# Repair Instructions

WABCO MAXX™ 22
Mechanical Sliding Caliper Disc Brake
Including Maintenance
Commercial Vehicles

AFTERMARKET

LEMFÖRDER SACHS TRW WABCO

# 1 Preface

## 1.1 Validity and field of application

This document applies to the following WABCO part numbers:

- 640 322 XXX 0 (OEM[1)], IAM[2)]brakes)
- 640 322 XXX R (Reman[3)]brakes)

XXX in the part number stands for the product versions.

All product versions can be maintained and repaired with this document.

## 1.2 Further information

Currently available **repair kits and spare parts** on the online product page:

www.wabco-customercentre.com

Local **contact**:

https://www.zf.com/site/locations/en/home/locations_worldwide.html

ZF **[pro]Academy**:

https://proacademy.zf.com

1) Original Equipment Manufacturer
2) Independent Aftermarket
3) remanufactured

# 2 Safety

## 2.1 Signal words and symbols

This document contains particularly highlighted safety instructions which are marked with one of the following signal words depending on the severity of the danger.

**⚠ DANGER**

DANGER
The signal word DANGER indicates a dangerous situation that, if not prevented, will lead to a severe injury or death.
⇨ Information as to how the danger can be prevented.

**⚠ WARNING**

WARNING
The signal word WARNING indicates a dangerous situation that, if not prevented, can lead to a severe injury or death.
⇨ Information as to how the danger can be prevented.

**⚠ CAUTION**

CAUTION
The signal word CAUTION indicates a dangerous situation that, if not prevented, can lead to a slight or moderate injury.
⇨ Information as to how the danger can be prevented.

***NOTICE***

The signal word NOTICE indicates a situation that, if not prevented, can lead to property damage.
⇨ Information as to how the property damage can be prevented.

The following symbols are additionally used:

⚠ This symbol refers to additional, safety-relevant information.

ⓘ This symbol indicates information concerning special workflows, methods, application of auxiliaries, etc.

## 2.2 General safety instructions

Read all safety instructions and information. Non-compliance may lead to property damage, serious injuries or death.

Observe safety instructions, applicable safety regulations and legal requirements to prevent malfunctions and damage.

Country-specific safety regulations, accident prevention regulations and environmental protection provisions apply additionally.

Wear safety-relevant workwear for all work. Depending on the work, also wear personal protective equipment.

After completing the work, check correct function and operational safety.

### Intended use

The WABCO product is exclusively intended for the application as defined in the contract and as agreed on delivery. Any other or extended form of use does not comply with this definition of intended use. The intended use includes compliance with this documentation and other applicable documents in order to avoid malfunctions and damage during operation. The WABCO product is designed and produced in line with state-of-the-art technology and is safe to operate when used as intended. However, this WABCO product may pose dangers if improperly used by unauthorized, untrained and uninstructed personnel, or if not used according to its intended use.

### Figures

Figures might deviate from the WABCO product and are not drawn to scale. No conclusions can be drawn with regard to size and weight.

### Assembly, commissioning, maintenance and repair

Only perform assembly, commissioning, maintenance and repair work according to this documentation and other applicable documents.

- Work must be performed in a professional manner and according to the technical provisions.
- Only use genuine WABCO spare parts.
- Only use genuine WABCO accessories.
- Only use original WABCO special tools.
- Changes, modifications and calibrations of the WABCO product may lead to the expiry of the operator's license, warranty or guarantee.

### Qualification and knowledge of the authorized, specialized staff

The activities described in this documentation require basic knowledge of automotive engineering and knowledge of the associated technical terms. To ensure safe use, these activities may therefore only be carried out by an appropriate specialist or a person instructed by a specialist (fitter).

A specialist is someone who, based on his technical training, knowledge and experience, as well as his knowledge of the relevant regulations, can assess the work assigned to him, recognize possible dangers and take suitable safety measures. A specialist must comply with the relevant technical rules.

A fitter is someone who, based on his knowledge and experience, as well as his knowledge of the relevant regulations, can assess the work assigned to him, recognize possible dangers and take suitable safety measures. A fitter must comply with the relevant technical rules.

### Procedure in the case of complaints or damage

In the case of damage or complaints, contact the WABCO partner and have the following data on the product ready:

- Type
- Part number
- Serial number
- Mileage
- Diagnostic memory log for electronics
- Detailed description of damage

### When working on the WABCO product

- Secure workspace.
- Depressurize the pneumatic system. Completely open spring-loaded accumulator and mechanically secure in this position.
- Depressurize the hydraulic system.
- Only carry out work when in a voltage-free state.
- Protect vehicle against being started accidentally. Attach instruction plate where it is clearly visible.
- Perform work when engine is switched off.
- Secure vehicle against rolling away or moving.
- Keep unauthorized persons away from the vehicle during work.
- Do not stand beneath a suspended load.
- Do not work on a suspended load.
- Only use permitted means of transport and lifting equipment with sufficient load rating.
- Secure parts against falling down using suitable bracket, e.g., vise.
- Close open piping and hoses and avoid damage.
- Observe tightening torques.
- Protect cables against mechanical damage.

### Operating supplies and auxiliary materials

Operating supplies and auxiliary materials might cause permanent damage to health and environmental damage. Observe material safety data sheets.

# 3 Information regarding work on the ZF product

## 3.1 General Information

- Read this documentation prior to starting repair, maintenance or assembly work.
- Consult your WABCO partner if you have any questions.
- All work on the WABCO product must be performed expertly and under clean conditions.
- Use the specified special tools and equipment intended for the working procedures described.
- Perform all work according to the working procedure described.
- Cover opened WABCO products to prevent entry of foreign matter.
- Cover parts that have been removed and that are reusable and protect them against dirt and damage.
- After completion of work and inspections, authorized, specialized staff must ensure that the WABCO product is again functioning perfectly and is safe to operate.

## 3.2 Cleaning the WABCO product

Clean the WABCO product with an appropriate cleaning agent prior to repair or assembly works.

| ***NOTICE*** |
| --- |
| Possible damage to WABCO product due to penetrating water.<br>⇨ Be careful when using a pressure washer on the WABCO product. |

## 3.3 Dismantling the WABCO product

- To avoid mixing up parts, the parts must be clearly assigned to the disassembled WABCO product.
- Inspect the parts during disassembly in order to find a potential cause of damage.

## 3.4 Assembling the WABCO product

Assemble the WABCO product at a clean workplace. The order of work steps, configuration data, and tightening torques must be observed. Use the special tools specified in the work steps.

## 3.5 Cleaning parts

Clean all reusable parts.

# 4 Description

## 4.1 Brief product description

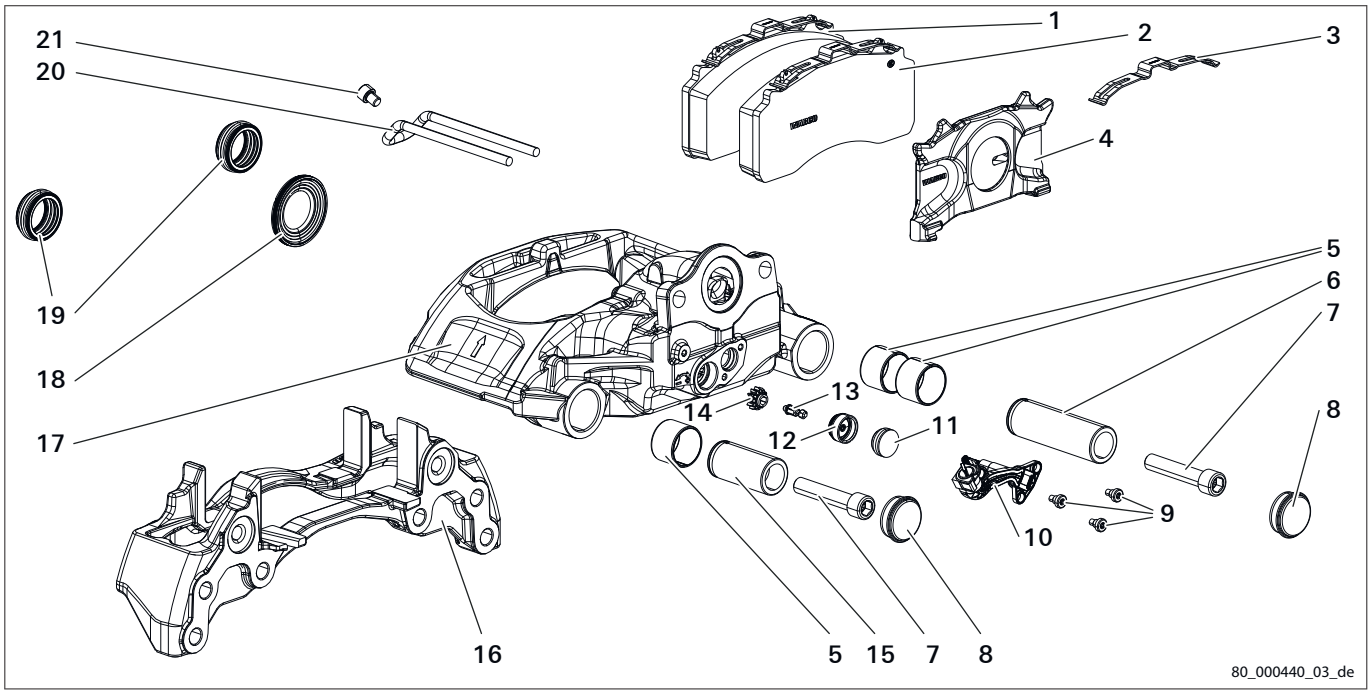



Fig. 1

1 Brake pad on rim side with pre-assembled leaf spring
2 Brake pad on cylinder side with pre-assembled leaf spring
3 Leaf spring
4 Pressure plate
5 Bush
6 Fitted bolt
7 Hexagon socket screw (width across flats 14 mm)
8 Sealing cap for fitted bolt pin guide
9 Torx® screw, T30 internal
10 Wear sensor (optional)
11 Return unit plug
12 Return unit seal
13 Return unit shaft
14 Return unit gear
15 Clearance bolt
16 Brake carrier
17 Brake caliper
18 Piston protection cap
19 Protective pin cap
20 Retainer clip
21 Hexagon socket screw (width across flats 8 mm)

# 5 Technical Data

## 5.1 Product-specific data

Product-specific data on online product page:

www.wabco-customercentre.com

## 5.2 Type plate

Identify the product by part number.

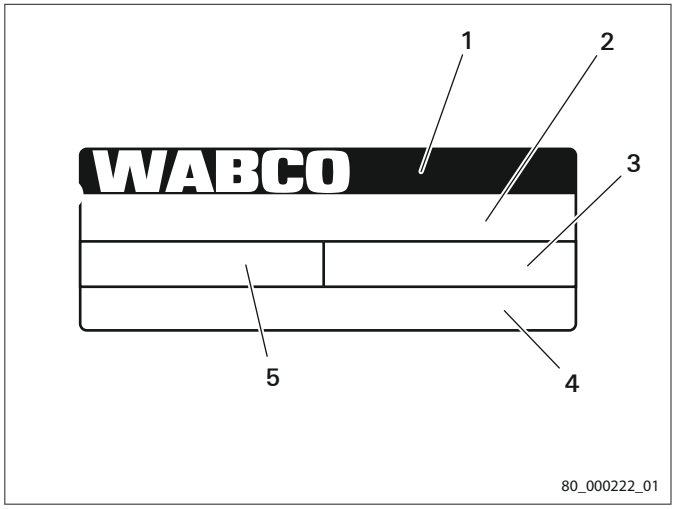



Fig. 2

1 Country of manufacture
2 Customer Number
3 Consecutive identification number for assembly data
4 Part number
5 Production date (year/month/day)

# 6 Transport and Storage

## 6.1 Scope of supply

### Scope of supply of exchange brake

- Brake (including brake carrier and pressure plate) is packed in plastic film and carton.
- Brake is protected against damage and contamination by means of transport safety devices and transport protection caps.

Brake pads, retainer system, wear indicator and brake disc are not included in the scope of supply. Available separately in repair kits.

### Repair kit scope of delivery

- Repair kit is supplied in single parts in a carton.
- Check completeness of the repair kit using the attached document.

## 6.2 Transportation

### 6.2.1 General transport instructions

- Product is supplied in a carton. Larger deliveries are shipped in a lattice box or on a pallet.
- Observe total weight, dimensions and required space for transporting and setting down *(refer to Chapter Technical Data)*.
- Secure the load carrier to the transport vehicle using suitable devices.
- Protect the product against dirt, moisture, and damage with suitable covers.
- Do not set down or store the load carrier outdoors.
- Immediately notify the WABCO partner of transport damage. Obvious transport damage must be noted on the delivery papers.
- With long transport times, high demands are placed on corrosion protection.

Observe the described transport instructions for a return delivery to WABCO. If necessary, request a load carrier from WABCO.

## 6.3 Storage

### 6.3.1 Short-term storage and long-term storage

**NOTICE**

Damage to WABCO product due to inappropriate storage possible.

⇨ Store the WABCO product in dry, closed rooms and protect from detrimental influences such as dirt, moisture, temperature and damage.

⇨ Failure to comply will void the warranty.

Storage conditions:

- Store the WABCO product in dry, closed rooms with as few temperature fluctuations and low relative humidity as possible.
- Protect the WABCO product against dirt, moisture, and damage by means of suitable covers and load carriers.
- Store the WABCO product in such a way that adverse impacts on quality and damage are prevented.

# 7 Decommissioning

## 7.1 Disposal

**NOTICE**

Inappropriate disposal may cause environmental damage.

⇨ Please dispose of the WABCO product, parts, operating supplies and auxiliary materials in accordance with the applicable regional, national, and international regulations of the respective operating country.

⇨ Please use an authorized disposal specialist to dispose of the WABCO product, parts, operating supplies and auxiliary materials.

Operating supplies and auxiliary materials might cause permanent damage to health and environmental damage. Observe material safety data sheets *(refer to Section Further information)*.

The WABCO product consists of various materials. Each of these materials must be treated, disposed of or recycled in accordance with the regional, national, and international regulations of the respective operating country.

### Disposal of packaging

- Nonreturnable packaging
  Separate the individual parts of the nonreturnable packaging by type and dispose of them in accordance with the applicable regulations of the operating country.
- Reusable packaging
  Please get in touch with your WABCO partner if you require further information on returning or disposing of reusable packaging.

### Preparing and dismantling the WABCO product for disposal

Please note the following steps and carry them out if required:

- Release the pressure from the hydraulic system.
- Release the pressure from the pneumatic system.
- Drain and/or remove operating supplies and auxiliary materials from the WABCO product.
- Clean WABCO product.
- If possible, have authorized, specialized staff dismantle the WABCO product completely.

### Disposal of parts

Clean parts and separate them by material type. Dispose of the parts in accordance with the applicable regulations of the operating country.

### Disposal of electrical and electronic components

Dispose of electrical and electronic components in accordance with manufacturer's specifications and the regulations of the operating country.

### Disposal of operating supplies and auxiliary materials

Collect and dispose of operating supplies and auxiliary materials in accordance with the applicable safety data sheets, manufacturer's specifications and the regulations of the operating country.

### WABCO deposit system for end-of-life parts

Send end-of-life parts to WABCO and receive your deposit in return. More information on the return procedure for end-of-life parts: http://www.wabco.info/i/1639

# 8 Installation Conditions

## 8.1 Installation conditions

For installation, take data from data sheet and product drawing *(refer to Chapter Technical Data and Section Further information)*.

Observe documents of axle and vehicle manufacturer.

# 9 Settings

| Designation | Dimensions | Measuring instrument | Comment<br>Chapter/Section |
|---|---|---|---|
| Tilting clearance of guide pin | max. 2.0 mm | Dial gauge with magnetic stand | • Checking the bearing clearance of the guide pins, page 30 |
| Limit value for lateral brake disc run-out | 0.15 mm | Dial gauge with magnetic stand | • Checking lateral brake disc run-out, page 40 |
| Running clearance | 1 mm | Feeler gauge | • Setting running clearance, page 51 |

# 10 Tightening Torques

| Designation | Tightening torque | Measuring instrument | Comment<br>Chapter/Section |
|---|---|---|---|
| Hexagon screw<br>(width across flats 8 mm) | 30 Nm(+15 Nm) | Torque wrench | For retainer clip<br>• Assembling the retainer system, page 43 |
| T30 torx screws (internal) | 7 Nm (+2 Nm) | Torx screwdriver | Screw wear sensor onto brake caliper tightly.<br>• Installing the wear sensor, page 45 |
| T2 torx screws (internal) and/or cross-headed screws | 1.3 Nm (-0.3 Nm) | Torx- and/or cross-head screwdriver | Screw vehicle-end wear sensor cable tightly to wear sensor.<br>• Installing the wear sensor, page 45 |
| Hexagon nut<br>(width across flats 24 mm) | 70 Nm (tightening torque);<br>180 - 210 Nm<br>(tightening torque) | Torque | Retightening torque: 70 Nm (tighten hexagon nut); tightening torque: 180 - 210 Nm (tighten hexagon nut); values only apply to original WABCO brake cylinder.<br>• Installing brake cylinder, page 56 |
| Hexagon socket screw<br>(width across flats 14 mm) | 70 Nm (tightening torque); 130 Nm + additional angle 90° (tightening torque) | Torque wrench | Tightening torque: 70 Nm (tighten pin); tightening torque + additional angle 130 Nm + 90° (tighten pin)<br>• Assembling guide pins and brake carrier, page 62 |

# 11 Workshop equipment

## 11.1 Standard tools and fixtures

To repair and maintain WABCO air disc brakes, the following standard tools and fixtures must be available.

| Standard tool | | |
|---|---|---|
| **Designation** | **Requirement** | **Comment** |
| Torque wrench | Calibrated to DIN EN ISO 6789, with noticeable and audible actuation | Tightening torques *(refer to Chapter Tightening Torques)* |
| Socket wrenches, spanner sockets, open-end wrenches, ring wrenches, engineers wrenches, screwdrivers, pliers | Various sizes | |
| Plastic hammer | Various sizes | |

Tab. 1

| Measuring instrument and test equipment | | |
|---|---|---|
| **Designation** | **Requirement** | **Comment** |
| Folding rule | | |
| Dial gauge | Measurement accuracy: 0.01 mm<br>Measurement range: various lengths | With magnetic stand |
| Caliper with digital display | Measurement accuracy: 0.01 mm<br>Measurement range: various lengths | |
| Feeler gauge | Measurement range: 0.05 mm to 1.20 mm | |

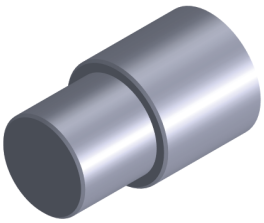
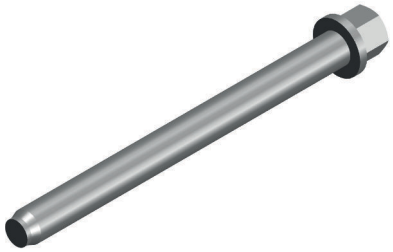
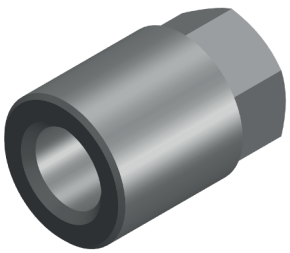
Tab. 2

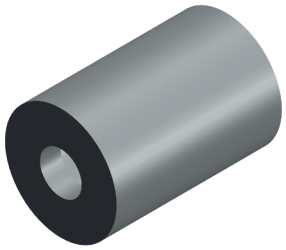
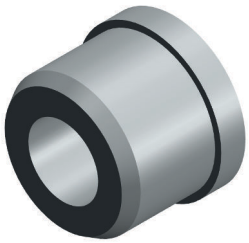
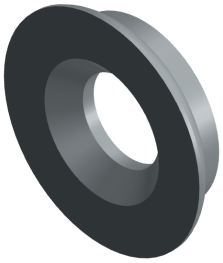
| Other equipment | | |
|---|---|---|
| **Designation** | **Requirement** | **Comment** |
| Bracket | | E.g., vise<br>Fixing the brake |
| Lifting equipment | | Lifting the brake |
| Cleaning cloth | | Cleaning, degreasing |
| Wire brush | | Cleaning of surfaces |
| Marking pen | Permanently opaque, removable with organic solvent | Marking a position |

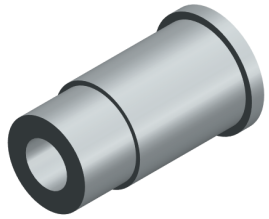
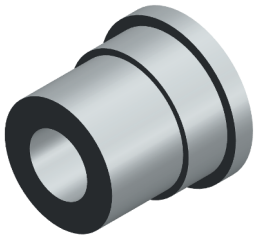
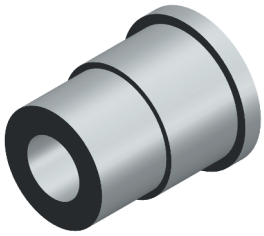
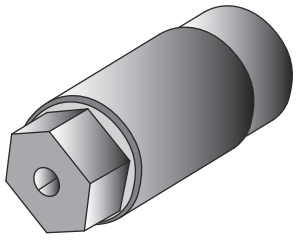
Tab. 3

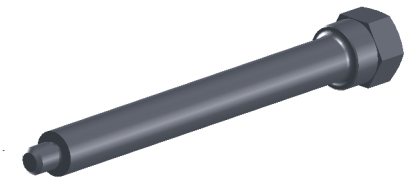
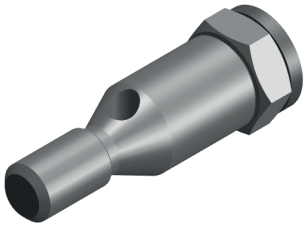
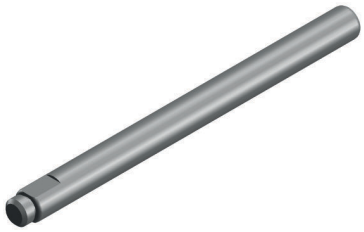
## 11.2 Special tools

The required quantity is listed. Please inquire as to packaging unit before ordering.

| Figure | Order no.<br>Designation<br>Chapter/Section | Qty. | Comment |
|---|---|---|---|
|  <br>80_000367_01 | 300 100 012 2<br><br>Ratchet<br><br>• Resetting brake, page 46 | 1 | Cannot be ordered as individual part. |
|  <br>80_000219_01 | 892 010 051 4<br><br>Drive-in sleeve cover<br><br>• Installing pin guide sealing caps, page 58 | 1 | Contained in tool kit 300 100 010 2. Cannot be ordered as individual part. |
|  <br>80_000209_01 | 300 100 005 4<br><br>TR 20x2 threaded spindle<br><br>• Removing bushes, page 65<br>• Installing bushes, page 66 | 1 | Contained in tool kit 300 100 010 2. Cannot be ordered as individual part. |
|  <br>80_000210_01 | 891 500 057 4<br><br>TR 20x2 nut<br><br>• Removing bushes, page 65<br>• Installing bushes, page 66 | 1 | Contained in tool kit 300 100 010 2. Cannot be ordered as individual part. |

| Figure | Order no.<br>Designation<br>Chapter/Section | Qty. | Comment |
|---|---|---|---|
|  <br>80_000211_01 | 893 040 012 4<br><br>Press-out sleeve<br><br>• Removing bushes, page 65 | 1 | Contained in tool kit 300 100 010 2. Cannot be ordered as individual part. |
|  <br>80_000212_01 | 893 040 013 4<br><br>Press-out bolt<br><br>• Removing bushes, page 65 | 1 | Contained in tool kit 300 100 010 2. Cannot be ordered as individual part. |
|  <br>80_000213_01 | 810 710 007 4<br><br>Release bearing<br><br>• Removing bushes, page 65<br>• Installing bushes, page 66 | 1 | Contained in tool kit 300 100 010 2. Cannot be ordered as individual part. |
|  <br>80_000214_01 | 810 409 017 4<br><br>Round washer<br><br>• Installing bushes, page 66 | 1 | Contained in tool kit 300 100 010 2. Cannot be ordered as individual part. |
|  <br>80_000215_01 | 300 100 003 4<br><br>Shim<br><br>• Installing bushes, page 66 | 1 | Contained in tool kit 300 100 010 2. Cannot be ordered as individual part. |

| Figure | Order no.<br>Designation<br>Chapter/Section | Qty. | Comment |
|---|---|---|---|
|  <br>80_000216_01 | 893 040 016 4<br><br>Press-in sleeve lower fitted bolt<br><br>• Installing bushes, page 66 | 1 | Contained in tool kit 300 100 010 2. Cannot be ordered as individual part. |
|  <br>80_000217_01 | 893 040 015 4<br><br>Press-in sleeve upper fitted bolt<br><br>• Installing bushes, page 66 | 1 | Contained in tool kit 300 100 010 2. Cannot be ordered as individual part. |
|  <br>80_000218_01 | 893 040 014 4<br><br>Press-in sleeve clearance bolt<br><br>• Installing bushes, page 66 | 1 | Contained in tool kit 300 100 010 2. Cannot be ordered as individual part. |
|  <br>80_000503_01 | 300 100 018 4<br><br>Extracting device<br><br>• Removing the return unit, page 69 | 1 | Contained in tool kit 300 100 011 2. Cannot be ordered as individual part. |
|  <br>80_000502_01 | 300 100 004 4<br><br>Hammer pin<br><br>• Removing the return unit, page 69<br>• Installing the return unit, page 70 | 1 | Contained in tool kit 300 100 011 2. Cannot be ordered as individual part. |

| Figure | Order no.<br>Designation<br>Chapter/Section | Qty. | Comment |
|---|---|---|---|
|  <br>80_000501_01 | 300 100 011 4<br><br>Handle<br><br>• Removing the return unit, page 69 | 1 | Contained in tool kit 300 100 011 2. Cannot be ordered as individual part. |
|  <br>80_000206_01 | 893 040 017 4<br><br>Press-in cup<br><br>• Installing piston protection cap, page 72 | 1 | Contained in tool kit 300 100 010 2. Cannot be ordered as individual part. |
|  <br>80_000207_01 | 300 100 007 2<br><br>Connecting bolt (3 pieces)<br><br>• Installing piston protection cap, page 72 | 1 | Contained in tool kit 300 100 010 2. Cannot be ordered as individual part. |
|  <br>80_000208_01 | 300 100 022 4<br><br>Holding rod<br><br>• Installing piston protection cap, page 72 | 1 | Contained in tool kit 300 100 010 2. Cannot be ordered as individual part. |

# 12 Maintenance

## 12.1 Maintenance plan

Observe the vehicle manufacturer specifications.

A visual inspection of the brakes through the vehicle wheel is recommended at each tire pressure check. The table contains instructions for planning maintenance intervals. However, depending on the application of the vehicle (e.g., corrosive environment, heavy use on rough or unpaved roads, etc.), more frequent checks of the brake system and its components may be required. Contained rubber parts and grease fillings are maintenance-free. Replace damaged parts.

| Maintenance work | Maintenance interval[4)] | | |
|---|---|---|---|
| | Every 6 months (4 months in case of extreme use) | Every 12 months | With every brake pad replacement |
| | Vehicle wheel installed | Vehicle wheel removed | |
| Check and test brake pads | X | X | |
| Checking and inspecting brake discs | X | X | X |
| Checking seals and bushes | | X | X |
| Checking brake pad wear | | X | X |
| Checking retainer system (retainer clip, leaf springs and screw) for damage (e.g., wear, fractures, cracks) | | X | X |
| Checking the bearing clearance of the guide pins | | X | X |
| Checking the adjuster | | X | X |
| Checking brake caliper movement | | | X |
| Checking caps, lines and external brake parts | | | X |
| Checking retainer system screw for tightening torque according to specification | | | X |

Tab. 4 Maintenance plan

## 12.2 Checking the adjuster

The following work can be performed with the brake installed.

Requirements:

- Vehicle wheel has been removed.

Intervals: *(refer to Section Maintenance plan)*

**NOTICE**

Damage at seal seat in brake caliper due to incorrect and improper use of tools.

⇨ Only use described tools in a proper way.

4) Depending on what occurs first.

Removing plug

1. Carefully lift out plug (1) from seal (2) at return unit using a screwdriver.

2. Check plug (1) for damage.

   Replace damaged part.

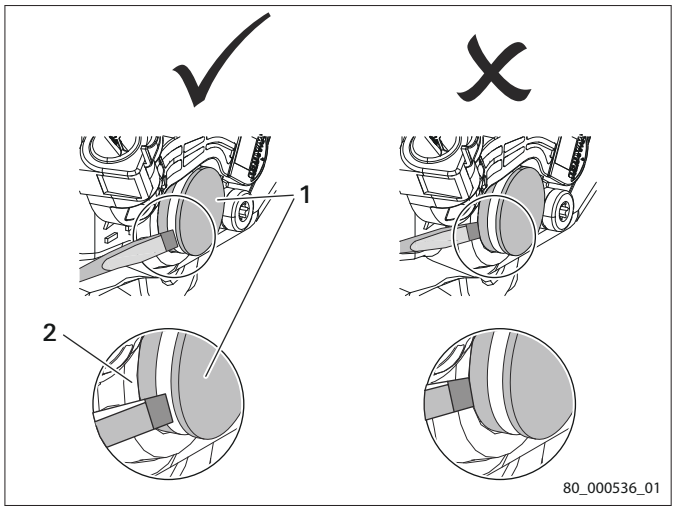



Fig. 3

Checking return unit

3. Check hexagon (1) and seal (2) of return unit for wear or damage.

   Replace damaged parts *(also refer to Section Replacing seal at return unit) (also refer to Section Replacing brake)*.

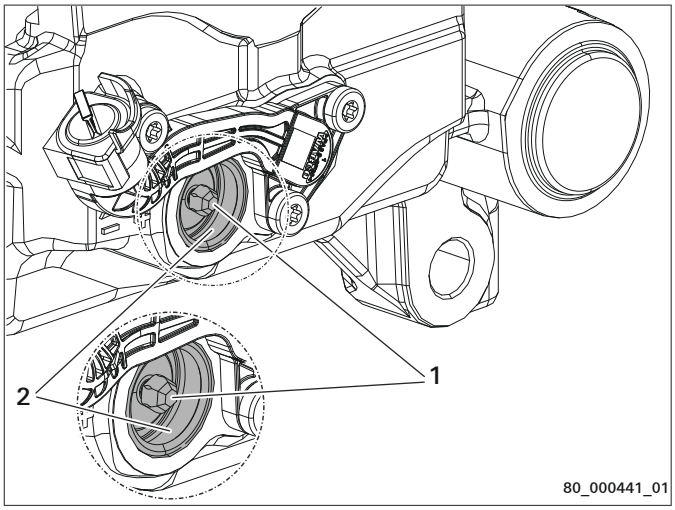



Fig. 4

Checking the adjuster

4. The following work should be performed by two persons.

   Checking the adjustment is only possible with a larger running clearance (2 mm to 3 mm).

   Direction of rotation at hexagon:

   Counter-clockwise rotation direction (returning): running clearance increases.

   Clockwise rotation direction (closing): running clearance decreases.

   Turning counter-clockwise requires more force than turning clockwise.

   Using an offset ring wrench (width across flats 8 mm), turn hexagon (1) of return unit half a turn counter-clockwise.

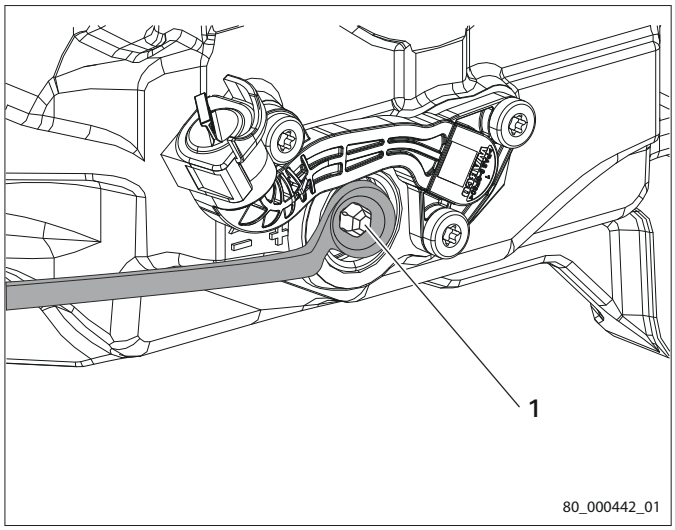


Fig. 5

5. Set running clearance from 2 mm to 3 mm.

   There must be sufficient space for the offset ring wrench (width across flats 8 mm) so that it is not obstructed when it is rotated during adjustment.

6. Leave offset ring wrench (width across flats 8 mm) on hexagon (1) of return unit.

   The tool is only used here as a visual aid so that the rotation of hexagon ((1)) of return unit is more clearly perceptible.

7. Now, a second person must lightly press the brake pedal five times. In the process, observe the ring wrench's movement.

   → Ring wrench gradually turns clockwise. Correct function.
   → Rotation angle gets smaller with each actuation of the brake pedal. Correct function.

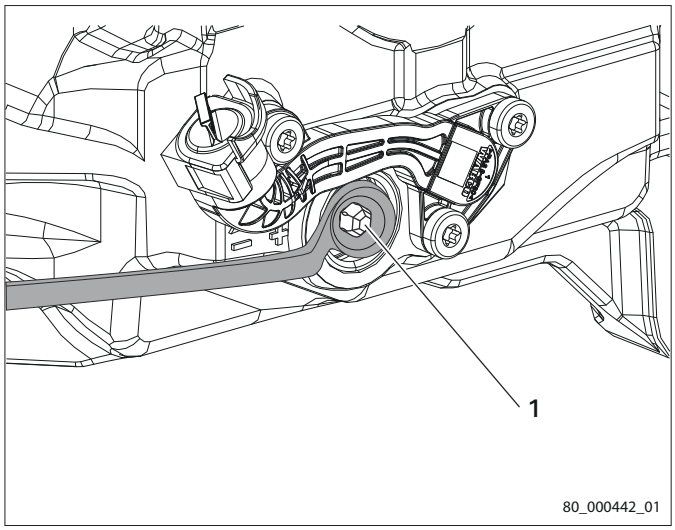


Fig. 6

Ring wrench does not turn. Incorrect function.
Ring wrench only turns with the first actuation of the brake pedal. Incorrect function.
Ring wrench turns back and forth with every actuation of the brake pedal. Incorrect function.

8. In case of incorrect function, replace brake *(refer to Section Replacing brake)*.

9. Remove offset ring wrench (width across flats 8 mm) from hexagon (1) of return unit.

10. After adjuster is checked, the running clearance must be set *(refer to Section Setting running clearance)*.

Fitting plug

11.

**NOTICE**

**Damage due to improper or incorrect fitting of plug.**
**Moisture or dirt might penetrate into brake and damage it.**

⇨ Completely press plug into return unit seal.
⇨ Ensure tight fit of plug.

Carefully and evenly press plug (2) into seal (1) at return unit.

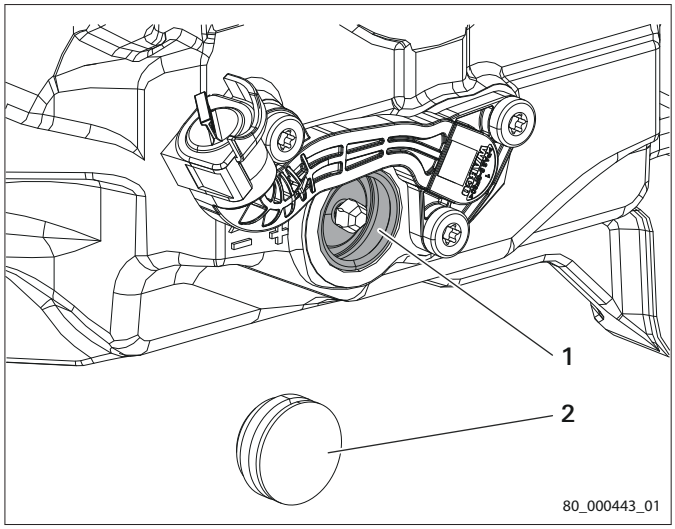



Fig. 7

## 12.3 Checking brake caliper movement

The following work can be performed with the brake installed.

Requirements:
- Vehicle wheel has been removed.
- Brake has been reset *(refer to Section Resetting brake)*.
- Brake pads have been removed *(refer to Section Removing brake pads)*.
- Retainer system has been dismantled *(refer to Section Dismantling retainer system)*.
- Pressure plate has been removed *(refer to Section Removing pressure plate)*.

- Observe documents of axle manufacturer and vehicle manufacturer.

**⚠ CAUTION**

Risk of injury due to falling parts.
Slight or moderate injury possible.
⇨ Secure parts against falling down.

1.

**⚠ CAUTION**

Risk of crushing due to moving parts.
Slight or moderate injury possible.
⇨ Do not reach into danger area!

Manually move brake caliper (1) horizontally in both directions (grab brake caliper from the outside) and check for ease of movement throughout complete displacement distance. Ensure that protective pin caps are not crushed or damaged.

Replace bushes, protective pin caps, guide pins, hexagon socket screws and sealing cap if the brake caliper is moving sluggishly *(refer to Chapter Replacing seals and bushes)*.

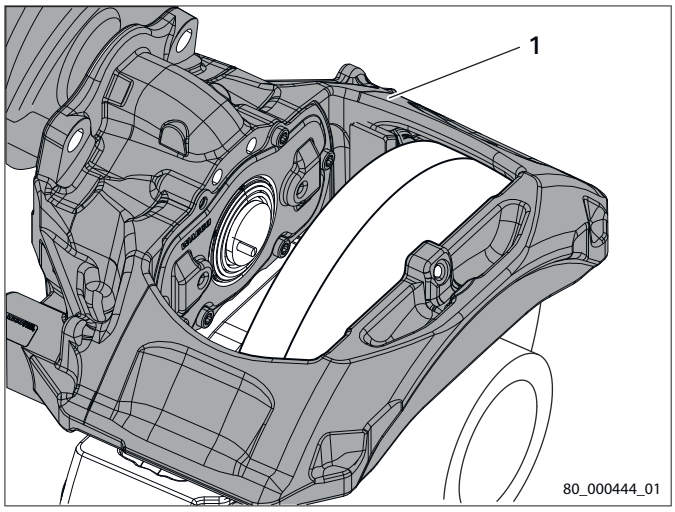


Fig. 8

## 12.4 Checking the bearing clearance of the guide pins

The following work can be performed with the brake installed.

Requirements:
- Vehicle wheel has been removed.
- Retainer system has been dismantled *(refer to Section Dismantling retainer system)*.
- Brake has been reset *(refer to Section Resetting brake)*.
- Brake pads have been removed *(refer to Section Removing brake pads)*.
- Pressure plate has been removed *(refer to Section Removing pressure plate)*.
- Observe documents of axle manufacturer and vehicle manufacturer.

Intervals: *(refer to Section Maintenance plan)*

1. Clean measuring point (1) at brake caliper (2).

   Measuring point (1) is located at molded edge on brake caliper (2) on rim side.

2. Push brake caliper (2) completely towards rim side.

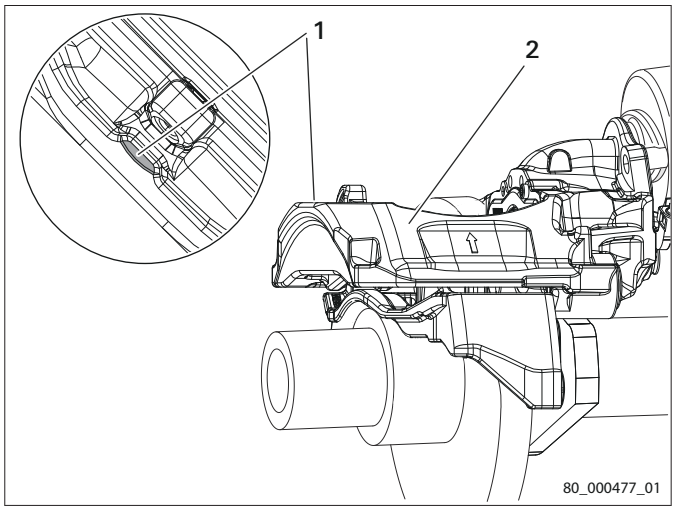



Fig. 9

3. Attach dial gauge with magnetic stand to brake carrier (2) or axle.

4. Align dial gauge vertically with measuring point at brake caliper (1).

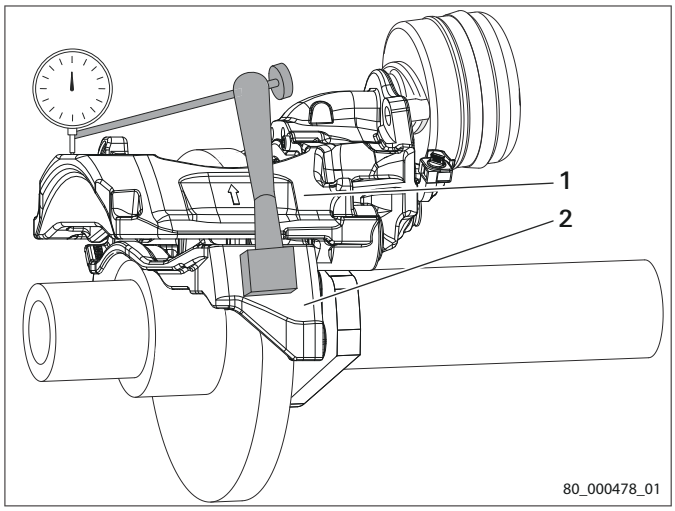



Fig. 10

5. Tilt brake caliper (2) with low tilting torque (approx. 10 Nm) as far towards rim side as possible by hand and keep it in this position.

6. Turn dial gauge (1) to zero.

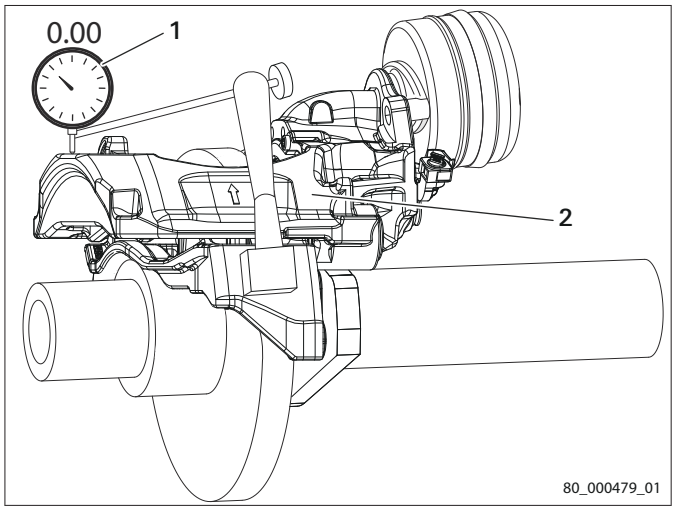



Fig. 11

7. Tilt brake caliper (2) with low tilting torque (approx. 10 Nm) as far towards cylinder side as possible by hand.

8. Read off tilting clearance from dial gauge (1). Tilting clearance of guide pin max. 2.0 mm

   → Tilting clearance smaller than 2 mm: tilting clearance is okay.
   → Tilting clearance larger than 2 mm: tilting clearance is not okay.

   Replace bushes of guide pins if tilting clearance is greater than 2 mm *(refer to Section Replacing seals and bushes)*.

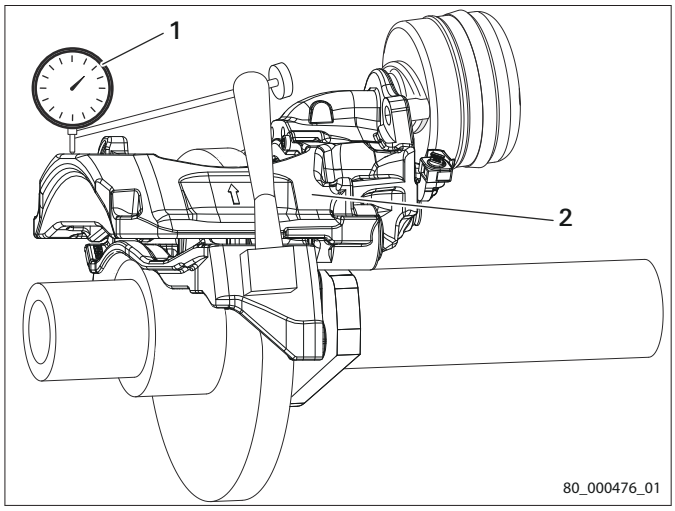


Fig. 12

9. Remove the dial gauge with magnetic stand.

## 12.5 Checking brake linings

### 12.5.1 Checking brake pads for damage

The following work can be performed with the brake installed.
If necessary, remove pressure plate *(refer to Section Removing pressure plate)*.

Requirements:
- Vehicle wheel has been removed.
- Retainer system has been dismantled *(refer to Section Dismantling retainer system)*.
- Brake has been reset *(refer to Section Resetting brake)*.
- Brake pads have been removed *(refer to Section Removing brake pads)*.
- Observe documents of axle manufacturer and vehicle manufacturer.

Intervals: *(refer to Section Maintenance plan)*

1. Chipping or glazing can be caused by improper handling or lack of maintenance.

   Replace brake pads *(refer to Chapter Replacing brake pads)*, if the following is determined:
   - Large-scale chipping on the surface
   - Burns, glazing or oiling
   - Major wear

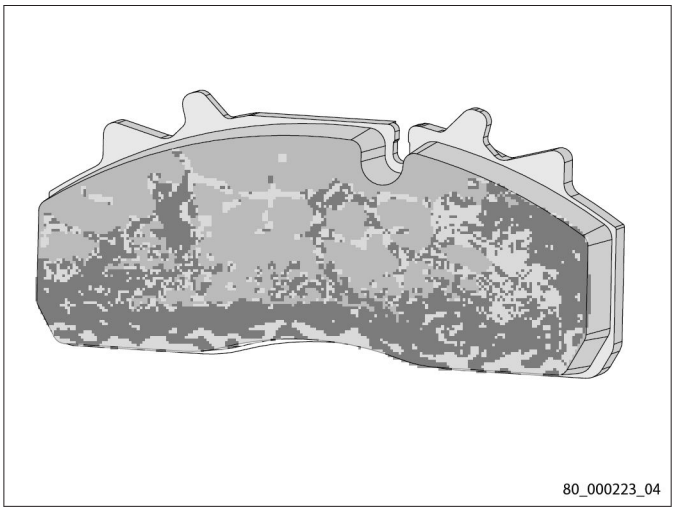



Fig. 13

### 12.5.2 Checking brake pad wear

The following work can be performed with the brake installed.

Intervals: *(refer to Section Maintenance plan)*

Not yet worn brake pads

1. If the edge (1) of the brake caliper is not covered by the surface (2) of the brake carrier, the brake pads are not yet worn.

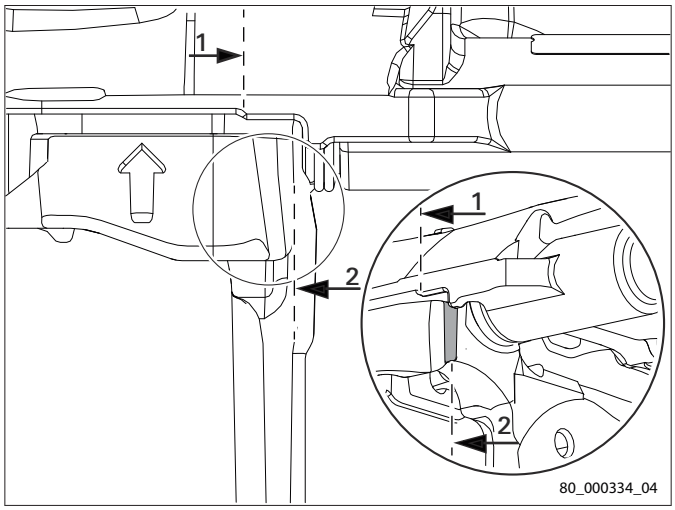



Fig. 14

Worn brake pads

2. If the edge (1) of the brake caliper is covered by the surface (2) of the brake carrier, the brake pads are worn.

   Replace brake pads if they are worn *(refer to Section Replacing brake pads)*.

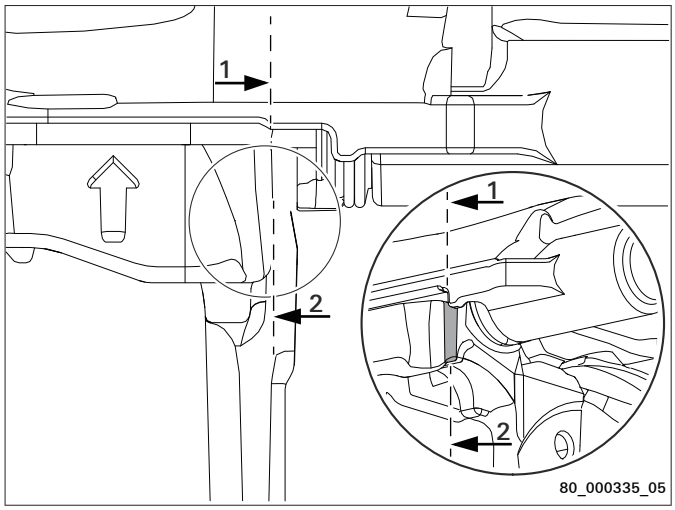



Fig. 15

### 12.5.3 Checking brake pad wear

The following work can be performed with the brake installed.
The mean brake pad wear can be measured using a folding rule – depending on accessibility – either on the fitted bolt side (long pin) or on the clearance bolt side (short pin).

Intervals: *(refer to Section Maintenance plan)*

Measuring on the clearance bolt side

1. Measure the distance from brake carrier surface (2) to clearance bolt edge (1) (short pin) using a folding rule.

   → Distance smaller than 96 mm: brake pad not yet worn.
   → Distance larger than 96 mm: brake pad worn.

   Replace brake pads if they are worn *(refer to Section Replacing brake pads)*.

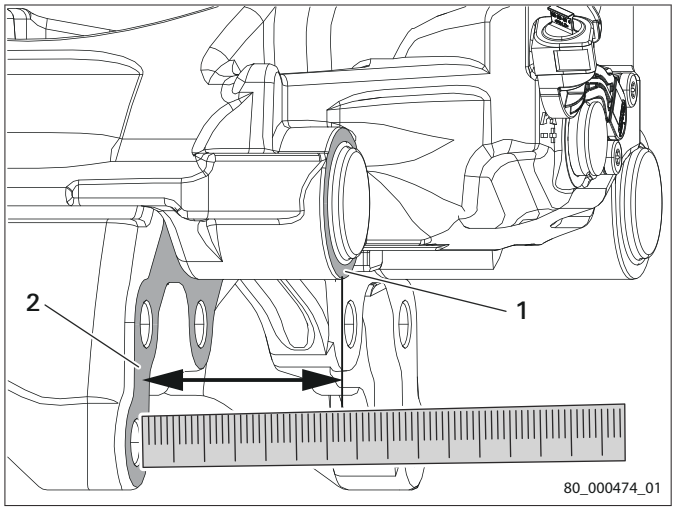



Fig. 16

Measuring on the fitted bolt side

2. Measure distance from brake carrier surface (2) to fitted bolt edge (1) (long pin) using a folding rule.

   → Distance smaller than 122 mm: brake pad not yet worn.
   → Distance larger than 122 mm: brake pad worn. Replace brake pads *(refer to Section Replacing brake pads)*.

   Replace brake pads if they are worn *(refer to Section Replacing brake pads)*.

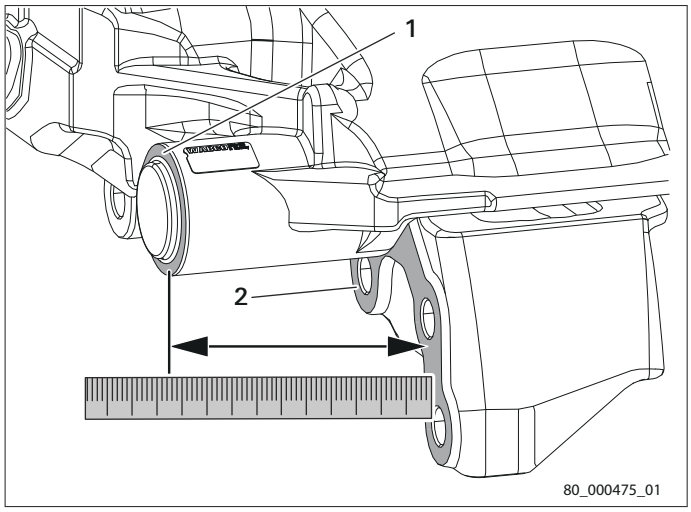



Fig. 17

### 12.5.4 Measuring the thickness of brake pads

The following work can be performed with the brake installed.
If necessary, remove pressure plate *(refer to Section Removing pressure plate)*.

Requirements:
- Vehicle wheel has been removed.
- Retainer system has been dismantled *(refer to Section Dismantling retainer system)*.
- Brake has been reset *(refer to Section Resetting brake)*.
- Brake pads have been removed *(refer to Section Removing brake pads)*.
- Observe documents of axle manufacturer and vehicle manufacturer.

Intervals: *(refer to Section Maintenance plan)*

1. Measure total thickness of brake pad carrier and brake pad.

   Original dimensions of brake pad
   - Total thickness of new brake pad: Dimension A: 30 mm
   - Thickness of brake pad carrier: Dimension B: 9 mm
   - Total thickness limit value: Dimension C: 11 mm
   - Thickness of brake pad limit value: Dimension D: 2 mm

   → Dimension C < 11 mm: The brake pad is worn.

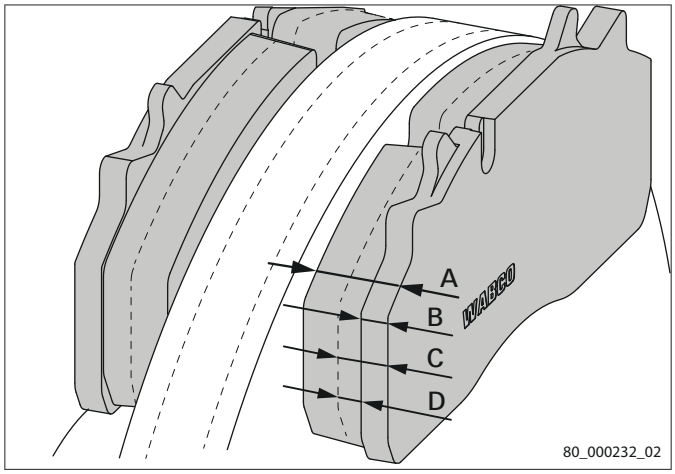



Fig. 18

Replace brake pads if they are worn *(refer to Section Replacing brake pads)*.

### 12.5.5 Differential wear

The following work can be performed with the brake installed.
If necessary, remove pressure plate *(refer to Section Removing pressure plate)*.

Requirements:

- Vehicle wheel has been removed.
- Retainer system has been dismantled *(refer to Section Dismantling retainer system)*.
- Brake has been reset *(refer to Section Resetting brake)*.
- Brake pads have been removed *(refer to Section Removing brake pads)*.
- Observe documents of axle manufacturer and vehicle manufacturer.

Intervals: *(refer to Section Maintenance plan)*

1. Friction material of brake pads is unevenly worn. The difference in total thickness of the friction material of both brake pads (1, 2) should not exceed 4 mm. In case of a difference of more than 4 mm, do the following:

   Brake pad (2) - brake pad (1) > 4 mm

   Check bearing clearance of pin guide *(refer to Section Checking bearing clearance of guide pins)*.

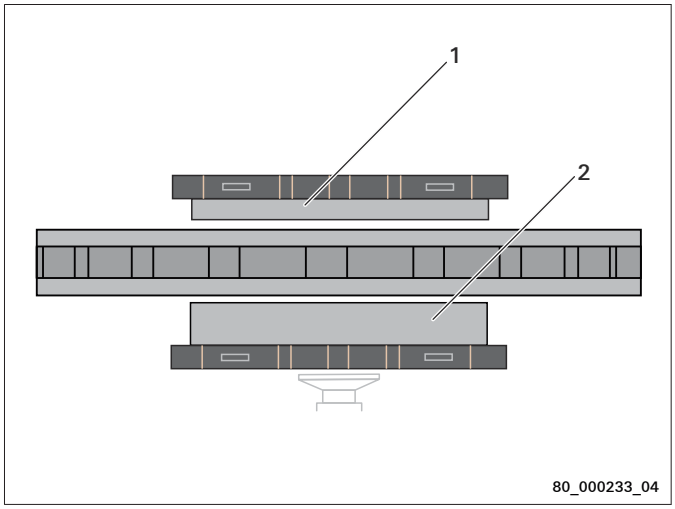


Fig. 19

2. Clean brake caliper and brake carrier and check individual components for proper function.

3. Check brake pads for ease of movement.

4. Check that brake (including connecting lines) is not obstructed over the entire displacement path and does not come into contact with other axle add-on parts.

5. Replace brake pads *(refer to Section Replacing brake pads)*.

### 12.5.6 Tangential oblique wear

The following work can be performed with the brake installed.
If necessary, remove pressure plate *(refer to Section Removing pressure plate)*.

Requirements:
- Vehicle wheel has been removed.
- Retainer system has been dismantled *(refer to Section Dismantling retainer system)*.
- Brake has been reset *(refer to Section Resetting brake)*.
- Brake pads have been removed *(refer to Section Removing brake pads)*.
- Observe documents of axle manufacturer and vehicle manufacturer.

Intervals: *(refer to Section Maintenance plan)*

1. Friction material of a brake pad (1, 2) is worn unevenly. The total thickness of the friction material should be the same at the front side $A_1$ and at the rear side $A_2$. In case of a difference of more than 2 mm between both sides, carry out the following tasks:

   $A_1 - A_2 > 2$ mm

   Check bearing clearance of pin guide *(refer to Section Checking bearing clearance of guide pins)*.

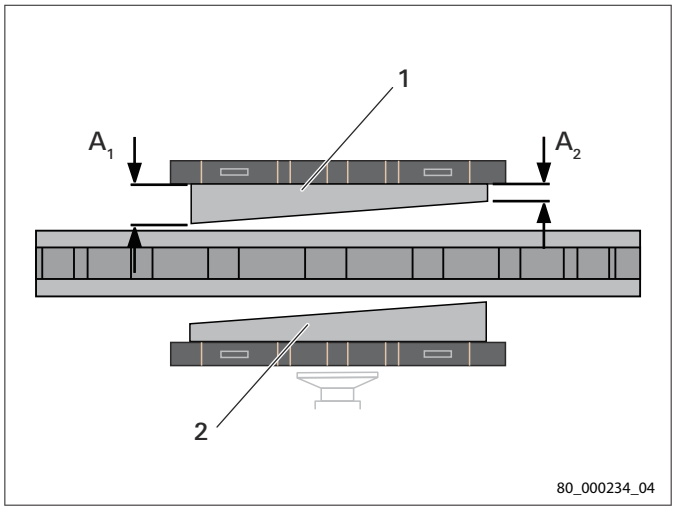


Fig. 20

2. Clean brake caliper and brake carrier and check individual components for proper function.

3. Check that brake (including connecting lines) is not obstructed over the entire displacement path and does not come into contact with other axle add-on parts.

4. Replace brake pads *(refer to Section Replacing brake pads)*.

### 12.5.7 Radial oblique wear

The following work can be performed with the brake installed.
If necessary, remove pressure plate *(refer to Section Removing pressure plate)*.

Requirements:
- Vehicle wheel has been removed.

- Retainer system has been dismantled *(refer to Section Dismantling retainer system)*.
- Brake has been reset *(refer to Section Resetting brake)*.
- Brake pads have been removed *(refer to Section Removing brake pads)*.
- Observe documents of axle manufacturer and vehicle manufacturer.

Intervals: *(refer to Section Maintenance plan)*

1. Friction material of a brake pad is worn unevenly. The total thickness of the friction material should be the same at the upper side $A_1$ and the lower side $A_2$. In case of a difference of more than 2 mm between both sides, carry out the following tasks:

   $A_2 - A_1 > 2$ mm

   Check bearing clearance of pin guide *(refer to Section Checking bearing clearance of guide pins)*.

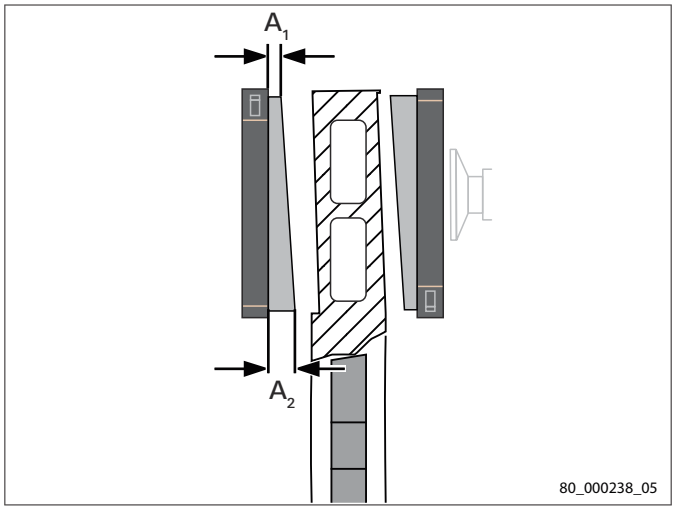


Fig. 21

2. Clean brake caliper and brake carrier and check individual components for proper function.

3. Check that brake (including connecting lines) is not obstructed over the entire displacement path and does not come into contact with other axle add-on parts.

4. Replace brake pads *(refer to Section Replacing brake pads)*.

## 12.6 Checking and inspecting brake disc

### 12.6.1 Checking brake disc for damage

The following work can be carried out with the brake installed.

Requirements:
- Vehicle wheel has been removed.
- Brake has been reset *(refer to Section Resetting brake)*.
- Observe documents of axle and vehicle manufacturer.

Intervals: *(refer to Section Maintenance plan)*

1. Cracking or scoring can be caused by improper handling or lack of maintenance.

   Check both friction surfaces for cracks and check surface condition.

2. Brake disc does not need to be renewed if it shows the following:

   → Mesh-like crack formation (D)
   → Radial cracks (A) up to a width (e) of max. 0.5 mm
   → Radial cracks (A) up to a maximum of 75% of the friction band height "g" (f)
   → Unevenness of friction surfaces (B) up to a depth of max. 1.5 mm

3. Renew brake disc if it shows the following:

   → Continuous cracks (C)
   → Radial cracks (A) larger than a width (e) of 0.5 mm
   → Radial cracks (A) larger than 75% of the friction band height "g" (f)
   → Unevenness of friction surfaces (B) deeper than 1.5 mm
   → In case of vented brake discs, if the cracks have reached the friction surface's outer or inner diameter

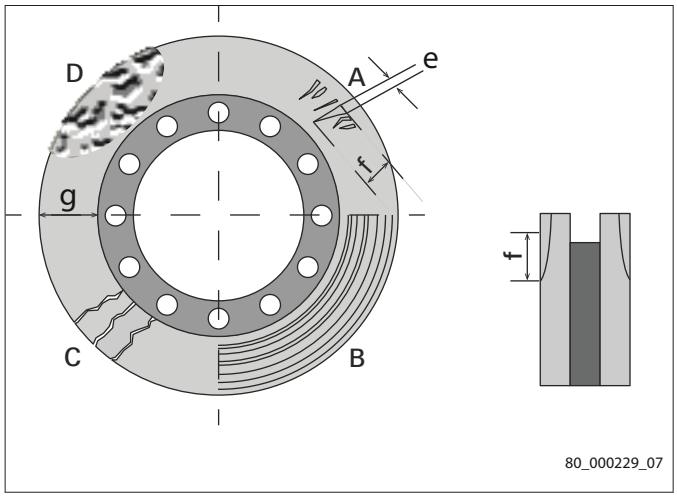


Fig. 22

### 12.6.2 Measuring brake disc thickness

The following work can be performed with the brake installed.

Requirements:
- Vehicle wheel has been removed.
- Retainer system has been dismantled *(refer to Section Dismantling retainer system)*.
- Brake has been reset *(refer to Section Resetting brake)*.
- Brake pads have been removed *(refer to Section Removing brake pads)*.
- Pressure plate has been removed *(refer to Section Removing pressure plate)*.
- Observe documents of axle manufacturer and vehicle manufacturer.

Intervals: *(refer to Section Maintenance plan)*

1. Measure brake disc thickness in the contact area to the brake pads at several spots as well as at the weakest spot using a caliper.
   Total thickness of new brake disc,
   Dimension (A): 45 mm
   Wear limit,
   Dimension (B): 37 mm

   → Replace brake disc if wear limit of 37 mm has been reached at thinnest point *(refer to Section Replacing brake disc)*.

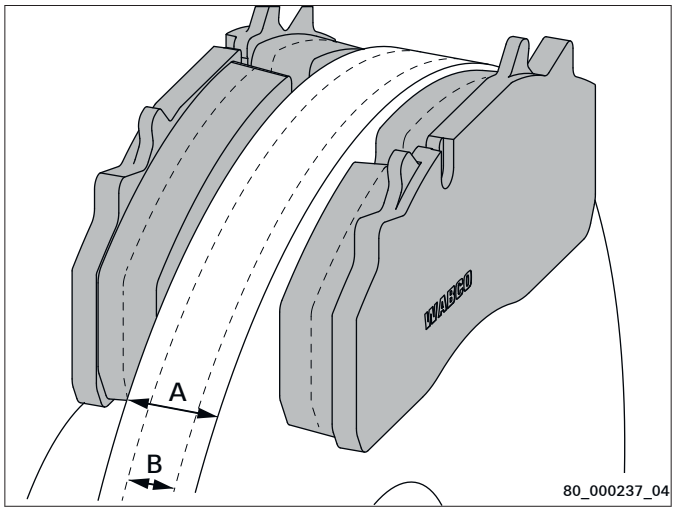



Fig. 23

### 12.6.3 Checking lateral brake disc run-out

The following work can be performed with the brake installed.

Requirements:
- Vehicle wheel has been removed.
- Retainer system has been dismantled *(refer to Section Dismantling retainer system)*.
- Brake has been reset *(refer to Section Resetting brake)*.
- Brake pads have been removed *(refer to Section Removing brake pads)*.
- Pressure plate has been removed *(refer to Section Removing pressure plate)*.
- Observe documents of axle manufacturer and vehicle manufacturer.

Intervals: *(refer to Section Maintenance plan)*

1. Attach dial gauge (1) with magnetic stand (3) at brake carrier (4).

2. Align dial gauge (1) at an angle of 90° to lateral surface of brake disc (2). Turn dial gauge (1) to zero. Mark dial gauge position on brake disc circumference with a marking pen.

3. Turn wheel hub by 360° into one direction and align with marking.

4. Measure lateral brake disc run-out.
   Limit value for lateral brake disc run-out 0.15 mm

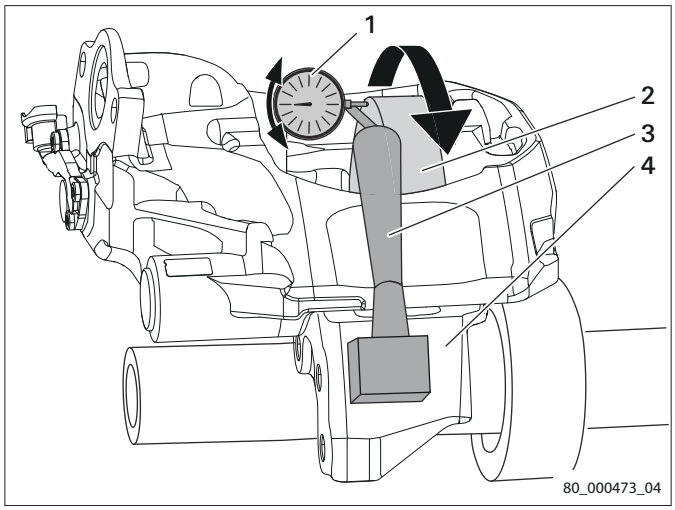



Fig. 24

Replace brake disc if lateral brake disc runout is larger than 0.15 mm *(refer to Section Replacing brake disc)*.

5. Remove the dial gauge with magnetic stand.

# 13 Replacing components

## 13.1 Replacing the retainer system

### 13.1.1 Dismantling retainer system

The following work can be performed with the brake installed.

Requirements:
- Vehicle wheel has been removed.
- Observe documents of axle manufacturer and vehicle manufacturer.

1. If the brake is mounted on the underside of the wheel, for example, brake pads and pressure plate might fall out when removing the retainer clip.

**⚠ CAUTION**

Risk of injury due to falling parts.
Slight or moderate injury possible.
⇨ Secure parts against falling down.

To avoid that brake pads and pressure plate assembly fall out, turn return unit clockwise until brake pads rest on brake disc.

2. **⚠ CAUTION**

Risk of injury due to parts under spring tension.
Slight or moderate injury possible.
⇨ Wear protective goggles.

Press retainer clip (1) towards brake pads and keep in this position.

3. Remove hexagon socket screw (width across flats 8 mm) (2).

4. Remove retainer clip (1) from brake caliper (3).

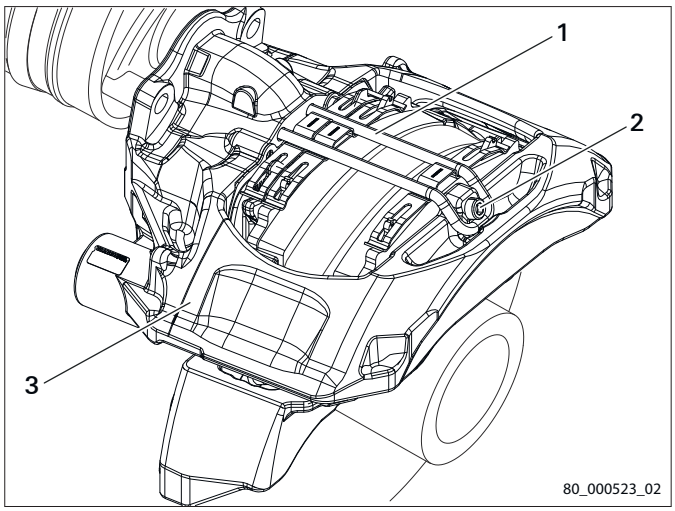



Fig. 25

### 13.1.2 Assembling the retainer system

The following work can be performed with the brake installed.
If parts of the brake caliper are to be replaced, remove the brake.

Requirements:
- Vehicle wheel has been removed.
- Brake pads have been installed *(refer to Section Installing brake pads)*.
- Running clearance has been set *(refer to Section Setting running clearance)*.
- Pressure plate is installed *(refer to Section Installing pressure plate)*.
- Observe documents of axle manufacturer and vehicle manufacturer.

Always replace retainer system when brake pads are replaced.

**⚠ CAUTION**

Risk of crushing due to moving parts.
Slight or moderate injury possible.
⇨ Do not reach into danger area!

1. Slide **new** retainer clip (1) into bores of brake caliper (2).

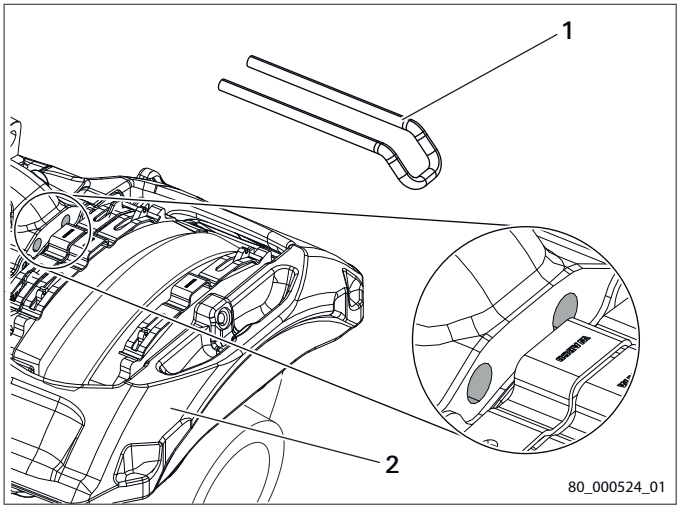


Fig. 26

2. Press down retainer clip (1) and keep in this position.

3. Screw retainer clip with **new** hexagon screw (width across flats 8 mm) (2) onto brake caliper (3) tightly.
Tightening torque: **30 Nm(+15 Nm)**

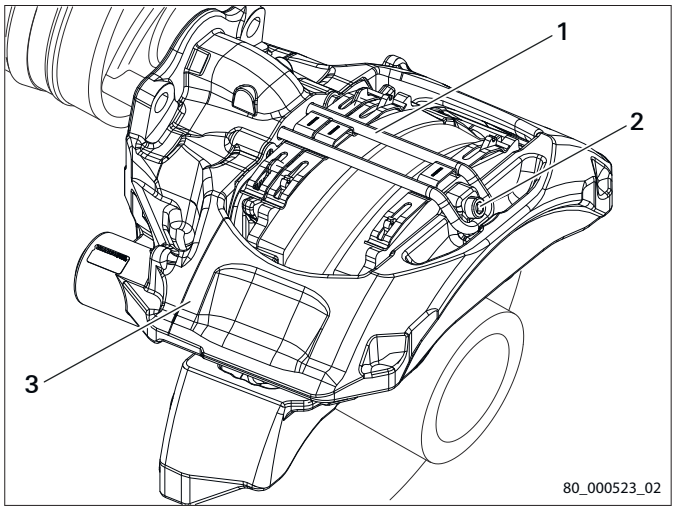



Fig. 27

## 13.2 Replacing wear sensor

### 13.2.1 Removing wear sensor

The following work can be performed with the brake installed.

Requirements:
- Vehicle wheel has been removed.
- Observe documents of axle manufacturer and vehicle manufacturer.

1. Loosen T20 torx screws (internal) and/or cross-headed screws (1) of the connection between vehicle-end wear sensor cable and wear sensor.

2. Disconnect vehicle-end wear sensor cable (2) from wear sensor.

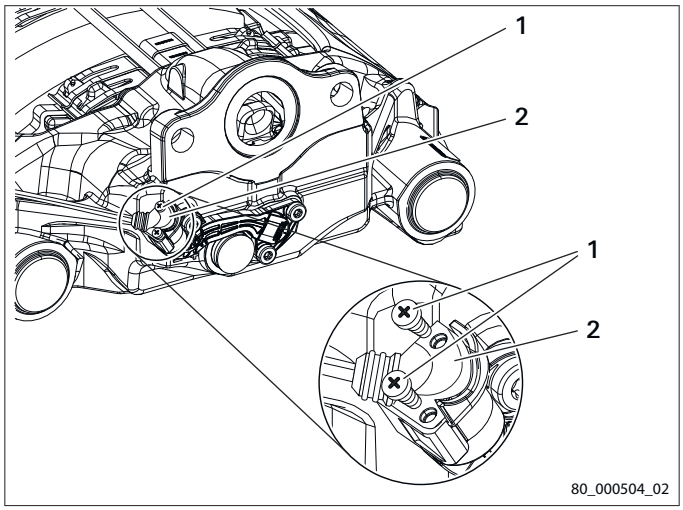



Fig. 28

3. Remove T30 torx screws (internal) (3) of the wear sensor.

4. Remove the wear sensor (2) from the brake caliper (1).

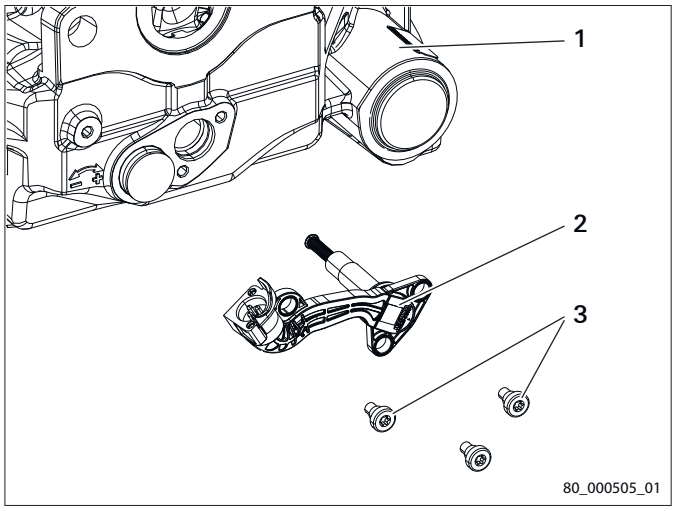



Fig. 29

### 13.2.2 Installing the wear sensor

The following work can be performed with the brake installed.

Requirements:
- Vehicle wheel has been removed.
- Observe documents of axle manufacturer and vehicle manufacturer.

1. Clean the wear sensor seat in the brake caliper.

2. If present, remove transport protection cap from wear indicator plug socket.

3. ***NOTICE***

   Damage to wear sensor and wear sensor cable
   - ⇨ Do not use wear sensor if it has fallen down, but dispose of it instead.
   - ⇨ Do not actuate the spring-guided tappet of the wear sensor.
   - ⇨ Do not apply transverse forces to the spring-guided tappet of the wear sensor.
   - ⇨ Do not directly touch pins and contact bushes.

   Insert the **new** wear sensor (2) into the cleaned opening of the brake caliper (1).

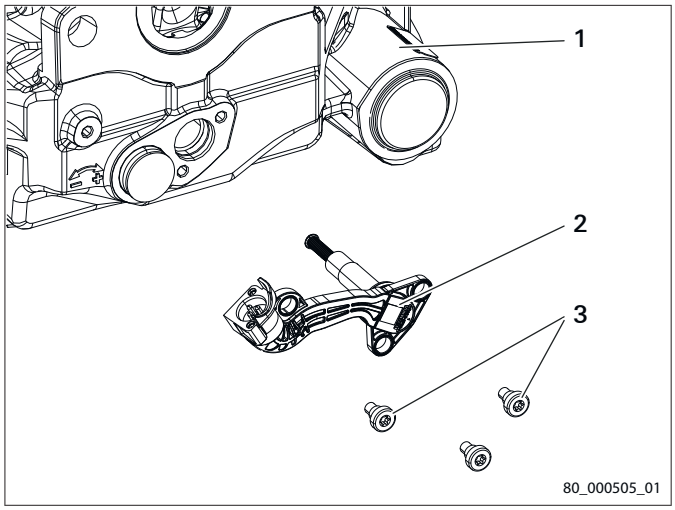



Fig. 30

4. Screw wear sensor (2) onto brake caliper (1) tightly with **new** T30 torx screws (internal) (3).

Tightening torque: **7 Nm (+2 Nm)**

5. Connect the plug of the vehicle-end wear sensor cable (2) to the plug socket of the wear sensor.

6. Screw tight T20 torx screws (internal) and/or cross-headed screws (1) of the connection between vehicle-end wear sensor cable and wear sensor.
   Tightening torque: **1.3 Nm (-0.3 Nm)**

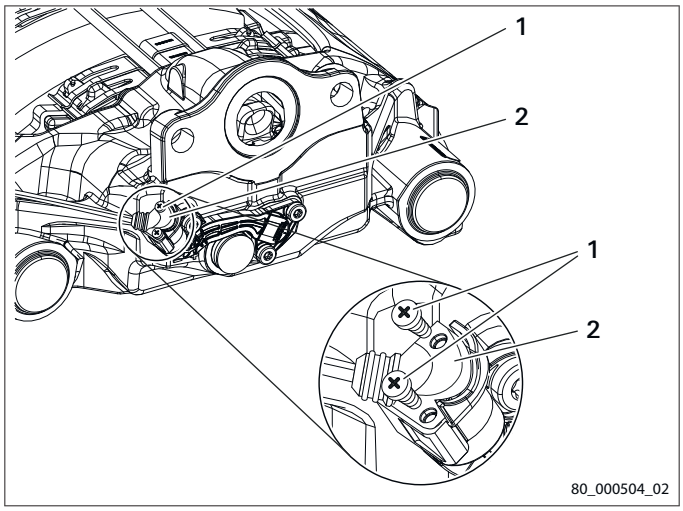



Fig. 31

## 13.3 Replacing brake linings

When replacing brake linings, also replace all fastening elements like retainer springs, screws, etc.

Always replace brake linings by axle.

### 13.3.1 Resetting brake

The following work can be performed with the brake installed.

Requirements:
- Vehicle wheel has been removed.
- Plug has been removed *(refer to Section Checking adjuster)*.
- Observe documents of axle manufacturer and vehicle manufacturer.
- Retainer system has been dismantled *(refer to Section Dismantling retainer system)*.
  Brake pads have been removed *(refer to Section Removing brake pads)*.

Special tools:
- 300 100 012 2 Ratchet

**NOTICE**

Damage to adjacent parts due to incorrect and improper use of tools.
⇨ Only use described tools in a proper way.

1.

Direction of rotation at hexagon:

Counter-clockwise rotation direction (returning): running clearance increases.

Clockwise rotation direction (closing): running clearance decreases.

Turning counter-clockwise requires more force than turning clockwise.

With brake installed:
use 300 100 012 2 [Ratchet].
Turn return unit hexagon (1) counter-clockwise to the stop using offset ring wrench (width across flats 8 mm) and then turn back again by 90°.

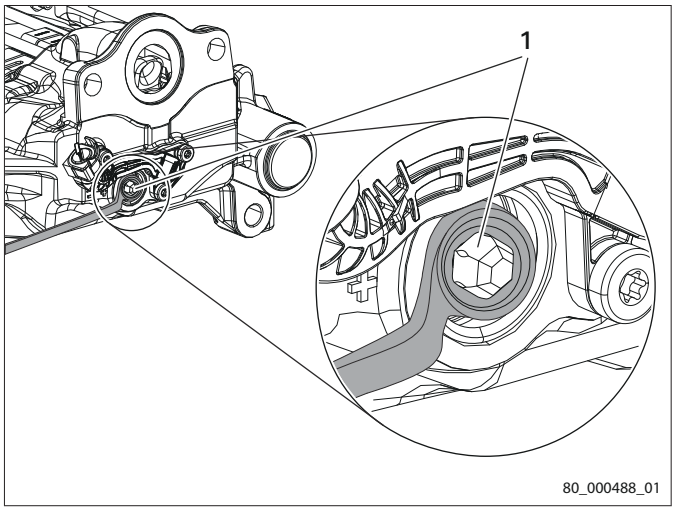



Fig. 32

### 13.3.2 Removing brake pads

The following work can be performed with the brake installed.
If parts of the brake caliper are to be replaced, remove the brake.

Requirements:

- Vehicle wheel has been removed.
- Retainer system has been dismantled *(refer to Section Dismantling retainer system)*.
- Brake has been reset *(refer to Section Resetting brake)*.
- Observe documents of axle manufacturer and vehicle manufacturer.

If the brake is mounted on the underside of the wheel, for example, brake pads and pressure plate might fall out.

**⚠ CAUTION**

Risk of injury due to falling parts.
Slight or moderate injury possible.
⇨ Secure parts against falling down.

1.

**⚠ CAUTION**

Risk of crushing due to moving parts.
Slight or moderate injury possible.
⇨ Do not reach into danger area!

Manually push brake caliper (1) towards rim side.

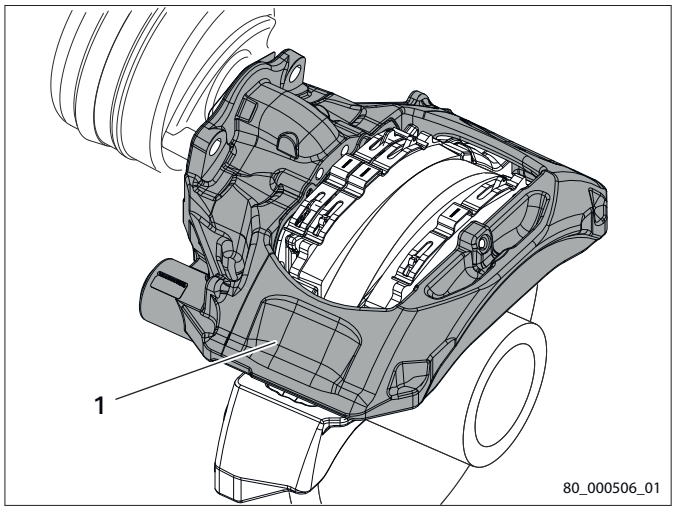



Fig. 33

2. Carefully remove brake pad (1) of rim side (with leaf spring) from the brake upwards.

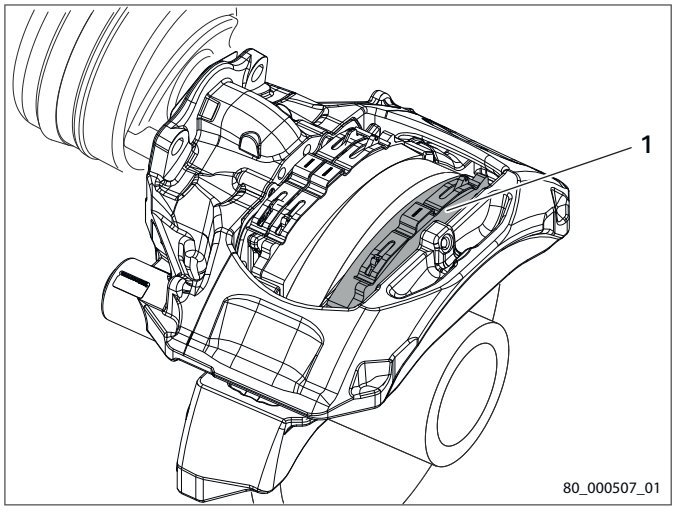



Fig. 34

3. Carefully push brake caliper (1) towards cylinder side by hand.

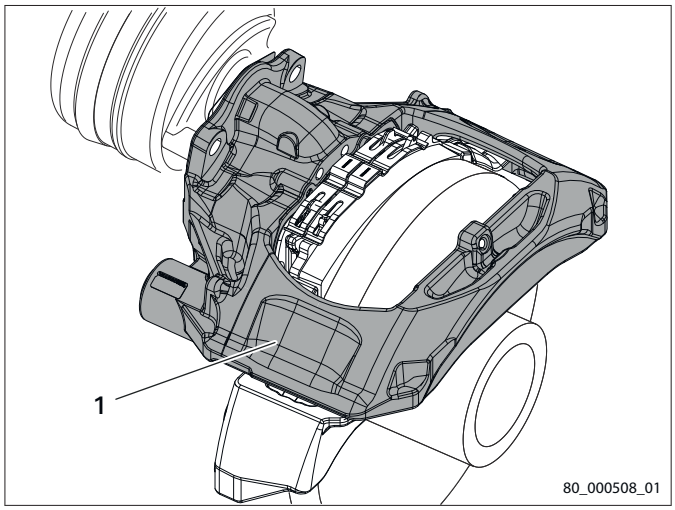



Fig. 35

4. Carefully remove brake pad (1) of cylinder side (with leaf spring) from brake upwards.

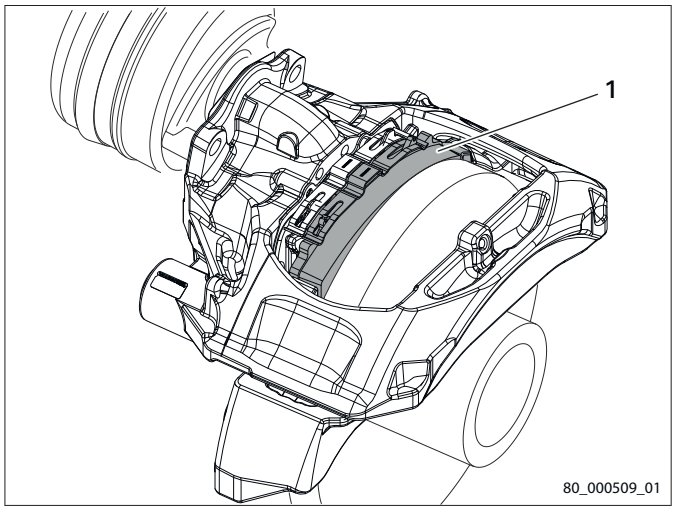



Fig. 36

### 13.3.3 Installing brake pads

The following work can be performed with the brake installed.

Requirements:

- Vehicle wheel has been removed.
- Retainer system has been dismantled *(refer to Section Dismantling retainer system)*.
- Brake has been reset *(refer to Section Resetting brake)*.
- Pressure plate is installed *(refer to Section Installing pressure plate)*.
- Plug has been removed *(refer to Section Checking adjuster)*.
- Insert pin of adjuster screw into retention groove of pressure plate.
- Observe documents of axle manufacturer and vehicle manufacturer.

If the brake is mounted on the underside of the wheel, for example, brake pads and pressure plate might fall out.

**⚠ CAUTION**

Risk of injury due to falling parts.
Slight or moderate injury possible.
⇨ Secure parts against falling down.

1. Turn return unit hexagon (3) clockwise until stop using offset ring wrench (width across flats 8 mm) (2) and then turn back again by 90° counterclockwise. In doing so, push pressure plate (1) towards cylinder side to ensure that the adjuster screw pin working as anti-rotation device does not slip out of the pressure plate's retention groove.

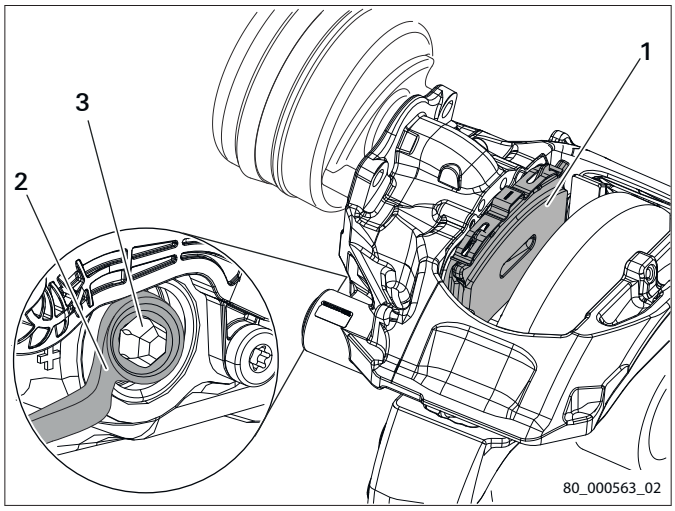



Fig. 37

2. Clean guide surfaces of pad shafts on brake carrier and pressure plate.

   → Guide surfaces of pad shafts on brake carrier and pressure plate must be free of corrosion, dirt and grease.

3. Check that pressure plate is seated in guide groove and rests completely on guide gibs of brake carrier.

4. Insert new brake pad (1) with pre-assembled leaf spring on cylinder side into brake from above.

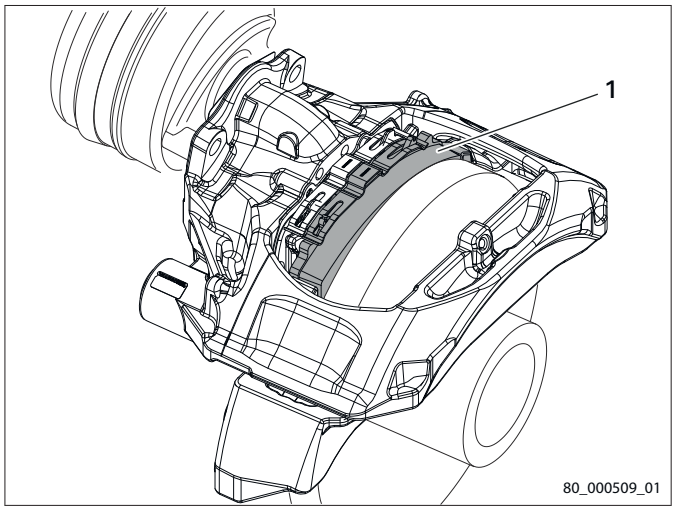



Fig. 38

5. **⚠ CAUTION**

**Risk of crushing due to moving parts.**
**Slight or moderate injury possible.**
⇨ Do not reach into danger area!

Carefully push brake caliper (3) towards rim side until brake pad (1) rests against brake disc.

6. Insert **new** brake pad (2) with pre-assembled leaf spring on rim side into brake from above.

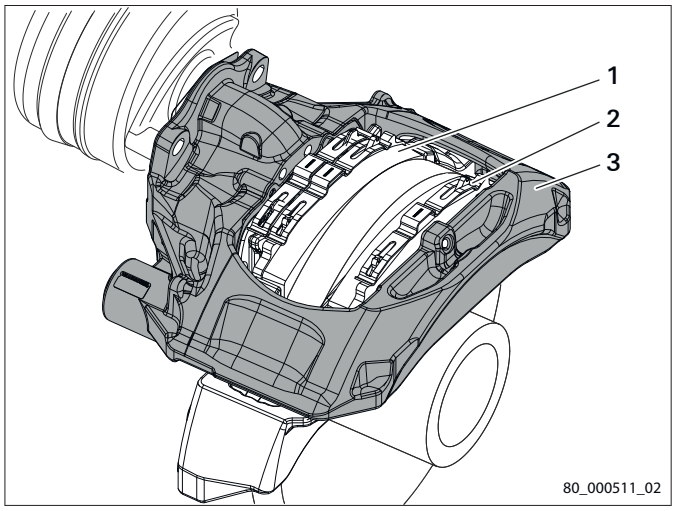



Fig. 39

### 13.3.4 Setting running clearance

The following work can be performed with the brake installed.

Requirements:
- Vehicle wheel has been removed.
- Pressure plate is installed *(refer to Section Installing pressure plate)*.
- Brake pads have been installed *(refer to Section Installing brake pads)*.
- Observe documents of axle manufacturer and vehicle manufacturer.

1. Insert feeler gauge (4) 1 mm at the center between brake caliper and brake pad on rim side.
Running clearance 1 mm

2. Direction of rotation at hexagon:

Counter-clockwise rotation direction (returning): running clearance increases.

Clockwise rotation direction (closing): running clearance decreases.

Turning counter-clockwise requires more force than turning clockwise.

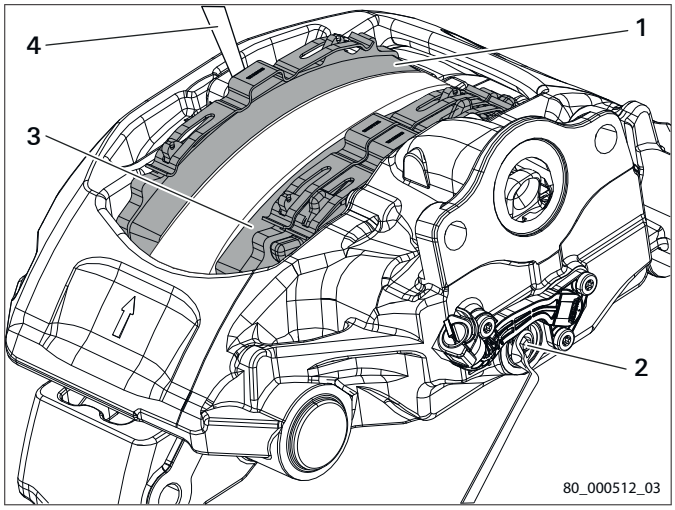



Fig. 40

**NOTICE**

**Damage to adjacent parts due to incorrect and improper use of tools.**
⇨ Only use described tools in a proper way.

Turn hexagon (2) clockwise using offset ring wrench (width across flats 8 mm) until brake pads (1, 3) rest against brake disc.

3. Remove feeler gauge.

4. Press **new** plug (2) into return unit seal (1). Ensure tight fit of plug.

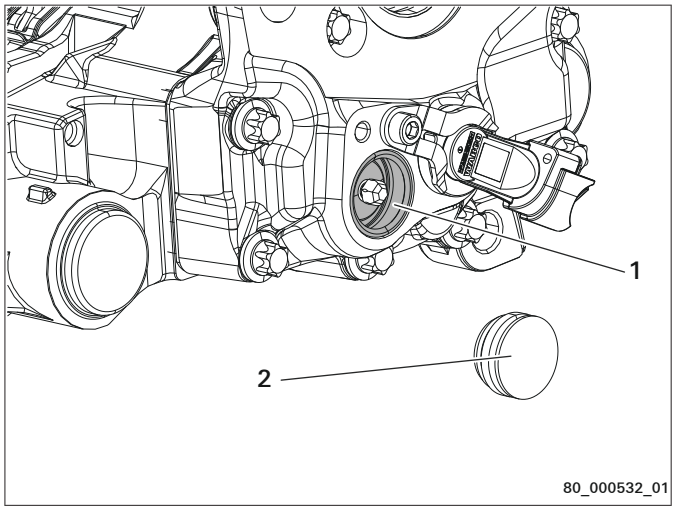



Fig. 41

## 13.4 Replacing pressure plate

### 13.4.1 Removing pressure plate

The following work can be performed with the brake installed.

Requirements:

- Vehicle wheel has been removed.
- Retainer system has been dismantled *(refer to Section Dismantling retainer system)*.
- Brake pads have been removed *(refer to Section Removing brake pads)*.
- Observe documents of axle manufacturer and vehicle manufacturer.

**⚠ CAUTION**

Risk of injury due to falling parts.
Slight or moderate injury possible.
⇨ Secure parts against falling down.

1. Remove pressure plate incl. leaf spring (1).

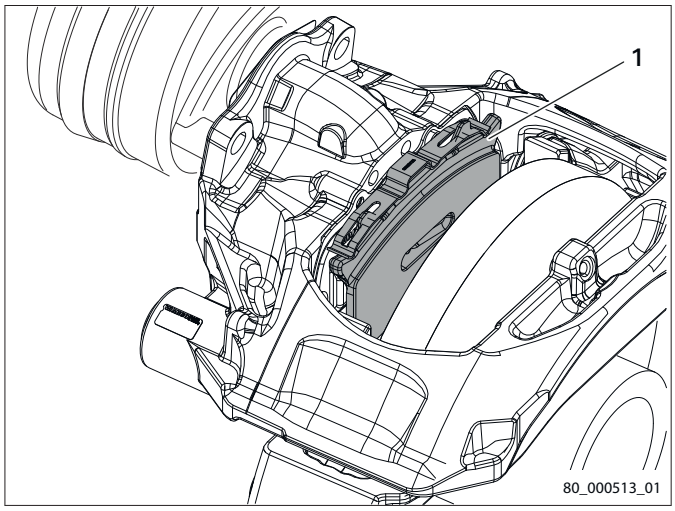



Fig. 42

2. Clean removed pressure plate and check for damage. Renew damaged pressure plate *(refer to Section Installing pressure plate)*.

### 13.4.2 Installing pressure plate

The following work can be performed with the brake installed.

Requirements:

- Vehicle wheel has been removed.
- Retainer system has been dismantled *(refer to Section Dismantling retainer system)*.
- Brake pads have been removed *(refer to Section Removing brake pads)*.
- Plug has been removed *(refer to Section Checking adjuster)*.
- Observe documents of axle manufacturer and vehicle manufacturer.

**⚠ WARNING**

Risk of accident due to loss of braking effect
Death or serious injury possible.
⇨ Do not apply lubricants on brake system parts.

***NOTICE***

Damage when assembling the brake due to use of lubricants.
⇨ Use of lubricants, e.g. copper paste or similar materials, might negatively impact the brake lining's wear resistance.

***NOTICE***

Damage and impaired function due to dirt or moisture penetrating into brake.
⇨ Clean brake in a way that no dirt or moisture penetrates.

1. Do not clean the piston protection cap and protective pin cap with a wire brush.

   Do not damage piston protection cap and protective pin cap.

   Piston protection cap may not be twisted.

   Clean brake pad shafts (1) at brake carrier.

   → Brake pad shafts (1) and brake disc must be free from corrosion, dirt and grease.

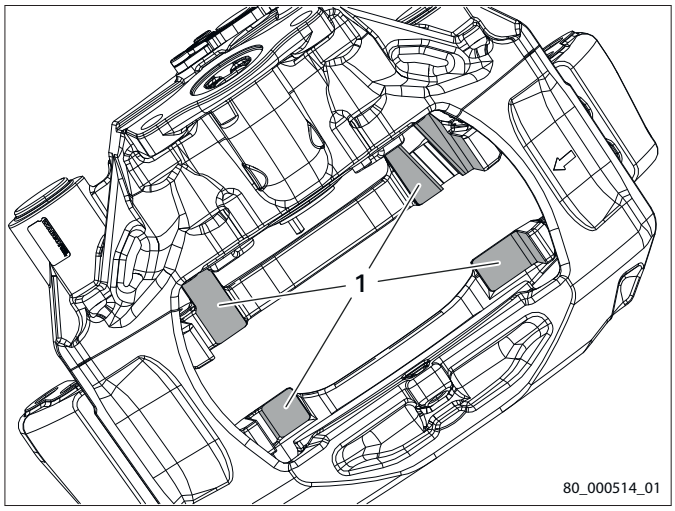



Fig. 43

2. If an old pressure plate is used, clean pressure plate.

   → Pressure plate must be free of damage and free from grease.

3. When fitting new brake pads, use a **new** leaf spring for pressure plate.

   Place pressure plate (1) including leaf spring in brake carrier and push it against adjuster screw.

   → Pin (2) of adjuster screw is seated in retention groove of pressure plate.

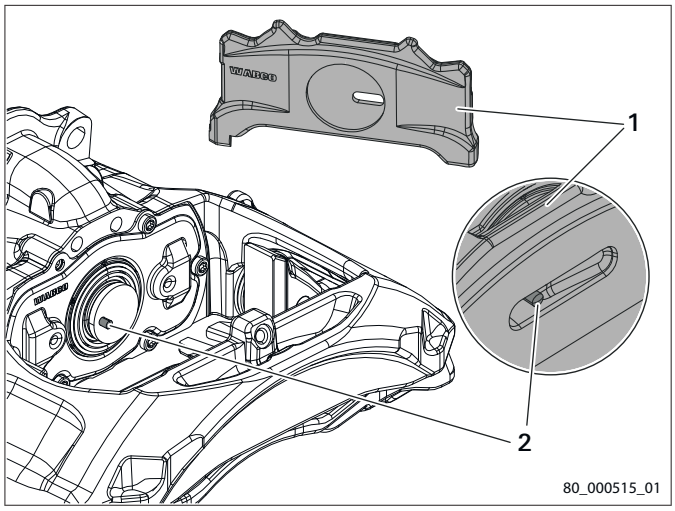



Fig. 44

4. Turn return unit hexagon (3) counter-clockwise until stop using offset ring wrench (width across flats 8 mm) (2) and then turn back again clockwise by 90°. In doing so, push pressure plate (1) towards cylinder side to ensure that the adjuster screw pin working as anti-rotation device does not slip out of the pressure plate's retention groove.

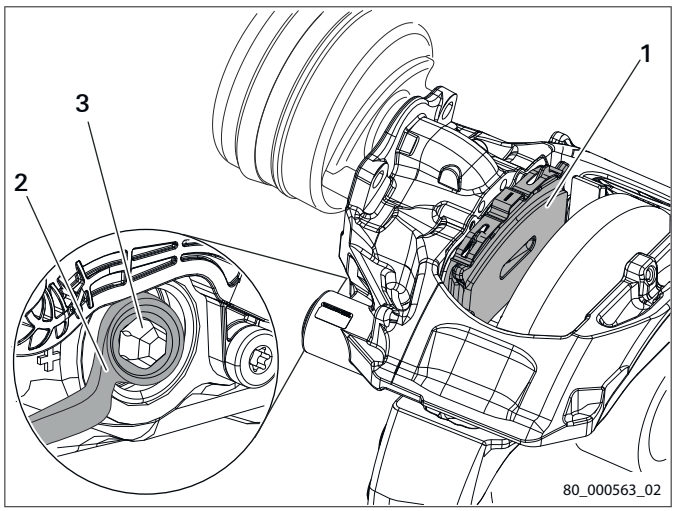



Fig. 45

5. Check that pressure plate is seated in guide groove and rests completely on guide gibs of brake carrier.

## 13.5 Replacing brake cylinder

### 13.5.1 Removing brake cylinder

If required, remove brake.

Requirements:
- Vehicle wheel has been removed.
- Observe brake cylinder manufacturer's documents.
- Observe documents of axle manufacturer and vehicle manufacturer.

1. Unscrew air connection (2) from brake cylinder (1).

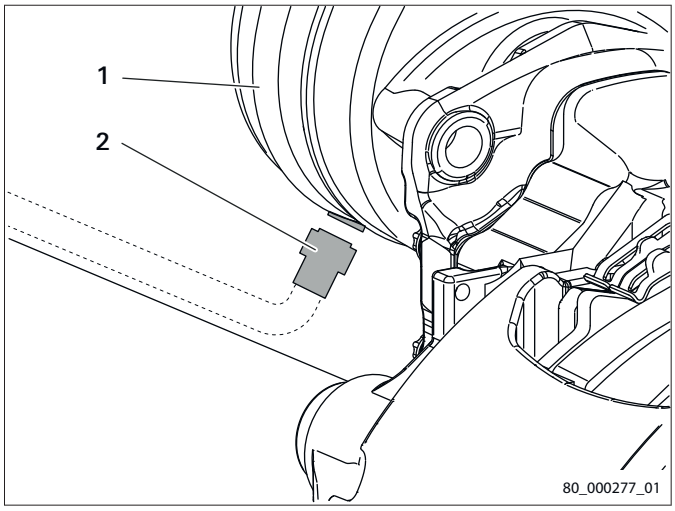



Fig. 46

2. Loosen and remove hexagon nuts (3) of brake cylinder (1) (for WABCO brake cylinders: width across flats 24 mm).

3. Remove brake cylinder (1) from brake caliper (2).

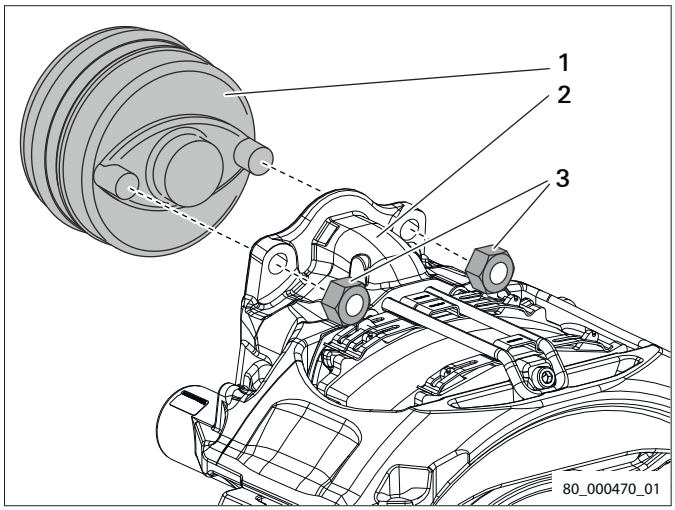



Fig. 47

4.

**⚠ WARNING**

Risk of accident due to failure of brake system.
Death or serious injury possible.
⇨ Do not install damaged parts.
⇨ Replace damaged parts.

Check inner area of piston rod seal and sealing and flange surfaces for wear and damage.

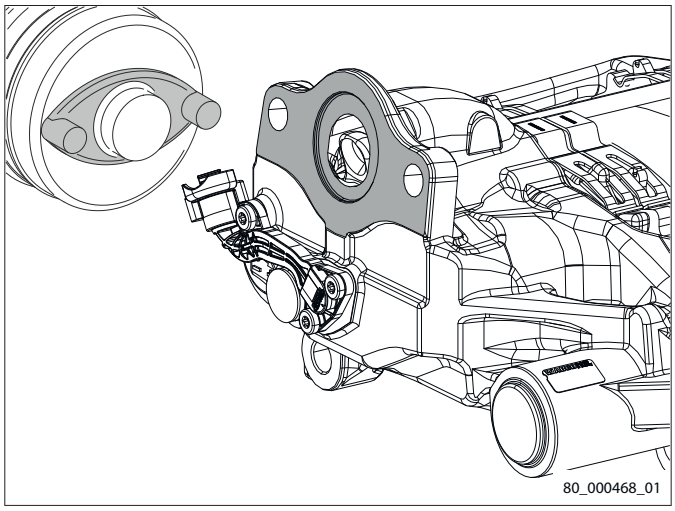



Fig. 48

### 13.5.2 Installing brake cylinder

If required, remove brake.

Requirements:
- Vehicle wheel has been removed.
- Observe brake cylinder manufacturer's documents.
- Observe documents of axle manufacturer and vehicle manufacturer.

1.

***NOTICE***

Damage and impaired function due to dirt and/or moisture penetrating into brake.
⇨ Clean brake in a way that no dirt or moisture penetrates.

Clean sealing and flange surfaces at brake cylinder and brake caliper.

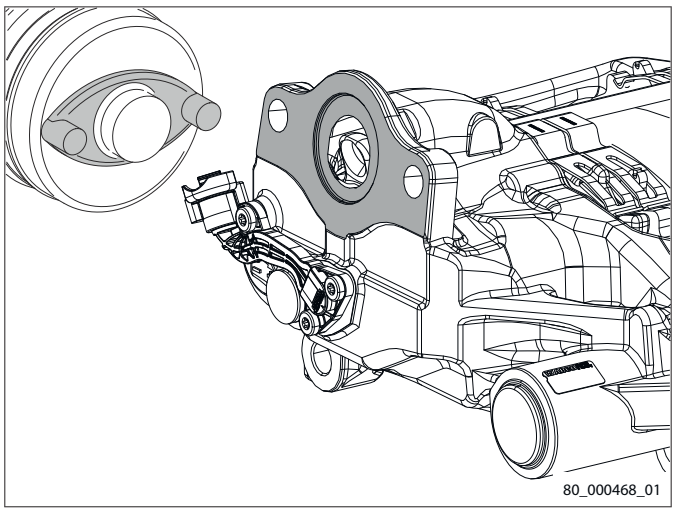



Fig. 49

2. Grease spherical cap (1) in brake lever (*for grease type and grease quantity, refer to brake cylinder manufacturer's documents*).

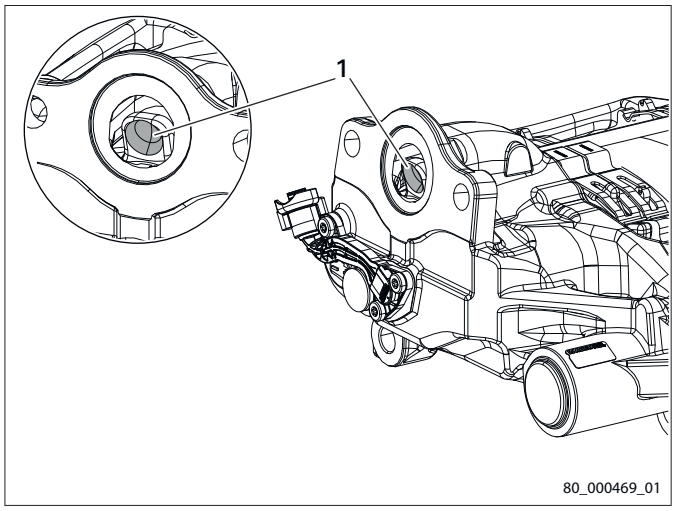



Fig. 50

3. Observe brake cylinder manufacturer's documents with regard to specifications for drainage openings.

   Flange brake cylinder (1) to brake caliper (2) in right position.

4. Screw **new** hexagon nuts (3) (for WABCO brake cylinders: width across flats 24 mm) onto brake cylinder (1) by hand until brake cylinder completely rests on brake caliper (2).

5. Values only apply to original WABCO brake cylinder.

   Tightening torque: **70 Nm** (tightening torque); **180 - 210 Nm** (tightening torque)

   Evenly fasten hexagon nuts (width across flats 24 mm) and tighten them subsequently (*for tightening torques, also refer to brake cylinder manufacturer's documents*).

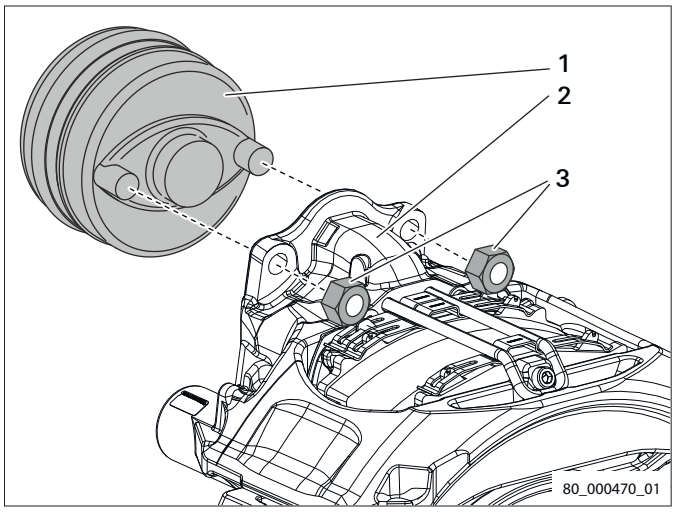



Fig. 51

6. Attach air connection (2) to brake cylinder (1).

   → Brake lines are not jammed and cannot be damaged.
   → Brake lines are routed in such a way that brake or brake caliper is not restricted in its motion.

7. Check air connection for tightness. Observe brake cylinder manufacturer's documents.

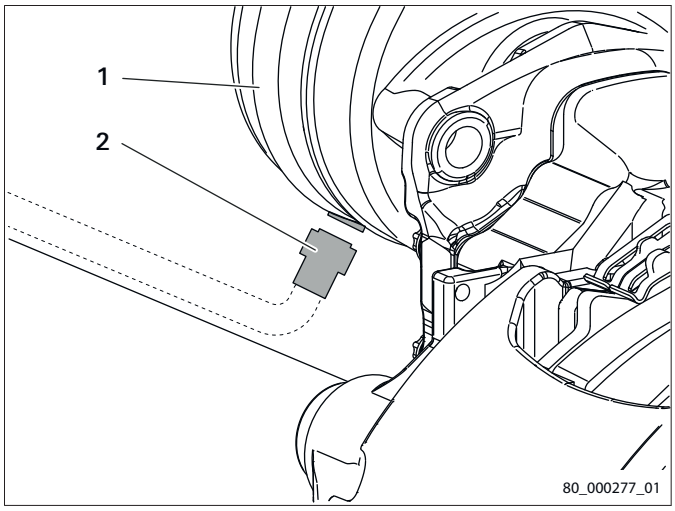



Fig. 52

## 13.6 Replacing seals and bushes

### 13.6.1 Removing pin guide sealing caps

Requirements:
- Vehicle wheel has been removed.
- Brake has been removed *(refer to Section Removing brake)*.
- Observe documents of axle manufacturer and vehicle manufacturer.

1.

**NOTICE**

**Damage at seal seat in brake caliper due to incorrect and improper use of tools.**

⇨ Only use described tools in a proper way.

Remove sealing cap (1) of pin guides using screwdriver and hammer. Do not damage front face (2) at brake caliper.

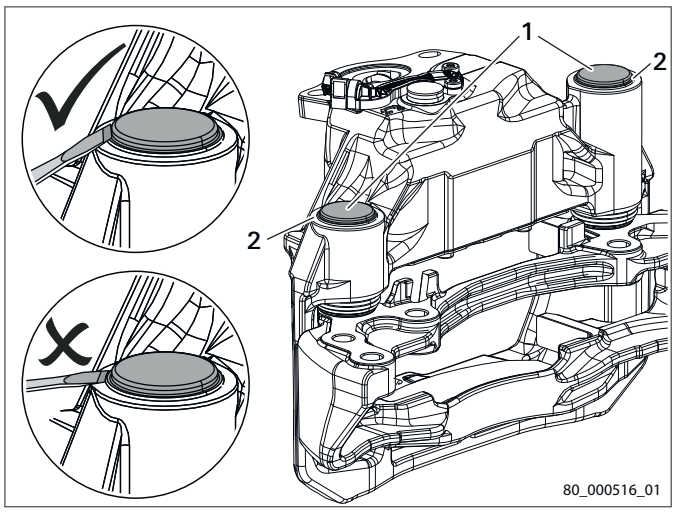



Fig. 53

### 13.6.2 Installing pin guide sealing caps

The following work can be performed with the brake installed. If required, remove brake.

Requirements:
- Vehicle wheel has been removed.
- Observe documents of axle manufacturer and vehicle manufacturer.

Special tools:

- 892 010 051 4 Drive-in sleeve cover

1. Clean bores (1) using cleaning cloth.

2. Apply grease in bores (1).

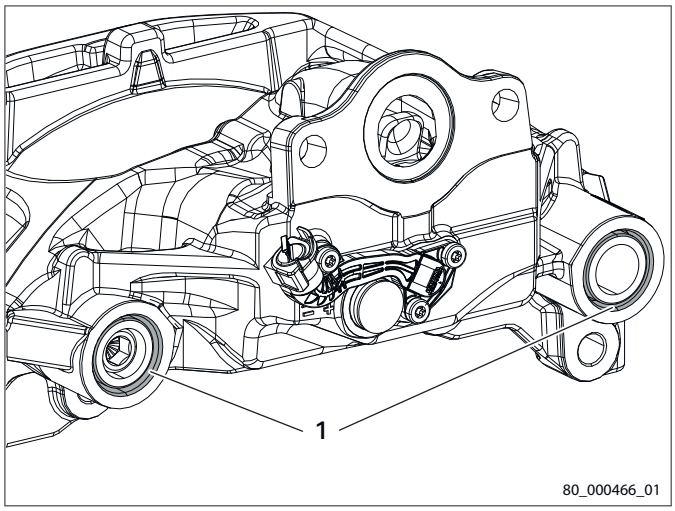



Fig. 54

3. Push brake caliper (1) against brake carrier (2).

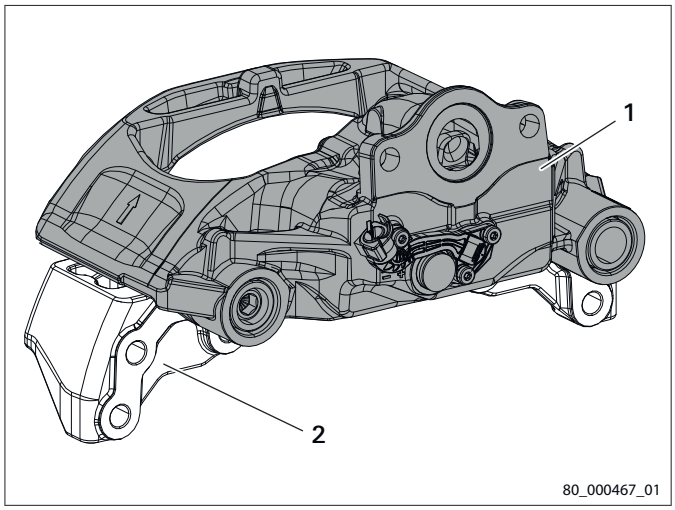



Fig. 55

4. Place **new** sealing caps (1) in bores.

   → Sealing caps (1) are located straight in the bore.

5. Drive in sealing cap (1) using 892 010 051 4 [Drive-in sleeve cover] (2) and plastic hammer until firmly home in bore.

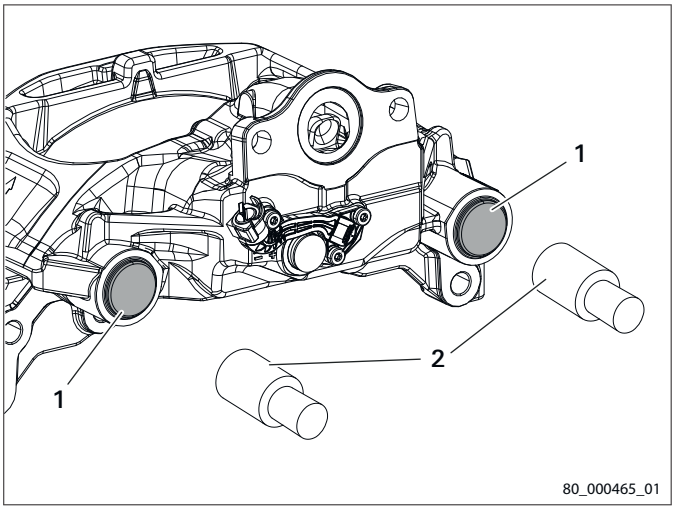



Fig. 56

6. Check brake caliper movement (*refer to Section Checking brake caliper movement*).

### 13.6.3 Removing protective pin caps

Requirements:
- Brake has been removed *(refer to Section Removing brake)*.
- Guide pins and brake carrier have been disassembled *(refer to Section Disassembling guide pins and brake carrier)*.

1. Only replace protective pin caps when damaged or worn.

   Remove protective pin caps (2) from ring groove (1) of brake caliper (use pliers if necessary).

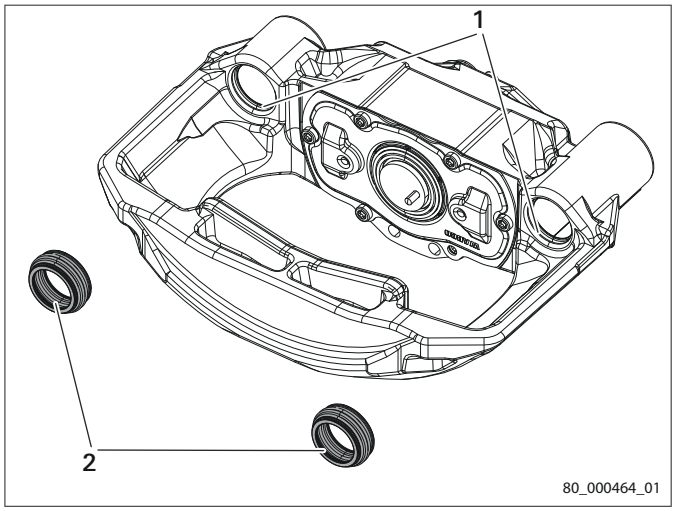



Fig. 57

### 13.6.4 Installing protective pin caps

Requirements:
- Brake has been removed *(refer to Section Removing brake)*.
- Guide pins and brake carrier have been disassembled *(refer to Section Disassembling guide pins and brake carrier)*.

1. Clean seal seats (1) and ring grooves (1). Seal seats and ring grooves must be clean and free of grease.

2.

**NOTICE**

**Damage and functional impairment due to incorrect installation of protective pin caps. Damaged protective pin caps might lead to leakage and defective brake.**

⇨ Install parts in a way that damage is excluded.

Press in **new** protective pin caps (1) completely into seal seats of brake caliper (2) by hand in a straight and concentric way. Make sure that protective pin caps lie evenly and without creasing in seal seats.

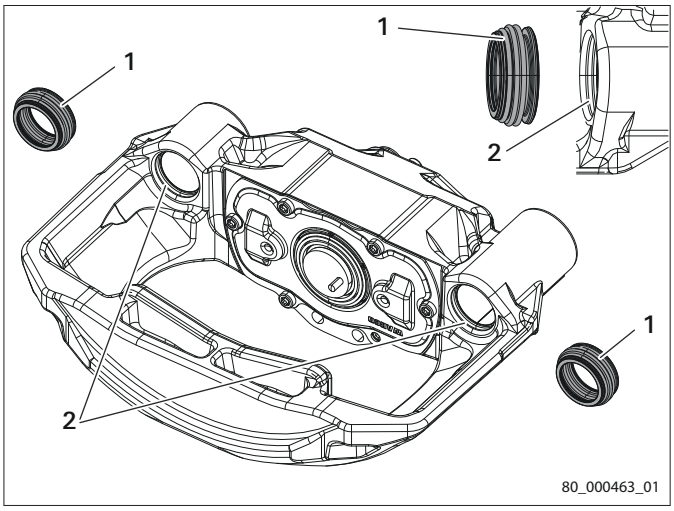



Fig. 58

### 13.6.5 Disassembling guide pins and brake carrier

Requirements:

- Brake has been removed *(refer to Section Removing brake)*.
- Retainer system has been dismantled *(refer to Section Dismantling retainer system)*.

1.

Pay attention to sequence when removing hexagon socket screws to avoid jamming:

1. Short side (clearance bolt side)

2. Long side (fitted bolt side)

Loosen and remove hexagon socket screws (width across flats 14 mm) (2) of guide pins.

2. Remove brake caliper (1) from brake carrier (3).

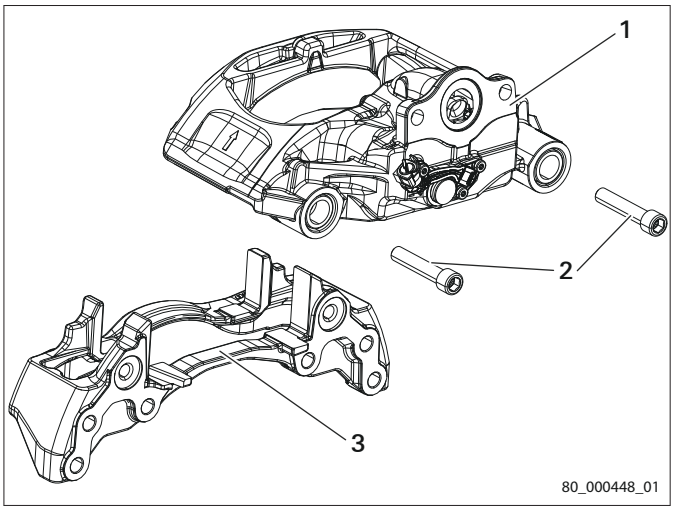



Fig. 59

3. Remove guide pin (2) from brake caliper (1).

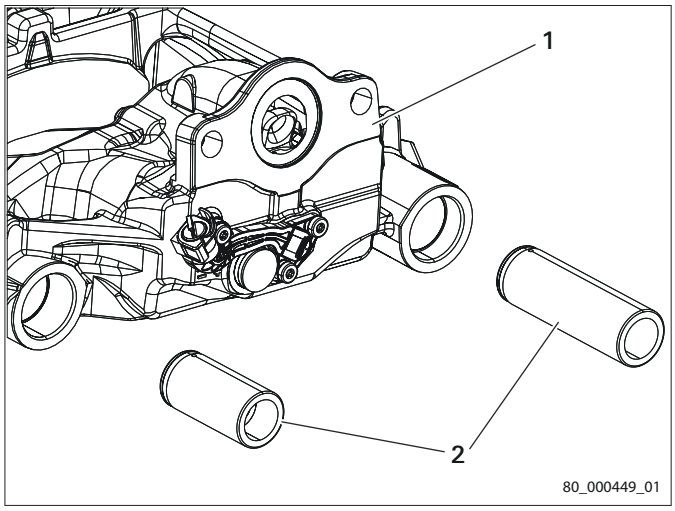



Fig. 60

### 13.6.6 Assembling guide pins and brake carrier

Requirements:

- Brake has been removed *(refer to Section Removing brake)*.

1. Clean contact surface (1) at brake carrier.

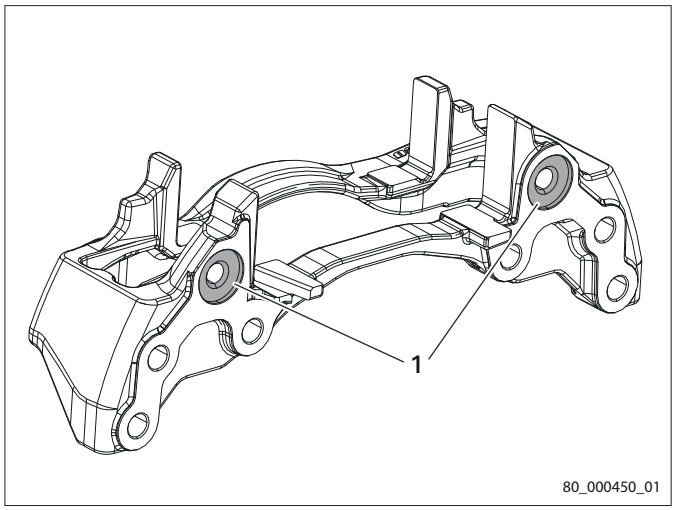



Fig. 61

2. Clean sliding surfaces (inner sides) (1) of bushes and bores of brake caliper with cleaning cloth.

3. Apply grease to sliding surfaces (inner sides) (1) of bushes.

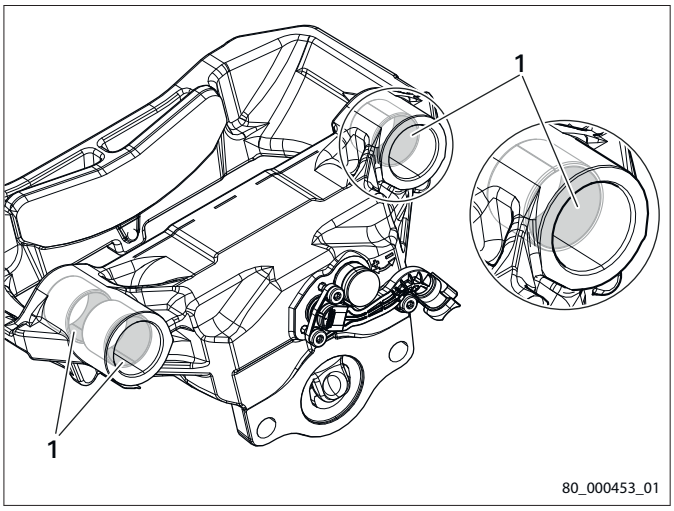



Fig. 62

4. Apply grease to running surfaces (1) of guide pins and beaded edge (2) of protective pin caps.

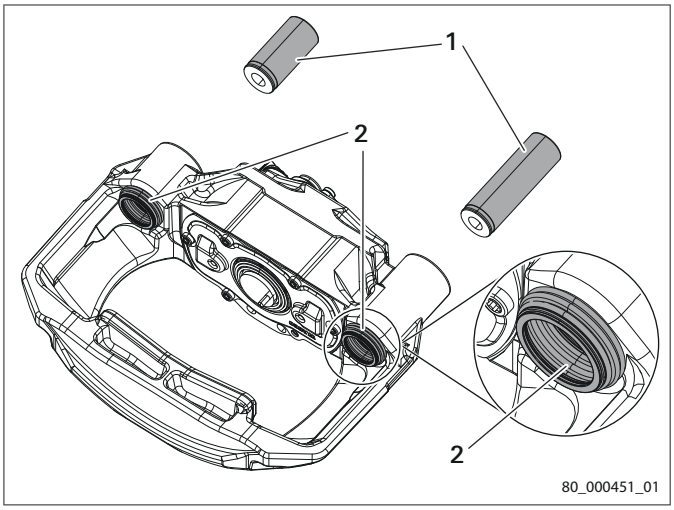



Fig. 63

5. Push both protective pin caps (1) over pin (3) into seal seat (ring groove) used for this purpose. If sheet metal ring (2) is available, it must not disengage from protective pin cap and must snap into place in correct position.

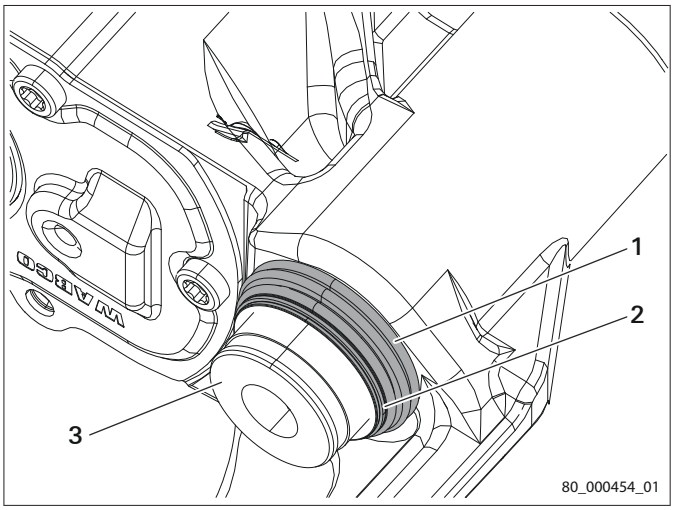



Fig. 64

6. Manually move guide pins back and forth in the bushes to check for ease of movement. Ensure that protective pin caps are not damaged.

7.

**NOTICE**

Damage and impaired function due to ingress of grease on plane faces of guide pins.
By moving guide pins, excess grease can get onto plane faces of guide pins resulting in loosening hexagon socket screws.

⇨ Before screwing brake caliper to brake carrier, make sure that plane faces of guide pins to brake carrier and contact surfaces are clean and free from grease.

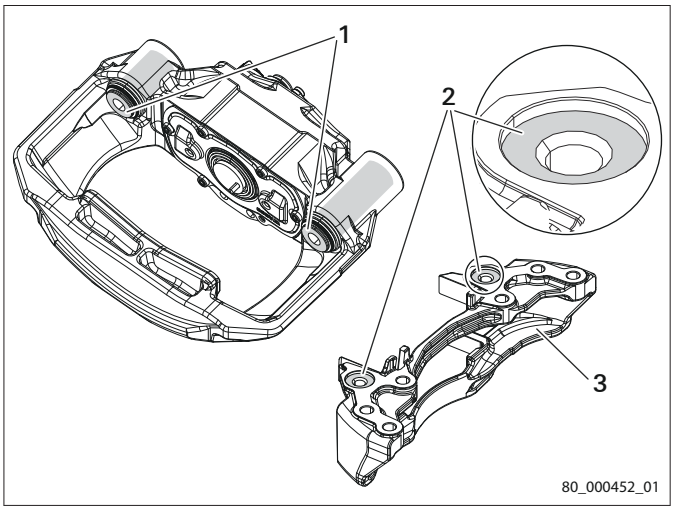



Fig. 65

Remove excess grease. Plane faces (1) of guide pins facing toward brake carrier and contact surfaces (2) at brake carrier (3) must be clean and free from grease.

8. Put brake caliper (1) on brake carrier (3).

9. Always use **new** hexagon socket screws.

Pay attention to sequence when inserting hexagon socket screws to avoid jamming:

1. Long side (fitted bolt side)

2. Short side (clearance bolt side)

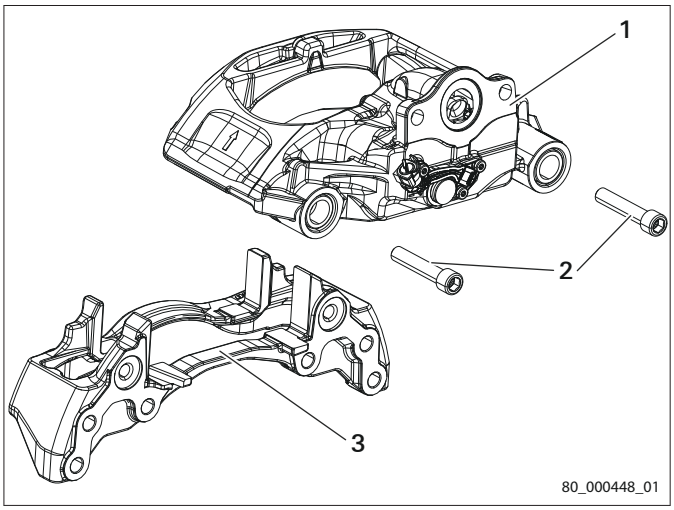



Fig. 66

**⚠ CAUTION**

Risk of crushing due to moving parts.
Slight to moderate injury possible.

⇨ Do not reach into danger area.

⇨ Move parts slowly and carefully.

Insert **new** hexagon socket screws (width across flats 14 mm) (2) through guide pins inserted in brake caliper. Do not twist protective pin caps when tightening hexagon socket screws.

10. Observe tightening sequence for guide pins to prevent jamming.

    Tightening torque: **70 Nm** (tightening torque); **130 Nm** + additional angle 90° (tightening torque)

    Tighten hexagon socket screw (width across flats 14 mm) in fitted bolt (2) and clearance bolt (1) using torque wrench with tightening torque of **70 Nm**.

11. Tighten hexagon socket screw (width across flats 14 mm) in fitted bolt (2) and clearance bolt (1) using torque wrench with a tightening torque and additional angle of **130 Nm + 90°**.

12. Check brake caliper movement (*refer to Section Checking brake caliper movement*).

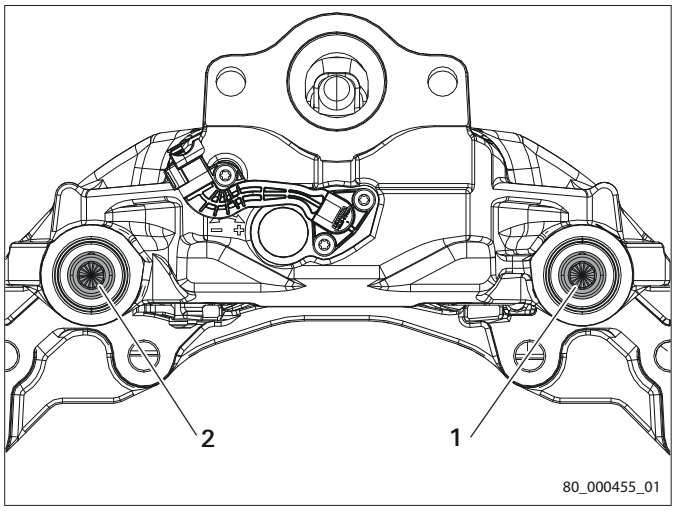


Fig. 67

### 13.6.7 Removing bushes

Requirements:
- Vehicle wheel has been removed.
- Brake has been removed *(refer to Section Removing brake)*.
- Brake cylinder has been removed *(refer to Section Removing brake cylinder)*.
- Brake has been reset *(refer to Section Resetting brake)*.
- Retainer system has been dismantled *(refer to Section Dismantling retainer system)*.
- Brake pads have been removed *(refer to Section Removing brake pads)*.
- Pressure plate has been removed *(refer to Section Removing pressure plate)*.
- Guide pins and brake carrier have been disassembled *(refer to Section Disassembling guide pins and brake carrier)*.
- Protective pin caps have been removed *(refer to Section Removing protective pin caps)*.
- Observe documents of axle manufacturer and vehicle manufacturer.
  Observe brake cylinder manufacturer's documents.

Special tools:
- 300 100 005 4 TR 20x2 threaded spindle
- 891 500 057 4 TR 20x2 nut
- 893 040 012 4 Press-out sleeve
- 893 040 013 4 Press-out bolt
- 810 710 007 4 Release bearing

1. Turn 300 100 005 4 [TR 20x2 threaded spindle] using open-end or ring wrench (width across flats 24 mm).

   Hold 891 500 057 4 [TR 20x2 nut] with open-end wrench
   (width across flats 27 mm).

   Press bushes (3) of fitted bolt out of brake caliper towards cylinder side into tool 893 040 012 4 [Press-out sleeve] (4) using the following tools:
   891 500 057 4 [TR 20x2 nut] (1)
   893 040 013 4 [Press-out bolt] (2)
   300 100 005 4 [TR 20x2 threaded spindle] (5)
   810 710 007 4 [Release bearing] (6)

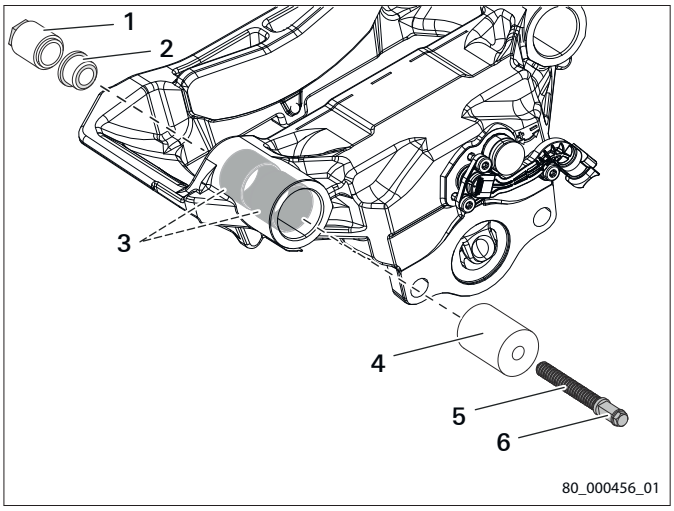



Fig. 68

2. Turn 300 100 005 4 [TR 20x2 threaded spindle] using open-end or ring wrench (width across flats 24 mm).

   Hold 891 500 057 4 [TR 20x2 nut] with open-end wrench
   (width across flats 27 mm).

   Press bush (6) of clearance bolt out of brake caliper towards cylinder side into tool 893 040 012 4 [Press-out sleeve] (5) using the following tools:
   891 500 057 4 [TR 20x2 nut] (1)
   893 040 013 4 [Press-out bolt] (2)
   300 100 005 4 [TR 20x2 threaded spindle] (4)
   810 710 007 4 [Release bearing] (3)

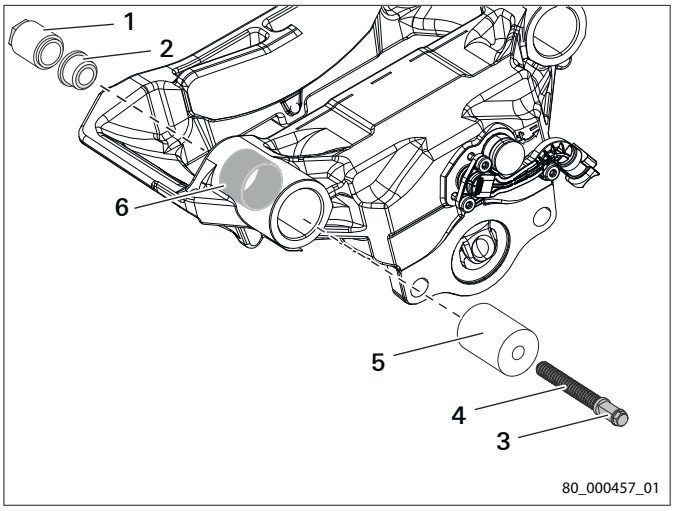



Fig. 69

### 13.6.8 Installing bushes

Only assemble bushes that are not greased.

Requirements:
- Vehicle wheel has been removed.
- Brake cylinder has been removed *(refer to Section Removing brake cylinder)*.
- Brake has been removed *(refer to Section Removing brake)*.
- Retainer system has been dismantled. *(refer to Section Dismantling retainer system)*
- Brake has been reset *(refer to Section Resetting brake)*.
- Brake pads have been removed *(refer to Section Removing brake pads)*.

- Pressure plate has been removed *(refer to Section Removing pressure plate)*.
- Guide pins and brake carrier have been disassembled *(refer to Section Disassembling guide pins and brake carrier)*.
- Protective pin caps have been removed *(refer to Section Removing protective pin caps)*.
- Observe documents of axle manufacturer and vehicle manufacturer.
  Observe brake cylinder manufacturer's documents.

Special tools:

- 300 100 005 4 TR 20x2 threaded spindle
- 891 500 057 4 TR 20x2 nut
- 810 409 017 4 Round washer
- 300 100 003 4 Shim
- 893 040 016 4 Press-in sleeve lower fitted bolt
- 810 710 007 4 Release bearing
- 893 040 015 4 Press-in sleeve upper fitted bolt
- 893 040 014 4 Press-in sleeve clearance bolt

1. Clean bores (1) for guide pins.

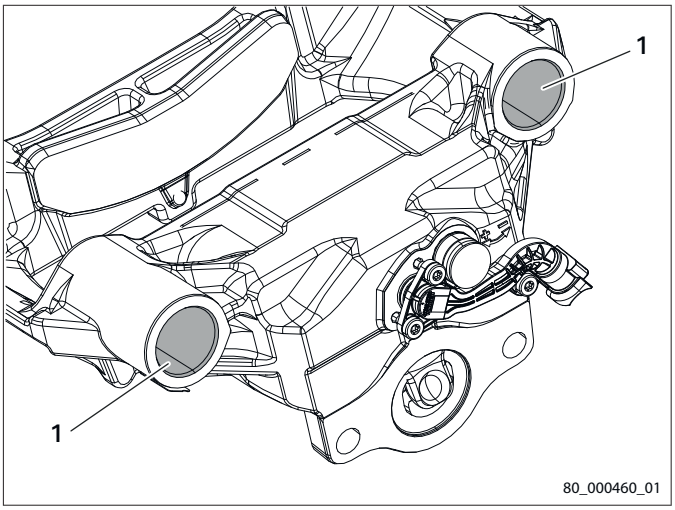



Fig. 70

2. Turn 300 100 005 4 [TR 20x2 threaded spindle] (7) using open-end or ring wrench (width across flats 24 mm).

   Hold 891 500 057 4 [TR 20x2 nut] (1) with open-end wrench (width across flats 27 mm).

   Press in **new** lower bush (4) for fitted bolt into brake caliper bore until firmly home using the following tools:
   891 500 057 4 [TR 20x2 nut] (1)
   810 409 017 4 [Round washer] (2)
   300 100 003 4 [Shim] (3)
   893 040 016 4 [Press-in sleeve lower fitted bolt] (5)

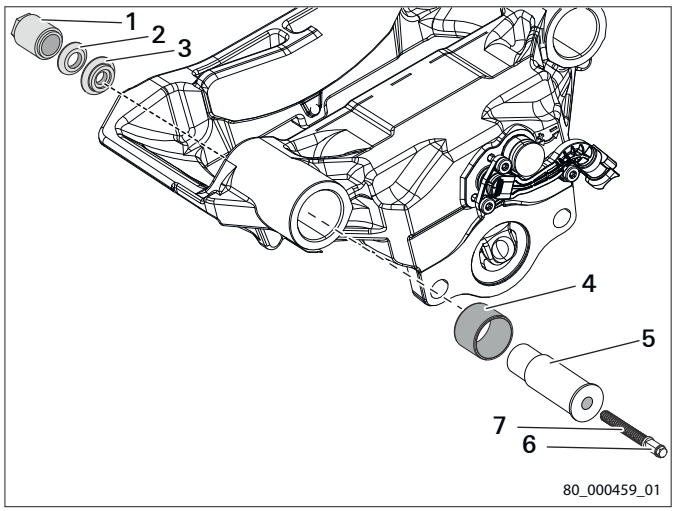



Fig. 71

300 100 005 4 [TR 20x2 threaded spindle] (7)
810 710 007 4 [Release bearing] (6)

3. Turn 300 100 005 4 [TR 20x2 threaded spindle] (7) using open-end or ring wrench (width across flats 24 mm).

   Hold 891 500 057 4 [TR 20x2 nut] (1) with open-end wrench (width across flats 27 mm).

Press in **new** upper bush (4) for fitted bolt into brake caliper bore until firmly home using the following tools:
891 500 057 4 [TR 20x2 nut] (1)
810 409 017 4 [Round washer] (2)
300 100 003 4 [Shim] (6)
893 040 015 4 [Press-in sleeve upper fitted bolt] (5)
300 100 005 4 [TR 20x2 threaded spindle] (7)
810 710 007 4 [Release bearing] (7)

→ Both bushes do not lie seamlessly next to each other.

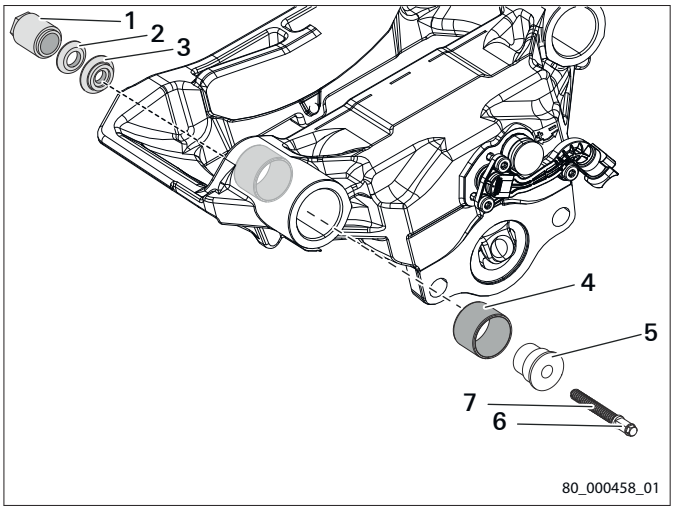


Fig. 72

4. Hold and turn 300 100 005 4 [TR 20x2 threaded spindle] (7) using open-end or ring wrench (width across flats 24 mm).

   Hold and turn 891 500 057 4 [TR 20x2 nut] (1) with open-end wrench (width across flats 27 mm).

   **New** bush rests on 893 040 014 4 [Press-in sleeve clearance bolt] (5). 893 040 015 4 [Press-in sleeve upper fitted bolt] (6) serves as spacer.

Press in **new** bush (4) for clearance bolt into brake caliper bore until firmly home using the following tools:
891 500 057 4 [TR 20x2 nut] (1)
810 409 017 4 [Round washer] (2)
300 100 003 4 [Shim] (3)
893 040 014 4 [Press-in sleeve clearance bolt] (5)
893 040 015 4 [Press-in sleeve upper fitted bolt] (6)
300 100 005 4 [TR 20x2 threaded spindle] (7)
810 710 007 4 [Release bearing] (8)

### 13.6.9 Removing the return unit

The return unit can be removed with the brake installed or removed.

Requirements:

- Plug has been removed *(refer to Section Checking adjuster)*.
  Observe documents of axle manufacturer and vehicle manufacturer.
  Observe brake cylinder manufacturer's documents.

Special tools:

- 300 100 018 4 Extracting device
- 300 100 004 4 Hammer pin
- 300 100 011 4 Handle

1. Screw tool 300 100 018 4 [Extracting device] (2) into the sleeve (1).

2. Use tool 300 100 004 4 [Hammer pin] (4) to beat against 300 100 011 4 [Handle] (3).

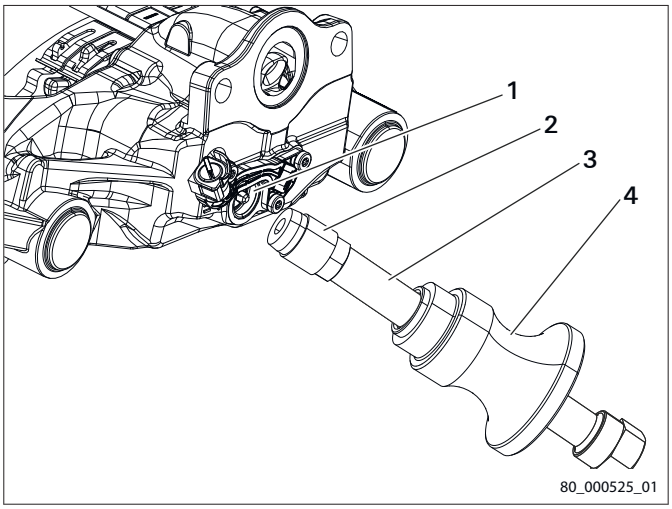



Fig. 73

3. Remove return unit (2) from brake caliper (1).

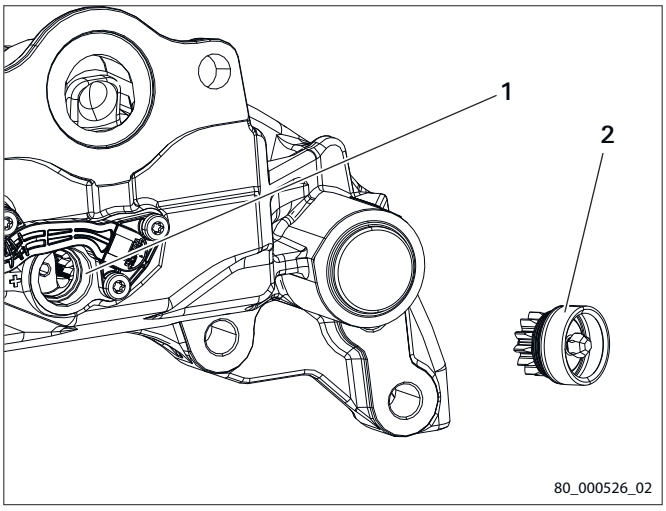



Fig. 74

### 13.6.10 Installing the return unit

The return unit can be installed with the brake installed or removed.

Requirements:
- Plug has been removed.

Special tools:
- 300 100 004 4 Hammer pin

1. **NOTICE**

   Damage and impaired function due to dirt or moisture penetrating into brake.
   ⇨ Clean brake in a way that no dirt or moisture penetrates.

   Clean seal seat in brake caliper and check for damage.

2. **NOTICE**

   Damage due to incorrect installation of shaft with gear
   ⇨ First insert gear into opening of brake caliper.

   Apply grease to lower end of shaft.

3. Insert shaft together with gear (2) into opening (1) of brake caliper.

   → Gears must both mesh.

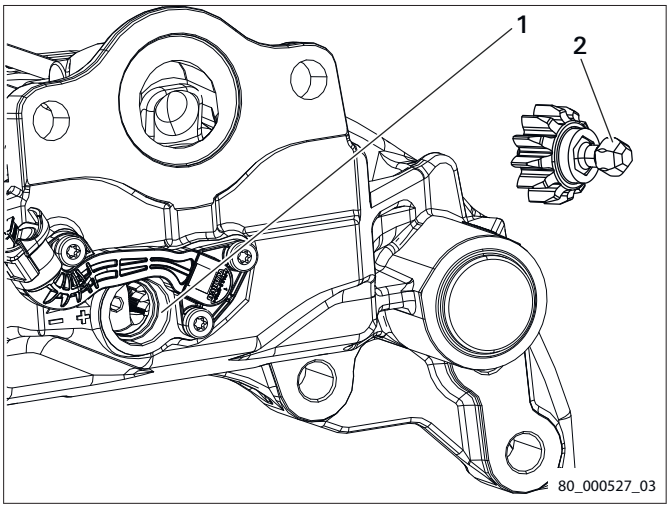


Fig. 75

4. Apply grease to sleeve of inner sealing lip.
5. Insert sleeve (2) into opening of brake caliper.
6. Position the small collar of tool 300 100 004 4 [Hammer pin] (3) on the sleeve edge (1).
7. Use tool 300 100 004 4 [Hammer pin] (3) to drive sleeve (2) completely into the seat of the brake caliper.

   → The seal of the sleeve is completely seated in the ring groove of the shaft.

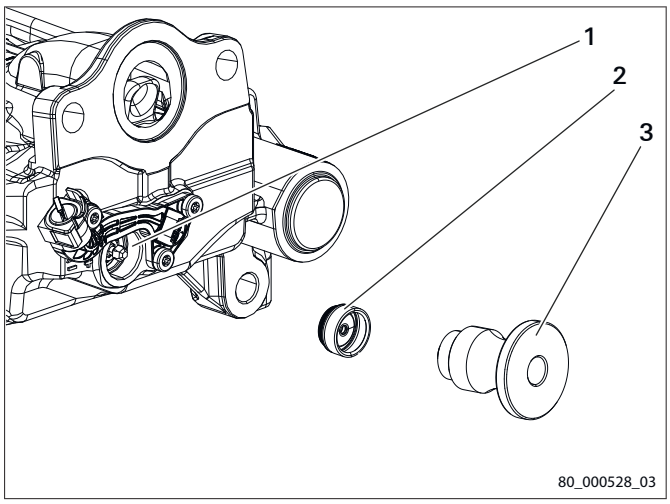


Fig. 76

### 13.6.11 Removing piston protection cap

The following work can be performed with the brake installed or removed.
If piston protection cap is removed individually, it is not necessary to remove the brake caliper and brake cylinder.

Requirements:
- Vehicle wheel has been removed.
- Retainer system has been dismantled *(refer to Section Dismantling retainer system)*.
- Brake has been reset *(refer to Section Resetting brake)*.
- Brake pads have been removed *(refer to Section Removing brake pads)*.
- Pressure plate has been removed *(refer to Section Removing pressure plate)*.
- Observe documents of axle manufacturer and vehicle manufacturer.

1. Using an offset ring wrench (width across flats 8 mm), turn return unit hexagon (1) counter-clockwise. In doing so, hold adjuster screw (2) at pin to avoid its turning.

   → Adjuster screw (2) has been unscrewed by 30 mm.

   Renew brake if adjuster screw has been completely unscrewed from brake *(refer to Section Replacing brake)*.

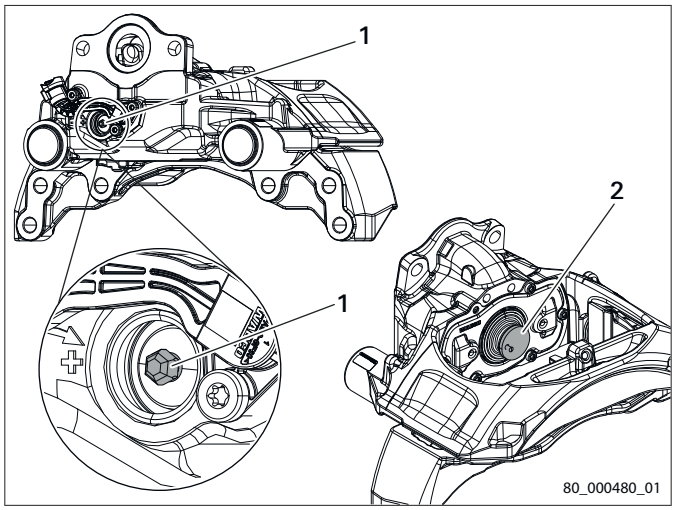



Fig. 77

2. Carefully push brake caliper (1) towards cylinder side by hand.

3. **NOTICE**

   **Damage at seal seat in brake caliper due to incorrect and improper use of tools.**
   ⇨ Only use described tools in a proper way.

   Remove piston protection cap (2) from seal seat/ring groove of adjuster screw (4) using a screwdriver (3).

   Replace brake if seal seat is worn or damaged *(refer to Section Replacing brake)*.

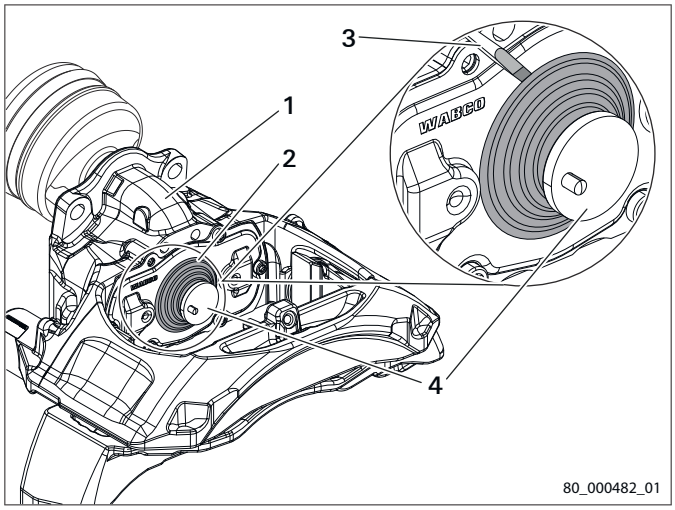



Fig. 78

4. Mark position of adjuster screw pin (2) at brake caliper (1).

   Adjuster screw pin (2) must be in same position after having checked adjuster screw.

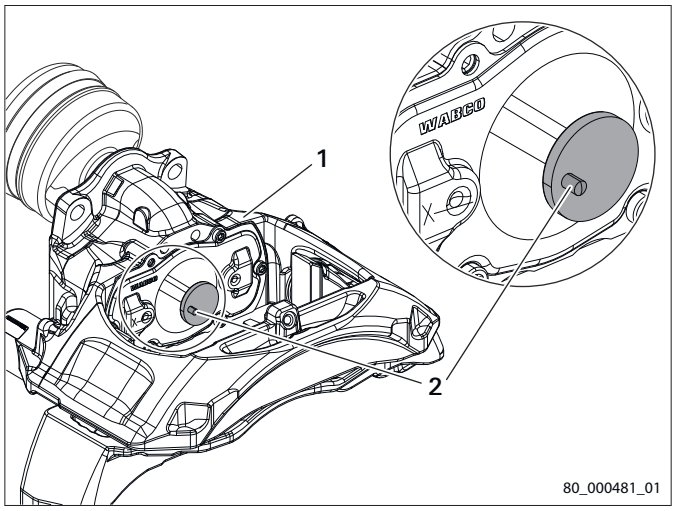



Fig. 79

### 13.6.12 Installing piston protection cap

The following work can be performed with the brake installed or removed.

Requirements:

- Removed brake
  Vehicle wheel has been removed.
- Brake cylinder has been removed *(refer to Section Removing brake cylinder)*.
- Brake has been removed *(refer to Section Removing brake)*.
- Retainer system has been dismantled *(refer to Section Dismantling retainer system)*.
- Brake has been reset *(refer to Section Resetting brake)*.
- Brake pads have been removed *(refer to Section Removing brake pads)*.
- Pressure plate has been removed *(refer to Section Removing pressure plate)*.
- Plug has been removed *(refer to Section Checking adjuster)*.
- Adjuster screw has been unscrewed by about 10 to 20 mm.
- Observe documents of axle manufacturer and vehicle manufacturer.
- Installed brake
- Vehicle wheel has been removed.
- Retainer system has been removed *(refer to Section Removing retainer system)*.
- Brake has been reset *(refer to Section Resetting brake)*.
- Brake pads have been removed *(refer to Section Removing brake pads)*.
- Pressure plate has been removed *(refer to Section Removing pressure plate)*.
- Adjuster screw has been unscrewed by about 10 to 20 mm.
- Observe documents of axle manufacturer and vehicle manufacturer.

Special tools:

- 893 040 017 4 Press-in cup
- 300 100 007 2 Connecting bolt (3 pieces)
- 300 100 022 4 Holding rod

1. Apply grease to inner edge bead of **new** piston protection cap (1).

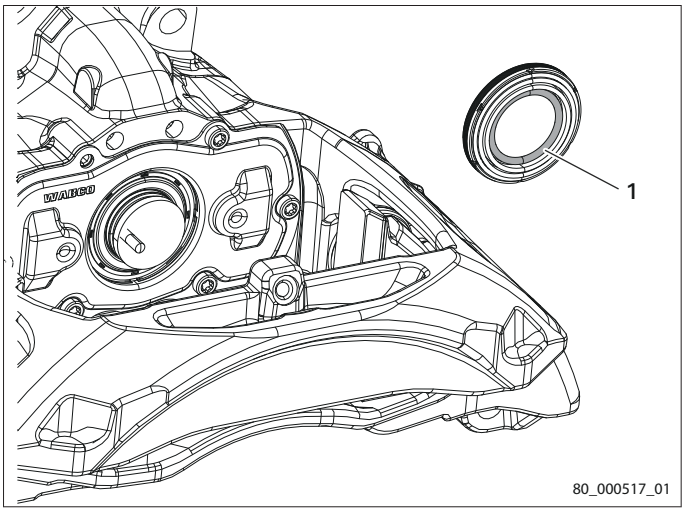



Fig. 80

2. Slide piston protection cap (1) over adjuster screw (3).

3. Center piston protection cap (1) and press to seal seat of brake caliper (2) by hand.

4. Insert edge bead of piston protection cap into seal seat of adjuster screw.

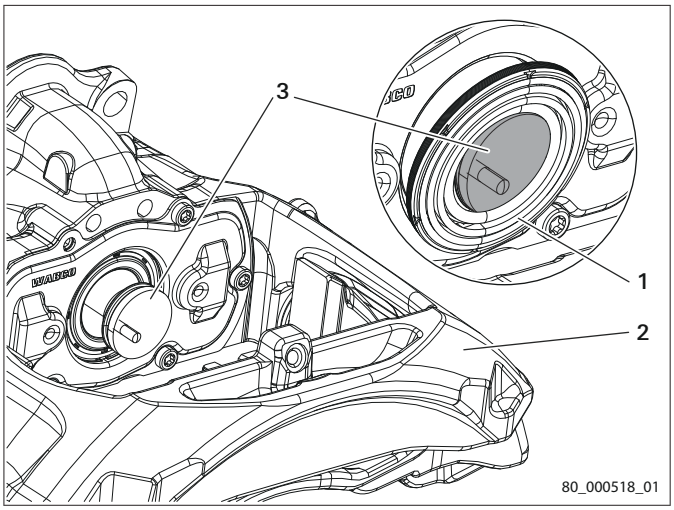



Fig. 81

5. Turn return unit hexagon (1) clockwise using ring wrench (width across flats 8 mm) until adjuster screw (2) is partly turned in.

   → Adjuster screw pin must be at same position as marking made before.

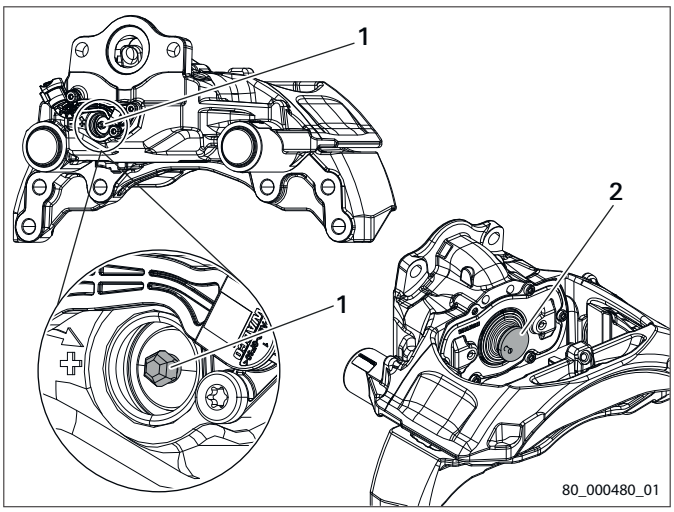



Fig. 82

Removed brake

6. Fit tools 893 040 017 4 [Press-in cup] (3), 300 100 007 2 [Connecting bolt (3 pieces)] (4) and 300 100 022 4 [Holding rod] (5).

7. Center tool 893 040 017 4 [Press-in cup] (3) on piston protection cap (1).

8. Turn the 300 100 007 2 [Connecting bolt (3 pieces)] tool (4) by hand, until it rests against the brake caliper (2) on the opposite side.

9. To press in the piston protection cap (1), turn out tool 300 100 007 2 [Connecting bolt (3 pieces)] (4) further using open-end wrench (width across flats 27 mm) until connecting pin rests on brake caliper. Turn further until piston protection cap (1) evenly rests on brake caliper seal seat. Ensure correct seal seat in brake caliper and equal position of edge bead of piston protection cap in ring groove of adjuster screw.

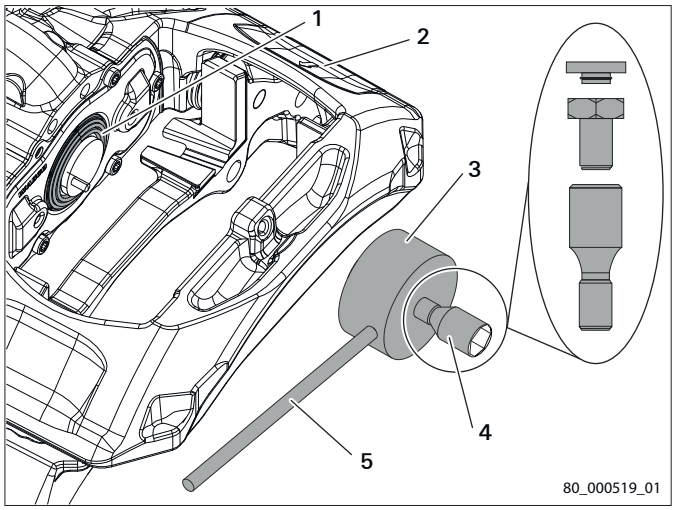


Fig. 83

Installed brake

10. Fit tools 893 040 017 4 [Press-in cup] (3), 300 100 007 2 [Connecting bolt (3 pieces)] (4) and 300 100 022 4 [Holding rod] (5).

11. Turn tool 300 100 007 2 [Connecting bolt (3 pieces)] (4) by hand until it rests against brake disc (6).

12. To press in the piston protection cap (1), turn out tool 300 100 007 2 [Connecting bolt (3 pieces)] (4) further using open-end wrench (width across flats 27 mm) until connecting pin rests on brake caliper. Turn further until piston protection cap (1) evenly rests on brake caliper seal seat. Ensure correct seal seat in brake caliper and equal position of edge bead of piston protection cap in ring groove of adjuster screw.

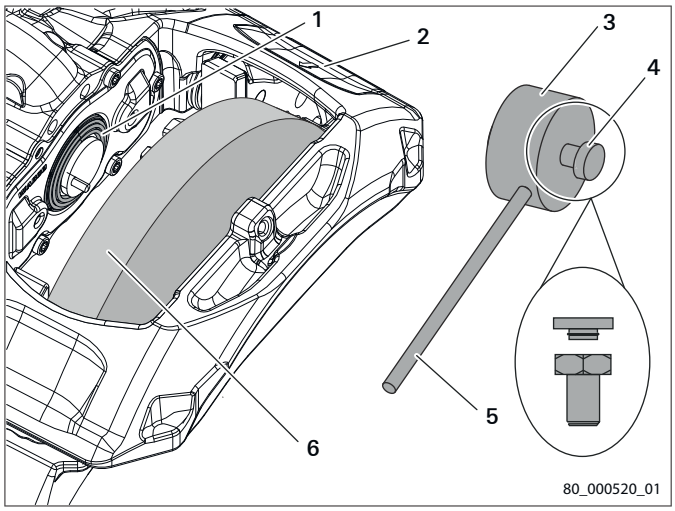


Fig. 84

## 13.7 Replacing brake

### 13.7.1 Removing brake

Requirements:
- Vehicle wheel has been removed.
- Brake cylinder has been removed *(refer to Section Removing brake cylinder)*.
- Retainer system has been dismantled *(refer to Section Dismantling retainer system)*.
- Brake pads have been removed *(refer to Section Removing brake pads)*.
- Pressure plate has been removed *(refer to Section Removing pressure plate)*.
- Plug connector of wear sensor to vehicle has been disconnected.
- Observe documents of axle manufacturer and vehicle manufacturer.
  Observe brake cylinder manufacturer's documents.

1. The following work should be performed by two persons or using suitable lifting equipment.

**⚠ CAUTION**

Risk of crushing due to moving parts.
Slight or moderate injury possible.
⇨ Do not reach into danger area!

Loosen mounting screws (width across flats 24 mm) to remove brake. Observe documents of axle manufacturer and vehicle manufacturer.

### 13.7.2 Installing brake

Do not mix up left and right brake during installation.
Pay attention to arrow (showing rotation direction of brake disc when moving forward) on brake caliper.
Compensation groove of brake carrier to avoid/reduce oblique wear is always mounted on inlet side.
Replacement brakes are delivered without brake pads and retainer system.

Requirements:
- Vehicle wheel has been removed.
- Brake has been removed *(refer to Section Removing brake)*.
- Retainer system has been dismantled *(refer to Section Dismantling retainer system)*.
- Brake pads have been removed *(refer to Section Removing brake pads)*.
- Pressure plate has been removed *(refer to Section Removing pressure plate)*.
- Observe documents of axle manufacturer and vehicle manufacturer.
  Observe brake cylinder manufacturer's documents.

1. Check mounting flanges and brake disc for wear and damage.

2. Clean mounting flanges on axle.

3. Remove transport safety devices (1) and adhesive label (2) from replacement brake.

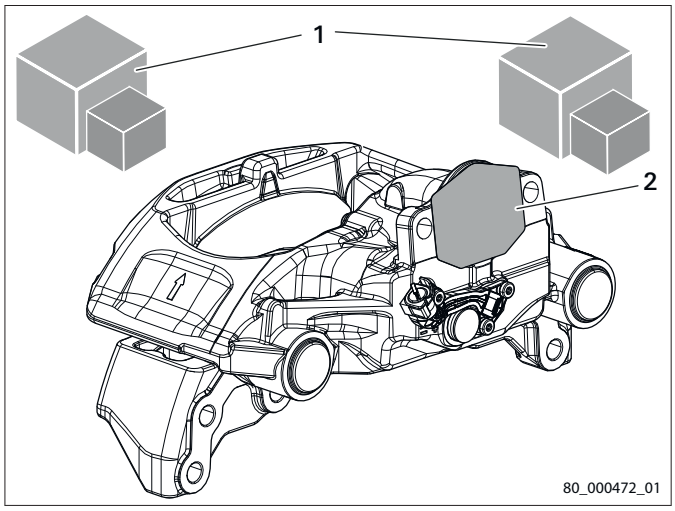



Fig. 85

4. The following work should be performed by two persons or using suitable lifting equipment.

   Place the brake over brake disc.

5. Fasten brake to axle with mounting screws (width across flats 24 mm).

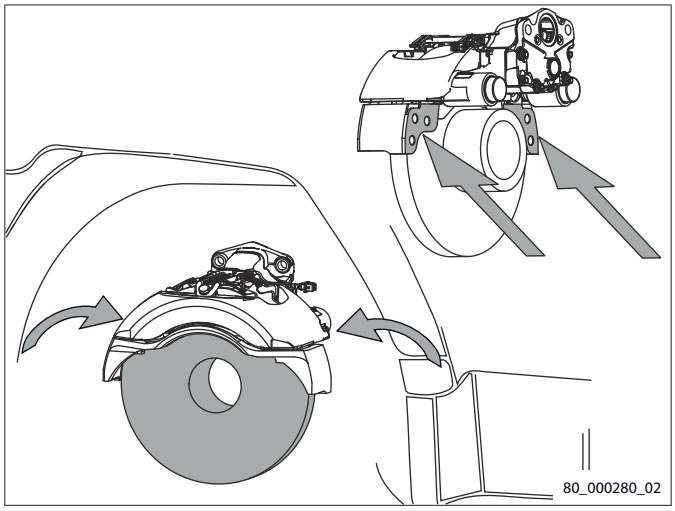



Fig. 86

# 14 Concluding Activities

## 14.1 Final checks

Requirements:
- Observe documents of axle manufacturer and vehicle manufacturer.

1. Check that all single parts of brake have been correctly reassembled.

2. Check that all tightening torques and setting values have been observed.
   *(refer to Section Tightening Torques)*
   *(refer to Section Settings)*

3. Check that all insulated cables/lines are laid/connected correctly and without damage.

4. Delete the diagnostic memory.

## 14.2 Functional test

Requirements:
- Observe documents of axle and vehicle manufacturer.

1. Check if wheel hub can be turned easily.

2. After having completed repair work and maintenance work, check function of brake and parking brake on roller test bench. Make a test drive if no roller test bench is available.

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