

# SERVICE MANUAL

**PNEUMATIC DISC BRAKE  
SN5**



**TRUCKSERVICES**

## Overview of Tool Kits and Service Manuals for Knorr-Bremse Air Disc Brakes

Brake	Tool Kit	Alternative
SB5...	II37951004	
SB6... SB7...	II37951004*	
SN5...	K037001	
SN6... SN7... SK7...	K039062K50	K000469 + Supplemental Kit K017062 + Supplemental Kit K046291K50 K005972 + Supplemental Kit K017062 + Supplemental Kit K046291K50 K016947 + Supplemental Kit K046291K50
SL7... SM7...	K039062K50	K016947 + Supplemental Kit K046291K50
ST7...	K039062K50	K016947 + Supplemental Kit K046291K50

\*) Additional tools are required -  
obtainable in kits K000469, K005972, K016947 and K039062K50

Brake	Service Manual
SB6... SB7...	C16352-#
SN5...	Y015044-#
SN6... SN7... SK7...	Y006471-#
SL7... SM7...	Y081564-#
ST7...	Y173241-#

# - Refer to website for latest revision **truckservices.knorr-bremse.com**

**Disclaimer**

The information contained in this document is intended for the exclusive use of trained persons within the commercial vehicle industry, and must not be passed on to any third party. All recommendations regarding products and their servicing or usage are with reference to Knorr-Bremse products and should not be considered applicable to products from other manufacturers.

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Any legal disputes arising from the use of this information shall be subject to German law.

Note: If service work is carried out on the vehicle, it is the responsibility of the workshop to ensure the vehicle is fully tested and in full functional order before the vehicle is returned into service. Knorr-Bremse accepts no liability for problems caused as a result of appropriate tests not being carried out.

This disclaimer is an English translation of a German text, which should be referred to for all legal purposes.

**Revision Details**

Rev. 003	July 2013	Changes throughout the document.
Rev. 004	July 2020	Complete layout update and changes throughout the document.
Rev. 005	June 2022	Small changes to layout plus additional safety paragraph added to pages 5 and 23

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## SAFETY AND ENVIRONMENT GUIDELINES

**Note:** The safety advice listed below is applicable to general service and diagnostic work on braking systems. Also observe any recommendations from the axle or vehicle manufacturer concerning towing, jacking-up and securing the vehicle.

**CAUTION:** KNORR-BREMSE IS NOT LIABLE FOR ANY INJURIES OR DAMAGES CAUSED BY IMPROPER USE OF SPECIFIED SERVICE KITS AND/OR SERVICE TOOLS. FURTHERMORE, MISUSE OF TOOLS OR INCORRECT INSTALLATION OR APPLICATION OF SERVICE KITS MAY RESULT IN DAMAGE OR POTENTIALLY UNSAFE VEHICLE OPERATIONS. IN THIS CASE, KNORR-BREMSE DOES NOT HAVE ANY WARRANTY OBLIGATIONS.

Before and whilst working on or around compressed air systems and devices, the following precautions should be observed, along with the many hazard notes contained throughout the document:

- 1 Always wear safety glasses when working with air pressure.
- 2 Never exceed the vehicle manufacturer's recommended air pressures.
- 3 Never look into air jets or direct them at anyone.
- 4 Never connect or disconnect a hose or line containing pressure; it may whip as air escapes.
- 5 When removing or servicing a product, ensure all pressure related to the specific system it is contained in has been depleted to 0 bar. Be aware that if the vehicle is equipped with an air dryer system, it can also contain air pressure along with its purge reservoir, if fitted, even after pressure has been drained from the other reservoirs.
- 6 If it is necessary to drain the air pressure from reservoirs, etc., keep away from brake actuator push rods and levers since they may move as system pressure drops. On vehicles fitted with air suspension, it is advised when undertaking such work, to support the chassis from sudden lowering and therefore prevent any possibility of being trapped between the chassis and axle or ground.
- 7 Park the vehicle on a level surface, apply the parking brakes, and always chock the wheels as depleting vehicle air system pressure may cause the vehicle to roll.
- 8 When working under or around the vehicle, and particularly when working in the engine compartment, the engine should be shut off and the battery disconnected. Where circumstances require that the engine be running, EXTREME CAUTION should be taken to prevent personal injury resulting from contact with moving, rotating, leaking, heated or electrically charged components. Additionally, it is advisable to place a clear sign on or near the steering wheel advising that there is work in progress on the vehicle.
- 9 When working on vehicles equipped with air suspension, to guard against injury due to unexpected downward movement of the chassis caused by sudden pressure loss in the suspension system, ensure that the vehicle chassis is mechanically supported with a 'prop' between the chassis and the axle or between the chassis and the ground.
- 10 Examine all pipework for signs of kinks, dents, abrasion, drying out or overheating. Be aware that kinks in pipework may result in air pressure being trapped in the pipework and associated equipment. Replacement hardware, tubing, hose, fittings, etc. must be of equivalent size, type and strength as original equipment and be designed specifically for such applications and systems. Check the attachment of all pipework; it should be installed so that it cannot abrade or be subjected to excessive heat.
- 11 Components with stripped threads or damaged/corroded parts must be replaced completely. Do not attempt repairs requiring machining or welding unless specifically stated and approved by the vehicle or component manufacturer.
- 12 Never attempt to install, remove, disassemble or assemble a device until you have read and thoroughly understood the recommended procedures. Some units contain powerful springs and injury can result if not properly dismantled and reassembled. Use only the correct tools and observe all precautions pertaining to use of those tools.
- 13 Before removing any device note its position and the connections of all pipework so that the replacement/serviced device can be properly installed. Ensure that adequate support or assistance is provided for the removal/installation of heavy items.
- 14 Use only genuine replacement parts, components and kits as supplied by Knorr-Bremse or the vehicle manufacturer containing original Knorr-Bremse parts. Only use the recommended tools as specified in related Knorr-Bremse instructions.
- 15 The serviced or replaced product must be checked for correct function and effectiveness.
- 16 If products have been dismantled, serviced or replaced, whose performance could affect braking performance or system behaviour, this should be checked on a roller dynamometer. Bear in mind that a lower performance may be experienced during the bedding-in phase if new brake pads/linings and/or brake discs/drums have been fitted.
- 17 The use of impact screwdrivers or impact wrenches in conjunction with Knorr-Bremse service tools for air disc brakes is not permitted. The service tools are not designed for such use. It is likely that the tools or the vehicle will be damaged and there is a serious risk of injury – see Caution above.
- 18 Do not use compressed air to clean the disc brake. Avoid air contamination of brake dust.
- 19 Prior to returning the vehicle to service, make certain that all components and the complete brake systems are leak free and restored to their proper operating condition.
- 20 Attention! During service work on vehicles with electronic parking brake, service or parking brake, or bus stop temporary hold brake, the brake system must be set to service and maintenance mode. Please also observe the instructions of the vehicle manufacturer.

## Welding

To avoid damage to electronic components when carrying out electrical welding, the following precautions should be observed:

- 1 In all cases, before starting any electrical welding, remove all connections from any electronic control units or modules, noting their position and the order in which they are removed.
- 2 When re-inserting the electrical connectors (in reverse order) it is essential that they are fitted to their correct assigned position - if necessary this must be checked by PC Diagnostics.

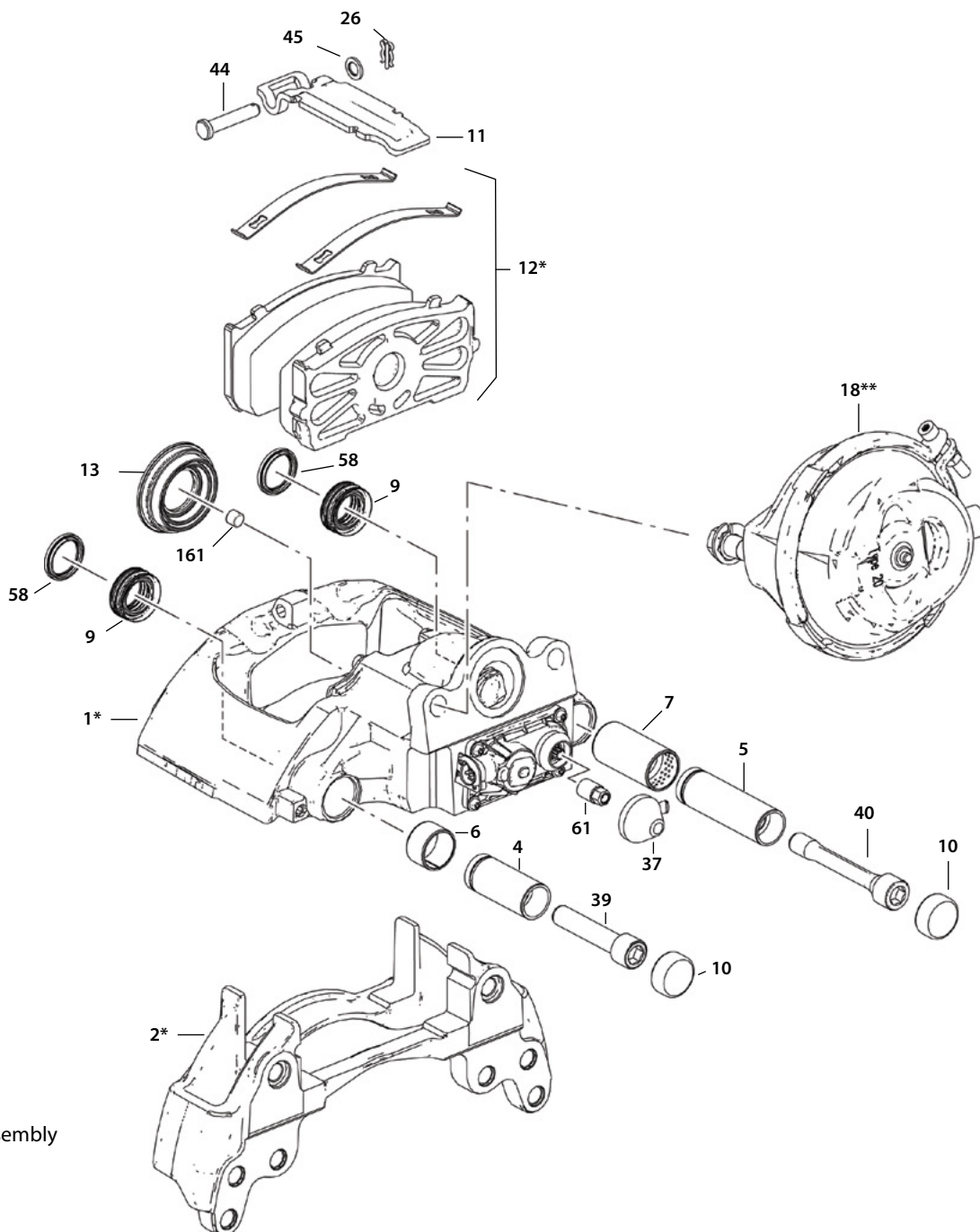


### Disposal of Waste Equipment by Business Users in the European Union

This symbol on the product, packaging or in user instructions, indicates that this product must not be disposed of with other general waste. Instead, it is your responsibility to dispose of the waste electrical and electronic parts of this product by handing them over to a company or organisation authorised for the recycling of waste electrical and electronic equipment. For more information about arrangements for waste equipment disposal please contact your Knorr-Bremse distributor or local Knorr-Bremse representative.

# 1 OVERVIEW

## 1.1 Disc Brake Components



### Legend:

- 1 Caliper\*
- 2 Carrier\*
- 4 Guide Pin\*
- 5 Guide Pin
- 6 Guide Sleeve\*
- 7 Brass Bush\*
- 9 Inner Boot\*
- 10 Cover\*
- 11 Pad Retainer\*
- 12 Pad (complete)\*
- 13 Tappet and Boot Assembly
- 18 Brake Actuator\*\*
- 26 Spring Clip
- 37 Adjuster Cap
- 39 Caliper Mounting Bolt\*
- 40 Caliper Mounting Bolt\*
- 44 Pad Retainer Pin
- 45 Washer
- 58 Ring\*
- 61 Shear Adapter
- 161 Tappet Bush

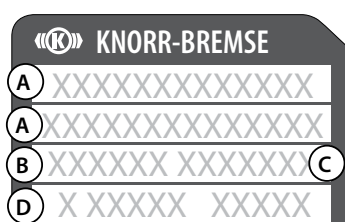
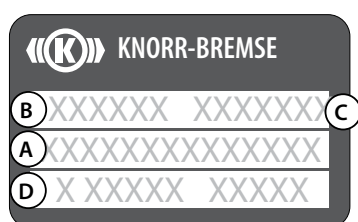
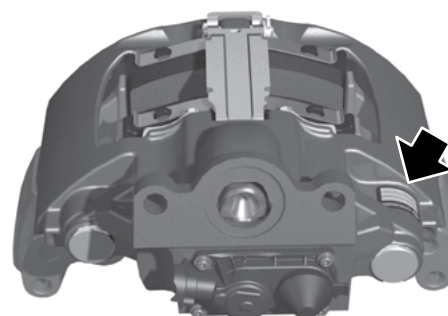
\* Variants possible (see also contents leaflet in the service kit)

\*\* Brake chamber or spring brake

# 1 OVERVIEW

## 1.2 Disc Brake Identification and Service Kits

A = Axle or vehicle manufacturer's identification number  
 B = Knorr-Bremse brake type number  
 C = Knorr-Bremse part number  
 D = Knorr-Bremse date of manufacture



*Use only genuine Knorr-Bremse parts!*

The following service kits are available:

Description	Content (Position No.)	
Carrier	Carrier (2) 1x	For specific service part numbers allocated to the disc brake see: <i>truckservices.knorr-bremse.com</i> <i>mytruckservices.knorr-bremse.com</i>
Guide and Seal Kit	4, 5, 6, 7, 9(2x), 10(2x), 39, 40, 58(2x)	
Tappet and Boot Kit	13 (2x), 161 (2x)	
Adjuster Cap	37 (10 Stck), 61 (10 Stck)	
Brake Pads (axle set)	11, 26, 44, 45	
Caliper	Supplied without carrier (2) and without brake pads (12). Guide Pins and Seals kit included for assembly of caliper to existing brake carrier	Knorr-Bremse offers a range of specifically designed rationalised calipers to service a wide range of disc brakes.  For specific caliper part number, see: <i>truckservices.knorr-bremse.com</i> <i>mytruckservices.knorr-bremse.com</i>

## 1.3 Brake Disc

Replacing brake discs is subject to the instructions of the vehicle or axle manufacturer, including when fitting Knorr-Bremse brake discs.

When replacing brake discs, make sure to use the correct connections and tightening torques.

The use of non-approved brake discs will reduce levels of safety, and will not be covered by any Knorr-Bremse liability.


Knorr-Bremse recommends the brake disc be changed as an axle set. Brake discs can be ordered through the Knorr-Bremse aftermarket organisation.


Additionally Knorr-Bremse recommends brake discs be changed at the latest every 6 years, even if the wear limits have not been reached.



## 2 GENERAL INFORMATION

 The use of impact screwdrivers / impact wrenches in conjunction with Knorr-Bremse service tools for air disc brakes is not permitted. The service tools are not designed for such use.

 Never turn the Adjuster (23) without Shear Adapter (61). If the given shear point of the Shear Adapter (61) is reached, the adapter will fail. Try again using a brand new shear adapter. If the adapter fails a second time, the whole caliper will need replacing due to internal damage. Do not use an open-ended spanner on the adapter as this could damage it.

 Attention: Risk of injury. Knorr-Bremse accepts no liability for damage or injury resulting from negligence; any damage to service tools resulting from such actions will void all warranty.

### 2.1 Service Tools

Tool	Description	Consisting of tool components:
(A)	Wedged fork for removal of tappet and boot assembly (13)	T15
(B)	Press-in tool for tappet and boot assembly (13)	T02, T30, T31, T32
(C)	Pull-in tool for inner boot (9)	T35, T38, T39
(D)	Pull-in/Pull-out tool for guide sleeve (6) and brass bush (7)	T20, T33, T34, T35, T36
(F)	Grooving tool for brass bush (7)	T37
(G)	Press-in tool for cover (10)	T43

**Note:** The current service tool kit (Part No. K039062K50) contains the above listed tool components. Older tool kits can be updated by purchasing supplementary tools (see table on page 2).

### 2.2 Diagnostic Equipment

Part No.	Description
K154433N50	A Knorr-Bremse hand-held device for checking potentiometer function (see also Service News Y123889)

### 2.3 Lubricant

Part No.	Quantity	Colour	Application
II14525	5g	White	5.2; 7.2; 8.2; 9.2; 9.3; 9.5; 11
K093430	10g	White	5.2; 7.2; 8.2; 9.2; 9.3; 9.5; 11
II32868	500g	White	5.2; 7.2; 8.2; 9.2; 9.3; 9.5; 11
K125122N50	1000g	White	6.2

### 2.4 Torque Requirements

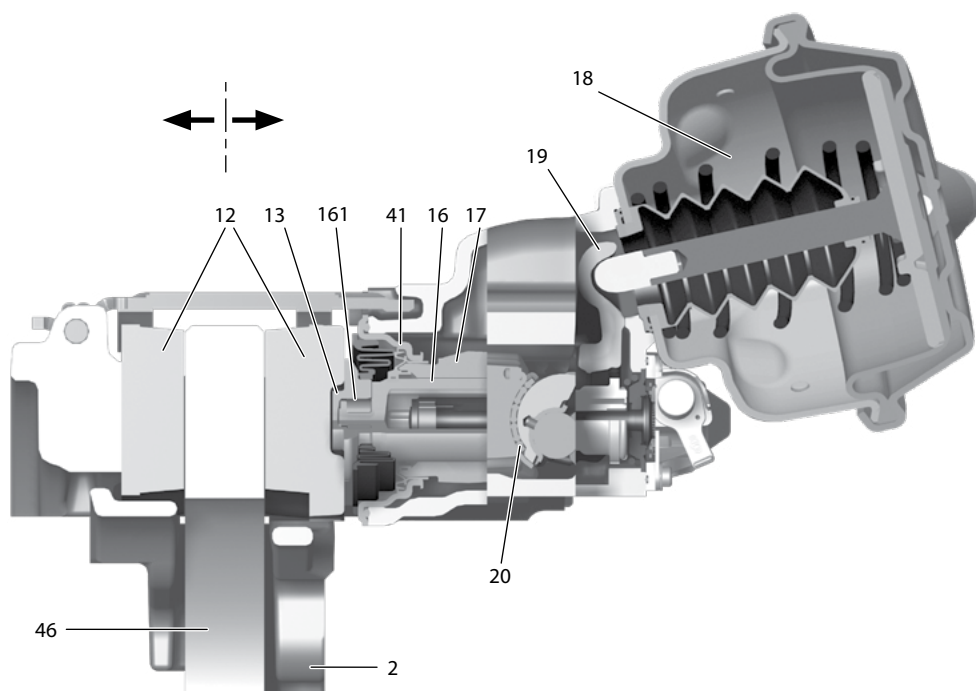
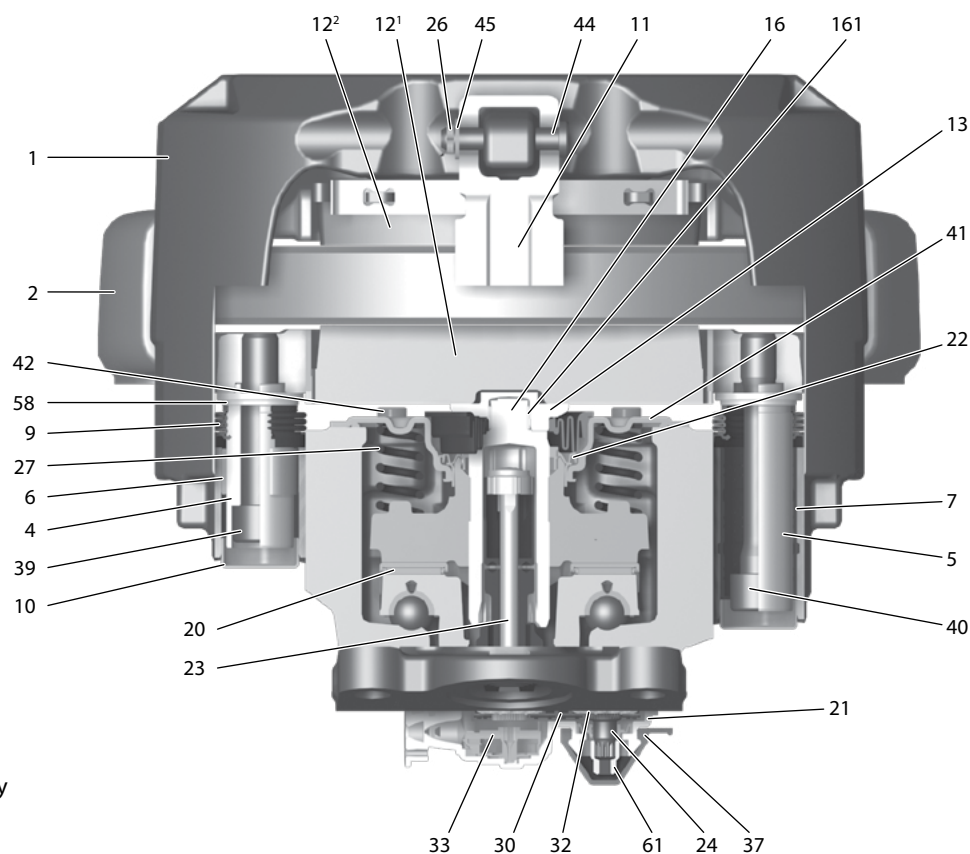
Item No.	Description	Torque	Spanner Size (mm)
39; 40	Caliper bolts (2x) M16x1.5 (hexagon socket head)	180 Nm plus 90°	14 (Hexagon key)
18	Brake chamber or spring brake	Follow the instructions of the brake actuator or vehicle manufacturer	

## 3 DESCRIPTION AND FUNCTION

### 3.1 Disc Brake Sectioned View

#### Legend:

- 1 Caliper
- 2 Carrier
- 4 Guide Pin
- 5 Guide Pin
- 6 Guide Sleeve
- 7 Brass Bush
- 9 Inner Boot
- 10 Cover
- 11 Pad Retainer
- 12 Pad (complete)
- 13 Tappet and Boot Assembly
- 16 Threaded Tube
- 17 Bridge
- 18 Brake Actuator
- 19 Lever
- 20 Eccentric Bearing
- 21 Cover Unit
- 22 Inner Seal
- 23 Adjuster Unit
- 24 Adjuster Shaft
- 26 Spring Clip
- 27 Return Spring
- 30 Chain
- 32 Chain Wheel
- 33 Wear Sensor
- 37 Adjuster Cap
- 39 Caliper Mounting Bolt
- 40 Caliper Mounting Bolt
- 41 Closure Plate
- 42 Cap Head Screw
- 44 Pad Retainer Pin
- 45 Washer
- 46 Brake Disc
- 58 Ring
- 61 Shear Adapter
- 161 Tappet Bush



## 3.2 Description of Operation

(Floating caliper principle)

### Brake Actuation

During actuation, the push rod of the actuator (18) moves the lever (19). The input forces are transferred via the eccentric roller bearing (20) to the bridge (17). The force is then distributed by the bridge (17) and the two threaded tubes (16) to the tappet

and boot assemblies (13) and finally to the inboard pad (12<sup>1</sup>).

After overcoming the running clearance between the inboard pad (12<sup>1</sup>) and the brake disc (46), the reaction forces are transmitted by the caliper to the outboard pad (12<sup>2</sup>). The clamping forces on the pads and the disc (46) generate the braking force for the wheel.

### Brake Release

After releasing the air pressure, the return spring (27) pushes the bridge (17) with the threaded tubes and lever (19) back to the start position.

### Brake Adjustment

The so called running clearance of the disc brake is the air gap between the brake pad (12) and the brake disc (46). This distance is necessary to achieve a free running (and therefore unbraked) disc when the brakes are in a 'non applied' state. Too large a running clearance can lead to a greater braking distance.

The designated running clearance is so designed to compensate for changes under typical use such as:

- expansion of parts due to high temperatures.
- viscoelastic effect of the brake pads.
- finish and runout tolerances of a brake disc and possible lip development

To ensure a constant running clearance between pads and disc, the brake is equipped with a non-wearing, automatic adjuster mechanism. The adjuster (23) operates with every cycle of actuation due to the mechanical connection with lever (19).

As the pads and disc wear, the running clearance increases. The adjuster (23) and turning device (24) turn the threaded tubes (16) by an amount necessary to compensate for this wear.

## 4 INSPECTION POINTS

Despite the use of long-life materials, it is necessary to check some of the components regularly for their general condition. The following inspection points will ensure a long-life and trouble-free operation of the disc brake.

### Every 3 months

The pad wear must be checked visually and independent of any wear indicator fitted to the vehicle (see Sections 5.1).

### With every pad replacement

It is important to check for the correct functioning of the adjuster (see Section 5.2) and the smooth operation of the caliper over its full range of movement (see Section 5.3). Also inspect the tappet and boot assemblies (13), the adjuster cap (37) and the sealing elements (9, 58) for correct fitting and condition as well as the caliper bearing in the area of the rubber bush/guide sleeve (6) (see Section 5.3.3).

### Annually

Check the caliper running clearance (see Section 5.3.1) and the correct fitting and condition of the cover (10), the adjuster cap (37) and cover (68c, 68d or 68e) (depending on the bearing variant).

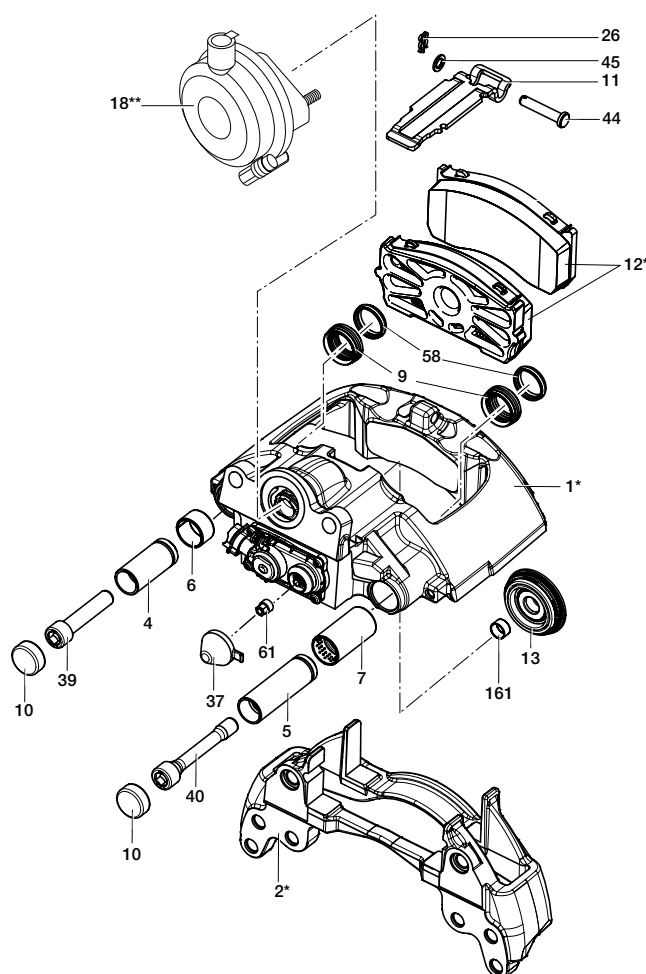
**Note:** These frequencies are a minimum and, depending on the vehicle application, a more frequent check of the components may be necessary.

Refer also to vehicle and/or axle manufacturer's instructions in regard to service intervals.

The discs should be checked according to the specification of the axle or vehicle manufacturer.

In the unlikely event of a problem, all relevant components must be returned in order that an objective investigation of the cause can be made.


For further information please refer to the Knorr-Bremse Document Y333409.



## 4.1 Safety Instructions for Service Work and Repair Work

Observe relevant safety instructions for service work and repair work on commercial vehicles, especially for jacking up and securing the vehicle.


Use only genuine Knorr-Bremse parts.

 *Before starting service work, ensure the service brake and parking brake, as well as the bus stop temporary hold brake, if fitted, are not applied and that the vehicle cannot roll away.*


Please follow service manual instructions and adhere to the wear limits of the pads and the discs (see Section 5.1).

Use only recommended tools (see Section 2.1).

Tighten bolts and nuts to the prescribed torque values (see Section 2.4).

 *Screw threads and tapped holes must be free of lubrication and residuals of thread locking products*

After re-fitting a wheel according to the vehicle manufacturer's recommendations, ensure that there is sufficient clearance between the tyre inflation valve, the caliper and the wheel rim, to avoid damage to the valve and the wheel.

 *After any service work:*  
*Check the brake performance and the system behaviour on a roller dynamometer. Check function and effectiveness. Bear in mind that a lower performance can appear during the breaking-in phase of the brake pads and/or the brake disc.*

Observe the "**Safety and Environment Guidelines**" section on pages 5 and 6.

## 5 FUNCTIONAL AND VISUAL CHECK

### 5.1 Wear Check of Pads and Brake Discs



For optimum safety, the pad and disc wear limits must not be exceeded.

#### Brake Pads

The thickness of the pads must be checked regularly dependent on the usage of the vehicle. The pads should be checked corresponding to any legal requirements that may apply. Even if a wear indicator is fitted and connected, this must be at least every 3 months.

5.1.1 Minor breakouts at the edges are permitted (see arrow).

5.1.2 Major breakouts on the surface of the brake pad are not permitted (see Fig.).

5.1.3 If the thickness of the friction material at its thinnest point is less than **2 mm** (dimension **C**) the pads must be replaced (see Fig.).

**A1** = Overall thickness of new brake pad **27 mm**

**A2** = Overall thickness of new brake pad **34 mm**

**B1** = Backplate **8 mm**

**B2** = Backplate **15 mm**

**C** = Minimum thickness of friction material **2 mm\***.

**D1** = Minimum allowed thickness in worn condition for backplate and friction material **10 mm\***

**D2** = Minimum allowed thickness in worn condition for backplate and friction material **17 mm\***

\*If these minimum allowed thicknesses are reached, brake pads must be replaced as an axle set.

#### Brake Disc

Measure the thickness of the brake disc at the thinnest point. Be aware of possible burring at the edge of the disc.

**E** = Total thickness of the brake disc

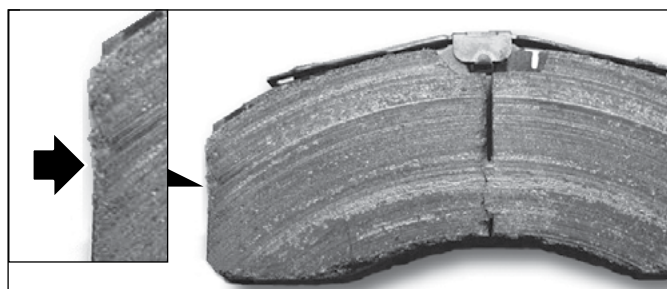
new condition = **34 mm**

worn condition = **28 mm** (the disc must be replaced)

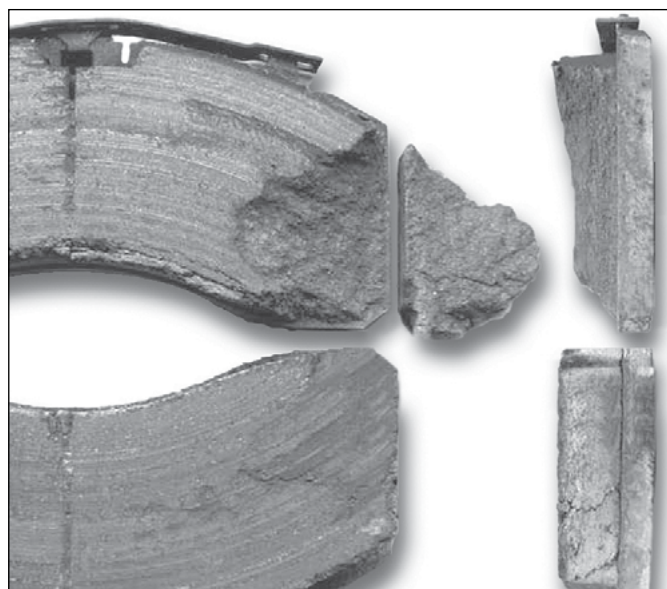
If the disc dimension **E ≤ 30 mm**, it is recommended that the disc should be renewed when the brake pads are changed.



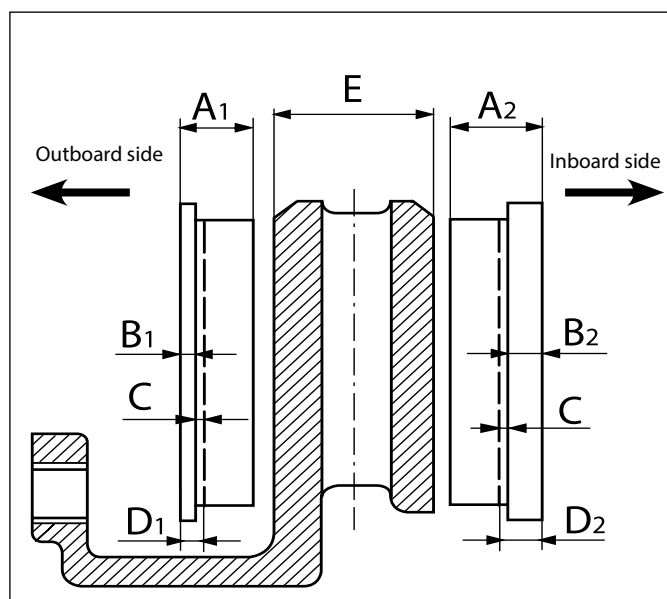
If these recommendations are ignored, there is a danger of brake failure and therefore increased risk of an accident.



5.1.1 - Brake pad with minor damage (permitted)



5.1.2 - Brake pad with major damage (not permitted)



5.1.3 - Brake pad and disc thicknesses



5.1.8 Check the discs per axle at each change of pads for grooves and cracks. If necessary replace the disc.

The figure shows possible surface conditions of the brake disc.

**A1** = Small cracks spread over the surface are allowed

**B1** = Cracks less than **1.5 mm** deep or wide, running in a radial direction are allowed  
Cracks to a max. length of **0.75 x a** are allowed  
(a = width of the friction ring)

**C1** = Unevenness of the disc surface less than **1.5 mm** deep is allowed

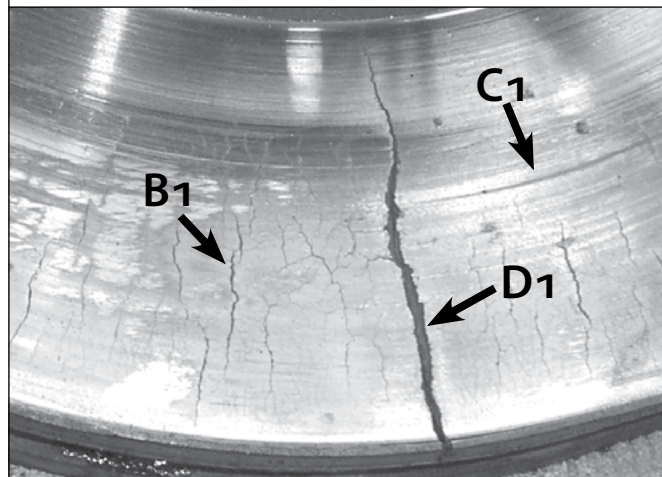
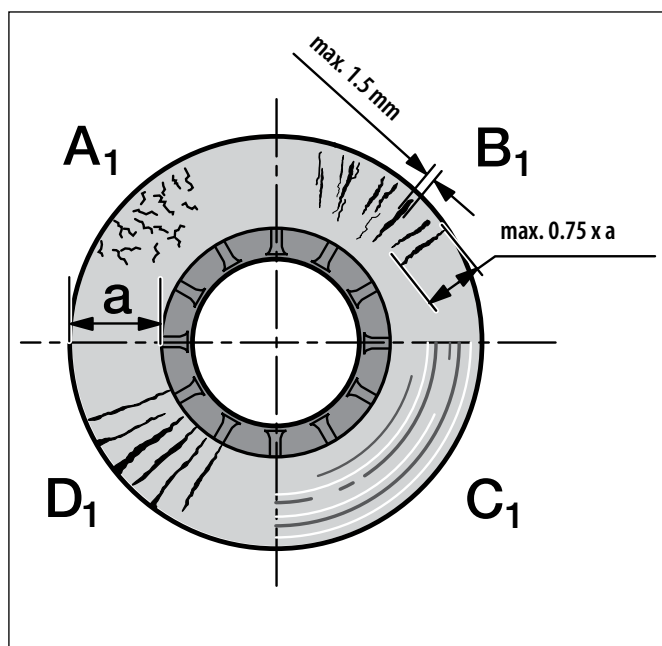
**D1** = Cracks going through to the cooling duct or onto the inner or to the outer edge of the friction ring are not allowed and the disc **MUST BE REPLACED**.

The photograph shows a real-life example of such cracks and wear grooves.

**Note:** In case of surface conditions **A1**, **B1** or **C1**, the disc can continue to be used until the minimum thickness **M = 28 mm** is reached.

Knorr-Bremse discs are normally service-free and grinding when changing pads is not necessary. However, grinding could be useful, e.g. to increase the load-bearing surface of the pads after severe grooving on the entire friction surface has occurred. To meet safety requirements, the minimum thickness after machining must be greater than **30 mm**.

In addition, the recommendations of the vehicle manufacturer about the machining of the brake disc **MUST** be followed.



5.1.8 - Tolerances and examples of cracks and grooves on a brake disc.



Grinding of a Knorr-Bremse Splined Disc® is not allowed.



If these recommendations are ignored, there is a risk of an accident. If the brake pads and/or the brake disc are worn down excessively, brake performance will be reduced and may be lost completely.

## 5 FUNCTIONAL AND VISUAL CHECK


### Brake Pad/Disc Wear Check (on vehicle) using Carrier to Caliper position with bearing variant (6c and 6e) Guide Sleeve and variant (6d) Capped Rubber Sleeve

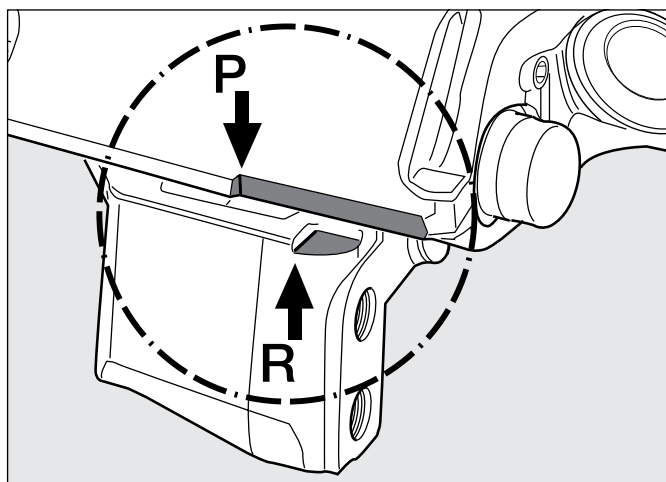
For all disc brakes which are equipped with a caliper to carrier marking.

5.1.9 The pad/disc wear can be visually determined without removing the road wheel by viewing the position of the caliper position **P** compared to the carrier marking **R** (see Figs.).

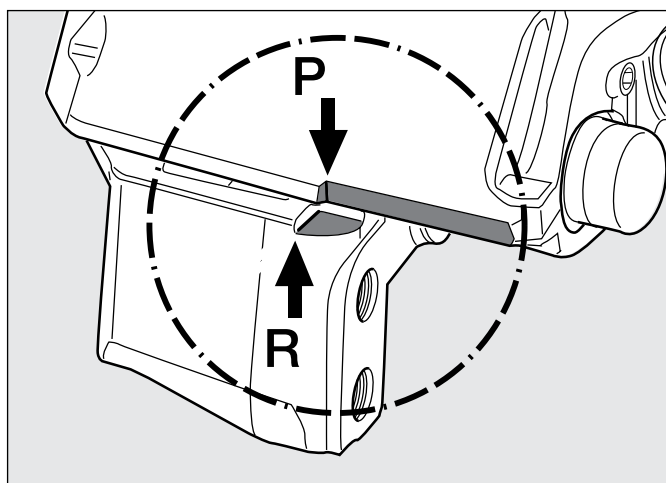
If the positions of **P** and **R** are similar to those shown in 5.1.9b, the brake pad thickness and the brake disc must be checked with the wheel removed. Depending on operating conditions, it may be necessary to check brake pad thickness and brake disc even before these dimensions are reached.

If any minimal tolerance limits have been reached (see Section 5.1) the pads and/or disc must be changed.

 **Brake Discs and Pads must be changed as an axle set** (see Section 6).



5.1.9a - Position of points **P** and **R** with new brake pads and disc



5.1.9b - Position of points **P** and **R** requires inspection of pad and discs with wheel removed



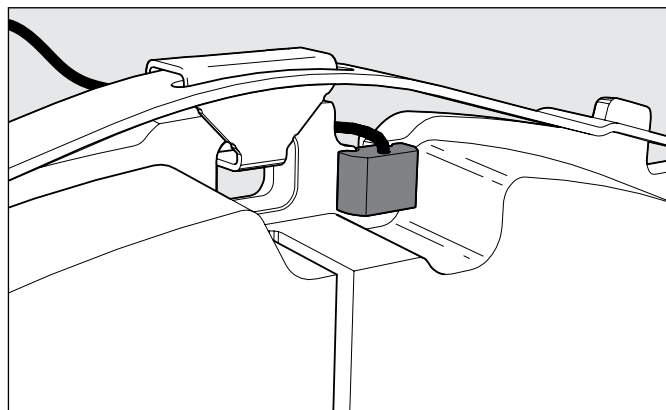
### Wear Indicators

5.1.10 Due to different vehicle manufacturers and vehicles there are several types of pad wear indicator used.

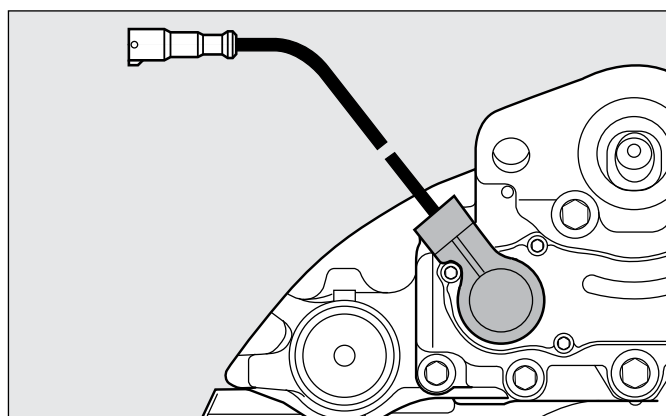
- a) In-pad normally **closed** indicator - circuit is broken when pad wear reaches limit (see Fig.).
- b) In-pad normally **open** indicator - circuit is made when pad wear reaches limit (see Fig.).
- c) Wear indicator using built-in potentiometer. This is available either as an **on/off** version or as a **continuous** signal version which can be linked to the vehicle's electronic monitoring systems (see Fig.).

Either acoustic or optical diagnostic units can be connected.

**Note:** Please also refer to specifications provided by the vehicle manufacturer.



5.1.10a - 5.1.10b - In-pad wear Indicator



5.1.10c - Wear Indicator with built-in potentiometer

### Knorr-Bremse diagnostic unit K154433N50

The Knorr-Bremse Potentiometer Tester serves;

- To test the Potentiometer function on Knorr-Bremse disc brakes
- To check the wear condition of the brake pads and brake discs

5.1.11 The Tester can be used on all current Knorr-Bremse brake types with continues or black/white Potentiometer.


**Note:** Knorr-Bremse recommends that before replacing a brake caliper with a suspected potentiometer failure, that it first be tested using the Potentiometer Tester. If no defect is found, the cause is not with the brake caliper and therefore does not need replacing.



5.1.11 - Knorr-Bremse diagnostic unit K154433N50

## 5 FUNCTIONAL AND VISUAL CHECK

### 5.2 Adjuster Check

 Before starting work, ensure that the wheels are chocked and the vehicle cannot roll away.

Ensure that service brake and parking brake, as well as bus stop temporary hold brake, if fitted, are in the released condition.


**Remove the wheel** (refer to vehicle manufacturer's recommendations).

5.2.1 If, due to the orientation of the caliper on the axle, there is no danger of the brake pads falling out, remove the pad retainer (11).


5.2.2 Push and pull caliper three times in an axial direction to check that there is clearance present.

5.2.3 Push caliper outboard on its guide pins (see Fig.).

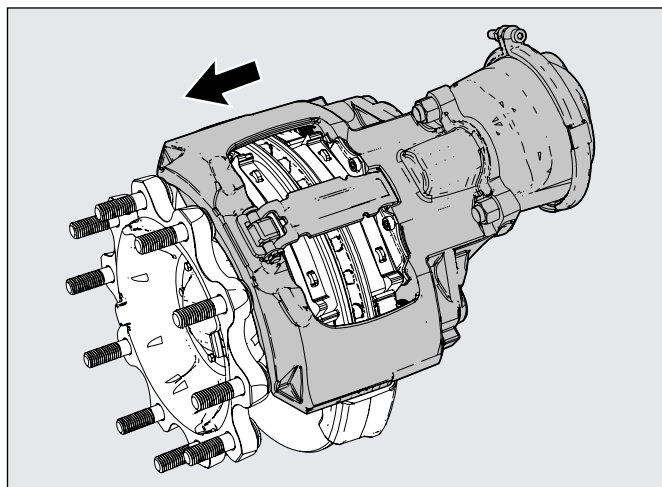
5.2.4 Using a suitable tool, lever the outboard pad (12) away from the contact surface towards the tappet (13) (see Fig.).

 Make sure there is no dirt between the pad's backplate and the caliper contact surface, as this may lead to an incorrect measurement. Clean if necessary.

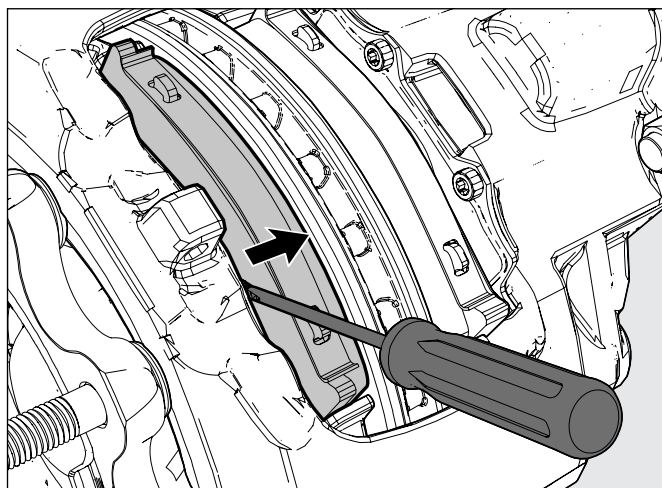
5.2.5 Check the gap between the pad abutment and the outboard pad backplate (12). The gap must measure between **0.6** and **1.1 mm**.

 If the clearance is too great, there is a danger of brake failure. If the clearance is too small, there is a danger of overheating that may lead to consequential damage.

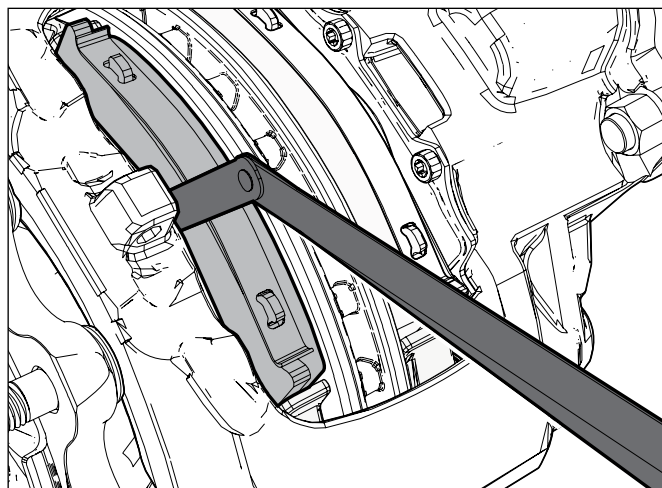
**Note:** If the clearance is too great or too small, it may be due to the adjuster not functioning correctly, in which case this should be checked as described in the following steps:



5.2.3 - Push caliper outboard



5.2.4 - Press inboard pad away from tappets



5.2.5 - Check gap between tappets and inboard pad

5.2.6 Pull off the adjuster cap (37) using the tag, taking care not to lose the shear adapter (61) (see Fig.).

**!** Removal of the adjuster cap (37) with a screwdriver, or similar, is not allowed since the seal may be damaged.

5.2.7 The adjuster (23) must be turned with the shear adapter (61) anti-clockwise (viewed from actuator side) for **three clicks** (increasing running clearance).

**!** Never turn adjuster (23) without shear adapter (61) being fitted. If the shear torque of the shear adapter is exceeded, then it is designed to fail. Try again with a new (unused) shear adapter. With a second failure of the shear adapter the caliper must be exchanged since internal damage is present.

**Do not** use an open-ended spanner as this may damage the adapter.

**!** Make sure the ring spanner or socket can turn freely clockwise during the following procedure.

5.2.8 By applying the brake (about 2 bar) 5 to 10 times the spanner or socket should turn clockwise (viewed from actuator side) in small increments if the adapter is functioning correctly (see Fig.).

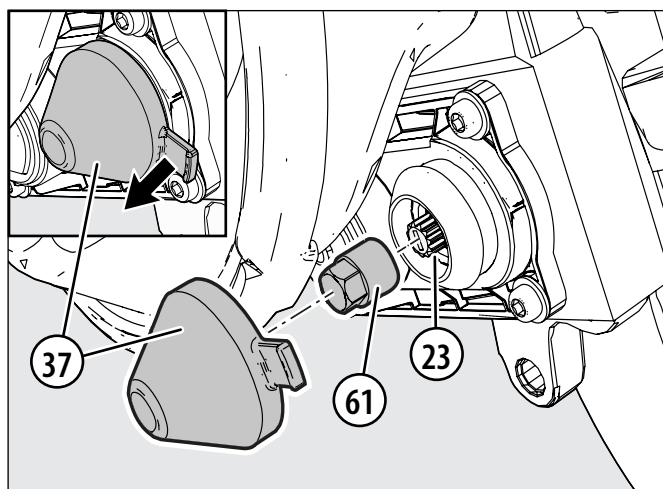
**Note:** As the number of applications increases, incremental movement of the ring-spanner or socket will decrease.

If the spanner or socket does not turn or turns only with the first application or turns forward and backward with every application, the automatic adjuster has failed and the caliper must be replaced.

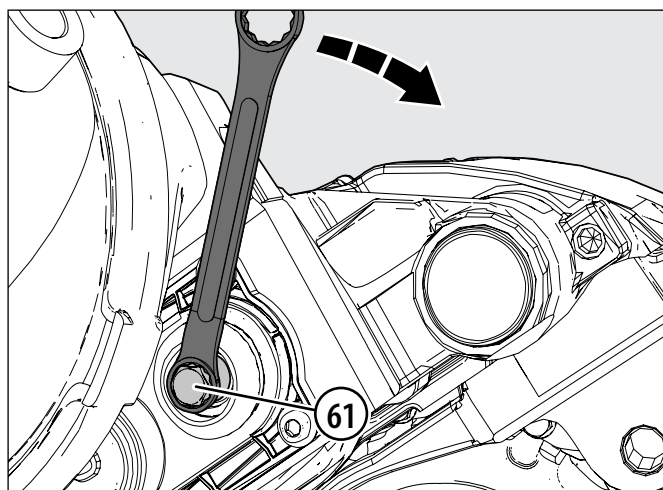
5.2.9 Lightly grease the contact surface of the cap with white grease (Part No. II14525, K093430 or II32868).

The tag of the adjuster cap (37) should be positioned as shown by the arrow in the adjacent figure. This ensures access is maintained for subsequent removal (see Fig.).

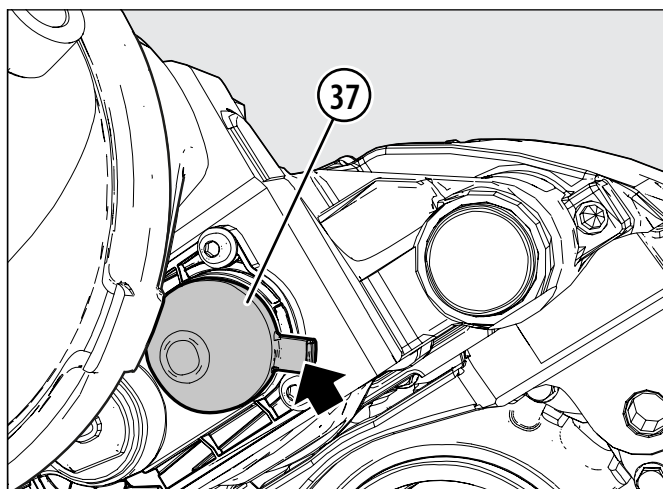
**Note:** A new adjuster cap (37) should be fitted even if the brake pads are not being replaced.



5.2.6 - Remove cap using the tag



5.2.8 - Apply the brake 5-10 times, spanner turns clockwise



5.2.9 - Tag positioning of the cap

## 5 FUNCTIONAL AND VISUAL CHECK

### 5.3 Caliper Check

#### Caliper Running Clearance

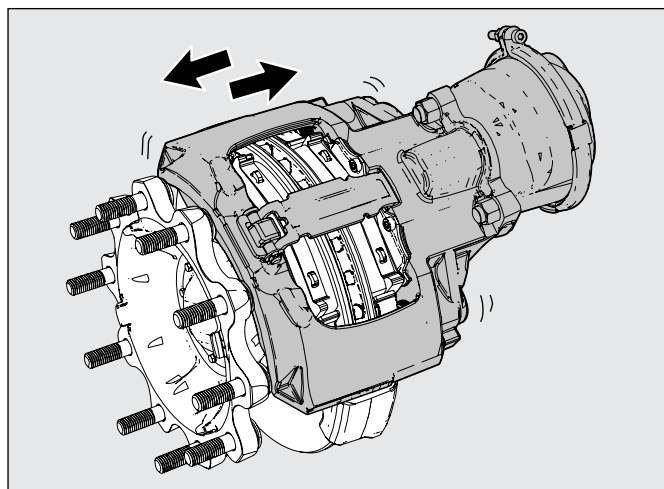


*Before starting work, ensure that the wheels are chocked and the vehicle cannot roll away.*

**Ensure that service brake and parking brake, as well as the bus stop temporary hold brake, if fitted, are in the released condition.**

5.3.1 By pushing and pulling the caliper in an axial direction by hand, a movement within the running clearance of **0.6 - 1.1 mm** (see Section 5.2) must be possible (see Fig.).

If, even using a high level of hand pressure (no tools), the caliper does not reach the running clearance of **0.6** to **1.1 mm** or is not moveable, the caliper guide pin seals must be examined (see Section 5.4).

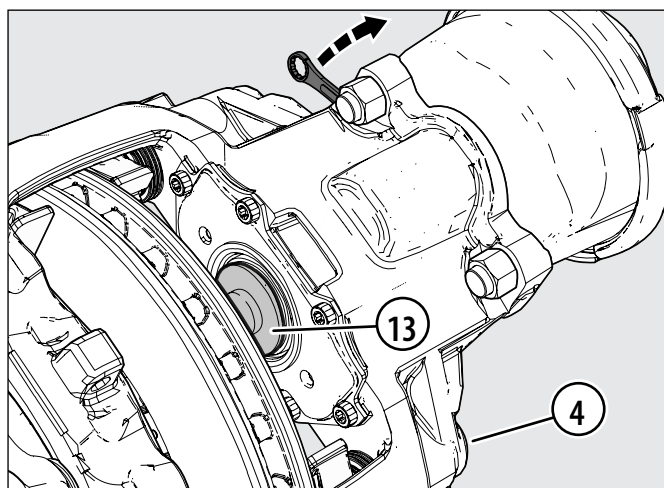


5.3.1 - Push and pull hand test

#### Caliper Movement along Guide Pins

5.3.2 Remove brake pads (see Section 6.1).

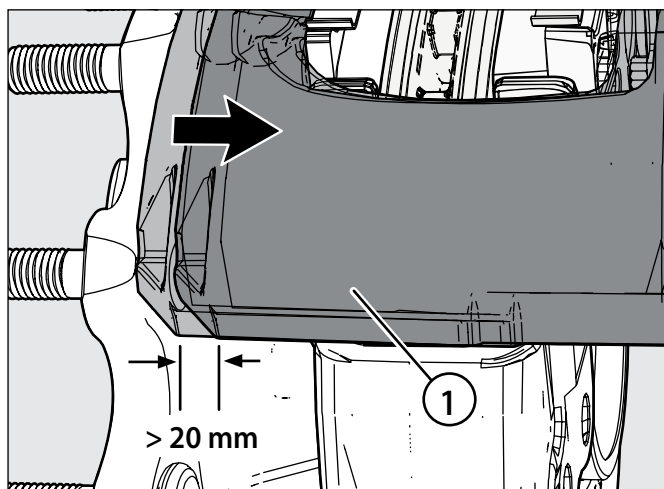
5.3.3 Rewind the tappet (13) completely back using a ring spanner and shear adapter (61). Clean dirt from around the guide bush (4) (see Fig.).



5.3.3 -Rewind tappets completely

5.3.4 Caliper (1) must slide freely along the whole length of the guide pin arrangement; movement should be greater than **20 mm**. (see Fig.).

If the caliper does not move at least **20 mm**, the caliper guide pin seals must be examined (see Section 5.4).



5.3.4 - Free movement of caliper > 20 mm

### Clearance Measurement of Guide Sleeve (6)

**Note:** Before commencing (removing the wheel), make sure there is no contact between caliper and axle, vehicle, chassis sections or carrier. In any such an event, the guide sleeve (6) must be replaced (see Section 10.2)

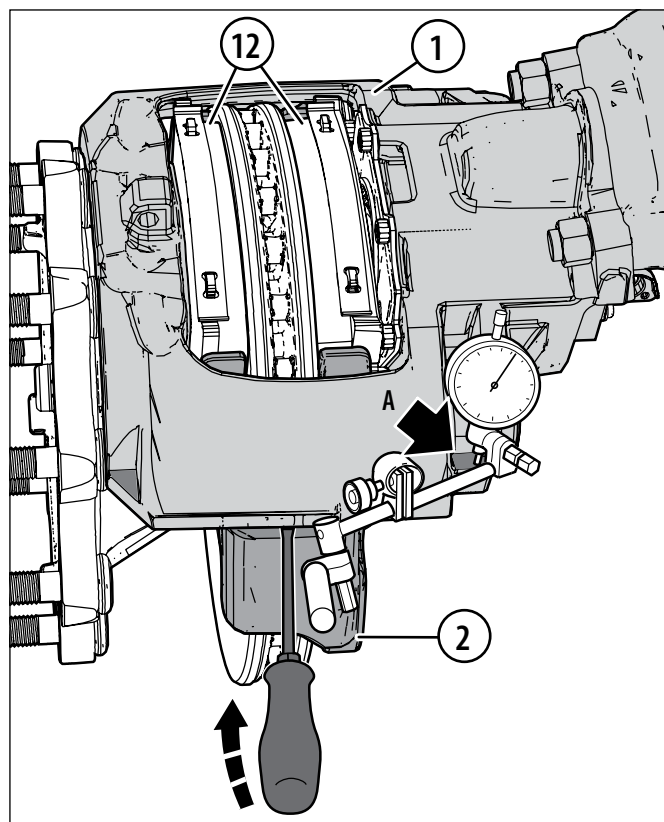
5.3.5 Remove the wheel, refer to vehicle manufacturer's recommendations.

5.3.6 Remove the pad retainer (11) (see Section 6.1.2)

To achieve the correct reading it is necessary to have a pair of new brake pads fitted.

If the clearance measuring is not taking place during a brake pad replacement, the current position of the assembled pads must be noted, so that they can be re-assembled in the same position. Remove old pads (see Section 6) (at this point Section 5.1 "Wear Check of Pads and Brake Discs" must also be observed) and fit new pads.

5.3.7 Fasten a magnetic dial-gauge holder to the carrier (2) on the short bearing side of the caliper (1). Use the casting tag on the caliper (1) as the measuring point - see arrow A (see Fig.).



5.3.7 - 5.3.10 -Measuring Guide Sleeve clearance

5.3.8 Set the dial-gauge to zero.

5.3.9 Place a suitable tool (e.g. screwdriver with at least 200 mm in length) in a central position between carrier (2) and caliper (1) and lever them in opposite directions (using normal hand-force) (see Fig.).

5.3.10 Read the maximum value of the bearing clearance on the dial-gauge.

**If the clearance is greater than 1 mm, the complete bearing will need replacing using the relevant service kit (see Section. 1.2 and Section. 10.2).**

If the clearance measuring is not taking place during a brake pad replacement, the new pads should be removed and the previously marked brake pads fitted in their original positions (see Section 6). Otherwise, replace with new brake pads as an axle set and set the clearance (see Section 6.2).

5.3.11 Fit the wheel (refer to vehicle manufacturer's recommendations). After replacing the wheel, check that it rotates without interference.



## 5 FUNCTIONAL AND VISUAL CHECK

### 5.4 Checking of Sealing Elements

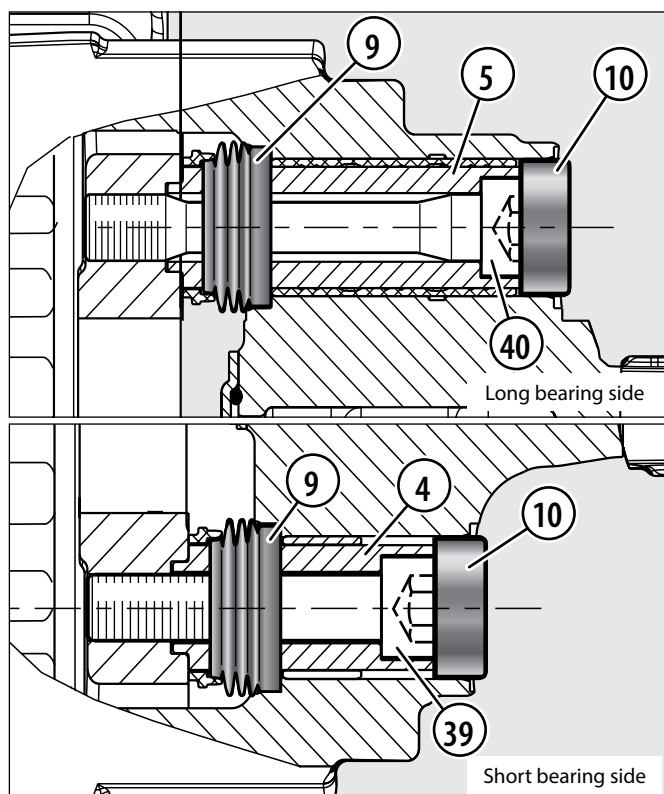
#### Caliper Guide Pin Seals

5.4.1 The guide pins (4) and (5) are sealed with cover (10) and inner boot (9). These items must be free of any signs of damage (see Fig.).

Check for correct location and fitting.

If necessary, remove pads (12) to inspect the inner boots (9) (see section 6.1).

If necessary, repair caliper with suitable service kit (see Section 1.2 and Section 8).




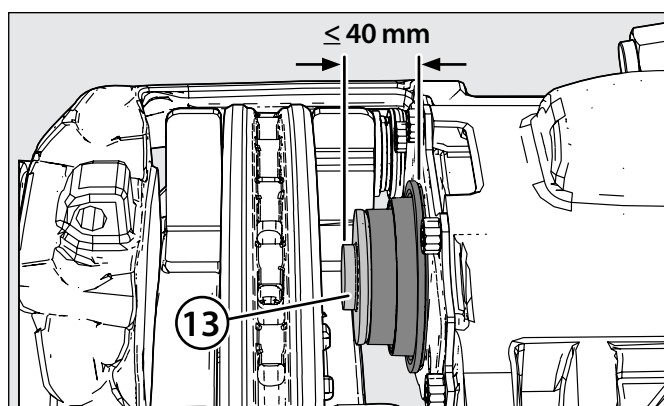
5.4.1 - Checking of guide pin and seals

#### Checking of Tappet and Boot Assembly (13)

If necessary remove pads (12) (see Section 6.1).

5.4.2 Screw out the tappet (13) using the shear adapter (61) clockwise (see Section 5.2) until the boot is clearly visible (see Fig.).

 The tappet must not be extended more than 40 mm.

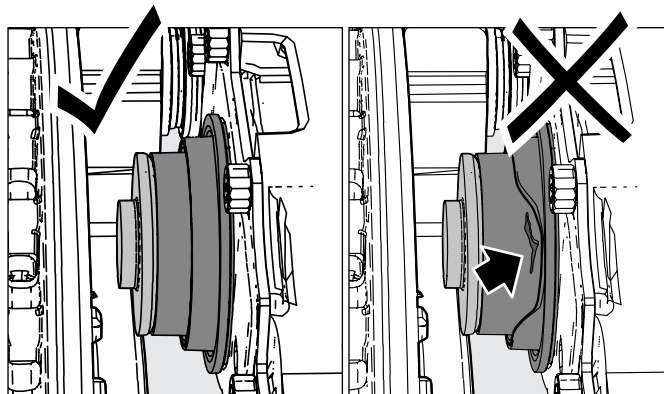


5.4.2 - Screw out tappet - max. 40 mm

5.4.3 The rubber boot on the tappet (13) must not have any cuts/tears or show any other signs of damage (see Fig.). Check for correct location and fitting.

**Note:** The penetration of dirt and moisture into the brake will lead to corrosion and impair the function of the clamping mechanism and wear adjuster.

If necessary replace tappet and boot assembly (see Section 7).



5.4.3 - Check rubber boot for damage

## 6 BRAKE PAD REPLACEMENT

**⚠** Before starting work, ensure that the wheels are chocked and the vehicle cannot roll away.

**Ensure that service brake and parking brake, as well as bus stop temporary hold brake, if fitted, are in the released condition.**

**⚠** During service work on vehicles with electronic parking brake, service or parking brake, or bus stop temporary hold brake, the brake system must be set to service and maintenance mode. Please also observe the instructions of the vehicle manufacturer.

### 6.1 Removal of Brake Pads

6.1.1 Remove wheel (refer to vehicle manufacturer's recommendations).

#### Important!

Before removing pads it is strongly recommended that the adjuster mechanism is checked for correct operation (see Section 5.2).

**⚠** Depending on the orientation of the caliper on the axle, brake pads could fall out when removing the pad retainer (11).

6.1.2 Remove spring clip (26) and washer (45), depress the pad retainer (11) and remove pin (44) (see Fig).

If necessary remove any in-pad wear sensor components.

6.1.3 Pull off the adjuster cap (37) using the tab, taking care not to lose the shear adapter (61) (see Fig. insert).

**Note:** Do not use any tools to remove the cap (37) as this can damage the sealing elements of the adjuster.

6.1.4 Fully wind back the tappet and boot assembly (13) by rotating the shear adapter (61) in an anti-clockwise direction (as viewed from actuator side) (see Section 5.2) – a clicking noise is generated (see Fig.).

**⚠** Never turn adjuster (23) without shear adapter (61) being fitted. If the shear torque of the shear adapter is exceeded, then it is designed to fail. Try again with a new (unused) shear adapter. With a second failure of the shear adapter the caliper must be exchanged since internal damage is present.

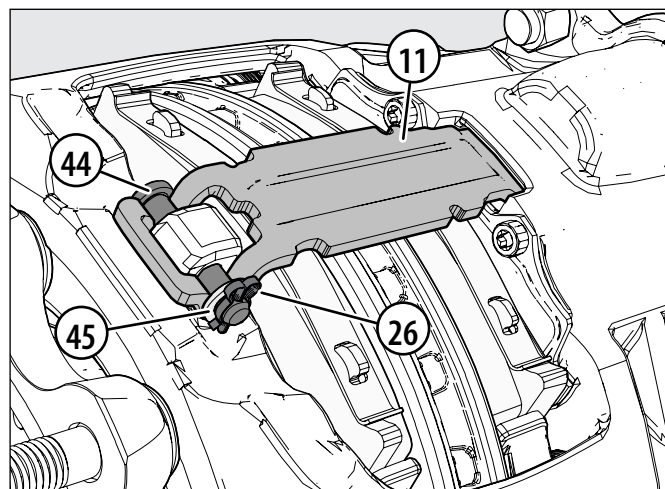
**Do not** use an open-ended spanner on the shear adapter!

6.1.5 Remove the outboard brake pad (12<sup>2</sup>) (see Fig.).

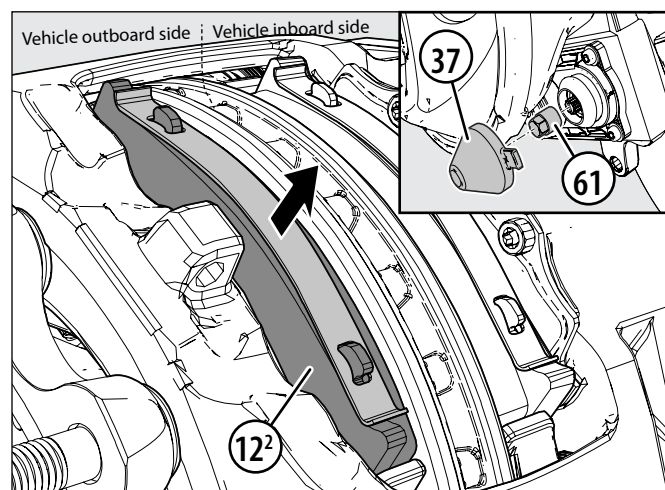
6.1.6 The inboard brake pad (12<sup>1</sup>) is guided by grooves in the Carrier (2) and is removed as follows:

- Pull caliper (1) towards the actuator (see Arrow "X").
- Push the inboard pad (12) towards the Actuator until it can be pulled out from the Carrier's grooves
- Now the inboard pad can be removed from the pad abutment

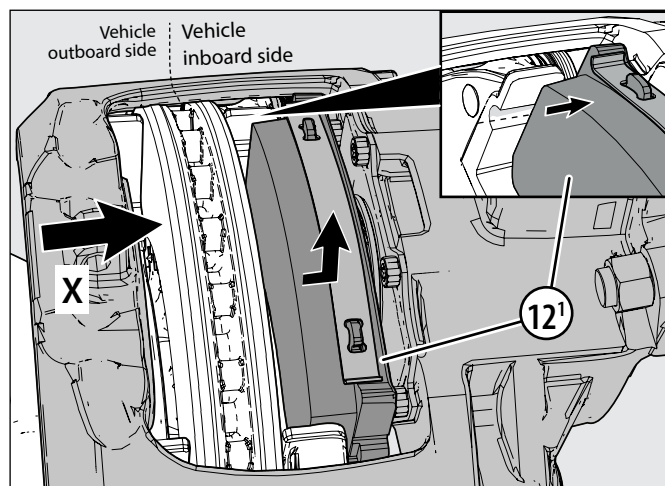
**Note:** The inboard brake pad (12<sup>1</sup>) can only be removed after the outboard brake pad (12<sup>2</sup>) has been removed.



6.1.2 - Removing pad retainer



6.1.3 - 6.1.5 - Rewind adjuster using shear adapter and remove firstly the outboard pad



6.1.6 - Push caliper inboard and remove inboard brake pad

## 6 BRAKE PAD REPLACEMENT

### 6.2 Pad fitting



*Pads must be changed as an axle set and NOT individually. Use only pads which are permitted by the vehicle manufacturer, axle manufacturer and disc brake manufacturer. Failure to comply with this will invalidate any Knorr-Bremse warranty, may invalidate the vehicle manufacturer's warranty and may impact on the vehicle's operating licence.*



*Fully wind back the tappet and boot assembly (13) by rotating the shear adapter (61) in an anti-clockwise direction.*

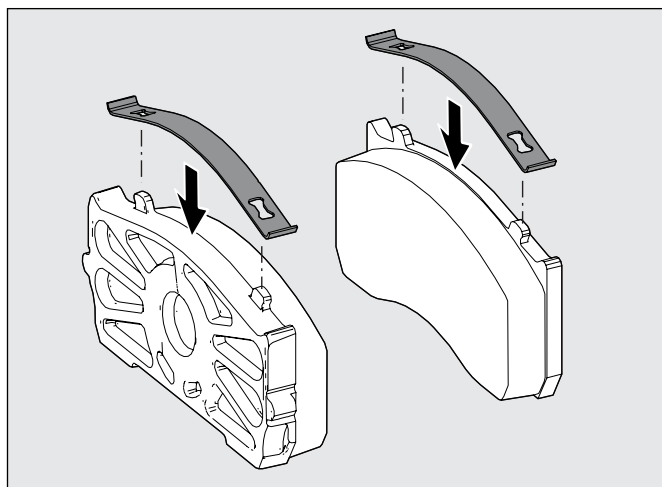
**6.2.1** If the service kit contains separate brake pad holder springs, these must be fitted first before continuing (see Fig.).

**6.2.2** Clean the pad abutments.

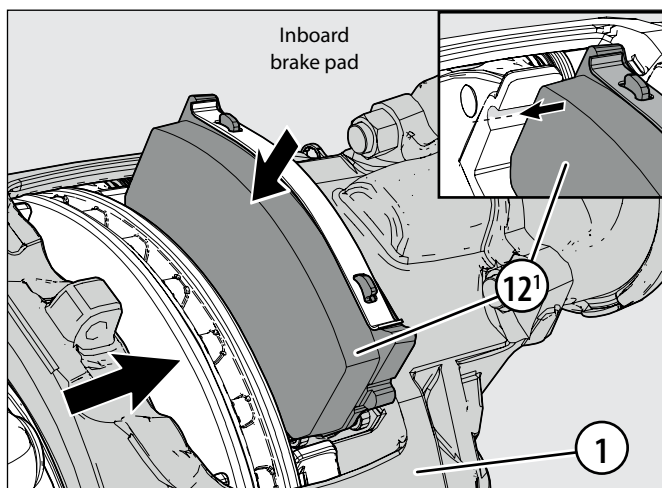
**6.2.3** Fit the brake pad as follows:

The geometry of the pad back plate for the **SN5** disc brake requires the following installation sequence of the brake pads (12).

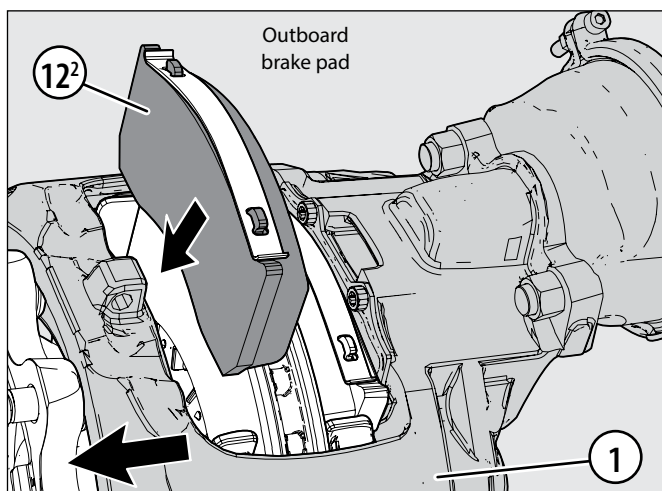
- Push caliper (1) towards the actuator. The inboard pad is guided over the grooves into the carrier (2) - Fit the inboard Pad (121). - (see Fig. 6.2.3a)
- Push caliper (1) towards the outside of the vehicle and fit the outboard brake pad (122) - (see Fig. 6.2.3b).



6.2.1 - Fitting the brake pad holder springs



6.2.3a - Fitting the inboard brake pad



6.2.3b - Fitting the outboard brake pad

**6.2.4** Turn the shear adapter (61) clockwise until the pads come into contact with the disc. Do not overwind the adjuster. Then turn back the adjuster **three clicks** and check the running clearance (see Section 5.2).



*If the clearance is too large there is a danger of brake failure. If the clearance is too small there is a danger of overheating that may lead to consequential damage.*

*Before the installation of the brake pads the tappet and boot assembly (13) must be fully wound back.*

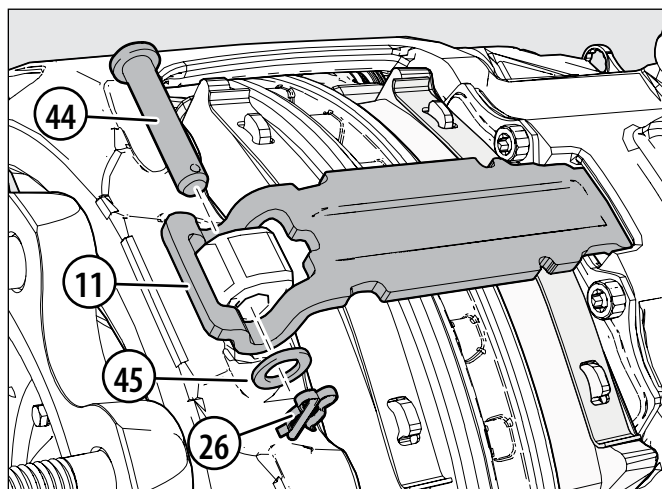


6.2.5 After fitting the pad retainer (11) into the groove of the caliper (1), it must be depressed to enable the insertion of the pad retainer pin (44) (only use new parts).

Fit a new washer (45) and then a new spring clip (26) to the pad retainer pin (44) (see Fig.).



*It is recommended that pad retainer pin (44) where possible, is installed pointing downwards. - (see Figure 6.2.4)*



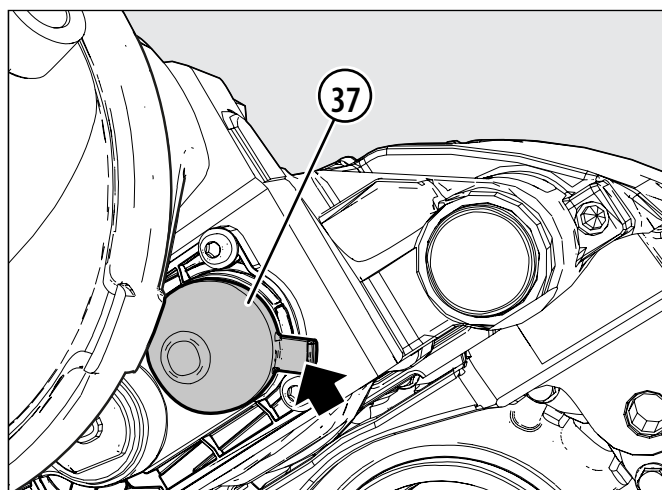
6.2.5 - Fitting the pad retainer

6.2.6 The adjuster cap (37) must then be replaced (use only a new cap) having lightly greased its contact surface with grease (available as Part No. II14525 or II32868) (see Fig.).

**Note:** The tag of the adjuster cap (37) should be positioned as shown (see arrow). This ensures access is maintained for subsequent removal.

6.2.7 Re-fit wheel according to the vehicle manufacturer's recommendations.

After the brake pedal is depressed and released, the wheel hub should turn freely by hand.



6.2.6 - Replace adjuster cap



*After any service work: Check the brake performance and the system behaviour on a roller dynamometer. Check function and effectiveness.*

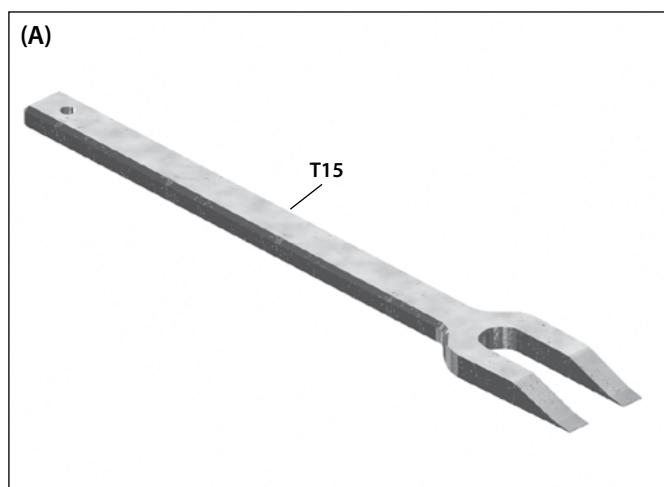
*Bear in mind that a lower performance can appear during the bedding-in phase of the brake pads and/or the brake disc.*

## 7 TAPPET AND BOOT ASSEMBLY (13) REPLACEMENT

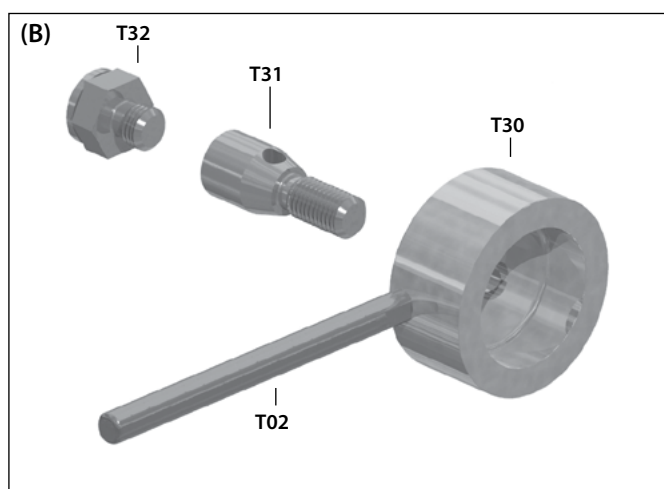
For ease of reference, each component of a tool is referred to by an identification number e.g. (T28); a complete tool (containing one or more such components) has been given a letter code e.g. **(B)** - see section 2.1.

To remove the tappet and boot assembly (13) use the wedge fork **(A)** (see Fig 7a).

To fit the tappet and boot assembly (13), use tool **(B)** (see Fig 7b).



7a - Tool for replacing the tappet and boot assembly



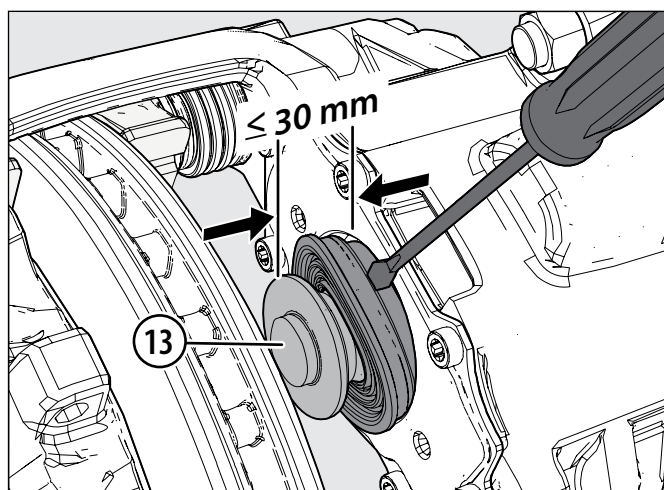
7b - Tool for fitting the tappet and boot assembly

### 7.1 Tappet and Boot Assembly (13) - Removal

**Note:** The removal of the tappet and boot assembly (13) can be done with the brake caliper fitted to, or removed from, the vehicle (see Section 8.1).

#### With Caliper Fitted to Vehicle:

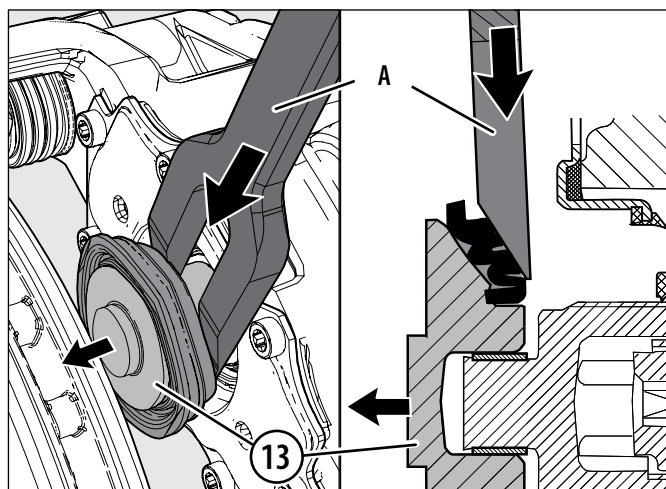
7.1.1 Wind-out the adjuster (23) using the shear adapter (61) until the boot is easily accessible (**max. 30 mm**) and, with a screwdriver or suitable lever, carefully prise the boot away from the caliper (see Fig.).



7.1.1 - Wind-out the adjuster, prise out the boot

# TAPPET AND BOOT ASSEMBLY (13) REPLACEMENT

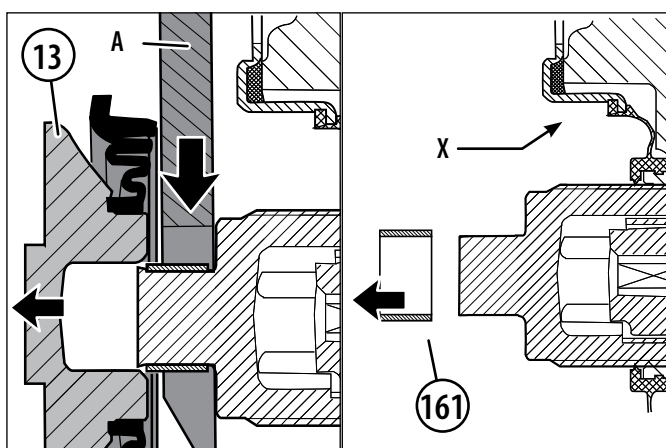
7.1.2 Remove the tappet and boot assembly (13) from the threaded tube (16) by using wedge fork (A) (II32202). Drive the fork between the tappet and the threaded tube.



7.1.2a - Remove tappet and boot assembly using tool (A)

7.1.3 Remove the old tappet bush (161) (see Fig.).

7.1.4 Check inner sealing face (arrow X) (see Fig.).



7.1.2b - Drive down wedge fork using hammer

7.1.3 - 7.1.4 - Remove old tappet bush, check sealing face

**!** This sealing face (X) must not be damaged. It cannot be replaced. If it is damaged, the caliper must be replaced. (see Section 8).

## Threaded Tube (16) - Inspection

7.1.5 Place an unworn pad (122) into the outboard gap to avoid loss of thread engagement of the threaded tube (16). Screw out the threaded tube (16) - (see Fig.).

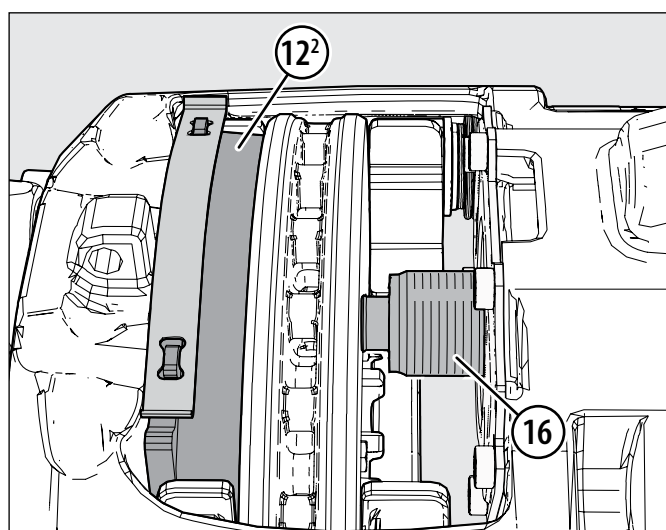
After screwing out, the thread can be checked for corrosion damage.

If there is water ingress or corrosion, the caliper must be replaced (see Section 8).

**!** Never turn adjuster (23) without shear adapter (61) being fitted. If the shear torque of the shear adapter is exceeded, then it is designed to fail. Try again with a new (unused) shear adapter. With a second failure of the shear adapter the caliper must be replaced since internal damage is present.

Do not use an open-ended spanner on the shear adapter!

**!** The threaded tubes must not extend more than 30 mm, otherwise synchronisation is lost and the caliper must be replaced.



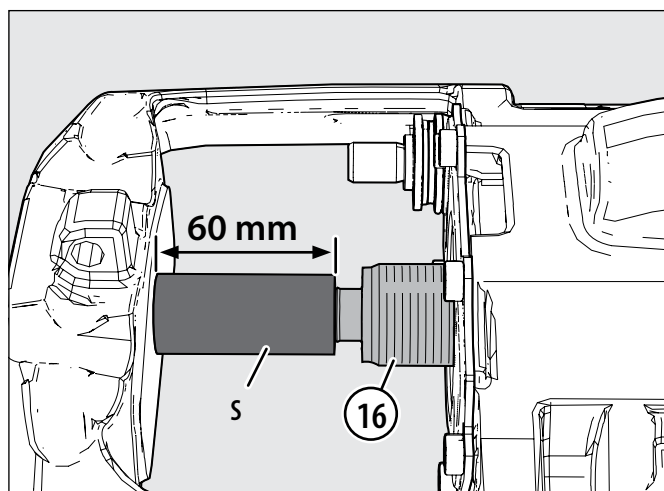
7.1.5 - Inspection of threaded tube (installed on vehicle) using new brake pad

## 7 TAPPET AND BOOT ASSEMBLY (13) REPLACEMENT

### Caliper not installed on vehicle

7.1.6 If the caliper is not installed on an axle, put a spacer **S** (length = **60 mm**) into the caliper (1) to avoid loss of thread engagement of the threaded tube (16) when screwing it out (see adjacent sketch). After screwing out, the thread can be checked for corrosion damage.

If there is water ingress or corrosion, the caliper must be replaced (see Section 8).



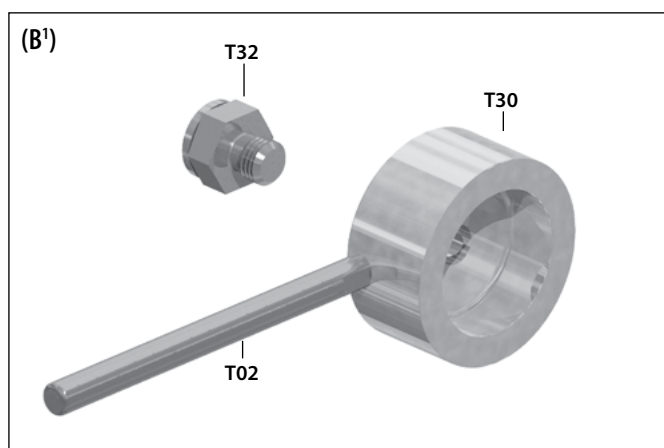
7.1.6 - Inspection of threaded tube (removed from vehicle) using spacer

### 7.2 Tappet and Boot Assembly (13) - Fitting



*The latest version of the tappet is provided with special long-term lubrication and is supplied with protective cap.*

*Before mounting the protective cap must be removed and properly disposed of. The grease must not be smeared or removed. Spreading of the grease on the bellows or on other components must be avoided. Similarly, additional lubrication of the tappet is not required.*



7.2.1 - Press-in Tool B¹

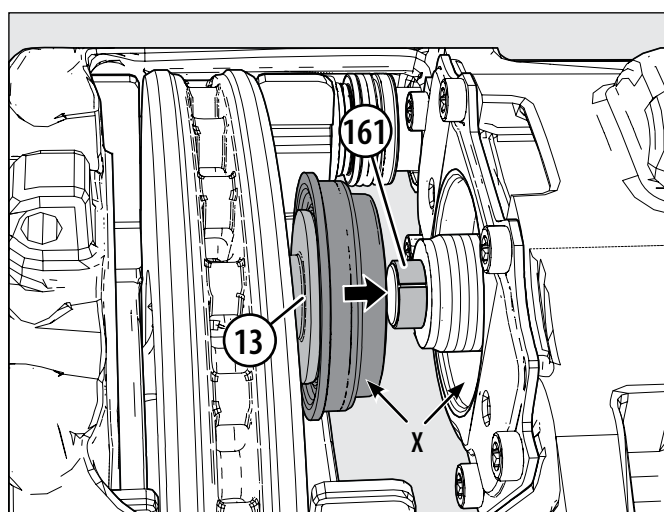
#### With Caliper installed on the vehicle:

7.2.1 To fit the tappet and boot assembly (13), use tool **(B¹)** (see Fig.).

7.2.2 Lubricate the thread with white grease (Part No. II14525, K093430 or II32868) and then wind back fully the threaded tube (16) until it stops (see Section 6.1.4).

**Note:** The sealing surface (**X**) for the boot in the caliper must be clean and free of lubrication.

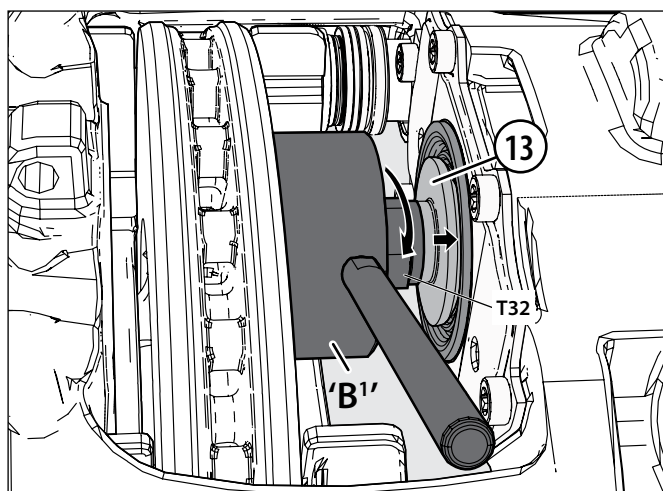
7.2.3 Fit new tappet bush (161) onto the spigot of the threaded tube (16), then follow with the tappet and boot assembly (13) pushing them into position (see Fig.).



7.2.3 - Fit new tappet bush / tappet with boot assembly to the spigot

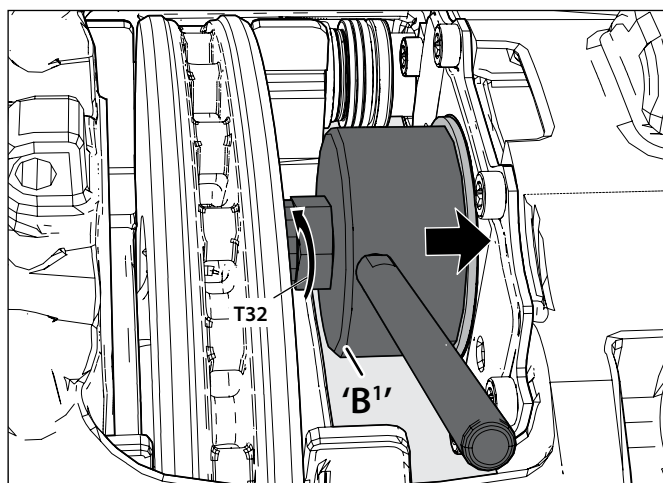
## TAPPET AND BOOT ASSEMBLY (13) REPLACEMENT

7.2.4 Position tool (**B'**) with components (T32+T30+T02), so that (T30) touches the brake disc (see Fig.). Using a spanner, screw out (T32) to press the tappet into place.



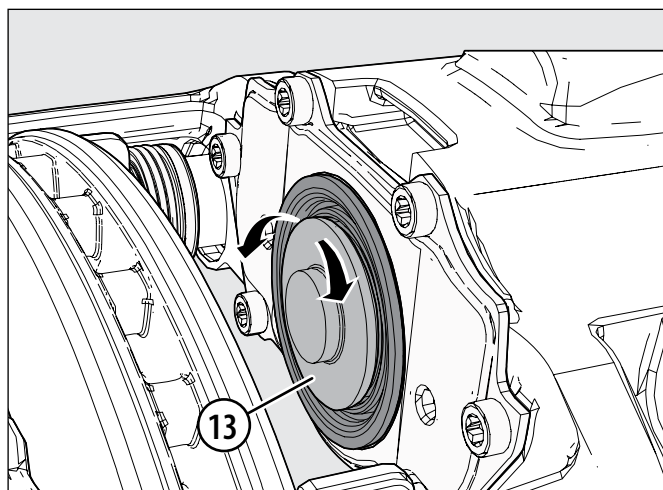
7.2.4 - Fitting the tappet using tool (**B'**)

7.2.6 Position tool (**B'**) so that (T30) fits over the boot (see Fig.). Using a spanner, screw out (T32) to press the boot into place.



7.2.6 - Fitting the boot using tool (**B'**)

7.2.7 Check that the tappet (13) turns slightly in each direction (take care not to overstretch the tappet boot) (see Fig.).



7.2.7 - Tappet should turn slightly in each direction



## 7 TAPPET AND BOOT ASSEMBLY (13) REPLACEMENT

### With caliper removed from the vehicle:

7.2.8 The fitting of the tappet and boot assembly (13) requires tool (B<sup>2</sup>) (see Fig.).

Lubricate the thread with white grease (Part No. II14525, K093430 or II32868) and then wind back fully the threaded tube (16) until it stops (see Section 6.1.4).

**Note:** The sealing surface (X) for the boot in the caliper must be clean and free of lubrication.

Fit new tappet bush (161) onto the spigot of the threaded tube (16), then follow with the tappet and boot assembly (13) pushing them into position.

7.2.9 Position tool (B<sup>2</sup>) with components (T32+T31+T30+T02) so that (T30) touches the caliper (see Fig.). Using a spanner, screw out (T32) to press the tappet into place.

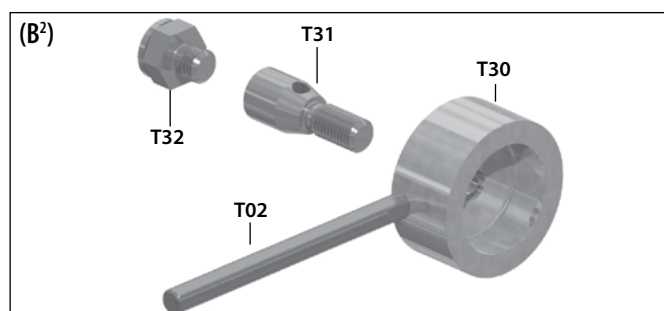
7.2.10 Turn over tool (B<sup>2</sup>).

7.2.11 Position tool (B<sup>2</sup>) so that (T30) fits over the tappet (see Fig.).

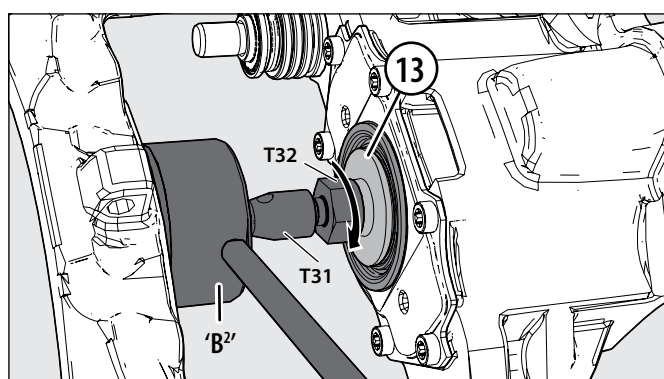
**Note:** To centralise (T30) with tappet (13), the threaded tube must be wound clockwise two turns by using the shear adapter (61).

Using a spanner, screw out (T32) to press the boot into place.

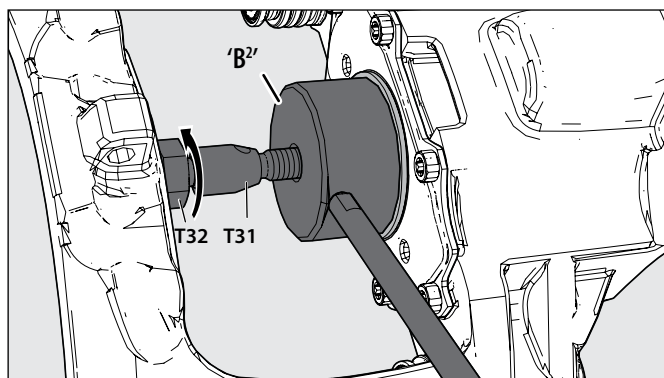
7.2.12 Check that the tappet (13) turns slightly in each direction (take care not to overstretch the tappet boot) (see Fig.).



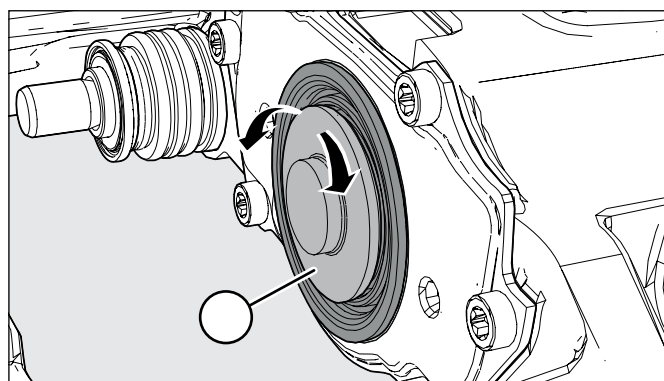
7.2.8 - Long press-in tool (B<sup>2</sup>) with T31



7.2.9 - Fitting the tappet using tool (B<sup>2</sup>)



7.2.11 - Fitting the boot using tool (B<sup>2</sup>)



7.2.12 - Tappet should turn slightly in each direction

## 8 CALIPER REPLACEMENT

For ease of reference, each component of a tool is referred to by an identification number e.g. (T28); a complete tool (containing one or more such components) has been given a letter code e.g. (E) - see section 2.1.

8.0. To replace the cover (10) use the press-in tool (G) (K028048) (see Fig.).

### 8.1 Caliper Removal from Carrier

8.1.1 Remove pads (see Section 6.1).

8.1.2 Remove the brake actuator (see Section 12.1, 12.3). Disconnect potentiometer type wear indicator, if fitted.

**⚠** Do not touch electrical contact points because of static discharge!

**Note:** It may be necessary for reasons of accessibility to remove the caliper and carrier from the axle (refer to Vehicle Manufacturer's recommendations) or remove only the caliper.

#### Removal of Cover (10)

8.1.3 Use a suitable tool (e.g a chisel) to penetrate the cover (10) creating a hole to allow easy removal (see Fig.).

**Note:** During penetration the cover (10) may move approximately **10 mm** inwards.

**⚠** Cover (10) should be penetrated in the middle. Do not drive the tool between caliper bore and cover (10) since caliper bore may be damaged.

8.1.4 Remove cover (10) using a suitable tool (e.g a screwdriver) by inserting it into the created hole and levering it out (see Fig.).

Check the inside area of the bearing for dirt or corrosion. If necessary replace with a new guide and seal kit. In case of damage or excessive corrosion, the caliper must be replaced.

#### Removal of Caliper from Carrier

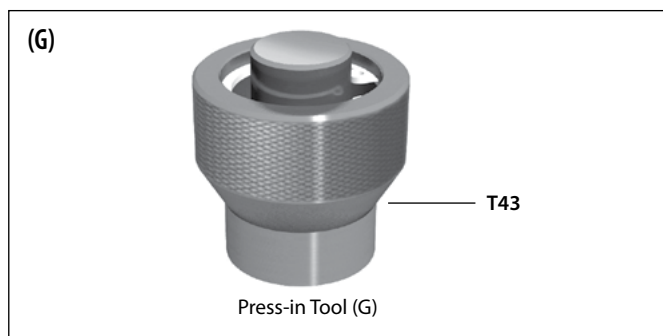
**⚠** Before removing the caliper bolts (39 and 40) ensure that the caliper (1) cannot move or fall when the caliper bolts are removed causing damage or injury.

8.1.5 Screw out the caliper bolts (39) and (40) (see Fig.).

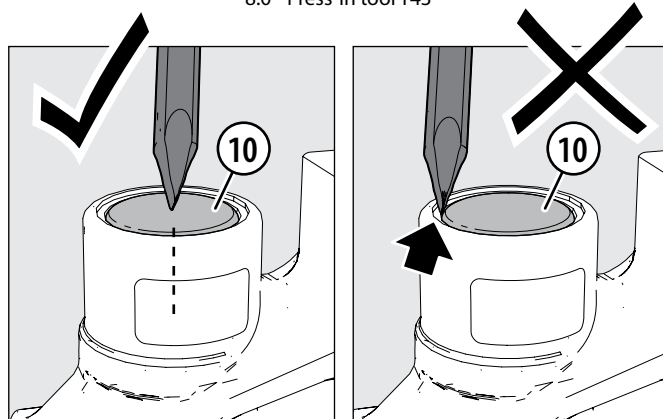
**⚠** Never hold the caliper with your fingers between caliper and carrier - there is a risk of injury! Do not fasten any lifting device to the pad retainer (11), since this could be damaged.

**⚠** The opening or dismantling of the caliper is not authorised. Use only genuine Knorr-Bremse replacement calipers.

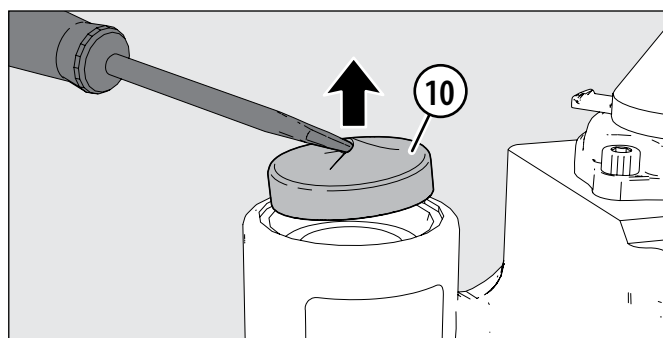
8.1.6 Remove caliper (1) from carrier (2).



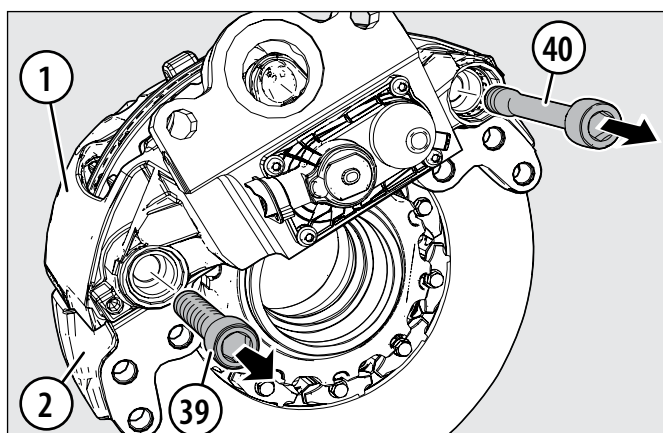
8.0 - Press-in tool T43



8.1.3 - Penetrate cover in the centre using suitable tool



8.1.4 - Remove cover using suitable tool



8.1.5 - Remove caliper bolts

## 8 CALIPER REPLACEMENT

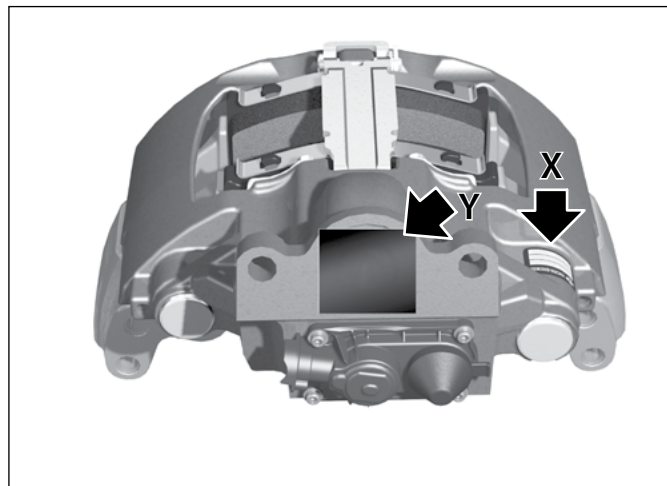
### 8.2 Fitting Caliper to Carrier - (Carrier assembled on vehicle)

8.2.1 The correct choice of caliper must be ensured by checking the part number on the identification label (arrow **X**).

Remove plastic cover or the adhesive tape (arrow **Y**) in the area of the actuator attachment from the replacement caliper (see Fig.).

The caliper guide sleeves should be serviced with the respective guide and seal kit (see Section 9 and 10), or the caliper replaced with the compatible rationalised caliper.

**Note:** The replacement caliper includes seals and guide pins as well as bolts and bushes for fitting the caliper to the carrier. Brake pads and wear sensors are not included.



8.2.1 - Note identification label, remove adhesive tape

If the replacement caliper is equipped with a potentiometer, then the connection must be made using the appropriate mating plug - refer to vehicle manufacturer's recommendations.

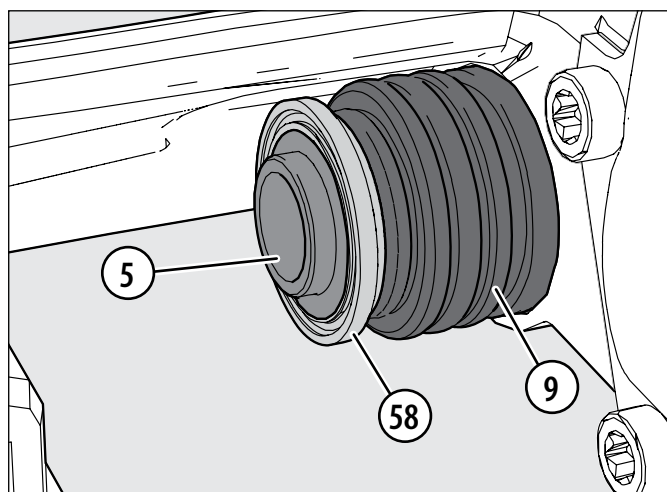


*Never hold the caliper with your fingers between caliper and carrier - there is a risk of injury! Do not fasten any lifting device to the pad retainer (11), since this could be damaged.*



*The guide pins (4) and (5) as well as the caliper bolts (39) and (40) are highly stressed items. They must be replaced whenever the caliper (1) is removed from the carrier (2).*


8.2.2 Check that the inner boot (9) and the ring (58) sit correctly on the guide pins (4 and 5) (see Fig.).



8.2.2 - Check that inner boot and ring sit correctly



8.2.3 Place caliper (1) onto the carrier (2) and insert the caliper bolts (39) and (40). Tighten bolts to 180 Nm, then tighten by a further 90° (**use only new parts**) (see Fig.).

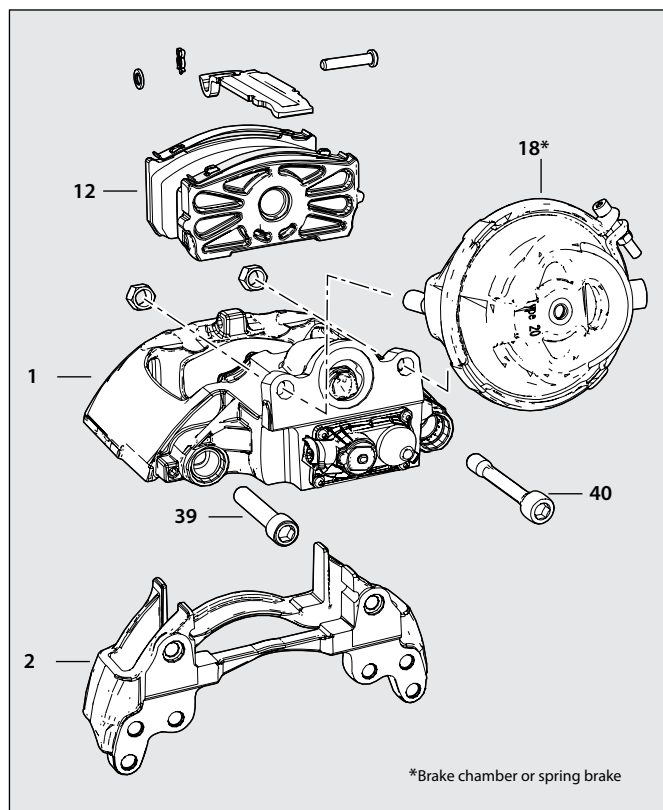
 **Screw threads and tapped holes must be clean and dry (free of lubrication and residuals of pre-applied adhesive).**

8.2.4 Check that the caliper slides easily on the guide pins. (see Section 5.3)

8.2.5 Fit brake pads (12) (see Fig. and Section 6.2).


8.2.6 Check adjuster function (see Section 5.2).

8.2.7 Fit brake actuator (18) (see Fig. and Section 12.2 or 12.4).



8.2.3 - 8.2.7 - Fit caliper onto carrier, tighten caliper bolts , fit brake pads, fit brake actuator

## Fitting of Cover (10) with Caliper (1) and Carrier (2) assembled on the Vehicle:

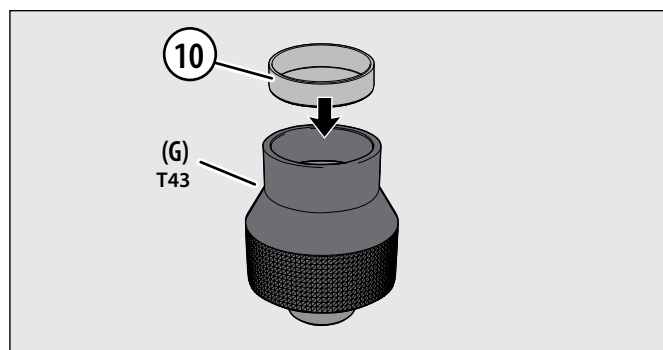
 **Fitting of cover (10) can only be done after the caliper has been fully bolted to the carrier (see Section 8.2).**

Caliper bores and cover must be clean and free from lubrication.

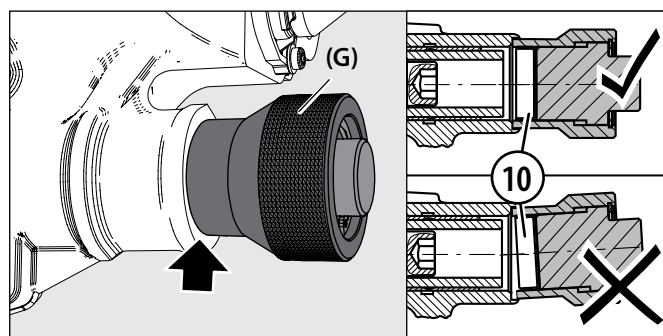
8.2.8 Clean the new cover (10) and the interior of the press-in tool (G) and insert the cover (10) into tool (G) as shown (see Fig.).

8.2.9 Check the plane surface of caliper bore is clean and not damaged (see arrow). Position the press-in tool (G) including cover (10) squarely and check it sits correctly as shown (see Fig.).

**Note:** Do not tilt the tool when assembling the cover (10)!



8.2.8 - Insert cover into tool (G)



8.2.9 - Press-in tool (G) with cover in position on the plane surface of the caliper

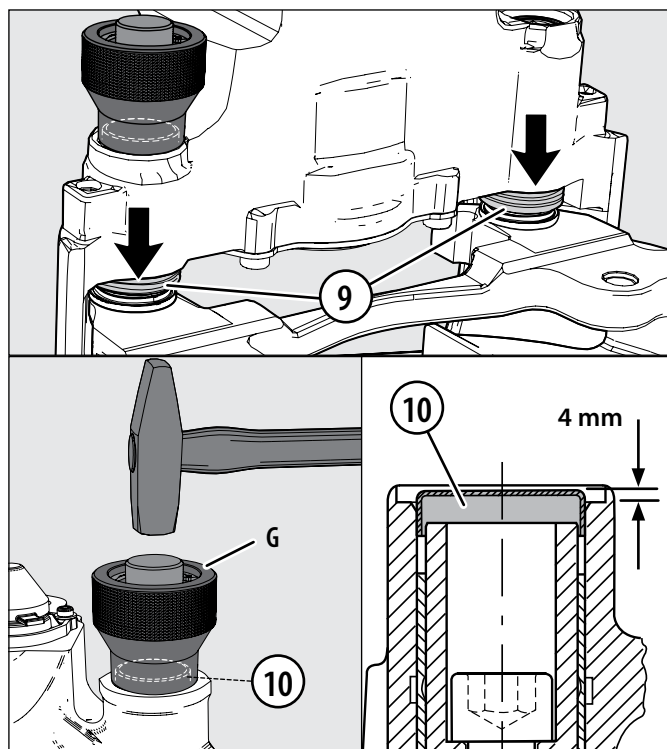
## 8 CALIPER REPLACEMENT



*The inner boot (9) must be in a compressed condition otherwise the caliper's freedom of movement will be limited.*

8.2.10 Press the mandrel of the press-in tool (G) firstly by hand until it stops, then, using a hammer on the mandrel, insert the cover to the end stop (see Fig.).

**Note:** After fitting the new cover (10), ensure that it protrudes **4 mm** from the plane surface of the caliper (see Fig.).



8.2.10 - Fitting cover to stop, final position protruding 4 mm

### Fitting of Cover (10) with Caliper (1) and Carrier (2) removed from the vehicle:

8.2.16 Check caliper slides freely along the whole length of the guide pin arrangement (see Section 5.3).

8.2.17 Fix the carrier securely as shown i.e. bench vice, and push the caliper down as much as possible against the carrier to ensure the inner boots (9) are fully compressed (see Fig.).



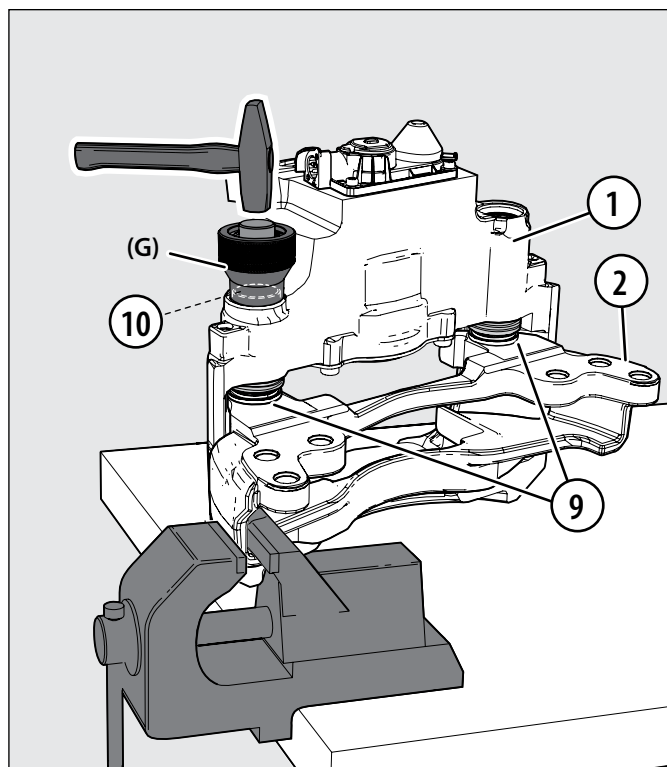
*The inner boots (9) must be in a compressed state otherwise the caliper's freedom of movement will be limited.*

8.2.18 Assembly of cover (10) can now proceed as previously described (see Section 8.2.8 - 8.2.14).

8.2.19 Fit brake pads (see Section 6.2).

8.2.20 Check adjuster (see Section 5.2).

8.2.21 Fit brake actuator (18) (see Section 12.2 or 12.4).



8.2.17 - 8.2.18 - Fitting cover (10) with the caliper (1) and carrier (2) removed from the vehicle

## 9 CALIPER BEARINGS REPLACEMENT

To replace the caliper bearings, all components of the fixed and floating bearing must be replaced by new components. For ease of reference, each component of a tool is referred to by an identification number (see section 2.1).

To fit the Inner Boot (9) use the tool combination (C) (K002254) (see Fig.).

**Note:** For caliper variants having an inner boot (9) on both bearing sides, the steps 9.1.1 - 9.1.5 are to be carried out on both sides.

### 9.1 Removal of Inner Boot (9)

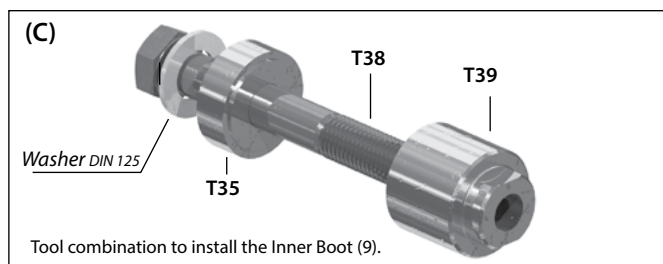
9.1.1 Remove caliper (see Fig. and Section 8.1).

9.1.2 Remove ring (58) (see Fig.).

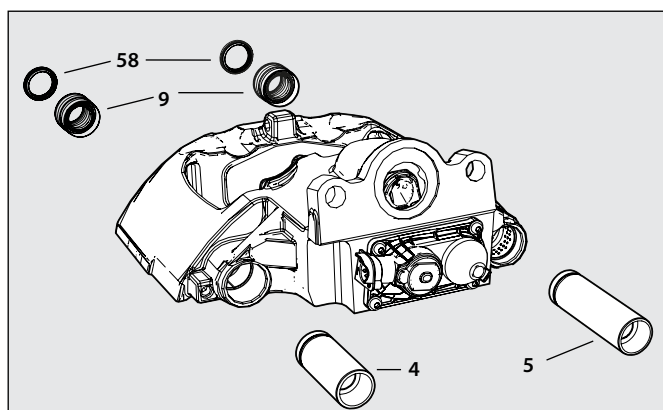
9.1.3 Pull out guide pins (4 and 5) (see Fig.).

9.1.4 Ease out inner boot (9) with a screwdriver or similar tool (see Fig.).

9.1.5 Check the sealing face of inner boot (9) for damage or corrosion.



9.1 - Tool combination (C)



9.1.1 - 9.1.5 - Remove parts as instructed

### 9.2 Fitting of Inner Boot (9)

**Note:** For caliper variants having an inner boot (9) on both bearing sides, the steps 9.2.1 - 9.2.5 are to be carried out on both sides.

9.2.1 The contact surface of the boot (9) must be clean and free of lubrication.

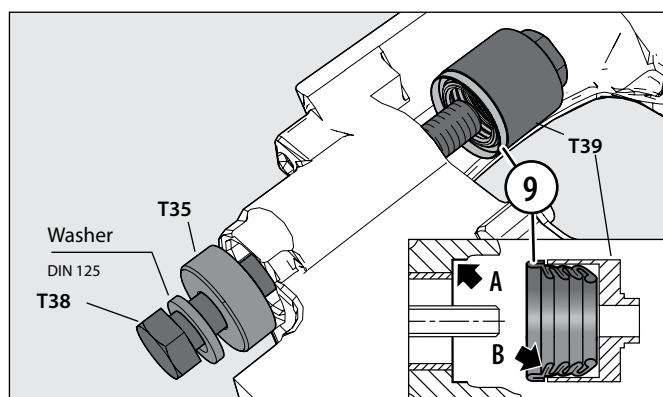
9.2.2 Check the sealing face of inner boot (9) for damage or corrosion (see Fig. Arrow A).

Check Brass Bush (7) and when available Guide Sleeve (6) for corrosion, dirt or damage, if necessary replace (see Section 10.1 or Section 10.2).

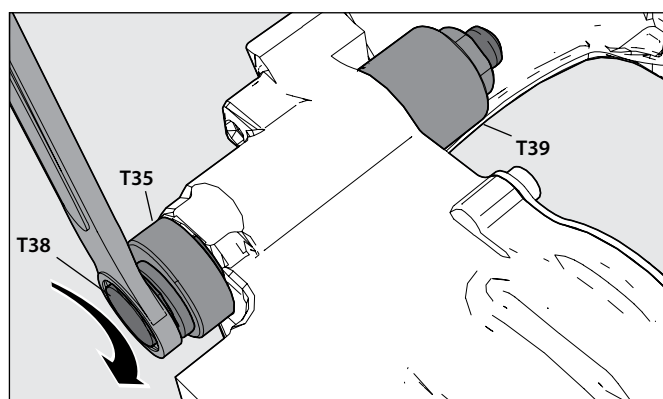
9.2.3 Fit new inner boot (9) into sleeve (T39) of tool (C). Make sure the rubber folds of the boot sit inside the tool (See Fig. arrow B).

9.2.4 Position the main part of tool (C) into the caliper bearing bore. Then attach the assembled sleeve (T39) with inner boot (9), pulling-in firstly by hand by turning tool (T38) (see Fig.).

9.2.5 Then, pull-in with a maximum torque of **8 Nm** (see Fig.).



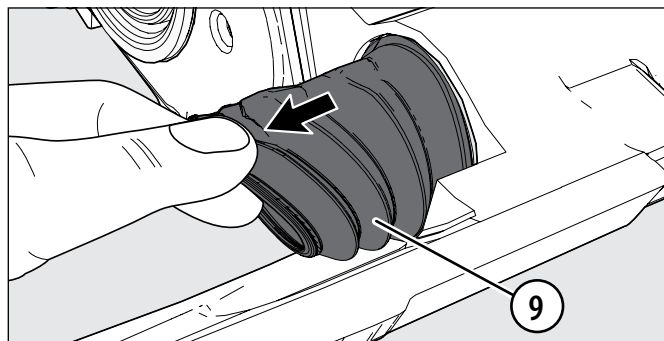
9.2.3 - 9.2.4 - Position tool (C) in the caliper bore and tighten by hand



9.2.5 - Pull-in with max. 8 Nm

## 9 CALIPER BEARINGS REPLACEMENT

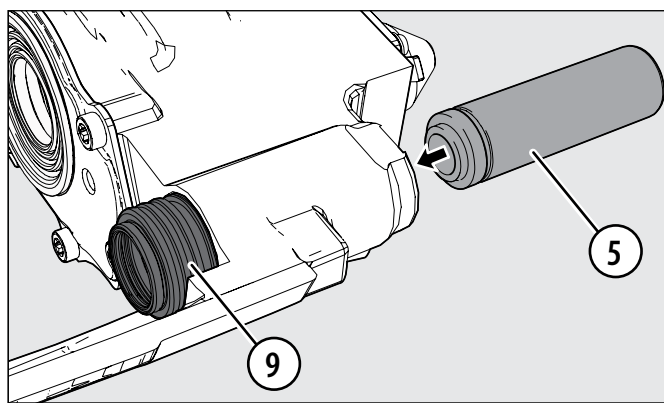
9.2.6 Check correct fitment of inner boot (9) by carrying out a pulling test (see Fig.).



9.2.6 - Carry out pulling test on inner boot

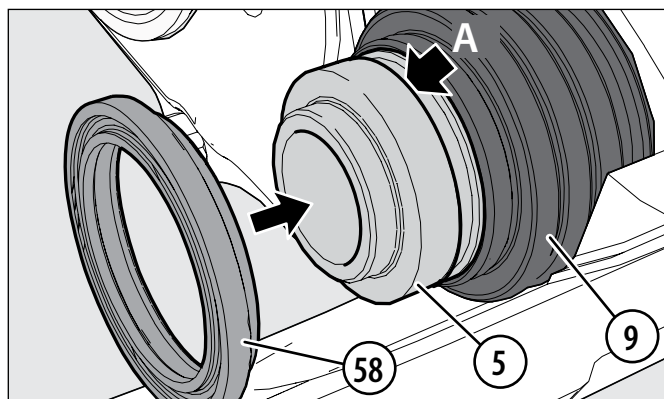
9.2.7 Completely cover inside of brass bush (7) and where applicable guide sleeve (6) with white grease (Part No. II14525, K093430 or II32868).

9.2.8 Fit guide pin (5) from outside the caliper into the caliper bore (see Fig.), and where applicable guide pin (4) from inside the caliper into the caliper bore.



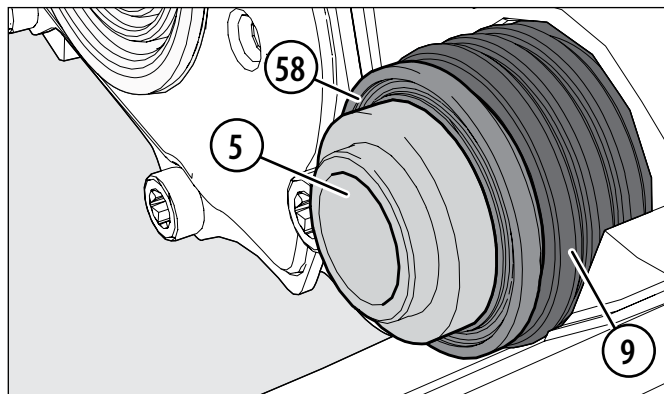
9.2.8 - Fit guide pin from outside caliper

9.2.9 The lip end of the inner boot (9) must engage in the groove of the respective guide pin variant (see Fig. arrow A).



9.2.9 - Lip of inner boot engages in groove on guide pin (arrow A).

9.2.10 Push on the ring (58) to secure engagement of inner boot (9) on guide pin (4 and/or 5) (see Fig.).



9.2.10 - Push on ring to secure boot in groove of guide pin

9.2.11 Fit brake caliper to carrier (see Section 8.2).

## 10 GUIDE PIN BUSH/SLEEVE REPLACEMENT

For ease of reference, each component of a tool is referred to by an identification number e.g. (T28); a complete tool (containing one or more such components) has been given a letter code e.g. (E) - see section 2.1.

Use the tool combination (D) for disassembly and assembly of the brass bush (7). In order to groove the brass bush (7) use the grooving tool (F).

Remove caliper (1) (see Section 8.1).

### 10.1 Brass Bush (7) Replacement

In order to remove and fit the brass bush (7) use the pull-out/pull-in (D). To groove the bush use the grooving tool (F)

10.1.1 Remove guide pin (5) and inner boot (9) (see Section 9). Clean surfaces (see arrows A and B) and clean brass bush (7) (see Fig.).

#### Removal of Brass Bush (7)

The use of impact screwdrivers / impact wrenches in conjunction with Knorr-Bremse service tools for air disc brakes is not permitted. The service tools are not designed for such use.

**⚠ Risk of injury. Knorr-Bremse accepts no liability for damage or injury resulting from negligence, any damage to service tools resulting from such actions will void all warranty.**

10.1.2 Place tool (D) in position as shown and ensure that (T34) is guided in brass bush (7). Pull out brass bush via spindle (T20) (see Fig.).

**Note:** Make sure that (T34) sits in the brass bush (7). Tool (T33) must be placed square on the surface (see arrow A). Do not tilt the tool when removing!

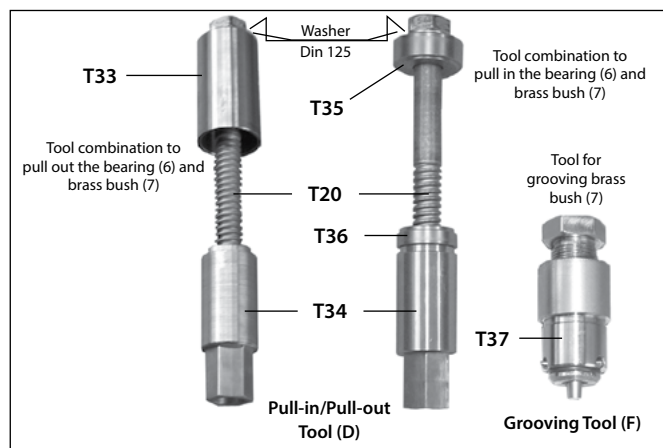
#### Fitting of Brass Bush (7)

10.1.3 Prepare tool (D) by firstly screwing (T35) onto the spindle (T20) until it stops. Place new brass bush (7) onto (T36) and insert into the caliper bore as shown (see Fig.).

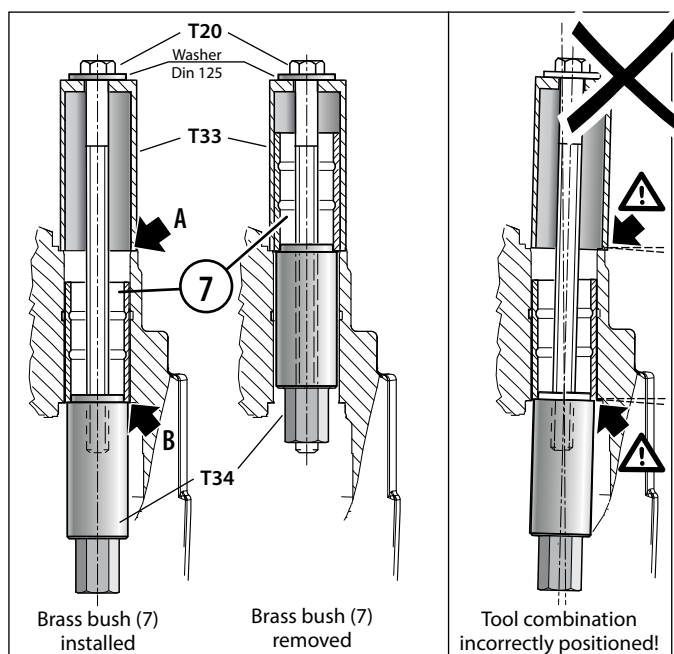
10.1.4 Position tool (D) from the opposite end and loosely screw into (T36) (see Fig.).

10.1.5 Screw (T20) into (T36) and (T34) by hand until it stops. Check the free movement of (T36); (T35) must lie square on the surface (arrow A) (see Fig.).

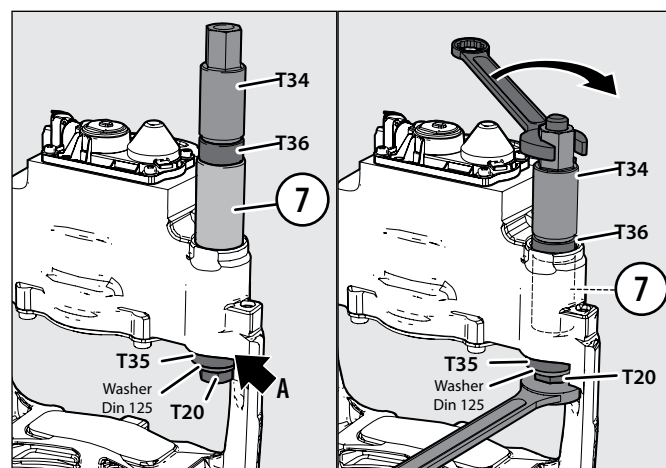
10.1.6 Pull-in brass bush (7) by turning (T34) until it stops (see Fig.).



10 - Tool combinations (D) and (F)



10.1.1 - 10.1.2 - Removal of brass bush using tool combination (D)



10.1.3 - 10.1.5 Positioning of tool (D) with new brass bush

10.1.6 - Pulling in brass bush by turning (T34)



## 10 GUIDE PIN BUSH/SLEEVE REPLACEMENT

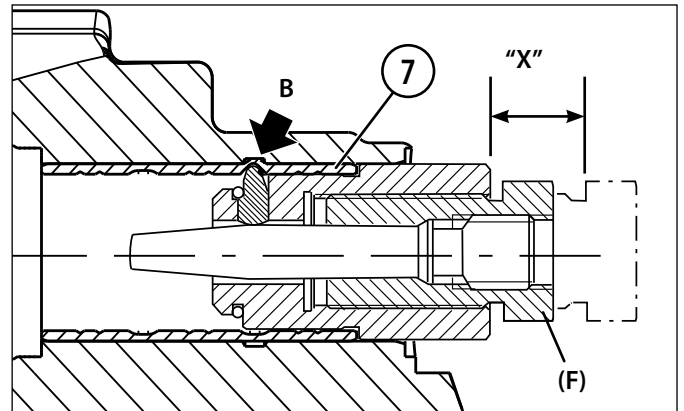
10.1.7 To prevent longitudinal displacement of the new brass bush (7) it must be grooved (see arrow **B**).

Before insertion of the grooving tool (**F**) (K002253), its hexagon screw must be wound out so that the head of the screw is approximately **20 mm** from the tool face - see measurement "**X**" in adjacent sketch.

Insert the grooving tool (**F**) fully into the brass bush (7), wind in and tighten the hexagon screw to its stop.

Slacken the screw and rotate the grooving tool (**F**) in the brass bush (7) by approximately **60°**. Again wind in the hexagon screw of the grooving tool (**F**) and tighten to its stop.

Before removing the grooving tool (**F**), its hexagon screw should be wound out approximately **20 mm**.



10.1.7 - 10.1.8 - Grooving of brass bush

10.1.8 Check contact area of brass bush (7) and remove any burrs if necessary.

10.1.9 Grease bush (7) with white grease (Part No. II14525, K093430 or II32868).

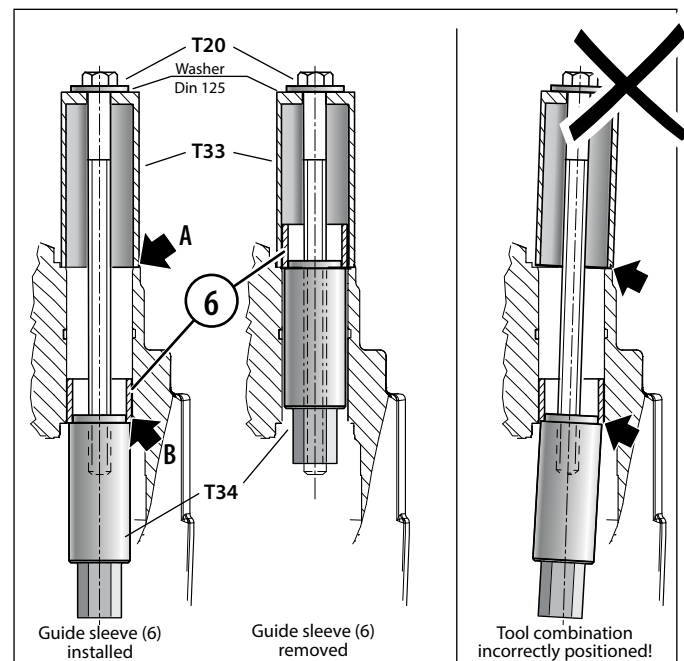
### 10.2 Guide Sleeve (6) - Replacement

#### Guide Sleeve (6) - Removal


10.2.1 Clean caliper in the area of the guide sleeve (6) and the pad abutment (see arrows "**A**" and "**B**").

10.2.2 Position the tool (**D**) (K002256) as shown in the adjacent picture. Screw on the nut (T34) by hand. Ensure that nut (T34) is located in guide sleeve (6).

Hold the nut (T34) with a ring spanner and with a suitable socket or ring spanner tighten spindle (T20) to remove the guide sleeve (6).




10.2.1 - 10.2.2 - Removal of guide sleeve using tool combination (**D**)

 The sealing face of inner boot (9) in the caliper must not be damaged (see arrow **B** in adjacent sketch).

#### Guide Sleeve (6) - Fitting

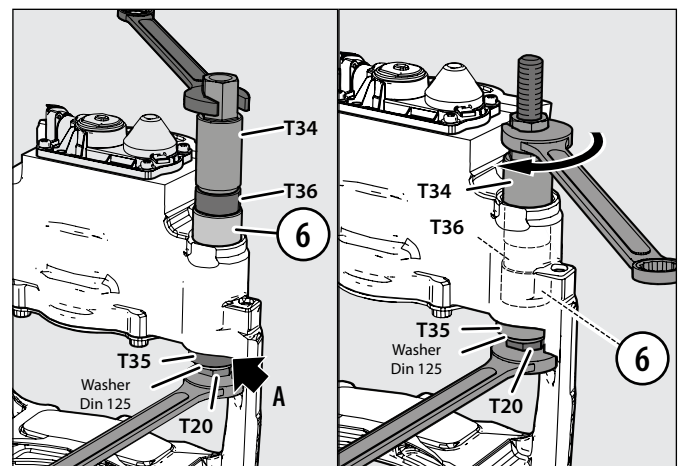
10.2.3 The bore in the caliper must be free from corrosion. Clean as necessary.

10.2.4 Push guide sleeve (6) into the tool (**D**) and position Tool (**D**) with guide sleeve (6). Screw on the spindle (T20), by hand until it stops. The disc (T36) must locate in the guide sleeve (6).

 The sealing face of inner boot (9) in the caliper must not be damaged (see arrow "**A**" in adjacent sketch).

10.2.5 Hold the spindle (T20) with a ring spanner and with a suitable socket or ring spanner tighten nut (T34) to fit the guide sleeve (6) (see Fig.).

10.2.6 Grease guide sleeve (6) with white grease (Part No. II14525, K093430 or II32868).



10.2.4 - Positioning of tool (**D**) with new guide sleeve

10.2.5 - Pulling in guide sleeve by turning (T34)

## 11 CARRIER REPLACEMENT

Depending on the installation, it may be possible to remove the caliper from the carrier and replace the carrier in situ. Else it may be necessary or more convenient to remove the complete carrier/caliper assembly from the vehicle where it can be separated and the carrier replaced.

**Note:** *The disc brake is very heavy, take great care in handling! Do not fasten any lifting device to the pad retainer (11) since this can be damaged.*

**Note:** *Use only new parts from the guide and seal kit when fitting the caliper to the carrier. This is not supplied with the caliper and must be ordered separately.*

See section 8 as applicable:

### Either:

11.1 Remove caliper from carrier.

11.2 Replace carrier – ensure new bolts and correct torques are used. Note, bolts to fit the calliper to the axle are not supplied by Knorr-Bremse but from the vehicle manufacturer. Refer to the vehicle manufacturer's fitting instructions and torque values.

11.3 Refit caliper to carrier.

### or:

11.1 Remove the complete caliper/carrier assembly.

11.2 Replace carrier.

11.3 Refit the complete caliper/carrier assembly – ensure new bolts and correct torques are used.

## 12 BRAKE ACTUATOR REPLACEMENT

**Note:** All references to brake actuators (brake chambers and spring brakes) in this section refer to Knorr-Bremse brake actuators. For other brake actuator manufacturers, follow their respective instructions.

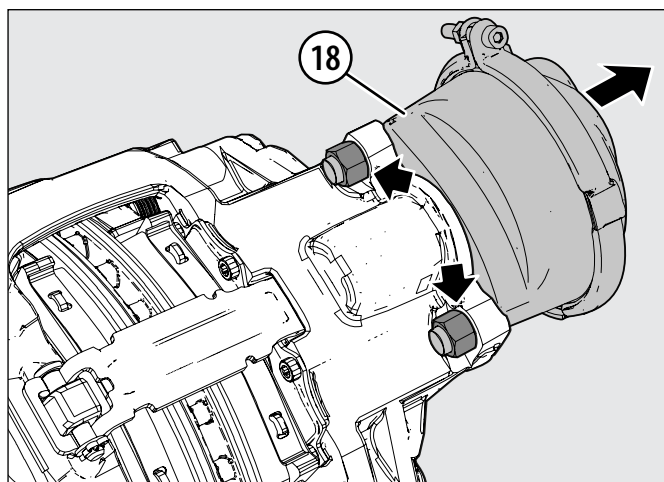
### 12.1 Removal of Knorr-Bremse Brake Chamber

12.1.1 Disconnect air connection from brake chamber (18) – **take care**, air connection must be free of air pressure!

12.1.2 Unscrew brake chamber mounting nuts and remove brake chamber (18) (see arrows in Fig.).



It is not allowed to reuse the nuts of the brake chamber (18).



12.1.2 - Brake chamber removal

### 12.2 Fitting of Knorr-Bremse Brake Chamber

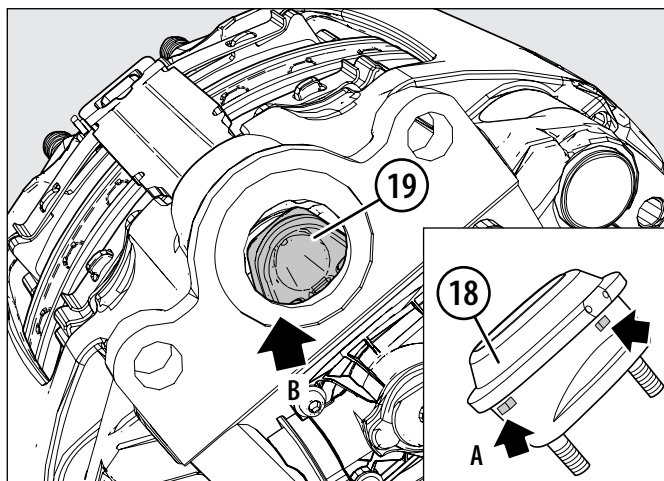
**Note:** New brake chambers (18) have drain plugs installed (see arrows **A**). Remove lowest plug (as viewed when brake chamber is installed). All other drain holes should be plugged (refer to the vehicle manufacturer's recommendations).

12.2.1 The sealing surface and the flange surface (see Fig. arrow **B**) must be:

- free from dust and corrosion
- free from damage
- flat

Take care that no dirt enters the brake caliper!

12.2.2. Before fitting the new brake chamber, the spherical cup (19) of the lever and the sealing surface of the caliper must be greased with white grease (Part No. II14525, K093430 or II32868).



12.2.1 - 12.2.2 - Check seal and flange surface of caliper, grease spherical cup and flange surface

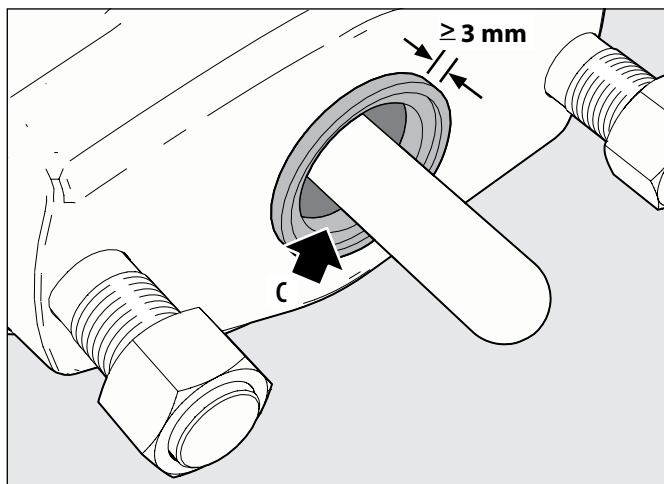


Do not use grease containing molybdenum disulphate. Use only actuators which are recommended by the vehicle manufacturer.

12.2.3 The seal, as well as the push rod area of the brake chamber (18) (see arrow **C**) must be clean and free of lubrication.

The seal must not show any signs of damage.

Note, if the brake chamber's seal protrudes less than **3 mm** the brake chamber must be replaced (see Fig.).



12.2.3 - Check seal, min. 3 mm





## Notes

Lined area for notes, spanning the majority of the page below the 'Notes' header.



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