INTORQ BFK551

Spring-applied brake with electromagnetic release

Translation of the Original Operating Instructions

www.kendrion.com

Document history

Material number	Version			Description
33008880	1.0	11/2020	SC	First edition
33008880	2.0	02/2021	SC	Change of name to Kendrion INTORQ. Updates to chapters 4.2, 4.7 and 8.3
33008880	3.0	02/2021	SC	Updates to chapters 5.2 and 6.2

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
  - unauthorized modifications to the product
  - improper work on or with the product
  - operating errors
  - disregarding the documentation

Warranty

Notice

The warranty conditions can be found in the terms and conditions of Kendrion INTORQ GmbH.

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

Product key

INTORQ B FK □□□ □□

Product group: Brakes (B)

Product family: Spring-applied brake (FK)

Type: 551 (□□□)

Size: 01, 02, 03, 04, 05 (□□)

Not coded: Connection voltage, hub bore diameter, options

Checking the delivery

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

Kendrion INTORQ does not accept any liability for deficiencies claimed subsequently.

- Claim visible transport damage immediately to the deliverer.
- Claim visible defects or incompleteness of the delivery immediately to Kendrion INTORQ.

NOTICE

Labeling of drive systems and individual components

- Drive systems and components are unambiguously designated by the labeling on their name plates.

Contents

1 General information

1.1 Using 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 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	Underlined, red		Reference to another page with additional information For example: Using these Operating Instructions, Page 6
Symbols	Wildcard	□	Wildcard (placeholder) for options or selection details For example: BFK551-□□ = BFK551-05
	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

Icon

Indicates the type of danger

Signal word

Characterizes the type and severity of danger.

Notice text

Describes the danger.

Possible consequences

List of possible consequences if the safety notices are disregarded.

Protective measures

List of protective measures required to avoid the danger.

Danger level

⚠ DANGER

DANGER indicates a hazardous situation which, if not avoided, *will* result in death or serious injury.

⚠ WARNING

WARNING indicates a potentially hazardous situation which, if not avoided, *could* result in death or serious injury.

⚠ CAUTION

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

NOTICE

Notice about a harmful situation with possible consequences: the product itself or surrounding objects could be damaged.

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
F	N	Spring 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_4	Nm	Torque that can be transmitted without slippage occurring (DIN VDE 0580)
M_A	Nm	Tightening torque of fastening screws
M_{dyn}	Nm	Average torque from initial speed to standstill
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_N	Ohms	Rated coil resistance at 20 °C
R_z	µm	Averaged surface roughness
S_h	1/h	Operating frequency: the number of switching operations evenly distributed over the time unit
S_{hue}	1/h	Transition operating frequency, thermal parameter of the brake
S_{hmax}	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
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 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 Kendrion INTORQ components when you notice they are damaged.
- Never make any technical changes to Kendrion INTORQ components.
- Never operate Kendrion INTORQ components when they are incompletely mounted or incompletely connected.
- Never operate Kendrion INTORQ components without their required covers.
- Only use accessories that have been approved by Kendrion 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, Kendrion INTORQ components may have both live (voltage carrying), moving and rotating parts. Such components require appropriate safety mechanisms.
- Surfaces can become hot during operation. Take 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 Kendrion 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 Kendrion 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

Kendrion 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 Kendrion INTORQ. The Kendrion 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 13) must be followed to comply with the proper and intended usage. Any other usage is consider improper and prohibited.

3.2 Layout

This chapter describes the design and functionality of the INTORQ BFK551 spring-applied brake.

3.2.1 BFK551

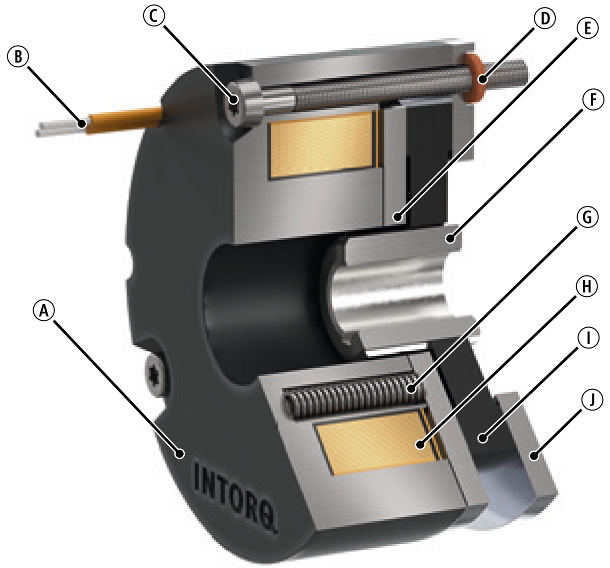


Fig. 1: **Design of an INTORQ BFK551 spring-applied brake (flange-side mounting)**

Ⓐ Stator	Ⓑ Connection cable	Ⓒ Fastening screw
Ⓓ Clamping disc	Ⓔ Armature plate	Ⓕ Hub
Ⓖ Spring	Ⓗ Coil	Ⓘ Rotor
Ⓙ Flange		

3.3 Function

This brake is an electrically releasable spring-applied brake with a rotating brake disk (rotor) that is 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 a service brake, and as an emergency stop brake for high speeds.

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

To release the brake, the armature plate is released electromagnetically from the rotor. The rotor, shifted axially and balanced by the spring force, can rotate freely.

3.4 Braking and release

During the braking procedure, the pressure springs use the armature plate to press the rotor (which can be shifted axially on the hub) against the friction surface. 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 energized 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 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 effects 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.
- Since the material properties of the friction linings are subject to fluctuations and as a result of different environmental conditions, deviations from the specified braking torque are possible. This has to be taken into account by appropriate dimensioning of the tolerances. Increased breakaway torque can occur in particular as an result of long standstill periods in humid environments with variing temperatures.
- If the brake is used as a pure holding brake without dynamic load, the friction lining must be reactivated regularly.

4 Technical specifications

4.1 Possible applications of the Kendrion INTORQ spring-applied brake

- Degree of protection:
  - The brake has IP00 protection. Because of the many ways of using the brake, it is necessary to verify the functionality of all mechanical components under the corresponding operating conditions.
- Ambient temperature:
  - -20 °C to +40 °C (Standard)

4.2 Characteristics

<table>
<tr><th rowspan="3">Size</th><th>Rated brake torque at Δn=100 rpm</th><th colspan="2">Air gap</th><th>Moment of inertia of rotor</th><th rowspan="2">Weight of brake</th></tr>
<tr><th>M_K</th><th>S_{LN} 1)</th><th>S_{Lmax}</th><th>J_{Rotor} 2)</th></tr>
<tr><th>[Nm]</th><th>[mm]</th><th>[mm]</th><th>[kg mm²]</th><th>[kg]</th></tr>
<tr><td>01</td><td>0.24</td><td rowspan="2">$0.15^{+0.08/-0.05}$</td><td rowspan="2">0.28</td><td>0.369</td><td>0.14</td></tr>
<tr><td>02</td><td>0.5</td><td>1.24</td><td>0.24</td></tr>
<tr><td rowspan="2">03</td><td>0.5</td><td rowspan="6">$0.15^{+0.1/-0.05}$</td><td>0.4</td><td rowspan="2">2.794</td><td rowspan="2">0.32</td></tr>
<tr><td>1</td><td>0.3</td></tr>
<tr><td rowspan="2">04</td><td>1</td><td>0.4</td><td rowspan="2">7.719</td><td rowspan="2">0.45</td></tr>
<tr><td>2</td><td>0.3</td></tr>
<tr><td rowspan="2">05</td><td>2</td><td>0.4</td><td rowspan="2">13.964</td><td rowspan="2">0.68</td></tr>
<tr><td>4</td><td>0.3</td></tr>
</table>

Tab. 1: **General data**

1) The air gap in the default (delivered) condition results from the total tolerance of the individual parts after the brake is mounted. When checking the air gap, the feeler gauge must not be inserted deeper than 15 mm into the air gap between the armature plate and the stator.

2) If a hub is used, its moment of inertia must also be taken into account.

Notice

The specified rated torque is achieved up to the maximum speed of Δn_{0max} = 5000 rpm.

Size	Outer diameter	Screw hole circle		Minimum thread depth in motor end shield	Tightening torque
		Diameter (Ø)	Thread[1]		M_A
	[mm]	[mm]		[mm]	[Nm]
01	37	32	3x M2.5	4.5	0.7
02	47	40			
03	56	48	3x M3	6	1.3
04	65	58			
05	75	66	3x M4	7	3

Tab. 2: **Mounting data**

[1] Fastening screws (socket-head cap screws according to DIN EN ISO 14580) are included in the scope of delivery

⚠ CAUTION

Functional incapacity of the brake

It is very important to comply with the minimum thread depth of the end shield (refer to the Mounting data, Page 14 table).

If the required thread depth is not maintained, the fastening screws may run onto the thread root. This has the effect that the required pre-load force is no longer established – the brake is no longer securely fastened!

The material of the end shield must have a tensile strength of R_m > 250 N/mm² !

Size	Electrical power P_N	Rated voltage U_N	Rated current I_N	Coil resistance R_N
	[W]	[V]	[A]	[Ω] ±8%
01	4.9	24	0.20	117.6
	6.2	24	0.26	92.90
02	6.4	103	0.06	1658
	5.9	205	0.03	7123
	8.3	24	0.35	69.40
03	8.2	103	0.08	1294
	8.0	205	0.04	5223
	10.9	24	0.45	52.84
04	10.8	103	0.10	982.3
	10.5	205	0.05	4002
	12.4	24	0.52	46.45
05	12.2	103	0.12	869.6
	13.1	205	0.06	3208

Tab. 3: **Coil data**

4.3 Switching times

The operating times listed here are guide values which apply to DC switching with rated air gap s_{LN}, warm coil and standard characteristic torque. The given operating times are average values and subject to variations. The engagement time t_1 is approximately 8 to 10 times longer for AC switching.

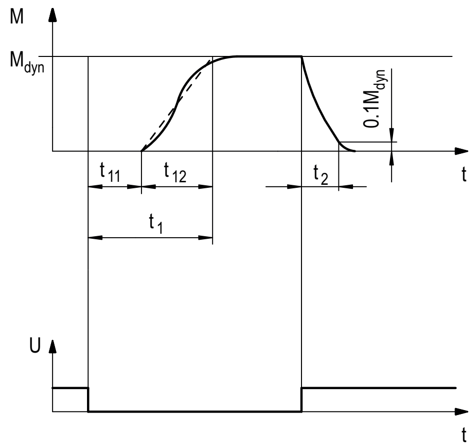


Fig. 2: **Operating/switching times of the spring-applied brakes**

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

Size	Rated brake torque at Δn=100 rpm M_K[1]	Q_E[1]	S_{hue}	Operating times [2] DC-side engagement t_{11}	t_{12}	t_1	Disengaging t_2	Maximum speed Δn_{max}
	[Nm]	[J]	[1/h]	[ms]	[ms]	[ms]	[ms]	[rpm]
01	0.24	200	160	5	7	12	22	5000
02	0.5	400	125	6	10	16	25	5000
03	0.5	800	100	16	17	33	13	5000
	1	800	100	7	13	20	28	5000
04	1	1200	90	18	24	42	20	5000
	2	1200	90	7	16	23	31	5000
05	2	1800	80	19	30	49	26	5000
	4	1800	80	8	19	27	34	5000

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

[1] The maximum permissible friction energy Q_E relates to the standard friction lining.

[2] These operating times are specified for usage of coils with a connection voltage of 24 V DC at s_{LN} and 0.7 I_N.

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.

Engagement time for AC-side switching: The engagement time is significantly longer (approx. 10 times longer).

	NOTICE
	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.

- 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, Page 31.

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 Kendrion INTORQ rectifiers and rated voltage.

4.4 Friction work / operating frequency

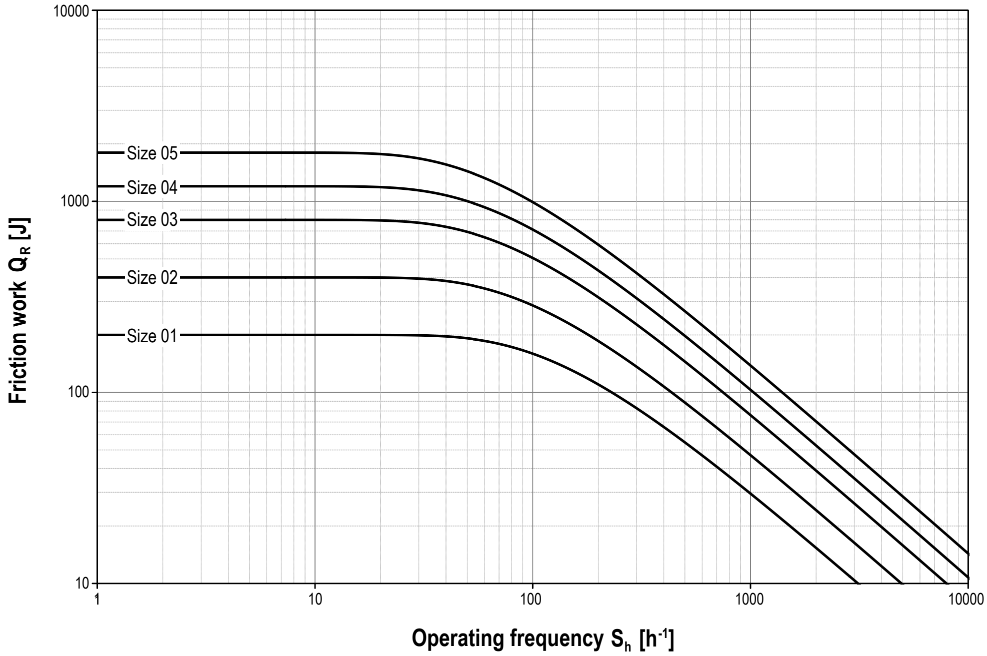


Fig. 3: **Friction work as a function of the operating frequency**

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

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

The permissible operating frequency S_{hmax} depends on the friction work Q_R (refer to Figure Friction work / operating frequency, Page 17). At a pre-set operating frequency S_h, the permissible friction work is Q_{Smax}.

Notice

With high speeds of rotation and switching energy, the wear increases, 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

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

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.

4.6 Emissions

Heat

Since the brake converts kinetic energy and electrical energy into heat, the surface temperature varies considerably, depending on the operating conditions and possible heat dissipation. A surface temperature of 130 °C may be reached under unfavorable conditions.

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.

4.7 Labels on product

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

Fig. 4: **Name plate (example)**

Kendrion INTORQ	Manufacturer
BFK551-01	Type (refer to Product key, Page 3)
24 V DC	Rated voltage
4.9 W	Rated power
No. 33008121	ID number
0.24 NM	Rated torque
05.02.21	Date of manufacture
	Data matrix code
CE	CE mark
	UL mark

Fig. 5: **Packaging label**

Kendrion INTORQ	Manufacturer
33008121	ID number
BFK551-01	Type (refer to Product key, Page 3)
	Bar code
SPRING-APPLIED BRAKE	Designation of the product family
24 V DC	Rated voltage
0.24 NM	Rated torque
10 pc.	Qty. per box
4.9 W	Rated power
05.02.21	Packaging date
Anti-rust packaging: keep friction surface free of grease!	Addition
CE	CE mark

5 Mechanical installation

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

Important notices and information

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

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 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

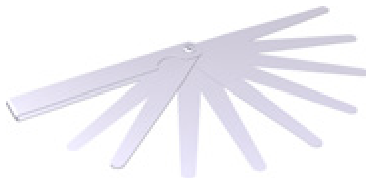
Size	Run-out	Concentricity	Tensile strength R_m (of the end shield's material)
	[mm]	[mm]	[N/mm^2]
01	0.02	0.05	> 250
02	0.02	0.05	
03	0.02	0.10	
04	0.02	0.10	
05	0.02	0.10	

Tab. 5: **Design of the motor end shield**

5.2 Tools

Size	Torque wrench	Insert for Torx® screws
		
	Measuring range	**Size**
	[Nm]	
01	0.3 to 4	T8
02		T10
03		
04		
05		T20

> **NOTICE**
>
> Tightening torques: refer to the Mounting data, Page 14 table in chapter Mounting data, Page 14.

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 the rated voltage)!

5.4 Installing the hub onto the shaft

Notice

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

- Tensile strength of the hub material:
  - Sizes 01 – 05: Tensile strength R_m > 460 N/mm^2

Notice

Depending on the brake size, the braking torque is transmitted to the shaft either by means of a key or grub screws.

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

5.4.1 Mounting the hub with grub screws

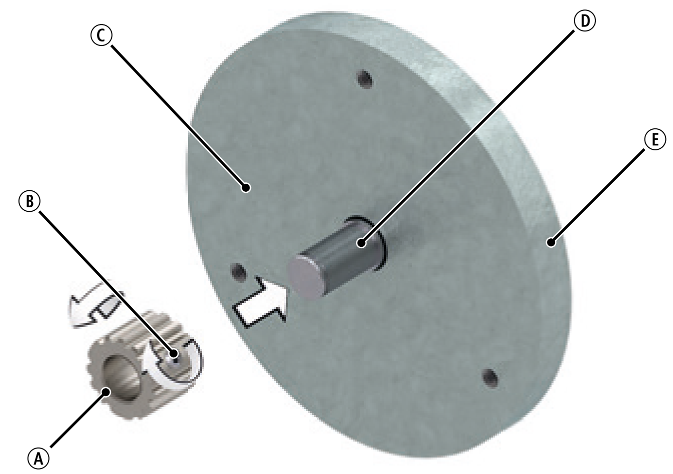


Fig. 6: **Using grub screws (sizes 01 and 02) to mount the hub**

Ⓐ Hub Ⓑ Grub screws Ⓒ End shield
Ⓓ Shaft

1. Push the complete hub (consisting of hub with screwed-in grub screws) onto the shaft.
2. Tighten the grub screws.

5.4.2 Mounting the hub using a key

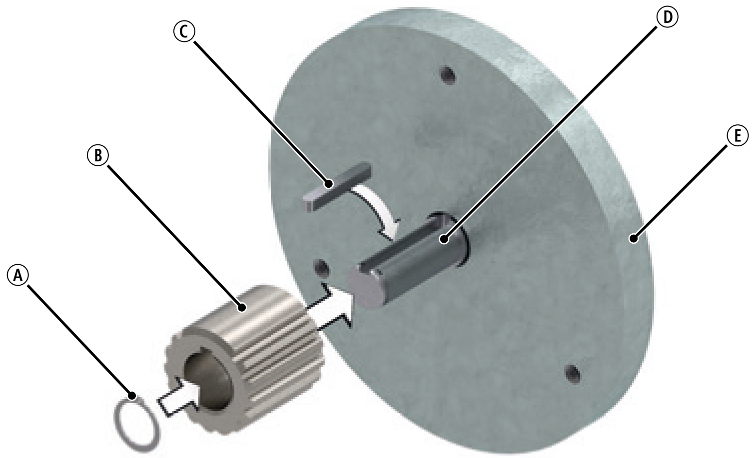


Fig. 7: **Mounting the hub (sizes 03 and 05)**

Ⓐ Circlip	Ⓑ Hub	Ⓒ Key
Ⓓ Shaft	Ⓔ End shield	

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 Mounting the brake

5.5.1 Mounting the BFK551

Notes

- As delivered, the brake is held together by the clamping disks on the screw threads. The pressure springs of the brake then press on the flange via the armature plate and the rotor, thus pushing it away from the stator until the flange is in contact with the clamping disks. This "pre-tensions" the screws. Thus, the screw heads have contact with the stator (or the flange when mounted on the housing side) before, during and, of course, after the assembly. During assembly, only the gap between the spacers and the flange of the brake is reduced. This gap is zero when the brake is mounted.
- In order to avoid tilting the armature plate during assembly, the fastening screws must be screwed in evenly and alternately. The air gap between the armature plate and the pole face only corresponds to s_{LN} after the fastening screws have been screwed in completely.
- During assembly, make sure that the connecting cable for the brake is not located between the armature plate and the pole face. Otherwise, the insulation of the connecting cable would be damaged when the fastening screws are tightened and the housing closes.

- The connecting cable must be routed in such a way that it is ensured for all operating conditions that the cable cannot be damaged by the moving parts of the brake (such as the rotor or armature plate).
- The connecting cable must be routed in such a way that the minimum bending radii are maintained under all operating conditions (for the minimum bending radii, refer to Minimum bending radius for the brake connection cable, Page 32).

Mounting the brake on the flange side

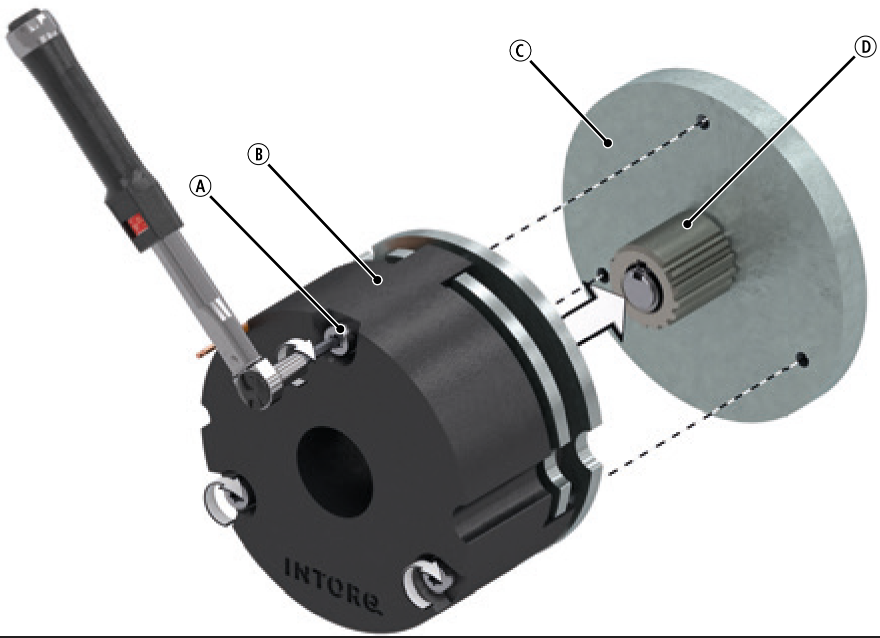


Fig. 8: **Mounting the brake (on the flange side)**

Ⓐ Fastening screw　Ⓑ Spring-applied brake　Ⓒ End shield
Ⓓ Hub

1. Push the spring-applied brake on the hub.
2. Screw the spring-applied brake to the end shield using the built-in fastening screws. Use a torque wrench (refer to the Mounting data, Page 14 table for the tightening torques).

Mounting the brake on the housing side

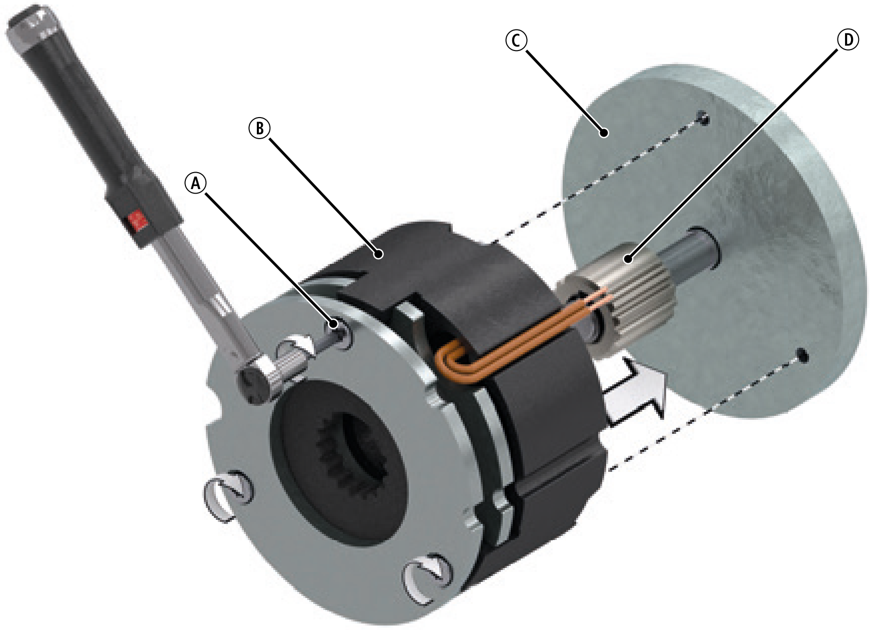


Fig. 9: **Mounting the brake (on the housing side)**

Ⓐ Fastening screw
Ⓑ Spring-applied brake
Ⓒ End shield
Ⓓ Hub

3. Push the spring-applied brake on the hub.
4. Screw the spring-applied brake to the end shield using the built-in fastening screws. Use a torque wrench (refer to the Mounting data, Page 14 table for the tightening torques).

6 Electrical installation

Important notes

	DANGER
	There is a risk of injury by electrical shock! ▮ 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.

	NOTICE
	Make sure that the supply voltage matches the voltage specification on the name plate.

6.1 Electrical connection

Switching suggestions

	NOTICE
	The terminal pin sequence shown here does not match the actual order.

6.1.1 AC switching at the motor – extremely delayed engagement

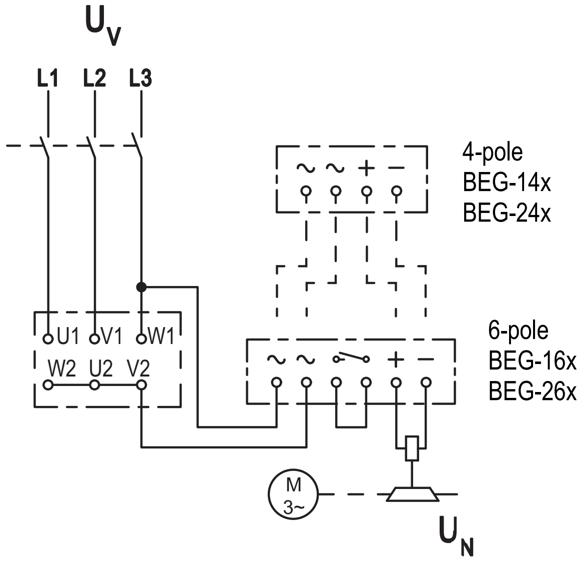


Fig. 10: **Supply: Phase-neutral**

Bridge rectifiers

BEG-1xx: U_N [V DC] = 0.9 • $\frac{U_V}{\sqrt{3}}$ [V AC]

Half-wave rectifiers

BEG-2xx: U_N [V DC] = 0.45 • $\frac{U_V}{\sqrt{3}}$ [V AC]

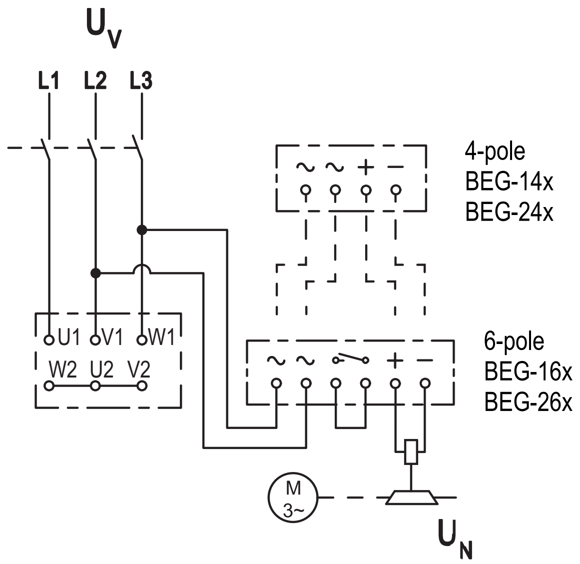


Fig. 11: **Supply: Phase-phase**

Bridge rectifier [1)]

BEG-1xx: U_N [V DC] = 0.9 • U_V [V AC]

Half-wave rectifier

BEG-2xx: U_N [V DC] = 0.45 • U_V [V AC]

[1)] Not recommended for most regional/national high-voltage mains voltages.

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6.1.2 DC switching at the motor – fast engagement

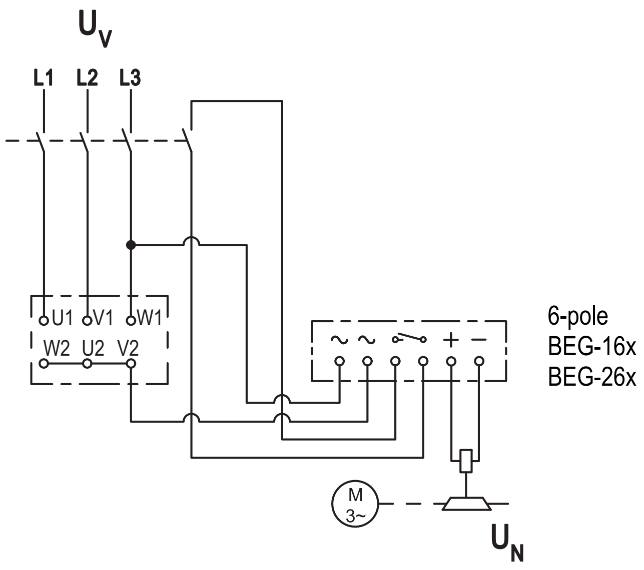

Fig. 12: **Supply: Phase-neutral**

Bridge rectifiers

BEG-1xx: U_N [V DC] = 0.9 • $\frac{U_V}{\sqrt{3}}$ [V AC]

Half-wave rectifiers

BEG-2xx: U_N [V DC] = 0.45 • $\frac{U_V}{\sqrt{3}}$ [V AC]

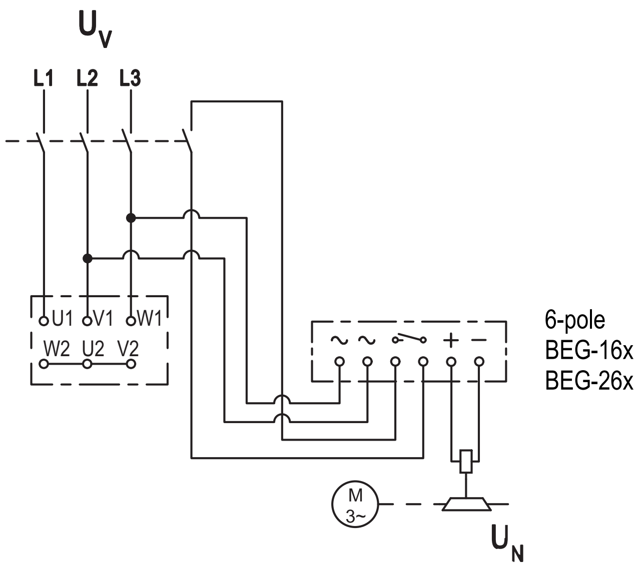

Fig. 13: **Supply: Phase-phase**

Bridge rectifier [1)]

BEG-1xx: U_N [V DC] = 0.9 • U_V [V AC]

Half-wave rectifiers

BEG-2xx: U_N [V DC] = 0.45 • U_V [V AC]

[1)] Not recommended for most regional/national high-voltage mains voltages.

6.1.3 AC switching at mains – delayed engagement

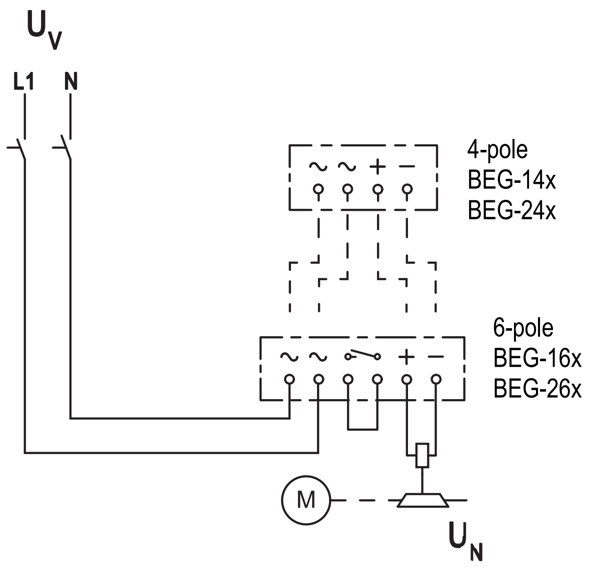

Fig. 14: **Supply: Phase-N**

Bridge rectifiers

BEG-1xx: U_N [V DC] = 0.9 • U_V [V AC]

Half-wave rectifiers

BEG-2xx: U_N [V DC] = 0.45 • U_V [V AC]

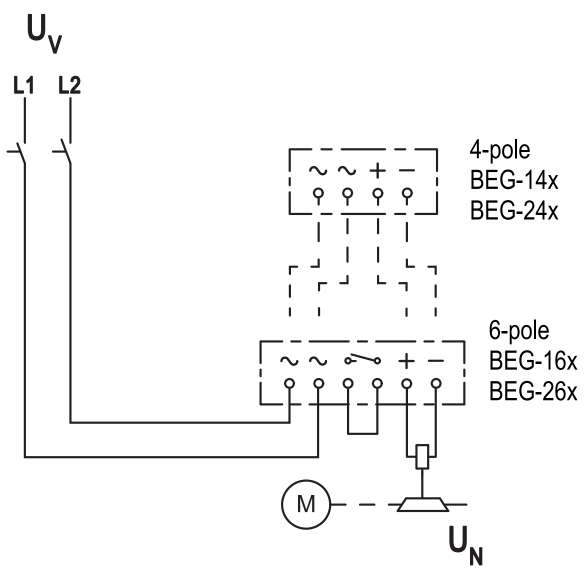

Fig. 15: **Supply: Phase-phase**

Bridge rectifier [1)]

BEG-1xx: U_N [V DC] = 0.9 • U_V [V AC]

Half-wave rectifiers

BEG-2xx: U_N [V DC] = 0.45 • U_V [V AC]

[1)] Not recommended for most regional/national high-voltage mains voltages.

6.1.4 DC switching at mains – fast engagement

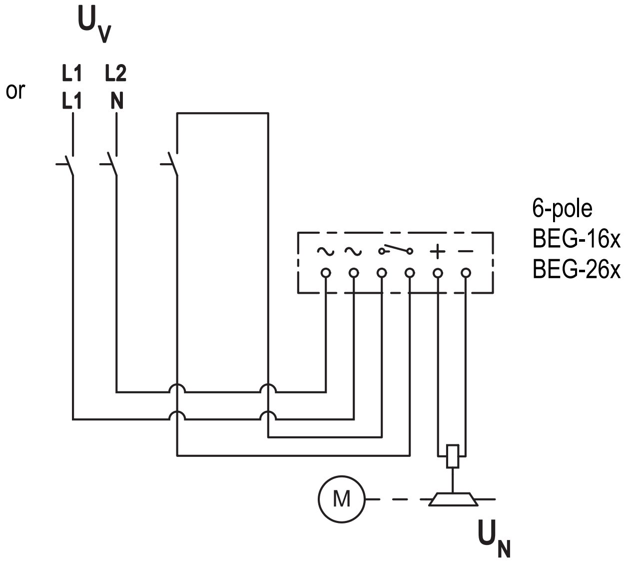

Fig. 16: **Supply: Phase-phase or phase-N via 6-pole rectifier**

Bridge rectifier [1]	Half-wave rectifiers
BEG-16x: U_N [V DC] = 0.9 • U_V [V AC]	BEG-26x: U_N [V DC] = 0.45 • U_V [V AC]

[1] For most regional/national high-voltage mains voltages, this only makes sense for supplies on L1 and N.

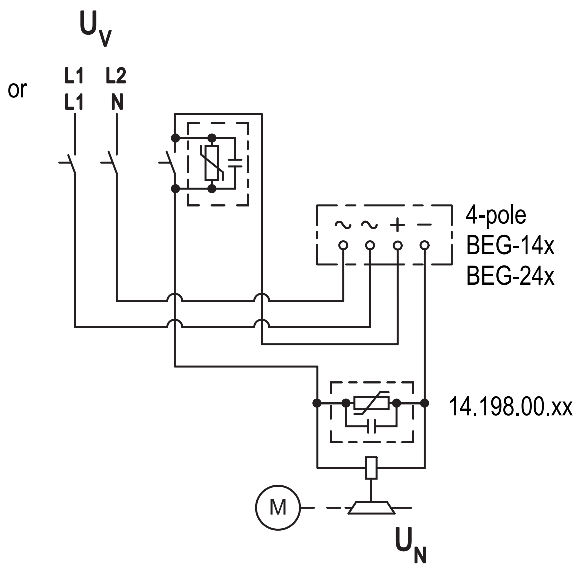

Fig. 17: **Supply: Phase-phase or phase-N via 4-pole rectifier**

Bridge rectifier [1]	Half-wave rectifiers
BEG-14x: U_N [V DC] = 0.9 • U_V [V AC]	BEG-24x: U_N [V DC] = 0.45 • U_V [V AC]

Spark suppressor:

14.198.00.xx (required once, select position)

[1] For most regional/national high-voltage mains voltages, this only makes sense for supplies on L1 and N.

6.1.5 Switching at a supply voltage of 24 V DC

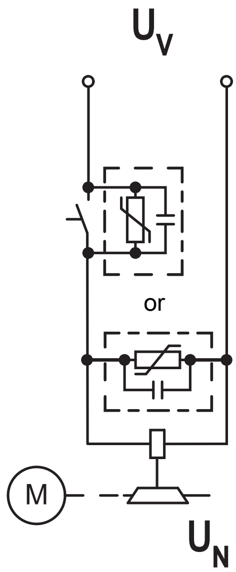

Fig. 18: **Supply: 24V DC**

Notice

Spark suppressor: 14.198.00.xx (required once, select position)

6.2 Minimum bending radius for the brake connection cable

Size	Wire cross-section	Minimum bending radius
01	AWG 26	2.6 mm
02		
03	AWG 24	3 mm
04		
05		

Tab. 6: **Minimum bending radius for the brake connection cable**

7 Commissioning and operation

7.1 Possible applications of the Kendrion INTORQ spring-applied brake

NOTICE

In case of high humidity: If condensed water and moisture are present, provide for an appropriate ventilation for the brake to ensure that all friction components dry quickly.
At high humidity and low temperatures: Take measures to ensure that the armature plate and rotor do not freeze.

Important notes

DANGER

Danger: rotating parts!

- The brake must be free of residual torque.
- The drive must not be running when checking the brake.

DANGER

There is a risk of injury by electrical shock!

The live connections must not be touched.

- The brake is designed for operation under the environmental conditions that apply to IP00 protection. Because of the many ways the brake can be used, it is necessary to check the functionality of all mechanical components under the corresponding operating conditions.

Notice

Functionality for different operating conditions

- The brakes are dimensioned in such a way that the specified rated torques are reached safely after a short run-in process.
- Since the material properties of the friction linings are subject to fluctuations and as a result of different environmental conditions, deviations from the specified braking torque are possible. This has to be taken into account by appropriate dimensioning of the tolerances. Increased breakaway torque can occur in particular as an result of long standstill periods in humid environments with varying temperatures.

Notice

Operation without dynamic loads (functioning as a pure holding brake)

- If the brake is used as a pure holding brake without dynamic load, the friction lining must be reactivated regularly.

7.2 Function checks before initial commissioning

	⚠ DANGER
⚠	**Danger: rotating parts!** ▮ The brake must be free of residual torque. ▮ The drive must not be running when checking the brake.

	⚠ DANGER
⚡	**There is a risk of injury by electrical shock!** The live connections must not be touched.

7.2.1 Function check of the brake

If a fault or malfunction arises during the function check, you can find important information for troubleshooting in the chapter Troubleshooting and fault elimination. If the fault cannot be fixed or eliminated, please contact the customer service department.

7.2.2 Release / voltage control

1. Switch off the supply to the motor and brake securely.
2. When switching on the brake supply, make sure that the motor DOES NOT start up (e.g. remove the two bridges on the motor terminals).
   - **Do not** disconnect the supply connections to the brake.
   - If the rectifier for the brake supply is connected to the neutral point of the motor, **also** connect the neutral conductor to this connection.

	⚠ DANGER
⚠	**Danger: rotating parts!** Your system should be mechanically immobilized in the event that it could start moving when the brake is released.

3. Switch the power on.
4. Measure the DC voltage at the brake.
   - Compare the measured voltage to the voltage specified on the name plate. A deviation of up to 10% is permitted.
5. Check the air gap s_L. The air gap must be 0.06 mm and the rotor must rotate freely.
6. Switch off the supply to the motor and brake securely.
7. Connect the bridges to the motor terminals. Remove any extra neutral conductor.

7.3 Commissioning

	⚠ DANGER
	Danger: rotating parts! ▮ The brake must be free of residual torque. ▮ The drive must not be running when checking the brake.

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

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

7.4 Operation

	⚠ DANGER
	Danger: rotating parts! ▮ 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
	There is a risk of injury by electrical shock! ▮ Live connections must not be touched. ▮ Take structural design measures on your final product and implement organizational safety rules to ensure that nobody can touch a connection.

- Checks must be carried out regularly. Pay special attention to:
  - unusual noises or temperatures
  - loose fixing/attachment elements
  - the condition of the electrical cables.
- While current is being applied to the brake, make sure that the armature plate is completely tightened and the drive moves without residual torque.
- Measure the DC voltage at the brake. Compare the measured DC voltage with the voltage indicated on the name plate. The deviation must be less than ± 10%!

8 Maintenance and repair

8.1 Wear of spring-applied brakes

⚠ WARNING

Braking torque reduction

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!

The table below shows the different causes of wear and their impact on the components of the spring-applied brake. The influencing factors must be quantified in order to calculate the service life and prescribed maintenance intervals of the rotor and brake accurately. The most important factors in this context are the applied friction work, the initial speed of rotation before 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.

<table>
<tr><th>Component</th><th>Cause</th><th>Effect</th><th>Influencing factors</th></tr>
<tr><td rowspan="5">Rotor</td><td>Service braking</td><td rowspan="5">Wear of the friction lining</td><td rowspan="4">Friction work</td></tr>
<tr><td>Emergency stops</td></tr>
<tr><td>Overlapping wear during start and stop of drive</td></tr>
<tr><td>Active braking via the drive motor with support of brake (quick stop)</td></tr>
<tr><td>Start-up wear in case of motor mounting position with vertical shaft, even when the brake is not applied</td><td>Number of start/stop cycles</td></tr>
<tr><td>Armature plate and counter friction surface</td><td>Rubbing and friction of the brake lining</td><td>Run-in of armature plate and counter friction surface</td><td>Friction work</td></tr>
<tr><td>Gear teeth of brake rotor</td><td>Relative movements and shocks between brake rotor and brake shaft</td><td>Wear of gear teeth (primarily on the rotor side)</td><td>Number of start/stop cycles</td></tr>
<tr><td>Armature plate support</td><td>Load reversals and shocks in backlash during reversals between armature plate and armature plate guide</td><td>Running in the armature plate into the armature plate guide</td><td>Number of start/stop cycles, braking torque</td></tr>
<tr><td>Springs</td><td>Axial load cycle and shear stress of springs through radial backlash on reversal of armature plate</td><td>Reduced spring force or fatigue failure</td><td>Number of switching operations of brake</td></tr>
</table>

Tab. 7: **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 of wear must be taken into account. Refer to the table Causes for wear, Page 36 in the chapter Verschleiß von Federkraftbremsen, Page 36. 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 facility.

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

Versions	Service brakes	Holding brakes with emergency stop
BFK551	▮ according to the service life calculation	▮ at least every 2 years
	▮ or else every six months	▮ after 1 million cycles at the latest
	▮ after 4000 operating hours at the latest	▮ Plan shorter intervals for frequent emergency stops.

8.3 Maintenance

Notice

Brakes with parts must be replaced completely.
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.

8.3.1 Checking the components

With mounted brake	▮ Check release function and control	Refer to Release / voltage, Page 38
	▮ Measure the air gap (and adjust if required)	Refer to Checking the air gap, Page 39
	▮ Thermal damage of armature plate or flange (dark-blue tarnishing)	
After removing the brake	▮ Check the play of the rotor gear teeth (replace worn-out rotors)	
	▮ Check for breaking out of the torque support at the spacers and the armature plate	
	▮ Check the springs for damage	
	▮ Check the armature plate and the flange – Flatness depending on the size – Max. run-in depth = rated air gap for the size	Refer to the General data, Page 13 table.

8.3.2 Release / voltage

⚠	⚠ **DANGER**
	Danger: rotating parts! The running rotor must not be touched.

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

1. Check the brake functionality when the drive is running: The armature plate must be tightened and the rotor must move without residual torque.
2. Measure the DC voltage at the brake.
3. Compare the measured voltage to the voltage specified on the name plate. A deviation of up to 10% is permitted.

8.3.3 Checking the air gap

⚠	**⚠ DANGER**
	Danger: rotating parts! The motor must **not** run while the air gap is being checked.

1. Measure the air gap s_L between the armature plate and the stator. The feeler gauge must not be inserted deeper than 15 mm. Inserting the feeler gauge too deeply can damage the functionality of the brake. Also make sure you do not damage the connecting cable with the feeler gauge.
2. Compare the measured air gap with the value for the max. permissible air gap s_{Lmax} . (Refer to the General data, Page 13 table for the values.)
3. Replace the complete brake before the max. permissible air gap is exceeded.

8.3.4 Brake replacement

⚠	**⚠ DANGER**
	Danger: rotating parts! Switch off the voltage. The brake must be free of residual torque. Your system should be mechanically immobilized in the event that it could start moving when the brake is released.

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 brake from the end shield.
4. Pull the brake off the hub.
5. Check the hub's gear teeth.
6. Replace the hub if wear is visible.
7. Check the function of the brake as described in the Release / voltage, Page 38 section. Mount a new brake if necessary.
8. Reconnect the connection cable and put the brake back into operations.
9. If necessary, deactivate the mechanical shutdown of the system.

8.4 Spare parts list

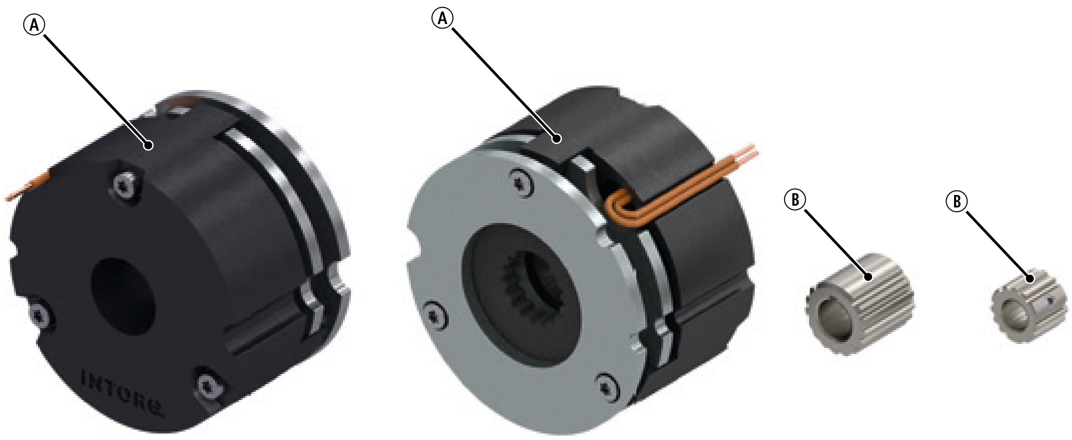

Fig. 19: INTORQ BFK551 spring-applied brake (left figure: mounting on flange side; right figure: mounting on housing side)

	Designation	Variant
Ⓐ	Brake	▮ Size ▮ Voltage ▮ Brake torque ▮ Mounting variant
Ⓑ	Hub	▮ Size ▮ Bore diameter

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.

<table>
<tr><th>Fault</th><th>Cause</th><th>Remedy</th></tr>
<tr><td rowspan="3">Brake cannot be released, air gap is not zero</td><td>Coil interruption</td><td>▮ Measure coil resistance using a multimeter:
– If resistance is too high, replace the complete spring-applied brake.</td></tr>
<tr><td>Coil has contact to earth or between windings</td><td>▮ Measure coil resistance using a multimeter:
– Compare the measured resistance with the nominal resistance. Refer to General data, Page 13 for the values. If the resistance is too low, replace the complete spring-applied brake.
▮ Check the coil for short to ground using a multimeter:
– 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).</td></tr>
<tr><td>Wiring defective or wrong</td><td>▮ Check the wiring and correct.
▮ Check the cable for continuity using a multimeter
– Replace the complete spring-applied brake if a cable is defective.</td></tr>
<tr><td>Brake cannot be released, air gap is not zero</td><td>Rectifier defective or incorrect</td><td>▮ Measure rectifier DC voltage using a multimeter.
▮ If DC voltage is zero:
– Check AC rectifier voltage.
▮ If AC voltage is zero:
– Switch on power supply
– Check fuse
– Check wiring.
▮ If AC voltage is okay:
– 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.</td></tr>
</table>

Fault	Cause	Remedy
Brake cannot be released, air gap is not zero	Air gap too big	Replace the complete brake
Rotor is too thin	Brake was not replaced in time	Replace the complete brake
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 defec-tive	Select a connection with a proper fuse.

Kendrion INTORQ GmbH
Germany
PO Box 1103
D-31849 Aerzen, Germany
Wülmser Weg 5
D-31855 Aerzen, Germany
☎ +49 5154 70534-0 (Headquarters)
☎ +49 5154 70534-222 (Sales)
+49 5154 70534-200
info@intorq.com

应拓柯制动器（上海）有限责任公司
INTORQ (Shanghai) Co., Ltd.
上海市浦东新区泥城镇新元南路600
号6 号楼一楼B 座
No. 600, Xin Yuan Nan Road,
Building No. 6 / Zone B
Nicheng town, Pudong
201306 Shanghai
☎ +86 21 20363-810
+86 21 20363-805
info@cn.intorq.com

INTORQ US Inc.
USA
300 Lake Ridge Drive SE
Smyrna, GA 30082, USA
☎ +1 678 236-0555
+1 678 309-1157
info@us.intorq.com

INTORQ India Private Limited
India
Plot No E-2/7
Chakan Industrial Area, Phase 3
Kharabwadi, Taluka – Khed
Pune, 410501, Maharashtra
☎ +91 2135625500
info@intorq.in

www.kendrion.com

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