Technical Documentation

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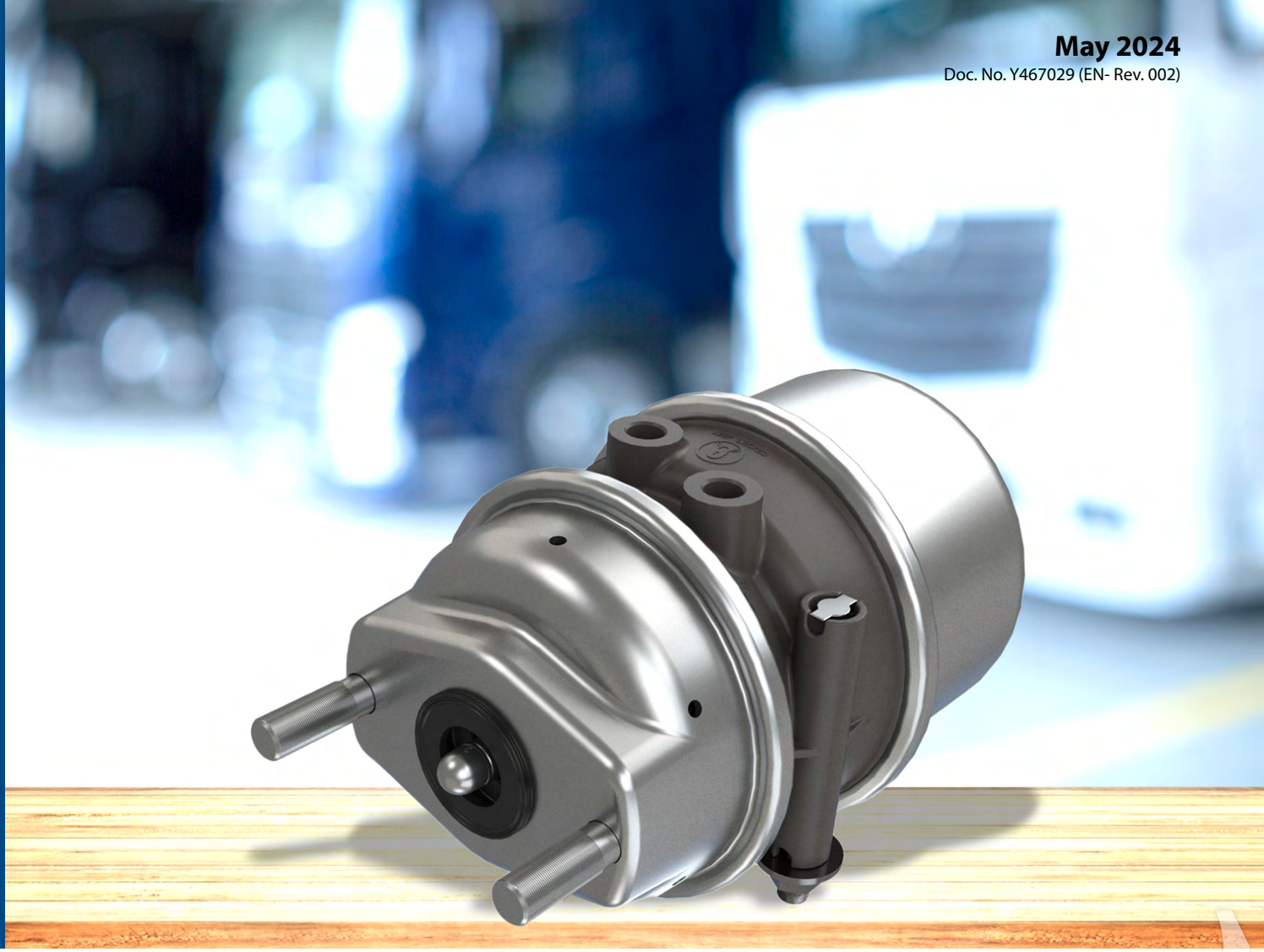


SERVICE MANUAL

High Force and Sealed Actuators NG4 Evo Pro
Spring Brake Diaphragm / Diaphragm Actuators

KNORR-BREMSE

TRUCKSERVICES

Safety and Environmental Guidelines for Knorr-Bremse Commercial Vehicle Systems products

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 costs and damage caused by improper installation and use of Knorr-Bremse aftermarket products, in particular in the event of (i) use in non-approved applications and/or use in non-compliance with the technical specifications and installation instructions, (ii) incorrect installation or removal of Knorr-Bremse aftermarket products and (iii) failure to observe instructions on the use of tools.

In addition to product-specific installation and hazard warnings, the following precautions and additional hazard warnings must be observed before and during work on and around compressed air systems:

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. 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. Only use tools specially designed for cutting pipes in order to prevent incorrect cutting and, in particular, to avoid shavings remaining in the pipes or other impurities which may later lead to leaking connections and subsequent malfunctions of the system.
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. We highly recommend to use only genuine replacement parts, components, and kits as supplied by Knorr-Bremse or the vehicle manufacturer containing original Knorr-Bremse parts. Knorr-Bremse will not be liable for any issues arising from the usage of non-Knorr-Bremse products. 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.
18. Do not use compressed air to clean the disc brake. Avoid air contamination of brake dust.

19. Prior to returning the vehicle to service, make certain that all components and the complete brake systems are leak free and restored to their proper operating condition.
20. During service work on vehicles with electronic parking brake, service or parking brake, or bus stop temporary hold brake, the brake system must be set to service and maintenance mode. Please also observe the instructions of the vehicle manufacturer.

Welding

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

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

Disposal of Waste Equipment by Business Users in the European Union

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

Revision Details

Rev. 002	May 2024	New layout, content update
Rev. 001	May 2023	Content update
Rev. 000	September 2022	New document

1. General Informations

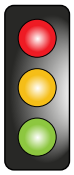
1.1. General Informations

Reference documentation

Y193970 – TruckServices Actuato;r Maintenance Gauge (Product Video)
Y194318 – TruckServices Actuator Maintenance Gauge (Service Instructions)
Y302415 – TruckServices Actuator Maintenance Gauge (Service Instructions)

Animation - Safety Information - NG4EVO PRO

Industrial terms for parking condition of an Spring Brake Actuator

Foot brake pedal	Hand brake valve lever	High-power Spring	Release bolt	Spring Brake Actuator	Air Disc Brakes	Vehicle Condition
						
Not applied	Applied / "park"	Wound-in	Tighten	Caged	Activated	Parking
Possible	Not applied / "run"	Wound-out	Loosen	Uncaged	Released	Driving

Spare Parts List

Knorr-Bremse PN	Description
II36860	Mounting Kit (2 hexagonal Self-locking Nuts)
K040394K50	Release screw Kit (Release bolt, Nut, Washer)
K258592K50	Exhaust Plug kit NG4 EVO PRO with leash
K272880K50	Optional Exhaust Plug kit NG4 EVO PRO w/o leash (1 pc)
K272881K50	Optional Exhaust Plug kit NG4 EVO PRO with leash (48 pcs)

Note:
The Mounting Kit can be used on all NG4 EVO PRO (BP7...) Spring brakes Actuators.

Service Tool

K108806K50 – Actuator Maintenance gauge

Spare Parts List

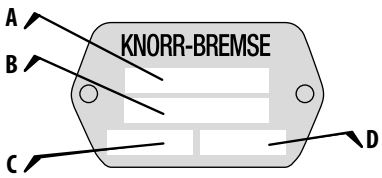
Thread size	Description	Tightening torque [Nm]	A/W Spanner size [mm]
M16x1.5	Mounting Nuts	180 $^{+30}$	24
M27x2	Exhaust plug	12 $^{+3}$	27
1/2-10 ACME	Release bolt	90 MAX	19
	Release bolt in the pocket	14 MIN	
M22x1.5	Air connector fittings	40 $^{+5}$	24

Caution!

All the used spanners must be equipped with torque measurement function in required range.

1.2 Product Identification and marking

1.2.1 Aluminium label fixed with rivet on the socket



A	Type number
B	Part number
C	Production date YY-CW-DAY IN WEEK
D	Plant and serial number

1.3. Important Safety

Before working on or around Air braking systems and devices, the following precautions should be observed:

- Stop the engine before working under a vehicle.
- Always chock the wheels because depleting vehicle Air system pressure may cause the vehicle to roll. Keep hands away from Spring Brake Actuator pusher or push rods; they may apply as system pressure drops.
- Never connect or disconnect an Air hose or line containing Air pressure, it may whip as Air escapes. Never remove a device or pipe plug unless you are sure that all system Air pressure has been depleted.
- Never exceed recommended Air pressure and always wear safety glasses when working with Air pressure. Never look into Air jets or direct them at anyone.
- Never attempt to dismantle a device until you have read and understood recommended procedures. Some units contain powerful springs and injury can result if not properly dismantled. Use only correct tools and observe all precautions relative to the use of these tools.

1.4. Note

- Use only genuine Knorr-Bremse parts and it is recommended to replace Spring Brake Actuators always as an axle set.
- For safety reasons, when fitting a new Spring Brake Actuator, remove connection(s) from old Spring Brake Actuator and disassemble and discard old male fitting(s); the fir-tree plug(s) should be left installed in the Air pipe(s).
- Always use only new mounting Nuts (for reference Knorr-Bremse Mounting kit PN: II36860) for the installation of the Spring Brake Actuator. Tightening torque is in the range of: **180 +30 Nm**.
- After installation of the replacement Spring Brake Actuator, ensure that the non pressure plate breather hole at the lowest point is unplugged. All other breather holes can be plugged or remain unplugged as in the Knorr-Bremse delivery condition.
- Please also refer to section Safety and Environment Guidelines on the Page 4 and 5 of this document, and other relevant safety instructions for repair work on commercial vehicles, especially for jacking up and securing the vehicle.

Attention!

The Knorr-Bremse Roman numerals I or II at the beginning of some old part numbers should not be read as 1 or 11.

Test preliminaries:

Before you begin testing the Air braking system, perform the following checks:

- Examine all pipework for signs of kinks, dents, abrasion, drying out or overheating.
- Check attachment of all pipework; it should be supported so that it cannot abrade or be subjected to excessive heat.

2. Product Features

Through Knorr-Bremse continuous improvement process from 2004 a design change was phased in to improve the Service portion of the Spring Brake Actuators. Due to that the latest mono block double crimped EVO design has the following benefits:

- All Parts are manufactured to the exact specifications as of the OE supplied Spring Brake Actuators.
- Incorporates Knorr-Bremse all latest design and quality features.
- NG4 EVO PRO is merging Spring Brake Actuator benefits of DDSB with sealed and inner breathing technology.
- NG4 EVO PRO is hybrid product of piston style and DDSB technology.
- Utilization of cost competitiveness of DDSB technology.

2.1. NG4

- Basic product naming stands for continues development on Double Diapraghm Spring Brake (DDSB) technology by Knorr-Bremse Engineering.

2.2. EVO

- Reduce number of variants for the Aftermarket and replacement parts.
- Original or genuine replacement Spring Brake Actuator includes all latest modifications such as non-clamp ring technology.
- Provides a quick and cost-effective option to the original Spring Brake Actuator servicing without additional manipulation or assembly equipment needs.
- Each Knorr-Bremse rationalized double crimped EVO Spring Brake Actuator is TÜV and KBA approved.

2.3. PRO

- Internal breathing system (no external breather tube or vented Parking brake portion solution) – reduces risk of contamination and simplifies the installation packaging.

2.4. HF

- Comparable release pressure to existing product range, no change in vehicle architecture needed due to high utilization of performance criteria's.

3. Service Intervals

3.1. Introduction

The service interval is the length of time from the vehicle first entering service, or from the last service, until the point in time - or distance travelled by the vehicle (whichever is the earlier) - when it is recommended that the specified braking system device is serviced using a genuine Knorr-Bremse service kit or replaced with a new part, or in the case of ABS subjected to a system functionality check.

This service interval is provided for preventative maintenance purposes so as to minimize the probability of a vehicle breakdown.

The service interval does not preclude the intermediate testing of the device on the vehicle to ensure that it is functioning in a correct manner, or the correct maintenance of other devices in the system that may influence the service interval.

The service interval can also be influenced by the positioning of the device on the vehicle, and the following service intervals are based on the assumption that each device is positioned such it cannot be inadvertently abused or that external rubber boots/seals are not exposed to abnormal influences.

In addition to legally required periodic vehicle inspections, it is recommended that simple routine inspections of a general nature are carried out to maintain the braking system at a high level of functionality.

3.2. Definition

These simple routine inspections, including a visual check of the Spring Brake Actuator to verify that there is no damage or unexpected wear, should be:

1) the weekly checking for excess water in the reservoirs by operation of the reservoir drain valves and
2) the **6 monthly / (50,000 km)** checking of the complete braking system for excessive Air leakage during a maximum pressure foot brake application with the vehicle stationary and the parking brake released.

This inspection has to be done especially for vehicles which are used in severe environments (very high or low temperatures, high humidity, presence of aggressive substances or fluids …) or submitted to frequent braking (buses or coaches, garbage trucks, urban distribution …)

These inspections are carried out as preventive maintenance so as to minimize the possibility of a vehicle breakdown. The service interval can also be influenced by the positioning of the device on the vehicle and the service intervals are based on the assumption that each device is positioned such it cannot be inadvertently abused or that external rubber boots / seals are not exposed to abnormal influences.

3.3. Spare Parts

The Spring Brake Actuator **MUST** be serviced by using the genuine Knorr-Bremse Service Kit or part.

In general Knorr-Bremse Service Kits contain all of the components that can deteriorate with use, such as rubber parts (O-Rings, special seals, bonded inlet / exhaust valves, exhaust flaps ...), plastic and metal parts (filter elements, springs ...), fasteners and the correct grease.

The range of Service Kits is designed to enable each device to be serviced in part or completely. Knorr-Bremse Service Kits are only designed for use with genuine Knorr-Bremse assemblies and are only to be used in the manner detailed in these service instructions.

After servicing, the assembly must also be checked in accordance with vehicle manufacturer's instructions to ensure correct operation before the vehicle is placed back in service.

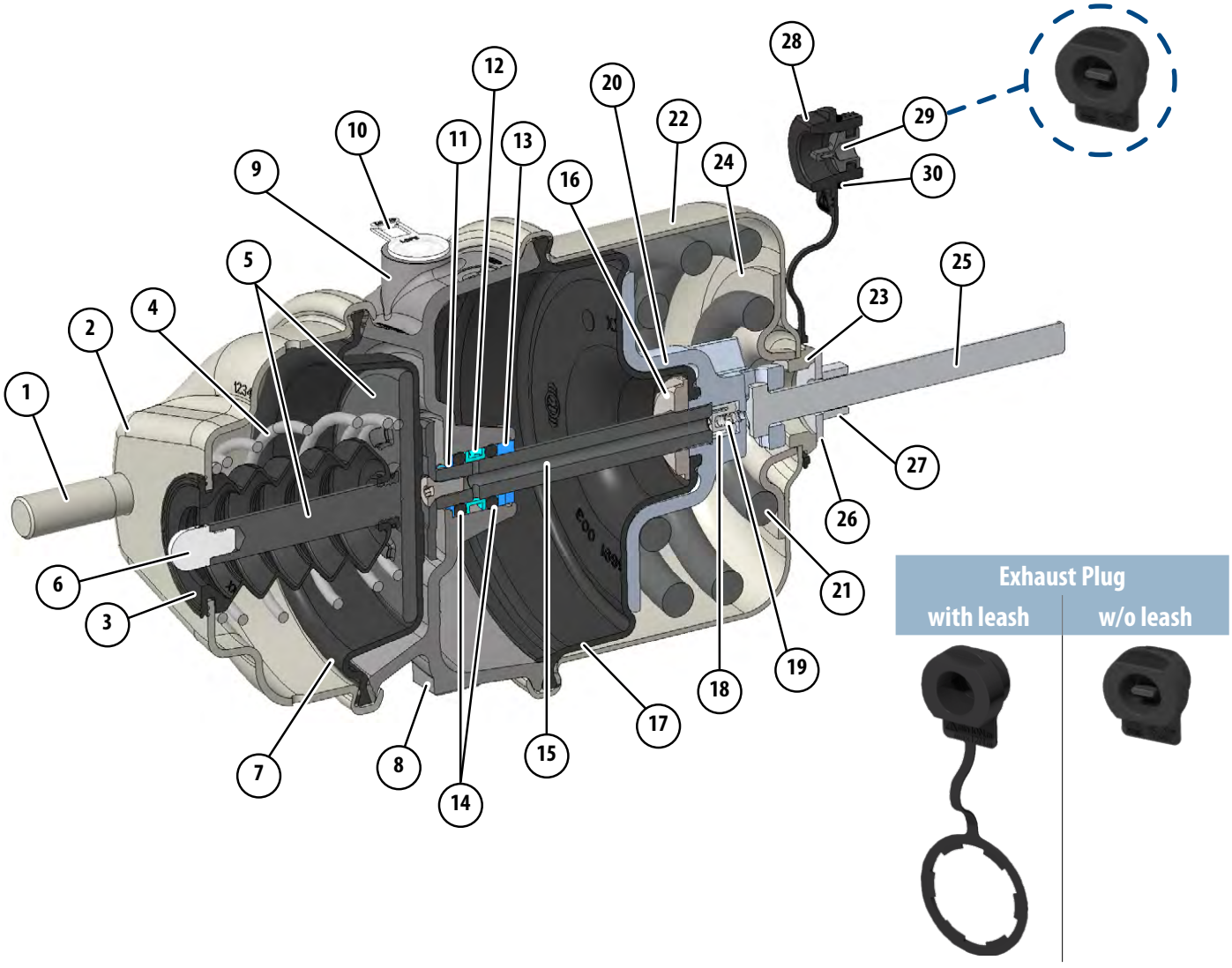
4. Basic Principles

4.1. Cross Section View and List of Components

Pos	Description
1	Mounting stud
2	Non-pressure plate (NPP)
3	Bellows
4	Return spring
5	Front piston
6	Pusher
7	Service diaphragm
8	Intermediate flange
9	Air Port
10	Airport plug

Pos	Description
11	Snap ring
12	Separating ring
13	Guide rings
14	O-Rings
15	APR rod (with Breathing channel)
16	Nut
17	Parking diaphragm
18	Breathing valve piston
19	Breathing valve return spring
20	Pressure plate

Pos	Description
21	High-power spring
22	Rear housing
23	Bushing
24	Reinforcement plate
25	Release bolt
26	Release washer
27	Release nut
28	Exhaust Plug Body with leash
29	Duckbill valve
30	O-Ring



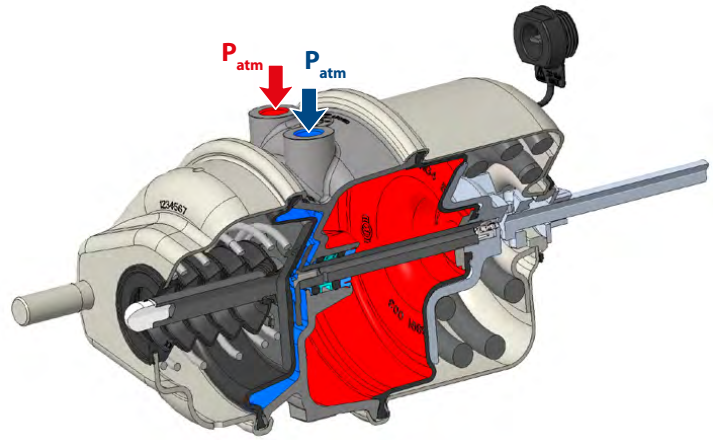
4.3. Application

The Spring Brake Actuator is used for generating the input force required for the service brake and the parking brake of the ADB Caliper.

4.4. Functional Descriptions

4.4.1. Delivery condition

In delivery condition, the manual release system is activated in order to fully compress the High-power Spring (caged condition) and to allow mounting onto ADB Caliper. The return spring keeps the Front piston at zero stroke.

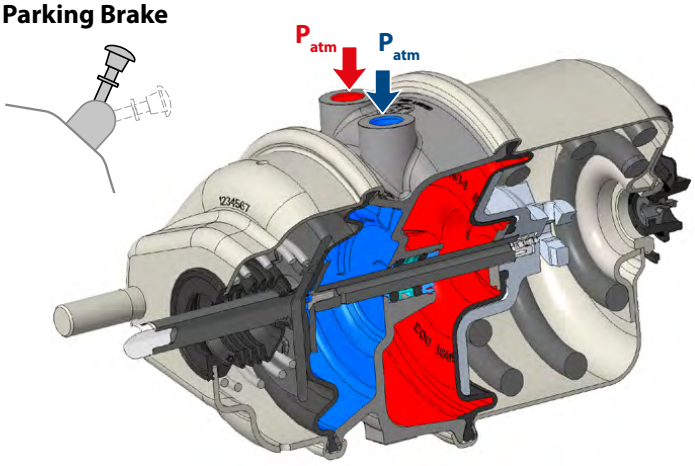


4.4.2. Parking brake condition (Braking with the Hand brake valve lever)

In parking brake condition, both Air connection Ports 11 and 12 are exhausted to atmosphere. Thus, the uncaged High-power Spring activates the Parking brake.

When the pressure in High-power Spring pressure chamber is exhausted, the Parking brake spring portion piston is pushed forward by the High-power Spring. The end of Pressure plate pushes the Parking diaphragm and APR rod outwards. The force of the High-power Spring is transferred to the ADB via the lever of ADB Caliper. When pressure is reapplied to High-power Spring pressure chamber, Parking brake spring portion piston compresses High-power Spring and allows Pressure plate and Parking diaphragm to be returned to the brakes released position by the Return spring. The equalization of pressure in the spring chamber is carried-out via the Breather valve in the APR rod and Exhaust valve.

Parking Brake



P_{12} < 5.6 bar (release pressure)

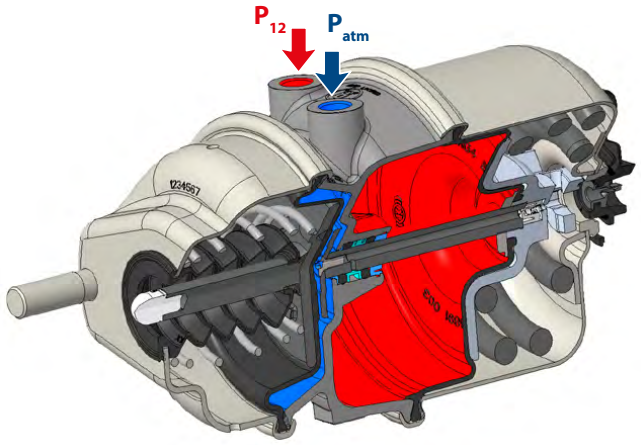
Breathing circuit opened

Parking brake not fully released and retracted:
Any pressure in **P_{11} > 0 bar** and **P_{11} < ≈ 1 bar** is leaking out into High-power Spring chamber, subsequently out of Spring Brake Actuator to atmosphere
(Details see chapter 4.5.3.)

4.4.3. Driving condition

During driving condition, the Air pressure supplied through Air connection Port 12 moves the Pressure plate backwards, High-power Spring pressure chamber is pressurized, and High-power Spring is held compressed by the Air pressure acting on Pressure plate. Consequently, the High-power Spring is fully compressed, and the Parking brake is not activated, the Parking brake spring portion is in the fully 'parking brake released' condition.

At the same time the Air connection Port 11 is vented to atmosphere, Service brake chamber is not pressurized. Front piston and Service diaphragm are held backwards in the 'Service brakes released' condition by the Return spring.



4.4.4. Service brake condition (Braking with the Foot brake pedal)

When Air pressure supplied through Air connection Port 11 is introduced into Service chamber the Service diaphragm moves the Front piston outwards with a force proportional to its effective area and the Air pressure value applied.

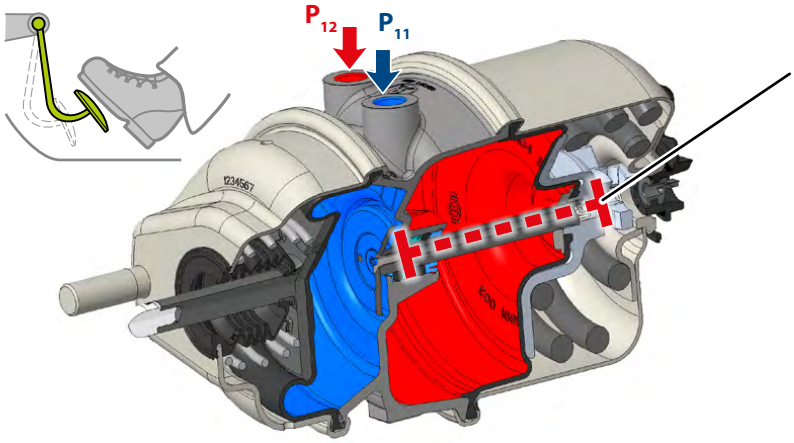
The Pusher transfers this force to the ADB via the Lever of the ADB Caliper, thus the service brake is activated.

When the pressure is reduced or removed, the Return spring moves the Front piston and the Service diaphragm backwards to the 'Service brake released' condition.

As the Service diaphragm moves forward, any water or other contamination is expelled through the vent drain hole.This also allows for equalization of any pressure between Non-pressure plate and atmosphere caused by the Air, displaced by the Service diaphragm.

During this phase, the Air pressure supplied through Air connection Port 12 keeps the Pressure plate backwards and the parking brake is not activated.

Service Brake



P_{12} > 5.6 bar (release pressure)

Breathing circuit closed

No link possible through Internal breathing channel independent on pressure level applied in P_{11}

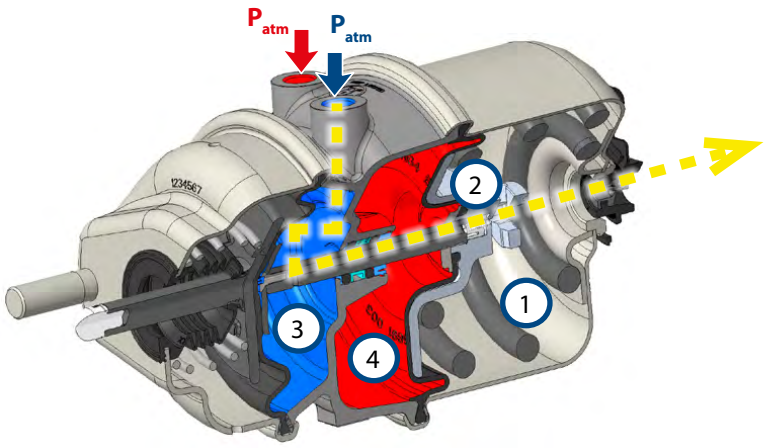
4.5. Extended functional features

4.5.1. Parking condition Inner breathing function purpose

When the parking brake is activated, vacuum is being generated in a High-power Spring chamber (1), which subsequently leads to force reduction.

To avoid that, when the service brake is no further activated, Breathing valve (2) is getting opened to equalize the High-power Spring chamber into atmospheric pressure.

Once the service brake is activated, breathing valve is getting closed in order to prevent leakage from service chamber (3) whilst High-power Spring pressure chamber is being released (4).



4.5.2. Internal breathing

Breather valve

Pressure equalization is carried out between High-power Spring chamber and atmosphere via Air connection Port 11 and the upstream equipment (e.g. Foot brake pedal) in order to protect High-power Spring chamber from dirt and humidity environmental deposits.

Breather valve is designed so that it remains open while the Service brake is not applied. Only when actuating the Service brake (pressure at Air connection Port 11), Breather valve is closed in order to prevent pressure build-up in the High-power Spring chamber.

Exhaust plug

Air pressure build in the High-power Spring chamber when the service brake is applied is ventilated via Exhaust plug in the atmosphere.

The Exhaust plug is fixed to the Spring Brake Actuator Rear housing (Valid only for version with leash).

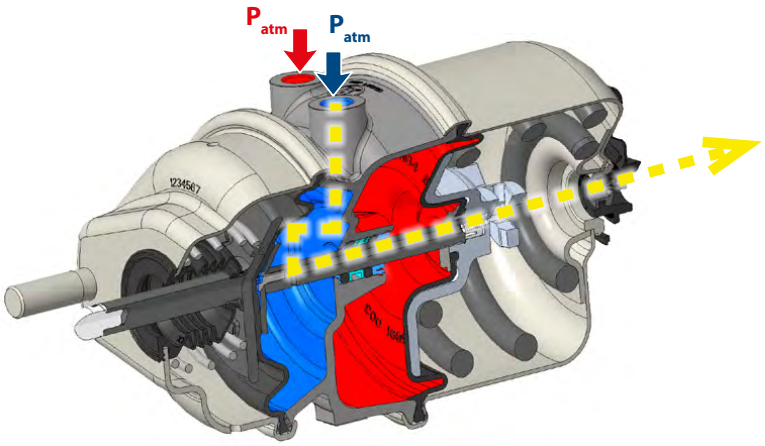
It must be installed carefully without damaging the Duckbill valve inside by using torque wrench with tightening torque range of:

Tightening torque development depends on the engraving on physical parts:

- 04/2023 - 10/2023 MAX 12 Nm
- 10/2023 - 04/2024 10+2 Nm
- 04/2024 - current serial production 12+3 Nm

All variants of Exhaust plug are technically fully compatible with product.

4.5.3. Parking condition Parking brake fully or partially activated



P_{12} < 5.6 bar (release pressure)

Parking brake not fully released and retracted:
Any pressure in **P_{11} > 0 bar** and **P_{11} < ≈ 1 bar** is leaking out into High-Power spring chamber, subsequently out of Spring Brake Actuator
Breathing circuit opened

If the Parking brake condition according chapter 4.4.2. is applied or during parking brake release sequence as well, the link between the Breather valve and Air connection Port 11 is being created.

The pressure equalization in the High-Power Spring chamber via this link starts corresponding to opening and ends at closing pressure of the Breather valve setup.

Designed air flow value starts to fill the High-power Spring chamber. In such condition the High-power Spring chamber is all ready equalized with ambient air pressure and increased pressure starts to open Exhaust plug and vent the air to atmosphere.

Be careful this is a normal condition showing fully functional Internal breathing system!

Caution!

Minimum tightening toque of 12 Nm must be applied to achieve full functionality of the product.

4.5.4. Mechanical release of the parking brake

The ADB Caliper can be released mechanically in the event of any Air pressure lost (Air connection Port 12) or failure in the Spring Brake Actuator.

Chock the wheels to make sure that the vehicle cannot start rolling and turn the Release nut with the help of an open-ended 19 mm A/F - across flats - spanner in an clockwise direction in the fully wound in position with a tightening torque of **90 Nm MAX** until the ADB Caliper is released.

Caution!

When the repair has been carried out, tighten the Release nut anti-clockwise direction to release the High-power Spring fully into the Spring Brake Actuator until the Release bolt is in the fully wound out position according chap. **5.4.1.**

5. Installation of the Spring Brake Actuator to the vehicle

Go to the Product Search section of the website truckservices.knorr-bremse.com to select the correct Spring Brake Actuator part number or type number.

5.1. General product precaution

In assembled position, there must be no risks of damage of the Spring Brake Actuator by any external element (friction, shocks, chemical substances, etc.).

Spring Brake Actuators before mounting on the ADB Caliper must be stored in a dry, clean place, at normal conditions regarding temperature and pressure, sheltered from sun, ultraviolet and chemical substances.

The Spring Brake Actuator must be handled with care. The product must not drop down and must not have any mark caused by a shock.

If any abnormality on the Spring Brake Actuator (non-conform aspect, damage, strange behaviour that cannot be controlled with a test bench, …) is noticed, the Spring Brake Actuator cannot be used.

Before mounting on the ADB Caliper, the Spring Brake Actuator must be in delivery condition (High-power Spring caged).

Note:

Before starting work on the vehicle interface please refer to the Safety Guidelines on Page 4 and 5.

Caution!

The Spring Brake Actuator must not be disassembled for safety reasons as it contains a compressed High-power Spring which can cause an injury.

5.2. ADB caliper preparation for the Spring Brake Actuator assembly

Prepare the ADB Caliper Interface for assembly of the Spring Brake Actuator according to the Service Manual.

Check that the ADB Caliper mounting surface is not cracked or damaged and is clean.

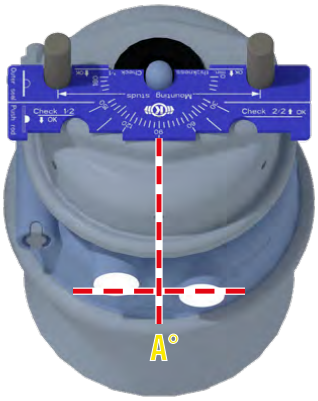
5.3. Preparation of the replacement Spring Brake Actuator before the installation

Make a final check that the replacement genuine Spring Brake Actuator matches the original in respect of Air connection Port´s angle and push rod length.

5.3.1. Usage of the Knorr-Bremse Maintenance Gauge Service Tool K108806K50

5.3.1.1. Air connection Port(s) orientation

Measure the angle (A) of the ports on the Intermediate flange relative to the Mounting studs.



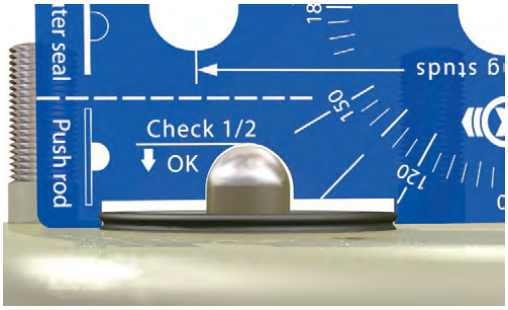
For help in usage of the Knorr-Bremse Maintenance Gauge see the animation Y193970 on the website: truckservices.knorr-bremse.com under Download Software then Animations. Other document´s refer Page 6.

5.3.1.2. Quad-ring seal

Check that the quad-ring seal is correctly located in the Non-pressure plate (NPP) by using the Knorr-Bremse Maintenance Gauge to check the seal height.

5.3.1.3. Push rod protrusion

Check that the front piston is correctly located in the diaphragm by using the Knorr-Bremse Maintenance Gauge to check the push rod protrusion.

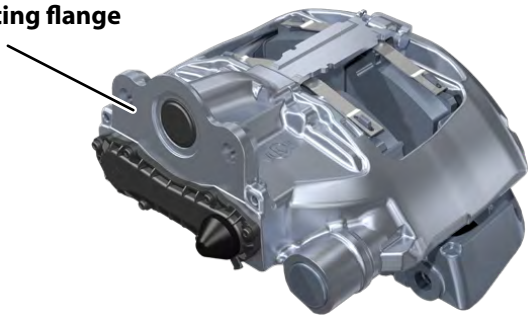


5.4. Assembly and merge of Spring Brake Actuator together with ADB caliper

Move the Hand brake valve lever to the "run" position (Air Disc Brakes are released).

Before mounting the Spring Brake Actuator on the ADB Caliper, the front Mounting flange surface (in contact with the ADB Caliper) must be inspected and cleaned.

Mounting flange



Assemble the genuine new Spring Brake Actuator on the ADB caliper. Always respect the orientations of the Air connection Ports 11 and 12.

Grease according to ADB Service manual must be present between the Pusher and the Lever of the ADB Caliper.

If the Spring Brake Actuator is supplied with a rubber Bellows which should now be fitted, ensure correct location in the surrounding ADB Caliper mounting face hole.

Caution!

Do not use Spring Brake Actuator with Bellows sealing interface thickness less than **3 mm**.

5 Installation of the Spring Brake Actuator to the vehicle

Manually fit 2 new and unused M16x1.5 Self-locking Nuts (parts included in the Knorr-Bremse genuine Mounting kit PN II36860) and tighten alternatively in line with recommended following procedure:

- Apply a pre-torque of 120 Nm on Nut #1 and Nut #2
- Apply a final torque Nut #1 and Nut #2, see chart:

Final torque	
Self-locking Nuts (EN ISO 10513)	200 $^{+10/-20}$ Nm
Alternative (Standard Nuts & Washer)	180 $^{+30}$ Nm

Important Note:

Washers are not supplied by Knorr-Bremse. In case you decide to use Nut and Washers, they must be fitted between the Mounting nuts and the ADB Caliper - never between the Spring Brake Actuator NPP and the ADB Caliper.

Caution!

Do not re-use the old Nuts – interface to ADB Caliper is safety feature.

Do not use an impact wrench.

Note:

Nut#1 is the one which is in higher position or less accessible from the operator who assembles the actuator.

5.4.1. Release (uncaging) of the compressed High-power Spring from the Spring Brake Actuator

Use a 19 mm A/F - across flats - spanner and rotate the Release nut in an anti-clockwise direction (INFO: tightening torque **90 Nm MAX**) until the Release bolt is in the fully wound out position.

Take out the "T" End of the Release bolt from the inside of the Rear housing of the Pressure plate internal slot.

Unscrew completely the Release nut and remove together with the Release washer.

Screw carefully the Exhaust plug in the hole of the Rear housing and tighten with tightening torque 12^{+3} Nm.

Caution!

Minimum tightening toque of **12 Nm** must be applied to achieve full functionality of the product.

Do not use an impact wrench.

Caution!

The Exhaust plug must be installed carefully without damaging the Duckbill valve. The O-Ring has to be always checked against any deformation, scratches or pollution of other homogeneous materials. In case of any visible damage of the rubber components (Duckbill valve, O-Ring), replace the Exhaust plug by the genuine new one.

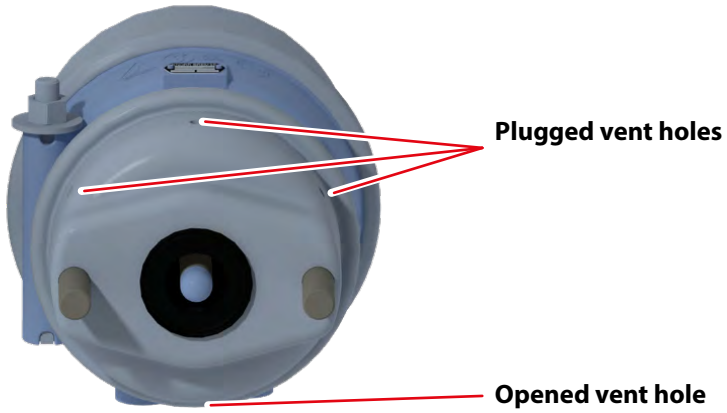
Place the Release bolt into the storage pocket on the side of the Intermediate flange and manually pre-tighten the Release nut with the Release washer, located only between the Release nut and Intermediate flange.

Final tightening torque for the Release bolt assembly in the pocket has to be **14 Nm MIN** unless otherwise specified.

Do not use an impact wrench.

5.4.2. Service portion vent drain (breathing) hole(s)

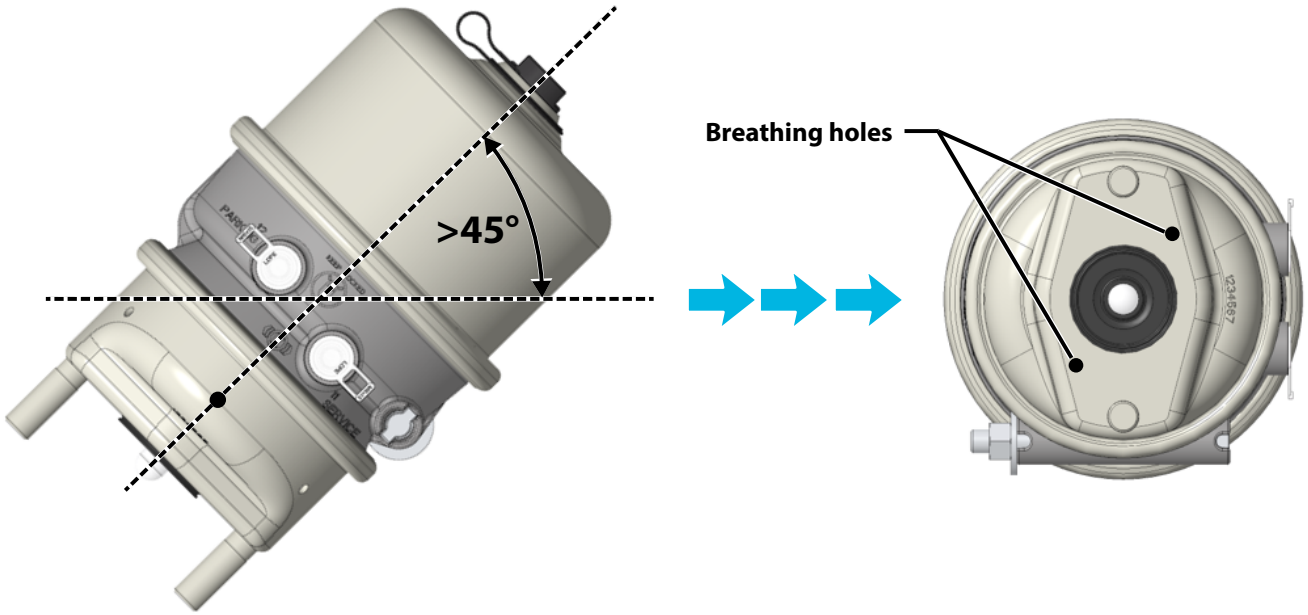
After installation of the Spring Brake Actuator on the vehicle make sure that there is an open vent drain hole in the Service portion Non-pressure plate (NPP) of the Service Brake Actuator pointing towards the ground with ± 30° MAX tolerance.



It is recommended by Knorr-Bremse to plug any other vent holes with plugs (included in the service kits) to decrease dust and water continual ingress inside of the NPP.

Note:

If the final angular position between the Spring Brake Actuator axis and the horizontal axis is superior to **45°**, Knorr-Bremse strongly recommends using a Non-pressure plate with 2 breathing holes on the front surface of the Spring Brake Actuator.



5.5. Port Connection to the Air Brake Circuits

All the sealing surfaces (Bellows, front surface of the Non-pressure plate, Air connection Ports, …) between the Spring Brake Actuator and the Air brake circuits or the braking system must be undamaged and clean.

Correctly connect Air service brake hose to Air connection Port 11 and Air parking brake hose to Air connection Port 12 (Port 11 & 12 are marked on the Intermediate flange of the Spring Brake Actuator) and be sure that the hoses are not twisted or in contact with moveable vehicle components.

Note:

If the ADB Caliper is a floating one, make sure that the Air hose length allows the full caliper / actuator travel.

Knorr-Bremse genuine Air connector fittings should be tightened to **40** $^{+5}$ **Nm**.

Other Air connection Port Fittings must be tightened according to value indicated by the vehicle manufacturer or in line with Service Kit producer advise.

All Connection Port Fittings has to be checked to ensure that there is no leakage during operation of the Spring Brake Actuator.

5.6. Testing

5.6.1. Final check of the installation setup

Check of the successful installation of Spring Brake Actuator on the ADB Caliper and vehicle interface.

Note:

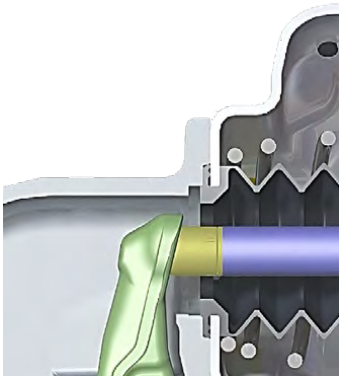
The pusher pivoting angle must not exceed ± 4° in all directions during the actuation´s.

Provide the test for leakage and check the brake functionality and effectiveness before operation.

Service portion

Apply Air pressure of approximately 10 bar 10 times to Air connection Port 11 by using the Foot brake pedal. During these applications, check the Air tightness of the Spring Brake Actuator in the crimping area using a leakage detection fluid or a soap solution and also check other Air supply interfaces like i.e.. Air connection Port 11 fitting.

The matching and the tightness between the Spring Brake Actuator and ADB Caliper are defined in the Knorr-Bremse Specification C15651 (see picture of interface cross-section)



Parking brake portion

Apply the Air pressure to the Air connection Port 12 of the Spring Brake Actuator by using the Hand brake valve lever (parking brake in "released" position) and keep the High-power Spring compressed. Check the correct function of the parking brake.

Apply the Air pressure of more than 1 bar to Air connection Port 11 using the Foot brake pedal and check for correct function of the service brake.

Before driving the vehicle, perform several applications of the service and parking brakes.

Refer to the vehicle manufacturer's instruction for any further recommendations regarding correct adjustment of the brakes and check for correct operation.

6. Replacement of Spring Brake Actuator

Caution!

Knorr-Bremse recommends replacement of Spring Brake Actuators always in axle sets.

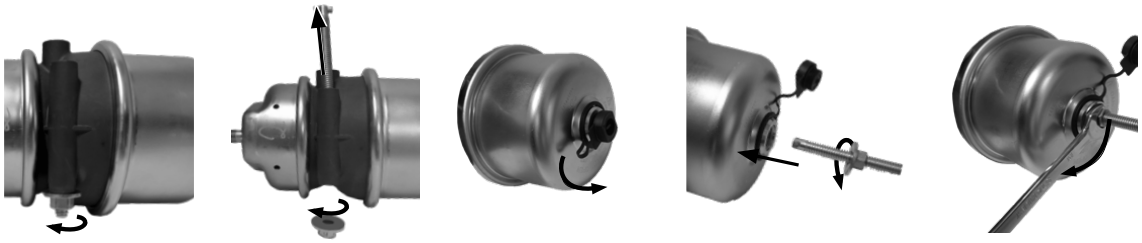
6.1. Removal of the old Spring Brake Actuator from the Vehicle

6.1.1. Vehicle stabilization against rolling

Ventilate the Air connection Port 12 via the Hand brake valve lever (to the "park" position Air Disc Brakes activated).

Then ensure that Air connection Port 11 and 12 are free of Air pressure. Ensure vehicle wheels are chocked.

6.1.2. Winding-off the High-power Spring



1 2 3 4 5

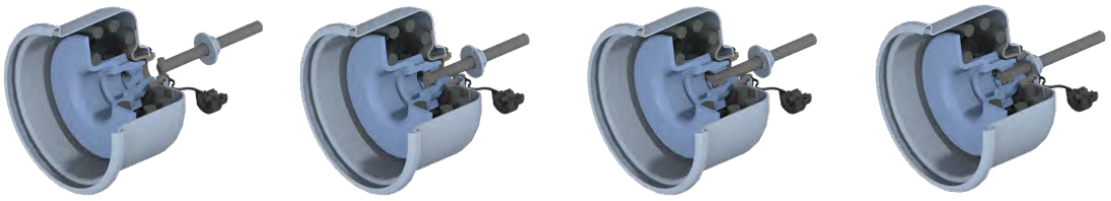
Set that the Hand brake valve lever in the "run" position (parking Air Disc Brake Calipers in "released" position). Air connection Port 12 is with Air pressure now.

Unscrew and unplug the Exhaust plug.

Note:

It must be removed carefully without damaging the duckbill valve and O-Ring.

6.1.2.1 T-bolt function explanation



1 2 3 4

Remove the Release bolt from the storage pocket on the side of the Intermediate flange and fully place the "T" End inside of the Rear housing into to the Pressure plate internal slot.

Turn until the tabs are locked up. Manually tighten up the Release nut with Release washer until the mechanical contact with the Rear housing is established (as shown on the picture 1-4).

Fully wind-off the parking brake High-power spring using the Release bolt.

For that operation use a 19 mm A/F - across flats - spanner, rotate and wind-off Release nut in a clockwise direction not exceed 90 Nm applied torque.

Do not use an impact wrench.

6.1.2.2. Disconnection

Release the Air from Parking brake portion by moving the Hand brake valve lever to the "park" position (brakes applied).

Disconnect Air pressure hoses from Air connection Ports 11 and 12 taking careful note of which hose is connected to each port for correct re-installation later.

Cover the Air connection Ports with plugs to prevent entry of dirt or fluid inside.

Untight and remove Spring Brake Actuator Mounting Nuts and remove Washers (if previously fitted) – Nuts and Washers cannot be re-used and has to be environmentally friendly scrapped in line with valid country regulations.

Remove Spring Brake Actuator from the common ADB Caliper interface.

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