KNORR-BREMSE

Knorr-Bremse Commercial Vehicle Systems Guideline

Subject:	Application guideline for pneumatic disc brake	008 Version
Valid for:	Knorr-Bremse Systems for commercial vehicles Divisions	
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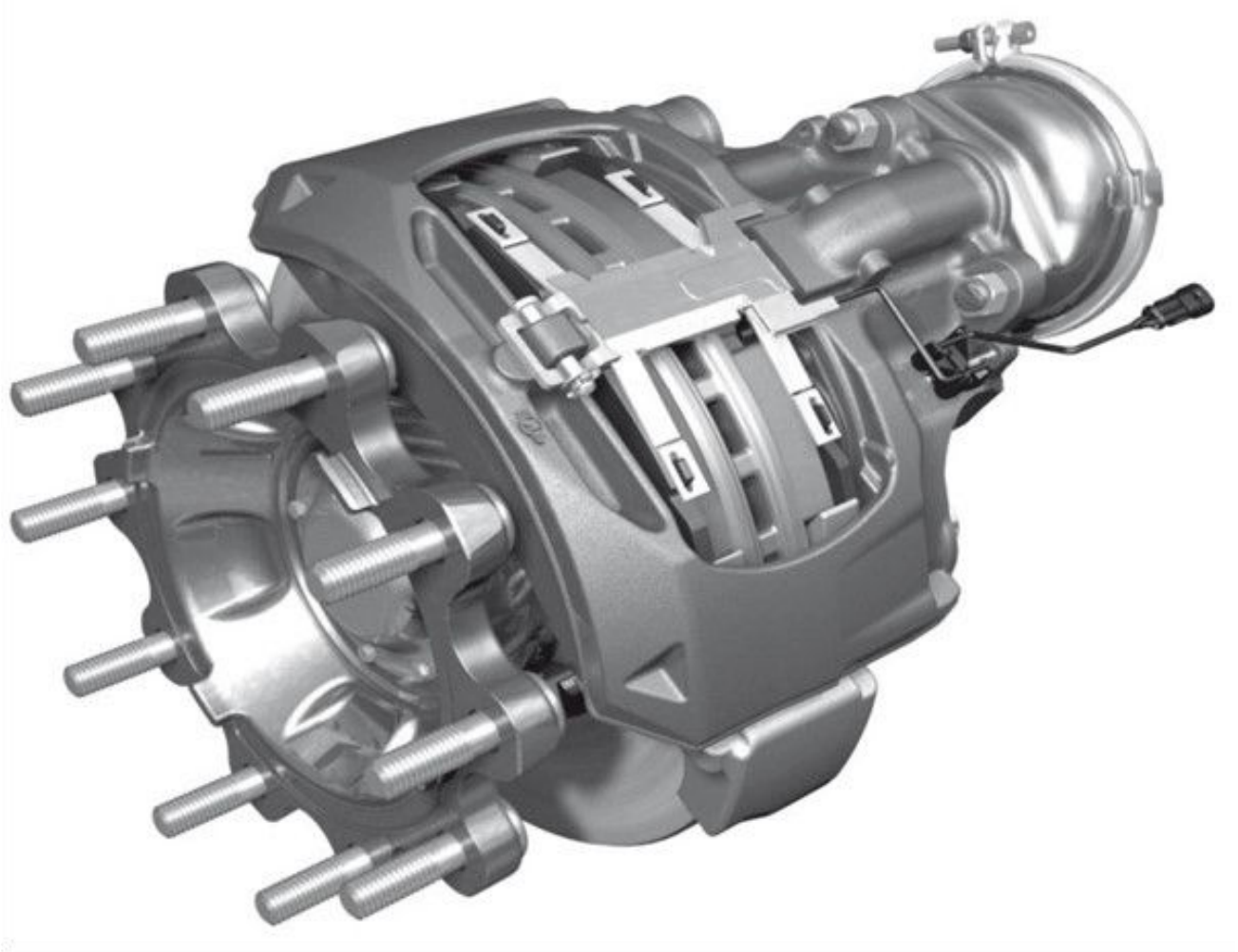
Released by:	Documentation of the approval process in CVS-PLM.Data on the revision and status in the watermark!	



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Version history

Version	Date	Name	Description
008	31.12.2021	Pritz_Wolfgang	Reworking of various chapters and addition of significant features according to the FMEA

Changes

The changes made are marked with an annotation of the respective version number.(08)

This specification and the listed guides are subject to change without notice and at the sole discretion of Knorr-Bremse Commercial Vehicle Systems (KNORR-BREMSE CVS). To obtain the latest version of this document, please contact KNORR-BREMSE CVS.

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Table of Contents

1 Purpose

This specification is intended to provide vehicle manufacturers, technical sales personnel, service technicians and end users worldwide with basic information on the application, installation and use of the KNORR-BREMSE CVS pneumatic disc brake in vehicle operation.

To ensure that a specific vehicle combination meets the requirements specified by KNORR-BREMSE CVS, a brake application request must be submitted for each application.

The vehicle manufacturer is solely responsible for compliance with all applicable regulations and the corresponding certification of the vehicle.

2 General

The selection of the type of disc brake is governed largely by the type of application that is planned. The field of application influences the working life of the brake parts and the wear behavior of the friction components.

In addition to the field of application, the correct system design is particularly important. For this purpose, KNORR-BREMSE CVS has a certified calculation program.

Unfavorable vehicle combinations considerably shorten the service life of wearing parts.

Under certain operating conditions, an excessive load on the disc brake - especially when using trailers with drum brakes - can lead to a reduction in the braking effect (fading) due to the significantly higher performance of the disc brake.

The brake corresponds to the technical data specified in the customer drawing and described in the product specification.

In order for the pneumatic disc brake to work properly, the application instructions must be observed when using the brake.

Without additional tests KNORR-BREMSE CVS assumes no liability for:

- Used brake systems
- Further braking applications
- Compatibility of the brake with other products of the customer
- Interaction with other parts not supplied by KNORR-BREMSE CVS, such as brake discs, brake pads, etc.
- Interaction with brake pads that have not been certified for the KNORR-BREMSE CVS product (08)
- Interfaces between brake and axle or brake and other components
- Damage due to incorrect mounting/handling or misuse

3 Function of the pneumatic disc brake

3.1 Application

The KNORR-BREMSE CVS pneumatic sliding caliper disc brake is designed for use in commercial vehicles with 17.5-inch, 19.5-inch and 22.5-inch wheels, consisting of the clamping unit and a brake carrier connected to it. This is used in trucks, tractors, buses and trailers on all axles with and without parking brake. The vehicle manufacturer is responsible for the system design.

The service life of the brake is represented by a multi-stage load collective, from which a single-stage load collective is derived. This forms the basis for the release-relevant fatigue tests. All tension-generating and transmitting components of the disc brake are designed to be maintenance-free for this period. The prerequisite for this is that the vehicle is within the load collective for which the brake was developed and tested over its entire service life.

3.2 Apply the brake (Figure 1)

When braking, the piston rod of the spring or brake cylinder presses on the lever (19). The translated force is transmitted to the bridge (17).

The clamping force acts on the inner brake lining (12) via the threaded tubes (16) and the thrust pieces (13).

As soon as the clearance between brake pad (12) and brake disc (46) is overcome, the reaction force is transmitted to the outer brake pad (12) via the brake Caliper (1).

The braking torque for the wheel is generated by the contact pressure of the brake pads (12) on the brake disc (46).

3.3 Releasing the brake (Figure 1)

When the brake pressure is released, the compression spring (27) pushes the bridge (17) with the threaded tubes (16) and the lever (19) back into the initial position.

3.4 Adjusting the brake (Figure 1)

To ensure that the clearance between the brake pads and the brake disc remains constant, the brake is equipped with an automatic and wear-free adjusting device.

Each brake actuation also actuates the adjuster (23) in the advance stroke, which is positively coupled to the lever (19). If the clearance increases due to brake lining or brake disc wear, the threaded tubes (16) are turned by the adjuster (23) and the chain linked driver (24) to accommodate the amount of wear. (08)

4 Designations and formulations

4.1 Brake components

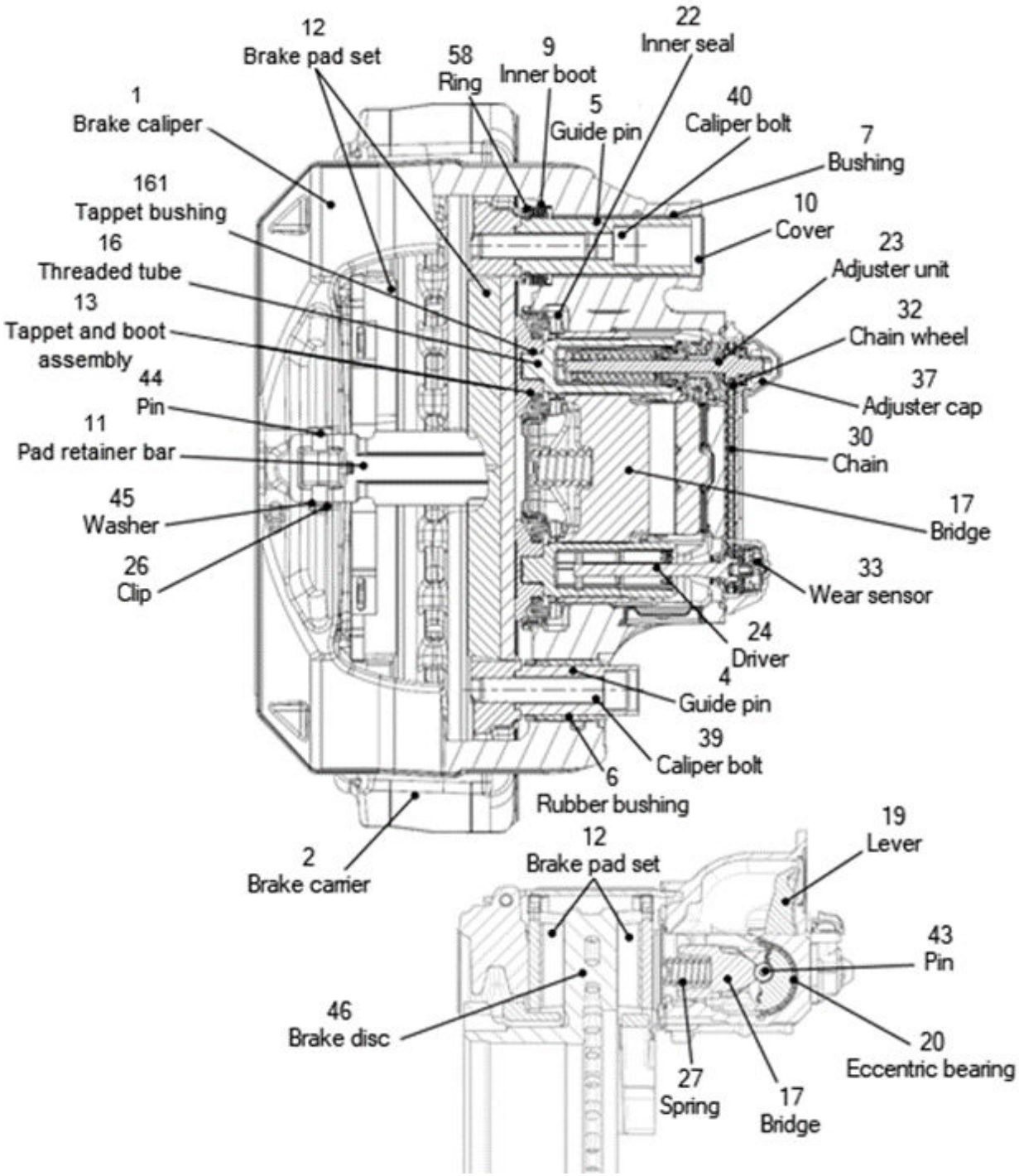

Figure 1: Brake components

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4.2 Wheel side components

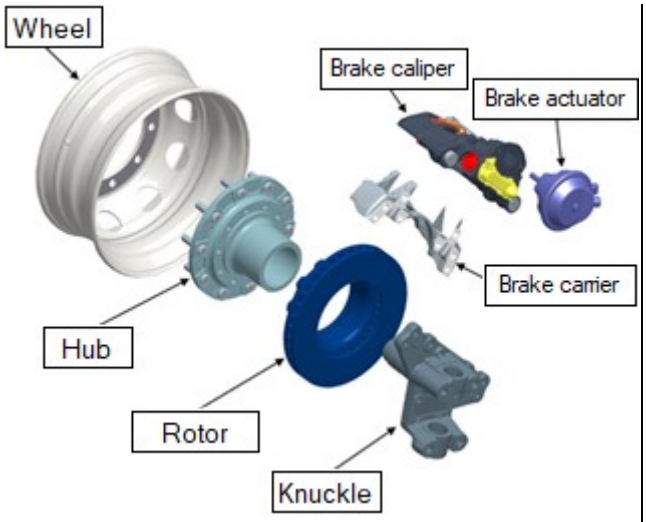


Figure 2: Front axle (example illustration)

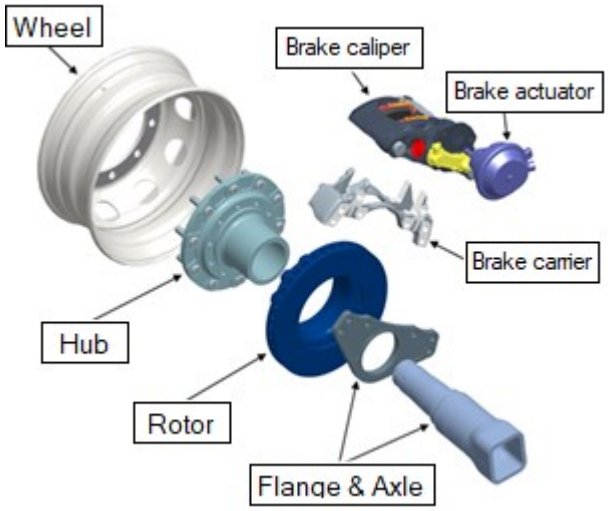
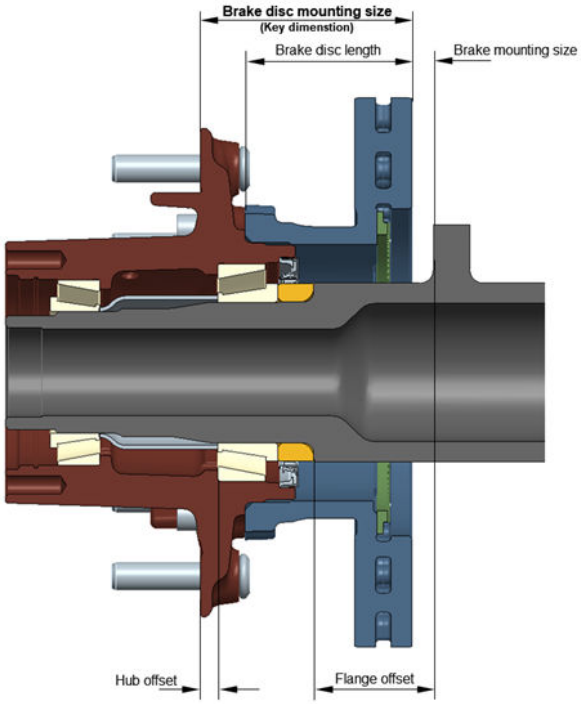


Figure 3: Rear axle (example illustration)

4.3 Essential dimensions of hub unit and brake



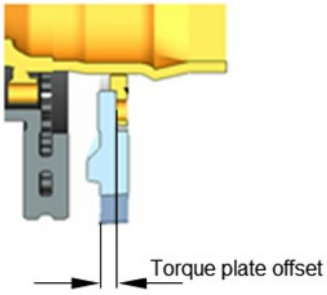


Figure 4: Dimensions at the hub unit

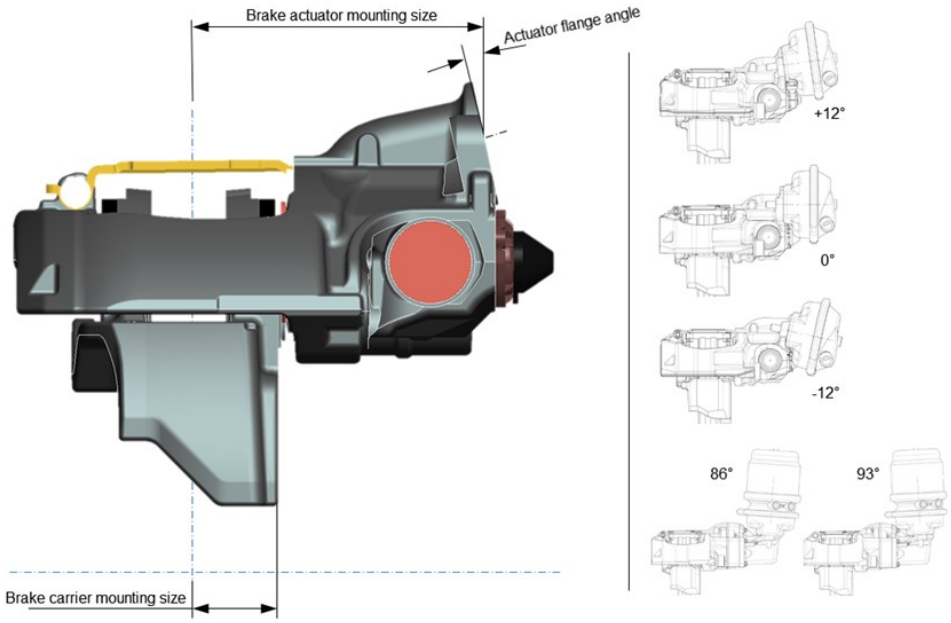


Figure 5: Dimensions of the air disc brake interfaces relative to the wheel center (08)

5 Installation instructions

The pneumatic disc brake from KNORR-BREMSE CVS does not represent symmetrical assemblies. There is a left and a right brake. The left or right disc brake is defined on the basis of the fixed bearing. (08)

Looking at the cylinder flange surface (view as in Fig.6), we speak of a right brake when the fixed bearing is on the right. Accordingly, when the fixed bearing is on the left, it is referred to as a left brake. (08)

This does not mean that a right-hand brake must be fitted on the right-hand side of the vehicle. The assignment of the brake (right/left) to the vehicle side is primarily based on the installation options. One left and one right brake must be installed in pairs on each axle. (08)

5.1 Selection of the direction of rotation

KNORR-BREMSE disc brakes are designed to be independent of the direction of rotation. If the direction of rotation of the disc is related to the fixed bearing of the brake, a distinction is made between "fixed pin leading" and "fixed pin trailing", as shown in Figure 6. (08)

The incoming or outgoing direction of rotation can have different influences on the brake. A generally valid recommendation for the direction of rotation cannot be made since the influencing variables depend on the different applications. It is recommended to verify the theoretical considerations by practical tests. (08)

If a fit bolt is used in the screw connection between the brake carrier and the axle, it must always be positioned so that it is in the trailing position. (08)

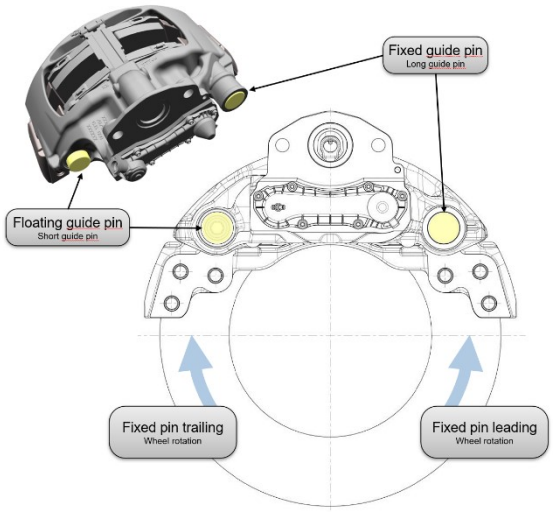


Figure 6: Description of the direction of rotation

5.2 Displacement of the brake caliper

The pneumatic disc brake is equipped with a sliding caliper. With this design variant, the brake Caliper moves further towards the centre of the vehicle with increasing brake pad and brake disc wear. When carrying out installation inspections, starting from the condition with new brake pads and new brake disc, a brake caliper shifting movement to the vehicle centre of at least 25 mm (SN5: 22mm) should be ensured.

5.3 Installation position

The mounting position must be selected so that the brake assembly does not come into contact with the suspension, axle, steering and other vehicle components. Figure 7 shows the preferred, acceptable and critical mounting positions for the brake assembly.

The pneumatic disc brake can be placed between the 8 and 4 o'clock position. If the installation position is 12 o'clock, the floating bearing must be selected according to the application. Mounting positions between the 4- and 8-o'clock position may require further investigations to be jointly coordinated.

The installation of spring brake cylinders is associated with further restrictions for the installation position of the brake assembly. For axial brakes, avoid installation positions between the 11 and 1 o'clock positions. For radial brakes, installation positions outside the above specification should be avoided. (08) If a parking brake is required for these installation positions, this may require jointly agreed investigations.

Depicted situation (1:30 o'clock):
The brake is in front of the axle at a 45 ° angle (08)

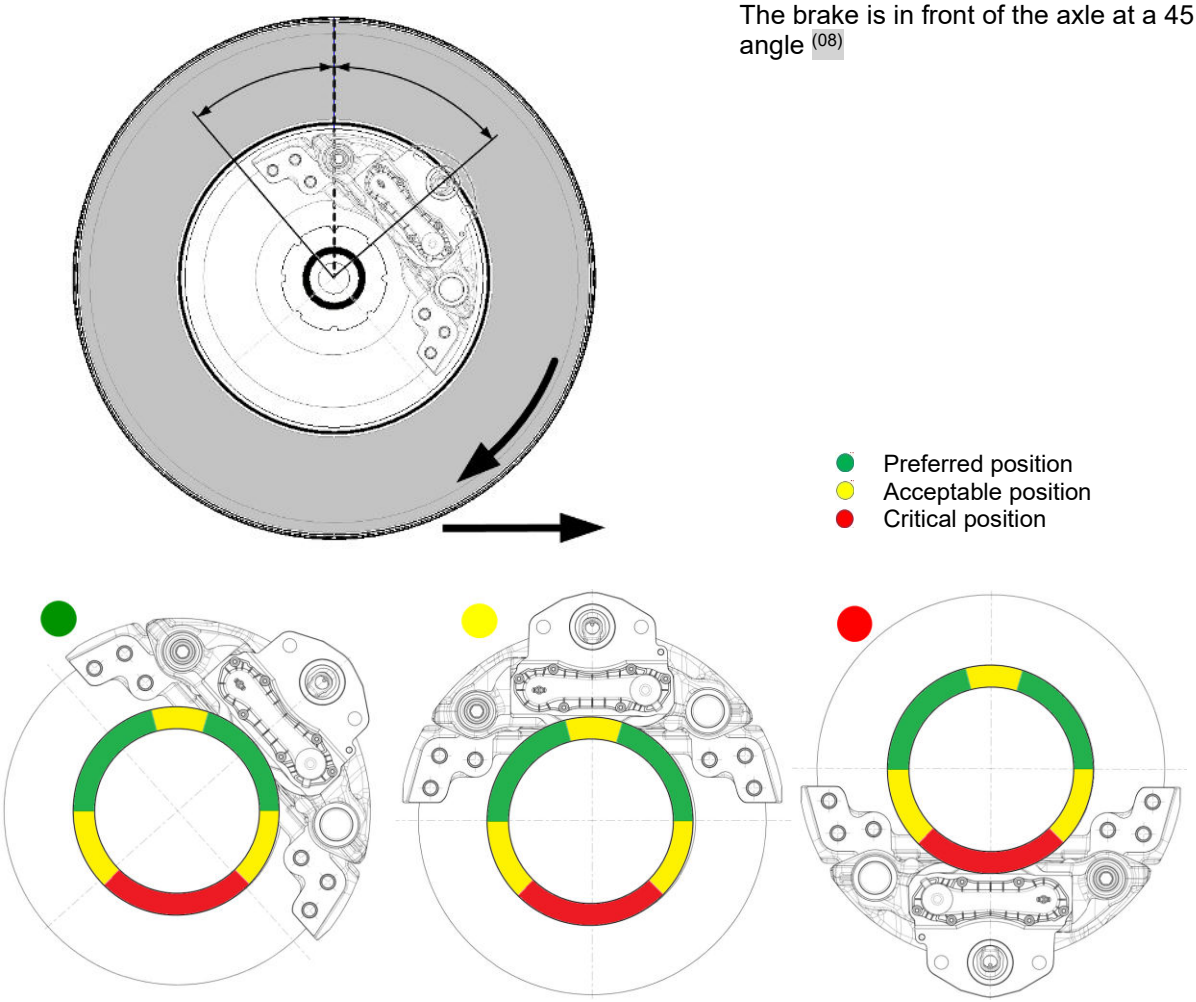


Figure 7: Installation positions for the brake assembly

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6 Brake disc

6.1 Requirement

The pneumatic disc brake is designed for use with one brake disc. This consists of the actual braking surface and the offset axle mounting. The wheel head/brake disc combination used in conjunction with the pneumatic disc brake must lie outside the envelope contour of the brake (according to the customer drawing) and consider all other wheel-side installation tolerances.

The brake disc is a crucial element of the friction pairing in the braking system. The design and material of the brake disc have an impact on the safety of the braking system. The choice of brake disc has an influence on the braking performance of the vehicle, homologation, hot cracking resistance, brake disc and brake pad wear, the operating temperature of adjacent components and vibration and noise behavior (NVH, "Noise, Vibration, Harshness").

The use of brake discs approved by KNORR-BREMSE CVS is recommended. Before the start of series production, a field test must be carried out to check whether the brake disc is suitable for the intended application.

The following criteria apply to the choice of brake disc:

- Strength requirements according to the load collective
- Thermal stress according to the application
- Heat cracking behavior
- Wear resistance

If brake discs are used that are not described in the KNORR-BREMSE CVS application release report, the installer assumes unlimited liability for the performance and service life of the brake system.

The customer is responsible for the design of the fasteners. (08)

Any corrosion protection must be removed from the brake disc before use. (08)

6.2 Lifetime

The brake disc is a wearing part. It is essential to observe the wear limit. The permissible wear limit for a brake disc is described in the customer drawings and service instructions.

In the interest of the longest possible service life of the brake disc, an continuous braking should be used. Especially for buses in urban traffic, this should not be able to be switched off.

Consistent use of the continuous braking system can significantly extend the service life of the brake components.

Heat cracks are unavoidable due to the high mechanical and thermal stress on the brake disc surface. The permissible limits can be found in the service instructions.

Some factors for hot cracking:

- High energy input into a cold brake disc, due to e.g.
  - Driving behavioral of the driver
  - Driving profile
- Chemical composition of the brake disc

7 Brake pads

7.1 Requirement

The brake pad is a crucial element of the friction pairing in the braking system. The design and material of the brake pad have an impact on the safety of the braking system. The choice of lining material has an influence on the braking performance of the vehicle, homologation, hot cracking resistance of the brake disc, brake disc and lining wear, operating temperature of adjacent components, brake cylinder size requirements and vibration and noise behavior (NVH).

It is recommended that the brake linings proposed by KNORR-BREMSE CVS be tested in a practical test with regard to the specific application.

The following criteria, among others, apply to the choice of brake pad quality:

- Friction coefficient
- Compressibility
- Heat transfer
- Thermal expansion
- Resilience

If brake pads are used that are not described in the KNORR-BREMSE CVS application release report, the installer assumes unlimited liability for the performance and service life of the brake system.

7.2 Lifetime

The brake pad is a wearing part. It is essential to observe the wear limit. The permissible wear limit for a brake lining is described in the customer drawings and service instructions.

In the interest of the longest possible service life of the brake lining, an continuous braking should be used. Particularly on buses in urban traffic, this should not be able to be switched off. Consistent use of the continuous braking system can significantly extend the service life of the brake components. However, too much unloading (e.g., hybrid vehicle) can have disadvantages on the performance and corrosion resistance of the brake lining. (08)

8 Hub unit

8.1 Requirement

The pneumatic disc brake is not compatible with all rim-valve combinations available worldwide. When pneumatic disc brakes are installed in a vehicle, the rims and valves offered must be checked to ensure that there is always sufficient clearance between the valve, rim and brake.

KNORR-BREMSE CVS recommends the use of tubeless tires with valves located outside the rim dish. In this way, the tire valve is in a safe and protected position in relation to the non-rotating parts of the pneumatic disc brake.

If tubular tires are used, the thermal stress of the tube must be checked.

After mounting the components or carrying out maintenance work on the brake or wheel head components, an inspection is necessary. In doing so, it must be ensured that components that move relative to each other do not collide. Details are described under "13. Installation requirements".

When deciding which wheels are compatible with the pneumatic disc brake, KNORR-BREMSE CVS offers CAD-supported installation tests.

9 Axle attachement

9.1 Requirement

When fastening the disc brake to the axle, the specifications in drawings Z000630 must be observed. The contact surface on the axle must be machined and without surface coating. (08)

The customer is responsible for the design of the fasteners. If no information is available, the fatigue test is based on the specifications of VDI 2230 "Systematic calculation of highly stressed bolted joints".

The bolting represents a significant feature according to the FMEA. To ensure a steady workflow, an automated process or work instruction should be defined. The tightening of the fasteners to the specified tightening torque should be carried out in several stages. This minimizes component distortion during brake mounting. (08)

As this connection is a highly stressed bolted connection, there is a risk of setting losses and thus loosening of the bolts. KNORR-BREMSE CVS disapproves the attachment of further parts to the brake carrier bolting, such as a disc cover plate. (08)

To achieve the largest possible contact surface of the bolt head, KNORR-BREMSE CVS recommends the use of collar bolts or washers according to ISO 7089-300HV. (08)

9.2 Lifetime

The axle components and in particular the mounting flange must be rigid enough to ensure that even under maximum brake load and hot brake, the brake and the new brake disc/axle components (wheel rim, hub, steering knuckle, suspension parts, etc.) do not come into contact with each other.

KNORR-BREMSE CVS can evaluate the influence of the axle flange on the brake (brake carrier) by means of FEM calculation. In particular, the stiffness of the flange (or steering knuckle), the hole pattern (08) and the quality of the bolting of the brake carrier have an influence on the stresses in the brake carrier and thus on the service life of the brake. To be able to meet a required braking torque coupled with a required number of load cycles, the flange (or steering knuckle) must also be sufficiently dimensioned.

10 Brake actuator

10.1 Requirement

The brake actuator plays a decisive role in the service life, function and sealing of the pneumatic disc brake. The interface on the brake to the brake cylinder is defined in document C15651.

It is recommended that the brake cylinders proposed by KNORR-BREMSE CVS be tested in a practical test about the specific application.

The stroke of the brake cylinder should be at least the same as the minimum usable tappet stroke of the disc brake. If cylinders with a shorter cylinder stroke are selected, it can lead to the fact that not the entire capacity of the brake or the available pressure of the vehicle is utilized. If lower braking torques are required according to the vehicle application, cylinders with a shorter stroke can also be used. If cylinders with a shorter cylinder stroke are selected, this may mean that existing pressure reserves can no longer be used. (08)

If brake cylinders are used that are not described in the KNORR-BREMSE CVS application release report, the installer assumes unlimited liability for the performance and service life of the brake system.

10.2 Lifetime

The service life of the brake cylinder connection, especially under vibration load, is only tested with brake cylinders from KNORR-BREMSE CVS. Weight, centre of gravity and resonance behavior have a significant influence on the service life and performance of the disc brake. (08)

If the pneumatic disc brake is to be used under water, special measures must be taken with regard to the brake cylinder.

10.3 Position of the breather hole

For the pneumatic disc brake to operate properly, there must be a breather or exhaust hole in the brake cylinder housing. This opening must be located +/- 30 degrees from the vertical axis in the vehicle mounting position and directed downward (Figure 8). (08)

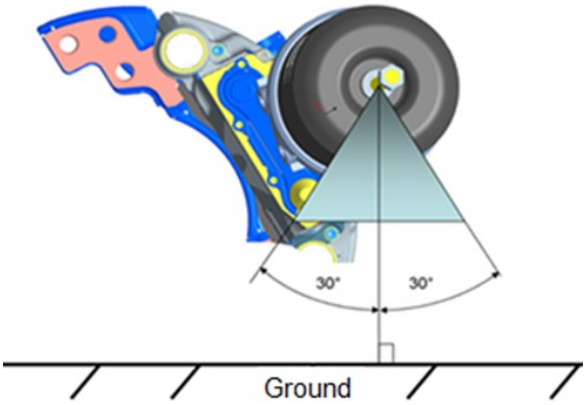

Figure 8: Spatial position of the breather hole in the brake cylinder for axial brakes

Radial brakes are a special case. The brake cylinders must be suitable for vertical use. The vent holes of the secondary chamber must be in the flange surface but must not be covered after brake cylinder assembly (Figure 9).

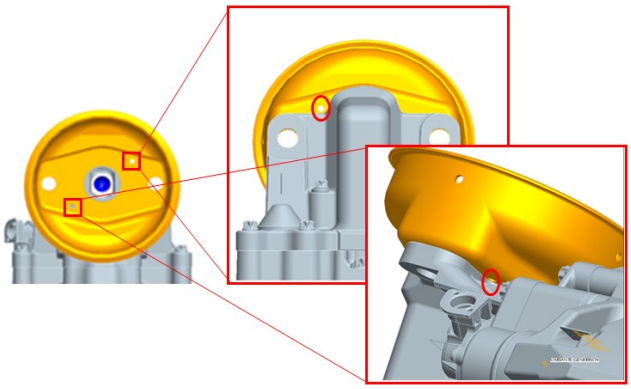

Figure 9: Spatial position of the vent hole in the brake cylinder for radial brakes

10.4 Force output of the brake actuator

The actual force output of the brake actuator plays a crucial role in the performance of the pneumatic disc brake. All KNORR-BREMSE CVS documents in which cylinder sizes are discussed assume KB brake cylinders. If other brake cylinders are used, these specifications may differ.

Only identical brake cylinders may be used on one axle. The determining factors that must be the same are the actuator manufacturer, model, size and type.

10.5 Parking brake release pressure

To ensure proper release of the parking brake in the installed brake system, a pressure level of at least 0.6bar above the max. release pressure of the cylinder used must always remain assured. (08)

For example: (08)

- ../ 24 max. 5,4bar (cylinder drawing) +0,6bar →pressure at port 12 min. 6,0bar
- ../ 24HFL3 max. 6,4bar (cylinder drawing) +0,6bar →pressure at port 12 min. 7,0bar

11 Influence of different operating conditions

The operational stability of the pneumatic disc brake depends on the number and strength of the brake actuations. The vehicle application is also decisive for this.

11.1 Vehicle deployment

The following are examples of common commercial vehicle applications. If the vehicle is to be used for a purpose that lies outside of a usual commercial vehicle application, a requirement profile suitable for this must be defined.

- Long-distance traffic
- Distribution traffic
- Heavy goods traffic
- Construction vehicle
- Garbage truck
- Touring Coach
- City bus / Urban service buses
- Fire-fighting vehicles
- Rescue service vehicles
- Mining

In the case of load-dependent axes, special attention must be paid to the control.

11.2 Requirements profile

The requirement profile has a significant influence on the service life and performance of the brake system. The application profile of the vehicle must be known or defined. The factors influencing the profile include:

- Mileage per year
- Individual routes
- Loading condition
- Road type and surface (e.g., asphalt, gravel, urban and motorway)
- Topology
- Brake control on the vehicle (e.g., ABS, EBS)
- Secondary braking systems (e.g., retarder)
- Change of direction (Frequency from forward to reverse driving)
- Parking brake applications
- Vehicle configuration (e.g., 6x2, 8x4)
- Overload protection valve (08)
- Bus stop brake (08)
- Hill start assist (08)

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12 Operating behavior of the brake

Various operating conditions lead to changes in the operating behavior of the brake. Some of these boundary conditions are listed below.

12.1 Thermal load

A high thermal load shortens the service life of the brake.

The installation space must be designed in such a way that the brakes are sufficiently ventilated. If necessary, constructive measures must be provided (e.g., air baffles, ventilation slots). This applies more when using brake pad and disc cover plates. (08)

If the disc brake takes over endurance braking functions, it must be ensured that no vehicle components are thermally overstressed. (08)

To be able to assess different thermal loads on the individual brakes and their influence on lining wear, it is recommended that a field test be carried out. Especially when using the brake in hybrid or electric vehicles, the issue of "underload" of the brake lining must be investigated. (08)

Figure 11 shows the temperature curve of the brake disc friction surface of a complete vehicle with harmonically tuned brake force distribution.

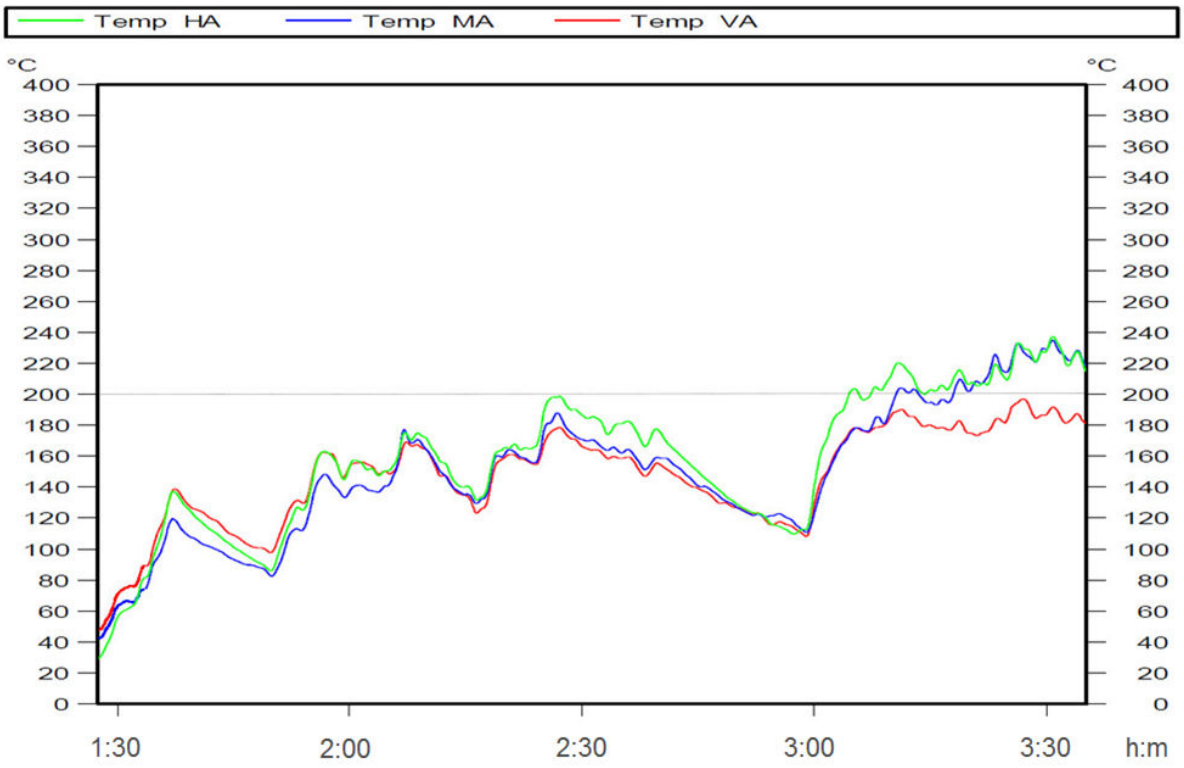


Figure 10: Harmonized temperature (example illustration)
Example of a thermal record for harmonized temperature distribution between three axles (6 x 2 vehicle). The time during which the 200 ºC mark was exceeded was restricted to a brief period and therefore was not critical

The thermal load due to the braking energy must be considered when designing the wheel head.

12.2 Vibration load

KNORR-BREMSE CVS release testing is based on test bench trials and general road tests in Western European operating areas.

The vibration loads actually occurring on the brake are largely dependent on the vehicle. The vehicle manufacturer must test this by means of road trials. If necessary, design measures must be taken.

12.3 Off-road use

The brakes are mainly designed for operation on asphalted roads. For continuous operation on unpaved roads, additional protective measures must be provided for the brake disc, brake pads and elastomer parts. The protective devices must be designed in such a way that the brakes are sufficiently ventilated (e.g., by ventilation slots).

12.4 Fording ability

KNORR-BREMSE CVS release testing does not currently provide for any specific wading capability tests. Within the scope of general brake testing, a check of the tightness function before, during and after various tests is part of the standard program.

It can be deduced from the tightness capability demonstrated in this way that a pure water crossing (e.g., stream or river crossing) at slow speed without braking can be regarded as uncritical.

For braking under water, a ventilation of the cylinder secondary chamber with a corresponding line into a protected area must be provided. Otherwise, the pressure rod bellows may be overprescribed.

After a water crossing, the braking power may be limited for a short time.

In case of longer wading operation, a functional test of the brake must be carried out afterwards.

As a special problem, it must also be considered that the water should not be run in with a hot disc (>300°C). Here there is a risk of disc cracks.

For further information see Y328284 "Notes for underwater applications of pneumatic disc brakes/brake cylinders". (08)

12.5 Vehicle downtimes

If the vehicle is not used for a longer period (> 1 week), rust may form on the brake disc and brake pad surface (metallic components of the brake pad compound).

In special cases, a suitable anti-corrosion agent (for example Castrol-Rustilo) can be applied to the brake disc if the vehicle is not used for several months. Care must be taken in the choice of suitable agents. If unsuitable agents are applied, this can lead to a loss of braking performance.

If the vehicle is parked for a long period of time with wet brake pads and a wet brake disc, in extreme cases this can lead to the brake pads sticking to the brake disc due to rust.

Slight rust formation (flash rust) on the brake disc surfaces is not critical. The brake disc surfaces can be cleaned by carefully applying the brake. If cleaning has not been carried out, the braking performance may deviate when the brake is applied for the first time.

13 Installation requirements

In order for the pneumatic disc brake to work properly, there must always be a clearance between the brake components and other vehicle parts in the entire operating range of the brakes. All tolerances and deformations due to operation and temperature must be taken into account when considering this.

The necessary distances between the brake components (brake caliper, brake carrier and brake cylinder) and all other vehicle components in the direct vicinity must be checked.

These distances shall be checked in all operating conditions, e.g.:

- over the entire compression and extension travel of the suspension
- over the entire steering movement range
- over the entire travel of the brake caliper.
  - with new brake pads
  - with worn brake pads
  - without brake pads
- with the release spindle on the spring-loaded cylinder turned out
- with mounted wheel balance weights
- with mounted snow chains (08)

13.1 CAD supported installation verification

A CAD installation test with models / drawings with nominal dimensions is to be carried out. KNORR-BREMSE CVS provides models for installation tests at the customer's site. If the installation inspection is carried out by KNORR-BREMSE, the corresponding data (3D models / drawings, tolerances, manufacturing processes) must be provided by the axle or vehicle manufacturer. If tolerances are not available, KNORR-BREMSE CVS recommends keeping the following distances:

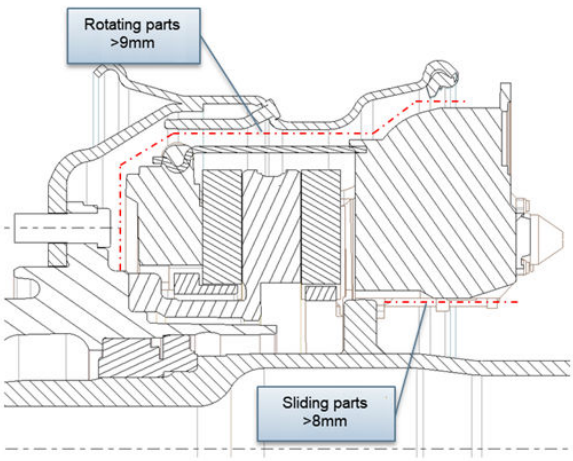
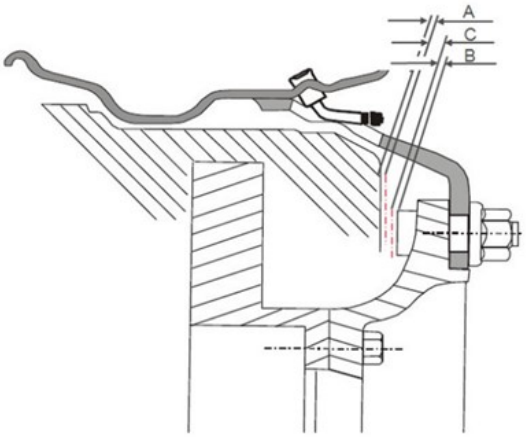


Figure 11: Overview of recommended clearances for nominal dimensional geometry

- 9 mm between rotating parts
  (such as brake caliper – rim, brake caliper – stud head)
- 8 mm between sliding parts
  (such as brake caliper – stub axle, brake actuator – transmission bell housing)
- 5 mm between fixed parts
  (such as brake carrier – axle flange)

These distances are based on the following assumptions:



A	Brake-related tolerances	3mm
B	Axle-related tolerances	3mm
C	for elastic and thermal deformation	3mm /2mm

Figure 12: Structure of the clearance values

13.2 Installation inspection on the vehicle

Installation tests must always be carried out before the start of series production. The installation tests must always be carried out in the most unfavorable operating conditions:

- Total displacement of the brake caliper
- Total suspension travel range of the vehicle
- Total steering range (at the steering axles)
- Max. Air bellows diameter

The pneumatic disc brake is equipped with a sliding caliper. When making hose connections, it must be ensured that the hoses, air lines and cables connected to the air chamber and/or the brake system are flexible and routed in such a way that the brake caliper can move freely in its entire range of movement. The axial forces of the supply lines must not displace the brake caliper so that permanent contact between brake pads and brake disc is avoided.

If the brake is supplied with a potentiometer, the description of the interface and the characteristic curve is provided. Further cables are the responsibility of the customer. The customer must ensure the suitability of the selected mounting, geometry of the connector and sealing elements. An existing connection without use in driving operation is not permitted. KNORR-BREMSE CVS can provide a connector without cable for this purpose. (08)

14 Painting the brake

When the brake is delivered, the surfaces of the brake Caliper are treated. This treatment is intended to ensure the functionality of the brake.

In case of an additional coating of the brake system at the customer's site, the following points must be observed.

14.1 Painting requirements

When painting the brake system, it must be ensured that the painting process does not impair the sealing capability of the brake caliper or cause any damage to other brake components. The painting process must not exceed the requirements of the specifications.

14.2 Coverage requirements

during painting, the following parts and surfaces must be protected from paint:

- Friction surface of the brake disc
- Friction surface of the brake pads
- Interface and connection surfaces (potentiometer connection already covered when delivered)
- Movable elastomer parts (rolling lobe already covered on delivery)
- Open bearing points (floating bearing spar already covered in delivery condition)

The paint protection caps fitted by KNORR-BREMSE CVS must be removed after the painting process has been completed.

15 Additional protection

When used with heavy external contamination (e.g., unpaved roads), additional protective measures must be provided for the brake disc, brake pads and elastomer parts. The protective devices must be designed in such a way that the function of the brake is not impaired.

15.1 Thermal load

Fitting a protective cover may result in an increase in temperature. This temperature increase must not cause the specified values to be exceeded. If necessary, suitable measures must be taken.

Existing wear sensing cables must not be exposed to the direct waste heat of the brake disc.

15.2 Vibration load

The stiffness and strength of a cover must be ensured by suitable tests.

The protective cover can cause additional noise. Particular attention should be paid to this issue in noise-sensitive applications.

15.3 Geometry

The protective cover should be designed in such a way that it does not protrude beyond the enveloping contour of the brake. If the enveloping contour of the brake is not adhered to, installation space investigations must be carried out.

The design of the cover must not impair the displaceability of the brake caliper during operation.

15.4 Fastening

If protective measures are subsequently fitted, it should be noted that additional machining of the brake is not permitted.

The screw connection of the brake to the axle flange must not be used to fasten a cover.

15.5 Material/Coating

When selecting materials and coatings, the influences that occur, such as temperatures, must be considered.

16 Maintenance and inspection

Despite the use of durable materials, the pneumatic disc brake must be checked regularly.

The service life data in the specifications refer to all tension-generating and transmitting components of the disc brake. They are designed to be maintenance-free for this period. Maintenance-dependent components are described in the service manual. The current version of the service manual is available at www.knorr-bremsecvs.com

16.1 Mounting tools/ lubricants

The brake can be repaired with commercially available tools and the special tools contained in the KNORR-BREMSE CVS. This must be agreed with KNORR-BREMSE CVS in each individual case.

The approved lubricants and the tightening torque can be found in the current service instructions.

16.2 Cleaning

If the brake system is to be cleaned, the criteria according to the specifications must be observed when using cleaning equipment and cleaning agents.

16.3 Training of the service personnel

KNORR-BREMSE CVS offers training courses for workshop personnel who are entrusted with the maintenance and service of disc brakes and brake discs.

The current training program can be found at www.knorr-bremsesfn.biz.

17 Application tests

During the development process, the brakes undergo various series of tests. These tests were used to check the general usability of the brake.

The connection to the axle and the friction pairing have a significant influence on the brake. For this reason, tests must be carried out on the original wheel end for application approval.

A one-year supervised field test is recommended before the start of series production. The test period should be at least one year so that all climatic influences are recorded.

The choice of vehicles must reflect the various intended applications.

18 Transport and storage instructions

The pneumatic disc brake is available with or without an installed brake cylinder. If the brake is transported without brake cylinder, the cylinder flange is protected by a cover. The type of cover can vary and must be selected according to the requirements. The cover does not provide permanent protection against penetrating moisture and dirt and is only intended for transport between KNORR-BREMSE CVS and the customer's parts store.

Brakes with KTL surfaces have untreated flange surfaces for the axle connection to ensure a perfect - mounting connection. Any corrosion agent applied must be removed before mounting.

The brake may only be stored in places where it is not exposed to the weather.

19 Disclaimer

The information contained in this document is intended solely for the use of qualified persons in the commercial vehicle industry and must not be passed on to third parties.

All recommendations concerning products and their maintenance or use refer to KNORR-BREMSE CVS products and do not apply to products of other manufacturers.

This information does not cover all conceivable areas and no responsibility is assumed because of its use. No liability is assumed about the accuracy, completeness or up-to-dateness of the data. In particular, the information provided does not constitute any guarantees or warranted characteristics in connection with the products or systems described.

No liability can be assumed on the basis of the information, its use, the recommendations, or advice provided. Liability for damages or losses is generally excluded unless we are responsible for intent or gross negligence or mandatory statutory provisions are opposed.

Any legal disputes arising from the use of this information shall be governed by German substantive law.

Note: If service work is carried out on a vehicle as a result of the information in a document, the workshop must ensure that the vehicle is fully tested and restored to a fully functional condition before the vehicle is used again. KNORR-BREMSE CVS accepts no liability for problems resulting from failure to carry out the necessary tests and measures.

20 Additional documents

- Z000630 Specifications for the assembly connection with axial connections
- VDI 2230 Systematic calculation of highly stressed bolted joints
- C15651 Interface Specification for brake cylinder connections
- Y006471 Service manual air disc brake SN7/SN6/SK7
- Y081564 Service manual air disc brake SM7/SL7
- Y015044 Service manual air disc brake SN5
- C16352 Service manual air disc brake SB7/SB6/SB7-RAD
- Y008095 Service manual SPLINED DISC® (08)
- SD-23-7541 ADB22X® Service Data Sheet (08)
- Z014500 Envelope profile for ADB22X® with integrated wear detection (08)
- Z015071 Envelope profile for the ADB22X® without wear detection (08)
- Y040535 Application guideline for ADB22X® shields (08)