POWERED BY KENDRION

INTORQ BFK470

Spring-applied brake with electromagnetic release

Translation of the Original Operating Instructions

www.kendrion.com

Document history

Material number	Version			Description
33001439	1.0	01/2012	TD09	First edition
33001439	1.1	03/2012	TD09	Supplemented the technical data
33001439	1.2	10/2012	TD09	Added to the "Brake assembly" chapter Updated the "Abbreviations used" table Supplemented the characteristics, rated data and switching times
33001439	2.0	05/2013	TD09	Degree of protection changed Note with regard to the end shield characteristics included Shaft characteristic defined, "Mechanical installation" chapter "Checking the brake" chapter (maintenance and repair) supplemented
33001439	3.0	05/2013	TD09	Text with regard to the disengagement time updated
33001439	3.1	03/2014	SC	Restructured FM; note concerning brake sealing
33001439	4.0	01/2015	SC	Harmonized connection diagrams
33001439	5.0	07/2016	SC	Additional sizes: 06, 08, 10, 12
33001439	6.0	03/2017	SC	Corrosion protection class, change in table
33001439	7.0	03/2020	SC	Migration to ST4 Revision of the chapter "Application range of the Kendrion INTORQ spring-applied brake"
33001439	8.0	10/2020	SC	Update of name plate and packaging sticker
33001439	9.0	02/2021	SC	Change of company name to Kendrion INTORQ. Update of chapter 4.7

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

Product family: Spring-applied brake

Type: 470

Size: 06, 08, 10, 12, 14, 16, 18

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.

Inhalt

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	Underscore, orange	___	Reference to another page with additional information For example: <u>Using these Operating Instructions, Page 6</u>
Symbols	Wildcard	□	Wildcard (placeholder) for options or selection details For example: BFK470-□□ = BFK470-10
	Notice		Important notice about ensuring smooth operations or other key information.

1.3 Safety instructions and notices

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

Structure of safety notices:

	⚠ **CAUTION**
	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
Cold Climate Version (CCV)	Version of the spring-applied brake suited for particularly low temperatures

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}

Letter symbol	Unit	Designation
t_3	ms	Slipping time, operation time of the brake (according to t_{11}) until standstill
t_{11}	ms	Delay during engagement (time from switching off the supply voltage to the beginning of the torque rise)
t_{12}	ms	Rise time of the braking torque, time from the start of torque rise until reaching the braking torque
t_{ue}	s	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

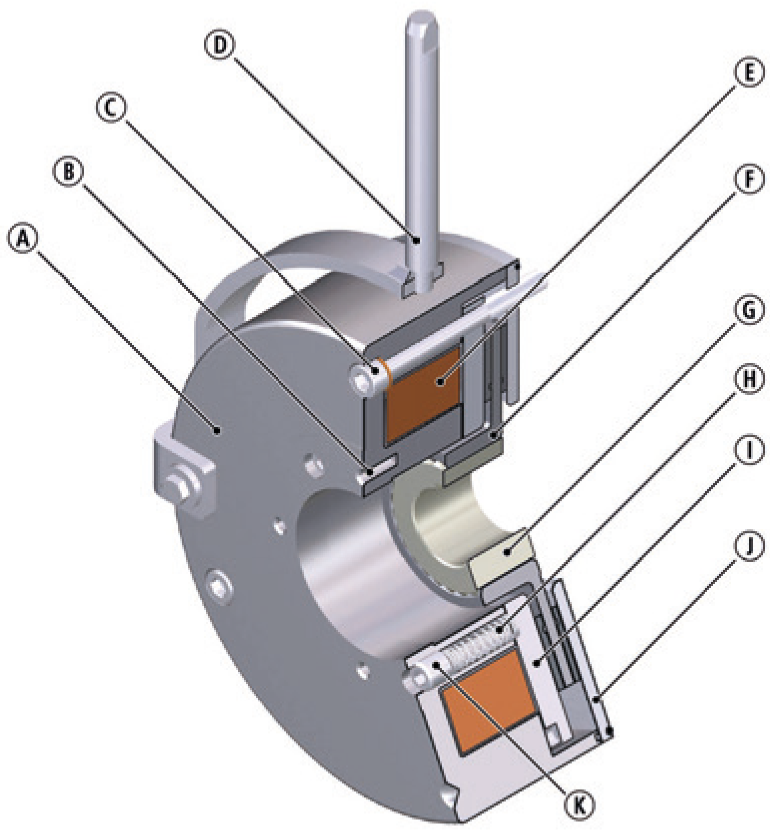


Fig. 1: **Design of the INTORQ BFK470 spring-applied brake: Complete stator + rotor + flange**

Ⓐ Stator
Ⓑ Bore holes (optional)
Ⓒ Socket-head cap screw
Ⓓ Hand-release (optional)
Ⓔ Coil
Ⓕ Rotor
Ⓖ Hub
Ⓗ Pressure spring
Ⓘ Armature plate
Ⓙ Flange (optional)
Ⓚ Setting screw for the factory-set adjustment of the spring force (sealed), applies only to sizes 12–18

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.

3.6 Optional configuration

3.6.1 Optional CCV

The Cold Climate Version (CCV) allows the brake to be operated at lower ambient temperatures.

3.6.2 Hand-release (optional)

To temporarily release the brake when there is no electricity available, a hand-release version is available as an option.

4 Technical specifications

4.1 Possible applications of the Kendrion INTORQ spring-applied brake

- Degree of protection:
  - The brake is designed for operation under the operating 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.
- Ambient temperature:
  - -20 °C to +50 °C (Standard)
  - -40 °C to +50 °C (Cold Climate Version: CCV)

4.2 Characteristics

Size	Max. speed [1] n_{max}	Temperature class stator	Duty cycle	Moment of inertia of rotor J_{Rotor}	Weight of brake			
					without hand-release		with hand-release	
					without flange	with flange	without flange	with flange
	[rpm]		[%]	[kg cm^2]	[kg]	[kg]	[kg]	[kg]
06	6000	F (155 °C)	100	0.15	1.3	1.5	1.4	1.6
08	5000	F (155 °C)	100	0.61	2.0	2.2	2.1	2.3
10	4000	F (155 °C)	100	2.0	3.5	3.9	3.7	4.0
12	3600	F (155 °C)	100	4.5	5.0	5.6	5.3	5.8
14	3600	F (155 °C)	100	6.3	7.7	8.5	8.1	8.9
16	3600	F (155 °C)	100	15.0	11.9	13.1	12.5	13.7
18	3600	F (155 °C)	100	29.0	17.6	19.1	18.6	20.0

Tab. 1: **General data**

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

Size	Air gap			Rotor thickness		
	S_{LN} [1]	S_{Lmax}		Min.		New state
	[mm]	Service brake [mm]	Holding brake [mm]	Service brake [mm]	Holding brake [mm]	[mm]
06	$0.2^{+0.08/-0.05}$	0.5	0.3	5.73	5.93	$6.0^{-0.05}$
08	$0.2^{+0.08/-0.05}$	0.5	0.3	6.73	6.93	$7.0^{-0.05}$
10	$0.2^{+0.13/-0.05}$	0.5	0.35	8.73	8.88	$9.0^{-0.1}$
12	$0.3^{+0.08/-0.10}$	0.6	0.45	9.68	9.83	$10.0^{-0.1}$
14	$0.3^{+0.10/-0.10}$	0.75	0.45	9.55	9.85	$10.0^{-0.1}$
16	$0.3^{+0.15/-0.05}$	0.80	0.50	11.05	11.35	$11.5^{-0.1}$
18	$0.4^{+0.20/-0.10}$	1.0	0.65	12.50	12.85	$13.0^{-0.1}$

Tab. 2: **Air gap and rotor thickness**

[1] The default (as delivered) air gap results from the sum tolerances of the individual components.

Size	Outer diameter	Screw hole circle		Fastening screws [1]		Minimum thread depth of motor end shield		Tightening torque
		Diameter (Ø)	Thread[1]	without flange	with flange	without flange	with flange	M_A
	[mm]	[mm]		[mm]	[mm]	[mm]	[mm]	[Nm]
06	89	72	M4	3x M4x40	3x M4x45	7.5	9.0	3.0
08	106	90	M5	3x M5x45	3x M5x50	10.5	10.0	5.9
10	130	112	M6	3x M6x55	3x M6x60	14.0	13.5	10.1
12	148	132	M6	3x M6x60	3x M6x65	12.5	12.5	10.1
14	168	145	M8	3x M8x75	3x M8x80	19.5	18.5	24.6
16	200	170	M8	3x M8x80	3x M8x85	18.0	17.0	24.6
18	226	196	M8	6x M8x90	6x M8x100	19.5	23.0	24.6

Tab. 3: **Mounting data**

[1] Fastening screws (socket-head cap screws according to DIN EN ISO 4762) 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/mm^2 !

<table>
<tr><th rowspan="2">Size</th><th rowspan="2">Rated torque
[Nm]
100 rpm</th><th colspan="3">Braking torque at Δn_0 [% of the rated torque]</th><th>Max. rotation speed Δn_{0max}</th></tr>
<tr><th>1500</th><th>3000</th><th>Max.</th><th>[rpm]</th></tr>
<tr><td>06</td><td>2.0 / 2.5 / 3.0 / 3.5 / 4.0 / 4.5 / 5.5 / 6.0 / 6.5 / 7.0 / 7.5</td><td>87</td><td>80</td><td>74</td><td>6000</td></tr>
<tr><td>08</td><td>3.5 / 5 / 6 / 7 / 8 / 9 / 10 / 11 / 12 / 14 / 15</td><td>85</td><td>78</td><td rowspan="3">73</td><td>5000</td></tr>
<tr><td>10</td><td>7 / 9 / 11 / 14 / 16 / 18 / 21 / 23 / 25 / 28 / 30 / 33 / 36</td><td>83</td><td>76</td><td>4000</td></tr>
<tr><td>12</td><td>12 / 14 / 15 / 16 / 18 / 23 / 27 / 32 / 36 / 40 / 45 / 46 / 48 / 50 / 55</td><td>81</td><td>74</td><td rowspan="4">3600</td></tr>
<tr><td>14</td><td>25 / 35 / 40 / 45 / 50 / 55 / 60 / 65 / 70 / 75 / 80 / 100 / 110</td><td>80</td><td>73</td><td>72</td></tr>
<tr><td>16</td><td>35 / 45 / 55 / 60 / 70 / 80 / 90 / 100 / 105 / 125 / 150</td><td>79</td><td>72</td><td>70</td></tr>
<tr><td>18</td><td>65 / 80 / 100 / 125 / 130 / 150 / 165 / 185 / 200 / 235 / 250</td><td>77</td><td>70</td><td>68</td></tr>
</table>

Tab. 4: Brake torques

Size	Electrical power P_{20} [1]	Rated voltage U_N	Rated current I_N	Coil resistance R_N
	[W]	[V]	[A]	[Ω] ±8%
06	20	12	1.667	7.2
		20	1.000	20.0
		24	0.833	28.8
		32	0.625	51.2
		42	0.476	88.2
		70	0.286	245.0
		96	0.208	460.8
		103	0.194	530.5
		127	0.158	806.0
	21	150	0.140	1071.0
	20	170	0.118	1445.0
		180	0.111	1620.0
		190	0.105	1805.0
		205	0.098	2101.0
		215	0.093	2311.0
		225	0.089	2531.0
	23	250	0.092	2717.0

Size	Electrical power P_{20} 1)	Rated voltage U_N	Rated current I_N	Coil resistance R_N
	[W]	[V]	[A]	[Ω] ±8%
08	25	12	2.083	5.76
		24	1.250	16.0
		20	0.833	28.8
		32	0.781	40.96
		42	0.595	70.56
		70	0.357	196.0
		96	0.260	368.6
		103	0.194	530.5
	27	127	0.213	597.4
	25	150	0.167	900.0
		170	0.147	1156.0
		180	0.111	1620.0
		190	0.132	1444.0
		205	0.098	2101.0
		215	0.116	1849.0
		225	0.111	2025.0
	27	250	0.108	2314.0

Size	Electrical power P_{20} [1)]	Rated voltage U_N	Rated current I_N	Coil resistance R_N
	[W]	[V]	[A]	[Ω] ±8%
10	30	12	2.500	4.8
		20	1.500	13.33
		24	1.250	19.2
		32	0.938	34.1
		42	0.714	58.8
		70	0.429	163.3
	31	96	0.323	297.3
	32	103	0.311	331.5
	30	127	0.236	537.6
		150	0.200	750.0
		170	0.176	963.3
	32	180	0.178	1013.0
	30	190	0.158	1203.0
	33	205	0.161	1273.0
	30	215	0.140	1540.83
	32	225	0.142	1582.0
	30	250	0.120	2083.0
12	40	12	3.333	3.6
		20	2.000	10.0
		24	1.667	14.4
		32	1.267	25.16
		42	0.952	44.128
		70	0.571	122.5
		96	0.417	230.4
		103	0.388	265.2
		127	0.315	403.2
		150	0.267	562.5
		170	0.235	722.5
		180	0.222	810.0
		190	0.211	902.5
		205	0.195	1051.0
		215	0.186	1156.0
		225	0.178	1266.0
	42	250	0.168	1488.0

Size	Electrical power P_{20} [1]	Rated voltage U_N	Rated current I_N	Coil resistance R_N
	[W]	[V]	[A]	[Ω] ±8%
14	61	24	2.542	9.443
	60	103	0.583	176.817
		180	0.333	540.0
	63	205	0.307	667.063
		288	0.219	1316.571
		310	0.203	1525.4
16	68	24	2.833	8.471
		103	0.660	156.015
		180	0.378	476.471
		205	0.332	618.015
		288	0.236	1219.765
18	85	24	3.542	6.776
		103	0.825	124.8
		180	0.472	381.176
		205	0.415	494.412

Tab. 5: **Coil data**

[1] Coil power at 20°C in W, deviation up to +10% is possible depending on the selected connection voltage.

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.

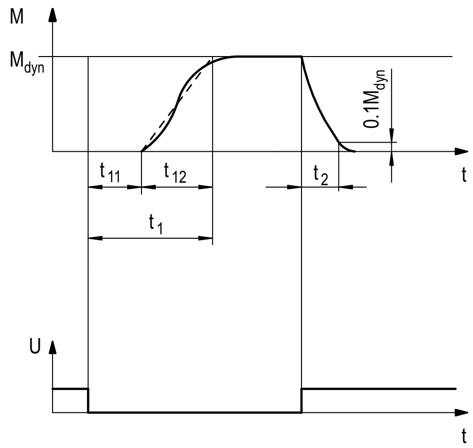


Fig. 2: **Operating/switching times of the spring-applied brakes**

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	Q_E	S_{hue}	Operating times [1)]			
				DC engagement[2)]			Disengaging
				t_{11}	t_{12}	t_1	t_2
	[Nm]	[J]	[1/h]	[ms]	[ms]	[ms]	[ms]
06	4	3000	79	16	25	41	32
08	8	7500	50	30	26	56	52
10	16	12000	40	40	46	86	107
12	32	24000	30	47	34	81	121
14	60	30000	28	30	47	76	162
16	80	36000	27	46	62	109	225
18	150	60000	20	62	92	155	343

Tab. 6: **Switching energy - operating frequency - operating times**

[1)] The switching times listed are guide values for brakes with standard characteristic torques for switching on the DC side, with rated air gap s_{LN} and warm coil. Brakes with a lower characteristic torque enable the brakes to open more quickly (t_2), but also take longer to build up torque (t_1). Brakes with a higher characteristic torque exhibit the correspondingly reverse behavior.

[2)] Measured with induced voltage limitation of -800 V DC

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.

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

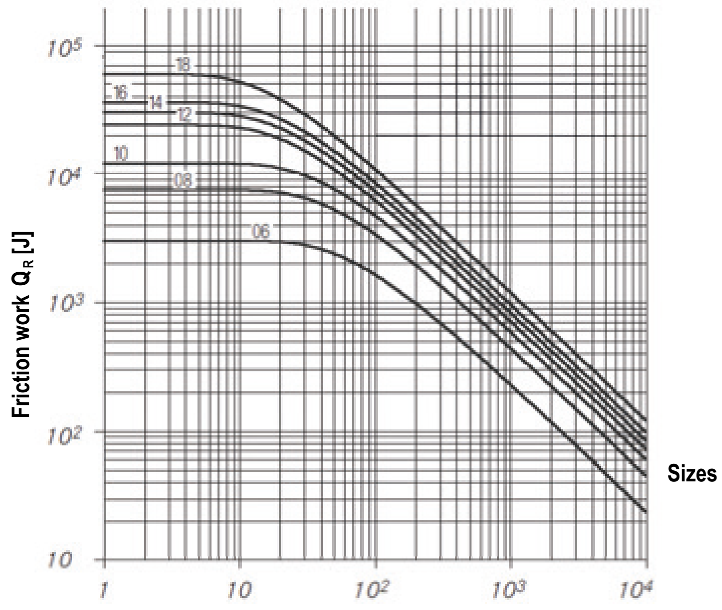


Fig. 3: Friction work as a function of the operating frequency

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

The permissible operating frequency S_{hmax} depends on the friction work Q_R (refer to Figure Friction work / operating frequency, Page 22). 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.

Miscellaneous
The abrasion of the friction parts produces dust.

4.7 Labels on product

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

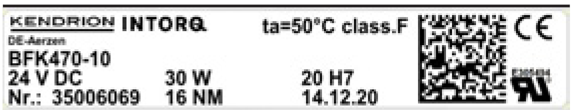


Fig. 4: Name plate (example)

Kendrion INTORQ	Manufacturer
ta = 50°C	Permissible ambient temperature
Class. F	Insulation class F
BFK470-10	Type (refer to Product key, Page 3)
24 V DC	Rated voltage
30 W	Rated power
20 H7	Hub diameter
35006069	ID number
16 NM	Rated torque
14.12.20	Date of manufacture
	Data matrix code
	CE mark
	UL mark

Fig. 5: **Packaging label (example)**

Kendrion INTORQ	Manufacturer
35006069	ID number
BFK470-10	Type (refer to Product key, Page 3)
	Bar code
SPRING-APPLIED BRAKE	Designation of the product family
24 V DC	Rated voltage
16 NM	Rated torque
pc.	Qty. per box
30 W	Rated power
20 H7	Hub diameter
14.12.20	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 form and position tolerances apply only to the materials mentioned. Consult with Kendrion INTORQ before using other materials; Kendrion INTORQ's written confirmation is required for such usage.
- The brake flange must be supported by the end shield across the full surface.
- Depending on the type of installation, additional clearing bore holes may be required.
- Keep the end shield free from grease or oil.

Minimum requirements of the end shield

Size	Material [1) 2)]	Roughness [2)]	Run-out	Levelness	Tensile strength R_m
			[mm]	[mm]	[N/mm^2]
06	S235JR; C15; EN-GJL-250	Rz10	0.05	≤ 0.03	250
08			0.05		
10			0.05		
12			0.05	≤ 0.05	
14			0.05		
16			0.05	≤ 0.08	
18			0.08	≤ 0.10	

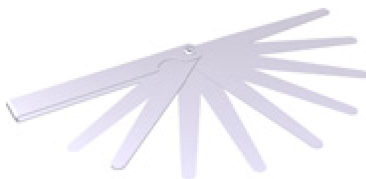
Tab. 7: **End shield as counter friction surface**

[1)] Consult with Kendrion INTORQ before using other materials.

[2)] If **no** brake flange is used.

5.2 Tools

Size	Torque wrench	Insert for hexagonal socket (Allen) screws
		
	Measuring range	Wrench width
	[Nm]	[mm]
06	1 to 12	3
08		4
10		5
12		
14	20 to 100	6
16		
18		

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.

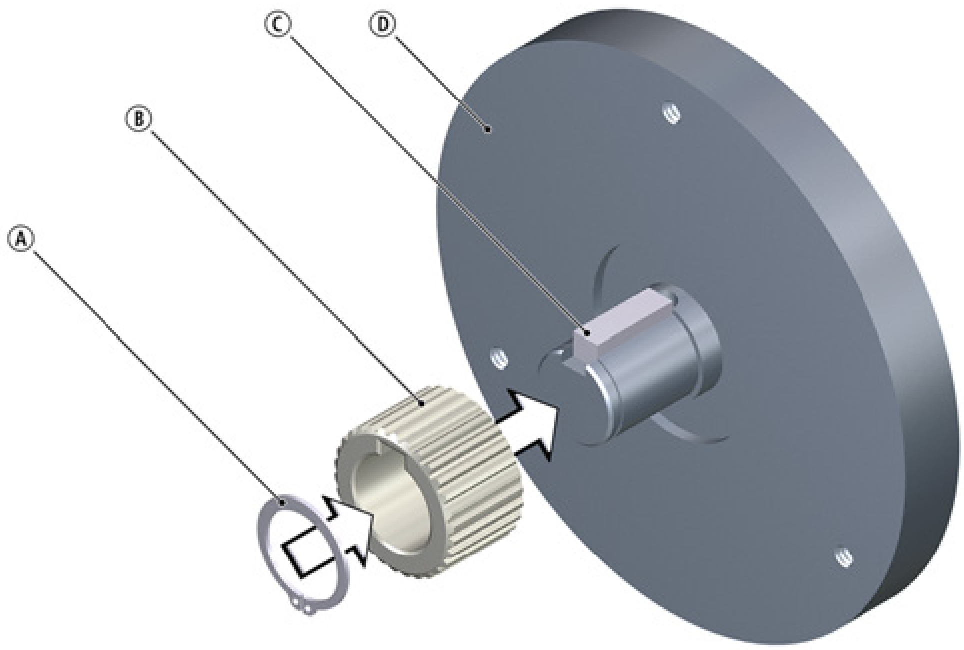


Fig. 6: **Installing the hub onto the shaft**

Ⓐ Circlip　Ⓑ Hub　Ⓒ Key

Ⓓ 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).

NOTICE

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

5.5 Mounting the brake

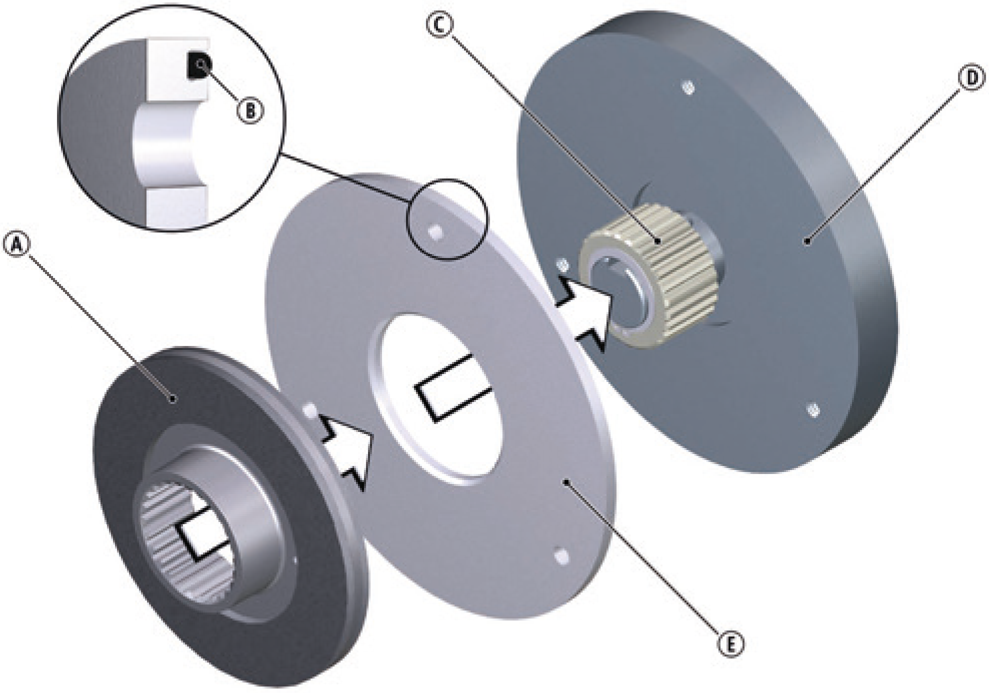


Fig. 7: **Mounting the flange and rotor**

Ⓐ Rotor	Ⓑ O-ring	Ⓒ Hub
Ⓓ End shield	Ⓔ Flange	

1. Optional: Slide the flange onto the shaft. Note the following:
   - The chamfer on the flange must point towards the brake so that the O-ring is positioned at the motor end shield.
   - Align the through holes of the flange in line with the mounting holes on the end shield.
2. Check if the rotor can be moved manually.

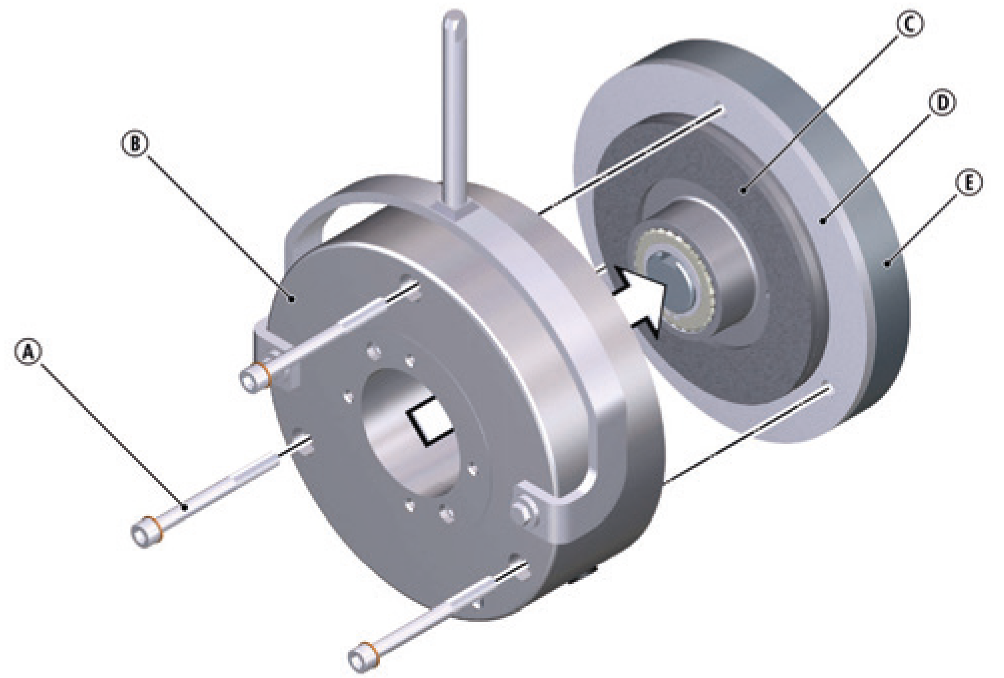


Fig. 8: **Mounting the complete stator**

Ⓐ Socket-head cap screw	Ⓑ Complete stator	Ⓒ Rotor
Ⓓ Flange	Ⓔ End shield	

3. Slide the brake onto the shaft.
4. Align the supplied cap screws with the mounting holes on the end shield.

NOTICE

When using a shaft sealing ring, the brake has to be mounted so that it is centerd properly! The shaft diameter must be implemented in accordance with ISO tolerance h11, with a radial eccentricity tolerance according to IT8 and an averaged surface roughness of $R_z \leq 3.2$ µm in the sealing area.

Notice

Please note the following for the version "brake with shaft sealing ring":

- Lightly lubricate the lip of the shaft sealing ring with grease.
- No grease should be allowed to contact the friction surfaces.
- When assembling the stator, push the shaft sealing ring carefully over the shaft. The shaft should be located concentrically to the shaft sealing ring

5. Screw the complete stator to the end shield Use the supplied screw set and a torque wrench (for tightening torque, refer to the table Mounting data, Page 14).

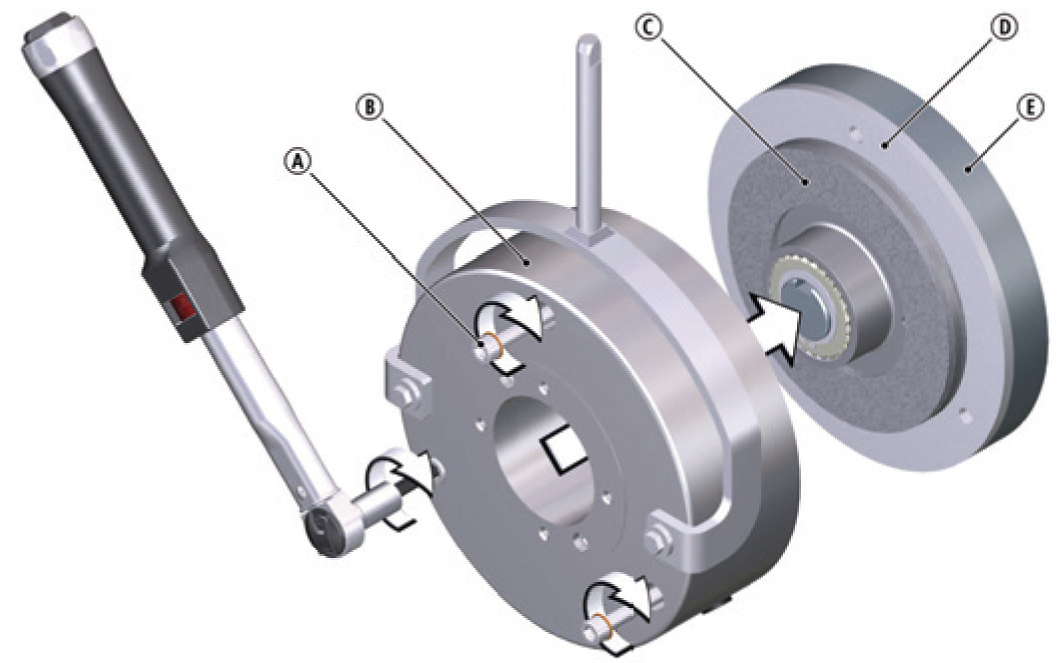


Fig. 9: **Tightening the screws with a torque wrench**

Ⓐ Socket-head cap screw Ⓑ Complete stator Ⓒ Rotor
Ⓓ Flange Ⓔ End shield

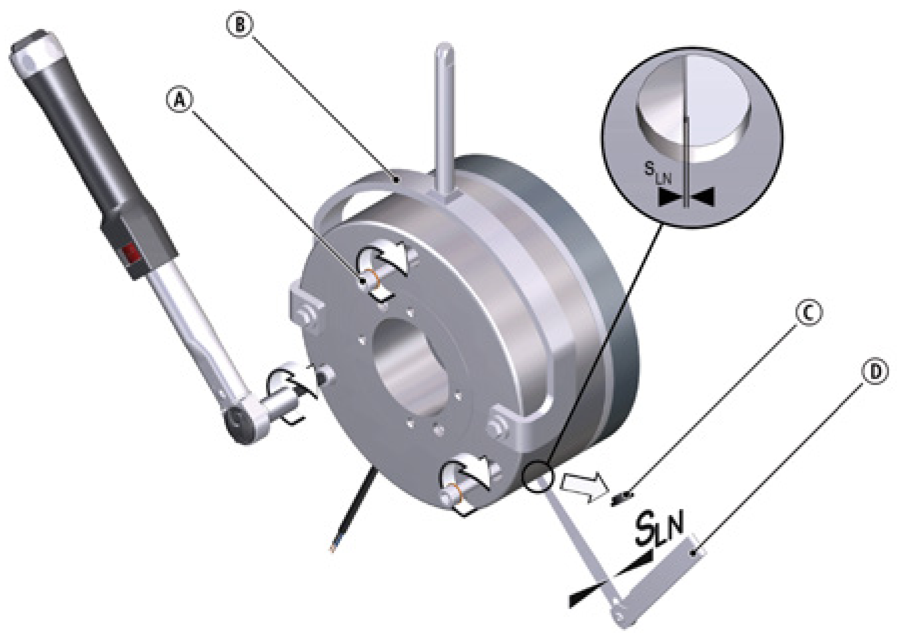


Fig. 10: **Measure the air gap (for sizes 12 to 18)**

Ⓐ Socket-head cap screw Ⓑ Hand-release Ⓒ Dummy plug
Ⓓ Feeler gauge

Notice

- Do not push the feeler gauge in more than 10 mm between the armature plate and the stator!
- The customer must seal the brake in this position himself if no shaft sealing ring or sealing cover is in use.
- If it is necessary to loosen the screws with the seal again, the seals or the complete screw set must be replaced.

6. Check the air gap near the screws using a feeler gauge (for components sized 12 to 18). These values must match the specifications for s_{LN} found in the table Air gap and rotor thickness, Page 14.

NOTICE

Tightening torques: refer to the table Mounting data, Page 14.

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.

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6.1.1 AC switching at the motor – extremely delayed engagement

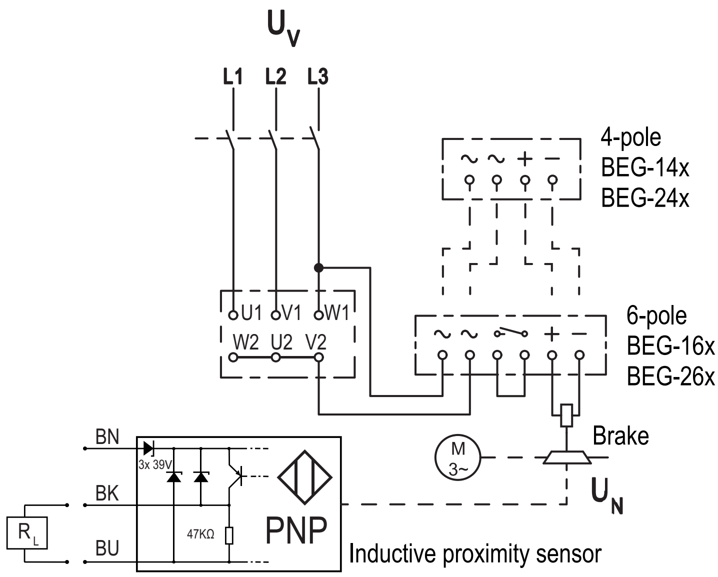


Fig. 11: **Supply: Phase-neutral**

Bridge rectifiers

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

Half-wave rectifier

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

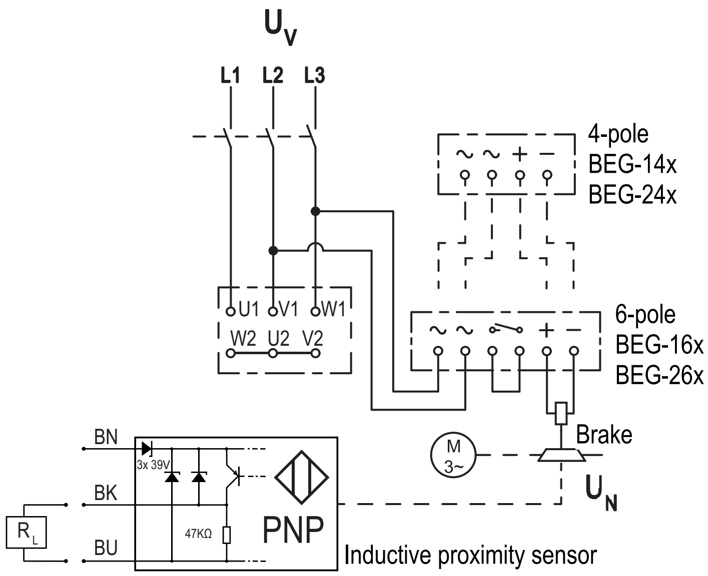


Fig. 12: **Supply: Phase-phase**

Bridge rectifier [1)]

BEG-1xx: U_N [V DC] = $0.9 \cdot U_V$ [V AC]

Half-wave rectifier

BEG-2xx: U_N [V DC] = $0.45 \cdot U_V$ [V AC]

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

6.1.2 DC switching at the motor – fast engagement

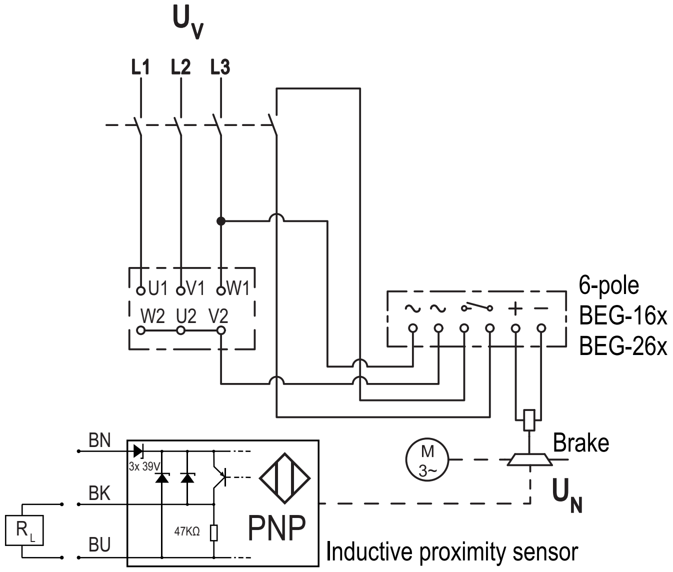


Fig. 13: **Supply: Phase-neutral**

Bridge rectifiers

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

Half-wave rectifier

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

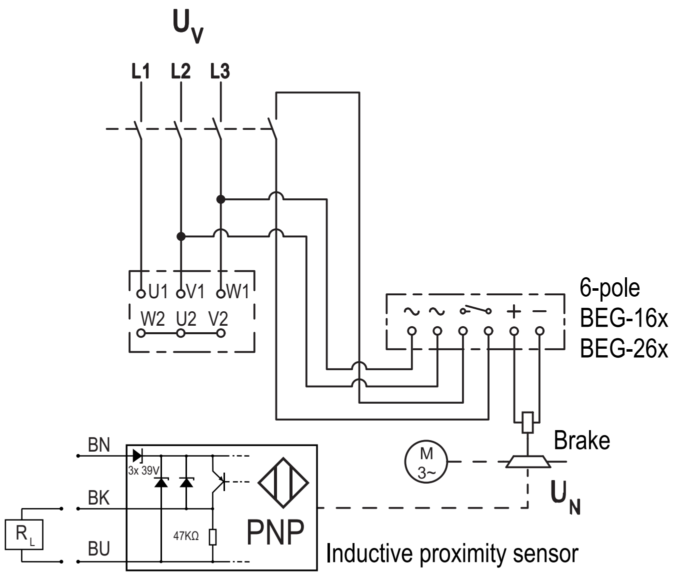


Fig. 14: **Supply: Phase-phase**

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.

6.1.3 AC switching at mains – delayed engagement

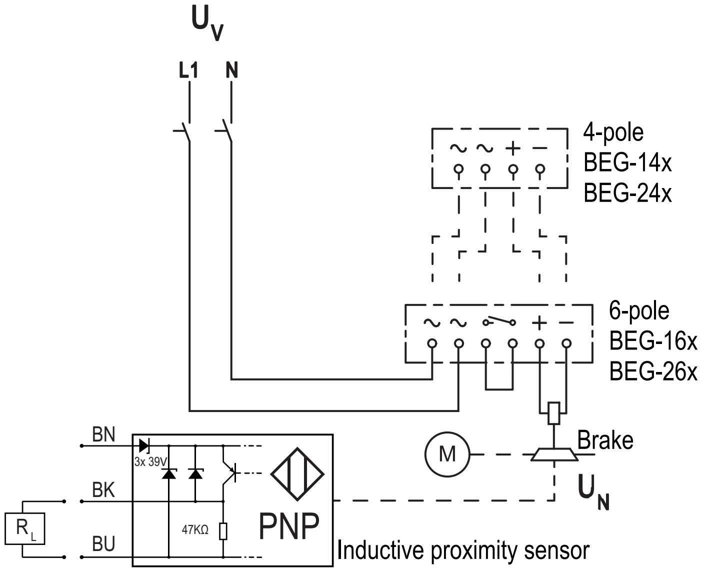


Fig. 15: **Supply: Phase-N**

Bridge rectifiers	Half-wave rectifier
BEG-1xx: U_N [V DC] = 0.9 • U_V [V AC]	BEG-2xx: U_N [V DC] = 0.45 • U_V [V AC]

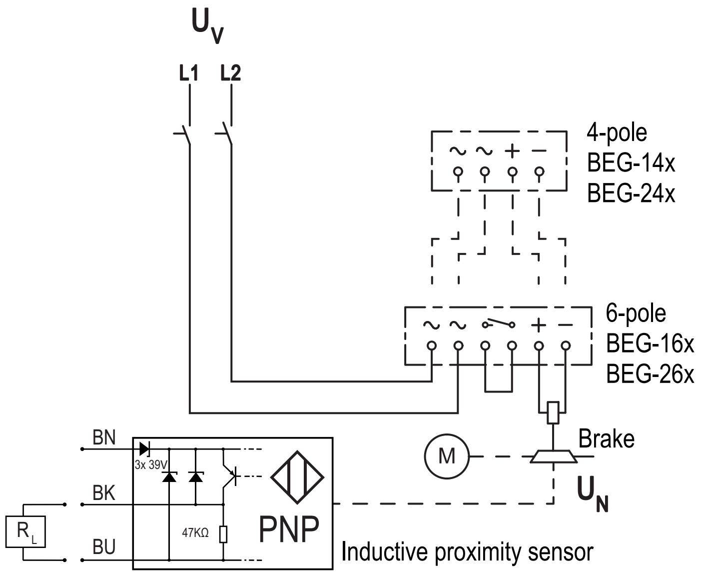


Fig. 16: **Supply: Phase-phase**

Bridge rectifier [1]	Half-wave rectifier
BEG-1xx: U_N [V DC] = 0.9 • U_V [V AC]	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

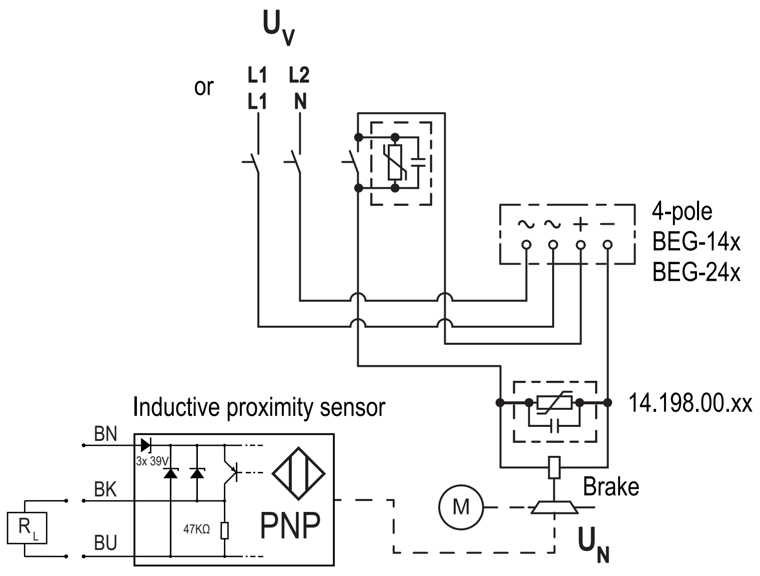


Fig. 17: **Supply: Phase-phase or phase-N via 6-pole rectifier**

Bridge rectifier [1)]	Half-wave rectifier
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.

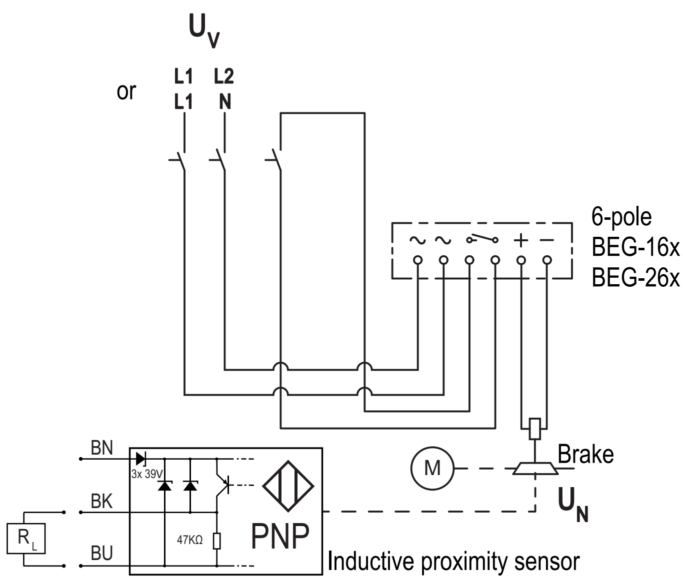


Fig. 18: **Supply: Phase-phase or phase-N via 4-pole rectifier**

Bridge rectifier [1)]	Half-wave rectifier
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.

6.2 Technical data for inductive proximity sensors

Design	PNP, N/O contact
Operating voltage	10 to 30 VDC
Permitted residual ripple	20% U_B
No-load current	Max. 10 mA
Output current	Max. 200 mA
Voltage drop at outputs	Max. 2.0 V at 200 mA
Short circuit protection	integrated
Reverse polarity protection	integrated
Induction protection	integrated
Protection class	P67
Cable configuration and parameters	
Cable (diameter / length / AWG)	Ø 3.3 mm / L = 2 m / AWG 26
Maximum cable length	100 m
Gray	Color of sheath insulation
Brown (BN)	+ U_B
Black (BK)	Signal (with released armature plate - brake energized)
Blue (BU)	- U_B
Operating conditions	
Ambient temperature range T_A	From -40°C to +120°C (no component damage) From -25°C to +120°C (information evaluation)
Shock and vibration	IEC 60947-5-2 / 7.4
EMC protection	
IEC 60947-5-2 (7.2.3.1)	1 kV
IEC 61000-4-2	Level 2
IEC 61000-4-3	Level 3
IEC 61000-4-4	Level 2

Tab. 8: **Technical specifications: Inductive proximity sensor for control of ventilation**

6.3 Minimum bending radius for the brake connection cable

Size	Wire cross-section	Minimum bending radius
06	AWG 20	28 mm
08		
10		
12		
14		
16		
18		46 mm

Tab. 9: **Minimum bending radius for the brake connection cable**

6.4 Bridge/half-wave rectifier (optional)

BEG-561-□□□-□□□

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

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

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

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

Rectifier type	Supply voltage	Over-excitation		Holding current reduction	
		Coil voltage	Size	Coil voltage	Size
	[V AC]	[V DC]		[V DC]	
BEG-561-255-030	230	103	06 – 18	205	06 – 12
BEG-561-255-130			-		14 – 18
BEG-561-440-030-1	400	180	06 – 18	-	-

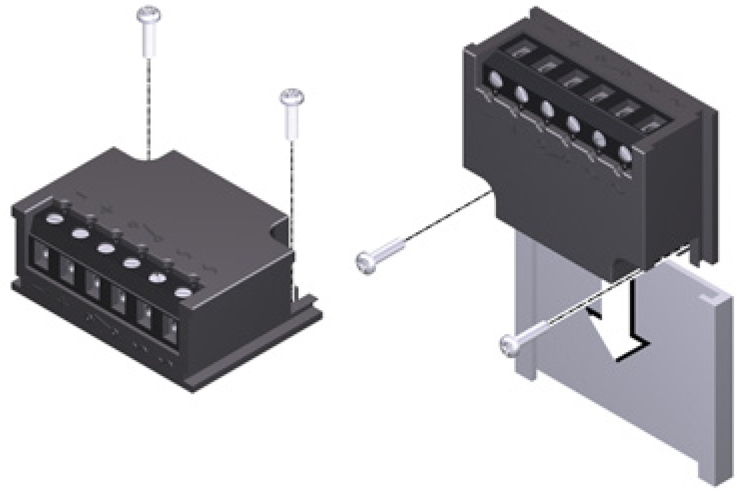


Fig. 19: **BEG-561 fastening options**

6.4.2 Technical specifications

Rectifier type	**Bridge / half-wave rectifier**
Output voltage for bridge rectification	0.9 x U_1
Output voltage for half-wave rectification	0.45 x U_1
Ambient temperature (storage/operation) [°C]	-25 – +70

U_1 input voltage (40 – 60 Hz)

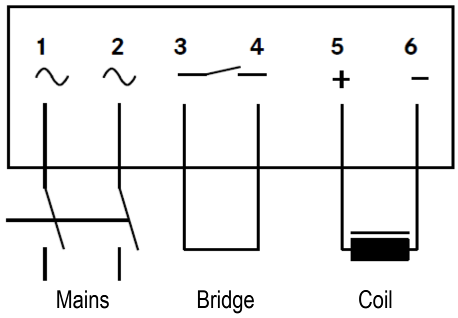
Type	**Input voltage U_1 (40 Hz – 60 Hz)**			**Max. current I_{max}**		**Over-excitation period t_{ue} (± 20 %)**		
	Min.	**Rated**	**Max.**	**Bridge**	**half-wave**	**at $U_{1\ min}$**	**at $U_{1\ Nom}$**	**at $U_{1\ max}$**
	[V~]	**[V~]**	**[V~]**	**[A]**	**[A]**	**[s]**	**[s]**	**[s]**
BEG-561-255-030	160	230	255	3.0	1.5	0.430	0.300	0.270
BEG-561-255-130						1.870	1.300	1.170
BEG-561-440-030-1	230	400	440	1.5	0.75	0.500	0.300	0.270
BEG-561-440-130				3.0	1.5	2.300	1.300	1.200

Tab. 10: **Data for bridge/half-wave rectifier type BEG-561**

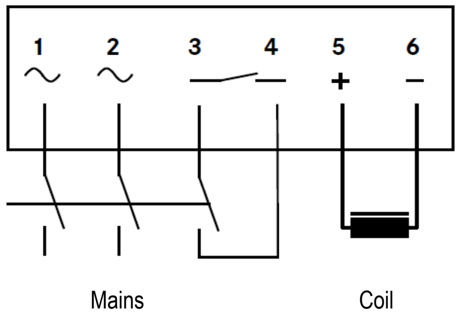
6.4.3 Reduced switch-off times

AC switching must also be carried out for the mains supply side switching (fast engagement)! Otherwise, there will be no overexcitation when it is switched back on.

Delayed engagement



Fast engagement



6.4.4 Permissible current load at ambient temperature

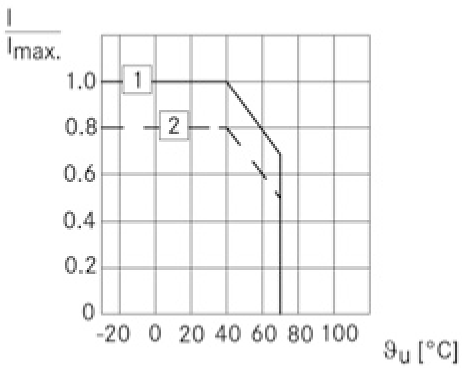


Fig. 20: **Permissible current load**

① If screwed to metal surface (good heat dissipation)

② For other installations (e.g. with adhesive)

7 Commissioning and operation

7.1 operating range for the Kendrion INTORQ spring-applied brake

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 IP66 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.
   - When using bridge/half-wave rectifiers: After switching to one-way voltage, the measured DC voltage may drop to 45% of the voltage specified on the name plate.
5. Check the air gap s_L. The air gap must be zero 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.

7.2.3 Checking a brake with proximity switch

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.
   - When using bridge/half-wave rectifiers: After switching to one-way voltage, the measured DC voltage may drop to 45% of the voltage specified on the name plate.
5. For sizes 12 to 18: Check the air gap s_L. The air gap must be zero and the rotor must rotate freely.
6. Check the switching status of the proximity switch (refer to table below).
7. Switch the power off.
8. Check the switching status of the proximity switch again (refer to table below).
9. Switch off the supply to the motor and brake securely.
10. Connect the bridges to the motor terminals. Remove any extra neutral conductor.

Contact type	Connection	Brake released	Proximity sensor is closed
NO contact	black / blue	no	no

Tab. 11: **Switching state of the proximity sensor**

7.2.4 Testing the hand-release functionality

	NOTICE
	This operational test must also be carried out!

1. Make sure that the motor and brake are de-energized.
2. Pull (with some force) on the lever until the force increases sharply.
   – The rotor must now rotate freely. A small residual torque is permissible.

	NOTICE
	▮ Make sure that the brake it not subject to excessive force. ▮ Do not use auxiliary tools (e.g. extension pipes) to facilitate the air release. Auxiliary tools are not permitted and are not considered as proper and intended usage.

3. Release the lever.
   – A sufficient torque must build up immediately!

Notice

If faults occur, refer to the error search table (Troubleshooting and fault elimination). If the fault cannot be fixed or eliminated, please contact the customer service department.

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%!
- When using bridge/half-wave rectifiers: After switching to one-way voltage, the measured DC voltage may drop to 45% of the voltage specified on the name plate.

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>
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<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 on reversal between armature plate and cylinder pin</td><td>Play of armature plate and cylinder pin</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. 12: **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 46 in the chapter Verschleiß von Federkraftbremsen, Page 46. 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
BFK470	▮ 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 defective armature plates, springs or flanges must be completely replaced. Observe the following for inspections and maintenance works:

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

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8.3.1 Checking the components

With mounted brake	▮ Check release function and control	Refer to Release / voltage, Page 49
	▮ Possible with the components sized 12 to 18: Measure the air gap	Refer to Checking the air gap, Page 48
	▮ Measure the rotor thickness (replace rotor if required)	Refer to Brake replacement, Page 49
	▮ Thermal damage of armature plate or flange (dark-blue tarnishing)	Refer to Brake replacement, Page 49
After removing the brake	▮ Check the play of the rotor gear teeth (replace worn-out rotors)	Refer to Brake replacement, Page 49
	▮ Check for breaking out of the torque support at the guide parts and the armature plate	
	▮ Check the springs for damage	
	▮ Check the armature plate and flange or end shield	
	– Flatness depending on the size	Refer to Brake replacement, Page 49
	– Max. run-in depth = rated air gap for the size	Refer to Checking the air gap, Page 48

8.3.2 Checking the air gap

⚠ **DANGER**

Danger: rotating parts!

The motor must **not** run while the air gap is being checked.

Notice

It is only possible to check the air gap for sizes 12 to 18.

1. Lift the plug out **by hand**. Do not use a sharp-edged tool since it could destroy the plug!
2. Measure the air gap s_L between the armature plate and the stator near the fastening screws using a feeler gauge as shown in the figure Measure the air gap (for sizes 12 to 18), Page 30. (Refer to the table Air gap and rotor thickness, Page 14 for the values.)
3. Compare the measured air gap with the value for the max. permissible air gap s_{Lmax} . (Refer to the Air gap and rotor thickness, Page 14 table for the values.)

NOTICE

Finally, push the plug straight and firmly back in again. Make sure that the plug does not become tilted!

4. Press the plug straight and firmly into the hole without tilting it!

NOTICE

The brake may only be used when the air gap $s_L < s_{Lmax}$!

8.3.3 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.
   – Compare the measured voltage to the voltage specified on the name plate. A deviation of up to 10% is permitted.
   – When using bridge/half-wave rectifiers: After switching to one-way voltage, the measured DC voltage may drop to 45% of the voltage specified on the name plate.

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 armature plate for thermal (heat-related) damage (dark blue tarnishing).
8. Replace the stator if it shows signs of thermal damage.
9. Check the flange. Replace it if scoring is clearly visible.
   - Replace the flange if it shows sign of thermal damage.
10. Check the end shield's friction surface. Replace the friction surface on the end shield when there is clearly visible scoring at the running surface. In case of strong scoring on the end shield, rework the friction surface.
11. Measure the thickness of the new rotor using a caliper gauge.

12. Install the new brake as described in the section Mounting the brake, Page 28.
13. Re-connect the connection cables.
14. Put the brake back into operations.
15. If necessary, deactivate the mechanical shutdown of the system.

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.

8.4 Spare parts list

Spring-applied brake INTORQ BFK470-06 to 18

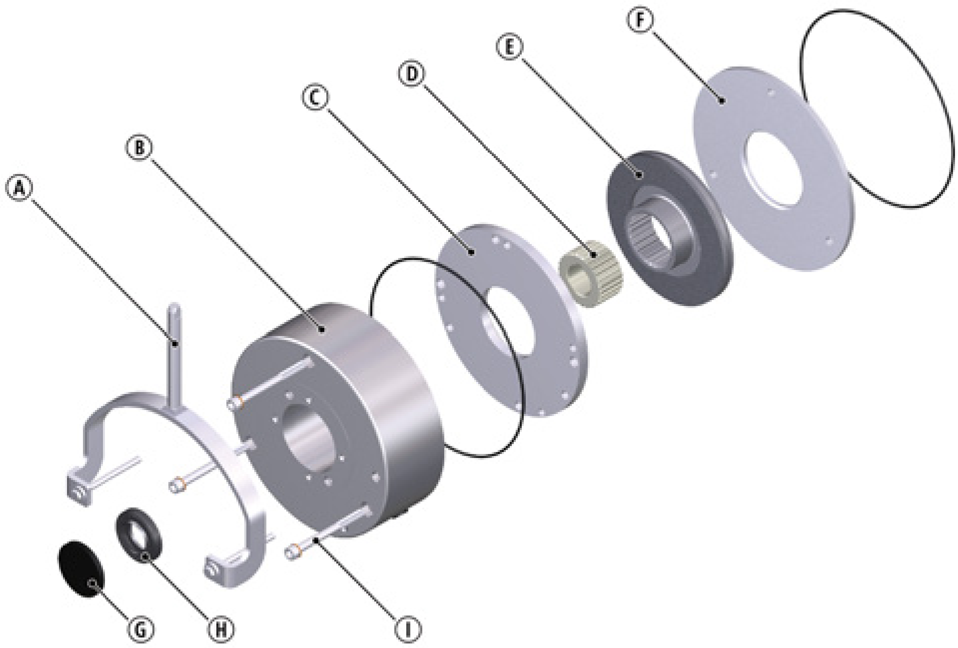

Fig. 21: **Spring-applied brake INTORQ BFK470-06 to 18**

	Designation	Variant
Ⓐ	Hand-release with standard lever	
Ⓑ	Complete stator	Voltage / braking torque
Ⓒ	Armature plate	
Ⓓ	Hub	Bore diameter [mm] keyway according to DIN 6885/1
Ⓔ	Complete rotor	Aluminum rotor
Ⓕ	Flange	
Ⓖ	Sealing cover	
Ⓗ	Shaft sealing ring	Shaft diameter on request
Ⓘ	Screw set DIN EN ISO 4762 - 8.8 in various designs and lengths	▮ for mounting to the motor ▮ for flange with through hole

9 Troubleshooting and fault elimination

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

Fault	Cause	Remedy
Brake cannot be released, air gap is not zero	Coil interruption	▮ Measure coil resistance using a multimeter: – If resistance is too high, replace the complete spring-applied brake.
	Coil has contact to earth or between windings	▮ Measure coil resistance using a multimeter: – Compare the measured resistance with the nominal resistance. Refer to Characteristics, 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).
	Wiring defective or wrong	▮ Check the wiring and correct. ▮ Check the cable for continuity using a multimeter – Replace the complete spring-applied brake if a cable is defective.
Brake cannot be released, air gap is not zero	Rectifier defective or incorrect	▮ 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.

Fault	Cause	Remedy
Brake does not release	Air gap too big	Replace rotor. Refer to Brake replacement, Page 49.
	Rotor is too thin	
Voltage too high	Brake voltage does not match the rectifier	Adjust rectifier and brake voltage to each other.
Voltage too low	Brake voltage does not match the rectifier	Adjust rectifier and brake voltage to each other.
	Defective rectifier diode	Replace the defective rectifier with a suitable undamaged one.
AC voltage is not mains voltage	Fuse is missing or defective	Select a connection with a proper fuse.

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