

INTORQ

setting the standard



INTORQ BFK455-25

Spring-applied brake with electromagnetic release

Translation of the Original Operating Instructions

www.intorq.com

Document history

Material number	Version			Description
33008102	1.0	07/2019	SC	First edition

Legal regulations

Liability

- The information, data and notes in these Operating Instructions are up to date at the time of printing. Claims referring to drive systems which have already been supplied cannot be derived from this information, illustrations and descriptions.
- We do not accept any liability for damage and operating interference caused by:
 - inappropriate use
 - unauthorised modifications to the product
 - improper work on or with the drive system
 - operating errors
 - disregarding the documentation

Warranty



Notice

The warranty conditions can be found in the terms of sale and delivery from INTORQ GmbH & Co. KG.

- Warranty claims must be made to INTORQ immediately after the defects or faults are detected.
- The warranty is void in all cases when liability claims cannot be made.

Spring-applied brakes of type BFK455-25

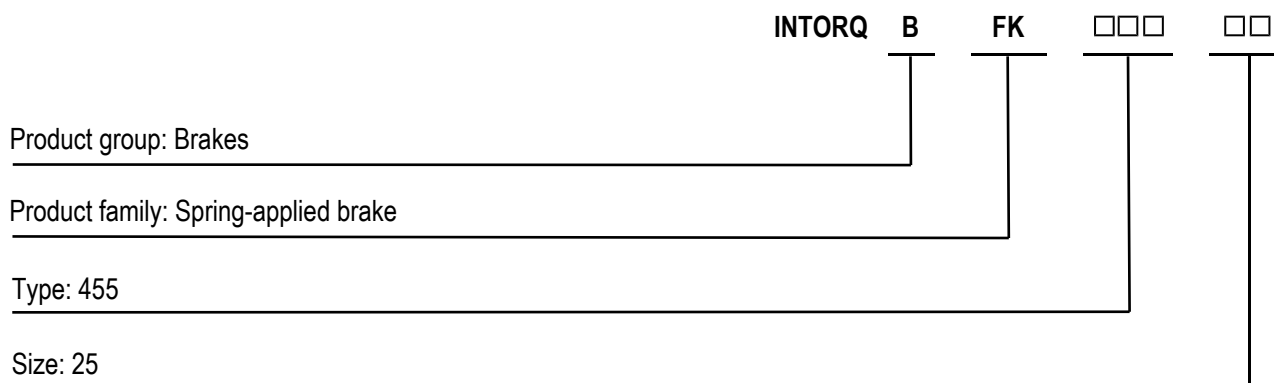
Version without hand-release



Version with hand-release



Product key



Not coded: Connection voltage, hub bore hole, options

Checking the delivery

After receipt of the delivery, check immediately whether the items delivered match the accompanying papers.

INTORQ does not accept any liability for deficiencies claimed subsequently.

- Claim visible transport damage immediately to the deliverer.
- Claim visible deficiencies or incomplete deliveries immediately to INTORQ GmbH & Co. KG.

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1 General information

1.1 Using these Operating Instructions

- These Operating Instructions will help you to work safely with the spring-applied brake with electro-magnetic release. They contain safety instructions that must be followed.
- All persons working on or with electromagnetically released spring-applied brakes must have the Operating Instructions available and observe the information and notes relevant for them.
- The Operating Instructions must always be in a complete and perfectly readable condition.

1.2 Conventions in use



This document uses the following styles to distinguish between different types of information:

Spelling of numbers	Decimal separator	Point	The decimal point is always used. For example: 1234.56
Page reference	Underscore, orange		Reference to another page with additional information For example: <u>Conventions in use, Page 6</u>
Symbols	Wildcard	□	Wildcard (placeholder) for options or selection details For example: BFK455-25-□□ = BFK455-25-10
	Notice		Important notice about ensuring smooth operations or other key information.



1.3 Safety instructions and notices



The following icons and signal words are used in this document to indicate dangers and important safety information:



Structure of safety notices:


	 CAUTION
	<p>Icon Indicates the type of danger</p>
	<p>Signal word Characterizes the type and severity of danger.</p>
	<p>Notice text Describes the danger.</p>
	<p>Possible causes List of possible consequences if the safety notices are disregarded.</p>
	<p>Protective measures List of protective measures required to avoid the danger.</p>

Danger level

	 DANGER
	<p>DANGER indicates a hazardous situation which, if not avoided, <i>will</i> result in death or serious injury.</p>

	 WARNING
	<p>WARNING indicates a potentially hazardous situation which, if not avoided, <i>could</i> result in death or serious injury.</p>

	 CAUTION
	<p>CAUTION indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.</p>

	NOTICE
	<p>Notice about a harmful situation with possible consequences: the product itself or surrounding objects could be damaged.</p>

1.4 Terminology used

Term	In the following text used for
Spring-applied brake	Spring-applied brake with electromagnetic release
Drive system	Drive systems with spring-applied brakes and other drive components

1.5 Abbreviations used

Letter symbol	Unit	Designation
F_R	N	Rated frictional force
I	A	Current
I_H	A	Holding current, at 20 °C and holding voltage
I_L	A	Release current, at 20 °C and release voltage
I_N	A	Rated current, at 20 °C and rated voltage
M_A	Nm	Tightening torque of fastening screws
M_{dyn}	Nm	Braking torque at a constant speed of rotation
M_K	Nm	Rated torque of the brake, rated value at a relative speed of rotation of 100 rpm
n_{max}	rpm	Maximum occurring speed of rotation during the slipping time t_3
P_H	W	Coil power during holding, after voltage change-over and 20 °C
P_L	W	Coil power during release, before voltage change-over and 20 °C
P_N	W	Rated coil power, at rated voltage and 20 °C
Q	J	Quantity of heat/energy
Q_E	J	Max. permissible friction energy for one-time switching, thermal parameter of the brake
Q_R	J	Braking energy, friction energy
Q_{Smax}	J	Maximally permissible friction energy for cyclic switching, depending on the operating frequency
R_m	N/mm ²	Tensile strength
R_N	Ohms	Rated coil resistance at 20 °C
R_z	µm	Averaged surface roughness
S_n	1/h	Operating frequency: the number of switching operations evenly spread over the time unit
S_{hue}	1/h	Transition operating frequency, thermal parameter of the brake
S_{nmax}	1/h	Maximum permissible operating frequency, depending on the friction energy per switching operation
s_L	mm	Air gap: the lift of the armature plate while the brake is switched
s_{LN}	mm	Rated air gap
s_{Lmin}	mm	Minimum air gap
s_{Lmax}	mm	Maximum air gap
s_{HL}	mm	Air gap for hand-release
t_1	ms	Engagement time, sum of the delay time and braking torque: rise time $t_1 = t_{11} + t_{12}$
t_2	ms	Disengagement time, time from switching the stator until reaching 0.1 M_K

Letter symbol	Unit	Designation
t_3	ms	Slipping time, operation time of the brake (according to t_{11}) until standstill
t_{11}	ms	Delay during engagement (time from switching off the supply voltage to the beginning of the torque rise)
t_{12}	ms	Rise time of the braking torque, time from the start of torque rise until reaching the braking torque
t_{ue}	s	Overexcitation period
U	V	Voltage
U_H	V DC	Holding voltage, after voltage change-over
U_L	V DC	Release voltage, before voltage change-over
U_N	V DC	Rated coil voltage; in the case of brakes requiring a voltage change-over, U_N equals U_L

2 Safety instructions

2.1 General safety instructions

- Never operate INTORQ components when you notice they are damaged.
- Never make any technical changes to INTORQ components.
- Never operate INTORQ components when they are incompletely mounted or incompletely connected.
- Never operate INTORQ components without their required covers.
- Only use accessories that have been approved by INTORQ.
- Only use original spare parts from the manufacturer.

Keep the following in mind during the initial commissioning and during operation:

- Depending on the degree of protection, INTORQ components may have both live (voltage carrying), moving and rotating parts. Such components require the appropriate safety mechanisms.
- Surfaces can become hot during operation. Take the appropriate safety measures (to ensure contact/touch protection).
- Follow all specifications and information found in the Operating Instructions and the corresponding documentation. These must be followed to maintain safe, trouble-free operations and to achieve the specified product characteristics.
- The installation, maintenance and operation of INTORQ components may only be carried out by qualified personnel. According to IEC 60364 and CENELEC HD 384, skilled personnel must be qualified in the following areas:
 - Familiarity and experience with the installation, assembly, commissioning and operation of the product.
 - Specialist qualifications for the specific field of activity.
 - Skilled personnel must know and apply all regulations for the prevention of accidents, directives, and laws relevant on site.

2.2 Disposal

The INTORQ components are made of various differing materials.

- Recycle metals and plastics.
- Ensure professional disposal of assembled PCBs according to the applicable environmental regulations.

3 Product description

3.1 Proper and intended usage

3.1.1 Standard applications

INTORQ components are intended for use in machinery and facilities. They may only be used for purposes as specified in the order and confirmed by INTORQ. The INTORQ components may only be operated under the conditions specified in these Operating Instructions. They may never be operated beyond their specified performance limits. The technical specifications (refer to [Technical specifications, Page 14](#)) must be followed to comply with the proper and intended usage. Any other usage is considered improper and prohibited.

3.2 Layout

The BFK455-25 spring-applied brake is a double-disc brake with four friction surfaces. The braking torque is applied through two separate braking circuits, both electrical and mechanical, via several compression springs in the form of friction locking. The brake circuits are released electromagnetically. Due to its division into two brake circuits, the brake is particularly suitable for applications such as lift systems and stage/platform technology. The brake can be selected based on the rated torque for one brake circuit. The second brake circuit meets the requirement for redundancy (refer to [Rated data for coil power, Page 15](#)).

The division of the brake circuits is done using two separate armature plates with their corresponding compression springs and electromagnetic coils. Each brake circuit can be operated individually due to the separate supply lines for each stator and armature plate (siehe [Switching suggestions for the BFK455-25, Page 38](#)).

Each brake circuit has a micro-switch which monitors the switching state of the spring-applied brake. Using the associated switching device, the supply voltage (AC voltage) is rectified and, when the brake is released, lowered after a short period of time. This results in a reduction of the average electrical power of the brake.

The stator is designed to comply with heat class F. The limit temperature of the coils is 155 °C. The BFK455-25 spring-applied brake is designed for a maximum duty cycle of 60 % with holding current reduction.

Size	Rated torque [Nm]	EC-type examination certificate
		Directive 2014/33/EC
25	2 x 800	EU-BD 1077
	2 x 1200	
	2 x 1500	

3.2.1 Basic module

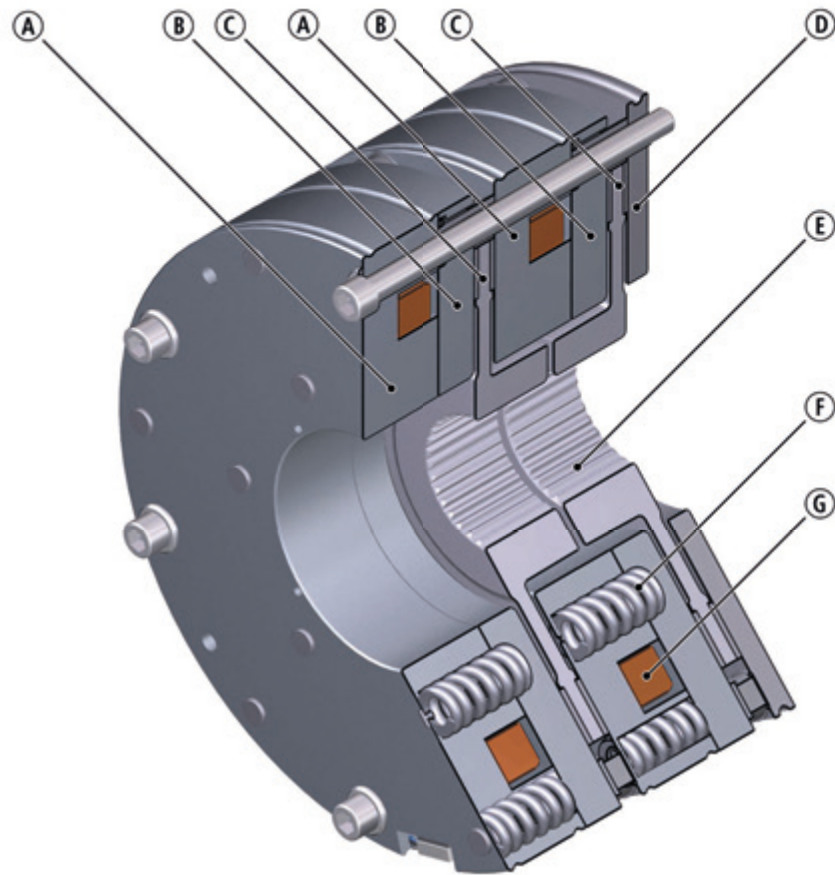


Fig. 1: Design of a BFK455-25 spring-applied brake

- | | | |
|----------|------------------|-----------------------|
| Ⓐ Tappet | Ⓑ Armature plate | Ⓒ Complete rotor |
| Ⓓ Flange | Ⓔ Gear teeth | Ⓕ Compression springs |
| Ⓔ Coil | | |

3.3 Function

This brake is an electrically releasable spring-applied brake with two rotating brake discs (rotors) that are equipped on both sides with friction linings. In its de-energized state, the rotor is clamped with braking force applied by pressure springs between the armature plate and a counter friction surface. This corresponds to a fail-safe functionality.

The brake torque applied to the rotor is transferred to the input shaft via a hub that has axial gear teeth.

The brake can be used as a holding brake, as an operating brake, and as an emergency stop brake for high speeds.

The asbestos-free friction linings ensure a safe braking torque and low wear.

3.4 Braking and release

During the braking procedure, the inner and outer springs use the armature plate to press the rotor (which can be shifted axially on the hub) against the friction surface. The asbestos-free friction linings ensure high braking torque and low wear. The braking torque is transmitted between the hub and the rotor via gear teeth.

When the brakes are applied, an air gap (s_L) is present between the stator and the armature plate. To release the brake, the coil of the stator is energised with the DC voltage provided. The resulting magnetic flux works against the spring force to draw the armature plate to the stator. This releases the rotor from the spring force and allows it to rotate freely.

3.5 Release monitoring

The spring-applied brake has a micro-switch for each braking circuit to monitor the switching state. When the brake is released, the micro-switches toggle. This means that it is possible to prevent the drive from being operated when the brake is closed. The micro-switches can be connected as both normally open and also normally closed.

To check that the micro-switches function correctly, we recommend testing the switching status (refer to table 6) in both the released and applied braking states.

3.6 Project planning notes

- When designing a brake for specific applications, torque tolerances, the limiting speeds of the rotors, the thermal resistance of the brake, and the effect of environmental influences must all be taken into account.
- The brakes are dimensioned in such a way that the specified rated torques are reached safely after a short run-in process.
- However, as the organic friction linings used do not all have identical properties and because environmental conditions can vary, deviations from the specified braking torques are possible. These must be taken into account in the form of appropriate dimensioning tolerances. Increased breakaway torque is common in particular after long downtimes in humid environments where temperatures vary.
- If the brake is used as a pure holding brake without dynamic load, the friction lining must be reactivated regularly.

3.7 Optional configuration

3.7.1 Hand-release (optional)

To temporarily release the brake when there is no electricity available, a hand-release function is available as an option. The hand-release function can be retrofitted.

3.7.2 Optional encapsulated design

This design not only prevents the penetration of spray water and dust, but also the spreading of abrasion particles outside the brake. This is achieved by the following enclosures:

- A cover ring over the armature plate and rotor.

4 Technical specifications

4.1 Possible applications of the INTORQ spring-applied brake

- Degree of protection:
 - The brake is designed for operation under the environmental conditions that apply to IP54 protection. Because of the numerous possibilities of using the brake, it is still necessary to check the functionality of all mechanical components under the corresponding operating conditions.
- Ambient temperature:
 - -20 °C to +40 °C (Standard)
- Humidity: no restrictions
 - In the event of condensation or moisture formation: provide for appropriate ventilation of the brakes to ensure that the friction pairs will dry quickly.
- Ambient temperature:
 - -5 °C to +40 °C
- At high humidity and low temperature:
 - Take the steps necessary to protect the armature plate and rotor from freezing.
- Protect the electrical connections against any contact or touching.

4.2 Rated data

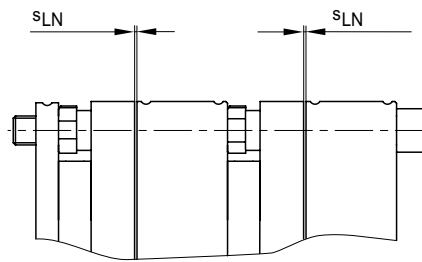


Fig. 2: Dimensions


Size	Rated torque	Air gap		Permissible wear distance	Rotor thickness		Mass per stator
		$s_{LN}^{+0.22/-0.02}$	s_{Lmax}		Min.	Max.	m
	[Nm]	[mm]	[mm]	[mm]	[mm]	[mm]	[kg]
25	2 x 800	0.3	0.6	0.3	12.7	13	35
	2 x 1200						
	2 x 1500						

Tab. 1: Rated data for air gap specifications

Size	Screw hole circle		Fastening screws DIN 912		Minimum thread depth		Tightening torque	
	Diameter	Thread	without flange	with flange	without flange	with flange ¹⁾	M _A	
							without flange	with flange ¹⁾
[mm]		[mm]	[mm]	[mm]	[mm]	[Nm]	[Nm]	
25	282	M12	6 x M12x190	6 x M12x200	25	22.5	105	105

Tab. 2: Rated data: screw kit for brake assembly onto flange

¹⁾ Flange only permissible for max. 2 x 1000 Nm

	⚠ CAUTION
	<ul style="list-style-type: none"> ■ The screws for the different brake attachment variants have different strength grades and may have special surface coatings. In order to guarantee a secure screw connection, use ONLY the proper screws from INTORQ! ■ It is very important to comply with the minimum thread depth of the end shield (refer to <u>Rated data: screw kit for brake assembly onto flange</u>, Page 15). ■ If the required thread depth is not maintained, the fastening screws may run onto the root. This has the effect that the required pre-load force is no longer established. The brake is no longer securely fastened!

Size	Voltage		Power		Coil resistance	Current
	Release ^{±10%}	Hold ^{±10%}	Brake release	Brake hold		
	U _L	U _H	P _N	P _H	R _N ^{±5%}	I _L
	[V DC]	[V DC]	[W]	[W]	[Ω]	[A]
25	160	80	2 x 236	2 x 59	2 x 108.5	2 x 1.48
	205	103			2 x 178.1	2 x 1.15
			2 x 425	2 x 106	2 x 98.9	2 x 2.07

Tab. 3: Rated data for coil power

4.3 Switching times

The switching times listed here are guide values which apply to DC switching with rated air gap s_{LN} , warm coil and standard characteristic torque. The switching times given are mean values and subject to variations. The engagement time t_1 is approximately 5 times longer for AC switching.

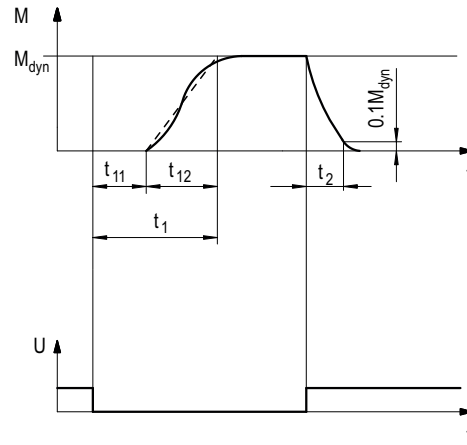


Fig. 3: Operating/switching times of the spring-applied brakes

- t_1 Engagement time
- t_2 Disengagement time (up to $M = 0.1 M_{dyn}$)
- M_{dyn} Braking torque at a constant speed of rotation
- t_{11} Delay time during engagement
- t_{12} Rise time of the brake torque
- U Voltage

Size	Rated torque	Max. perm. switching energy	Transitional operating frequency	Switching times						Max. speed
				Engaging				Disengaging		
				$t_{10}^{1)}$	$t_{90}^{1)}$	$t_{11.AC}^{2)}$	$t_{1.AC}^{2)}$	$t_{2ab}@s_{LN}^{3)}$	$t_{2ab}@s_{Lmax}^{3)}$	
M_K	Q_E	S_{hue}	[ms]	[ms]	[ms]	[ms]	[ms]	[ms]	$n_{max}^{5)}$	
	[Nm]	[J]	[1/h]							[rpm]
25	2 x 800	240000	7.5	0.085	0.250	0.400	1.400	0.288	0.480	1150
	2 x 1200							0.360	0.600	
	2 x 1500							0.068	0.181	0.330


Tab. 4: Switching energy - operating frequency - switching times

- ¹⁾ Switching times according to type examination certificate are based on the rated torque $t_{50} = (t_{10} + t_{90}) / 2$
- ²⁾ Switching times refer to steady braking torque.
- ³⁾ Venting times under unfavorable conditions (240 switching operations per hour, 60% DC, 40 °C ambient temperature)
- ⁴⁾ Brake supplied with overexcitation (release voltage / holding voltage = 2 / 1)
- ⁵⁾ Max. speed according to type examination certificate (for higher speeds, please first contact the manufacturer)

Engagement time

The transition from a brake-torque-free state to a holding-braking torque is not free of time lags.

For emergency braking, short engagement times for the brake are absolutely essential. The DC-side switching in connection with a suitable spark suppressor must therefore be provided.

	NOTICE
	<p>Connect the spark suppressors in parallel to the contact. If this is not admissible for safety reasons (e.g. with hoists and lifts), the spark suppressor can also be connected in parallel to the brake coil.</p>

- If the drive system is operated with a frequency inverter so that the brake will not be de-energized before the motor is at standstill, AC switching is also possible (not applicable to emergency braking).
- The specified engagement times are valid for DC switching with a spark suppressor.
 - Circuit proposals: refer to DC switching at mains – fast engagement.



Notice

Spark suppressors are available for the rated voltages.

Disengagement time

The disengagement time is the same for DC-side and AC-side switching. The specified disengagement times always refer to control using INTORQ rectifiers and rated voltage.

4.4 Friction work / operating frequency

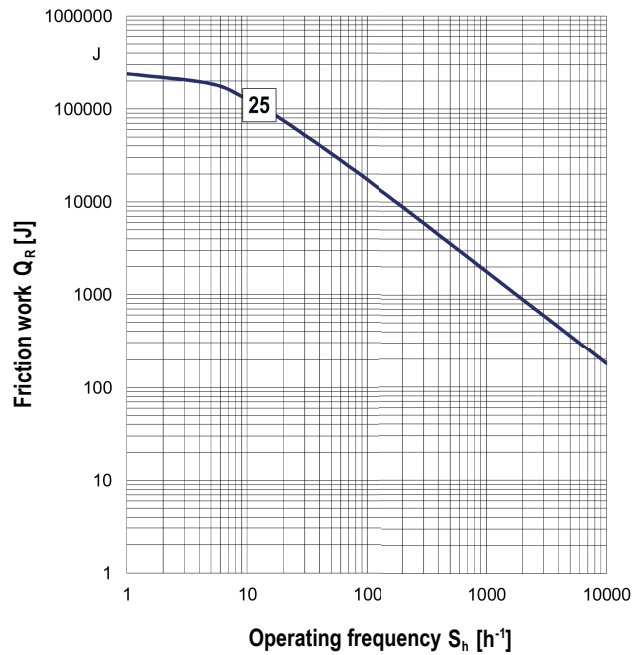


Fig. 4: Friction work as a function of the operating frequency

$$S_{hmax} = \frac{-S_{hue}}{\ln\left(1 - \frac{Q_R}{Q_E}\right)}$$

$$Q_{smax} = Q_E \left(1 - e^{-\frac{S_{hue}}{S_h}}\right)$$

The permissible operating frequency S_{hmax} depends on the amount of heat Q_R (refer to [Figure Friction work / operating frequency, Page 18](#)). At a pre-set operating frequency S_h , the permissible amount of heat is Q_{smax} .



Notice


With high speeds of rotation and switching energy, the wear increases strongly, because very high temperatures occur at the friction surfaces for a short time.

4.5 Electromagnetic compatibility



Notice

The user must ensure compliance with EMC Directive 2014/30/EC using appropriate controls and switching devices.

NOTICE	
	<p>If an INTORQ rectifier is used for the DC switching of the spring-applied brake and if the operating frequency exceeds five switching operations per minute, the use of a mains filter is required.</p> <p>If the spring-applied brake uses a rectifier of another manufacturer for the switching, it may become necessary to connect a spark suppressor in parallel with the AC voltage. Spark suppressors are available on request, depending on the coil voltage.</p>

4.6 Emissions

Heat

Since the brake converts kinetic energy as well as mechanical and electrical energy into heat, the surface temperature varies considerably, depending on the operating conditions and possible heat dissipation. Under unfavourable conditions, the surface temperature can reach 130 °C.

Noise

The loudness of the switching noise during engaging and disengaging depends on the air gap "s_L" and the brake size.

Depending on the natural oscillation after installation, operating conditions and the state of the friction surfaces, the brake may squeak during braking.

Others



The abrasion of the friction parts produces dust.

4.7 Labels on product

There is a packaging label on the package. The name plate is glued to the outer surface of the brake.



Fig. 5: Packaging label

INTORQ	Manufacturer
33006670	ID number
BFK455-25	Type (refer to Product key, Page 3)
	Bar code
SPRING-APPLIED BRAKE	Designation of the product family
205/205 V DC	Rated voltages of both braking circuits
1500/1500 NM	Rated torque
Pieces	Qty. per box
425/425 W	Rated powers for both braking circuits
26.04.18	Packaging date
Anti-rust packaging: keep friction surface free of grease!	Addition
	CE mark

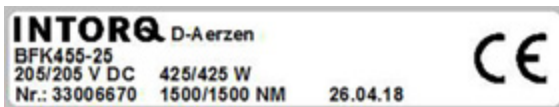


Fig. 6: Name plate (example)



INTORQ	Manufacturer
BFK455-25	Type (refer to Product key, Page 3)
205/205 V DC	Rated voltages of both braking circuits
425/425 W	Rated powers for both braking circuits
No. 33006670	ID number
1500/1500 NM	Rated torque
26.04.18	Date of manufacture
	CE mark




Fig. 7: Product traceability sticker

BFK455-25	Type (refer to Product key, Page 3)
33006670	ID number
G1804260000000000	Serial number
	QR code

5 Mechanical installation

This chapter provides step-by-step instructions for the installation.

Important notes

	NOTICE
	<ul style="list-style-type: none"> ■ The gear teeth and screws must not be lubricated with grease or oil. ■ Do not change the optional factory coating on the gear teeth.



Notice

The two "complete stators" of a brake are delivered in pairs. One of the two stators has the name plate for the complete brake and, when necessary, additional attachments. This stator must be mounted as a second stator.

5.1 Design of end shield and shaft

- Comply with the specified minimum requirements regarding the end shield and the shaft to ensure a correct function of the brake.
- The diameter of the shaft shoulder must not be greater than the tooth root diameter of the hub.
- The form and position tolerances apply only to the materials mentioned. Consult with INTORQ before using other materials; INTORQ's written confirmation is required for such usage.
- It may be necessary to use a flange as a counter friction surface.
- The brake flange must be supported by the end shield across the full surface.
- Depending on the type of installation, additional clearing bore holes may be required.
- Keep the end shield free from grease or oil.



Minimum requirements of the end shield




Size	Material ¹⁾	Roughness	Run-out	Levelness
			[mm]	[mm]
25	S235JR; C15; EN-GJL-250	Rz6	0.1	< 0.1

Tab. 5: End shield as counter friction surface

¹⁾ Consult with INTORQ before using other materials.

5.2 Tools

Size	Torque wrench	Insert for hexagonal socket (Allen) screws
		
	Measuring range	Wrench width
	[Nm]	[mm]
25	40 to 400	10

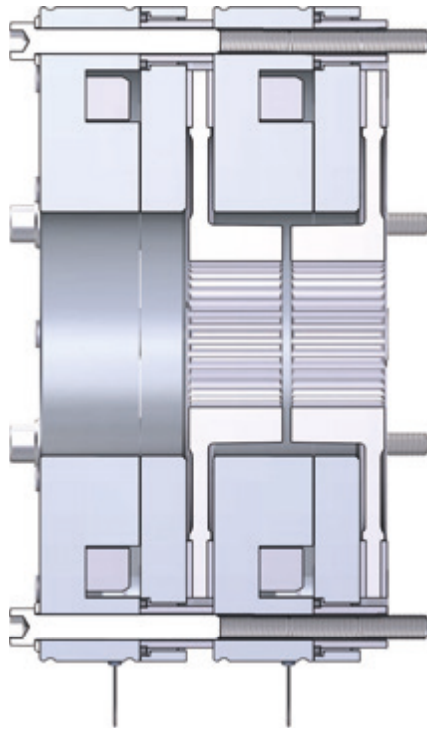
Multimeter	Caliper gauge	Feeler gauge
		

5.3 Preparing the installation

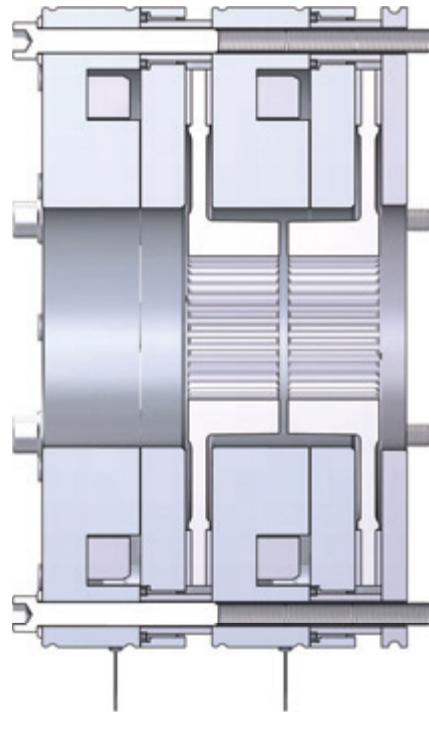
1. Remove the packaging from the spring-applied brake and dispose of it properly.
2. Check the delivery for completeness.
3. Check the name plate specifications (especially rated voltage)!

Overview

Without separate counter friction surface



With flange



5.4 Installing the hub onto the shaft



Notice

The customer is responsible for dimensioning the shaft-hub connection. Make sure that the supporting length of the key is identical to the length of the hub.



NOTICE

If you are using the spring-applied brake for reverse operations, glue the hub to the shaft.

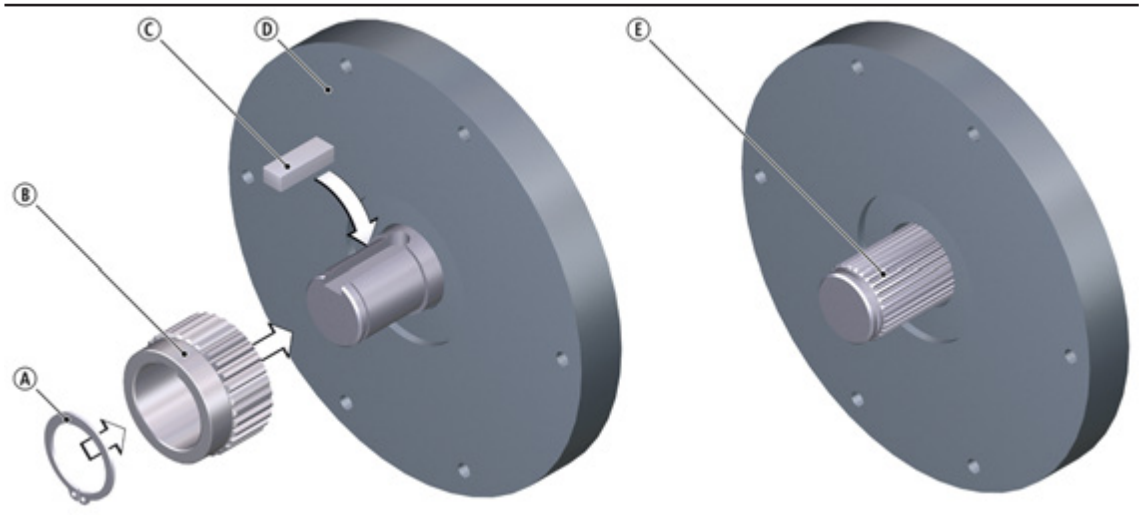


Fig. 8: Installing the hub onto the shaft

- Ⓐ Circlip
- Ⓑ Hub (optional)
- Ⓒ Key shape B (angular version)
- Ⓓ End shield
- Ⓔ Toothed shaft (optional)

1. Insert the key into the shaft.
2. Press the hub with a moderate amount of force to the shaft.
3. Secure the hub against axial displacement (for example, by using a circlip).

5.5 Brake mounting



Notice

Here, the mounting of the brake is shown in the version with the optional flange and toothed shaft

NOTICE	
	<p>Only in the case of rotors with mounting paste on their gear teeth:</p> <ul style="list-style-type: none"> ■ Remove cover films from both front ends of the rotor. ■ Protect friction surfaces against contact with mounting paste! ■ After the mounting, excessive mounting paste must be removed properly!

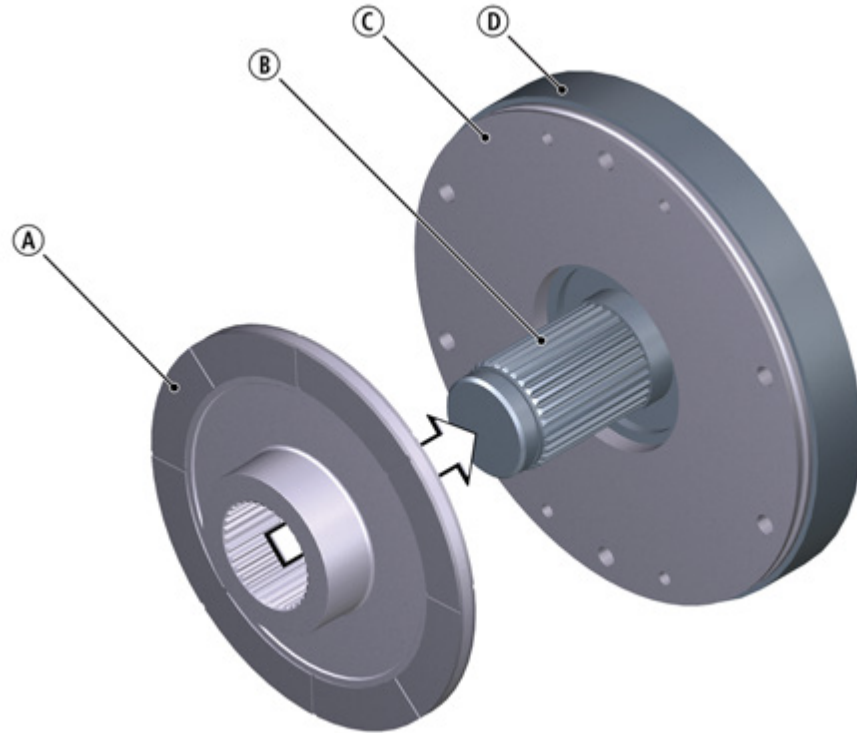


Fig. 9: Mounting the first rotor

- Ⓐ Rotor
- Ⓑ Toothed shaft
- Ⓒ Flange
- Ⓓ End shield

1. Push the rotor onto the shaft and check that it can be moved by hand.

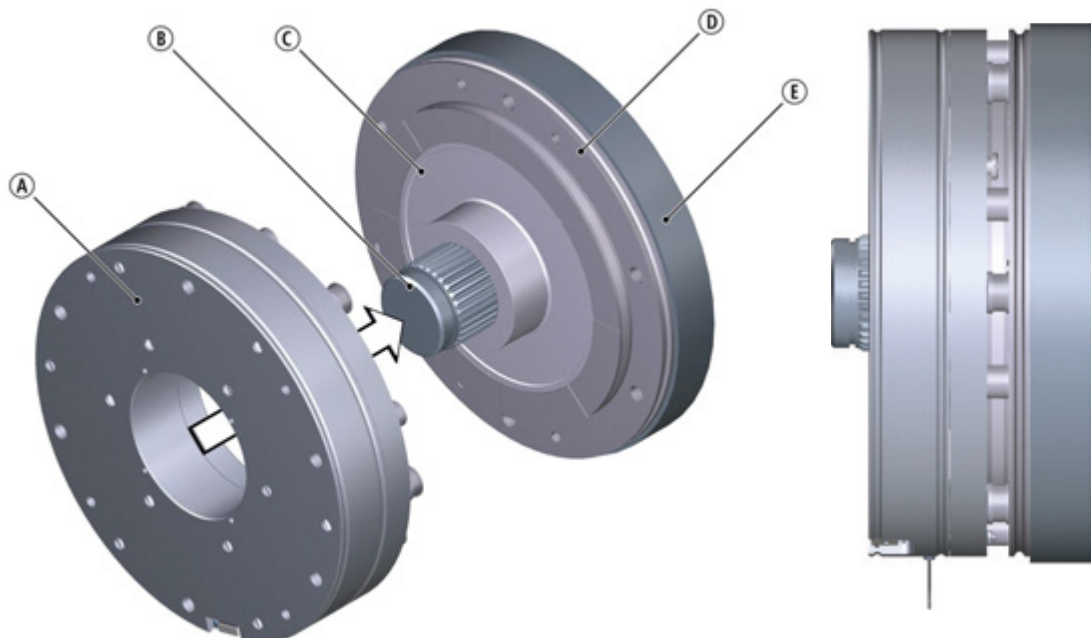


Fig. 10: Mounting the first stator

- Ⓐ Complete stator
- Ⓑ Toothed shaft
- Ⓒ Rotor
- Ⓓ Flange
- Ⓔ End shield

2. Push the complete stator onto the shaft.

3. Align the through holes in the complete stator to the threads of the fastening bore holes.

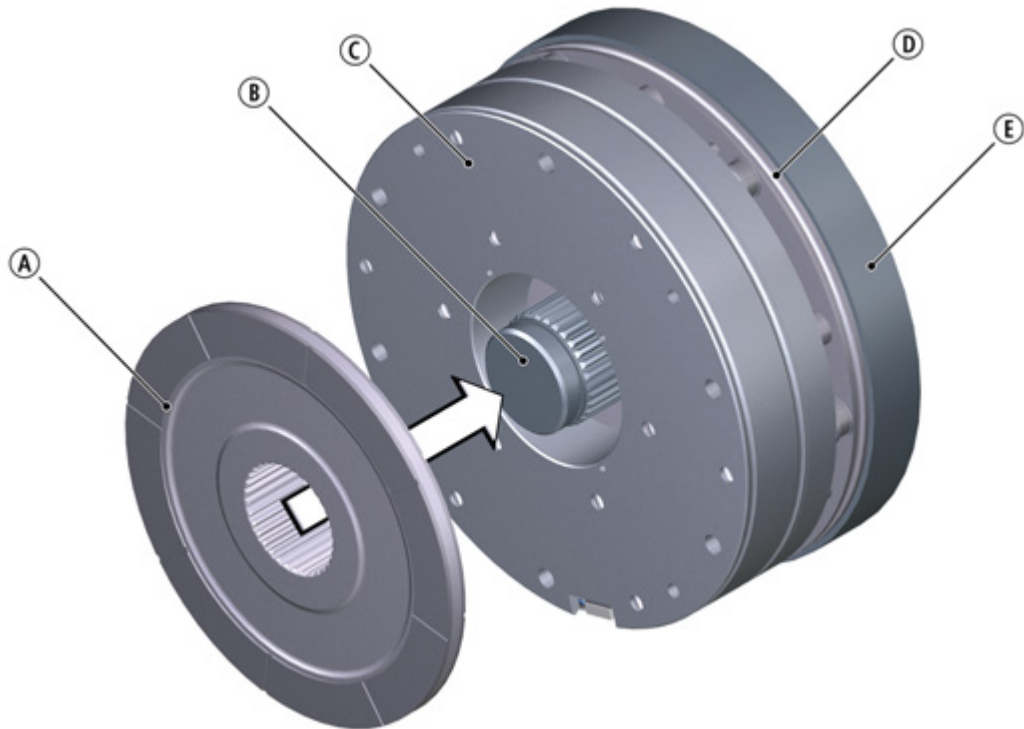


Fig. 11: Mounting the second rotor

- Ⓐ Rotor
- Ⓑ Toothed shaft
- Ⓒ Complete stator
- Ⓓ Flange
- Ⓔ End shield

4. Push the complete rotor onto the shaft and check that it can be moved by hand.



Notice

If a hand-release mechanism is to be installed, the required steps (in the Chapter Mounting the hand-release (retrofitting), Page 31 must be carried out **now!**

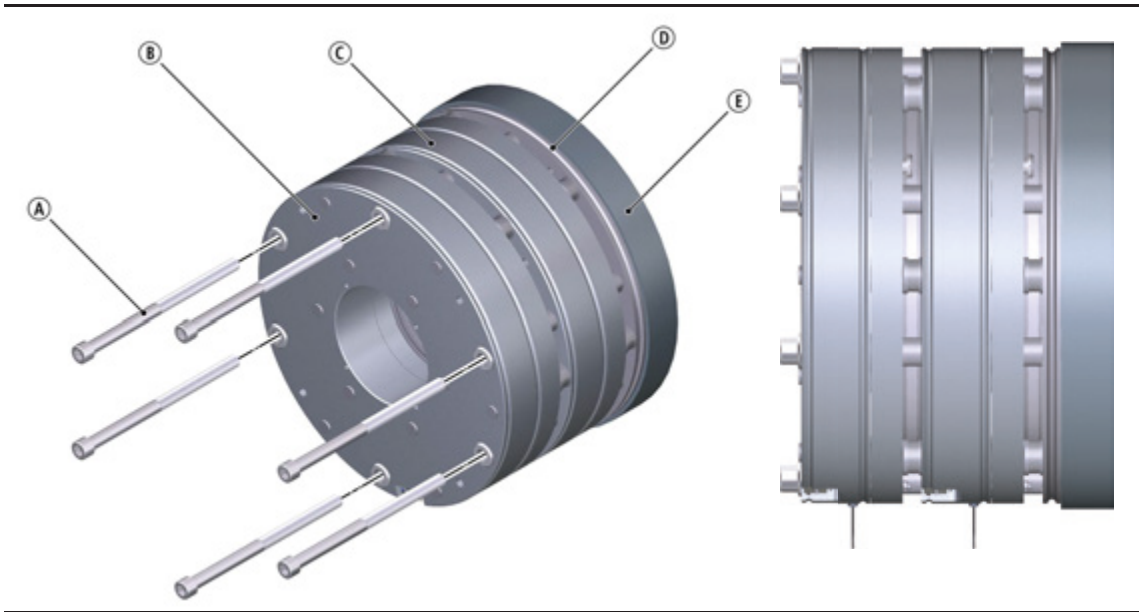


Fig. 12: Mounting the second stator

- Ⓐ Fastening screws
- Ⓑ Second complete stator
- Ⓒ First complete stator
- Ⓓ Flange
- Ⓔ End shield

5. Push the complete stator onto the shaft.
6. Align the through holes in the complete stator to the threads of the fastening bore holes in the first stator.
7. Evenly tighten the brake with the six socket head cap screws included in the scope of supply in several runs using a torque wrench.
8. Establish the electrical connection and energize the brake (siehe Chapter [Electrical connection](#), Page 38).

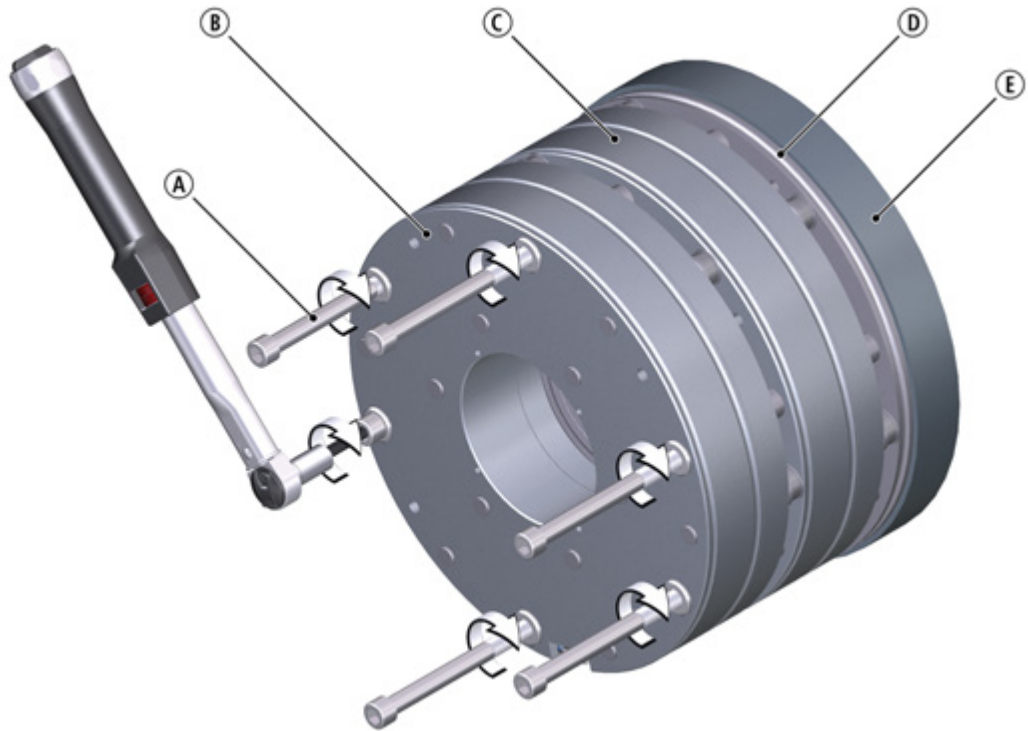


Fig. 13: Tighten using a torque wrench

- Ⓐ Fastening screws
- Ⓑ Second complete stator
- Ⓒ First complete stator
- Ⓓ Flange
- Ⓔ End shield

9. Use a torque wrench to retighten the supplied fastening screws with the required tightening torque, as shown in the table Rated data: screw kit for brake assembly onto flange, Page 15.
10. Switch off the power.

Checking the air gap

	<p>⚠ DANGER</p> <p>Danger: rotating parts!</p> <p>Switch off the voltage. The brake must be free of residual torque.</p>
--	--

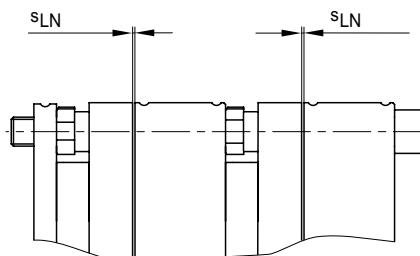


Fig. 14: Checking the air gap

- Check the air gap near the screws by means of a feeler gauge. Compare the measured values to the values for "s_{L,N}" in the table (Rated data, Page 14).



Notice

Do not insert feeler gauge more than 10 mm between armature plate and stator!

5.6 Cover ring assembly



NOTICE

Brakes without flange require a groove at the end shield for the lip of the cover ring.

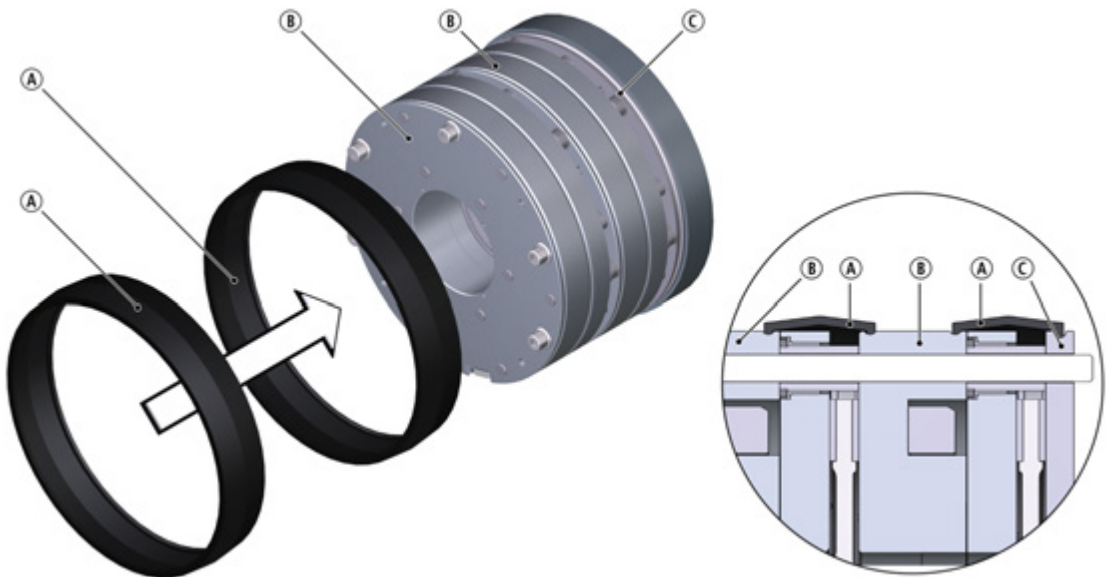


Fig. 15: Cover ring assembly

Ⓐ Cover ring

Ⓑ Complete stator

Ⓒ Flange

- Disconnect electrical connection.
- Pull the cable through the cover rings.
- Push the cover rings over the complete stators.
- Press the lips of the first cover ring into the groove of the complete stator and flange / end shield.
- Press the lips of the second cover ring into the groove of the first and second complete stators.
- Re-establish the electrical connection.



NOTICE

Cover ring with condensation drain hole:
Attach the cover ring so that condensation can drain through the bore hole.

5.7 Mounting the hand-release (retrofitting)



Notice

- The hand-release is designed for activation via a Bowden cable.
- For activation without a Bowden cable, the lever has to be extended.
- An individual brake circuit can only be released electrically.

The hand-release is mounted when the double-spring-applied brake is installed. No power is applied to the brake.

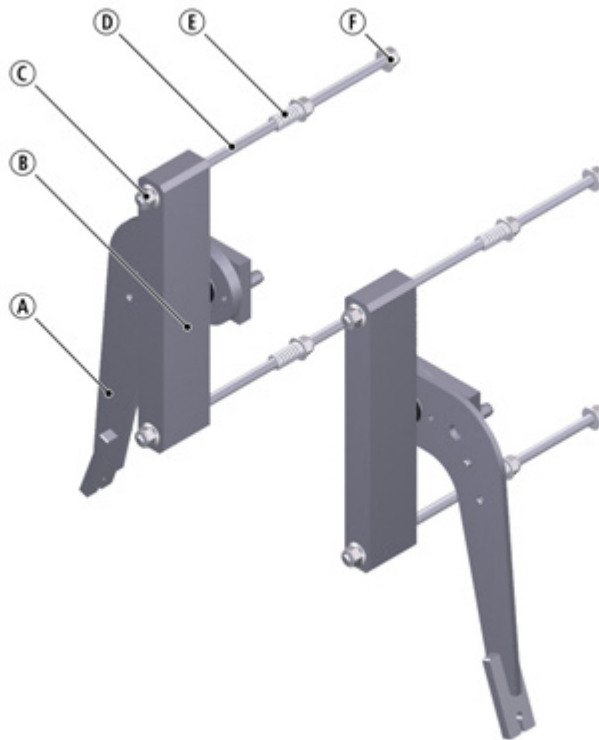


Fig. 16: Components of the hand-release

- | | | |
|----------------------|-------------------|--------------------|
| Ⓐ Hand-release lever | Ⓑ Clip | Ⓒ Self-locking nut |
| Ⓓ Tension rod | Ⓔ Pressure spring | Ⓕ Self-locking nut |

1. Mount the first rotor, the first complete stator, and the second rotor according to Chapter [Brake mounting, Page 25](#).



Fig. 17: Applying the hand-release lever

- | | | |
|-------------------------|--------------------------|---------|
| Ⓐ Hand-release lever | Ⓑ Second complete stator | Ⓒ Rotor |
| Ⓓ First complete stator | Ⓔ End shield | |

- Put both levers completely onto the second complete stator. To do this, push in the plates' pins into the corresponding holes of the stator (using a suitable tool).



Notice

The plates are not symmetric. The pin with the greater distance from the axis of rotation must be oriented towards the outside. The lever must also face outwards.

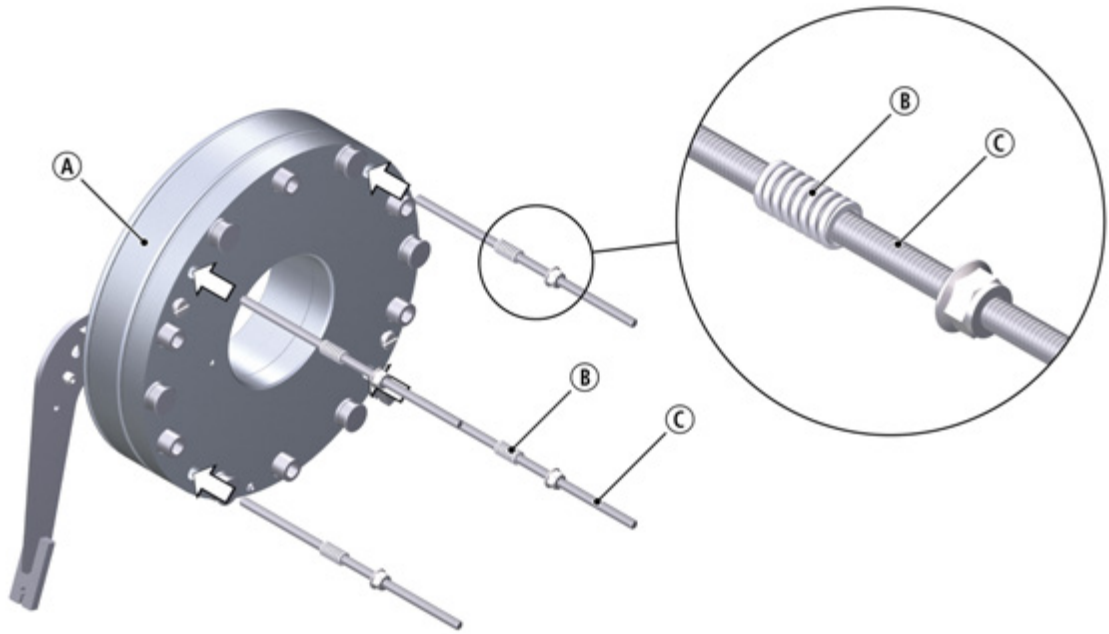


Fig. 18: Installation of the tension rods

- Ⓐ Second complete stator Ⓑ Pressure spring Ⓒ Tension rod

3. Assemble the four pre-assembled tension rods with one spring each.



Notice

Carry out steps 4 and 5 separately for each side of every lever.

4. From the armature plate end, plug one pair of pre-assembled tension rods each into the provided bore holes (Ø 9 mm) of the second stator. Insert the springs of the tension rod into the clearing hole of the armature plate (Ø 13.5 mm).

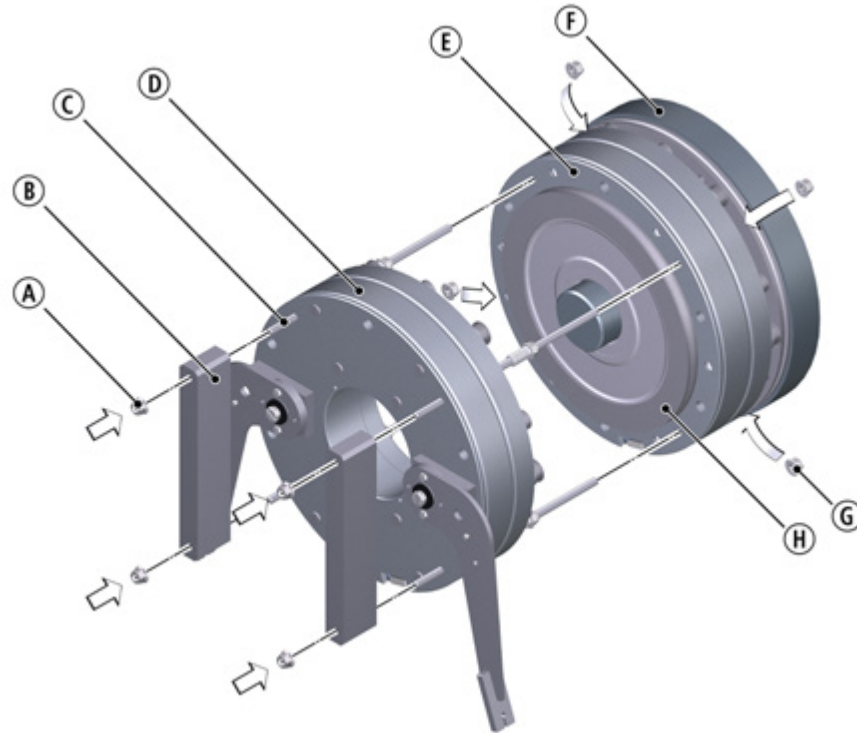


Fig. 19: Final installation of the hand-release

- | | | |
|--------------------------|-------------------------|---------------|
| Ⓐ Self-locking nut | Ⓑ Clip | Ⓒ Tension rod |
| Ⓓ Second complete stator | Ⓔ First complete stator | Ⓕ End shield |
| Ⓖ Self-locking nut | Ⓗ Rotor | |

5. Attach the clips with the bore holes (\varnothing 9 mm) to the tension rods and tighten them with the lock nuts. The blind holes (\varnothing 17 mm) are now pointing in the direction of the stator and the screw heads of the hand-release levers are completely sunk into the clips.
6. Position the second stator in front of the first complete stator. Insert the pre-assembled tension rods into the through holes (\varnothing 9 mm) of the first complete stator.



NOTICE

Make sure that the tension rods are not bent!

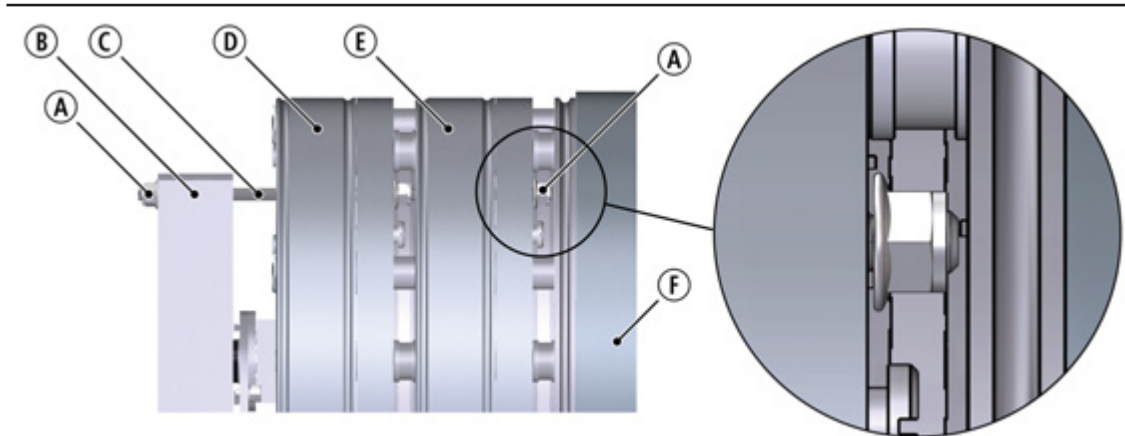


Fig. 20: Hand-release at the motor

- | | | |
|--------------------------|-------------------------|---------------|
| Ⓐ Self-locking nut | Ⓑ Clip | Ⓒ Tension rod |
| Ⓓ Second complete stator | Ⓔ First complete stator | Ⓕ End shield |

7. Screw four lock nuts between the motor end shield and the complete stator onto the tension rods up to the point where the back side of the lock nut aligns with the top of the tension rod.
8. Evenly tighten the brake with the six socket head cap screws included in the scope of supply in several runs using a torque wrench.
9. Establish the electrical connection and energize the brake (siehe Chapter [Electrical installation](#), Page 37).
10. Use a torque wrench to re-tighten the supplied fastening screws with the required tightening torque ([Rated data: screw kit for brake assembly onto flange](#), Page 15).
11. Switch off the power.

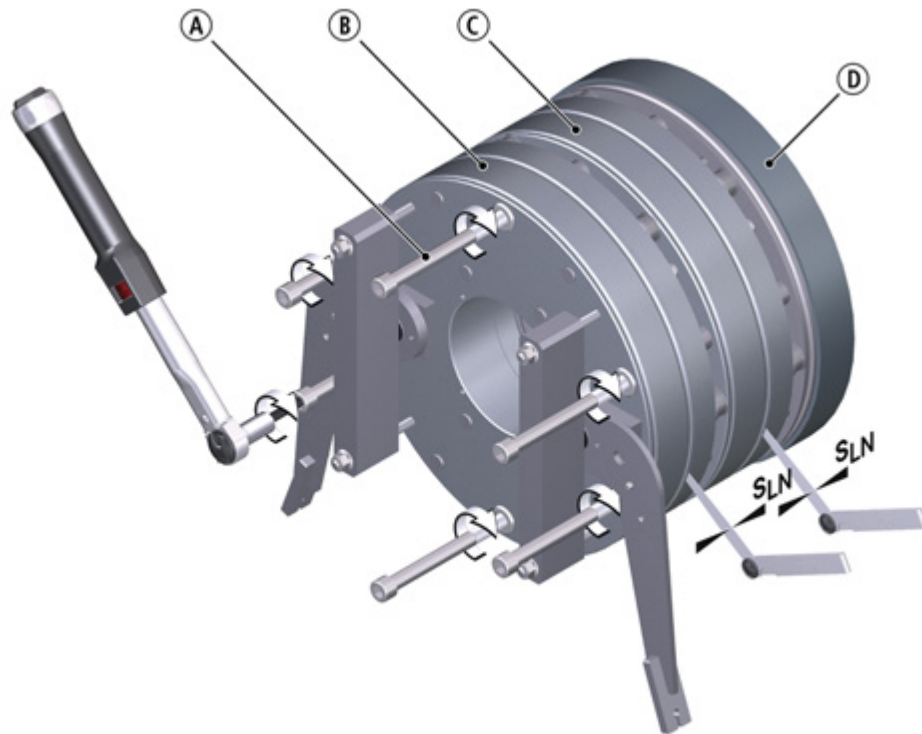







Fig. 21: Checking the air gap

- Ⓐ Self-locking nut Ⓑ Second complete stator Ⓒ First complete stator
Ⓓ End shield

12. Check the air gap using a feeler gauge (s_{LN} refer to table [Rated data, Page 14](#)), as shown in the Figure [Checking the air gap, Page 29](#).
13. Connect the Bowden cable (not included in this delivery) and pull until the motor shaft can be freely rotated.


6 Electrical installation

Important notices and information

	<p>⚠ DANGER</p> <p>There is a risk of injury by electrical shock!</p> <ul style="list-style-type: none"> ■ The electrical connections may only be made by trained electricians! ■ Make sure that you switch off the electricity before working on the connections! There is a risk of unintended start-ups or electric shock.
	<p>NOTICE</p> <p>Make sure that the supply voltage matches the voltage specification on the name plate.</p>
	<p>NOTICE</p> <ul style="list-style-type: none"> ■ If an emergency stop is carried out without the required suppressor circuit, the control unit may be destroyed. ■ Observe the correct polarity of the suppressor circuit!
	<p>NOTICE</p> <ul style="list-style-type: none"> ■ To functionally test the individual brake circuits, the power supply must be able to be switched off individually. For a new over-energizing during switch-on, it is also necessary to open switches K1/K3. ■ The protective circuitry contained in the INTORQ switching device BEG-561-xxx is not permitted for use in the lift system. The protective circuitry must be connected in parallel to the brake coil (refer to the figure Switching suggestions for the BFK455-25, Page 38).
	<p>NOTICE</p> <ul style="list-style-type: none"> ■ Only operate the brake with a holding current reduced to 25 % of P_N ! ■ You can use the INTORQ switching device BEG-561-xxx for this purpose.

6.1 Electrical connection

⚠ DANGER



There is a risk of injury by electrical shock!
The brake must only be electrically connected when no voltage is applied!

Switching suggestions

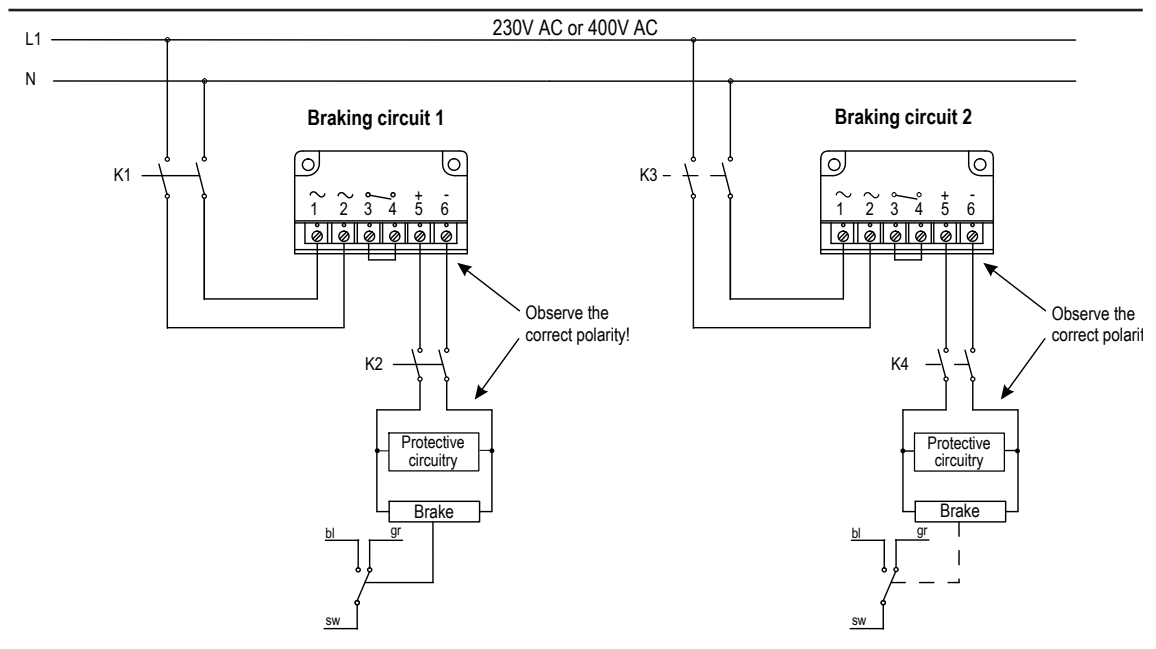


Fig. 22: Switching suggestions for the BFK455-25

Switching on

- K2/K4 must be switched on **before or at the same time** as K1/K3!

Switching off

- Normal - AC switching
 - K2/K4 remain closed
 - K1/K3 open
- Emergency stop - DC switching
 - K1/K3 and K2/K4 are opened at the same time



Notice

Recommended current load for the micro-switches

- DC current: 10 mA to 100 mA at 12 V
- AC current: 10 mA to 5 A at 12 V / max. 250 V

- Suppressor circuit: the limit voltage impacts the switching times (siehe the table [Switching energy - operating frequency - switching times](#), Page 16).

6.2 Bridge/half-wave rectifier (optional)

BEG-561-□□□-□□□

The bridge-half-wave rectifiers are used to supply electromagnetic DC spring-applied brakes which are approved for use with such rectifiers. Other use is only permitted with the approval of INTORQ.

Once a set overexcitation period has elapsed, the bridge-half-wave rectifiers switch over from bridge rectification to half-wave rectification.

Terminals 3 and 4 are in the DC circuit of the brake. The induction voltage peak for DC switching (refer to the circuit diagram DC switching at the motor – fast engagement) is limited by an integrated overvoltage protection at terminals 5 and 6.

6.2.1 Assignment: Bridge/half-wave rectifier – brake size

Rectifier type	Connection voltage	Coil voltage Release / holding	Assigned brake
	[V AC]	[V DC]	
BEG-561-255-130	230 ±10%	205 / 103	BFK455-25 (205 V)
BEG-561-440-130	400 ±10%	360 / 180	BFK455-25 (360 V)

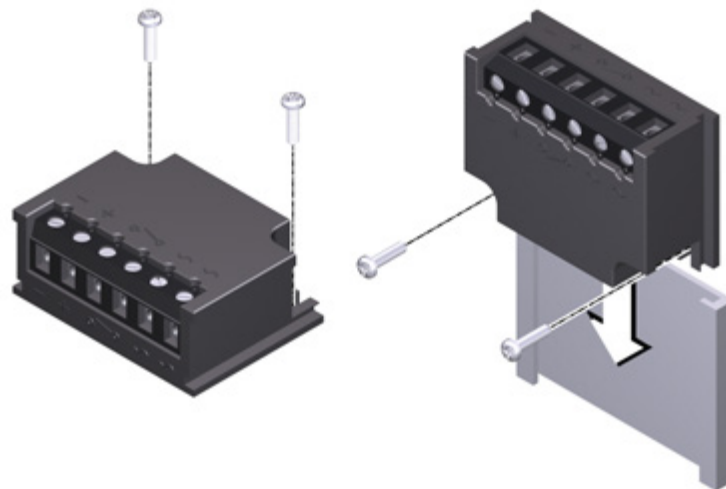


Fig. 23: BEG-561 fastening options

6.2.2 Technical specifications

Rectifier type	Bridge / half-wave rectifier
Output voltage for bridge rectification	$0.9 \times U_1$
Output voltage for half-wave rectification	$0.45 \times U_1$
Ambient temperature (storage/operation) [°C]	-25 – +70
U_1 input voltage (40 – 60 Hz)	

Type	Input voltage U_1 (40 Hz – 60 Hz)			Max. current I_{max}		Overexcitation period t_{ue} ($\pm 20\%$)		
	Min.	Rated	Max.	Bridge	half-wave	at U_{1min}	at U_{1Nom}	at U_{1max}
	[V~]	[V~]	[V~]	[A]	[A]	[s]	[s]	[s]
BEG-561-255-030	160	230	255	3.0	1.5	0.430	0.300	0.270
BEG-561-255-130						1.870	1.300	1.170
BEG-561-440-030-1	230	400	440	1.5	0.75	0.500	0.300	0.270
BEG-561-440-130				3.0	1.5	2,300	1.300	1.200

Tab. 6: Data for bridge/half-wave rectifier type BEG-561

6.2.3 Permissible current load at ambient temperature

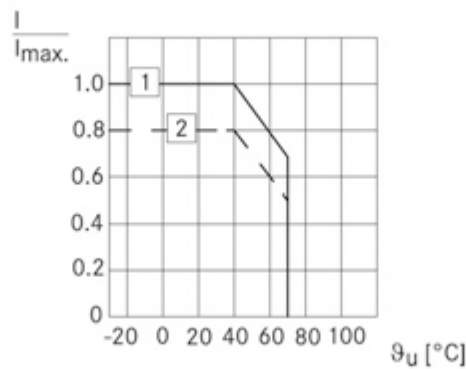






Fig. 24: Permissible current load

- ① If screwed to metal surface (good heat dissipation)
- ② For other installations (e.g. with adhesive)

7 Commissioning and operation


Important notes

	 DANGER
	<p>Danger: rotating parts!</p> <ul style="list-style-type: none"> ■ The running rotor must not be touched. ■ Take structural design measures on your final product and implement organizational safety rules to ensure that nobody can touch a rotor.
	 DANGER
	<p>There is a risk of injury by electrical shock!</p> <p>The live connections must not be touched.</p>

7.1 Function checks before initial commissioning

7.1.1 Brake with micro-switch

1. The switching contact for the brake must be open.
2. Remove two bridges from the motor terminals to de-energize the motor.
 - Do not switch off the voltage supply to the brake.

	NOTICE
	<p>If the brake is connected via the neutral point of the motor, this connection must also be used for connecting the neutral conductor.</p>

3. Apply DC voltage to the brake.
4. Measure the AC voltage at the motor terminals. The measured level must be zero.
5. Close the switching contact for the brake.
 - The brake is released.
6. Measure the DC voltage at the brake:
 - After the over-excitation time (refer to the table [Data for bridge/half-wave rectifier type BEG-561, Page 40](#)), the measured DC voltage must correspond to the holding voltage (refer to [Assignment: Bridge/half-wave rectifier – brake size, Page 39](#)). A deviation of $\pm 10\%$ is permissible.
7. Check the air gap "s_L".
8. It must be zero and the rotor must rotate freely.
9. Check the switching status of the micro-switch (siehe to table [Switching status of micro-switch, Page 42](#)).
10. Open the switching contact for the brake.
 - The brake is applied.

11. Check the switching status of the micro-switch (siehe to table [Switching status of micro-switch, Page 42](#)).
12. Switch off DC voltage for the brake.
13. Screw the bridges onto the motor terminals.
14. If necessary, remove the neutral conductor from the neutral point (step 2).

Contact type	Connection	Brake released	Micro-switch closed
N/C contact	black / grey	yes	no
		no	yes
NO contact	black / blue	yes	yes
		no	no


Tab. 7: Switching status of micro-switch


The preparations for commissioning are completed.

7.2 Commissioning

1. Switch on drive system.
2. Carry out a braking test.

7.3 During operation

	⚠ DANGER
	<p>Danger: rotating parts!</p> <ul style="list-style-type: none"> ■ The brake must be free of residual torque. ■ The drive must not be running when checking the brake.


	⚠ DANGER
	<p>There is a risk of injury by electrical shock!</p> <p>The live connections must not be touched.</p>

- Checks must be carried out regularly. Pay special attention to:
 - unusual noises or temperatures
 - loose fixing elements
 - the condition of the electrical cables
- The armature plate must be attracted and the rotor must move without residual torque.
- Measure the DC voltage at the brake.
 - After the over-excitation time (refer to the table [Data for bridge/half-wave rectifier type BEG-561, Page 40](#)), the measured DC voltage must correspond to the holding voltage (refer to [Assignment: Bridge/half-wave rectifier – brake size, Page 39](#)). A deviation of $\pm 10\%$ is permissible.
- If a fault occurs once, go through the troubleshooting table (siehe the chapter [Troubleshooting and fault elimination, Page 48](#)). If the fault cannot be fixed or eliminated, please contact the customer service department.

8 Maintenance and repair

INTORQ spring-applied brakes are wear-resistant and designed for long maintenance intervals. The friction lining and braking mechanism are subject to operational wear. To ensure safe and trouble-free operations, the brake must be checked at regular intervals and replaced when necessary (refer to the table [Maintenance intervals, Page 44](#)).

8.1 Wear of spring-applied brakes

	<p>⚠ WARNING</p>
	<p>Braking torque reduction</p> <p>The system must not be allowed to continue operations after the maximum air gap s_{Lmax} has been exceeded. Exceeding the maximum air gap can cause a major reduction in the braking torque!</p>

The table below shows the different causes of wear and their impact on the components of the spring-applied brake. The influential factors must be quantified so that the service life of the rotor and brake can be calculated and so that the prescribed maintenance intervals can be specified accurately. The most important factors in this context are the applied friction work, the initial speed of rotation of braking and the operating frequency. If several of the causes of friction lining wear occur in an application at the same time, the effects should be added together when the amount of wear is calculated.

Component	Cause	Effect	Influencing factors
Friction lining	Braking during operation	Wear of the friction lining	Friction work
	Emergency stops		
	Overlapping wear during start and stop of drive		
	Active braking via the drive motor with support of brake (quick stop)		
	Starting wear in case of motor mounting position with vertical shaft, even when the brake is not applied		Number of start/stop cycles
Armature plate and flange	Rubbing and friction of the brake lining	Armature plate and flange are run in	Friction work
Gear teeth of brake rotor	Relative movements and shocks between brake rotor and brake hub / toothed shaft	Wear of gear teeth (primarily on the rotor side)	Number of start/stop cycles
Brake support	Load reversals and jerks in the backlash between the armature plate and guide pins	Breaking of armature plate and guide pins	Number of start/stop cycles, braking torque
Springs	Axial load cycle and shear stress of springs through radial backlash on reversal of armature plate	Reduced spring force or fatigue failure	Number of switching operations of brake

Tab. 8: Causes for wear

8.2 Inspections

To ensure safe and trouble-free operations, the spring-applied brakes must be checked at regular intervals and, if necessary, replaced. Servicing at the facility will be easier if the brakes are made accessible. This must be considered when installing the drives in the plant.

Primarily, the required maintenance intervals for industrial brakes result from their load during operation. When calculating the maintenance interval, all causes for wear must be taken into account. (Refer to the table Causes for wear). For brakes with low loads (such as holding brakes with emergency stop function), we recommend a regular inspection at a fixed time interval. To reduce costs, the inspection can be carried out along with other regular maintenance work in the plant.

Failures, production losses or damage to the system may occur when the brakes are not serviced. Therefore, a maintenance strategy that is adapted to the particular operating conditions and brake loads must be defined for every application. For the spring-applied brakes, the maintenance intervals and maintenance operations listed in the table below must be followed. The maintenance operations must be carried out as described in the detailed descriptions.

8.2.1 Maintenance intervals

Size	Operating brakes	Holding brakes with emergency stop
BFK455-25	<ul style="list-style-type: none"> ■ according to the service life calculation 	<ul style="list-style-type: none"> ■ at least every 2 years
	<ul style="list-style-type: none"> ■ or else every six months 	<ul style="list-style-type: none"> ■ after 1 million cycles at the latest*
	<ul style="list-style-type: none"> ■ after 4000 operating hours at the latest 	<ul style="list-style-type: none"> ■ Plan shorter intervals for frequent emergency stops.

8.3 Maintenance





Notice



Brakes with defective armature plates, springs or flanges must be completely replaced. Observe the following for inspections and maintenance works:

- Contamination by oils and greases should be removed using brake cleaner, or the brake should be replaced after determining the cause. Dirt and particles in the air gap between the stator and the armature plate endanger the function and should be removed.
- After replacing the rotor, the original braking torque will not be reached until the run-in operation for the friction surfaces has been completed. After replacing the rotor, the run-in armature plates and the flanges have an increased initial rate of wear.

8.3.1 Release / voltage



1. Put the motor and the controller into operations.

	 DANGER
	<p>Danger: rotating parts! The running rotor must not be touched.</p>

	 DANGER
	<p>There is a risk of injury by electrical shock! The live connections must not be touched.</p>



2. Observe the air gap " s_L " when the drive is running. The air gap must be zero.
3. Measure the DC voltage at the brake.
 - After the over-excitation time, the measured DC voltage must correspond to the holding voltage (refer to [Assignment: Bridge/half-wave rectifier – brake size, Page 39](#)). Deviations up to ± 10 are permissible.

8.3.2 Checking the air gap

	 DANGER
	<p>Danger: rotating parts! The motor must not be running during this check.</p>



1. Shut down the motor and the controller!
2. Measure the air gap " s_L " near the fastening screws between the armature plate and the stator using a feeler gauge.
3. Compare the measured air gap to the max. permissible air gap " s_{Lmax} ". (Refer to the table [Rated data, Page 14](#) for the values.)
4. When necessary, replace both rotors completely.

8.3.3 Checking the rotor thickness

	 DANGER
	Danger: rotating parts! The motor must not be running when checking the rotor thickness.

1. Shut down the motor and the controller!
2. Remove the motor cover.
3. Remove the cover ring, when present.
4. Measure the rotor thickness using a caliper gauge.
5. Compare the measured rotor thickness with the minimum permissible rotor thickness (for the values, refer to the table [Kenndaten Luftspaltangaben, Page 14](#)). If the measured rotor thickness is insufficient, the rotor must be replaced completely. (Refer to the description at [Replacing the rotor, Page 46.](#))

8.3.4 Replacing the rotor

	 DANGER
	Danger: rotating parts! Switch off the voltage. The brake must be free of residual torque.

1. Remove the connection cables.
2. Loosen the screws evenly and then remove them.
3. Pay attention to the connection cable during this step! Remove the complete stator from the end shield.
4. Pull the rotor off the gear teeth.
5. Check the shaft's gear teeth.
6. In wear is visible, follow the instructions from the drive manufacturer.
7. Check the end shield's friction surface. Replace the friction surface on the end shield when there is clearly visible scoring at the running surface. In case of strong scoring on the end shield, rework the friction surface.
8. Mount the new rotor and the stator.
9. Re-connect the connection cables.

8.4 Spare parts list

- Only parts with item numbers are available.
 - The item numbers are only valid for the standard design.
- Please include the following information with the order:
 - Order number of the brake
 - Position number of the spare part

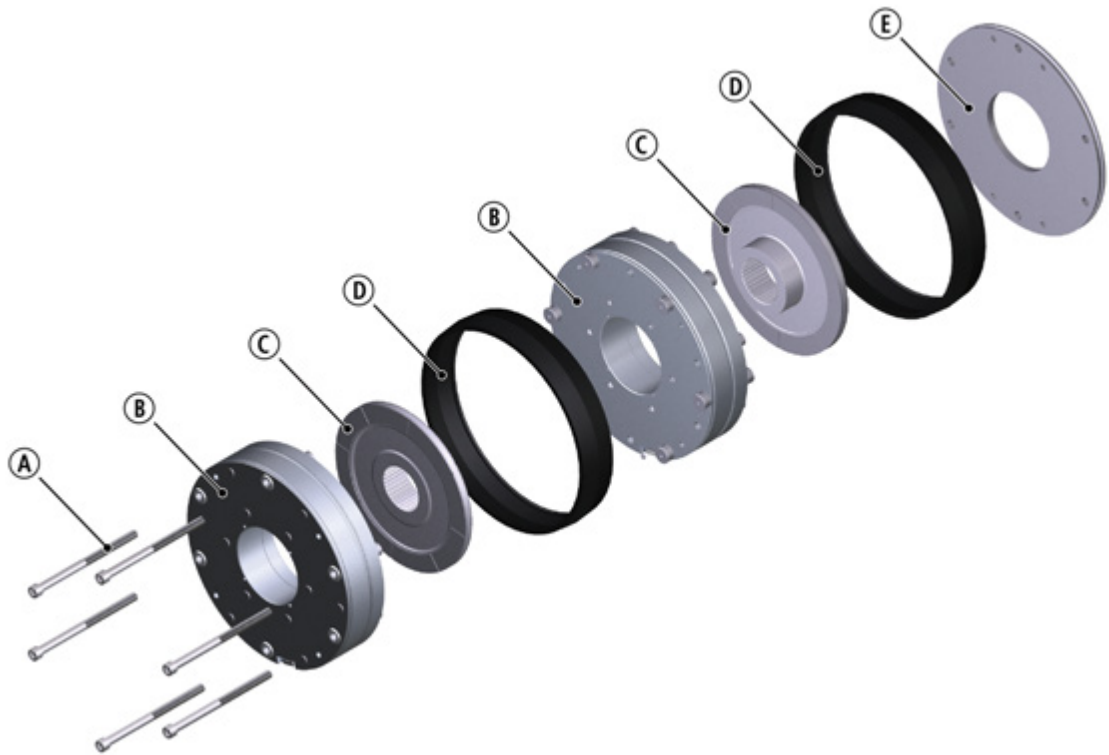


Fig. 25: Spring-applied brake 455-25

	Designation	Variant
A	Fastening screws Socket head cap screw set, DIN912	<ul style="list-style-type: none"> ■ for mounting to the flange with through-holes ■ for mounting to the motor
B	Complete stator	Voltage
C	Complete rotor	
D	Cover ring	
E	Flange	

9 Troubleshooting and fault elimination

If any malfunctions should occur during operations, please check for possible causes based on the following table. If the fault cannot be fixed or eliminated by one of the listed steps, please contact customer service.

Fault	Cause	Remedy
Brake cannot be released, air gap is not zero	Coil interruption	<ul style="list-style-type: none"> ■ Measure coil resistance using a multimeter: <ul style="list-style-type: none"> – If resistance is too high, replace the complete stator.
	Coil has contact to earth or between windings	<ul style="list-style-type: none"> ■ Measure coil resistance using a multimeter: <ul style="list-style-type: none"> – Compare the measured resistance with the nominal resistance. Refer to <u>Rated data for coil power, Page 15</u> for the values. If resistance is too low, replace the complete stator. ■ Check the coil for short to ground using a multimeter: <ul style="list-style-type: none"> – If there is a short to ground, replace the complete spring-applied brake. ■ Check the brake voltage (refer to section on defective rectifier, voltage too low).
	Wiring defective or wrong	Check the wiring and correct. <ul style="list-style-type: none"> ■ Check cable for continuity using a multimeter <ul style="list-style-type: none"> – Replace defective cable.
	Rectifier defective or incorrect	<ul style="list-style-type: none"> ■ Measure rectifier DC voltage using a multimeter. ■ If DC voltage is zero: <ul style="list-style-type: none"> ■ Check AC rectifier voltage. ■ If AC voltage is zero: <ul style="list-style-type: none"> – Switch on power supply – Check fuse – Check wiring. ■ If AC voltage is okay: <ul style="list-style-type: none"> – Check rectifier, – Replace defective rectifier ■ Check coil for inter-turn fault or short circuit to ground. ■ If the rectifier defect occurs again, replace the entire spring-applied brake, even if you cannot find any fault between turns or short circuit to ground. The error may only occur on warming up.

Fault	Cause	Remedy
Brake cannot be released, air gap is not zero	Incorrect micro-switch wiring	Check the wiring of the micro-switch and correct it.
	Micro-switch incorrectly set	Replace the complete stator and make a complaint about the setting of the micro-switch to the manufacturer.
	Air gap "s _L " is too large	<ul style="list-style-type: none"> ■ For adjustable brakes: <ul style="list-style-type: none"> – Adjust the air gap (Adjusting the air gap). ■ For non-adjustable brakes: <ul style="list-style-type: none"> – Replace all rotors.
Rotor cannot rotate freely	Air gap "s _L " too small	Check the air gap "s _L " and adjust if necessary (Adjusting the air gap).
Rotor is too thin	Rotor has not been replaced in time	Replace the rotor (Replace rotor).
The voltage is not zero during the functional test (refer to the chapter Function checks before initial commissioning, Page 41).	Incorrect micro-switch wiring	Check and correct the wiring of the micro-switch.
	Micro-switch defective or incorrectly set	Replace the complete stator and return the defective complete stator to the manufacturer.
Voltage too high	Brake voltage does not match the rectifier	Adjust rectifier and brake voltage to each other.
Voltage too low	Brake voltage does not match the rectifier	Adjust rectifier and brake voltage to each other.
	Defective rectifier diode	Replace the defective rectifier with a suitable undamaged one.
AC voltage is not mains voltage	Fuse is missing or defective	Select a connection with proper fusing.
	Incorrect micro-switch wiring	Check and correct the wiring of the micro-switch.
	Micro-switch defective or incorrectly set	Replace the complete stator and return the defective complete stator to the manufacturer.

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