TECHNICAL DOCUMENTATION

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SERVICE MANUAL

SPLINED DISC® BRAKE DISC 22,5“

TRUCKSERVICES

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Disclaimer

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

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

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

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

Revision Details

Rev. 001	December 2012	Changes throughout the document
Rev. 002	July 2020	Layout updated only - no technical change

CONTENTS

SAFETY AND ENVIRONMENT GUIDELINES

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

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

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

1 Always wear safety glasses when working with air pressure.

2 Never exceed the vehicle manufacturer's recommended air pressures.

3 Never look into air jets or direct them at anyone.

4 Never connect or disconnect a hose or line containing pressure; it may whip as air escapes.

5 When removing or servicing a product, ensure all pressure related to the specific system it is contained in has been depleted to 0 bar. Be aware that if the vehicle is equipped with an air dryer system, it can also contain air pressure along with its purge reservoir, if fitted, even after pressure has been drained from the other reservoirs.

6 If it is necessary to drain the air pressure from reservoirs, etc., keep away from brake actuator push rods and levers since they may move as system pressure drops. On vehicles fitted with air suspension, it is advised when undertaking such work, to support the chassis from sudden lowering and therefore prevent any possibility of being trapped between the chassis and axle or ground.

7 Park the vehicle on a level surface, apply the parking brakes, and always chock the wheels as depleting vehicle air system pressure may cause the vehicle to roll.

8 When working under or around the vehicle, and particularly when working in the engine compartment, the engine should be shut off and the battery disconnected. Where circumstances require that the engine be running, EXTREME CAUTION should be taken to prevent personal injury resulting from contact with moving, rotating, leaking, heated or electrically charged components. Additionally, it is advisable to place a clear sign on or near the steering wheel advising that there is work in progress on the vehicle.

9 When working on vehicles equipped with air suspension, to guard against injury due to unexpected downward movement of the chassis caused by sudden pressure loss in the suspension system, ensure that the vehicle chassis is mechanically supported with a 'prop' between the chassis and the axle or between the chassis and the ground.

10 Examine all pipework for signs of kinks, dents, abrasion, drying out or overheating. Be aware that kinks in pipework may result in air pressure being trapped in the pipework and associated equipment. Replacement hardware, tubing, hose, fittings, etc. must be of equivalent size, type and strength as original equipment and be designed specifically for such applications and systems. Check the attachment of all pipework; it should be installed so that it cannot abrade or be subjected to excessive heat.

11 Components with stripped threads or damaged/corroded parts must be replaced completely. Do not attempt repairs requiring machining or welding unless specifically stated and approved by the vehicle or component manufacturer.

12 Never attempt to install, remove, disassemble or assemble a device until you have read and thoroughly understood the recommended procedures. Some units contain powerful springs and injury can result if not properly dismantled and reassembled. Use only the correct tools and observe all precautions pertaining to use of those tools.

13 Before removing any device note its position and the connections of all pipework so that the replacement/serviced device can be properly installed. Ensure that adequate support or assistance is provided for the removal/installation of heavy items.

14 Use only genuine replacement parts, components and kits as supplied by Knorr-Bremse or the vehicle manufacturer. Only use the recommended tools as specified in related Knorr-Bremse instructions.

15 The serviced or replaced product must be checked for correct function and effectiveness.

16 If products have been dismantled, serviced or replaced, whose performance could affect braking performance or system behaviour, this should be checked on a roller dynamometer. Bear in mind that a lower performance may be experienced during the bedding-in phase if new brake pads/linings and/or brake discs/drums have been fitted.

17 The use of impact screwdrivers or impact wrenches in conjunction with Knorr-Bremse service tools for air disc brakes is not permitted. The service tools are not designed for such use. It is likely that the tools or the vehicle will be damaged and there is a serious risk of injury – see Caution above.

18 Do not use compressed air to clean the disc brake. Avoid air contamination of brake dust.

19 Prior to returning the vehicle to service, make certain that all components and the complete brake systems are leak free and restored to their proper operating condition.

Welding

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

1 In all cases, before starting any electrical welding, remove all connections from any electronic control units or modules, noting their position and the order in which they are removed.

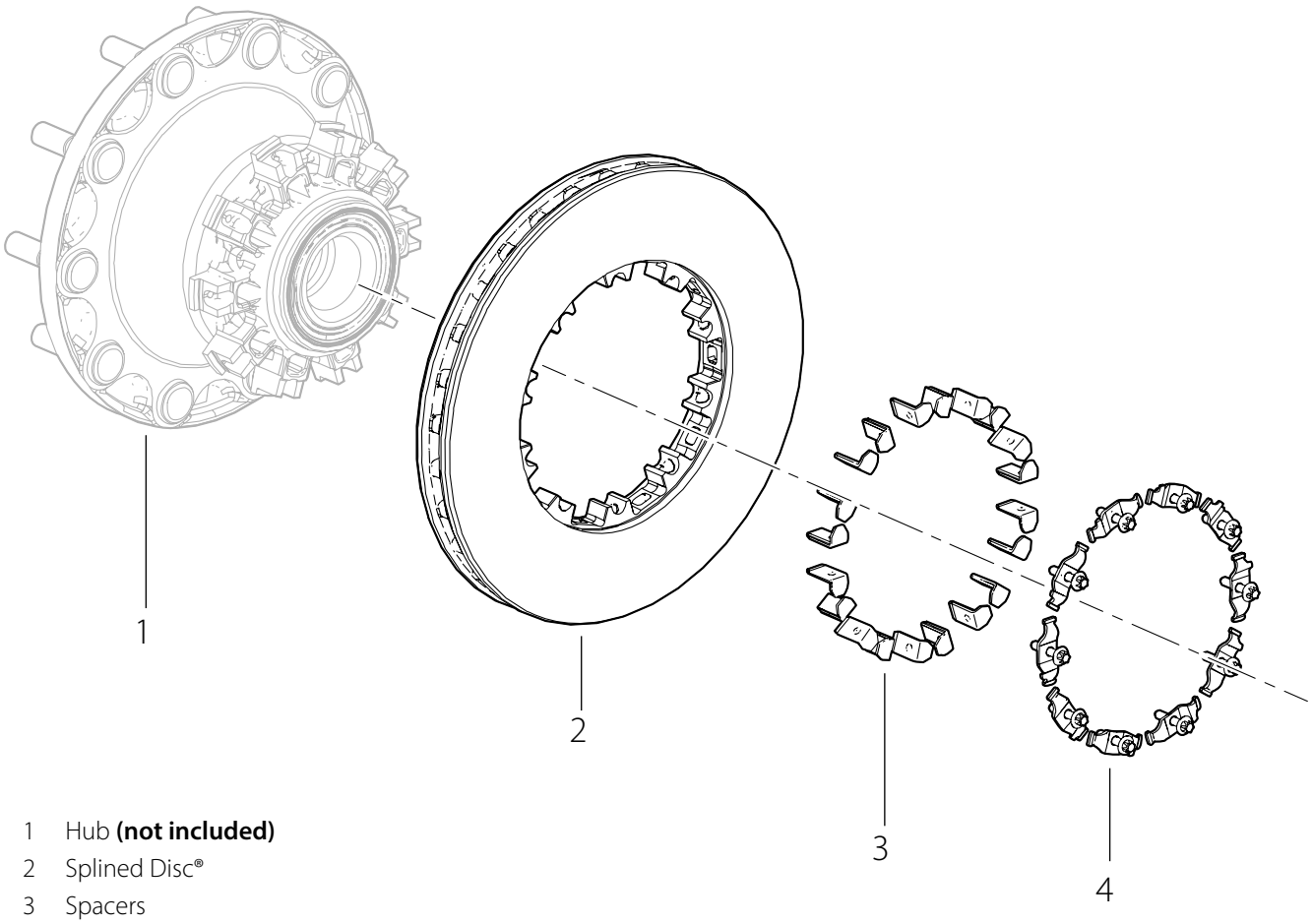
2 When re-inserting the electrical connectors (in reverse order) it is essential that they are fitted to their correct assigned position - if necessary this must be checked by PC Diagnostics.

Disposal of Waste Equipment by Business Users in the European Union

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

1 OVERVIEW

1.1 Splined Disc® Components



1 Hub **(not included)**
2 Splined Disc®
3 Spacers
4 Spring elements and screws

1.2 Service Kit for Splined Disc®

Use only genuine Knorr-Bremse parts

Content of the service kit:

Pos. No.	Description	Quantity
2	Splined Disc®	1
3	Spacer	20
4	Spring element and screw	10
5	Assembly grease for spacers 20g	1

2. GENERAL INFORMATION

Throughout this manual, reference is made to additional use of the latest revision of the relevant air disc brake service manual. This can be found at truckservices.knorr-bremse.com in the "Download Documentation".

2.1 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 adhere to the wear limits of the pads and the discs (see Section 4.1).

Tighten bolts and nuts to the prescribed torque values (see Section 2.3).

⚠ *Screw threads and tapped holes must be free of lubrication and residues of thread locking products.*

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

⚠ *After any service work:*

Check the brake performance and the system behaviour on a roller dynamometer. Check function and effectiveness. Bear in mind that a lower performance can appear during the bedding-in phase of the brake pads and/or the brake disc.

Observe the "**Safety and Environment Guidelines**" section on pages 4 and 5.

2.2 General Information for 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, and will not be covered by any Knorr-Bremse liability.

Brake discs can be ordered through the Knorr-Bremse aftermarket organisation.

2.3 Torque Requirements

Pos. No.	Description	Torque	E-Torx®
4	Spring elements and screws M8 x 1.25 10.9	30 $^{\pm 2}$ Nm	E12

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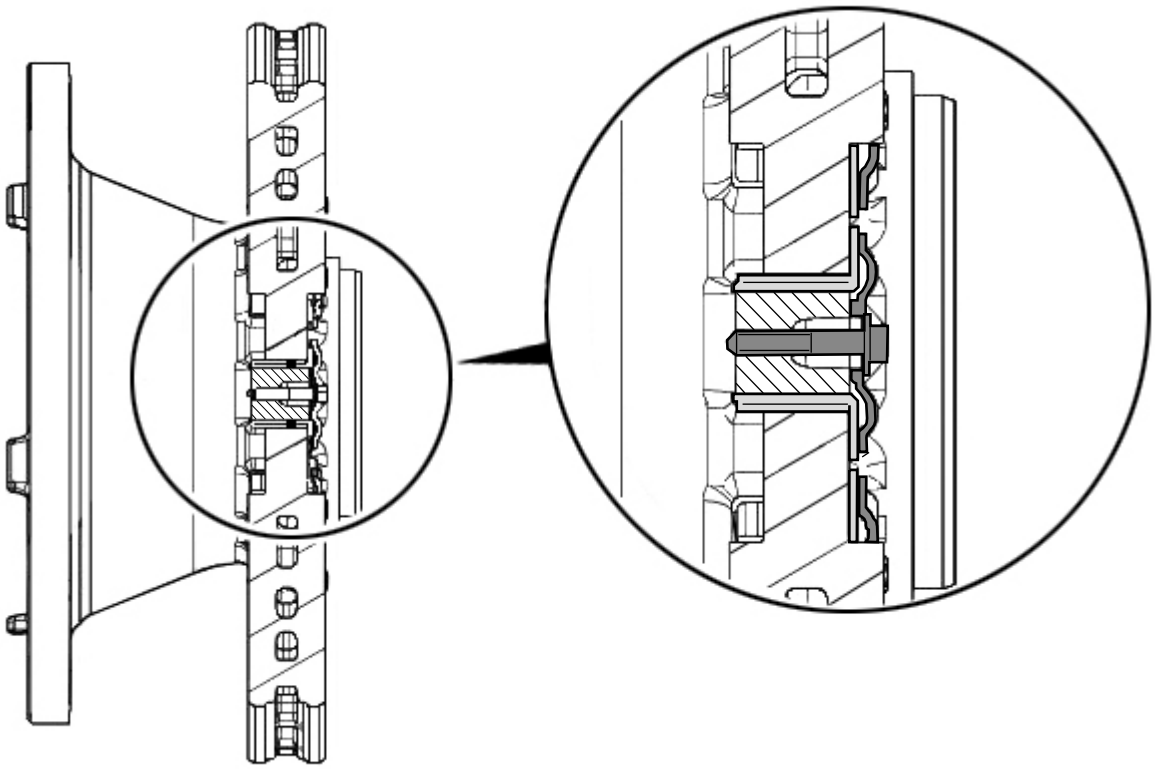
3. DESCRIPTION AND FUNCTION

3.1 Splined Disc® Sectioned View



1 Hub
2 Splined Disc®
3 Spacer
4 Spring element and screw

3.2 Fastening Method

The Splined Disc® (2) is supported on the shoulders of the wheel hub (1) teeth. See arrow in fig. 5.3.1.

The spacers (3) are positioned between the teeth of the brake disc and the teeth of the hub.

The brake disc and the spacers are fixed with spring elements and screws (4), the latter being screwed to the hub.

4. INSPECTION POINTS

4.1 Splined Disc® Check Frequency

The disc 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.

For optimum safety, the pad and disc wear limits must not be exceeded. If these recommendations are ignored, there is a risk of an accident. If the brake pads and/or the brake disc are worn down excessively, brake performance will be reduced and may be lost completely.

4.2 Splined Disc® Wear Check

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

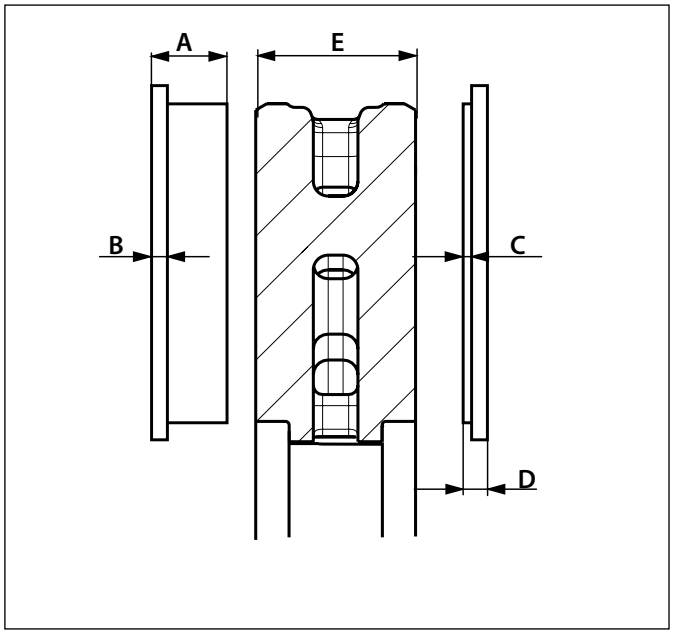
A = Overall thickness of new brake pad **30 mm**

B = Backplate **9 mm**

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

D = Minimum allowed thickness in worn condition for backplate and friction material **11 mm**, the brake pads must be replaced

E = Total thickness of the brake disc new condition **45 mm**, worn condition **37 mm** (the disc must be replaced)



4.2.1 - Check dimensions

If the disc dimension **E ≤ 39 mm**, it is recommended that the disc should be renewed when the brake pads are changed.
It is not allowed to use the disc with a thickness less than **37mm**.

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

Y008095: 002: EN, English: Released:Haag: 2020/07/09-09:55:01

4.3 Splined Disc® Surface check

4.3.1 Check the disc at each change of brake pads for grooves and cracks. If necessary replace the disc.

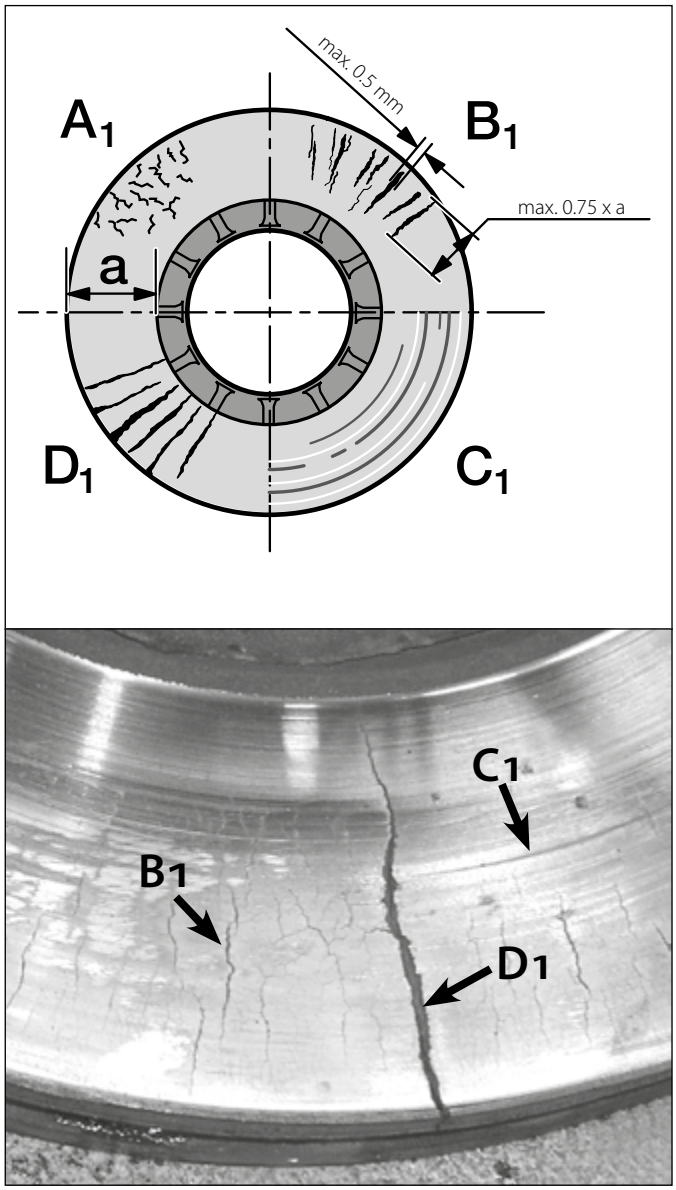
The figure shows possible surface conditions of the brake disc -

- **a** = width of the friction ring
- **A_1** = Small cracks spread over the surface are **allowed**
- **B_1** = Cracks less than **1.5 mm** deep or wide, running in a radial direction are **allowed**. Cracks to a max. length of **0.75 x** '**a**' are **allowed**
- **C_1** = Circumferential grooves on the disc surface less than **1.5 mm** deep are **allowed**
- **D_1** = Cracks going through to the cooling ducts or onto the inner or outer edge of the friction ring are **not allowed** and the disc **MUST BE REPLACED**

Note: *In case of surface conditions* ***A_1***, ***B_1*** *or* ***C_1***, *the disc can continue to be used until the minimum thickness* ***E = 37 mm*** *is reached.*

Grinding of the Splined Disc® is <u>not</u> allowed.

If the surface condition **B_1** is observed, the advancement of the cracks must be frequently checked.

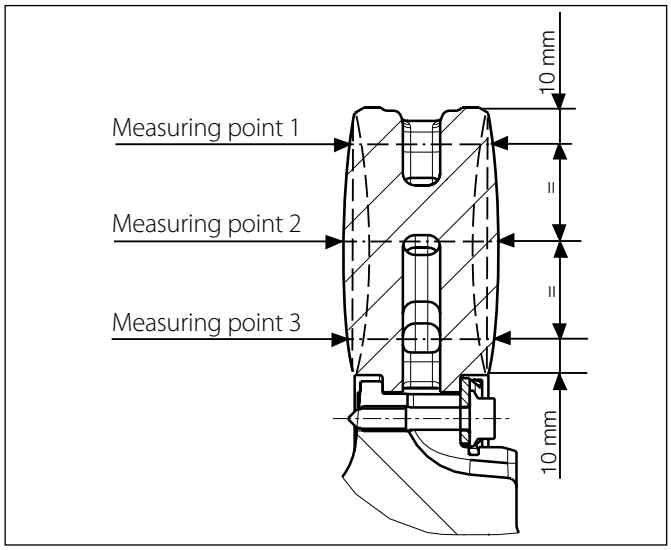


4.3.1 - Tolerances and examples of cracks and grooves on a brake disc

4 INSPECTION POINTS

4.4 Splined Disc® Flatness check

4.4.1 When fitting new brake pads on a partly worn brake disc, the flatness of the disc should firstly be determined. The thickness of the disc should be measured at three points (see Fig.); a maximum difference of **1.5 mm** is permitted between any two measuring points.

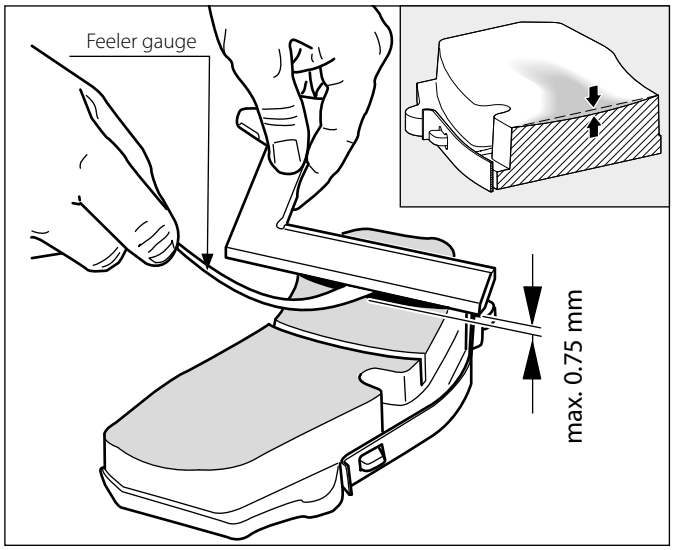


4.4.1 - Measuring points on the brake disc

4.4.2 The flatness of the disc can be estimated indirectly by the inspection of the friction surface of worn or partly worn brake pads.

Measurement should be made as shown i.e. parallel to the groove in the pad. A maximum "out of flat" dimension of **0.75 mm** is allowed.

⚠ *If the value is higher than **0.75 mm**, the brake disc must be replaced.*



4.4.2 - Measuring uneven surface wear

4.5 Crack Check of the Splined Disc® Connection Parts

In case of the brake disc check - see Section 4. - and when the brake disc is replaced, the brake disc connection parts must be checked for damage or cracks.

If cracks are visible at the teeth of either the Splined Disc® or wheel hub, the respective components must be replaced immediately.

If there is any sign of damage to the spring elements (4) or spacers (3), all connection components and the Splined Disc® itself must be replaced - see section 1.2.

4.6 Clearance Check between Splined Disc® (2) and Hub (1)

The axial clearance and the rotational clearance between Splined Disc® and hub must be checked with every replacement of the brake pads or hub or disc.

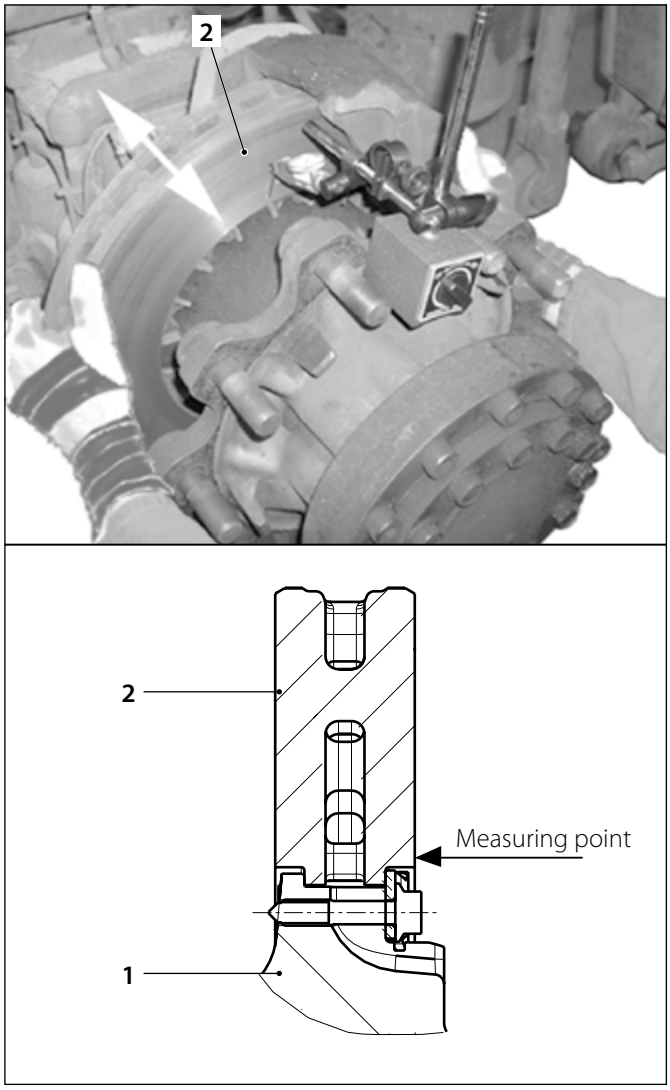
4.6.1 Axial Clearance check

4.6.1.1 An axial clearance between the Splined Disc® (2) and and the hub (1) is not allowed.

For checking, push and pull the Splined Disc® in an axial direction.

The clearance must be measured between the inner friction ring and the hub.

If a clearance is measured, the hub and the Splined Disc® must be checked for damage and if necessary, replaced - see section 1.



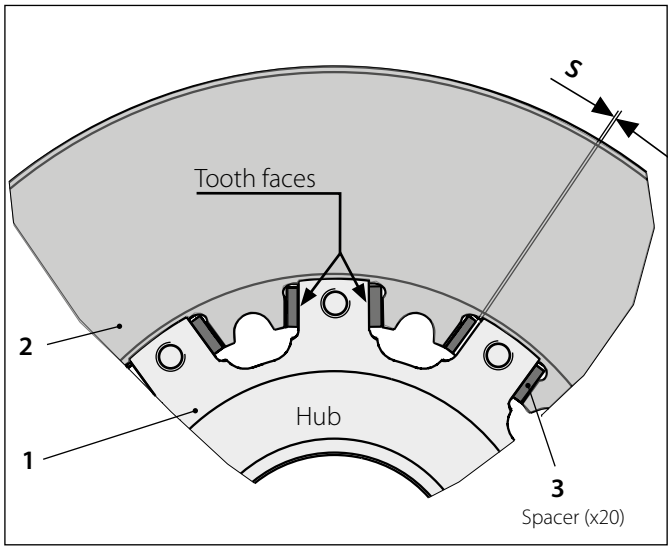
4.6.1.1 - Axial clearance check measuring point

4.6.2 Rotational Clearance Check

4.6.2.1 The rotational clearance “S” between each face of each hub tooth and its adjacent spacers (3) must be checked with a feeler gauge.

A maximum tooth clearance of **0.4 mm** is permitted.

*If the clearance is **>0.4 mm** the hub (1) and the Splined Disc® must be checked for damage and if necessary, replaced - see section 1.*



4.6.2.1 - Rotational clearance “S”

5. SPLINED DISC® REPLACEMENT

5.1 Hub and Splined Disc® - Removal from Axle

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

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

Refer to axle - and vehicle manufacturer's recommendations and, for functional and visual checks and detailed instructions regarding the air disc brake, refer to the latest revision of the relevant Knorr-Bremse service manual.

- Remove wheel.

- Remove brake pads.

- Remove air disc brake, complete with carrier, from the axle.

- Remove the hub, complete with the mounted brake disc, from the axle.

5.2 Hub and Splined Disc® - Disassembly

5.2.1 Removal of screws and spring elements (4).

Using a suitable tool, carefully remove all screws and their corresponding spring elements (see Fig.).

5.2.2 Removal of spacers (3)

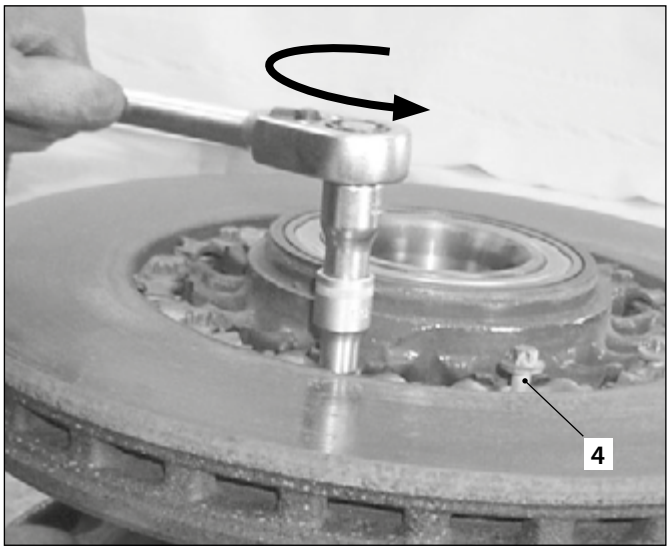
Pull out the spacers (3) between the brake disc (2) and the hub (1).

5.2.3 Removal of brake disc (2)

Remove the brake disc from the hub using a copper hammer.

If the brake disc cannot be removed from the hub by using a hammer, place the hub and brake disc on e.g. an old brake drum under a press and carefully push out the hub.

Prevent the hub and the brake disc from damage during disassembly.



5.2.1 - Remove screws with spring elements (4)

5.3 Hub Cleaning

Lift the hub (1) carefully onto the work bench.

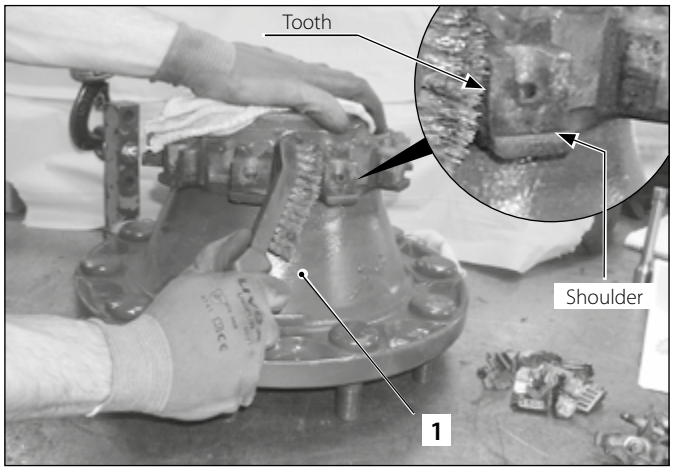
Ensure safe handling, the assembly is heavy!

5.3.1 Thoroughly clean between the teeth of the hub, the teeth faces, teeth flanges and the shoulder of the hub using a wire brush.

Remove all dust and dirt from the hub.

Wear suitable protection e.g. mask, to avoid inhalation of dust.

Check the hub, especially the teeth and shoulder, for grooves, corrosion or damage.



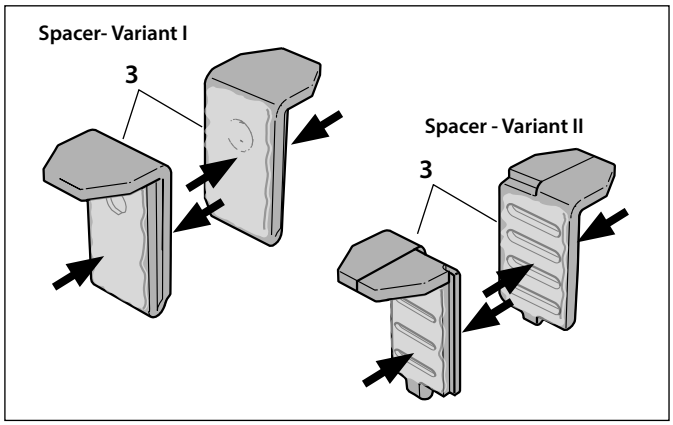
5.3.1 - Cleaning the Hub (1)

5.4 Hub and Splined Disc® - Assembly

Fitting of the brake disc to the hub is only possible when the hub is not installed on the vehicle.

Use only genuine Knorr-Bremse parts.

Carefully fit the brake disc onto the hub. The brake disc can be fitted either way around (there is no specific inboard/outboard face).



5.4.1.1 - Spacer variants with assembly grease applied

5.4.1 Fitting of the Spacers

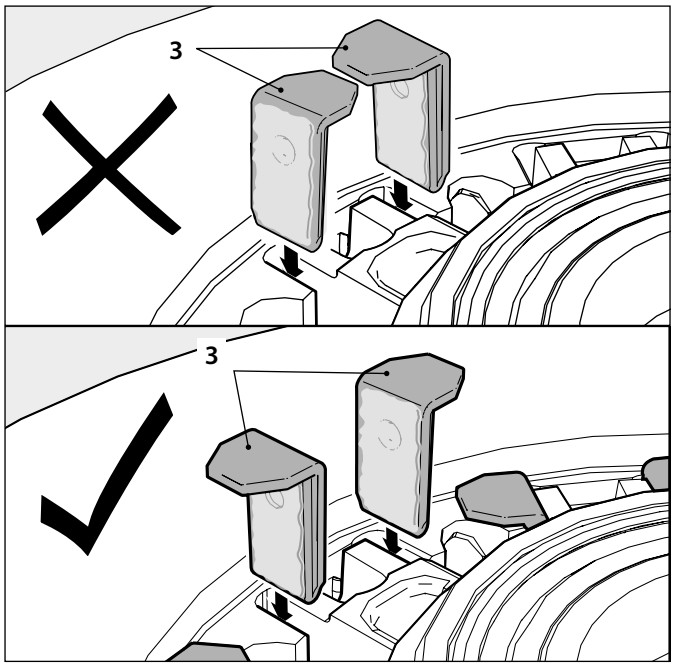
5.4.1.1 Before mounting the Spacers (3), apply the assembly grease to both sides of the contact surface of the spacers - see arrows.

Take care that the assembly grease does not come into contact with other oils or greases because its lubrication characteristic will change.

5.4.1.2 Push the spacers (3) as far as possible by hand into the clearances between the teeth of the brake disc and the teeth of the hub.

Take care that each spacer is mounted in the correct orientation, i.e. pointing away from the bolt hole.

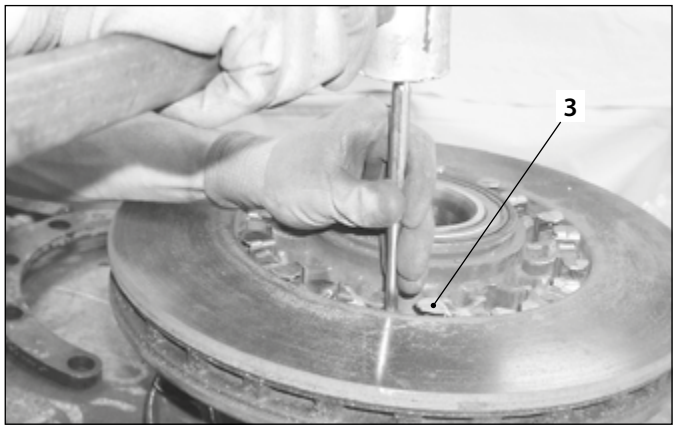
Use only genuine Knorr-Bremse parts.



5.4.1.2 - Incorrect and correct orientation of spacers (3)

5 SPLINED DISC® REPLACEMENT

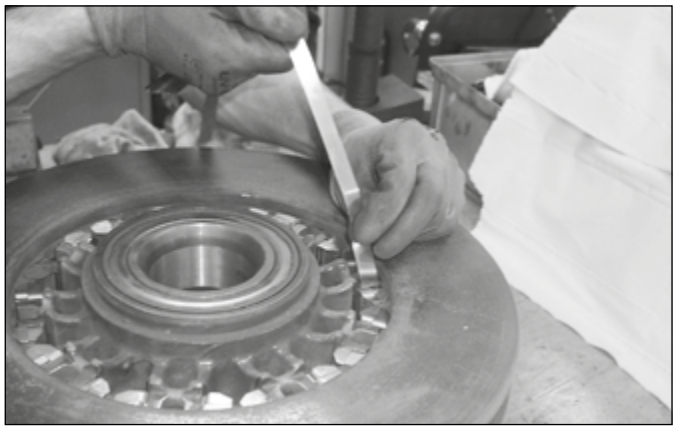
5.4.1.3 Push in each of the spacers (3) up to its stop using a suitable tool.



5.4.1.3 - Push in Spacers (3) using a suitable tool

5.4.1.4 Check clearance "S" see section 4.6.2.

Note: *Make sure all 20 spacers are fitted and in the correct orientation.*



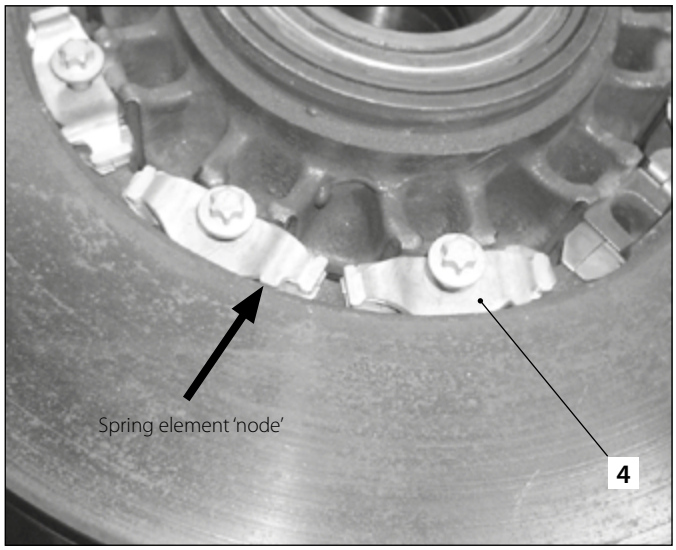
5.4.1.4 - Check radial clearance "S"

5.4.2 Fitting of the Screws and Spring Elements

5.4.2.1 Fit the screws with spring elements (4) by hand.

Take care that the spring elements are each fitted in the orientation shown with the 'node' to the edge of the friction ring (see arrow), otherwise the threaded holes in the hub could be damaged.

Use only genuine Knorr-Bremse parts.

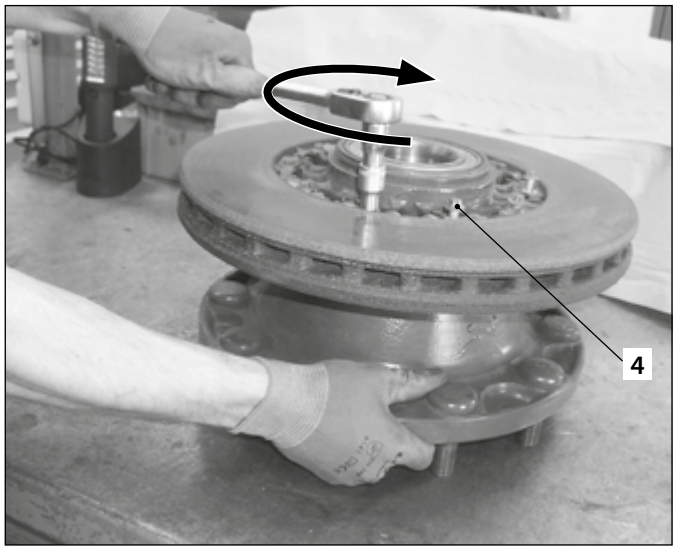


5.4.2.1 - Orientation of spring element 'node'

5.4.2.2 Tighten the screws of the spring elements crosswise with the recommended torque of **30 ±2 Nm**.

The use of impact tools is not allowed.

Check axial clearance - see section 4.6.1.



5.4.2.2 - Tighten screws with spring elements (4) crosswise

5.5 Hub and Splined Disc® - Fitting to Axle

5.5.1 Referring to section 5.1, fit the hub (1), complete with Splined Disc® (2), on the axle.

5.5.2 Check axial clearance - see section 4.6.1.

Fit the air disc brake, complete with carrier, to the axle.

5.5.3 Fit the brake pads.

The friction surface should be free from dust and grease

5.5.4 Fit the wheel.

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

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

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

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