



INTORQ

setting the standard

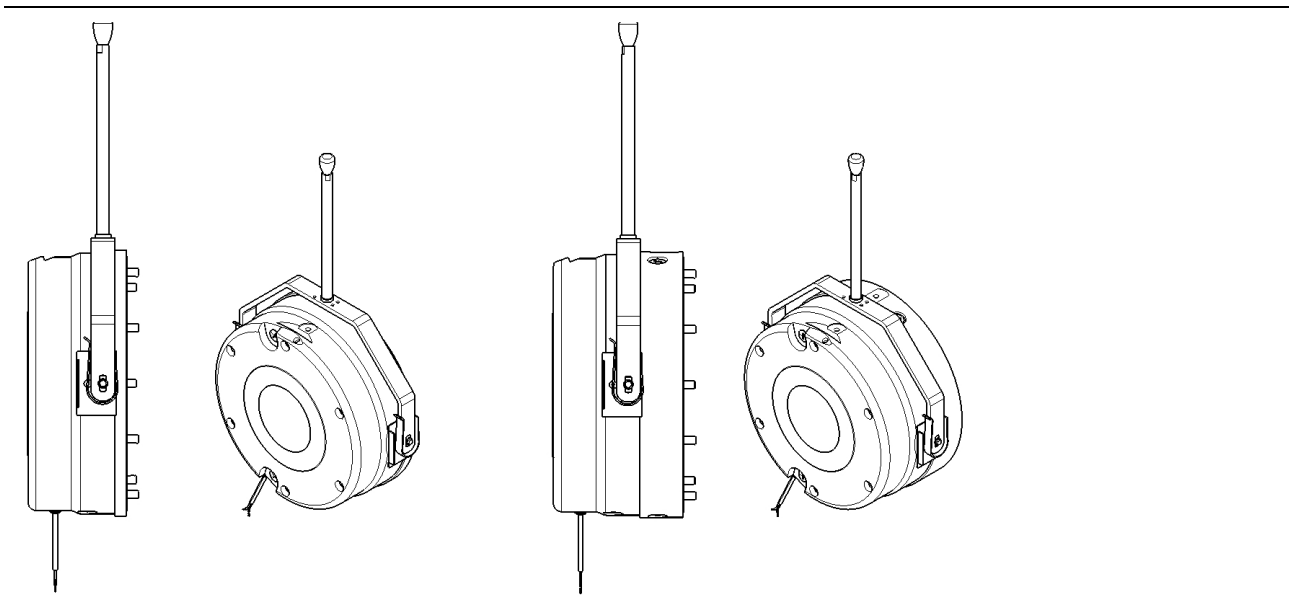
INTORQ BFK471-25

Electromagnetically Released Spring-Applied Brake

Translation of the Original Operating Instructions

www.intorq.com

This documentation applies to the:



Product key

INTORQ B FK □□□ - □□

Product group: Brakes

Product type Spring-applied brake

Type: 471

Size: 25

Not coded: Supply voltage, hub bore hole, options

Identification

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

The information in the following tables corresponds to the positions on the package label and the nameplate.

Packaging label

Manufacturer		Bar code
Type (see product key)		Type number
Designation		
Release voltage/holding voltage	Rated torque	Quantity per box
Release power/holding power	Hub diameter	Packaging date
Note		CE mark

Nameplate

Manufacturer		CE mark
Type (see product key)		
Release voltage/holding voltage	Release power/holding power	Hub diameter
Type number	Rated torque	Date of manufacture

Document history

Material number	Version			Description
33002383	1.0	02/2016	SC	First edition

Refer to www.intorq.de for the latest version of these operating instructions.

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1 Preface and general information

1.1 About these Operating Instructions




- These Operating Instructions will help you to work safely with the spring-applied brake with electromagnetic 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 Terminology used

Term	In the following text used for
Spring-applied brake	Electromagnetically Released Spring-Applied Brake
Drive system	Drive systems with spring-applied brakes and other drive components

1.3 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
Symbols	Page reference		Reference to another page with additional information For example:  16 = refer to page 16
	Wildcard	<input type="checkbox"/>	Wildcard for options, selections For example: BFK458- <input type="checkbox"/> <input type="checkbox"/> = BFK458-10
	Note		Important notice about ensuring smooth operations or other key information.

1.4 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 fixing 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	Max. permissible friction energy for cyclic switching, depending on the switching frequency
R_N	Ohms	Rated coil resistance at 20 °C
S_h	1/h	Operating frequency: the number of switching operations evenly spread over the time unit
S_{hue}	1/h	Transition switching frequency, thermal parameter of the brake
S_{hmax}	1/h	Maximum permissible switching 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
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_{dyn}
t_3	ms	Slipping time, operation time of the brake (according to t_{11}) until standstill




Letter symbol	Unit	Designation
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	Over-excitation time
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

1.5 Safety instructions and notices








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

Safety instructions

Structure of safety instructions:

	 SIGNAL WORD
	Icon Indicates the type of danger
	Signal word Characterizes the type and severity of danger
	Note Describes the danger
	Possible consequences ■ List of possible consequences if the safety instructions are disregarded
	Protective measure ■ List of protective measures to avoid the danger

Danger level

	<p> DANGER</p> <p>DANGER indicates a hazardous situation which, if not avoided, <i>will</i> result in death or serious injury.</p>
	<p> WARNING</p> <p>WARNING indicates a potentially hazardous situation which, if not avoided, <i>could</i> result in death or serious injury.</p>
	<p> CAUTION</p> <p>CAUTION indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.</p>
	<p>NOTICE</p> <p>Notice about a harmful situation with possible consequences: the product itself or surrounding objects could be damaged.</p>

1.6 Scope of 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.

1.7 Disposal

The spring-applied brake consists of different types of material.

- Recycle the metal and plastic parts.
- Ensure professional disposal of assembled circuit boards according to the applicable environmental regulations.

1.8 Drive systems

Labelling

Drive systems and components are unambiguously designated by the indications on the nameplate.

Manufacturer: INTORQ GmbH & Co. KG, Wülmser Weg 5, D-31855 Aerzen, Germany

- The spring-applied INTORQ brake is also delivered in single modules which can then be put together by the customer according to their requirements. The specifications – particularly the packaging label, nameplate and type code – apply to a complete stator.
- The labelling is not included when modules are delivered individually.

1.9 Legal regulations

Liability

- The information, data and notes in these Operating Instructions met the state of the art 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

- Terms of warranty: Refer to the terms of sale and delivery for 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.

2 Safety instructions

2.1 General safety instructions

- INTORQ components:
 - ... must only be used as directed.
 - ... must not be used if they are noticeably damaged.
 - ... must not be technically modified.
 - ... must not be commissioned if they are incompletely mounted or connected.
 - ... must not be operated without the required covers.
 - ... can include live (current-carrying) as well as moving or rotary parts during operation according to their degree of protection. Surfaces may be hot.
- For INTORQ components:
 - ... the documentation must always be kept at the installation site.
 - ... only permitted accessories are allowed to be used.
 - ... only original spare parts of the manufacturer are allowed to be used.
- Follow all specifications and information found in the corresponding enclosed documentation. These must be followed to maintain safe, trouble-free operations and to achieve the specified product characteristics.
- Only qualified, skilled personnel are permitted to work on and with INTORQ components. According to IEC 60364 or CENELEC HD 384, qualified, skilled personnel are persons:
 - ... who are familiar with the installation, mounting, commissioning, and operation of the product.
 - ... who have the qualifications necessary for their occupation.
 - ... who know and apply all regulations for the prevention of accidents, directives, and laws relevant on site.
- Risk of burns!
 - Surfaces may be hot during operation! Provide for protection against accidental contact.
- Risk of injury due to a rotating shaft!
 - Wait until the motor is at standstill before you start working on the motor.
- The friction lining and the friction surfaces must never contact oil or grease since even small amounts reduce the braking torque considerably.
- The brake is designed for operation under the environmental conditions that apply to IP66 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.

2.2 Application as directed

- INTORQ components:
 - ... are intended for use in machinery and systems.
 - ... must only be used for the purposes ordered and confirmed.
 - ... must only be operated under the ambient conditions prescribed in these Operating Instructions.
 - ... must not be operated beyond their corresponding power limits.

Any other use or excessive usage is considered improper!

Usage conditions for the INTORQ spring-applied brake

- No explosive or aggressive atmosphere.
- Humidity: no restrictions
- Ambient temperature:
 - Standard design:
-20 °C to +40 °C
- At high humidity and low temperature:
 - Take measures to protect the armature plate and rotor from freezing.
- Protect the electrical connections against any contact or touching.

Check bore hole




NOTICE


In the case of strongly fluctuating temperatures/increased water condensation, drain the condensed water from time to time via the check hole (metal screwed cap, refer to Figure 1 and 2) provided for this purpose.

3 Technical specifications

3.1 Product description

3.1.1 Important notes

	NOTICE
	This brake should only be operated with the bridge-half-wave rectifier (included in delivery). The power during the release is 440 W for 1.3 sec., then it is reduced to 110 W.

 **NOTICE**
 Due to the structural design of the stator, the air gap cannot be installed downstream.

- When the wear limit is reached:
 - in the case of the single-rotor design, the rotor must be replaced
 - in the case of the double-rotor design, the "Flange complete" unit and the rotor must be replaced.

Single-rotor design

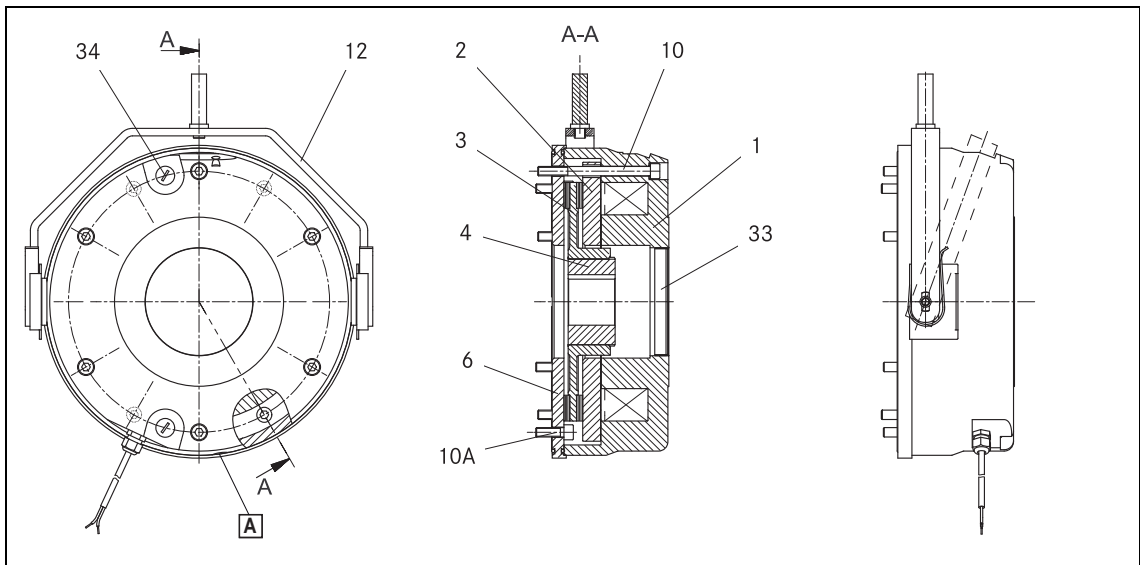


Fig. 1 Design of the BFK471-25 spring-applied brake, single-rotor design

A Check hole, air gap with plug screw

- | | | |
|--------------------|--|---------------------------|
| 1 Stator, complete | 4 Hub | 12 Manual release |
| 2 Armature plate | 6 Flange | 33 Hollow shaft end cover |
| 3 Complete rotor | 10 Six socket head cap screws, DIN EN ISO 4762 | 34 Plug screw |
| | 10A Four socket head cap screws, DIN EN ISO 4762 (short) | |

Double-rotor design

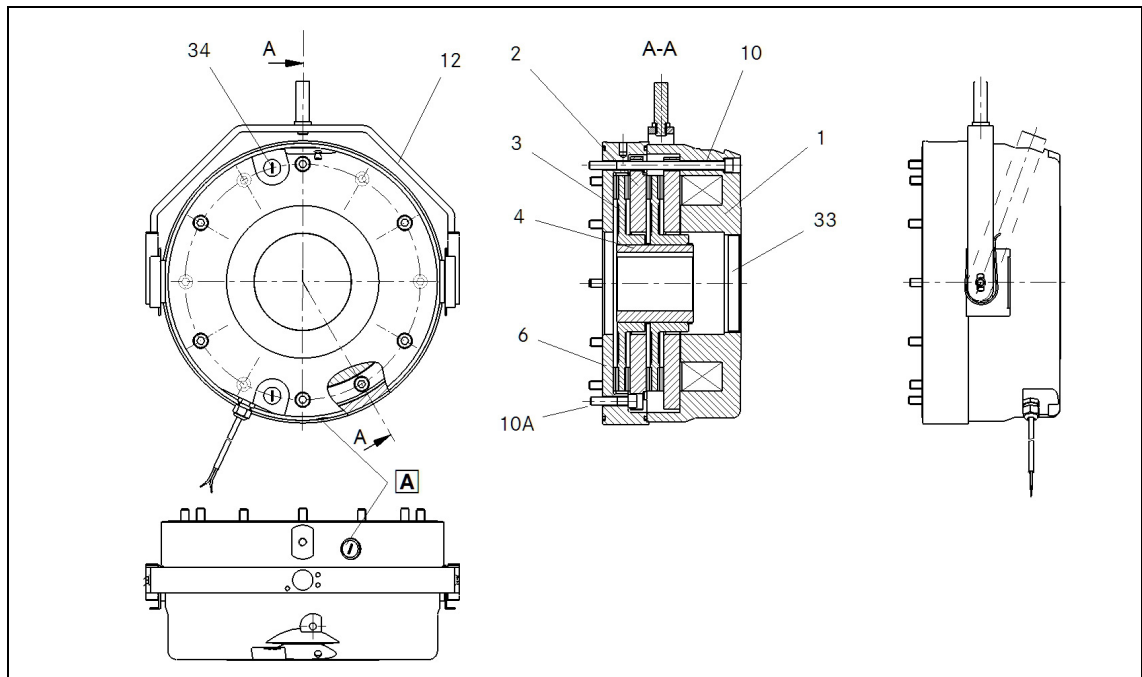


Fig. 2 Design of the BFK471-25 spring-applied brake, double-rotor design

A Check hole, air gap with plug screw

- | | | |
|--------------------|---|---------------------------|
| 1 Stator, complete | 4 Hub | 12 Manual release |
| 2 Armature plate | 6 Flange | 33 Hollow shaft end cover |
| 3 Complete rotor | 10 Six socket head cap screws, DIN EN ISO 4762 | 34 Plug screw |
| | 10A Six socket head cap screws, DIN EN ISO 4762 (short) | |

The spring-applied brake is designed for converting mechanical work and kinetic energy into heat energy. Due to the static braking torque, loads can be held at standstill. Emergency braking is possible at high speed of rotation. The wear increases as the switching energy increases (operating speeds 15).

The spring-applied brake is a disc brake with two or four friction surfaces, depending on the design. The braking torque is generated by several pressure springs with friction locking. The braking circuits are released electromagnetically.

3.1.2 Brakes

During the braking procedure, the pressure springs use the armature plate (2) to press the rotor (3) (which can be shifted axially on the hub (4)) against the friction surface. The asbestos-free friction linings ensure high braking torque and low wear. The braking torque is transmitted between the hub (4) and the rotor (3) via gear teeth.



3.1.3 Brake release

When the brakes are applied, an air gap "s_L" is present between the stator (1) and the armature plate (2). To release the brake, the coil of the stator (1) is energised with the DC voltage provided. The resulting magnetic flux works against the spring force to draw the armature plate (2) to the stator (1). This releases the rotor (3) from the spring force and allows it to rotate freely

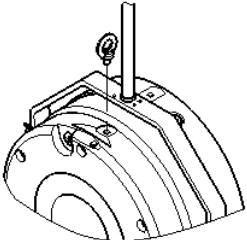
3.1.4 Project planning notes

- The brakes are dimensioned in such a way that the given rated torques are reached safely after a short run-in process.
- However, since 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.

3.2 Transporting the brake

	 CAUTION
<p>Risk of injury Auxiliary transport materials (e.g. eye bolts or bearing plates) must be screwed in completely. They must also be attached so that they are flat and level! Auxiliary transport materials (e.g. eye bolts or bearing plates) should be loaded perpendicular to their screw axis! Angled or lateral stresses reduce their load-carrying capacity! Follow the specifications in DIN 580! Use suitable means for carrying so that the load direction is perpendicular and a high load-carrying capacity is ensured. Secure the carrying materials so that they cannot slip!</p>	

These brakes come standard with threaded holes for attaching eye bolts according to DIN 580. The locations of the threaded holes are shown in the following illustration. The eye bolts are not included.

Positioning	Threaded hold, standard eye bolt
	M10, DIN 580

Tab. 1: Positioning of the eye bolt

3.3 Rated data

Type BFK471-25	Max. speed of rotation ¹⁾ n_{max} [rpm]	Heat class Stator	Operating time [%]	Moment of inertia Rotor [kgcm ²]	Weight			
					Hub [kg]	Flange [kg]	Stator complete [kg]	Brake [kg]
with one rotor	1800	F	100	200	1.8	7.2	46.5	58
double rotor				200+200	2.7	23.8		75

Tab. 2: General brake characteristics

¹⁾ Maximum speed of rotation when installed horizontally (for higher speeds, contact the manufacturer)




Type BFK471-25	Air gap		Rotor thickness	
	s_{LN} [mm]	s_{Lmax} [mm]	min. [mm]	max. [mm]
with one rotor	0.5	1.5	19.1	20.0
double rotor	0.8		19.7 + 19.7	

Tab. 3: Air gap / rotor thickness; monitor using the  feeler gauge through the check hole

Type BFK471-25	Outer diameter [mm]	Pitch circle		Fixing screws DIN EN ISO 4762 - 8.8 [mm]	Minimum thread depth [mm]	Tightening torque M_A [Nm]
		\varnothing [mm]	Thread			
with one rotor	333	278	Twelve M10	Six M10x120 * Four M10x30	19	48 ±10%
double rotor				Six M10x160 * Six M10x45		

Tab. 4: Installation data

* Notice: When handling seals

	 CAUTION
	<ul style="list-style-type: none"> The minimum thread depth of the end shield must be maintained!  Tab. 4. If the required thread depth is not maintained, the fixing 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!

3.4 Rated data (dimensioning data) electrical data

Type	Voltage		Power		Coil resistance	Current	
	Release ±10% (1.3 sec.)	Holding ±10%	Brake release	Holding		Brake release	Holding
	U _L [V DC]	U _H [V DC]	P _L [W]	P _H [W]		I _L [A]	I _H [A]
BFK471-25	205	103	440	110	96.5	2.14	1.07
	360	180			294.6	1.22	0.61

Tab. 5: Coil powers of the BFK471-25



Type BFK471-25	Rated torque M _{dyn} at 100 rpm [Nm]	Reduction of rated torque M _{dyn} to X [%]	
		1500 rpm	1800 rpm
Design			
with one rotor	750	70 %	65 %
double rotor	1500		

Tab. 6: Rated torque reduction depending on the speed of rotation

3.5 Switching times

Engagement time

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

- The engagement times apply for **DC switching** with a spark suppressor.
 - Spark suppressors are available for the rated voltages.
 - Connect the spark suppressors in parallel to the contact. If this switching 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.
 - Circuit proposals:  29
- The engagement times are approx. 10 times longer with **AC switching**.
 - Connection:  29

Disengagement time

The disengagement time is the same for DC and AC switching. The specified disengagement times always refer to control using over-excitation (i.e. current feed with $U_L = U_N$ (potential difference across air gap = rated coil voltage)).

Type BFK471-25	Rated torque M_{dyn} [Nm]	Max. perm. friction energy Q_E [J]	Transitional switching frequency S_{hue} [1/h]	Switching times [ms] ¹⁾ at s_{LN} and $0.7 I_N$				
				Engaging DC side ¹⁾			Disengaging	
Design				t_{11}	t_{12}	t_1	$t_2 s_{LN}$	$t_2 s_{Lmax.}$
with one rotor	750	90000	16	120	200	320	350	1050
double rotor	1500	180000	8				450	

Tab. 7: Friction work - switching frequency - switching times

¹⁾ Measured with induced voltage limitation of -150 V DC

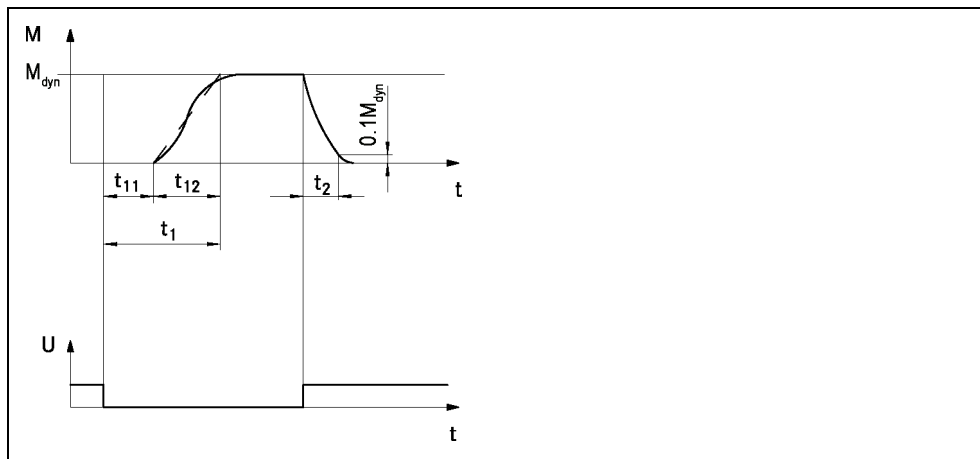


Fig. 3 Operating/switching times of the spring-applied brakes

- 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} Reaction delay of engagement
- t_{12} Rise time of the braking torque
- U Voltage

3.6 Switching energy / switching frequency

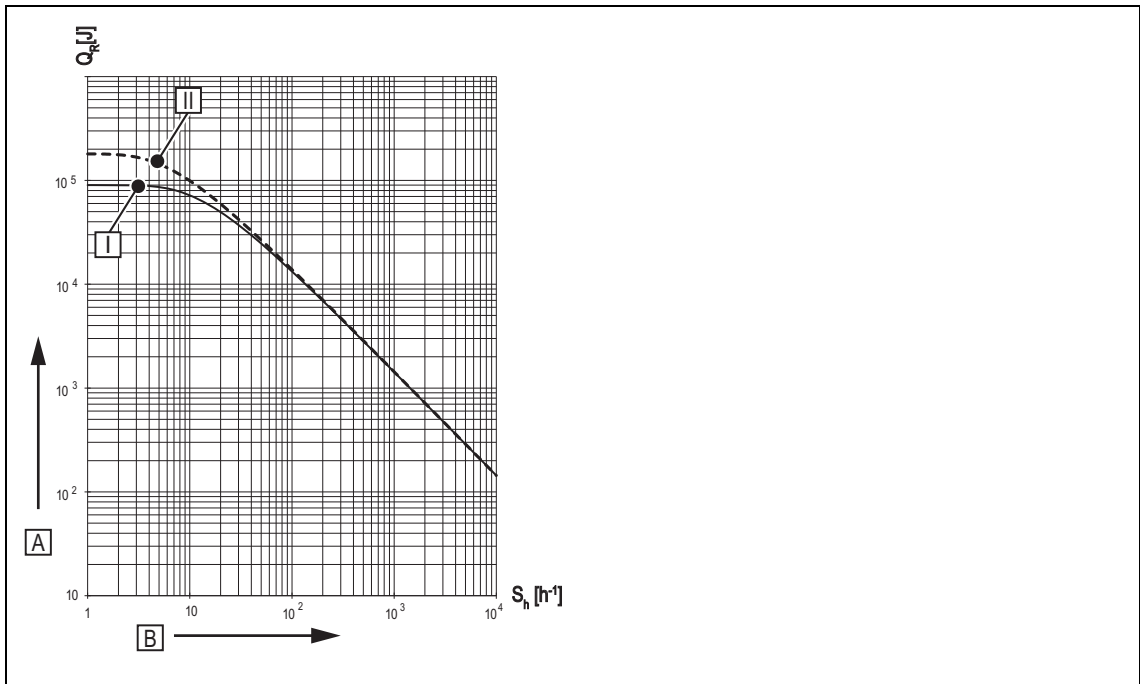


Fig. 4 Switching energy as a function of the switching frequency

A Switching energy Q_R [J]

B Operating frequency S_h [h^{-1}]

I BFK471-25 single-rotor

II BFK471-25 double-rotor

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

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

The permissible switching frequency " S_{hmax} " depends on the amount of heat " Q_R " (refer to Figure 4). At a pre-set switching frequency " S_h ", the permissible amount of heat is " Q_{smax} ".

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.

3.7 Emissions

Electromagnetic compatibility

**NOTICE**

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

If an INTORQ rectifier is used for the DC switching of the spring-applied brake: If the switching frequency exceeds five switching operations per minute, the use of a mains filter is required.

Spark suppressors are available on request, depending on the coil voltage.

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 switching noise during engagement and disengagement varies depending on the air gap, braking torque and brake size.


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

Miscellaneous

The abrasion of the friction parts produces dust.

4 Mechanical installation


4.1 Important notes

	NOTICE
	The toothed hub and screws must not be lubricated with grease or oil.

4.1.1 Design of end shield and motor shaft

- Comply with the mentioned minimum requirements regarding the end shield and the motor 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. Contact INTORQ if you are using other materials.
- The brake flange must be supported by the end shield across the full surface.

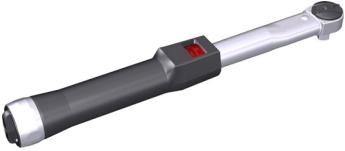

Design of the end shield

Type	Minimum requirements				Miscellaneous
	Material	Evenness [mm]	Axial run-out [mm]	Roughness ¹⁾	
BFK471-25	Cast Steel	< 0.08	0.08	R _z max. 16	<ul style="list-style-type: none"> ■ Threaded holes with minimum thread depth  15 ■ Free of grease and oil



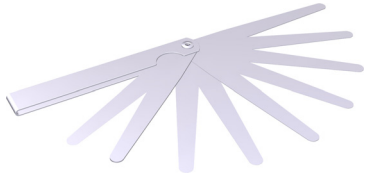
Tab. 8: Minimum requirement for the leakproofness

¹⁾ Especially near the O-rings

4.1.2 Necessary tools

Type	Torque wrench  Measuring range [Nm]	Bit for hexagon socket screws  Wrench width [mm]
BFK471-25	20 - 100	8x½" square

Tab. 9: Required tools

Multi-meter 	Calliper gauge 	Feeler gauge 


Tab. 10: Required measuring instruments

4.2 Assembly

4.2.1 Preparation

1. Unpack the spring-applied brake.
2. Check for completeness.
3. Check the nameplate data (especially the rated voltage).

4.2.2 Brake assembly

	NOTICE
	The toothed hub and screws must not be lubricated with grease or oil.

Installation of the hub onto the shaft

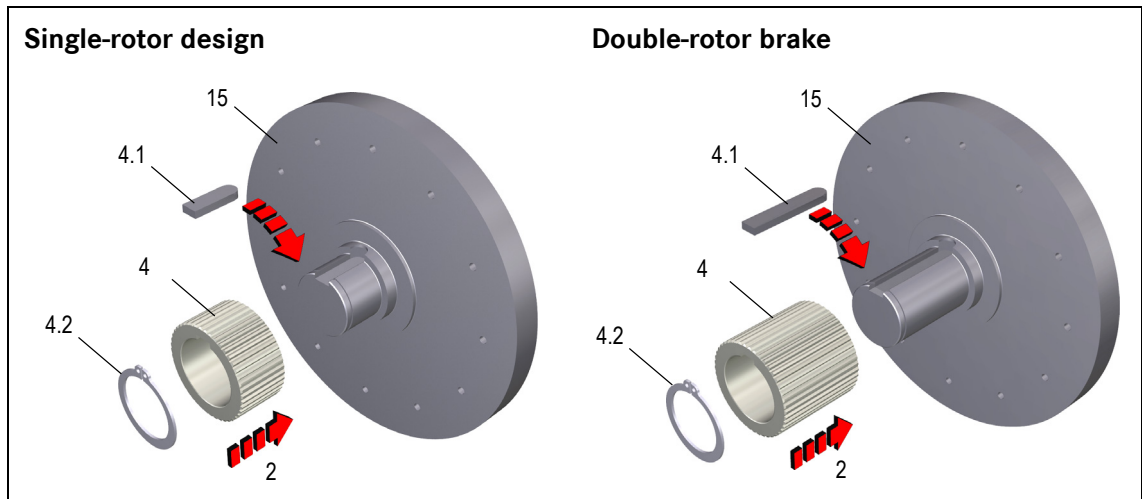



Fig. 5 Installing the hub onto the shaft

- | | | |
|---------------|---------|-------------|
| 4 Hub | 4.1 Key | 4.2 Circlip |
| 15 End shield | | |

1. Insert keyway (4.1) into the shaft.
2. Press the hub (4) onto the shaft.
3. Secure the hub against axial displacement (for example, by using a circlip (4.2)).

	NOTICE
	For reverse operations, we recommend also glueing the hub to the shaft.

Single-rotor design
Mounting the flange

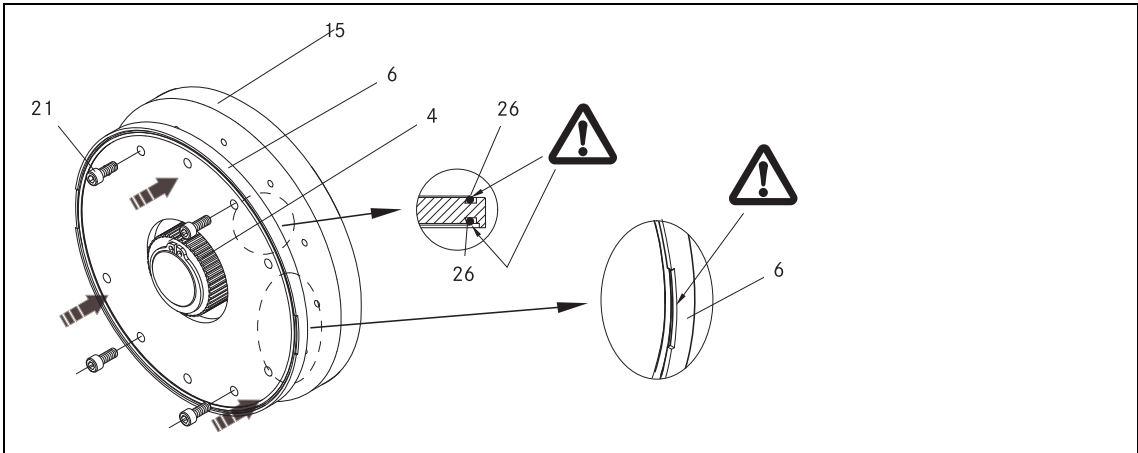


Fig. 6 Assembly of the flange

4	Hub	15	End shield	26	O-rings
6	Flange	21	Fixing screws		

1. Check fit of the two O-rings (26) in the flange (6).
2. Position the flange (6) on the end shield.
 - Observe flange position relating to the recesses for the manual release!
 - The chamfer at the flange must be directed towards the motor end shield!
 - Align through holes of the flange (6) with the fixing holes in the end shield (15) and tighten to the flange using the fixing screws (21). Tightening torque 15 - use a torque wrench!

Assembly of the rotor

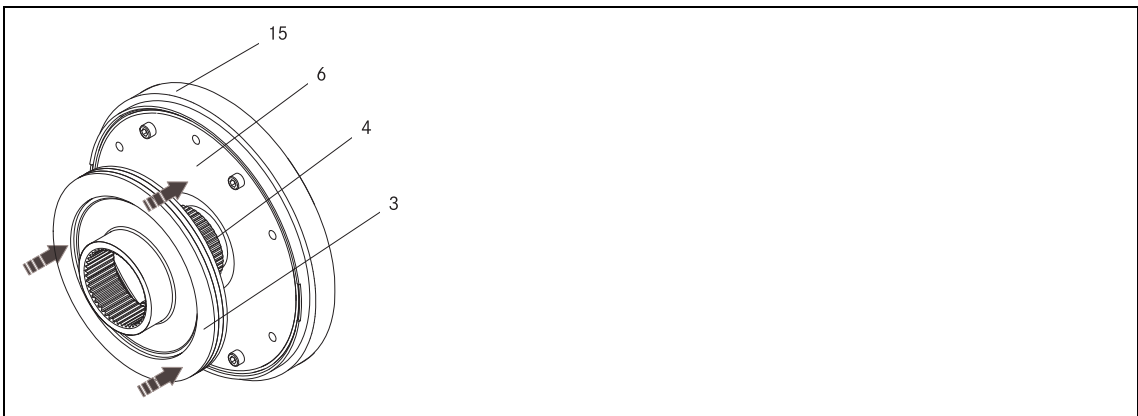


Fig. 7 Mounting the single-rotor version

3	Rotor	6	Flange	15	End shield
4	Hub				

3. Push the rotor (3) onto the hub (4) and check whether it can be moved by hand.

Assembly of the stator

1. Push the complete stator (1) onto the shaft.

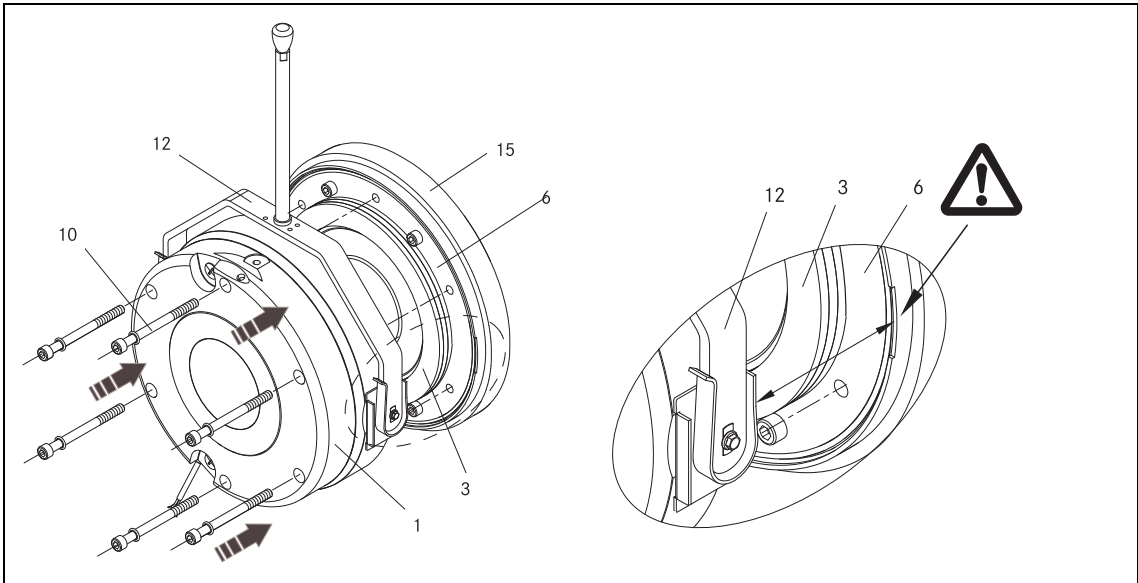


Fig. 8 Assembly of the stator

- | | | |
|--------------------|------------------------------------|----------------------------|
| 1 Stator, complete | 6 Flange | 12 Complete manual release |
| 3 Complete rotor | 10 Socket head cap screw with seal | 15 End shield |



Fig. 9 Mounting the stator to the end shield

2. Screw the complete stator (1) onto the end shield (15) using the screw set supplied (10). Tightening torque 15 - use a torque wrench!

	NOTICE
	In order to ensure that there are no leaks, be sure to use the screw set with seals (included in the delivery)! New seals must always be used!

Double-rotor design
Mounting the flange

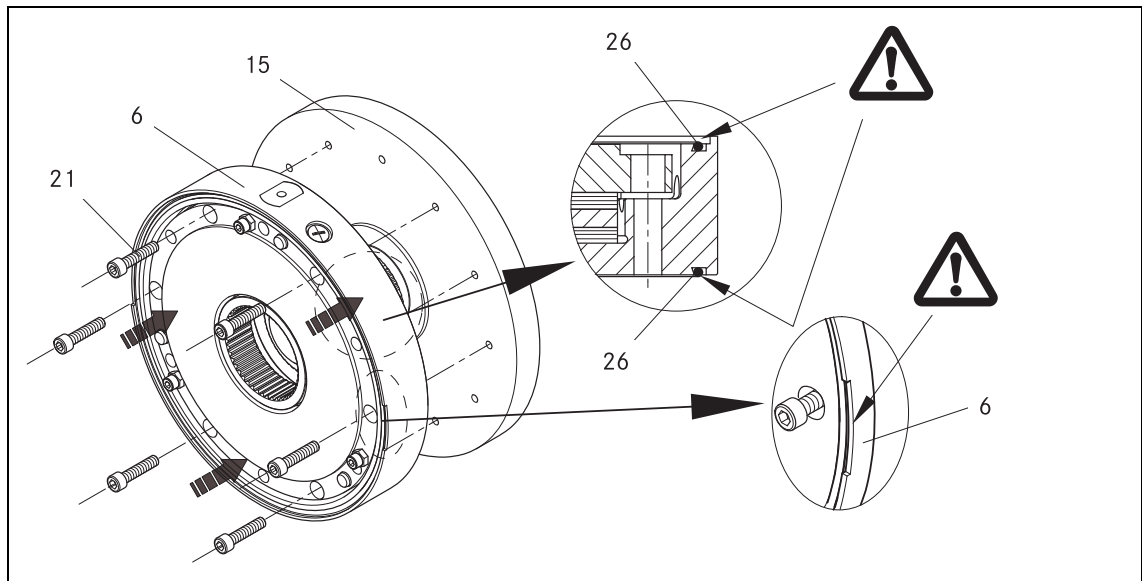



Fig. 10 Assembly of the flange

4	Hub	15	End shield	26	O-rings
6	Flange	21	Fixing screws		

1. Check fit of the two O-rings (26) in the flange (6).
2. Push flange (6) onto the shaft.
 - Observe flange position relating to the recesses for the manual release!
 - The chamfer at the flange must be directed towards the motor end shield!
 - Align through holes of the flange (6) with the fixing holes in the end shield (15) and tighten to the flange using the fixing screws (21). Tightening torque  15 - use a torque wrench!

Assembly of the rotor

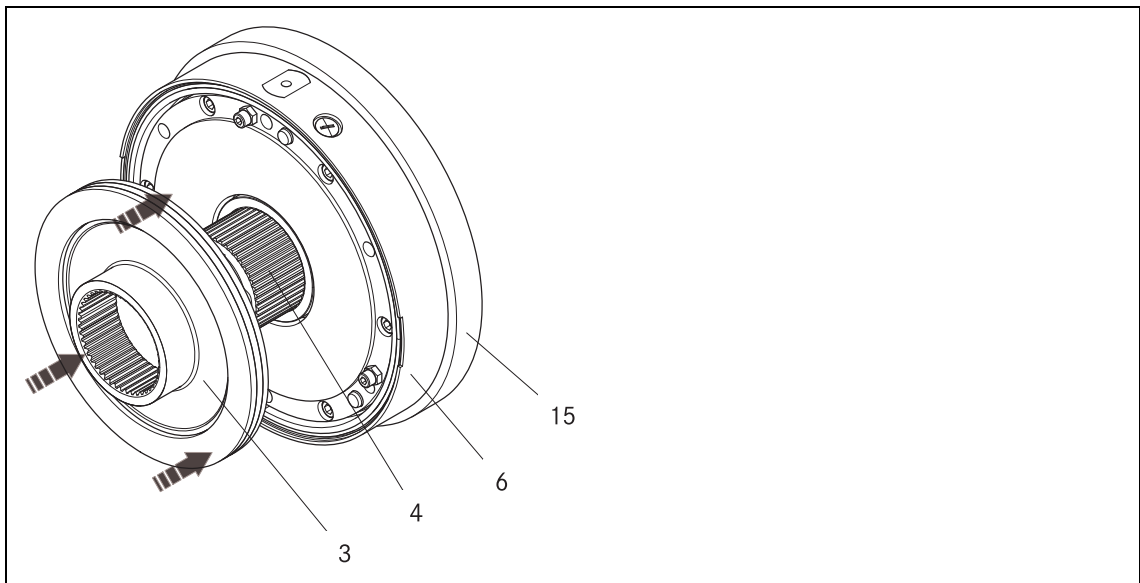


Fig. 11 Mounting of double-rotor design

- | | | | | | |
|---|----------------|---|-----------------|----|------------|
| 3 | Complete rotor | 6 | Complete flange | 15 | End shield |
| 4 | Hub | | | | |

3. Push the rotor (3) onto the hub (4) and check whether it can be moved by hand.

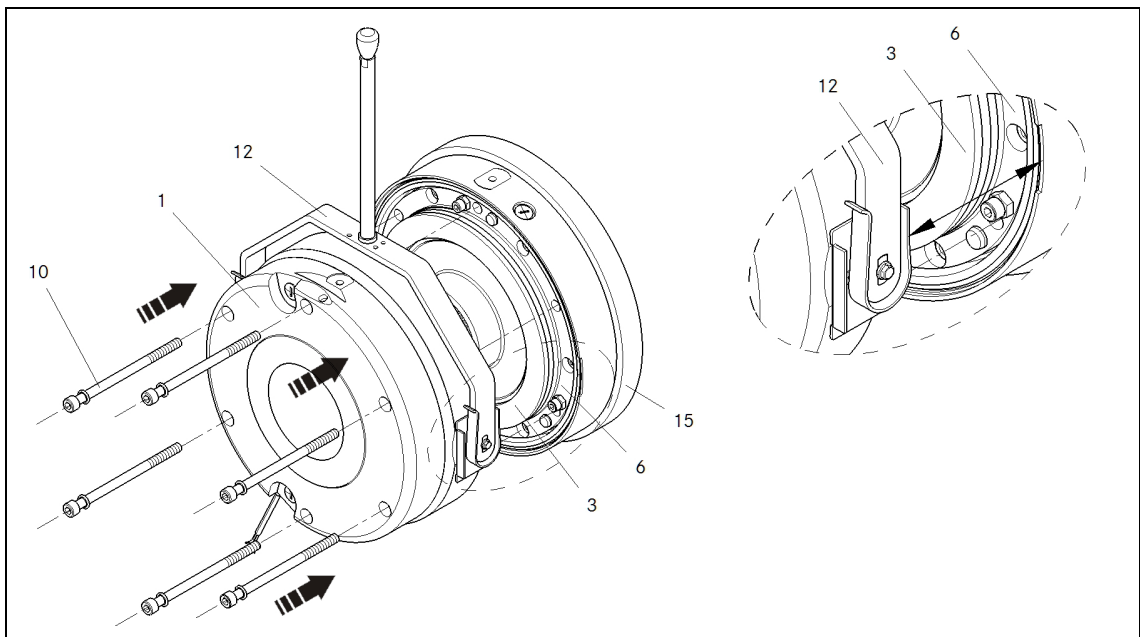




Fig. 12 Mounting the stator (double-rotor version)



Fig. 13 **Mounting the stator to the end shield (double-rotor version)**





- | | | | | | |
|---|------------------|----|---------------------------------|----|-------------------------|
| 1 | Stator, complete | 6 | Complete flange | 12 | Complete manual release |
| 3 | Complete rotor | 10 | Socket head cap screw with seal | 15 | End shield |

4. Screw the complete stator (1) onto the end shield (15) using the screw set supplied (10). Tightening torque  15 - use a torque wrench!

	NOTICE
	In order to ensure that there are no leaks, be sure to use the screw set with seals (included in the delivery)! New seals must always be used!

5 Electrical installation

5.1 Important notes

	 DANGER
	<p>There is a risk of injury by electrical shock!</p> <ul style="list-style-type: none"> ■ The electrical connections must only be made by skilled personnel! ■ Only carry out connection work when no voltage is applied (no live parts)! There is a risk of unintended start-ups or electric shock.
	<p>NOTICE</p> <ul style="list-style-type: none"> ■ Make sure that the supply voltage corresponds to the data on the nameplate.
	<p>NOTICE</p> <p>This brake should only be operated with the bridge-half-wave rectifier (included in delivery). The power during the release is 440 W for 1.3 sec., then it is reduced to 110 W.</p>

5.2 Minimum bending radius for the brake connecting cable


Brake size	Wire cross-section	Minimum bending radius
BFK471-25	AWG 16	8 x 6 = 48.0 mm

5.3 Bridge-half-wave rectifier

BEG-561-□□□-□□□

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

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

Terminals 3 and 4 are located in the DC circuit of the brake. The induction voltage peak for DC switching (see "DC switching - fast engagement" circuit diagram,  30) is limited by an integrated overvoltage protection at terminals 5 and 6.



NOTICE

For more information see the documentation for the bridge-half-wave rectifier (included in the scope of supply).


Rectifier type	Supply voltage	Coil voltage U_L release / U_H holding
	[V AC]	[V DC]
BEG-561-255-130	230 $\pm 10\%$	205 / 103
BEG-561-440-130	400 $\pm 10\%$	360 / 180

Tab. 11: Connection voltages / coil voltages

The brake requires voltage switching. The rated voltage of the brake corresponds to the release voltage $U_N = U_L$.

5.4 Electrical connection

5.4.1 Switching suggestions

	NOTICE
	<p>If the rectifier is connected to the neutral point of the motor, the neutral conductor must also be connected to this point. Otherwise, the rectifier and the brake may be damaged if there is a mains phase loss.</p>

AC switching, delayed engagement

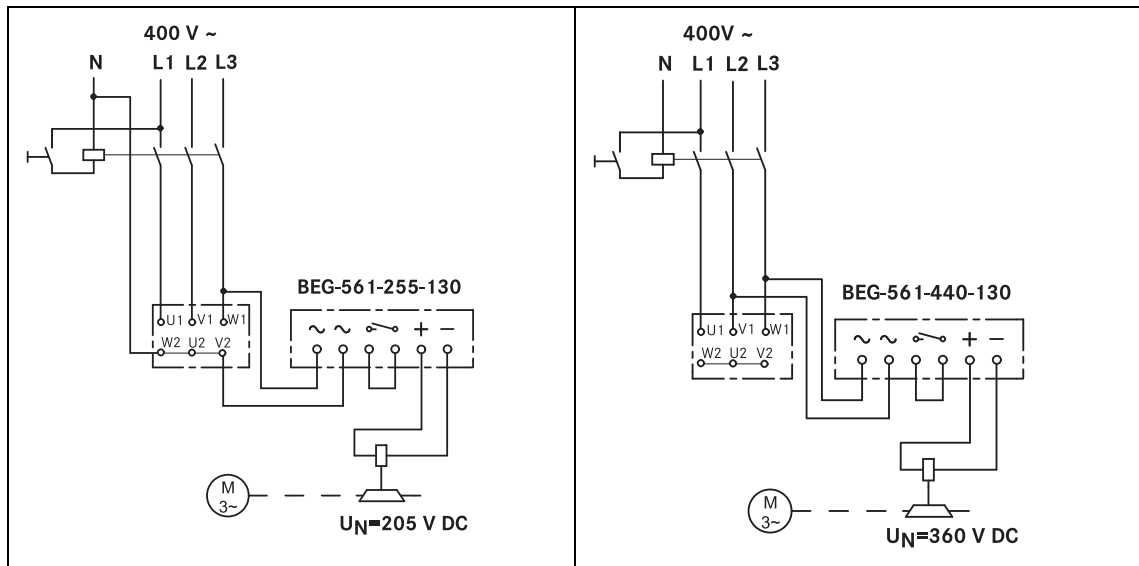


Fig. 14 Bridge-half-wave rectifier in parallel to the motor, extremely delayed engagement

DC switching - fast engagement

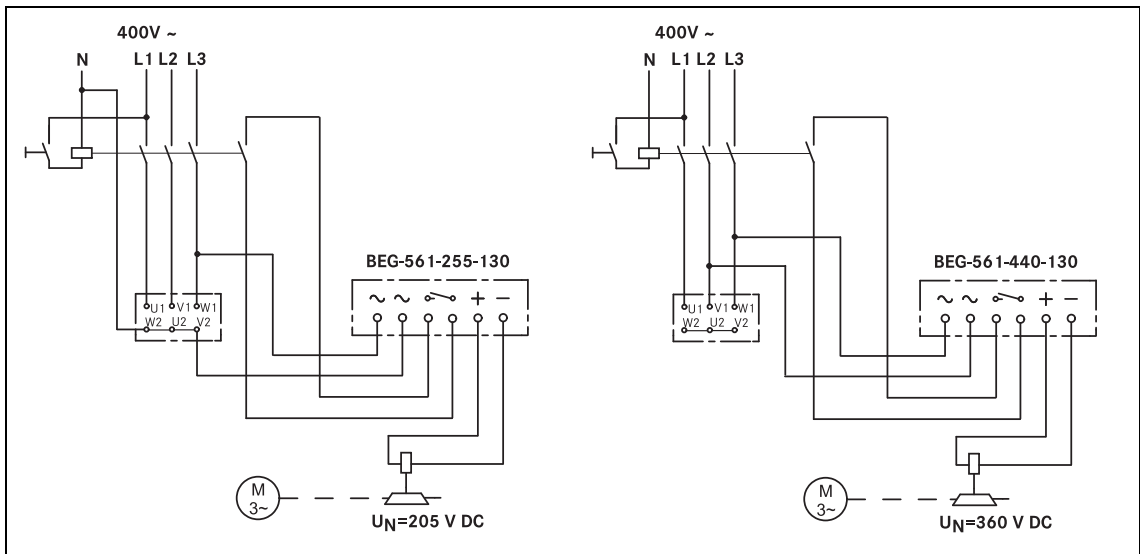


Fig. 15 Bridge-half-wave rectifier with DC-side switching, fast engagement

Inductive proximity switches for release checks

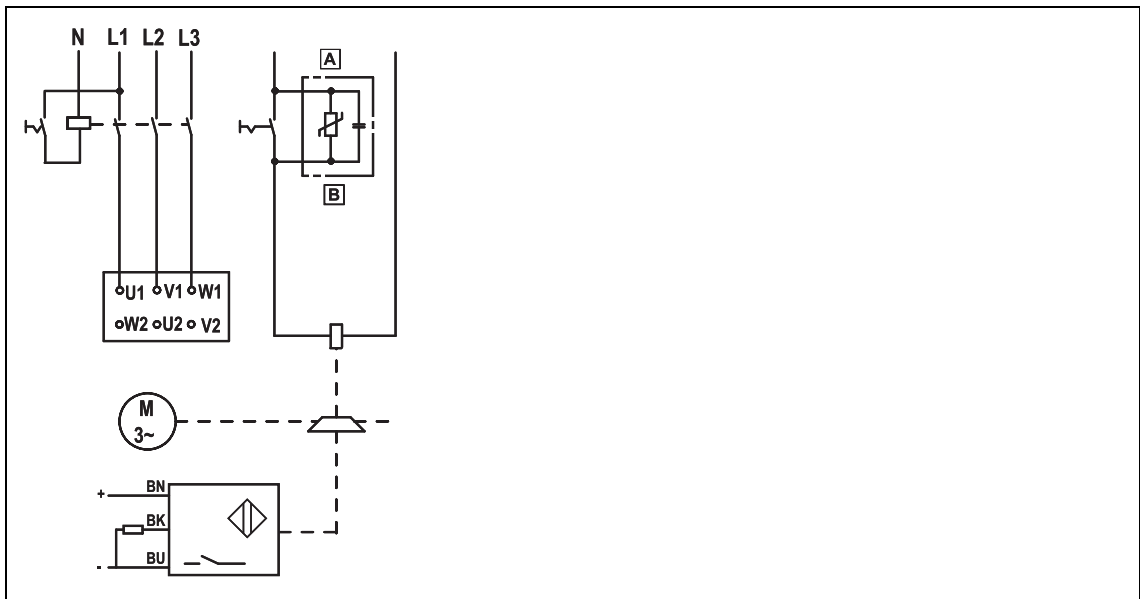


Fig. 16 With inductive proximity switch (release check); circuit diagram is also valid for star connection

- [A] DC voltage depending on coil voltage
- [B] Spark suppressor

Design	PNP, N/O contact
Operating voltage	10 to 30 V
No-load current	10 mA
Output current	Max. 200 mA
Short circuit behaviour	Short circuit protection
Temperature range:	-25 to +125 °C
Protection class	IP67
Cable configuration and parameters	
Grey (sheath insulation)	Ø 3.3 mm / L = 2 m, 3 x 0.14 mm ²
Brown (BN)	+
Black (BK)	Signal when vented armature plate (brake energized)
Blue (BU)	-

Tab. 12: Technical data for inductive proximity switches (release check)

Proximity switch to check for wear

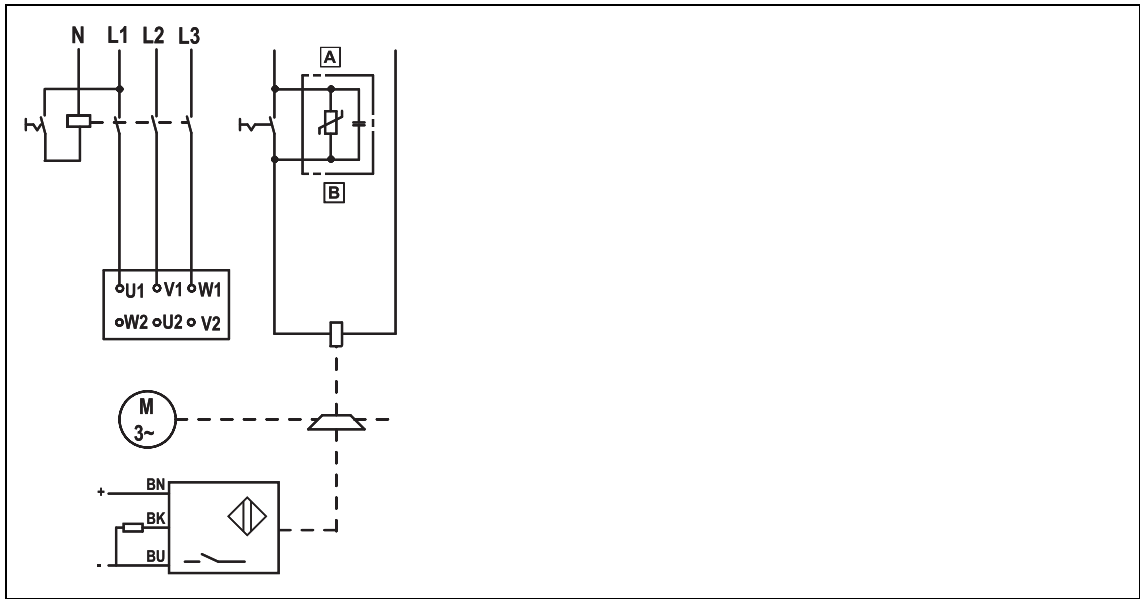


Fig. 17 With inductive proximity switch (check for wear); circuit diagram is also valid for star connection



- [A] DC voltage depending on coil voltage [B] Spark suppressor



Design	PNP, N/O contact
Operating voltage	10 to 30 V
No-load current	< 10 mA
Output current	Max. 150 mA
Short circuit behaviour	Short circuit protection
Temperature range:	-25 to +70 °C
Protection class	IP67
Cable configuration and parameters	
Black (jacket insulation)	Ø 2 mm / L = 2 m, 3 x 0,073 mm ²
Brown (BN)	+
Black (BK)	Signal is continuously active until the wear limit is reached.
Blue (BU)	-



Tab. 13: Technical data for inductive proximity switches (check for wear)

6 Commissioning and operation

6.1 Important notes

	 DANGER
	<p>There is a risk of injury by electrical shock!</p> <ul style="list-style-type: none"> ■ The electrical connections must only be made by skilled personnel! ■ Only carry out connection work when no voltage is applied (no live parts)! There is a risk of unintended start-ups or electric shock.



	 DANGER
	<p>There is a risk of injury by electrical shock!</p> <ul style="list-style-type: none"> ■ Live connections must not be touched.


	 WARNING
	<p>Danger: rotating parts!</p> <p>The brake must be free of residual torque. The motor must not run!</p>

- The brakes are dimensioned in such a way that the given rated torques are reached safely after a short run-in process.
- However, since 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.


6.2 Function checks before commissioning

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



	 DANGER
	<p>There is a risk of electric shock! If the rectifier is connected to the neutral point of the motor, the neutral conductor must also be connected to this point.</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.
 - Compare the DC voltage with the voltage indicated on the nameplate. A deviation of 10 % is permissible.
 - If the measured value deviates:  47
7. Open the switching contact for the brake.
 - The brake is applied.
8. Switch off DC voltage for the brake.
9. Screw the bridges onto the motor terminals (step 2).
10. If necessary, remove the neutral conductor again from the neutral point (step 2).

The preparations for commissioning are completed.

If faults or malfunctions occur, refer to the error search table ( 46). If the fault cannot be fixed or eliminated, please contact your customer service.

6.3 Brake with proximity switch

	 DANGER
	<p>There is a risk of injury by electrical shock!</p> <ul style="list-style-type: none"> ■ The electrical connections must only be made by skilled personnel! ■ Only carry out connection work when no voltage is applied (no live parts)! There is a risk of unintended start-ups or electric shock.

	 WARNING
	<p>Danger: rotating parts!</p> <p>The brake must be free of residual torque. The motor must not run!</p>

6.3.1 Release monitoring

1. The switching contact for the brake must be open.
2. Remove two bridges from the motor terminals to de-energise the motor.
 - Do not switch off the voltage supply to the brake.
 - When connecting the rectifier to the neutral point of the motor, the PE conductor must also be connected to this point.
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 will then be released.
6. Measure the DC voltage at the brake:
 - Compare the DC voltage with the voltage indicated on the nameplate. A deviation of $\pm 10\%$ is permissible. Note that the bridge-half-wave rectifier is used in this configuration!
7. Check the air gap "s_L".
 - The air gap must be zero and the rotor must rotate freely.
8. Start the proximity switch.
9. Check the technical specifications for the proximity switch: When using an operating voltage between 10 – 30 volts, the no-load current must be 10 mA. (The output current must not exceed 200 mA.)
10. Open the switching contact for the brake.
 - The brake is applied.
11. Check the switching status for the release check of the proximity switch (refer to Table 14):
 - A signal must be present at the proximity switch only when the brake is released (the switching contact is closed).
 - If the brake is not released (switching contact is open), there should not be a signal at the proximity switch!
12. Switch off DC voltage for the brake.

13. Screw the bridges back onto the motor terminals. Remove additional PE conductor, if necessary.

Contact type	Connection	Brake released	Proximity switch: Signal is present
N/O contact	black / blue / brown +24 V	yes	yes
		no	no

Tab. 14: Switching status of the proximity switch for checking the air gap

6.3.2 Monitoring wear

1. The switching contact for the brake must be open.
2. Remove two bridges from the motor terminals to de-energise the motor.
 - Do not switch off the voltage supply to the brake.
 - When connecting the rectifier to the neutral point of the motor, the PE conductor must also be connected to this point.
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 will then be released.
6. Measure the DC voltage at the brake:
 - Compare the DC voltage with the voltage indicated on the nameplate. A deviation of $\pm 10\%$ is permissible. Note that the bridge-half-wave rectifier is used in this configuration!
7. Check the air gap "s_L".
 - The air gap must be zero and the rotor must rotate freely.
8. Start the proximity switch.
9. Check the technical specifications for the proximity switch: When using an operating voltage between 10 – 30 volts, the no-load current must remain under 10 mA. (The output current must not exceed 150 mA.)
10. Open the switching contact for the brake.
 - The brake is applied.
11. Check the switching status for the wear check of the proximity switch (refer to Table 15):
 - As long as the wear limit has not been reached, there must be a signal at the proximity switch, regardless of whether the switching contact is opened or closed.
 - If the wear limit is reached, no signal may be present at the proximity switch!
12. Switch off DC voltage for the brake.

13. Screw the bridges back onto the motor terminals. Remove additional PE conductor, if necessary.



Contact type	Connection	Brake released	Proximity switch: Signal is present
N/O contact	black / blue / brown +24 V	yes	yes
		no	yes
		Wear limit has been reached	no


Tab. 15: Switching status of the proximity switch for checking the wear

6.4 Commissioning

1. Switch on the drive system.
2. Carry out several test brake checks.

6.5 During operation

	<p style="margin: 0;"> DANGER</p> <p style="margin: 0;">There is a risk of injury by electrical shock!</p> <ul style="list-style-type: none"> ■ Live connections must not be touched.
---	---

- Checks must be carried out regularly. Pay special attention to:
 - unusual noises or temperatures
 - loose attachment elements
 - the condition of the electrical cables
 - The armature plate must be tightened and the rotor must move without residual torque.
- Measure the DC voltage at the brake.
 - The release voltage is applied for about 1.3 sec. The system is then reduced to the holding voltage (refer to the nameplate).
- If faults or malfunctions occur, refer to the error search table ( 46). If the fault cannot be fixed or eliminated, please contact your customer service.

7 Maintenance and repair

7.1 Wear of spring-applied brakes

INTORQ spring-applied brakes are wear-resistant and designed for long maintenance intervals. The friction lining and braking mechanism are subject to operational wear. For safe and trouble-free operation, the brake must be checked at regular intervals or replaced, if necessary (📖 33).

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 the prescribed maintenance intervals can be specified accurately. The most important factors in this context are the applied friction energy, the initial speed of rotation of braking and the switching frequency. If several of the causes of friction lining wear occur in an application at the same time, the influencing factors should be added together when the amount of wear is calculated.


Component	Cause	Effect	Influencing factors
Friction lining	Braking during operation	Wear of 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)		Number of start-stop cycles
Starting wear in case of motor mounting position with vertical shaft, even when the brake is not applied			
Armature plate and flange	Rubbing of 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 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. 16: Causes for wear

7.2 Inspections



7.2.1 Important notes

To ensure safe and trouble-free operations, the spring-applied brakes must be checked at regular intervals and, if necessary, be replaced. Servicing will be easier at the plant 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,  38. 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.

Maintenance intervals

Time interval	for operating brakes:	for holding brakes with emergency stop:
	<ul style="list-style-type: none"> ■ according to service life calculation ■ or else every six months ■ after 4000 operating hours at the latest 	<ul style="list-style-type: none"> ■ at least every two years ■ after 1 million cycles at the latest
Inspections with assembled brake	<ul style="list-style-type: none"> ■ Check release function and control once a year ■ Check the air gap s_L; check the screw plug; check the O-rings 	 43
Inspections after removing the brake	<ul style="list-style-type: none"> ■ Check rotor ■ Check hub ■ Check armature plate and counter friction face 	 40

Tab. 17: Maintenance intervals

7.3 Maintenance



NOTICE

Observe the following for inspections and maintenance works:

- Brakes with defective armature plates, socket head cap screws, springs or counter friction faces must always be replaced completely.
- Remove impurities through oil and grease using brake cleaning agents.
 - Identify and remove the cause of impurity
 - If required, replace the brake.

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 counter friction faces have an increased initial rate of wear.

- For maintenance work, the brake must be dismantled.

7.3.1 Check the brake

	DANGER
	<p>There is a risk of injury by electrical shock! Switch off the voltage. The brake must be free of residual load torque.</p>

1. Remove the brake (35 and 36).
2. Check the rotor:

Rotor thickness

 - Measure the rotor thickness using a caliper gauge.
 - Compare the measured rotor thickness with the minimally permissible rotor thickness (16).
 - If necessary, exchange the rotor.

Gear teeth

 - Check the teeth of the rotor for wear and seizing marks.
 - If the gear teeth are damaged, replace the rotor.
3. Check hub:
 - Check the teeth of the rotor for wear and seizing marks.
 - If the gear teeth are damaged, dismount and replace the hub.

4. Check armature plate:

Thermal damage

- In the case of thermal damage (dark blue tarnishing), replace the stator. (If necessary, the manufacturer should replace the armature plate.)
- Levelness < 0.15 mm

5. Check counter friction face:


Flange

- Maximum insertion depth < 0.1 mm.
- In the case of strong scoring, replace the flange.
- In the case of thermal damage (dark blue tarnishing), replace the flange.





NOTICE

Use new INTORQ screw sets when re-mounting the brake!

6. Assemble the brake ( 22).

7. Connect the supply cable.

8. Recommission the brake ( 30).

	NOTICE
	For the double-rotor brake, the second rotor is included with the "complete flange" component. This component must be completely replaced as needed; it should not be taken apart!



NOTICE

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.

7.3.2 Dismantling the single-rotor brake

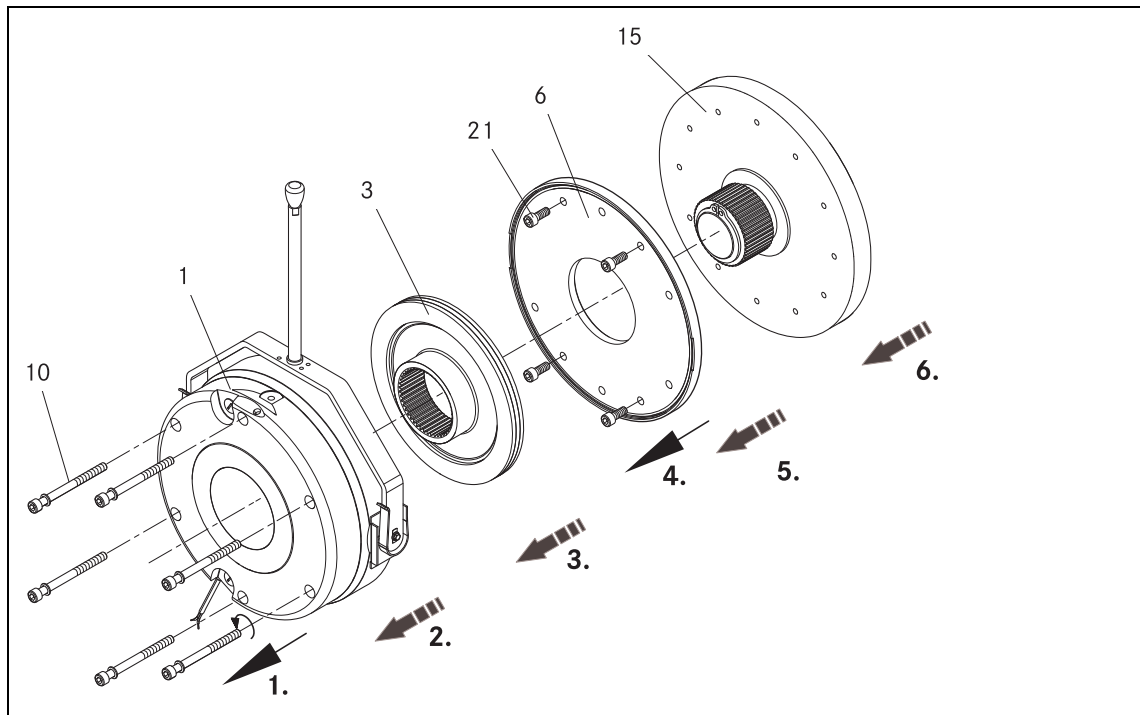


Fig. 18 Dismantling the brake

1	Stator	3	Rotor	21	Fixing screws
6	Flange	10	Socket head cap screws	15	End shield

1. Disconnect the connection cable.
2. Loosen the socket head cap screws (10) and remove them.
3. Detach stator (1) from the shaft.
4. Detach rotor (3) from the hub.
5. Loosen fixing screws (21) and remove them.
6. Remove flange (6) from the end shield (15).

7.3.3 Dismantling the double-rotor brake

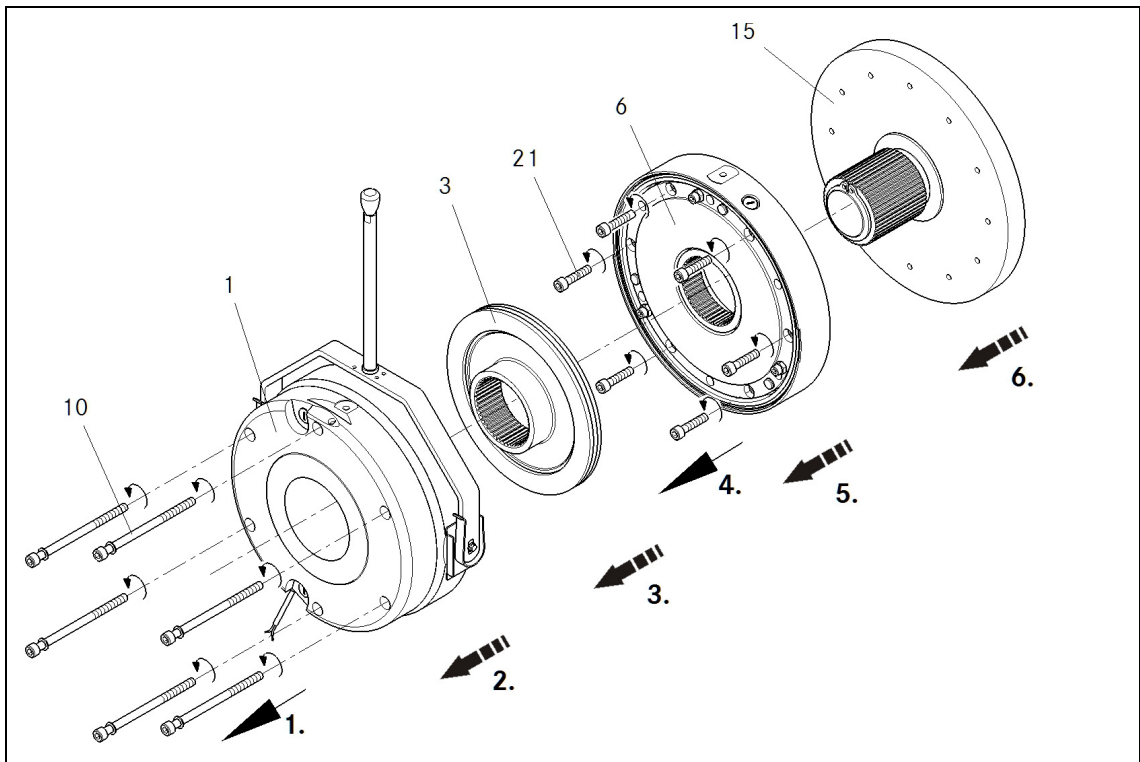




Fig. 19 Dismantling the brake (double-rotor version)

- | | | |
|-----------------------------------|---------------------------|------------------|
| 1 Stator | 3 Rotor | 21 Fixing screws |
| 6 Component with flange and rotor | 10 Socket head cap screws | 15 End shield |

1. Disconnect the connection cable.
2. Loosen the socket head cap screws (10) and remove them.
3. Detach stator (1) from the shaft.
4. Detach rotor (3) from the hub.
5. Loosen fixing screws (21) and remove them.
6. Remove the "Complete Flange" component (6) from the shaft.

7.3.4 Release / voltage

	 DANGER
There is a risk of injury by electrical shock! Live connections must not be touched.	

1. Observe the brake functionality while the drive is operating. The armature plate must be tightened and the rotor must move without residual torque.
2. Measure the DC voltage at the brake.
 - Compare the DC voltage with the voltage indicated on the nameplate. A deviation of 10 % is permissible.

7.4 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

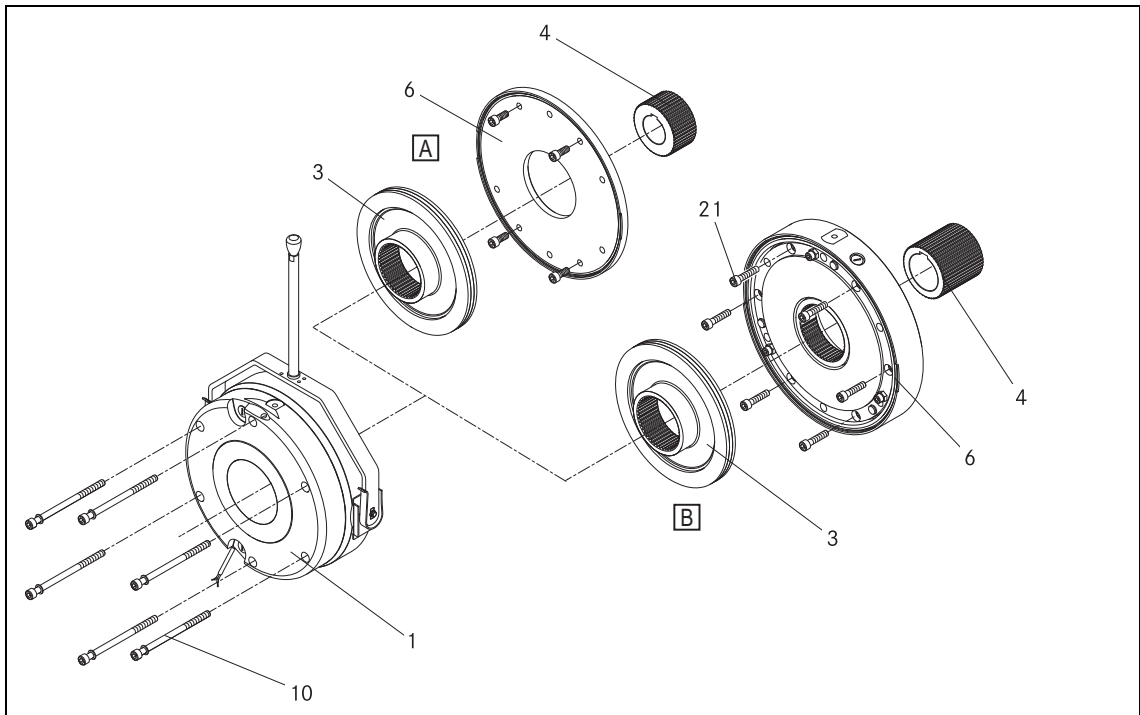


Fig. 20 BFK471 spring-applied brake

A Single-rotor design

B Double-rotor design

Item	Designation	Variant
1	Stator, complete	Voltage, characteristic torque
3	Complete rotor	
4	Hub	Bore diameter
6	Flange "Flange incl. rotor" component	Single-rotor design Double-rotor design
10	Fixing screws with seals Socket head cap screw set DIN EN ISO 4762	Single-rotor design Double-rotor design
21	Fixing screw set	For flange mounting (single-rotor design) For "Complete Flange" component (double-rotor design)
35	Locking element of the manual release (45)	Optional

Tab. 18: Spare-parts list

7.5 Accessories

Locking element of the manual release

The locking element (35) of the manual release can be procured optionally as retrofit kit.

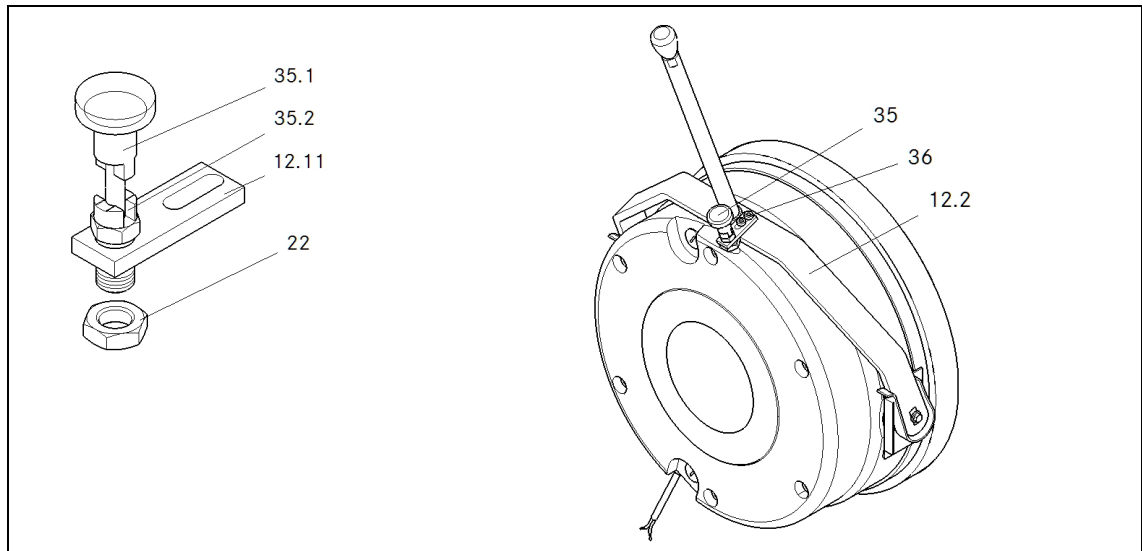




Fig. 21 Installation of manual release or locking element

1. Pre-assemble the clip (12.11) loosely on the manual release shackle (12.2) with screws (36).
2. Screw the locking bolt (35.2) into the clip (12.11) and secure it by means of the lock nut (22).
3. Setting approx. 1-2 mm above magnet housing.
4. Operate the manual release. Engage the locking bolt (35.2) into the corresponding hole in the magnet housing. Turn the head of the locking bolt (35.1) to secure it. Tighten the screws (36, M6) using 9 Nm torque. The rotor must be able to rotate freely. This position is set by correspondingly moving the clip (12.11).
5. Check the function of the manual release or locking element; if required, repeat the adjustment process.


8 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 measures, please contact customer service.

Brake malfunctioning

Fault	Cause	Remedy
Brake does not release	Coil interruption	<ul style="list-style-type: none"> ■ Measure the 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 with multimeter: <ul style="list-style-type: none"> - Compare measured value with rated resistance. - Values:  16 - If resistance is too low, replace the complete stator. ■ Check coil for short circuit to ground using a multimeter: <ul style="list-style-type: none"> - Replace the complete stator if short circuit to ground is detected. ■ Check brake voltage (see "defective rectifier, voltage too low").
	Wiring defective or incorrect	<ul style="list-style-type: none"> ■ Check and correct. <ul style="list-style-type: none"> - Check cable for continuity using a multimeter: ■ Replace the complete stator if a cable is defective.
	Defective or incorrect rectifier	<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 OK: <ul style="list-style-type: none"> - Check rectifier. - Replace the defective rectifier. If DC voltage is too low: <ul style="list-style-type: none"> - Check rectifier. - If diode is defective, use a suitable new rectifier. ■ Check coil for inter-turn fault or short circuit to ground. ■ If the rectifier defect occurs again, replace the entire stator, even if you cannot find any fault between turns or short circuit to ground. The fault may occur later during heating-up.
	Air gap too big	Replace the rotor  42 and read corresponding note
Rotor thickness too small		

Tab. 19: Troubleshooting

	NOTICE
	For the double-rotor brake, the second rotor is included with the "complete flange" component. This component must be completely replaced as needed; it should not be taken apart!

Deviations in measured values


Measured value	Cause	Remedy
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 defective rectifier with a suitable undamaged one.
AC voltage is not mains voltage	Fuse is missing or defective	Install fuse. Exchange fuse.

Tab. 20: Deviations in measured values

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