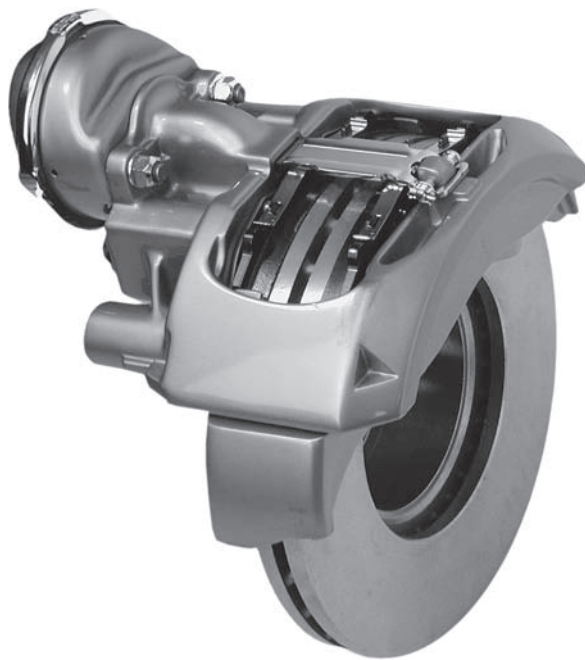


# Pneumatic Disc Brake SN6.../ SN7.../ SK7.../ ADB22X



**New**  
Includes  
instructions for  
using the new tools  
for the bearing  
covers

- Description/Function
- Service kits
- Service
- Accessories

**KNORR-BREMSE**



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

Brake	Tool Kit	Alternative
SB5...	II37951004EN	
SB6... SB7...	II37951004EN see note *)	
SN5...	K004789	
SN6... SN7... SK7... ADB22X	K016947	K001288 + Supplemental Kit K017062 K005973 + Supplemental Kit K017062

Brake	Service Manual
SB6... SB7...	C16352-EN
SN5...	Y015044-EN
SN6... SN7... SX7... ADB22X	Y006471-EN

\*) additional tools are required - available in kit K001288 or K005973 or K016947

### 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.

This information does not purport to be all-inclusive and no responsibility is assumed as a result of its use. We cannot accept any liability nor offer any guarantee regarding data accuracy, completeness or timeliness. The information does not represent any guarantee or ensured characteristics of the Products or Systems described.

No liability can be accepted based on the information, its use, recommendations or advice provided. In no event may we be held liable for any damage or loss except in the case of wilful intent or gross negligence on our part, or if any mandatory legal provisions apply.

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.

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**Note:** The safety advice listed below is applicable to general service and diagnostic work on braking systems and may not all be directly relevant to the activities and products described in this document.

Before and during working on or around compressed air systems and devices, the following precautions should be observed in addition to any specific advice given in this document:

- Always wear safety glasses when working with air pressure.
- Never exceed manufacturer's recommended air pressures.
- Never look into air jets or direct them at anyone.
- Never connect or disconnect a hose or line containing pressure; it may whip as air escapes.
- Never remove a device or pipe plug unless you are certain all system pressure has been depleted.
- 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.
- If work is being performed on the vehicle's air braking system, or any auxiliary pressurised air systems, and 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. 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.
- When working under or around the vehicle, and particularly when working in the engine compartment, the engine should be shut off and the ignition key removed. 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.
- 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.
- 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.
- 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. 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.
- Use only genuine Knorr-Bremse replacement parts, components and kits.
- 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.

### Welding

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

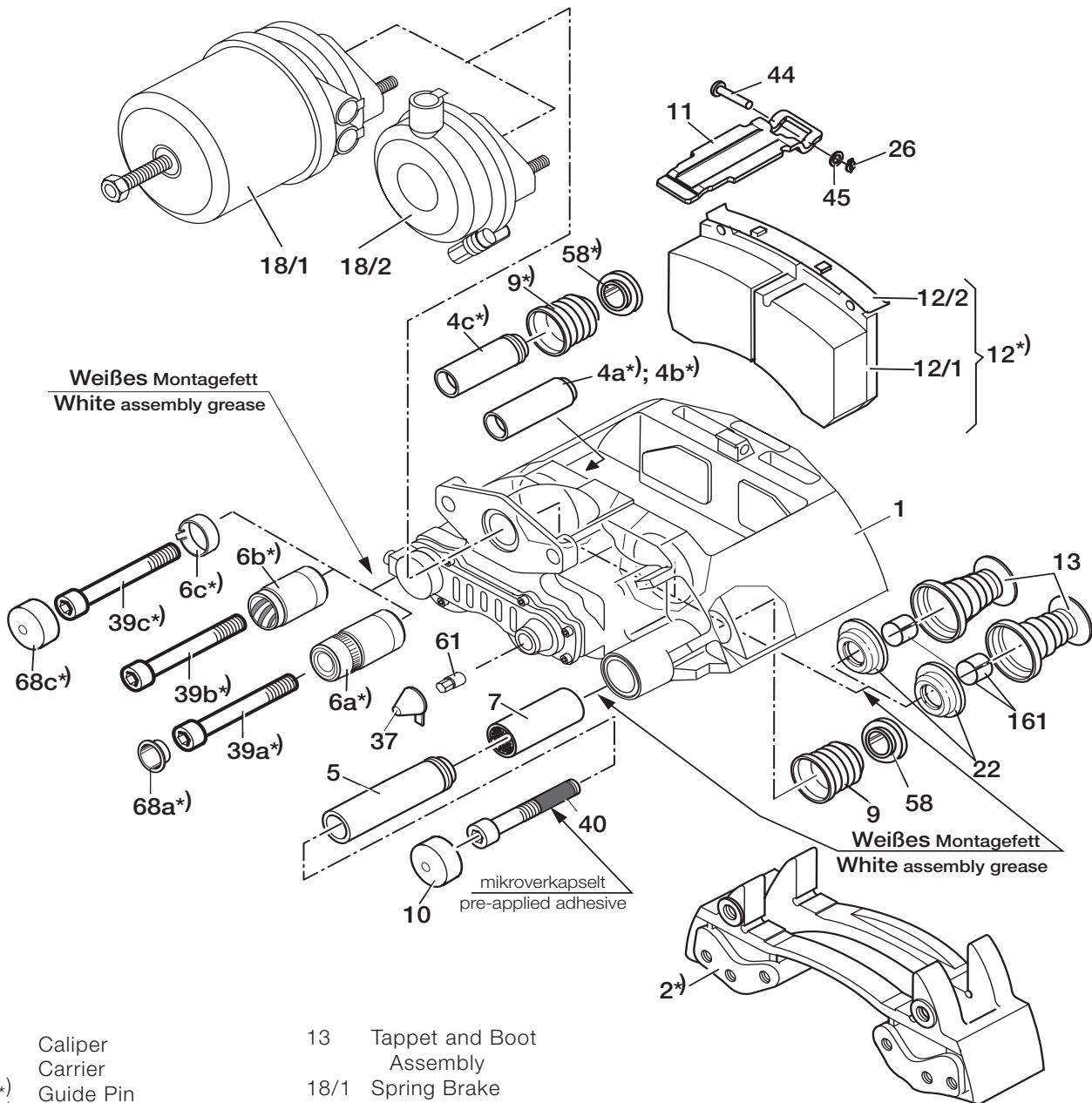
- In all cases, before starting any electrical welding, remove all connections from any electronic control units or modules, noting their position and the order in which they are removed.
- When re-inserting the electrical connectors (in reverse order) it is essential that they are fitted to their correct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

# 1 Overview

## 1 Overview

### 1.1 Disc Brake Components

(Wear Indicators see Section 1.2.1)

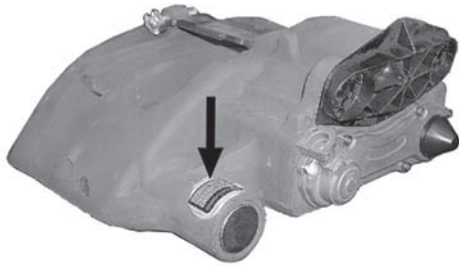


1	Caliper	13	Tappet and Boot Assembly
2*)	Carrier	18/1	Spring Brake
4a*)	Guide Pin	18/2	Brake Chamber
4b*)	Guide Pin	22	Inner Seal
4c*)	Guide Pin	26	Spring Clip
5	Guide Pin	37	Adjuster Cap
6a*)	Rubber Bush	39a*)	Hexagon Socket head cap screw
6b*)	Rubber Bush	39b*)	Hexagon Socket head cap screw
6c*)	Guide Sleeve (DU)	39c*)	Hexagon Socket head cap screw
7	Brass Bush	40	Hexagon Socket head cap screw
9*)	Inner Boot	44	Pad Retainer Pin
10	Cover	45	Washer
11	Pad Retainer	58	Ring
12*)	Pad (complete)	61	Shear Adapter
12/1	Pad	68a*)	Cap
12/2	Pad Retainer Spring	68c*)	Cover
		161	Tappet Bush

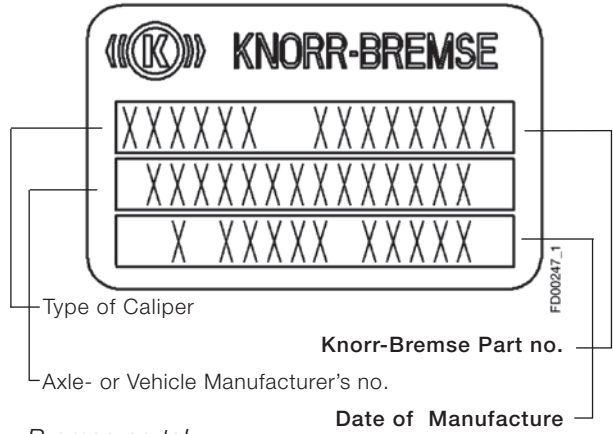
\*) Variants are possible see also contents leaflet in the service kit

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1.2 Brake Identification and Service Kits for Air Disc Brakes



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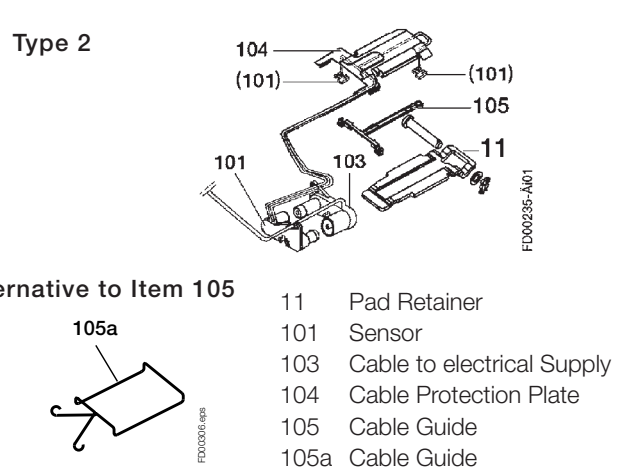
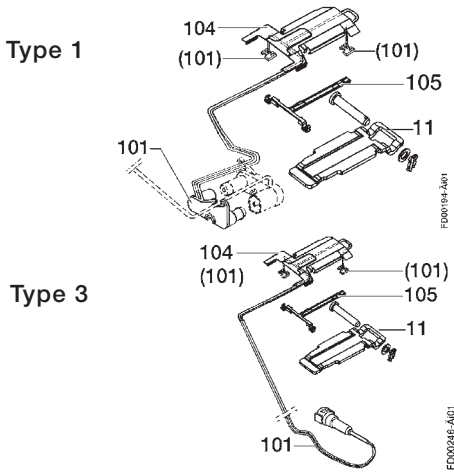
Use only genuine Knorr-Bremse parts!

The following Service Kits are available :

Description	Contents	
Carrier	2	
Guide and Seal Kit	4a*), 5, 6a*), 7, 9, 10, 39a*), 40, 58 (4b*), 4c*), 6b*), 6c*), 39b*), 68a*), 68c*)	For specific Service Part Numbers allocated to the Disc Brake see: <a href="http://www.knorr-bremseCVS.com">www.knorr-bremseCVS.com</a> <a href="http://www.knorr-bremseCVS.biz">www.knorr-bremseCVS.biz</a>
Tappet and Boot Kit	13 (2x), 22 (2x), 161 (2x)	
Adjuster Cap Kit	37 (10 pcs), 61 (10 pcs)	
Pad Kit (per axle)	11, 12, 26, 37, 44, 45, 61	
Wear Indicator Kit (per axle)	Variants see Section. 1.2.1	
Caliper	Air Disc Brake <b>without</b> Carrier (2) and <b>without</b> Brake Pads (12). Guide Pins and Seals Kit provided 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: Brochure Y028774 or <a href="http://www.Knorr-BremseCVS.com">www.Knorr-BremseCVS.com</a> <a href="http://www.Knorr-BremseCVS.biz">www.Knorr-BremseCVS.biz</a>

1.2.1 Wear Indicator Kits (typical kits are shown below)

\*) Variants



- 11 Pad Retainer
- 101 Sensor
- 103 Cable to electrical Supply
- 104 Cable Protection Plate
- 105 Cable Guide
- 105a Cable Guide

# 1 Brake Disc

## 1.3 Brake Disc

Replacing Brake Discs is subject to the instructions of the Vehicle 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, invalidate warranty and not be covered by any Knorr-Bremse liability

Brake Discs can be ordered through the Knorr-Bremse Aftermarket Organisation.



## 2 General Information

### 2.1 Service Tools

Tool combination		Description	consisting of Tool Components:
Part No.	Identifier		
Z004190	(B )	Press-in Tool for Tappet and Boot Assembly (13)	T1, T2 T3, T4
Z004357	(C)	Pull-in Tool for Inner Boot (9)	T7, T8, T10
Z004354	(D)	Pull-in/Pull-out Tool including Grooving Tool for Brass Bush (7)	T8, T12, T13, T14, T16
II32202	(A)	Wedged Fork for removal of Tappet and Boot Assembly (13)	T15
K015825	(H)	Press-in Tool for Cover (10)	T26 (replaces T17)
K016743	(M)	Press-in Tool for Cover (68c)	T27 (replaces T25)
Z004198	(R)	Pull-in/Pull-out Tool for Rubber Bush (6a) and (6b)	T5, T6, T18, T19,T20, T21, T22
K005986	(N)	Pull-in/Pull-out Tool for Guide Sleeve (6c)	T5, T6, T8, T14, T20, T21
Z003934	(K)	Press-in Tool for Cap (68a)	T11
Z004361	(L)	Press-in Tool for Inner Seal (22)	T3, T4, T9
K004082	(P)	Ring for Tappet and Boot Assembly (13)	T24

#### Note

The Service Tool Kit (Part No. **K016947**) contains the above listed tools, to fit tool combinations for items 6a, 6b, 6c, 7, 9, 10, 13, 22, 68a and 68c. This English Service Manual as well a German one and a Service DVD (Part No. **K016953**) are included. Customers who already own the Service Tool Kits (Part No. **K005973** or **K001288**) may supplement this with the "Supplemental Tool Kit" (Part No. **K017062**). This contains the tool combinations (Part No. **K015825**), (Part No. **K016743**) and (Part No. **K004082**) as well as a revised Service-DVD (Part No. **K016953**). An English and a German Service Manual are supplied in the "Supplemental Tool Kit" as well.

### 2.2 Diagnostic Equipment

Part-Number	Description
II40598F	<b>ZB9031-2</b> hand-held device for checking Potentiometer function (Pad plus Disc wear) where 13 pin chassis plug is installed. <b>ZB9031-2</b> replaces <b>ZB9031</b> - see page 19.

### 2.3 Lubricant

Part Number	Colour	Quantity
II14525	white	5g
II32868	white	500g

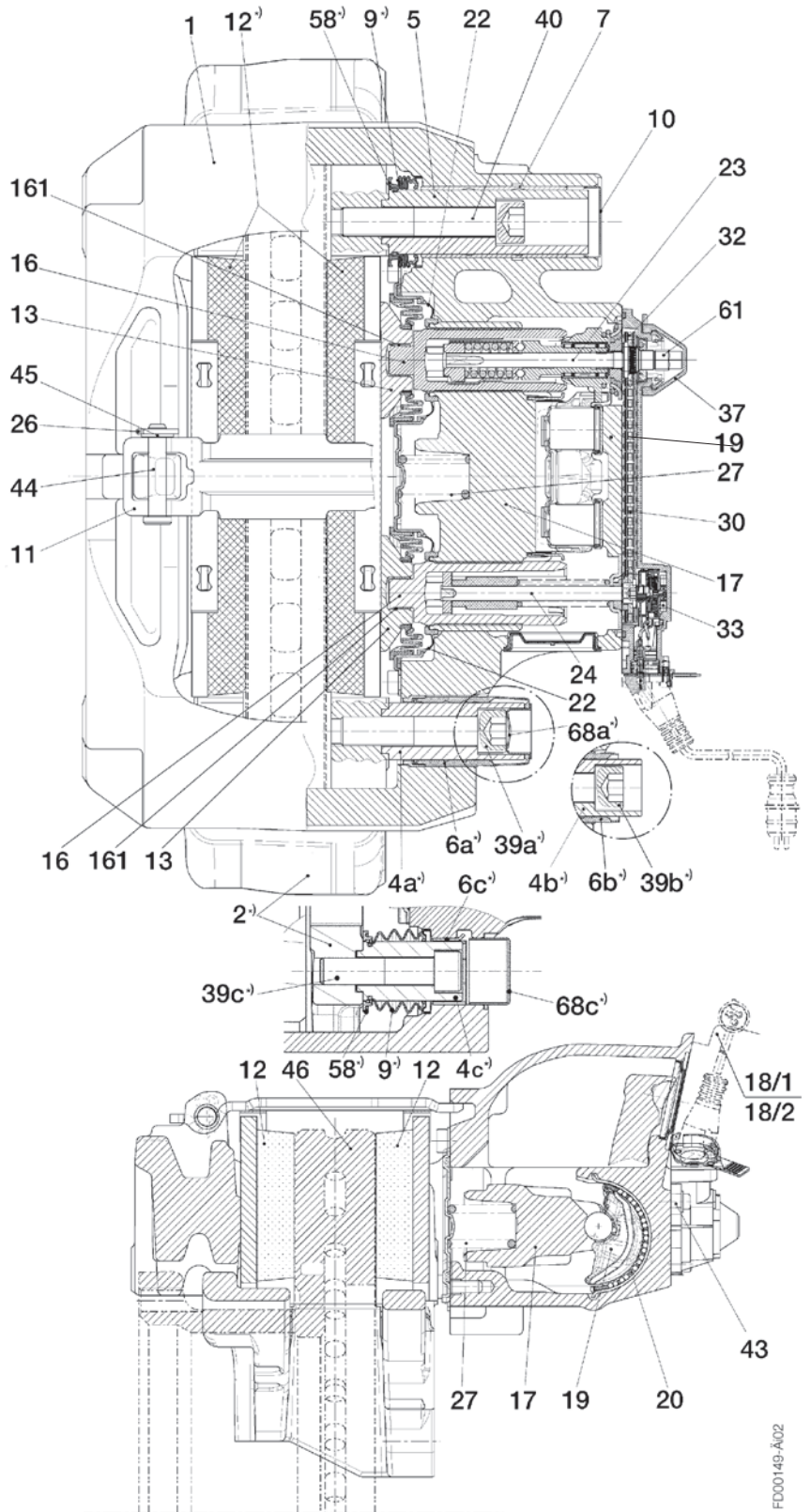
### 2.4 Torque Requirements

Item Number		Torque	Spanner Size (mm)
39a; 39b; 39c; 40	Caliper Bolts (2x) M16x1,5 (Hexagon socket head)	180 Nm plus 90°	14 (Hexagon key)
18/1; 18/2	Brake Chamber or Spring Brake	Follow the instructions of the Brake Actuator Manufacturer	-

3 Description and Function

3.1 Disc Brake Sectioned View

- 1 Caliper
- 2\*) Carrier
- 4a\*) Guide Pin
- 4b\*) Guide Pin
- 4c\*) Guide Pin
- 5 Guide Pin
- 6a\*) Rubber Bush
- 6b\*) Rubber Bush
- 6c\*) Guide Sleeve (DU)
- 7 Brass Bush
- 9\*) Inner Boot
- 10 Cover
- 11 Pad Retainer
- 12\*) Pad (complete)
- 13 Tappet and Boot Assembly
- 16 Threaded Tube
- 17 Bridge
- 18/1 Spring Brake
- 18/2 Brake Chamber
- 19 Lever
- 20 Eccentric Bearing
- 22 Inner Seal
- 23 Adjuster Unit
- 24 Turning Device
- 26 Spring Clip
- 27 Spring
- 30 Chain
- 32 Chain Wheel
- 33 Wear Sensor
- 37 Adjuster Cap
- 39a\*) Hexagon Socket head cap screw
- 39b\*) Hexagon Socket head cap screw
- 39c\*) Hexagon Socket head cap screw
- 40 Hexagon Socket head cap screw
- 43 Bolt
- 44 Pad Retainer Pin
- 45 Washer
- 46 Disc
- 58\*) Ring
- 61 Shear Adapter
- 68a\*) Cap
- 68c\*) Cover
- 161 Tappet Bush



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\*) Varianten beachten

## 3.2 Description of Operation

(Floating Caliper Principle)

### 3.2.1 Brake Actuation

During actuation, the Push Rod of the Actuator (18/1 or 18/2) 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).

After overcoming the running clearance between the Pads and the Disc, the reaction forces are transmitted by the caliper to the outboard Pad (12). The clamping forces on the Pads (12) and the Disc (46) generate the braking force for the wheel.

### 3.2.2 Brake Release

After releasing the air pressure, the Return Spring (27) pushes the Bridge (17) and Lever (19) back to the start position; this ensures a running clearance between Pads and Disc is maintained.

### 3.2.3 Brake Adjustment (automatic)

To ensure a constant running clearance between Pads and Disc, the brake is equipped with a low 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. The total running clearance (sum of clearance both sides of Disc) should be between 0.6 and 1.1 mm; smaller clearances may lead to overheating problems.

### 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 points ensure a long-life and trouble-free operation of the disc brake. The inspection frequencies specified are minimum values. Depending on the vehicle application a more frequent check of the components may be necessary.

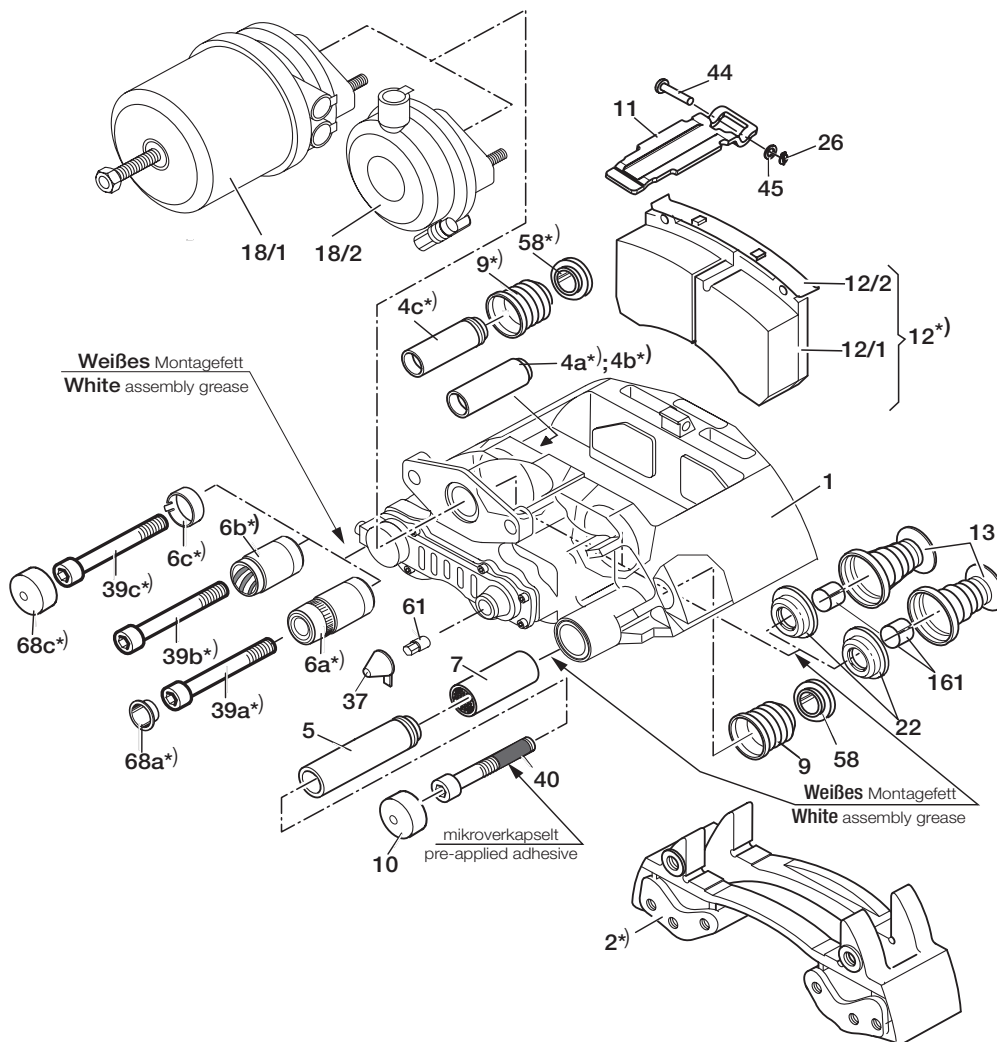
The brake pad wear must be checked visually on a regular basis, e.g. each time the tyre pressures are checked, or at least every three months (see Sections 5.1.1, 5.1.2, 5.1.3).

At least annually, e.g. during the inspection regulated by law, the clearance of the caliper related to the running clearance must be checked. Also inspect the Cover (10) and the Cap (37) as well as the Cap (68a) or the Cover (68c) for correct fitting and condition.

With each Pad change 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 5.3.2). Also inspect the Tappet and Boot Assemblies (13), the Adjuster Cap (37) and the sealing elements (6a, 9, 10, 58, 68a or 68c) for correct fitting, condition and damage as well as the caliper bearing clearance..

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

In the unlikely event of a warranty claim, all relevant components - e.g. Pads (12/1) and Pad Retainer Springs (12/2) - must be returned in order that an objective investigation of the cause can be made.



## 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.



*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, please 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.*

## 5 Functional and Visual Check

### 5.1 Wear Check of Pads and Brake Discs



*For optimum safety, stay within the Pad and Disc Wear Limits.*

#### 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.

If the friction material is less than 2mm at its thinnest area (see dimension E, Sketch 3), the Pads must be replaced.

Minor breakouts at the edges are permitted (see arrow, Sketch 1).

Major breakouts on the surface of the brake Pad are not permitted (see arrow, Sketch 2).

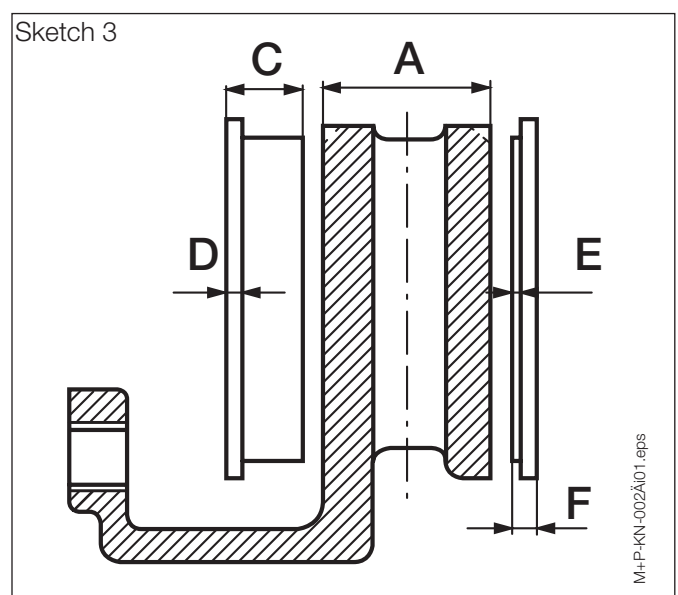
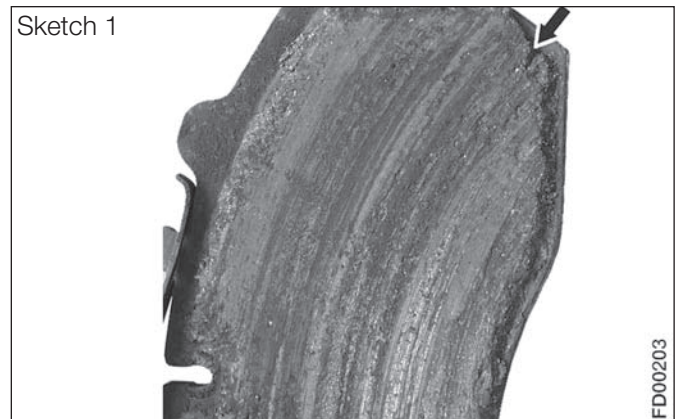
#### Brake discs

Measure the thickness of the brake disc at the thinnest point. Avoid measuring near the edge of the disc as a burr may be present.

- A = Total thickness of the brake disc  
new condition = 45 mm  
worn condition = 37 mm (the disc must be replaced)
- C = Overall thickness of Brake Pad 30mm (new condition)
- D = Backplate - 9 mm with SN6... and SN7...  
Backplate - 7 mm with SK7... and ADB22X.
- E = Minimum thickness of friction material 2mm
- F = Minimum allowed thickness in worn condition for backplate and friction material.  
With 9 mm backplate, F = 11 mm.  
With 7 mm backplate, F = 9 mm.  
If these minimum allowed thicknesses are reached, replacement of the Brake Pads is necessary

If the Disc dimension  $A \leq 39$  mm, it is recommended that the Disc should be renewed when the brake pads are next changed.

If the disc thickness is less than 37 mm, the disc must be replaced.



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

Check Disc at each change of Pads for grooves and cracks.

The diagram shows possible surface conditions of the brake disc.

- A1 = Small cracks spread over the surface **are allowed**
- B1 = Cracks less than 1.5mm deep or wide, running in a Radial direction **are allowed**
- C1 = Unevenness of the disc surface less than 1.5mm deep **is allowed**
- D1 = Cracks going through to the cooling duct or onto the inner or to the outer friction ring **are not allowed**.  
The Disc **MUST BE REPLACED**.

a = width of the friction surface

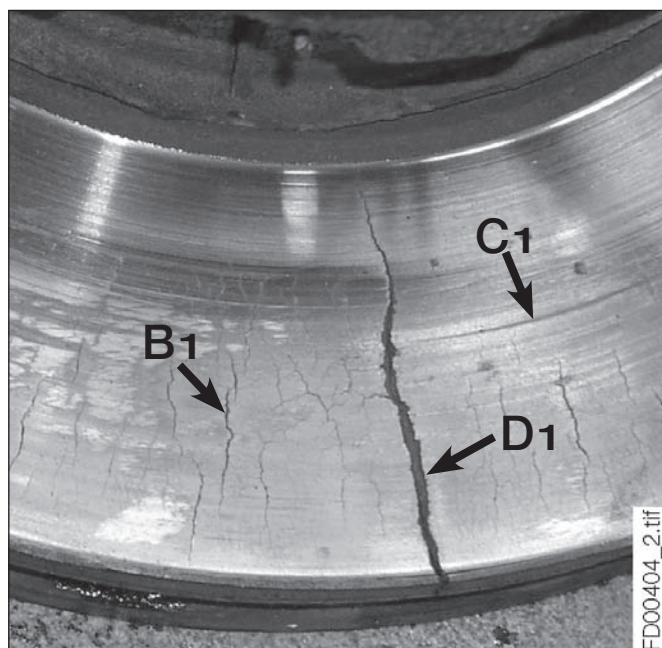
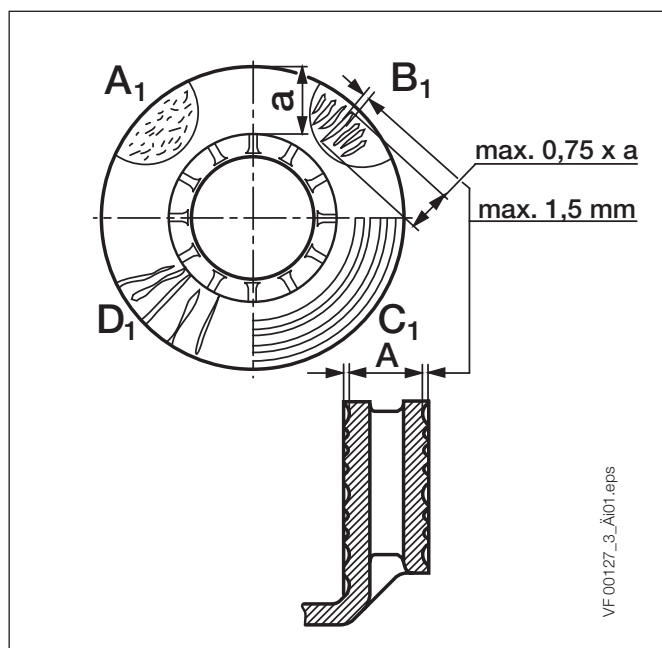
**Note:**

In case of surface conditions A1, B1 and C1, the Disc can continue to be used until the minimum thickness of 37mm 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 39 mm.

In addition, the recommendations of the Vehicle Manufacturer about the machining of the brake disc **MUST** be followed.

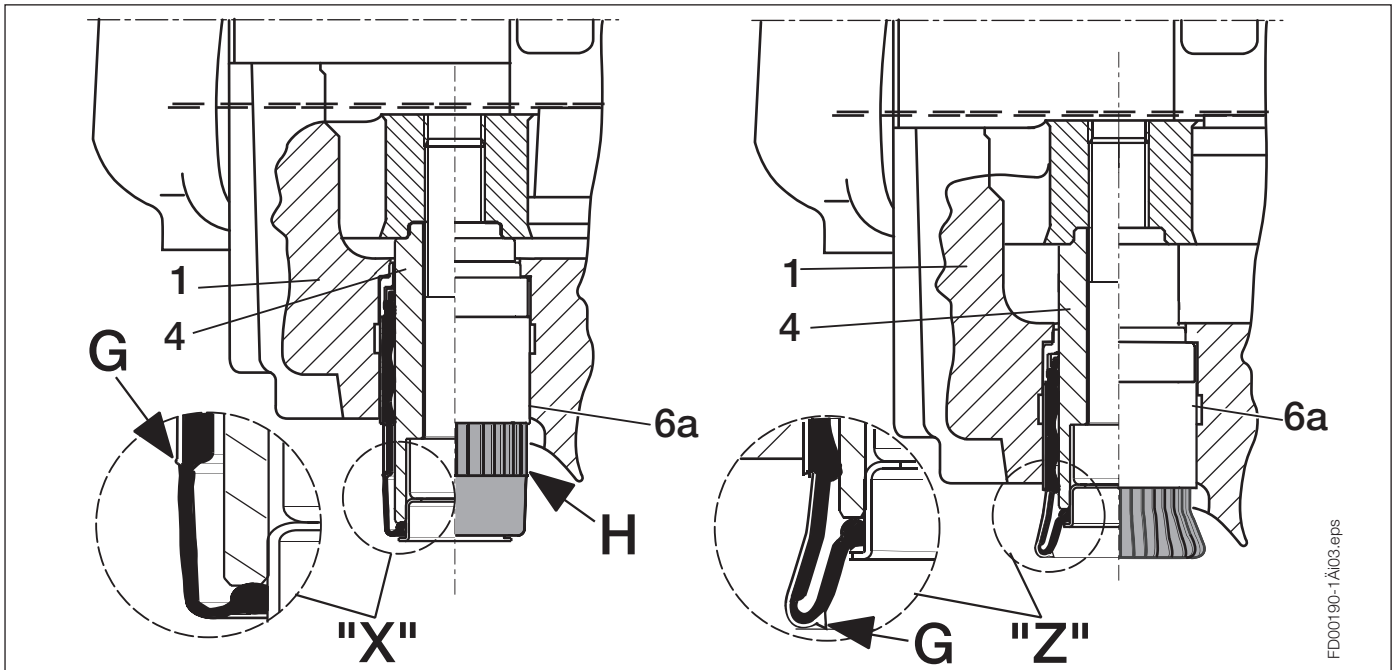
The adjacent picture shows some examples of cracks and grooves on a Brake Disc.



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

### 5.1.1 Brake Wear Check using Rubber Bush (6a):

For all Disc Brakes which are equipped with a Rubber Bush that is axially ribbed (see H in sketch).



The condition of the Pads can be visually determined, without removing the road wheel, by viewing the position of the wear marking "G" (change-over from the ribbed area to the flat area).

#### **New Condition** (see "X")

Shown by the position of the wear marking 'G' on the Rubber Bush (6a).

#### **The wear limit** (see "Z")

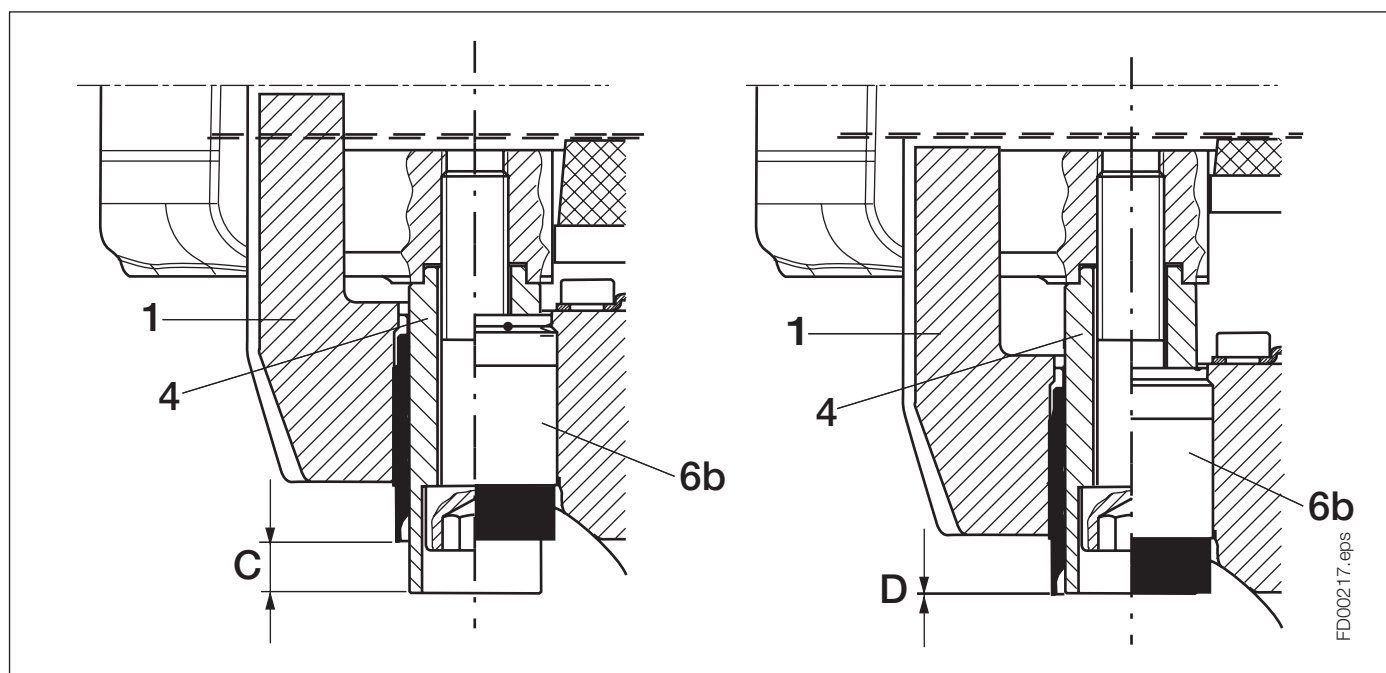
Shown by the new position of the wear marking "G" on the Rubber Bush (6a). This condition requires a check of the brake pad thickness and the brake disc with the wheel removed.

If necessary change the Pads (see Section 6) and/or the Disc - see Vehicle Manufacturer's recommendations.



### 5.1.2 Brake Wear Check using Rubber Bush (6b):

For all Disc Brakes which are equipped with open Rubber Bush Version.



The condition of the Pads can be visually determined without removing the wheel by checking the position of the caliper (1) compared to the fixed Guide Pin (4).

If dimension 'C' is less than 1mm, the brake pad thickness and the brake disc must be checked with the wheel removed.

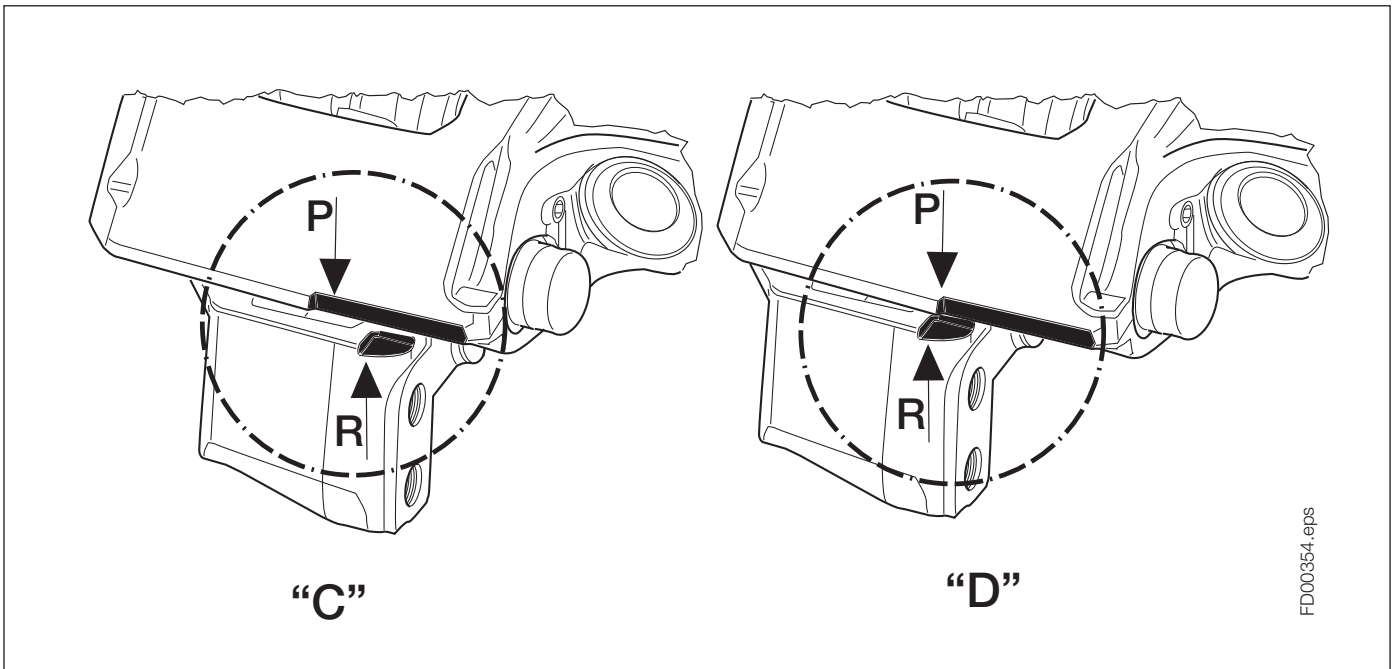
If necessary change the Pads (see Section 6) and/or the Disc - see Vehicle Manufacturer's recommendations.

C = new condition

D = brake pads and disc must be checked with the wheel removed.

### 5.1.3 Brake Wear Check using Carrier to Caliper position (6c):

For all Disc Brakes which are equipped with a Caliper to Carrier marking.



The condition of the Pads can be visually determined without removing the road wheel by viewing the position of the Caliper position (P) compared to the Carrier marking (R).

If the condition "D" is reached the brake pad thickness and the brake disc must be checked with the wheel removed.

If necessary change the Pads (see Section 6) and/or the Disc - see Vehicle Manufacturer's recommendations.

C = new condition

D = pads and disc must be checked with the wheel removed.

### 5.1.4 Wear Indicators

Due to different Vehicle Manufacturer and vehicle types there are several types of Pad Wear Indicator used.

- In-pad Normally Closed Indicator - Circuit is broken when Pad Wear reaches limit.
- In-pad Normally Open Indicator - Circuit is made when Pad Wear reaches limit.
- 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.

An optical or acoustic device may be linked to any of the above.

#### Note:

Please also refer to specifications provided by the Vehicle Manufacturer.

### 5.1.5 Diagnostic Equipment

**The Knorr-Bremse Diagnostic Unit ZB9031-2 is a hand held device suitable for vehicles that are fitted with Knorr-Bremse Disc Brakes using a continuous signal type of Wear Indicator Potentiometer.**

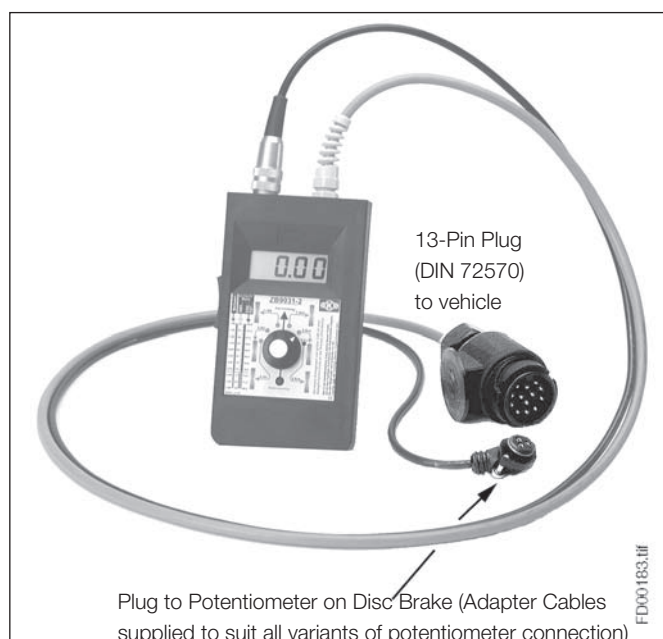
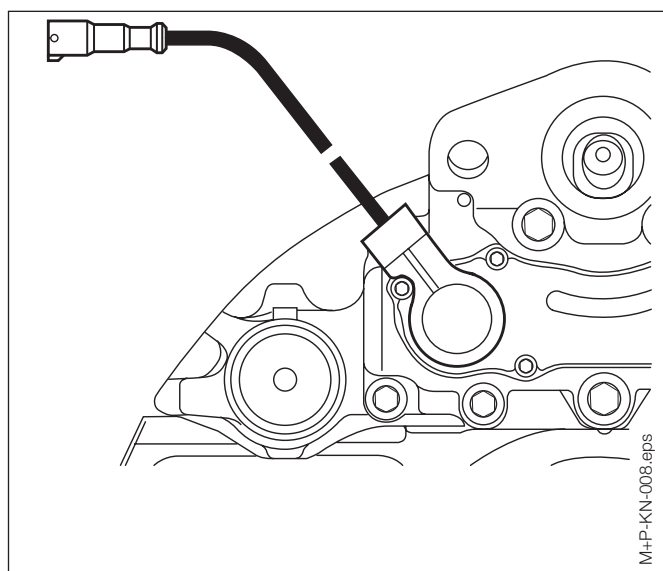
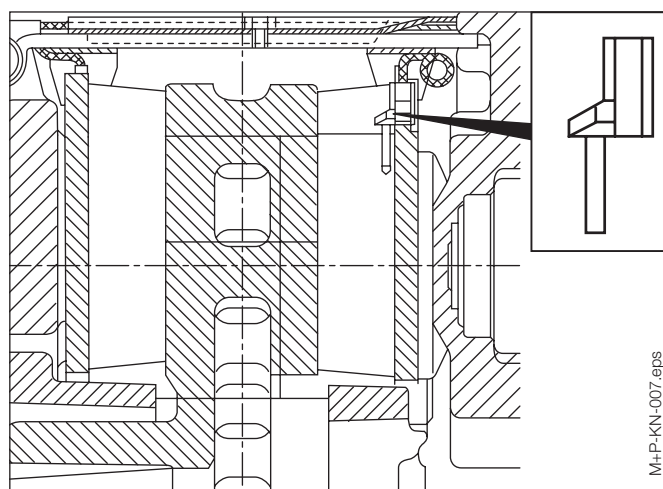
The wear condition of each brake can be measured by connecting the device to a suitable 13 pin socket (DIN 72570), where fitted. This socket will have been connected to each sensor by the vehicle manufacturer.

The Diagnostic unit allows:

- Quick and simple wear check.
- A check of the potentiometer function.
- A simultaneous check of up to six brakes, without removing the wheels.

#### Note:

A detailed instruction manual is included with each unit.



### 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 the bus stop temporary hold brake, if fitted, are in the released condition.

Remove wheel.

The caliper assembly should be pushed inboard on its Guide Bushes. Using a suitable tool, press the inboard pad (12) away from the Tappets and check the gap between Tappet and inboard pad backplate - it must be between 0.6 - 1.1mm.

**!** If the clearance is too wide, 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.

If the running clearance is too small or too large, the adjuster may not be functioning correctly and should be checked as follows.

Pull off the Adjuster Cap (37) using the tag, taking care not to lose the Shear Adapter (61).

The Adjuster (23) must be turned with the Shear Adapter (61) anti-clockwise for 2 or 3 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 that the ring spanner or socket can turn freely clockwise during the following procedure.

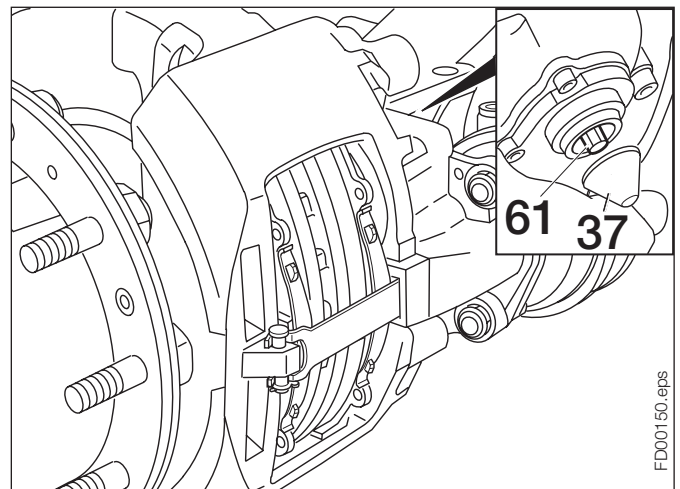
By applying the brake (about 2 Bar) 5 to 10 times the spanner or socket should turn clockwise in small increments if the Adapter is functioning correctly (see notes below).

#### Note:

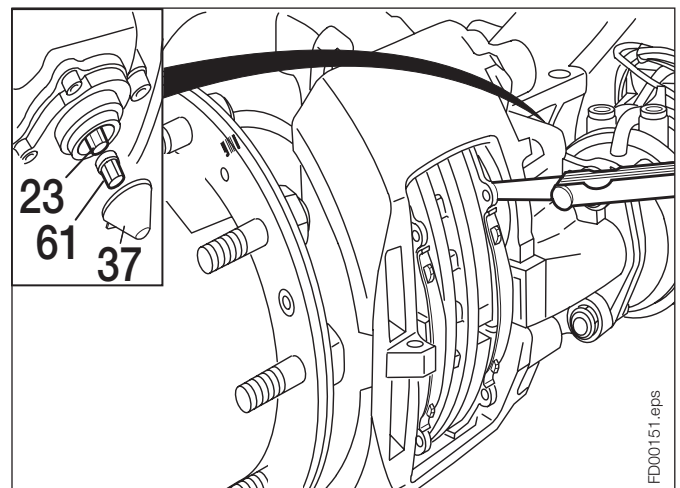
As the number of applications increases, incremental movement of the ring-spanner or socket will decrease.

#### Note:

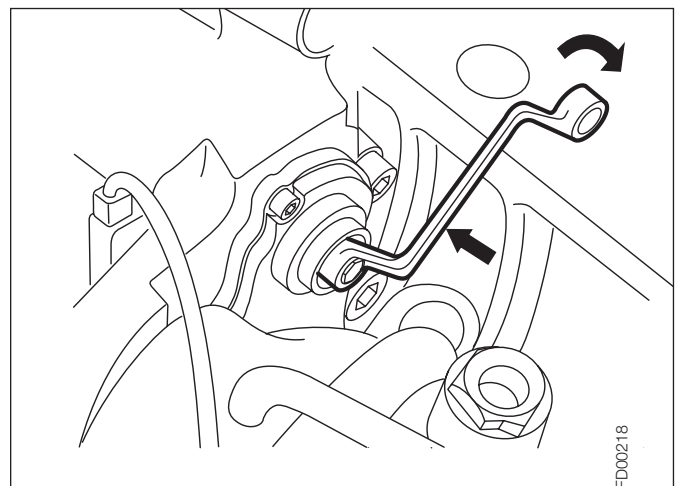
If the spanner or socket does not turn or turns only with the first application or turns forward and backward with every application, the automatic Adjuster has failed and the Caliper must be replaced.



FD00150.eps



FD00151.eps



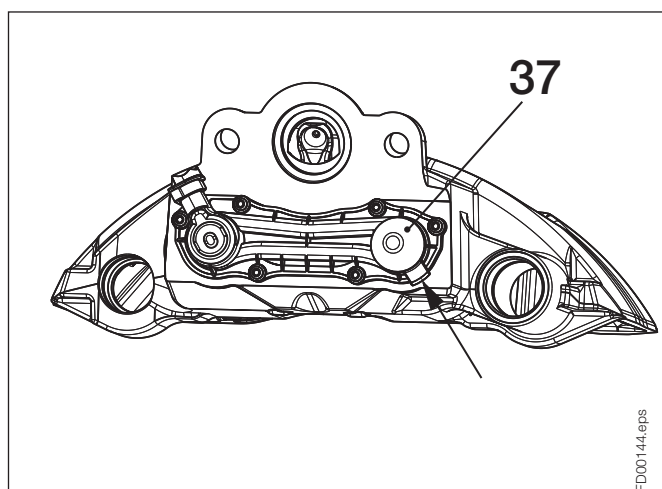
FD00218

**Note:**

Even if pads are not being changed, a new adjuster cap (37) should be fitted, having lightly greased the contact surface with white grease (available as Part No. II14525 or II32868).

**Notes:**

The tag of the Adjuster Cap (37) should be positioned as shown by the arrow in the adjacent diagram. This ensures access is maintained for subsequent removal. Removal of the Adjuster Cap with a screwdriver, or similar, is not allowed since the seal may be damaged.



# 5 Functional and Visual Check

## 5.3 Caliper Checks

### 5.3.1 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.

By pushing and pulling the Caliper in an axial direction by hand (see arrow A in adjacent sketch), a movement of 0.6 - 1.1 mm must be possible.

If, even using a high level of hand pressure (no tools), the Caliper is not moveable, the Caliper guidance must be further examined (see Section 5.3.2).

### 5.3.2 Caliper Movement along Guide Pins

Remove Pads (see Section 6.1)  
Clean dirt from Guide Bush (4a) or (4b) (see arrows in sketch).  
Using hand pressure only (no tools), the Caliper (1) must slide freely along the whole length of the Guide Pin arrangement; movement should be greater than 25mm.

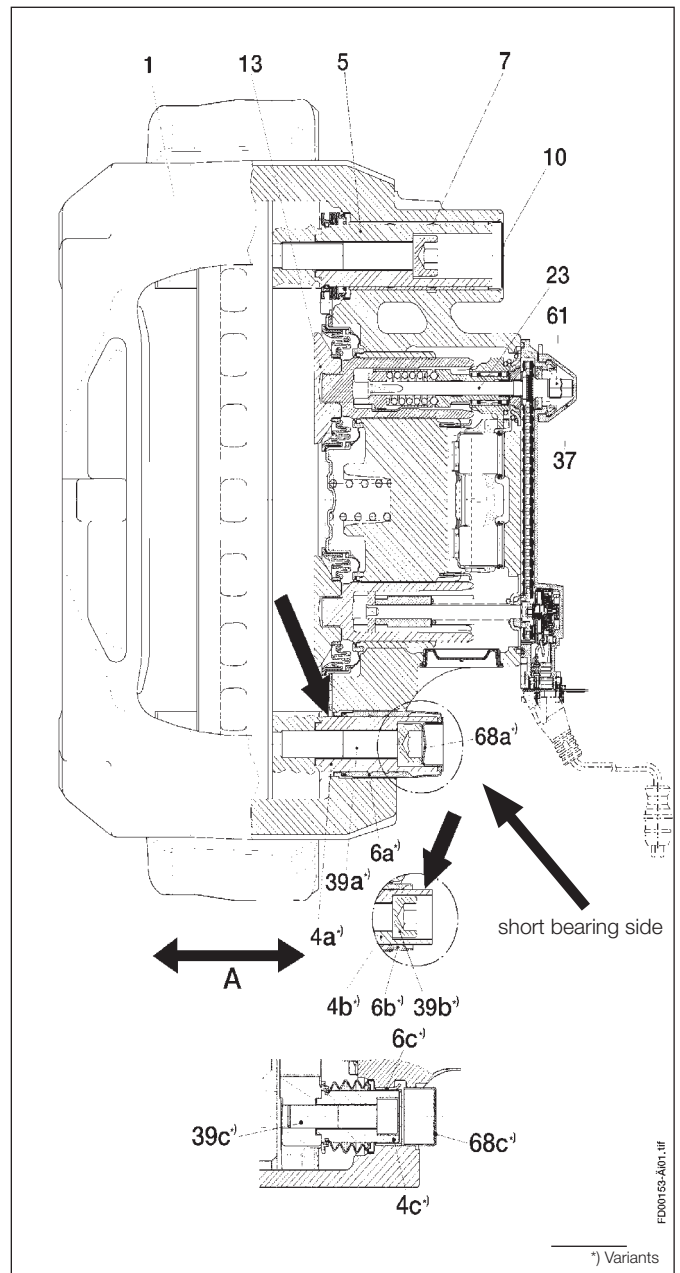
### 5.3.3 Rubber Bush (6a, 6b) or Guide Sleeve (6c) to Guide Pin clearance

**Note:**  
Before removing the wheel, note that there is no contact between Caliper and axle, vehicle, chassis sections or Carrier. If necessary the Rubber Bush (6a, 6b) or Guide Sleeve (DU) (6c) must be replaced (see Section 10.2).

To measure the clearance, the following steps must be taken:

Remove the wheel. Refer to Vehicle Manufacturer's recommendations.

Remove Pad Retainer (11), but leave the Pads (12) in the brake.



Fasten a magnetic dial-gauge holder to the Carrier (2) on the short bearing side of the Caliper (1) - see also adjacent Sketch.

Use the casting tag on the Caliper (1) as the measuring point - see arrow in adjacent sketch.

Press Caliper (1) in the direction of Carrier (2) and set the dial-gauge to zero.

Place a suitable tool (e.g. Screwdriver) between Carrier (2) and Caliper (1) forcing them in opposite directions.

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

#### Note:

Knorr-Bremse distinguishes between the two bearing variants

- variant with Rubber Bush (6a) or (6b).

- variant with Guide Sleeve (6c).(DU)

If the short bearing side is open, or closed by Cap (68a), and the measured bearing clearance is greater than 2.0 mm, the Rubber Bush (6a or 6b) must be replaced using a suitable kit (see Section 1.2 and Section 8).

If the short bearing side is closed by Cover (68c) and the measured bearing clearance is greater than 1.0 mm, the Guide Sleeve (6c) must be replaced using a suitable kit (see Section 1.2 and Section 8).

Note that there must be no contact between Caliper and axle, vehicle, chassis sections or Carrier. If necessary the caliper bearing must be replaced using a suitable kit (see Section 1.2 and Section 8).

Fit Pads and adjust running clearance (see Section 6.2).

Fit the wheel. (Refer to Vehicle Manufacturer's recommendations).

## 5.4 Checking of Sealing Elements

### 5.4.1 Caliper Guide Pin Seals

The Guide Pin (5) is sealed with Cover (10) and with the Inner Boot (9).

The variant with the Guide Pin (4c) is also sealed with Inner Boot (9) and with Cover (68c).

The components (9), (10) and (68c) must be free of any signs of damage.

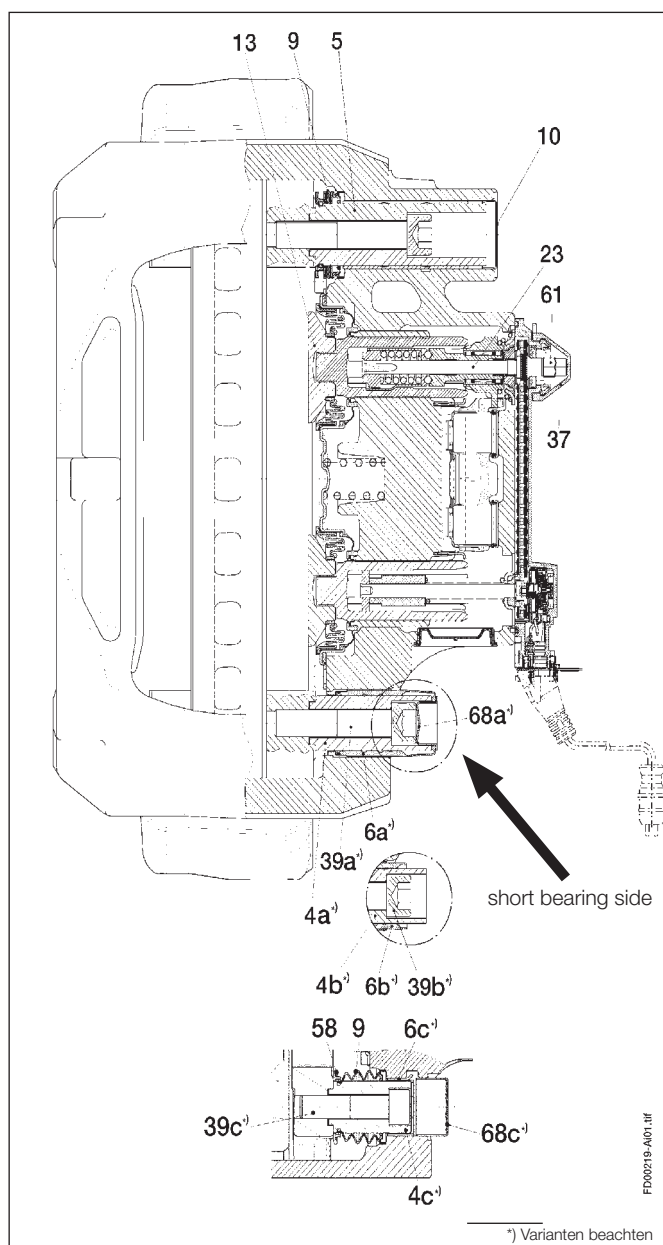
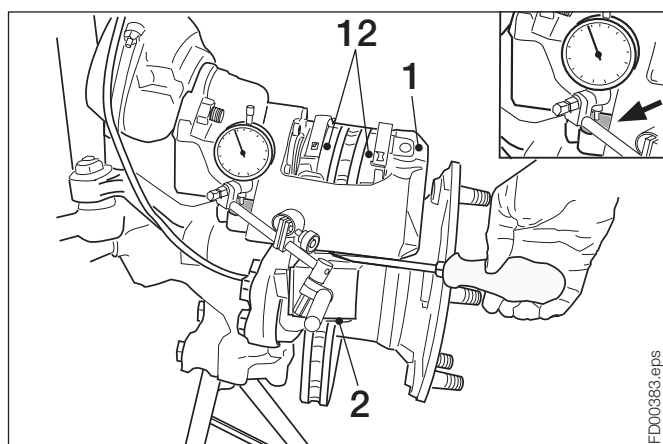
For versions with Rubber Bushes (6a) and (6b), check that the Rubber Bushes are free from damage.

Check for correct location and fitment.

#### Note:

If necessary remove the Pads 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 and following).



## 5

### Functional and Visual Check

#### 5.4.2 Checking of Tappet and Boot Assemblies (13)

If necessary remove Pads (12) (see Section 6.1). Screw the Shear Adapter (61) clockwise (see Section 5.2) until the boots are clearly visible.

**Note:**

The tappet must not be extended more than 30 mm (see sketch) because then the synchronisation is lost and the caliper must be replaced.

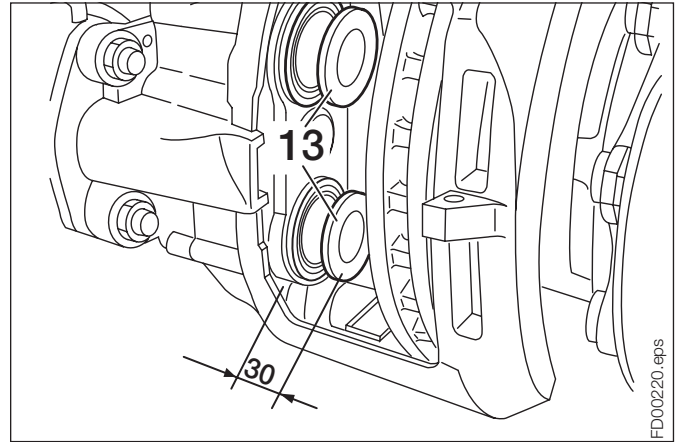
The Tappet and Boot Assemblies (13) must not show any signs of cracks or other damage.

Check for correct location and fitment.

**Note:**

The penetration of dirt and moisture into the brake will lead to corrosion and impair the function of the Disc Brake.

If necessary replace Tappet and Boot Assemblies (see Section 7).





## 6 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 the bus stop temporary hold brake, if fitted, are in the released condition.

### 6.1 Pad Removal

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).

Remove Clip (26) and Washer (45), depress the Pad Retainer (11) and remove Pin (44).

If necessary remove any in-pad wear sensor components.

If the Pad Retainer (11) is corroded or damaged, it must be replaced. Pull off the Adjuster Cap (37) using the tab, taking care not to lose the Shear Adapter (61).

Removal of the adjuster cap with a screwdriver or similar is not allowed since the seal may be damaged.

Fully wind back the Tappet and Boot Assemblies (13) by rotating the Shear Adapter (61) in an anti-clockwise direction (see Section 5.2) – a clicking noise is generated.

**⚠** 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.

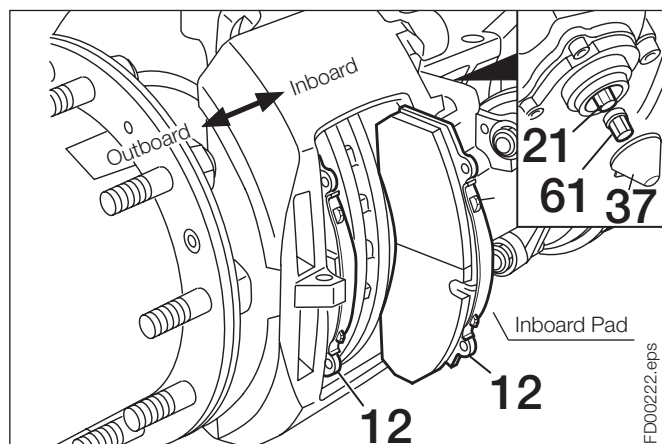
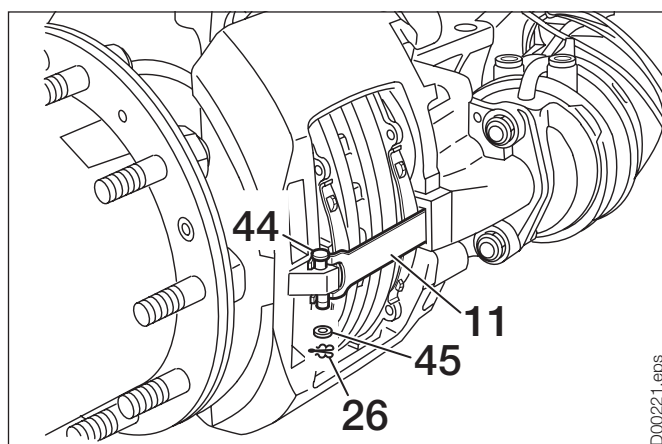
#### Note:

The shape of the backplate in SK7- and ADB22X- Disc Brakes means that the steps below for removal of the brake pads (12) must be followed:

- slide Caliper (1) fully outboard,
- remove outboard Pad (12),
- slide Caliper (1) fully inboard,
- remove inboard Pad (12).

#### Note:

The removal steps for SN6- and SN7-Disc Brakes can be carried out in any order.



## 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.

### Note:

Fully wind back the Tappet and Boot Assemblies (13) by rotating the Shear Adapter (61) in an anti-clockwise direction before fitting the pads (see Section 5.2),

**⚠** 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.

### Clean the Pad abutments.

### Note:

The shape of the backplate in SK7- and ADB22X- Disc Brakes means that the fitting steps below must be followed:

- slide Caliper (1) fully inboard,
- fit inboard Pad (12)
- slide Caliper (1) fully outboard
- fit outboard Pad (12)

### Note:

The fitting steps for SN6- and SN7-Disc Brakes can be carried out in any order.

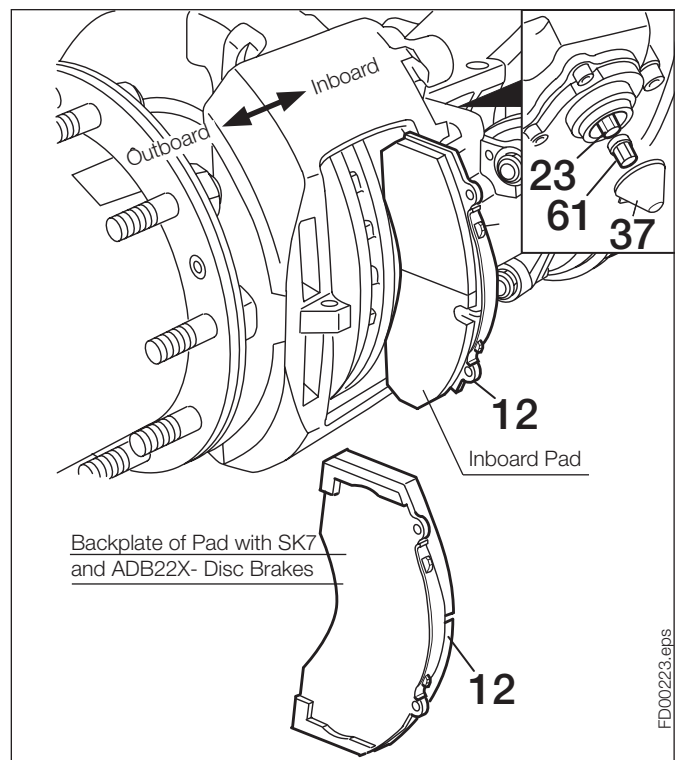
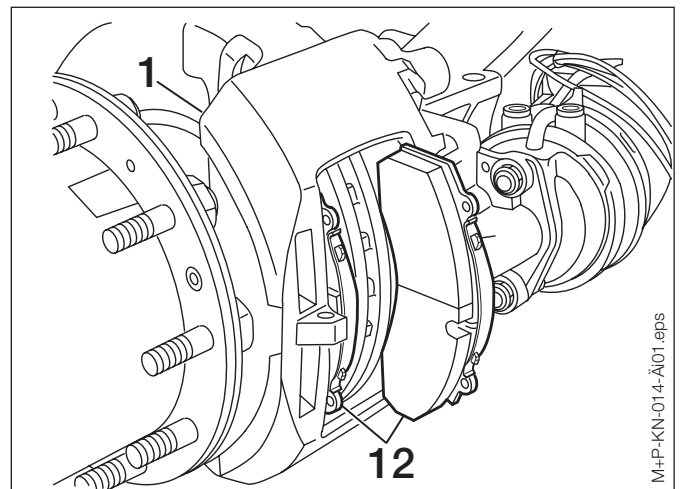
Fit new in-pad Wear Indicator kit, if appropriate (see Section 1.2.1 and Section 6.3).

Install the cable so that it cannot be damaged.

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 two clicks (see Section 5.2) and check the running clearance.

The hub should turn easily by hand after having applied and released the brake.



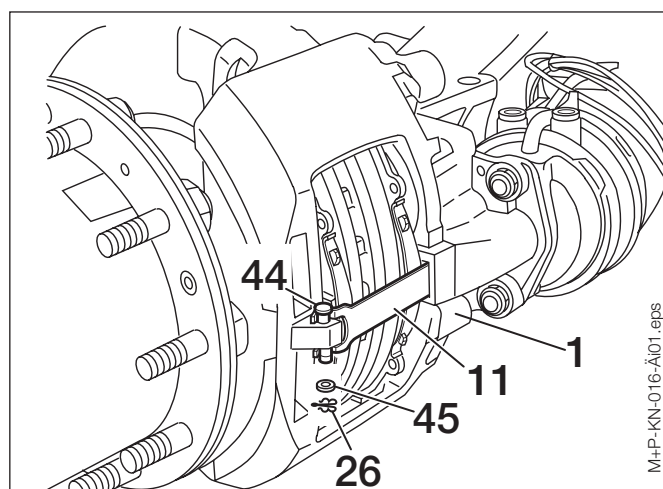
After fitting the Pad Retainer (11) into the groove of the Caliper (1), it must be depressed to enable the insertion of the Pad Retainer Pin (44).

Fit washer (45) and Spring Clip (26) to the Pad Retainer Pin (44) (use only new parts).

It is recommended that Pad Retainer Pin (44) is installed pointing downwards (see Sketch).


Re-fit wheel according to the Vehicle Manufacturer's recommendations.

The Adjuster Cap (37) must then be replaced (use only a new Cap) having lightly greased its contact surface with white grease (available as Part No. II14525 or II32868).

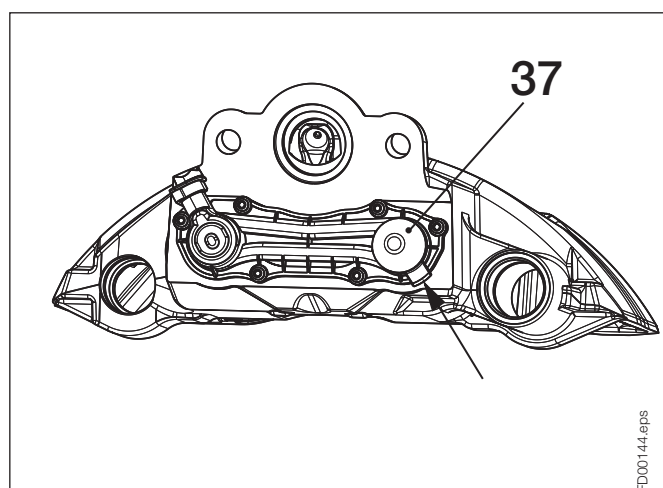


#### Note:

The tag of the Adjuster Cap (37) should be positioned as shown by the arrow in the adjacent Sketch. This ensures access is maintained for subsequent removal.

 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.



### 6.3 Wear Indicator Fitting

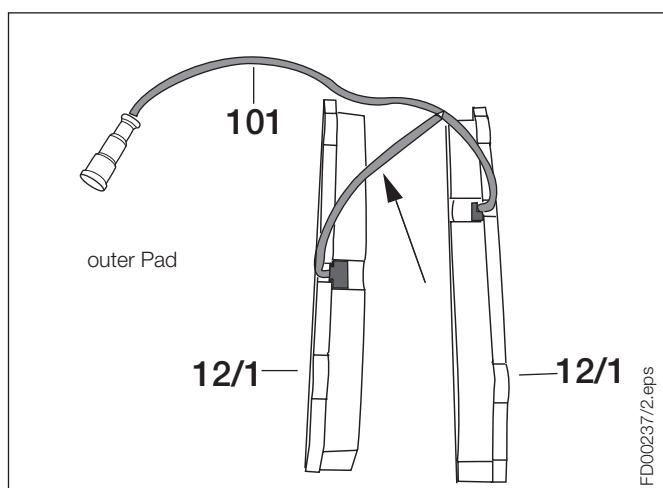
(In-pad cable type)

Remove Pads (12) - see Section 6.1.

Wear Indicator Kits consist of items as shown in Section 1.2.1.

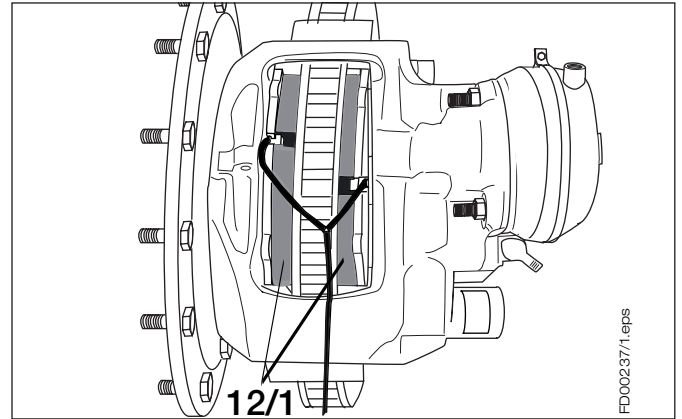
Insert the Wear Indicator Cables (101) into the groove of the Pads. The Wear Indicators snap into place in the holes in the Pad material.

The longer end of the Wear Indicator cable (101) (see arrow) must be fitted in the outer Pad (12/1).

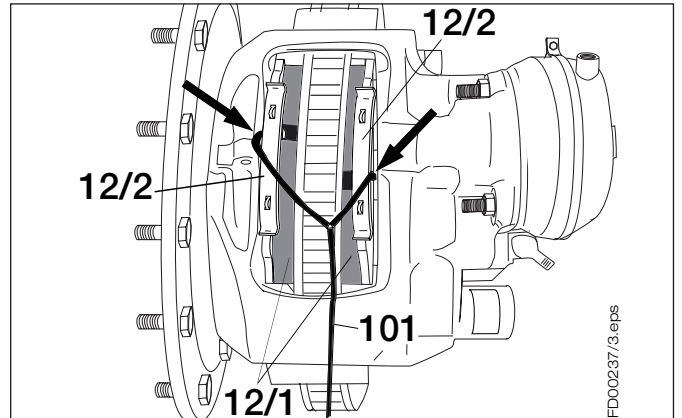


## Pad Replacement

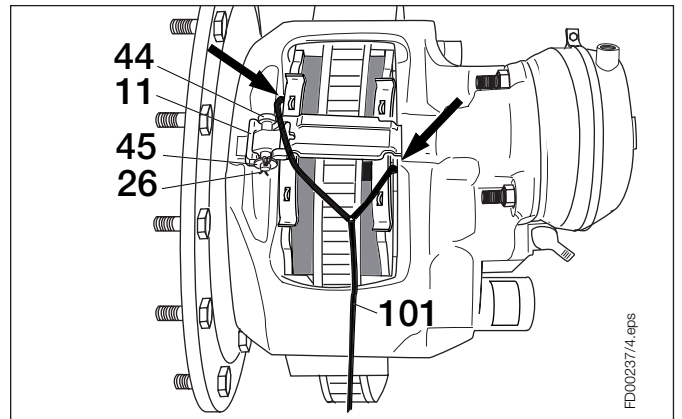
Insert Pads (12/1) into the Pad abutments (see Section 6.2).



Fit Pad Holder Springs (12/2) onto the Pads (12/1). Pay attention to correct installation of Wear Indicator Cable (101) (see arrows).

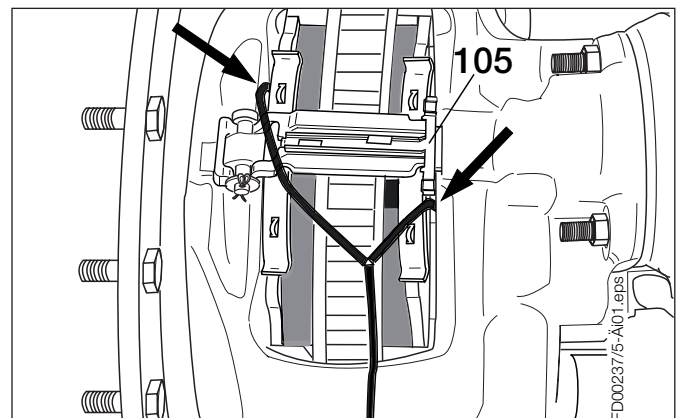


Fit Pad Retainer (11), Pad Retainer Pin (44), Washer (45) and Spring Clip (26) (see Section 6.2) Pay attention to correct installation of the Wear Indicator Cable (101) (see arrows).



### 6.3.1 Cable Guide Variant (105)

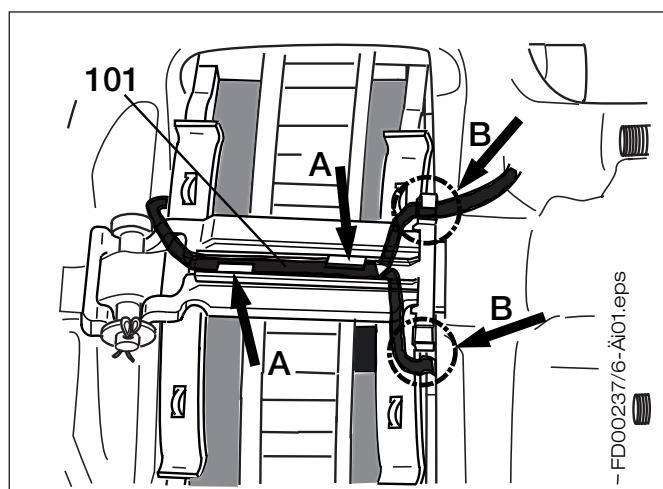
Fit Cable Guide (105) onto the Pad Retainer (11). In the right position, the Cable Guide (105) snaps into place by pressing it lightly onto the Pad Retainer (11).



Press Wear Indicator Cable (101) into the locating tabs of the Cable Guide (105) (see arrows A).

According to vehicle type, install the cable that leads to the electrical supply of the vehicle in one of the two locating tabs (see arrows B).

The short cable end of the Wear Indicator Cable (101) must **not** be secured by locating tabs of the Cable Guide.



### 6.3.2 Cable Guide Variant (105a)

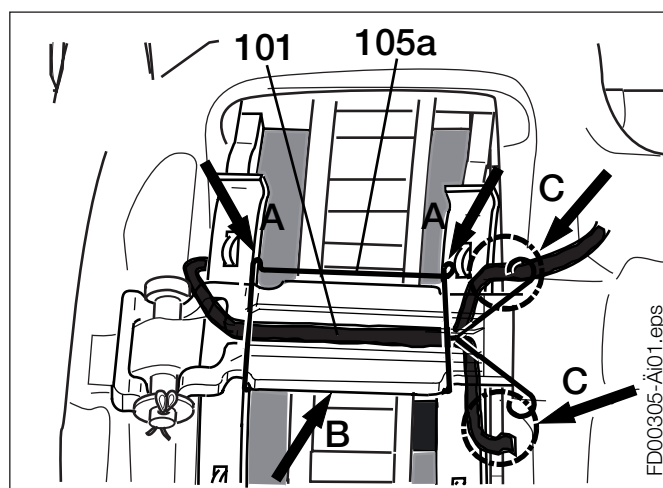
Install Indicator Cable (101) in the middle of the Pad Retainer (11).

Insert Cable Guide (105a) on one side of the Pad Retainer (11) (see arrow B).

Slightly press on the other side of the Pad Retainer (11) (see arrows A). The Cable Guide (105a) snaps into place.

According to vehicle type, install the cable that leads to the electrical supply of the vehicle in one of the wire loop (see arrows C).

The short end of the Wear Indicator Cable (101) must **not** be secured by a wire loop of the Cable Guide (105a) (see arrows C).

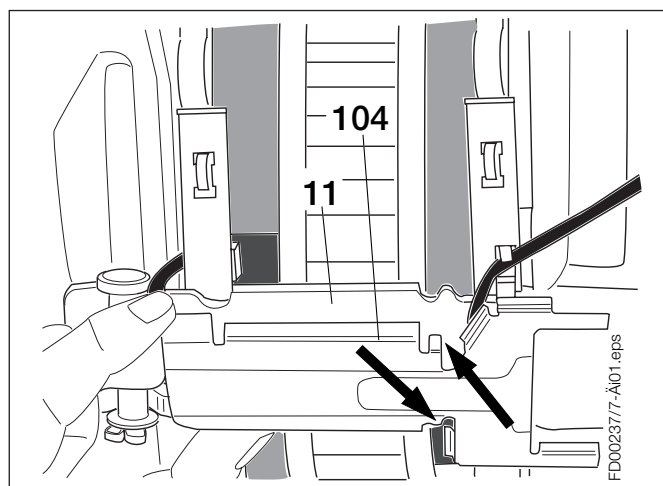


### 6.3.3 Protection Plate (104)

Insert the Cable Protection Plate (104) on one side of the pad retainer bar (11)

Pay attention to the correct position of the Cable Protection Plate's catch (see arrows).

Exert radial hand pressure to the Cable Protection Plate (104); it will snap into place.



# 7 Replacement of Tappet and Boot Assemblies (13) and Inner Seals (22)

## 7 Replacement of Tappet and Boot Assemblies (13) and Inner Seals (22)

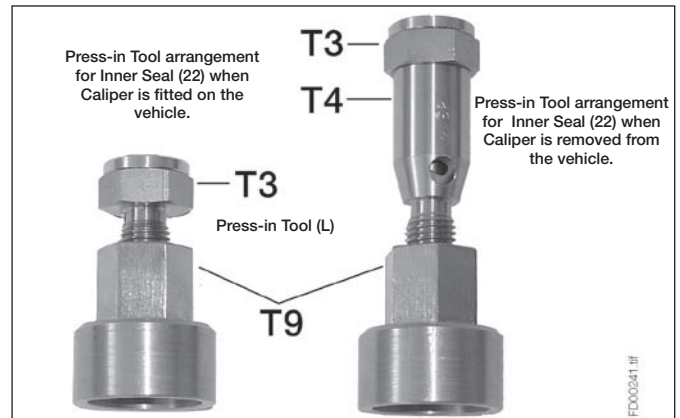
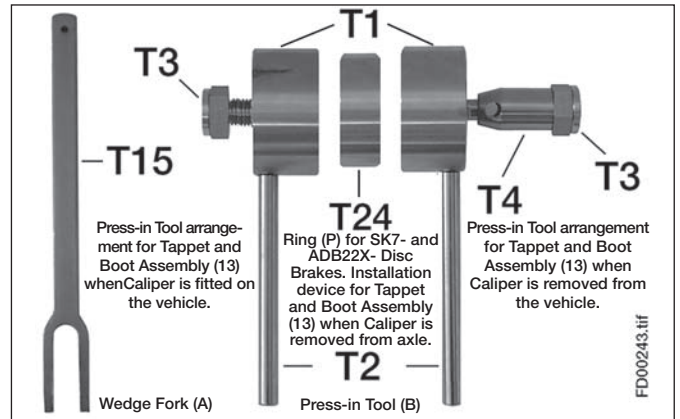
The components of the tools are referred to by identification number for ease of reference.

To remove the Tappet and Boot Assembly (13) use the Wedge Fork (A) (II32202).

To fit the Tappet and Boot Assembly (13) use the Press-in Tool (B) (Z004190).

Use the insert ring (P) (K004082) for brake type SK7 and ADB22x.

To fit the Inner Seal (22), use the Press-in Tool (L) (Z004361).




### 7.1 Tappet and Boot Assemblies (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)

The Shear Adapter (61) must be screwed clockwise until the Boots can be reached (max. 30 mm) (see Section 7.1.1).

Remove the Boot by using a screwdriver or similar (see item B in adjacent sketch).

 The inner sealing face (see arrow X in adjacent sketch) must not be damaged. It cannot be replaced.

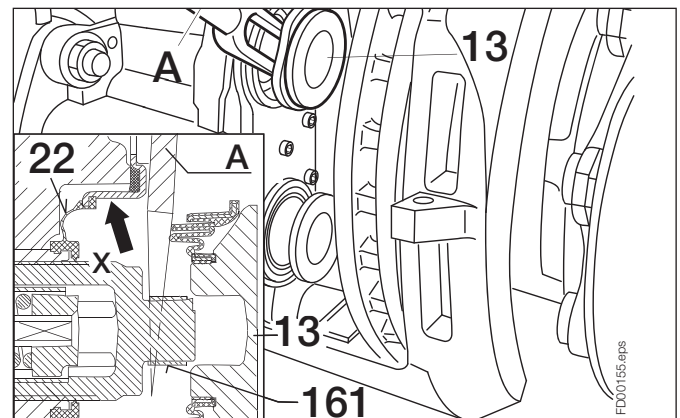
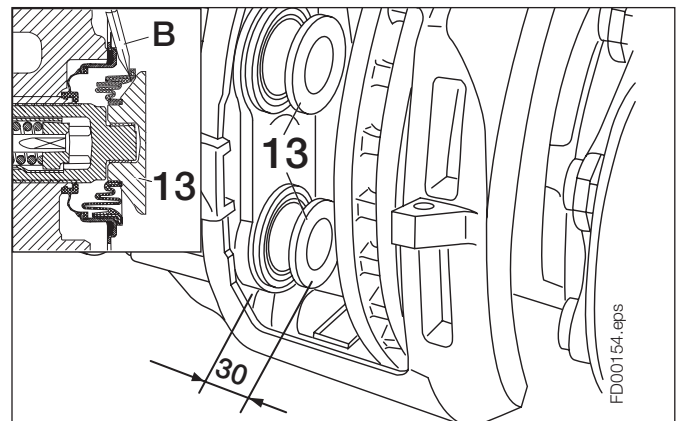
Remove the Tappet and Boot Assemblies (13) from the Threaded Tubes (16) by using Wedge Fork (A) (II32202) Drive the fork between the Tappet and the Threaded Tube.

Remove the old Tappet Bush (161).

Check inner sealing face (see arrow X).

If the inner sealing surface (X) is damaged, the caliper must be replaced.


When replacing Tappet and Boot Assemblies (13), the Inner Seals (22) must also be replaced.



## Replacement of Tappet and Boot Assemblies (13) and Inner Seals (22)

### 7.1.1 Threaded Tubes (16) - Inspection

Place a new Pad (12) into the outboard gap to avoid loss of thread engagement of the Threaded Tubes.

 *Do not unscrew the threaded tubes totally out of the bridge because then the synchronisation is lost and the caliper must be replaced.*

If the Caliper is not installed on the axle, put a spacer E (length = 70mm) into the Caliper (1) to avoid loss of thread engagement of the Threaded Tubes (16) when screwing them out (see adjacent Sketch). Check the threads during screwing for corrosion and damage.


In case of water ingress or corrosion, the Caliper must be replaced (see Section 8).

### 7.2 Inner Seals (22) - Replacement

Fully wind back the Threaded Tubes (16) by turning the Shear Adapter (61) anti-clockwise (see Section 5.2).

Clean area of the Inner Seal (22).

Remove the Inner Seal (22) by using a screwdriver or similar (see A in adjacent sketch).

 *The sealing surface (X) in the caliper for the Inner Seal (22), must not be damaged else the caliper must be replaced (see arrow in bottom sketch).*

Clean sealing surface (X) .

For the inspection of the threads, the tubes must be screwed out (max. 30mm) by turning the Shear Adapter (61) clockwise.

Grease threads with white grease (Part No. II14525 or II32868) and then screw them into the caliper until they stop.

Fit each Inner Seal (22) onto a Threaded Tube (16).

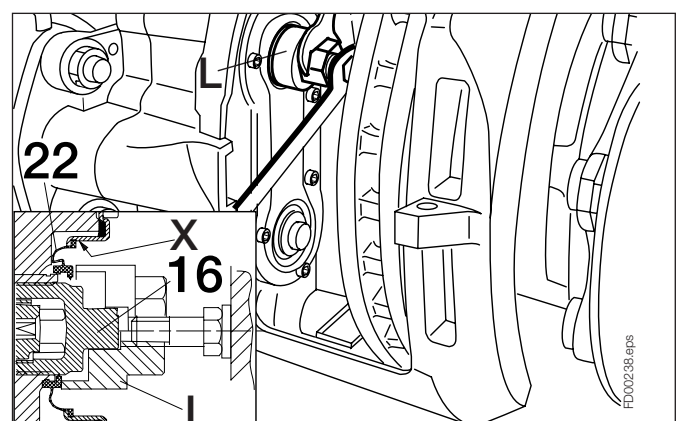
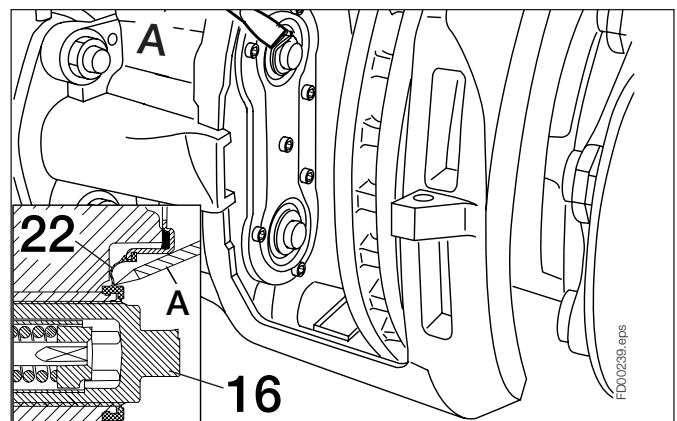
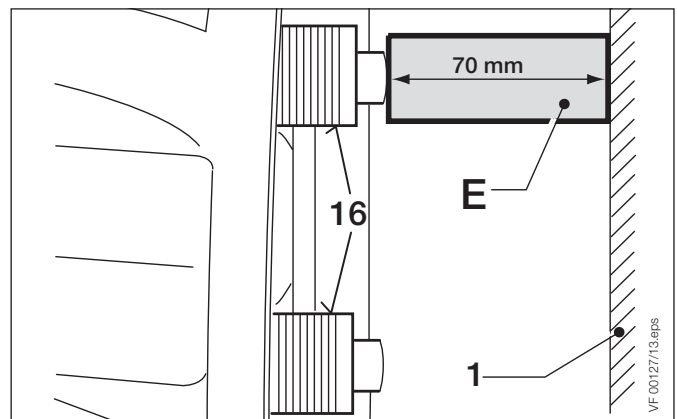
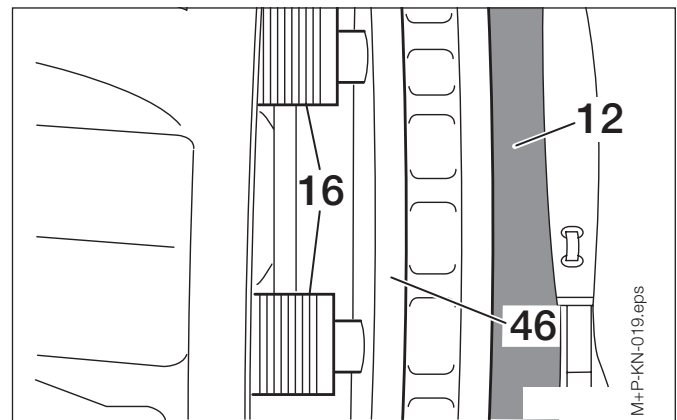
#### With Caliper installed on axle

Remove the Tappet Bush (161).

Position Tool (L) (Z004361) with the short strut in the position shown.

The Tool (L) is guided over the spigot of the Threaded Tube (16).

Fully press in the Inner Seal (22) by rotating Tool T3 using a spanner - see adjacent Sketch.



## Replacement of Tappet and Boot Assemblies (13) and Inner Seals (22)

To check the correct fit of the Inner Seal (22), screw out the Threaded Tubes (16) four or five threads by turning the Shear Adapter (61) clockwise.

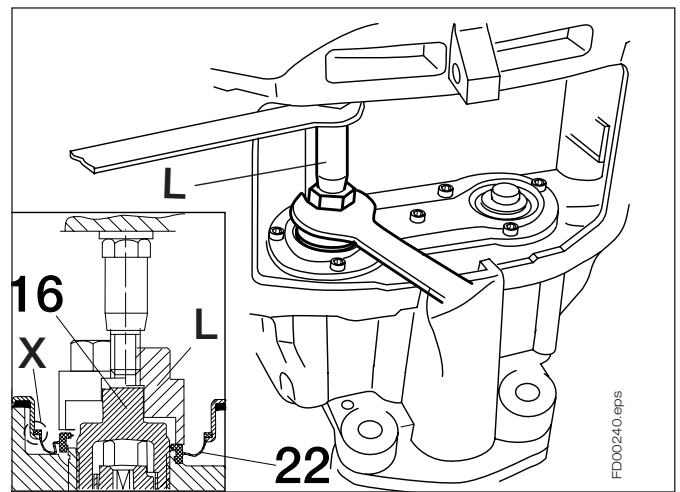
The Inner Seal (22) must not turn.

### With Caliper not installed on axle

The fitting sequence of Inner Seal (22) is the same as when the caliper is installed on the axle (see previous section).

When pressing in the Inner Seal (22) however, use the long strut (T3+T4) for Tool (L) (Z004361) - see page 30.

To check the correct fit of the Inner Seal (22), screw out the Threaded Tubes (16) four or five threads by turning the Shear Adapter (61) clockwise.



### 7.3 Tappet and Boot Assemblies (13) - Fitting

#### With Caliper installed on axle

The Threaded Tubes (16) must be screwed fully back (see Section 5.2).

The sealing seat in the caliper for each boot of the Tappet and Boot Assemblies (13) must be clean and free of grease.

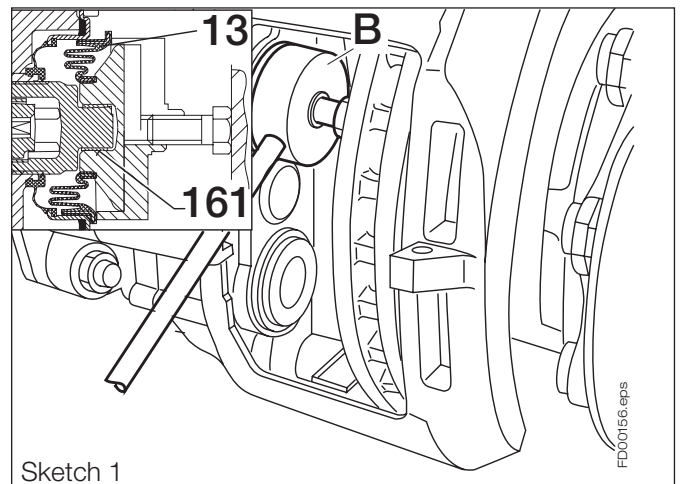
Fit a new Tappet Bush (161) onto the spigot of each Threaded Tube (16).

Position a Tappet and Boot Assembly (13) onto the attachment piece of the Threaded Tube (16).

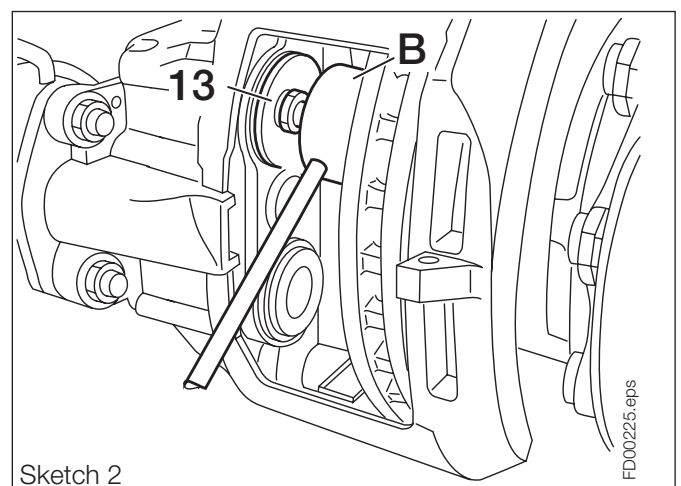
Centre the Push-in Tool (B) (Z004190) with the short strut (T3) and press in the Boot - see Sketch 1.

Turn over the tool combination (B) and press in the tappet (13) with the short strut (T3) see sketch 2.

After assembly the Tappets must be free to turn in both directions.



Sketch 1



Sketch 2



## Replacement of Tappet and Boot Assemblies (13) and Inner Seals (22)

### With Caliper not installed on axle

The Threaded Tubes (16) must be screwed fully back (see Section 5.2).

The sealing seat in the caliper for each boot of the Tappet and Boot Assemblies (13) must be clean and free of grease.

Fit a new Tappet Bush (161) onto the spigot of each Threaded Tube (16).

Position a Tappet and Boot Assembly (13) onto the attachment piece of each Threaded tube (16).

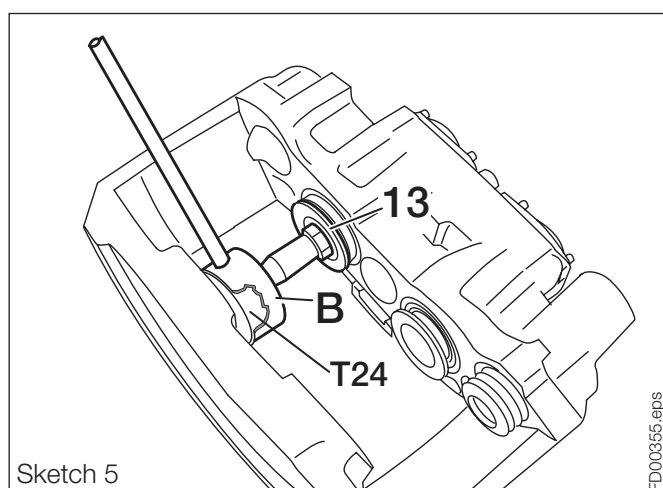
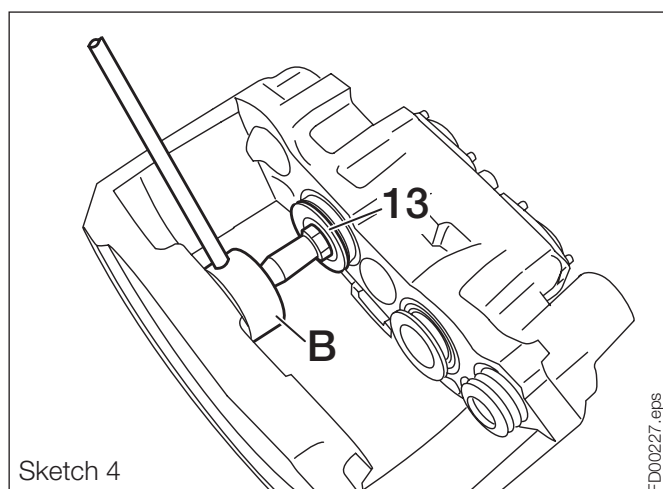
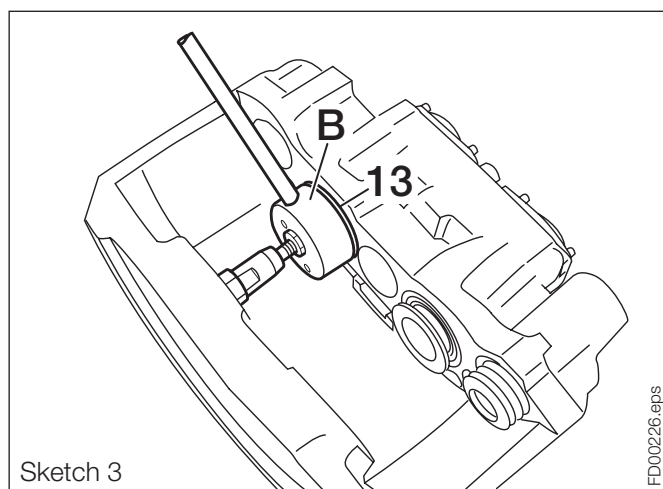
Centre the Push-in Tool (B) (Z004190) with the long strut (T3+T4) and press in the Boot - see Sketch 3.

Turn over the tool combination (B) and press in the tappet (13) with the long strut (T3+T4) see sketch 2

After assembly the Tappet must be free to turn in both directions.

### Note:

With brake types SK7 and ADB22x, insert the ring (T24) into the tool in order to support the tool (B) correctly on the caliper's back - See figure 5.



## 8 Caliper Replacement

The components of the tools are referred to by identification number for ease of reference.

To fit the Cap (68a), use the Press-in Tool (K) (Z003934).

To fit the Cover (68c), use the Press-in Tool (M) (K016743).

To fit the Cover (10) use Press-in Tool (H) (K015825).

### 8.1 Caliper Removal from Carrier

Remove Pads (12) (see Section 6.1).

Remove Brake Actuator (see Section 12.1, 12.3).

If fitted, remove Wear Indicator Cable and Potentiometer Cable.

**⚠** 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.

#### 8.1.1 Removal of the Cover (10)

Use a suitable Tool (e.g a screwdriver) to penetrate the Cover (10).

During penetration, the Cover may move approximately 10 mm inwards.

Remove Cover (10).

**⚠** 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.

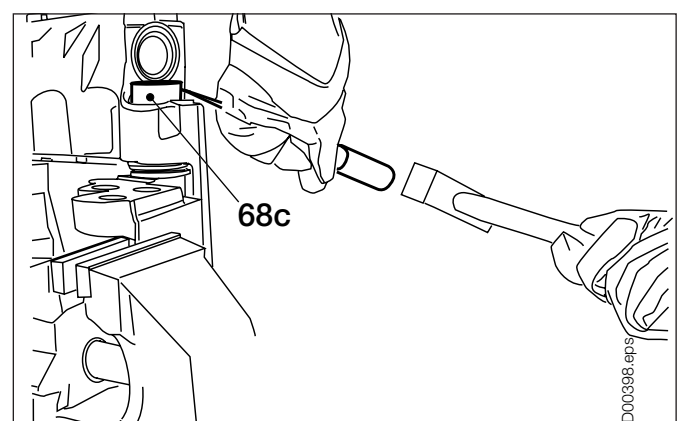
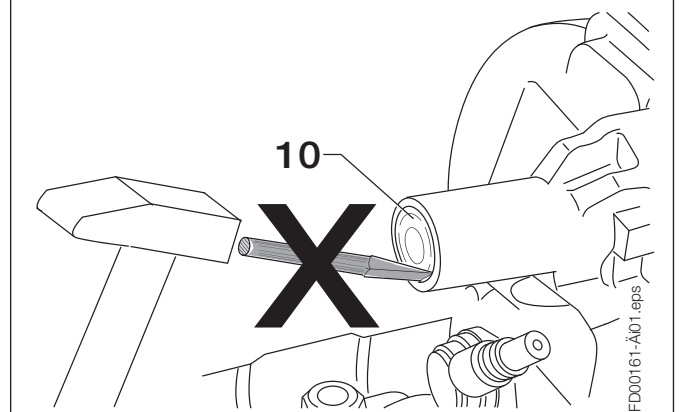
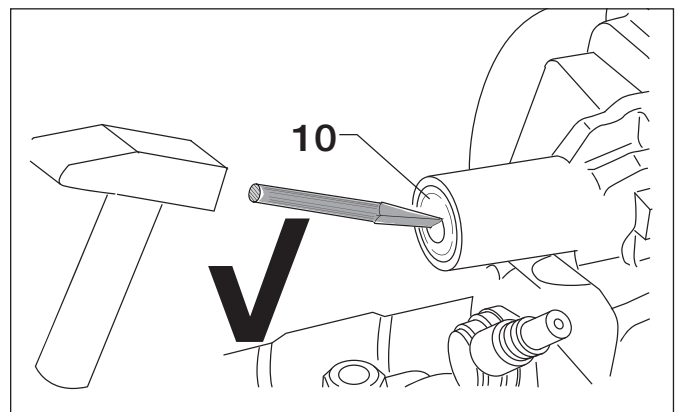
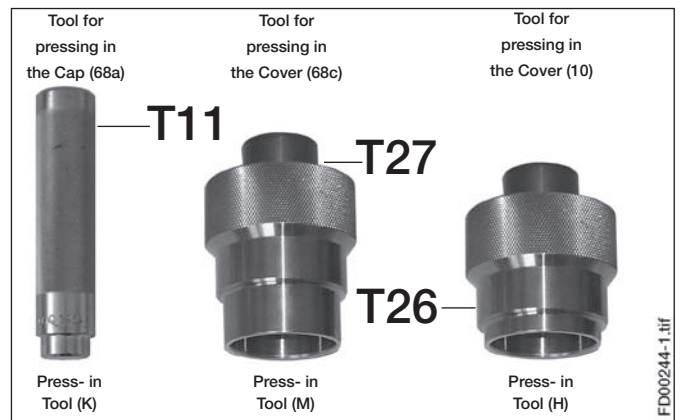
Check the inside area of the removed cover (10) as well as the inside area of the bearing for dirt or corrosion. If corroded, the Caliper must be replaced.

#### 8.1.2 Removal of the Cover (68c)

Because of the protruding Cover (68c) it must be disassembled using a screwdriver or similar as shown in adjacent sketch.


Do not disassemble the Cover (68c) in direction of the Caliper since the Caliper or its components might be damaged.

Check the inside area of the removed cover (10) as well as the inside area of the bearing for dirt or corrosion. If corroded, the Caliper must be replaced.




### 8.1.3 Removal of Cap (68a)


On Calipers with Rubber Bush (6a), pull the Cap (68a) from the Guide Pin (4a) using a suitable tool (see adjacent figure).


 Take care not to damage Rubber Bush (6a). If necessary replace it by means of a suitable Guide and Seals Kit.

### 8.1.4 Remove Caliper from Carrier

 Before removing the Caliper Bolts (39 and 40) ensure that the Caliper (1) cannot move or fall down when the Caliper Bolts are removed causing damage or injury.

Remove Caliper Bolts (39) and (40) and discard.

 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.

Remove Caliper (1) from Carrier (2).

## 8.2 Caliper Fitting

(Carrier is fitted on the axle)


The correct choice of Caliper must be ensured by checking the part number on the identification label (see arrow A in adjacent figure).

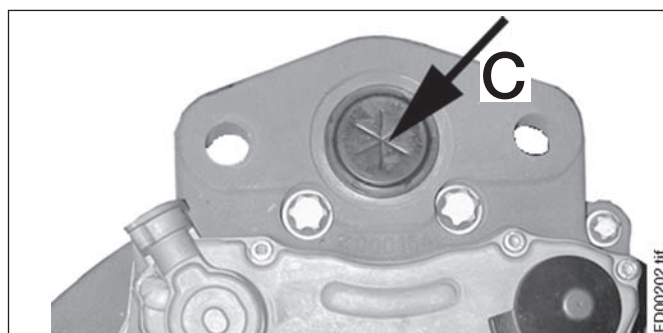
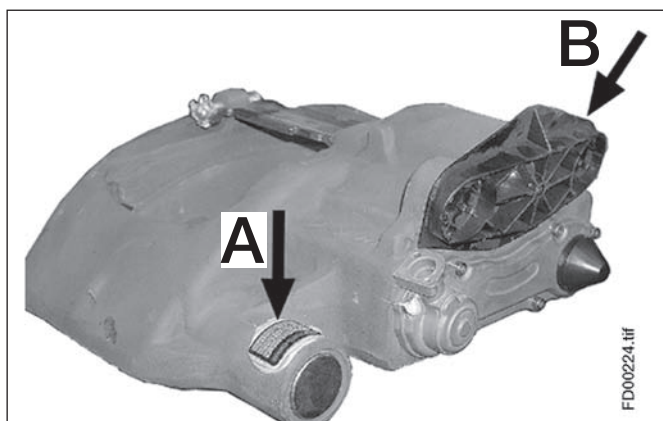
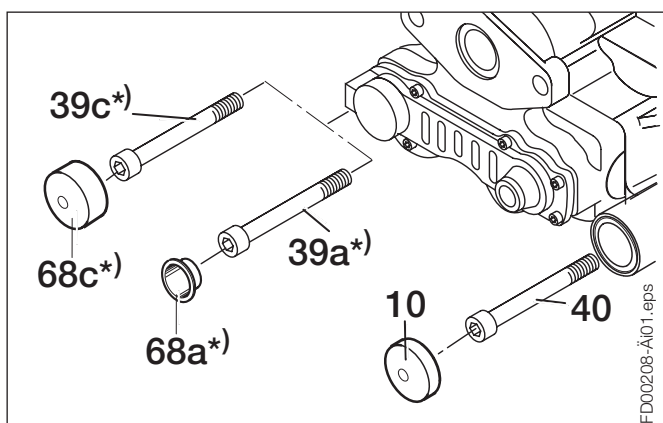
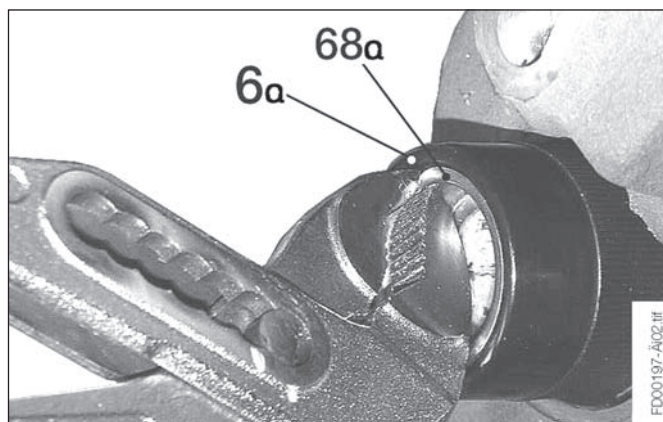
Remove the plastic cap or adhesive tape in the area of the actuator attachment from the replacement caliper (see arrow B in sketch). Alternatively, if the replacement Caliper has a breakthrough diaphragm, it should be left in place (see arrow C in sketch).

### Note:

The replacement Caliper includes Seals and Guide Pins without Pads.

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



## Caliper Replacement

**⚠** 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).

Fit the Caliper to the Carrier.

Screw in new Caliper Bolts (39) and (40) and tighten to 180 Nm, then tighten by a further 90° (**use only new parts**).

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

Check that the Caliper slides easily on the Guide Pins. Check the position of the Inner Boot (9) and the ring (58) on the Guide Pin (5).

According to the Caliper variant check also the position of the Inner Boot (9) and the ring (58) on the Guide Pin (4).

Fit Pads (see Section 6.2).

Check Adjuster function (see Section 5.2).

Fit Brake Actuator (see Section 12.2 or 12.4).

### 8.2.1 Fitting of Cover (10) and (68c)

Caliper bores and Covers (10) and (68c) must be clean and free from lubrication.

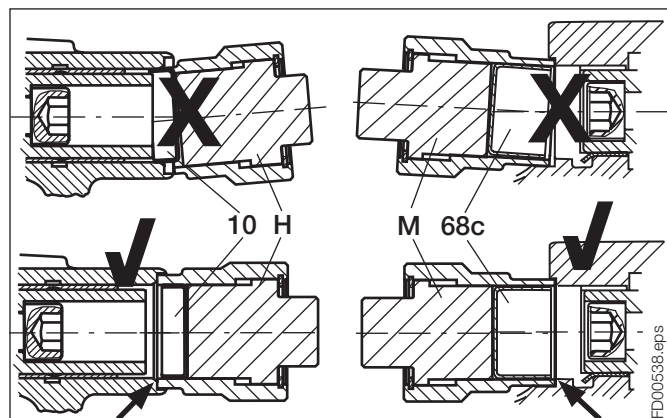
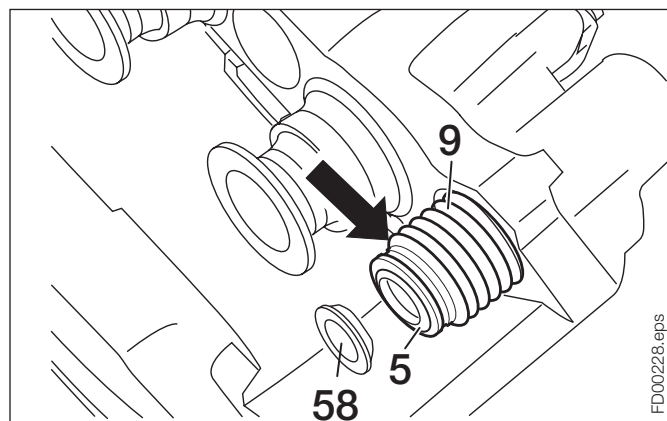
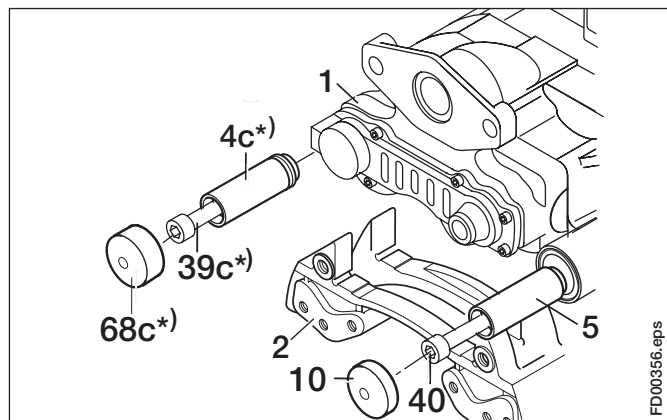
Clean the new Cover (10) or (68c) thoroughly and check that the plane surface and the chamfer areas (see arrows in lower sketch) are clean and not damaged.

Clean the interior of the Press-in tool (H) or (M) and place the Cover (10) or (68c) inside - see adjacent figure.

Position the Press-in tool (H) or (M) including Cover (10) or (68c) to the plane surface of the caliper bore. The centring of the tool is achieved by using the diameter of the plane surface.

**Note:**

Do not tilt the tools when assembling the Covers (10) or (68c) - see adjacent figure.



**!** *The Inner Boot (9) must be in a compressed condition - see adjacent figure -, otherwise the calipers's freedom of movement will be limited .*

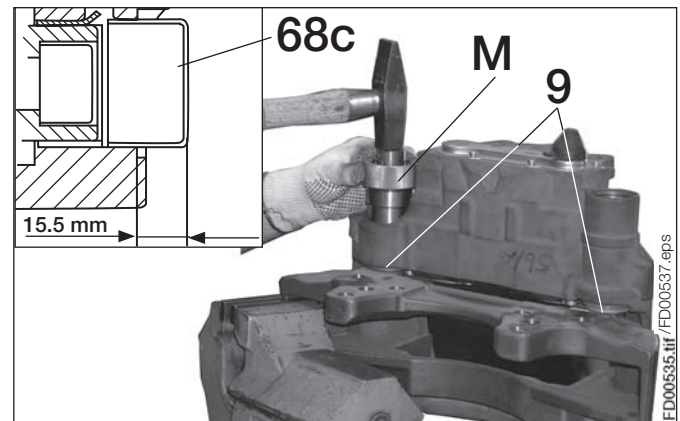
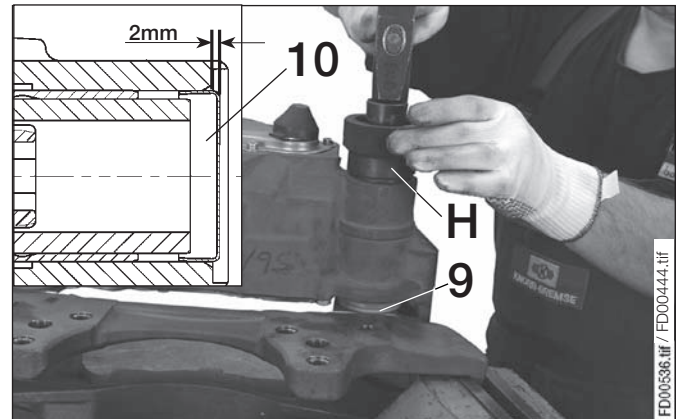
Press on the mandrel of the press in tool (H) or (M) by hand until it stops. Use a hammer on the mandrel to insert the cover to the end stop.

**Note:**

After fitting the new Cover (10), ensure that it protrudes 2 mm from the plane surface of the caliper - see adjacent figure.

**Note:**

After fitting the new Cover (68c), ensure that it protrudes 15,5 mm from the plane surface of the caliper - see adjacent figure.



**8.2.2 Fitting of Cap (68a)**

Fit the Cap (68a) using Tool (K) (Z003934) and a hammer. Force the Cap (68a) into the Guide Pin (4) until it is firmly seated. The seal is achieved by the compression of the lip of the Rubber Bush (6a) between the Guide Pin (4) and Cap (68a) (see view "Y").

**If the Caliper (1) and Carrier (2) is not fitted to the vehicle**

**!** *Check that the caliper slides easily on the Guide Pins. Push the caliper into the shown clamping position (i.e. bench vice) as far as possible against the carrier. The Inner Boot (9) must be in a compressed condition - see adjacent figure -, otherwise the calipers's freedom of movement will be limited.*

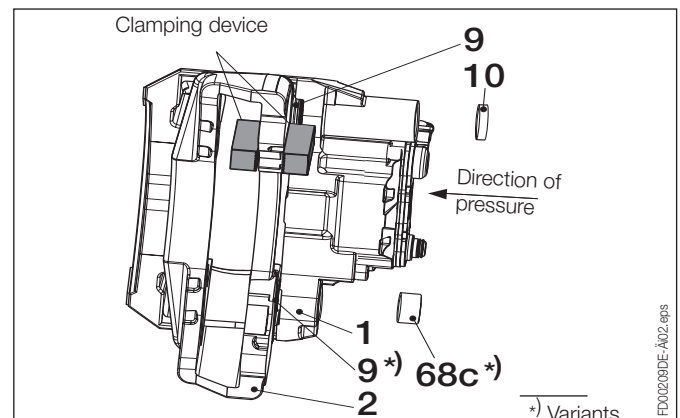
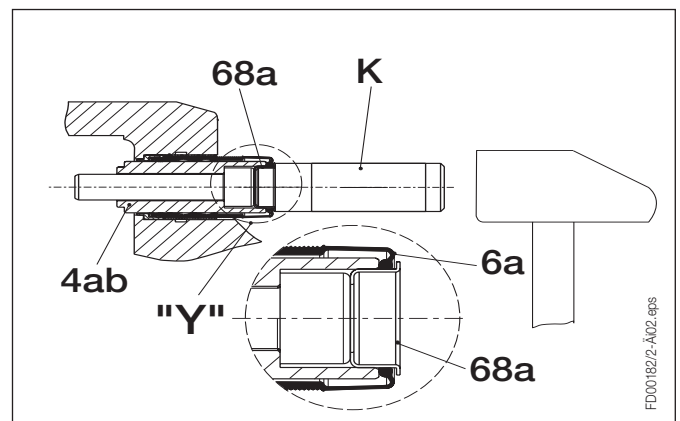
Fit new Cover (10), Cover (68c) or Cap (68a) as described above.

Pay attention to the vehicle manufacturer's recommendations during the following assembly to the vehicle axle.

Fit the Pads (see Section 6.2).

Check Adjuster function (see Section 5.2).

Attach Brake Actuator (see Section 12.2 or 12.4).



9 Replacement of Inner Boot (9)

The components of the tools are referred to by identification number for ease of reference.

To fit the Inner Boot (9) use the Pull-in Tool (C) (Z004357).

Remove Caliper (see Section 8.1).

Remove Ring (58).

Pull out Guide Pin (5).

Push out Inner Boot (9) with screwdriver or similar.


**Note:**

For variants with boot sealing on both sides:

Remove Ring (58).

Pull out Guide Pin (4c).

Push out Inner Boot (9) with screwdriver or similar.

 *The sealing face of Inner Boot (9) in the Caliper must not be damaged (see arrow A in adjacent Sketch).*

The contact surface of the boot on the Guide Pin (5) or (4c) must be clean and free of lubrication. Check for corrosion (see arrow A in adjacent Sketch).

Check Brass Bush (7) and, if installed, Guide Sleeve (6c), for corrosion, dirt or damage and replace as necessary (see Section 10.1 or 10.2)

Fit new Boot (9) into the Sleeve of the Tool (C) (Z004357). See arrow B in adjacent Sketch.

Pay attention that the bellow-folds of Inner Boot (9) are positioned within the tool.

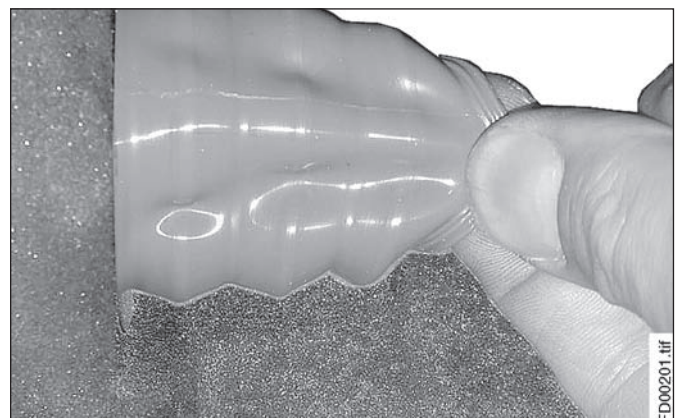
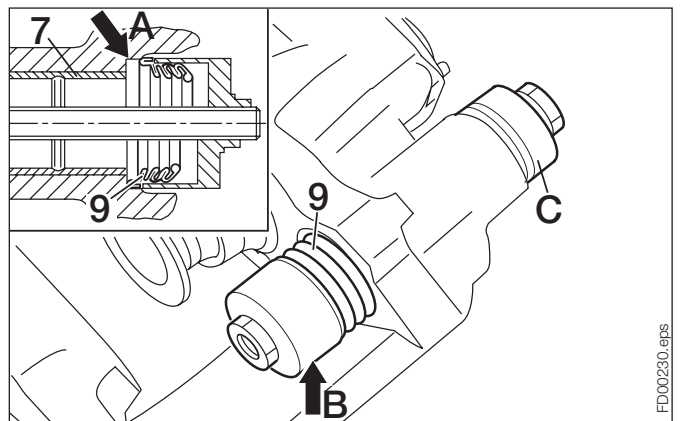
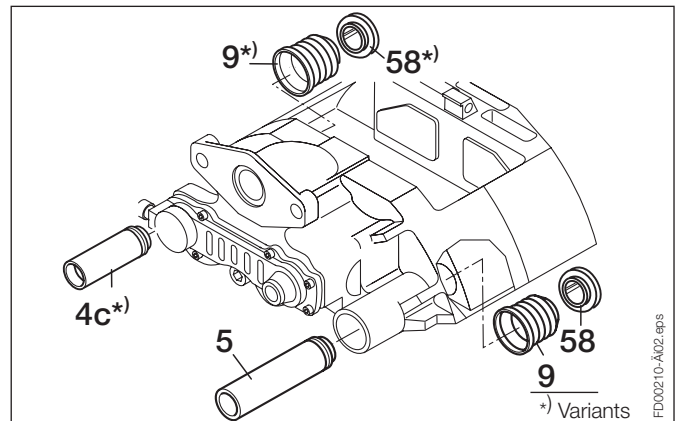
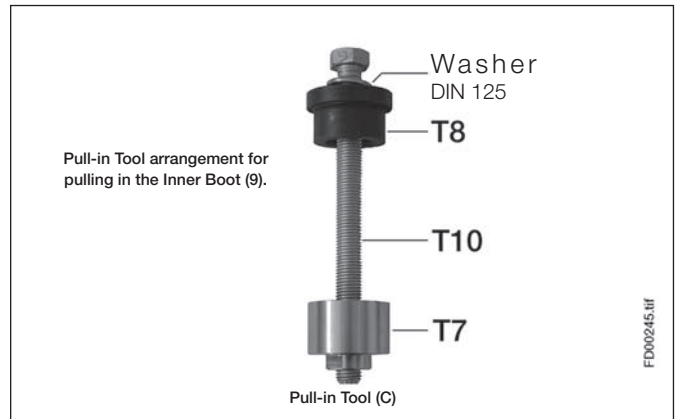
Position Sleeve of the tool (C) with Inner Boot (9) into the Caliper bore and pull in by hand.

Then pull in with a maximum torque of 8 Nm.

**Note:**

Pay attention to the correct position of Inner Boot (9).

Carry out a pulling check (see adjacent figure).



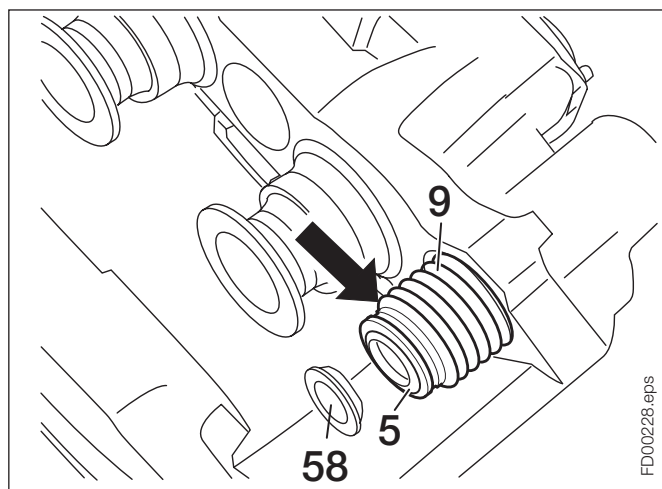
Grease Brass Bush (7) and if installed Guide Sleeve (6c) with white grease (Part No. II14525 or II32868).

Fit Guide Pin (5) and if necessary Guide Pin (4c).

The lip in the end of the Inner Boot must engage in the groove of the Guide Pin (5) and, if installed, in the groove of the Guide Pin (4c) (see arrow).

Pushing on the Ring (58) ensures that the Boot (9) is engaged in the groove of the Guide Pin (5) or, if installed, in the groove of the Guide Pin (4c).

Fit Caliper (see Section 8.2).



### 10 Replacement of Guide Sleeves

The components of the tools are referred to by identification number for ease of reference.

In order to remove, fit and groove the Brass Bush (7) use the Pull-out/Pull-in and Grooving Tool (D) (Z004354).

Remove Caliper (see Section 8.1 and following).

#### 10.1 Brass Bush (7) - Replacement

Remove Guide Pin (5) and Inner Boot (9) (see Section 9). Clean surface (X), surface (Y) and Brass Bush (7) (see Sketch 2).

##### 10.1.1 Removal of Brass Bush (7)

Position tool combination (D) for pulling out Brass Bush (7) (see Sketch 2).

**Note:**

Ensure that brass Nut (T14) is guided in Brass Bush (7). Support tool (T12) must be placed plane on surface (X). Pull out Brass bush with spindle (T13) - see Sketch 2.

##### 10.1.2 Fitting of Brass Bush (7)

Screw Brass Nut (T14) on to Spindle (T13) until it stops.

Place new Brass Bush (7) on the Groover (T16) and insert into caliper bore - see Sketch 3a.

Screw Spindle (T13) by hand up to stop.

**Note:**

Pay attention to Groover (T16) - see Sketch 3a. It must be able to move freely.

The tool element (T8) must be located flat onto the caliper surface (X) see figure 3a.

Pull in Brass Bush (7) using Brass Nut (T14) up to stop - see Sketch 3b.

To prevent longitudinal displacement of Brass Bush (7) it must be "grooved" - see Sketch 3c.

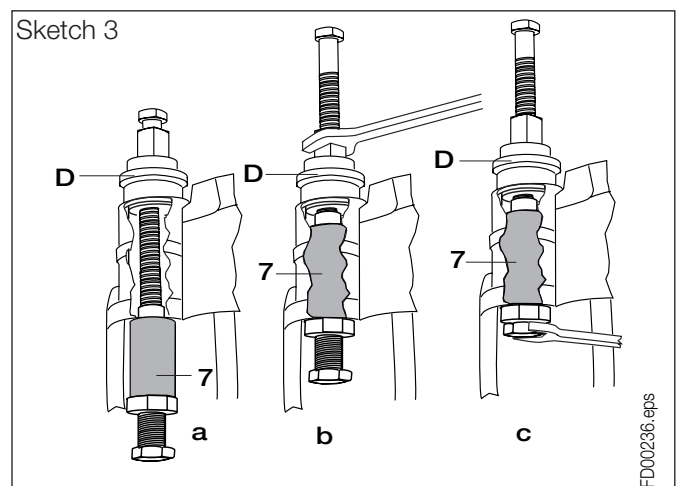
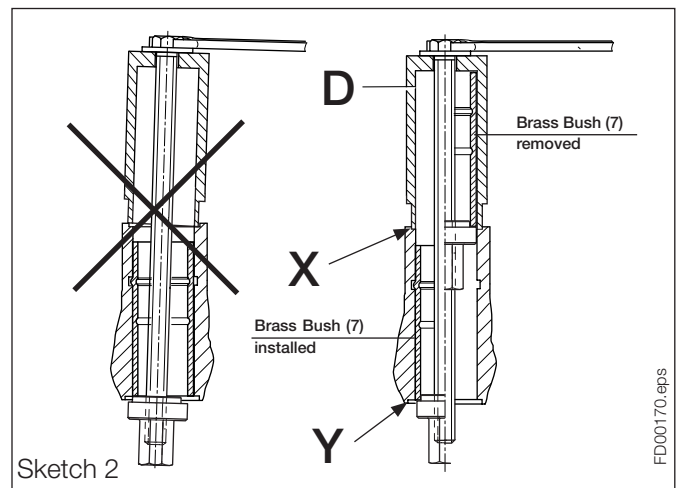
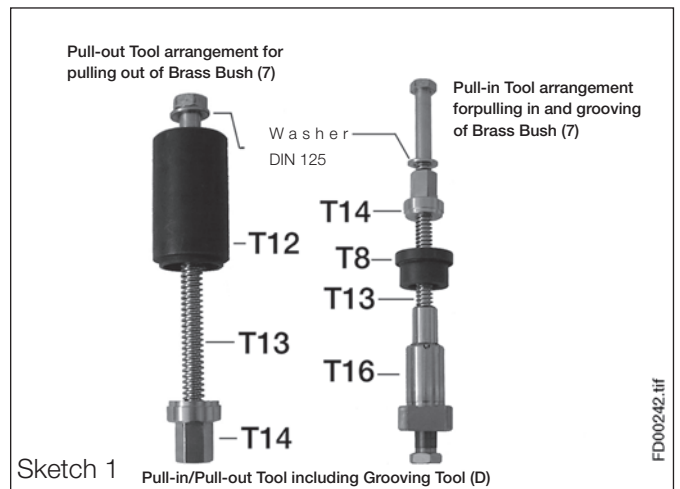
To do so the hexagon bolt of the Groover (T16) must be screwed in up to stop.

Wind back the hexagon bolt of the Groover (T16) approximately 20 mm.

Slacken the Brass Nut (T14) and rotate the Groover (T16) through approximately 60°.

Repeat the process of "grooving".

The new Brass Bush (7) is now grooved with the Caliper. Before removing the Tool (D), the hexagon screw of the Groover (T16) should be set in the starting position.





Check contact area of Brass Bush (7) and remove any burrs.  
Grease Bush (7) with white Grease (Part No. II14525 or II32868).

### 10.2 Rubber Bush (6a, 6b) and Guide Sleeve 6c) - Replacement

Use Tool (R) for the removal and fitting of the Rubber Bush (6a or 6b) - see adjacent sketch.

**Note:**

Do **not** use the Disc T5 with Ø35 with SN Type Disc Brake.

Use Tool (N) for fitting of the Guide Sleeve (6c) (see adjacent sketch).

#### 10.2.1 Removal of Rubber Bush (6a or 6b)

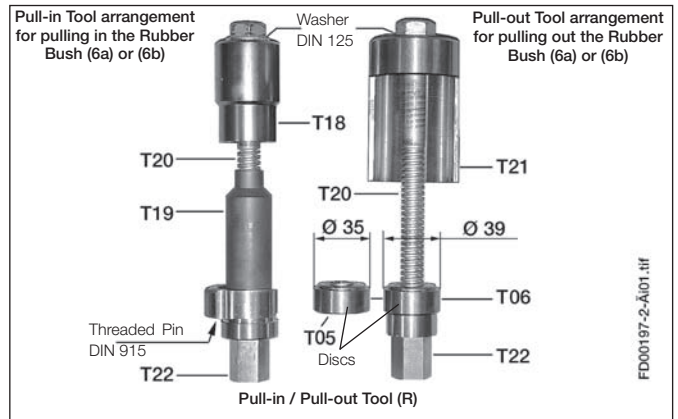
Remove Guide Pin (4a or 4b).

Clean Caliper in the area of the Rubber Bush.

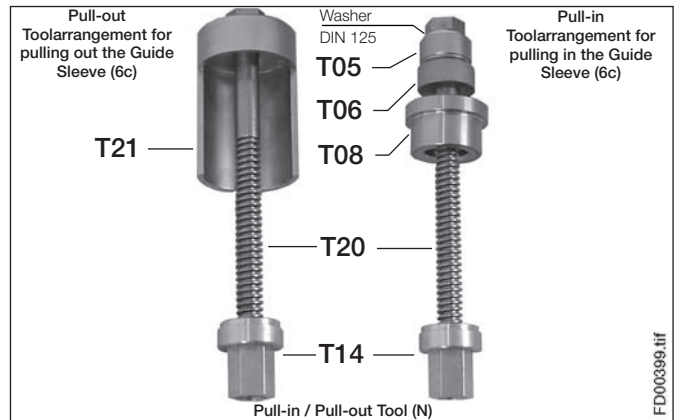
Select Disc T6 with Ø39.

Position the Tool (R) as shown in the adjacent picture.  
Screw on the Nut (T22) by hand.

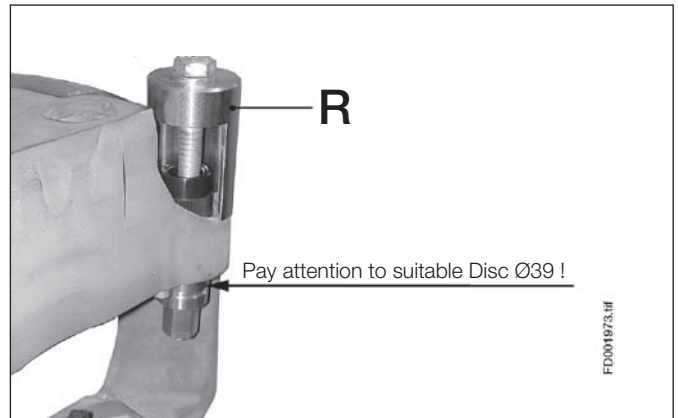
Lock the Nut (T22) with a ring spanner and with a suitable socket or ring spanner tighten Spindle (T20) to remove the Guide Sleeve.



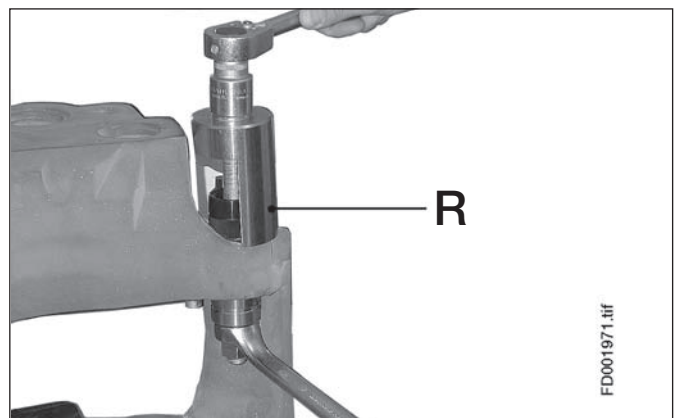
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FD000399.tif



FD001972.tif



FD001971.tif

## Replacement of Guide Sleeves

### 10.2.2 Removal of Guide Sleeve (6c)

Remove Guide Pin (4c).

In order to separate the tab from the Guide Sleeve (6c) use the screwdriver or similar tool whose width is smaller than the tab.

Place the screwdriver as close as possible to the base of the tab (see arrow in the adjacent Sketch).

Then separate the tab from the Guide Sleeve (6c) by means of the screwdriver and a hammer (see adjacent Sketch).

Clean Caliper in the area of the Guide Sleeves (6c) and the areas surrounding the Brake Pads.

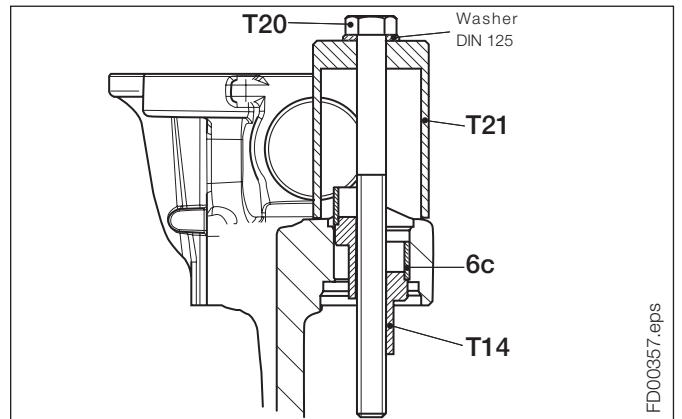
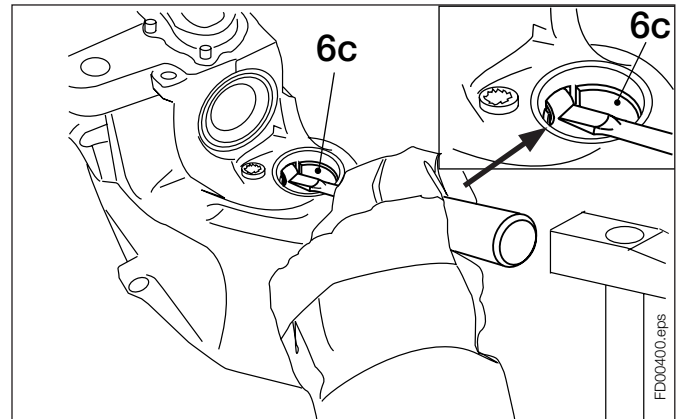
**Note:**

Caliper groove can be on left or right side of the caliper bore.

Position Tool (N) as shown in adjacent Sketch.

Screw on the Nut (T14) by hand.

Lock the Nut (T14) with a ring spanner and with a suitable socket or ring spanner tighten Spindle (T20) to remove the Guide Sleeve (6c).



### 10.2.3 Fitting of Rubber Bush (6a or 6b)

Check bore for corrosion and clean.

Ensure that the Threaded Bush in the Tool (R) is unscrewed, so that there is no projection at the contact surface.

Push Rubber Bush (6a or 6b) into the Tool (R).

Position Tool (R) with Rubber Bush (6a or 6b).

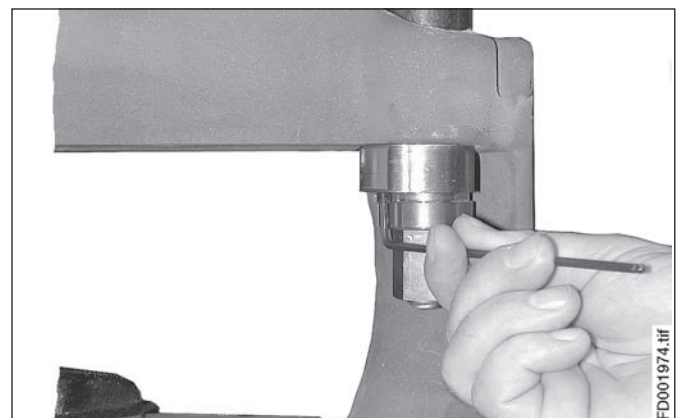
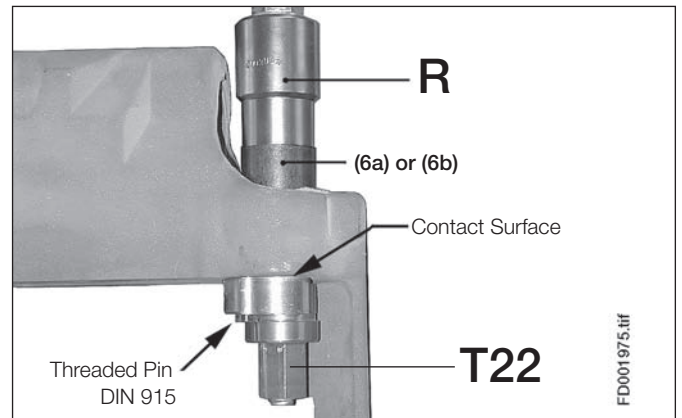
Lightly screw on the Nut (T22) by hand.

**Note:**

Do not tilt the Rubber Bush (6a or 6b) when pulling-in.

Pull in Rubber Bush (6a or 6b) into the caliper up to stop.

Remove the Tool.



**!** If the torque is < 8 Nm or > 45 Nm, then the Caliper must be replaced.

**!** *The metal ring (see arrows in adjacent sketch) must not move. When checking for movement, ensure that the sealing elements of the Rubber Bush (6a or 6b) are not damaged.*

Grease inside the Rubber Bush (6a or 6b) with white Grease (Part No. II14525 or II32868).

**!** *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).*

Fit Guide Pins (4a or 4b) via the Pad abutment in the Rubber Bush (6a or 6b).

**10.2.4 Fitting of Guide Sleeve (6c)**

Check bore for corrosion. Clean and, if necessary, protect with corrosion protective paint.

Position the Guide Sleeve (6c) - (see adjacent Sketch).

**!** *Before pressing in Guide Sleeve (6c) the tab must be in such a position that it will snap into the Caliper groove when Guide Sleeve (6c) reaches its final position.*

**Note:**

Caliper groove can be on left or right side of the caliper bore.

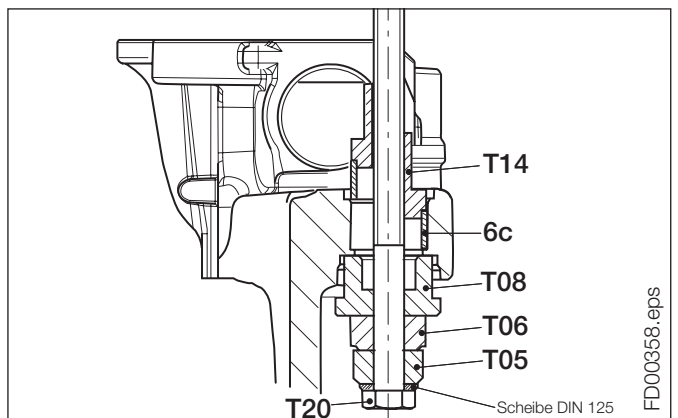
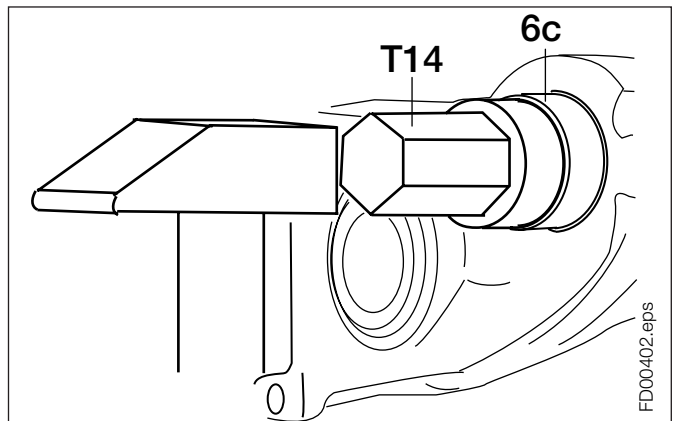
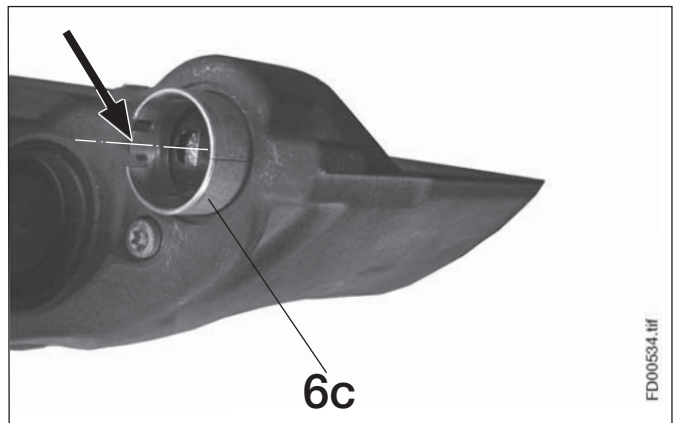
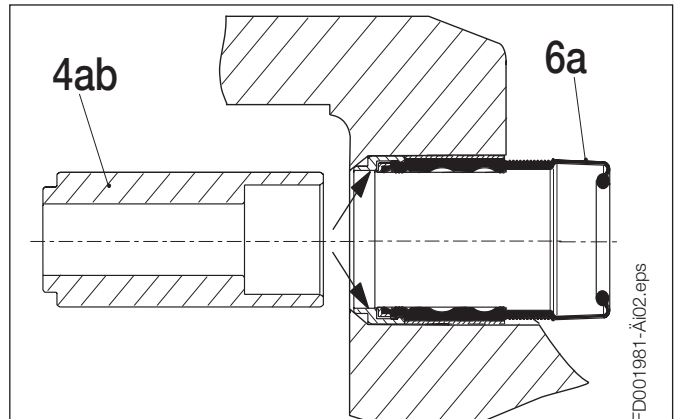
Press in the Guide Sleeve (6c) by means of the tool (T14) and a hammer making sure that the position of the tab is aligned with the groove of the caliper.

Insert Tool (N) into the Guide Sleeve (6c) -see sketch below right.

Tighten Spindle (T20) by hand.

Hold Nut (T14) by means of a ring spanner and with a suitable socket or another suitable tool, tighten Spindle (T20) up to stop.

**!** *Do not turn Nut (T14) because Guide Sleeve (6c) may turn and lose its correct position.*



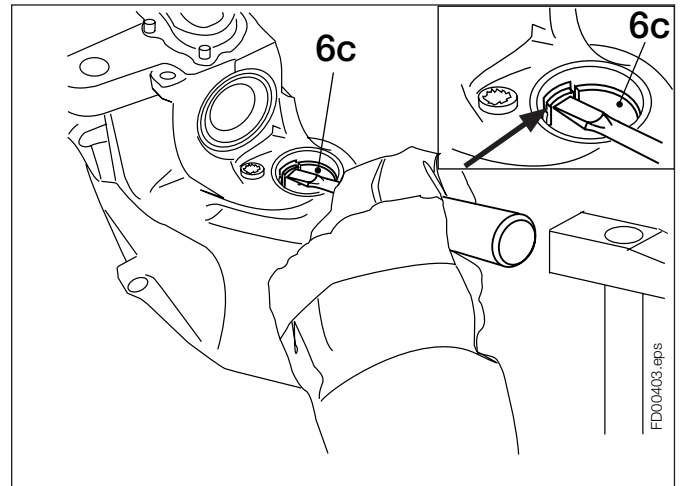
Remove Tool (N).

In order to press in the tab from the Guide Sleeve, use a screwdriver or similar tool whose width is smaller than the tab. Place the screwdriver as close as possible to the top of the tab (see adjacent sketch). Bend the tab into the groove of the caliper.

The Guide Sleeve (6c) is now secured against rotational and axial movement.

Grease inside the Guide Sleeve (6c) with white Grease (Part No. II14525 or II32868).

Fit Guide Pin (4c).



## 11 Carrier Replacement

If necessary remove Caliper (see Section 8.1)

Unscrew the bolts and remove the Carrier (2) from the axle (if necessary with the caliper).

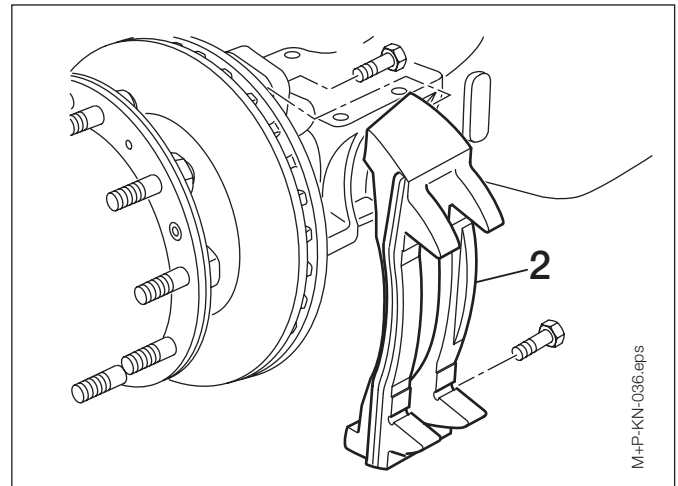
### Note:

Do not fasten any lifting device to the Pad Retainer (11), since this can be damaged.

Clean axle contact area.

Fit new Carrier (2) with new bolts supplied by the Vehicle Manufacturer according to the vehicle manufacturer's specification. (Bolts are not Knorr-Bremse spare parts).


If necessary, refit Caliper (see Section 8.2).



## 12 Brake Actuator Replacement

### 12.1 Brake Chamber Removal

Unscrew air connection from Brake Chamber (18/2) – **take care**, air connection must be free of air pressure!

 *Unscrew Brake Chamber mounting nuts (see arrow B). They must not be reused!*

Remove Brake Chamber (18/2).

### 12.2 Brake Chamber Fitting

**Note:**

New Brake Chambers (18/2) 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.

The sealing surface and the flange surface (see arrow C in adjacent sketch) must be:


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

Take care that no dirt enters the brake!

Before fitting the new Brake Chamber, the Spherical Cup (19) in the Lever and the sealing surface must be greased with white Grease (Part No. II14525 or II32868).

The Seal, as well as the Push Rod area - see adjacent picture - must be clean and free of lubrication.

Note, if the Brake Chamber's seal protrudes less than 3 mm the Brake Chamber must be replaced – see adjacent sketch.


 *Do not use Grease containing molybdenum disulphate. Use only Actuators which are recommended by the Vehicle Manufacturer.*

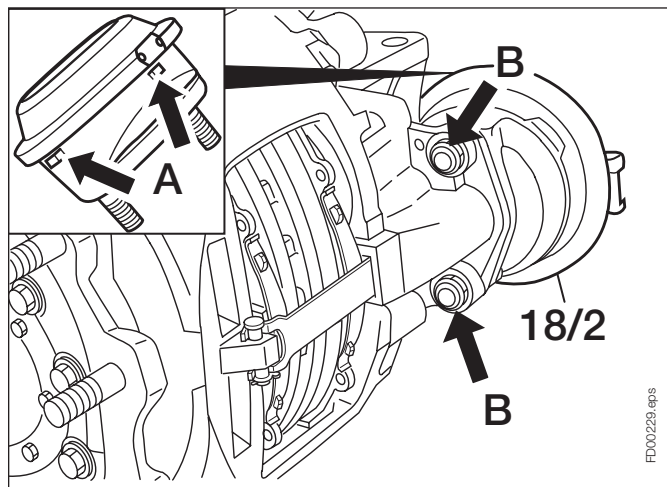
Attach Brake Chamber using new nuts.

In order not to tilt the Brake Chamber during its attachment, the new nuts must be gradually tightened symmetrically with a suitable tool. After that, tighten the nuts according to the specifications of the actuator manufacturer

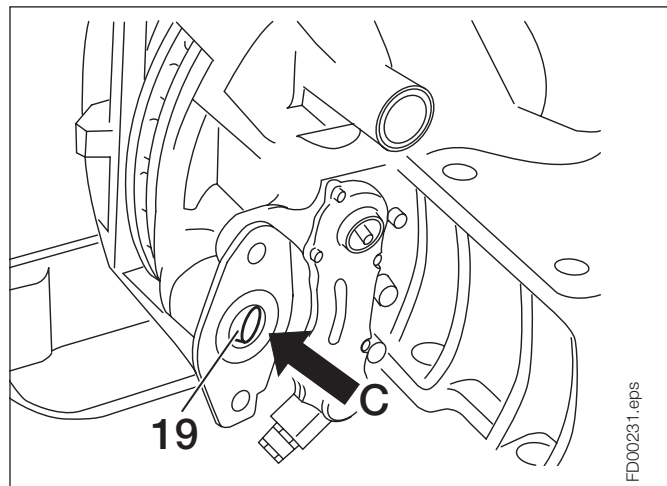
Connect air hose and check for leakage.

Make sure that hose is not twisted and that chafing is not possible.

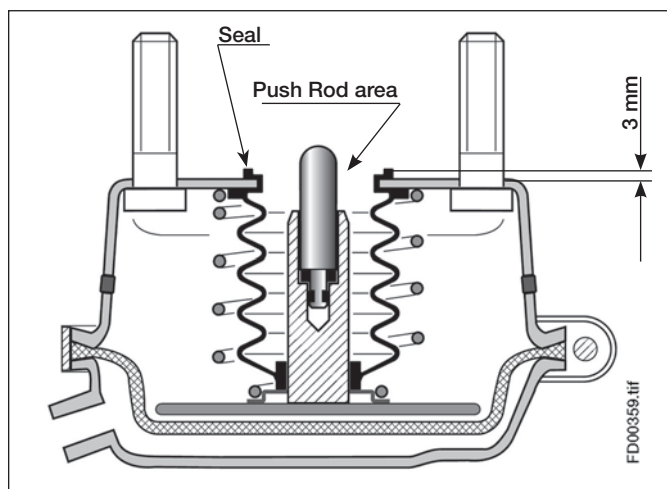
 *Check function and effectiveness of the service brake system.*



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### 12.3 Spring Brake Removal


 Chock wheels before releasing Spring Brake to ensure the vehicle cannot roll.

Release parking brake.

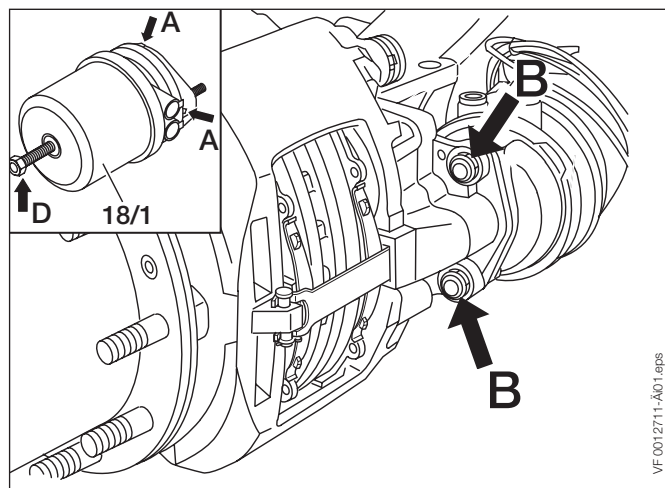
Screw-out release bolt (arrow D) with a maximum torque of 35 Nm to the release position (refer to the Vehicle Manufacturer's recommendations).

Apply parking brake.

Disconnect air connections from Spring Brake (18/1) – **take care**, air connection must be free of air pressure

 Unscrew Spring Brake mounting nuts (see arrow B). They must not be reused!

Remove Spring Brake (18/1).



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### 12.4 Spring Brake Fitting

#### Note:

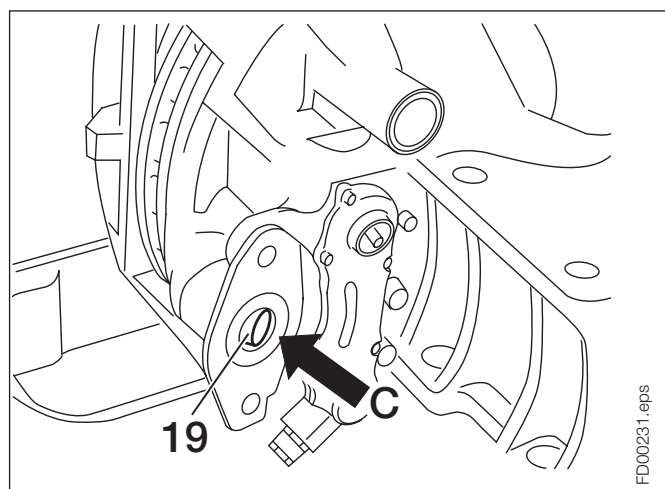
New Spring Brakes (18/2) have drain plugs installed (see arrows A). Remove lowest plug (as viewed when Spring Brake is installed). All other drain holes should be plugged. Refer to the Vehicle Manufacturer's recommendations.

The sealing surface and the flange surface (see arrow C in adjacent sketch) must be:

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

Take care, that no dirt enters the brake!


Before fitting the new Spring Brake, the Spherical Cup (19) in the Lever and the sealing surface must be greased with white Grease (Part No. II14525 or II32868).

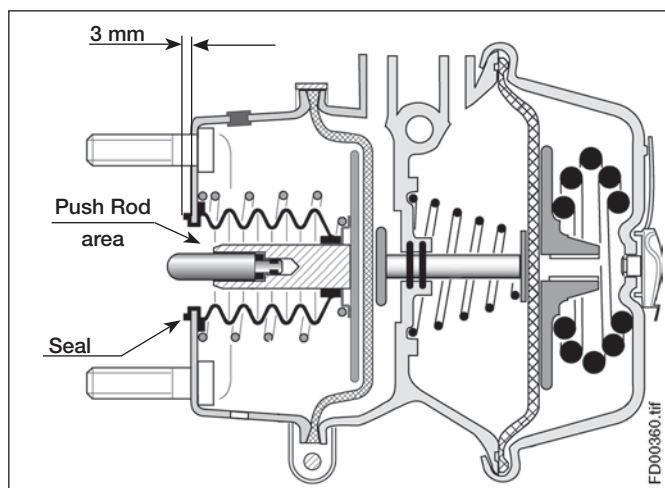


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The Seal, as well as the Push Rod area - see adjacent picture - must be clean and free of lubrication.

Note, if the Spring Brake's seal protrudes less than 3 mm the Spring Brake must be replaced – see adjacent sketch.

 Do not use grease containing molybdenum disulphate. Use only Actuators which are recommended by the Vehicle Manufacturer.



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Attach Spring Brake using new nuts.

In order not to tilt the Spring Brake during its attachment, the new nuts must be gradually tightened symmetrically with a suitable tool. After that, tighten the nuts according to the specifications of the actuator manufacturer.

Connect air hoses, ensuring that they are replaced in the correct ports.

Make sure that hoses are not twisted and that chafing is not possible.

Release parking brake.

Screw in Spring Brake Release bolt with maximum 70 Nm.

Check air connections for leakage.



*Check function and effectiveness of the service brake system and parking brake system.*









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