SERVICE MANUAL

TRUCKS

L 385

Export Service Department

AKTIEBOLAGET
VOLVO
GÖTEBORG . SWEDEN

Control Valve

When the trailer is braked with the hand control, compressed air passes through the control valve connection (1, Fig. 7-22) into the trailer brake line (3). When the truck unit is braked with the foot brake, compressed air passes from the Airpak control valve to the connection (5). The plunger (4) is pushed over to the left and closes the line from the hand control (1) at the same time as the trailer line (3) is exposed and the trailer is braked at the same time as the truck unit.

HANDBRAKE

The handbrake (Fig. 7-23) is of the transmission shaft type with internally expanding brake shoes. It is operated from the handbrake lever through a system of levers and pull rods.

REPAIR INSTRUCTIONS

FOOT BRAKE

Hydraulic System

Removing Wheel Brakes

1. Remove the front wheel hub (see Part 6) or the rear wheel hub (see Part 5).
2. Fit a clamp or lash locking wire on the wheel cylinder unit so that the component parts do not separate and fall out when the brake shoes are removed. Remove the brake shoes by lifting them upwards and outwards.
3. If the wheel unit cylinders are to be removed from the brake backing plate, brake lines and the attaching bolts must be disconnected.
4. Remove the clamp or lock wire used from the wheel cylinder unit and separate the component parts. Remember that the cylinder is filled with brake fluid.

Fitting Wheel Brakes

Fitting is carried out in a reverse order to that used when removing. The brake shoes should be fitted in the following way.

1. Fit one of the return springs in its position on the inside of the brake backing plate,
2. Fit the lower brake shoe in its position and the upper as shown in Fig. 7-24. Fit the other spring. Then lift the upper shoe upwards until it is in position.

After the brake shoes have been fitted their position should be checked and adjusted. This is carried out by using tool SVO 2203 as follows:

1. Adjust the pin in the tool according to the width of the brake lining.
2. Fit the tool on the brake shoes as shown in Fig. 7-25. Loosen the lock nut and adjust the support screw (1) so that the brake lining is in contact with the pin over its complete width. Tighten the lock nut.
3. Turn the tool and adjust the other brake shoe in the same way.
4. Carry out a final check to ensure that both the brake shoes are correctly adjusted.

Master Cylinder

Note. Always exercise great cleanliness when working on hydraulic system. Dirt is removed from the component parts by using clean alcohol. Gasoline or kerosene cannot be used.

Removing:

1. Take out the fuse for the stoplight.
2. Disconnect the cables from the stoplight switch. Disconnect the pipe lines from the master cylinder and the brake fluid container. Let the brake fluid from the container run out into a vessel.
3. Remove the bolt from the push rod. Loosen the attaching bolts and lift out the master cylinder.

Disassembly:

1. Clean the cylinder externally before disassembling.
2. Remove the dust cover (2, Fig. 7-2) and the push rod (17). Remove the lock ring (16) with a screwdriver. Keep the plunger pushed down.
3. Release the plunger and take out the washer (10) and the springs (9). Remove the lock ring and separate the check valve.

Inspection:

After dirt has been removed from the component parts with clean alcohol, they should be carefully examined. Damaged or worn parts should be replaced.

Assembly:

Assembly is carried out in the reverse order to that used when removing.

The plunger with its washers should be dipped into brake fluid before being fitted. After

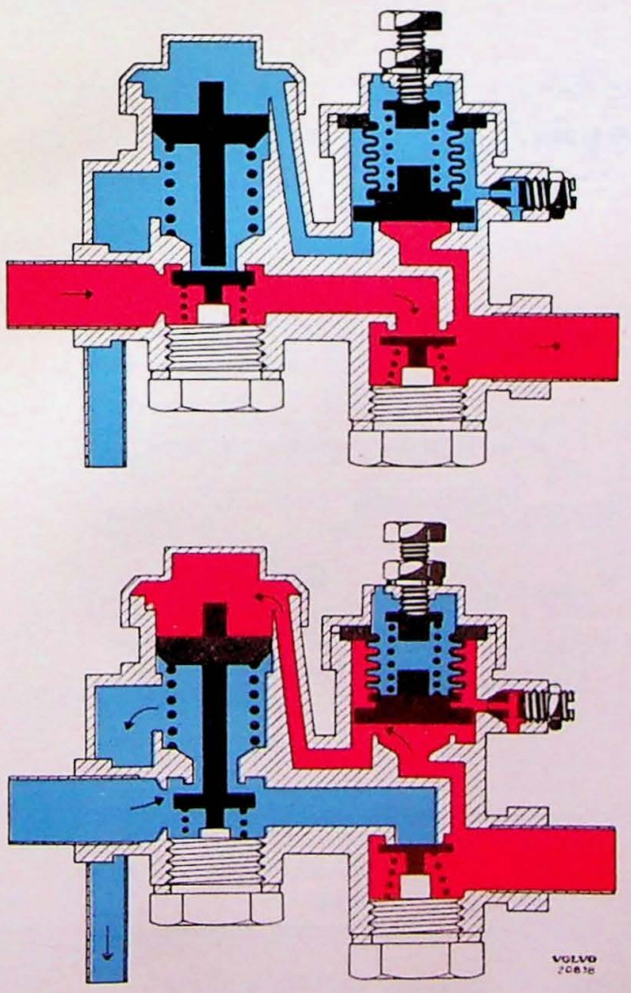


Fig. 7—18. Function of pressure regulator.

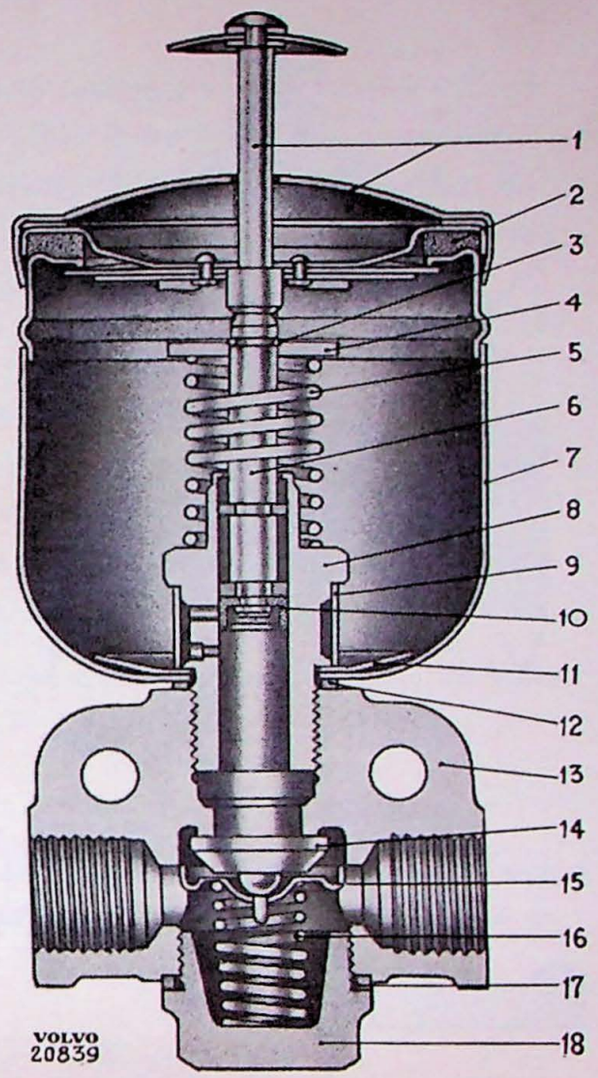


Fig. 7—19. Anti-freeze pump.

1. Cover with push rod
2. Gasket
3. Lock ring
4. Washer
5. Spring
6. Plunger
7. Bowl
8. Pump housing
9. Strainer
10. Plunger gasket
11. Washer
12. Washer
13. Valve housing
14. Valve disk
15. Valve guide
16. Spring
17. Washer
18. Plug

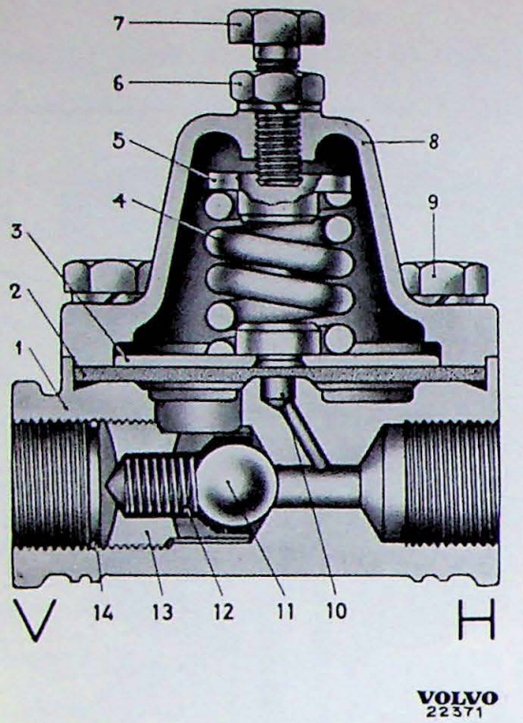


Fig. 7—20. Relief valve.

1. Valve housing
2. Diaphragm
3. Thrust plate
4. Spring
5. Thrust washer
6. Lock nut with spring washer
7. Adjuster screw
8. Cover for valve housing
9. Bolt with spring washer
10. Relief channel
11. Valve ball
12. Spring
13. Screw union
14. Lock ring

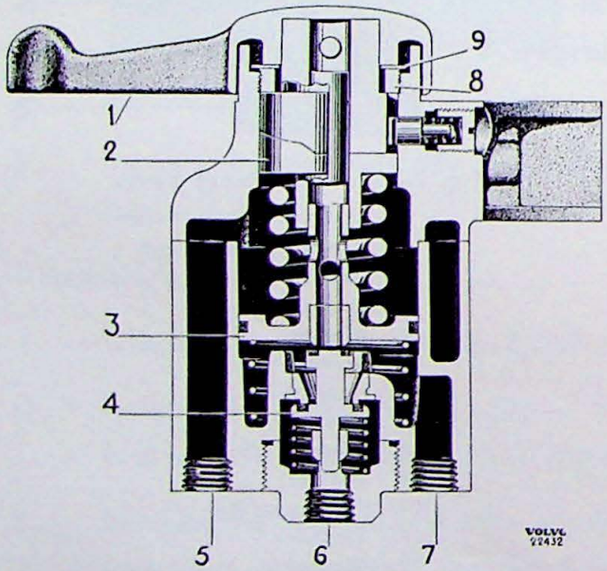


Fig. 7—21. Hand control.

1. Handle
2. Cam
3. Plunger
4. Valve
5. Outlet
6. Connection for compressed air
7. Connection for trailer brakes
8. Adjuster nut
9. Lock washer

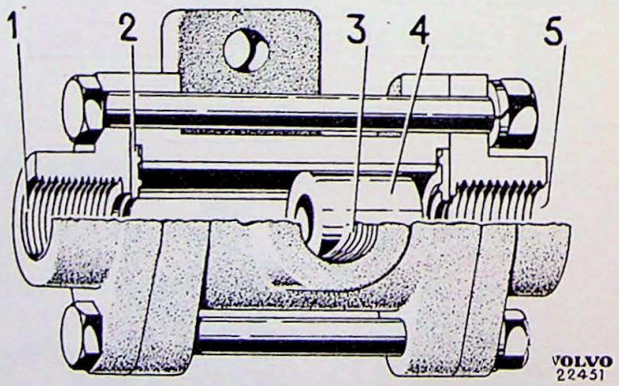


Fig. 7—22. Control valve.

1. Connection for hand control
2. Washer
3. Connection for trailer brakes
4. Plunger
5. Connection for Airpak

assembling check that the equalizer hole is free by inserting a piece of wire 0.5 mm (0.02") thick through the equalizer hole (Fig. 7-26). It should be then possible to push in the plunger about 0.5 mm (0.02" = dimension "A") before the wire jams. Be careful not to damage the plunger washers. If the equalizer hole is not free, then the master cylinder has usually been faultily assembled.

Fitting:

The master cylinder is fitted in the reverse order to that used when removing. When it has been fitted, the brake pedal free play should be adjusted to about 10 mm (1/2"). Make sure first that the pedal stop screw is correctly set. The stop screw should be adjusted so that the pedal goes as far upwards as possible without coming into contact with the floor plate. The extent of the free play is adjusted with the link rod.

Fill up with brake fluid and then air-vent the brake system. Only use first-class brake fluid satisfying the properties laid down in SAE 70 R 1.

Brake Lines

If leakage occurs on the hydraulic system lines or if these have been damaged in such a way that leakage may result, the lines concerned should be replaced. This is done in the following way:

1. Remove the damaged brake line.
2. Cut the new pipe to the required length. The pipe should be cut at right angles and all metallic burr should be removed.
3. The pipe should be flared and this is done with tool SVO 2049. Fit the tool in a vise. Insert the pipe until its end comes level with the clamp shoe as shown in Fig. 7-27. Tighten the nuts.
4. Place the drift OP 1 in the tool. Strike the drift with a copper hammer until it bottoms. The edge of the pipe is then flanged as shown in Fig. 7-28.
5. Remove drift OP 1 and replace it with drift OP 2 (Fig. 7-29) and then strike this until it bottoms.
6. Fit the connection nuts and repeat operation 3 to 5 above on the corresponding end of the pipe.
7. Bend the new brake line using the old pipe as a pattern. Bending should be carried out on a round object with the same radius as the desired curve.
8. Blow the pipe line clean internally and fit.
9. Air-vent the brake system.

Reconditioning the Pedals

See Part 2.

Adjusting the Wheel Brakes

If, when the brakes are applied, the brake pedal goes down too far towards the floor plate, the brakes must be adjusted. Check first through the inspection covers on the brake backing plate and the brake drum that the brake linings are not worn out.

Adjustment is carried out in the following way:

1. Jack up the front part of the truck and put blocks under the axle.
2. Turn the adjuster pin in a clockwise direction (Fig. 7-30) until the brake drum is locked. Then loosen it again until the wheel rotates freely.
3. Adjust the other brake shoes in the same way. Lower the front part of the truck before jacking up the rear part.

If, in spite of the fact that adjustment has been carried out and the brake fluid container is full, the brake pedal still goes down too far towards the toe-plate when the brakes are applied, there is either air in the system or there is some fault on the master cylinder.

Air-venting the Brakes

Before air-venting is carried out, the servo-system must be put out of function, for example by removing the plug in the rear end of the servo-brake cylinder. The servo-device would otherwise work so quickly that a real check of the air-venting would be impossible.

Air-venting is carried out in the following way:

1. Connect an air-venting hose to the nipple on the master cylinder. Let the other end of the hose hang down below the fluid level in a suitable container. Open the nipple and have someone depress the brake pedal repeatedly. Keep the nipple open as long as air bubbles pass out. Then close the nipple while the brake pedal is fully depressed.
2. Air-vent the servo-brake cylinder hydraulic cylinder and wheel cylinders in the same way. Keep the brake fluid container full the whole time. Use brake fluid satisfying the conditions laid down in SAE 70 R 1.

If, for example, only one wheel cylinder has been removed, it is usually sufficient if this alone is air-vented.

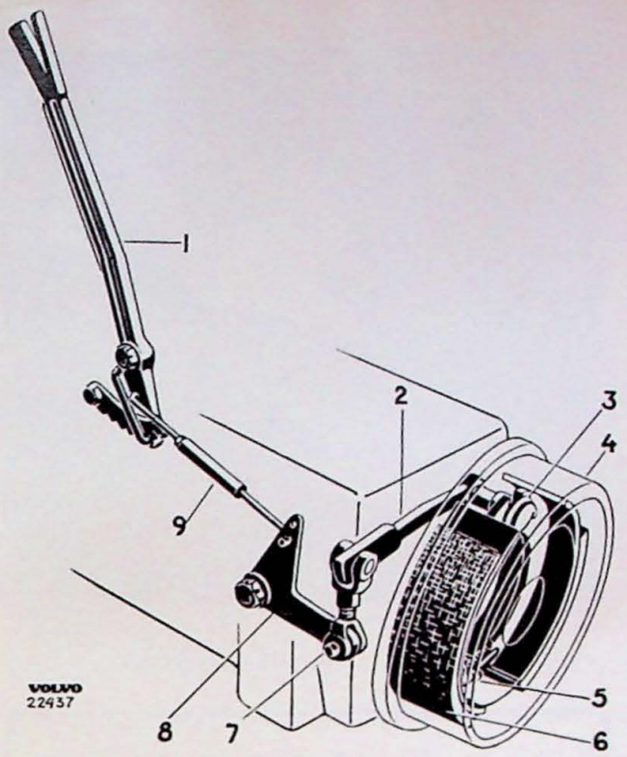


Fig. 7—23. Handbrake.

1. Handbrake lever
2. Lever
3. Brake cam
4. Brake drum
5. Adjuster screw
6. Brake shoe
7. Push rod
8. Right-angle lever
9. Spring pull rod

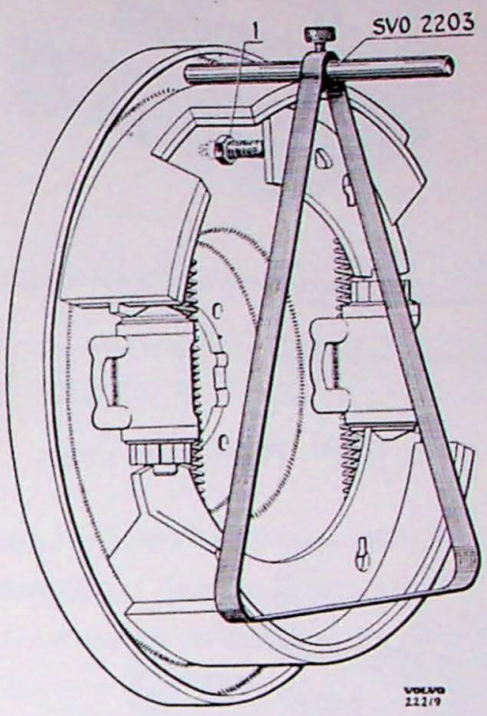


Fig. 7– 25. Checking the setting.

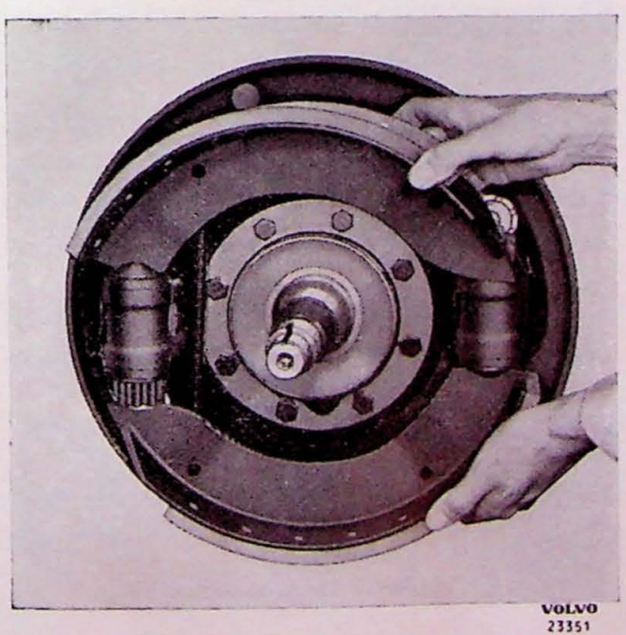


Fig. 7—24. Fitting a brake shoe.

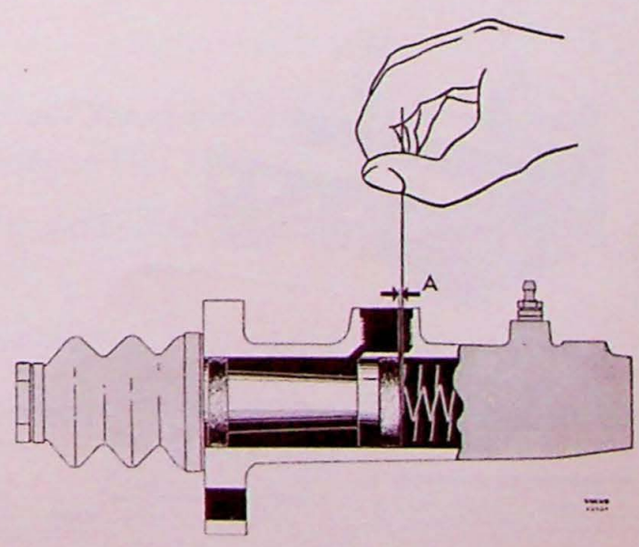


Fig. 7—26. Checking the equalizer hole.

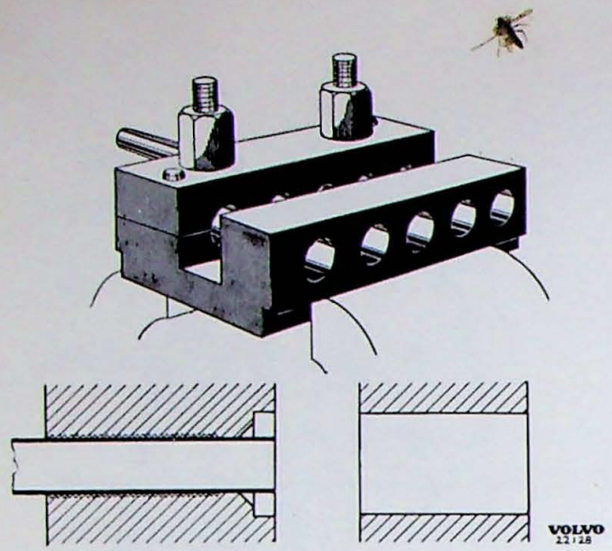


Fig. 7—27. Flaring brake piping.

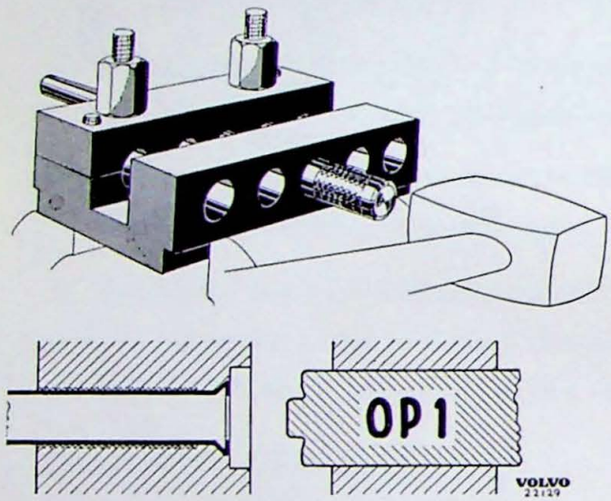


Fig. 7—28. Flaring brake piping.

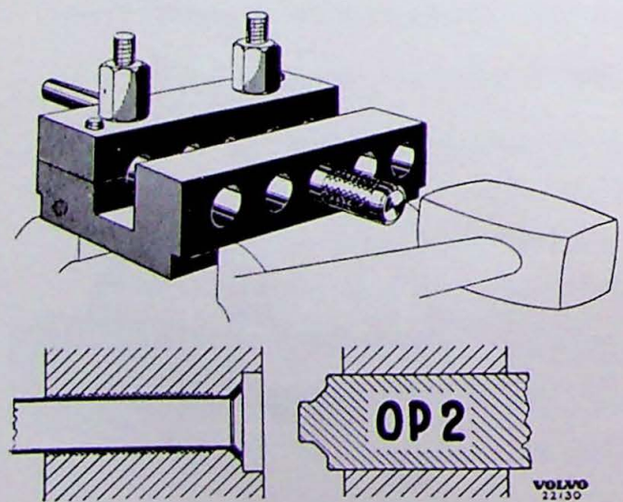


Fig. 7—29. Flaring brake piping.

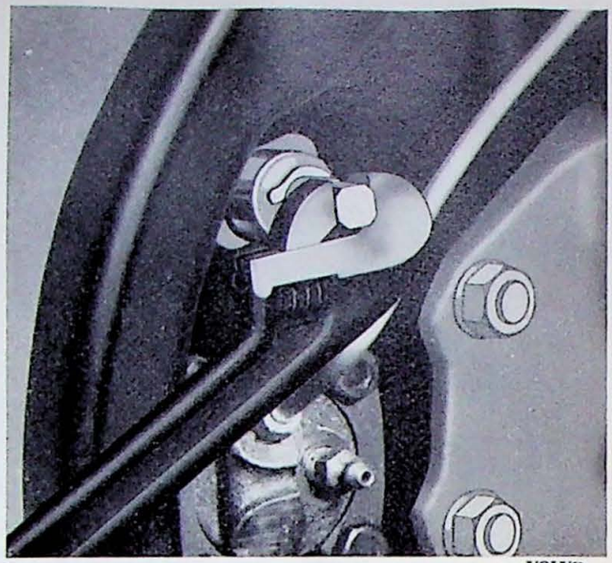


Fig. 7—30. Adjusting the brakes.

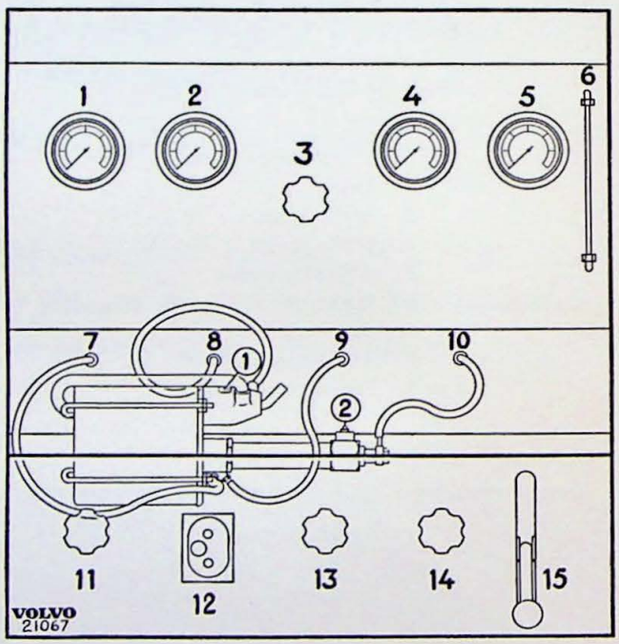


Fig. 7—31. Testing the Hydrovac.

1. Constant vacuum gauge
2. Control vacuum gauge
3. Hydraulic cut-off valve
4. Hydraulic inlet pressure gauge
5. Hydraulic outlet pressure gauge
6. Fluid level gauge
7. Connection for constant vacuum
8. Connection for control vacuum
9. Connection for hydraulic inlet
10. Connection for hydraulic outlet
11. Vacuum valve
12. Switch for vacuum pump
13. Hydraulic inlet valve
14. Hydraulic outlet valve
15. Hydraulic pump

① and ② Air-venting nipples

SERVO-SYSTEM

Vacuum-hydraulic Brake System

Removing the Hydrovac

1. Disconnect the hose connections and the pipe lines from the Hydrovac.
2. Loosen the nuts retaining the Hydrovac on the rear attachment. Loosen the front attachment and lift down the Hydrovac.

Testing the Hydrovac

Before disassembling the Hydrovac it should be tested in a Bendix Hydrovac test bench. Any faults there may be can thus be localized systematically. The Hydrovac is fitted in a test bench as shown in Fig. 7-31. The vacuum lines should not be connected before the pressure cylinder has been air-vented. Air-venting and testing of the Hydrovac is carried out in accordance with the following instructions.

Air-venting the Hydrovac before Testing

Test bench settings for air-venting:

Close the hydraulic cut-off valve (3) and open the hydraulic inlet and outlet valves (13, 14).

The fluid level gauge (6) on the upper part of the test bench at the right shows if there is sufficient brake fluid present for testing.

Air-venting:

There are two air-venting nipples on the Hydrovac. The screws should be opened one at a time in the order shown by the figures in circles on Fig. 7-31.

Loosen air-venting nipple No. 1 and pump until the brake fluid passes out through the air-venting screw.

Tighten nipple No. 1 and loosen air-venting nipple No. 2. Repeat the same procedure.

After air-venting has been carried out, both the vacuum lines are connected as shown in Fig. 7-31.

Primary Tests

These tests are intended to localize any leakage there may be when the Hydrovac is in its rest position. A hydraulic test and a vacuum test are carried out.

Hydraulic test:

Close the hydraulic cut-off valve (3) and open the hydraulic inlet and outlet valves (13,14). Then pump slowly until the hydraulic inlet pressure gauge shows 2 kg/cm^2 (28 p.s.i.). Then stop for 30 seconds. If this pressure sinks it depends on leakage in the end seals on the Hydrovac. See Fault Tracing table, point 4. If the pressure does not sink, close the hydraulic inlet valve (13) and continue to pump until the hydraulic outlet pressure gauge shows 125 kg/cm^2 (1775 p.s.i.). Stop for 1 minute. If the pressure sinks, pump it up and try again. If the pressure still sinks more rapidly than 5 kg/cm^2 (70 p.s.i.) in 1 minute, this depends on hydraulic leakage. Make sure that the hydraulic lines between the Hydrovac and the test bench are not leaking and that there is no leakage through pipe connections. If these are in good order, the pressure drop is caused by leakage in the Hydrovac. See the Fault Tracing table on page 7-39.

Vacuum test:

Start the vacuum pump and open the vacuum valve (11). When the vacuum gauges show 0.7 kg/cm^2 (10 p.s.i.) or more, close the vacuum valve (11). If the vacuum sinks at a more rapid rate than 0.06 kg/cm^2 (0.85 p.s.i.) during 15 seconds, examine to determine whether the vacuum lines between the Hydrovac and the test bench are leaking or if there is leakage on pipe connections. If these are in good order then it is the Hydrovac that is leaking. See Fault Tracing table on page 7-39.

Operating Test

After having tested the Hydrovac in its resting position, an operating test is carried out. This consists of two parts.

1. Check of the hydraulic inlet and outlet pressure at the moment when the control valve opens (the so-called opening point).
2. Check of the hydraulic inlet and outlet pressure when the brakes are fully applied.

The tests consist of comparisons between the values obtained during testing on the hydraulic inlet and outlet pressure in the test bench and the corresponding values in the table on page 7-42.

Inlet pressure and outlet pressure at the opening point:

Close the hydraulic cut-off valve (3) and open the vacuum valve (11) as well as the hydraulic inlet and outlet valves (13, 14).

Both the vacuum gauges (1,2) should show 0.7 kg/cm^2 (10 p.s.i.). Pump up the hydraulic pressure until the control vacuum sinks to about 0.06 kg/cm^2 (0.85 p.s.i.). This shows that the Hydrovac control valve has just begun to open and that the vacuum

plunger moves forward and presses out brake fluid towards the wheel cylinders. Read off the hydraulic inlet and outlet pressures on the test bench gauges (4, 5) and compare these readings with the values shown in the table on page 7-42.

Inlet pressure and outlet pressure when the brakes are fully applied:

Continue to pump up the hydraulic pressure until the control vacuum gauge (2) shows zero. There is then full atmospheric pressure on the pressure side of the vacuum plunger and about 0.7 kgm/cm^2 (10 p.s.i.) vacuum on the suction side. At this point the Hydrovac gives full brake application. Read off the hydraulic inlet and outlet pressures on the test bench gauges (4, 5) and compare them with the value shown in the table on page 7-42.

If these values do not agree, see the Fault Tracing table on page 7-39.

High pressure test:

Continue to pump up the hydraulic inlet pressure to 25 kgm/cm^2 (355 p.s.i.).

Close the vacuum valve (11). If the constant vacuum gauge sinks, this can depend on vacuum leakage.

If the vacuum remains constant (does not sink more than 0.06 kgm/cm^2 = 0.85 p.s.i. in 15 seconds) but the hydraulic inlet and outlet pressures sink, pump up the pressure and try again. If the gauge still sinks, this depends upon hydraulic leakage. See the Fault Tracing table on page 7-39.

Return to rest position:

If all earlier tests have been satisfactory, open the vacuum valve (11) and the hydraulic cut-off valve (3). The hydraulic gauges should then return to O and the control vacuum gauge should show the same value as the constant vacuum gauge.

Check of Relief Valve

1. Disconnect the hydraulic outlet line.
2. Adjust the valves as in the previous tests. Pump up the hydraulic pressure so that brake fluid runs out from the hydraulic outlet connection on the Hydrovac.
3. Then move the hydraulic inlet line from the inlet connection over to the outlet connection. The vacuum gauges should show 0.7 kgm/cm^2 (10 p.s.i.) or more when this is done.
4. Pump up the hydraulic pressure and make sure that brake fluid, as in point 2, runs freely out from the hydraulic inlet connection on the Hydrovac.

If a smaller amount of brake fluid runs out or none at all, this can depend upon the fact that the relief valve is not opening properly. See point 7 in the Fault Tracing table on page 7-39.

Removing the Hydrovac

1. Close the three hydraulic valves.
2. Remove the Hydrovac and clean the test bench.
3. Plug all hydraulic and vacuum connections on the Hydrovac to prevent dirt and dust from coming in.

Disassembling the Hydrovac

1. Release the lock nut (30, Fig. 7-3) and screw out the cylinder (29). Remove the packings (31).
2. If required fit the end of the pressure cylinder in a vise and screw off the pressure cylinder with a fixed wrench on the flat part of the cylinder. Remove the washer (28) and the air-venting nipple (23). Remove the lock ring (27), remember that the washer (26) is spring-loaded. Remove the washer, spring and return valve.
3. Loosen the hose clamps (2) and slide over the hose (1) onto one of the pipes. Loosen the stay (38) and separate the vacuum cylinder.
4. Compress the vacuum cylinder return spring and fit a couple of clamps as shown in Figs. 7-32 and 7-33. Move up the lock spring and push out the lock pin retaining the pressure cylinder plunger to the plunger rod (Fig. 7-33). Remove the clamps and let the return spring expand again.
5. Remove the lock ring from the pressure cylinder plunger and take out the retainer, the spring and the ball. The moveable yoke should not be removed. If the plunger packing is damaged it should be removed from the plunger.
6. If the vacuum plunger packing or any other part is damaged, the nut should be loosened and the parts removed. Since the cylindrical section of the plunger rod is sensitive to scoring, it is best to tension the nut in a vise and then loosen with a fixed wrench on the hex of the plunger rod (Fig. 7-34).
7. Loosen the screws (9, Fig. 7-3) for the control valve cover (20) and remove this, the spring (11), the diaphragm (10) and the washer. Remove the lock ring (16), the washer with the air pipe (15), the packing (17) and the spring (14).
8. Use a 1.1/8" socket wrench and loosen the control valve hydraulic cylinder (6).

Push the plunger (4) out of the cylinder. If required take out the lock ring (8) and the stop washer (7).

9. Remove the lock ring for the plunger rod seal with a small pair of pliers. Remove the stop washers, the retainer (32), the packing (34) and the fiber washer (35). If required drive out the seal ring (36) with a suitable tool.

NOTE. It is not possible to remove the seal ring without damaging it.

Inspecting the Hydrovac

All parts should be thoroughly cleaned before inspection. Parts made of rubber and other parts which come into contact with the brake fluid may only be cleaned with alcohol. Other parts can be cleaned with kerosene or white spirit.

The plunger packing should be soft and undamaged and may not be worn or scored.

The vacuum cylinder may not be dented or distorted in other ways by stones thrown up from the wheels. Neither may it be rusty or scored internally. Slight rust damage or scoring can be polished off by using a fine emery paper or steel wool.

The pressure cylinder should be smooth and free from any unevenness. Slight scoring can be polished off by using a very fine emery paper. If there is any deep scoring, the cylinder should be replaced. The same thing concerns the hydraulic cylinder in the control valve.

The rubber diaphragm in the control valve should be undamaged and soft. If there are the slightest signs of cracks or other defects, the diaphragm should be replaced.

Check the vacuum and air valves. If either of these is faulty, the complete cover with valves should be replaced.

Assembling the Hydrovac

Use new packings when assembling the Hydrovac.

1. Drive in the seal ring (1, Fig. 7-35) with a suitable tool. Fit the fiber washer (2), the packing (3), the retainer (4), the stop washer (5) and the lock ring (6).

2. Fit the stop washer (7, Fig. 7-10) and the lock ring (8) in the control valve hydraulic cylinder (6). Fit the plunger (4) in the cylinder with the drilled end towards the stop washer. Use a new packing and tighten the hydraulic cylinder in the end.

3. Fit the spring (14), the packing (17), the washer with pipe (15) and the lock ring (16) in the control valve cover (20). Fit the packing, the diaphragm (10), the spring (11), and the cover (20). Fit the cover so that the air-venting nipple is

between both the connections on the cover. See Fig. 7-36. Use three guide screws when fitting as shown in Fig. 7-36. These guide screws can be made by sawing the heads off 5/32"-32x1" bolts.

4. The vacuum plunger is assembled in the following way. Drill a 5/16" hole in the work bench and insert the plunger rod in this hole. The various parts of the plunger are fitted on the plunger rod in the order shown in Fig. 7-38. Notice which way the plunger washers are turned.

   The tension band (3, Fig. 7-38) is inserted in the felt packing (2) with the pressed hooks facing upwards. Fit the end of the loop under the hook on the other end of the tension band (Fig. 7-37).

   Put on the nut (7, Fig. 7-38) and tighten it by hand. Lift up the plunger and set the nut in a vise. Tighten with a fixed wrench on the plunger rod hex. Make sure that the plunger rotates with the plunger rod. Otherwise the rubber seal (5) can be severely damaged. Lock the nut by staking. Dip the plunger in Bendix vacuum cylinder oil until the felt packing is thoroughly soaked. Let excess oil run off.

   In order to facilitate assembly of the vacuum plunger, an assembly ring can be used. This is laid over the large plunger plate after which the plunger packing and other parts are inserted in the ring.

5. Fit the ball, the spring, the retainer and lock ring in the pressure cylinder plunger. If a new plunger packing is to be fitted, it is immersed in brake fluid before fitting. Fig. 7-3 shows the way in which the spring and packing should be turned.

6. Put the return spring (39, Fig. 7-3) on the plunger rod (40) with the small end towards the plunger. Insert the plunger rod carefully through the packings in the end. Compress the return spring and fit the clamps on the plunger and end as shown in Fig. 7-33. Dip the pressure cylinder plunger in brake fluid and attach it to the plunger rod with the lock pin.

7. Fit the end section (22) in a vise. Insert the return valve (25), the spring and washer (26). The smaller end of the spring is turned to face the valve. Compress the spring and fit the lock ring (27) in its groove. Screw in the air-venting nipple (23), fit a new packing (28) and then fit the pressure cylinder (29) in the end section.

8. Fit the pressure cylinder packing (31) in the end and fit the packing (31) for the lock nut (30) on the pressure cylinder. Fit the pressure cylinder over the plunger and screw it into the end by hand as far as it will go. The pressure cylinder should then be turned until both the air-venting nipples are in line. In this connection it should be pointed out that the pressure cylinder may not be turned more than half

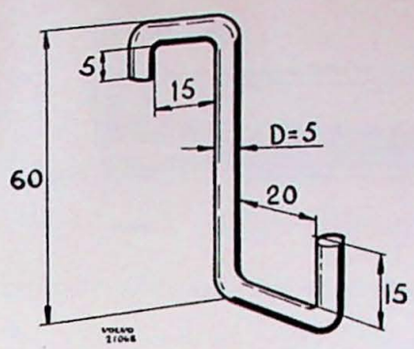


Fig. 7—32. Clamp.

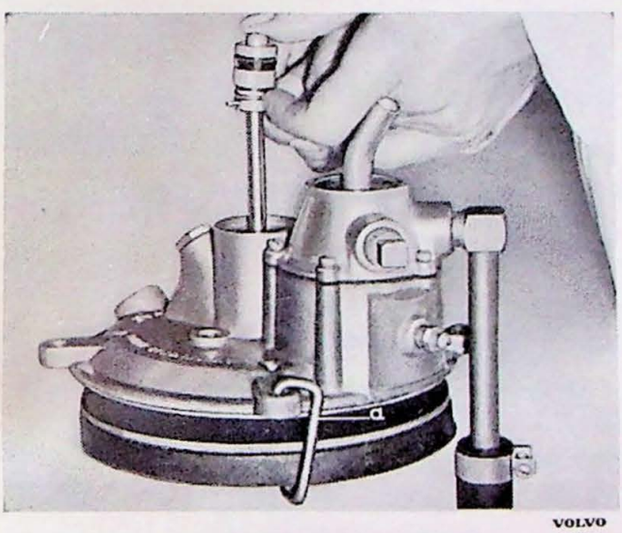


Fig. 7—33. Removing the hydraulic plunger and clamp.

Fig. 7—34. Removing the vacuum plunger.

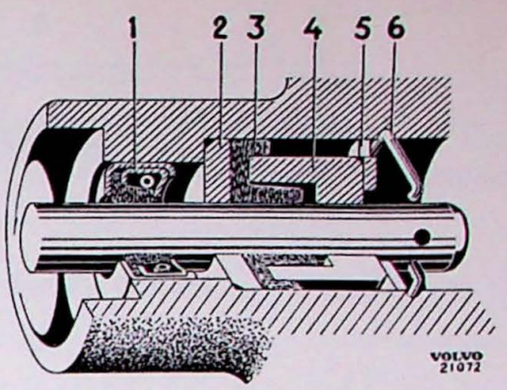


Fig. 7—35. Plunger rod seal.

1. Seal ring
2. Fiber washer
3. Packing
4. Retainer
5. Stop washer
6. Lock ring

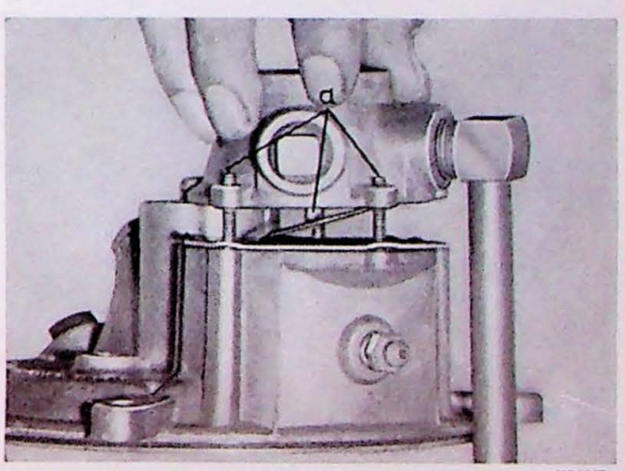


Fig. 7—36. Fitting the cover and guide screws.

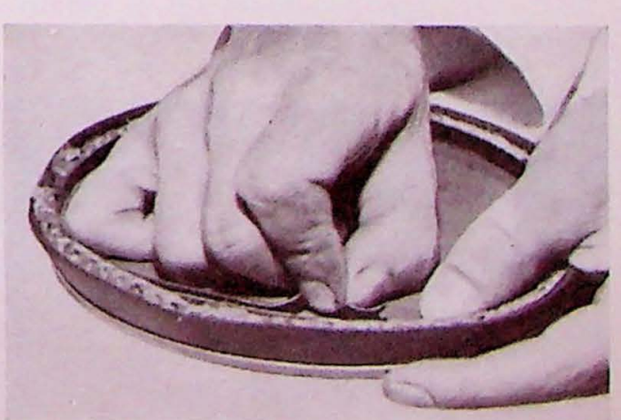


Fig. 7—37. Assembling the vacuum plunger.

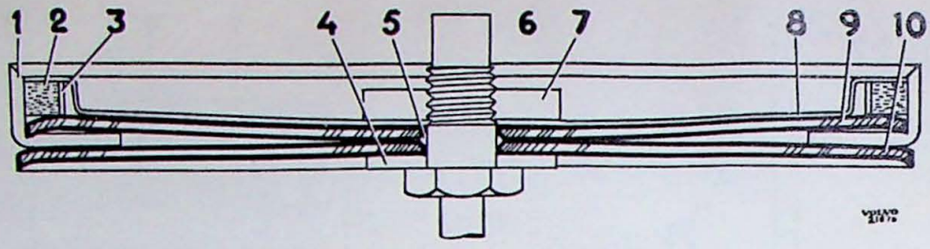


Fig. 7—38. Vacuum plunger.

1. Plunger packing
2. Felt packing
3. Tension band
4. Washer
5. Rubber seal
6. Plunger rod
7. Nut
8. Retainer
9. Small plunger washer
10. Large plunger washer

Fig. 7—39. Assembling the Hydrovac.

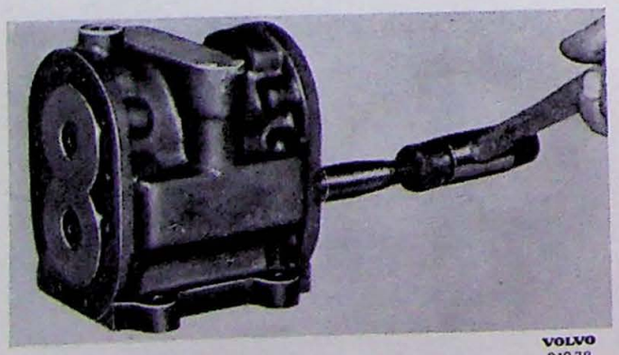


Fig. 7—40. Disassembling the vacuum pump.

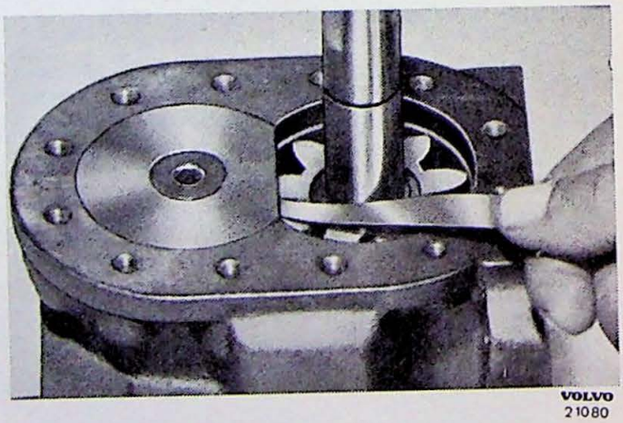


Fig. 7—41. Measuring clearance.

a turn with the wrench. If there is more than half a turn left, it should be loosened instead until the air-venting nipples are in line. Tighten the lock nut.

9. Remove the assembly clamps and put the packing for the vacuum cylinder (41) in the groove on the end. Oil in the vacuum cylinder with Bendix vacuum cylinder oil. Fit the plunger in the cylinder by tipping it as shown in Fig. 7-39. Fit the stay (38) and tighten it evenly all round.

10. After assembly, the Hydrovac should be checked by testing it in a test bench.

Fitting the Hydrovac

The Hydrovac is fitted in the reverse order to that used when removing. Fill up with oil through the plug in the end of the vacuum cylinder. Oil should be filled intil it starts to run out through the lubricating hole. Use vacuum cylinder oil. Air-vent the brake system.

Air Cleaner

The Hydrovac air cleaner should be removed and cleaned after every 10.000 km (6000 miles). If the truck is being run on dusty roads, cleaning should be carried out more often.

Removal is carried out by screwing the complete air cleaner out of the retainer. Disassembly is then carried out by loosening the screw in the cover. If the filter is very dirty, it should be replaced and the other component parts cleaned. When fitting, insert the nets with the bottoms towards each other.

Leakage Test

A leakage test should be carried out every time part of the brake system has been disassembled, otherwise once a month. It is carried out in the following way:

Hydraulic Test

1. With the engine switched off and the vacuum meter indicating zero, the brake pedal should be depressed as far as possible. Keep the brake pedal depressed for a time.

2. Start the engine and run it until a vacuum of 7 meters (275") water column is obtained. Then depress the pedal again as above.

If the pedal goes down to the floor during a test there is some leakage on the hydraulic system. If the pedal sinks with the same speed under both tests, there is probably a leak in the master cylinder, the lines to the Hydrovac or in the Hydrovac itself. If the pedal goes down more rapidly during test 2, there is leakage on the lines to the wheel cylinders or in one of the wheel cylinders.

Vacuum Test

1. Run the engine until the vacuum meter shows 7 meters (275") water column. Stop the engine and read off the vacuum decrease during 15 seconds.

2. Run the engine until the vacuum meter shows 7 meters (275") water column. Depress the brake pedal fully and stop the engine. Keep the brake pedal depressed for 15 seconds and read off the vacuum decrease.

The vacuum system is in good condition if the vacuum decrease is less than 1 meter (39.4") water column during 15 seconds in both tests. If leakage is excessively great during one of the tests, the control valve should be checked. If leakage is great during both tests, the fault is in the check valve or in the vacuum lines. The check valve and the vacuum lines can be checked as follows.

Check of check valve and lines:

Disconnect and plug the vacuum line to the Hydrovac. Then run the engine until 7 meters (275") water column of vacuum has been obtained. Stop the engine and read off the vacuum decrease during 15 seconds. If the vacuum meter sinks more than 1 meter (39.4") water column in 15 seconds, first the lines and then the vacuum tank should be examined. If there is no leakage on these, the check valve should be replaced.

Vacuum Pump

Removing

1. Disconnect the pipe lines from the vacuum pump.

2. Loosen the bolts retaining the vacuum pump on the engine. Lift off the pump.

Disassembling

1. Remove the lock pin and loosen the nut. Remove the pulley using a puller. Remove the key.

2. Loosen the bolts for the ends (1, 5, Fig. 7-10) and separate the parts. If the bushings (9) fit firmly in the housing, strike carefully on the end of the shaft with a soft-headed hammer (Fig. 7-40). The seal ring (10) can be removed if required.

Inspection

All component parts should be carefully cleaned in kerosene or white spirit before inspection.

Examine the gear teeth for wear or scoring. If there is scoring, the gears do not seal

sufficiently for air with the result that the capacity of the pump decreases. Damaged gears should be replaced. See under "Assembling" for gear axial clearance.

The pump housing should not be worn or scored internally.

If the pump housing is worn internally this shows that there is excessively great bearing clearance. The radial clearance of the bearings should normally be 0.02-0.09 mm (0.0008"-0.0035"). If clearance exceeds these values, the bearing bushings and possibly also the shafts should be replaced.

Check that the bearing bushing flanges are not worn. If these are worn then the gears have excessively great axial clearance.

Assembling

1. Fit the seal ring in the end with tool SVO 1224.
2. Fit the rear bearing bushings, the packing (6, Fig. 7-10) and the end (5).
3. Put in the gear (7) with the shafts (3,11). Insert one forward bearing bushing at a time and then measure the clearance between the gear and the bushing (Fig. 7-41). Clearance should be 0.03-0.10 mm (0.0012-0.0039").
4. Fit both the forward bearing bushings. Fit the packing (8) and the end (1). Fit the key, the gear and the nut. Lock the nut with a cotter pin.

Fitting

Fit the vacuum pump in the reverse order to that used when removing. Fill the pump and oil lines with engine oil when fitting.

Compressed Air-hydraulic Brake System

Before any component parts are removed from the brake system, all air pressure must be disposed of. The simplest way to do this is to open the valves on the compressed air reservoir tanks a few turns.

The various component parts in the system can be tested in a special test bench. Various models of test benches are available. Figs. 7-42 to 7-44 show three suitable types of test bench.

Under the heading "Testing" for the units concerned (with the exception of Airpak) there is a table showing test times and test data. The table contains the information which is necessary in order to carry out a test with the above-mentioned test benches. On the connecting diagrams in the tables there are three groups of valves at the top. These refer

to the types of test bench concerned and show how the valves should be set during the test. The following abbreviations are used in the test tables:

B = Bosch. BS = Bosch large test bench. Bl = Bosch small test bench. Bx = Bendix test bench. The sign over "Bs" shows the connection of the test bench filter. Connections for this bench can be otherwise seen from the numbering of the hose connections. For Bx, S means closed and Ö means open. The figures there refer to Fig. 7-44.

Disassembling the Airpak Unit

1. Remove all pressure from the system, loosen the hose connections and pipe lines from the Airpak unit.
2. Loosen the nut retaining the Airpak on the rear mounting. Loosen the forward mounting and lift down the Airpak.

Testing the Airpak

The Airpak can suitably be tested in a Bendix test bench. The lines are connected as shown in Fig. 7-45. Do not connect the air hoses until the Airpak has been air-vented.

Air-venting the Airpak:

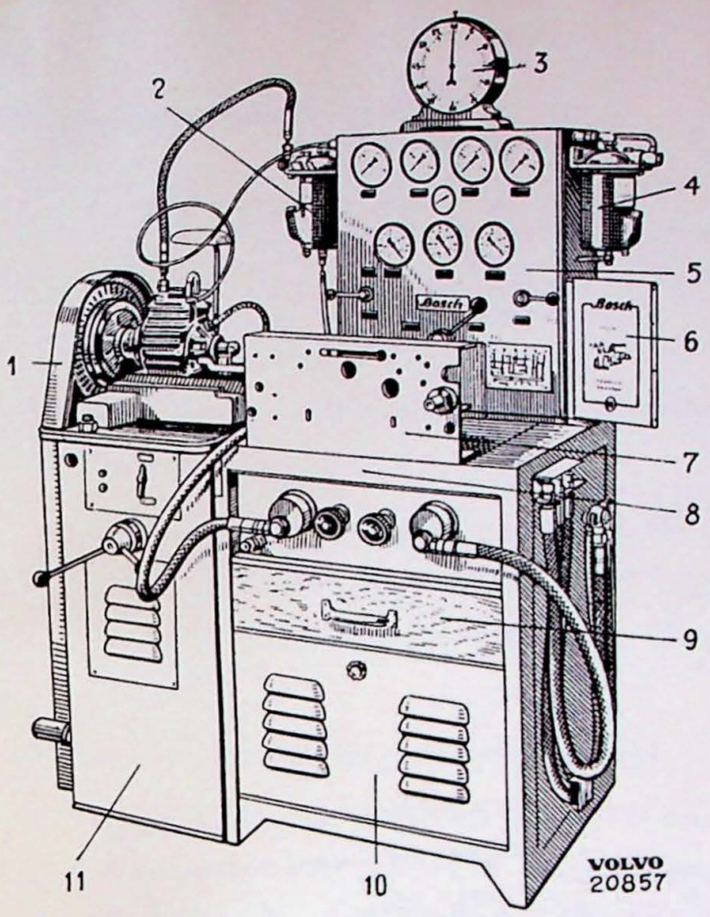
1. Close the hydraulic cut-off valve and open the hydraulic inlet and outlet valves (27 and 28, Fig. 7-44). The fluid gauge (12) shows if there is sufficient brake fluid for testing purposes.
2. Open the air-venting valve on the control valve and operate the hand pump (30) until the brake fluid passing out is free from air bubbles. Close the air-venting nipple.
3. Air-vent the hydraulic cylinder in the same way.

Primary tests:

These tests are intended to determine the extent of leakage when the Airpak is in its rest position. The tests consist of one hydraulic test and one air pressure test.

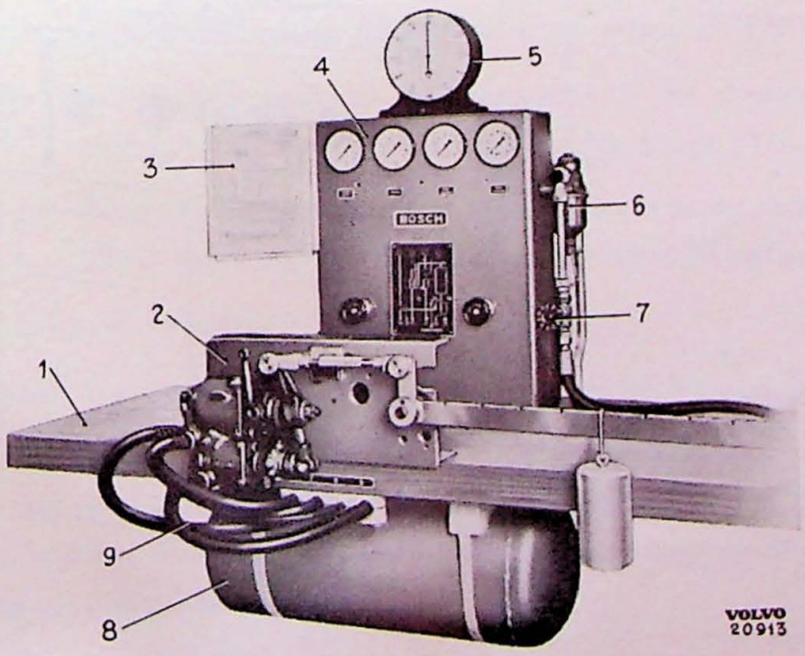
Hydraulic test:

1. With the valve (11) closed and the valves (27) and (28) open, pump slowly until the gauge (9) shows 2 kg/cm^2 (28 p.s.i.). Stop for 30 seconds. If the pressure sinks, this depends on leakage in the connections or in the hydraulic plunger packing.
2. If the pressure does not sink, continue to pump until the outlet gauge (10) shows 125 kg/cm^2 (1775 p.s.i.). Stop for 1 minute. If the pressure sinks, pump up again and stop for 1 minute. If the pressure still sinks this depends on leakage either in the connections or in the hydraulic cylinder. Open the hydraulic cut-off valve (11).



1. Compressor drive gear
2. Oil deflector
3. Stop watch
4. Oil deflector
5. Instrument panel
6. Holder for graphs and tables
7. Angle arms for attachment
8. Bench
9. Drawer
10. Cupboard
11. Drive unit

Fig. 7—42. Bosch large test bench.



1. Bench
2. Mounting plate
3. Holder for graphs and tables
4. Instrument panel
5. Stop watch
6. Filter
7. Cut-off cock
8. Air-reservoir
9. Connecting hoses

Fig. 7—43. Bosch small test bench.

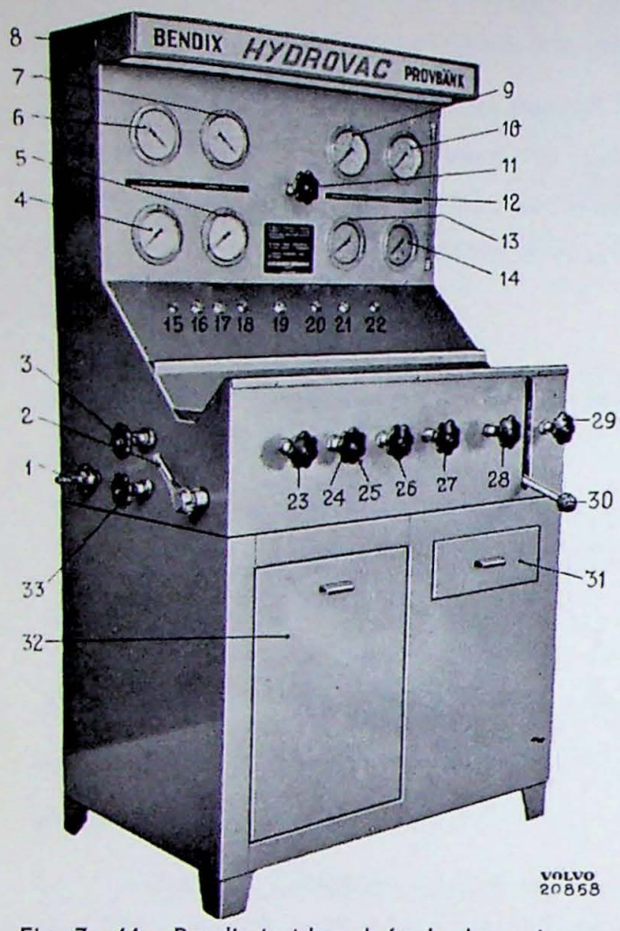


Fig. 7—44. Bendix test bench for brake system.

1. Connection for compressor
2. Compressed air regulator, instrument 2
3. Cut-off valve for compressed air container 4
4. Compressed air gauge No. 1
5. Compressed air gauge No. 2
6. Constant vacuum gauge
7. Control vacuum gauge
8. Switch for lighting
9. Hydraulic inlet pressure gauge
10. Hydraulic outlet pressure gauge
11. Hydraulic cut-off valve
12. Control sight glass for brake fluid
13. Compressed air gauge No. 3
14. Compressed air gauge No. 4
15. Connection for constant vacuum hose
16. Connection for compressed air hose No. 1
17. Connection for compressed air hose No. 2
18. Connection for control vacuum hose
19. Connection for compressed air hose No. 3
20. Connection for hydraulic hose, inlet
21. Connection for compressed air hose No. 4
22. Connection for hydraulic hose, outlet
23. Cut-off valve for vacuum
24. Cut-off valve for compressed air gauge No. 1
25. Switch for vacuum pump
26. Cut-off valve for compressed air gauge No. 3
27. Hydraulic inlet valve
28. Hydraulic outlet valve
29. Cut-off valve for compressed air gauge No. 4
30. Hydraulic hand pump
31. Tool box
32. Inspection cover
33. Cut-off valve for compressed air

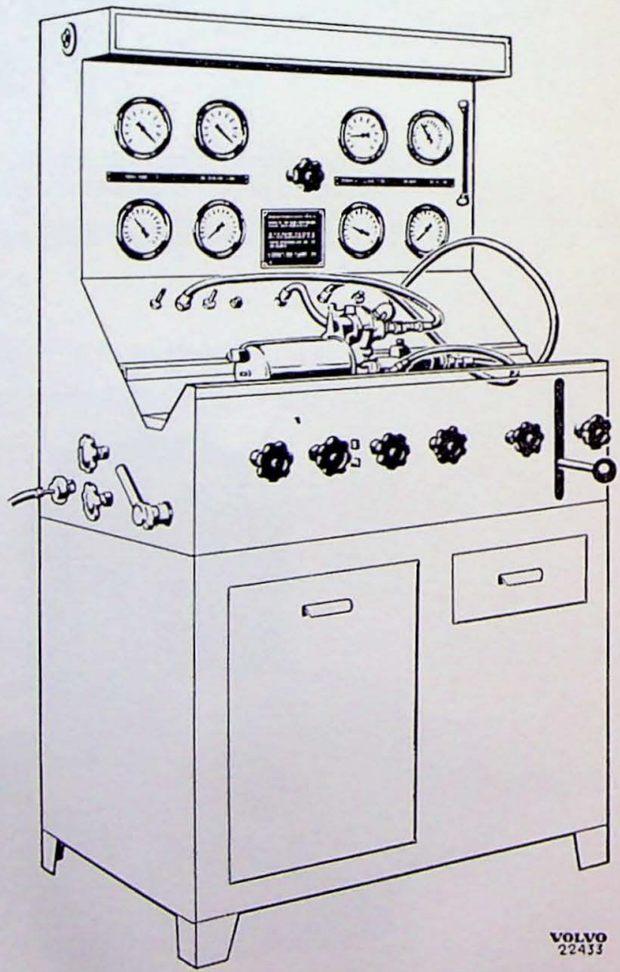


Fig. 7—45. Testing the Airpak.

Air pressure test:

Open the air valve (24) until the gauge (4) shows 6.5 kg/cm^2 (92 p.s.i.) and then close the valve. The pressure should not sink more than 1 kg/cm^2 (14 p.s.i.) in 15 seconds. If it sinks more, the Airpak need reconditioning.

Operating test:

After having tested the Airpak in the rest position, an operating test is carried out. This consists of two parts.

1. A check of the hydraulic inlet and outlet pressures at the moment when the control valve opens (the so-called opening point).
2. A check of the hydraulic inlet and outlet pressures when the brakes are fully applied.

Inlet and outlet pressure at the opening point:

1. Close the hydraulic cut-off valve (11) and open the inlet and outlet valves (27 and 28). Open the air valve (24) until the gauge (4) shows 6.5 kg/cm^2 (92 p.s.i.). Open the valve (26).
2. Pump up the pressure until the air valve in the Airpak just begins to open. This happens when the control gauge (13) begins to show an increase.
3. Read off the inlet pressure. It should not exceed 3.5 kg/cm^2 (50 p.s.i.).

Inlet pressure and outlet pressure when brakes are fully applied:

1. Continue to pump up the pressure until the check gauge shows 6.5 kg/cm^2 (92 p.s.i.), that is to say the same pressure as the gauge (4). The air valve is then fully open.
2. Read off the gauges 9 and 10. The inlet pressure should be 14-15.5 kg/cm^2 (199-220 p.s.i.) and the outlet pressure 105-120 kg/cm^2 (1491-1704 p.s.i.).

High pressure test:

When the valve (24) is closed, air leakage at the above-mentioned pressure should not exceed 2.5 kg/cm^2 (35 p.s.i.) during 15 seconds.

Pump up the inlet pressure to 16 kg/cm^2 (227 p.s.i.). The hydraulic gauges (9 and 10) should not show any noticeable decrease. If they do show decrease, the Airpak unit must be reconditioned.

Return to rest position:

Open the air valve (24) and the hydraulic valve (11) slowly. The hydraulic gauges and the check gauge should then return to 0.

Check of relief valve:

1. Disconnect the hydraulic outlet line. The valves should remain in the same position as the previous test.

2. Operate the hand pump so that brake fluid runs out freely from the Airpak outlet connection.

3. Move the hydraulic inlet line from the inlet connection to the outlet connection.

4. Operate the hand pump and make sure that brake fluid runs out freely from the hydraulic inlet connection as in operation 2 above.

If a small amount of brake fluid runs out or if no brake fluid at all runs out, this depends upon the fact that the relief valve is not opening properly. Remove it.

Disassembling the Airpak Unit

1. Remove the pipe between the control valve and the cylinder. Mark the cylinder and the end as well as the control valve and the end. Remove the large screw plug, packing and spring from the end of the control valve housing. Remove the six bolts in the cover, lift off the housing and take out the return spring, the diaphragm system and the lock washer.

2. When disassembling the diaphragm, the hex nut is clamped in a vise after which the diaphragm rod is removed with the help of a tool in the rod hole.

3. Fit the pressure cylinder end section in a vise, loosen the large lock nut and the compressed air cylinder attaching bolts and remove the cylinder and the compressed air plunger.

4. Fit the large hex nut on the compressed air plunger in a vise. Place the end of the plunger rod in the plunger hole and compress the return spring. Retain the spring in the compressed position by hooking on 2 clamps made in accordance with Fig. 7-46. Remove the hydraulic pressure cylinder from the end. Move up the lock spring and remove the hydraulic plunger lock pin and the plunger. Remove the clamps, the cylinder end return spring and the plunger rod.

5. Remove the lock ring from the pressure cylinder plunger and take out the retainer, the spring and the ball. The moveable yoke should not be removed. If the plunger packing is damaged it should be removed from the plunger.

6. Fit the hydraulic pressure cylinder end section in a vise and remove the cylinder with the help of the flat surfaces on the cylinder. Remove the return valve lock ring but remember that the washer is spring-loaded. Work will be facilitated if a Bendix lock ring tool T-25277 is used. Remove the return valve.

7. Secure the cylinder end and loosen the control valve plunger sleeve with the help of a right-angle wrench. Remove the plunger and packings.

8. Remove the hydraulic pressure cylinder packing from the cylinder end and then take out the lock ring, the lock washer, the packing sleeve, the plunger ring packing and the lock washer. When removing the plunger rod packing,screw a 1/4" pipe thread pin in the packing and then drive it out through the cylinder end while a tool is inserted from the opposite side of the end.

9. If the compressed air plunger packing or any other component part is damaged, the nut is loosened and component parts are separated. Since the plunger is sensitive to scoring, it is best to tension the nut in a vise and then turn the plunger.

Inspection of the Airpak

Before inspection, all parts should be carefully cleaned. Parts made of rubber and parts that come into contact with brake fluid may only be cleaned with alcohol. Other component parts can be cleaned with kerosene or white spirit.

Examine all parts for wear and damage. Damaged or worn parts should be replaced. Be particularly careful when examining the plunger packings.

Assembling the Airpak

Use new packings when assembling. See. Fig. 7-12.

1. Assembly of the compressed air plunger is facilitated by using the assembly ring (Bendix SER 429). Fit the assembling ring on the work bench and then lay in the plunger packing with the folded side upwards and the plunger washer with the concave side downwards. Clip off the lubricating felt to the right length and then lay it in against the inner lip of the plunger packing. Roll up the tension band and fit the inside of the lubricating felt with the grip points upwards and the junction at the formed part of the spring under the clamp which is near the opposite end of the spring. Fit the plunger washer with the recess in the washer above the formed end of the spring. Put the assembly ring with the plunger parts over the threaded center bolt of the plunger and screw on the nut. Tighten the nut by clamping it in a vise and turning the plunger. Avoid damaging the plunger or packing.

2. Fit a new packing and seal ring in the cylinder end. The lip on the seal ring should be turned to face the packing. Fit the guide washer with the bevelled side nearest the packing, the plunger rod packing with the flat side towards the guide washer and the packing retainer with the recessed side nearest the packing. Fit the stop washer and lock ring as well as the outer packing. Dip the plunger packings in

brake fluid and fit them on the control valve plunger with the lips away from each other. Note. The packing which is marked with the red spot should be on the hole side of the plunger. Insert the plunger and packing in the plunger sleeve from the threaded side. Fit the packing and plunger sleeve and then tighten the plunger sleeve with a right-angle wrench. Fit the lock ring.

3. Fit the hydraulic pressure cylinder end section in a vise. Insert the return valve, spring and washer. The narrower end of the spring should be turned to face the valve. Compress the spring and fit the lock ring in its groove. Screw in the air-venting nipple, lay in a new packing and then fit the pressure cylinder in the end section.

4. Fit the relief valve components in the plunger. Dip the plunger packing in brake fluid and fit it on the plunger with the packing lip turned towards the relief valve. Tighten the nut on the compressed air cylinder plunger in a vise. Fit the lock ring end of the plunger rod in the plunger recess and fit the large washer on the plunger rod with the concave side upwards. Fit the return spring with the narrower part towards the washer. Guide the cylinder end carefully over the plunger rod, compress the return spring and hold it in a compressed condition with the help of clamps, Fig. 7-46. Fit the hydraulic plunger on the plunger rod and insert the lock pin. Check that the lock pin is retained in its position by the spring. Slide the hydraulic pressure cylinder carefully over the plunger and screw the cylinder into the end as long as you can by hand. Remove the clamps.

5. Dip the compressed air plunger in Bendix Vacuum Cylinder Oil. Smear the cylinder as well with a thin layer of oil. Fit a new packing in the groove on the cylinder end. Place the plunger on the end of the plunger rod and fit it in the compressed air cylinder. Align the cylinder and end with the help of the marking. Attach the end with bolts, washers and nuts. Screw in the hydraulic pressure cylinder so that the distance from the end section outer part to the end attaching nuts is about 190 mm (7.1/2"). Then align the cylinder so that both the air-venting nipples are in line. Tighten the lock nut.

6. Fit the nut, washer and diaphragm on the diaphragm rod. The flat side of the washer should be nearest the nut and the concave side of the diaphragm should be nearest the washer. Insert the tool through the hole of the rod and tighten the nut. Lay in the spacer washer in the recess in the end with the flat side outwards. Screw in a pair of attaching bolts from the opposite side where they serve as guide pins. Fit the diaphragm onto the bolts and fit the spring with the narrower end towards the diaphragm. Fit the valve housing in accordance with the markings and screw in the attaching bolts and washers. Fit the spring with the narrower side towards the

air valve and screw in the union. Fit the pipe between the control valve and the compressed air cylinder.

Fitting the Airpak Unit

Fitting is carried out in the reverse order to that used when removing. After fitting, fill the compressed air cylinder with oil. This is done by removing the plug in the end of the cylinder and filling Bendix Vacuum Cylinder Oil to the level when oil will run out through the hole. During lubrication, the engine should be switched off and the Airpak unit should be in the released position.

Compressor

Valve Check

Check (cleaning) of valves should be carried out when required or after every 10.000 km (6000 miles).

1. Release pressure on air system.
2. Loosen compressed air pipe at compressor.
3. Remove bolts and lift off cylinder head. Be sure that the cylinder head gasket is not damaged.
4. See pages 7-25 to 7-30 for disassembly, inspection and assembly of cylinder head and valves.
5. Clean top of cylinder block and gasket. See that gasket is not damaged. A damaged gasket must be replaced by a new gasket (of recommended type) 0.7 mm (0.028").
6. Place gasket on cylinder block and bolt down cylinder head. Begin with the two central bolts but do not tighten them before the outer bolts have been partially tightened.
7. Screw the compressed air pipe to the connection marked "Druck". Only metal washers may be used to seal the compressed air pipe.

Oil Inlet Valve Check

Check (cleaning) of the oil inlet valve should be carried out after every 20.000 km (12000 miles).

1. Remove all dirt round oil inlet valve.
2. Loosen oil pressure line and take out the spring (47, Fig. 7-14).
3. Screw out the valve holder bolt (43) from the crankcase. Remove the valve (48).

4. Clean and inspect all components. If any are damaged, replace with new parts.

5. Screw home valve holder bolt. Insert valve. Rotate compressor crankshaft and measure travel of valve. It should be 0.8-1.6 mm (0.0032-0.063"). Fit spring and connect oil pressure line. Check by starting that the connection does not leak.

Replacement of Seal Ring for Crankshaft

1. Loosen pulley belt tensioner and remove belts from compressor pulley.

2. Remove nut (1, Fig. 7-13) and spring washer for belt pulley (2). Remove pulley with help of puller SVO 2002. See Fig. 7-47. Remove key (3).

3. Remove forward cover (5). Use screwdriver. Check that the shaft is not scratched.

4. Replace seal ring (4) in crankshaft cover. Use sealing agent between the cover and the ring.

5. Fit crankcase cover with help of tool V 392.

6. Fit key, pulley and spring washer. Tighten nut.

7. Fit pulley belts and tighten tensioner. When the tension is correct it should be possible to move them about 5 mm (1/5") at a point half-way between the tensioner pulley and the compressor pulley.

Removing the Compressor

1. Release pressure on system.

2. Release belt tensioner and remove belts from compressor belt pulley.

3. Clean thoroughly round the compressed air connection and the oil pressure pipe. Loosen both pipes and insert protector plugs.

4. Loosen the oil overflow pipe.

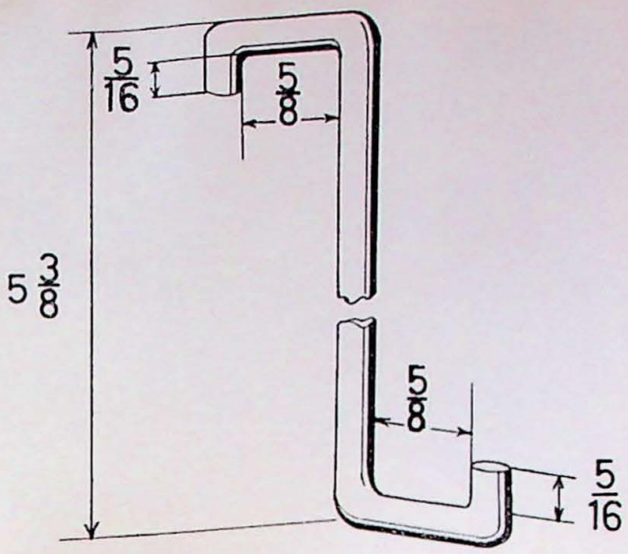
5. Remove the four bolts holding the compressor and lift it up.

6. Clean compressor thoroughly on the outside. Remove the plug (49, Fig. 7-14) and drain remaining oil. Wash compressor house internally with diesel oil.

Disassembling the Compressor

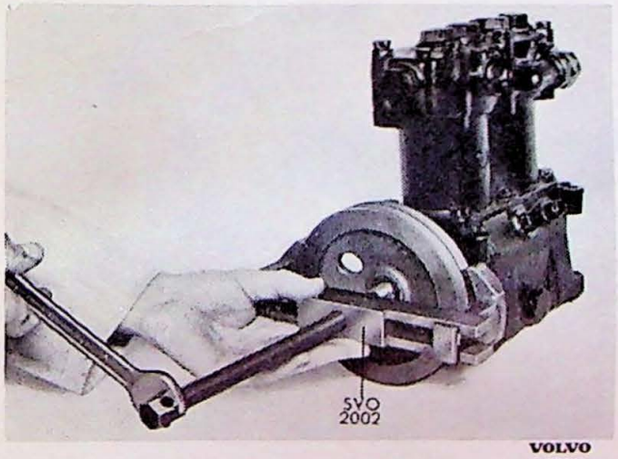
1. Remove nut and spring washer for the pulley and draw off pulley. Use puller SVO 2002 as shown in Fig. 7-47. Remove the key (3, Fig. 7-13).

2. Loosen the six bolts (18) holding the cylinder head and lift off. Make sure that the cylinder head gasket is not damaged. To take apart cylinder head see Page 7-25.



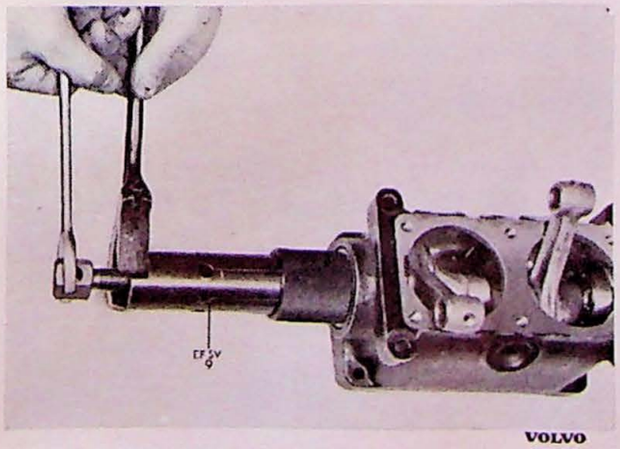
VOLVO
22438

Fig. 7—46. Clamp.



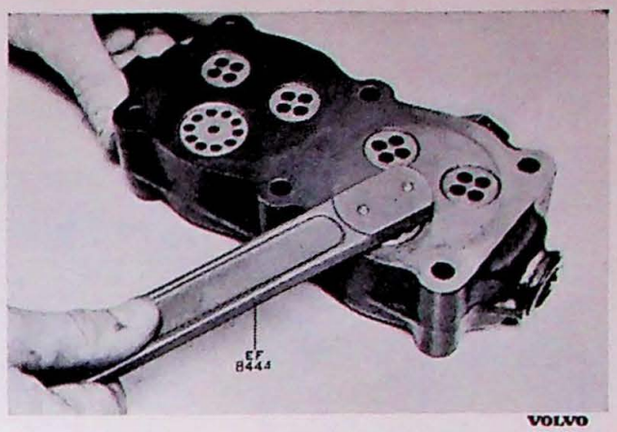
VOLVO
20852

Fig. 7—47. Removing the pulley.



VOLVO
20853

Fig. 7—48. Removing the bearing.



VOLVO
20902

Fig. 7—49. Removing the valve housing.

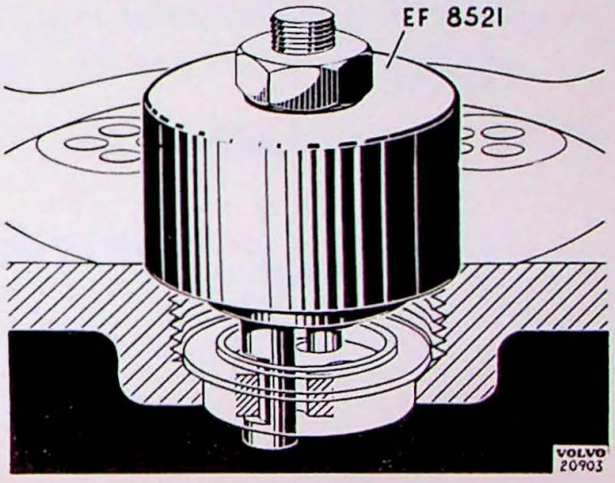
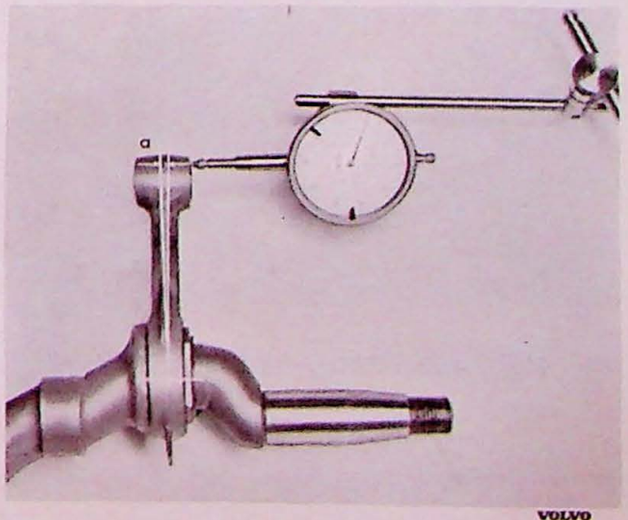


Fig. 7—50. Removing the valve seat.



VOLVO
20905

Fig. 7—51. Checking lateral play.

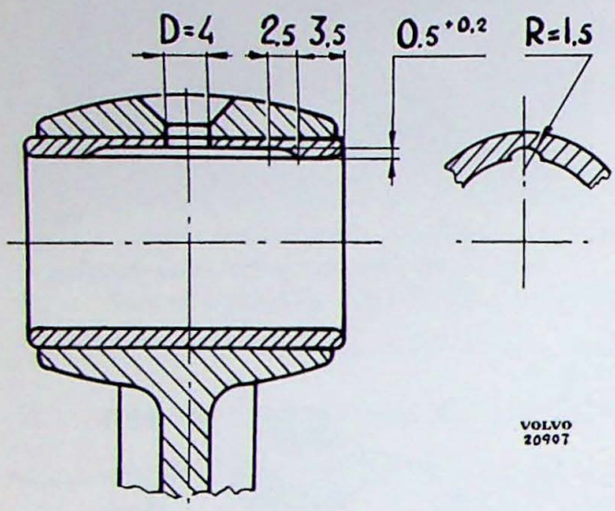


Fig. 7—52. Connecting rod bushing.

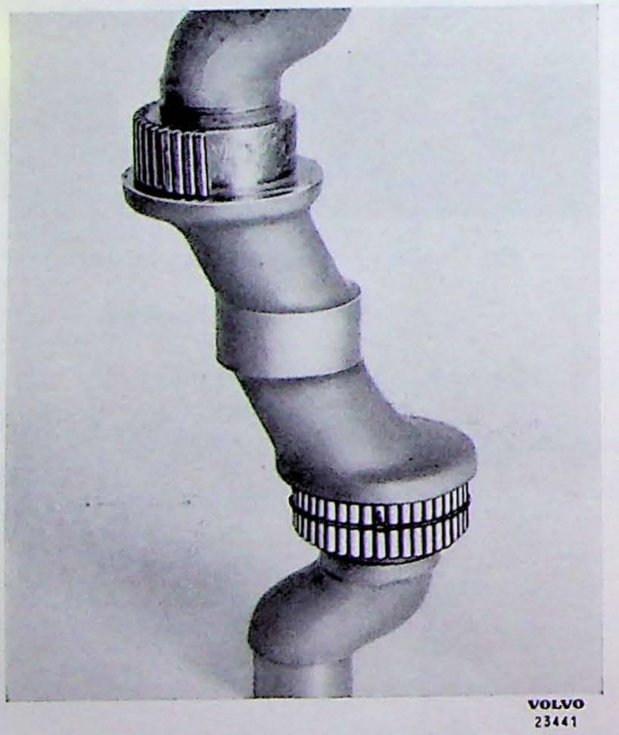


Fig. 7—53. Fitting the needle bearing.

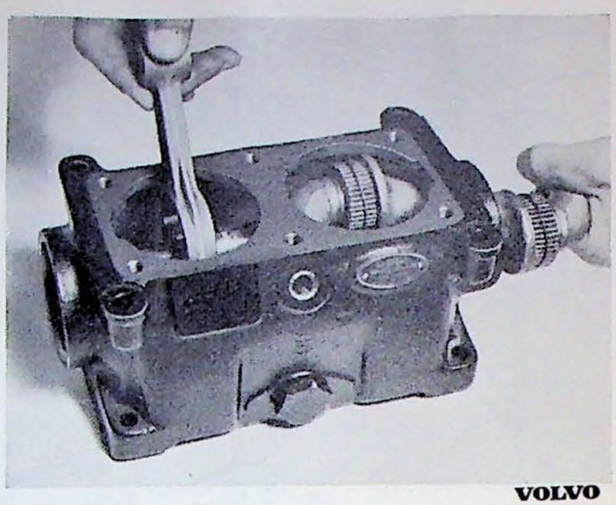


Fig. 7—54. Fitting the crankshaft.

Fig. 7—55. Fitting the cylinder block.

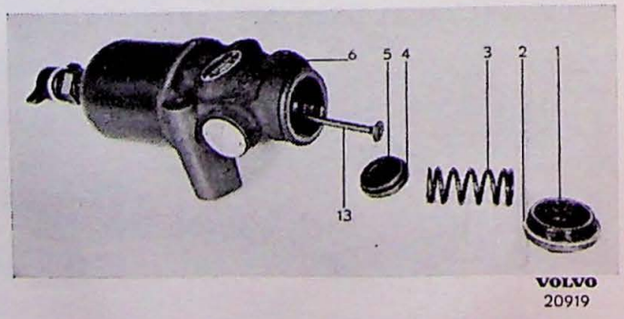


Fig. 7—56. Filter and tire inflation device.

3. Screw out valve holder bolt (43) for oil inlet valve. Disassemble the valve.

4. Mark the front edge of the cylinder with one punch mark and the front edge of the pistons respectively with one and two marks.

5. Loosen the bolts (42) which hold together the cylinder and crankcase. Lift off the cylinder. Take great care that the gasket, pistons and piston rings are not damaged.

6. Remove one lock ring (30) on each piston, press out the piston pins and lift off the pistons from the connecting rods. Mark the front of the connecting rods 1 and 2 with chalk.

7. Remove piston rings from pistons. Place them in order, one on top of the other in the same order that they are removed from the pistons. Use piston ring pliers.

8. Remove the forward cover (5), the rear cover (34) and both lock rings (6 and 37). Use a screwdriver.

9. Apply puller EFSV 9 and draw out the rear and forward ball bearings (35 and 7) as shown in Fig. 7-48. See that the connecting rod ears are not damaged by the projection in the bottom of the housing.

10. Remove the lock ring (38) and the spacer washer (39) for the rear connecting rod. Then lift the crankshaft forwards and the connecting rod (33) backwards. Collect the needle bearing rollers (40). There are 42 of these.

11. Remove the lock ring and the spacer washer for the forward connecting rod. Lift the crankshaft backwards. The forward connecting rod may now be lifted out forwards. Collect the needle bearing rollers. There are 42 of these. Do not mix them with those from the rear bearing.

12. Clean all parts thoroughly with the exception of the cylinder head. Use diesel oil. Clean in order ball bearings, needle bearing rollers, pistons and rings, piston pins and oil valve.

Cylinder head:

1. Loosen screw caps (24) from the cylinder head. Remove the upper springs (25) and valve housing (23) for the outlet valves.

2. Remove valve disk (21) and spring (22) from outlet valve housing by pressing in valve disk and tilting it.

3. Screw out the valve housings (12) for the inlet valves from the underside of the cylinder head. Use tool EF 8444, Fig. 7-49. Remove the springs (13) and the valve disks (14).

4. If required remove the valve seats (19 and 15). Use EF 8521 for inlet valve seat. See Fig. 7-50.

5. Clean cylinder head and valve components thoroughly.

Inspection

Crankcase:

Inspect crankcase for cracks. Cracks can lead to oil leakage and can weaken the compressor mounting. A cracked crankcase must be replaced. Metal washers for the oil drainage plugs to be replaced if damaged.

Ball bearings:

Ball bearings which are so worn that they are obviously loose must be replaced by new. Ball bearings showing slightly tarnished patches on balls and ball races but otherwise undamaged need not be replaced. If there are indentations on balls or ball races, pore marks or other damage on the ball retainers, the bearing must be replaced.

Crankshaft and connecting rods:

Check carefully the connecting rod bearings on the crankshaft as well as rollers, spacer washers, lock rings and the bearing surfaces on the connecting rods. Bearing races should not be dented, cracked, scratched and there should be no oval pressure points. If such damage exists then the crankshaft and/or connecting rod must be replaced. If any of the rollers are broken or damaged in other ways then all the rollers in the bearing in question must be replaced. A whole new bearing can be fitted instead of separate rollers. The lock ring should not be distorted or so stretched that it does not meet properly around the shaft.

After the above-mentioned control and possible replacements, the connecting rods are reassembled with their bearings on the crankshaft. The needle bearing consists of 42 of these rollers which have a diameter of 3 mm (0.118"). Fit the spacer washer and lock ring. Clamp the crankshaft between copper jaws in a vise and check lateral play as shown in Fig. 7-51. The maximum play "a" at the upper end of the connecting rod is 0.6 mm (0.024"). Minimum play should be almost imperceptible (0.1 mm = 0.0042"). If, on the other hand, no play whatsoever may be felt, and this must not be confused with the spring effect due to excessively hard pressure, then the crankshaft bearing race must be polished with very fine polishing paper. If the play is too much then a new set of rollers is tried in the needle bearing. If the desired result is not achieved the connecting rod and possibly the crankshaft as well must be replaced.

Examine the eccentric for the oil inlet valve. Scarred or scratched eccentrics are honed and polished with fine polishing paper. After such an operation the travel of the valve must always be checked. If the travel proves to be inadequate, a new valve stem is used for testing.

Cylinder head and seals:

Forward and rear covers must be tight and should press tightly against the crankcase when fitted. If this is not the case then they must be replaced.

The seal on the forward end of the crankshaft must be replaced if it does not stretch against the shaft or if it has a scarred contact surface.

Oil inlet valve:

The valve must sit tightly on the valve seat in the valve holder. Tightness can be checked by blowing from the inlet side. If it is leaky the valve and seat are ground with fine grinding paste. In the case of more serious damage, valve and/or seat replacement must be effected. Valve travel is measured when the crankshaft is assembled. Travel should be 0.8-1.6 mm (0.032-0.063"). If the travel proves to be inadequate then a new valve stem is used for testing.

Cylinders and pistons:

Slide the pistons into the cylinders one at a time and measure the clearance between the cylinder and the piston in various positions by using a feeler gauge. The clearance at any point may not exceed 0.1 mm (0.004"). If it exceeds this value or if the cylinder is scored then the cylinders are ground to the nearest oversize and new pistons are fitted. Grinding to diameters exceeding 71 mm (2.80") may not be carried out.

Piston rings:

The sliding and sealing surfaces of the rings as well as the edges must be completely free from damage. Rings with pocked, roughened sliding surfaces and otherwise very worn or broken, must be replaced. Make sure that the new rings are the right size. Rings are available in three sizes for cylinder diameters of 70, 70.5 and 71 mm (2.75", 2.77" and 2.79"). The rings should have an end clearance of 0.2 mm (0.0080") and should be checked with the feeler gauge. If clearance is too small, one end of the ring is filed down.

Piston pins and connecting rod bushings:

Examine the piston pins. The best way to do this is to check it at the same time as the connecting rod. Hold the piston firmly when it is fitted onto the connecting rod and try to push the connecting rod lengthwise. The free play here may not exceed 0.1 mm (0.004"). If the play is greater than this value it must be determined whether it is the piston pin that is worn or else the connecting rod bushing. The piston pin is not usually worn at the

ends so that they can be used to check wear in the bushing. If the play is relatively large then it is usually both the bushing and the piston pin which need replacing. See "Replacement of Connecting Rod Bushing" below.

Cylinder head and valves:

Examine the cylinder head carefully. The recess in the cylinder head must be completely free from carbonised oil. If cracked, the cylinder head must be replaced.

Examine valve seats. Those with slight damage on the sealing surfaces are removed from the cylinder and ground. Grinding is carried out with fine grinding paper on a face plate. Valve seats with more serious damage are replaced.

Valve disks are examined with emphasis on dents from the seats. If the dents on any disk exceed 0.2 mm (0.008") then it is replaced. Disks with shallower dents may be reversed and are good for further service. Bent or cracked disks are replaced.

Valve springs must exert the required tension. Springs which have become brittle through overheating, become twisted, "tired" or broken are replaced.

Gaskets:

Check the cylinder head gasket and gasket between the cylinder and the crankcase. If these are in the least damaged and allow leakage of air or oil, they must be replaced by new gaskets of recommended type.

Replacement of Connecting Rod Bushing

1. Press out the old bushing in a press using tool EF 8515/2 and ring EF 8515/3. Press in the new ring. Be careful to see that the connecting rod lies flat and that the bushing does not go crooked.
2. Align the connecting rod in a lathe and turn the bushing to the diameter of the piston pin minus 0.1 mm (0.004") i.e. 15.9 mm = 0.627".
3. Ream the bushing so that a close running fit is obtained between the pin and the bushing.
4. Drill a lubricating hole and form an oil channel as seen in Fig. 7-52. Carefully remove all burr.
5. Check the connecting rods with pistons fitted in a connecting rod aligning apparatus If not parallel, make sure that the connecting rod bushing is true before straightening the connecting rod. A faultily reamed bushing is replaced by a new.

Assembling

1. Fit the plugs (49 and 50, Fig. 7-13) if they have been removed from crankcase. Only metal washers may be used. Place the crankcase on a clean surface.

2. Coat the crankshaft needle bearing races with a thin layer of bearing grease and press into this 42 rollers on each ball race. Assembly is facilitated if a thin metal wire or a rubber band is placed round the rollers as shown in Fig. 7-53.

3. Pass the forward connecting rod into the crankcase according to the marking and lift in the crankshaft through the rear end of the crankcase as shown in Fig. 7-54. Set the connecting rod on the needle bearings and remove the wire or rubber band. Fit the spacer washer and lock ring.

4. Lift the crankshaft forwards and fit the rear connecting rod. Fit the spacer washer (39) and the lock ring (38).

5. Press forward the front and rear ball bearings into position on the crankshaft (bearings 7 and 35). Use tool V 391. Use a firm support for the other end of the crankshaft during this operation.

6. Fit both the lock rings (6 and 37) in front of the ball bearings. Check axial play. This should be 0.45-1.25 mm (0.0177-0.049").

7. Push in the seal ring (4) into the forward cover. Fit the forward and rear covers (5 and 34). Use tool V 392. Water glass is used as sealing agent.

8. Fit the pistons to the connecting rods in accordance with the markings. Smear the piston pins with oil. Fit the lock rings (30) on the ends of the piston pins and ensure that they sit correctly in their grooves.

9. If the piston rings have been replaced but end clearance has not been checked with the rings mounted on the cylinder, this is carried out. See "Inspection".

10. Fit the piston rings. Use piston ring pliers and take care to ensure that the rings are not damaged. Fit the oil ring first and then the three compression rings.

11. Place the gasket (8) on the crankcase. Oil the pistons and rings. Piston ring gaps are arranged so that they are evenly distributed round the piston. None of the gaps should be allowed to come in front of the piston pin recesses.

12. Fit the cylinder block. Use tool EF 8515/1 as shown in Fig. 7-55. Bolt down. the cylinder block onto the crankcase.

13. Tighten the oil inlet valve holder (43) on the crankcase. Assemble the valve (48), the spring (47) and the stud connection (46).

14. Drive home the key (3) in the crankshaft, fit the pulley, the spring washer and tighten the nut (1).

15. Rotate the crankshaft and ensure that it revolves easily in all positions.

Cylinder head:

1. If the valve seats are to be replaced, the new seats are fitted in the cylinder head. Use driver EF 8522.

2. Place the valve disk (14, Fig. 7-13) and spring (13) in the cylinder head. Screw in the valve housings (12) for both inlet valves. Do not confuse the inlet valve springs with the outlet valve springs. Inlet valve springs are weaker and have broader windings.

3. Assemble the outlet valve housing (23), spring (22) and valve disk (21). The valve disk is fitted by tilting it sideways at the same time as it is pressed down.

4. Place the outlet valves in the cylinder head, fit the upper springs (25), tighten the screw caps (24) and washers (26).

5. Place the gasket (11) on the cylinder block and tighten the cylinder head with the bolts (18). Use only gaskets of recommended type. Tighten the central bolts first but do not screw these home until the outer bolts have been partially tightened.

Compressor Testing

After repair work has been carried out, all compressors must be checked by test bench running. Testing consists of mechanical trials as shown in test tables and is intended to check that details correspond to constructional classifications and to ensure that bolts and nuts are properly tightened and fitted with spring washers where required.

Trial running concerns continuous operation and efficiency test as shown in the testing tables below and detection of possible noisy running. The efficiency of the compressor is determined by the time taken to produce a pressure of 10 kg/cm^2 (142 p.s.i.) in an empty reservoir at the given number of revolutions. Abnormal thumps and knocking should not be audible.

Compressor connections during testing are shown by the diagrams in the test tables.

The test tables show the various test sequences to be carried out as well as the test values for these sequences.

Fitting the Compressor

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

Use new washers on the oil valve nipple. The compressed air pipe is attached to the

connection marked "Druck". Only metal washers may be used on this pipe connection. Do not stretch the pulley belts too much. When the tension is correct it should be possible to press in the belts about 5 mm (1/5") at a point half-way between the tensioner pulley and the compressor pulley.

Air Cleaner

The air cleaner is cleaned after every 10.000 km (6000 miles). When roads are very dusty, cleaning of the air cleaner must be carried out more frequently.

Remove the air cleaner from the cylinder by unscrewing. Remove the cap from the cleaner. Wash the cap and filter with clean gasoline. Immerse the filter in engine oil and allow to drain. Re-insert the filter and fit the cap with the air intake downwards.

Filter and Tire Inflation Device

Cleaning the Filter and Container

The filter and container should be cleaned after every 10.000 km (6000 miles). Only the filter and container need to be removed and this is done in accordance with instructions 2-5 under the heading "Disassembling" below.

Removing

1. Release pressure in system.
2. Disconnect screw connections and remove filter.
3. Insert protector caps and clean filter externally.

Disassembling

1. Loosen the screw connection (1, Fig. 7-15) and 7-56) with washer (2) and remove the spring (3), washer (4), valve disk (5) and valve retainer (13). Loosen screw connection carefully since there is powerful spring pressure on it.
2. Loosen the butterfly nut (17).
3. Unscrew the support pipe (15, Fig. 7-15 and 7-57) and separate the outer filter housing (14) from the valve housing (6).
4. Pull the support pipe out of the filter housing and remove the inner filter housing (9) and the filter itself (10).
5. Clean all parts in gasoline.

Assembling

Assembly is carried out in the reverse order to that used when disassembling. Replace damaged or hard gaskets.

After assembly, test the filter device in accordance with the test table, Fig. 7-59.

Fitting

Fitting is carried out in the reverse order to that used when removing. The pipe from the compressor should be connected to the opening marked "L".

Pressure Regulator

Adjustment when fitted in Truck

If the pressure regulator has too high or too low cut-in pressures, it should be adjusted. An increase in spring tension increases and a decrease in spring tension decreases the air pressure value.

1. Start the engine and allow the compressor to build up air pressure.
2. When the pressure regulator has cut in and removed load from the compressor, tramp on the brake pedal a few times so that the pressure decreases. When the pressure regulator cuts in again for charging, the pressure on the air pressure gauge is read off.
3. If this value is higher or lower than 4.8 kg/cm^2 (68 p.s.i.) then pressure on the regulator spring (21, Fig. 7-16) is adjusted by means of the set screw (24).
4. When the cut-in pressure has been adjusted as above, then the cut-out value is read off. This should normally be about 5.3 kg/cm^2 (75 p.s.i.). Permissible maximum is 5.6 kg/cm^2 (79 p.s.i.) and the permissible minimum is 5.0 kg/cm^2 (71 p.s.i.). If too high or too low values are obtained or if the cut-in pressure cannot be adjusted to 4.8 kg/cm^2 (68 p.s.i.) then the pressure regulator is disassembled, cleaned and tested.

Removing

1. Release pressure in system.
2. Remove pipe unions, lift out pressure regulator.
3. Set in protector plugs and wash pressure regulator thoroughly externally.

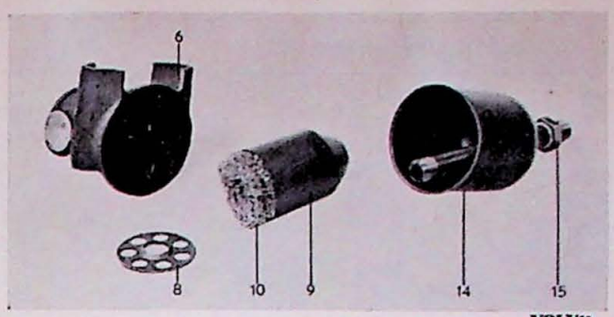
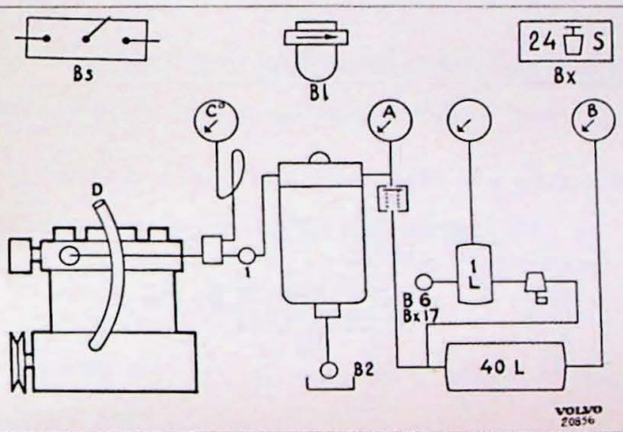


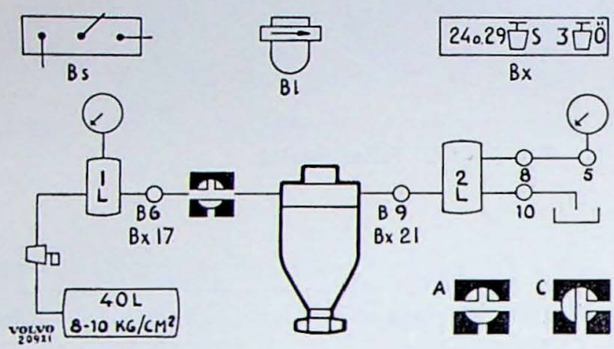
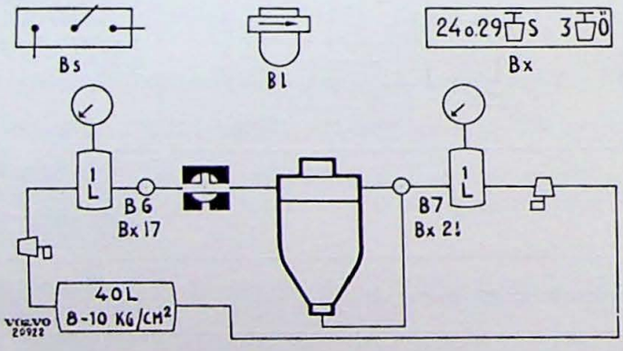
Fig. 7—57. Filter device.

Test sequence	Connection diagrams	Procedure
I Mechanical condition		Check assembly, axial play and oil valve travel.
II Continuous operation		Before testing is commenced the oil valve holder is removed and 0,3 litre (½ pint) of engine oil SAE 30 is poured into the crankcase. Thread rubber tubing onto oil valve nipple. Run compressor and adjust valve from B 6 (Bx 17) so that pressure in the air reservoir is maintained constant at 3 kg/cm² (43 p.s.i.). Meter B. After testing, release air from reservoir.
III Efficiency	Connections as in test II	Valve from B6 (Bx 17) is closed. Start compressor and measure filling time with stop watch. Meter B.
IV Abnormal noise	Connections as in test II	Carried out exactly as in test II. Listen carefully to running sounds.

Test values:

Test sequence	Test at		Filling time		Clearance and temperature
	rev./min.	pressure kg/cm² (p.s.i.)	New	Used	
I	—	—	—	—	Axial play on crankshaft 0.45—1.25 mm. (0.0177—0.049″). Oil valve travel 0.8—1.6 mm. (0.032—0.064″).
II	1800	3.0 (43)	10 min.	10 min.	Highest temp. 180° C (365° F)
III	500	0—10,0 (0—142)	5 min. 25 sec. (5.42 min.)	6 min. 5 sec. (6.08 min.)	Highest temp. 120° C (248° F)
	1800	0—10,0 (0—142)	1 min. 40 sec. (1.67 min.)		Highest temp. 170° (338° F)
IV	1800	3.5—5.0 (50—71)	—	—	—

Fig. 7—58. Test table for compressor SV/DTK 150×2/3.

Test sequence	Connection diagrams	Procedure
I Working procedure a. Valve opening pressure b. Flow time		**The butterfly nut** is replaced by a similar nut without a thrust bolt. B. Three-way cock in position A. Valve from B 6 and Bx17 respectively opened and compressed air allowed to pass into vessel B (2 liters=122 cu. in.) and Bx (1.5 liters=91.5 cu. in.). Pressure over 7.5 kg/cm² (106 p.s.i.). Use normal butterfly nut. Pressure over 7.5 kg/cm² (106 p.s.i.) B. Three-way cock in position A. Valve from B 6 and Bx 17 respectively opened and compressed air allowed to pass into vessel B (2 liters=122 cu. in) and Bx (1.5 liters =91.5 cu. in.). The valve is closed at 5 kg/cm² (71 p.s.i.). B. The three-way cock is turned rapidly to position C. Bx. Close 33 and open 24. When the air is passed out, 2 is opened quickly.
II Container leakage		B. Three-way cock in position A. Valve from B 6 and Bx 17 respectively opened and compressed air allowed into vessel B (2 liters= 122 cu. in.) and Bx (1.5 liters= 91.5 cu. in.). At 7 kg/cm² (99 p.s.i.) the valve is closed.
III Valve leakage		B. Three-way cock in position A. Valve from B 7 and Bx 21 respectively closed. Valve from B 6 and Bx 17 respectively opened and compressed air allowed into vessel B (2 liters=122 cu. in.) and Bx (1.5 liters=91.5 cu. in.) respectively. At 7 kg/cm² (99 p.s.i.) the valve is closed.

Test values:

Test sequence	Test value	Test vessel
1a	The valve should open for pressures exceeding 7,5 kg/cm² (106 p.s.i.).	—
1b	Pressure fall from 5 to 0 kg/cm² (71—0 p.s.i.) in less than 2 seconds.	With 2 liters=122 cu. in. test vessel.
2	Permissible pressure fall during 3 minutes from 7.5—6.8 kg/cm² (106—90 p.s.i.).	With 2 liters=122 cu. in.+1 liter (61 cu. in.) test vessels.
3	Permissible pressure fall during 3 minutes from 7.0—6.8 kg/cm² (99—96 p.s.i.).	With 1 liter+1 liter (61 cu. in.=61 cu. in.) test vessels.

Fig. 7—59. Test table for filter and tire inflation device SV/DFB 1/2.

Disassembling

1. Remove the protector plugs.
2. Remove the flange (29, Fig. 7-16 and 7-17) and screw out the set screw (17).
3. Loosen the plug (14), remove the spring (13) and the idler valve (16). See Fig. 7-60.
4. Loosen the plunger cover (7), plate (6) and washer (8). Remove the plunger (2), the gasket (5), washer (4) and plunger spring (3). See Fig. 7-61.
5. Loosen the plug (10), remove the spring (9) and check the valve (12). See Fig. 7-62.
6. Loosen the screw cap (22) and remove the bushing (25), the spring (21), the control valve (20) and the valve disk (27). See Fig. 7-63.
7. Wash all parts with clean gasoline with the exception of those made of rubber. Blow body channels clean with compressed air.

Inspection

The inspection is primarily concerned with a check of the valve disks, plunger gasket, bellows and springs.

Check first the idler and check valves. If the sealing surface on any of the valves is damaged then the valve must be replaced. Slighter damage may be repaired by grinding with emery paper on a flat surface. For damaged valve seats use reamer EFSV 1. Do not remove more material than required to ensure flat surfaces.

Examine the control valve bellows and control valve disk. The bellows must not show any signs of cracks. If there are cracks it must be soldered or replaced. The valve disk is replaced if it shows any damage on the surface in contact with the seat. In case of slighter damage it should be removed from the bellows and ground with emery paper on a flat surface.

Check the plunger gasket in the housing. It should press well against the sides all round. Worn, scratched or in other ways damaged gaskets are replaced.

Check springs. Crooked or "tired" springs (compare with new) must be replaced.

Examine gaskets and washers and replace any which may be damaged.

Check that the body is well cleaned and that valve seats are free from damage. Deeply scratched valve seats must be levelled.

Assembling

The pressure regulator is assembled in the reverse order to that used when taking apart. Ensure that the check valve spring (the weaker) is not confused with the idler valve spring (stronger).

Grease the plunger gasket, valve stems and screw threads sparingly. Use Bosch grease Ft 1v5.

The pressure regulator is tested in operation after assembly.

Testing of Pressure Regulator

The pressure regulator is tested with emphasis on the cut-in pressure. The cut-out pressure is obtained automatically. The difference between the cut-in pressure and the cut-out pressure determines the idling time. Idling time in the table Fig. 7-65 concerns a test arrangement with a 40 liters (1.41 cu.ft.) air container. For a 60 liters (2.12 cu.ft.). or 80 liters (2.82 cu.ft.) holder multiply idling time by 1.5 and 2 respectively.

Fitting

The pressure regulator is assembled in the reverse order to that used when removing.

Be careful to see that no dirt comes into the air pipes during assembly. Ensure that all pipe junctions are properly tightened.

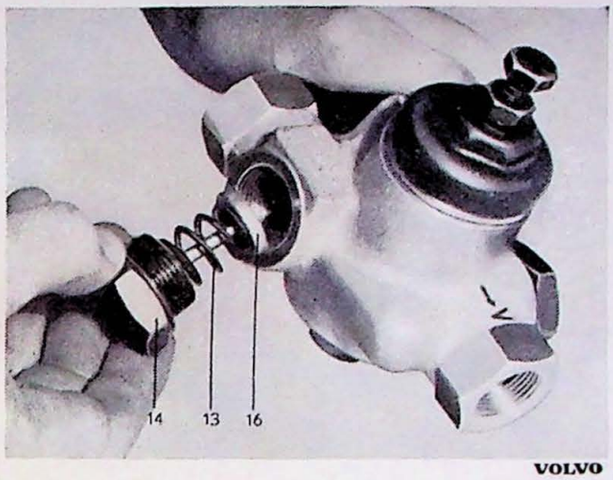
Anti-freeze Pump

Removing

1. Release pressure in system.
2. Screw out pipe unions, lift out anti-freeze pump.
3. Fit protector plugs and drain remaining anti-freeze medium. Replace cover and clean anti-freeze pump thoroughly externally.

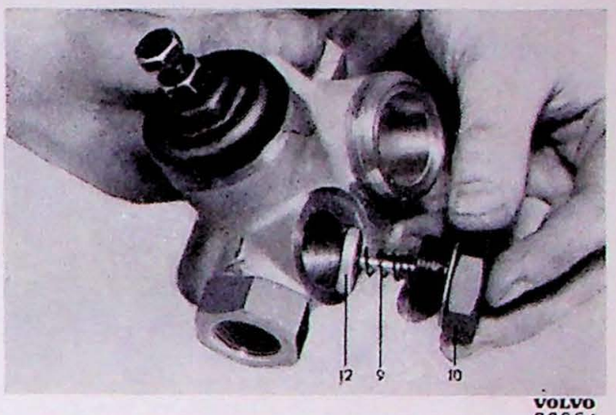
Disassembling

1. Remove the cover with push rod (1, Fig. 7-19) and gasket (2).
2. Remove the lock ring (3) and the washer (4) from the plunger. Lift off the spring (5).
3. Screw out the pump housing (8) from the valve housing (13) and lift it out with the washer (11), bowl (7) and washer (12). Remove the plunger (6) and strainer (9) from the pump housing.



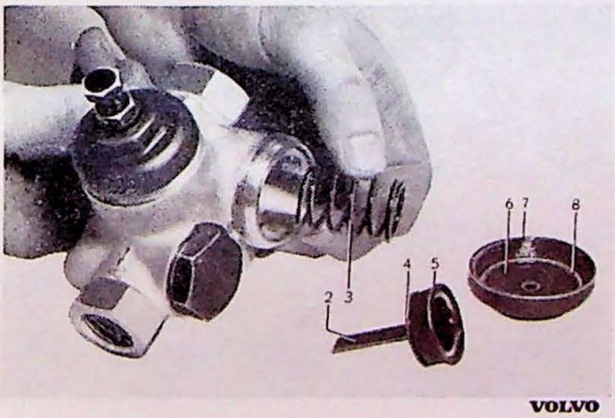
VOLVO
20862

Fig. 7—60. Removing the idler valve.



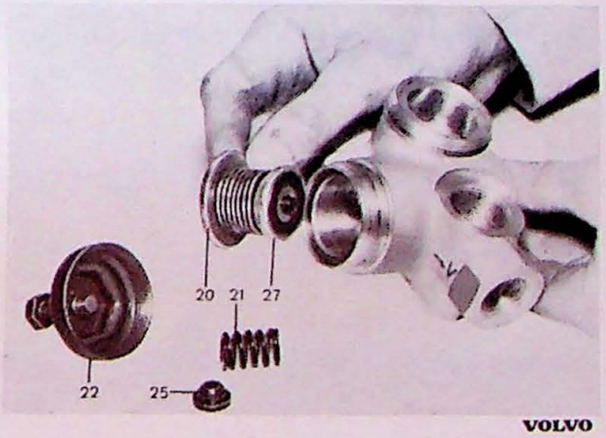
VOLVO
20864

Fig. 7—62. Removing the check valve.



VOLVO
20863

Fig. 7—61. Removing the plunger.



VOLVO
20865

Fig. 7—63. Removing the control valve.

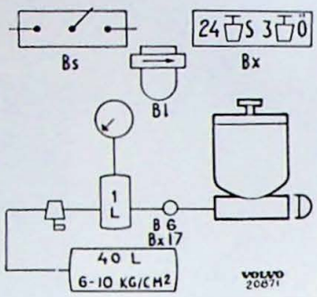
Test sequence	Procedure	Test value
I Tightness		
a. Bowl	Fill anti-freeze pump with about 150 cm³ (¼ pint) of Bosch oil OL 24VI, secure cover, tilt pump sideways and revolve it. Do not tilt the pump so much that oil runs out between the plunger stem and the lid.	Oil should not run out at the edge of the cover.
b. Valve	Connect anti-freeze pump as shown in diagram. Open valve from B6(Bx17) and let in compressed air to a pressure of 6 kg/cm² (85 p.s.i.) into test container B 1 liter (61 cu. in.) Bx 1.5 liters (91.5 cu. in.) after which the valve is closed. D shows the connector housing. 	Pressure fall during 1 minute is not to exceed 0.2 kg/cm² (6.0—5.8 kg/cm²) = 2.8 p.s.i. (85.3—82.5 p.s.i.) with a 1 liter container (61 cu. in.).
c. Plunger and cylinder	Pump the push rod about 5 times and then load it with 7 kg (15½ lbs.). Measure position of push rod.	The push rod should not move down under the influence of the weight during 1 minute.
II Operation	Carefully remove plug from outlet nipple and place a vessel under. Close inlet nipple and depress the push rod several times till oil runs out through the outlet nipple. When the oil has ceased running, depress push rod as far as it will go 10 times and measure the amount of oil which runs out.	After 10 strokes the amount of oil should be at least 15 cm³ (½ fl. oz.).

Fig. 7—64. Test table for anti-freeze pump SV/DFP 250 H 2/1.

4. Screw out the plug (18), remove the spring (16), valve guide (15) and valve disk (14).

5. Wash all parts.

Inspection

Inspection is concerned mainly with the valve disk, valve seat and plunger washer.

Check the valve disk, the sealing surface of which must be absolutely flat. Damage may be repaired by grinding with emery paper mounted on a flat surface. Check the valve spring. It must no be crooked or "tired". (Compare with a new spring). Replace damaged springs.

Examine piston washer and body of piston. A worn washer is replaced as is also a badly scratched piston body.

Assembling

The anti-freeze pump is assembled in the reverse order to disassembly.

The pump is tested after assembly. Testing is carried out as shown in the test table (Fig. 7-64).

Fitting

The anti-freeze pump is fitted in the reverse order to that used when removing.

Ensure that a good seal is obtained at every connection. Replace damaged cones in pipe unions.

Fill, when required, with 1/4 liter (1/2 U.S. pint) of anti-freeze. Use a glycol-water mixture. See also "Anti-freeze Pump" on page 7-4.

Compressed Air Reservoir Tanks

The compressed air reservoirs require no attention other than to drain out the accumulated condensation water once a week. Unscrew the bottom plug a few turns. The truck should stand as near horizontal as possible.

Relief valve

Removing

1. Release pressure in system.

2. Loosen pipe unions and lift out relief valve.

3. Apply protector plugs and wash thoroughly externally.

Disassembly

1. Remove the lock ring (14, Fig. 7-20), loosen the union (13), remove the spring (12) and valve ball (1).
2. Loosen the four bolts (9) in the housing. Remove the diaphragm cover (8), thrust washer (5), spring (4), thrust plate (3) and diaphragm (2).
3. Clean components thoroughly and inspect them. Replace diaphragm if cracked. Check valve ball, seal and spring and replace them if damaged.

Inspection

Examine the spring and valve ball for back surge. The spring must have the required tension and length. The ball should not be uneven as this might lead to leakage.

Check the spring and diaphragm for relief operation. The spring should not be crooked or "tired". Examine diaphragm for cracks or leaks in the form of scars on the contact surface with the seat.

Worn or damaged parts are replaced.

Assembling

Assembly is carried out in the reverse order to disassembly. After assembly the relief valve must be adjusted and tested before being re-installed in the brake system. See test table, Fig. 7-66.

Coat parts with a suitable grease such as Bosch Ft 1v5.

Fitting

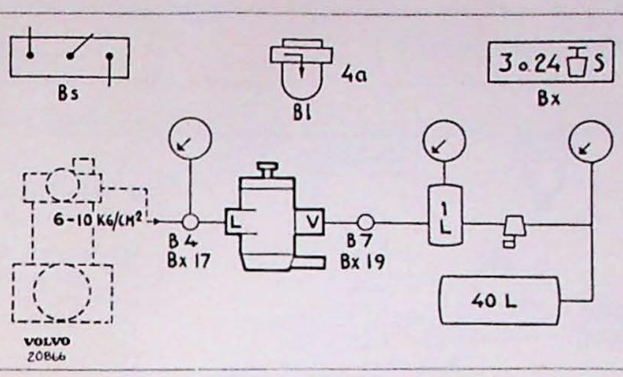
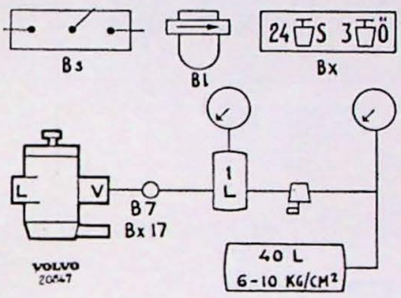
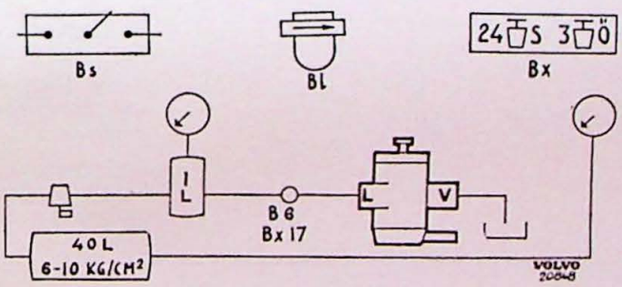
The relief valve is assembled in the reverse order to that used when removing. The plug marked "H" is connected to the larger air reservoir (2).

Pipe Unions

Pipe lines are connected with each other and with the various components in the compressed air system by means of pipe unions. Tightening of cones in pipe unions and assembly in general must be carried out carefully in accordance with the directions below.

For tightening of the cones on the pipes a special tightening device is used (Bosch EF 8366 and EF 8367). The pipe union nipple can be used. See Fig. 7-67.

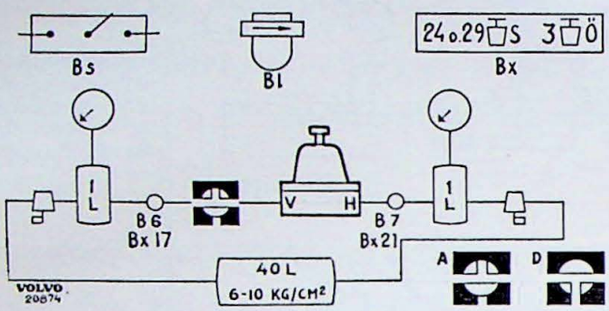
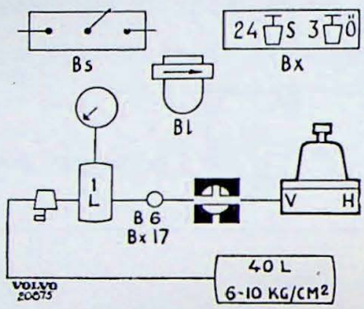
1. Before assembling the cones ensure that the length of pipe is about 4 mm (5/32") shorter than the distance between the connection points.
2. Place tightening device (nipple) in a vise.
3. File pipe ends flat and remove all burr.

Test sequence	Connection diagrams	Procedure
I Pressure regulator operation		After adjustment of the pressure regulator at least 15 rapid tests are carried out by closing the valve from B 7 (Bx 19) and testing with this valve open. Air container capacity: B. 40 liters (1.41 cu. ft.). Bx. 15 liters (0.53 cu. ft.)
II Tightness of check valve		Valve from B 7 (Bx 17) is opened. Let compressed air into container B 1 liter (62 cu. in.). Bx 1.5 liters (91 cu. in.). Pressure 3 kg/cm² (43 p.s.i.).
III Tightness of guide valve	Connections as in Test II	As in Test II. Pressure 4.5 kg/cm² (64 p.s.i.).
IV Tightness of idler valve		Valve from B 6 (Bx 17) is opened. Compressed air is let into test container B 1 liter (62 cu. in.). Bx 1.5 liter (91 cu. in.). Pressure 3 kg/cm² (43 p.s.i.).

Test values:

Test sequence	Test value	Test container
I	Lowest cut-in pressure 4.8 kg/cm² (68 p.s.i.). Highest cut-in pressure 5.6 kg/cm² (80 p.s.i.). Lowest idler time 30 seconds. Highest idler time 180 seconds.	40 liters container (1.41 cu. ft.). For rapid test 1 liter (61 cu. in.)
II	Maximum pressure fall during 3 minutes from 3.0—2.8 kg/cm² (43—40 p.s.i.).	1 liter container (61 cu. in.).
III	Maximum pressure fall during 1 minute from 4.5—4.3 kg/cm² (64—61 p.s.i.).	1 liter container (61 cu. in.).
IV	Maximum pressure fall during 2 minutes from 3.0—2.6 kg/cm² (43—37 p.s.i.).	1 liter container (61 cu. in.).

Fig. 7—65. Test table for pressure regulator SVVE 23/5Z.

Test sequence	Connection diagrams	Procedure
I Relief and check valve tightness		B. Three-way cock in position A. Valve from B 7 (Bx 21) closed. Valve from B 6 (Bx 17) opened and compressed air let in to a pressure of 3 kg/cm² (43 p.s.i.) after which the valve is closed. Left-hand meter.
II Relief action		B. Three-way cock in position A. Valve from B 6 (Bx 17) opened and compressed air let in. Pressure 4—5 kg/cm² (57—71 p.s.i.).
III Back surge	Connections as in Test I	B. Three-way cock in position A. Valve from B 7 (Bx 21) closed. Valve from B 6 (Bx 17) opened and compressed air let in to a pressure of 5 kg/cm² (71 p.s.i.). Both meters, close valve. Three-ways cock rapidly changed to position D.

Test values:

Test sequence	Test value	Test container
I	Pressure fall during one minute should be 0.3 kg/cm² (3.0—2.7)=4 p.s.i. (42—38).	1 liter test container (61 cu. in.).
II	Relief action at 4.2—4.5 kg/cm² (60—64 p.s.i.).	—
III	Equal and simultaneous pressure fall on both sides from 5 to 0 kg/cm² (71—0 p.s.i.).	—

Fig. 7—66. Test table for Bosch relief valve SVVE 22/2Z.

4. Thread nut and cone onto pipe and coat cone with grease.

5. Press pipe and cone against tightening device (nipple) and tighten nut properly with a wrench.

6. Loosen nut and connect pipe to corresponding point on other member by using pressure ring and washer.

Hand Control

Removing

1. Release pressure in system.

2. Disconnect screw unions and clamp. Lift out control system.

Disassembly

1. Disconnect the four attaching bolts and separate the cover from the housing.

2. Lift out the cam, the spring and the plunger.

3. Unscrew the bottom plug with compressed air connection (6, Fig. 7-21) and remove the valve with spring.

Inspection

Check all parts for wear and damage. Examine valve and plunger packings very carefully. Replace these if there are any signs of damage.

Assembly and fitting

Carry out in reverse order to that used when removing and disassembling.

HANDBRAKE

Removing the Handbrake

1. Loosen the nuts on the transmission flange. Loosen the center bearing from the cross-member and lower the propeller shaft. Remove the brake drum.

2. Remove the brake spring with special pliers. Lift out the brake shoes (6, Fig. 7-23) and the adjuster screw (5).

3. The following procedure is only followed if the transmission shaft brake is to be completely disassembled.
   a) Loosen the nut and remove the companion flange using a puller.
   b) Remove the cotter pin and bolt from the push rod (7).

c) Loosen the brake cam lever and pull it out together with the eccentric for the brake shoes.

d) Loosen the bolts and remove the brake backing plate.

Fitting the Handbrake

The handbrake is fitted in the reverse way to that used when removing. The brake shoes are fitted as shown in Figs. 7-68 and 7-69.

Adjusting the Handbrake

The handbrake should start to "take" at the third or fourth notch on the quadrant. Normally, only adjustment in points 1,3 and 5 below needs to be carried out. But in certain cases, for example after brake lining replacement, adjustment in accordance with points 2 and 4 may be necessary.

1. Jack up truck and block up rear axle. Check that handbrake lever is in released position (right forward).
2. Loosen push rod (7, Fig. 7-23).
3. Expand brake shoes with screwdriver as shown in Fig. 7-70 until brake drum is locked.
4. Adjust push rod length so that the bolt can just be pushed in.
5. Loosen the adjuster screw so that the brake drum can rotate freely.