

Brakes

**Repairs and
Maintenance**

**Section
5**

**Group
50-55**

Brakes

**240, 260
1976-**

VOLVO

Contents—Brakes, Repair and Maintenance

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Indicates changes in text and/or specification in this manual.

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Specifications

Front wheel brakes (disc brakes), non-ventilated

		Metric	US
Brake discs:	Diameter	263 mm	10.35"
	Thickness, new	14.3 mm	0.563"
	Min. thickness when reconditioned	13.4 mm	0.536"
	Max. warp	0.10 mm	0.004"
Brake linings:	Thickness, new	10 mm	0.394"
	Effective area, Girling	166 cm ²	25.7 in ²
	ATE (1975)	145 cm ²	22.5 in ²
	Girling, and ATE	DB 818	
Wheel cylinders: (4 per wheel)	Area, Girling 1975	10.25 cm ²	1.59 in ²
	Area, Girling 1976—	11.34 cm ²	1.76 in ²
	ATE (1975)	10.17cm ²	1.58 in ²

Front wheel brakes (disc brakes), ventilated

Brake discs:	Diameter	263 mm	10.35"
	Thickness, new	24 mm	0.94"
	Min. thickness when reconditioned	20.8 mm	0.83"
	Max. warp	0.10 mm	0.004"
Thickness variation:	Front and rear 0.0008", max. between different points on disc.		
Warp:	Front and rear max. 0.004" measured at furthest point on circumference.		
Thickness:	Front disc non-ventilated, machined, min.	13.2 mm	(0.51968")
	Front disc ventilated (girling Caliper) machined, min.	20.8 mm	(0.8189")
	Front disc ventilated (ATE Caliper) machined, min.	22.8 mm	(0.89764")
	Rear discs machined, min.	8.4 mm	(0.33071")
Brake linings:	Thickness, new	10 mm	0.394"
	Effective area, Girling	166 cm ²	25.7 in ²
	Effective area, ATE	145 cm ²	22.5 in ²
	Girling, early models	DB818	
	ATE, Girling, late models	DB818	
Wheel cylinders:	Area, 1975	10.17 cm ²	1.58 in ²
	Area, 1976—	11.34 cm ²	1.76 in ²

Rear wheel brakes (disc brakes), all models

Brake discs:	Diameter	281 mm	11.06"
	Thickness, new	9.6 mm	0.378"
	Min. thickness when reconditioned	8.4 mm	0.331"
	Max. warp	0.10 mm	0.004"
Brake linings:	Thickness, new Girling	8 mm	0.315"
	ATE	10 mm	0.394"
	Effective area, Girling	100 cm ²	15.5 in ²
	ATE	105 cm ²	16.3 in ²

Specifications

Rear wheel brakes (disc brakes), all models

ATE, Girling DB-828

Wheel cylinders:	Area, Girling	11.43 cm ²	1.77 in ²
(2 per wheel)	ATE	11.33 cm ²	1.75 in ²

Master cylinder (tandem-type, step-bored), 4 cyl., 6 cyl.

Diameter:	Secondary bore	15.75 mm	0.620"
	Primary bore	22.3 mm	0.877"

Brake lines

Outer diameter:	6 mm	3/16"
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Brake (reducer) valve (ATE BRM 18)

Operating pressure,	242 and 244 1975	3.0 MPa	435 psi
	1976—	3.4 MPa	480 psi
	245 1975-1976	4.5 MPa	640 psi
	1977—	5.0 MPa	730 psi
	264	2.5 MPa	355 psi
	265	3.4 MPa	480 psi

Vacuum booster cylinder, 240, 260

Make:	All (240, 1978—)	tandem 8"
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Ratio:	1:4
Vacuum pump (some models)	Pierburg
Type	Diaphragm

Parking brake, all models

Brake drum:	Diameter	160.45 mm	6.32"
	Max. warp	0.15 mm	0.006"
	Max. out-of-round	0.2 mm	0.008"

Brake linings:	Effective area	176 cm ²	27 in ²
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Tightening torques

Front brake caliper retaining bolts	90-110 Nm	65-72 ft. lbs.
Rear brake caliper retaining bolts	52-64 Nm	38-46 ft. lbs.
Wheel nuts	100-130 Nm	72-94 ft. lbs.
Master cylinder retaining bolts	30-50 Nm	22-36 ft. lbs.
Bleeder nipples	3.5-5.5 Nm	2.5-4.0 ft. lbs.
Brake pipe connections	8-12 Nm	6-9 ft. lbs.
Brake hose connections to brake (reducer) valve	12-16 Nm	9-12 ft. lbs.
Retaining nuts rear attachment plate	45-55 Nm	33-40 ft. lbs.
Retaining bolts, anchor	30-50 Nm	22-36 ft. lbs.

Special Tools

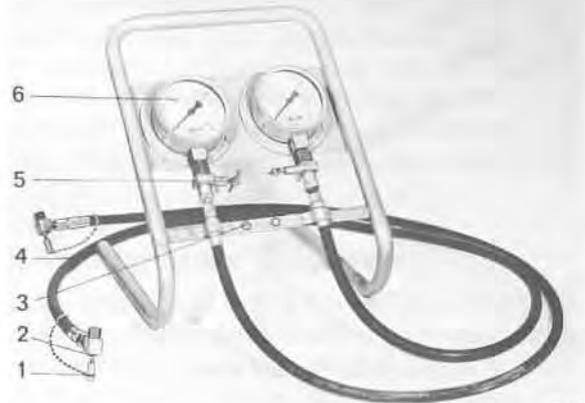
General

Brake calipers of make ATE are supplied for certain markets. Where the instructions for these differ from the other brake caliper make (Girling), the letters ATE will follow.

The following special tools are used for repair work on the brake system. The special tools are marked 999 or SVO (e.g., 999 2742 or SVO 2742).

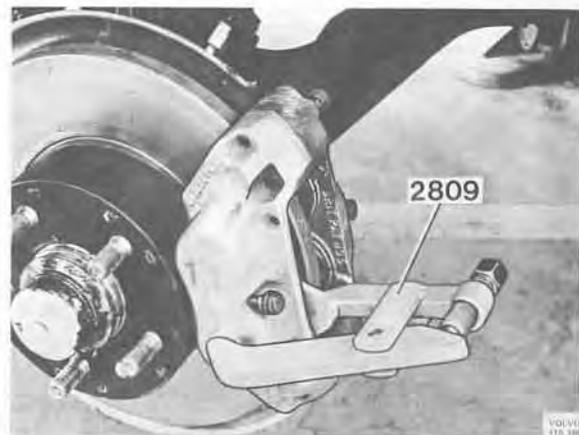
The tester 2741 is used to diagnose the brake system. Wooden inserts as shown facilitate removal of the brake caliper pistons. A brake bleeder unit of the type shown is required to maintain constant pressure when servicing the hydraulic system. A connection cover for the brake fluid container is also needed.

2741	Tester to diagnose the brake system
2809	Press tool pressing in and checking piston in brake caliper/holder for plate and dial gauge
2917	Extractor for brake pads
2918	Tool to revolve piston in rear brake caliper (ATE)
2919	Template piston in rear brake caliper (ATE)
2971	Bleeder wrench for ATE-brakes
	Bleeder unit to maintain fluid pressure when servicing the hydraulic system
	Connection for the brake fluid container
	Wooden blocks for brake calipers

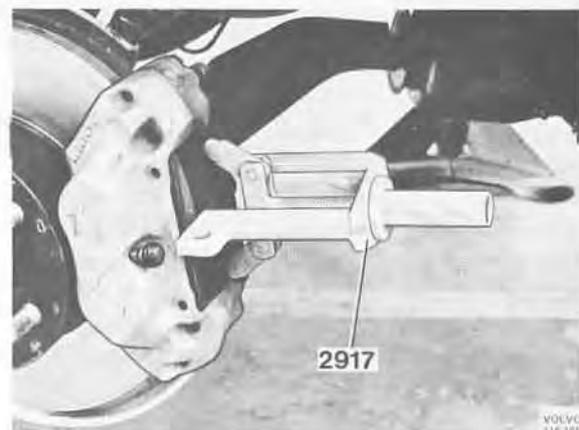


Tester 2741

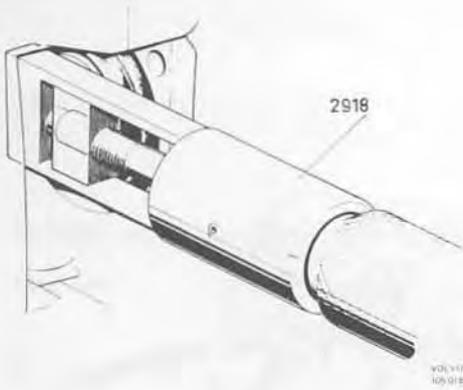
- | | |
|----------------------|-------------------|
| 1. Protection cover | 4. Hose |
| 2. Connection nipple | 5. Bleeder tap |
| 3. Enlarging nipple | 6. Pressure gauge |



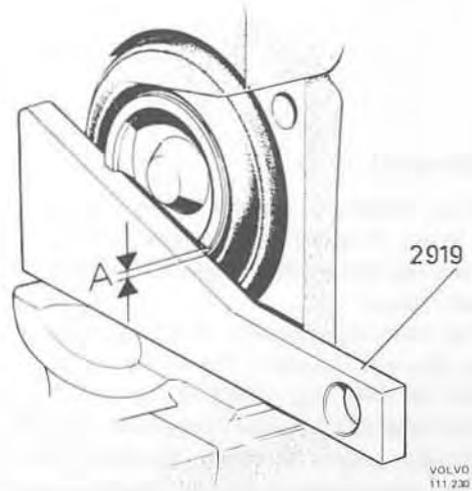
2809 Press tool
pressing in and checking piston in brake caliper/holder for plate and dial gauge



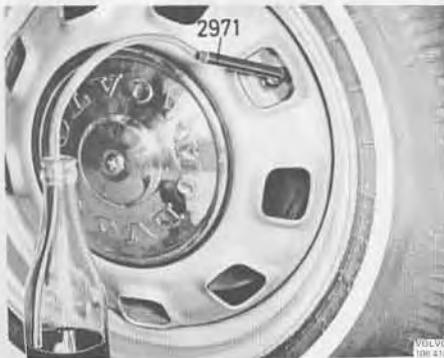
2917 Extractor
for brake pads



2918 Tool
to revolve piston in rear brake
caliper (ATE)



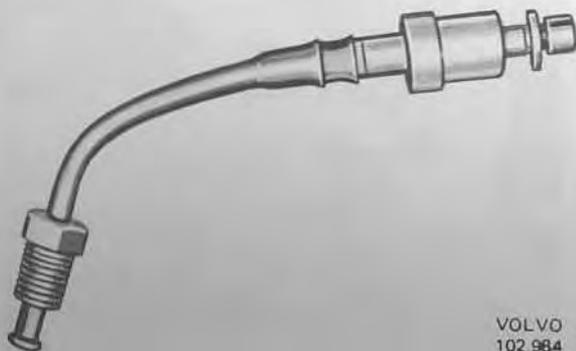
2919 Template
piston in rear brake caliper (ATE)



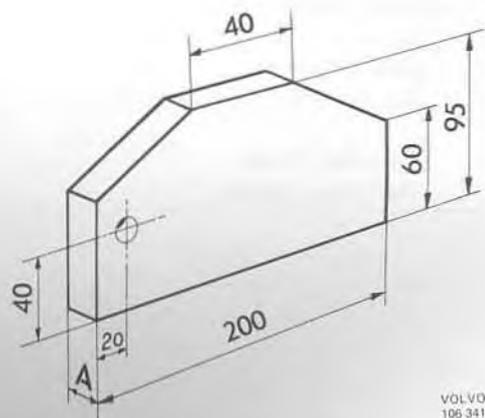
2971 Bleeder wrench
for ATE-brakes



Bleeder unit



Connections



Wooden insert for brake calipers
AA = 15.5 mm (5/8") for front brake calipers
13 mm (1/2") for rear brake calipers

General Procedures

Cleaning

Hydraulic Brake System Components should be cleaned in clean brake fluid or special solvent which does not contain benzene (benzol).

Do **not** use gasoline, kerosene, trichloroethylene or alcohol with benzene for cleaning. Such solvents, as well as the slightest trace of mineral oil, attack rubber seals and cause them to swell out. For this reason, hands also should be washed with soap and water before internal parts are touched. It is an excellent idea to provide the mechanic working with hydraulic components with rubber gloves.

Final rinsing should be made in a cleaning agent free from impurities and after that the parts can be dried in the open air. Filtered and compressed air free from moisture can also be used.

It is very important that no alcoholic residue is left in the system when it is filled with brake fluid. Traces of cleaning alcohol in brake fluid reduces the boiling point and can result in formation of vapour which severely effects brake function.

After being cleaned and dried, the components should be immersed in brake fluid before assembling. Then the brake system should be filled with brake fluid as soon as possible in order to prevent corrosion attacks from air moisture.

To counteract corrosion on brake parts which are to be stored or for any other reason not immersed in brake fluid, coat plungers, cylinders and seals with a thin layer of brake paste. Under no condition whatsoever must other types of grease or rustproofing oil be used.

Brake Fluid

Brake fluid is hygroscopic in nature and absorbs water vapor from the air. For this reason, it is important to keep brake fluid in a tightly sealed container. If only a small amount of fluid is required, it should be purchased in small cans. Avoid storing small quantities of fluid in bulk containers. The boiling point for brake fluid depends on several factors including the age of the fluid and climate conditions. Any brake fluids' efficiency will deteriorate as it becomes older. It should be changed at least every three years for cars in normal service.

Only brake fluid with designation DOT 4 (SAE J 1703) should be used. Use only high quality brake fluid which is guaranteed by a well-known manufacture to fulfill these requirements. Brake fluids which only fulfill lower requirements (example: SAE 70 R 1, AE qualities or FS-VH-H 910 A) must not be used. Avoid mixing different brands of brake fluid.

Utmost cleanliness should be observed in order to prevent dirt from getting into the system when for instance filling the master cylinder. Only clean unused brake fluid should be filled. Brake fluid which is expelled during, e.g. bleeding, must not be re-used.

During extended periods of time, it is normal that even first-class brake fluid gradually deteriorates through absorption of moisture and small impurities. Deteriorated brake fluid can be recognized by the fact that, compared with new brake fluid, it is darker or has changed colour, is relatively odourless and watery (that

means when felt between the fingers it lacks the normal feeling of a light lubricating film). Such brake fluid should be replaced by new fluid. This should also be done when master cylinder and wheel brake units are being overhauled. The brake should be overhauled and the brake fluid changed regularly, service scheduled at 45,000 miles (75,000 km) or every third year. When driving under extremely hard conditions, like mountain driving or in humid climate, the brake fluid should be replaced every year.

Checking brake fluid level

Every time the fuel tank is filled the brake fluid level should also be checked. The level in the master cylinder container should not be below the "Min." mark. This can be done without removing the cap. Every 7500 miles (12,500 km), or when necessary, top up to the "Max" container mark. Observe maximum cleanliness when filling fluid. Avoid spilling brake fluid onto paint work as it might be damaged. Check that the breather hole in the cap is not blocked.

Checking brake pads

Check the brake pads for wear regularly or at least every 7,500 miles (12,500 km). The pads should be replaced when they are worn to a thickness of less than $1/8'' = 3 \text{ mm}$. Under no circumstances must pads be worn down below $1/6'' = 1.5 \text{ mm}$.

Operation check

In addition to regular checks by the driver when driving, the brakes should be checked every 7500 miles (12,500 km).

The service brake system should be checked to make sure that the operation is correct. If necessary use proper testing equipment. Also check to make sure that there is no leakage and that the brake lines are not exposed to damage that may result in leakages. The parking brake should provide full braking power, the parking brake should be fully applied at notches 3-4. Otherwise adjust according to instructions.

Overhaul

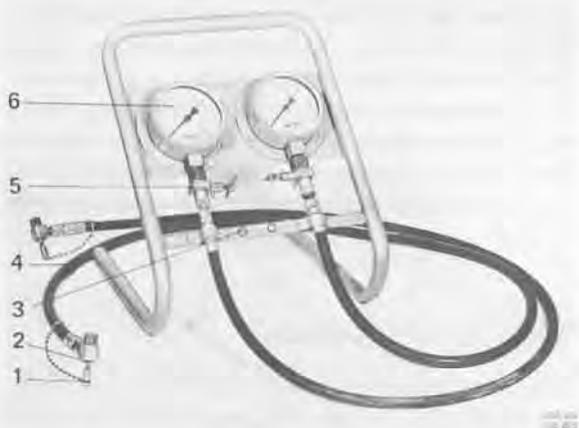
The brake system should be overhauled and the brake fluid changed every third year. Every third year or 45,000 miles (75,000 km) brake system seals and air filter for the power cylinder should be replaced. Where driving conditions are mostly dusty the air filter should be replaced more often.

For cars that are subjected to severe braking conditions (i.e. mountain driving, trailer towing) or driven in hot, high humidity areas, the fluid should be changed at least once a year.

Service diagnosis

The following service diagnosis can be used when the service brake system is behaving abnormally or to prevent faults.

1. Check that the level of the brake fluid is up to the "Max" mark on the container. Top up if necessary.
2. Remove both inside bleeder nipples at one of the front brake calipers and connect tester 2741. For the ATF brakes also nipple 2920 is used.

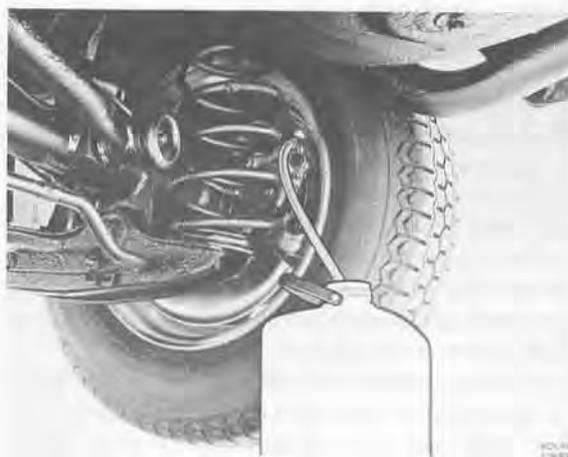


Tester 2741

- | | |
|----------------------|-------------------|
| 1. Protection cover | 4. Hose |
| 2. Connection nipple | 5. Bleeder tap |
| 3. Enlarging nipple | 6. Pressure gauge |
3. Depress the brake pedal several times to even out any vacuum in the power cylinder, thereby disconnecting it. When free, the brake pedal should be about level with the clutch pedal.
 4. Apply and release the brake pedal while reading the pressure gauges of the tester. The pressure in both circuits should be observed. At 1420 psi = 100 kp/cm², the pressure must not differ more than 43 psi = 3 kp/cm².
 5. Use an assistant or a pedal jack to apply the footbrake. Obtain a brake pressure of approx. 1420 psi = 100 kp/cm². Check pipes hoses and parts for damage and leakages. The pressure should remain unchanged for at least 15 seconds.
 6. Remove the pedal jack. Depress the brake pedal and maintain the pressure. Start the engine. A considerable lowering of the pedal should be felt when the power cylinder starts operating.
 7. Stop the engine after running for at least 1 minute. Use an assistant or a pedal jack to apply a hydraulic pressure of 355 psi = 25 kp/cm². Observe the pressure for a couple of minutes. The hydraulic pressure is not allowed to drop more than 70 psi = 5 kp/cm².
 8. Check the warning valve. Connect the testing device to one of the bleeder nipples. Open. Apply the footbrake slowly with

a pedal jack. Check the pressure gauge when the warning light comes on. It should come on at the pressure differential of 70–210 psi = 5–15 kp/cm² between the circuits.

After testing, shut off the bleeder nipple and remove pedal jack.



9. Check the brake (reducer) of one circuit. Connect the tester to the bleeder nipple on the left rear wheel brake and to the upper nipple on one of the front wheel brakes.

Read incoming pressure on the pressure gauge for the front wheel brake. Read outgoing pressure on the gauge which is connected to the rear wheel brake.

Operating pressure:

242 and 244	3.4 MPa = 480 psi
245	4.5 MPa = 640 psi
264	2.5 MPa = 355 psi
265	3.4 MPa = 480 psi

10. Check the other brake valve the same way. Connect the tester to the right rear wheel brake and the inner, lower nipple of the front wheel brake.
11. Raise up the vehicle so that the wheels rotate freely. Apply and release the brake. The wheels should be free half a second after the pedal has been released. The test should be made with and without vacuum in the power brake cylinder.

NOTE: The two pressure readings should be approximately equal up to the pressures indicated in the table above. Above those pressures the rear pressure should increase slower than the front pressure.

Service diagnosis

Test operation	Condition	Cause	Correction
3	Pedal too low or too high	Incorrect adjustment	Adjust
4	Fading pressure	Damaged brake line Blocked hose	Replace the damaged line Replace hose
	Difference between circuits 2.7 psi	Blockage in one of the circuits Defective adjustment	See point 5 Recondition master cylinder
5	Pressure drops	External leakage Leaking brake valve Leaking seal in wheel unit cylinder Leaking seal in master cylinder	Tighten connections and replace line of recondition leaking part Replace brake valve Recondition wheel unit cylinder Recondition master cylinder
6	The pedal does not go down	Leaking vacuum line Blocked air filter or leaking seal for front pressure plunger in servo cylinder Defective power cylinder	Replace vacuum line Replace filter or seal Replace power cylinder completely
7	The pressure drops more than 5 kp/cm ² (71 psi)	Leaking check valve Leaking seal for outgoing thrust rod in power cylinder Internal fault in power cylinder	Remove and blow clean the valve and replace the seal ring. If insufficient, replace check valve. Remove master cylinder and replace seal Replace power cylinder complete
	Pressure increases	Leaking rear sealing ring in power cylinder	Replace rear sealing ring
8	The parking brake warning lamp does not light Footbrake warning lamp does not light	Wrongly adjusted switch Defective electrical parts Defective switch	Adjust the switch Replace defective parts Replace switch
	Warning lamp does not go out when pistons have returned to normal position	Pistons seize	Replace warning valve
	Warning when pressure difference is other than 5-15 kp/cm ² (7-213 psi)	Defective warning valve	Replace valve
9-10	Incorrect outgoing pressure	Defective valve	Replace brake valve
11	All wheel brakes fade	Incorrectly adjusted front pressure plunger in power cylinder	Adjust the pressure plunger
	A circuit fades	Blocked equalizing hole in master cylinder	Recondition the master cylinder
	The rear wheel brakes fade	Parking brake cable chafes Incorrectly adjusted parking brake Defective brake valve	Replace the cable Adjust the parking brake Replace brake valve
	A wheel brake fades	Damaged brake line Blocked hose Worn sealing ring	Replace line Replace hose Recondition wheel brake unit
12	Brake pulsation felt in steering	Loose wheel bearings Out of balance tires Brake disc surface uneven	Adjust front wheel bearings Inspect for damage and/or balance tires Install abrasive pads
	Brake pulsation felt in brake pedal	Loose front wheel bearings Warped brake disc Disc friction surface uneven	Adjust front wheel bearings Machine or replace brake discs Install abrasive pads

*See special instructions in back of manual

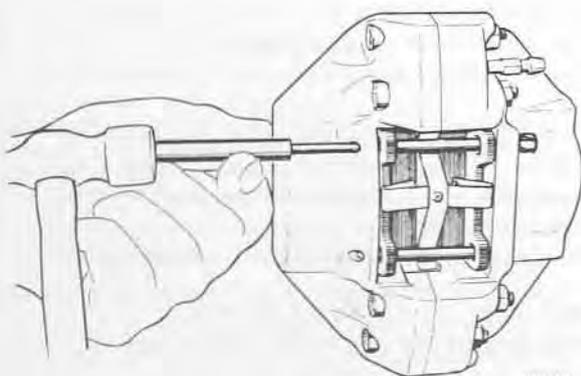
Group 51

Wheel Brake Assemblies

Replacing brake pads

The brake pads should be replaced when approx. 3 mm (1/8") of the lining thickness remains. On no account may the linings be worn down below 1.5 mm (1/16").

1. Remove the hub caps and slacken the wheel nuts slightly.
2. Jack up the vehicle and put stands under the rear axle and front jack attachments. Remove the wheel nuts and lift off the wheels.
- 3a. Girling: Remove the hairpin-shaped locking clips for the guide pins. Pull out one of the lock pins while holding the damper springs in place. Remove the springs and the other lock pin.
- 3b. ATE: Tap out the upper guide pin with a drift, diameter 2.5 mm (9/64"), see Fig. below. Take out the tensioning spring. Tap out the lower guide pin.

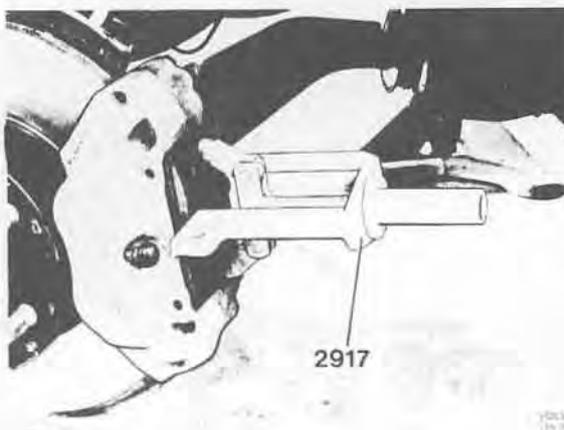


Removing guide pin, ATE

4. Pull out the pads with tool 2917. If the used pads are to be re-installed, mark them to ensure they are restored to their original position.
5. Carefully clean out the cavity in which the pads are located. Replace any dust covers that are da-

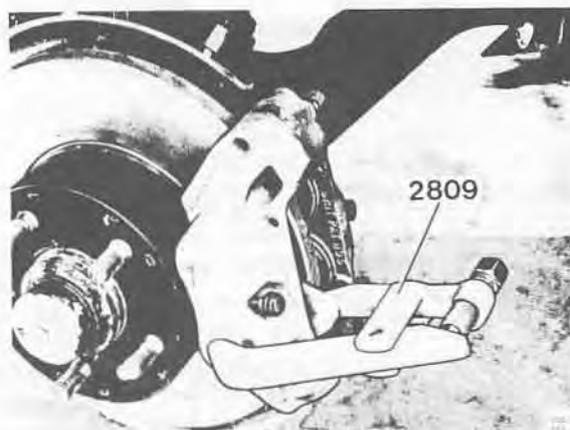
maged. If dirt has penetrated into the cylinder due to a damaged cover, recondition the brake unit. Check the friction area of the brake disc. Grind off rust, the brake pads should not be used for such removal.

6. To provide room for the new brake pads, press the pistons into the cylinders. The pistons can be



Removing brake pads

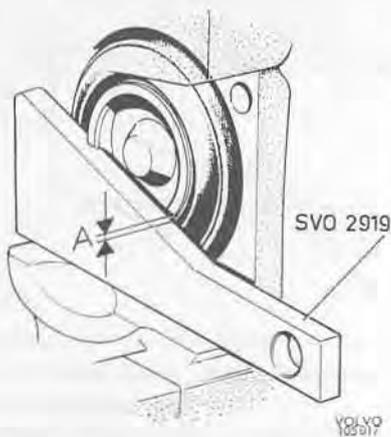
pressed in evenly and without risk with tool 2809 according to Fig. below: If done properly, the pistons can be pressed in perhaps more rapidly with another tool in the



Pushing in piston

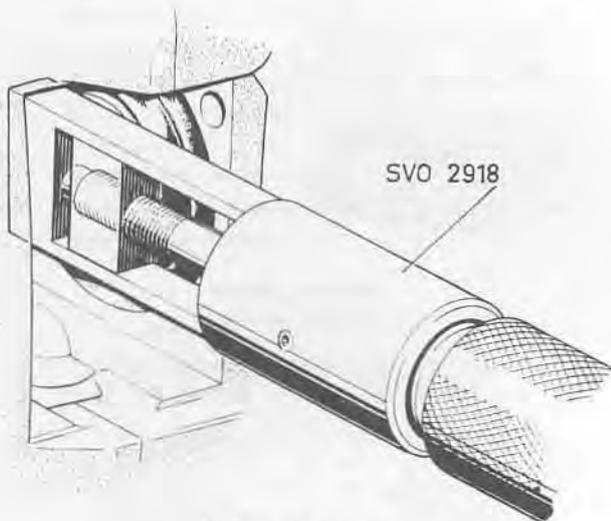
same way but, for example, if a screwdriver is used and wrongly applied, the pad, rubber seal and piston may be damaged. Note that when pressing in the pistons, the brake fluid level in the container rises so that the brake fluid can spurt out.

7. Rear wheel brakes ATE: Check to make sure the pistons are in the proper position to avoid brake squeal. The piston recess should incline 20° in relation to the lower guide area on the caliper. Check position with template 2919, see Fig. below. The tolerance is $\pm 2^\circ$, that is, when the template is placed against the one recess, the distance to the other (meas. A) may be max. 1 mm = 0.04". If necessary, adjust the location of the piston with tool 2918. To do this, move the tool into position as shown.



Checking location

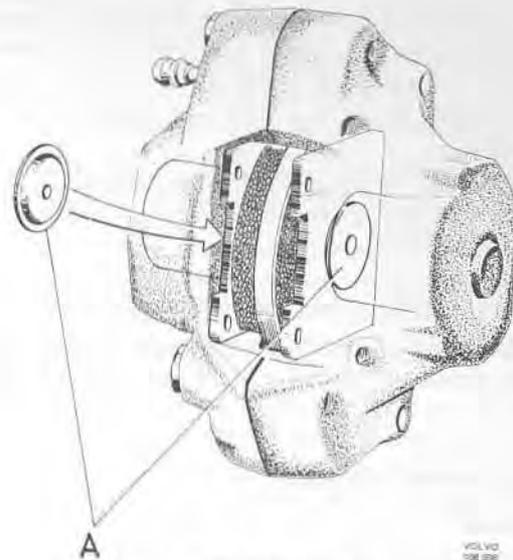
Press the tool against the piston and force out the shoes by screwing in the handle. Turn the piston, release the tool and re-measure with the template.



Adjusting location

- 8a. Girling: Install the new pads. If the caliper previously has been equipped with intermediate plates between pad and caliper, they should be re-installed. If, on the other hand, round damper washers have

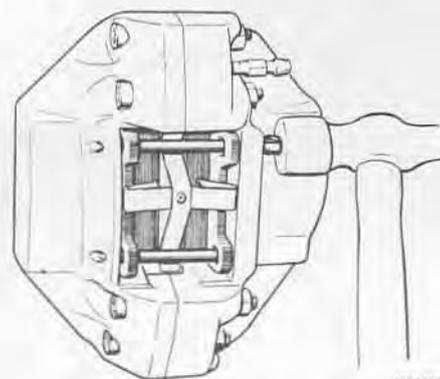
previously been installed, they should be re-installed, the smaller contact face towards the pad. Use a feeler gauge for the installation, never grease or glue.



Rear brake caliper
A. Damper washers

Intermediate plates must not be installed in calipers equipped with round damper washers. Position one of the lock pins and install the damper springs and the other lock pin. Fix the pins with new locking clips. Check that the pads are movable.

- 8b. ATE: Install the new pads. Place one of the guide pins in position and tap it in with a hammer without help from a tool, see Fig below.



Installation of guide pin, ATE

NOTE: The guide pin must not be knocked in with a drift which has a diameter smaller than the pin since the tensioning sleeve can then shear off the pin flange. Install a new tensioning spring for the pads. Install the other guide pin while pushing in the tensioning spring. Check that the pads can move.

9. After replacing brake pads, depress the brake pedal several times to check that the movement is

normal. Generally, the system does not require bleeding after replacing the brake pads.

10. Re-install the wheels after cleaning the contact surfaces and brake disc of sand, dirt, etc. Tighten the nuts sufficiently so that the wheels are securely held. Lower the vehicle and tighten finally the wheel nuts. Tighten every other nut a little at a time until all are finally tightened to a torque of 100–140 Nm (70–100 lb.ft). Install the hub caps.

N.B. The function and lifetime of the linings will benefit if lengthy and hefty braking is avoided in the beginning.

Reconditioning wheel brake units

When working with the hydraulic system, observe the instructions under "Cleaning" and "Brake Fluid", Group 50.

Front brake calipers

Removal

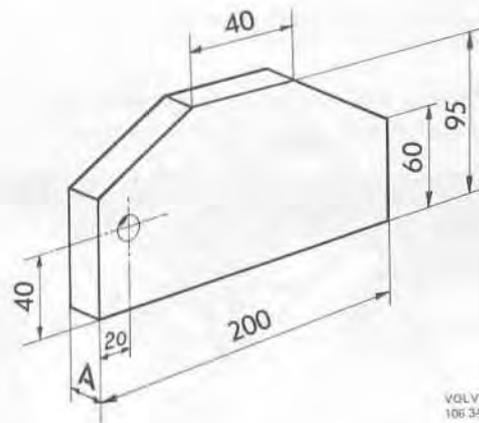
1. Remove the hub caps and slacken the wheel nuts slightly. Temporarily block the vent-hole in the brake fluid container cover to reduce leakage.
2. Jack up the front end and put stands under the front jack attachments. The control arms should be off-loaded so that the brake hoses can be installed in the correct position. Remove the wheel nuts and lift off the wheels.
3. Disconnect the brake lines at the caliper. Then remove the retaining screws (2) and the caliper.



Front wheel brake

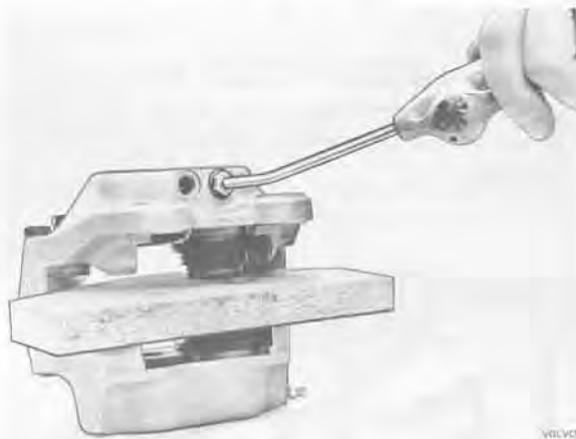
Disassembly

1. Remove the brake pads, see operations 3a and 3b under "Replacing brake pads".
2. Remove the retaining rings and the rubber dust covers. Place a wooden disc, see Fig. below, between the pistons and press them out towards the disc with air as shown.



Wooden insert for brake calipers

AA = 15.5 (5/8") for front brake calipers
13 mm (1/2") for rear brake calipers



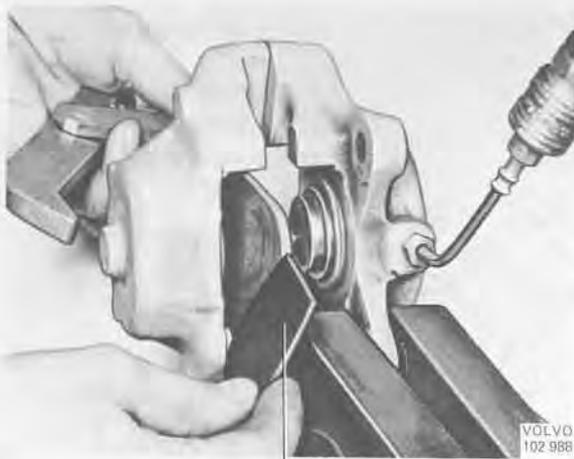
Removing pistons

1. Wooden disc

The pistons can then be easily removed. If a piston feels stiff to remove, use air pressure. Lever off the rubber covers.

3. Remove the seals with a blunt tool. Be careful not to damage the edges of the grooves. Screw out the bleeder nipple and brake lines.

The brake caliper halves should not be separated. The reason for this is that subsequent assembly would require test pressure equipment and special fluid for the bolts.



Removing piston

A = rubber dust cover

Inspection

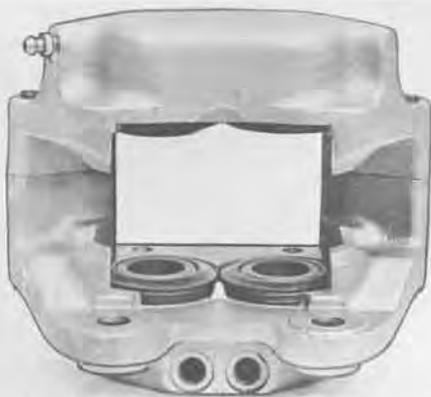
Before inspection, clean all parts according to the instructions under "Cleaning", Group 50. Make sure the channels are clean.

Seals and rubber dust covers should be replaced. If cylinders are scored or scratched the complete cylinder housing should be replaced. Inspect the other parts and replace any damaged or worn.

Check also the brake disc, see under "Brake Disc", page 5-13.

Assembly

1. Coat the working surfaces of pistons and cylinders with brake fluid.
2. Install the seals in the cylinders.
3. Install the pistons with the large diameter end facing inwards. Make sure the pistons are installed straight and not scratched.
4. Install the rubber cover on the piston and housing. Install the lock rings (Girling).



Front brake caliper

5. Install brake pads, see operations 8a and 8b under "Replacing brake pads".
6. Install bleeder nipples and brake lines.

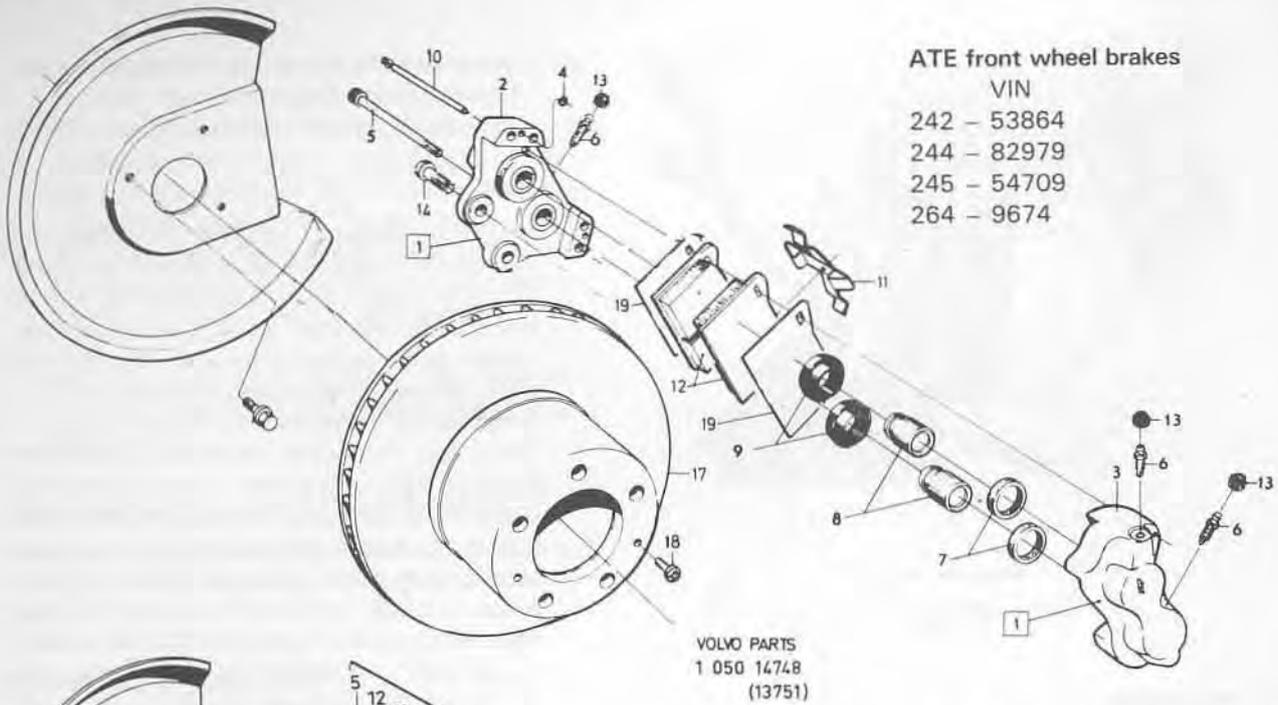
Installation

1. Position the calipers. Check that the contact surfaces of the retainers are clean and not damaged. Check the location of the brake caliper in relation to the brake disc. Axial deviation is checked with a feeler gauge on both sides of the disc the distance between disc and caliper support nib. The difference in measurement is max. 0.022" = 0.010 mm. The caliper should be parallel with the disc. This is checked by measuring the distance to the upper and lower support nibs in the caliper. The location of the brake caliper can be adjusted with shims, which are available in thicknesses of 0.008" and 0.016" = 0.2 and 0.4 mm. Install the attaching bolts after they have been coated with a couple of drops of Loctite, type AV. Check that the brake disc can rotate easily in the brake pads.
2. Connect the brake lines to the caliper. Remove the plug in the master cylinder reservoir cover.

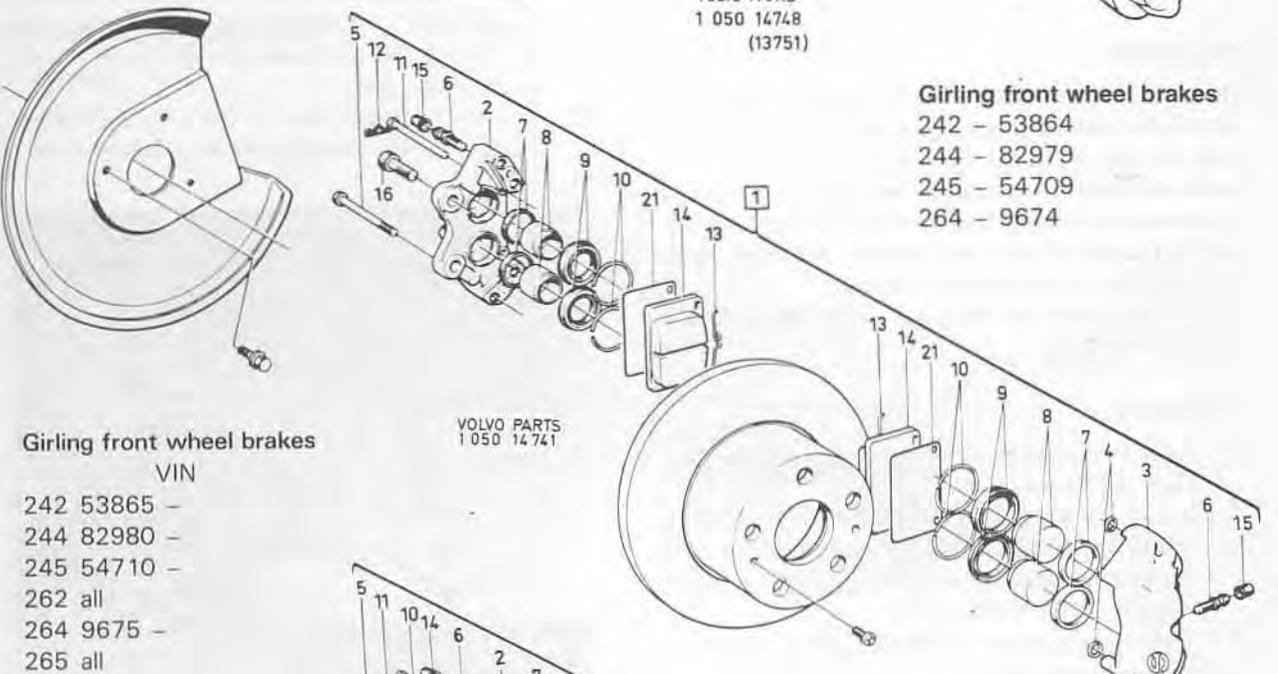


Front wheel brake

3. Install the wheel after the contact surfaces have been cleaned of dirt, etc., and then tighten the nuts sufficiently so that the wheel cannot be displaced on the hub. Lower the vehicle and tighten the wheel nuts. Tighten every other nut a little at a time until all are finally tightened to a torque of 100-140 Nm (70-100 lb.ft). Install the hub cap.
4. Bleed the brake system, see Group 52.



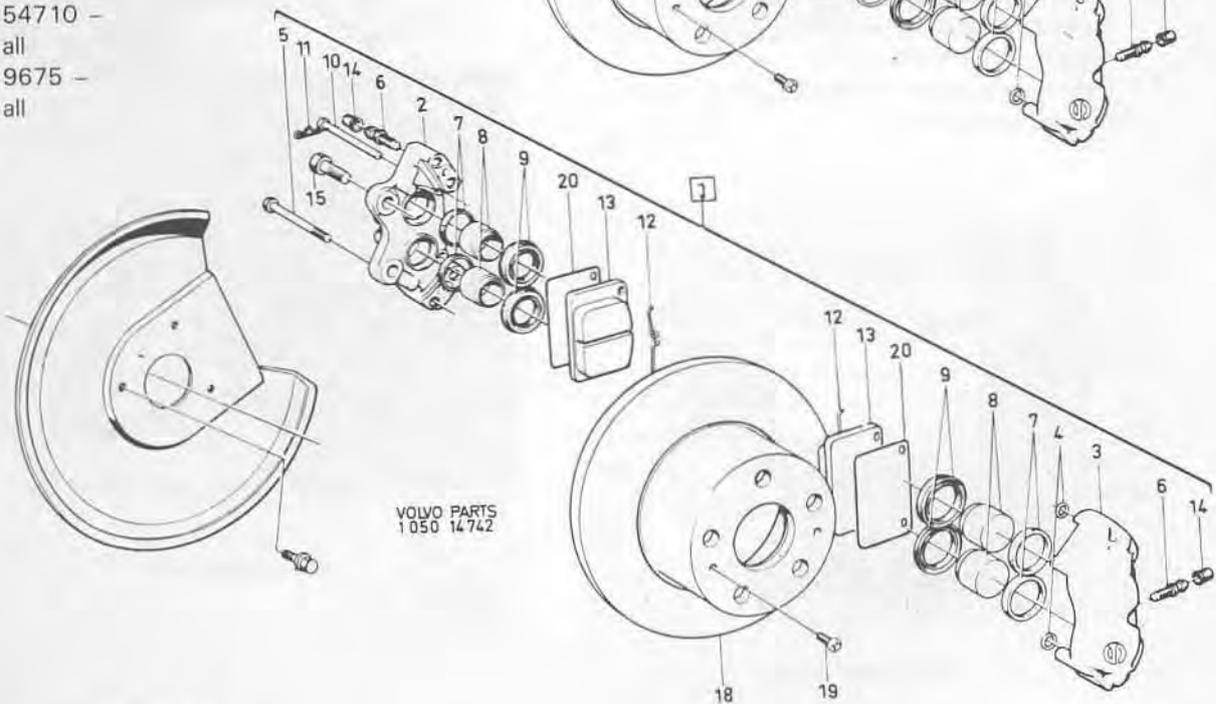
ATE front wheel brakes
 VIN
 242 - 53864
 244 - 82979
 245 - 54709
 264 - 9674



Girling front wheel brakes
 242 - 53864
 244 - 82979
 245 - 54709
 264 - 9674

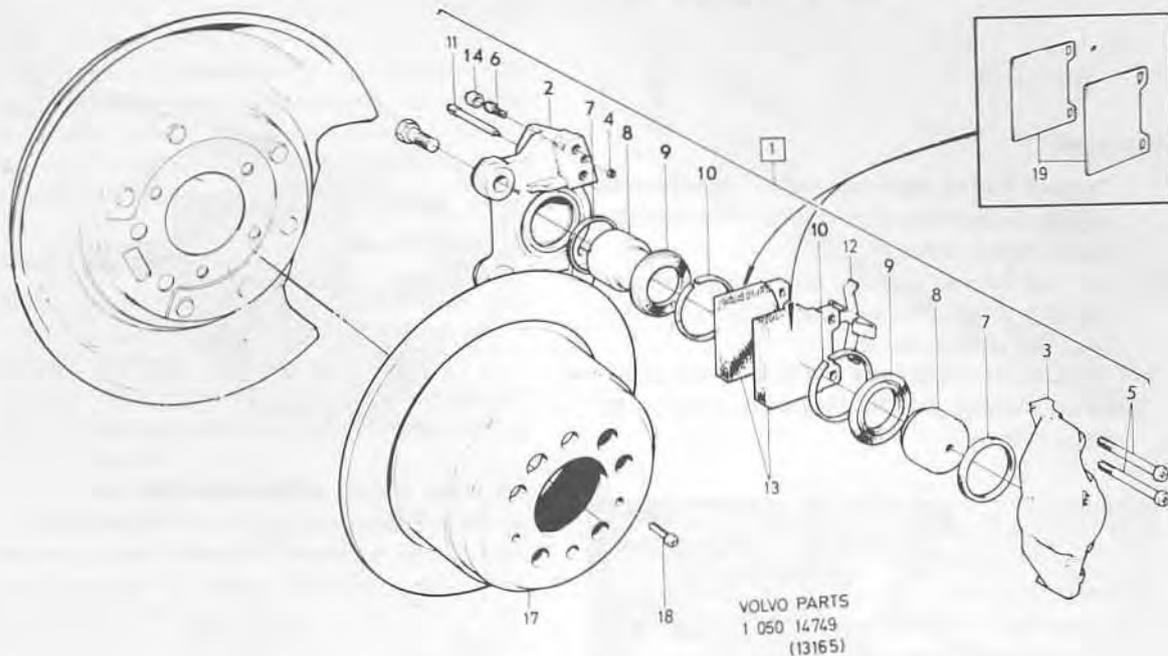
Girling front wheel brakes
 VIN

- 242 53865 -
- 244 82980 -
- 245 54710 -
- 262 all
- 264 9675 -
- 265 all

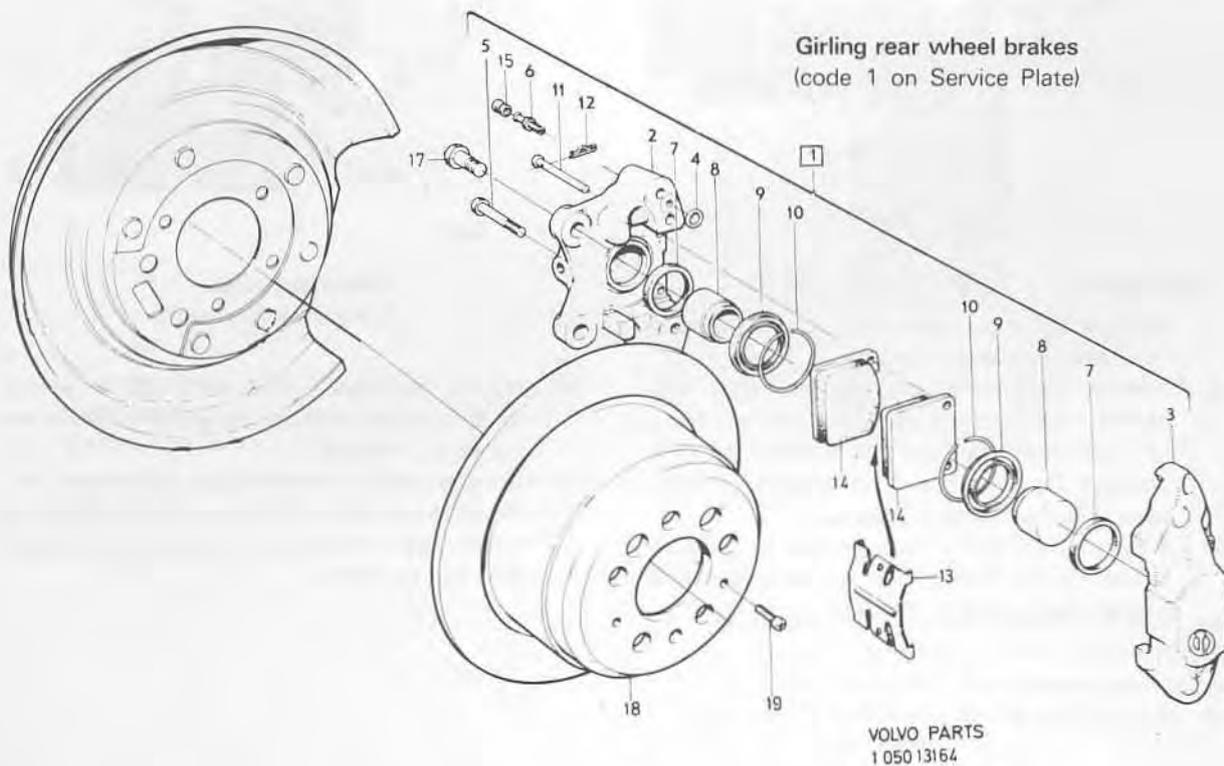


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ATE rear wheel brakes
(code 2 on Service Plate)



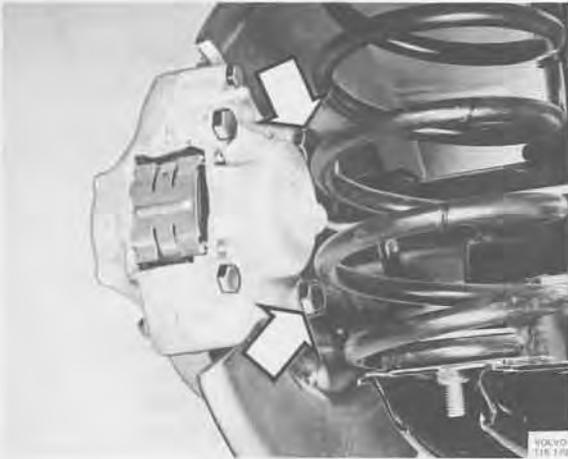
Girling rear wheel brakes
(code 1 on Service Plate)



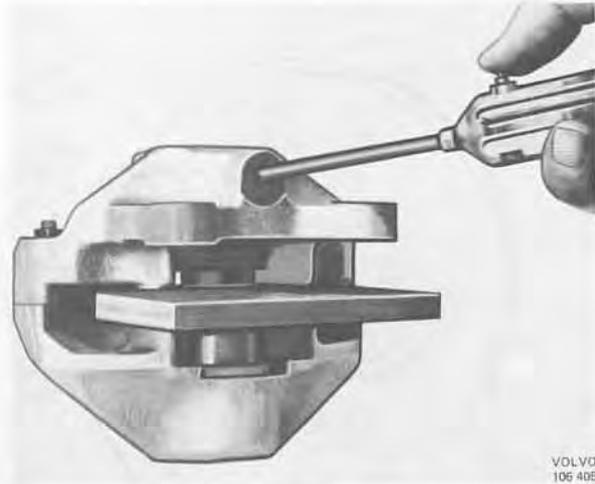
Rear brake calipers

Removal

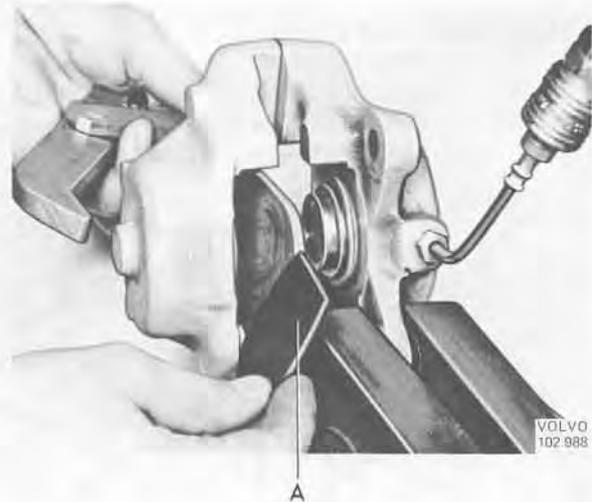
1. Remove the hub caps and slacken the wheel nuts slightly. Temporarily plug the brake fluid container cap to reduce leakage.
2. Jack up the rear end and put stands under the rear axle. Remove wheel nuts and the wheel. Release the parking brake.
3. Disconnect the brake line and install the protective cover. Remove the attaching bolts. Remove the brake caliper.



Rear wheel brake



Removing piston



Removing piston

A = rubber dust cover

Disassembly

1. Remove the brake pads, see 3a and 3b under "Replacing the brake pads".
2. Remove the retaining ring and the rubber dust covers. Place a wooden disc between the pistons and press them out towards the disc, using air pressure. The pistons can then be easily removed. Lever off the rubber covers.
3. If piston feels stiff to remove, use air pressure to blow it out. The cylinder can be sealed by a rubber washer and tool 2809:
4. Remove the seals with a blunt tool, so as not to damage the edges of the grooves. Screw out the bleeder nipple. The brake caliper halves should not be separated. The reason for this is that subsequent assembling would require test pressure equipment and special fluid for the bolts.

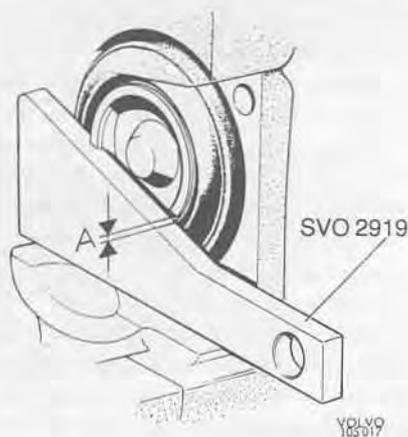
Inspection

Before inspecting clean all the parts according to the instructions under "Cleaning", Group 50. Make sure the channels are clean.

Seals and rubber dust covers are replaced after each reconditioning. If cylinder is scored, scratched, etc., the entire cylinder housing must be replaced completely. Inspect other parts and replace if damaged or worn. Also check brake disc, see "Brake Disc".

Assembly

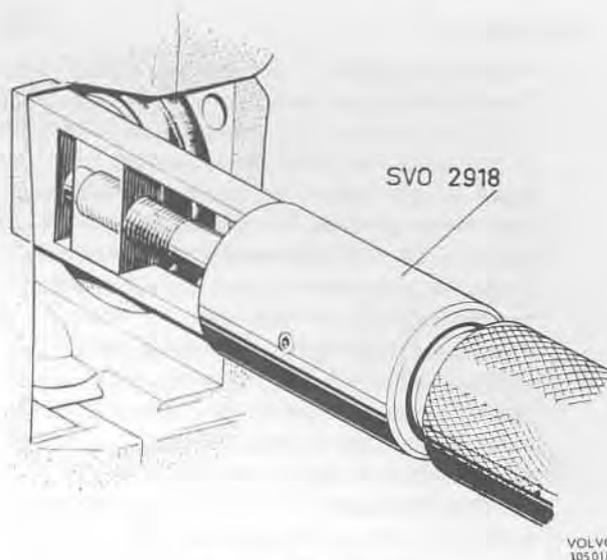
1. Coat the working surfaces of the pistons and cylinders with brake fluid.
2. Install new seals in the cylinders.
- 3a. Girling: Install one of the pistons in the caliper. Make sure the piston is installed straight and is not scratched.
- 3b. ATE: Check to make sure the pistons are in the proper position to avoid brake squeal. The piston recess should incline 20° in relation to the lower guide area on the caliper. Check the location with template 2919, see below:



Checking location

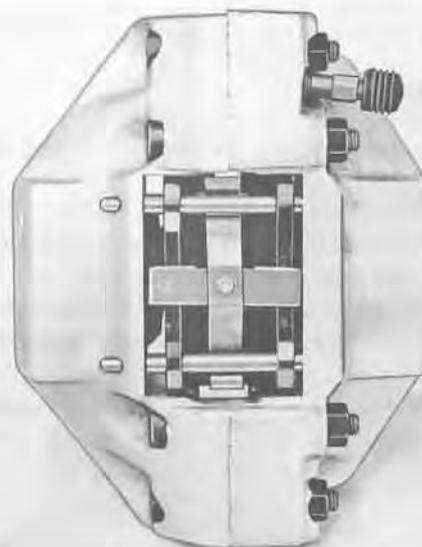
The tolerance is $\pm 2^{\circ}$, that is, when the template is placed against the one recess, the distance to the other (meas. A) may be max. $0.040'' = 1 \text{ mm}$.

If necessary, adjust the location of the piston with tool 2918. To do this, move the tool into position as shown.



Adjusting location

Press it against the piston and force out the shoes by screwing in the handle. Turn the piston, release the tool and re-measure with the template.



Rear brake caliper assembled

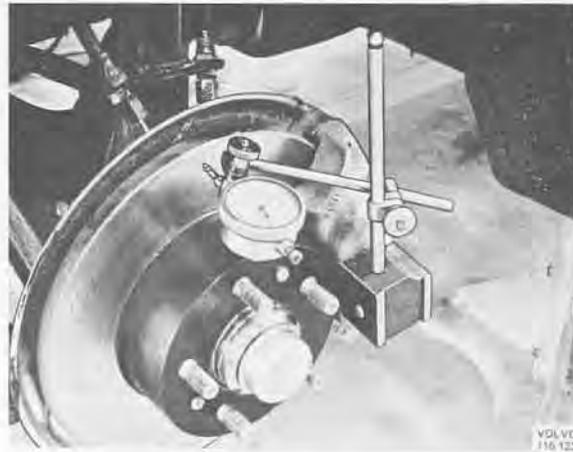
4. Install and test the other piston in the same way as above. Place the new rubber dust covers on the piston and housing. Install new retaining rings.
5. Install the brake pads, see 8a and 8b under "Replacing brake pads".
6. Screw in the bleeder nipple.

Installation

1. Position the caliper. Check that the contact surfaces of the retainer are clean and not damaged. Check the location of the brake caliper in relation to the brake disc when the drive shaft is at the outer position within the clearance limits. Axial deviation is checked by measuring with a feeler gauge on both sides of the disc the distance between disc and caliper support nib. Permitted difference is $0.010'' = 0.25$ mm.
The caliper should be parallel with the disc. This is checked by measuring the distance to upper and lower support nibs on the caliper. The brake caliper location can be adjusted with shims, which are available in thicknesses between 0.024 and $0.072'' = 0.6$ and 1.8 mm. Coat the attaching bolts with a couple of drops of Loctite, type AV, and then install them.
2. Connect the brake line. Remove the plug for the breather hole in the brake fluid container cover.
3. Clean the wheel contact surfaces and disc before installation of the wheel. Tighten the wheel nuts so much that the wheel cannot be moved. Lower the vehicle and tighten the wheel nuts finally. Tighten every other nut a little at a time until all are finally tightened to a torque of $70-100$ lb. ft. = $100-140$ Nm. Install hub cap.
4. Bleed the brake caliper, see Group 52.

Brake disc

The brake disc should be examined with regard to friction surface, warp and thickness. Small marks on the friction surface or linings are of minor importance, but radial scratches increase brake pad wear. The warp must not exceed $0.004'' = 0.1$ mm for the front wheel brakes and $0.006'' = 0.15$ mm for the rear wheel brakes at the outer edge of the disc and is measured.



Checking warp

First check that the wheel bearings are correctly adjusted and that the disc fits securely on the hub. The thickness is measured with, for example, a micrometer. It should not vary more than $0.0008'' = 0.02$ mm, when the disc is rotated one turn, since this can cause a vibrating brake pedal. If a fault is discovered during the inspection, the brake disc should be replaced. When doing this, the brake caliper should first be removed. Then remove the lock bolts and lift off the brake disc. Tap on the inside of the disc with several light blows from a plastic hammer or similar tool. If for some reason a new brake disc is not available, the old one can be reconditioned by fine-polishing or fine-turning. Accurate disc aligning is required and the turning should be equal on both sides. After turning, the disc thickness may not be more than $0.050'' = 1.2$ mm less than original thickness, see "Specifications". The surface finish should be max. 3μ measured on an arbitrary diameter and max. 5μ measured radially. After reconditioning, the disc warp may not exceed $0.004'' = 0.1$ mm, and its thickness may not vary more than $0.0008'' = 0.02$ mm.

Prior to machining

Measure the thickness of the disc and inspect for defects such as corrosion, deep grooves and pad marks. Minimum thickness must always be maintained after the machining operation.

The minimum thickness of the disc is cast into the disc as shown.

Group 52

Hydraulic Footbrake System

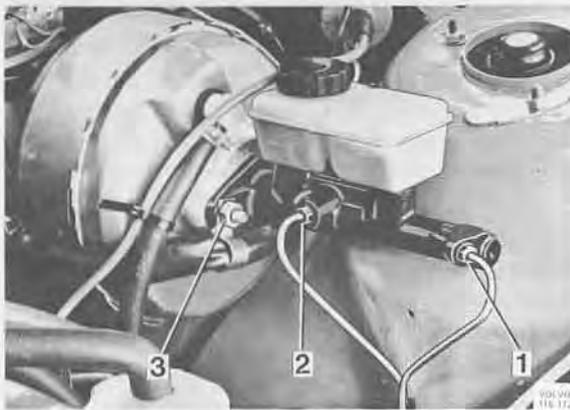
Master cylinder

When the master cylinder is removed, the brake pedal should not be depressed because the resulting abnormal position of the power cylinder parts may cause damage.

Removal

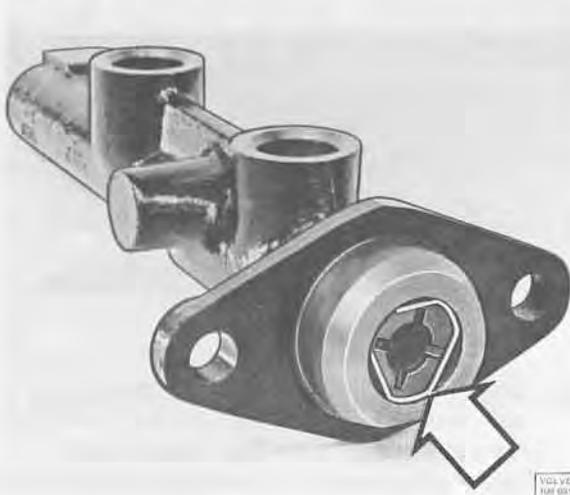
Place a cover over the fender and rags under the master cylinder in order to avoid possible damage to the paintwork from the brake fluid.

Remove brake lines (1 and 2, Fig. below) and fit plastic plugs. Then remove the retaining nuts (3) and remove the cylinder.

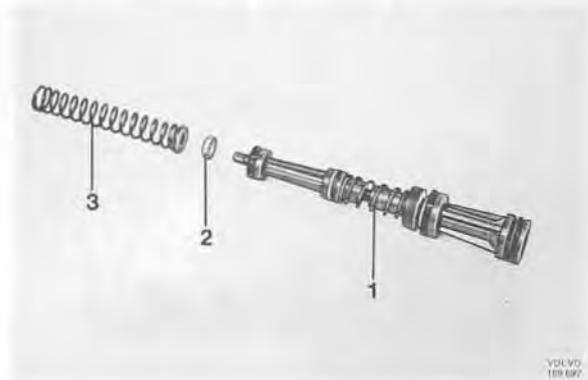


Overhaul

1. Remove filler cap and strainer and drain the cylinder of brake fluid.

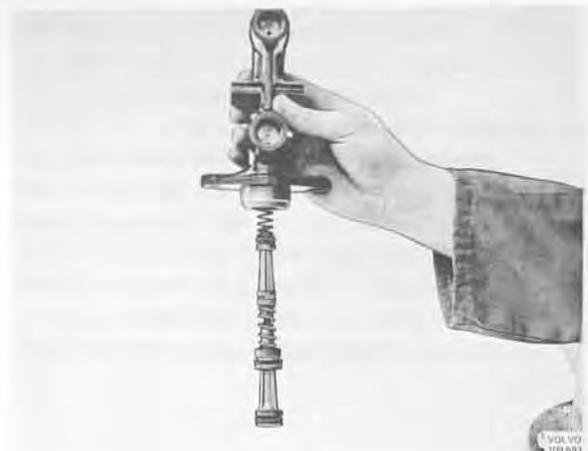


2. Remove the container by pulling it upwards. Remove the container seals from the master cylinder.
3. Remove the snap ring (Fig. below) Remove pistons and return spring.
4. Clean the master cylinder and all parts in alcohol or other suitable solvent. Blow compressed air through equalizing and overflow hole.
5. Examine the inside of the cylinder carefully. If scored or scratched, the cylinder should be replaced. Both pistons with connector sleeve and seals are replaced as an assembly.
6. Coat the cylinder with brake fluid and lubricate the piston seals with special brake grease (available at vendors). Then install pistons, spring seat and spring, see below:



1. Piston assembly
2. Spring seat
3. Spring

7. Position the cylinder over the pistons and the spring:

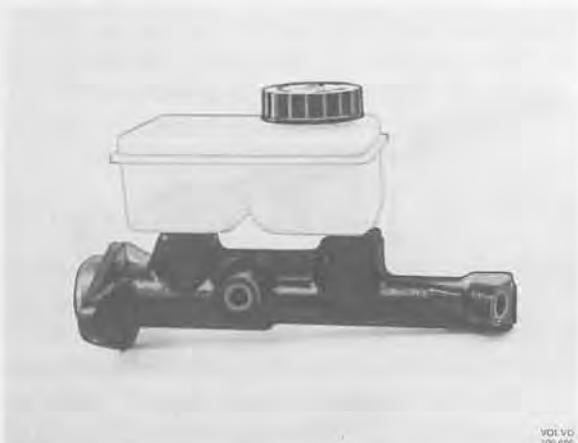


8. Install the snap ring for the pistons.



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9. Install the brake fluid container with seals.



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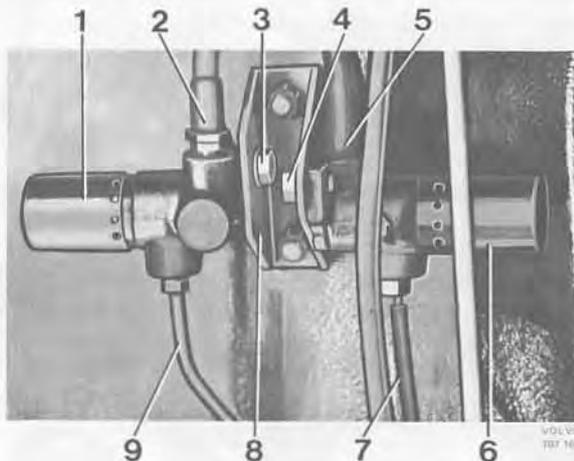
Installation

Position the master cylinder and install the retaining nuts. Connect the brake lines and bleed the brake system according to instructions.

Brake (reducer) valves

Checks

For checking the brake valve with tester 2741, see separate instructions. The valve cannot be repaired if defective and must be replaced.



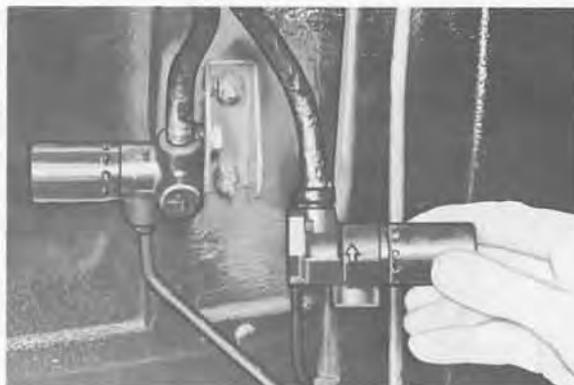
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Brake valves

- | | |
|-----------------------------------|---|
| 1. Left brake valve | 6. Right brake valve |
| 2. Brake hose to left rear wheel | 7. From the master cylinder |
| 3. Attaching screw | 8. Bracket |
| 4. Attaching screw | 9. From the master cylinder secondary circuit |
| 5. Brake hose to right rear wheel | |

Replacement

1. Disconnect and plug connection (9) of the brake pipe. Loosen brake hose (5) maximum 1/4 turn at the valve. Remove attaching screw and valve from the brake hose:



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Removing brake valve

2. Screw the new brake valve onto the brake hose with new seal. Position the valve and check that there is no tension in the hose. Install the attaching screw and connect the brake pipe. Tighten the connection. Bleed the brake system.

Brake lines

Cleaning

The brake lines can be cleaned by flushing with brake fluid or alcohol and then by blowing them clean with moisture-free, filtered, compressed air. This is to remove all brake fluid and dirt particles and should be made in connection with reconditioning of the hydraulic system and a new fitting.

When reconditioning system, the brake service unit (see Group 50) can be connected to the master cylinder and then the system emptied through the bleeder nipple. The system should therefore be flushed with alcohol and blown clean with compressed air. The components of the hydraulic system should be taken out and checked to ensure that any dirt and flushing fluid have been effectively removed.

NOTE: See general instructions in Group 50 for requirements concerning cleaning agent. Do not top up with brake fluid which has been drained from the system.

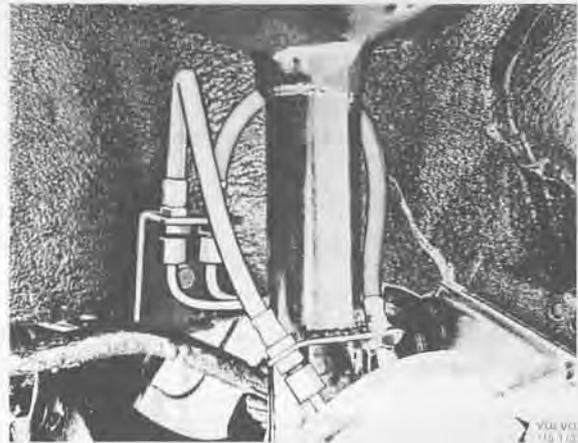
Replacing brake lines

If leakage occurs or if the brake lines have been exposed to such external damage that leakage or blockage can result, the damaged lines should be replaced according to instructions below. If the replacement concerns the front brake hoses, it should be made with no load on the front wheels.

1. To prevent unnecessary spilling of brake fluid, the existing filter cap on the master cylinder container should be temporarily replaced with one without breather hole.
2. Clean round the connections and remove the damaged brake line.
3. Take a new brake line, blow it clean internally with moisture-free, filtered, compressed air and fit it. Make sure the brake line lies in such a position that it does not chafe against anything during driving. Particularly important points are where the pipes pass the steering rod, where they must not come nearer than 10 mm (3/8").
If the pipe is not bent correctly, it should be adjusted manually **before** being installed. Bending a pipe which is already connected often results in deformation at the connections. The front brake hoses may only be installed according to Figures above right.
4. Bleed the brake system according to instructions below. Then re-install the filler cap with the breather hole on the container.

Bleeding hydraulic system

A sign that there is air in the system is that the brake



Front wheel brake hoses (earlier models)



Front wheel brake hoses (later models)

pedal can be depressed without any appreciable resistance, or it feels spongy.

As soon as any part of the system has been removed, bleeding must be made. Air can also enter the system if there is too small a quantity of brake fluid in the container. If only one rear brake caliper has been removed and little brake fluid runs out, it is generally only necessary to bleed the brake caliper. Otherwise, bleed the entire system.

No brake fluid must be permitted to come into contact with friction surfaces or linings. Avoid spilling any fluid on the paintwork as this can damage it.

Should the car be on stands during the bleeding, the rear end should be higher than the front end.

When filling fluid, the following should be observed: The brake fluid must fulfill the requirements according to DOT 4 SAE J 1703. Brake fluid which has been bled from the system must under no circumstances be returned to the bleeder unit or the brake fluid container. Bleeding of the entire brake system is as follows:

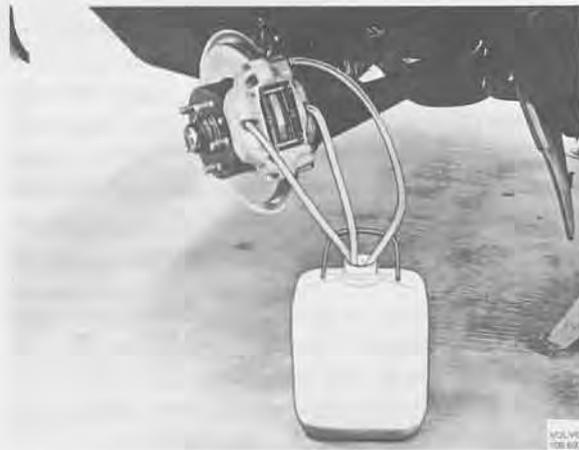
Bleeding the brake system with bleeder unit

This procedure concerns bleeding when the brake master cylinder has been emptied of brake fluid. If the master cylinder has not been emptied, disregard 9, 10 and 11.

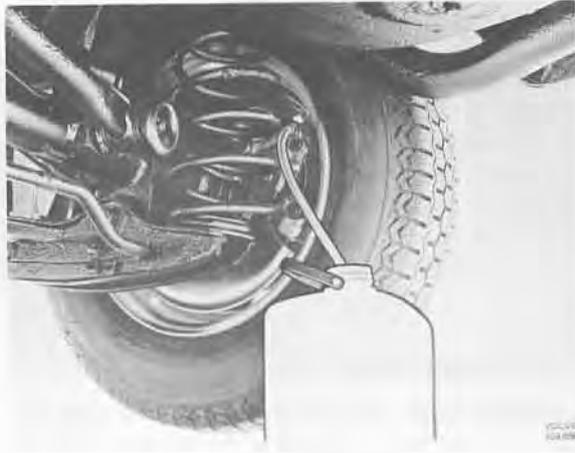
1. Put the vehicle on stands and remove the front wheels.
2. Connect the bleeder unit to the brake fluid container (Fig. below) and set the work pressure to $3.5-4 \text{ kp/cm}^2 = 50-60 \text{ psi}$.



3. Start on left front wheel. Connect hoses to all three bleeding nipples and route them into a collecting vessel:



4. Open the three bleeding nipples. Pump the brake pedal five times and then close the bleeding nipples.
5. Move the hoses and collecting vessel to the right front wheel. Open the nipples, pump the pedal five times and then close the nipples.
6. Connect one hose and the collecting vessel to the right rear wheel bleeding nipple:



7. Open the bleeding nipple. Check that the brake fluid does not contain any bubbles and close the nipple.
8. Connect hose and collecting vessel to left rear wheel. Open the nipple, check that the brake fluid does not contain any air bubbles and then close the nipple.
9. Re-connect the hoses and the collecting vessel to left front wheel, open the nipples, pump the pedal three times and close the nipples.
10. Repeat on right front wheel, pumping the brake pedal three times.
11. Repeat points 6, 7 and 8.
12. Check by depressing the brake pedal with a pedal force of approx. $20 \text{ kg} = 45 \text{ lbs.}$ that there is no air in the system. The pedal travel may not exceed $60 \text{ mm} = 2 \frac{3}{8}''$ and the brake failure warning light must not light or flash. If incorrect, repeat steps 9, 10 and 11. (NOTE: without vacuum booster assist.)
13. Disconnect the bleeder unit and check the brake fluid level.
14. Install protective caps on the bleeder nipples, install the front wheels and restore.

Bleeding without bleeder unit

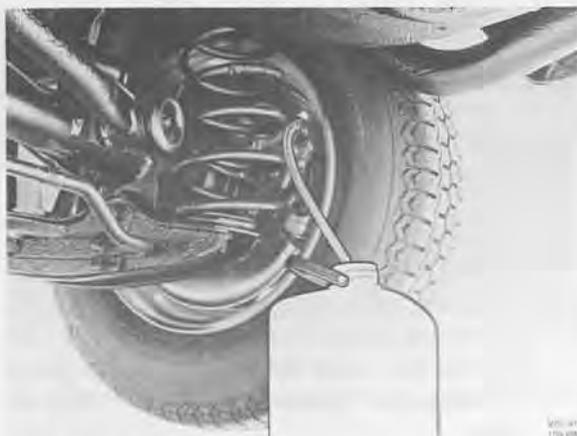
"Manual bleeding".

1. Put the vehicle on stands and remove the front wheels.
2. Check the brake fluid level.
NOTE: The fluid level should be watched throughout the procedure.
3. Start on left front wheel.
Connect hoses to the three bleeder nipples and immerse the other ends in brake fluid in a vessel.



The nipple connections should be tight and the hose ends always immersed.

4. Pump the pedal 10 times. Use assistants to open the nipples when depressing the pedal and close at the end of the stroke. All nipples should be opened and closed simultaneously.
5. Repeat the procedure at the right front wheel.
6. Depress the pedal 3-5 times, all nipples closed, to "level out" the master cylinder.
7. Connect one hose and the vessel at the rear right wheel bleeder nipple.



8. Open the nipple and "gravity bleed", no pumping of the pedal. Close the nipple when brake fluid free from bubbles comes out.
9. Repeat the rear left wheel.
10. To re-assure correct bleeding of the master cylinder, re-connect hoses and vessel at the three nip-

ples of the front left wheel. Open the three nipples and pump the pedal a few times. Close the nipples.

Adjusting brake pedal position

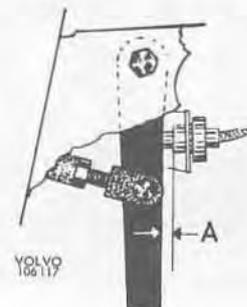
The brake pedal travel can be measured only when bleeding the two brake circuits simultaneously. The stroke A should be approx. 6.1" (145-165 mm) and the pedal bottom approx. 0.4" = 10 mm (B) from the floor.

Do not depress the brake pedal with the master cylinder removed. The resulting abnormal position will damage the power brake parts.

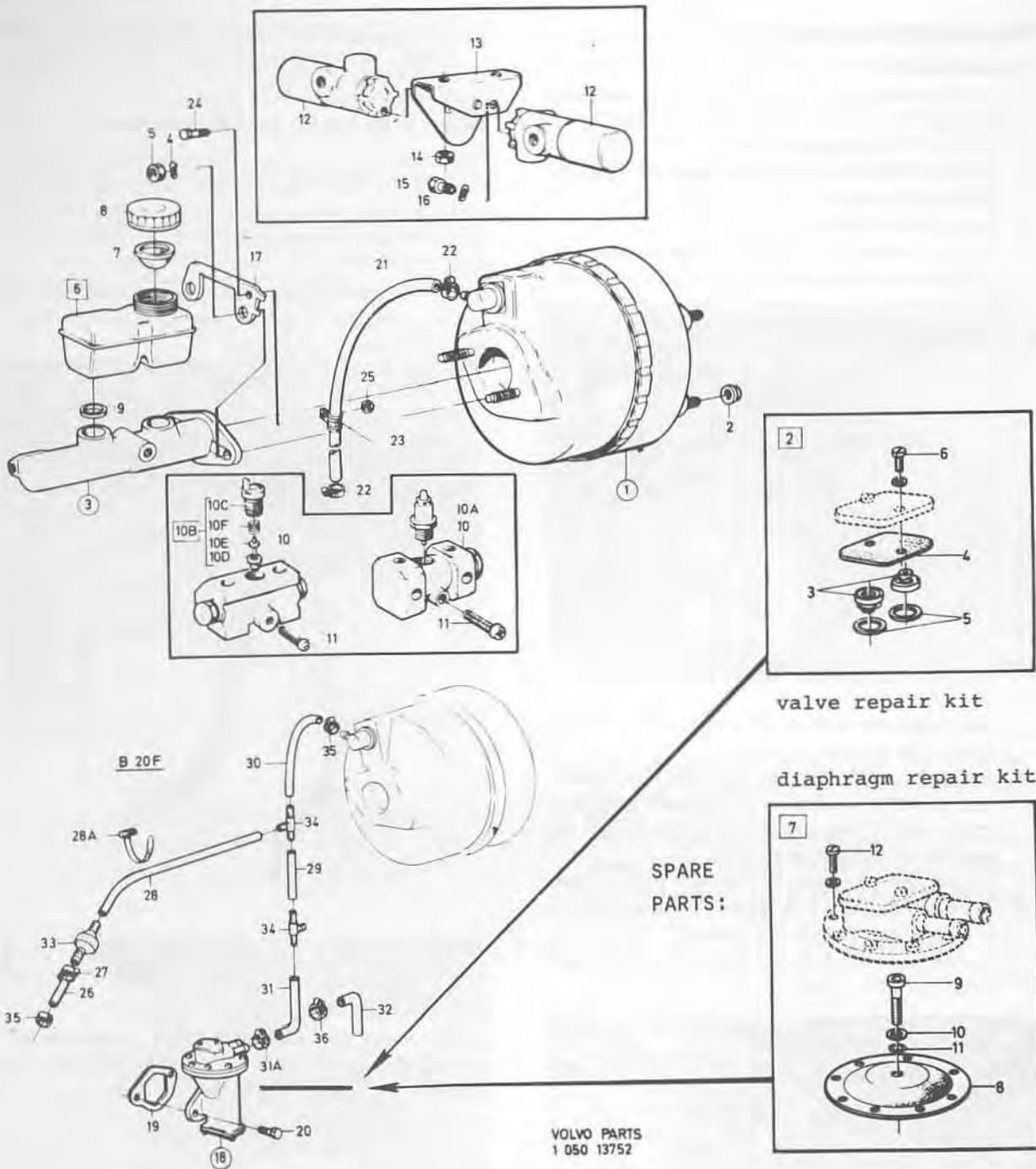


A = Approx. 6.1" (145-165 mm)
B = Approx. 0.4" (approx. 10 mm)

When released, the brake pedal should be same height as the clutch pedal. To adjust, slacken the lock nut, remove the cotter pin and turn the fork.

Adjusting brake warning light switch

The distance A should be 0.16" (2-6 mm). To adjust, release the retaining screws and move the bracket.



Replacing power cylinder

Removing

1. Remove the master cylinder. Disconnect the vacuum hose from the power cylinder.
2. Disconnect the link from the brake pedal. Remove the bracket with clutch pedal stop.
3. Remove the 4 nuts securing the power cylinder.
4. Pull the power cylinder forwards and disconnect the fork from the link arm.

Installing

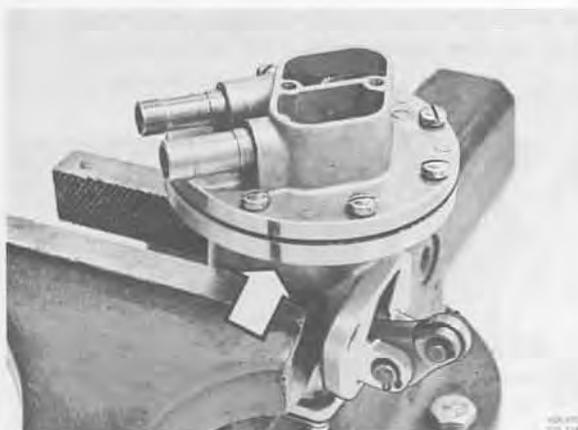
1. Check that the rubber cover is pressed down properly at the protective washer for the cleaner. Secure the fork to the link arm. Push in the power cylinder so that the attaching bolts come into position.
2. Place the resilient washers under the attaching nuts. Secure the cylinder.
3. Fit the bracket for the clutch pedal. Secure the link arm to the brake pedal.
4. Fit the vacuum hose. The connection for the vacuum hose should face downwards.
5. Bleed the brake system.

Vacuum pump

The vacuum pump diaphragm should be replaced every 30,000 miles (50,000 km) as part of regular maintenance to ensure effective service life.

Disassembly

1. Put the pump in a vise. Use soft jaws. Remove the valve housing cover.
2. Mark the position of the valve housing. Remove the valve housing.



3. Remove diaphragm, washers and spring from the pump.



4. Turn the pump upside down and remove the bottom cover.
5. Remove pump lever pin. Remove pump lever, pump rod and nylon bushing.

Assembly

1. Place the bushing on the pump rod. Install the rod in the pump housing.
2. Install lever and pin.



3. Install bottom cover and gasket.
4. Place washer and O-ring on the diaphragm screw. Apply locking fluid on the screw end.



5. Install diaphragm assembly.
6. Install valve housing according to marking.
7. Install valves and seals.

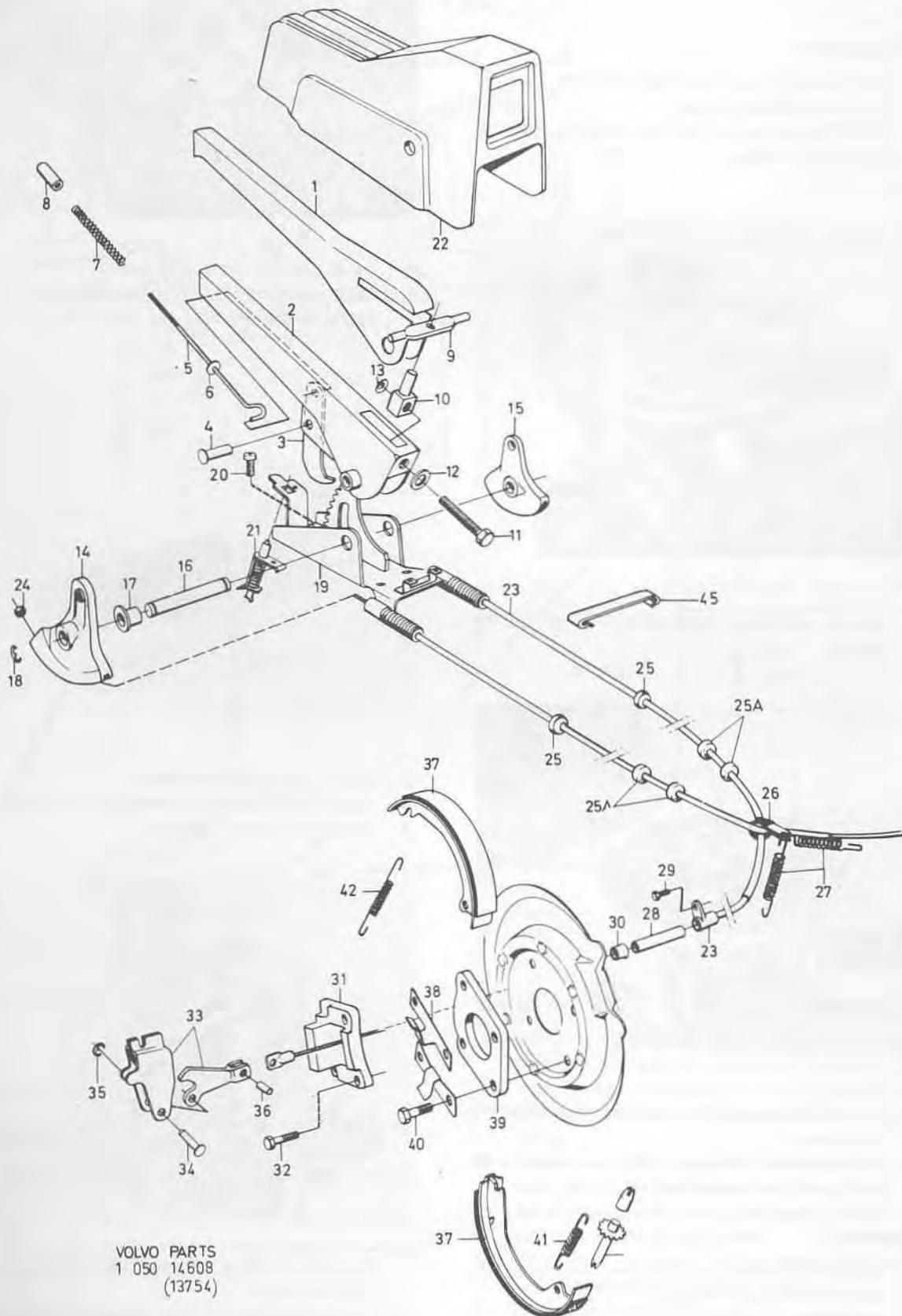


8. Install valve housing cover with spring and gasket.

The domed side of the discs should point towards the diaphragm.

Group 55

Parking Brake

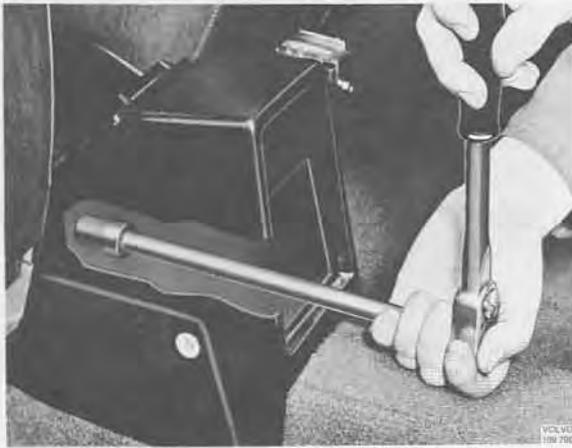


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Adjusting parking brake

The parking brake should be fully applied at notches 3-4. Otherwise adjust the parking brake as follows:

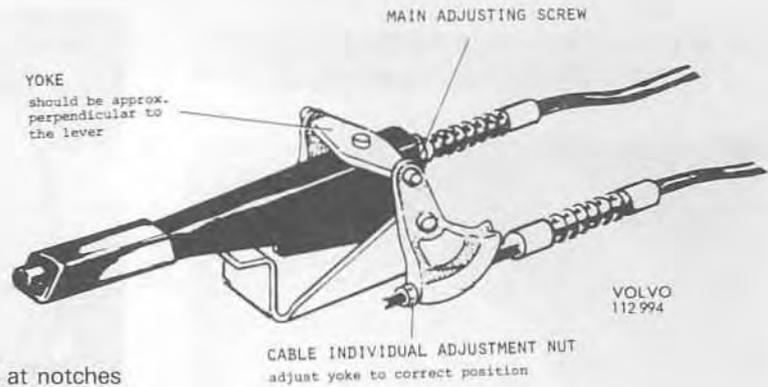
1. Remove the rear ash-tray.
2. Tighten the wires with the adjustment screw at the rear end of the parking brake lever so that the brake is fully applied after 2-3 notches:



3. Install the ash-tray.

Replacing brake shoes

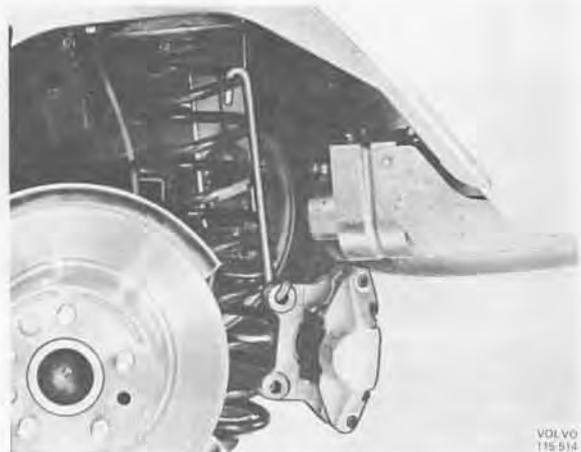
1. Remove the rear ash-tray and screw out the adjustment screw at the rear end of the parking brake lever so that the cable is slackened.
2. Put the rear end on stands and remove the rear wheels.



3. Remove clamp (1) for the brake line. Screw out the retaining screws (2) for the yoke:



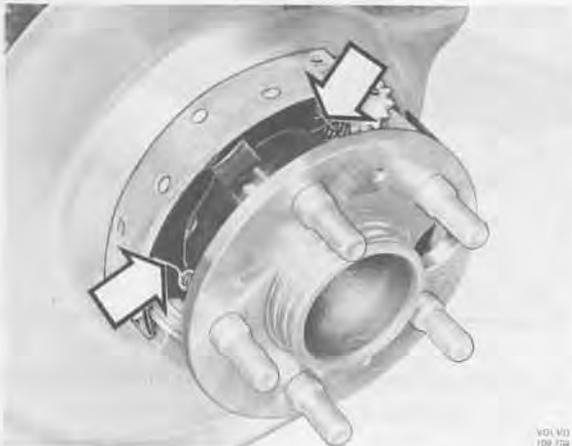
4. Hang up the brake yoke in a wire so that no sharp bends are made on the brake line:



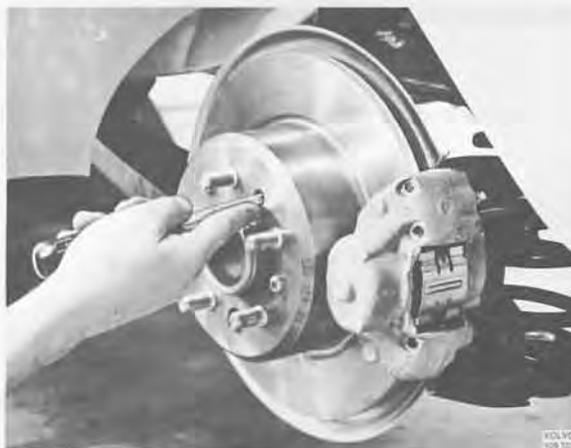
5. Remove the bolts for the brake drum and remove the drum.

Parking brake shoes

6. Unhook the springs with a brake spring tool. Remove the brake shoes and the adjustment device:



7. Before installing new shoes, check that there is no oil leakage from the rear axle. Also check that levers, cables and adjustment devices are not worn or seized. The brake drums should be replaced if they are scored, convex or out of round more than 0.2 mm = 0.008". Clean the sliding surfaces for the brake shoes on the brake shields.
8. Apply a thin layer of heat resistant graphite grease on the brake shoe sliding surfaces on the brake shields, on the levers and on the adjustment devices.
9. Install brake shoes and lower return spring:



10. Install upper return spring and adjustment device:
11. Install brake drum and brake caliper. Use a locking fluid for the caliper retaining screws. Check that the brake disc is free from the brake pads.
12. Clamp the brake line to the rear axle:
13. Align the brake drum so its hole is in front of the adjustment screw and adjust the shoes by turning the adjustment wheel with a screwdriver.

Stop turning when the drum just about cannot be turned around, then turn back 5-4 teeth. Turn the brake drum and check that the brake shoes do not drag. If that is the case, turn back another 2-3 teeth.

14. Install the wheels.
15. Tighten the wires with the adjustment screw at the rear end of the parking brake lever so that the brake is fully applied after 2-3 notches. Restore.

Replacing parking brake cable, one side

Loosen seat belt anchors 17 mm

1. Remove the parking brake lever cover. Disconnect the wire for the ash-tray light.
2. Slacken the wire by screwing out the adjustment screw.



1. Adjustment bolt
2. Lock screw

Remove nut (2) while retaining the cable with a small screwdriver at the end.

NOTE: The cables cross each other under the floor which means that left cable controls right wheel, and vice versa.

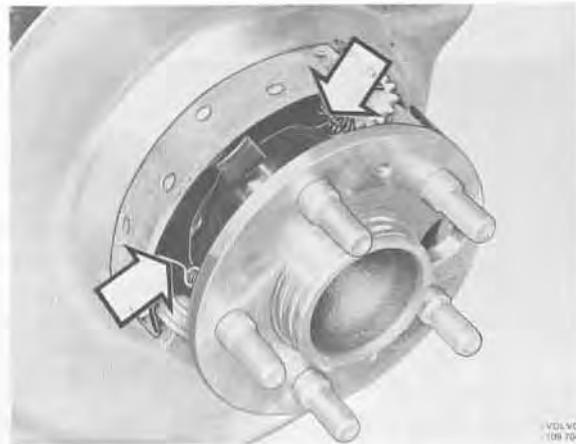
3. Lift the front end of the rear seat cushion, fold away the floor mat and loosen the clamps holding the wire to the floor.
4. Disconnect the wire end sleeve and rubber grommet from the rear seat support.
5. Put the rear end on stands and remove the rear wheel.
6. Remove the clamp (1), for the brake line, Remove the retaining screws (2) for the brake caliper:



7. Hang up the brake caliper in a wire so that no sharp bends are caused on the brake line.



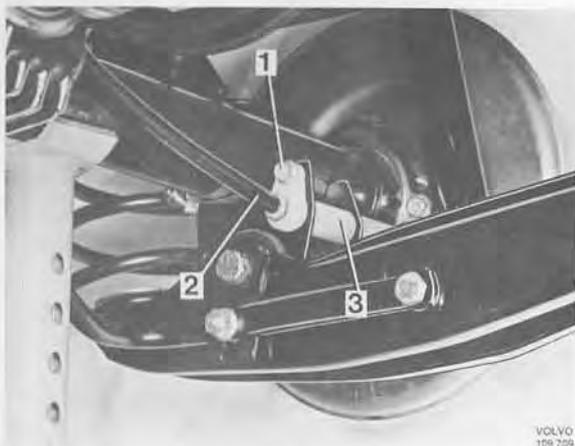
8. Remove the brake drum.
9. Unhook the springs with a brake spring tool and remove the brake shoes:



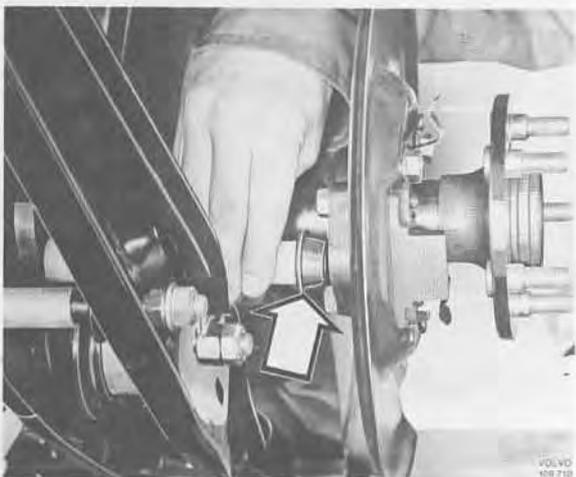
10. Press out the lock pin retaining the cable to the lever:



- ✓ 11. Remove the screw (1). Pull out the cable (2) and plastic tube (3) with rubber seal:



- ✓ 12. Pull out the cable assembly from the center support and the floor passage.
- ✓ 13. Align the plastic tube through the bracket and install the rubber seal:

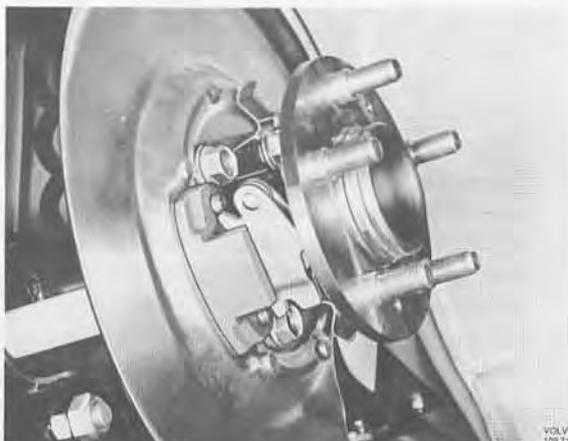


- ✓ 14. Route the new cable through the center support and through the hole in the floor.
NOTE: The left wheel cable should be routed through the hole to the right of the propeller shaft, and vice versa.
Right wheel cable goes on top when they cross.
- ✓ 15. Route the cable through the plastic pipe and connect it to the bracket.
- ✓ 16. Lubricate the lever pivot as well as the sliding surfaces for the brake shoes with a thin layer of

heat resistant graphite grease. Attach the lever to the cable:



- ✓ 17. Push in the cable and locate the lever behind the rear axle flange:



- ✓ 18. Apply a thin layer of graphite grease on the sliding surfaces for the brake shoes. Install brake shoes and lower return spring:



Additional Information

Driving tips

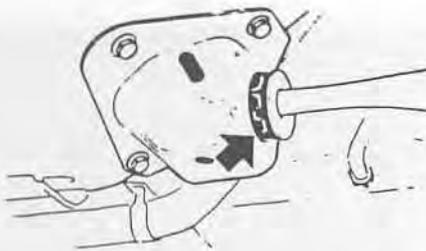


To avoid excess temperature buildup in the brake system, careful driving techniques, including engine braking on down-hill sections, should be utilized if the vehicle is heavily loaded. Since efficient brake cooling is also important under these conditions, accessory spoilers should only be used in conjunction with Volvo alloy rims, which provide greater brake cooling.



Brake Pulsations

Control arm bushing



On vehicles prior to chassis numbers listed below, install a hard type bushing P/N 1221982-0 on the right side lower link arm. (For installation instructions see Service Manual, Section 6 (TP300001)).

242	-131408	244	-320353	245	-183700
262	-3413	264	-52806	265	-12930



1205826-9
SOFT



1221982-0
HARD

NOTE: The harder bushing is standard on the left side on vehicle above these chassis numbers. The bushing can be inspected without being removed and identified as illustrated below. The bushing should also be inspected for damage such as cracks which will cause the bushing to lose its resiliency.

Brake disc condition

To assist in diagnosis and to determine corrective measures listed below are examples of brake disc surfaces:

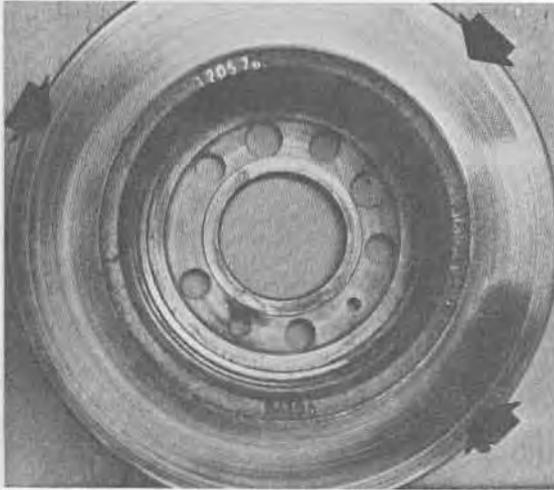
INSPECT BRAKE DISCS

Brake discs having a friction surface as illustrated under

"A" and "B" shall be corrected with the use of ABRA-SIVE brake pads.

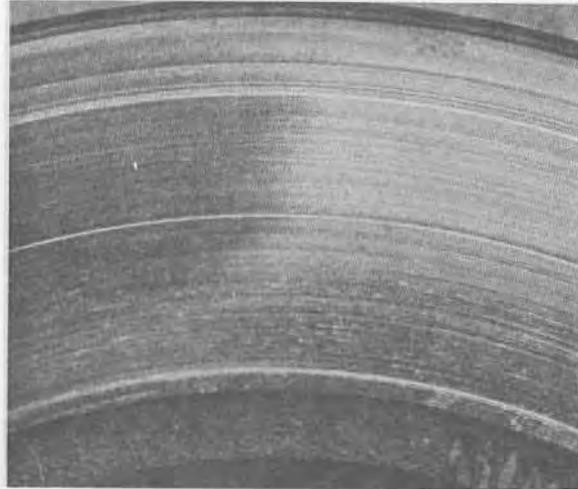
Discs having a friction surface as shown under "C" and "D" may have to be resurfaced through the use of a special brake lath machine.

A



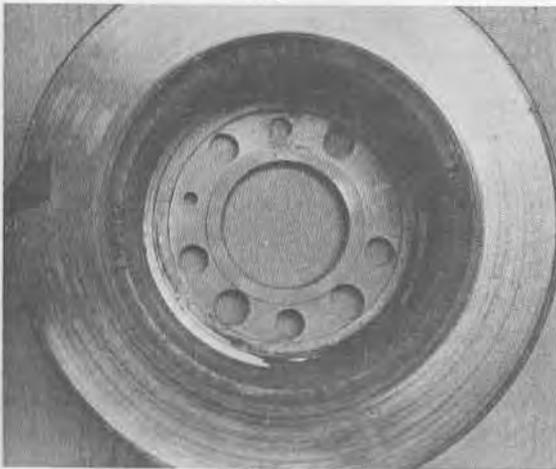
Several elongated marks.
See arrows.

B



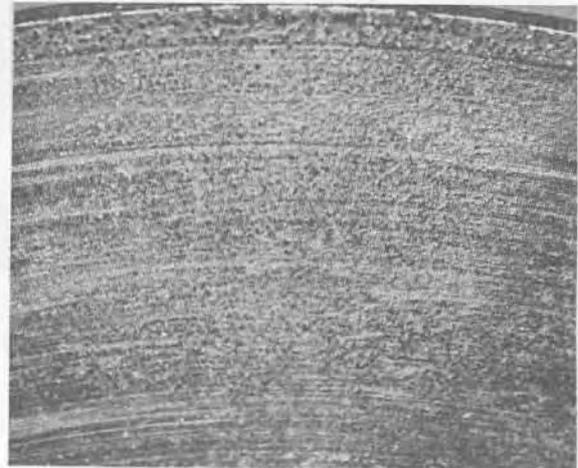
Deposits on the disc
causing high spots.

C



Single mark 2"-3" long causing
low spot as shown.

D



Small deep pitted holes.

Corrective Procedures

A. USING ABRASIVE PADS

Characteristics of Abrasive Brake Pads

The abrasive pad consists of a standard pad with a very thin top coating of abrasive material. Therefore, it is not necessary to reinstall standard pads.

Some brake squeal and noise will be present until the abrasive layer is worn down. This could last up to 300 miles, depending on frequency of brake application.

In most cases, it is sufficient to use abrasive pads on the front discs only. Due to the possibility of rear wheel lockup, abrasive brake pads should *not* be installed on the rear brakes alone.

The latest version abrasive pads for the front brakes does not have an abrasive layer, but are slightly abrasive throughout. (T269)

B. BRAKE DISCS

Experience has shown the necessity for machining of brake discs is not very common. Should it, however, be required, discs should be machined in pairs, i.e., front wheels and rear wheels, with the cutting depth kept to a minimum.



**VOLVO SUPPORTS VOLUNTARY
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