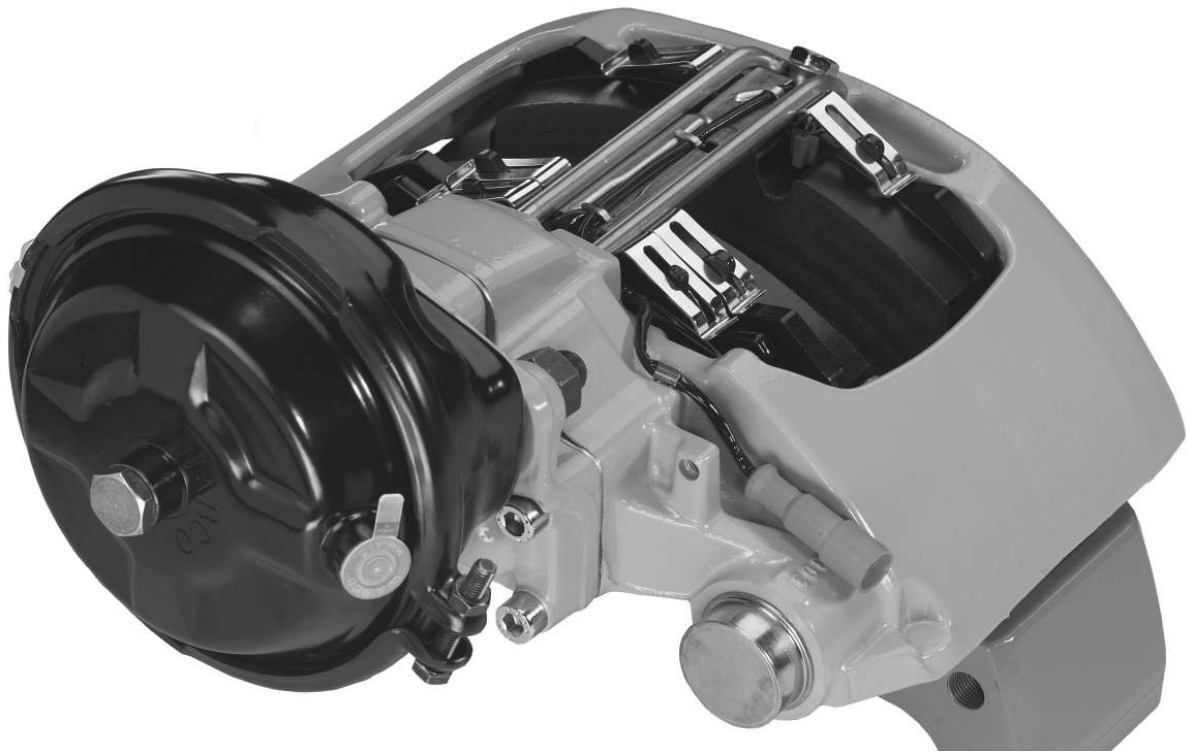


## Mechanical Sliding Caliper Disc Brake

Type **PAN 19-1** 


## Assembly and Maintenance Instructions



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 **Note:**

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## 1. Description of the Mechanical Sliding Caliper Disc Brake

### 1.1 Introduction

The Brake **"PAN 19-1" <sup>plus</sup>** is a pneumatic one-piston-brake, which is intended for use in commercial vehicles and trailers on front and rear axles for 19,5" or 22,5" wheel rims as service, auxiliary and parking brake. It is actuated mechanically via a diaphragm brake cylinder or a spring brake cylinder which is mounted to the end cover of the brake caliper.

A very compact unit is achieved by the direct mounting of the brake cylinder onto the caliper. This enables optimal utilisation of the installation situations.

The complete disc brake including brake cylinder consists of two assemblies:

- Brake Caliper (1)

- Brake Carrier (2)



Fig. 1

The brake caliper (1) slides axially on guide pins (8, 9) mounted in the brake carrier (2) and the axially moveable brake pads (35, 36) are held in the brake carrier by a hold down hoop (38) and hold down springs (37). Thereby the brake force is then transmitted to the abutment faces in the brake carrier – shown in Fig. 1, 2 & 3.

The radially open design of the brake caliper allows for simple and quick changes of the brake pads.

Brake pads with a large wear volume are used in order to prolong the pad replacement intervals with this brake.

The actuation unit of the brake is equipped with an Automatic Adjuster to compensate for wear of the brake pads and brake disc. This Automatic Adjuster, independent of load and operating conditions, maintains a constant predetermined gap between brake pads and brake disc. This, together with the robust and stiff construction of the brake caliper, ensures safe control of the brake system and increases safety margins during emergency stopping.

The internal moving components of the brake are lubricated for life, and all sealing components are maintenance free unless damaged.

Optionally the disc brake is equipped with an electrical wear indicator / sensor (40).

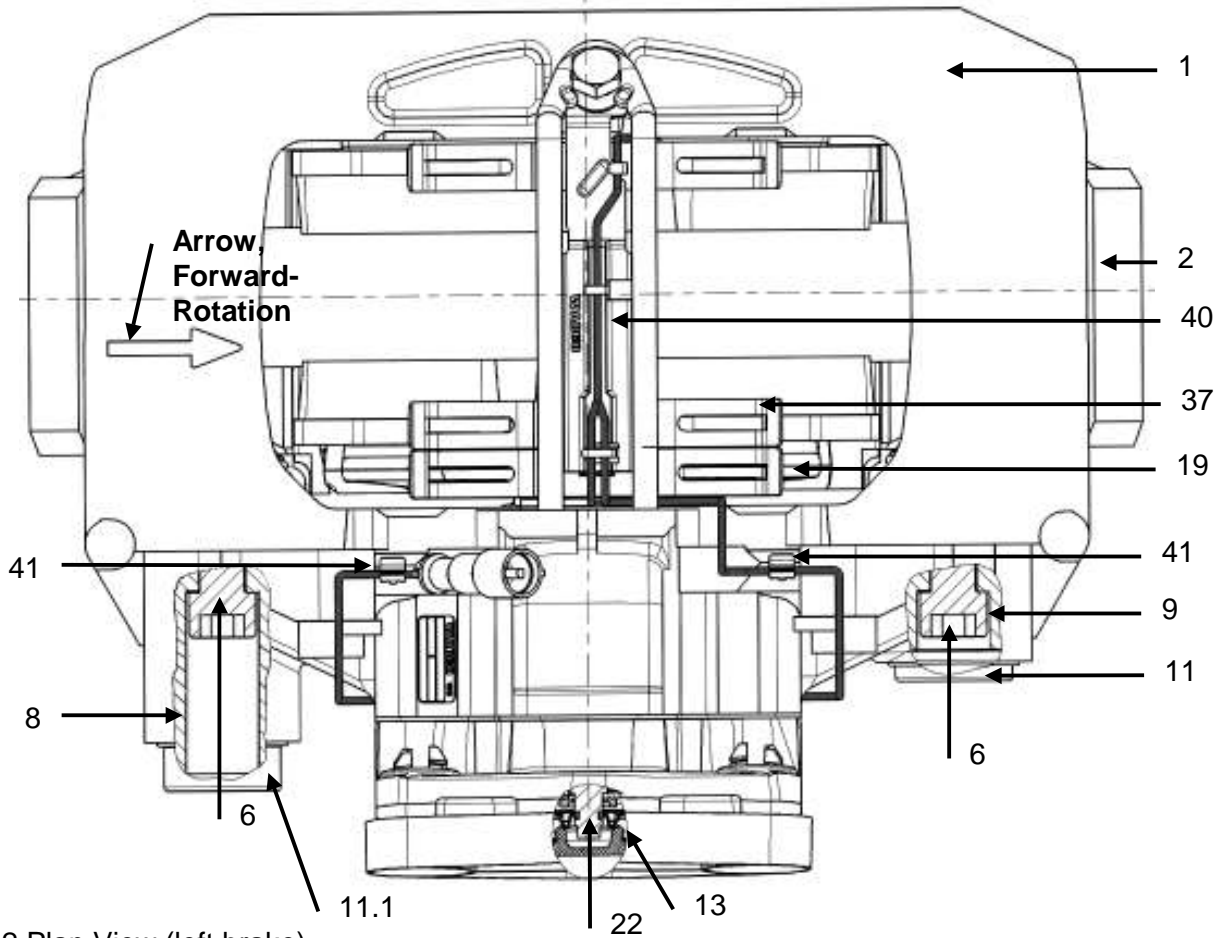


Fig. 2 Plan View (left brake)

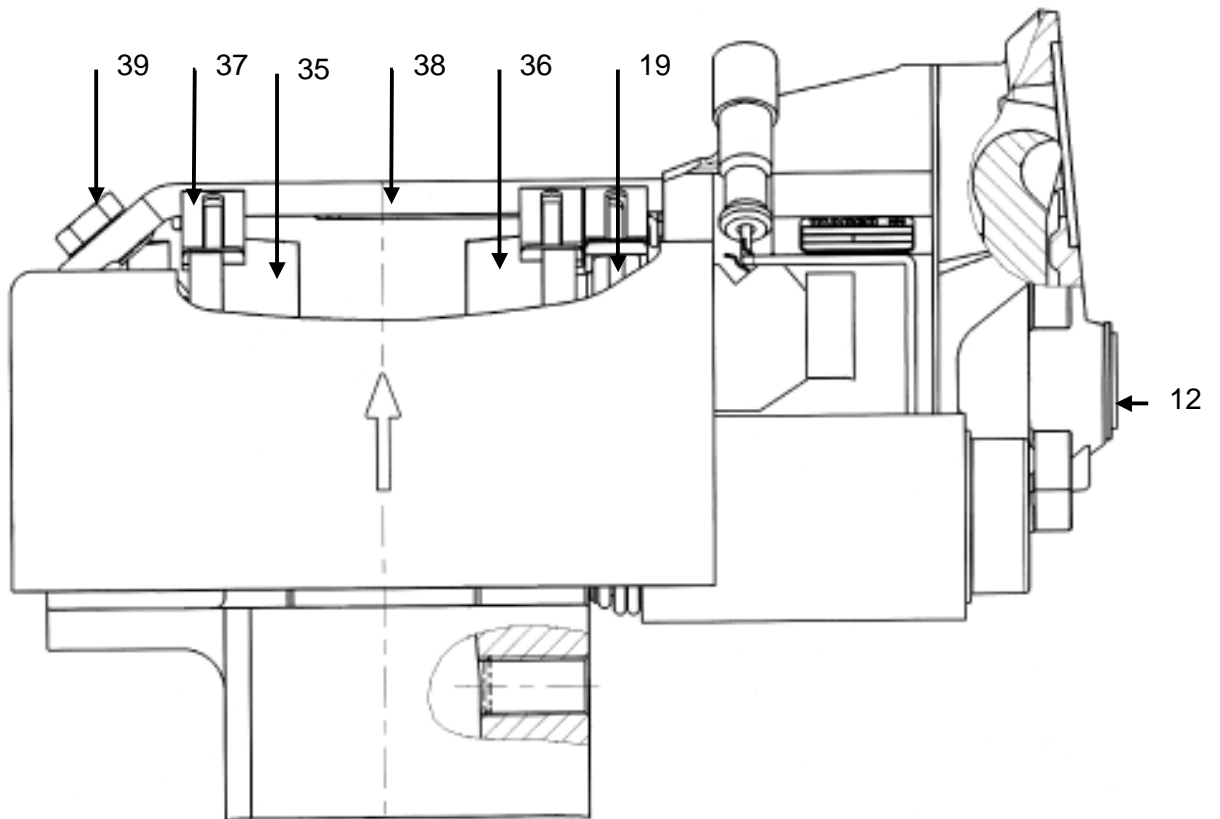



Fig. 3 Side View (left brake)


## 2. Service Instructions


The instructions with the following pictures encompass the necessary steps and work sequences to replace the available repair kits. The spanner size and the tightening torques in the sequences are listed in Table 1. **For lubrication use only the tube of grease supplied with the brake repair kit.**

### 2.1 Safety Tips to be considered during Repair


The flawless technical condition of the Disc Brake is of utmost importance to ensure good driving and safe braking characteristics.


 All service and repair works which can be implemented at the brake are to be accomplished exclusively by trained technical personnel. Inappropriate works on the brake system can lead to the loss of the brakes and to traffic accidents.


 Observe the wear limits of the brake pads and brake disc. When brake pads or brake disc are damaged, or worn beyond their specified minimum thickness, brake effectiveness will diminish and possibly result in an accident. Burned, glazed or oil contaminated brake pads must be replaced immediately. **Always replace brake pads with a new brake pad hold down system for pads and spreader plates on a per axle basis!**

 During repairs on the brake the vehicle must be parked on a level surface and be blocked to prevent rollaway. Only approved and suitable fixtures are to be used for the lifting and blocking of the vehicle. While working on the brake it must be ensured that the brake can not be actuated inadvertently.


**Do not actuate the brake when brake pads are removed. Danger of destruction of brake parts! Danger of Bodily Injury!**

 Do not clean the brake when repair or whilst cleaning at the vehicle with pressurised air or other high pressure cleaning apparatus. Danger of destruction of the rubber parts! Danger of Bodily Injury!

 While working at the brake or moving of the brake caliper handle the caliper only from outside to avoid injury! Keep hands and fingers out of the inside of the caliper! Danger of Bodily Injury!

 A second technician must assist during removal and installation of the brake. Heavy Load - Danger of Bodily Injury!

**Never attach a lifting device to the pad hold down hoop as the hoop could be damaged.**

 During repairs outside of the vehicle, the brake must be secured in a fixture, such as a heavy vise, as high torque is required during removal and installation of the bolts. Danger of Bodily Injury!

**The Brake Caliper with Clamping Unit shall not be opened**, therefore the bolts holding the cover shall not be loosened. No serviceable parts are inside the clamping unit.


**Only original and genuine WABCO Service Parts and approved brake pads with a new brake pad hold down system for pads and spreader plates are to be used.**

During repairs use only recommended tools. **Do not use power-driven sockets or unsuitable tools!** Tighten Nuts and Bolts only to specified torque limits.

With newly installed brake pads avoid emergency stops and long braking cycles during the first 50 km to prevent excessive temperatures.

**When wear of the cast brake parts, such as cracks or heavy abrasion, is observed, replace the entire brake assembly according to instructions.**

Dispose the used up and exchanged parts considering environmental protection according to the national and / or the regional defaults. Usually brake parts can be scrapped.

 Upon completion of repairs the vehicles braking system must be tested on a roller dynamometer. If no roller dynamometer is available a driving test with brake applications must be performed.




## **2.2 Overview of the tools and tightening torques**

For service works on the disc brake the following tools are needed:







- Ring spanner / tool for hexagonal at the brake adjuster <sup>\*)</sup>
- Tools for pressing the bushings - guiding pins - out from the brake caliper <sup>\*)</sup>
- Tools for pressing the bushings - guiding pins - into the brake caliper <sup>\*)</sup>

**\*) WABCO Tools can be ordered under the following part / set numbers – see page 5.**

- I. WABCO basis tool set 640 195 522 2.  
The basis tool set is necessary for all WABCO Air Disc Brakes.


Nr.	Term	Tool Illustration	Tool Set
10	Grip / Pin		640 195 522 2
11	Adapter part		
12	Ring Spanner / Ratchet		
13	Extension		

- II. WABCO tool set 640 195 521 2 for PAN 19-1 Plus.  
Additionally the WABCO basis tool set 640 195 522 2 is necessary.

Nr.	Term	Tool Illustration	Tool Set
21	Extrusion mandril		640 195 521 2
22	Insert mandril long-1		
25	Insert mandril long -2		
26	Insert mandril short		
27	Insert mandril for closing covers		
28*)	Insert mandril short		

\*) This tool as a component of the tool set is not needed for this brake type PAN 19-1 Plus.

**Table 1:** Overview of the necessary tools and tightening torques

Position	Term	Spanner Width [SW]	Hexagon		Tightening Torque [Nm]
			External	Internal	
I	Hexagon head / adjuster	8	X	--	Turning direction of hexagon: <ul style="list-style-type: none"> <li>• Adjust, anti-clockwise (left), maximum 3, air gap decrease.</li> <li>• De-adjust, clockwise (right), maximum 12, air gap increase.</li> </ul>  <b>Do not use power-driven sockets!</b>
II	Hexagon bolt / Pad hold down hoop	17	X	--	30 + 15
III	Brake mounting	24	X	--	290 ± 20 recommended. Please note the special assembly instructions of the axle respectively vehicle manufacturer.
IV	Guide pin mounting	14	--	X	310 ± 30 Tightening order for guide pins: <ol style="list-style-type: none"> <li>1. Close fit pin (with internal hexagon bolt)</li> <li>2. Clearance fit pin (with internal hexagon bolt)</li> </ol>
V	Brake cylinder mounting	24	X	--	210 – 30 <b>(only apply for original WABCO cylinders)</b> The attachment of the brake cylinder at the disc brake is recommended as follows: <ul style="list-style-type: none"> <li>• Screw on the fastening nuts manually till the brake cylinder is snug on the surface.</li> <li>• Tighten the fastening nuts with approximately 120 Nm.</li> <li>• Tighten the fastening nuts with 210 – 30 Nm using a torque wrench.</li> </ul> <b>Note: Use fastening nuts only once.</b>



## 2.3 Checking Brake Function

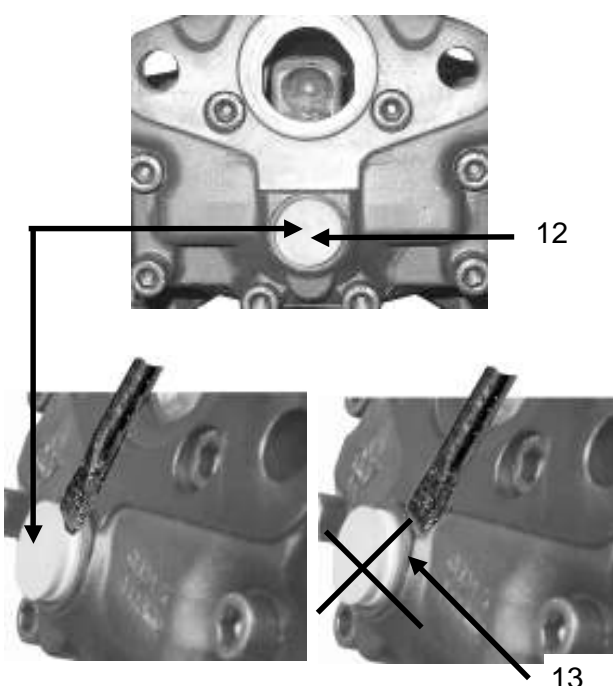
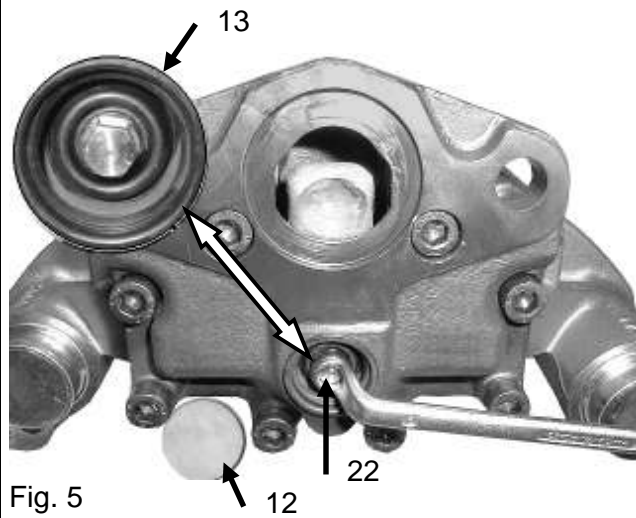
**Note:** It is not necessary to dismantle the brake cylinder. The brake is shown only for better representation without brake cylinder.

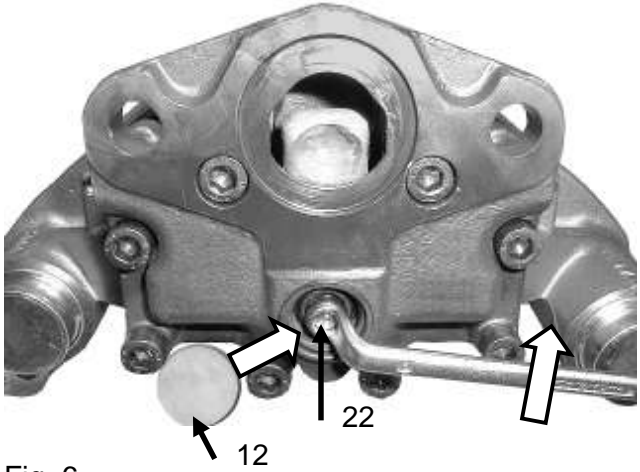
**⚠ Caution: Do not use power-driven sockets!**

**While working at the brake or moving of the brake caliper handle the caliper only from outside to avoid injury!**

### 2.3.1 Checking Adjuster Function:

**Generally Note:** The turning directions and the torques for the hexagon on the adjuster nut are given in Table 1, Position I.

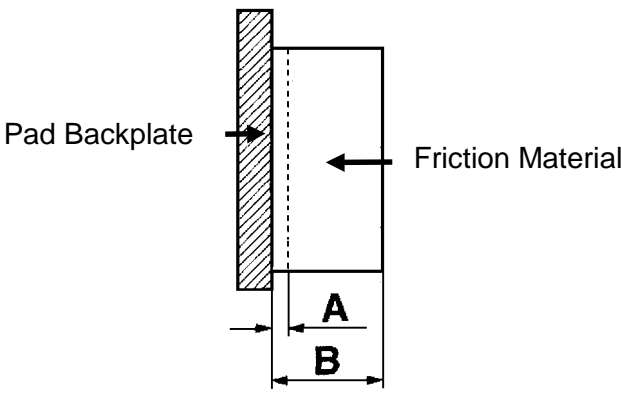
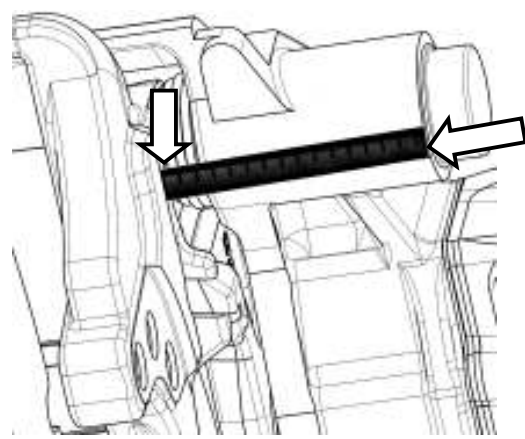
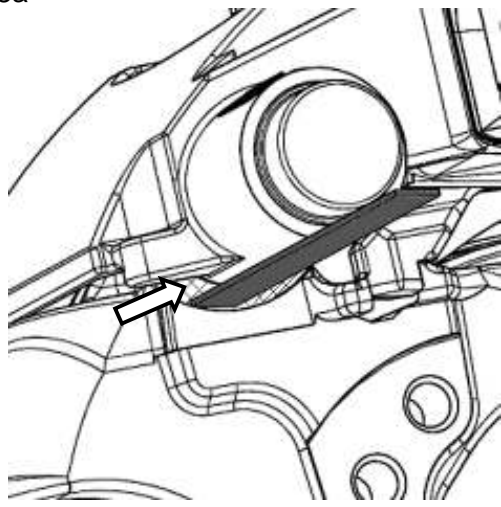
Work Sequences	Figures
<p><b>Note:</b> Brake pads and spreader plate are inserted.</p> <ul style="list-style-type: none"> <li>Remove plug 12 for the adjuster 22 from the caliper carefully.</li> </ul> <p><b>Caution: On disassembly the proper tool position is against the plug 12 (left side in Fig. 4)!</b></p> <p><b>Do not place the tool between caliper and outer side of the sealing ring, otherwise there is a danger of the damage the inner sealing 13 (right side in Fig. 4)!</b></p> <ul style="list-style-type: none"> <li>Check the adjuster nut gaiter 13 for wear and damage. <b>Renew defect gaiter according to Section 5.3!</b></li> <li>Using a ring spanner / tools 12 and 13 (page 5) / (Table 1, Position I), turn the adjuster hexagon. c. 1/2 turn in the clockwise direction.</li> </ul>	 <p>Fig. 4</p>
<p><b>Caution: Testing of the adjuster is possible only with a higher air gap. Do not overload the adjuster 22 hexagon.</b></p> <p><b>Do not use an open ended spanner.</b></p> <p><b>With the ring spanner mounted on the adjuster nut ensure that there is sufficient space such that it will not be prevented from turning during the adjuster check!</b></p>	 <p>Fig. 5</p>

Work Sequences	Figures
<ul style="list-style-type: none"><li>• Actuate the brake lightly about 5 times (c. 1 bar). The adjuster is functioning when the ring spanner (arrow) turns in the anti-clockwise direction with every brake actuation.</li></ul> <p><b>Note:</b> With increasing adjustment increments the angular movement of the ring spanner becomes smaller. The adjuster is in order when the ring spanner rotates as described above.</p> <ul style="list-style-type: none"><li>• Remove ring spanner / tools <b>12</b> and <b>13</b> (page 5).</li><li>• Refit plug <b>12</b>, <b>ensure that the plug sits properly.</b></li></ul> <p><b>Possible faults:</b></p> <p>The adjuster <b>22</b> respectively ring spanner (arrow)</p> <ul style="list-style-type: none"><li>a) does not turn</li><li>b) turns only with the first actuation</li><li>c) turns backwards and forwards with every actuation, then the adjuster is not in order.</li></ul> <p><b>Exchange the brake according to Section 4.!</b></p>	 <p>Fig. 6</p>

## 2.4 Checking Brake Pads

**Notice:** The brake pad thickness is to be checked regularly dependent on operating conditions during maintenance intervals and under applicable local laws and regulations. Burned, glazed or oil contaminated brake pads must be replaced immediately.

**Always replace brake pads with a new brake pad hold down system for pads and spreader plates on a per axle basis!**

Work Sequences	Figures
<p><b>Caution:</b> To avoid damage to the brake disc, the brake pads should be replaced at the latest when the thinnest section of the friction material is 2 mm over the pad backplate.</p> <p>The remaining brake pad thickness must not be less than 2 mm.</p> <p><b>A</b> = Remaining brake pad thickness 2 mm.  <b>B</b> = Total friction material thickness - new 21 mm.</p> <p>At remaining brake pad thickness <b>A &lt; 2 mm</b>, renew brake pads according to Section 3.</p> <p><b>Wear Measurement</b></p> <p>The medium pad wear can be measured with a tape measure or a ruler either at the fitted pin (long guide pin near the disc leading side) or at the non-fitted pin (short guide pin near the disc trailing side) where better accessible.</p> <ul style="list-style-type: none"> <li>Here the distance between the brake carrier and the edge of the caliper housing of each pin is measured (see arrows Fig. 8a).</li> </ul> <p><b>Caution:</b> The measuring point at the brake carrier is the worked on area for screwing of the respective guide pin (arrow Fig. 8b at the shaded square).</p> <p>Reaching the values below, the pad wear limit is reached or exceeded respectively:  <b>Short guide pin: Dimension &gt; 96 mm - replace brake pads</b>  <b>Long guide pin: Dimension &gt; 122 mm - replace brake pads</b></p>	 <p>Fig. 7</p>  <p>Fig. 8a</p>  <p>Fig. 8b</p>

## 2.5 Checking Brake Disc

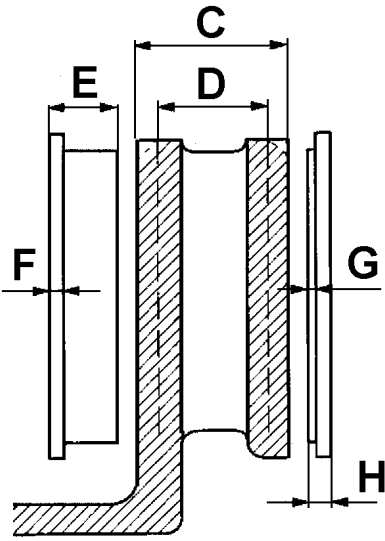
Work Sequences	Figures
<ul style="list-style-type: none"> <li>Remove brake pads according to Section 3., and measure thickness of disc over the rubbing faces.</li> </ul> <p><b>C</b> = Total disc thickness - new 45 mm  <b>D</b> = <b>Wear allowance limit 37 mm, the brake disc must be renewed. The renewal is recommend on a per axle basis.</b>  <b>E</b> = Total pad thickness - new 30 mm  <b>F</b> = Pad backplate thickness 9 mm  <b>G</b> = Minimum remaining brake pad thickness 2 mm  <b>H</b> = Absolute minimum pad thickness 11 mm, the brake pads must be renewed.</p> <p><b>!</b> <b>Caution: Observe brake pad and disc wear limits. Worn-out pads and discs reduce the brake effectiveness and can cause brake failure! Discs must be free of oil. Accident danger!</b></p>	 <p>The diagram shows a cross-section of a brake disc and pad. Dimension C is the total disc thickness. Dimension D is the wear allowance limit. Dimension E is the total pad thickness. Dimension F is the pad backplate thickness. Dimension G is the minimum remaining brake pad thickness. Dimension H is the absolute minimum pad thickness.</p>

Fig. 9

## 2.6 Checking Guide Pin Clearance

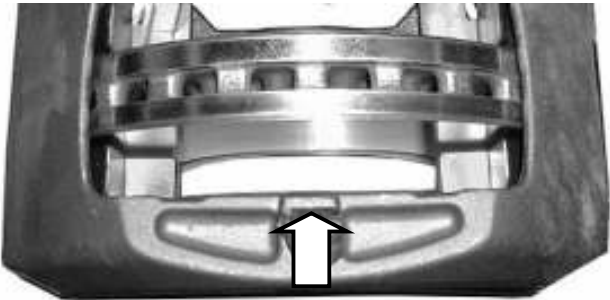
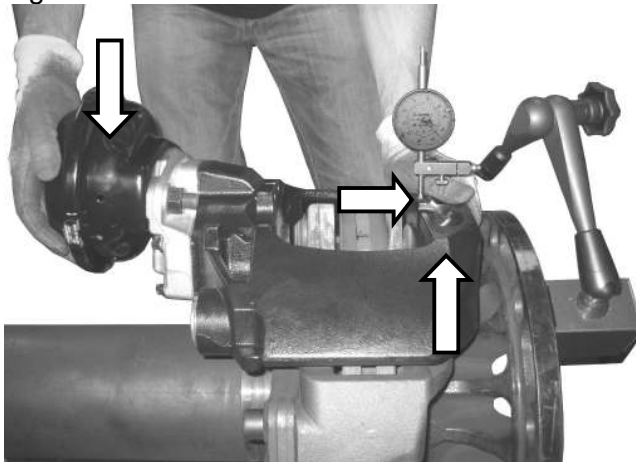
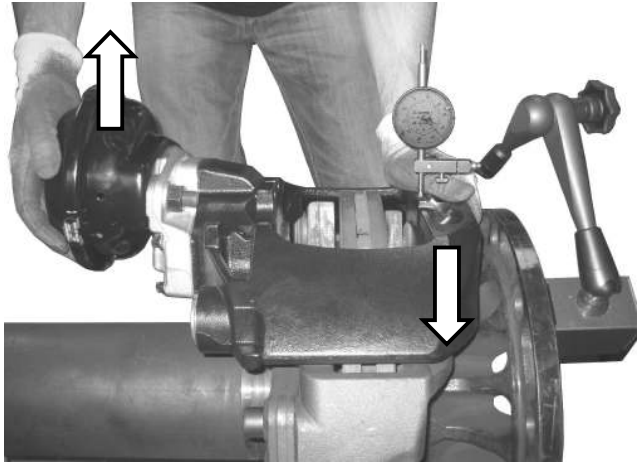
Work Sequences	Figures
<ul style="list-style-type: none"> <li>Remove the wheel according the axle respectively vehicle manufacturer instructions.</li> <li>Remove brake pads and spreader plate according to Section 3.</li> </ul> <p><b>Note:</b> Use always the measuring point on the caliper at the wheel side – see arrow in figure 10. Clean the measuring point before the measurement.</p> <ul style="list-style-type: none"> <li>Slide the caliper by hand fully towards the wheel side.</li> </ul> <ul style="list-style-type: none"> <li>Fasten a magnetic dial-gauge holder to the brake carrier or to the axle.</li> <li>Press the dial-gauge in the direction of measuring point - see arrow in figure.</li> <li>Press brake caliper maximally in radial direction with easily hand strength and set the dial-gauge to zero.</li> </ul>	 <p>The photograph shows a close-up of a brake caliper. A white arrow points to the measuring point on the caliper at the wheel side.</p>  <p>The photograph shows a person using a magnetic dial-gauge holder to measure guide pin clearance. A white arrow points to the dial-gauge, and another white arrow points to the measuring point on the caliper.</p>

Fig. 10

Fig. 11

Work Sequences	Figures
<ul style="list-style-type: none"><li>• Press brake caliper maximally in opposite radial direction with easily hand strength.</li><li>• Read the maximum value on the dial-gauge. <b>The measured guide pin clearance may not be larger than 2.0 mm.</b> If the value is greater than 2.0 mm, the parts must be replaced according to Section 5.1.</li><li>• Remove the measuring instrument.</li><li>• Install spreader plate and brake pads and set clearance. Carry out according to Section 3. and pay attention to Notes.</li><li>• Install the wheel according the axle respectively vehicle manufacturer instructions.</li></ul>	 <p data-bbox="842 757 938 790">Fig. 12</p>

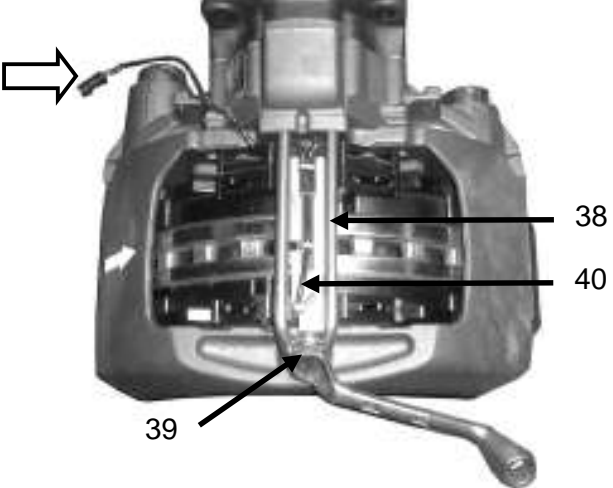
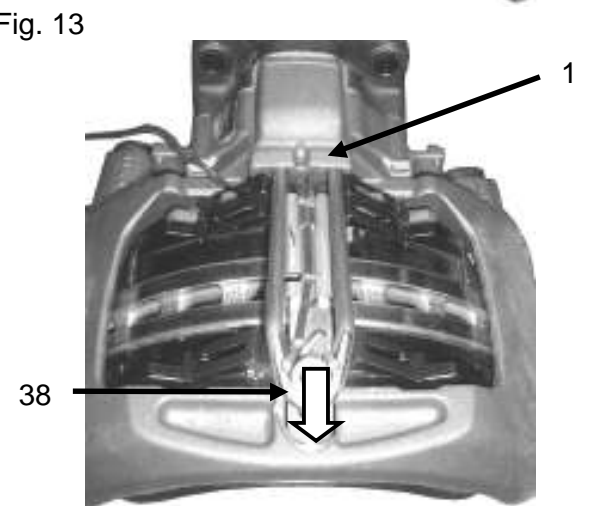
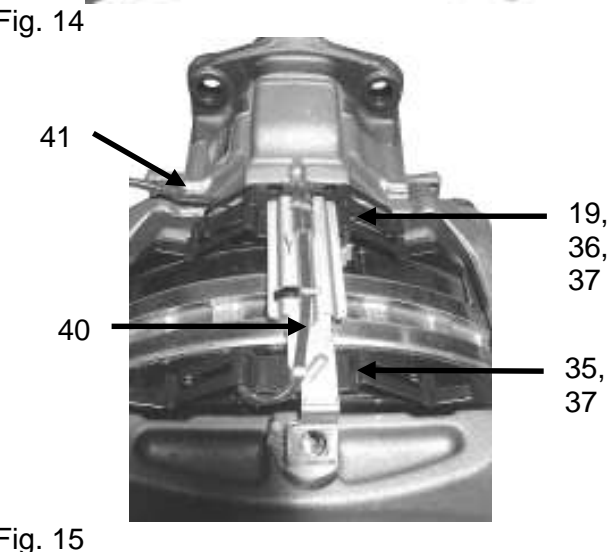
### 3. Renewing Brake Pads

**Note:** It is not necessary to dismantle the brake cylinder. The brake is shown only for better representation without brake cylinder.

**⚠ Caution: Do not use power-driven sockets!**

**While working at the brake or moving of the brake caliper handle the caliper only from outside to avoid injury!**

#### Working Sequences for Removal of Pads:

Work Sequences	Figures
<ul style="list-style-type: none"> <li>Remove the wheel according the axle respectively vehicle manufacturer instructions.</li> <li>Disconnect cable of the wear indicator 40 at the plug (arrow).</li> <li>Remove hexagon bolt 39 from pad hold-down hoop 38 with spanner (Table 1, Position II).</li> </ul>	 <p>Fig. 13</p>
<ul style="list-style-type: none"> <li>Withdraw pad hold-down hoop 38 from caliper 1.</li> </ul>	 <p>Fig. 14</p>
<ul style="list-style-type: none"> <li>Remove three hold-down springs 37 from the brake pads 35, 36 and the spreader plate 19.</li> <li>Remove cable guide 40 and contacts from the brake pads.</li> <li>Remove both cable clips 41 from brake caliper.</li> </ul>	 <p>Fig. 15</p>

**Work Sequences**

- Remove plug 12 for the adjuster 22 from the caliper 1 carefully.

**Caution: During disassembly of the plug 12 see the notes to Fig. 4!**

- De-adjust the brake by rotating the hexagon on the adjuster nut 22 with a ring spanner/ tools 12 and 13 (page 5) / (Table 1, Position I), then release by c. 1/4 turn.

**Note:** The turning direction to de-adjust is to the right, i.e. clockwise.

**Caution: When de-adjusting, push back the spreader plate 19 (arrow Fig. 17) by hand at the same time to ensure the pin in the adjuster screw remains engaged in the slot in the spreader plate; otherwise there is a danger that the adjuster screw will turn, thereby damaging its gaiter!**

- Check the gaiter 13 for wear and damage. **Renew defect gaiter according to Section 5.3!**

- Slide the caliper 1 by hand towards the wheel side and remove the brake pad 35.

- Slide the caliper 1 by hand towards the cylinder side (arrow) and remove the brake pad 36 and the spreader plate 19.
- Examine the spreader plate 19 for damage and strong corrosion.

**Caution: If the spreader plate is not any more correct, a new spreader plate must be inserted. Always replace spreader plates on a per axle basis in the left and the right brake!**

**⚠ Caution: Do not actuate the brake when brake pads are removed! Danger of destruction of brake parts! Danger of Bodily Injury!**

**Figures**

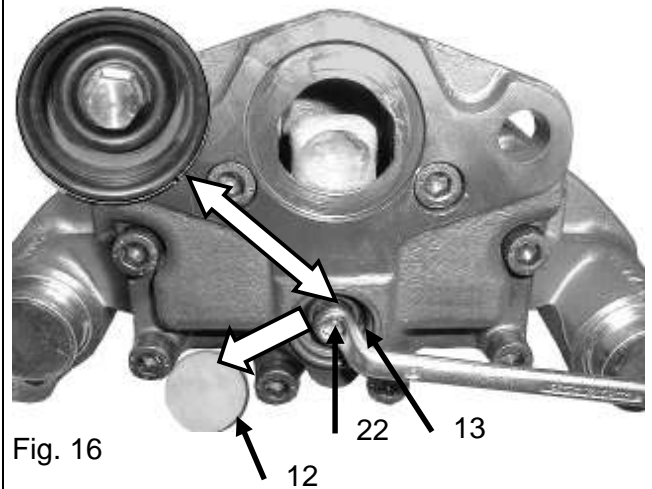


Fig. 16

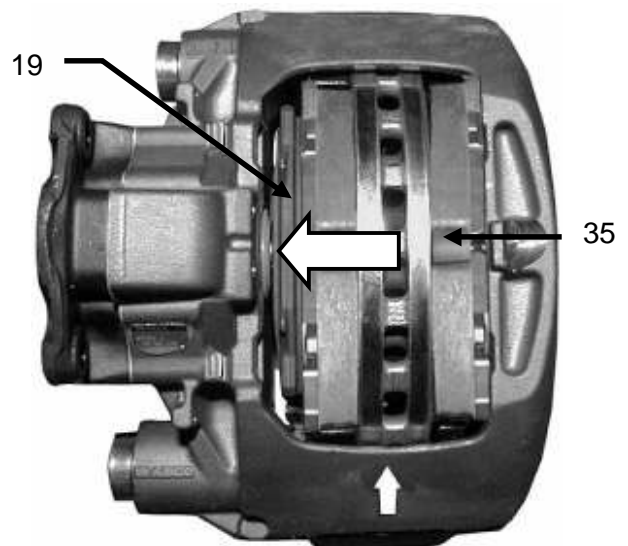


Fig. 17

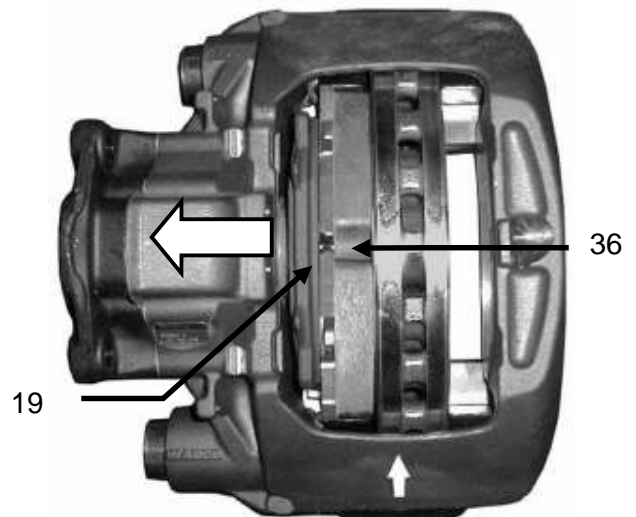


Fig. 18

**Work Sequences**

**Figures**

- Using a wire brush remove any corrosion from the spreader plate, brake pad slot, and spreader plate and brake pads guide surfaces.

**Caution: Take care not to damage the dust caps (gaiters) 5, 10. The guide surfaces must be clean and free of grease!**

**Inspecting the Dust Caps (Gaiters) and Checking Brake Caliper Movement:**

- Slide the caliper towards the cylinder side to allow examination of the gaiters 5, 10, the guide pins 8, 9, and the adjuster screw 21 for wear and damage. **Renew all defect gaiters according to Section 5.1 and 5.2!**

**Caution: In case of a damaged gaiter 10 must be checked, if dirt or water has already entered and damaged the inner parts of the brake or the gaiter seat in the caliper by corrosion. In case of doubt the brake must be renewed according to Section 4. If the gaiter 10 is damaged during servicing the brake, the gaiter must be renewed according to Section 5.2.**

- Slide the caliper on the guide pins by hand over its total displacement and check for freedom of movement. **If the movement is restricted, renew the guide pins, the guide pin bushes and gaiters according to Section 5.1.**

**Caution: Do not squeeze the dust caps of the guide pins against the torque plate!**

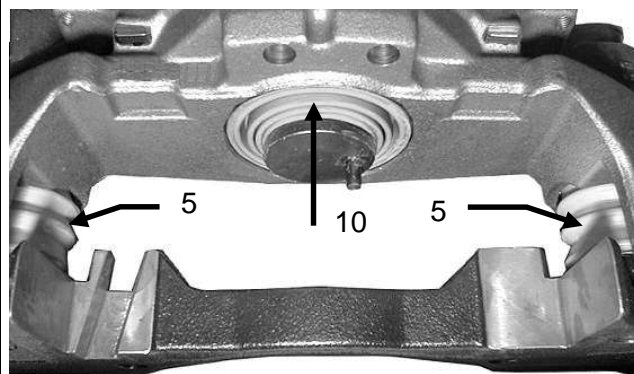


Fig. 19

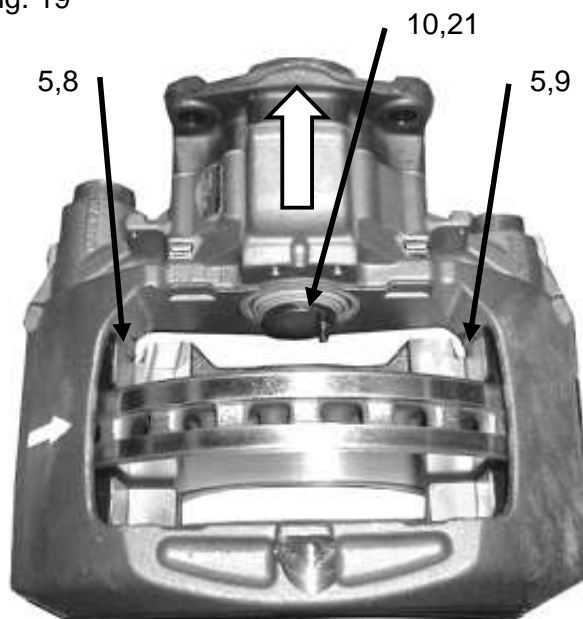


Fig. 20

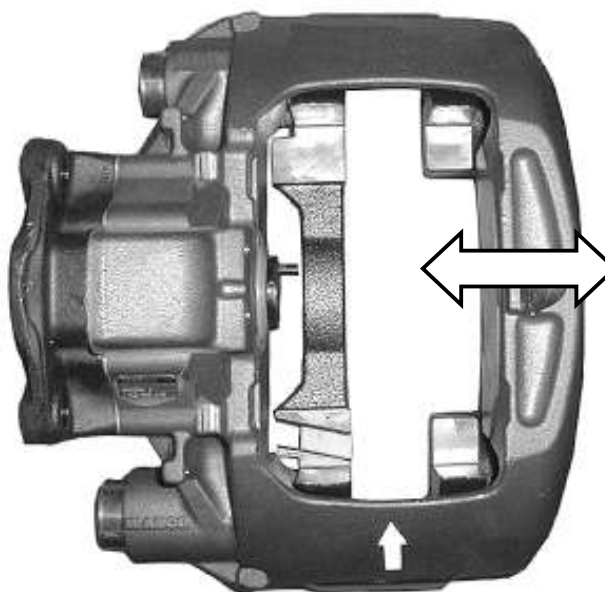


Fig. 21



**Work Sequences**

**Figures**

**Checking the Adjuster Unit (Clamping Unit):**

- Prevent the adjuster screw turning by e.g. holding the pin (arrow) during the test and whilst rotating the adjuster hexagon.

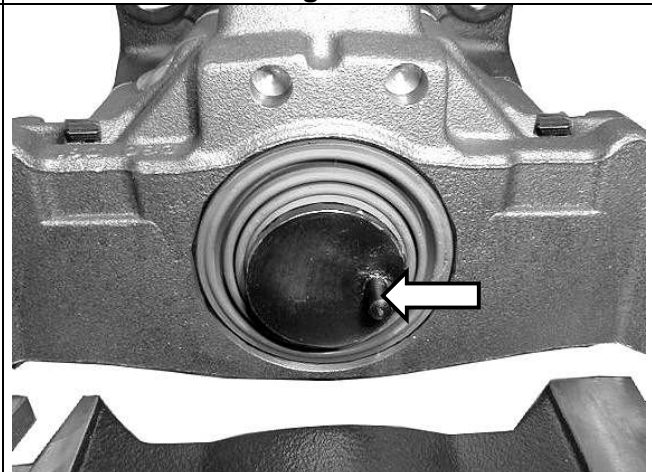


Fig. 22

- Extend the adjuster 22 towards the brake disc by turning the adjuster hexagon in the anti-clockwise direction with a ring spanner / tools **12** and **13** (page 5) / (Table 1, Position I) and check for ease of movement.
- After checking the adjuster unit return the adjuster screw completely by turning in the clockwise direction.

**Note:** The torque to return the adjuster screw is greater than when turning the screw towards the disc.

**Caution:** Do not overload the adjuster 22 hexagon. Do not use an open ended spanner.

- If necessary, check adjuster function according to Section 2.3.1.

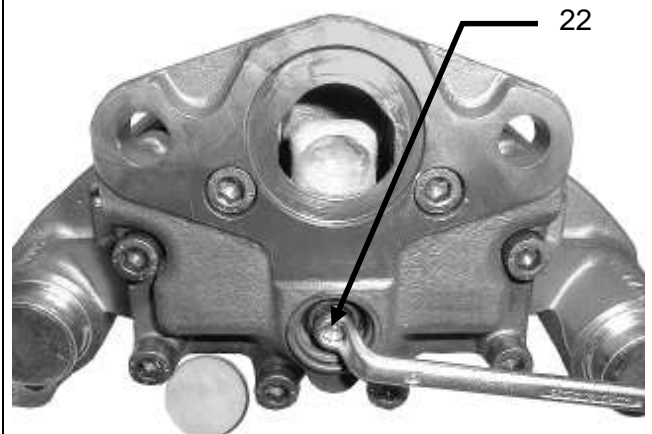


Fig. 23

**Brake Disc Condition Inspection:**

Check brake disc for cracks, condition of rubbing surfaces and maximum wear dimension.

- A** = Crazing = permissible
- B** = Radial cracks max. 0.5 mm (width) = permissible
- C** = Unevenness under 1.5 mm = permissible
- D** = Cracks across rubbing surface = not permissible

**a** = Rubbing surface

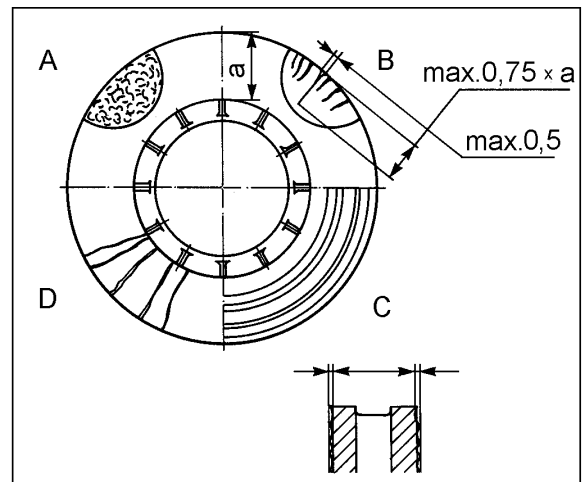


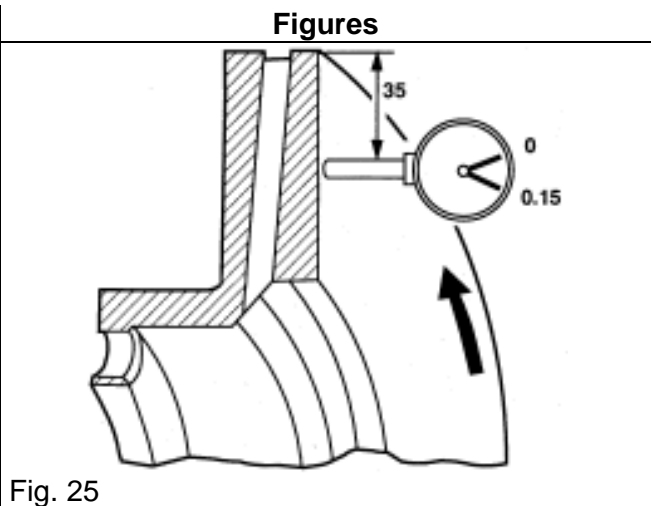
Fig. 24

**Work Sequences**

**Checking Brake Disc Runout:**

- Mount a dial indicator on the brake carrier.
- With the disc installed measure the runout by rotating the hub as shown in Fig. 25. Runout limit 0.15 mm.

**Note:** At higher values rework or renew the disc. Only cleaned brake discs have to be installed. Brake discs must be free of oil.



**Work Sequence for Pad Installation:**

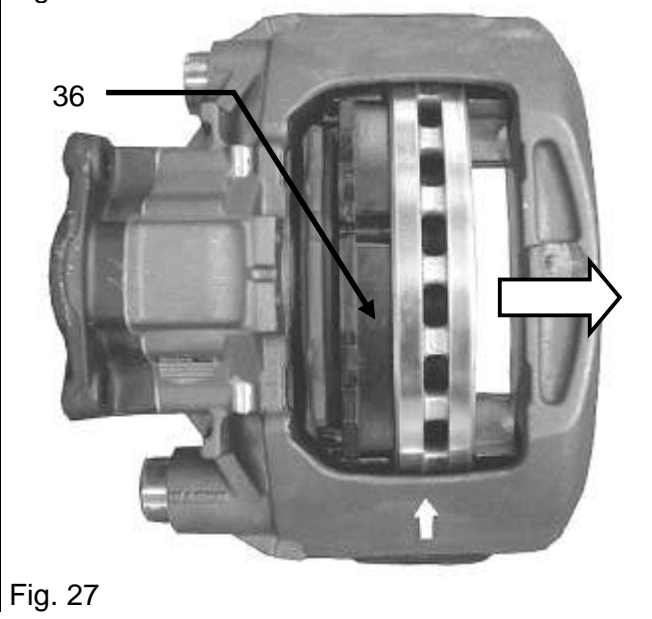
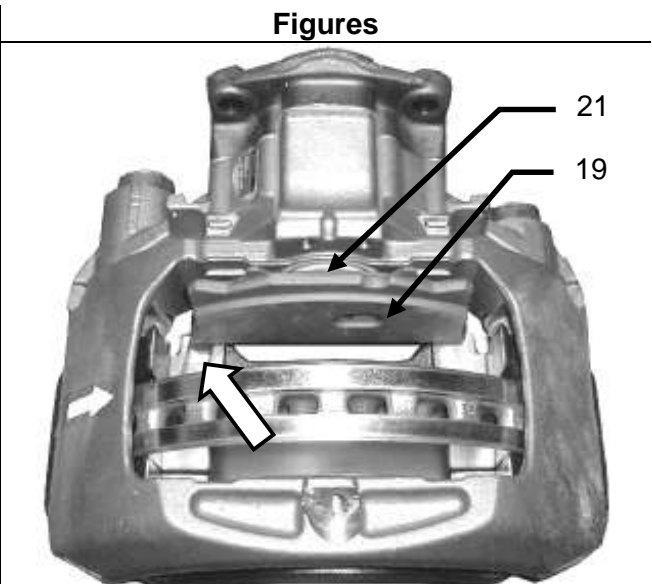
**Work Sequences**

- Slide the caliper until there is sufficient space between the actuation side and the disc to insert the brake pad.
- Insert spreader plate 19 in the brake carrier and engage with the adjuster screw 21.

**Caution:** The spreader plate always has to be placed in the guideway (arrow) of the brake carrier correctly and overlie the entire surface of the guide bar of the brake carrier. Otherwise the spreader plate might slide out of the guiding. If necessary, move the caliper a little towards the wheel side!

The pin in the adjuster screw must be located in the slot in the spreader plate. Otherwise the function of the adjuster mechanism is jeopardised! The adjuster screw can be turned to obtain alignment but thereby ensure the gaiter does not become twisted!

- Insert **new** brake pad 36 into the actuation side.
- Slide caliper towards the wheel side until brake pad 36 contacts the disc.



**Work Sequences**

- Insert **new** brake pad 35 into the wheel side.
- Adjust the clearance (air gap) by using a 1 mm thick feeler gauge (arrow) and inserted between the backing plate of the brake pad on the wheel side and the brake caliper, turn the hex nut 22 of adjuster screw with a closed end wrench / tools **12** and **13** (page 5) / (Table 1, Position I) until both brake pads contact the brake disc.

**Caution: Always insert the feeler gauge into the brake centre between brake caliper and pad backplate. Do not overstress the hex nut of the adjuster screw!**

**Note:** The turning direction to close up the pads is anti-clockwise. **Do not** fit pad hold-down hoop before setting clearance!

- Remove the feeler gauge.

- Install **new** cable clips 41 in brake caliper.
- Install **new** pre-assembled wear indicator and cable guide 40 and insert sensor contacts into brake pads.

**Caution: The sensor contacts must be pointed in the direction of the brake disc and the contacts must be properly seated!**

- Lift up the cable guide 40 lightly from brake caliper, and
- position three **new** hold down springs 37 under the cable guide and on top of the spreader plate and the brake pads.

**Caution: Route cables on the actuation side (see arrow) so that they do not rest on the brake pad (see cable position to the Fig.).**

**Figures**

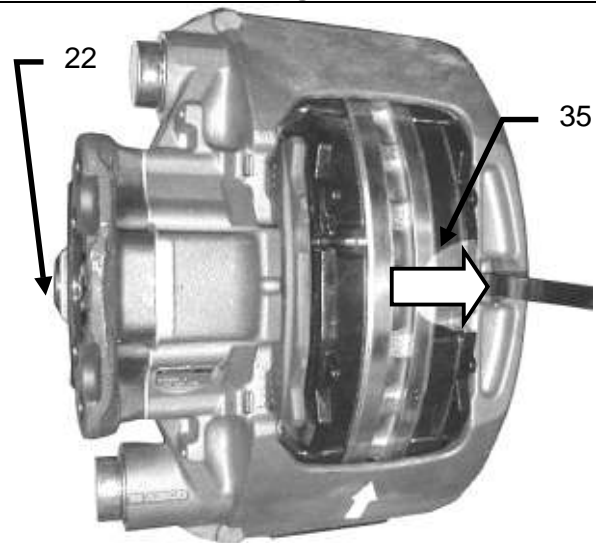


Fig. 28

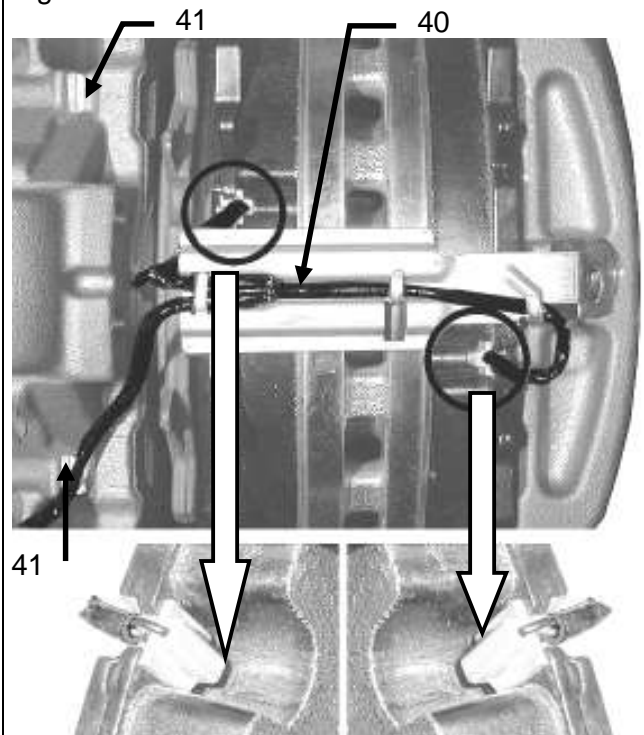


Fig. 29

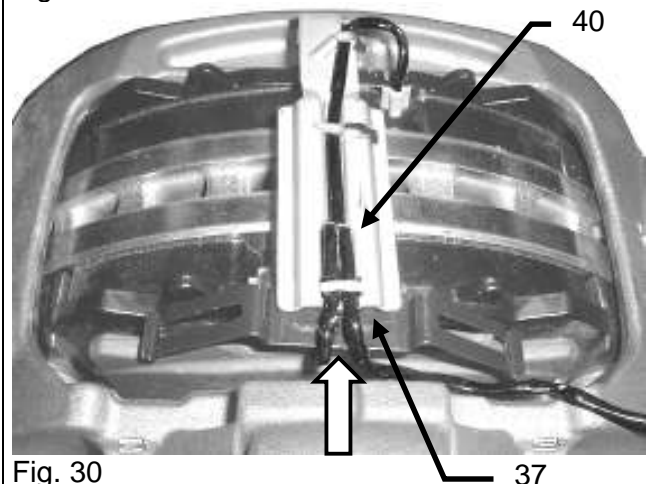


Fig. 30

**Work Sequences**

**Figures**

- After that press the cable guide in correct position against brake caliper.



Fig. 31

- Slide **new** hold down hoop 38 in openings in the brake caliper (arrows), then push downward so that the hold down hoop snap between the radial corners of the hold down springs.

**Note:** Mount the hold down hoop above the cables of the wear indicator.

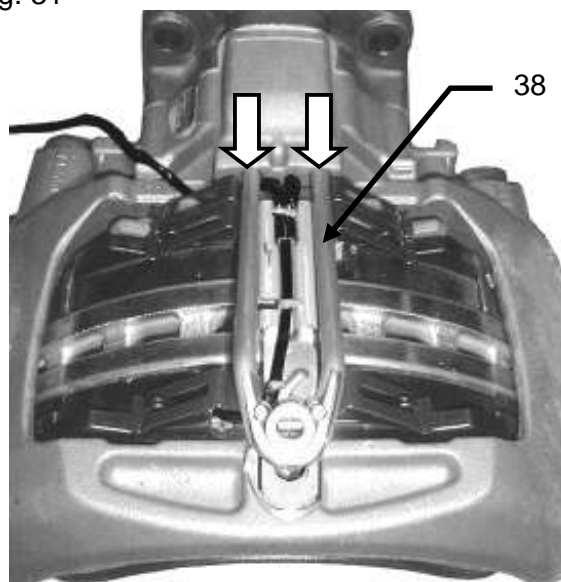


Fig. 32

- Fit **new** hexagon bolt 39 to the brake caliper (Table 1, Position II).
- Connect wear indicator cable plug to mating end on vehicle side.
- Secure exit cable on **new** cable clip 41.

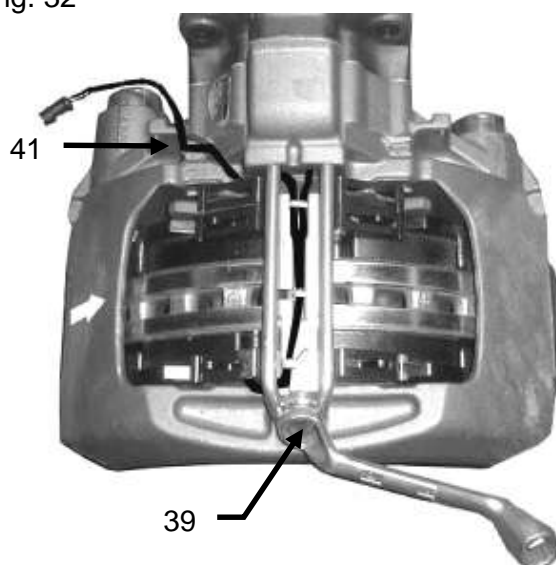


Fig. 33

## Work Sequences

## Figures

- Check the correct cable position.

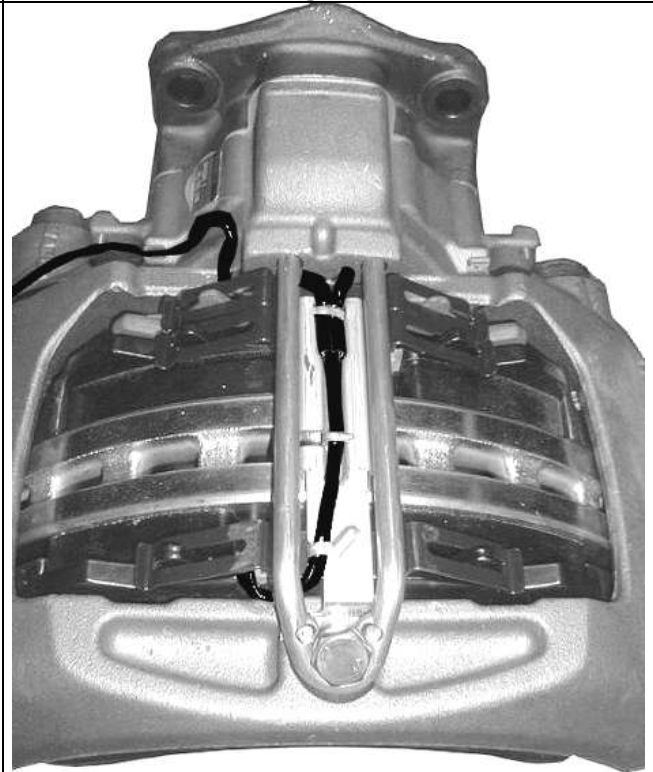


Fig. 34

- Fit **new** plug 12 to the opening in the brake caliper! **Check and make sure the correct seat!**
- Check that the hub rotates freely.
- Install the wheel according the axle respectively vehicle manufacturer instructions.

**⚠ Caution: Upon completion test the brakes on the roller dynamometer!**



Fig. 35

12

**4. Renewing Brake**

**⚠ Caution: Do not use power-driven sockets!**

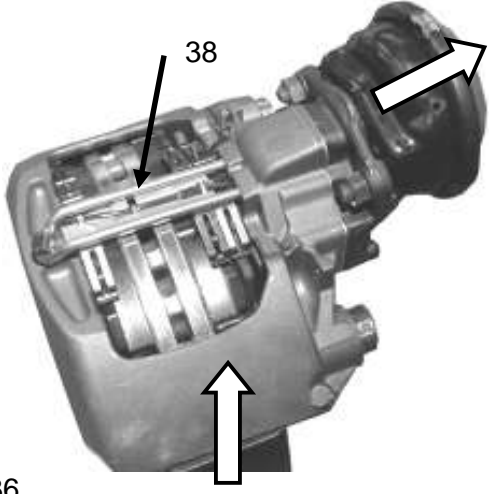
**While working at the brake or moving of the brake caliper handle the caliper only from outside to avoid injury!**

**Never attach a lifting device to the pad hold down hoop 38 as the hoop could be damaged.**

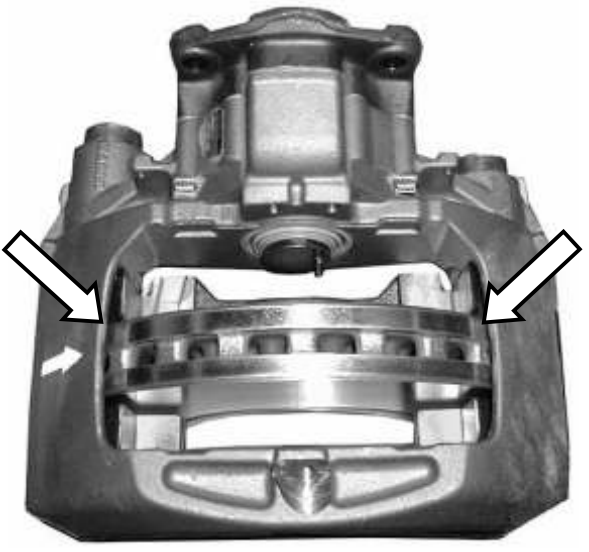
**Note:** New brakes without brake pads are assembled and together with the brake carrier can be fitted in the assembled state to the axle. **Make sure the brakes are mounted onto the correct side on the vehicle in forward direction (left hand brake/vehicle left side; right hand brake/vehicle right side). Should new pads be required, then all pads on the axle must be renewed!**

**Note:** The graphic representation of the brake carrier may differ from the actual design, so that the representation does only apply in principle.

**Work Sequences for Brake Removal:**

Work Sequences	Figures
<ul style="list-style-type: none"> <li>Remove the wheel according the axle respectively vehicle manufacturer instructions.</li> <li>Remove brake pads according to Section 3.</li> <li>Remove brake cylinder from the brake caliper according to Section 6.</li> <li>Dismantle the caliper with the carrier from the axle (Table 1, Position III).</li> <li>Check brake disc according to Section 2.5.</li> <li>The removed brake pads must be tested for wear according to section 2.4.</li> <li>Prior to brake assembly, inspect and clean the axle contact respectively mounting surfaces. <b>Remove any loose debris, rust or oil which may be present.</b></li> </ul>	 <p>Fig. 36</p>

**Work Sequences for Installing Brake:**

Work Sequences	Figures
<ul style="list-style-type: none"> <li>Mount the <b>new</b> brake over the brake disc on the axle. Tighten hexagon bolts with spanner (Table 1, Position III).</li> </ul> <p><b>Caution: If necessary note the correct fixing order of the hexagon bolts according the axle respectively vehicle manufacturer special instructions (Table 1, Position III).</b></p>	 <p>Fig. 37</p>

**Work Sequences**

- Remove **all** the transport protection parts on the **new** brake.

**Caution:** The transport protection / adhesive cover (arrow) at the brake caliper in the area of the brake cylinder attachment must be completely removed before the mounting of cylinder.

- Install brake pads and set clearance. Carry out according to Section 3. and pay attention to Notes.

**⚠ Caution:** Check the brake cylinder on damages before mounting. Particularly the internal piston rod sealing must be checked for damages. A defective brake cylinder may not be attached again.

- Clean the sealing surface and surface area of the brake cylinder flange.
- Refit the brake cylinder on the caliper according to Section 6.

**Note:** The special assembly instructions of the axle respectively vehicle manufacturer must be noted.

**Caution:** With the brake cylinder in its installed position, ensure that the lower drainage hole facing the ground is open! Depending upon cylinder type and according the cylinder manufacturer instructions, the other holes can be either openly, or must be plugged!

- Check that the hub rotates freely.
- Install the wheel according the axle respectively vehicle manufacturer instructions.

**⚠ Caution:** Upon completion test the brakes on the roller dynamometer!

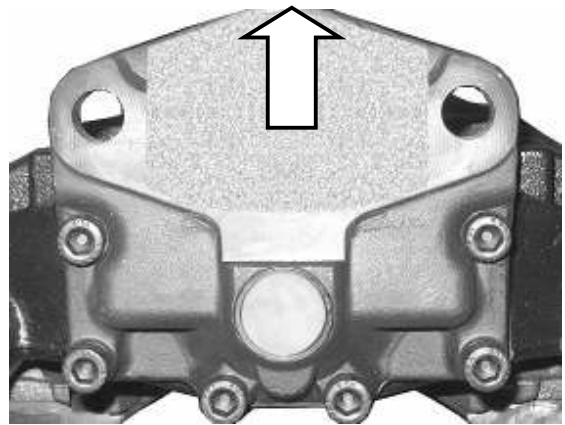
**Figures**

Fig. 38

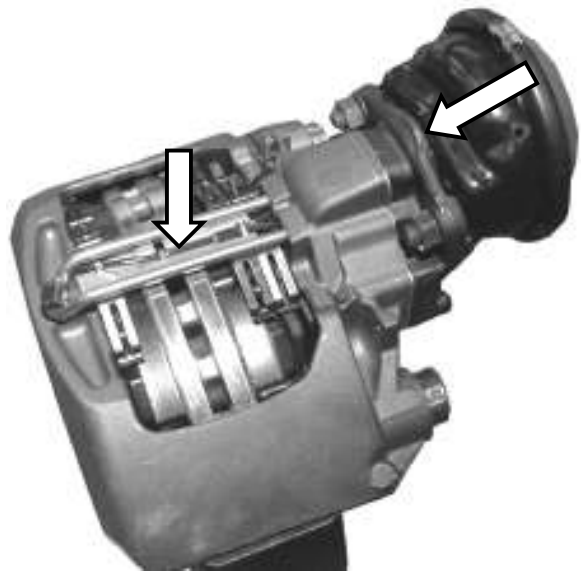


Fig. 39

## 5. Renewing Gaiters

**⚠ Caution: Do not use power-driven sockets! While working at the brake or moving of the brake caliper handle the caliper only from outside to avoid injury!**

**Never attach a lifting device to the pad hold down hoop 38 as the hoop could be damaged.**

**Note:** When replacing all of the gaiters in the caliper, the work sequences 5.1 and 5.2 should be combined so as not to repeat some operations.

When replacing individual gaiters, follow the corresponding work sequences of the sections 5.1 and 5.2.

### 5.1 Renewing Guide Pin Gaiters and Bushes

**Note:** The graphic representation of the brake carrier may differ from the actual design, so that the representation does only apply in principle.

#### Work Sequences for Removal:

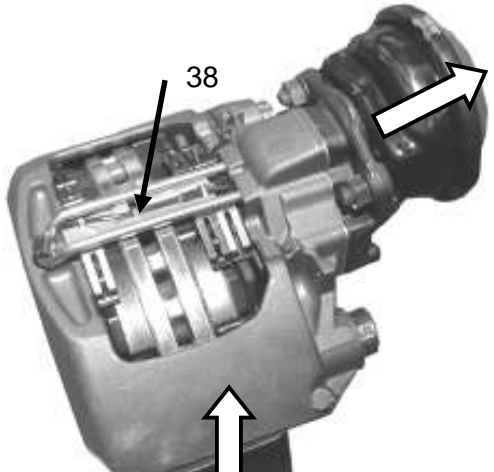
- | Work Sequences  | Figures   |
|---|---|
| <ul style="list-style-type: none"> <li>Remove the wheel according the axle respectively vehicle manufacturer instructions.</li> <li>Remove brake pads according to Section 3.</li> <li>Remove brake cylinder from the brake caliper according to Section 6.</li> <li>Dismantle the caliper with the carrier from the axle according to Section 4.</li> </ul>  |  |
| <p><b>⚠ Caution: During repairs on the guidance parts of the brake, the brake carrier must firmly in a mounting plate e.g. vice to be fastened!</b></p> <ul style="list-style-type: none"> <li>Dismantle brake caliper 1 from brake carrier 2 by removing short and long caps 11, 11.1 from the guide pins 8, 9 in the caliper housing 1 with a suitable tool, e.g. chisel.</li> </ul> <p><b>Caution: Take care not to damage cover bores in housing.</b><br/>The proper tool position is against the covers.</p> |   |



Fig. 40

Fig. 41



**Work Sequences**

**Figures**

- Release the bolts 6 with a male socket (Table 1, Position IV) and separate the caliper 1 from the carrier 2.

**⚠ Caution: Moving Brake Caliper. Danger of Bodily Injury!**

- Clean the mating surfaces (collars) of the carrier 2.

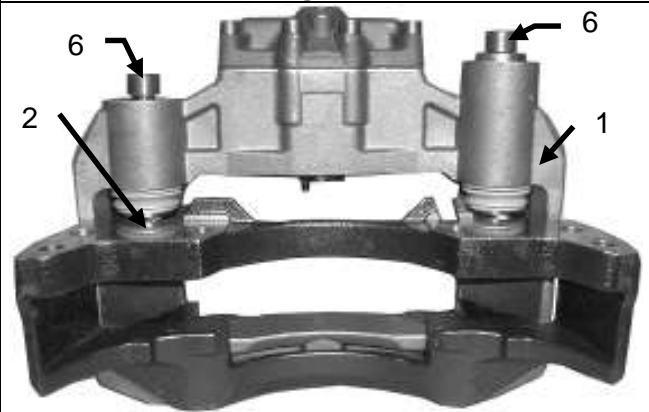


Fig. 42

- Withdraw the guide pins 8, 9 and remove the gaiters 5 from the caliper 1.

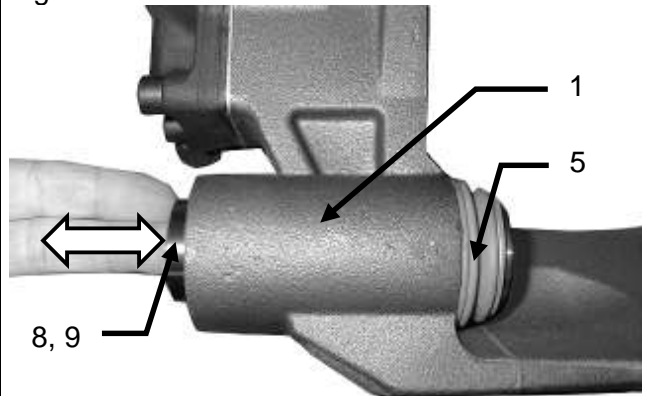


Fig. 43

- Place the caliper 1 on a firm base to push out the bushes 4, so that the caliper opening is facing upwards.



Fig. 44

**For the change of the bushes 4 use the WABCO tools (page 5).**

- Press the bushes 4 out of the caliper 1 using tools 10, 11 and 21.
- Clean the bores in the caliper.

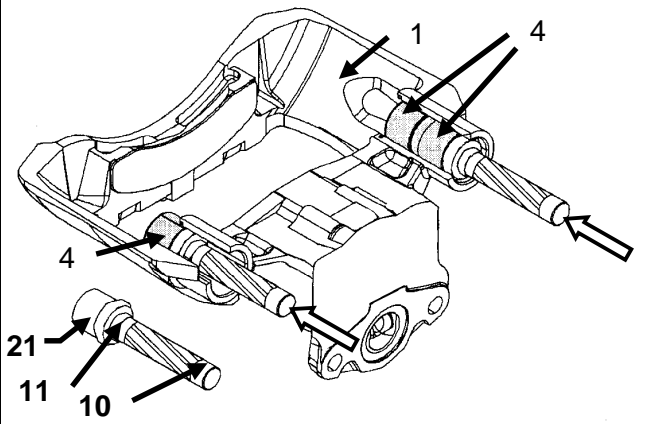
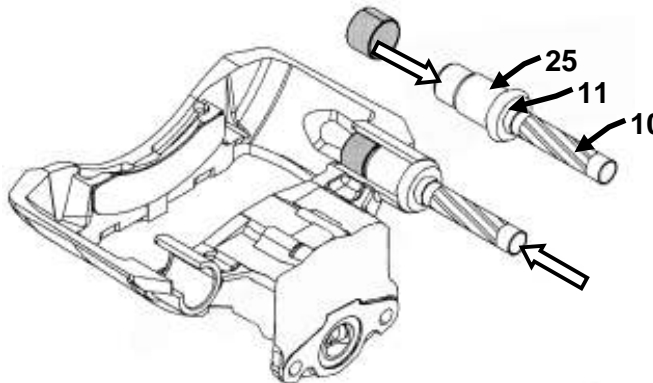
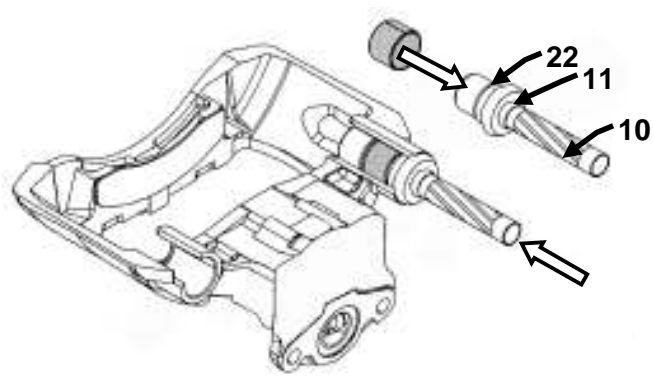
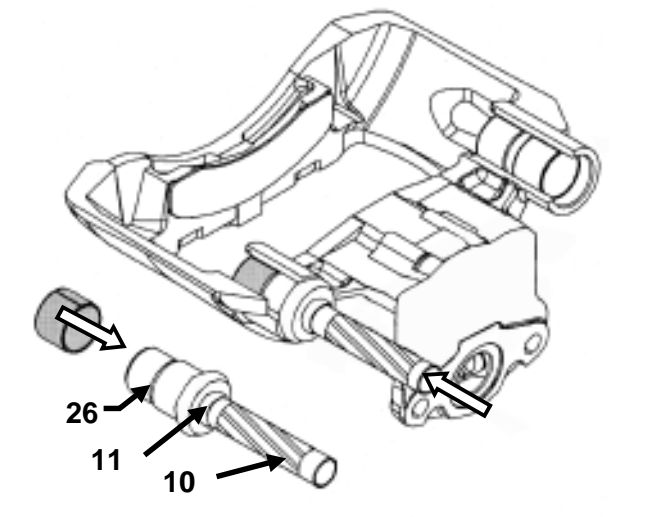


Fig. 45

**Work Sequences for Installation:**

Work Sequences	Figures
<ul style="list-style-type: none"> <li>• Press in two <b>new</b> bushes for the longer guide pin.</li> <li>• Firstly fit the inner bush with tools <b>10</b>, <b>11</b> and <b>25</b> by pressing in as far as the tool abutment.</li> </ul>	 <p>Fig. 46</p>
<ul style="list-style-type: none"> <li>• Secondly fit the outer bush with tools <b>10</b>, <b>11</b> and <b>22</b> by pressing in as far as the tool abutment.</li> <li>• Grease the bushes and the space between them.</li> </ul>	 <p>Fig. 47</p>
<ul style="list-style-type: none"> <li>• Press in one <b>new</b> bush for the shorter guide pin with tools <b>10</b>, <b>11</b> and <b>26</b> by pressing in as far as the tool abutment.</li> <li>• Grease the bush.</li> </ul>	 <p>Fig. 48</p>

**Work Sequences**

**Figures**

- Fit **new green** gaiters 5 in the gaiter seats (ring groove / arrow) in the brake caliper 1.

**Note:** Clean gaiter seats before fitment. **The seats must be clean and free of grease.** It is possible to fit the gaiters by hand. **Ensure that the gaiters are fitted evenly into the seats in the brake caliper!**

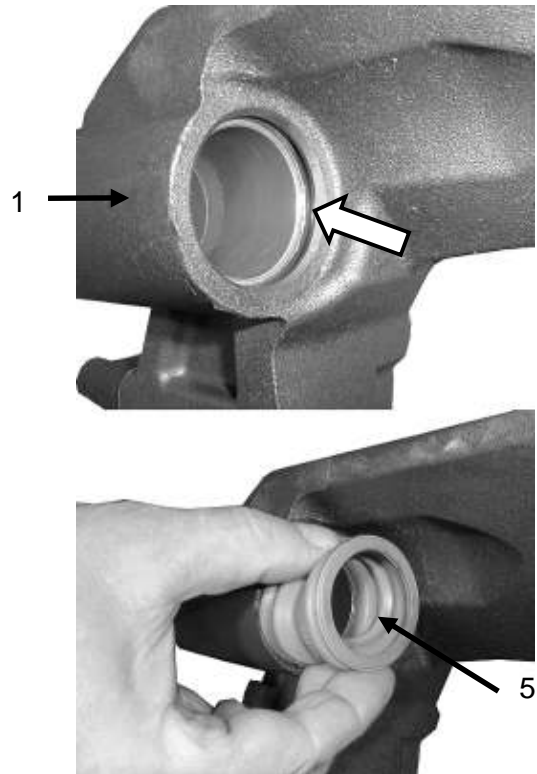


Fig. 49

- Grease the sliding surfaces of the guide pins 8, 9 and the inner lip of the gaiters 5.
- Insert the **new** guide pins from the cylinder side into the caliper and through the gaiter lip, and
- push gaiters 5 against its guide pin seat.
- Move guide pins backwards and forwards as shown in Figure several times. Check for ease of movement.

**Caution:** The longer guide pin 8 is a close fit and is located at the brake disc leading side. The shorter guide pin 9 is a clearance fit and is located at the brake disc trailing side. Remove all excess grease. The brake carrier end of the guide pins (arrow) and the mating surfaces of the carrier must be clean and free of grease!  
Do not lose the metal-ring on gaiter 5 and check the proper seat (right side in Fig. 50)!

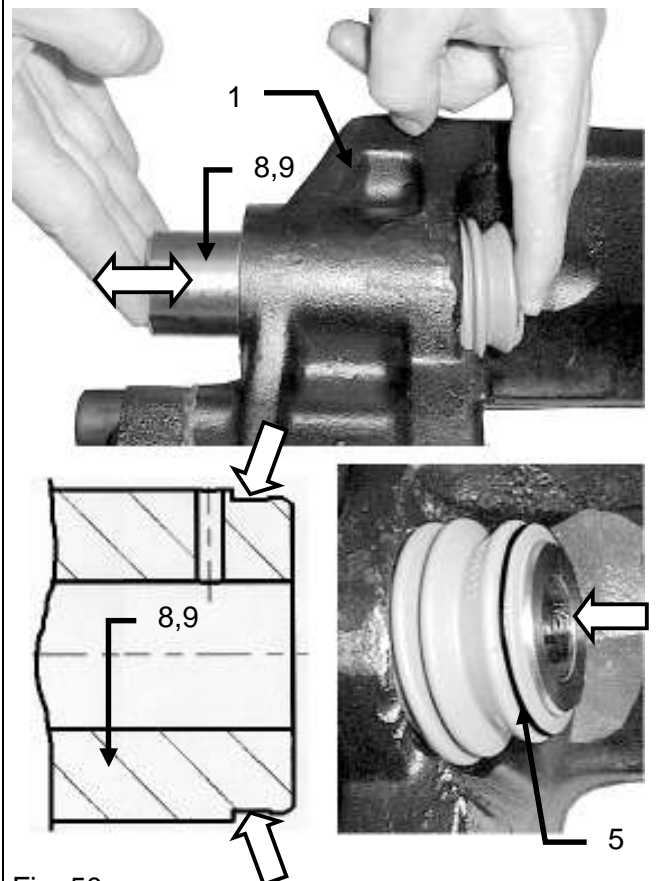


Fig. 50

**Work Sequences**

- Place the caliper 1 on the carrier 2 and insert the guide pins 8, 9 into the collars in the carrier.
- Insert **new** bolts 6 into the guide pins in the brake caliper.
- Screw bolts to the brake carrier 2 with spanner (Table 1, Position IV).

**Caution: On assembly ensure that the gaiters 5 are not damaged or twisted during tightening the bolts.**  
 Firstly, tighten the bolt for the close fit longer pin 8, followed by the bolt for the clearance fit shorter pin 9.  
 Should during maintenance work the guide pin 8, 9 fastening to the carrier 2 be loosened, then new bolts 6 must be used when reassembling!

- Move brake caliper backwards and forwards on guide pins 8, 9 several times. Check for ease of movement.

**Caution: Do not squeeze guide pin dust caps against brake caliper!**

**Figures**

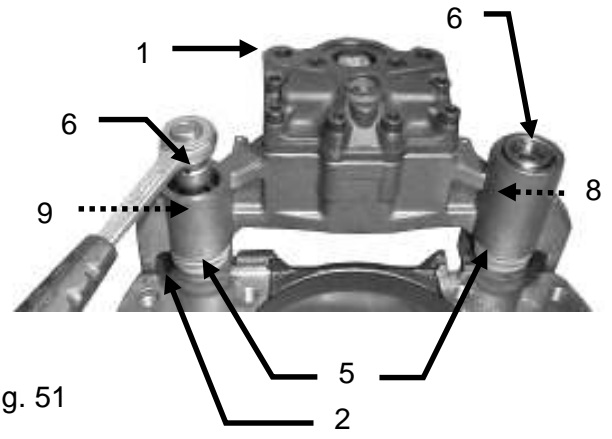


Fig. 51

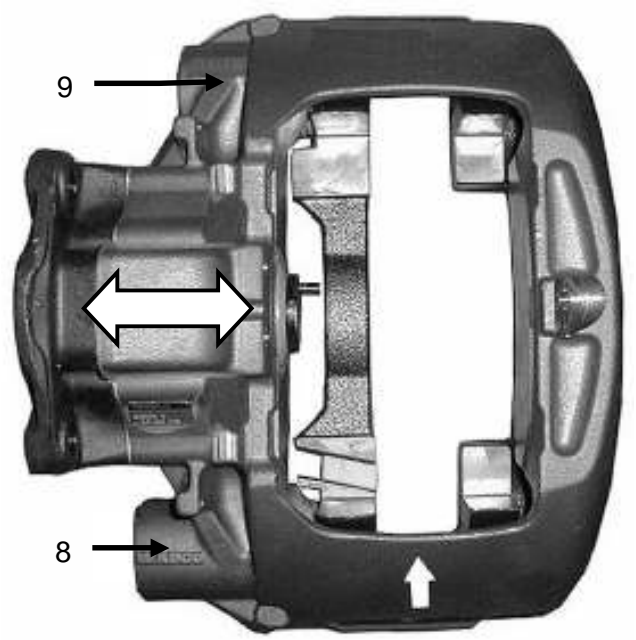


Fig. 52

**Work Sequences**

- Lubricate the bores for the caps 11, 11.1 in the brake caliper 1.
- Slide brake caliper against the brake carrier.
- Place **new** caps 11, 11.1 in the bores in the brake caliper 1 and press home with tools 10, 11 and 27.

**Note:** Fit the long cap 11.1 on the longer guide pin 8. Take care to avoid damaging the covers.

- Prior to brake assembly, inspect and clean the axle and brake carrier contact respectively mounting surfaces. **Remove any loose debris, rust or oil which may be present.**
- Mount brake over the brake disc on the axle according to Section 4.

**Note:** Special assembly instructions of the axle respectively vehicle manufacturer have to be noted.

- Install brake pads and set clearance. Carry out according to Section 3. and pay attention to Notes.
- Before refitting the brake cylinder clean the sealing surface and the mounting flange on the caliper and grease the concave seat (arrow) in the brake lever.

**Note:** When cleaning be careful to ensure, that dirt or water does not enter in the brake.

**⚠ Caution: Check the brake cylinder on damages before mounting. Particularly the internal piston rod sealing must be checked for damages. A defective brake cylinder may not be attached again.**

- Clean the sealing surface and surface area of the brake cylinder flange.
- Refit the brake cylinder according to Section 6.

**Caution: With the brake cylinder in its installed position, ensure that the lower drainage hole facing the ground is open! Depending upon cylinder type and according the cylinder manufacturer instructions, the other holes can be either openly, or must be plugged!**

- Install the wheel according the axle respectively vehicle manufacturer instructions.

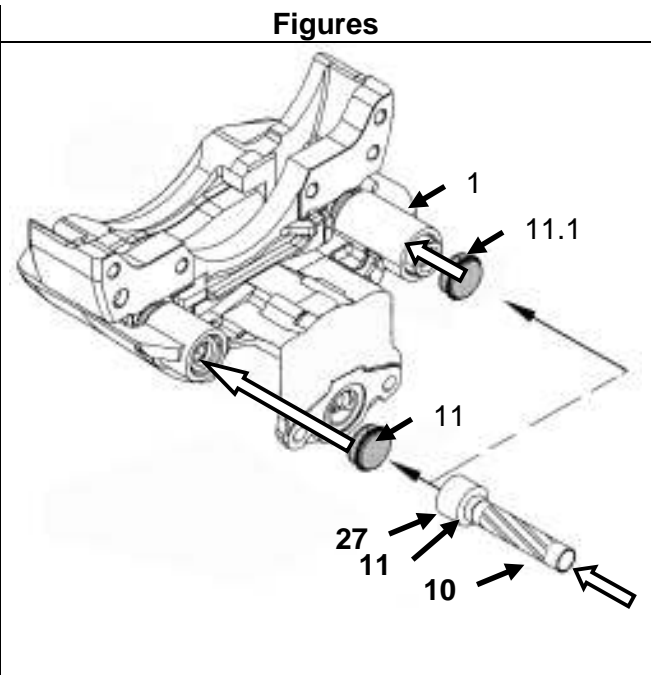


Fig. 53

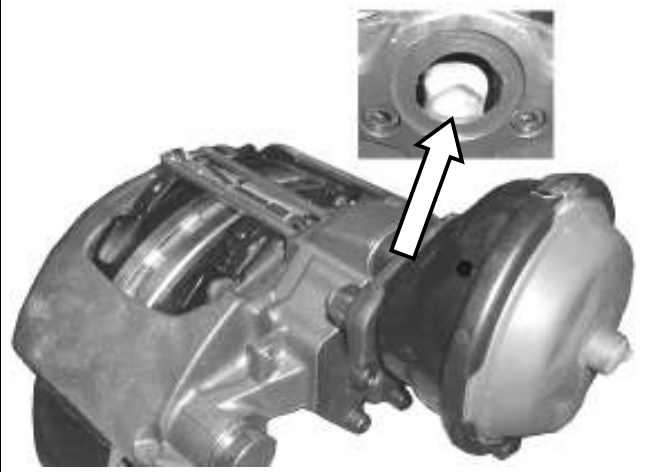

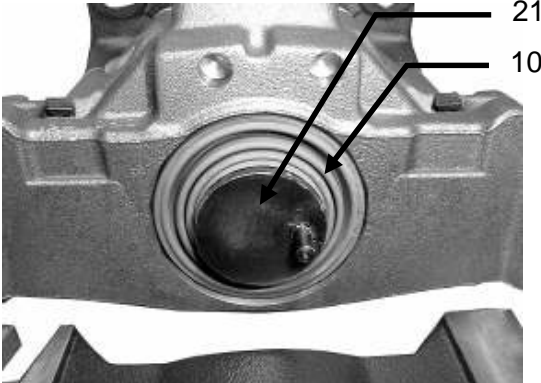



Fig. 54

## 5.2 Renewing Adjuster Screw Gaiter

**Note:** If the gaiter only is to be renewed it is not necessary to dismantle the brake caliper and cylinder.

### Work Sequences for Removal:

Work Sequences	Figures
<ul style="list-style-type: none"> <li>Remove brake pads and spreader plate according to Section 3.</li> <li>Push brake caliper to the actuation / cylinder side by hand.</li> </ul>	 <p>Fig. 55</p>
<ul style="list-style-type: none"> <li>Pull the gaiter 10 out the annular groove in the adjuster screw 21.</li> <li>Remove the gaiter from the seat in the brake caliper by means of a screwdriver.</li> </ul> <p><b>Caution: Take care not to damage gaiter seat in caliper!</b></p>	 <p>Fig. 56</p>
<ul style="list-style-type: none"> <li>Check the adjuster screw thread.</li> </ul> <p><b>Note:</b> For this purpose refit the wheel side brake pad so that the adjuster screw cannot be screwed completely out of the adjuster.</p> <p><b>After the thread check remove the brake pad.</b></p>	 <p>Fig. 57</p>

**Work Sequences**

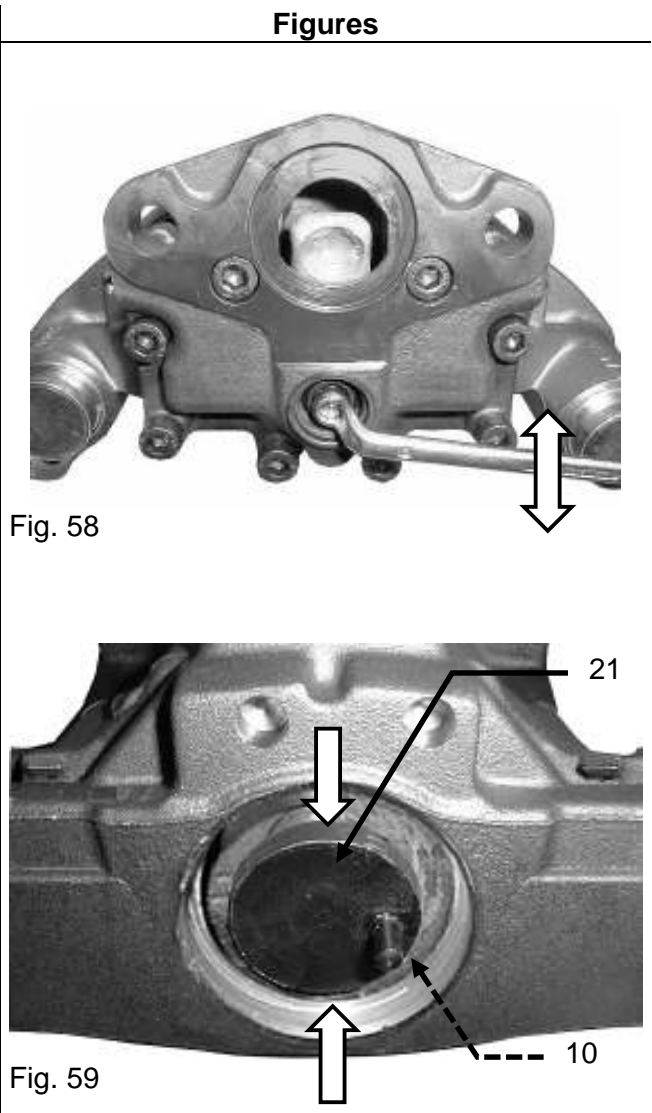
- Secure adjuster screw 21 against turning (arrow Fig. 57) and screw out the adjuster screw c. 30 mm by turning the adjuster hexagon in the anti-clockwise direction with a ring spanner / tools **12** and **13** (page 5) / (Table 1, Position I).
- Examine the thread for corrosion and damage whilst screwing out.

**Caution: The gaiter 10 can be renewed, if definitely no dirt or no water has penetrated into the brake caliper, or if the gaiter has been directly damaged during servicing the brake. In case of doubt the brake has to be replaced according to Section 4., if internal parts are corroded.**

- Clean the gaiter 10 seats in the caliper and the annular groove in the adjuster screw 21 (arrows).

**Caution: The seat in caliper for gaiter 10 must be clean and free of oil or grease.** When cleaning be careful to ensure, that dirt or water does not enter in the brake.

- After examination grease the thread and partly screw back the adjuster screw in clockwise sense by hand. The pin position must be in the same direction like before screw out.

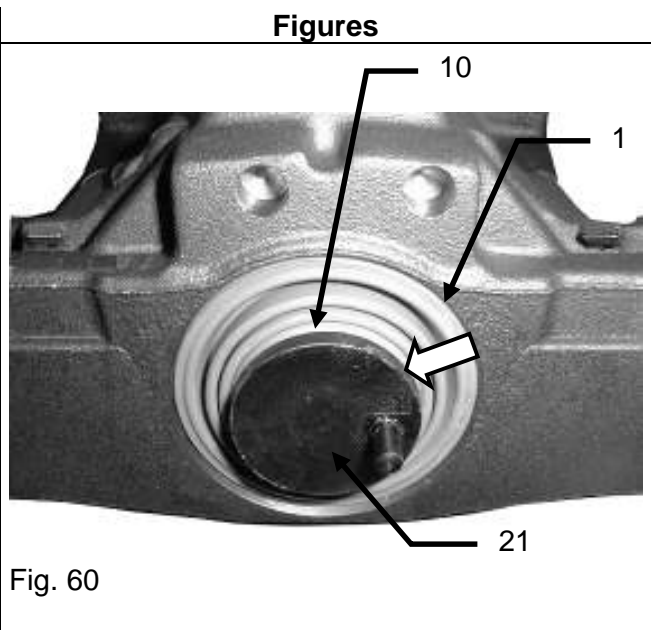



**Work Sequences for Installation:**

**Work Sequences**

- Push the **new** and **greaseless** gaiter 10 over the adjuster screw, centre and press by hand into the seat in the caliper 1.
- Lubricate gaiter 10 lip (arrow) lightly to ease fitment.
- Fit gaiter 10 into its seat in the adjuster screw 21.

**Note:** Ensure that the gaiter lip in the annular groove in the adjuster screw sits proper and free of folds!



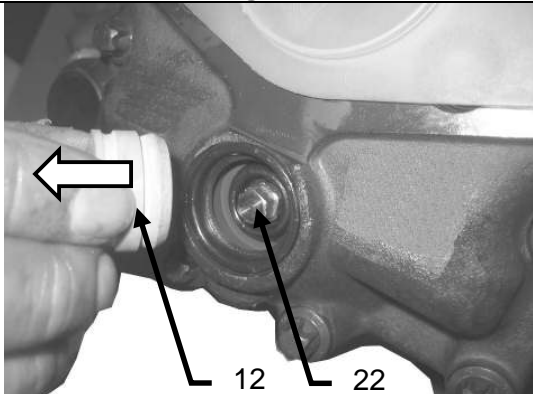
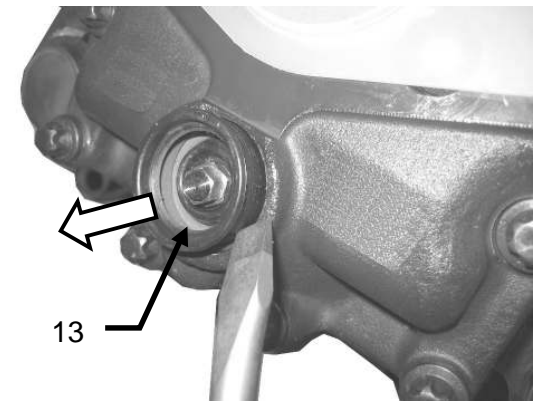

Work Sequences	Figures
<ul style="list-style-type: none"><li>• Install brake pads and set clearance. Carry out according to Section 3. and pay attention to Notes.</li></ul>	 <p data-bbox="842 853 933 882">Fig. 61</p>



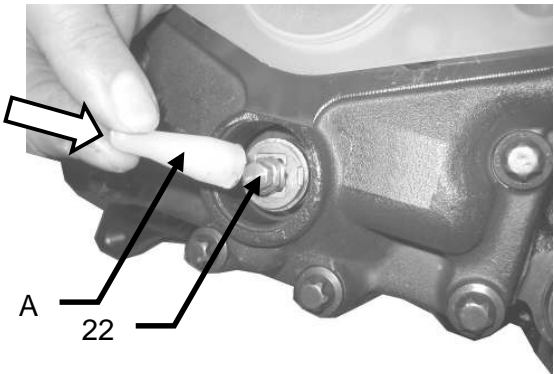
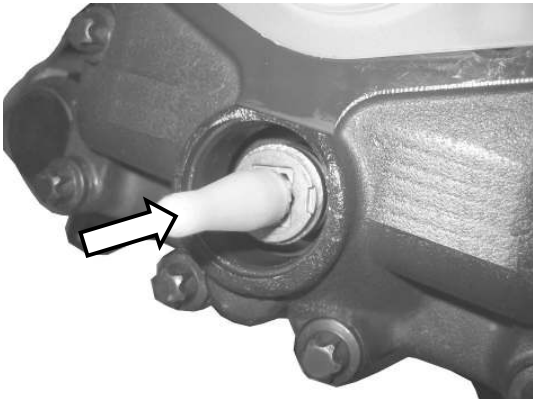
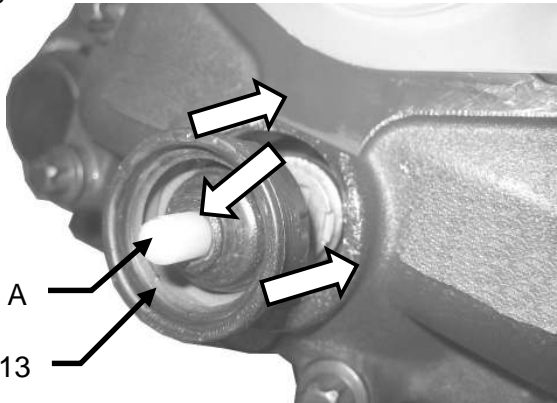
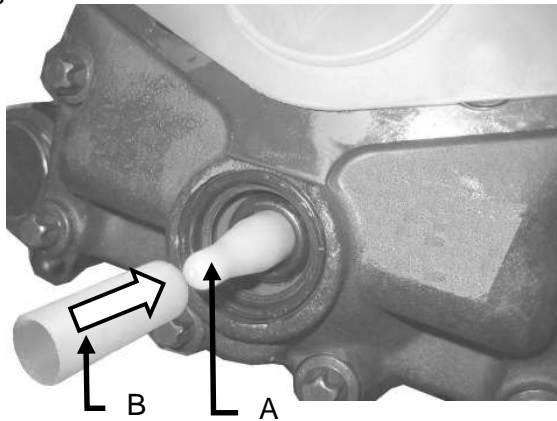
### 5.3 Renewing Adjuster Nut Gaiter

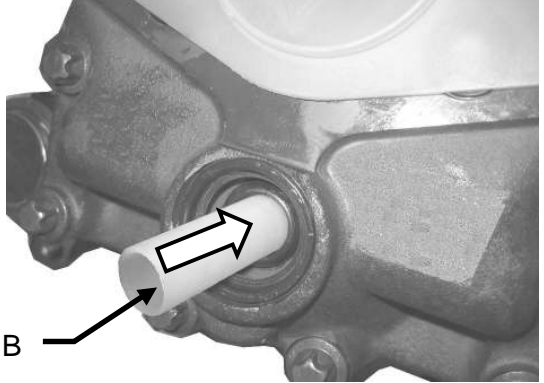
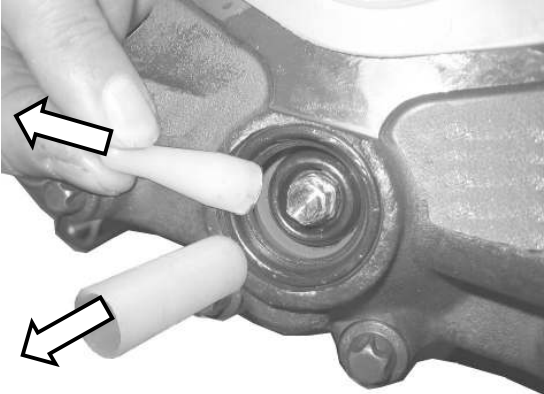
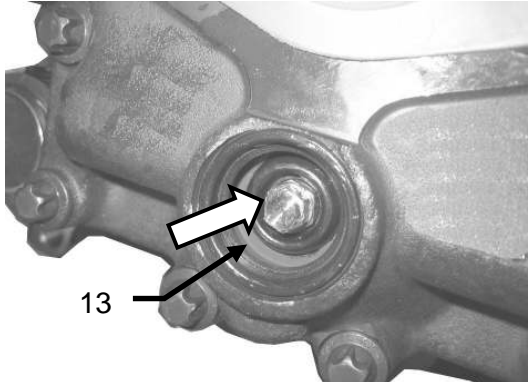
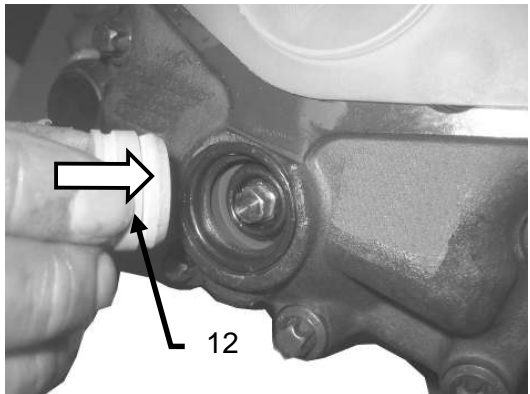
**Note:** If the gaiter only is to be renewed it is not necessary to dismantle the brake caliper and cylinder.

#### Work Sequences for Removal:

Work Sequences	Figures
<ul style="list-style-type: none"><li>Remove plug 12 for the adjuster 22 from the caliper</li></ul>	 <p>Fig. 62</p>
<ul style="list-style-type: none"><li>Remove the gaiter 13 from the seat in the brake caliper by means of a screwdriver, and pull gaiter out the adjuster nut.</li></ul>	 <p>Fig. 63</p>
<ul style="list-style-type: none"><li>Clean the gaiter seats in the caliper.</li></ul> <p><b>Note:</b> When cleaning be careful to ensure, that dirt or water does not enter in the brake.</p> <p><b>Caution:</b> The gaiter 13 can be renewed, if definitely no dirt or no water has penetrated into the brake caliper, or if the gaiter has been directly damaged during servicing the brake. In case of doubt the brake has to be replaced according to Section 4., if internal parts are corroded.</p>	 <p>Fig. 64</p>

**Work Sequences for Installation:**

Work Sequences	Figures
<ul style="list-style-type: none"> <li>Place the mounting cap A on the hexagon of adjuster 22 and push it towards the stop.</li> </ul>	  <p>Fig. 65</p>
<ul style="list-style-type: none"> <li>Lubricate <b>only</b> the inner gaiter lip (arrow) of the <b>new</b> gaiter 13 lightly to ease fitment.</li> <li>Push the gaiter 13 over the mounting cap A, and</li> <li>press by hand into the seat stop in the caliper.</li> </ul>	 <p>Fig. 66</p>
<ul style="list-style-type: none"> <li>Place the mounting sleeve B on the mounting cap A</li> </ul>	 <p>Fig. 67</p>

Work Sequences	Figures
<ul style="list-style-type: none"> <li>• Press mounting sleeve B against the inner gaiter lip towards, that the inner gaiter lip fit correct in the annular groove of the adjuster.</li> </ul>	 <p>Fig. 68</p>
<ul style="list-style-type: none"> <li>• Remove mounting sleeve and mounting cap.</li> </ul>	 <p>Fig. 69</p>
<ul style="list-style-type: none"> <li>• Check and make sure the correct seat of gaiter 13 in the brake caliper and annular groove (arrow).</li> </ul>	 <p>Fig. 70</p>
<ul style="list-style-type: none"> <li>• Fit <b>new</b> plug 12 to the opening in the brake caliper!</li> </ul>	 <p>Fig. 71</p>

**Work Sequences**

**Figures**

- **Check and make sure the correct seat!**



Fig. 72

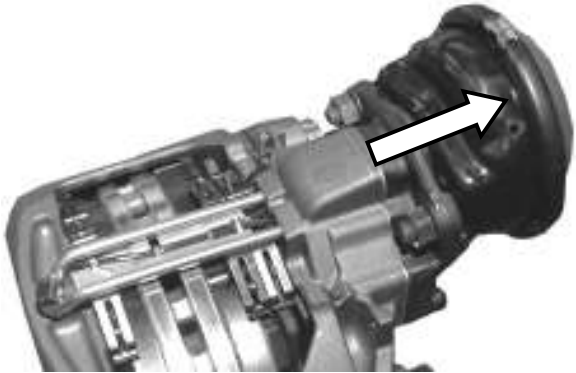
## 6. Renewing Brake Cylinder

**⚠ Caution:** Do not use power-driven sockets! While working at the brake or moving of the brake caliper handle the caliper only from outside to avoid injury!

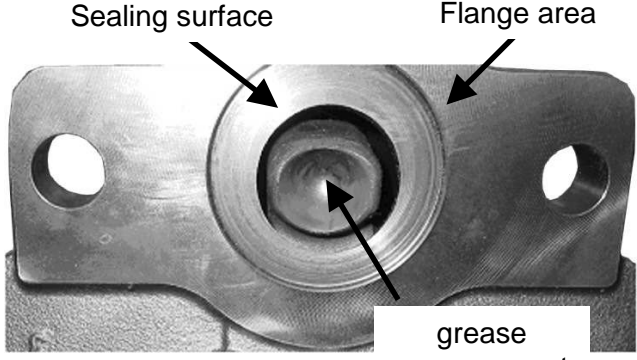
**Note:** Only use cylinders as specified by vehicle manufacturer. The following work sequences only inform in principle about the assembly and disassembly of the brake cylinder. Detailed assembly and check instructions have to be used according to the cylinder type and the instructions of the cylinder manufacturer.

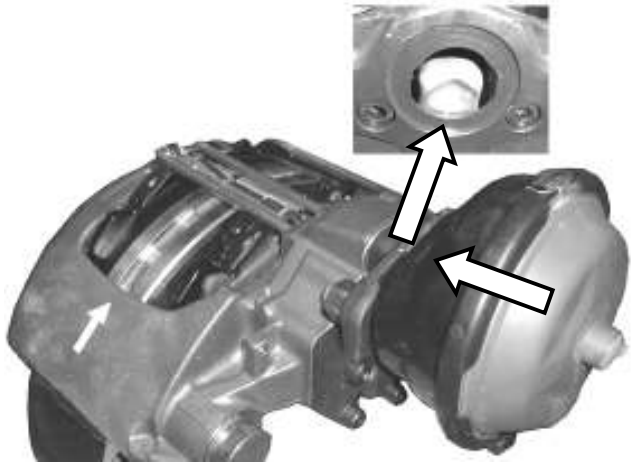
**Note:** The graphic representation of the brake carrier may differ from the actual design, so that the representation does only apply in principle.

### Work Sequences for Removal:

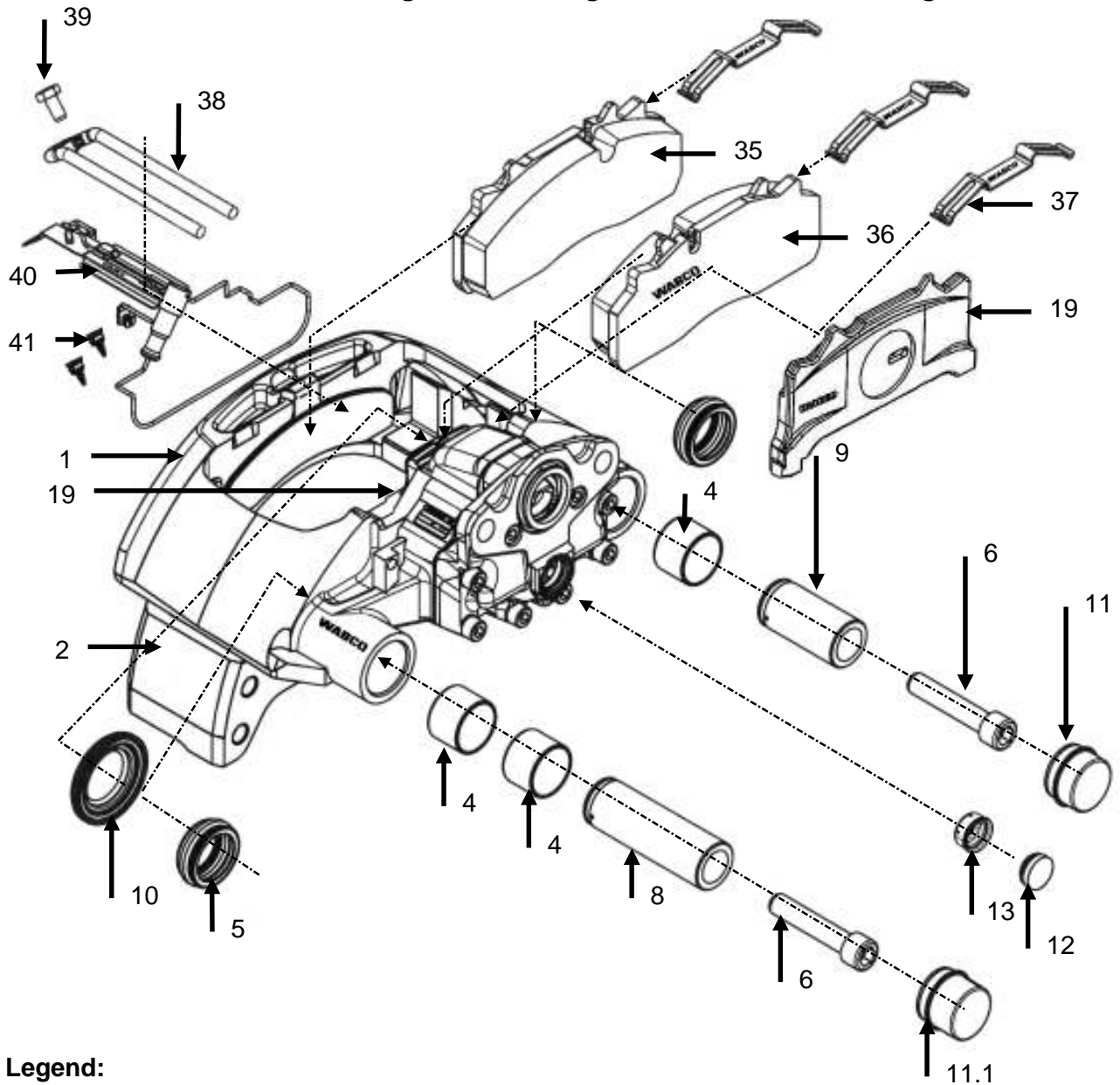
Work Sequences	Figures
<ul style="list-style-type: none"> <li>• Disconnect air line to cylinder (according to cylinder manufacturer's data).</li> <li>• Remove brake cylinder from caliper by releasing cylinder nuts (Table 1, Position V).</li> </ul> <p><b>Note:</b> When disassembling be careful to ensure, that dirt or water does not enter in the brake.</p>	 <p>Fig. 73</p>

### Work Sequences for Fitment:

Work Sequences	Figures
<p><b>Caution:</b> With the brake cylinder in its installed position, ensure that the lower drainage hole facing the ground is open! Depending upon cylinder type and according the cylinder manufacturer instructions, the other holes can be either openly, or must be plugged!</p> <ul style="list-style-type: none"> <li>• Before refitting the brake cylinder clean the sealing surface and the mounting flange on the caliper and grease the concave seat (arrow) in the brake lever.</li> </ul> <p><b>Note:</b> When cleaning be careful to ensure, that dirt or water does not enter in the brake.</p>	 <p>Fig. 74</p>

Work Sequences	Figures
<ul style="list-style-type: none"><li>• Fit brake cylinder and tighten nuts with spanner (Table 1, Position V). <b>For the attachment observe the references in the table.</b></li><li>• Reconnect brake hose to brake cylinder (according to cylinder manufacturer's data).</li></ul> <p><b>Note:</b> The brake hose must not be twisted or located such that it will rub against anything! The brake hose of the air supply is not allowed to have an influence on the moveability of the brake caliper over its full range of movement.</p> <ul style="list-style-type: none"><li>• Test air connection for leaks (according to cylinder manufacturer's data).</li><li>• Carry out function and effectiveness tests (according to cylinder manufacturer's data).</li></ul>	 <p>Fig. 75</p>

**Explosive Diagram of the PAN 19-1 <sup>plus</sup> Replacement Parts**  
 (a left hand brake is shown)  
**Observe left and right brake configurations. Do not interchange!**



**Legend:**

1	Preassembled Brake Caliper 1 with clamping unit inside, Brake Carrier 2 and Spreader Plate 19	13	Adjuster Nut Gaiter
4	Guide Pin Bushes	19	Spreader Plate
5	Guide Pin Gaiters	35	Brake Pad, Wheel Side
6	Internal Hexagon Bolts	36	Brake Pad, Actuation Side
8	Guide Pin (long)	37	Hold Down Springs
9	Guide Pin (short)	38	Pad Hold Down Hoop
10	Adjuster Screw Gaiter	39	Screw
11	Cap / Cover (short)	40	Wear Indicator (pre-mounted)
11.1	Cap / Cover (long)	41	Cable Clips
12	Plug		

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