Unscrew the three attaching bolts and lift off the cylinder. On P 1800 the four attaching bolts for the bracket are first removed and the bracket then lifted up so that the cylinder can be taken off.

DISMANTLING

1. Remove the air filter from the servo brake cylinder.

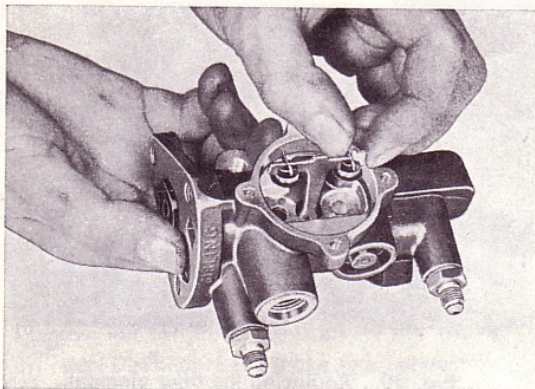


Fig. 32. Removing the valve arm.

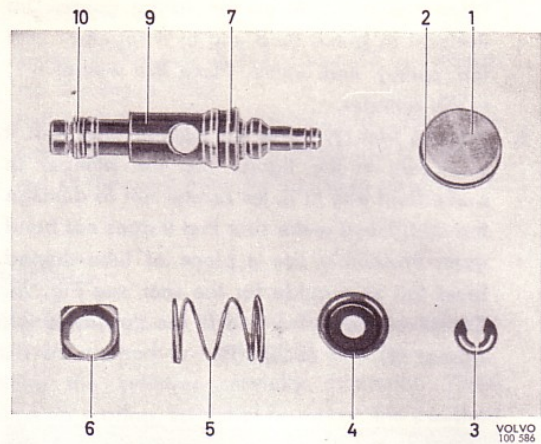


Fig. 33. Control parts.

- | | |
|-------------------|------------------|
| 1. Plug | 6. Washer |
| 2. Sealing ring | 7. Plunger seat |
| 3. Locking washer | 9. Plunger |
| 4. Washer | 10. Plunger seal |
| 5. Spring | |

2. Unscrew the screws (22, Fig. 8) when the cover (19) will be lifted off by the spring-loaded plunger. Remove the cover, gasket (20), plunger (17) and return spring (16). Unscrew the three bolts (26) and remove the cylinder (24) from the body (28).
3. Remove the cover (7) from the valve body (6). Unscrew the screws (10) and lift out the yoke (11) and spring (4). Press carefully on the control cylinder plug and lift up the valve arm as shown in Fig. 32.
4. Remove the gasket and strike the housing against a wooden object so that the plug (1, Fig. 37) falls out. Remove the control plunger (9) and take it apart.

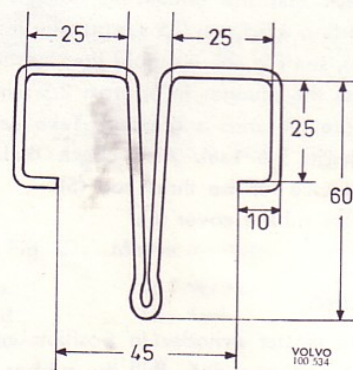
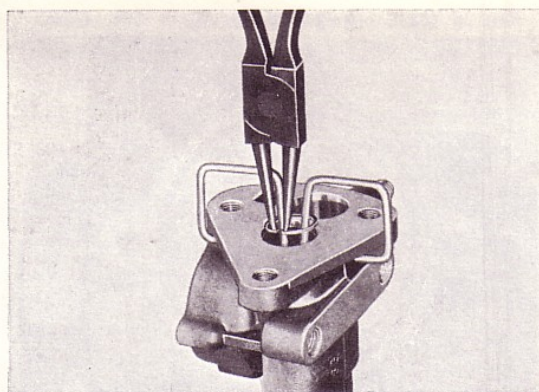


Fig. 34. Clip.

Measurement in mm



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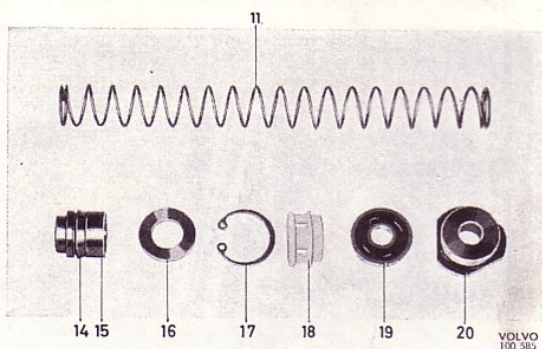
Fig. 35. Removing the circlip.

- Remove the guide sleeve (20), seal (19) and spacing sleeve (18). Compress the pressure cylinder return spring with the help of a clamp manufactured as shown in Fig. 34 and fitted as shown in Fig. 35.

Then remove the circlip (17) carefully with the help of circlip pliers. Take off the clamp and remove the other parts.

INSPECTING

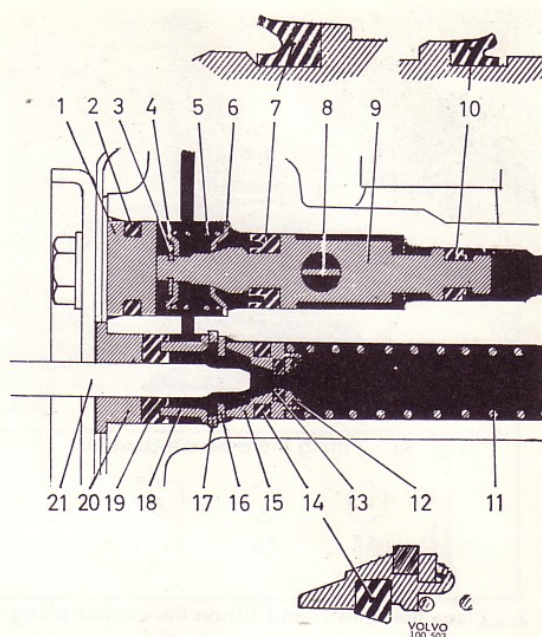
Before inspecting, all parts should be thoroughly cleaned. Rubber parts and parts which come into contact with the brake fluid must only be cleaned in spirit which does not contain benzol. It is therefore advisable to clean all parts in methylated spirit. Place the cleaned parts on a clean cloth and observe the utmost cleanliness when continuing the work.



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Fig. 36. Pressure cylinder parts.

- | | |
|----------------------|--------------------|
| 11. Spring | 17. Circlip |
| 14. Plunger seal | 18. Spacing sleeve |
| 15. Pressure plunger | 19. Seal |
| 16. Washer | 20. Plunger sleeve |



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Fig. 37. Hydraulic parts.

- | | |
|--------------------|----------------------|
| 1. Plug | 12. Washer |
| 2. Sealing ring | 13. Seal |
| 3. Locking washer | 14. Plunger seal |
| 4. Washer | 15. Pressure plunger |
| 5. Spring | 16. Washer |
| 6. Washer | 17. Circlip |
| 7. Plunger seal | 18. Spacing sleeve |
| 8. Valve arm | 19. Seal |
| 9. Control plunger | 20. Sleeve |
| 10. Plunger seal | 21. Plunger rod |
| 11. Spring | |

Inspect all parts for wear and other damage. All seals and any damaged or worn parts should be replaced. If the plunger rod or leather seal is damaged, replace the vacuum plunger complete.

ASSEMBLING

- Take a new plunger (15, Fig. 37) with inner seal (13) fitted. Fit the plunger seal (14) and turn it as shown in the figure. Place the spring (11) on the plunger. Dip the plunger in brake fluid and insert the spring into the cylinder, see Fig. 38. Fit the washer (16) and carefully press in the plunger with the help of the clamp. Fit the circlip carefully as shown in Fig. 35. Check that it locates properly in its groove. Place the seal (19) on the spacing sleeve (18) and fit this. Place the sleeve (20) in position.

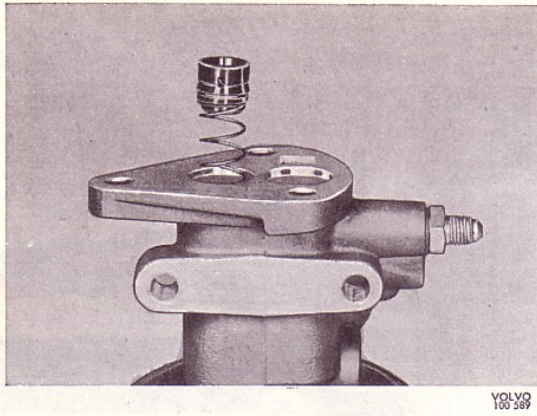


Fig. 38. Fitting the pressure plunger.

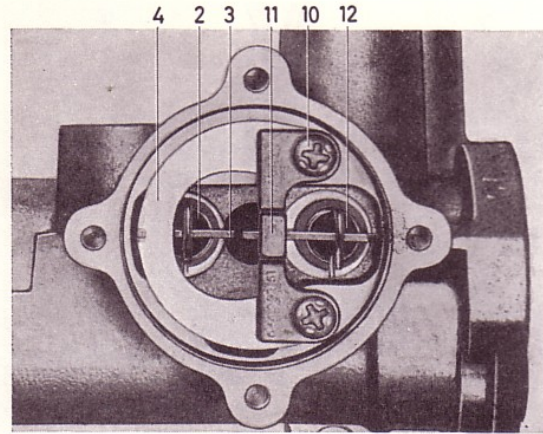


Fig. 40. The valve fitted.

2. Place the seals (7 and 10) on the control plunger and turn them as shown in the figure. Fit the washer, spring and locking washer (3). Dip the plunger in brake fluid and fit it, see Fig. 39. Turn the plunger so that the valve arm can be fitted in its hole.
3. Fit the valves (2 and 12, Figs. 8 and 40) on the valve arm (3) and place the unit in position in the housing as shown in Fig. 32. Fit the spring (4), yoke (11), washers and screws (10). Tighten the screws to a torque of 0.3—0.4 kgm (2—3 lb.ft.). Test the function by pressing the control plunger backwards and forwards as shown in Fig. 41, when the valves should open and close respectively. In the normal position the valve nearest the flange should be open

- | | |
|--------------|------------------|
| 2. Air valve | 10. Screw |
| 3. Valve arm | 11. Yoke |
| 4. Spring | 12. Vacuum valve |

and the other one closed. Fit the gasket and cover with vacuum line. A suitable tightening torque for the screws is 0.3—0.4 kgm (2—3 lb.ft.).

4. Place the sealing ring (2, Fig. 37) on the plug (1) and fit it. Let the plug project 1—2 mm (about 1/16") outside the flange. Fit the plate (21, Fig. 8) on the vacuum line, place the new gasket (27), the cylinder (24) and plate (25) in position and insert the connecting pipe (23) through the rubber bush (18). The pipe should not lie against the cover (19). Fit the three bolts (26) with new washers and tighten them to a torque of 1.4—1.8 kgm (10—12 lb.ft.).

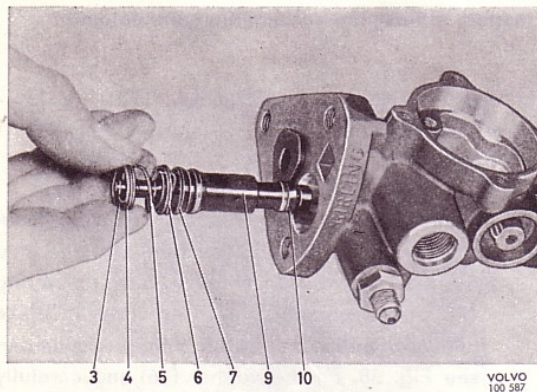


Fig. 39. Fitting the control plunger.

- | | |
|-------------------|--------------------|
| 3. Locking washer | 7. Plunger seal |
| 4. Washer | 9. Control plunger |
| 5. Spring | 10. Plunger seal |
| 6. Washer | |

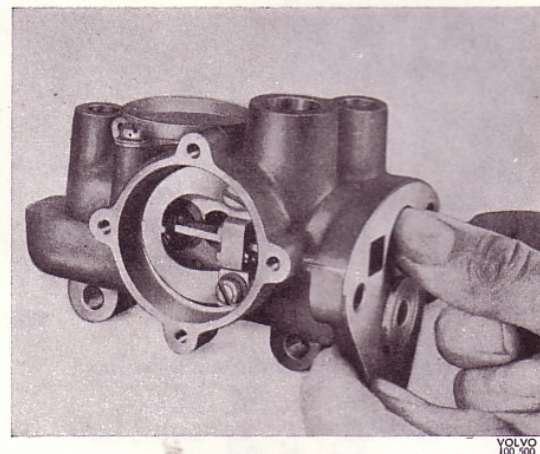


Fig. 41. Testing the control device.

5. Check that the vacuum cylinder (24) is still clean internally. Place the return spring (16) in position.

Fit the vacuum plunger (17) complete with new rubber ring (14) and carefully insert the plunger rod (15) into the bush. Press down the plunger to full stroke length a few times to check that the plunger and plunger rod do not bind. The return spring should press back the plunger immediately when it is released. Fit on a new gasket (20) and bolt on the cover (19) and plate (21). A suitable tightening torque for the bolts is 0.3—0.4 kgm (2—3 lb.ft.).

6. Fit a gasket and air filter element and place on the cover and clamp. In the case of a late production air filter (Fig. 30), the bolt is tightened to a torque of 0.3—0.4 kgm (2—3 lb.ft.).

After assembly, the servo brake cylinder must be tested.

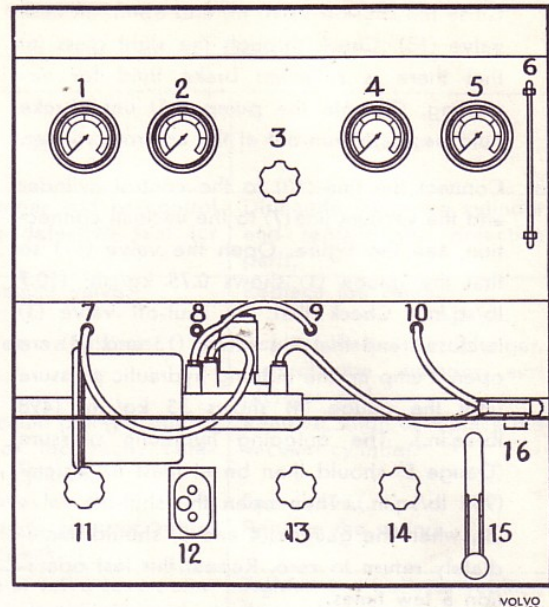


Fig. 42. Connections for testing.

- | | |
|--|-------------------------------------|
| 1. Gauge for constant vacuum | 8. Connection for control vacuum |
| 2. Gauge for control vacuum | 9. Connection for hydraulic inlet |
| 3. Hydraulic shut-off valve | 10. Connection for hydraulic outlet |
| 4. Gauge for hydraulic inlet pressure | 11. Vacuum valve |
| 5. Gauge for hydraulic outlet pressure | 12. Switch for vacuum pump |
| 6. Sight glass | 13. Hydraulic inlet valve |
| 7. Connection for constant vacuum | 14. Hydraulic outlet valve |
| | 15. Hydraulic pump |
| | 16. Control cylinder |

TESTING

For complete testing, a test bench is required together with a control cylinder of a type as shown in Figs. 42 and 43. The purpose of the control cylinder is to enable a stroke to be obtained corresponding to that which would occur with the servo cylinder installed in the vehicle.

If no testing equipment is available, a certain amount of fault diagnosis can be carried out by testing the servo cylinder when installed in the vehicle.

If testing reveals any faults, these should be remedied as shown in the fault tracing scheme.

Testing on test bench

Testing should preferably be carried out as follows:

1. Connect the vacuum line (7, Fig. 42) to the servo brake cylinder hydraulic inlet. When doing this, brake fluid should naturally be emptied from the cylinder. The hydraulic connections have a 3/8" x 24 UNF thread. Plug the hydraulic outlet. Start the vacuum pump and open the vacuum valve (11). When a vacuum of 0.75 kg/cm² (10.7 lb/sq.in.) has been reached (Gauge 1), close the valve (11). The servo brake cylinder should maintain a vacuum of at least 0.7 kg/cm² (10 lb/sq.in.) for five seconds. Then disconnect the vacuum line and open the hydraulic outlet.
2. Connect the servo cylinder hydraulic inlet to the line (9) and its hydraulic outlet to the control cylinder (16).

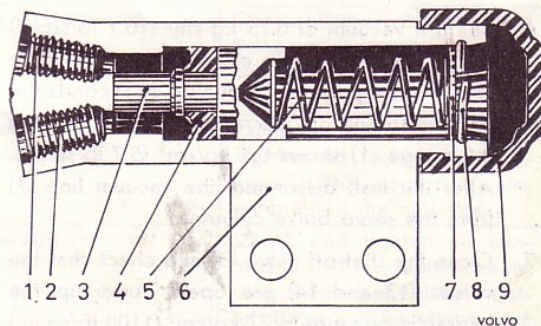


Fig. 43. Control cylinder.

- | | |
|--|---------------------|
| 1. Connection for test bench | 5. Return spring |
| 2. Connection for servo brake cylinder | 6. Cylinder body |
| 3. Plunger | 7. Washer |
| 4. Seal | 8. Circlip |
| | 9. Protecting cover |

Close the shut-off valve (3) and open the inlet valve (13). Check through the sight glass (6) that there is sufficient brake fluid for air-venting. Operate the pump (15) until brake fluid begins to run out at the control cylinder.

3. Connect the line (10) to the control cylinder and the vacuum line (7) to the vacuum connection, see the figure. Open the valve (11) so that the gauge (1) shows 0.75 kg/cm^2 (10.7 lb/sq.in.). Check that the shut-off valve (3) is closed and that the valves (13 and 14) are open. Pump up the ingoing hydraulic pressure until the gauge (4) shows 35 kg/cm^2 (498 lb/sq.in.). The outgoing hydraulic pressure (Gauge 5) should then be at least 67 kg/cm^2 (950 lb/sq.in.). Then open the shut-off valve (3), when the gauges (4 and 5) should immediately return to zero. Repeat this test operation a few times.
4. Remove the servo brake cylinder air filter and plug the air intake hole. Set in a vacuum of 0.75 kg/cm^2 (10.7 lb/sq.in.). (Gauge 1). Close the valve (3) and open the valves (13 and 14). Pump up the ingoing hydraulic pressure to a value exceeding 3.5 kg/cm^2 (50 lb/sq.in.). The ingoing and outgoing pressures should then be equal (Gauges 4 and 5). After the test, open the shut-off valve (3), remove the plug and refit the air filter.
5. Check that the gauge (1) shows 0.75 kg/cm^2 (10.7 lb/sq.in.) vacuum. Close the valve (3) and check that the valves (13 and 14) are open. Pump up the ingoing pressure to 2.5 kg/cm^2 (35.6 lb/sq.in.) (Gauge 4). The outgoing pressure (Gauge 5) should then be at least 3.5 kg/cm^2 (10.7 lb/sq.in.). Open the shut-off valve (3).
6. Set in a vacuum of 0.75 kg/cm^2 (10.7 lb/sq.in.) on the gauge (1). Then close the vacuum valve (11). After a period of 1 minute 40 seconds the vacuum should not decrease more than so that the gauge (1) shows 0.4 kg/cm^2 (5.7 lb/sq.in.). After the test, disconnect the vacuum line (7) from the servo brake cylinder.
7. Close the shut-off valve (3) and check that the valves (13 and 14) are open. Pump up the hydraulic pressure to 77 kg/cm^2 (1100 lb/sq.in.) (Gauges 4 and 5). After 1 minute the pressure should not have decreased noticeably. Then open the shut-off valve (3) and close the valves (13 and 14). Disconnect the connections and lift off the servo brake cylinder.

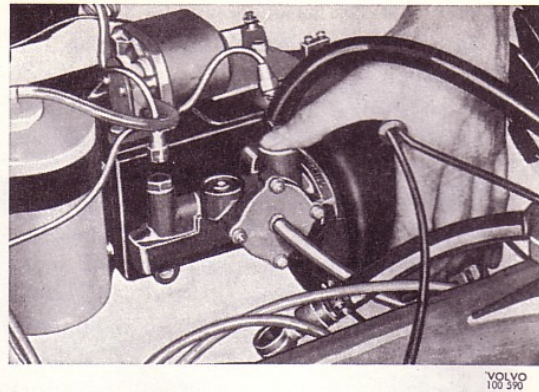


Fig. 44. Testing operation 1.

Testing when installed in vehicle

1. This testing operation must only be carried out on a servo brake cylinder from which all the brake fluid has been emptied. Place the servo brake cylinder in position on its bracket. Plug the hydraulic outlet and fit a hose connection in the hydraulic inlet. The hydraulic connections have a $3/8 \times 24 \text{ UNF}$ thread. Connect the vacuum line to the hydraulic inlet and remove the air filter. Start the engine and let it run at idling speed. With the help of a finger, check to see whether there is any air flow through the filter connection and the ordinary vacuum connection, see Fig. 44.
2. Connect all the parts and lines in their correct places and air-vent the system. Start the engine. When the brakes are applied, it should be possible to hear a whistling noise from the air flowing in, and to feel the movement of the vacuum cylinder with the hand.
3. Shut off the engine after it has run for at least half a minute after brake application. Wait for two minutes. Then apply the brakes again, when the servo cylinder should function as described in point 2.
4. Start the engine and let it run at idling speed. Apply the brakes hard for 15—20 seconds. During this time the pedal must not sink noticeably.
5. Jack up the front end so that the wheels are clear. With the engine running, apply and release the brakes while checking whether the wheel can rotate or not. The wheels should be free half a second after the pedal has been released. If the brakes bind, remove the vacuum connection and repeat the test.

FAULT TRACING SCHEME FOR THE SERVO BRAKE CYLINDER

Testing on bench

Test operation	Fault	Cause	Action
1.	Leakage greater than 0.05 kg/cm ² (0.7 lb/sq.in.)	Scored plunger rod or control cylinder or defective seal for same.	Dismantle the servo cylinder and replace the defective parts.
3.	Outgoing hydraulic pressure too low. Inlet pressure increases, outlet pressure decreases. Outgoing pressure is the same as ingoing pressure. Outgoing pressure does not return to zero.	Leaking vacuum valve. Leaking pressure plunger. Binding vacuum plunger due to deformed or incorrectly centered vacuum cylinder. a) See above b) the vacuum plunger return spring too weak.	Replace the valve. Replace the pressure plunger. Inspect the cylinder and plunger rod. Remove, align or replace the vacuum cylinder. See above. Replace the spring.
4.	Outgoing pressure larger than ingoing pressure. Ingoing pressure larger than outgoing pressure.	Air leakage at valve cover, connecting pipe or cylinder end. Binding pressure plunger and vacuum plunger.	Tighten the bolts or replace the gasket. Recondition the servo cylinder.
5.	See point 3.	See point 3.	See point 3.
6.	Excessive vacuum leakage.	Leakage at valve cover, connecting pipe or cylinder end.	Tighten the bolts or replace the gaskets.
7.	Hydraulic pressure falls.	Control plunger seals leaking.	Replace the seals, check the cylinder.

Testing when installed in vehicle

Test operation	Fault	Cause	Action
1.	Air flow through vacuum connection. Air flow through air filter connection.	Leakage in plunger rod or control plunger seal. Leakage as above and at the air valve.	Dismantle the servo cylinder and replace the faulty parts. See above.
2.	No operating sound or movement can be noticed.	Servo brake cylinder not functioning.	Check all the connections. If these are undamaged, remove and recondition the servo brake cylinder.
3.	Servo brake cylinder does not function as in test operation 2.	Vacuum leakage.	Examine the check valve. Tighten all outside connections. If this does not help, recondition the cylinder.
4.	Pedal sinks during test.	Hydraulic leakage.	Check and tighten all connections. If the fault remains, plug the master cylinder outlet. If there is no alternation, recondition the master cylinder.
5.	The brake bind only when the vacuum hose is connected. The brakes bind after the vacuum hose has been disconnected.	Binding vacuum plunger due to deformed cylinder or defective seal. Deformed brake line or binding wheel unit cylinder plungers.	Recondition the servo brake cylinder. Replace the faulty parts.

INSTALLING

Bolt the servo brake cylinder to the bracket. If the bracket has been removed, fit it in position. Connect the ingoing hydraulic line. Check that there is sufficient brake fluid in the master cylinder and depress the brake pedal very slowly. When brake fluid just begins to run out of the servo brake cylinder, stop depressing the pedal brake. Connect the outgoing hydraulic line and vacuum line. Air-vent the whole brake system, see under "Air-venting the hydraulic system".

Vacuum tank

The P 1800 is equipped with a vacuum tank as standard up to chassis number 6999. This is placed between the left front mudguard and wheel arch and is accessible after the splash plate has been removed. The early production P 120 can also be equipped with a vacuum tank, in which case it is placed under the left front mudguard.

Brake lines

The brake lines should be flushed through in conjunction with complete reconditioning of the hydraulic system.

Before flushing through, air should be removed from the system through the air-venting nipples. The lines are then disconnected at the wheel unit cylinders one by one and flushed with brake fluid or spirit. Flushing should preferably be done by filling the master cylinder and carrying out repeated braking movements with the pedal. After flushing with spirit, all lines should be blown clean with moisture-free, filtered compressed air since the spirit can give rise to gas bubbles in the system and cause spongy pedal action. In the event of leakage, or when the lines have been subjected to any outside damage so that leakage can be suspected, the damaged lines should be replaced. **Note that there are two different types of brakes lines and connections, see Fig. 45.** Type 1 is factory-fitted on P 1800 up to chassis number 6999. After this it only occurs on the front wheel brake connections. On P 120 series type 1 occurs only on the front wheel brake connections. Otherwise the cars are equipped with type 2. These two types are only interchangeable if all the brake lines with branch unions are replaced at the same time.

Brake line replacement should preferably be carried out as follows:

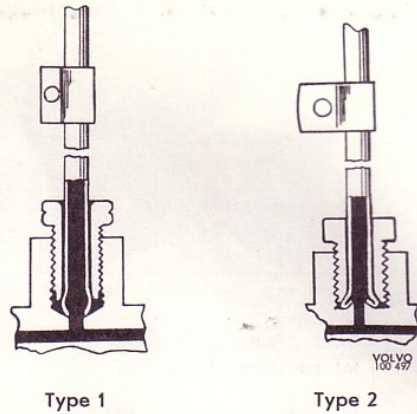


Fig. 45. Connecting parts.

1. Remove the damaged brake line.
2. Take a complete new brake line of the correct type, blow it clean internally with moisture-free, filtered compressed air and fit it. Make sure that the brake line lies in such a position that it cannot chafe while driving. Particularly important points are where the pipes pass the rear spring attachments on the rear axle, where they must not come nearer than 10 mm (3/8"), and where they pass the support arms. If the pipe is not bent correctly, it should be adjusted by hand before being fitted. Bending a pipe which is already connected often results in deformation at the connections.
3. Air-vent the hydraulic system.

Air-venting the hydraulic system

A sign that there is air in the system is that the brake pedal can be depressed without any appreciable resistance, or if it feels spongy.

When any part of the system has been removed, air-venting must be carried out. Air can also enter the system if there is too small a quantity of brake fluid in the container. If, for example, only one wheel unit cylinder has been removed, it is usually sufficient to air-vent this only. If, on the other hand, the master cylinder or lines from this have been removed, the whole brake system must be air-vented. When air-venting or other similar work is being carried out, no brake fluid must be permitted to get onto the friction surfaces or linings.

Air-venting the whole brake system is done as follows:

1. Clean round the filling plug on the master cylinder. Unscrew the plug and if necessary top up with brake fluid. Use only first-class

brake fluid fulfilling the requirements of SAE 70 R 3. Fluid which only fulfils the requirements of SAE 70 R 1 or HD quality must not be used. Cut out the servo brake cylinders by disconnecting the vacuum line (2, Fig. 31).

2. On P 1800 up to chassis number 6999, the air-venting nipple is placed on the outside of the front wheel brake unit, so that the front wheels must be removed in this case.
Clean the air-venting nipple. Connect a hose onto the nipple and let the other end of the hose hang down in the fluid in a collecting vessel. If tool SVO 2381, (Fig. 46) is used, make sure that there is no leakage between the nipple and tool, which would otherwise give misleading results.
3. Open the nipple and have somebody press down the brake pedal slowly. Close the nipple before releasing the pedal, otherwise air can be sucked in since there is no check valve between the master cylinder and lines. Repeat this procedure as long as there are air bubbles in the fluid running out.
4. Air-vent the remaining wheels in the same manner. Between each operation, check that there is sufficient brake fluid in the container.
5. Connect the vacuum lines by screwing in the banjo plug.

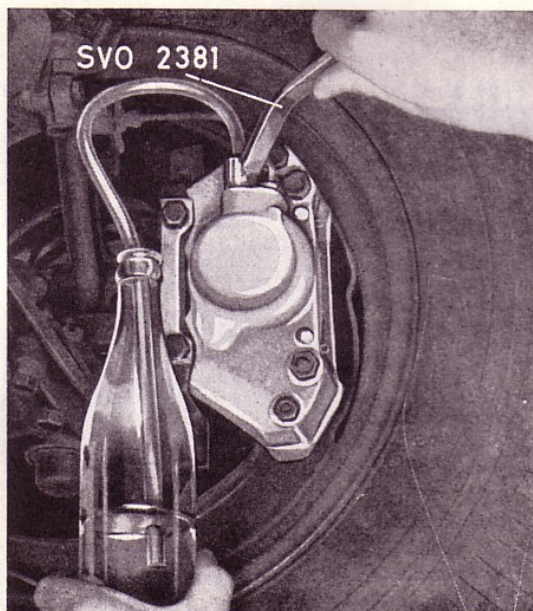


Fig. 46. Air-venting.

Leakage test

Once or twice a year, and when any hydraulic component has been removed, it is advisable to check the system for leaks. This can be done by placing the system under pressure by means of a pedal jack, after which all the hydraulic parts can be examined for leakage. It is even better if the test can be done with a special pressure tester. This is connected to the hydraulic system and the pressure raised to a maximum of 10 kg/cm² (1420 lb/sq.in.). After 10 minutes the pressure set on the gauge must not fall more than 10 % of the first reading and should then remain constant. If there is the slightest leakage in the system, the pressure will drop.

If any leakage is found, the fault must be remedied before the car is taken into use.

Brake pedal

ADJUSTING THE PEDAL POSITION

When the brake pedal is released, it should take up the same position as the clutch pedal. The position is adjusted by slackening the locknut and turning the push rod for the master cylinder. Do not forget to tighten the locknut.

REPLACING THE PEDAL AND/OR BUSHES

See under "Reconditioning the pedal shaft", Part 4.

HANDBRAKE

REPLACING THE HANDBRAKE CABLE

Removing

1. Apply the handbrake, remove the hub cap, slacken the wheel nuts and castle nut.
2. Jack up the rear end, place blocks under the rear axle and remove the wheel. Release the handbrake.
3. Pull off the brake drum and hub with puller SVO 1791, see Fig. 21. Unhook the cable from the brake shoe lever.
4. Unscrew the screws for the cable casing attachment on the brake backing plate. Remove the cable casing front attachment with rubber support sleeve. Unhook the cable from the clevis and pull out the cable.

Fitting

1. Fit the rubber support sleeve on the cable casing. Insert the cable into the brake backing plate and hook it onto the lever.

2. Hook the cable onto the clevis.
3. Tighten the bolts in the brake backing plate. Fit the cable casing front attachment and make sure that the clamp enters the groove on the sleeve. If necessary, slacken the adjusting nuts. Fit the rubber support sleeve in its bracket.
4. Fit on the hub with brake drum and wheel. Tighten the castle nut and wheel nuts sufficiently for the drum and wheel to come into the correct position.
5. Adjust the handbrake. Lower the car and tighten the wheel nuts to a torque of 10—14 kgm (70—100 lb.ft.). Tighten and lock the castle nut. Fit on the hub cap.

REPLACING THE RUBBER COVER

If the handbrake cable rubber cover has been damaged for any reason it must be replaced, as otherwise water and dirt can penetrate and cause rusting. For this replacement there is a special rubber cover available with sealing plugs (part numbers 86850 and 86851 respectively.) When replacing, the pull rod is removed from the lever and the cable unhooked from the clevis. Cut off the old cover and fit on the new one. Hook the cable onto the clevis and refit the pull rod. Fit the slotted sealing plug (1, Fig. 47) onto the cable (2) and press it into the rubber cover (3).

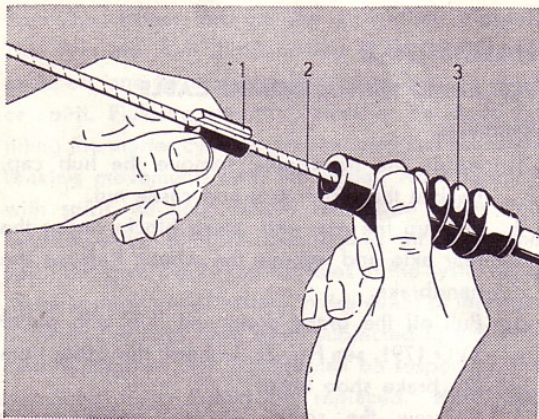


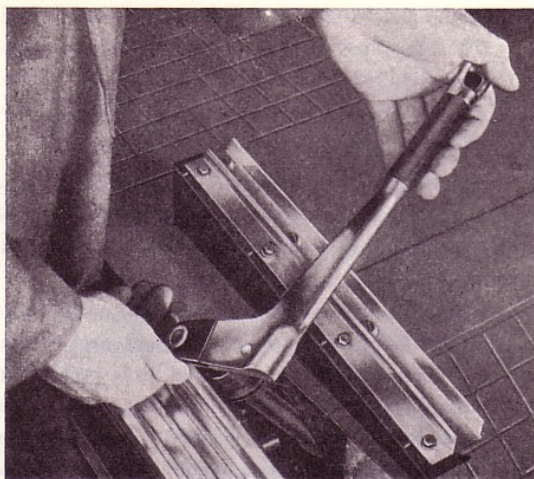
Fig. 47. Fitting the rubber cover.

- | | |
|-----------------|-----------------|
| 1. Sealing plug | 3. Rubber cover |
| 2. Cable | |

REPLACING THE HANDBRAKE LEVER OR RATCHET PARTS, P 120

1. Jack up the rear end and place blocks under the rear axle.

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Fig. 48. Removing the handbrake lever, P 120.

2. Remove the split pin and pull the cables so that the pull rod (11, Fig. 49) can be removed from the lever. Remove the bracket (13).
3. Turn back the floor mat and remove the rubber cover over the ratchet segment. Remove the ratchet segment.
4. Move the handbrake lever towards the centre of the car until it releases at the outer support attachment. Remove the rubber seal and pull out the handbrake lever complete, see Fig. 48.

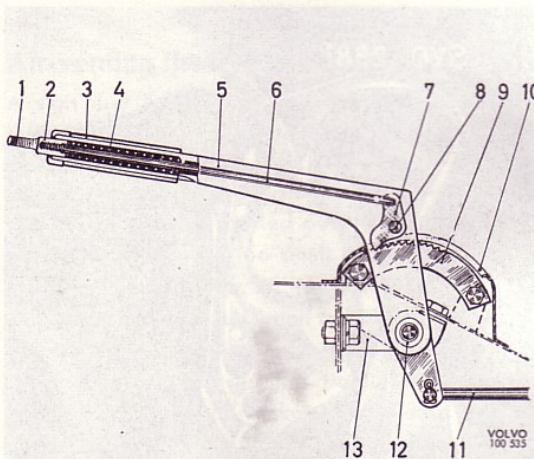


Fig. 49. Handbrake lever, P 120.

- | | |
|-------------|--------------------|
| 1. Loop | 8. Rivet |
| 2. Button | 9. Ratchet segment |
| 3. Handle | 10. Rubber cover |
| 4. Spring | 11. Pull rod |
| 5. Lever | 12. Bush |
| 6. Push rod | 13. Bracket |
| 7. Pawl | |

5. Screw out the locking screw and remove the loop (1, Fig. 49) and button (2). Take out the spring (4) from the lever. Remove the rivet (8) and take out the push rod (6) and pawl (7).
6. Fit the new parts in the reverse order, see Fig. 49. Make sure that the rivet is properly secured without the movement of the pawl being affected. Lubricate the bushes with a thin layer of ball bearing grease. Do not forget to lock the pull rod and ensure that the rubber cover on the shaft seals properly.

REPLACING THE HANDBRAKE LEVER OR RATCHET PARTS, P 1800

1. Release the handbrake and remove the protective cover.
2. Remove the split pin and washer on the shaft lever (6, Fig. 50). Turn the pull rod (7) so that it can be removed from the handbrake lever. Remove the ratchet segment (1).
3. Unscrew the bolts for the support attachment (8) and drive out the pin and attachment. Lift off the lever (3).
4. Unscrew the locking screw and remove the loop (5) and button (4). Take off the spring from the lever. Remove the rivet (2) and take out the push rod (6, Fig. 13) and pawl (18).
5. Fit the new parts in the reverse order. Make sure that the rivet is secure but without affecting the movement of the pawl. Lubricate the bushes with a thin coating of ball bearing grease. Do not forget to lock the pull rod.

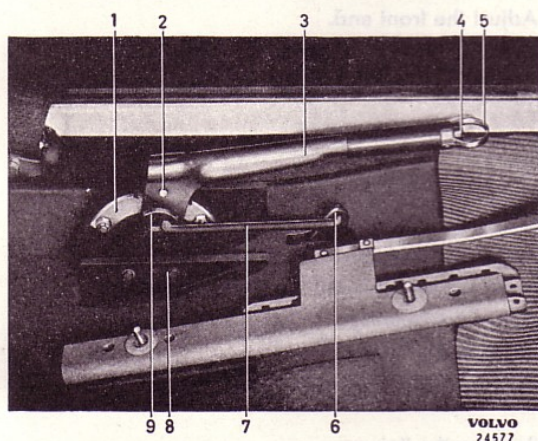


Fig. 50. Handbrake parts, P 1800.

- | | |
|--------------------|-----------------------|
| 1. Ratchet segment | 6. Lever |
| 2. Rivet | 7. Pull rod |
| 3. Handbrake lever | 8. Support attachment |
| 4. Button | 9. Lever |
| 5. Loop | |

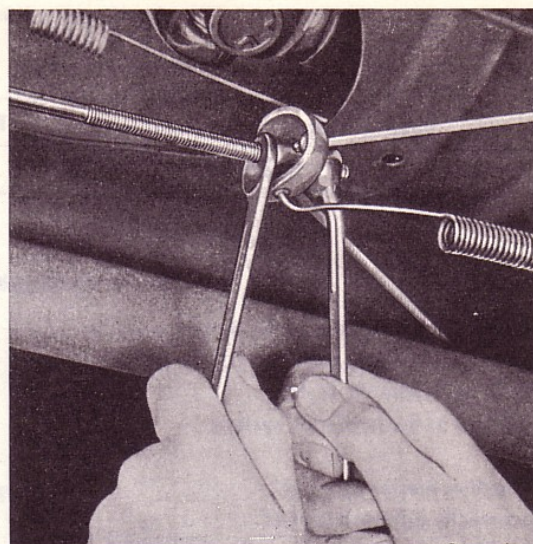


Fig. 51. Adjusting the handbrake.

REPLACING THE HANDBRAKE SHAFT, P 1800

1. Jack up the rear end and place blocks under the rear axle.
2. Release the handbrake and disconnect the pull rod (7, Fig. 50) from the shaft lever (6).
3. Remove the split pin and pull the cables so that the pull rod (2, Fig. 13) can be removed from the shaft lever. Remove the support attachments and lift off the shaft (21).
4. Lubricate the bushes in the new shaft with a thin coating of ball bearing grease. Check that the support attachment studs are undamaged. Fit the shaft in the reverse order to removing.

ADJUSTING THE HANDBRAKE

The handbrake should give full effect at the fourth — fifth notch. If not, the handbrake should be adjusted. Before adjusting, make sure that the trouble is not in the wheel brake units. The rear wheel brakes should therefore first be adjusted, see "Adjusting the wheel brake units". The handbrake is adjusted by moving the clevis on the pull rod, see Fig. 51. Tighten the nuts well after adjusting.

FAULT TRACING

FAULT

REASON	REMEDY
--------	--------

No or poor braking effect

Insufficient brake fluid in the system.

Air in the hydraulic system.

Leakage in the hydraulic system.

Defective master cylinder.

Incorrectly adjusted brakes.

Unsuitable brake linings.

Grease or oil on the brake linings.

Excessive clearance due to out-of-true brake disc.

Fill up with brake fluid.

Check for leakage. Air-vent.

Air-vent the system.

Check and repair the leakage.

Air-vent the system.

Recondition the master cylinder.

Adjust the brakes.

Replace with genuine Volvo linings.

Replace the brake linings.

Check the adjacent oil seal.

Recondition or replace the brake disc.

The car pulls to one side when braking

Grease or oil on one of the brake linings.

Unevenly adjusted brakes.

Out-of-round or uneven brake drum.

Defective wheel unit cylinder.

Excessive play in the wheel bearings or faulty wheel alignment.

Uneven tyre pressure.

Unevenly worn tyres.

Incorrectly adjusted front end.

Replace the lining. Check the oil seal.

Adjust the brakes.

Replace or grind the drum.

Recondition the wheel unit cylinder.

Adjust the front end.

Adjust the tyre pressure.

See part 8.

Adjust the front end.

The brakes bind

Badly adjusted brakes.

Moisture on the brake linings.

Excessive play in the wheel bearings.

Brake linings worn out.

Brake linings glazed owing to contamination with oil.

Damaged or loose brake linings.

Loose brake backing plate or retainer.

Out-of-round brake drum.

Broken return spring.

"Jumping" pedal due to excessive thickness variations on the brake disc.

Adjust the brakes.

Brake repeatedly until the fault disappears.

Adjust the bearings.

Replace the linings.

Replace the linings and repair the leakage.

Replace the linings.

Tighten the brake backing plate or retainer.

Replace the drum.

Replace the spring.

Recondition or replace the brake disc.

Brake drag on one of the rear wheels

Brakes incorrectly adjusted	Adjust the brakes.
Broken return spring.	Replace the return spring.
Handbrake cable chafing.	Lubricate or replace the handbrake cable.
Brake line to the wheel blocked or damaged.	Clean or replace the line.

Brake drag on one of the front wheels

Brake line to the wheel blocked or damaged.	Clean or replace the line.
Plungers binding.	Recondition the wheel unit cylinders.

Brake squeal

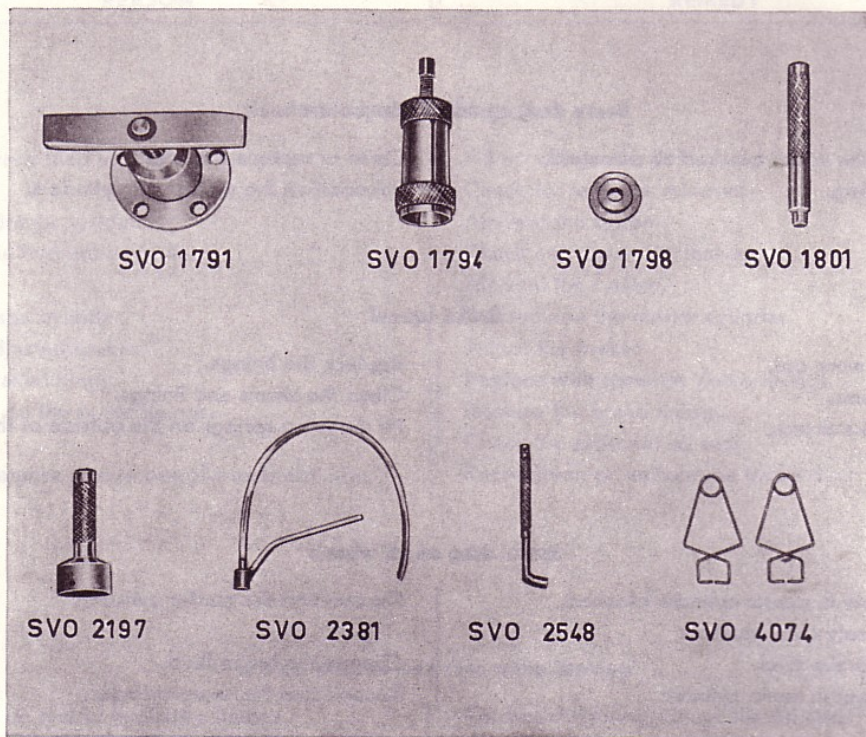
Brake linings worn out.	Replace the linings.
Dirt in the drums.	Clean the drums and linings.
Vibrating brake drums.	Fit damping springs on the outside of the drums.

Brake drag on all wheels

Equalizing hole in master cylinder blocked.	Recondition the master cylinder.
During extremely cold weather: poor quality brake fluid.	Change the brake fluid.
Binding plunger in servo cylinder.	Recondition the servo cylinder.

TOOLS

The following special tools are required for repairs to the brake system.



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Fig. 52. Special tools.

- SVO 1791 Puller for hub (with sleeve SVO 2581 for rear wheels).
- SVO 1794 Puller for inner ring, front wheel.
- SVO 1798 Drift for fitting oil seal in hub.
- SVO 1801 Standard handle 18×200.
- SVO 2197 Drift for fitting and removing grease cap.
- SVO 2381 Air-venting key.
- SVO 2548 Adjusting key for rear wheel brakes.
- SVO 4074 Spring clips for wheel unit cylinder.

SPECIFICATIONS

FRONT WHEEL BRAKES

Type	Disc brakes
Brake disc:	
External diameter, early production	276.5 mm (10 7/8")
late production	268.5 mm (10 9/16")
Thickness, new	12.7—12.8 mm (0.500—0.504")
reconditioned	Min. 12.2 mm (0.480")
Thickness variation	Max. 0.03 mm (0.0012")
Run-out	Max. 0.1 mm (0.004")
Brake pad facings:	
Number per wheel	2
Thickness	10.7 mm (0.421")
Friction area per wheel	92.5 cm ² (14.3 sq.in.)
Wheel unit cylinders:	
Number per wheel	3
Diameter, inner cylinder	2 1/8" (53.98 mm)
outer cylinders	1 1/2" (38.1 mm)
Tightening torque, inner bolts (12, Fig. 2)	6.2—7 kgm (45—50 lb.ft.)
outer bolts (13, Fig. 2)	3.5—4.2 kgm (25—30 lb.ft.)

REAR WHEEL BRAKES

Type	Drum brakes
Brake drum:	
Diameter	9" (228.6 mm)
Radial throw	Max. 0.15 mm (0.006")
Brake linings:	
Width	2" (50.8 mm)
Thickness	3/16" (4.76 mm)
Length	220 mm (8 21/32")
Friction area per wheel	223 cm ² (34.6 sq.in.)
Rivets for brake linings, size	11/64" × 17/64" (6.7 × 4.4 mm)
number per shoe	10
Wheel unit cylinder:	
Bore, P 120,	1" (25.4 mm)
P 1800 early production	7/8" (22.23 mm)
late production	3/4" (19.05 mm)
Clearance between plunger and cylinder	Max. 0.25 mm (0.010")

MASTER CYLINDER

Bore	22.2 mm (7/8")
Clearance between plunger and cylinder	Max. 0.20 mm (0.008")

BRAKE LINES

External diameter	3/16"
-------------------------	-------

SERVO BRAKE CYLINDER

Make and designation	Girling AHV 550 MK 2
Vacuum cylinder bore	5 1/2" (139.7 mm)
Test values at a vacuum of 0.7 kg/cm ² (10 lb/sq.in.):	
Outgoing hydraulic pressure at an ingoing pressure of 2.5 kg/cm ² (35.6 lb/sq.in.)	Min. 3.5 kg/cm ² (50 lb/sq.in.)
Outgoing hydraulic pressure at an ingoing pressure of 35 kg/cm ² (500 lb/sq.in.)	Min. 67 kg/cm ² (950 lb/sq.in.)
Tightening torque, bolts in valve housing	0.3—0.4 kgm (2—3 lb.ft.)
bolts for vacuum cylinder	1.4—1.8 kgm (10—12 lb.ft.)
bolts for vacuum cylinder cover	0.3—0.4 kgm (2—3 lb.ft.)
bolt for air filter cover	0.3—0.4 kgm (2—3 lb.ft.)

Notes

SPECIFICATIONS

analyzed and approved by the following:

FRONT WHEEL BRAKES

Type	Disc brakes
External diameter early production	174.5 mm (6.872")
External diameter late production	168.3 mm (6.626")
Thickness	12.7—13.8 mm (0.500—0.543")
Thickness early production	12.7 mm (0.500")
Thickness late production	13.8 mm (0.543")
Run-out	0.05 mm (0.0019")
Brake pad diameter	127 mm (5.000")
Number per wheel	1
Thickness	10.3 mm (0.405")
Friction area per wheel	42.3 cm ² (6.54 sq.in.)
Wheel hub diameter	71.9 (2.831 in.)
Number per wheel	1
Diameter inner cylinder	71.9 (2.831 in.)
Diameter outer cylinder	71.9 (2.831 in.)
Clearance between piston and cylinder	0.05—0.10 mm (0.0019—0.0039 in.)

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