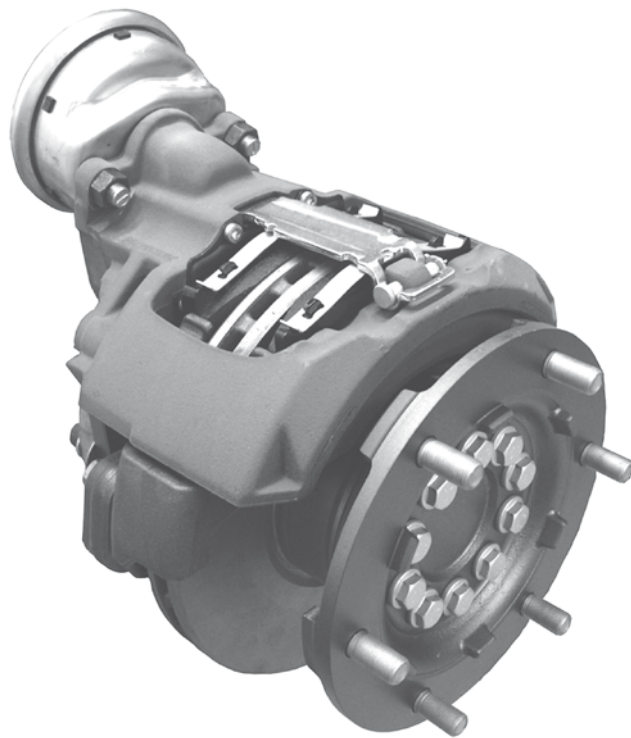


Service Manual

Air Disc Brake SN5...



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

- Description/Function
- Service kits
- Servicing
- 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...	was K004789	now K037001
SN6... SN7... SK7... ADB22X	K016947	K001288 + Supplemental Kit K017062 K005973 + Supplemental Kit K017062

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

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

Disclaimer

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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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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 electrical equipment. For more information about arrangements for waste equipment disposal please contact your Knorr-Bremse distributor or local Knorr-Bremse representative.

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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.

Before and during working on or around compressed air systems and devices, the following precautions should be observed:

- 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 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.
- 9 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.
- 10 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.
- 11 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.
- 12 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.
- 13 Use only genuine replacement parts, components and kits as supplied by Knorr-Bremse or the vehicle manufacturer.
- 14 The serviced or replaced product must be checked for correct function and effectiveness.
- 15 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.
- 16 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

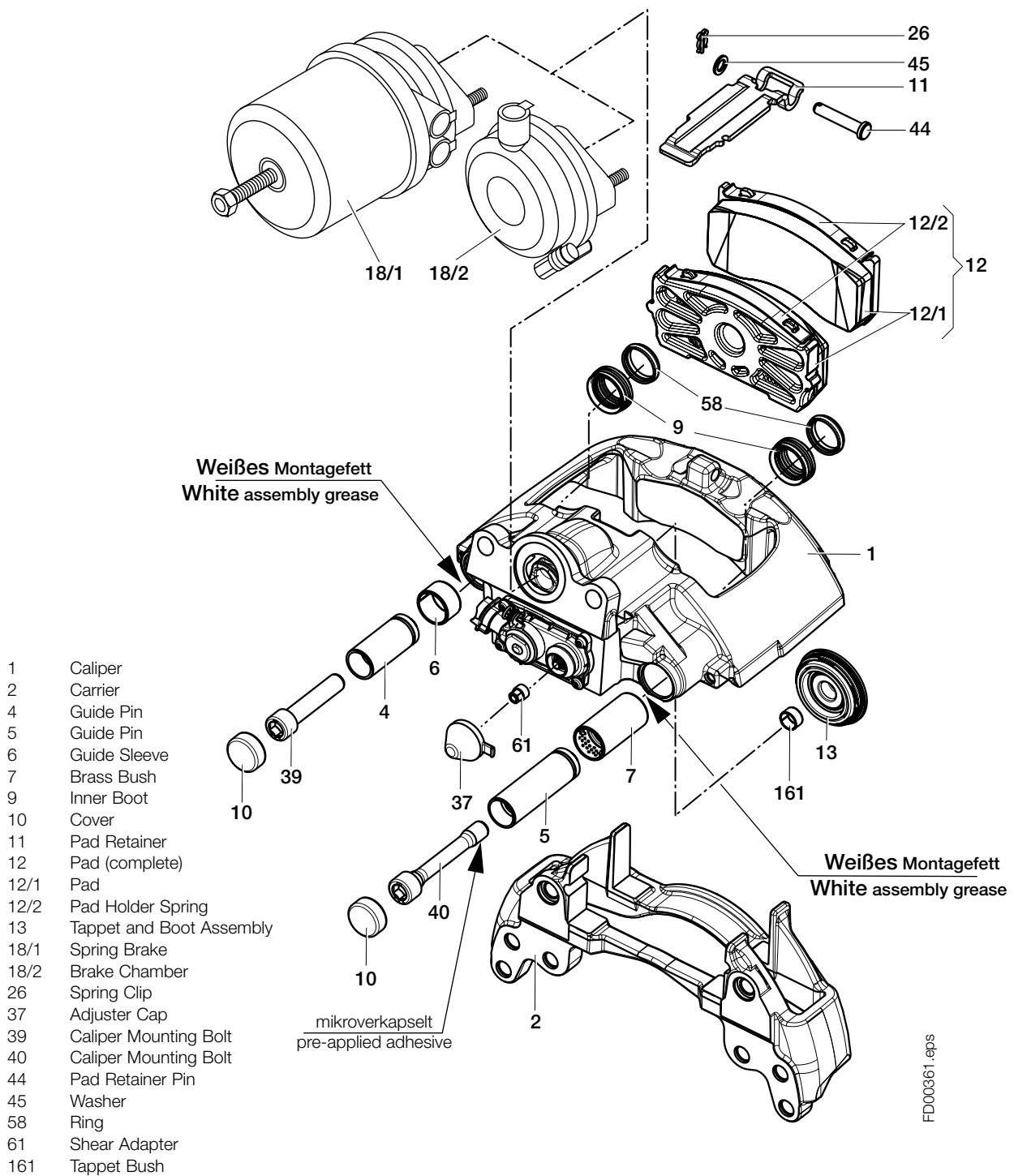
To avoid damage to electronic components when carrying out electrical welding, the following precautions should be observed:

- 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.

1 Overview

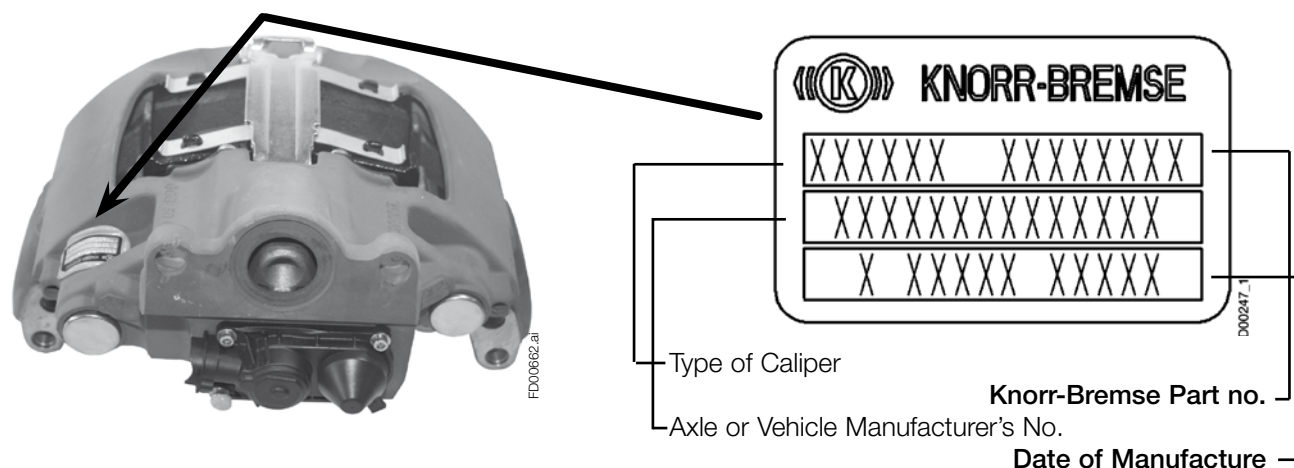
1 Overview

1.1 Disc Brake Components



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1.2 Disc Brake Identification and Service Kits



 Use only genuine Knorr-Bremse parts!

The following Service Kits are available:

Description	Contents	
Carrier	2	For specific Service Part Numbers for each Disc Brake, see: www.Knorr-BremseSfN.com www.Knorr-BremseSfN.biz
Guide Pin and Seal Kit	4, 5, 6, 7, 9 (2x), 10 (2x), 39, 40, 58 (2x)	
Tappet and Boot Kit	13, 161	
Adjuster Cap Kit	37(10 pcs), 61(10 pcs)	
Pad Kit (per Axle) (see Note)	12, 26, 37, 44, 45, 61	
Pad Retainer Kit (per Axle) (see Note)	11, 26, 44, 45	
Caliper	Air Disc Brake without Brake Carrier (2) and without Pads (12). Guide and Seal 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: Document Y028774 www.Knorr-BremseSfN.com www.Knorr-BremseSfN.biz

1.3 Brake Disc

Replacing the Discs is subject to the instructions of the Vehicle Manufacturer, including when fitting Knorr-Bremse Discs.

When replacing Discs, make sure that the correct fixings and tightening torques are used.

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

Discs can be ordered through the Knorr-Bremse Aftermarket organisation.

2 General Information

2.1 Service Tools

Tool Number	Description	Comprises
K002252 / (B)	Press-in Tool for Tappet and Boot Assembly (13)	T02, T30 T31, T32
K002254 / (C)	Pull-in Tool for Inner Boot (9)	T35, T38, T39
K002256 / (D)	Pull-in/Pull-out Tool for Brass Bush (7) Pull-in/Pull-out Guide Sleeve (6)	T20, T33, T34, T35, T36
II32202 / (A)	Wedged Fork for removal of Tappet and Boot Assembly (13)	T15
K028048 / (G)	Press-in Tool for Cover (10)	T43
K002253 / (F)	Grooving Tool for Brass Bush (7)	T37

Note

K037001 Tool Kit contains this Service Manual and Tools K002252, K002254, K002256, K028048 and K002253. Tool II32202 is not included. It is included in Tool Kits for SB6/7 and SN6/7 Air Disc Brakes or can be ordered separately.

2.2 Diagnostic Equipment

Part Number.	Description
II40598F	ZB9031-2 hand held unit for checking Potentiometer function (Pad plus Disc wear) when 13 pin chassis plug is installed. ZB9031-2 replaces ZB9031

2.3 Lubrication

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

2.4 Torque Specifications

Item Number		Torque	Spanner Size
39; 40	Caliper Mounting Bolts (x2) M16x1,5 (Hexagon socket head)	180 Nm plus 90° additional rotation	14 mm (Hexagon socket)
18/1; 18/2	Brake Chamber or Spring Brake	See actuator manufacturer's recommendation	

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 Bearing (20) to the Bridge (17). The force is then distributed by the Bridge (17) and the Threaded Tube (16) to the Tappet and Boot Assembly (13) and finally to the inboard Pad (12).

After overcoming the running clearance between the Pads (12) and the Brake Disc (46), the reaction forces are transmitted to the outboard Pad (12). The clamping forces on the Pads (12) and the Brake 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 the Disc and the Pads, 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) turns the Threaded Tube (16) by an amount necessary to compensate for this wear. The total running clearance (sum of clearances on both sides of the 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 will ensure a long-life and trouble-free operation of the disc brake.

3 monthly - (e.g. each time the tyre pressures are checked) the pad wear must be checked visually (see Sections 5.1.1, 5.1.2).

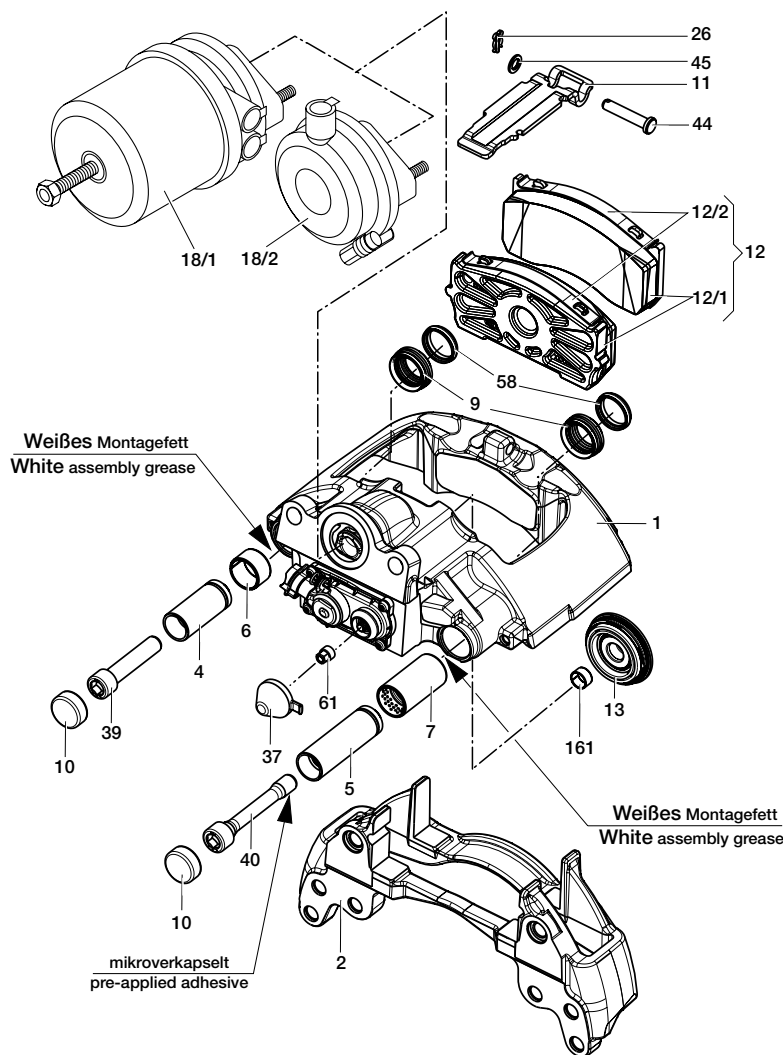
Note that if the pads need to be changed, it is important to check for the correct functioning of the Adjuster (see Section 5.2) and the smooth operation of the caliper over its full range of movement (see Section 5.3.2). Also inspect the Tappet and Boot Assembly (13), the Adjuster Cap (37) and the sealing elements (9, 58) for correct fitting and condition as well as the Caliper Bearing in the area of 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) and the Adjuster Cap (37).

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

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 - e.g. Pads (12/1) and Pad Holder Springs (12/2) – must be returned in order that an objective investigation of the cause can be made.




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4.1 Safety Instructions for Service Work


Please refer to Safety Advice earlier in this manual.

Use only original 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 carefully 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.

 *The use of impact wrenches on Knorr-Bremse service tools is not permitted.*

Tighten bolts and nuts to the torque values specified in 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, 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 be experienced during the bedding-in phase of the pads and/or the disc.*

5 Functional and Visual Check

5.1 Wear Check of Pads and 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 (at least every three months even if a Wear Indicator is fitted). The Pads should be checked corresponding to any legal requirements that may apply.

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

Minor damage at the edges is permitted (see arrow, Sketch 1).

Major damage on the surface of the Pad is not permitted (see arrow, Sketch 2).

Discs

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

A = Disc thickness
 new condition = 34 mm
 worn condition = 28 mm (the disc must be replaced).

C₁ = Overall thickness of Pad (new condition) 27 mm

C₂ = Overall thickness of Pad (new condition) 34 mm

D₁ = Backplate 8 mm

D₂ = Backplate 15 mm

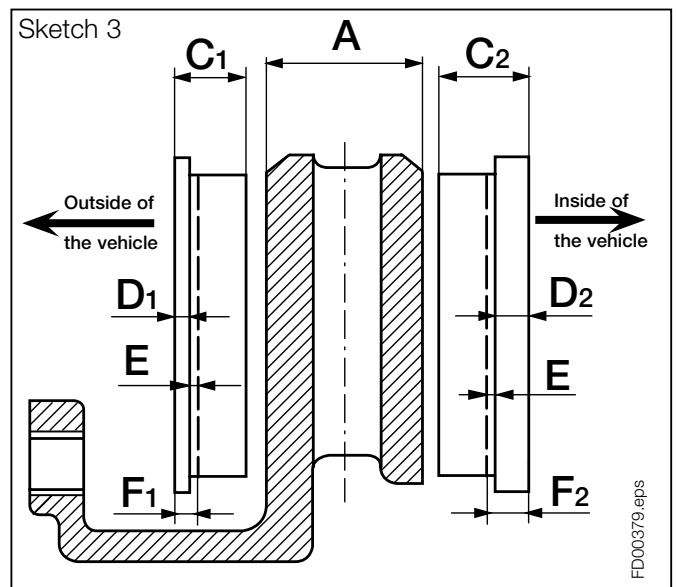
E = Minimum thickness of friction material 2 mm


F₁ = Minimum allowed thickness in worn condition for backplate and friction material 10 mm (replacement of Pads necessary).

F₂ = Minimum allowed thickness in worn condition for backplate and friction material 17 mm (replacement of Pads necessary).

If the disc dimension $A \leq 30$ mm, it is recommended that the Disc should be renewed when the Pads are next changed.

If the disc thickness is less than 28 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.

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**

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

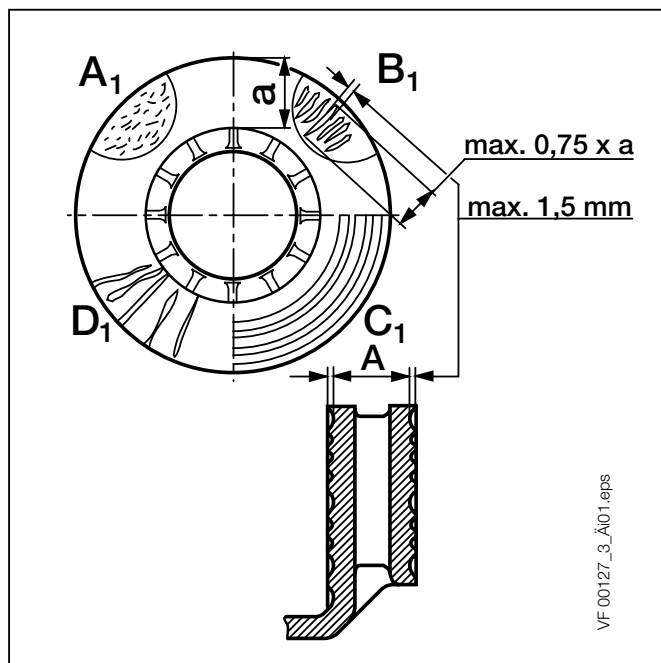
Note:

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

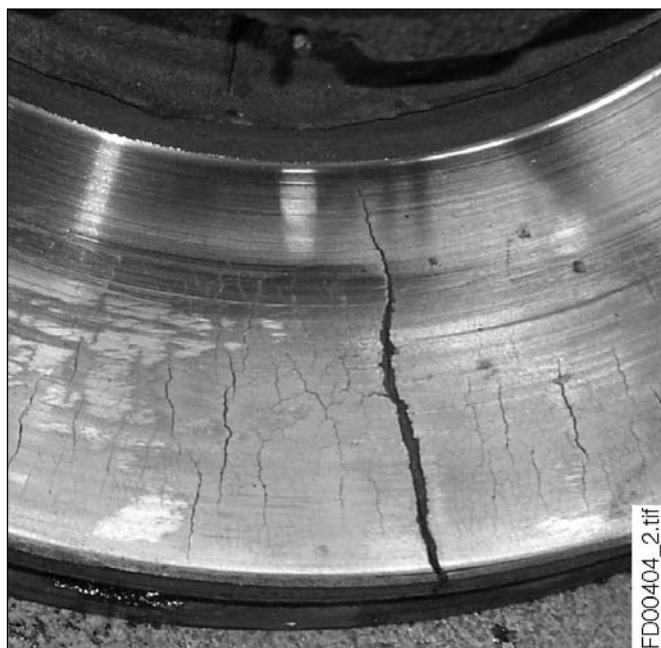
Knorr-Bremse Discs are normally service-free and grinding when changing Pads is not necessary. However, grinding could be useful, e.g. to increase the load-bearing surface of the Pads if severe grooving on the entire friction surface has occurred. To meet safety requirements, the minimum thickness after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

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

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



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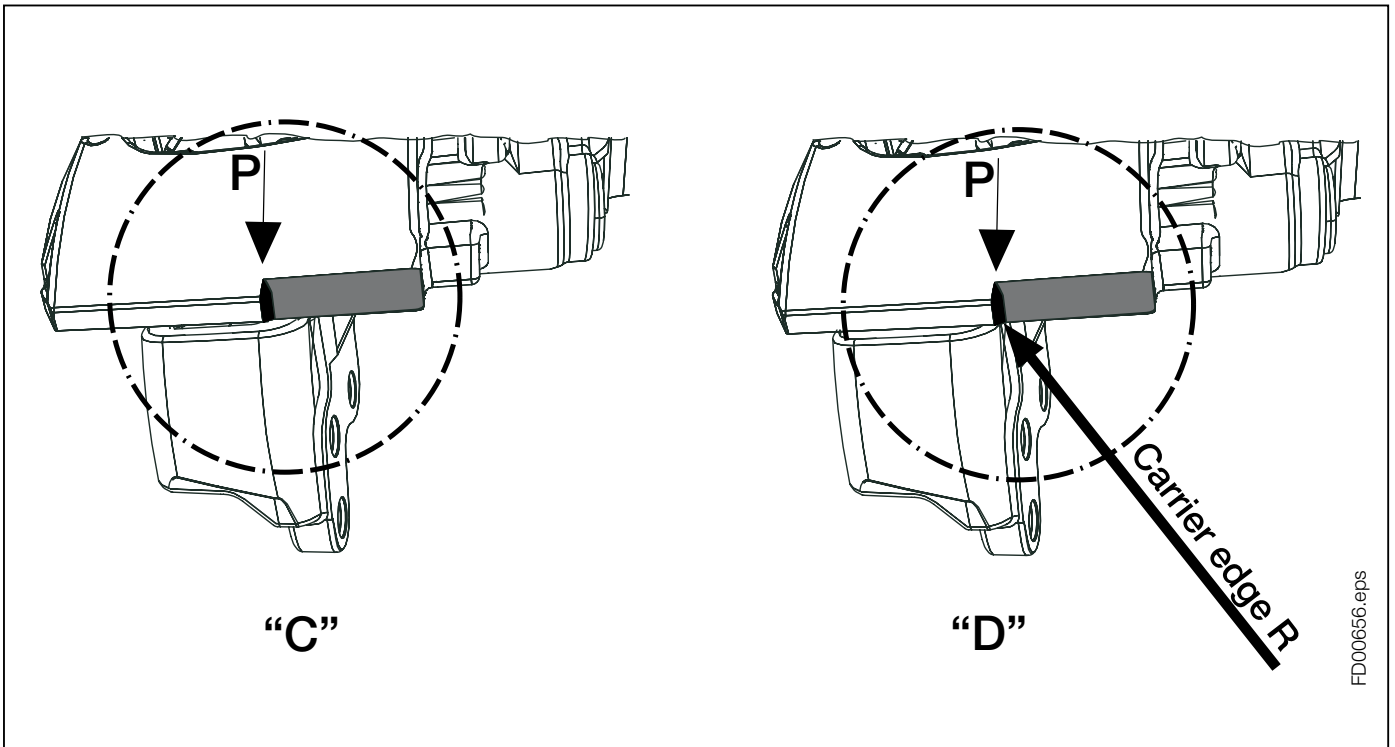


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If these recommendations are ignored, there is a risk of accident. If the pads and/or the disc are worn down excessively, brake performance will be reduced and may be lost completely.

5.1.1 Brake Wear Check using Caliper to Carrier position:
For all Disc Brakes which are equipped with a Caliper marking.



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

If the condition "D" is reached the wheel must be removed so that the wear of the Pads and Disc can be checked.

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

"C" = shown in new condition

"D" = Pads and Disc must be checked with road wheel removed

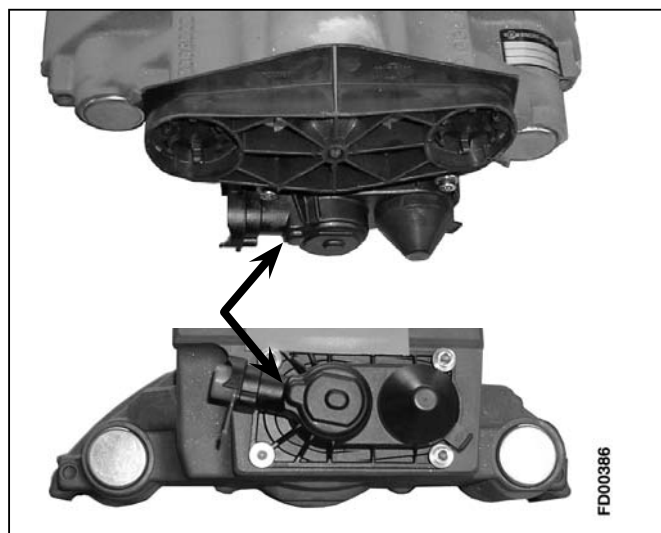
5.1.2 Wear Indicator

Wear Indicator using built-in potentiometer (see arrows on adjacent photos). 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 either of the above.

Note:

Please also refer to specifications provided by the Vehicle Manufacturer.



5.1.3 Diagnostic Equipment ZB9031-2

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 Diagnostic unit allows:

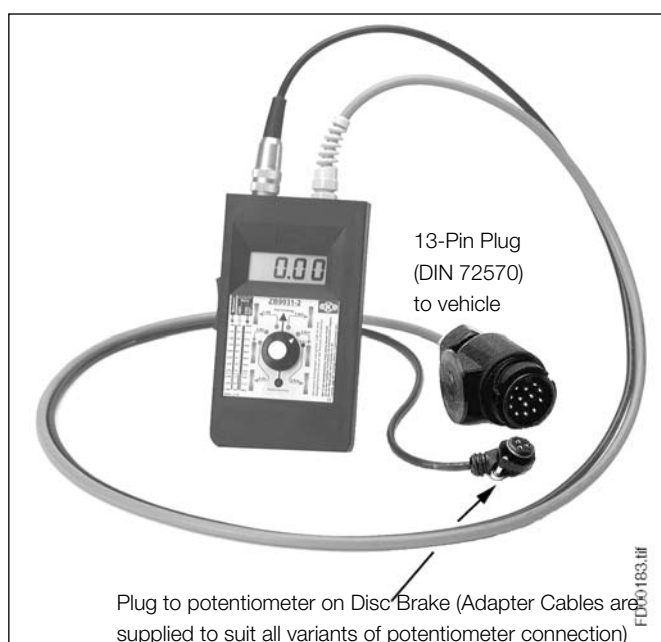
- Quick and simple wear check.
- A check of the potentiometer function.
- A simultaneous check of up to six brakes, without removing the wheels.

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

Alternatively the wear condition of an individual brake can be measured by connecting the unit directly to the potentiometer connection on the caliper.

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 outboard on its Guide Pins. Using a suitable tool, press the outboard pad (12) towards the Tappet and check the gap between Pad abutments and outboard pad backplate - it must be between 0.6 mm & 1.1 mm.

! 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 Shaft (24) must be turned with the Shear Adapter (61) anti-clockwise for 3 clicks (increasing running clearance).

! Never turn the Adjuster Shaft (24) 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. Exception: if the Shear Adapter (61) fails because the Adjuster has been wound back to its limit then the Caliper does not need to be replaced.

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.

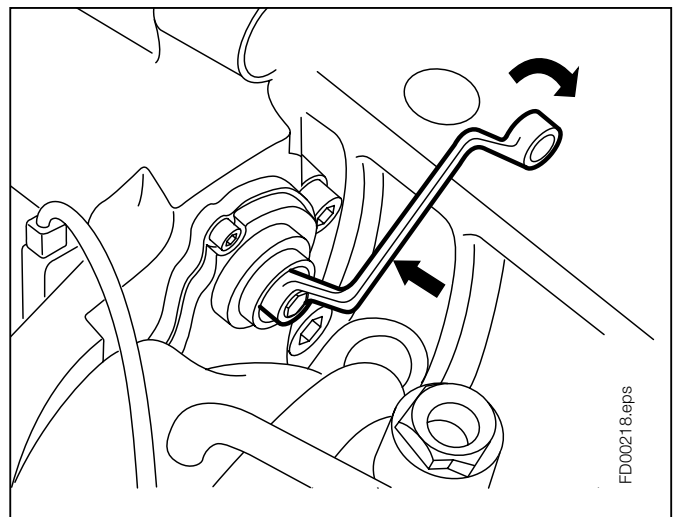
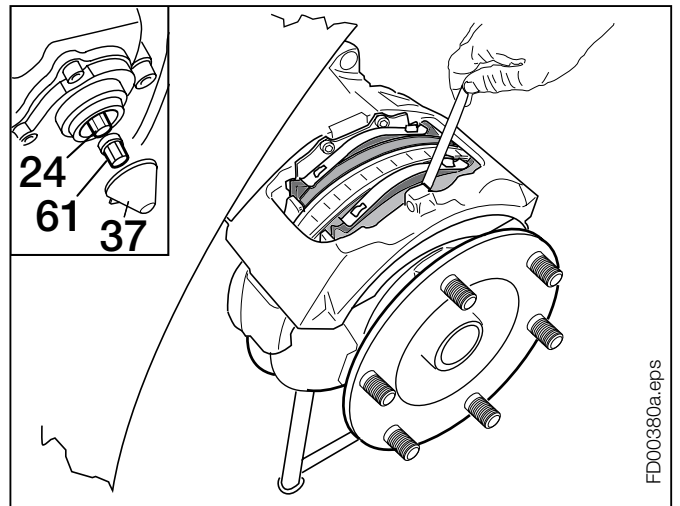
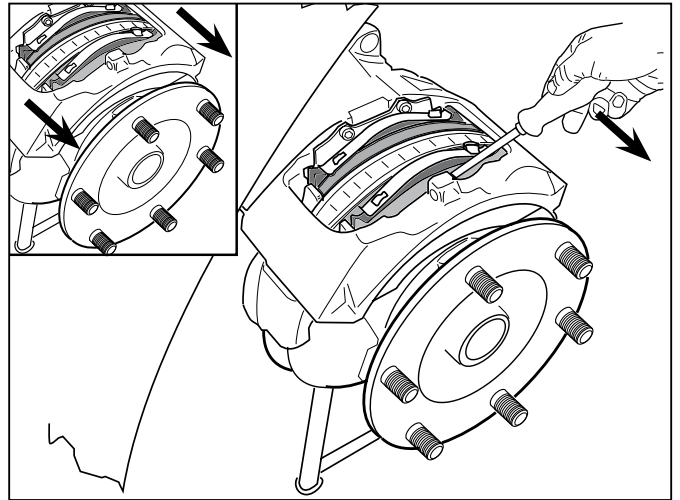
With a ring spanner or socket fitted to the Shear Adapter (61), by applying the brake (about 2 Bar) 5 - 10 times the spanner or socket should turn clockwise in small increments if the Adjuster is functioning correctly (see notes below).

NOTE:

As the number of applications increases, incremental movement will decrease.

NOTE:

If the ring 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.

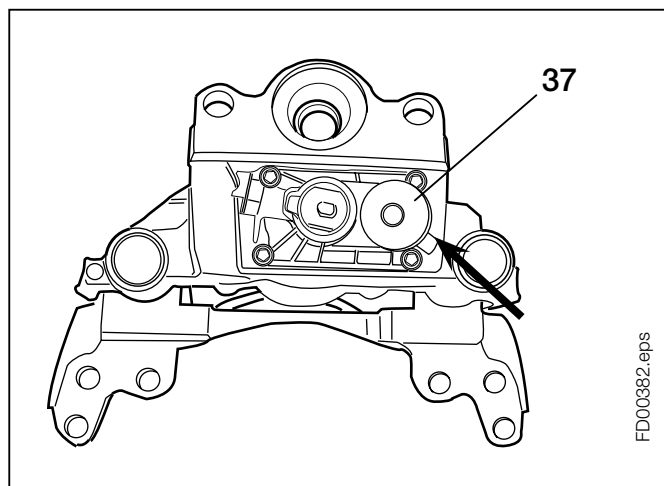


Note:

Even if Pads are not being changed, a new Adjuster Cap (37) should be fitted having lightly greased the mating 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 diagram. This ensures access is maintained for subsequent removal. Removal of the Adjuster Cap with a screwdriver, or similar, is not recommended since the seal may be damaged.



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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 A in adjacent sketch), a movement of 0,6 -1,1 mm must be possible.

If, even using a high level of hand pressure only (no tools), the Caliper is not movable, 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)

Fully wind-back the Tappet and Boot Assembly (13) by rotating the Shear Adapter (61) in an anti-clockwise direction (see Section 5.2).

Using hand pressure only (no tools), the Caliper (1) must slide freely along the whole length of the Guide Pin arrangement. This should be greater than 20 mm.

5.3.3 Guide Sleeve (6) 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 Guide Sleeve (6) 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 abutment.

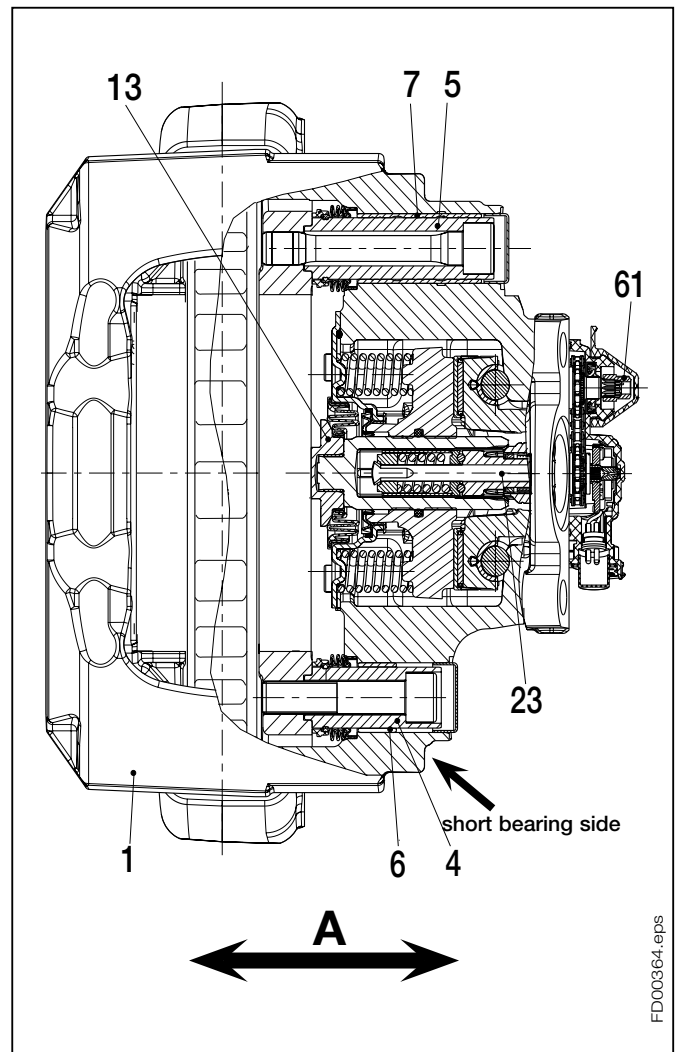
Fasten a magnetic dial-gauge holder to the Carrier (2) on the short bearing side of the Caliper (1) - see also Sketch above.

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

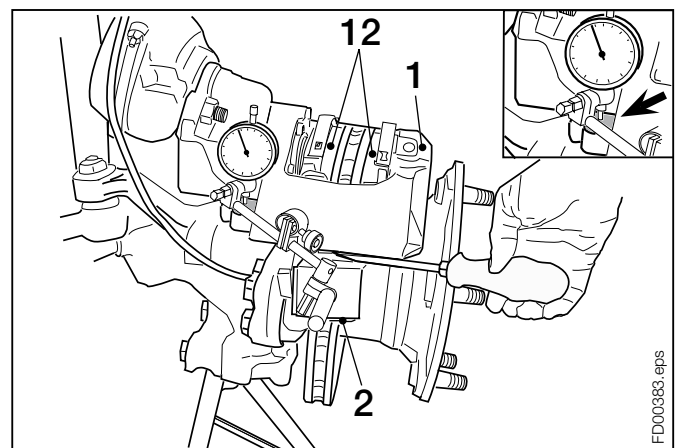
Press Caliper (1) in the direction of Carrier (2) and set the dial-gauge to zero.

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.



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If the distance is **greater than 1,0 mm**, the Guide Sleeve (6) must be replaced (see Section 1.2, Section 8 and following).

Note:

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 Sections 1.2 and 8)

Fit Pads and adjust 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 Pins (4) and (5) are sealed with Inner Boots (9) and the Caps (10). These items (9) and (10) must not show signs of cracking or damage.

Check for correct location and fitment.

Note:

It may be necessary to remove the Pads to inspect the Inner Boots (9) - dependent on the amount of pad wear.

If necessary, service Caliper with suitable Kit (see Section 1.2, Section 8 and following).


5.4.2 Tappet and Boot Assembly (13)

If necessary, remove Pads (12) (see Section 6.1) and screw the Shear Adapter (61) clockwise (see Section 5.2) until the boot is clearly visible.

Note:

The Tappet should not extend more than 40 mm (see sketch).

Turn the threaded tube clockwise with the shear adapter against the brake disc (max. extension 40mm)

 *The Threaded Tube should not lose engagement with the inner thread of the Bridge (17) because the potentiometer setting will be lost and the caliper must be replaced..*

Place an unworn Pad (12) into the outboard gap to avoid loss of thread engagement of the Threaded Tube.

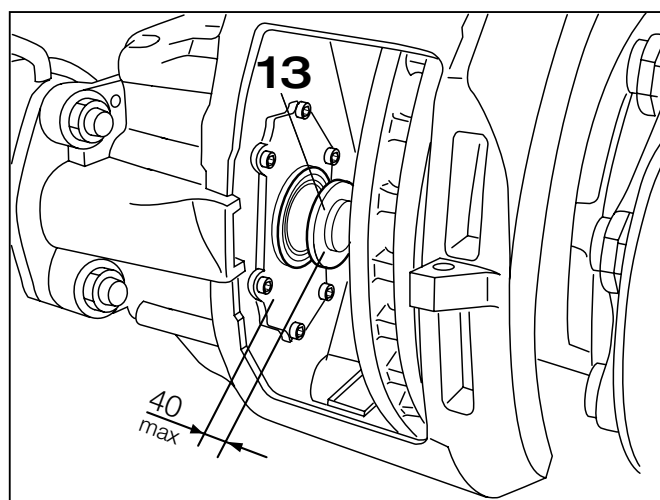
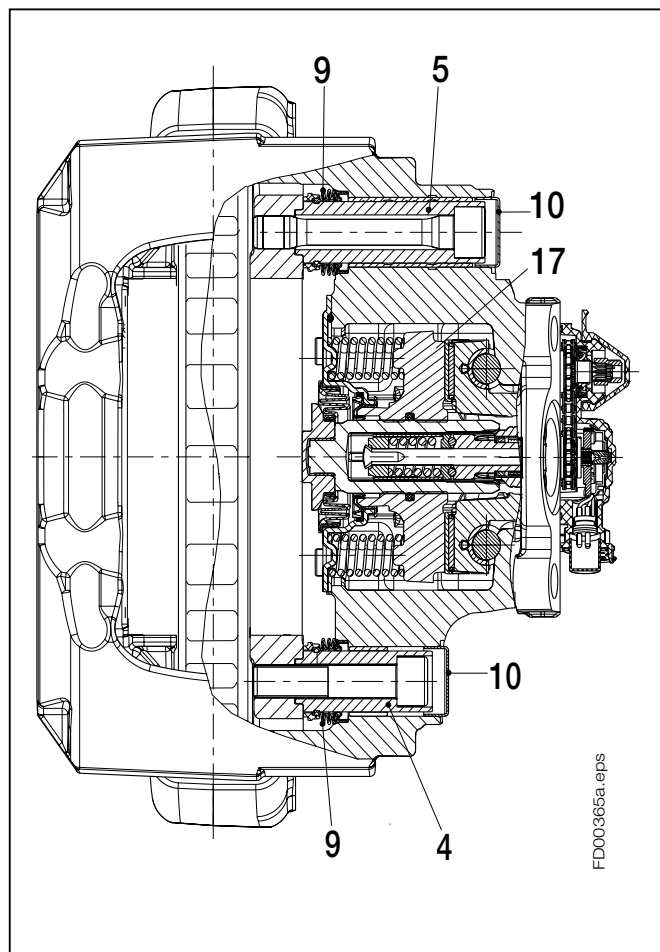
The Tappet and Boot Assembly (13) must not show any signs of damage.

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 Assembly (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 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 as the seal may be damaged.

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

Remove the outboard Pad.

⚠ Never turn Adjuster Shaft (24) 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.

Exception: if the Shear Adapter (61) fails because the Adjuster has been wound back to its limit then the Caliper does not need to be replaced.

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

The inboard Pad is guided by grooves in the Carrier (2) - see adjacent Sketch.

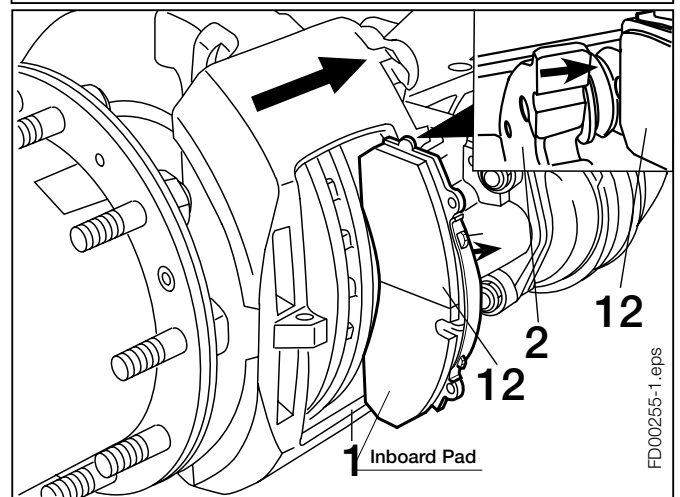
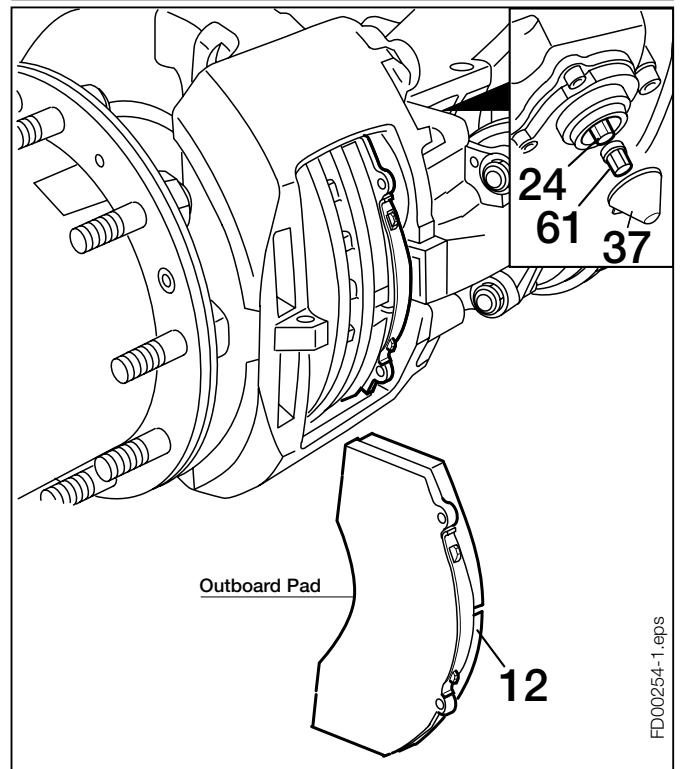
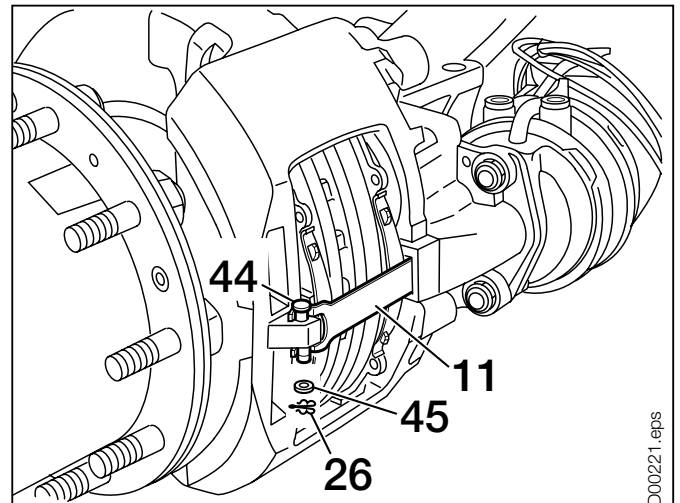
Push Caliper (1) toward Actuator - see arrow.

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 Pad can only be removed, if the outboard Pad has been already removed.



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 Assembly (13) by rotating the Shear Adapter (61) in an anti-clockwise direction (see Section 5.2).

! Never turn Adjuster Shaft (24) 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.

Exception: if the Shear Adapter (61) fails because the Adjuster has been wound back to its limit then the Caliper does not need to be replaced.

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

! 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.

Clean the Pad abutments.

Push Caliper (1) towards the Actuator - see Sketch above.

The inboard Pad is guided over the grooves into the Carrier (2) - see adjacent Sketch.

Fit inboard Pad (12).

Note, that the inboard Pad is guided by the Carrier's grooves - see Sketch above.

Push Caliper (1) outboard and fit the outboard Pad (12) -see adjacent Sketch.

Turn the Shear Adapter (61) clockwise until the Pads come into contact with the Disc.

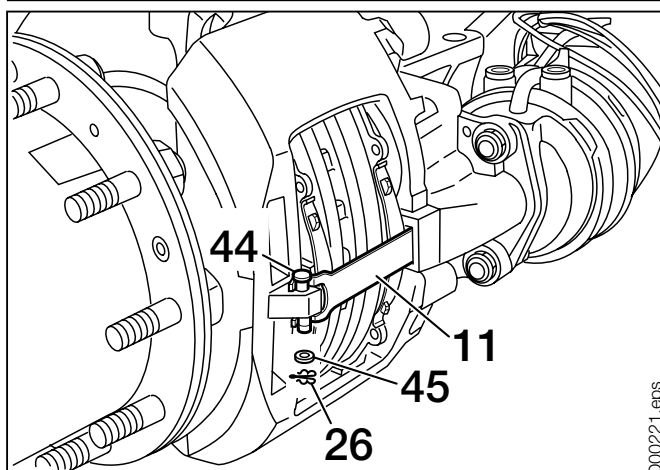
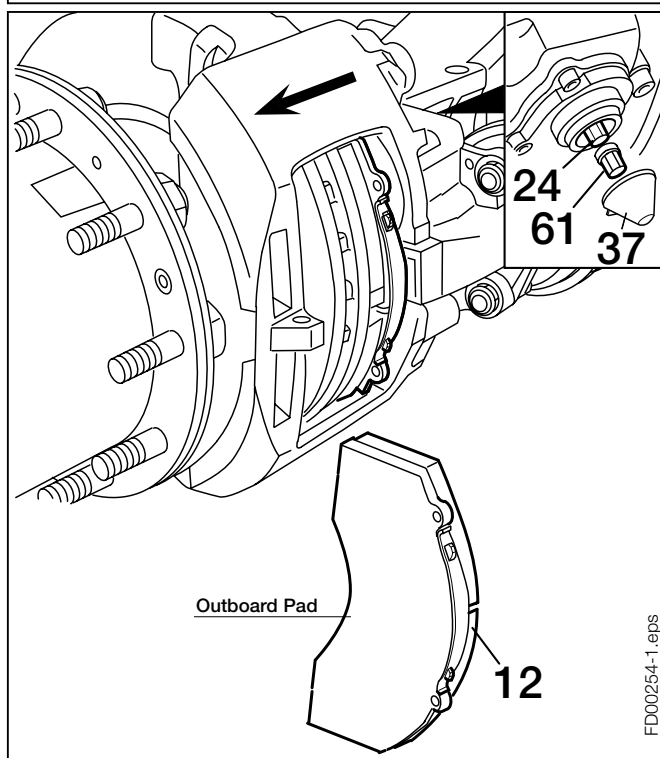
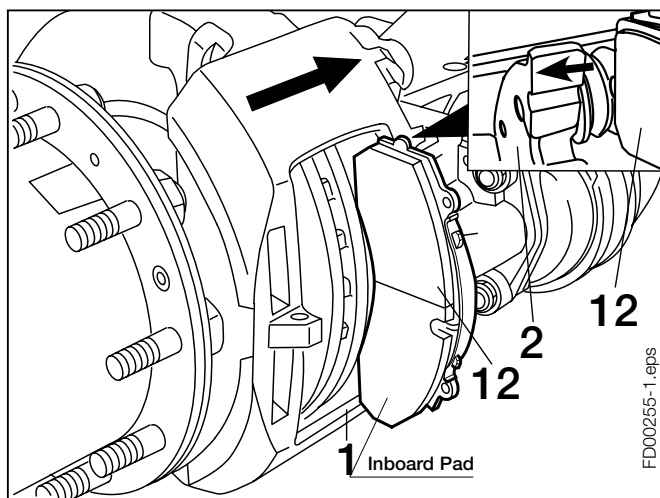
Then turn back the Adjuster 3 clicks and check the clearance (see Section 5.2).

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.




Pad Replacement

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

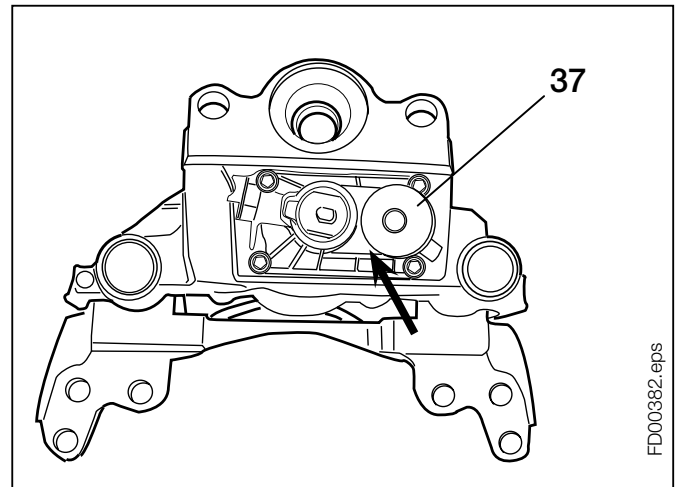
Note:

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.

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

 *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 be experienced during the bedding-in phase of the pads and/or the disc.



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7 Replacement of Tappet and Boot Assembly (13)

The components of the tools are referred to by item 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) (K002252).


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).

The Shear Adapter (61) must be screwed clockwise until the Boots can be reached (max. 40 mm) (see Section 7.1.1).

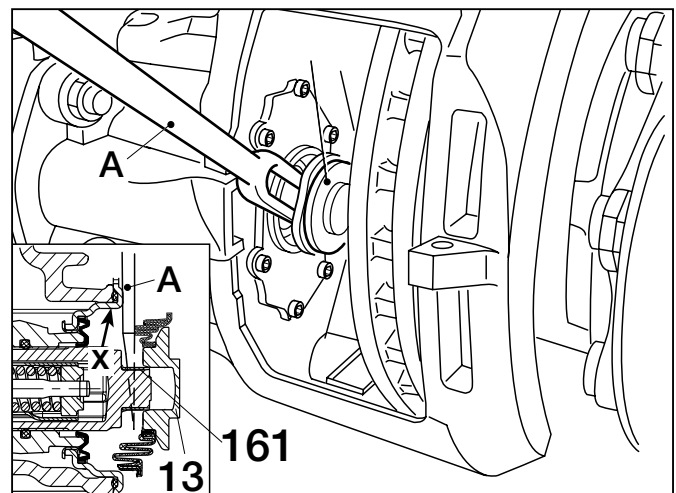
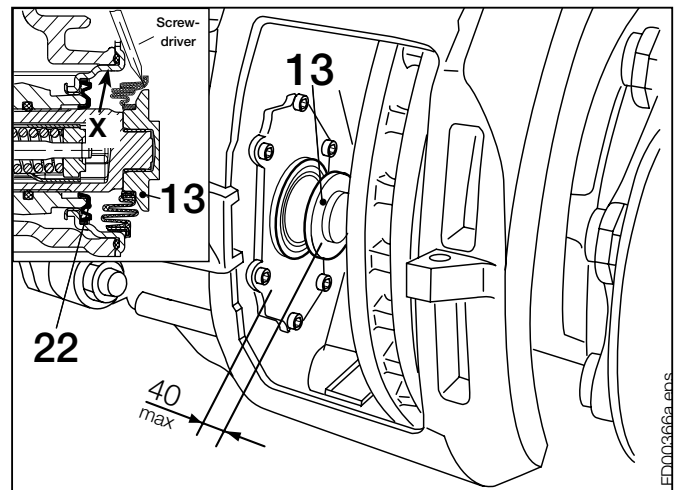
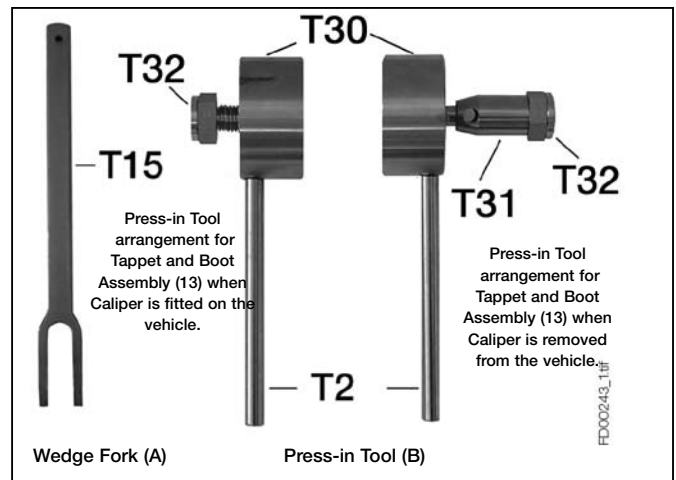
Remove the Boot by using a screwdriver, or similar (see adjacent Sketch).

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

Remove the Tappet and Boot Assembly (13) from the Threaded Tube (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 Seal (22) as well as the inner sealing face - see arrow "X" - and, if damaged, the Caliper must be replaced (see Section 8).



Replacement of Tappet and Boot Assembly (13)

7.1.1 Threaded Tube (16) - Inspection

For the inspection of the thread, the tube must be screwed out (max. 40 mm) by turning the Adjuster Shaft (24) with Shear Adapter (61) clockwise.

 *The Threaded Tube should not lose engagement with the inner thread of the Caliper. The Caliper must be replaced if potentiometer setting is lost.*

Place an unworn Pad (12) into the outboard gap to avoid loss of thread engagement of the Threaded Tube.

If the Caliper is not installed on an axle, put a spacer E (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).

7.2 Tappet and Boot Assembly (13) - Fitting

With Caliper installed on an axle:

Grease thread with **white** grease (Part No. II14525 or II32868).

Screw back Threaded Tube (16), by turning the Adjuster Shaft (24) with Shear Adapter (61) anti-clockwise (see Section 5.2).

The Sealing Seat in the Caliper for Tappet and Boot Assembly (13) - see arrow "X" - must be clean and free of grease.

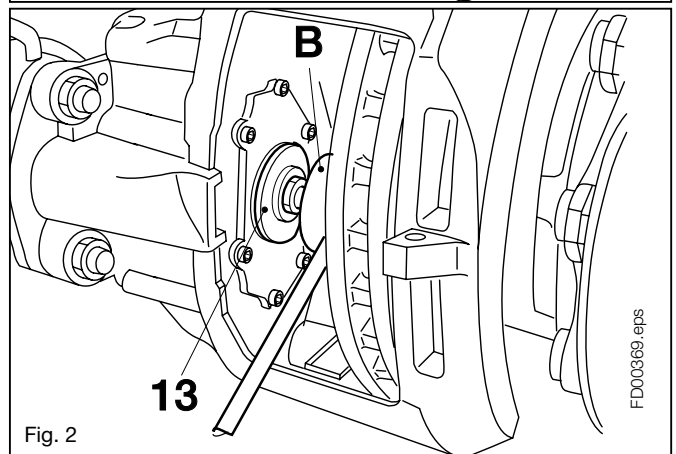
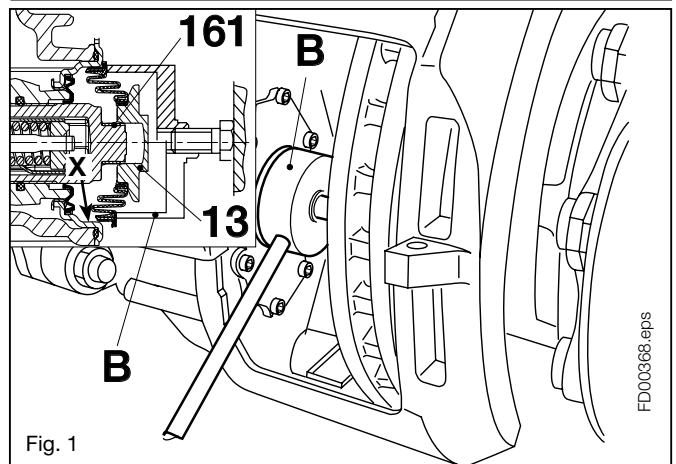
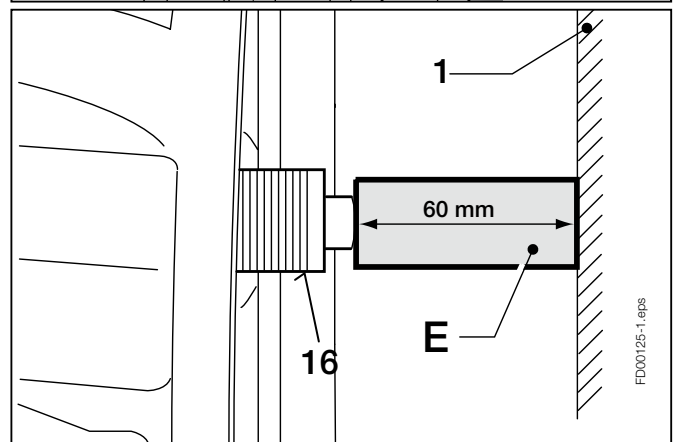
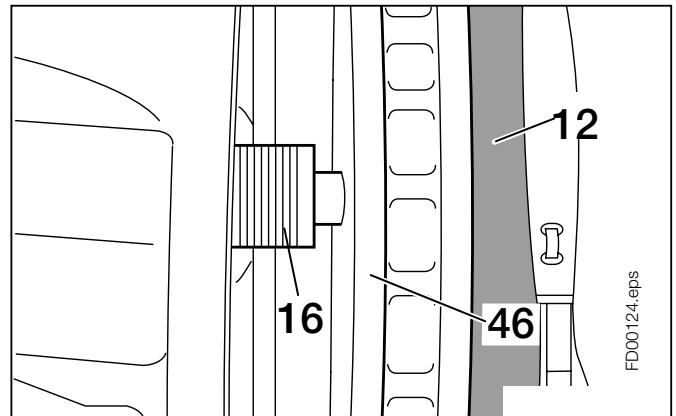
Push new Tappet Bush (161) onto the spigot of the Threaded Tube (16) until it stops.

Place Tappet and Boot Assembly (13) onto the spigot of the Threaded Tube (16).

Centre the Push-in Tool (B) with the short strut (T32) (II19252) and press in the Boot (see Fig. 1).

Turn over the Push-in Tool (B) and press the Tappet (13) onto the Tappet Bush with short strut T32 (see Fig. 2).

After assembly the Tappet (13) must be free to turn in both directions.



Replacement of Tappet and Boot Assembly (13)

With Caliper not installed on an axle

Grease threads with **white** grease (Part No. II14525 or II32868).

Screw back Threaded Tube (16), by turning the Adjuster Shaft (24) with Shear Adapter (61) anti-clockwise (see Section 5.2).

The Sealing Seat in the Caliper for the Tappet and Boot Assembly (13) - see arrow "X" - must be clean and free of grease.

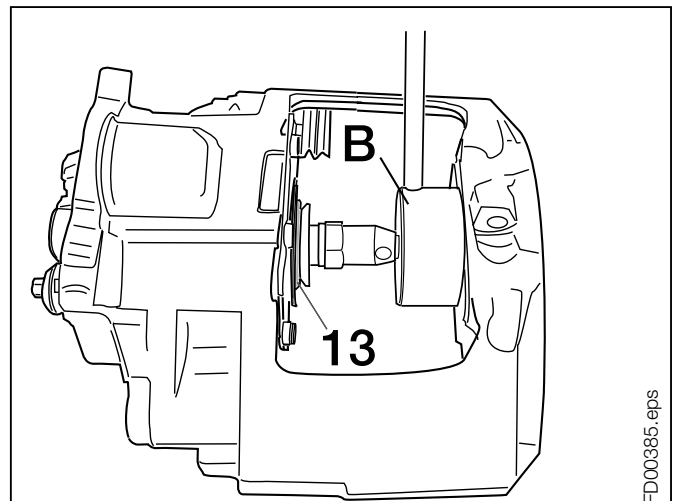
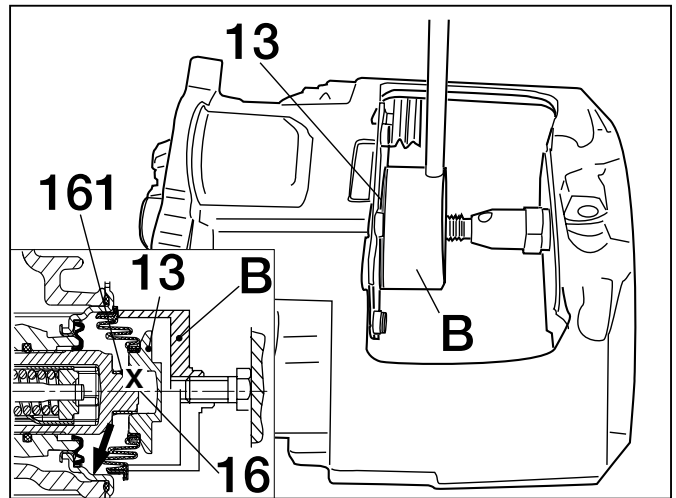
Push new Tappet Bush (161) onto the spigot of the Threaded Tube (16) until it stops.

Place Tappet and Boot Assembly (13) onto the spigot of the Threaded Tube (16).

Centre the Push-in Tool (B) with the long strut (T31+T32) and press in the Boot (see adjacent Sketch).

Turn over the Push-in Tool (B) and press the Tappet (13) onto the Tappet Bush with long strut (T31+T32) - see adjacent Sketch.

After assembly the Tappet (13) must be free to turn in both directions.



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8 Caliper Replacement


To fit the Cover (10) use the Press-in Tool (G) (K028048).

8.1 Caliper Removal from Carrier

Remove Pads (see Section 6.1).

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.

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


During penetration, the Cover may move 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.*

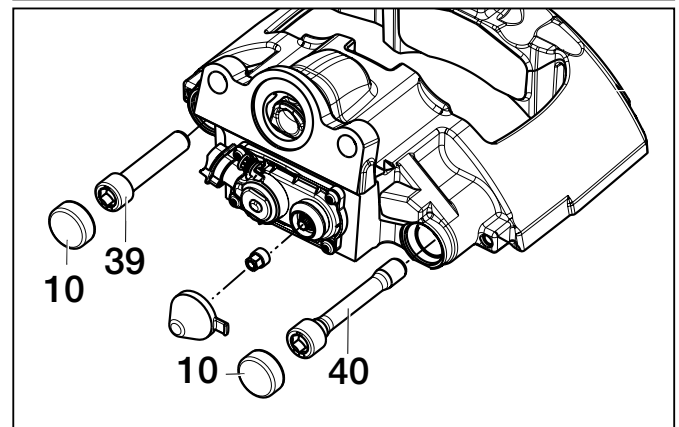
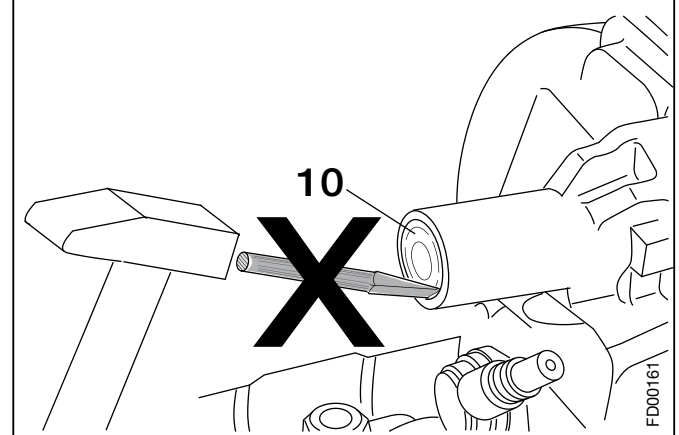
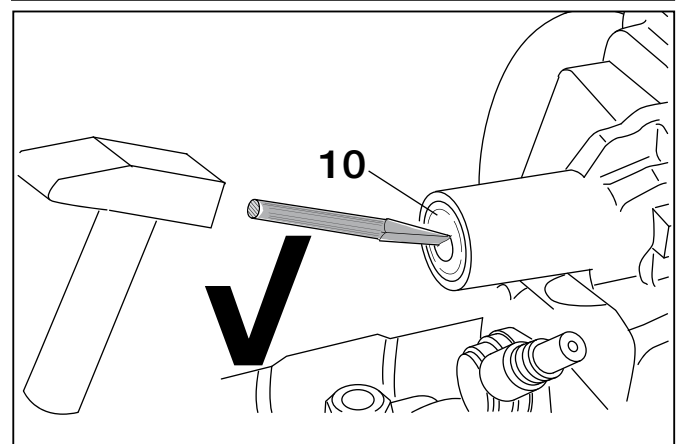
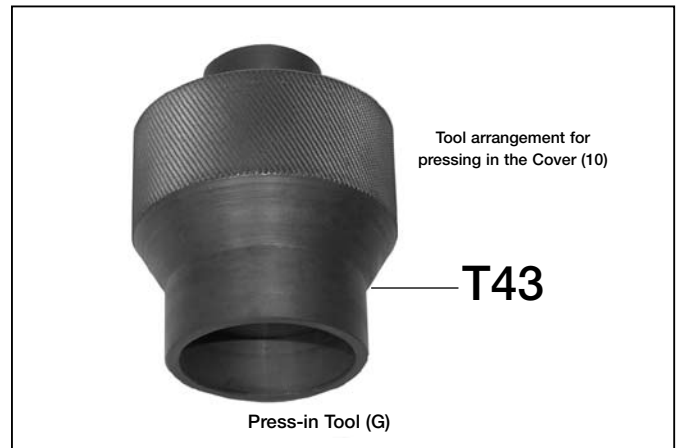
 *Before removing the Caliper Mounting Bolts (39 and 40) ensure that the Caliper (1) cannot move or fall down when the Bolts are removed causing damage or injury.*

Remove Caliper Mounting Bolts (39) and (40) and discard. They must not be re-used.

 *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 to the Carrier

(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 sketch 1 and Section 1.2).

The replacement Caliper may have a plastic cap or adhesive tape in the area of the actuator attachment (see arrows B and C). Remove the cap or tape before fitting the Brake Actuator.

Note:

The replacement Caliper includes Seals and Guide Pins. Pads and Carrier are not included.

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 Mounting Bolts (39 and 40) are highly stressed items. They must be replaced whenever the Caliper (1) is removed from the Carrier (2).

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

Insert Guide Pins (4) and (5).

The lip in the end of the Inner Boot must engage in the groove of the Guide Pins (4) and (5) (see arrow in the sketch below).

Pushing on the Rings (58) ensures that the Boots (9) engage in the grooves of the Guide Pins (4) and (5).

Fit the Caliper (1) to the Carrier (2).

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

Note:

Only use new bolts.

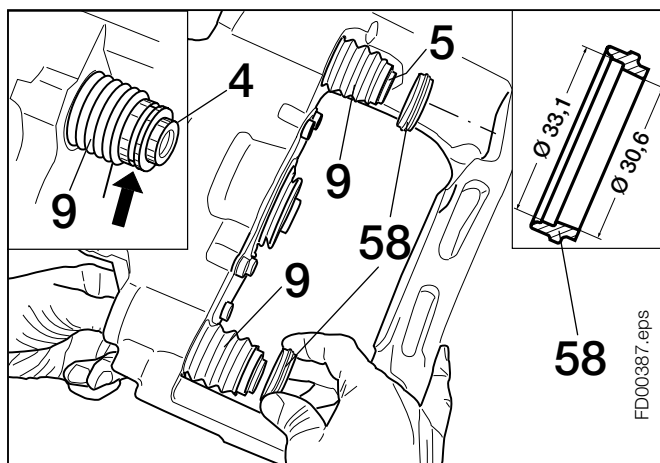
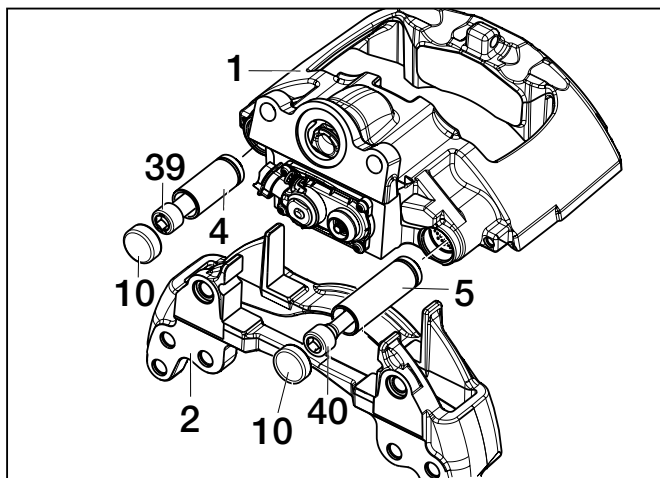
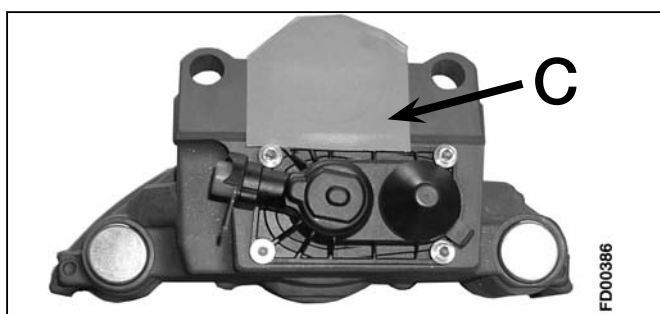
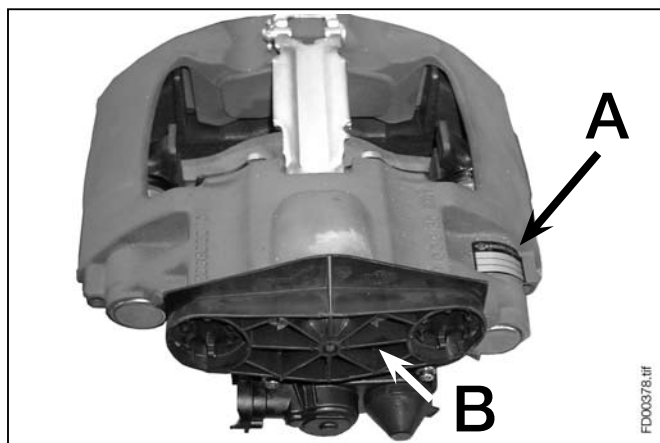
! Screw threads and tapped holes must be clean and dry (free of lubrication and residuals of pre-applied adhesive).

Check that the Caliper slides easily on the Guide Pins.

Check the position of the Inner Boot (9) on the Guide Pins (4) and (5) - see arrow - as well as the position of Ring (58).

Fit the Pads (see Section 6.2)

Check Adjuster function (see Section 5.2).



Caliper Replacement

8.2.1 Fitting of Cover (10)

Caliper bore and Cover (10) must be clean and free from lubrication.


Clean the new Cover (10) 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 (G) and place the Cover (10) inside - see adjacent figure.

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

Note:

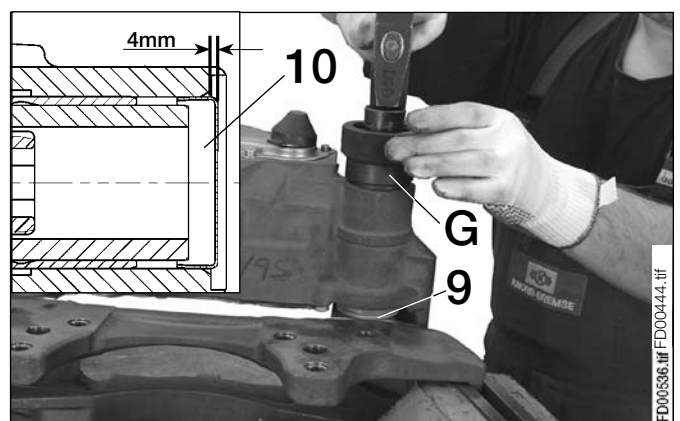
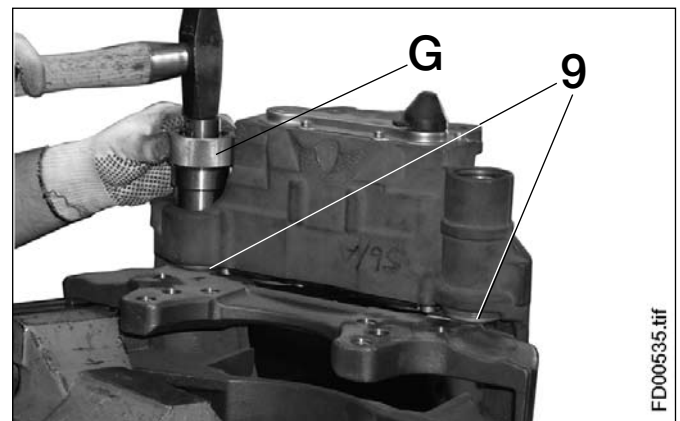
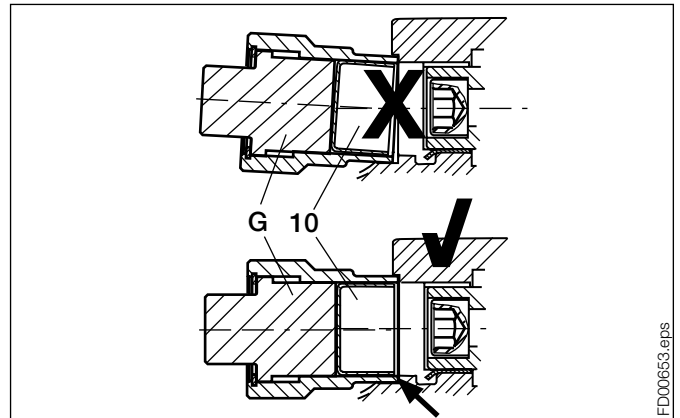
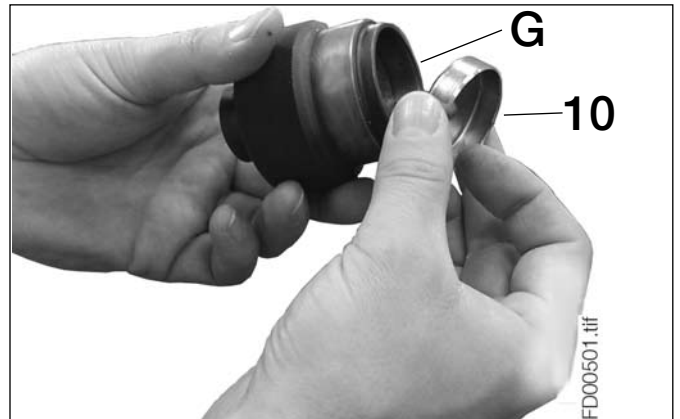
Do not tilt the tools when assembling the Cover (10) - see adjacent figure.

 *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 (G) 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 4 mm from the plane surface of the caliper - see adjacent figure.



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

Hold using a suitable clamping device. Move the Caliper against the Carrier so that the Inner Boots (9) are in a compressed condition.

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

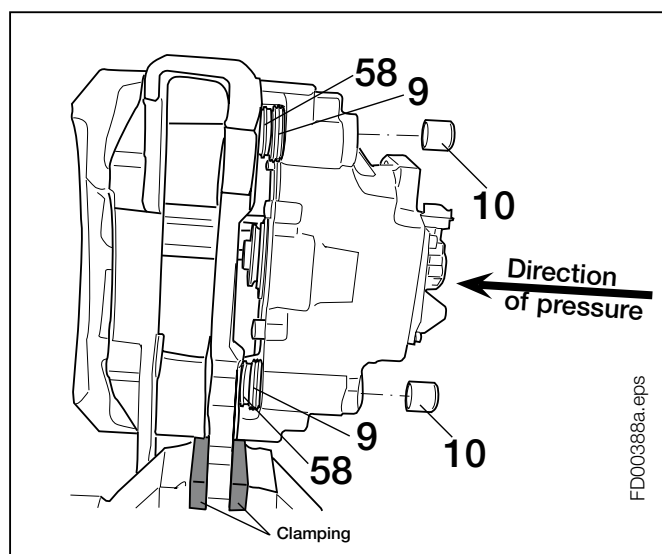
Fit new Cover (10) as described above.

Pay attention to the vehicle manufacturer's recommendations for during subsequent 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).



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Replacement of Inner Boot (9)

9 Replacement of Inner Boot (9)

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


To fit the Inner Boots (9) use the Pull-in Tool (C) (K002254).

Remove Caliper (see Section 8.1).

Remove Rings (58).

Pull out Guide Pins (4) and (5).

Push out Inner Boots (9) with a screwdriver.

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

The contact area of the boot on the Guide Pin (4) or (5) must be clean and free of lubrication.

Check for corrosion (see arrow A in adjacent Sketch).

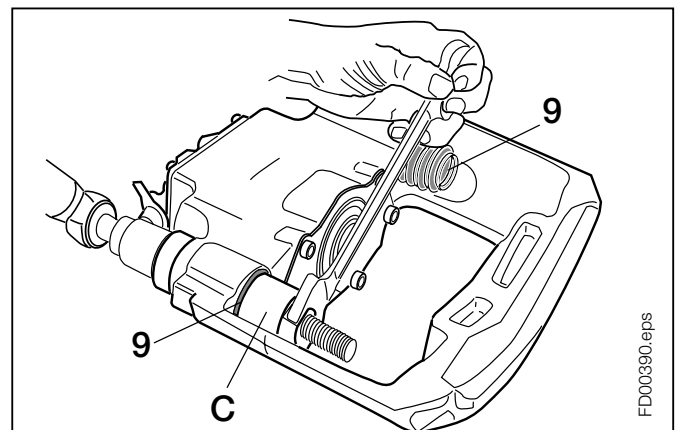
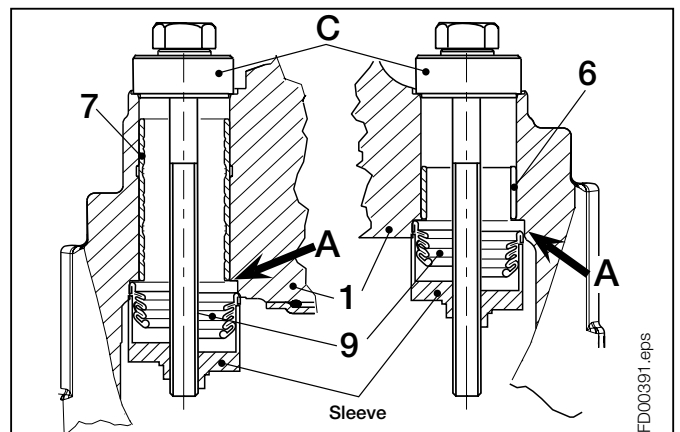
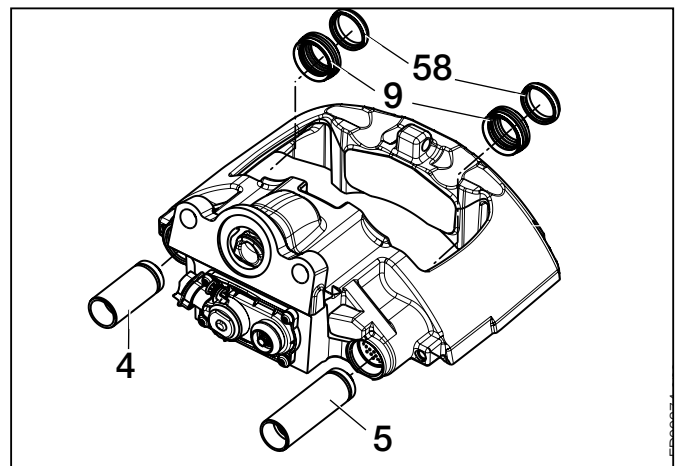
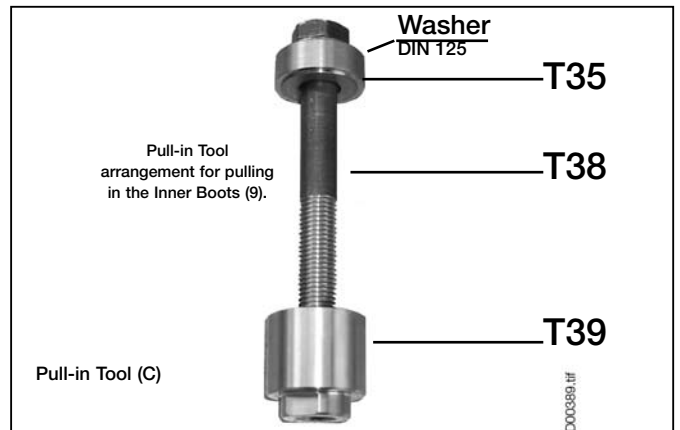
Check Brass Bush (7) and, if installed, Guide Sleeve (6), for corrosion, dirt or damage and replace as necessary (see Section 10.1 or 10.2)

Fit new Boot (9) into the Sleeve (T39) of the Tool (C) (K002254) - see adjacent Sketch.

Ensure that the folds of Inner Boot (9) are positioned within the tool - see adjacent Sketch.

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

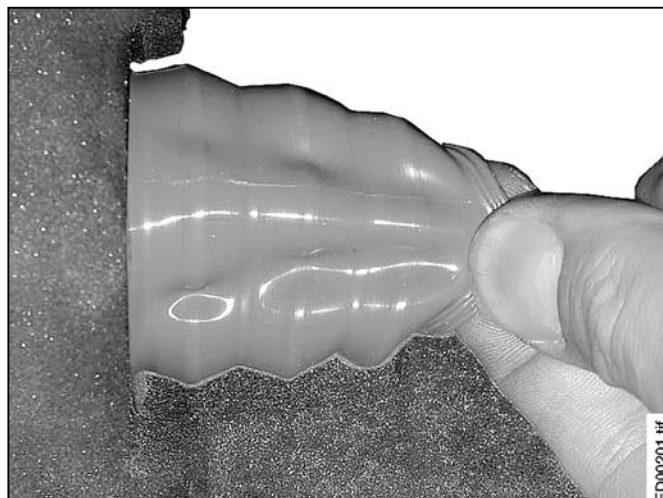
Then pull in with a **maximum torque of 8 Nm**.



Note:

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

Carry out a "pulling check" - see adjacent Sketch.



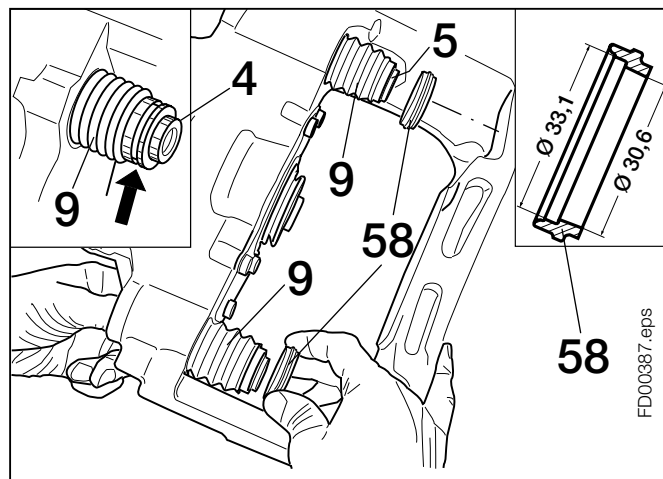
Grease Brass Bush (7) and Guide Sleeve (6) with **white** grease (Part No. II14525 or II32868).

Fit Guide Pins (4) and (5).

The lip in the end of the Inner Boot must engage in the groove of the Guide Pins (4) and (5) (see arrow).

Pushing on the Rings (58) ensures that the Boots (9) are engaged in the grooves of the Guide Pins (4) and (5).

Fit Caliper to Carrier (see Section 8.2).



10 Replacement of Guide Sleeves

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

In order to remove and re-fit the Brass Bush (7) and the Guide Sleeve (6) use the Pull-out/Pull-in Tool (D) (K002256).

In order to groove the Brass Bush (7) use the Grooving Tool (F) (K002253).

Remove Caliper (see Section 8.1).

Remove Guide Pins (4) and (5) as well as the Inner Boots (9) (see Section 9).

10.1 Brass Bush (7) - Replacement

10.1.1 Brass Bush (7) - Removal


Clean surfaces - see arrow "X" and sealing face of the boot - see arrow "A" - and Brass Bush (7).

Position Tool arrangement for pulling out Brass Bush (7).

Note:

Ensure that Brass Nut (T34) is located in Brass Bush (7).

The end of Tube (T33) must be firmly located against the surface - see arrow "X".

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


Pull out Brass Bush (7) by means of the Spindle (T20).

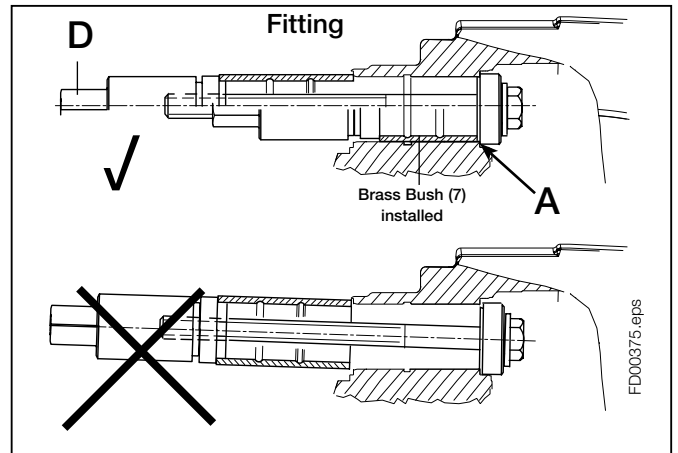
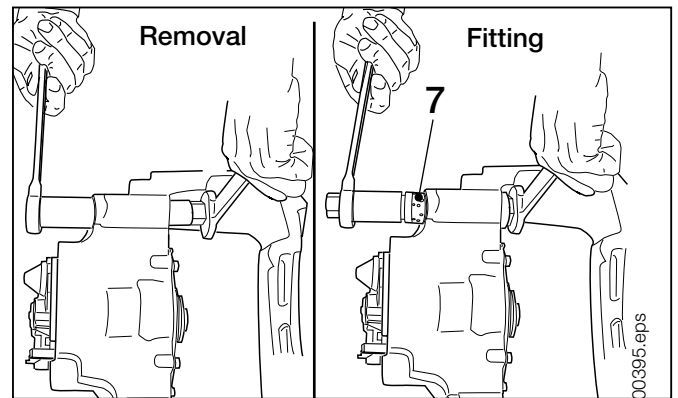
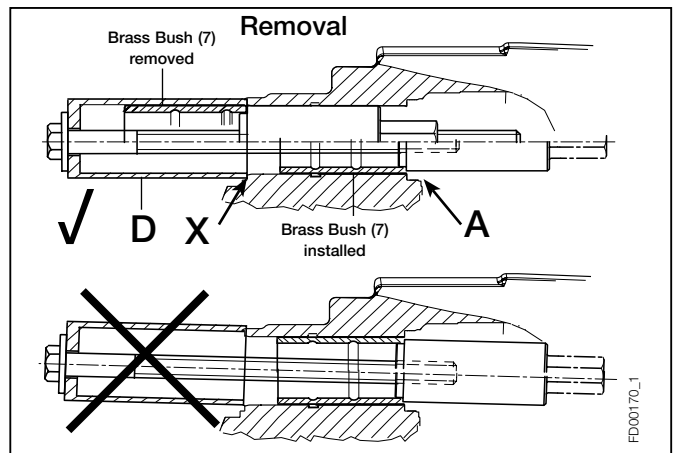
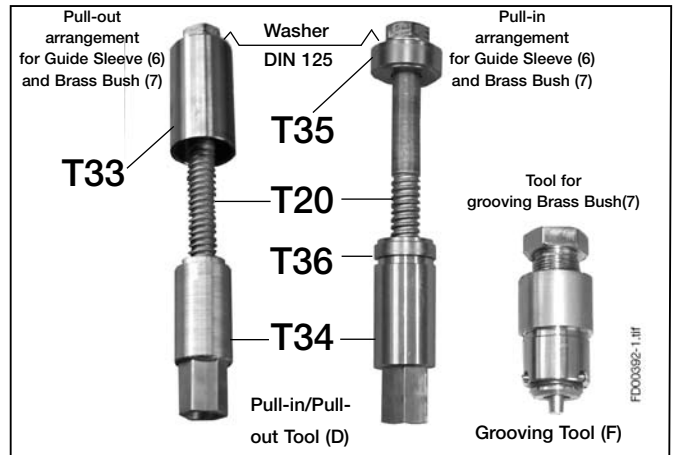
10.1.2 Brass Bush (7) - Fitting

Place new Brass Bush (7) on the Pull-in Tool (D) and insert into caliper bore - see adjacent Sketch.

Screw Spindle (T20) by hand up to stop. The Disc (T36) must locate in the Brass Bush (7).

Hold the spindle (T20) by using a ring spanner and pull in the new brass bush up to the stop using a suitable tool on hexagon nut (T34).

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



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 degrees.

Again wind in the hexagon screw of the Grooving Tool (F) and tighten to its stop.

The new Brass Bush (7) is now firmly retained in the Caliper (see arrow B).

Before removing the Grooving Tool (F), its hexagon screw should be wound out approximately 20 mm.

Check contact area of Brass Bush (7) and remove any burrs if necessary.


Grease Bush (7) with white Grease (Part No. II14525 or II32868).

10.2 Guide Sleeve (6) - Replacement

10.2.1 Guide Sleeve (6) - Removal

Clean Caliper in the area of the Guide Sleeve (6) and the Pad abutment.

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).


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

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).

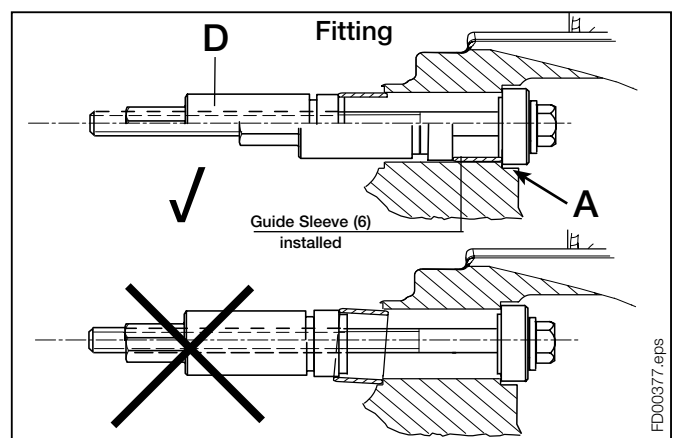
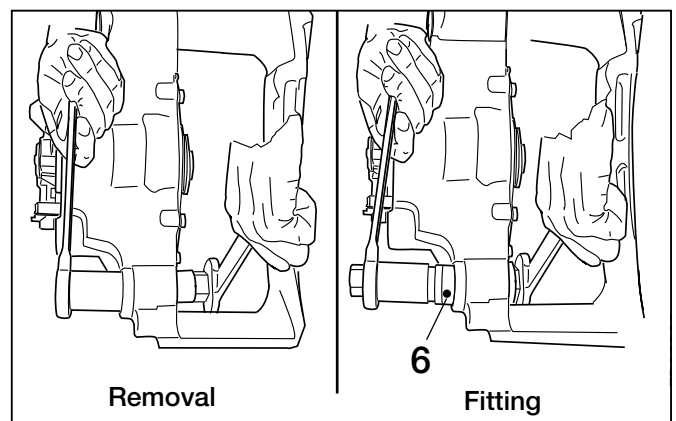
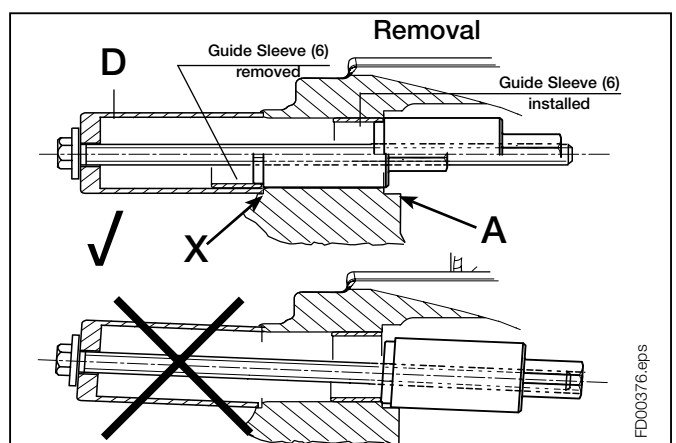
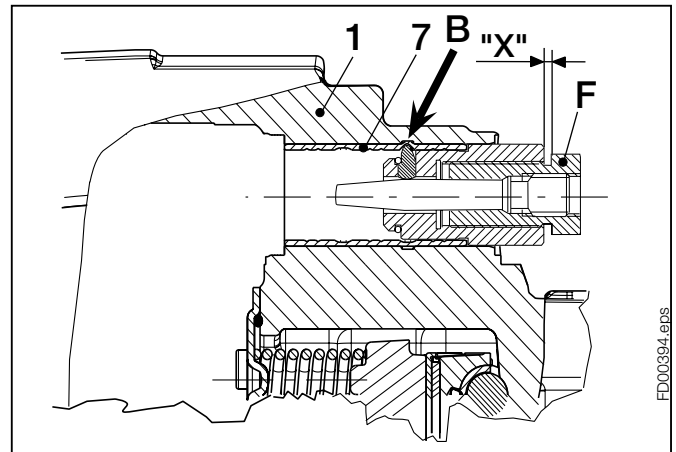
10.2.2 Guide Sleeve (6) - Fitting

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

Push Guide Sleeve (6) into the Tool (D) and position Tool (D) with Guide Sleeve (6) - see Sketch. Screw on the Spindle (T20), by hand, up to stop. 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).


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).



11

Carrier Replacement

11 Carrier Replacement

 *Before removing the Caliper or Carrier Mounting Bolts ensure that the Caliper / Carrier cannot move or fall down when the bolts are removed causing damage or injury.*

If necessary remove Caliper (see Section 8.1).

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

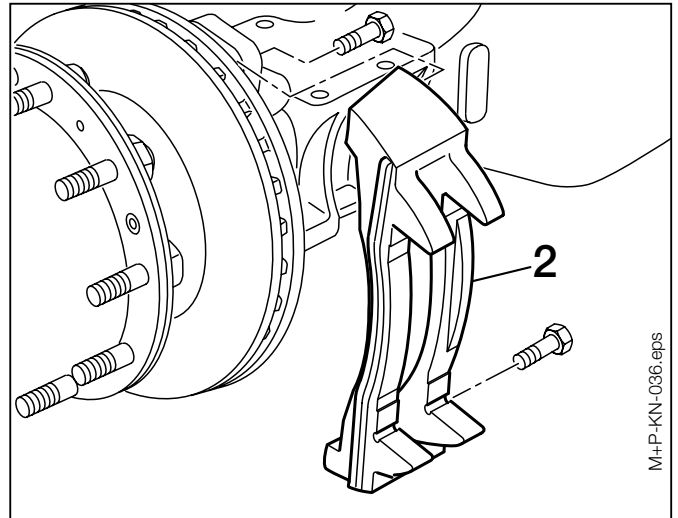
Note:

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 at 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 re-used.

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 from lubrication.

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


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

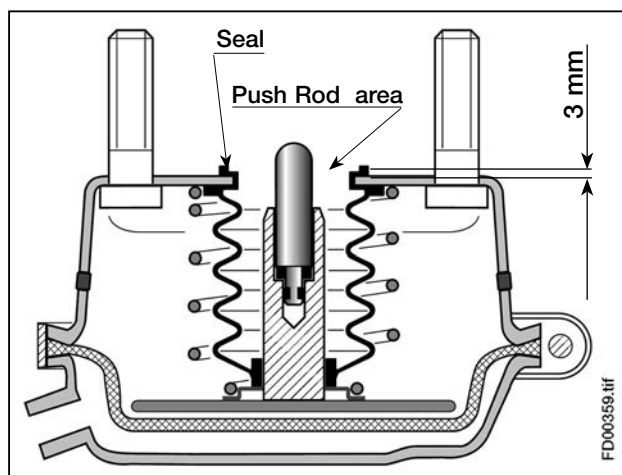
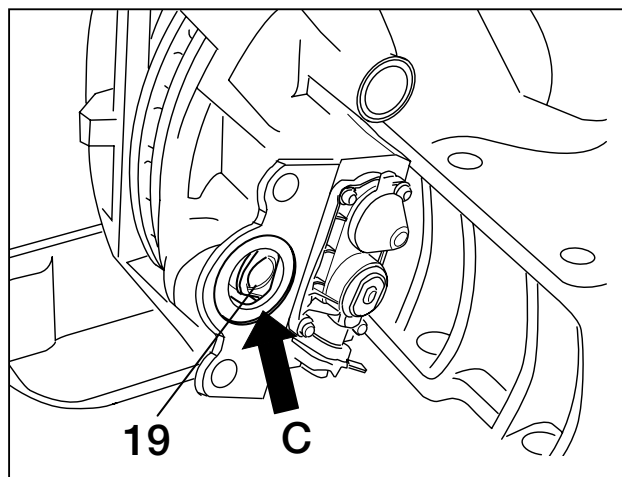
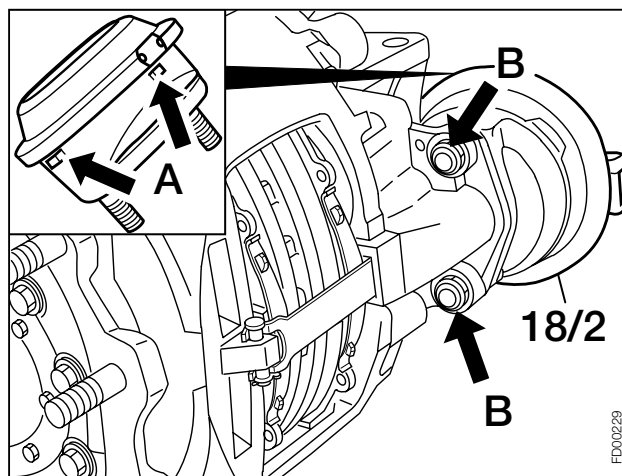
Attach Brake Chamber using new nuts.

In order not to tilt the Brake Chamber, screw the mounting nuts step-by step alternately by hand and then with a suitable tool. Then tighten to the torque specified by the manufacturer of the Brake Chamber.

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 brake.



12.3 Spring Brake - Removal

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

Move Hand Control Valve to 'run' position to release parking brake.

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

Move Hand Control Valve lever to 'park' position to apply the parking brake (releasing air from the spring brake).

Disconnect air connections from Spring Brake (18/1) - take care air connections must be free of air pressure.

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

Remove Spring Brake (18/1).

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

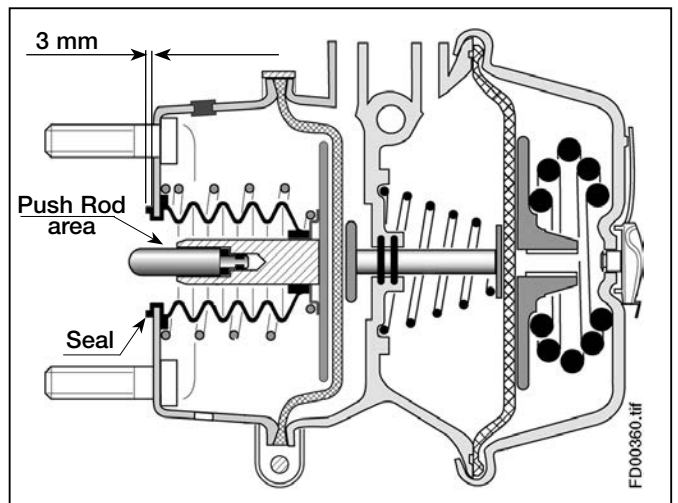
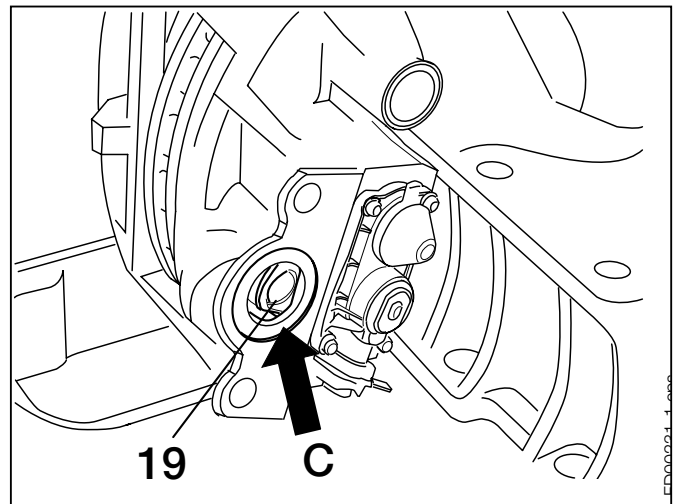
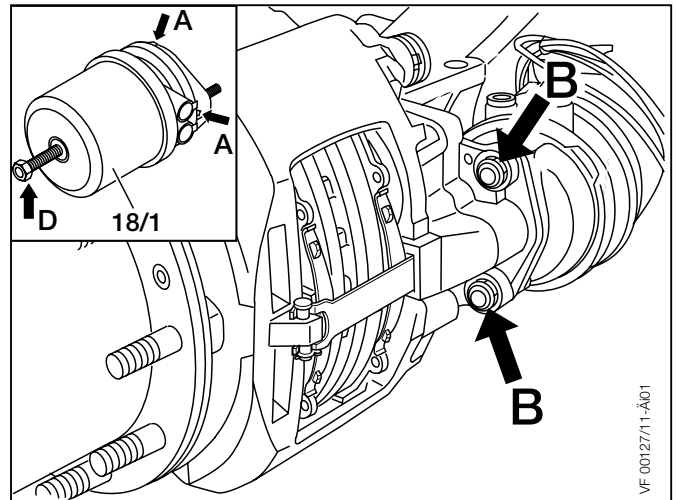
Take care, that no dirt enters the brake!

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).

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

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

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



Attach Spring Brake using new nuts.

In order not to tilt the Spring Brake, screw the mounting nuts step-by step alternately by hand and then with a suitable tool. Then tighten to the torque specified by the manufacturer of the Spring Brake.

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.

Move Hand Control Valve to 'run' position to release parking brake, and check for leakage.

Screw in Spring Brake Release bolt to a maximum of 70 Nm.

Check air connections for leakage.



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

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