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DESCRIPTION

The PV 444 is fitted with two independent brake systems. One of these, the footbrake, is controlled by means of a brake pedal and operates on all four wheels through a hydraulic system. The other brake system, the handbrake, is controlled by a brake lever and operates mechanically on both the rear wheels.

Footbrake

The arrangement of the footbrake is shown in Fig. 1.

When the brake pedal (11) is depressed, it operates on the plunger in the master cylinder (9) by means of a link rod (10). The hydraulic pressure in the master cylinder rises and is trans-

mitted through the brake fluid in the pipeline (6) to the wheel unit cylinders (2). The plungers (5) in these are then pressed outwards and the brake is applied.

When pressure on the pedal is released, the hydraulic pressure decreases and the return springs (4) cause the brake shoes to return to their rest position. The valve (15) maintains a low residual pressure in the system which is necessary for correct functioning.

Since the brake shoes are flexibly attached to the brake backing plate and because of the shape of the lower support (Fig. 2), the brake shoes are self-centring. In addition, the front brake shoes, the linings of which are as a rule subjected to most wear, are self-adjusting.

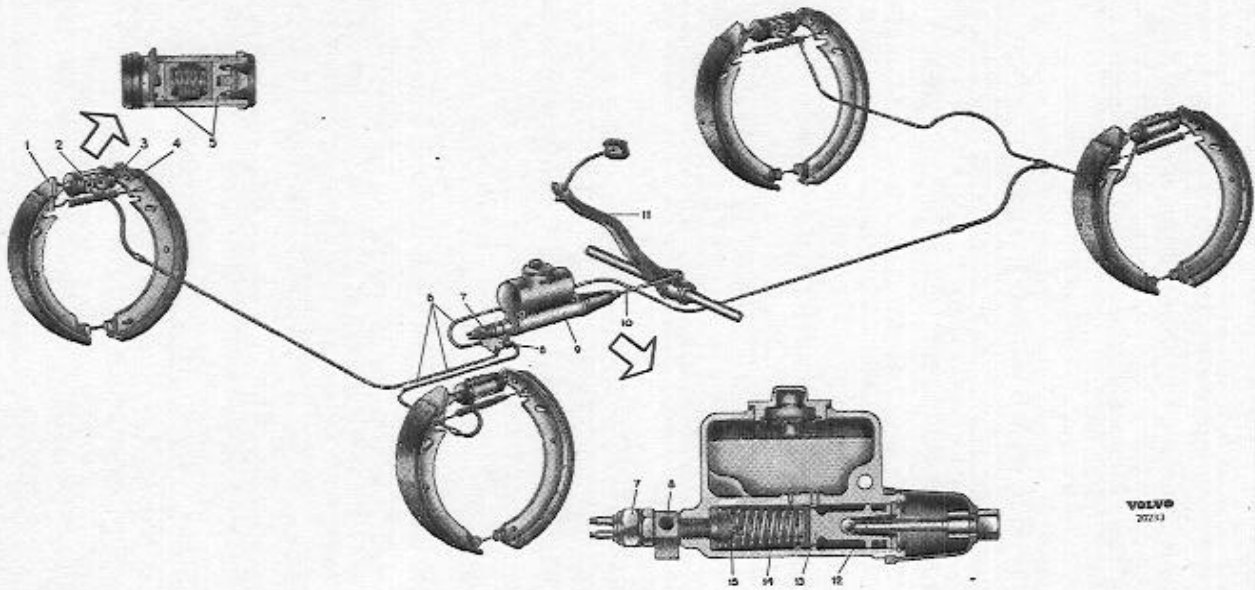


Fig. 1. Footbrake system.

- | | |
|------------------------|--------------------|
| 1. Brake shoe, front | 9. Master cylinder |
| 2. Wheel unit cylinder | 10. Link rod |
| 3. Brake shoe, rear | 11. Brake pedal |
| 4. Return spring | 12. Thrust rod |
| 5. Plunger | 13. Plunger |
| 6. Brake pipelines | 14. Return spring |
| 7. Brake contact | 15. Valve |
| 8. Three-way union | |

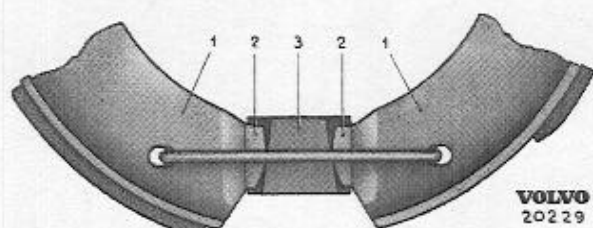


Fig. 2. Lower support.

1. Brake shoe 2. Lip 3. Support

The self-adjusting device (Fig. 3) functions in the following way.

A contact plug (4) is fitted in a hole in the brake shoe. The outer end of this plug is in contact with the brake drum and is held against this by a spring (2). As the brake lining wears down, the contact plug is moved inwards causing the lever (7) to press against the eccentric (6) by means of a stud (3). In this way the distance between the guide lip (8) on the brake shoe and the toothed lip (9) on the lever (7) is widened. The toothed key (11) which is influenced by a spring

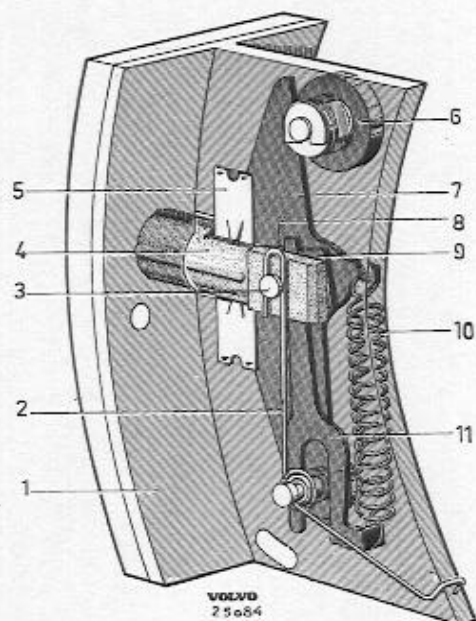


Fig. 3. Self-adjusting device.

- | | |
|-------------------|--------------|
| 1. Brake shoe | 7. Lever |
| 2. Spring | 8. Guide lip |
| 3. Stud | 9. Lip |
| 4. Contact plug | 10. Spring |
| 5. Damping spring | 11. Key |
| 6. Eccentric | |

(10), is then pulled in between the above lips (8 and 9 respectively). The return movement of the brake shoe is thereby limited so that the clearance between the brake lining and drum remains constant regardless of the degree of wear on the brake lining.

When the brake linings have worn down so that the contact plug reaches the web of the brake shoe, self-adjusting ceases. With further lining wear the clearance between the lining and drum increases. If the pedal stroke increases, i.e. it can be pressed down nearer to the floor, this often means that the brake linings are worn out and require replacing.

In order to prevent the contact plug from vibrating, a damping spring (5) is fitted between the brake shoe and contact plug.

On early production self-adjusting devices there is a coil spring inside the contact plug and locking springs on the stud instead of the spring (2).

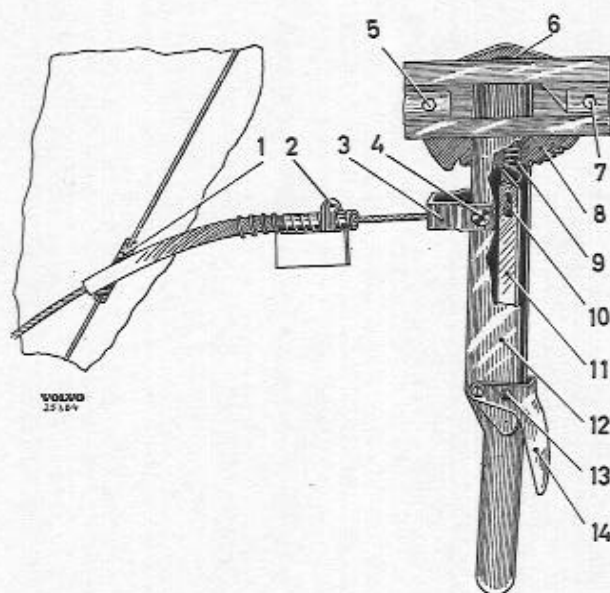


Fig. 4. Handbrake control, PV 444 chassis numbers 1-12504.

- | | |
|-------------------|--------------------|
| 1. Rubber bushing | 8. Ratchet segment |
| 2. Clamp | 9. Spring |
| 3. Shackle | 10. Bolt |
| 4. Bolt | 11. Ratchet rod |
| 5. Bolt | 12. Brake lever |
| 6. Pivot pin | 13. Rivet |
| 7. Bolt | 14. Release grip |

Handbrake

The control device for the handbrake is placed under the instrument panel to the left of the driver. On chassis numbers 1—12504 the handbrake is controlled by an arrangement as shown in Fig. 4. From chassis numbers 12505 onwards the handbrake is controlled by means of a pull rod (see Fig. 5).

The movement of the control device is transmitted through the front brake cable (21, Fig. 6) to the intermediate lever (2). From there the movement continues via the equalizing link (3) and rear brake cable (5) to the rear wheel brake unit levers (2, Fig. 32). The upper end of the lever is attached to the rear brake shoe. When the lever is pulled forward the shoes are forced outwards with the help of the link (1) thereby applying the brakes.

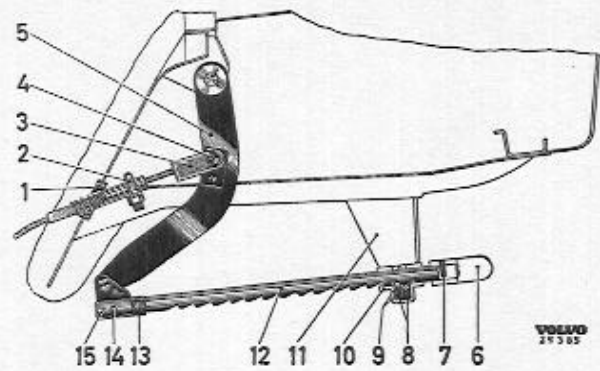


Fig. 5. Handbrake control PV 444 chassis numbers 12505 onwards.

- | | |
|-----------------------------|---------------------|
| 1. Rubber bushing | 8. Springs |
| 2. Clamp | 9. Interlock balls |
| 3. Shackle | 10. Ratchet housing |
| 4. Bolt | 11. Bracket |
| 5. Front intermediate lever | 12. Pull rod |
| 6. Handle | 13. Return spring |
| 7. Locking pin | 14. Stop pin |
| | 15. Link |

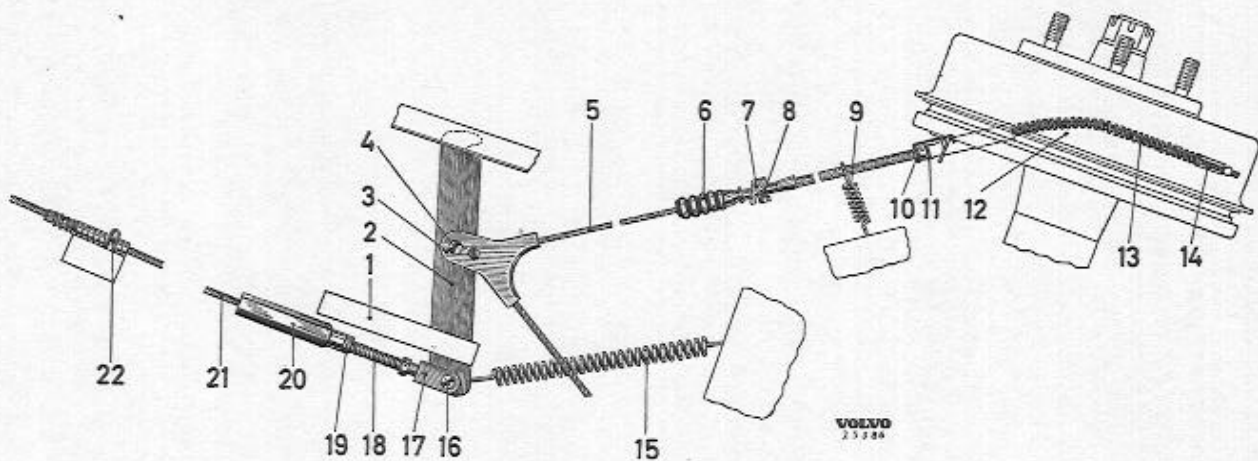


Fig. 6. Part of handbrake system.

- | | |
|-----------------------------------|-----------------------|
| 1. Support for intermediate lever | 12. Brake drum |
| 2. Intermediate lever | 13. Return spring |
| 3. Equalizing link | 14. Lever |
| 4. Stud | 15. Return spring |
| 5. Rear brake cable | 16. Stud |
| 6. Rubber casing | 17. Shackle |
| 7. Bracket | 18. Adjusting screw |
| 8. Clamp | 19. Lock nut |
| 9. Support spring | 20. Turnbuckle |
| 10. Locking spring | 21. Front brake cable |
| 11. Sealing ring | 22. Clamp |

REPAIR INSTRUCTIONS

Footbrake

Wheel brake units

Disassembling front wheel brake units

1. Remove hub cap and slacken wheel nuts slightly. Lift up car and place block under lower control arm. Remove wheel.

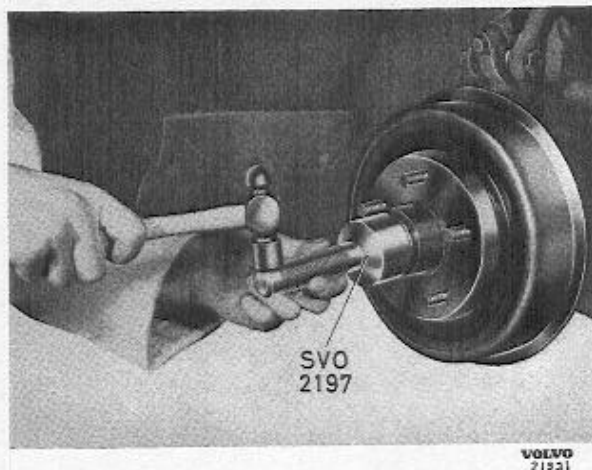


Fig. 7. Removing grease cap.

2. Remove grease cap with tool SVO 2197 (Fig. 7). Remove split pin and castle nuts. Pull off hub with tool SVO 1791 (Fig. 8). If the inner bearing does not come out with it, this can be pulled off the spindle with tool SVO 1794 (Fig. 9). For hubs with 4 wheel studs (earlier production), use pulpers SVO 1446 and SVO 4016 instead of the above.

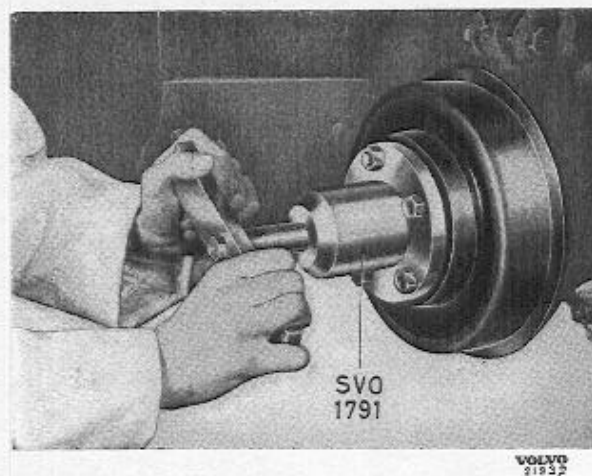


Fig. 8. Removing hub.

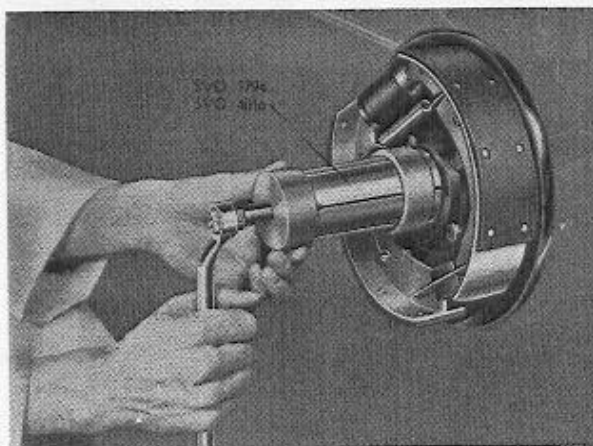


Fig. 9. Removing inner bearing.

3. Place clamp SVO 4074 on wheel unit cylinder so that the plungers cannot be pressed outwards. Remove lower spring with help of brake pliers SVO 1221 (see Fig. 11). Unhook return spring with help of pliers or key (Fig. 10). Remove locking washer and other washers from adjusting cam pivot pin. Lift off the shoes.

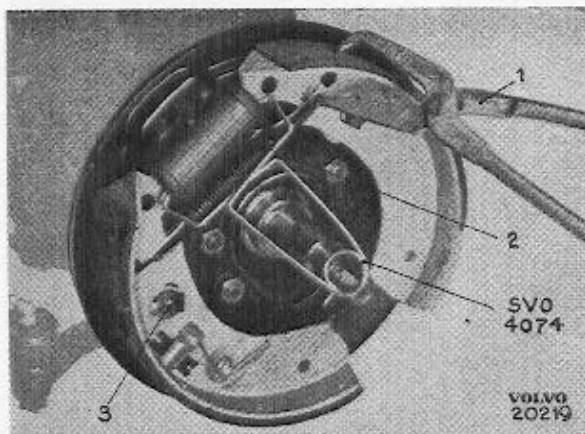


Fig. 10. Removing return spring.

Disassembling rear wheel brake unit

1. Apply the handbrake. Remove hub caps. Remove split pin and slacken the castle nut and wheel nuts slightly. Lift up the car and place blocks under rear axle. Remove wheel.

2. Release handbrake. Pull off hub with tool SVO 1791, see Fig. 8. If the hub has 4 wheel studs (chassis numbers 1—20004) use SVO 1446.
3. Place clamp SVO 4074 on wheel unit cylinder so that the plungers cannot be pressed outwards. Remove the lower spring with the help of brake pliers SVO 1221 (see Fig. 11). Remove locking washer and other washers from front shoe. Then turn the shoe outwards so that the handbrake link can be removed. Remove brake shoe and return spring. Disconnect handbrake cable and remove rear shoe.

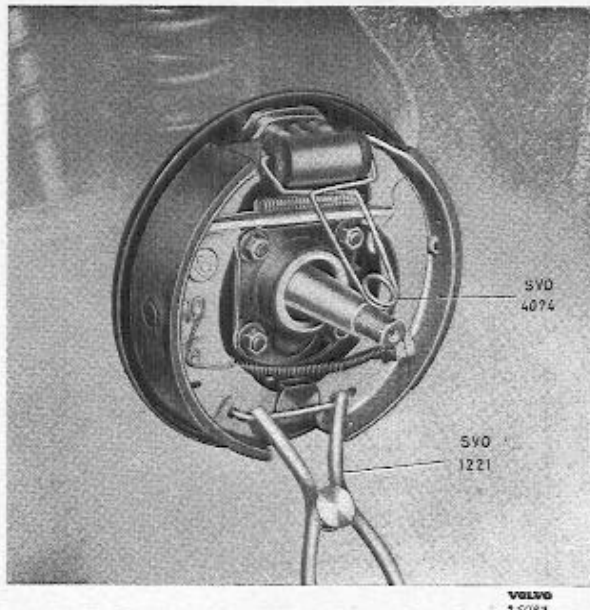


Fig. 11. Removing lower spring.

Replacing brake linings

Late production PV 444 cars are fitted with bonded brake linings. These can also be fitted on earlier production cars but must be done in pairs so that each axle has the same type of brake lining on both sides, otherwise uneven braking effect will result.

Brake linings should be replaced as follows.

Early production (riveted)

Remove the old linings by pressing out the rivets in a rivet press. Then wash the brake shoes and self-adjusting parts and blow them dry with compressed air.

When fitting new linings, ensure that the correct sizes are used. The hole in the longer

lining should be 19 mm ($\frac{3}{4}$ "). For further details see "Specifications".

Begin riveting at the centre of the lining and see that the lining beds properly on the shoe through its entire length. Use a rivet press and rivet punches suitable for the sizes of the rivets. The rear lining (shorter one) should be fitted on the upper part of the shoe (see Fig. 32).

Late production (bonded)

The old linings should preferably be removed in a hand grinding machine. They can also be chiseled off after which the brake shoe should be polished with emery cloth. Use care in both cases to ensure that the shoe is not damaged.

After polishing, wash the shoe in clean petrol or similar and then allow it to dry. After this the contact surface for the lining must not be touched or allowed to become dirty.

The sizes of the new linings are given in the "Specifications". When fitting, see that the lining does not come obliquely on the shoe and that the hole in the front lining comes opposite the contact plug. The rear lining is fitted on the upper part of the shoe.

Use only bonding compound which is specially made to withstand the high temperatures arising during prolonged periods of braking. Volvo original linings are ready-treated with suitable quantities of such bonding compound. The procedure for bonding varies with different makes of oven so that no general description can be given. Therefore follow the manufacturer's recommendations carefully.

Self-adjusting device

Disassembling

1. Press in the contact plug (4, Fig. 3) and check that the key (11) is in its inner position.
2. Disconnect the spring (10) for key and spring (2) for contact plug.
3. Remove lever (7), key (11), contact plug (4), damping spring (5) and guide lip (8).

Assembling

1. Fit the guide lip (8, Fig. 3). Replace the contact plug and fit the new one in position in the brake shoe. Place key (11) in position with the smooth side facing the guide lip.

2. Press in the contact plug far enough so that the hole in this comes opposite the hole in the brake shoe and fit lever (7) and spring (2) for contact plug.
3. Connect on spring (10) for key and fit damping spring.

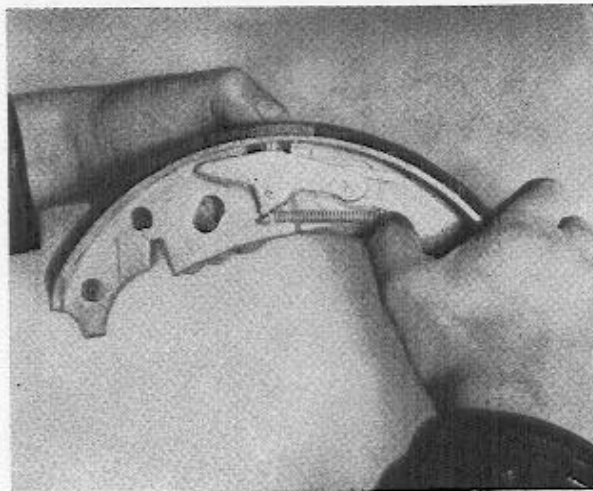


Fig. 12. Testing self-adjusting device.

Testing

Testing is carried out in such a way that while the contact plug is held pressed in, the key is moved to its outer position, see Fig. 12, after which pressure is released and the key removed. When the contact plug is pressed again the spring should be able to pull the key inwards, see Fig. 13. With pressure still being maintained, the key should move back to its outer position and the brake shoe is now ready for the contact plug to be adjusted.

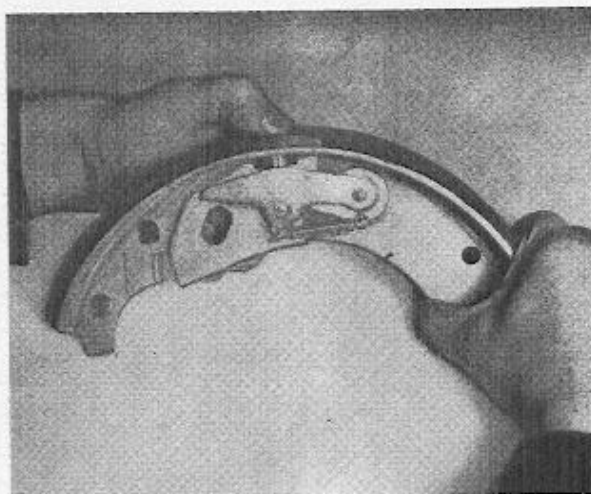


Fig. 13. Testing self-adjusting device.

Adjusting contact plug

The contact plug is adjusted with the help of a file and adjusting jig (part number 210030).

With the contact plug in the outer position, hold the brake shoe in a vice. The lip of the lever (2, Fig. 14) should rest against one of the jaws so that the plug cannot be pushed in during adjustment, causing faulty adjustment to be made.

Place the adjusting jig (1) over the contact plug and file this flush with the adjusting jig (see Fig. 14). This will cause the plug to come 0.1 mm (0.004") above the surface of the brake lining.

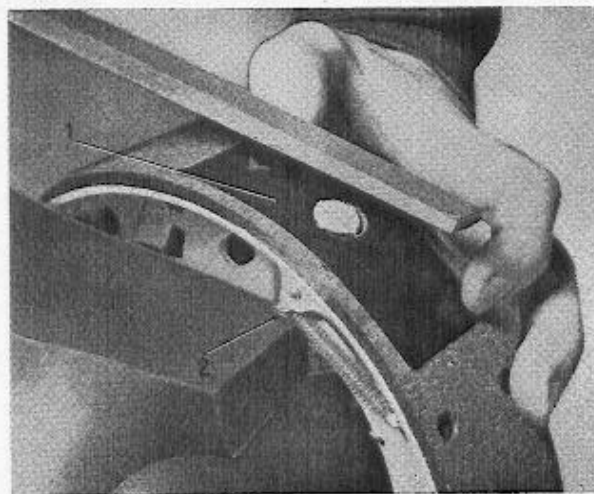


Fig. 14. Adjusting contact plug.

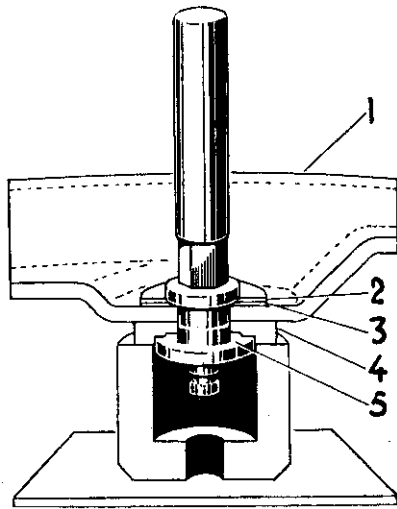
1. Adjusting jig 2. Lip

Replacing stud for adjusting cam

The stud (5, Fig. 15) for the adjusting cam (4) which is fitted in the brake backing plate can be replaced by pressing out the old stud and fitting in a new stud with the compressing tool SVO 2119 provided for this purpose.

The stud is replaced as follows.

1. Remove the brake backing plate. Place the backing sleeve of the compressing tool in a press as shown in Fig. 15 and press out the stud (5) with the help of a drift.
2. Turn the backing sleeve and place a new stud above this. Place adjusting cam (4), brake backing plate (1), spacing washer (3) and the spring washer with internal teeth (2) on the stud. Press down the washers with the help of the compressing tool, see Fig. 16.



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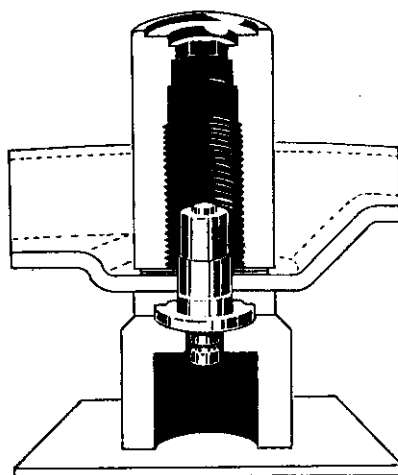
Fig. 15. Removing stud.

- | | |
|------------------------|------------------|
| 1. Brake backing plate | 4. Adjusting cam |
| 2. Washer | 5. Stud |
| 3. Washer | |

3. Turn the tool and centre it on the stud. See that it comes in a straight line with the stud. Press down the tool, see Fig. 17. Cease pressing at a maximum pressure of 8 tons. Turn the tool and check that the stud does not move too easily. If so, press further slightly.
4. Place in the bolt and pull the tool off the stud, see Fig. 18.

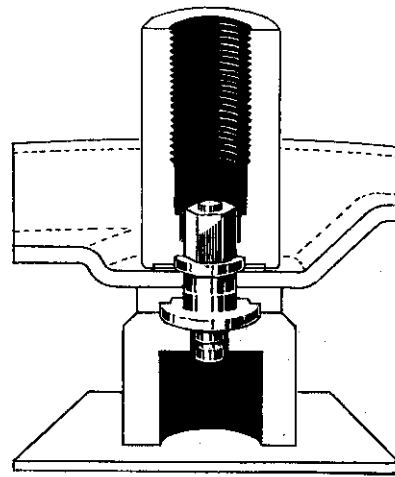
Brake drum

The friction surface and radial throw of the brake drum should be checked. The radial throw



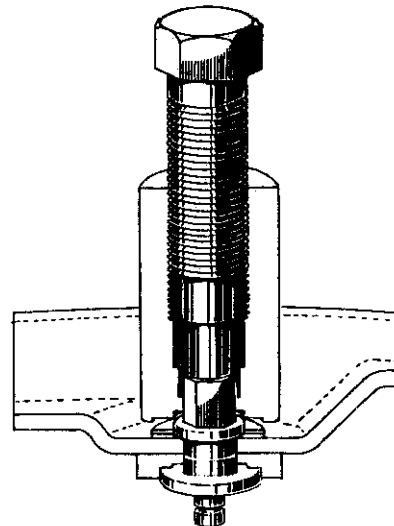
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Fig. 16. Fitting washers.



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Fig. 17. Compressing.



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Fig. 18. Removing tool.

must not exceed 0.15 mm (0.006"). If the friction surface is concave, scratched or cracked, the brake drum must be replaced. Rust spots and small scratches can be polished or ground off in a machine.

Assembling front wheel brake unit

1. Check that the key in the self-adjusting device is in the outer position and that the eccentrics on the brake backing plate are turned to their lowest positions. The self-adjusting device must not be lubricated as this results in dirt adhering which will impair the functioning of the device.

2. Place the rear shoe in position. Fit flat washer, spring washer, flat washer and locking washer on adjusting cam stud. Squeeze up the locking washer slightly after fitting.
3. Hook the return spring onto the shoes, place the front shoe in position on the wheel cylinder, turn the shoe outwards and fit it in position. Fit the locking arrangement. Place the lower spring in position with the help of brake pliers SVO 1221. Remove clamp SVO 4074.
4. Check that the return springs and locking washers are properly in position and that the linings are free from burr, grease and dirt.
5. If the front wheel bearing has been removed, this is placed in position in the hub. Lubricate if necessary with ball bearing grease. Press in the sealing ring with help of drift SVO 1798 (for chassis numbers 1—20004, SVO 4001) and standard handle SVO 1801, see Fig. 19.
6. Fit hub and brake drum on the spindle. Fit on outer bearing, washer, and castle nut.

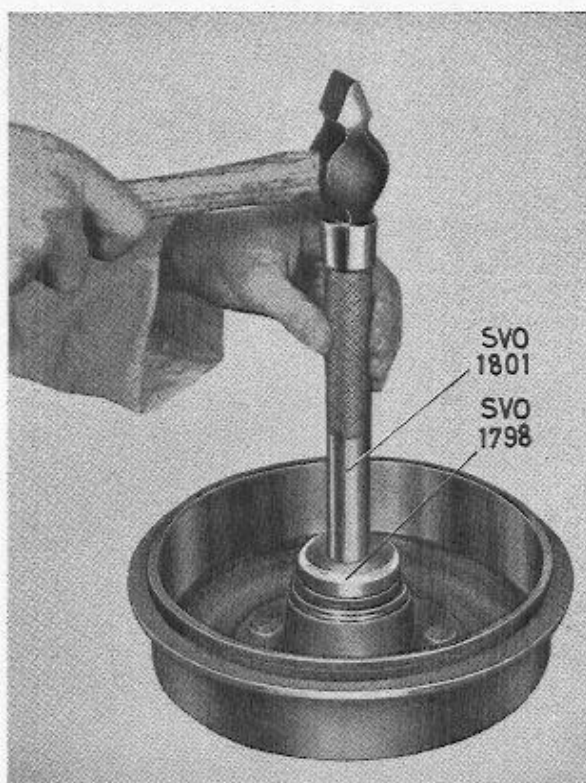


Fig. 19. Fitting sealing ring.

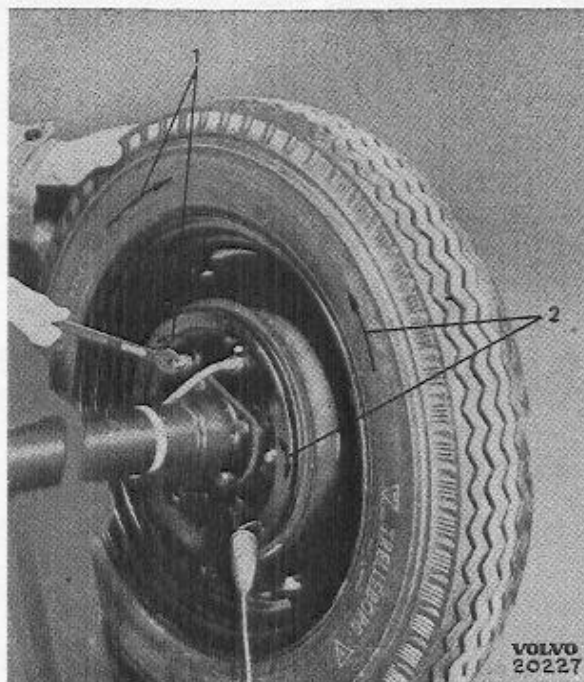


Fig. 20. Adjusting wheel brake unit.

Adjust the bearings by first tightening the nut to a torque of 6.9 kgm (50 lb.ft.). Then slacken the nut 1/3rd of a turn and lock it. Fill the grease cap with grease and fit same with drift SVO 2197.

7. Fit the wheel and adjust the brakes, see under "Adjusting wheel brake units". Lower the car. Tighten the wheel nuts to a torque of 10—14 kgm (70—100 lb.ft.). Fit on the hub cap.

Assembling rear wheel brake units

1. Proceed according to points 1 and 2 under "Assembling front wheel brake units".
2. Hook the return spring onto the shoes, place the front shoe in position on the wheel unit cylinder, turn the shoe outwards, fit the handbrake link and then place the shoe in position. Fit the locking arrangement.
3. Fit the lower spring with the help of brake pliers SVO 1221. Hook on the handbrake cable. Remove clamp SVO 4074. See Fig. 32.
4. Check that springs and locking washers are properly in position and that the linings are free from burr, grease and dirt.

5. Fit the hub, brake drum washer and castle nut. Fit the wheel. Adjust the brakes, see under "Adjusting wheel brake units".

Lower the car. Tighten the castle nut properly and lock it with split pin. Tighten the wheel nuts to a torque of 10—14 kgm (70—100 lb.ft.). Fit on hub cap.

Adjusting wheel brake units

Check that the handbrake is not applied. Rotate the wheel backwards and turn the eccentric for the front brake shoe away from the wheel unit cylinder (anti-clockwise on right wheel, clockwise on left wheel) until the wheel is locked by the brake shoe. Then slacken the eccentric sufficiently to enable the wheel to rotate freely (see 2, Fig. 20). Adjust the rear brake shoe by rotating the wheel forwards and applying the eccentric in the opposite direction to the front one (see 1, Fig. 20).

Hydraulic system

Observe the utmost cleanliness in all work connected with the hydraulic system. Wash the hands with soap and water before cleaning the internal parts. These should be washed in clean spirit. Petrol, paraffin, etc. must not be used.

Use only high-quality brake fluid which fulfills the requirements of SAE 70 R 1 (HD quality). Do not spill any brake fluid onto the paintwork as this can cause damage.

Master cylinder

Removing

The master cylinder is removed from underneath. Remove the cover plate and disconnect the brake pipeline connections at the cylinder and the leads for the brake contact. Disconnect the link rod from the brake pedal. Unscrew the two bolts which hold the master cylinder to the body and lift off the cylinder. Avoid spilling any brake fluid.

Disassembling

1. Blow the master cylinder clean externally. Remove the filling plug and empty out the brake fluid.

2. Pull the rubber cover (5, Fig. 21) off the master cylinder and remove thrust-rod (4) with rubber cover.
3. Remove plunger (8), seal (9), return spring (10) with valve (11) and seal (12).
4. Remove the three-way union (1) with brake contact.

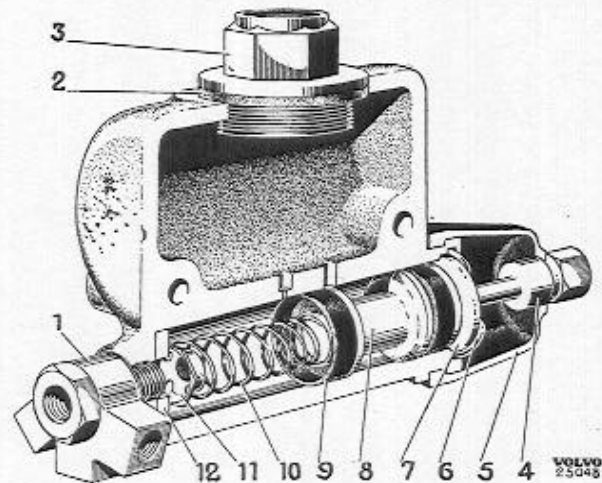


Fig. 21. Master cylinder.

- | | |
|--------------------|-------------------|
| 1. Three-way union | 7. Stop washer |
| 2. Washer | 8. Plunger |
| 3. Plug | 9. Seal |
| 4. Thrust-rod | 10. Return spring |
| 5. Rubber cover | 11. Valve |
| 6. Locking ring | 12. Seal |

Inspecting

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

Inspect the cylinder carefully internally. There must be no grooves, scratches or rust spots on the polished surface. Such damage can as a rule be eliminated by honing the cylinder. The procedure for this varies with different tools so that no general description can be given. Therefore follow the manufacturer's instructions carefully. Clean the cylinder carefully after honing and check that the equalizing hole is free.

The clearance between plunger and cylinder should be 0.025—0.127 mm (0.001—0.005") and is measured as shown in Fig. 22. If the clearance exceeds 0.127 mm (0.005"), test with a new plunger. If this does not help, the master cylinder must be replaced.

The free length of the return spring should be 75 mm (2¹⁵/₁₆").

Check seals and other parts for wear and damage. Damaged or worn parts must be replaced.

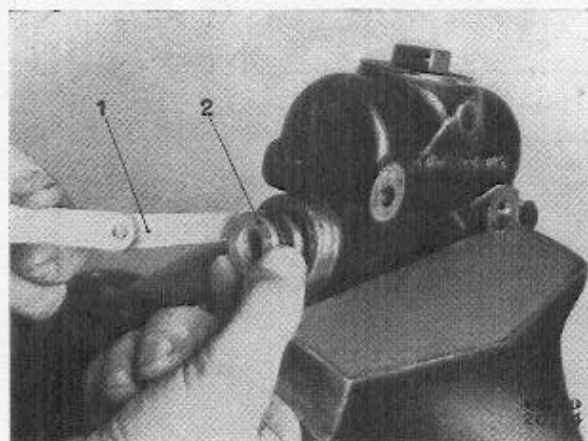


Fig. 22. Checking clearance.

1. Feeler gauge 2. Plunger

Assembling

Before assembling, check that the two holes between the cylinder and brake fluid container and the overflow holes in the plunger are open.

1. Place the seal (12, Fig. 21) and valve and return spring (10) in the cylinder.
2. Fit the rear seal on plunger (8). Dip plunger and seal (9) in brake fluid and press them into the cylinder. Fit the stop washer (7) in position and fit lock ring (6).

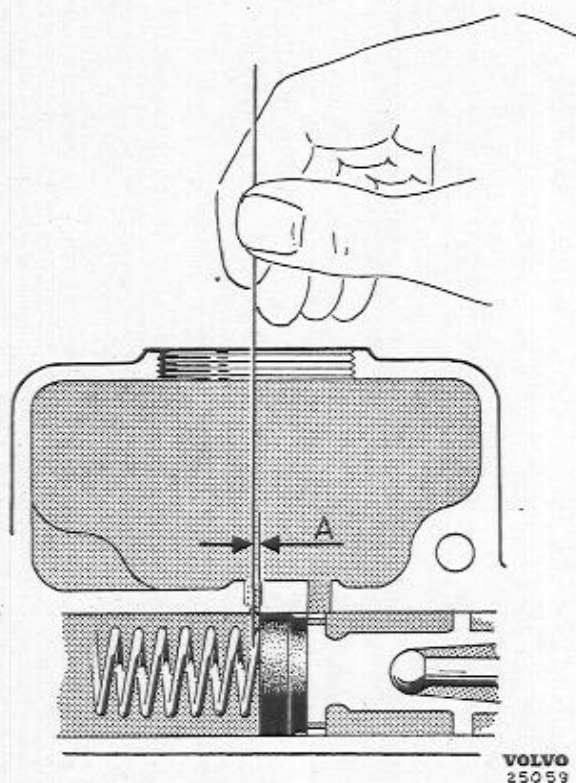


Fig. 23. Checking equalizing hole.

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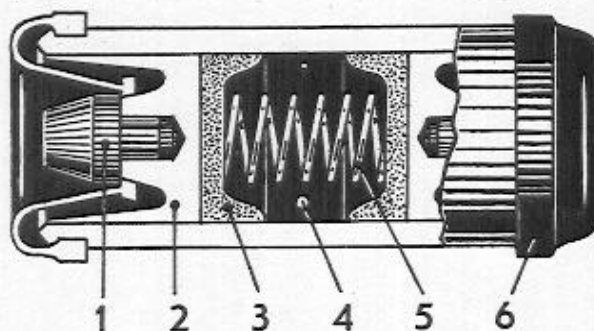
3. Place the thrust-rod (4) in plunger (8) and pull rubber cover (5) over the shoulder on master cylinder. Fit the three-way union (1) with brake contact.
4. Check that the equalizing hole is clear by pushing down a 0.5 mm (0.02") wire through the hole (Fig. 23). It should then be possible to press the plunger in about 0.5 mm (0.02") (A, Fig. 23) before the wire is gripped. Be careful to see that the seal is not damaged. If the equalizing hole is not clear, this usually means that the master cylinder has been assembled wrongly.

Fitting

The master cylinder is fitted in the reverse sequence to removing.

Fill up with brake fluid and bleed according to the instructions under "Bleeding the brake system".

Check and if necessary adjust the brake pedal free travel. This should be 7—12 mm ($\frac{9}{32}$ — $\frac{15}{32}$ ") and is adjusted according to instructions under "Adjusting free travel".



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Fig. 24. Wheel unit cylinder.

- | | |
|---------------|----------------------------------|
| 1. Thrust pin | 4. Connection for brake pipeline |
| 2. Plunger | 5. Spring |
| 3. Seal | 6. Rubber cover |

Wheel unit cylinders

Removing

1. Remove hub and brake shoes, see under "Disassembling wheel brake units".
2. Remove brake pipelines and wheel unit cylinder attaching bolts. Lift out the wheel unit cylinder but see that no brake fluid gets onto the linings.

Overhauling

Remove clamp, pull off the rubber cover (6, Fig. 24) and remove plunger (2), seal (3) and spring (5). Wash all parts in clean spirit.

Examine the cylinder carefully internally. There must be no scoring, scratches or rust spots on the polished surface. Such damage can be removed by honing the cylinder. Since the procedure for this varies with different types of tool, follow the respective manufacturer's instructions. Clean the cylinder carefully after honing when the bleeding nipple should be removed.

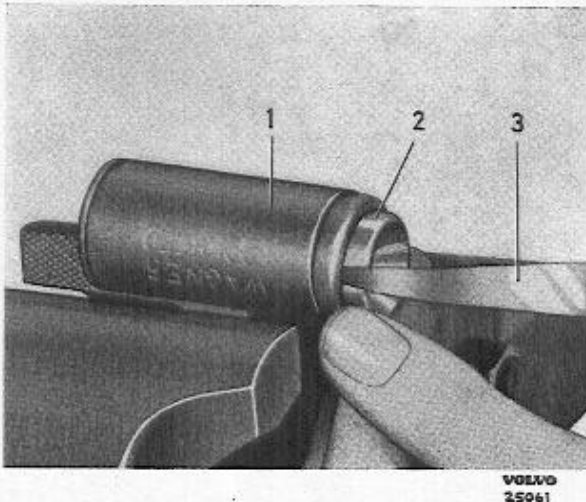


Fig. 25. Checking clearance.

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

The clearance between plunger and cylinder should be 0.025—0.127 mm (0.001—0.005") and is measured as shown in Fig. 25. If the clearance exceeds 0.127 mm (0.005"), test with a new plunger. If this does not help, the wheel unit cylinder must be replaced.

Examine the seals and other parts for wear and damage. Damaged or worn parts must be replaced.

Assemble the parts in the reverse sequence to disassembling. Dip plungers and seals in brake fluid.

Fitting

Fitting is done in the reverse sequence to removing. When working on both front and rear wheel unit cylinders, remember that the front wheel unit cylinder should be 1" in diameter

and rear wheel unit cylinder $\frac{7}{8}$ " diameter. Bleed the wheel unit cylinder.

Brake pipelines

The brake pipelines should be flushed in connection with complete overhaul of the hydraulic system.

The pipelines should be disconnected one by one from the wheel unit cylinders and flushed with clean spirit. This is preferably done by filling the master cylinder with spirit and then carrying out repeated braking movements with the pedal. When the master cylinder has been overhauled, this is filled with brake fluid after which the pipelines are flushed free from spirit. All spirit must be carefully removed from the pipelines as otherwise bubbles may occur in the system giving rise to a "spongy" pedal.

If any leakage occurs or if the pipelines have been subjected to any external damage whereby leakage can be suspected, replace the damaged pipelines. This should be done as follows.

1. Remove the damaged pipeline.
2. If the replacement involves a pipe which is not available ready made, a new pipe should be cut off to the length required (see "Specifications"). The pipe should be cut off at right-angles and all burr removed.
3. If the pipe is of copper, this is flanged in the usual way. If it is a steel pipe, it should be double-flanged which is done with tool SVO 2049. Place the tool in a vice, insert the pipe far enough so that its end comes flush with the jaw as shown in Fig. 26. Tighten the nuts.

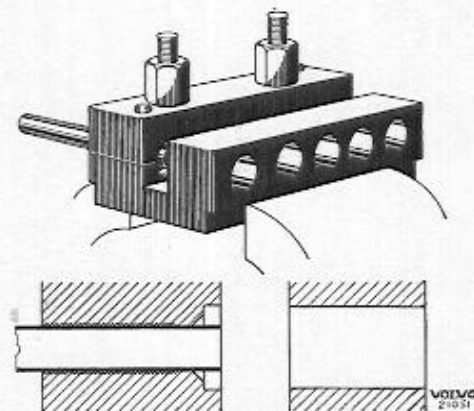


Fig. 26. Flanging brake pipe.

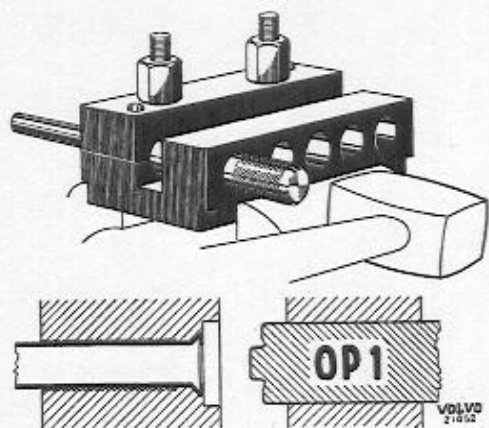


Fig. 27. Flanging brake pipe.

4. Place drift OP 1 in the tool. Knock drift with a copper mallet until it bottoms. The edge of the pipe is then flanged as shown in Fig. 27.
5. Replace the drift with OP 2 (Fig. 28) and knock this in until it bottoms.
6. Fit on the union nuts and repeat operations 3—5 at the other end of the pipe.
7. Bend the brake pipeline thus made using the old one as a pattern. Bending should be done round an object having the same radius as the bend required.
8. Blow the pipe clean internally and fit it. Ensure that the pipe comes in such a position that it cannot be chafed during driving. Particularly important points to watch are where the pipe passes over the support arm clamps on the rear axle, where it must not be nearer to the clamps than 10 mm ($\frac{3}{8}$ ") and where it passes the rear springs.
9. Bleed the hydraulic system.

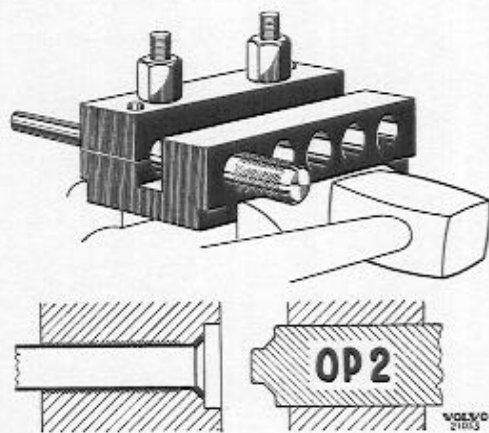


Fig. 28. Flanging brake pipe.

Bleeding the hydraulic system

Symptoms that there is air in the hydraulic system are that the brake pedal can be depressed without any noticeable resistance or if it feels "spongy".

Bleeding must be done whenever any part of the system has been removed. Air can also enter the system if there is insufficient brake fluid in the container. If, for example, only one wheel unit cylinder has been removed, it is usually sufficient to bleed this only. If, on the other hand, the master cylinder or pipelines from same have been removed, then the whole system should be bled.

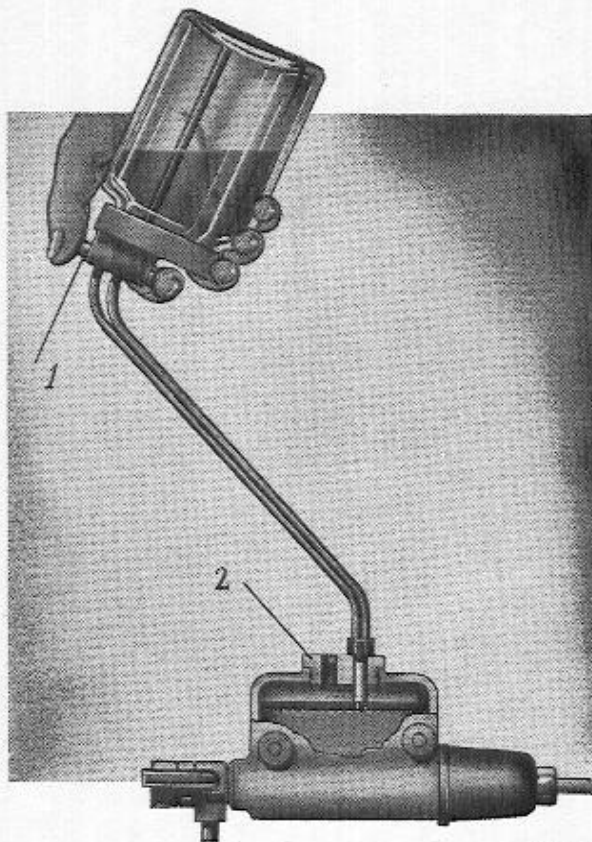


Fig. 29. Filling brake fluid.

1. Tap 2. Plug

Bleeding of the whole brake system is carried out as follows.

1. Clean around the filling cover and bleeding nipples.
2. Remove the master cylinder cover. Use wrench SVO 1457 on chassis numbers 1—20004 and wrench SVO 2384 on chassis numbers 20005 onwards. Fill up with brake fluid if necessary.

It is best to use a special filling flask as shown in Fig. 29. Screw the plug (2) into the place of the cover. Insert the pipe through one of the holes in the plug and open the tap (1). The flask will then maintain the fluid level constant and at the correct level during bleeding.

3. Fit wrench SVO 1431 with hose on bleeding nipple and let the other end of the hose hang down in the fluid in a suitable collecting vessel, see Fig. 30.

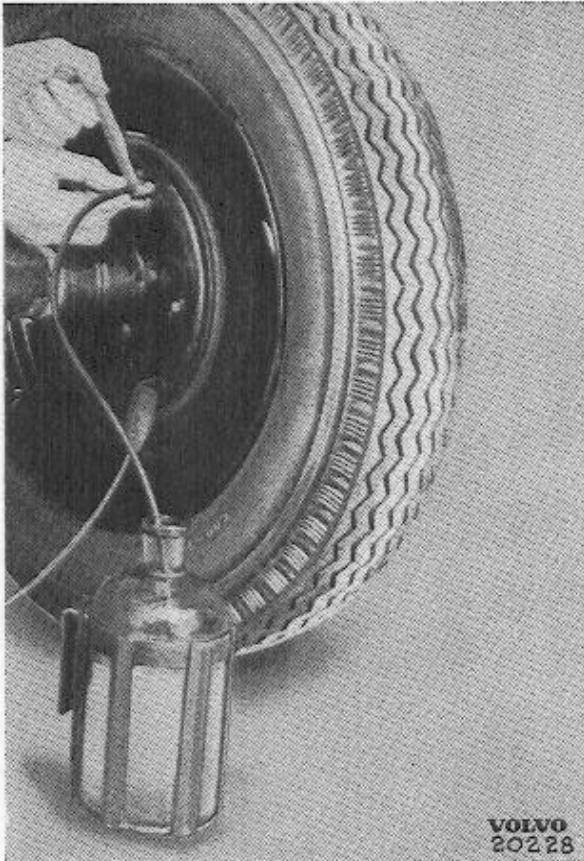


Fig. 30. Bleeding.

4. Open the nipple and have someone slowly depress and release the brake pedal a few times. Keep the nipple open as long as there are air bubbles in the fluid which flows out. Then close the nipple while the brake pedal is held fully depressed.
5. Bleed the other wheels in the same manner. Then close the tap on the filling flask and remove it. Check the gasket and screw in the cover.

When bleeding, a special bleeding device can be used which maintains the hydraulic system under a certain positive pressure. In this case the brake pedal does not need to be depressed so that bleeding can be carried out by one person.

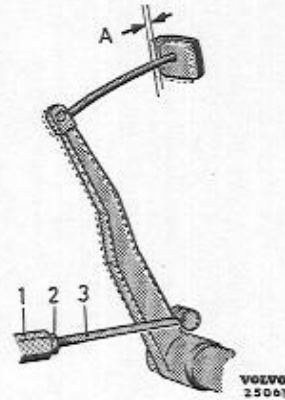


Fig. 31. Adjusting free travel.

1. Thrust-rod
2. Lock nut
3. Link-rod

Brake pedal

Adjusting free travel

It is important that the brake pedal has correct free travel. If this is insufficient, the equalizing hole between the cylinder and fluid container can be obstructed by the plunger seal with the result that the brake shoes are prevented from returning to their rest positions. If the free travel is too great, the effective stroke can be insufficient so that "pumping" must be carried out to obtain sufficient braking effect.

The brake pedal free travel is set by adjusting the length of the link-rod (3, Fig. 31). Slacken the lock nut (2) and turn the thrust-rod (1) until the pedal has a free travel of 7—12 mm ($\frac{9}{32}$ — $\frac{15}{32}$ " (measurement A). Tighten the lock nut.

Replacing bushing and shaft

This is done in connection with overhauling the clutch pedal, see Service Manual, Part 2 under heading "Overhauling pedal shaft".

Handbrake

Replacing rear brake cable

Removing

1. Apply the handbrake. Remove the rear wheel hub caps. Remove split pins and slacken the castle nuts and wheel nuts slightly. Lift up the car and place blocks

under the rear axle. Remove the rear wheels.

2. Release the handbrake. Pull off hubs with tool SVO 1791, see Fig. 8. If the hub has four wheel studs, use SVO 1446.
3. Remove the stud (4, Fig. 6) and equalizing link (3). If the return spring (15) is attached to the bolt (early production), the spring must first be unhooked. For cables with outer casings, the clamps and springs must also be removed.
4. Unhook the cable (3, Fig. 32) from the lever (2) on the rear brake shoe. The cable with outer casing can then be pulled forwards after the locking spring has been unhooked. For cables without outer casings, the rubber cover is first pulled off the pipe after which the cable is pulled to the rear so that the locking washer can be removed. If the guide sleeve does not come off with the cable, it can be knocked to the rear with a narrow drift.

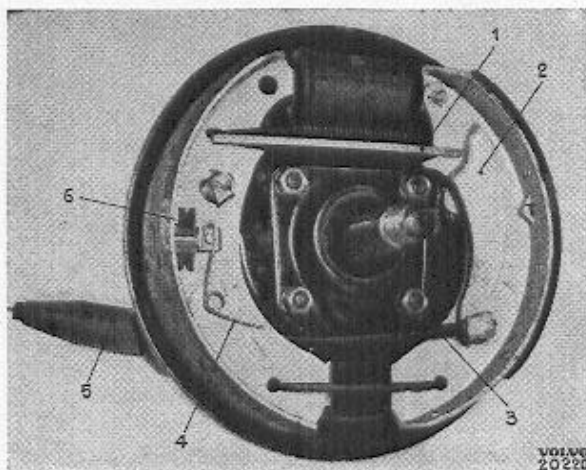


Fig. 32. Rear wheel brake unit.

- | | |
|----------------|----------------------------|
| 1. Link | 4. Spring for contact plug |
| 2. Lever | 5. Rubber cover |
| 3. Brake cable | 6. Damping spring |

Fitting brake cables without outer casings

1. Screw back the screw (18, Fig. 6) in the turnbuckle. Place the cable in the equalizing link (3) and fit this to the intermediate lever (2). Hook on the return spring if this has been removed.

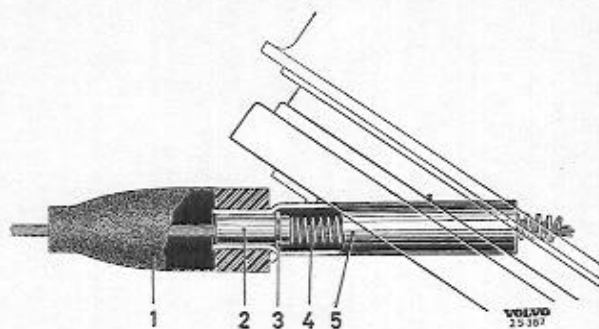


Fig. 33. Cable guide.

- | | |
|-------------------|--------------------------------|
| 1. Rubber casing | 4. Cable |
| 2. Sleeve | 5. Tube in brake backing plate |
| 3. Locking washer | |

2. Insert the cable and guide sleeve through the support in the body and then through the tube in the brake backing plate and fit locking washer (3, Fig. 33) and then place the guide sleeve in position. Fit the cable to the lever. Pull on the rubber casing.
3. Fit hub with brake drum, washer and castle nut. Fit wheel. Adjust the handbrake after both wheel brake units have been fitted. Lower the car. Tighten the castle nut properly and lock with split pin. Tighten the wheel nuts to a torque of 10—14 kgm (70—100 lb. ft.). Fit on hub cap.

Fitting cables with outer casings

1. If the car was previously equipped with cables without outer casings, first weld the retainers supplied in set no. 276354 onto the body floor as shown in Fig. 34.
2. Place the cable in equalizing link (3, Fig. 6) and fit this to the lever (2). Hook on return spring if this has been removed.

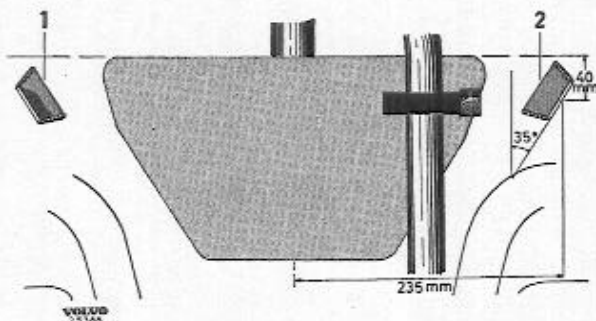


Fig. 34. Location of brackets.

- | | |
|-----------------|------------------|
| 1. Left bracket | 2. Right bracket |
|-----------------|------------------|

3. Fit the sealing ring (11) over the spring and insert the cable through the tube in the brake backing plate. Hook the cable onto the lever. Fit the locking spring (10). Repeat the procedure on the other wheel.
4. Attach the cable sleeves to the welded retainers by means of clamp (8), spring washer and nut. See that the clamp enters the groove on sleeve. If necessary slacken the adjusting screw (18) on the front cable turnbuckle. Pull on the rubber casing (6).
5. Fit springs (9). If these were not fitted previously, first drill a 4 mm ($5/32$ ") hole in the centre of each support arm about 300 mm ($11\ 13/16$ ") from the front joint.
6. See point 3 under "Fitting brake cables without outer casings".

Replacing rubber casing

If the handbrake cable rubber casing has been damaged for any reason, it must be replaced. If not, water and dirt can penetrate and cause it to rust up. A special rubber casing with sealing plug (part numbers 86850 and 86851 respectively) are available for this replacement.

The hub on the side where the rubber casing is to be replaced should be removed, see points 1 and 2 under "Replacing rear brake cable". Then unhook the cable from the brake shoe lever. If the replacement concerns a cable without outer casing, the damaged casing is pulled off, the locking washer removed and the cable pulled out. For cables with outer casing, the clamp and springs are removed.

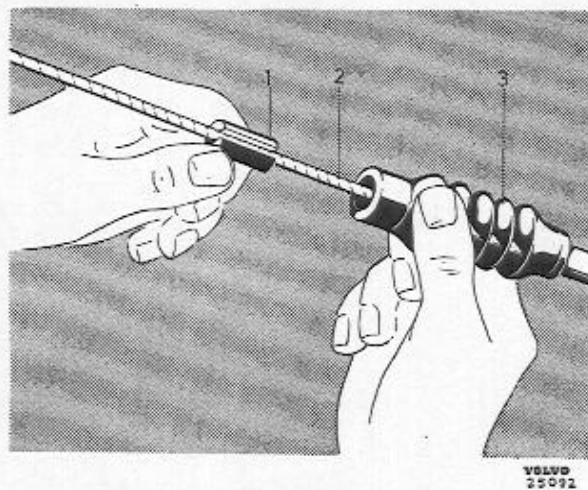


Fig. 35. Fitting rubber casing.

1. Sealing plug 2. Cable 3. Rubber casing

The new casing is placed in position on the cable over the spring and outer casing respectively and the parts are put together. The slotted sealing plug (1, Fig. 35) is fitted on the cable (2) and pressed into the rubber casing (3). Fit the hub and wheel, see point 3 under "Fitting brake cables without outer casings".

Replacing front brake cable

1. Unhook return spring (15, Fig. 6) and remove stud (16). Remove clamp (22) and any clips.
2. Remove clamp (2, Figs. 4 and 5 respectively), bolt (4), rubber bushing (1) and clip. Pull the cable forwards and screw off shackle and adjusting screw (18, Fig. 6).
3. Fit the shackle to the turnbuckle in the new brake cable. Place the cable in position and fit bolts, rubber bushing, clamps and clips.
4. Adjust the handbrake.

Replacing ratchet rod and segment (handbrake lever type)

Removing

1. Remove the left-hand glove compartment.
2. Remove the bolt (4, Fig. 4) which attaches the shackle (3) to the handbrake lever.
3. Remove the two bolts (5 and 7 respectively) which retain the ratchet segment (8) and lift out the lever and segment.
4. Remove the pivot pin (6) which holds the lever and segment together. Disconnect the spring (9).
5. Grind off the head of the rivet (13) which attaches the ratchet rod (11) to the release grip (14). Drive out the rivet. Remove the ratchet rod bolt (10).

Fitting

1. Insert the ratchet rod into the brake lever, place in rivet and rivet same ensuring that it is not riveted so tightly as to prevent the grip from being fully moveable in all positions. Fit in the bolt at the other end of the ratchet rod.
2. Fit the lever to the segment and connect on the spring.

3. Bolt the segment to its attachment. Connect the brake cable shackle to the handbrake lever.

Replacing brake lever and ratchet housing (pull-rod type)

1. Disconnect the return spring (13, Fig. 5) for the pull-rod (12) and drive out the stop pin (14) at the link (15) for the intermediate lever.
2. Remove the ratchet housing (10) from the bracket (11) and take out the pull-rod and ratchet housing.
3. Remove the return spring and ratchet housing from the pull-rod. Drive in the pin (7) for the pull-rod and pull off the handle.
4. Push the handle on to the new pull-rod and knock in the pin flush with the handle.
5. Fit springs and interlock balls in ratchet housing and push this onto the pull-rod together with return spring.

6. Insert the pull-rod into the intermediate lever link and drive in the stop pin. Fit on return spring.
7. Bolt the ratchet housing to the bracket.

Adjusting the handbrake

There are two possibilities for adjusting the handbrake. In the first place the front brake cable is stretched by turning the adjusting screw (18, Fig. 6) until the handbrake gives full braking effect at the 6th—8th notch. If the adjusting screw is fully screwed into the turn-buckle, there is further possibility of adjustment by moving the equalizing link (3) forwards. First screw the adjusting screw back after which the stud (4) can be fitted into the rear hole in the equalizing link. Carry out final adjustment with the adjusting screw as above.

Do not forget to lock the stud (4) or to tighten the lock nut (19).

FAULT TRACING

FAULT	
REASON	REMEDY

No or only weak braking effect

<p>Pedal free travel excessive. Insufficient brake fluid in the system.</p> <p>Air in the hydraulic system. Leakage in hydraulic system. Defective master cylinder. Incorrectly adjusted brakes. Unsuitable brake linings. Grease or oil on brake linings.</p>	<p>Adjust free travel. Top up with brake fluid. Check for leakage. Bleed. Bleed the system. Check and repair leakage. Bleed. Overhaul master cylinder. Adjust the brakes. Replace with original brake linings. Replace brake linings. Check sealing ring.</p>
--	---

Car pulls to one side when braking

<p>Grease or oil on one of the brake linings. Unevenly adjusted brakes. Out-of-round or uneven brake drums. Defective wheel unit cylinder. Excessive play in wheel bearings or incorrect front wheel alignment. Uneven tyre pressure. Unevenly worn tyres.</p>	<p>Replace the lining. Check the sealing ring. Adjust the brakes. Replace or grind brake drum. Overhaul wheel unit cylinder. Adjust front end.</p> <p>Adjust tyre pressure. See Part 8.</p>
--	---

Brakes grab

<p>Badly adjusted brakes. Moisture on brake linings.</p> <p>Excessive play in the wheel bearings. Worn out brake linings. Carbonized brake linings. Damaged or loose brake linings. Loose brake backing plate. Out-of-round brake drum. Broken return spring.</p>	<p>Adjust brakes. Carry out repeated brakings until the fault disappears. Adjust the bearings. Replace the linings. Replace linings and repair leakage. Replace linings. Tighten brake backing plate. Replace or grind brake drum. Replace spring.</p>
---	--

Brakes bind on all wheels

Brakes incorrectly adjusted.
Pedal has too little free travel, obstructs equalizing hole.
Equalizing hole blocked up with dirt.
During extremely cold weather: poor quality brake fluid.

Adjust the brakes.
Adjust pedal free travel.

Overhaul master cylinder.
Replace brake fluid.

Brakes bind on one of the wheels

Brakes incorrectly adjusted.
Broken return spring.
Handbrake cable chafes.
Brake pipeline to wheel blocked up or damaged.
Excessive play in wheel bearings.

Adjust the brakes.
Replace spring.
Lubricate or replace cable.
Pipeline to be cleaned or replaced respectively.

Adjust the bearings.

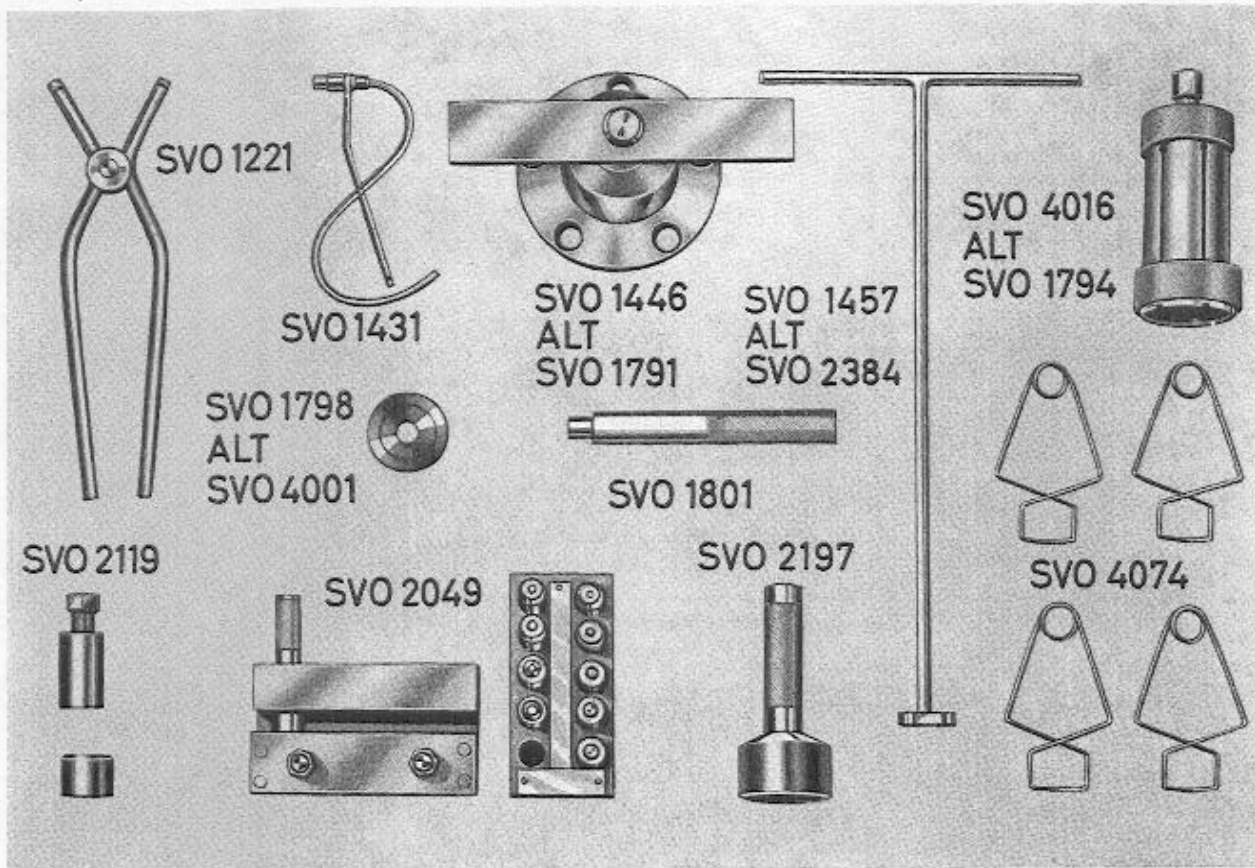
Brake squeal

Brake linings worn out.
Dirt in brake drums.
Unsuitable brake linings.

Replace linings.
Clean drums and linings.
Replace with original linings.

TOOLS

The following special tools are required when repairing the brake system.



VOLVO
24417

- | | | | |
|----------|--|----------|--|
| SVO 1221 | Pliers for removing and fitting lower brake spring. | SVO 1801 | Standard handle. |
| SVO 1431 | Spanner for bleeding screw. | SVO 2119 | Compressing tool for adjusting cam stud. |
| SVO 1446 | Puller for hub with brake drum on front and rear wheels (PV 444 chassis numbers 1—20004). | SVO 2049 | Flanging tool for brake pipeline. |
| SVO 1457 | Key for master cylinder filling plug (PV 444 chassis numbers 1—20004). | SVO 2197 | Drift for removing and fitting grease cap for front wheel hub. |
| SVO 1791 | Puller for hub brake drum on front and rear wheels (with effect from PV 444 chassis number 20005 onwards). | SVO 2384 | Key for master cylinder filling plug (PV 444 with effect from chassis number 20005 onwards). |
| SVO 1794 | Puller for inner bearing on front wheel spindle (with effect from PV 444 chassis number 20005 onwards). | SVO 4001 | Drift for removing sealing ring in front wheel hub (PV 444 chassis numbers 1—20004). |
| SVO 1798 | Drift for fitting sealing ring in front wheel hub (PV 444 with effect from chassis number 20005 onwards). | SVO 4016 | Puller for inner bearing on front wheel spindle (PV 444 chassis numbers 1—20004). |
| | | SVO 4074 | Spring clamp for wheel unit cylinder. |

SPECIFICATIONS

Master cylinder:

Bore	25.4 mm (1")
Clearance between plunger and cylinder	0.025—0.127 mm (0.001—0.005")
Return spring free length	75 mm (2 ¹⁵ / ₁₆ ")

Wheel unit cylinder:

Bore, front wheels	25.4 mm (1")
rear wheels	22.2 mm (⁷ / ₈ ")
Clearance between plunger and cylinder	0.025—0.127 mm (0.001—0.005")

Brake pipelines:

External diameter	³ / ₁₆ "
Length (late production) left, front	485 mm (19 ³ / ₃₂ ")
right, front	935 mm (36 ¹³ / ₁₆ ")
left, rear	485 mm (19 ³ / ₃₂ ")
right, rear	940 mm (37")
master cylinder—rear axle	2150 mm (84 ⁵ / ₈ ")

Brake drum:

Diameter	228.6 mm (9")
Radial throw, maximum	0.15 mm (0.006")

Brake linings:

Width	50.8 mm (2")
Thickness	4.8 mm (³ / ₁₆ ")
Length, front shoe	260 mm (10 ¹ / ₄ ")
rear shoe	200 mm (7 ⁷ / ₈ ")
Hole diameter for contact plug	19 mm (³ / ₄ ")
Effective area, early production (riveted linings)	850 cm ² (133 sq. in.)
late production (bonded linings)	930 cm ² (145 sq. in.)

Brake lining rivets:

Number, front shoe	10
rear shoe	8
Size	3.5 × 8 mm (⁹ / ₆₄ × ⁵ / ₁₆ ")

Length of return spring for brake shoe at a loading of

15.5—20.5 kg (34—45 lb.)	154 mm (6 ¹ / ₁₆ ")
Clearance between brake shoe and drum	0.10 mm (0.004")
Pedal free travel	7—12 mm (⁹ / ₃₂ — ¹⁵ / ₃₂ ")

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ATTENTION

This Service Manual deals with wheel brake units of early and late production. In this connection, late production concerns wheel brake units of the Duo-servo type fitted at the factory on P 1200 with drum brakes with effect from chassis number 15329 and on chassis numbers 14986—14987, 15069—15072, 15075—15081, 15084, 15097—15105 and 15178—15185.

DESCRIPTION

The P 1200 is equipped with two brake systems which are completely independent of each other. One of these, the foot brake, is controlled by a brake pedal and operates on all four wheels through a hydraulic system. The other system, the handbrake, is controlled by a brake lever and operates mechanically on both the rear wheels.

When the brake pedal (6) is depressed, it influences the plunger in the master cylinder (4) by means of a push rod (5). The hydraulic pressure in the master cylinder then rises and this is transmitted through the brake fluid in the lines (2) to the wheel unit cylinders. The plungers in these are then pressed outwards and apply the brakes.

Foot brake

This can either be of the drum type or of the disc type. The arrangement of the foot brake system is shown in Figs. 1 and 3 respectively.

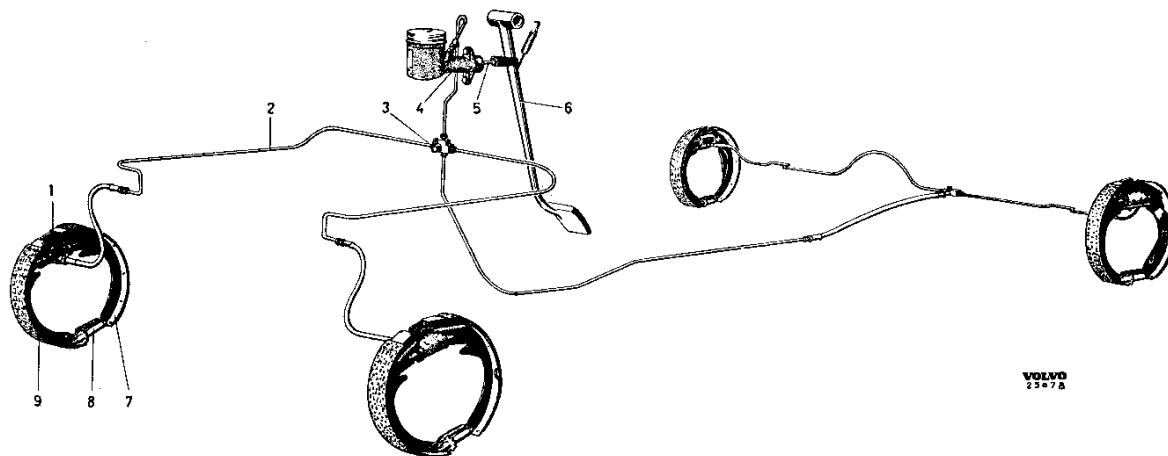
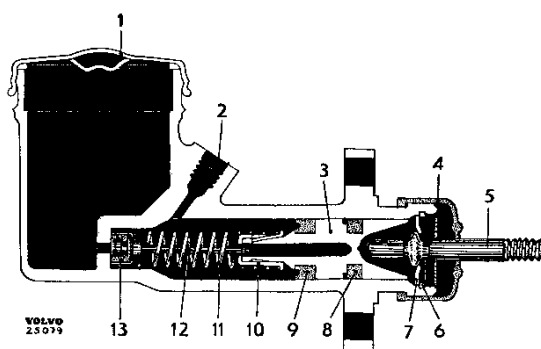


Fig. 1. Foot brake system, drum brakes.

- | | | |
|------------------------|--------------------|---------------------|
| 1. Wheel unit cylinder | 4. Master cylinder | 7. Rear brake shoe |
| 2. Brake line | 5. Push rod | 8. Adjusting device |
| 3. Brake contact | 6. Brake pedal | 9. Front brake shoe |



- | |
|------------------------------|
| 1. Cap |
| 2. Connection for brake line |
| 3. Plunger |
| 4. Rubber cap |
| 5. Push rod |
| 6. Locking ring |
| 7. Washer |
| 8. Packing |
| 9. Packing |
| 10. Spring retainer |
| 11. Spring |
| 12. Valve rod |
| 13. Valve |

Fig. 2. Master cylinder, early production.

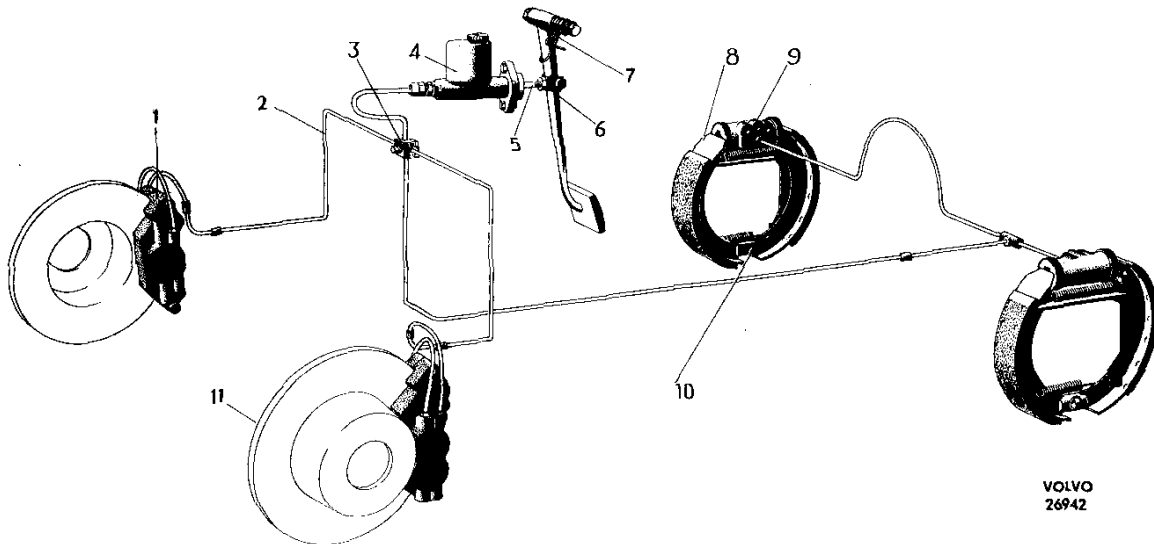


Fig. 3. Foot brake system, vehicle with front wheel disc brakes.

- | | | |
|---------------------------|------------------|------------------------|
| 1. Front wheel brake unit | 5. Push rod | 9. Wheel unit cylinder |
| 2. Brake line | 6. Brake pedal | 10. Adjusting device |
| 3. Brake contact | 7. Return spring | 11. Brake disc |
| 4. Master cylinder | 8. Brake shoe | |

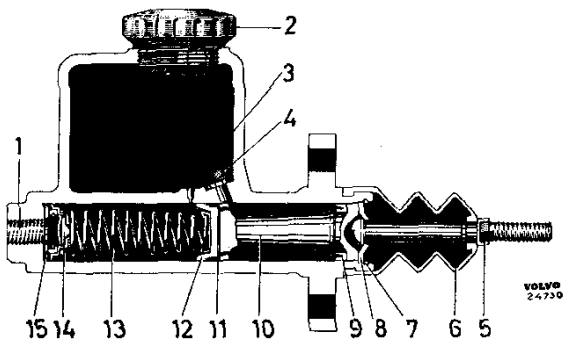


Fig. 4. Master cylinder, late production.

- | | | |
|------------------------------|-----------------|-------------|
| 1. Connection for brake line | 6. Rubber cap | 12. Packing |
| 2. Cap | 7. Locking ring | 13. Spring |
| 3. Equalizing hole | 8. Stop washer | 14. Valve |
| 4. Strainer | 9. Packing | 15. Washer |
| 5. Push rod | 10. Plunger | |
| | 11. Washer | |

Wheel brake unit, drum brakes, early production

The front wheel brakes (Figs. 5 and 6) are of the "Two leading shoe" type, that is to say, each wheel has two brake cylinders with a plunger in each. By means of this arrangement

both the shoes function as primary shoes. Each shoe has a self-adjusting device.

The rear wheel brake units (Figs. 7 and 9) have a wheel unit cylinder with two plungers. At the bottom the shoes rest against a support attached to the brake backing plate. The front shoe is provided with a self-adjusting device and the rear shoe has a shorter lining.

Since the shoes can be displaced radially, they are self-centring. The clearance between the brake lining and drum can be adjusted by means of an eccentric which can be turned.

The self adjusting device (Fig. 8) functions as follows:

A contact plug (4) is fitted in a hole in the brake shoe. The outer end of this plug is held in contact with the brake drum by means of a spring (2). As the brake lining becomes worn, the contact plug moves inwards and influences the lever (7) by means of a stud (3), pressing the lever against the eccentric (6). This widens the distance between the guide lip (8) on the brake shoe and the lips (9) on the lever (7). The notched key (11), which is influenced by a spring (10), is then pulled in between the lips (8 and 9). The return movement of the brake shoe is thus limited so that the clearance between the brake lining and drum remains constant regardless of the wear on the brake lining.

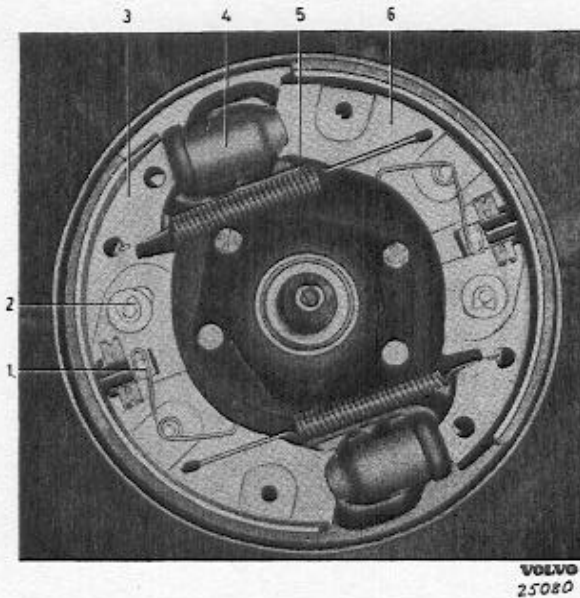


Fig. 5. Wheel brake unit, early production, left-hand front wheel.

- | | |
|--------------------------|------------------------|
| 1. Self adjusting device | 4. Wheel unit cylinder |
| 2. Locking washer | 5. Return spring |
| 3. Front brake shoe | 6. Rear brake shoe |

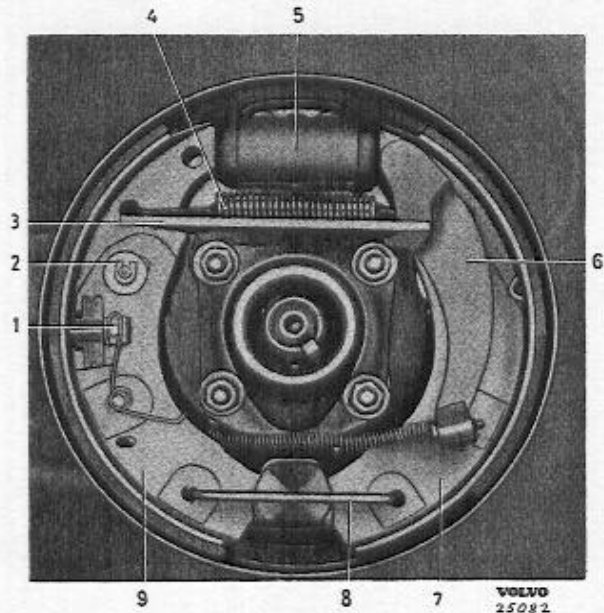


Fig. 7. Wheel brake unit, early production, left-hand rear wheel.

- | | |
|--------------------------|---------------------|
| 1. Self-adjusting device | 6. Lever |
| 2. Locking washer | 7. Rear brake shoe |
| 3. Handbrake link | 8. Spring |
| 4. Return spring | 9. Front brake shoe |
| 5. Wheel unit cylinder | |

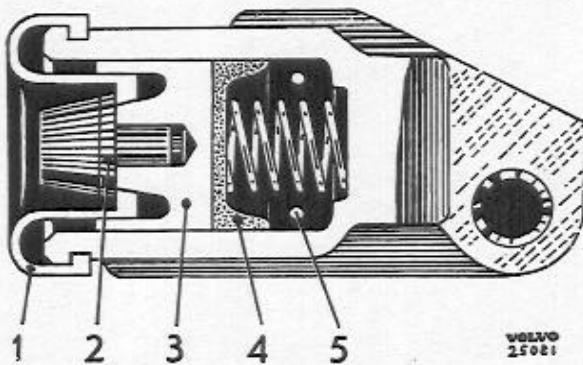


Fig. 6. Wheel unit cylinder, front wheel.

- | | |
|----------------|------------------------------|
| 1. Rubber cap | 4. Plunger packing |
| 2. Plunger rod | 5. Connection for brake line |
| 3. Plunger | |

When the contact plug reaches the web of the brake shoe as a result of brake lining wear, the self-adjusting function ceases. Further brake lining wear will then increase the clearance between the lining and drum. If the pedal stroke increases, that is to say, it can be pressed further down towards the floor, this means that the brake linings are worn and need replacing. In order to prevent vibration in the contact plug, a damping spring (5) is fitted between the brake shoe and contact plug.

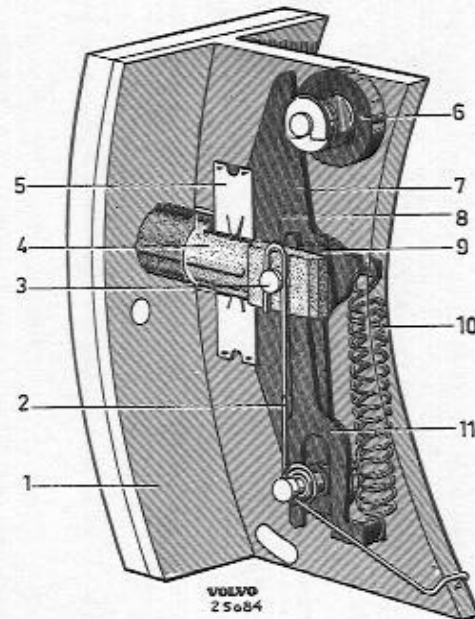
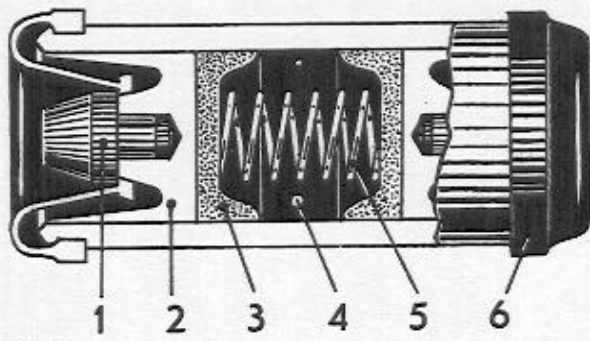


Fig. 8. Self-adjusting device.

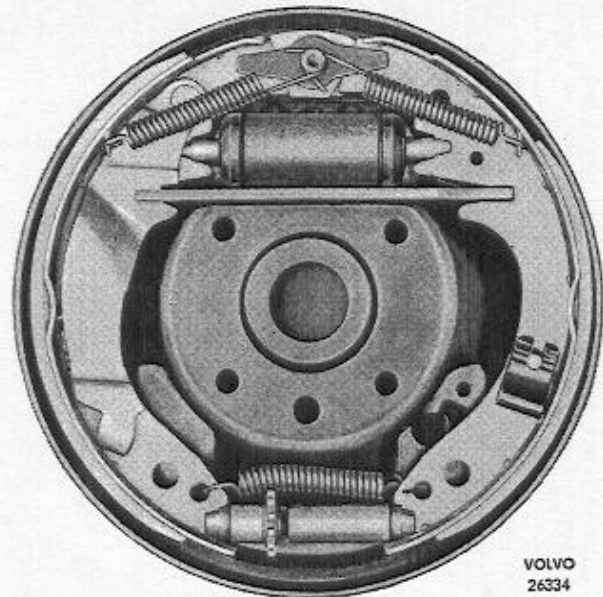
- | | |
|-------------------|--------------|
| 1. Brake shoe | 7. Lever |
| 2. Spring | 8. Guide lip |
| 3. Stud | 9. Lip |
| 4. Contact plug | 10. Spring |
| 5. Damping spring | 11. Key |
| 6. Cam | |



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25063

Fig. 9. Wheel unit cylinder, rear wheel.

1. Plunger rod
2. Plunger
3. Packing
4. Connection for brake line
5. Spring
6. Rubber cap

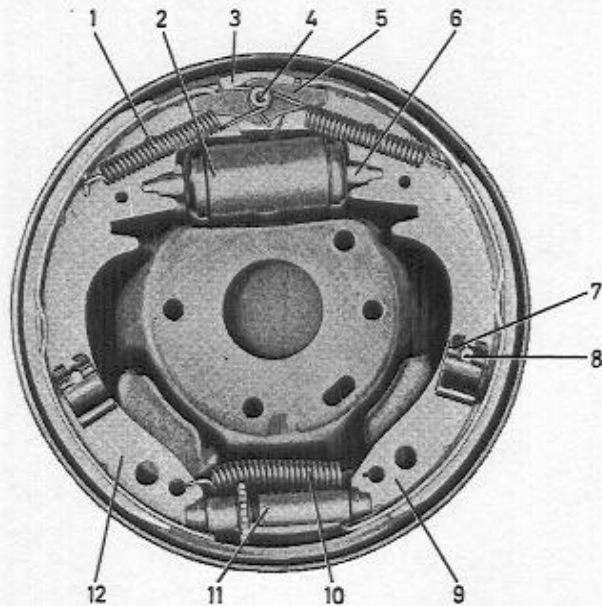


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Fig. 11. Wheel brake unit, late production, right-hand rear wheel.

Wheel brake unit, drum brakes, late production

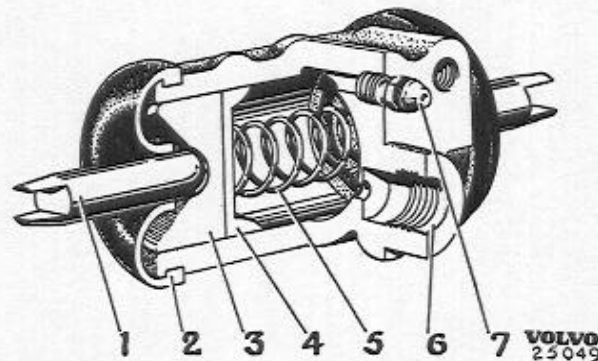
The brake shoes (12 and 9, Fig. 10) are movably attached to the brake backing plate by means of guide pins (8) and spring clips (7). The upper ends of the shoes are kept pressed against the rotating centring block (3) by the return springs (1). The lower ends are joined by means of the adjusting device (11) against which they are held pressed by the spring (10) which also locks the toothed wheel of the adjusting screw. This arrangement means that the brake shoes are self-centring and both shoes partially self-applying (Duo-servo).



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26333

Fig. 10. Wheel brake unit, late production, right-hand front wheel.

1. Return spring
2. Wheel unit cylinder
3. Centring block
4. Anchor stud
5. Guide plate
6. Plunger rod
7. Clip
8. Guide pin
9. Front brake shoe
10. Locking spring
11. Adjusting device
12. Rear brake shoe



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25049

Fig. 12. Wheel unit cylinder, late production.

1. Plunger rod
2. Rubber cap
3. Plunger
4. Plunger packing
5. Return spring
6. Connection for brake line
7. Air-venting nipple

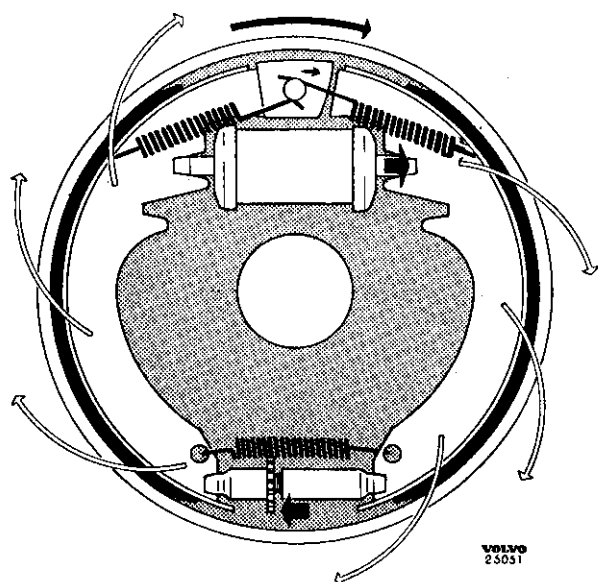


Fig. 13. Method of application of wheel brake unit.

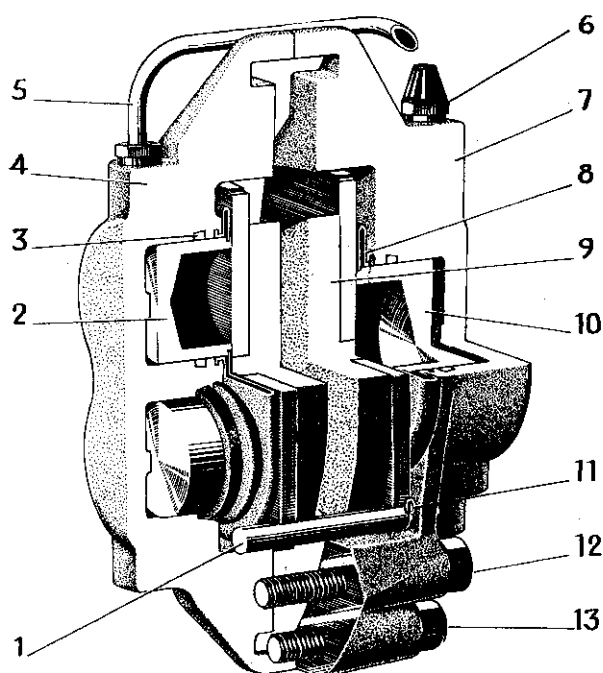


Fig. 14. Front wheel brake unit.

- | | |
|--------------------|--------------------|
| 1. Guide pin | 8. Dust cover |
| 2. Outer plunger | 9. Pad assembly |
| 3. Plunger packing | 10. Inner plunger |
| 4. Outer housing | 11. Locking spring |
| 5. Bridge pipe | 12. Bolt |
| 6. Brake line | 13. Bolt |
| 7. Inner housing | |

Wheel brake units on vehicles fitted with disc brakes at front.

In this arrangement the front wheel brakes are of the disc type. The discs (11, Fig. 3) are made of steel and are attached to the hubs with which they rotate. At each steering knuckle there is a retainer for the wheel unit cylinders and brake pad assemblies, in future called the front wheel brake unit (1). In addition, protecting plates for the brake discs are attached to the steering knuckles. The brake pad assemblies (9, Fig. 14) are provided with moulded-in linings. During braking, one of the linings is pressed against the inner face of the brake disc by a large hydraulic plunger (10) and the other against the outer face of the disc by two smaller plungers (2). When braking ceases, the linings move back such an amount that they are always at a certain minimum distance from the brake disc, so that the front wheel brake units are self-adjusting.

The rear wheel brake units are of the drum type. The upper ends of the brake shoes (8, Fig. 3) rest against a double-acting wheel unit cylinder, and the lower ends against an adjusting device (10).

When the brake is applied, the wheel unit cylinder plungers press out the shoes against the brake drum by means of the plunger rods (6, Fig. 10). Because of the friction between the drum and lining, the shoes will follow round in the direction of rotating of the drum. Due to the "floating" attachment of the shoes, the primary shoe (9) is pressed downwards and the secondary shoe (12) upwards until its upper end encounters the centring block (see Fig. 13). The end of the secondary shoe is then displaced by the block so that the shoe is centred in relation to the drum. Since the pivoting centre of the secondary shoe is at the anchor stud (4, Fig. 10) and that of the primary shoe at the adjusting device, friction between the drum and lining will assist with applying the brake, see Fig. 13. This action is also assisted by the fact that the primary shoe tends to follow round in the direction of rotation of the drum, which assists the application of the secondary shoe.

In order to give the brake linings as long life as possible, the rear shoes of the front wheel brake units (secondary shoes) are provided with thicker and eccentrically ground linings.

Wheel brake units of this type were at first provided with longer linings than those shown in Figs. 10 and 11.

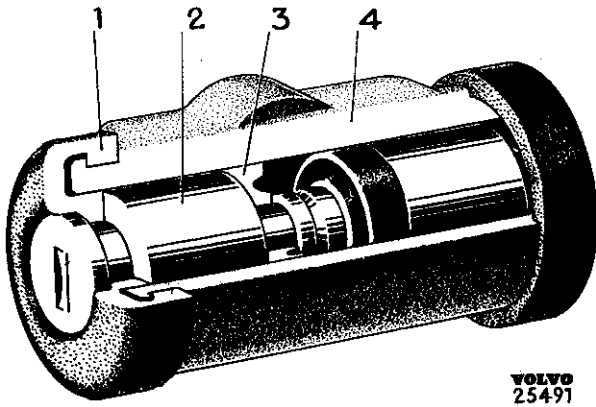


Fig. 15. Rear wheel brake unit cylinder on vehicles fitted with disc brakes at front.

- | | |
|----------------|--------------------|
| 1. Rubber seal | 3. Plunger packing |
| 2. Plunger | 4. Housing |

Handbrake

The handbrake lever is floor-mounted on the outside of the driving seat. The movement of the lever is transmitted by means of a shaft, lever and pull rod to the clevis (3, Fig. 16). From there the movement is transmitted by means of cables (5) to the rear wheel brake unit levers (11). The upper end of this lever is attached to the rear brake shoe. When the lever is pulled forwards, the shoes are forced outwards by means of the links (10), causing the handbrake to be applied.

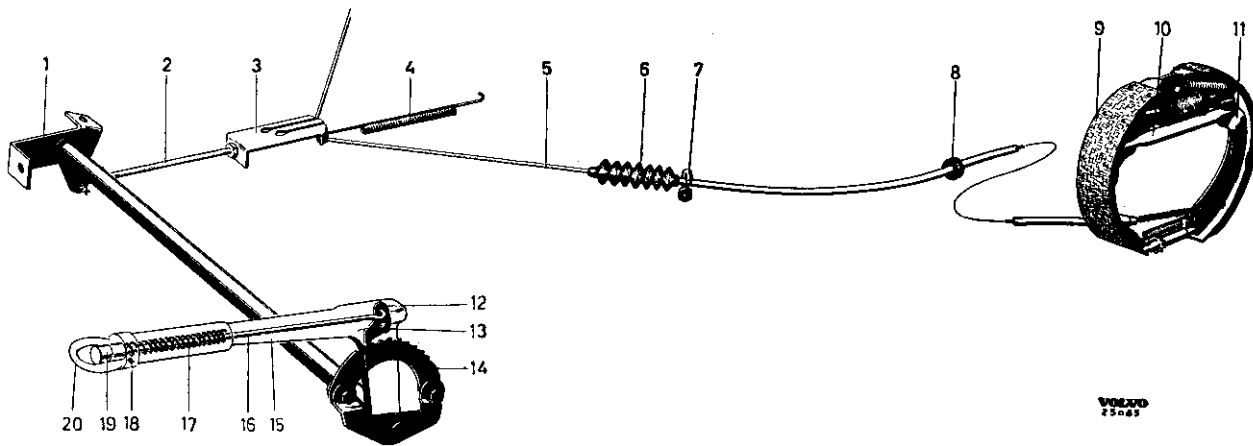


Fig. 16. Handbrake system.

- | | |
|--------------------------------|---------------------|
| 1. Bearing support | 11. Lever |
| 2. Pull rod | 12. Pawl |
| 3. Clevis, early production | 13. Pin |
| 4. Spring | 14. Ratchet segment |
| 5. Handbrake cable | 15. Handbrake lever |
| 6. Bellows | 16. Push rod |
| 7. Attachment for outer casing | 17. Spring |
| 8. Bushing | 18. Screw |
| 9. Brake shoe | 19. Button |
| 10. Link | 20. Loop |

REPAIR INSTRUCTIONS

FOOT BRAKE

Wheel brake units, drum type,
early production

Dismantling the front wheel
brake unit

1. Remove the hub cap and slacken the wheel nuts slightly. Lift up the vehicle and block up under the lower control arm. Remove the wheel.

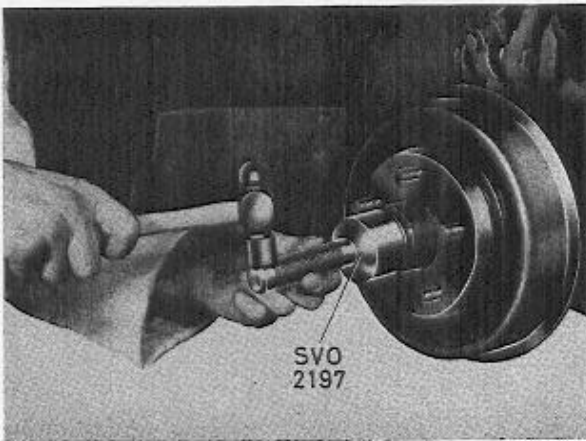


Fig. 17. Removing the grease cap.

2. Remove the grease cap with tool SVO 2197 (Fig. 17). Remove the split pin and castle nut. Pull off the hub with tool SVO 1791 (Fig. 18). If the inner bearing does not come out, pull it off the spindle with tool SVO 1794 (Fig. 19).

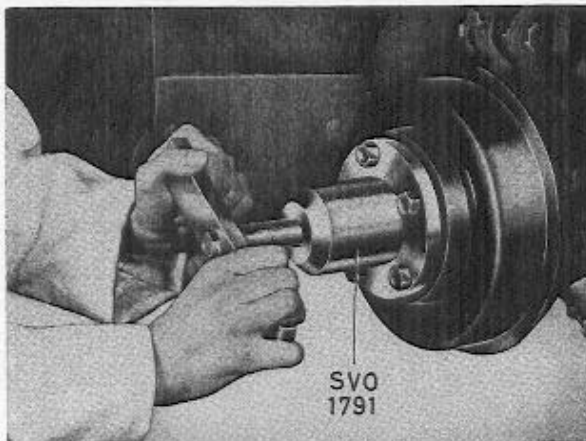


Fig. 18. Removing the hub.

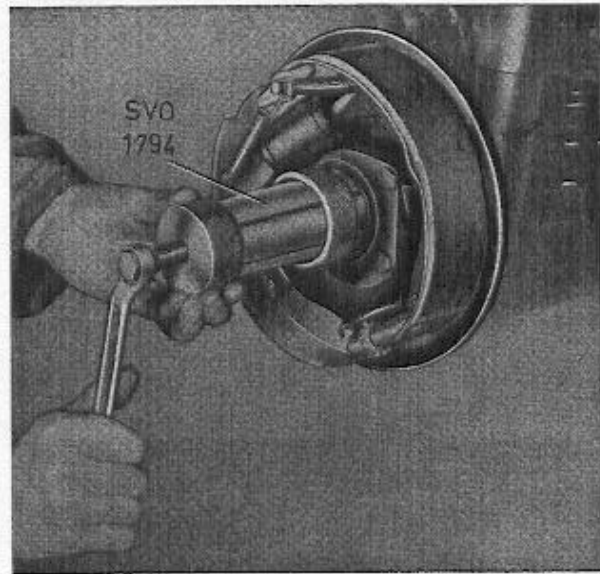


Fig. 19. Removing the inner bearing.

3. Remove the locking washer and other washers from the stud for the adjusting cam on the front brake shoe. Remove the shoe and springs as shown in Fig. 20. Remove the rear shoe in the same way.

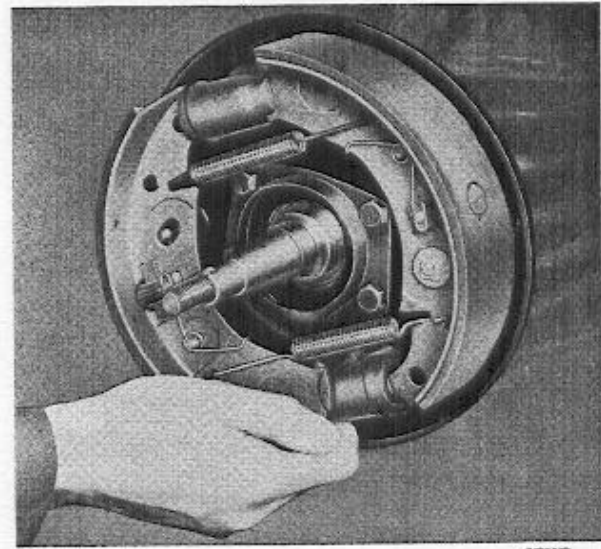


Fig. 20. Removing the brake shoe.

Dismantling the rear wheel brake unit

1. Remove the hub cap and slacken the wheel nuts slightly. Lift up the vehicle and block up under the rear axle. Remove the wheel.
2. Release the handbrake. Remove the split pin and castle nut. Pull off the hub with tool SVO 1791 (Fig. 18).
3. Place clamp SVO 4074 on the wheel unit cylinder so that the plungers cannot be pressed outwards. Remove the lower spring with the help of pliers SVO 1221 (Fig. 21). Remove the locking washer and other washers from the front shoe. Then turn the shoe outwards so that the handbrake link can be removed. Lift off the front brake shoe and return spring. Disconnect the handbrake cable and remove the rear shoe.

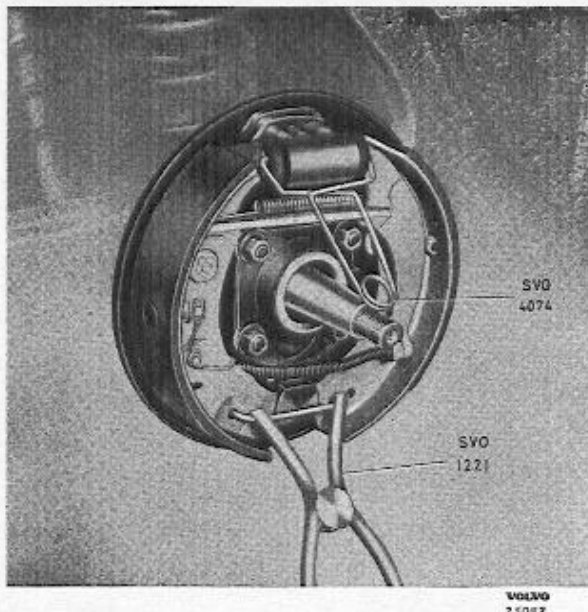


Fig. 21. Removing the lower spring.

Replacing the brake linings

The old linings are removed in a hand-type grinding machine. They can also be chiseled off, after which the brake shoe should be cleaned with emery cloth. In both cases, take care not to damage the shoe.

After having been cleaned up, the brake shoe should be washed in clean petrol or similar and then allowed to dry. If the linings are to be bonded on, the contact surface on the shoe must not be touched or made dirty after cleaning.

The dimensions of the new linings are given in the "Specifications". When fitting, make sure that the linings do not lie diagonally on the shoe and that the holes come opposite the contact plugs. The rear lining of the rear wheel brake unit is fitted on the upper part of the shoe.

When bonding, use only adhesive specially manufactured to withstand the high temperatures which arise during prolonged braking. The procedure for bonding varies with the different makes of adhesive and oven, so that a generally applicable description cannot be given. Follow the manufacturer's recommendations.

When riveting, begin at the centre of the lining. Use a rivet press and rivet punches corresponding to the size of the rivets. Check that the lining beds down properly along its whole length.

Self-adjusting device

Dismantling

1. Press in the contact plug (4, Fig. 8) and check that the key (11) is in its lower position.
2. Disconnect the spring (10) for the key and the spring (2) for the contact plug.
3. Remove the lever (7), key (11), contact plug (4) damping spring (5) and guide lip (8).

Assembling

1. Fit the guide lip (8, Fig. 8). Replace the contact plug and fit the new one in position in the brake shoe. Place the key (11) in position with the smooth side towards the guide lip.
2. Press in the contact plug so that the hole in it comes opposite the hole in the brake shoe, and fit the lever (7) and spring (2) for the contact plug.
3. Hook on the spring (10) for the key and fit the damping spring.

Testing

Testing is carried out as follows. While the contact plug is held pressed in, the key is moved to its outer end position, see Fig. 22, after which the pressure is taken off and the key released. When the contact plug is pressed in again, the spring should be able to pull the key inwards, see Fig. 23. While retaining pressure, the key is moved back to its outer position and the brake shoe is now ready for adjustment of the contact plug.

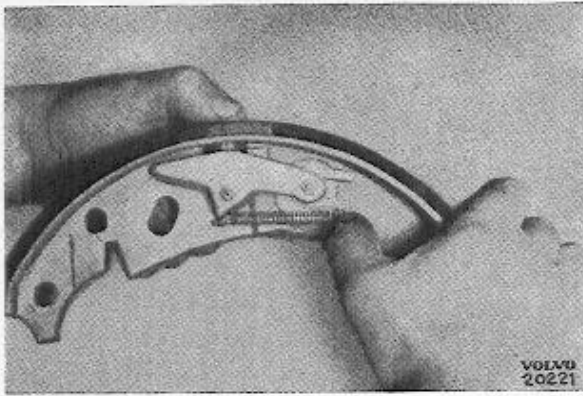


Fig. 22. Testing the self-adjusting device.

Adjusting the contact plug

The contact plug is adjusted with the help of a file and an adjusting jig (part number 210030).

With the contact plug in the outer position, the brake shoe is secured in a vice. The lip of the lever (2, Fig. 24) should rest against one of the jaws in order to prevent the plug from being pressed in when adjusting, thus making the adjustment incorrect.

Place the adjusting jig (1) over the contact plug and file this off flush with the jig (see Fig. 24). The plug will then come 0.1 mm (0.039") above the surface of the brake lining.

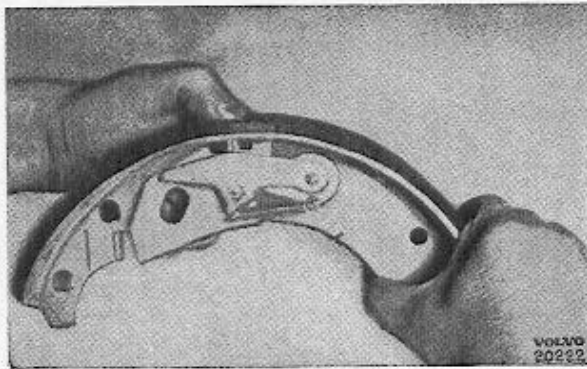


Fig. 23. Testing the self-adjusting device.

Replacing stud for adjusting cam

The stud (5, Fig. 25) for the adjusting cam (4) which is fitted in the brake backing plate can be replaced by pressing out the old stud and staving in a new stud with the special staving tool SVO 2119.

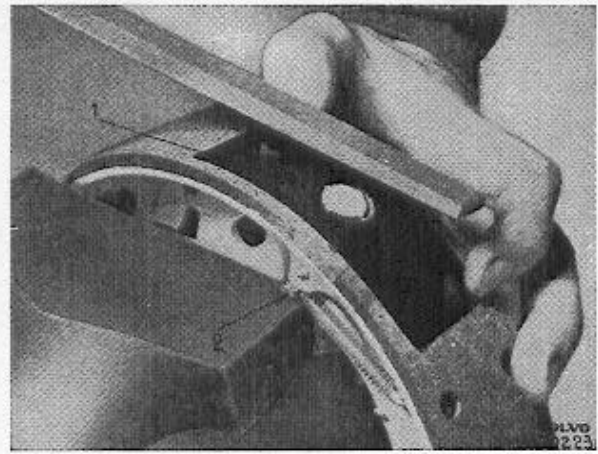


Fig. 24. Adjusting the contact plug.

1. Adjusting jig 2. Lip

NOTE. On later type front shoes, the cam and stud are made in one piece, so that a larger cushioning sleeve which goes over the cam should be used.

The stud is replaced as follows:

1. Remove the brake backing plate. Place the cushioning sleeve belonging to the staving tool in a press as shown in Fig. 25 and press out the stud (5) with the help of a drift.
2. Turn the cushioning sleeve and place a new stud above it. Fit the adjusting cam (4), brake backing plate (1), spacing washer (3) and the internally toothed washer (2) over the stud. Press down the washers with the help of the staving tool, see Fig. 26.

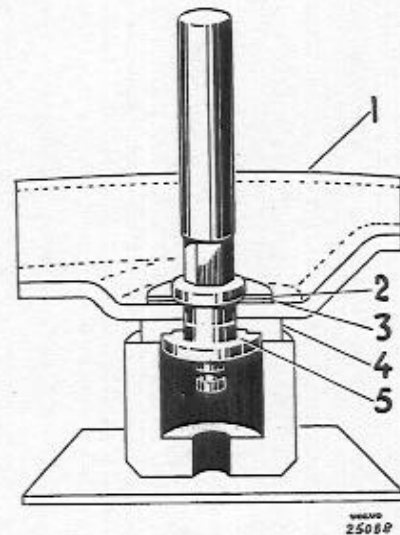


Fig. 25. Removing the stud.

- | | |
|------------------------------|------------------|
| 1. Brake backing plate | 4. Adjusting cam |
| 2. Internally toothed washer | 5. Stud |
| 3. Spacing washer | |

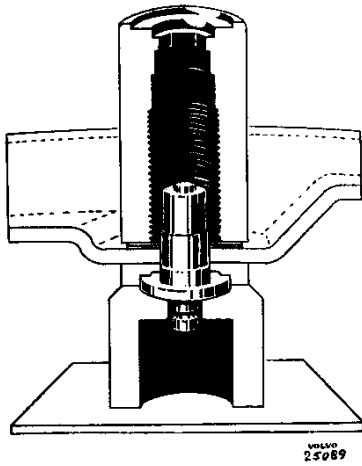
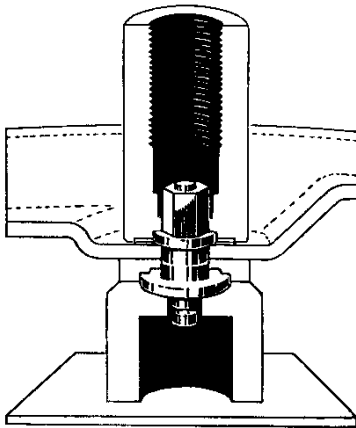


Fig. 26. Fitting the washers.



Fi. 27. Pressing together.

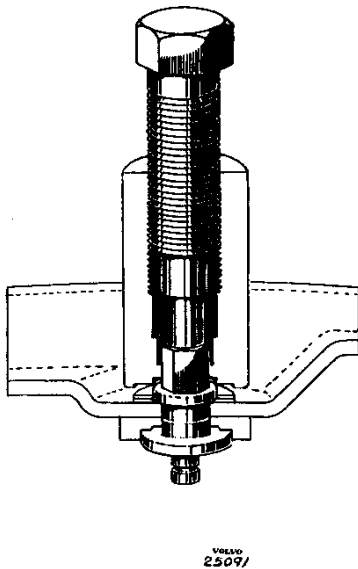


Fig. 28. Removing the tool.

3. Turn the tool round and centre it on the stud. Ensure that it is aligned with the stud. Press down the tool, see Fig. 27. Discontinue pressing at a maximum of 8 tons pressure. Turn the tool and check that the stud does not move too easily. If so, further pressure should be applied.
4. Screw in the bolt and pull the tool off the stud, see Fig. 28.

Brake drum

The friction surface and radial throw of the brake drum should be checked. The radial throw must not exceed 0.15 mm (0.006"). If the friction surface is concave, scratched or cracked, the brake drum should be replaced. Rust spots and minor scratches can be polished or ground off in a machine.

Assembling the front wheel brake unit

1. Check that the key in the self-adjusting device is in its outer position and that the eccentrics on the brake backing plate are turned to their lowest position. The self-adjusting devices must not be lubricated since this results in dust and dirt adhering to the parts, impairing the function of the device.
2. Place the rear shoe in position. Fit the flat washer, spring washer, flat washer and locking washer on the adjusting cam stud. Squeeze up the locking washer slightly after fitting.
3. Hook on the return springs to both shoes and fit the front shoe, see Fig. 20. Fit the locking arrangement as described above.
4. Check that the return springs and locking washers are properly in place and that the linings are free from burr, grease and dirt.
5. If the inner front wheel bearing has been removed, fit it in place in the hub. If necessary, pack it with wheel bearing grease. Press in the sealing ring with the help of drift SVO 1798 and standard handle SVO 1801.
6. Fit the hub and brake drum on the steering knuckle. Place on the outer bearing, washer and castle nut. Adjust the bearings by first tightening the nut to a torque of 7 kgm (50 lb.ft.). Then slacken the nut a third of a turn and lock it. Fill the grease cap with grease and fit it with drift SVO 2197.

7. Fit the wheel. Adjust the brake, see under "Adjusting the front wheel brake unit". Lower the vehicle. Tighten the wheel nuts to a torque of 10—14 kgm (70—100 lb.ft.) Fit on the hub cap.

Assembling the rear wheel brake unit

1. Proceed in accordance with operations 1 and 2 under "Assembling the front wheel brake unit".
2. Hook the return spring onto the shoes, place the front shoe in position in the wheel unit cylinder, turn the shoe outwards, fit the handbrake link and place the shoe in position. Fit the locking arrangement.
3. Fit the lower spring with the help of pliers SVO 1221. Hook on the handbrake cable. Remove the clamp SVO 4074.
4. Check that the springs and locking washers are properly in position and that the linings are free from burr, grease and dirt.
5. Fit the hub, brake drum, washer and castle nut. Lock with a split pin after the nut has been tightened. Fit the wheel. Adjust the brake, see under "Adjusting the rear wheel brake unit". Lower the vehicle. Tighten the wheel nuts to a torque of 10—14 kgm (70—100 lb.ft.). Fit on the hub cap.

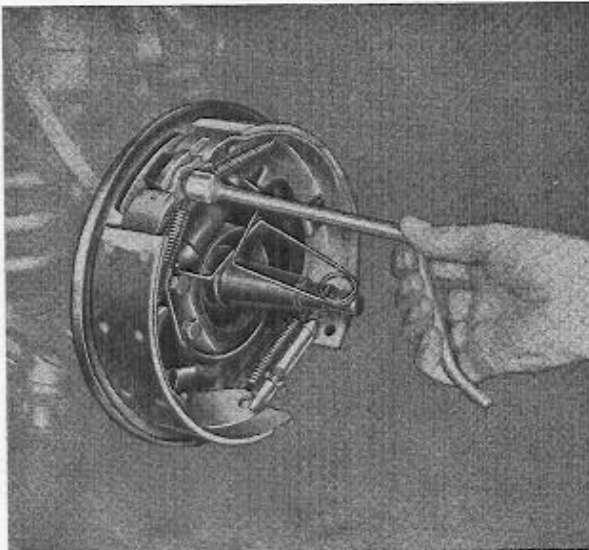


Fig. 29. Removing the return spring with brake spring tool (Snap-on BT 11 or corresponding).

Adjusting the front wheel brake unit

Rotate the wheel backwards and turn the eccentric for the front brake shoe anti-clockwise on the right-hand wheel and clockwise on the left-hand wheel until the wheel is locked by the brake shoe. Then slacken the eccentric just sufficiently so that the wheel can rotate freely. Adjust the rear brake shoe in the same way.

Adjusting the rear wheel brake unit

Check that the handbrake is released. Rotate the wheel backwards and turn the eccentric for the front brake shoe anti-clockwise on the right-hand wheel and clockwise on the left-hand wheel until the wheel is locked by the brake shoe. Then slacken the eccentric just sufficiently so that the wheel can rotate freely. Adjust the rear brake shoe by rotating the wheel forwards and applying the eccentric in the opposite direction to the front shoe.

Wheel brake units, drum brakes, late production

Dismantling the front wheel brake unit

1. Remove the hub cap and slacken the wheel nuts slightly. Lift up the vehicle and block up under the lower control arm. Remove the wheel.
2. Remove the grease cap with tool SVO 2197 (Fig. 17). Remove the split pin and castle nut. Pull off the hub with tool SVO 1791 (Fig. 18). If the inner bearing does not come out with it, pull this off the spindle with tool SVO 1794 (Fig. 19).
3. Fit on the clamp SVO 4074 as shown in Fig. 30 so that the plungers in the wheel unit cylinder cannot be pressed outwards. The procedure for removing the shoes depends on which tool is used.

The two return springs are first disconnected with a brake spring tool as shown in Fig. 29, after which the locking clamps are removed and the shoes lifted off together with the adjusting device.

The locking spring is disconnected with the help of the brake spring pliers as shown in Fig. 30. Pull apart the shoes and remove the adjusting device. Hold against the guide pin on the rear side of the brake backing plate and remove the locking clamp. Turn the shoe outwards until the

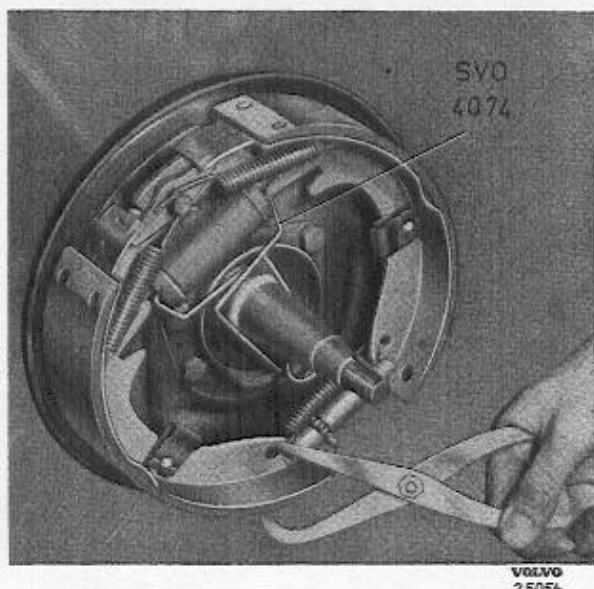


Fig. 30. Removing the locking spring.

push rod of the wheel unit cylinder is released, see Fig. 31. Then turn the shoe inwards until the return spring can be disconnected and the shoe lifted off. Remove the other shoe in the same way.

Dismantling the rear wheel brake unit

1. Apply the handbrake. Remove the hub cap. Remove the split pin and slacken the castle nut and wheel nuts slightly. Lift up the vehicle and block up under the rear axle. Remove the wheel.
2. Release the handbrake. Remove the castle nut. Pull off the hub with tool SVO 1791 (Fig. 18).

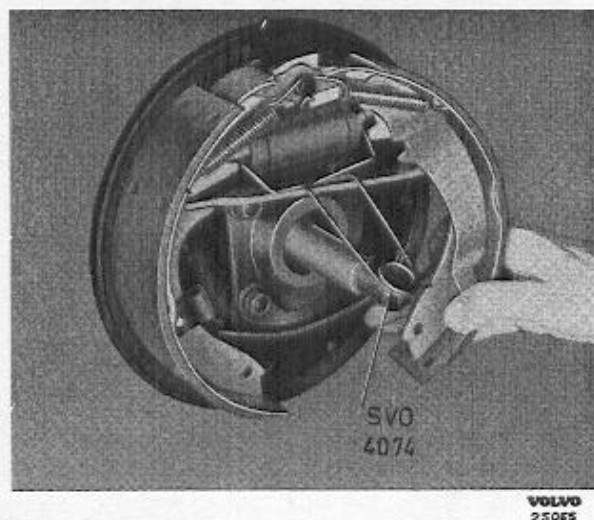


Fig. 31. Removing the brake shoe.

3. Place the clamp SVO 4074 over the wheel unit cylinder so that the plungers cannot be pressed outwards. Disconnect the handbrake cable from the lever. The procedure when removing the shoes depends on which tool is used. With a brake spring tool as shown in Fig. 29, the two return springs are first disconnected, after which the locking clamps are removed and the shoes lifted off together with the adjusting device.

With the help of brake spring pliers, the locking spring is disconnected as shown in Fig. 30. Pull apart the shoes and remove the locking clamp for the rear shoe. Turn the shoe outwards until the push rod from the wheel unit cylinder together with the handbrake link are released, see Fig. 31. Then turn the shoe inwards until the return spring can be disconnected and the shoe lifted off. Remove the other shoe in the same way.

Replacing the brake linings

The vehicle can be equipped with different types of brake lining. The linings can be riveted or bonded onto the shoes, the primary shoes can have long or short linings and the linings can be of two different qualities. These can be differentiated since the earlier type is marked brown and green and stamped H 3142. *In order to avoid uneven braking effect, both wheels on the same shaft must have the same type of brake lining.*

The brake linings are replaced as follows.

Riveted brake linings

Remove the old linings by pressing out the rivets in a rivet press. Then wash the shoes clean and dry them.

Fit ready-made original linings. *When doing this, note that the thicker and eccentrically ground linings which are marked on the wearing side as shown in Fig. 32, should be fitted on the rear brake shoes (secondary shoes) of the front wheels. The thicker part (marked) should face upwards. On types with shorter primary linings, these are fitted as shown in Figs. 10 and 11 respectively.*

Use rivet sizes in accordance with those given in the specifications. Begin riveting at the middle of the lining and make sure that the lining beds down properly on the shoe along its whole length. Use a rivet press and rivet drifts corresponding to the rivet sizes.

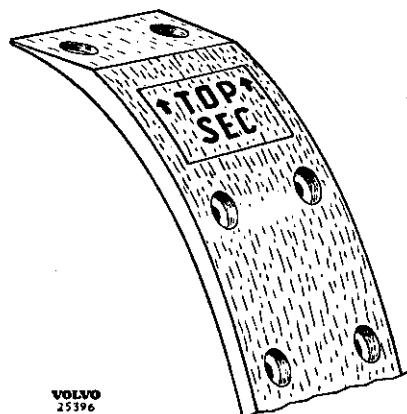


Fig. 32. Rear brake lining of front wheel.

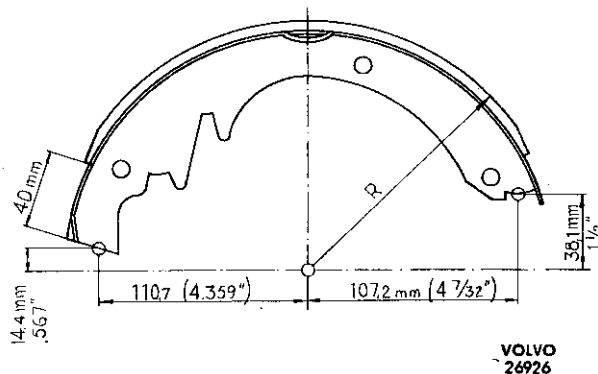


Fig. 34. Adjusting measurement for brake shoe, front wheel.

Bonded brake linings

The old linings should preferably be removed in a band-type grinding machine.

They can also be chiseled off, after which the brake shoe should be cleaned up with emery cloth. In both cases care should be taken to ensure that the shoe is not damaged. After cleaning up, the shoe should be washed in clean petrol or similar and then allowed to dry. After this, the contact surface for the lining must not be touched or made dirty.

For bonding purposes use only adhesives which are specially made to withstand the high temperatures arising during prolonged braking. Volvo original brake linings are ready-prepared with suitable quantities of such adhesive. The procedure when bonding varies with different makes of oven so that a generally applicable description cannot be given. Follow the manufacturer's instructions carefully.

When fitting, make sure that the lining does not come diagonally on the shoe and that it is placed as shown in Figs. 34 and 35 respectively. $\frac{1}{4}$ " linings (part number 661279) should be fitted on the rear brake shoes (secondary shoes) of the front wheels and $\frac{3}{16}$ " linings on the others.

After bonding, the linings should be ground to the correct measurements. Since the rear brake linings of the front wheels must be ground eccentrically, this requires a grinding machine which can be specially adjusted for this type of lining. There are different types of these machines, so that the grinding procedure varies accordingly. Fig. 33, shows how much the pivoting centre should be displaced in relation to the brake shoe centre when grinding the eccentric lining (part number 661279). For other linings, the pivoting centre coincides with the brake shoe centre. The grinding radius (R) = half the diameter of the brake drum less 0.1—0.2 mm (0.004—0.008"). Machines which are graduated for the drum diameter should thus be set to a value which is 0.2—0.4 mm (0.008—0.016") less than the diameter of the brake drum. Before the linings are ground they should be chamfered.

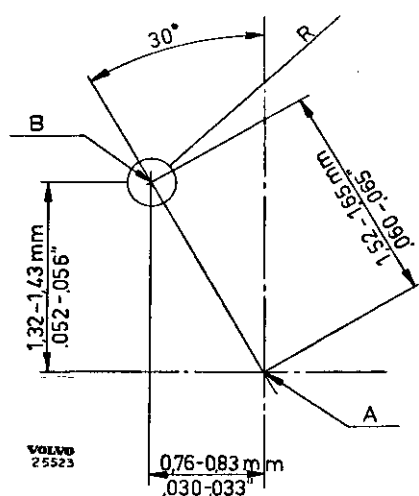


Fig. 33. Eccentricity for brake lining 661279.

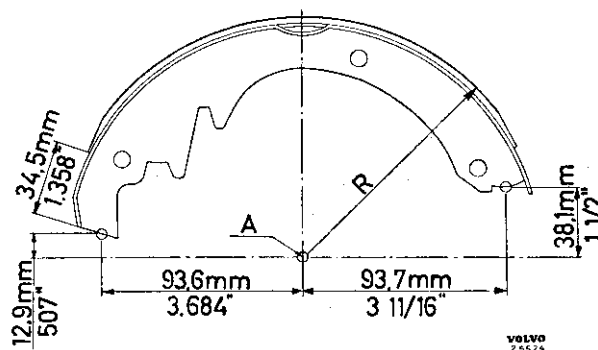


Fig. 35. Adjusting measurements for brake shoe, rear wheel.

Brake drum

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 must be replaced. Rust spots and minor scratches can, however, be polished or ground off in a machine.

Assembling the front wheel brake unit

1. Check, and if necessary, face the surface of the lips on the brake backing plate against which the shoes and centring block slide. Clean up the sliding surfaces on the shoes and centring block. Coat the surfaces with a very thin layer of heat-resistant grease. Place the centring block (3, Fig. 10) in position with the rounded side forwards when the stamped-in arrow should point in the direction of rotation of the brake drum. Place on the guide washer (5).
2. Hold the front shoe in place so that the return spring can be hooked on. Turn the shoe outwards so that the wheel unit cylinder push rod can be placed in position, see Fig. 36. Fit the guide pin (8) and clip (7).
Fit the rear shoe in the same way. Remove the clamp SVO 4074. Fit the ad-

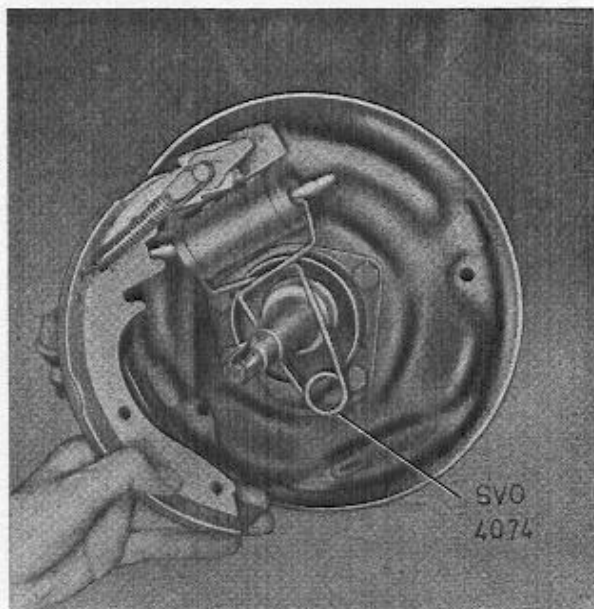


Fig. 36. Fitting brake shoe.

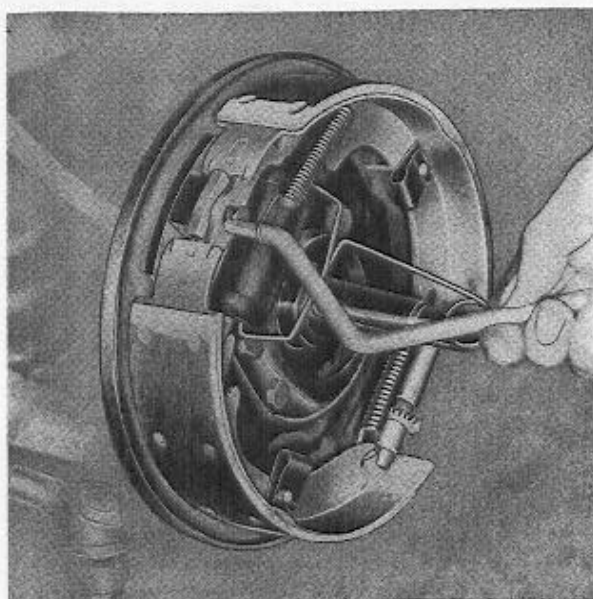


Fig. 37. Hooking on return springs.

justing device and its locking spring. If a brake spring tool as shown in Fig. 37 is available, it is possible to begin instead by fitting the adjusting device and locking spring, after which the shoes are placed in position. The locking clips are then fitted and the return springs hooked on with the pointed end of the tool, see Fig. 37.

3. Check that the springs and locking clamps are located properly, that the linings are free from burr, grease and dirt and that the thicker part of the lining on the rear shoe is turned upwards.
4. If the inner front wheel bearing has been removed it should be placed in position in the hub. If necessary, pack with wheel bearing grease. Press in the sealing ring with the help of drift SVO 1798 and standard handle SVO 1801.
5. Fit the hub with cleaned brake drum on the spindle. Place on the outer bearing, washer and castle nut. Adjust the bearings by first tightening the nut to a torque of 7 kgm (50 lb.ft.) Then slacken the nut a third of a turn and lock it. Fill the grease cap with grease and fit it with drift SVO 2197.
6. Fit the wheel. Adjust the brakes, see under "Adjusting the wheel brake unit". Lower the vehicle. Tighten the wheel nuts to a torque of 10—14 kgm (70—100 lb.ft.). Fit on the hub cap.

Assembling the rear wheel brake unit

1. Proceed in accordance with operations 1 and 2 under "Assembling the front wheel brake unit". Place the handbrake link with spring in position in the front shoe before fitting the rear shoe. Connect on the handbrake cable.
2. Check that the springs and locking clips are properly located and that the linings are free from burr, grease and dirt.
3. Fit the hub with cleaned brake drum, washer and castle nut. Fit the wheel. Adjust the brakes, see under "Adjusting the wheel brake units". Lower the vehicle. Lock the castle nut with a split pin after the nut has been tightened properly. Tighten the wheel nuts to a torque of 10—14 kgm (70—100 lb.ft.). Fit on the hub cap.

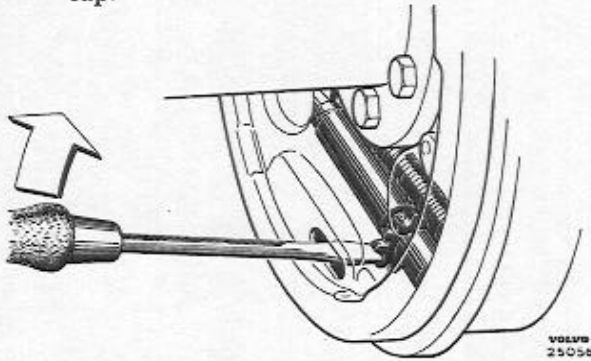


Fig. 38. Adjusting the wheel brake unit.

Adjusting the wheel brake units

The brakes should be checked and if necessary adjusted every 5,000 km (3,000 miles).

If it is suspected that the linings are worn out, remove the brake drum for checking this. The adjusting device permits adjustment to be carried out even when the linings are worn down to the rivets. Such wear can cause the rivets to damage the drums. Regular examination of the linings should be carried out every 20,000 km (12,500 miles), and more frequently in the case of hard driving.

Adjusting is carried out as follows.

1. Lift up the vehicle and block up under the control arms or rear axle. Release the hand brake.
2. Remove the rubber seal, insert a screwdriver into the recess and apply the brake shoes by moving the screwdriver upwards as shown in Fig. 38. Turn the notched wheel of the adjusting screw until the brake drum is locked.

3. Turn back the adjusting screw 8 notches. Then check that the drum can rotate freely. If not, depress the brake pedal in order to centre the shoes. If this does not help, turn the adjusting screw back a further 2 notches. Repeat the procedure until the drum can rotate freely. Fit the rubber seal.

Front wheel brake unit, disc brakes

Replacing the pad assemblies

The pad assemblies should be replaced when there is about 3 mm ($1/8''$) left of the lining thickness. In no circumstances may the linings be worn down to under 1.5 mm ($1/16''$).

1. Remove the hub cap and slacken the wheel nuts slightly.
2. Lift up the front end and block up under the lower control arms. Screw off the wheel nuts and lift down the wheel.
3. Remove the hairpin-shaped locking clips and guide pins for the pads. Pull out the pads as shown in Fig. 39.
4. Press in the plungers of the wheel unit cylinders carefully and fit the new pads. When doing this, note that the brake fluid level in the master cylinder rises and may run over. Re-fit the guide pins and locking clips.
5. Operate the brake pedal repeatedly and check that the movement feels normal. It is not generally necessary to carry out air-venting after replacing the pads.
6. Lift on the wheel after having cleaned the contact surfaces between the wheel and hub free from grit and dirt, and then

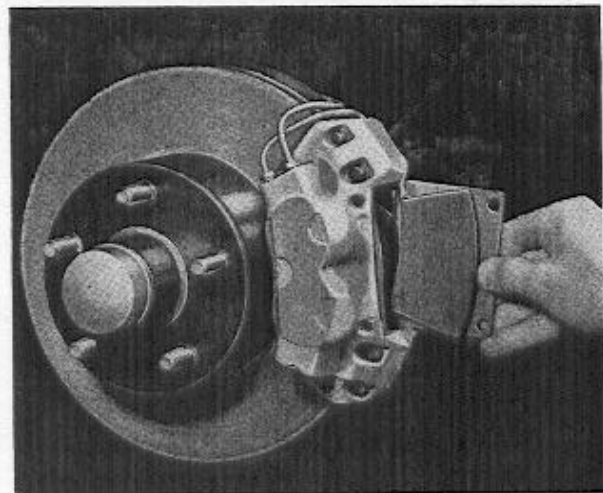


Fig. 39. Removing the pads.

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screw up the nuts so that the wheel cannot be disturbed on the hub. Lower the vehicle and tighten the wheel nuts. Tighten every other nut a little at a time until all of them are tightened to a torque of 10—14 kgm (70—100 lb.ft.). Fit the hub cap.

Reconditioning the wheel unit cylinders

Removing

1. Remove the wheel, see operations 1—2 under "Replacing the pad assemblies".
2. Clean the front wheel brake unit externally.
3. Unscrew the brake line (3, Fig. 40) and plug the connection. Brake fluid must not be allowed to get onto the brake disc or pads. Bend up the locking washer (6) and screw out the attaching bolts (4 and 5). Lift off the brake unit complete, see Fig. 41.

Dismantling

1. Remove the hairpin-shaped locking clips, (11, Fig. 14) and guide pins (1). Pull out the pads (9).

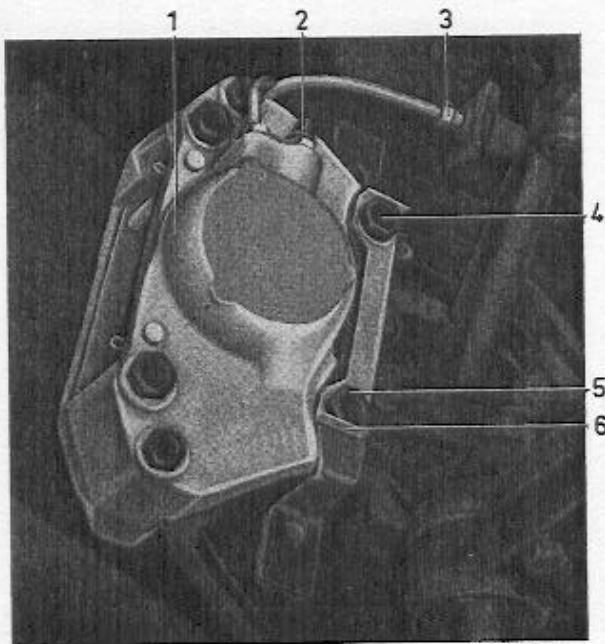


Fig. 40. Front wheel brake unit.

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

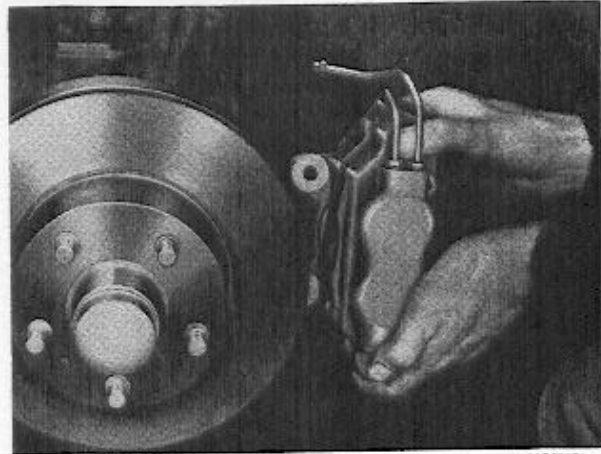


Fig. 41. Removing the front wheel brake unit.

2. Remove the plungers and pull off the rubber dust covers (8).
3. Take out the packings (3) from the cylinders with the help of a blunt tool. Be careful to avoid damaging the edges of the grooves.

Inspecting

Before inspecting, all parts should be washed in methylated spirits. The plungers and cylinders should be inspected carefully. There must be no scoring, scratches or rust spots on the polished surface. Damaged plungers must be replaced. Minor damage in the cylinders can generally be put right by honing. When doing this, the two halves of the brake are taken apart. The procedure varies with different types of machine, so that no general description can be given. Follow the manufacturer's instructions carefully. Clean the cylinders thoroughly after honing and check that the channels are clear.

Assembling

1. Coat the working surfaces of the plungers and cylinders with brake fluid
2. Fit new packings (3, Fig. 14) into the cylinders. Place the rubber dust covers (8) in position and make sure that they enter the cylinder grooves.
3. Fit the plunger with the closed end first. Press the plungers right in and make sure that the rubber dust covers enter the plunger grooves.

- Place the pads (9) in position. If the two halves of the brake unit have been taken apart, fit these together. Tighten the inner, larger attaching bolts (12) to a torque of 6.2—7 kgm (45—50 lb.ft.) and the outer, smaller bolts (13) to a torque of 3.5—5.2 kgm (25—30 lb.ft.) Fit the guide pins and locking clips.

Fitting

Check that the contact surfaces on the front wheel brake unit and retainer are clean and undamaged since it is vital that the brake unit is located correctly in relation to the brake disc. Fit the brake unit, see Fig. 40.

Check that the brake disc runs freely between the pads. Place on the locking washer (6) and tighten the attaching bolts (4 and 5) and lock them. Connect the brake line (3) and air-vent the wheel unit cylinders. Fit the wheel, see operation 6 under "Replacing the pad assemblies".

Brake disc

The brake disc should be examined as regards the friction surface, run-out and thickness. There must be no rust spots or scoring on the friction surface. The run-out must not exceed 0.1 mm (0.004") and should be measured as shown in Fig. 42. First check 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 fine turning or fine grinding. Machining should be done together with the hub. After machining, the thickness of the disc must not be less than

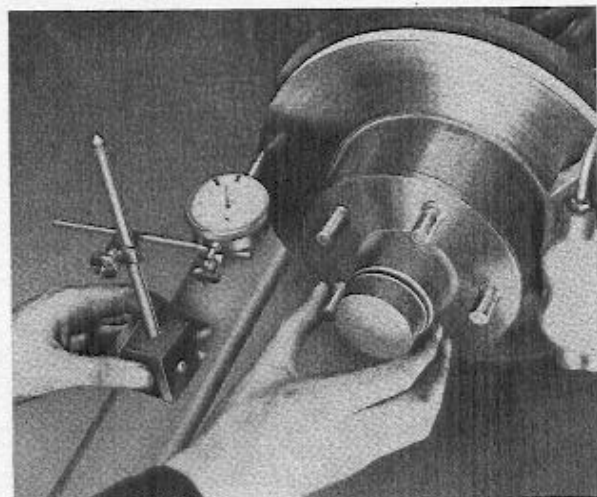
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Fig. 42. Checking run-out.

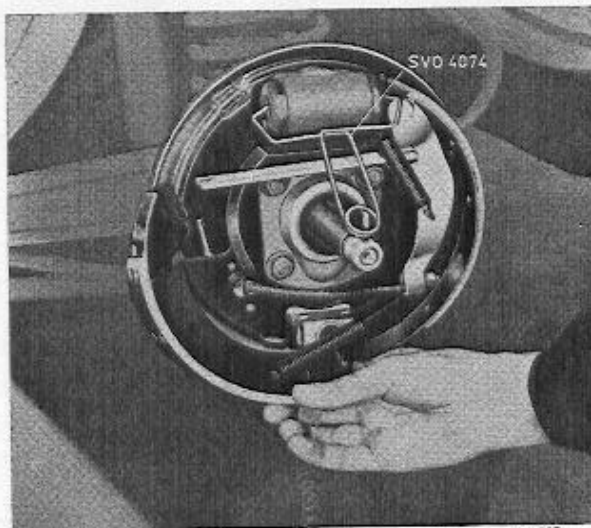
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Fig. 43. Removing the brake shoe.

12.2 mm (0.4803") and the surface texture should be max. 3 μ measured on a random diameter, and max. 5 μ measured radially. After reconditioning, the disc must not have a run-out exceeding 0.10 mm (0.004") and its thickness must not vary more than 0.03 mm (0.0012").

If the brake disc cannot be put in order in accordance with the above, or if there are cracks or similar damage, the disc together with the hub should be replaced. Concerning 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. Before the stud can be pressed through the hole in the brake disc, this must be drilled out to 16.6—16.8 mm (0.653—0.661").

Rear wheel brake unit, on vehicles fitted with disc brakes at front

Dismantling

- Remove the hub cap and the split pin in the drive shaft. Slacken the castle nut and wheel nuts slightly. Lift up the vehicle and block up underneath the rear axle. Remove the wheel.
- Release the handbrake. Pull off the hub with tool SVO 1791, see Fig. 18.
- Place clamp SVO 4074 over the wheel unit cylinder so that the plungers cannot be pressed outwards. Remove the upper return spring with the help of brake pliers. Pull down the front shoe into the groove on the brake backing plate, hold



Fig. 44. Removing the adjusting plunger.

against the guide pin on the back of the plate and turn and remove the locking washer. Lift off the shoe, see Fig. 43.

- Remove the rear shoe in a similar manner and disconnect the handbrake cable. Unhook the return springs and if necessary the handbrake link.
- Screw in the adjusting screw slightly. Remove the adjusting plungers, see Fig. 44.

Replacing brake linings

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

- Press out the rivets with the special drift in a rivet press. Then wash the shoes clean and dry them.
- Rivet on the ready-manufactured original linings. The front lining is placed at the bottom of the shoe and the rear one on top, see Fig. 45. Use rivets in accordance with the specifications and a rivet press with suitable drifts. Begin to rivet at the centre and continue 'outwards towards the ends. Check after riveting that the brake lining beds down properly along its whole length.
- In order to obtain best results, the linings should be ground in a special grinding machine. When doing this, make sure that the linings have a radius 0.2—0.4 mm (0.008—0.016") smaller than that of the brake drum.

Brake drum

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 must be replaced. Rust spots and minor scratches, can, however, be cleaned up in a machine.

Assembling

- Screw back the adjusting screw and fit the cleaned adjusting plungers after having coated them lightly with heat-resistant grease. Check that the plungers move easily.
- Fit the lever onto 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 recess in the clip.
- Place the handbrake link in position and make sure that it is turned the right way round. Hook on the lower return spring and fit the front brake shoe with guide pin and locking clip. Hook on the upper return spring with brake pliers. Remove SVO 4074. Fit the spring clip (5, Fig. 45).
- Check that the springs and locking washers are properly in position and that the linings are free from burr, grease and dirt.

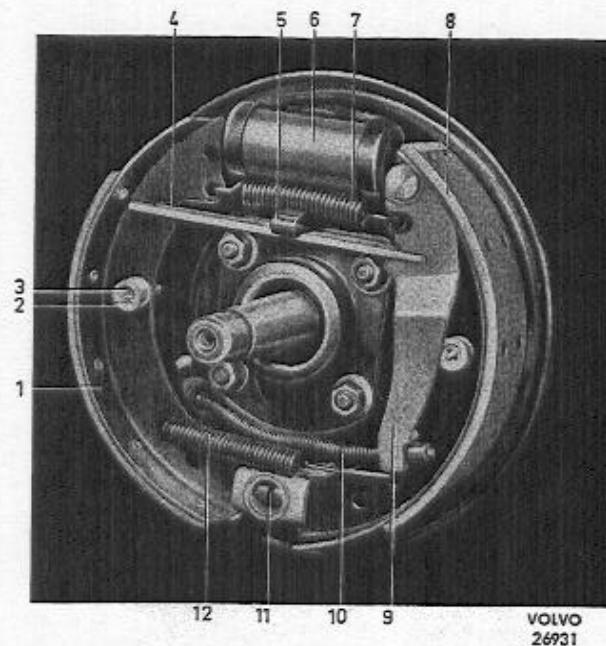


Fig. 45. Rear wheel brake unit.

- | | |
|------------------------|--------------------------------|
| 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 spring for lever |
| 6. Wheel unit cylinder | 12. Lower return spring |

5. Check that the key is fitted 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 grit, and tighten the nuts sufficiently so that the wheel cannot be disturbed on the hub. Adjust the brakes, see under "Adjusting the wheel brake units". Lower the vehicle and tighten the wheel nuts. Tighten every other nut a little at a time till all are tightened to a torque of 10—14 kgm (70—100 lb.ft). Tighten the castle nut finally and lock with a split pin. Fit the hub cap.

Adjusting the wheel brake units

The front wheel disc brakes are so designed that the linings always stand at a certain minimum distance from the brake disc regardless of wear. The front wheel brake units are therefore self-adjusting and it is not necessary to carry out any manual adjustment of the pad assemblies.

If the brake pedal goes too far down towards the floorboard when braking, this generally means that the brake linings on the rear wheel are worn and that the brake shoes requires adjusting. If it is suspected that the linings are worn out, the brake drum should be removed for checking this. The adjusting device permits further adjustment even if the linings are worn down to the rivets, and this situation can lead to the rivets damaging the drum. The linings should be inspected regularly at least every

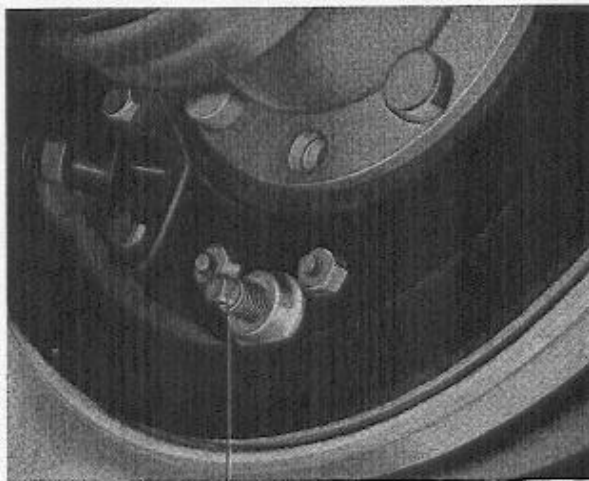
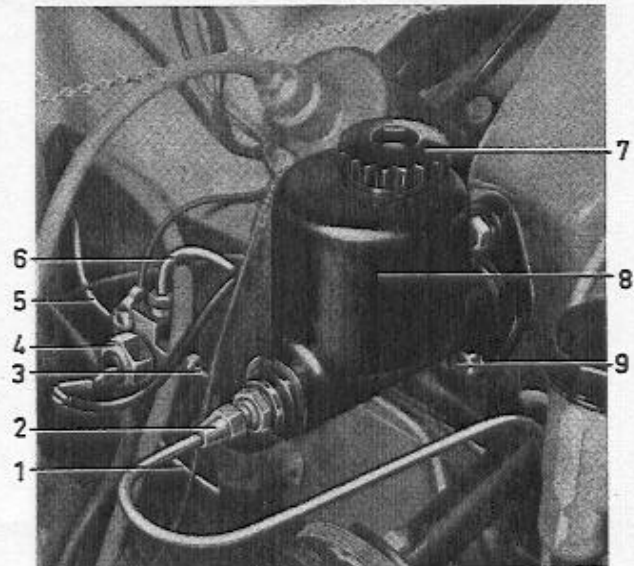


Fig. 46. Adjusting device for rear wheel brake unit.

1. Adjusting screw



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Fig. 47. Brake parts.

1. Brake line, rear wheels
2. Connection
3. Brake line, left front wheel
4. Brake contact
5. Brake line, right front wheel
6. Brake line, master cylinder
7. Filling cap
8. Master cylinder
9. Attaching bolt

20,000 km (12,500 miles), and more frequently in the case of hard driving. Adjusting is carried out as follows:

1. Lift up the rear end and block up under the rear axle. Release the handbrake.
2. Turn the adjusting screw (1, Fig. 46) clockwise until the brake drum locks. Then slacken the screw until the drum can rotate freely.
3. Adjust the other rear wheel in the same way. Lower the vehicle.

Hydraulic system

Observe the utmost cleanliness when working on the hydraulic system. Wash the hands with soap and water before cleaning the internal parts. These should be cleaned with methylated spirits. Petrol, paraffin or spirit containing benzol must not be used.

Use only first-class brake fluid which fulfills the requirements of SAE 70 R1 or R3 (HD quality). Avoid spilling brake fluid on the paintwork as this can cause damage.

Master cylinder, early production Removing

1. Remove the split pin and stud for the brake pedal. Disconnect the return spring. Remove the rubber cover.

- Slacken the connection for the brake line. Collect up the brake fluid which runs out. Remove the two attaching bolts for the master cylinder. Take out the master cylinder carefully. Avoid spilling brake fluid onto the paintwork since this can cause damage.

Dismantling

- Remove the cap and empty out the brake fluid.
- Bend back the rubber cover (4, Fig 2) and remove the locking ring (6), washer and push rod (5). Shake out the parts from the cylinder. Bend up the locking ring on the spring retainer (10) which is placed on the plunger (3) and separate the parts. Remember that the spring (11) is under tension.

Inspecting

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

The cylinder should be inspected thoroughly internally. There must be no scoring, scratches or rust spots on the polished surface.

The clearance between the plunger and cylinder must not exceed 0.15 mm (0.006") and this can be measured as shown in Fig. 48. If the clearance exceeds 0.15 mm (0.006"), test with a new plunger. If this does not help, the master cylinder must be replaced.

Examine packings and other parts for wear and damage. Damaged or worn parts must be replaced.

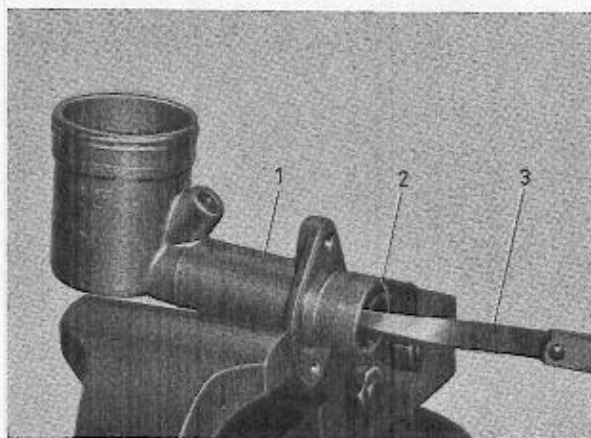


Fig. 48. Checking the clearance.

- Master cylinder
- Plunger
- Feeler gauge

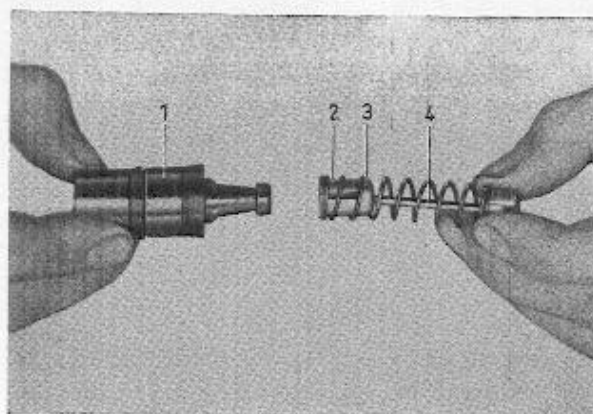


Fig. 49. Assembling the plunger.

- Plunger
- Locking piece
- Spring retainer
- Push rod

Assembling

- Fit the packings onto the plunger (3, Fig. 2) and valve (13).
- Assemble the valve. Turn the convex part of the spring washer to face the packing.
- Fit the spring and spring retainer (3, Fig. 49) onto the push rod (4) and assemble these parts to the plunger, see Fig. 49. Then press down the locking piece (2) on the spring retainer so that the parts are held in position.
- Dip the packing and plunger in brake fluid and fit them into the cylinder. Fit the push rod, (5, Fig. 2), washer and locking ring (6).

Fitting

Fitting is done in the reverse order to removing. Do not forget the split pin in the pedal stud. Fill up with brake fluid and air-vent the system in accordance with the instructions under "Air-venting the brake system".

Master cylinder, late production

Removing

See under "Master cylinder, early production".

Dismantling

- Unscrew the cap (2, Figs. 4 and 50) and empty out the brake fluid.
- Bend back the rubber cover (6) and remove the locking ring (7), washer (8) and push rod (5). Shake all the parts out of the cylinder, see Fig. 50.

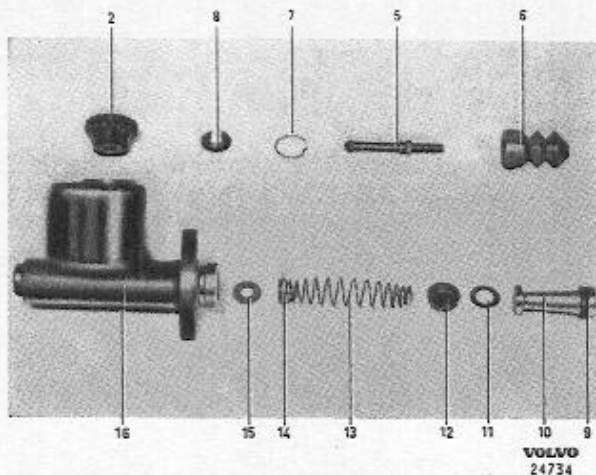


Fig. 50. Master cylinder, late production.

- | | |
|-----------------|----------------------|
| 2. Cap | 11. Washer |
| 5. Push rod | 12. Packing |
| 6. Rubber cover | 13. Spring |
| 7. Locking ring | 14. Valve |
| 8. Stop washer | 15. Washer |
| 9. Packing | 16. Cylinder housing |
| 10. Plunger | |

Inspecting

Before inspecting, all the master cylinder parts should be washed in methylated spirits. The cylinder must be examined thoroughly internally. There must be no scoring, scratches or rust spots on the polished surface. Such damage can as a rule be eliminated by honing the cylinder. The procedure for this varies with

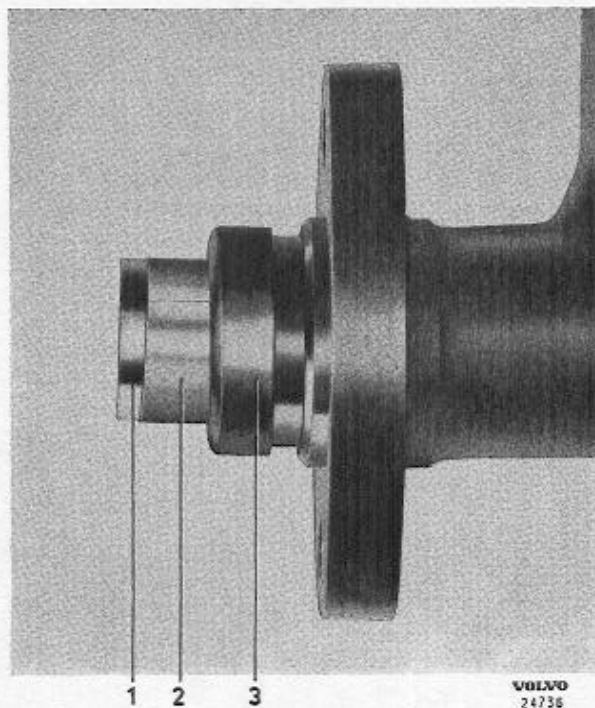


Fig. 51. Fitting the plunger.

1. Plunger
2. Brass foil
3. Master cylinder

different machines so that no general description can be given. Therefore follow the manufacturer's instructions. Clean the cylinder thoroughly after honing and check that the holes are clear.

The clearance between the plunger and cylinder must not exceed 0.20 mm (0.008") which can be measured with a feeler gauge as shown in Fig. 48. If the clearance exceeds 0.20 mm (0.008"), test with a new plunger. If this does not help, the master cylinder must be replaced.

Examine the packings, valves and other parts for wear and damage. Damaged or worn parts must be replaced.

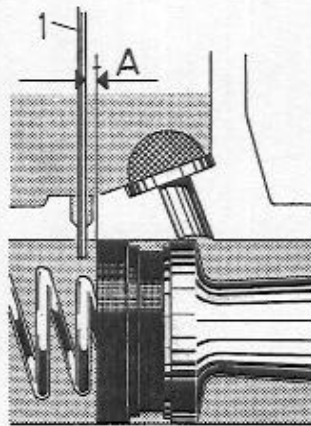


Fig. 52. Checking the equalizing hole.

1. 0.5 mm (25 gauge) wire A = approx. 0.5 mm (0.02")

Assembling

1. Fit the washer (15, Fig. 50), in the bottom of the cylinder.
2. Place the packing (12) on the spring guide. Dip the packing in brake fluid and fit it together with the spring and valve. Place the washer (11) into the cylinder.
3. Pull the packing (9) onto the plunger and turn it as shown in the figure. Dip the plunger in brake fluid and fit it. Take care to see that the packing (9) is not damaged. It is best to use a piece of brass foil formed into a ring to act as a guide for the packing, see Fig. 51. Compress the spring and fit the push rod (5), washer (8) and locking ring (7).

Check that the equalizing hole is clear by inserting a piece of 0.5 mm (25 gauge) wire through the hole, see Fig. 52. It should then be possible to press the plunger in approx. 0.5 mm (0.02") before the wire is gripped. Take care not to damage the packing. Also check that there is clearance for the push rod (5).

5. Fit the rubber cover (6).

Fitting

Fitting is done in the reverse order to removing. Do not forget the split pin in the pedal stud. Fill up with brake fluid and air-vent in accordance with the instructions under "Air-venting the brake system".

Wheel unit cylinder

Concerning the wheel unit cylinders of the disc brakes, see under "Front wheel brake unit, disc brakes".

Removing, drum brakes, late production

1. Remove the hub, see under "Dismantling the wheel brake unit".
2. Place clamp SVO 4047 over the wheel unit cylinder. Move the brake shoes to one side with the help of a screwdriver in order to release the push rods from the shoes, see Fig. 53.
3. Disconnect the brake lines and unscrew the wheel unit cylinder attaching bolts. Lift off the wheel unit cylinder but make sure that no brake fluid gets onto the linings.

Removing, remainder

1. Remove the hub and brake shoes, see under "Dismantling the wheel brake unit".
2. Disconnect the brake line and unscrew the wheel unit cylinder attaching bolts. Lift off the wheel unit cylinder.



Fig. 53. Removing the wheel unit cylinder.

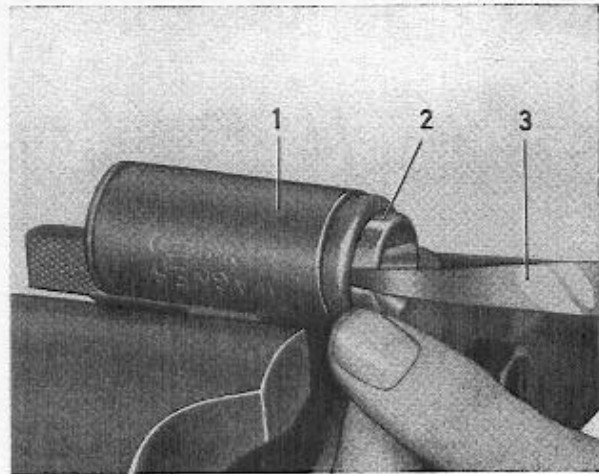


Fig. 54. Checking the clearance.

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

Reconditioning

Remove the clip, pull off the rubber seals and take out plungers, packings and springs. Wash all parts in clean spirit.

The cylinder must be examined thoroughly internally. There must be no scoring, scratches, or rust spots on the polished surface. Such damage can as a rule be eliminated by honing the cylinder. Since the procedure for this varies with different machines, follow the instructions of the manufacturer concerned. Clean the cylinder thoroughly after honing, when the air-venting nipple should be removed.

The clearance between the plunger and cylinder must not exceed 0.25 mm (0.010") which is measured as shown in Fig. 54. If the clearance exceeds 0.25 mm (0.010"), test with a new plunger. If this does not help, the wheel unit cylinder must be replaced.

Examine the packings and other parts for wear and damage. Damaged or worn parts must be replaced.

Assemble the parts in the reverse order to dismantling. When doing this, dip the plungers and packings in brake fluid.

Fitting

Fitting is done in the reverse order to removing. When working on both front and rear wheel unit cylinders of late production, remember that the front cylinder has a diameter of 1" and the rear of $\frac{13}{16}$ ". Air-vent the wheel unit cylinder.

Brake lines

The brake lines should be flushed through in connection with full reconditioning of the hydraulic system.

The lines are disconnected at the wheel unit cylinders one by one and flushed through with brake fluid or spirit. Flushing is preferably done by filling the master cylinder and then carrying out repeated braking movements with the pedal.

After having been flushed through with spirit, all leads must be blown clean with water-free, filtered compressed-air, since the spirit can cause gas bubbles in the system, giving rise to a "spongy pedal".

In the case of leakage or where the lines have been subjected to damage so that leakage is suspected, the damaged lines should be replaced. This is done as follows:

1. Remove the damaged brake line.
2. Take a new original brake line, blow it clean internally with water-free, filtered compressed-air, and fit it. Make sure that the brake line is in such a position that it cannot be chafed during driving. Particularly important points are those where the pipes pass the rear spring attachments on the rear axle, where the pipe must not be closer than 10 mm ($\frac{3}{8}$ "), and where the pipes pass the support arms. If the pipe is not bent correctly, it should be adjusted by hand before fitting. If bending is done after the pipe has been fitted, this often results in deformation at the connections. On vehicles with disc brakes, note that the line between the front wheel brake unit and hose does not have the same type of cone in both ends.
3. Air-vent the hydraulic system.

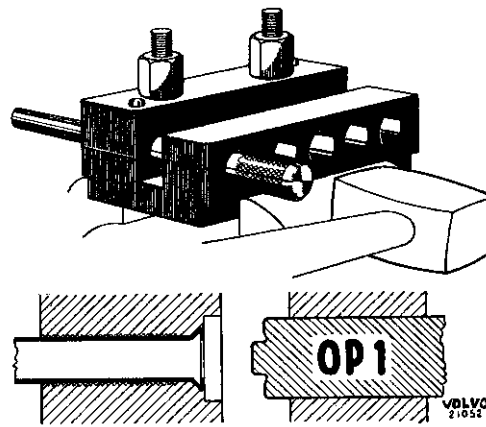


Fig. 56. Flanging a brake pipe.

If for any reason the brake line is not available ready-made, it can be manufactured as follows. This description does not apply, however, to lines for the front wheel brakes on vehicles with disc brakes.

1. Cut the new pipe to the length required. The pipe should be cut at right angles, after which all burr should be removed.
2. Place tool SVO 2042 in a vice. Insert the pipe so far that its end comes flush with the vice jaw as shown in Fig. 55. Tighten the nuts.
3. Place the drift OP 1 in the tool. Strike the drift with a copper mallet until it goes right in. The edge of the pipe is thus bent out as shown in Fig. 56.
4. Replace the drift with OP 2 (Fig. 57) and knock this right in.
5. Place on the keeper nuts and repeat operations 3—5 at the other end of the pipe.
6. Bend the new brake line using the old one as a pattern. Bending should be done round an object having the same radius as the bend required.

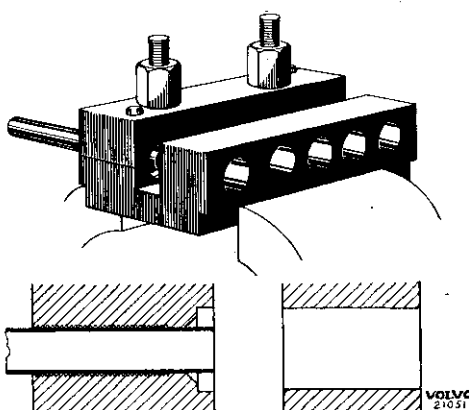


Fig. 55. Flanging a brake pipe.

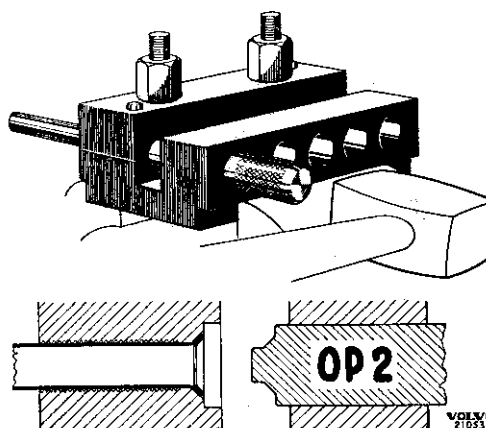


Fig. 57. Flanging a brake pipe.

Air-venting the hydraulic system

An indication that there is air in the system is that the brake pedal can be depressed with very little resistance or that it feels "spongy". After any part of the system has been removed for repairs, air-venting must be carried out. Air can also enter the system if there is insufficient brake fluid in the container. If, for example, only one wheel unit cylinder has been removed, it is usually sufficient just to air-vent this. If, on the other hand, the master cylinder or lines from this have been removed, then the whole system must be air-vented.

Air-venting the whole brake system is carried out as follows.

1. Clean around the filling cap on the master cylinder. Screw off the cap and top up with brake fluid if necessary.
2. Clean the air-venting nipple. Place the air-venting key with hose on the air-venting nipple and let the other end of the hose hang down in the fluid in a collecting vessel, see Fig. 58. For front wheel brake units of early production, key SVO 2280 is used, for disc brakes SVO 2381, and for other brakes SVO 1431.

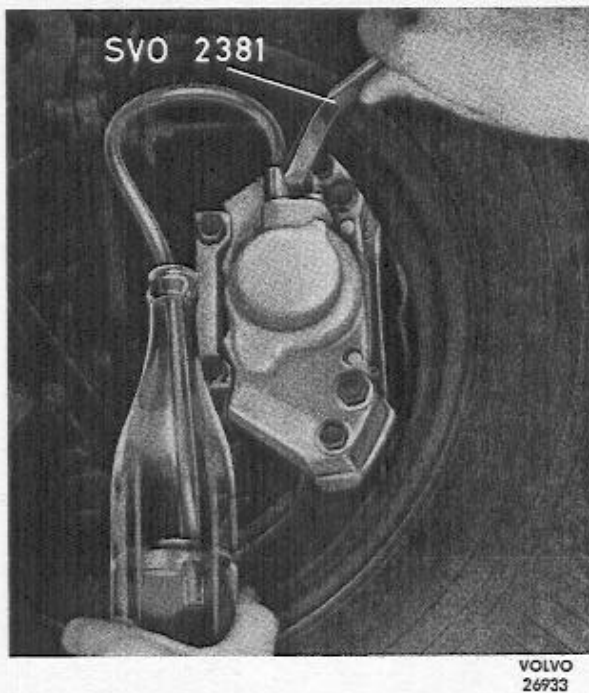


Fig. 58. Air-venting the disc brakes.

3. Open the nipple and have someone depress the brake pedal gradually. Close the nipple before the pedal is released, otherwise air can be sucked in if there is no non-return 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 other wheels in the same way. Check between every wheel that there is sufficient brake fluid in the container.

A special air-venting apparatus can also be used which maintains the fluid in the system under a certain pressure. In this case it is not necessary for the brake pedal to be operated, so that one man can carry out air-venting.

Leakage test

Once or twice a year, and when any hydraulic part has been removed, it is a good idea 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 is done with a special pressure tester. This is connected to the hydraulic system and the pressure raised to a maximum of 100 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 there is any leakage, the fault should be remedied before the vehicle 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 bushings

See under "Reconditioning pedal shaft", Service Manual, Part 2.

HANDBRAKE

Replacing the handbrake cable

Removing

1. Apply the handbrake, remove the hub cap, slacken the wheel nuts and castle nut.
2. Lift up the rear end, block up 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. 18. Disconnect the cable from the brake shoe lever.
4. Remove the bolts of the cable casing attachment on the brake backing plate or the locking spring if the brakes are of early production. Remove the cable casing front attachment with rubber sleeve. Disconnect the cable from the clevis and pull out the cable forwards. In the case of older type cables (up to chassis number 534), this is pulled first backwards so that the locking washer can be removed. If the guide sleeve and locking washer do not come out with the cable, knock the guide sleeve to the rear with a narrow drift.

Fitting

1. Fit the rubber sleeve over the cable casing and connect the cable to the clevis.
2. Thread the sealing ring over the cable spring (does not apply to cables with locking springs). Insert the cable through the brake backing plate. On older type cables the guide sleeve and locking washer are then fitted. Connect the cable to the brake shoe lever.
3. Place on the locking spring or tighten the bolts, whichever the case may be. 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 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 vehicle 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, otherwise water and dirt can penetrate, causing rusting.

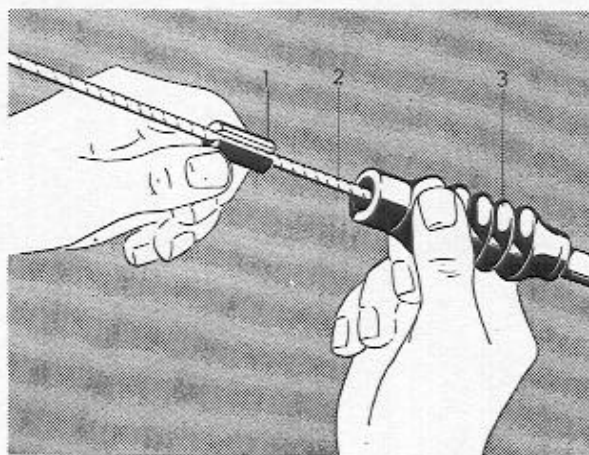


Fig. 59. Fitting the rubber cover.

1. Sealing plug 2. Cable 3. Rubber cover

For this purpose there is a special rubber cover with sealing plug (part numbers 86850 and 86851 respectively). When replacing, the pull rod is disconnected from lever and the cable disconnected from the clevis. Cut off the old cover and thread on the new one. Connect the cable to the clevis and re-fit the pull rod. Place the slotted sealing plug (1, Fig. 59) onto the cable (2) and press it into the rubber casing (3).

Replacing the handbrake lever or catch parts

1. Lift up the rear end and block up under the rear axle.
2. Remove the split pin and pull the cables so that the pull rod (2, Fig. 16) can be removed from the lever. Remove the bearing support (1).

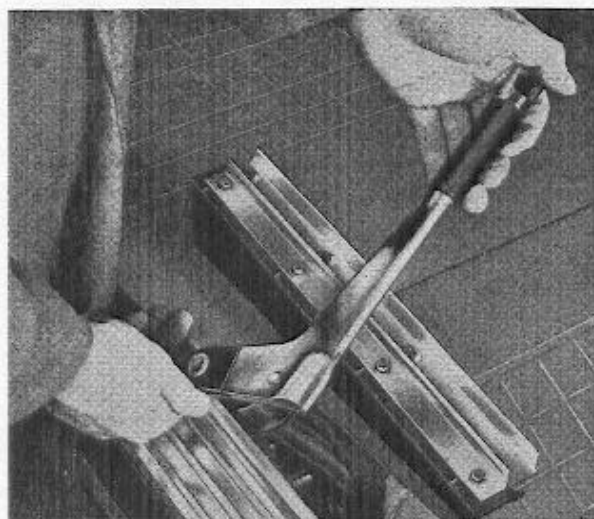


Fig. 60. Removing the handbrake lever.

3. Turn back the floor mat and remove the rubber cover over the ratchet segment. Remove the ratchet segment.
4. Move the brake lever (15) towards the centre of the vehicle until it releases at the outer bearing. Remove the rubber seal and pull out the handbrake lever forwards with shaft and lever, see Fig. 60.
5. Screw out the locking screw (18) and remove the loop (20) and button (19). Take the spring out of the lever. Remove the pin (13) and take out the push rod (16) and pawl (12).
6. Fit the new parts in the reverse order. Make sure that the pin is properly secured without the movement of the pawl being affected. Lubricate the bushings with a thin layer of ball bearing grease. Do not forget to lock the pull rod and ensure that the rubber on the shaft seals properly.

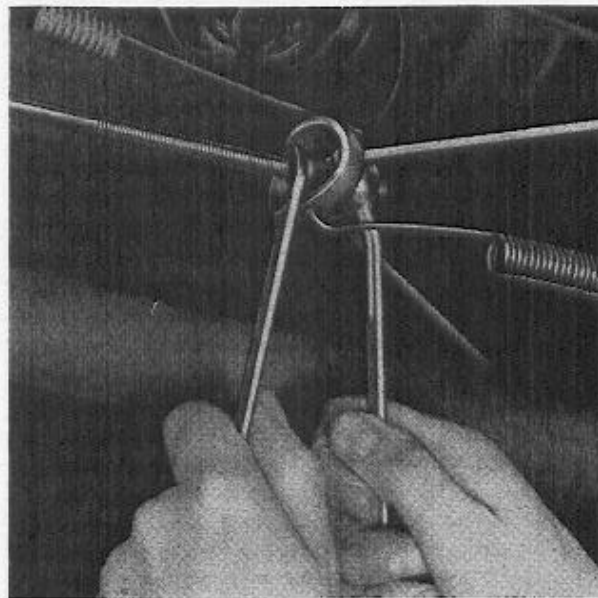
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Fig. 61. Adjusting handbrake.

Adjusting the handbrake

The handbrake should give full effect at the 4th—5th ratchet notch. If not, the handbrake should be adjusted. Before adjusting, make sure that the fault is not in the wheel brake units. On vehicles with late production wheel brake

units (without self-adjusting), the rear wheel brakes should therefore be adjusted first.

The handbrake is adjusted by moving the clevis on the pull rod, see Fig. 61. Tighten the nuts properly after adjusting.

FAULT TRACING

FAULT

REASON	REMEDY
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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.

Top up with brake fluid. Check for leakage.

Air-vent.

Air-vent the system.

Check and repair the leakage. Air-vent.

Recondition the master cylinder.

Adjust the brakes.

Change over to original brake linings.

Replace the brake linings. Check the sealing ring.

Vehicle pulls to one side when braking

Grease or oil on one of the brake linings.

Different types of brake lining.
Brakes unevenly adjusted.
Oval or uneven brake drum.
Defective wheel unit cylinder.
Excessive play in wheel bearings, or faulty wheel alignment.
Uneven tyre pressure.
Tyres unevenly worn.

Replace the brake lining. Check the sealing ring.

Replace with the same type.
Adjust the brakes.
Replace or grind the drum.
Recondition the wheel unit cylinder.
Adjust the front end.

Adjust the tyre pressure.
See Part 8.

The brakes grab

Brakes badly adjusted.
Moisture on the brake linings.

Excessive play in wheel bearings.
Brake linings worn out.
Brake linings glazed.
Damaged or loose brake linings.
Loose brake backing plate or retainer.
Oval brake drum.
Broken return spring.
Wheel brake unit centring block damaged.
Uneven sliding surfaces on brake shoes and centring block.

Adjust the brakes.

Apply the brakes several times, when the trouble will disappear.
Adjust the bearings.
Replace the linings.
Replace the linings and repair the leakage.
Replace the linings.
Tighten the brake backing plate.
Replace or grind the drum.
Replace the spring.
Replace the centring block.
Clean up the sliding surfaces.

Brakes bind on one of the wheels

Brakes incorrectly adjusted.
Broken return spring.
Handbrake cable binds.
Brake line to the wheel blocked up or damaged.
Excessive play in wheel bearings.

Adjust the brakes.
Replace the spring.
Lubricate or replace the cable.
Clean or replace the line.
Adjust the bearings.

Brakes bind on all wheels

Brakes incorrectly adjusted.
During very cold weather: poor quality brake fluid.
Equalizing hole in late production master cylinder blocked up.

Adjust the brakes.
Change the brake fluid.
Recondition the master cylinder.

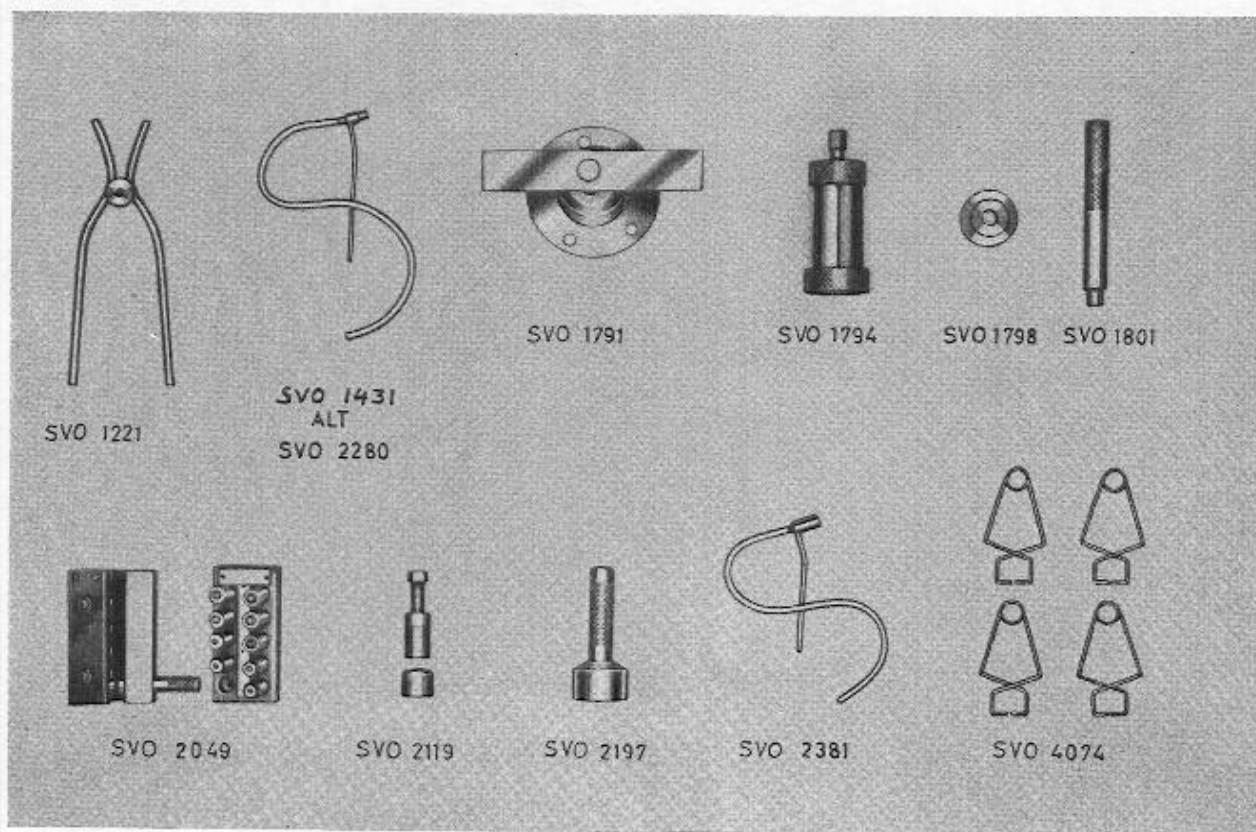
The brakes squeal

Brake linings worn out.
Dirt in the brake drums.
Vibrating brake drums.

Replace the linings.
Clean the drums and linings.
Fit damping springs on the outside of the drums.

TOOLS

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



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Fig. 62. Special tools.

- | | | | |
|----------|---|----------|---|
| SVO 1221 | Pliers for lower spring, rear wheel brake unit, early production. | SVO 2119 | Staving tool for eccentric stud, early production. |
| SVO 1431 | Key for air-venting nipple. | SVO 2197 | Drift for removing and fitting grease cap for front wheel hub. |
| SVO 1791 | Puller for hub and brake drum. | SVO 2280 | Key for air-venting nipple, front wheel brake unit, early production. |
| SVP 1794 | Puller for inner bearing on steering knuckle. | SVO 2381 | Key for air-venting nipple, vehicles with disc brakes. |
| SVO 1798 | Drift for fitting sealing ring in front wheel hub. | SVO 4074 | Spring clip for wheel unit cylinder. |
| SVO 1801 | Standard handle. | | |
| SVO 2049 | Tool for flanging brake pipe. | | |

SPECIFICATIONS

Wheel brake units, drum brakes

Early production

Brake drums, diameter	9" (228.6 mm)
radial throw, max.	0.15 mm (0.006")
Brake linings:	
Width	2"
Thickness	$\frac{3}{16}$ "
Length, front wheel	260 mm ($10\frac{1}{4}$ "
rear wheel, front shoe	260 mm ($10\frac{1}{4}$ "
rear shoe	200 mm ($7\frac{7}{8}$ "
Effective area, front wheel	520 cm ² (80.6 sq.in.)
rear wheel	465 cm ² (72.1 sq.in.)
total	985 cm ² (152.7 sq.in.)
Return spring for brake shoe:	
Applied force necessary for a total length of	
154 mm (6.06"), front wheel	13.5—20.5 kg (29.7—45.1 lb.)
rear wheel	15.5—20.5 kg (34.1—45.1 lb.)
Clearance between brake lining and drum	0.1 mm (0.004")
Rivets for brake linings, size	$\frac{9}{64} \times \frac{5}{16}$ " (3.5 × 8 mm)

Late production

Brake drum, diameter, front wheel	10" (254 mm)
rear wheel	9" (228.6 mm)
Width	0.15 mm (0.006")
Brake linings, early production:	
radial throw, max.	2"
Thickness, rear lining, front wheel	$\frac{1}{4}$ — $\frac{3}{16}$ " (ground)
others	$\frac{3}{16}$ "
Length, front wheel	275 mm ($10\frac{53}{64}$ "
rear wheel	250 mm ($9\frac{27}{32}$ "
Effective area, front wheel	560 cm ² (86.8 sq.in.)
rear wheel	508 cm ² (78.7 sq.in.)
total	1068 cm ² (165.5 sq.in.)
Brake linings, late production:	
Width	2"
Thickness, rear lining, front wheel	$\frac{1}{4}$ — $\frac{3}{16}$ " (ground)
others	$\frac{3}{16}$ "
Length, front wheel, front shoe	192 mm ($7\frac{9}{16}$ "
rear shoe	250 mm ($9\frac{27}{32}$ "
rear wheel, front shoe	212 mm ($8\frac{11}{32}$ "
rear shoe	250 mm ($9\frac{27}{32}$ "
Effective area, front wheel	497 cm ² (77 sq.in.)
rear wheel	451 cm ² (70 sq.in.)
total	948 cm ² (147 sq.in.)
Rivets for brake linings, size	$\frac{9}{64} \times \frac{5}{16}$ " (3.5 × 8 mm)

Wheel brake units on vehicles fitted with disc brakes at front

Front wheel brake unit

Type	Disc
Brake disc:	
External diameter	276.5 mm (10.88")

P 1200

Thickness, new	12.7—12.8 mm (0.500—0.504")
reconditioned	min. 12.2 mm (0.480")
Run-out	max. 0.1 mm (0.004")

Brake linings:

Number per wheel	2
Thickness	10.7 mm (0.422")
Effective area per wheel	92.5 cm ² (14.3 sq.in.)

Rear wheel brake unit

Type	Drum
Brake drum, diameter	9" (228.6 mm)
Brake drum, radial throw	max. 0.15 mm (0.006")

Brake linings:

Width	2"
Thickness	³ / ₁₆ "
Length	210 mm (8 ¹ / ₄ ")
Effective area per wheel	210 cm ² (32.5 sq.in.)
Rivets for brake linings, size	¹¹ / ₆₄ × ¹⁷ / ₆₄ " (6.7 × 4.4 mm)

Return spring for brake shoe:

Applied force necessary for a total (outer) length of for upper spring, 95 mm (3.74")	7—9.5 kg (15.4—21 lb.)
for lower spring, 132 mm (5.20")	5.5—8 kg (12.1—17.6 lb.)

Hydraulic system

Master cylinder

Inner diameter, early production	⁷ / ₈ " (22.23 mm)
late production	⁷ / ₈ " (22.23 mm)
Clearance between plunger and cylinder, early production	max. 0.15 mm (0.006")
late production	max. 0.20 mm (0.008")
Tightening torque for adjusting nuts for master cylinder push rod	1.1—1.2 kgm (8—9 lb.ft.)

Wheel unit cylinder, drum brakes

Internal diameter, front wheel, early production	⁷ / ₈ " (22.23 mm)
late production	1" (25.4 mm)
rear wheel, early production	⁷ / ₈ " (22.23 mm)
late production I	¹³ / ₁₆ " (20.64 mm)
late production II	⁷ / ₈ " (22.23 mm)
Clearance between plunger and cylinder	Max. 0.25 mm (0.010")

Wheel unit cylinder, on vehicles fitted with disc brakes at front

Front wheel:

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	6.2—7.0 kgm (40—50 lb.ft.)
outer bolts	3.5—4.2 kgm (25—30 lb.ft.)

Rear wheels:

Internal cylinder diameter	1" (25.4 mm)
Clearance between plunger and cylinder	max. 0.25 mm (0.010")

Brake lines

External diameter	³ / ₁₆ "
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