



SERVICE MANUAL

PV 544

Part **07**

BRAKES

Service Department

AKTIEBOLAGET

VOLVO

GÖTEBORG SWEDEN

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NOTE

This Service Manual deals with the brake systems for PV 544 equipped with Duo-servo type wheel brake units. Such brakes have been included in production with effect from chassis no. 207866 and on chassis nos. 205370—205374, 207045—207173 and 207212—207801.

A first small series of PV 544 was equipped with wheel brake units of a different type. Regarding these, refer to Service Manual PV 444—445, Part 7.

DESCRIPTION

The PV 544 is fitted with two brake systems which are completely independent of each other. One of these is the footbrake which is controlled by a brake pedal and which operates through a hydraulic system on all four wheels. The other system, the handbrake, is controlled by a brake lever and operates mechanically on both the rear wheels.

Footbrake

The lay-out of the brake system is shown in Figs. 1—5.

When the brake pedal (9, Fig. 1) is depressed it actuates the plunger in the master cylinder (7) by means of a link rod (10) and thrust rod. The hydraulic pressure in the master cylinder increases

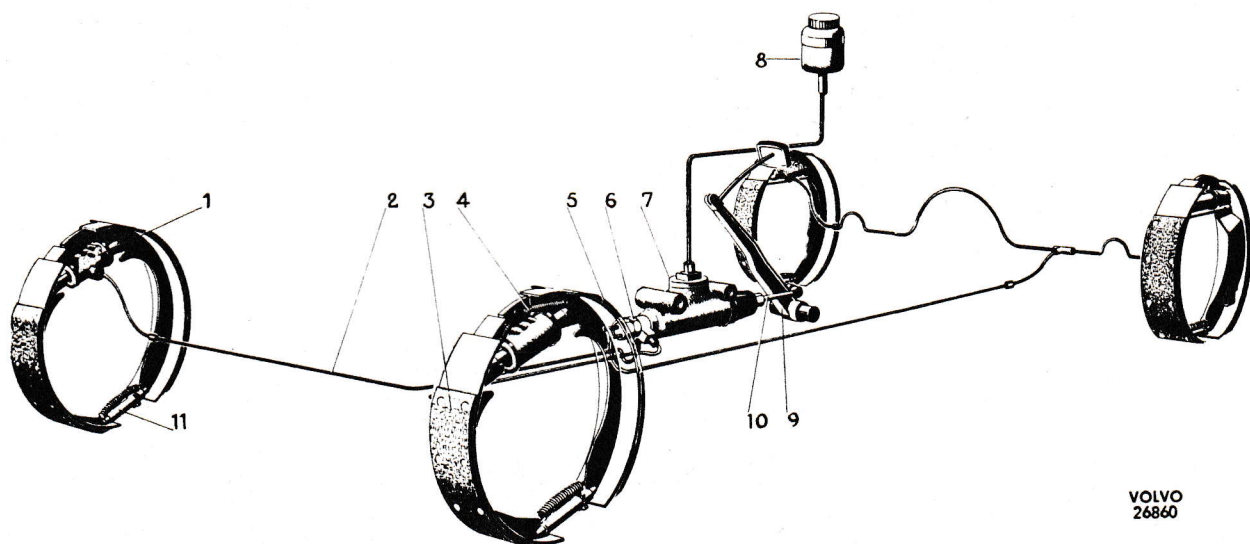


Fig. 1. Footbrake system.

- | | | | |
|------------------------|--------------------|--------------------------|----------------------|
| 1. Wheel unit cylinder | 4. Return spring | 7. Master cylinder | 9. Brake pedal |
| 2. Brake line | 5. Rear brake shoe | 8. Brake fluid container | 10. Link rod |
| 3. Front brake shoe | 6. Brake contact | (late prod.) | 11. Adjusting device |

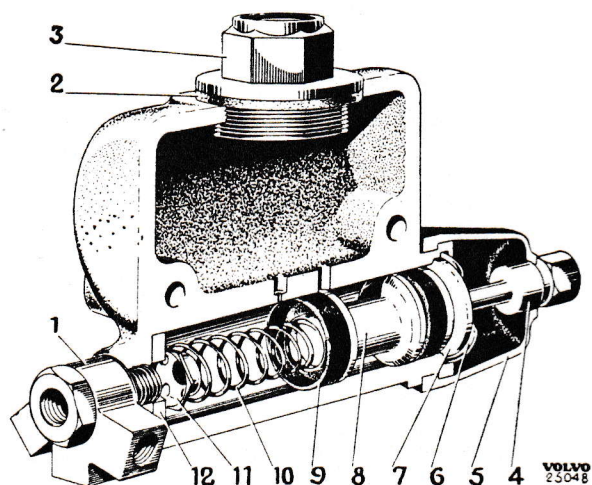


Fig. 2. Master cylinder.

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

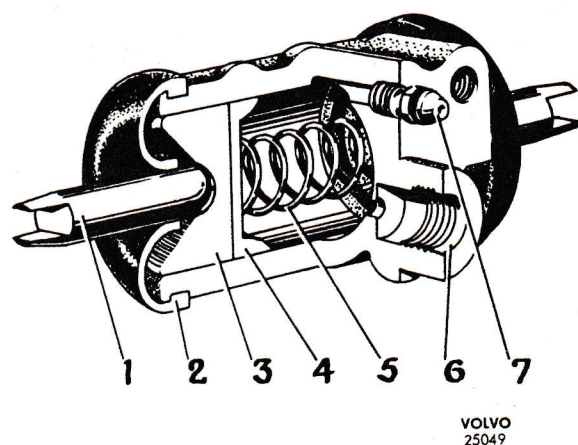


Fig. 3. Wheel unit cylinder.

- | | |
|-----------------|---------------------------------|
| 1. Thrust rod | 5. Spring |
| 2. Rubber cover | 6. Connection for
brake line |
| 3. Plunger | 7. Bleeding nipple |
| 4. Packing | |

and this is transmitted through the brake fluid in the pipelines (2) to the wheel unit cylinders (1). The plungers in these are thus pressed outwards and apply the brake.

The brake shoes (9 and 12, Fig. 4) are flexibly attached to the brake backing plate by means of guide pins (8) and spring clips (7). The upper ends of the shoes are held pressed against the riveted centring block (3) by the return springs (1). The lower ends are jointed by means of an adjusting device (11) against which they are held pressed by the spring (10), which in addition locks the adjusting screw star wheel. This arrangement makes the brake shoes self-centring and both the shoes partly self-applying (Duo-servo).

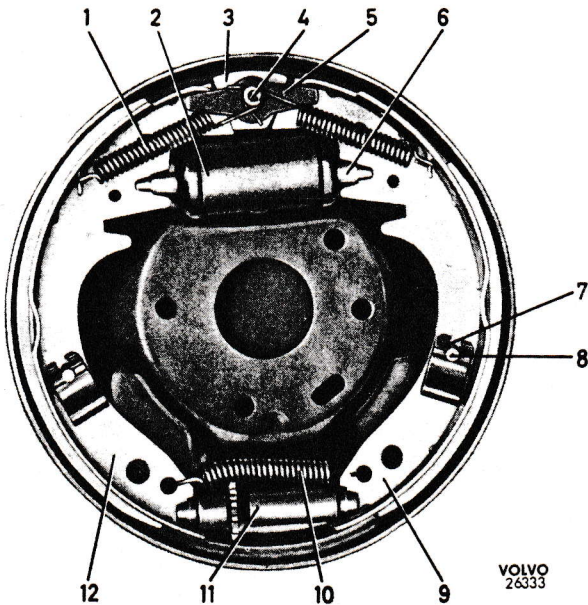


Fig. 4. Wheel brake unit, right front wheel.

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

When the brake is applied, the wheel unit cylinder plungers press out the brake shoes against the brake drum by means of the thrust rods (6, Fig. 4). Because of the friction between the drum and lining, the shoes will follow round in the direction of rotation of the drum. Because of the flexible suspension of the brake shoes, the primary shoe (9) will

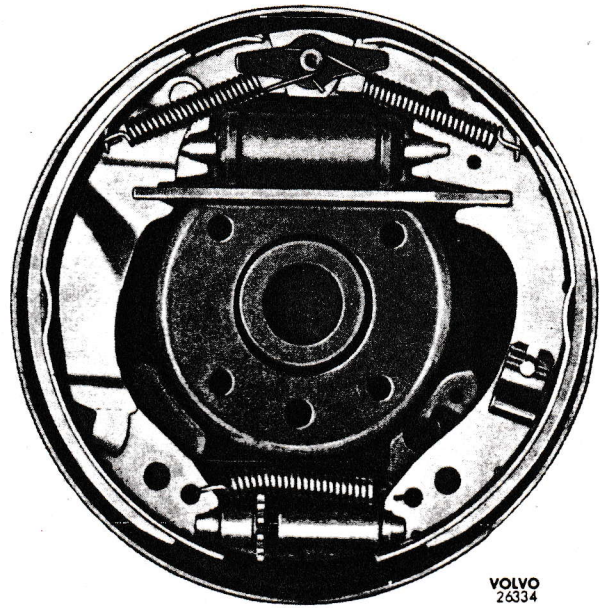


Fig. 5. Wheel brake unit, right rear wheel.

be pressed downwards and the secondary shoe (12) upwards until its upper end comes up against the centring block, see Fig. 6. The end of the secondary shoe in then displaced on the block so that the shoe becomes centred in relation to the brake drum. Since the pivoting point of the secondary shoe is at the anchor stud (4, Fig. 4) and that of the primary shoe at the adjusting device, friction between the drum and lining will assist with brake application, Fig. 6. This effect is also amplified by the fact that

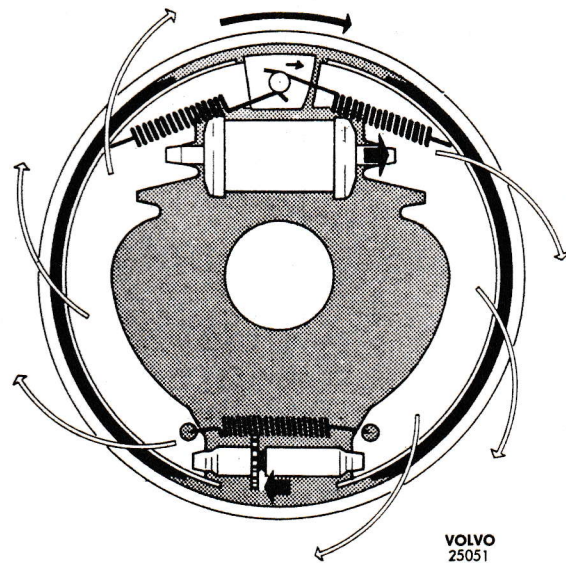


Fig. 6. Application of wheel brake units.

the primary shoe tends to follow round in the direction of rotation of the brake drum and this has the effect of applying the secondary shoe.

In order for the brake linings to attain the greatest possible length of life, the rear shoes (secondary shoes) on the front wheel brake units are fitted with thicker and eccentrically ground linings.

Handbrake

The handbrake lever is fitted on the tunnel between the front seats. The action of the lever is transmitted through a system of rods and levers to the clevis (12, Fig. 7). From there the movement is transmitted by cables (14) to the rear wheel brake unit levers (20). The upper ends of these levers are attached to the rear brake shoes. When the levers are pulled forwards the shoes are pressed outwards by means of the link (19) and the handbrake is thus applied.

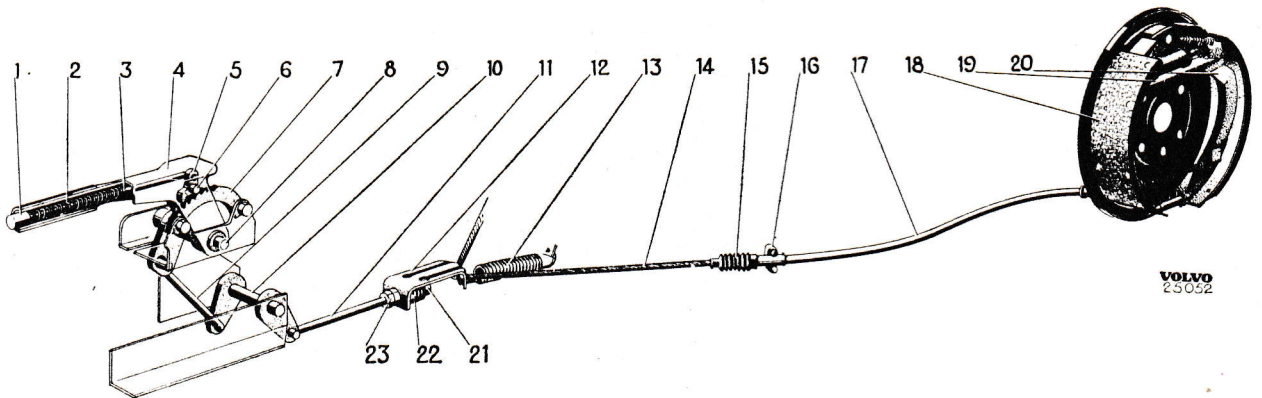


Fig. 7. Handbrake system.

- | | | |
|--------------------|--------------------------|-----------------------|
| 1. Release button | 9. Pull rod | 17. Protective casing |
| 2. Spring | 10. Countershaft | 18. Brake shoe |
| 3. Thrust rod | 11. Pull rod | 19. Link |
| 4. Handbrake lever | 12. Clevis (early prod.) | 20. Lever |
| 5. Ratchet pawl | 13. Return spring | 21. Nut |
| 6. Rivet | 14. Handbrake cable | 22. Spring |
| 7. Ratchet segment | 15. Rubber cover | 23. Nut |
| 8. Shaft | 16. Attaching clamp | |

REPAIR INSTRUCTIONS

FOOTBRAKE

Wheel brake units

Disassembling the front wheel brake units

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

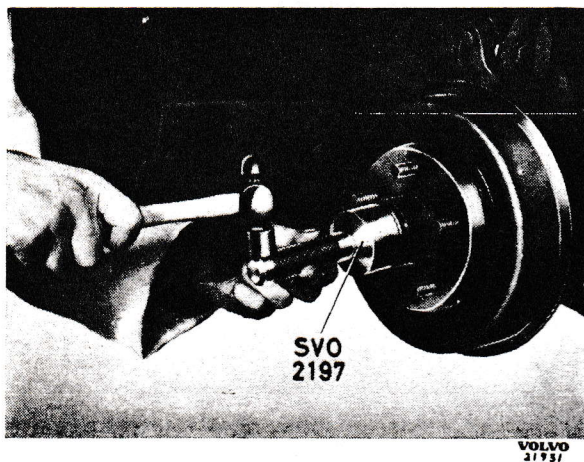


Fig. 8. Removing the grease cap.

2. Remove the grease cap with tool SVO 2197 (Fig. 8). Remove the split pin and castle nut. Pull off the hub with tool SVO 1791 (Fig. 9). If the inner bearing does not come out with it this can be pulled off the spindle with tool SVO 1794 (Fig. 10).

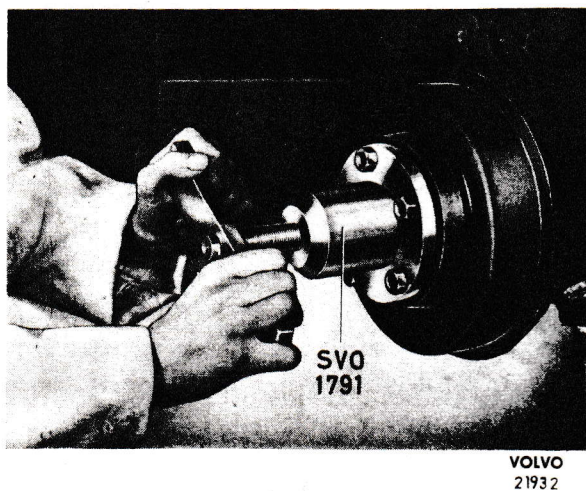


Fig. 9. Removing the hub.

3. Place the clamp SVO 4074 as shown in Fig. 12 so that the plungers in the wheel unit cylinder cannot be pressed out.

Disconnect the locking spring with the help of the brake spring pliers as shown in Fig. 12. Pull the shoes apart and remove the adjusting device. Hold against the guide pin on the backside of the brake backing plate and remove the locking clip. Turn the shoe outwards until the thrust rod from the wheel unit cylinder is released, see Fig. 13. Then turn the shoe inwards until the return spring can be released and the shoe lifted off. Remove the other shoe in the same way.

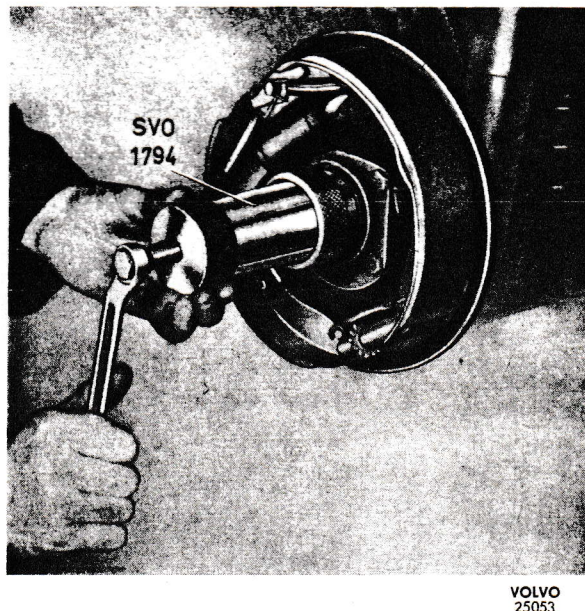
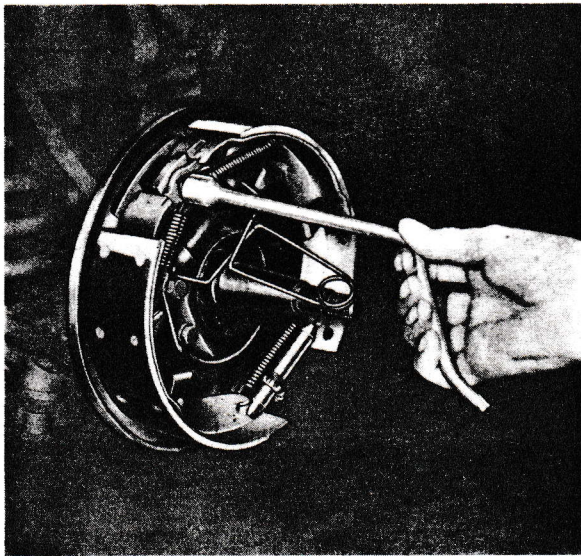


Fig. 10. Removing the inner bearing.

Removing the rear wheel brake unit

1. Apply the handbrake. Remove the hub cap. Remove the split pin and slacken the castle nut and place blocks 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. 9).
3. Place clamp SVO 4074 over the wheel unit cylinder so that the plungers cannot be pressed out. Disconnect the handbrake cable from the lever. The procedure for removing the shoes

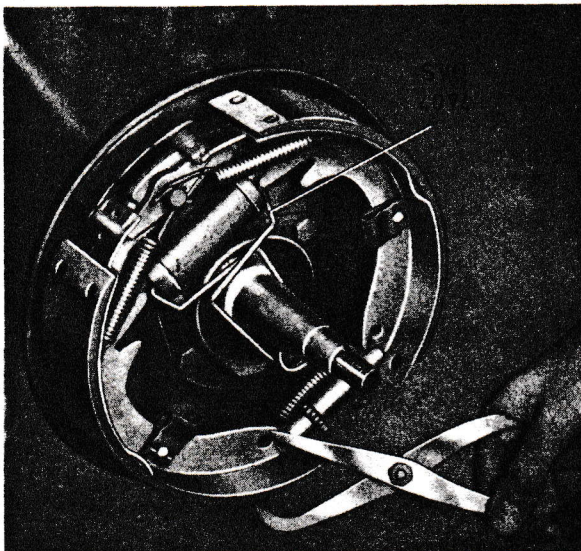


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Fig. 11. Removing return spring with brake spring tool (Snap-on BT 11 or similar).

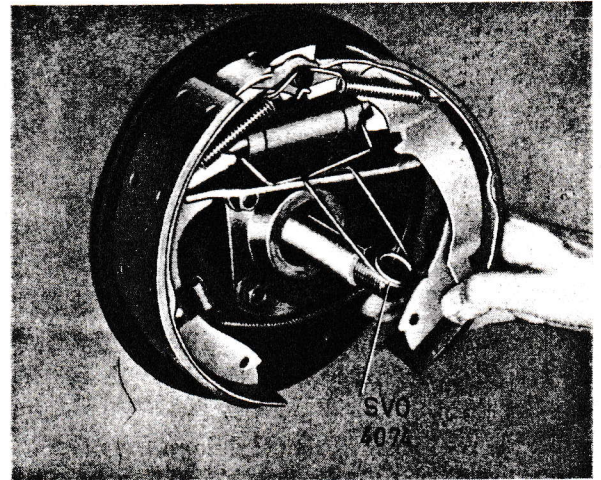
depends on which tool is used. With a brake spring tool as shown in Fig. 11, the two return springs are first disconnected, after which the locking clips are removed and the shoes lifted off together with the adjusting device.

When using the brake spring pliers, the locking spring is disconnected, see Fig. 12. Pull the shoes apart and remove the adjusting device. Hold against the guide pin on the back of the brake backing plate and remove the locking



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Fig. 12. Removing the locking spring.



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Fig. 13. Removing the brake shoe.

clip for the rear shoe. Turn the shoe outwards until the push rod from the wheel unit cylinder and the handbrake link are released, see Fig. 13. Then turn the shoe inwards until the return spring can be disconnected and the shoe lifted off. Remove the other shoe in a similar manner.

Brake drum

The friction surface of the brake drums and radial throw should be checked. Radial throw should not exceed 0.15 mm (0.006"). If the friction surface is hollow, scratched or cracked, the brake drum should be replaced.

Rust spots and small scratches can, however, be polished or ground off.

Replacing brake linings

The car can be equipped with different types of brake lining. The linings can be either riveted or bonded on the shoes, and the primary shoes can have long or short linings, as well as the linings being of different qualities. The latter can be differentiated by the fact that the earlier type is marked with red and green and stamped with 2201 — H8 on the back, and the later type is marked with brown and green and stamped H 3142. *In order to avoid uneven braking effect, both wheels on the axle concerned must have the same type of lining.*

Replacing the brake linings is carried out as follows.

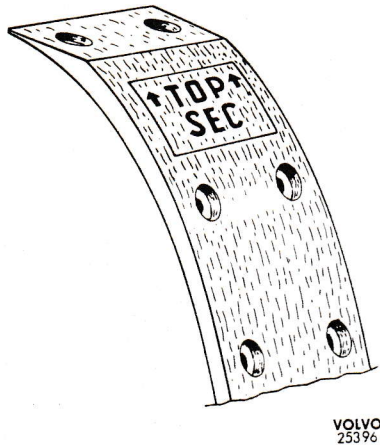


Fig. 14. The front wheel rear brake lining.

Riveted brake linings

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

Fit the ready-made original linings. Note that the rear brake shoes (secondary shoes) on the front wheels are fitted with thicker and eccentrically ground linings which are marked on the wear side as shown in Fig. 14. The thicker (marked section) should face upwards. The shorter primary shoe lining is fitted as shown in Fig. 4 and Fig. 5 respectively.

Use the rivets as listed in the specifications. Start riveting at the middle of the lining and make sure that the lining is in good contact with the shoe along its entire length. Use a rivet press and rivet punches which correspond to the rivet sizes.

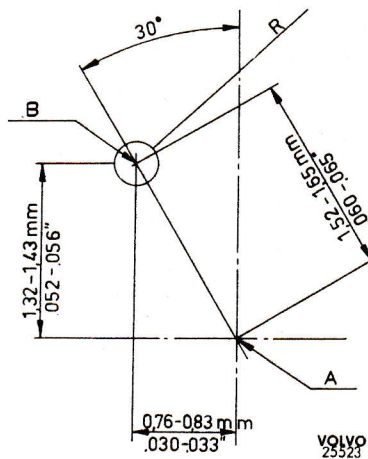


Fig. 15. Eccentricity for rear brake linings on front wheels, riveted model.

- A = Centre of brake shoe
- B = Pivoting centre
- R = Grinding radius

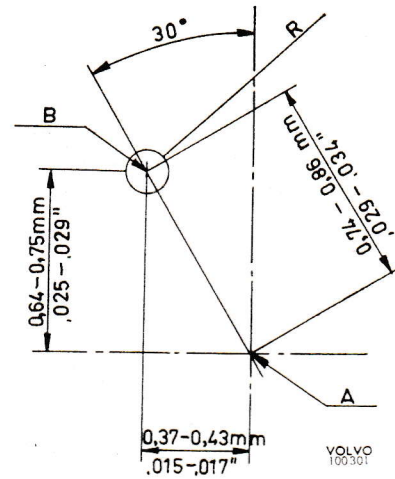


Fig. 16. Eccentricity for rear brake linings on front wheels, bonded model.

- A = Centre of brake shoe
- B = Pivoting centre
- R = Grinding radius

If it is necessary for some reason to grind the riveted linings, a machine which can be adjusted for eccentric grinding must be used for the rear brake linings on the front wheels. The degree of eccentricity is shown in Fig. 15, the grinding radius for all linings being equal to half the diameter of the brake drum decreased by 0.4 mm (0.016").

Bonded linings

The simplest way to replace bonded linings is to fit replacement shoes onto which the linings are already bonded.

If the old linings are to be removed from the shoes, this should be done by using a band grinder. They can also be removed with a chisel, after which the brake shoe should be polished clean with emery cloth. Take care in both cases to avoid damaging the shoe.

The bonding procedure varies with different types of oven and test apparatus so that it is not possible to give a general description. Always follow the recommendations of the bonding compound manufacturer.

When fitting make sure that the lining is correctly located on the shoe as shown in Figs. 17 to 19. On the front wheel rear (secondary) shoes, fit 1/4" linings and 3/16" linings on other shoes.

Use only the bonding compound that is specially made to withstand the high temperatures resulting from prolonged braking.

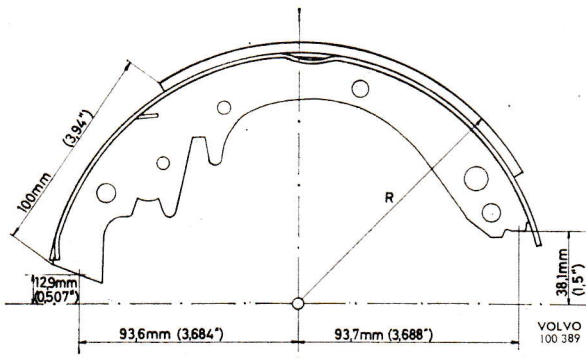


Fig. 17 Adjusting measurements for front brake shoes.

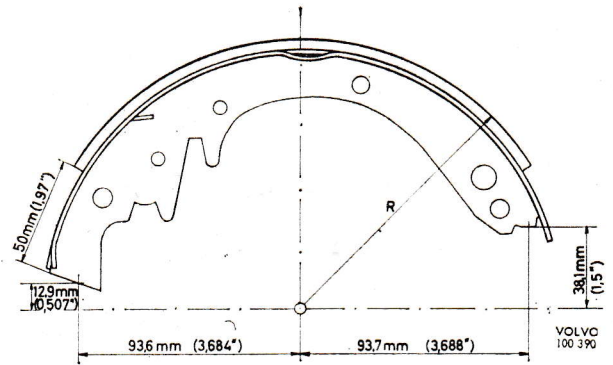


Fig. 19. Adjusting measurement for rear brake shoes on rear wheels.

After bonding, the brake linings must be ground to the correct dimensions.

Since the rear brake linings on the front wheels must be ground eccentrically, the grinding machine used must be of a type that can be adjusted for this type of lining. Different makes of machine are available and, for this reason, the grinding procedure is dependent on the design of the machine. Fig. 16 shows the degree of displacement of the pivoting centre relative to the centre of the brake shoe when grinding an eccentric brake lining. In the case of other brake linings, the pivoting centre coincides with that of the brake shoe.

The grinding radius (R) is equal to half the diameter of the brake drum decreased by 0.4 mm (0.016"). On machines that are graduated for drum diameters, the setting made must be 0.8 (0.032") less than the diameter of the brake drum.

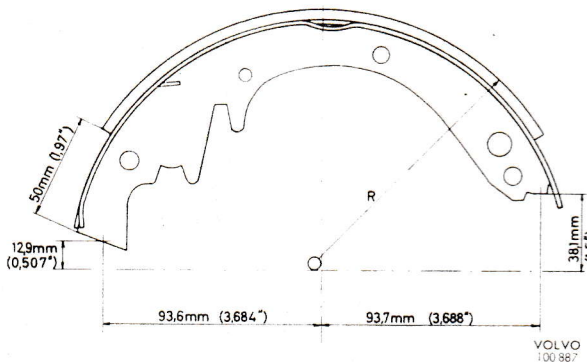


Fig. 18. Adjusting measurements for rear brake shoes on front wheels.

Assembling the front wheel brake units

1. Check and if necessary smooth off the surfaces on the brake backing plate lugs against which the shoes and the centring block slide. Polish the friction surfaces on the brake shoes and the centring block. Smear the surfaces with a very thin layer of heat resistant grease. Fit the centring block (3, Fig. 4) in position with the rounded side facing forward and with the stamped arrow pointing in the direction of rotation of the drum.

There are different models of centring blocks. Both the centring blocks on the axle must be of the same model. On the latest production model there is a spot and an "S" stamped in addition to the arrow. Fit the guide plate (5).



Fig. 20. Fitting the brake shoe.

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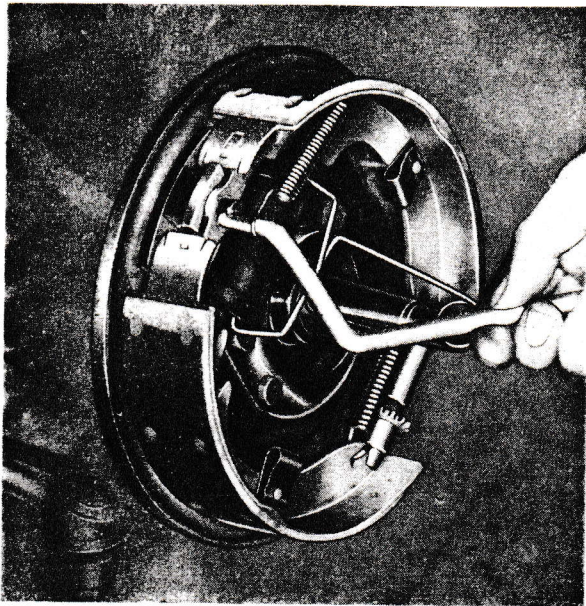
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Fig. 21. Fitting the return spring with the brake spring tool.

2. Hold the front shoe in position 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. 20. Fit the guide pin (8) and the clip (7).

Fit the rear shoe in the same way.

Remove the clamp SVO 4074. Fit the adjusting device and its locking spring.

If a brake spring tool is available, see Fig. 21, the adjusting device and locking spring can instead be fitted first and then the shoes can be placed in position. The locking clips are then fitted and the return spring hooked on by using the pointed end of the tool, see Fig. 21.

3. Check that the springs and locking clips are correctly located, that the linings are free from burr, grease and dirt and also that the thicker end of the lining faces upwards on the rear shoes.
4. If the inner wheel bearing on the front wheels has been removed, fit it in position in the hub.

Pack with wheel bearing grease if necessary. Press in the seal ring by using tool SVO 1798 and standard handle SVO 1801.

5. Fit the hub and brake drum (after it has been cleaned) on the spindle. Fit 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 loosen the nut one third of a turn and lock it. Fill the grease cap with grease and fit it by using tool SVO 2197.
6. Fit the wheel. Adjust the brakes, see under the heading "Adjusting the wheel brakes". Lower the car. Tighten the wheel nuts to a torque of 10—14 kgm (70—100 lb.ft.). Fit the hub cap.

Assembling the rear wheel brake units

1. Follow operations 1 and 2 under the heading "Assembling the front wheel brake units".

Locate the handbrake link with its spring in the front shoe before fitting the rear shoe. Connect up the handbrake cable.

2. Check that the springs and locking clips are correctly located and that the linings are free from burr, grease and dirt.
3. Clean the brake drum and fit it together with the hub, washer and castle nut. Fit the wheel. Adjust the brakes, see under the heading "Adjusting the wheel brakes". Lower the car. Lock the castle nut with the cotter pin after the nut has been thoroughly tightened. Tighten the wheel nuts to a torque of 10—14 kgm (70—100 lb.ft.). Fit the hub cap.

Test driving

When test driving after replacing brake linings, avoid repeated hard braking from high speeds. This can cause overheating and permanent damage to the linings before they are properly worn in. Instead carry out repeated braking at relatively long intervals to allow time for cooling.

Adjusting the wheel brakes

If there is reason to believe that the brake linings are worn out, remove the brake drum for inspection. The adjusting device permits adjustment even if the brake linings are worn down and wear can then damage the brake drum. The brake linings should be inspected regularly after every 10,000 km (6,000 miles) or more often in the case of hard driving.

Adjustment is carried out as follows:

1. Jack up the car and place supports under the control arms and the rear axle. Release the handbrake.
2. Remove the rubber seal. Turn the wheel in its *normal direction of rotation* (not backwards and forwards) while the brake shoes are brought into contact with the drum by using the adjuster screw. Use a screwdriver to turn this screw or a tool as shown in Fig. 22. When the wheel can just be turned by using one hand, stop tightening the screw. Then back off the adjuster screw 12 notches. Fit the rubber seal.

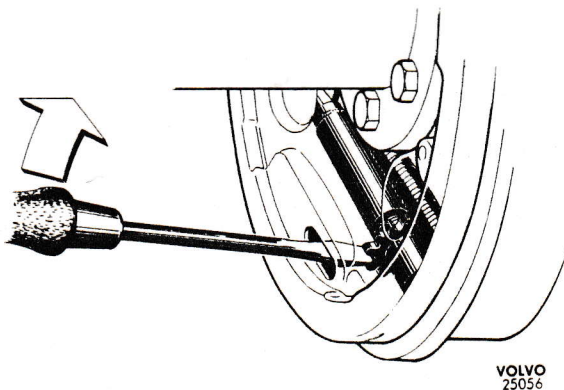


Fig. 22. Adjusting the wheel brakes.

To TIGHTEN FRONT R.H. SIDE

Hydraulic system

Always observe the greatest possible cleanliness when working on the hydraulic system. Wash your hands well with soap and water before cleaning the internal parts. These parts should be cleaned in methylated spirit. Never use petrol (gasoline), paraffin (kerosene), trichlorethylene or alcohol containing benzol.

Use only high grade brake fluid satisfying the conditions laid down in SAE 70 R 3. Avoid spilling brake fluid on the surface finish of the car since it can cause damage.

Master cylinder

Removing

Remove the master cylinder from underneath. Remove the protector plate and disconnect the brake pipeline connections on the cylinder as well as the electric leads for the brake stoplight contact. On late production models there is a separate container for the brake fluid. When removing the master cylinder on this model, first disconnect the pipeline from the brake fluid container and allow the brake fluid to run out into a suitable vessel. Disconnect the link rod from the brake pedal. Remove the two bolts retaining the master cylinder to the body and lift out the cylinder. Avoid spilling any brake fluid.

Disassembling

1. Blow the master cylinder clean externally. Loosen the filler plug and empty out the brake fluid.
2. Pull off the rubber cover (5, Fig. 2) from the master cylinder and remove the push rod (4) with the rubber cover.
3. Remove the plunger (8), the packing (9), the return spring (10) with its valve (11) and the packing (12).
4. Remove the three-way union (1) with the brake stoplight contact.

Inspection

All parts of the master cylinder assembly should be washed in methylated spirit before inspection is carried out.

Examine the cylinder thoroughly internally. There must be no scars, scratches or rust patches on the polished surface. Damage of this type can usually be removed by honing the cylinder. Since this operation varies depending on the tools used, it is not possible to give a general description. Follow the instructions provided by the manufacturer. Clean the cylinder thoroughly after honing and check that the equalizing hole is not blocked.

The clearance between the plunger and the cylinder must not exceed 0.25 mm (0.010") and this can be determined by measuring the diameter of the plunger with a micrometer and the cylinder with an indicator.

The minimum permissible cylinder diameter is 25.25 mm (0.994").

To TIGHTEN L.H. SIDE
Move screwdriver downwards
Engaging panel.

The free length of the return spring should be 75 mm (3").

Each time reconditioning is carried out, all the packings should be replaced by new units. In addition, worn and damaged parts should be replaced.

Assembling

Before assembling, make sure that the two holes between the cylinder and the fluid container as well as the relief hole in the plunger are not blocked.

1. Place the packing (12, Fig. 2) and the valve and return spring (10) in the cylinder
2. Fit the rear packing on the plunger (8). Dip the plunger and packing (9) in brake fluid and then press them into the cylinder. Fit the stop washer (7) in position and fit the locking ring (6).
3. Place the push rod (4) in the plunger (8) and force the rubber cover (5) over the shoulder on the master cylinder. Fit the three-way union (1) with the brake stoplight contact.
4. Check that the equalizing hole is not blocked by inserting a 0.5 mm (0.02") thick wire through the equalizing hole (Fig. 23). It should then be possible to press in the plunger about 0.5 mm (0.02") (measurement A) before the wire jams. Be careful not to damage the pack-

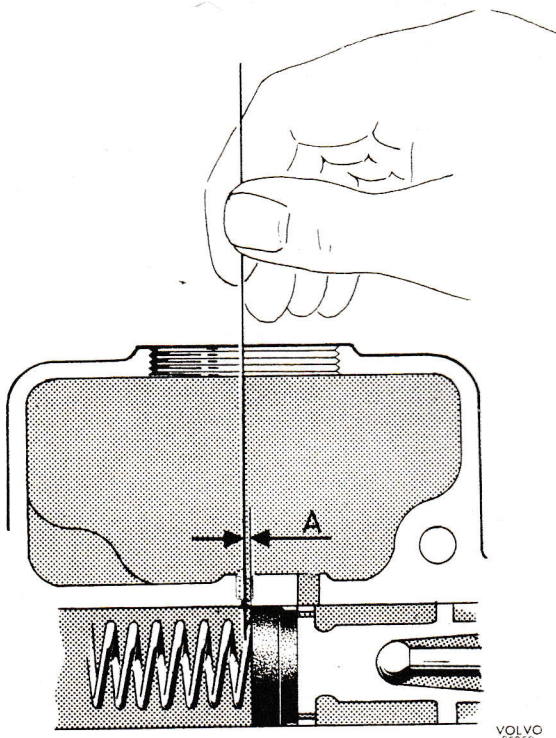


Fig. 23. Checking the equalizing hole.

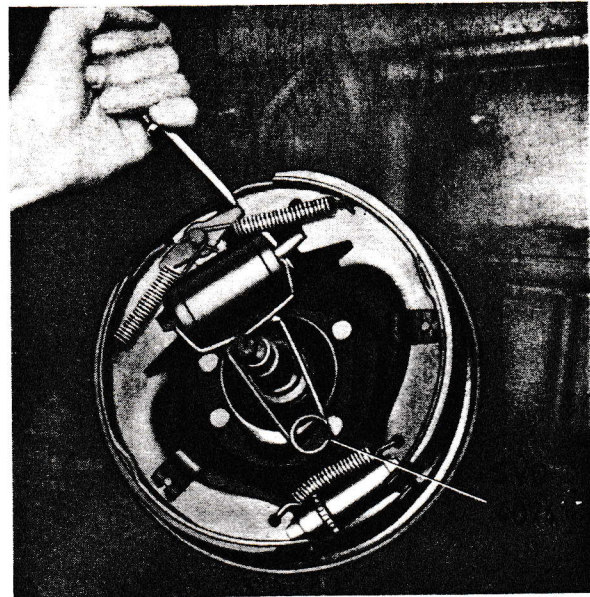


Fig. 24. Removing the wheel unit cylinder.

ing. If the equalizing hole is blocked, this usually means that the master cylinder has been faultily assembled.

Fitting

The master cylinder is fitted in the reverse order to that used when removing.

Fill up with brake fluid and bleed in accordance with the instructions under the heading "Bleeding the brake system".

Check and if necessary adjust the brake pedal free travel. This should be 7—12 mm (1/4—1/2") and adjustment is carried out in accordance with the instructions under the heading "Adjusting the free travel".

Wheel unit cylinders

Removing

1. Remove the hub, see operations 1 and 2 under the heading "Disassembling the wheel brake units".
2. Locate the clamp SVO 4074 over the master cylinder. Move the brake shoes to one side by using a screwdriver so far that the push rods are clear from the shoes, see Fig. 24.
3. Disconnect the brake pipeline and remove the wheel unit cylinder attaching bolts. Remove the wheel unit cylinder by moving it forwards but make sure that no brake fluid gets on to the brake linings.

Reconditioning

Remove the clip, force off the rubber cover (2, Fig. 3) and remove the packings (4) and the spring (5). Wash all the parts in methylated spirit.

Examine the cylinder carefully internally. There must be no scars, scratches or rust patches on the polished surface. Damage of this type can usually be eliminated by honing the cylinder. Since the procedure varies depending on the tools used, follow the instructions supplied by the respective tool manufacturers. Clean the cylinder thoroughly after honing. The bleeding nipple should be removed while this is done.

The clearance between the plunger and the cylinder must not exceed 0.25 mm (0.010") and this can be determined by measuring the plunger diameter with a micrometer and the cylinder with an indicator. If the clearance exceeds 0.25 mm (0.010"), try using a new plunger. If this does not help then the wheel unit cylinder must be replaced.

This clearance can also be checked by using a feeler gauge as shown in Fig. 25. Since this measuring method does not indicate the maximum clearance in the same way, the clearance obtained by measuring in this way should not exceed 0.15 mm (0.006").

Each time reconditioning is carried out, the packings and the rubber casing should be replaced by new units. In addition to this, replace worn and damaged parts.

Assemble the parts in the reverse order to that used when disassembling. Dip the plungers and packings in brake fluid first.

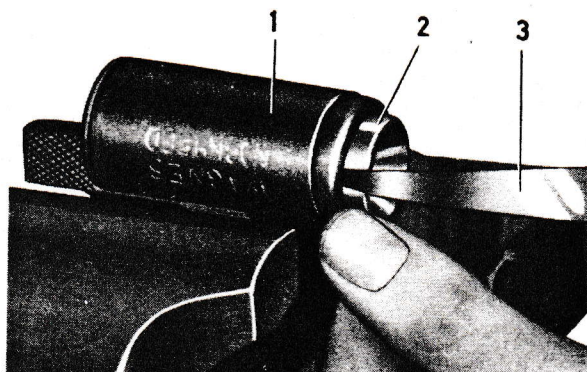


Fig. 25. Checking the clearance.

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

Brake pipelines

The brake pipelines should be flushed through in connection with a complete reconditioning of the hydraulic system.

The pipelines should be disconnected at the wheel unit cylinders and should be flushed through one at a time with brake fluid or methylated spirit. A convenient way to carry out this flushing is to fill the master cylinder and then carry out repeated braking by depressing the brake pedal.

After being flushed through with methylated spirit, all the brake pipelines should be blown clean by using moisture-free filtered compressed air since the methylated spirit can cause gas bubbles in the system and result in a "spongy" pedal movement.

In cases of leakage or when the pipelines have been damaged so that there is a risk of leakage, replace the damaged pipelines by new units. This can be done most conveniently as follows:

1. Remove the damaged brake pipeline.
2. Take a new original brake pipeline, blow it clean internally by using moisture-free, filtered compressed air and then install it. Make sure that the pipeline is positioned so that it is not subjected to chafing while the car is being driven. Particularly important points in this connection include the installation where the pipeline passes the rear spring attachments and also on the rear axle where the pipeline must not be closer than 10 mm (3/8") as well as where the pipeline passes the support arms. If the curvature of the pipe is not correct it must be corrected by hand before being installed. Attempts to bend the pipelines after they have been installed often result in deformation at their attachments.
3. Bleed the hydraulic system.

If no pipelines of the type required are available, they can be made as follows:

1. Cut the new pipe to the required length. Remember that the flaring operation shortens the pipe by about 8 mm (3/16"). The pipe must be cut at right-angles and all burr removed.
2. Place the tool SVO 2049 in a vice. Insert the pipe so far that its end is level with the clamp jaw as shown in Fig. 26. Tighten the nuts.

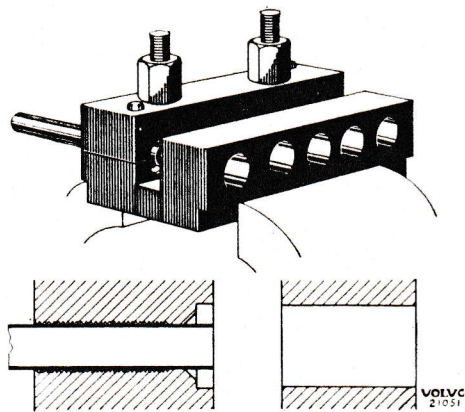


Fig. 26. Flaring brake pipeline.

3. Place drift OP I in the tool. Knock the drift with a copper mallet until the drift bottoms. The end of the pipe is thus flared as shown in Fig. 27.
4. Replace the drift with OP II (Fig. 28) and drive this in until it bottoms.
5. Place on the union nuts and repeat operations 2—5 at the other end of the pipe.
6. Bend the pipe thus made using the old one as a pattern. Bending should be done round an object having the same radius as the bend required.
7. Blow the pipe clean internally and fit it. Ensure that the pipe has such a position that it cannot become chafed during driving. Particularly important points to note are where the pipes pass over the support arm clamps on the rear axle, where they must not lie nearer the clamps than 10 mm (3/8"), and also where they pass the rear springs.
8. Bleed the hydraulic system.

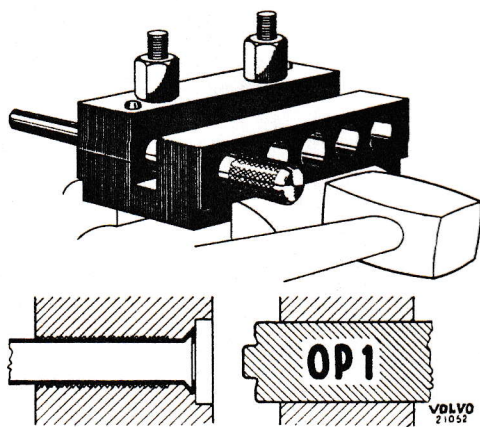


Fig. 27. Flaring brake pipeline.

Bleeding the hydraulic system

The symptoms that there is air in the system are that the brake pedal can be depressed without any considerable resistance or if it feels "spongy".

Bleeding must be carried out after any part of the system has been removed. Air can also enter the system if there is too small a quantity of brake fluid in the container. If, for example, only one wheel unit cylinder has been removed, it is usually sufficient to bleed just this one. If, on the other hand, the master cylinder or lines from this have been removed, then the whole brake system must be bled.

Bleeding the whole brake system is done as follows:

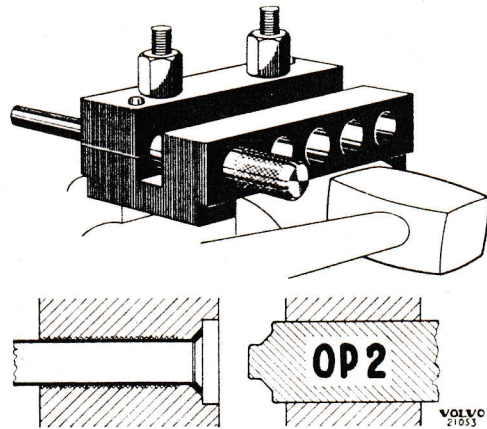


Fig. 28. Flaring brake pipeline.

1. Clean round the filling cap and bleeding nipples.
2. Remove the master cylinder cover with key SVO 2384, or screw off the brake fluid container cap. If necessary, fill up with high quality brake fluid which fulfils the requirements of SAE 70 R 3. On early type master cylinders it is best to use a special filling flask as shown in Fig. 29. When doing this, screw the plug (2) in place of the cover. Push the pipe down through one of the holes in the plug and open the tap (1). The flask will then maintain the fluid at a constant level during the bleeding process.

3. Place key SVO 1431 B with hose on the bleeding nipple and immerse the other end of the hose in a collecting vessel, see Fig. 30.
4. Open the nipple and have someone slowly depress the brake pedal several times. Keep the nipple open as long as air bubbles appear in the fluid which runs out. Then close the nipple while the brake pedal is fully depressed.
5. Bleed the other wheels in the same way. Close the tap on the filling bottle and remove it. Click the gasket and screw on the cover.

A special bleeding device can be used when bleeding which maintains the fluid in the system under positive pressure. In this case the brake pedal is not required to be depressed, so that bleeding can be carried out by one person.

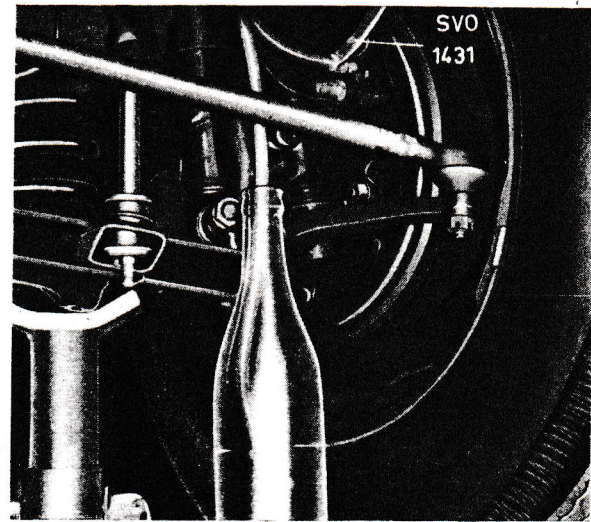


Fig. 30. Bleeding.

Brake pedal

Adjusting free travel

It is important that the brake pedal should have the correct free travel. If this is too small the equalizing hole between the cylinder and the fluid container will be blocked by the plunger packing, with the result that the brake shoes are prevented from returning to their rest position. If the pedal free travel is too great, the effective stroke may be insufficient so that "pumping" must be carried out in order to obtain full brake effect.

Adjusting the brake pedal free travel is done by means of adjusting the length of the link rod (3, Fig. 31). When doing this, slacken the locking nut (2) and turn the thrust rod (1) until the pedal has a free travel of 7—12 mm ($\frac{1}{4}$ — $\frac{1}{2}$ " (measurement (A)). Tighten the locking nut.

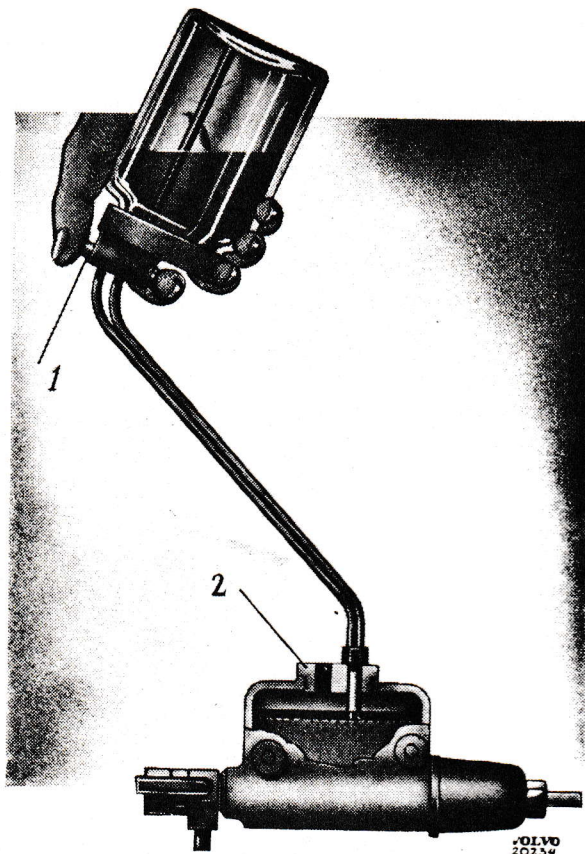


Fig. 29. Filling brake fluid (early prod.).

1. Tap 2. Plug

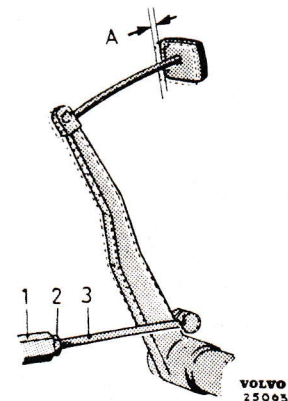


Fig. 31. Adjusting the free travel.

1. Thrust rod 2. Locking nut 3. Link rod

Replacing bushing and shaft

This is done in conjunction with reconditioning the clutch pedal, see Service Manual, Part 2 under the leading "Reconditioning the pedal shaft".

HANDBRAKE

Replacing handbrake cable

Removing

1. Apply the handbrake, remove the hub cap, slacken the wheel nuts and castle nut.
2. Lift up the rear of the car, place blocks under the rear axle and remove the wheel. Release the handbrake.
3. Remove the bolts and the cable outer casing attachment in the brake backing plate. Remove the cable outer casing front attachment and spring. Remove the split pin and release the pull rod (11, Fig. 7). Unhook the cable from the clevis.
4. Pull off the brake drum and hub with puller SVO 1791, see Fig. 9. Remove the cable from the brake shoe lever and pull the cable forwards.

Fitting

1. Insert the cable in the brake shoe and hook it on to the lever.
2. Hook the cable onto the clevis and fit pull rod and split pin. Bolt the cable outer casing attachment to the brake backing plate and bracket, and fit the spring.
3. Place on the hub, brake drum and wheel. Tighten the castle nut and wheel nuts sufficiently for the brake drum and wheel to take up the correct position.
4. Adjust the handbrake. Lower the car and tighten the wheel nuts to a torque of 10—14 kgm (70—100 lb.ft.). Tighten and lock the castle nut. Fit on the hub cap.

Replacing the rubber cover

If the rubber cover at the front end of the cable outer casing has been damaged for any reason, it

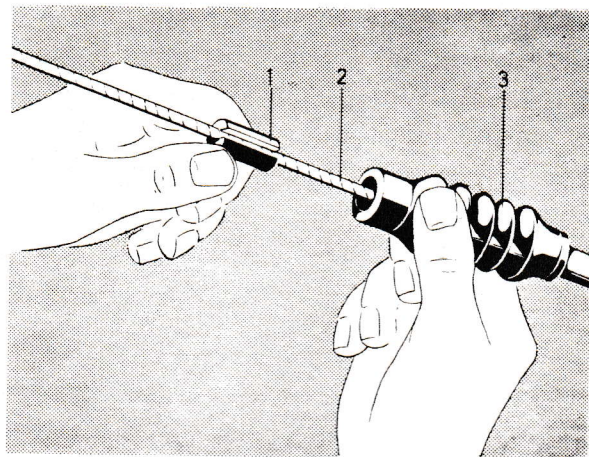


Fig. 32. Fitting the rubber cover.

1. Sealing plug 2. Cable 3. Rubber cover

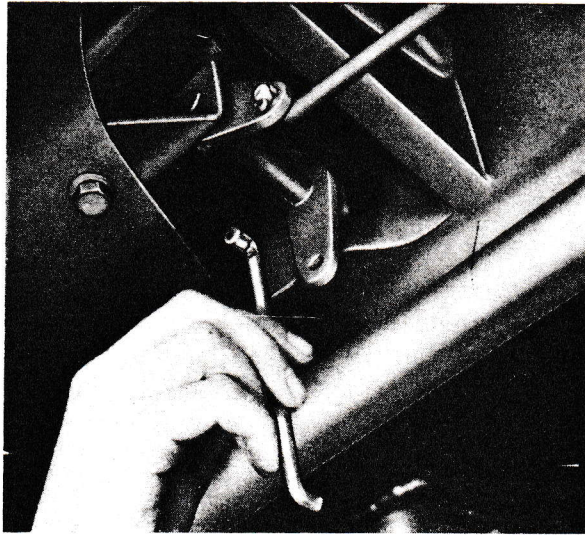
must be replaced, otherwise water and dirt can penetrate into the outer casing and the cable could gradually become rusted up.

For this replacement there is a special rubber cover with sealing plug (part nos. 86850 and 86851 respectively).

When replacing, remove the rear pull rod from the countershaft and unhook the cable from the clevis. Cut off the old casing and place on the new one. Hook the cable onto the clevis and fit the pull rod back in position. Fit the slotted sealing plug (1, Fig. 32) onto the cable (2) and press it into the rubber cover (3).

Replacing the handbrake lever and ratchet parts

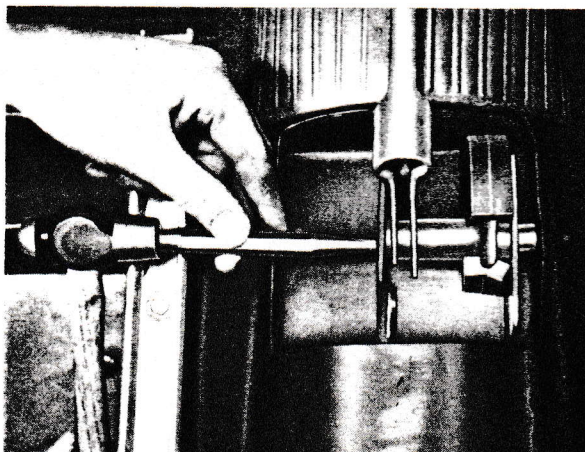
1. Lift up the rear of the car and place blocks under the rear axle.
2. Remove the split pin and draw the cables so that the front pull rod can be released from the countershaft. Then unhook the pull rod from the handbrake lever arm, see Fig. 33.
3. Remove the cover over the handbrake lever attachments. Lift up the mat over the propeller shaft tunnel and remove the ratchet segment. Remove the split pin and knock out the lever shaft as shown in Fig. 34. Pull out the handbrake lever forwards.



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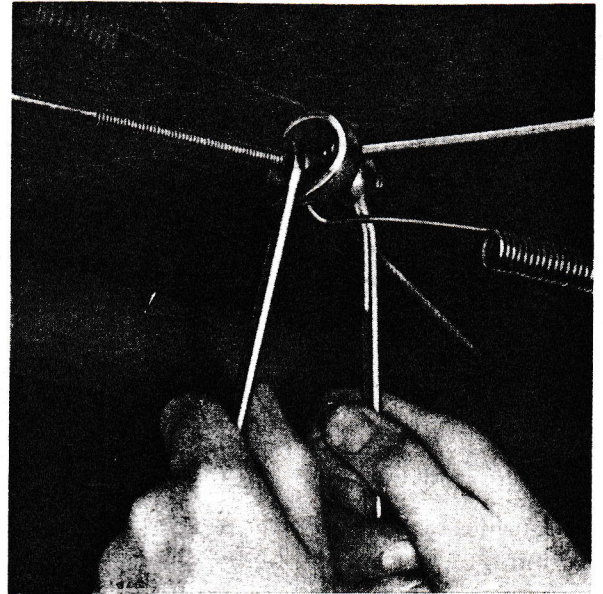
Fig. 33. Removing the pull rod.

4. Screw off the release button (1, Fig. 7) and remove the spring (2) from the handbrake lever. Drill out the rivet (6) and take out the ratchet pawl. In late production, the stop screw and yoke are first removed.
5. Fit the new parts in reverse sequence. Check that the ratchet pawl can move easily after riveting. If a new rubber seal is to be fitted, this should be stuck onto the attaching plate on the tunnel with adhesive. Do not forget to lock the shaft and pull rod with split pins. Check and, if necessary, adjust the handbrake.



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Fig. 34. Removing the shaft.



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Fig. 35. Adjusting the handbrake.

Adjusting the handbrake

1. Adjust the rear wheel brake units as described in points 1—3 under "Adjusting the wheel brake units".
2. Check that the handbrake gives full effect at the 4th—5th notch on the ratchet. If not, adjust the handbrake by moving the clevis on the pull rod as shown in Fig. 35. On late production with a spring on the pull rod, the rear nut is tightened so that the spring just begins to tension.

FAULT TRACING

FAULT

REASON	REMEDY
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No or poor braking effect

Pedal free travel too great. Too little brake fluid in the system. Air in the hydraulic system. Leakage in the hydraulic system. Defective master cylinder. Faultily adjusted brakes. Unsuitable brake linings. Grease or oil on the brake linings.	Adjust free travel. Fill up with brake fluid. Check for leakage. Bleed. Bleed the system. Check and repair the leakage. Bleed. Overhaul the master cylinder. Adjust the brakes. Replace with original brake linings. Replace the linings. Check the sealing ring.
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Car pulls to one side when braking

Grease or oil on one of the brake linings. Different types of brake lining. Unevenly adjusted brakes. Out-of-round or uneven brake drums. Defective wheel unit cylinder. Excessive play in the wheel bearings or faulty front wheel alignment. Uneven tyre pressure. Tyres unevenly worn.	Replace the brake linings. Check the sealing ring. Change to same type. Adjust the brakes. Replace or grind the drum. Overhaul the wheel unit cylinder. Adjust the front end. Adjust tyre pressure. See part 8.
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Brakes grab

Badly adjusted brakes. Moisture on the brake lining. Too large a clearance in wheel bearings. Worn-out brake linings. Oil carbonized on the brake linings. Damaged or loose brake linings. Loose brake backing plate. Out-of-round brake drum. Broken return spring. Wheel brake unit centring block damaged. Uneven sliding surfaces on shoes and centring block.	Adjust the brakes. Apply the brakes repeatedly until the fault disappears. Adjust the bearings. Replace the linings. Replace the linings and repair the leakage. Replace linings. Tighten brake backing plate. Replace or grind the drum. Replace the spring. Replace the centring block. Clean up the sliding surfaces.
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Brakes bind on all wheels

Brakes faultily adjusted. The pedal has too small a free travel and obstructs the equalizing hole. Equalizing hole blocked up with dirt. During very cold weather: poor quality brake fluid.	Adjust brakes. Adjust the pedal free travel. Overhaul the master cylinder. Change the brake fluid.
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Brake binds on one of the wheels

Brake faultily adjusted.
Broken return spring.
Handbrake cable jamming.
Brake pipeline to the wheel blocked or damaged.
Excessive play in wheel bearings.

Adjust the brake.
Replace the spring.
Lubricate or replace the cable.
Clean or replace the pipeline.
Adjust the bearings.

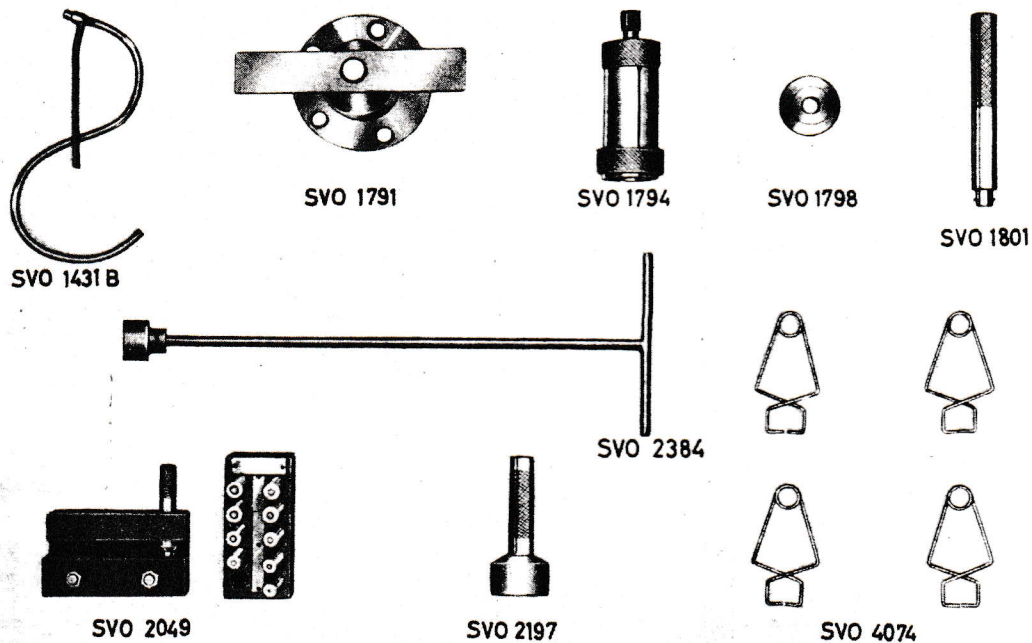
Brakes squeal

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

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 repairing the brake system.



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Fig. 36. Special tools.

- | | | | |
|------------|--|----------|--|
| SVO 1431 B | Key for bleeding nipple. | SVO 2049 | Tool for flaring brake pipes. |
| SVO 1791 | Puller for hub and brake drum. | SVO 2197 | Drift for removing and fitting grease cap for front wheel hub. |
| SVO 1794 | Puller for inner bearing on stub axle. | SVO 2384 | Wrench for master cylinder filler cap. |
| SVO 1798 | Drift for fitting sealing ring in front wheel hub. | SVO 4074 | Spring clamp for wheel unit cylinder. |
| SVO 1801 | Standard handle. | | |

SPECIFICATIONS

Master cylinder:

Internal diameter	1" (25.4 mm)
Clearance between plunger and cylinder.....	max. 0.25 mm (0.010")
Free length of return spring	75 mm (3")

Wheel unit cylinders:

Internal diameter, front wheels	1" (25.4 mm)
" " rear wheels	13/16" (20.64 mm)
Clearance between plunger and cylinder	max. 0.25 mm (0.010")

Brake pipelines:

External diameter	3/16"
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Brake drums:

Diameter, front wheels	228.6 mm (9")
" " rear wheels	228.6 mm (9")
Radial throw, max.	0.15 mm (0.006")

Brake linings, riveted, model I:

Width	2"
Thickness, rear lining, front wheels	1/4×3/16" (ground)
" others	3/16"
Length	250 mm (10")
Effective friction area, total	1016 sq.cm. (157 sq.in.)

Brake linings, riveted, model II:

Width	2"
Thickness, rear lining, front wheels	1/4×3/16" (ground)
" others	3/16"
Length, front shoes	192 mm (7.56")
" rear shoes	250 mm (10")
Effective friction area, total	902 sq.cm. (140 sq.in.)
Rivets for brake linings, size	9/64×5/16" (3.5×8 mm)

Brake linings, bonded model:

Width	2"
Thickness, rear linings, front wheels	1/4×3/16" (ground)
" others	3/16"
Length, front shoes	165 mm (6.3")
" rear shoes	220 mm (8.7")
Effective friction area, total	796 sq.cm. (124 sq.in.)

Brake pedal free play	7—12 mm (1/4—1/2")
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