INTORQ

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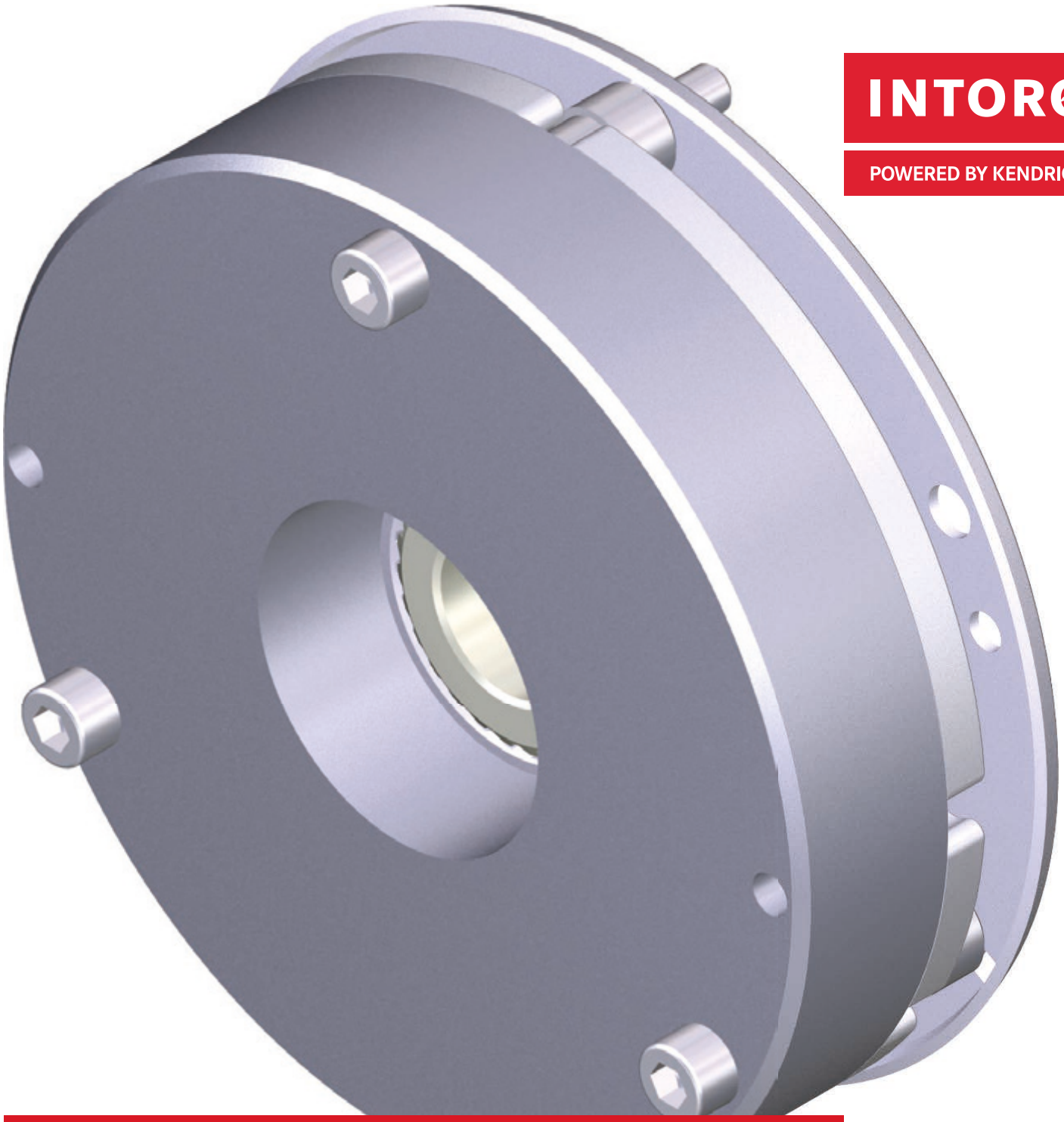


INTORQ BFK557

Spring-applied brake with electromagnetic release

Translation of the Original Operating Instructions

www.kendrion.com

Document history

Material number	Version			Description
33008776	1.0	04/2020	SC	First edition, Additional sizes: 06, 08, 10, 12
33008776	2.0	07/2020	SC	Notice added to chapter 5.5, updated chapter 8.2.1 and chapter 8.3
33008776	3.0	01/2021	SC	Change of name to Kendrion INTORQ, updated chapter 4.6 and chapter 8.3
33008776	4.0	03/2022	SC	Updating chapters 3.5, 4.2, 4.3, 5.1, 5.2, 5.5.2, 7.1, 8.2 and 8.3

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

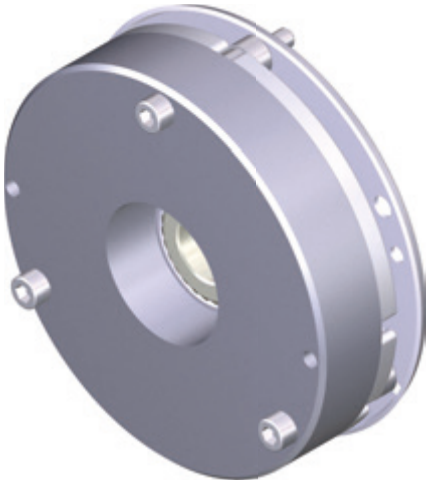
Notice

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.

Spring-applied brakes of type BFK557-06...12

Design sizes 06-12



Product key

INTORQ B FK □□□ □□ □

Product group: Brakes

Product family: Spring-applied brake

Type: 557

Size: 06, 08, 10, 12

Design/type:
H-version (rated torque + tolerance)
Not specified: Standard brake (rated torque +/-tolerance)

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.

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 7
Symbols	Wildcard	□	Wildcard (placeholder) for options or selection details For example: BFK557-□□ = BFK557-10
	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

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 15) 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 BFK557 spring-applied brake.

3.2.1 Sizes 06 to 12

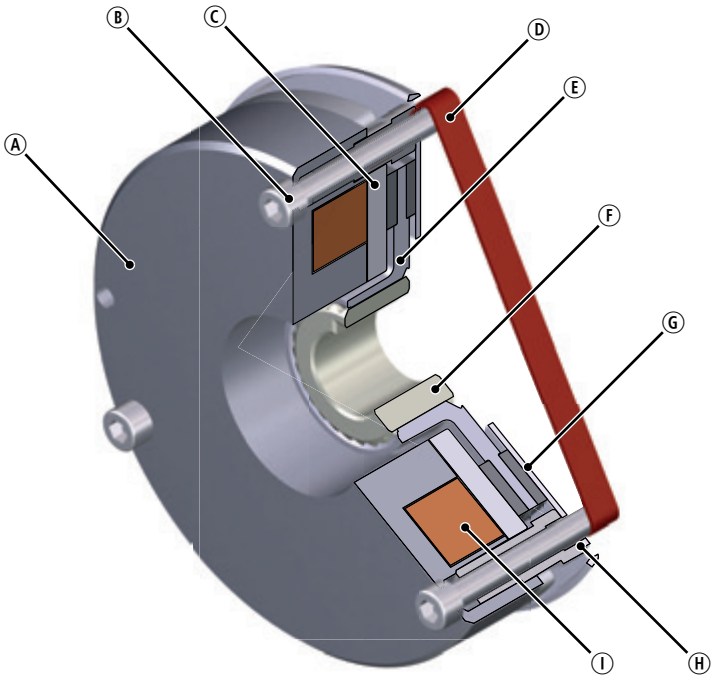


Fig. 1: **Design of a INTORQ spring-applied brake BFK557-06 to 12: Complete stator + rotor + friction plate**

Ⓐ Stator	Ⓑ Socket-head cap screw	Ⓒ Armature plate
Ⓓ Assembly lock (rubber ring)	Ⓔ Rotor	Ⓕ Hub
Ⓖ Friction plate (optional)	Ⓗ Sleeve bolt	Ⓘ Coil

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 and for emergency stops.

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 effect of environmental influences must all be taken into account.
- The brakes are dimensioned in such a way that the specified rated torques are reached safely after a short run-in period.
- Increased breakaway torque can occur as a result of long standstill periods in humid environments with varying temperatures.
- 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. These must be taken into account in the form of appropriate dimensioning tolerances. Increased breakaway torque can occur in particular as an result of long standstill periods in humid environments with varying 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 Hand-release (optional)

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

3.6.2 Optional flange

If no suitable friction surface is available, an optional flange can be delivered.

3.6.3 Optional friction plate

A friction plate can be used if there is an available flat surface that is not suitable for use as a friction surface.

3.6.4 Optional cover ring

The cover ring prevents most dust and moisture from escaping or penetrating into the brake compartment.

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 IP54 protection. Because of the numerous possibilities of using the brake, it is still necessary to check the functionality of all mechanical components under the corresponding operating conditions.
- Ambient temperature:
  - -20 °C to +50 °C (Standard)

4.2 Characteristics

Size	Brake torque		Max. permissible switching energy	Air gap		Moment of inertia of rotor	Weight of brake
	Rated value at Δn=100 rpm	Rated value of the H-version					
	M_K	M_K	Q_E	S_{LN} [1)]	S_{Lmax}	J_{Rotor}	m
	[Nm]	[Nm]	[J]	[mm]	[mm]	[kg cm²]	[kg]
06	2.5	2	3000	0.2 $^{-0.1}$	0.5	0.130	0.86
	3	2.5			0.4		
	5	4			0.3		
08	5	4	7500	0.2 $^{-0.1}$	0.5	0.450	1.34
	7	5			0.4		
	10	8			0.3		
10	10	8	12000	0.25 $^{-0.1}$	0.6	2.0	2.58
	13	10			0.5		
	20	16			0.35		
12	20	16	24000	0.3 $^{-0.1}$	0.65	4.5	3.77
	27	21			0.55		
	40	32			0.4		

Tab. 1: **General data**

[1)] The default (as delivered) air gap results from the sum tolerances of the individual components. These operating times are specified for usage of Kendrion INTORQ bridge/half-wave rectifiers and coils with a connection voltage of 205 V DC at s_{LN} and 0.7*I_N.

Size	Outer diameter	Screw hole circle		Minimum thread depth	Tightening torque	
					Screws	Lever
		Diameter (Ø)	Thread[1)]		M_A	M_A
	[mm]	[mm]		[mm]	[Nm]	[Nm]
06	83	72	3x M4	11	3.0	2.8
08	103	90	3x M5		5.9	
10	127	112	3x M6	14	10.1	4.8
12	147	132				

Tab. 2: **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 table Mounting data, Page 16).

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	Rated brake torque at Δn=100 rpm	Braking torque at Δn_0			Max. rotation speed Δn_{0max}
	M_K	1500	3000	Max.	
	[%]	[%]	[%]	[%]	[rpm]
06	100	87	80	74	6000
08		85	78	73	5000
10		83	76		4000
12		81	74		3600

Tab. 3: **Brake torques**

Size	Electrical power	Rated voltage	Rated current	Coil resistance
	P_N	U_N	I_N	R_N
	[W]	[V]	[A]	[Ω] ±8%
06	20	24	0.83	28.8
	19.3	103	0.187	550
	18.7	127	0.147	863
	19.9	180	0.111	1620
	20	205	0.098	2101
	18.7	215	0.087	2472
	20	250	0.08	3125
08	23	24	0.958	25.04
	24	103	0.233	442
	23	127	0.181	701
	23.5	180	0.131	1379
	24.5	205	0.12	1715
	23	215	0.107	2010
	23.5	250	0.094	2660
10	24	24	1.0	24.0
		103	0.233	442
	25	127	0.197	645
	27	180	0.15	1200
		205	0.132	1556
	25	215	0.116	1849
	26	250	0.104	2404
12	38	24	1.583	15.2
		103	0.369	279
	40	127	0.315	403
	38	180	0.211	853
	40	205	0.195	1051
		215	0.186	1156
		250	0.160	1563

Tab. 4: **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.

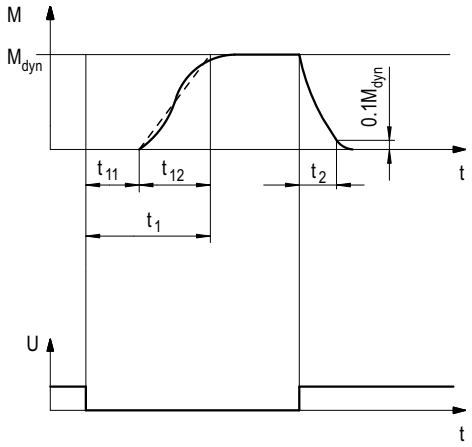


Fig. 2: **Operating/switching times of the spring-applied brakes**

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

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 34.

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.

Size	Rated torque		Max. permissible switching energy	Operating times [2]			
	at 100 rpm	H-version		DC-side engagement			Disengaging
	M_K	M_K	Q_E [1]	t_{11}	t_{12}	t_1	t_2
	[Nm]	[Nm]	[J]	[ms]	[ms]	[ms]	[ms]
06	2.5	2	3000	20	13	33	30
	3	2.5		16	13	29	40
	5	4		10	13	23	60
08	5	4	7500	30	16	46	40
	7	5		25	16	41	50
	10	8		15	16	31	65
10	10	8	12000	50	19	69	70
	13	10		40	19	59	90
	20	16		25	19	44	120
12	20	16	24000	55	25	80	100
	27	21		45	25	70	130
	40	32		30	25	55	170

Tab. 5: **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 Kendrion INTORQ bridge/half-wave rectifiers and coils with a connection voltage of 205 V DC at s_{LN} and 0.7 I_N.

4.4 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.

4.5 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.

4.6 Labels on product

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

Fig. 3: **Packaging label**

Kendrion INTORQ	Manufacturer
33007925	ID number
BFK557-10	Type (refer to Product key, Page 3)
	Bar code
SPRING-APPLIED BRAKE	Designation of the product family
205 V DC	Rated voltage
16 NM	Rated torque
1 pc.	Qty. per box
27 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

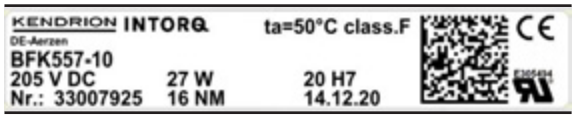


Fig. 4: **Name plate (example)**

Kendrion INTORQ	Manufacturer
ta=50°C	Permissible ambient temperature
Class. F	Insulation class F
BFK557-10	Type (refer to Product key, Page 3)
205 V DC	Rated voltage
27 W	Rated power
20 H7	Hub diameter
No. 33007925	ID number
16 NM	Rated torque
14.12.20	Date of manufacture
	Data matrix code
CE	CE mark
	UL 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; written confirmation is required for such usage.
- If a friction plate is used as a counter friction surface, the customer must ensure that it is fully supported by the motor end shield.
- 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/mm²]
06	S235JR; C15; EN-GJL-250	Rz6	0.03	< 0.06	250
08			0.03		
10			0.03		
12			0.05		

Tab. 6: **End shield as counter friction surface**

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

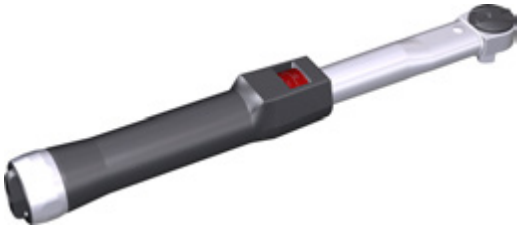
[2)] When **no** brake flange or friction plate is used.

5.2 Tools

NOTICE

Tightening torques: refer to the table Mounting data, Page 16.

Multimeter	Caliper gauge	Feeler gauge
		

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		

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.

Notice

Recommended ISO fitting for shaft:	Up to 50 mm diameter: k6 Greater than 50 mm diameter: m6
Recommended roughness of the shaft:	R_{zmax} 10

- Tensile strength of the hub material:
  - Sizes 06 – 12: Tensile strength R_m > 460 N/mm²

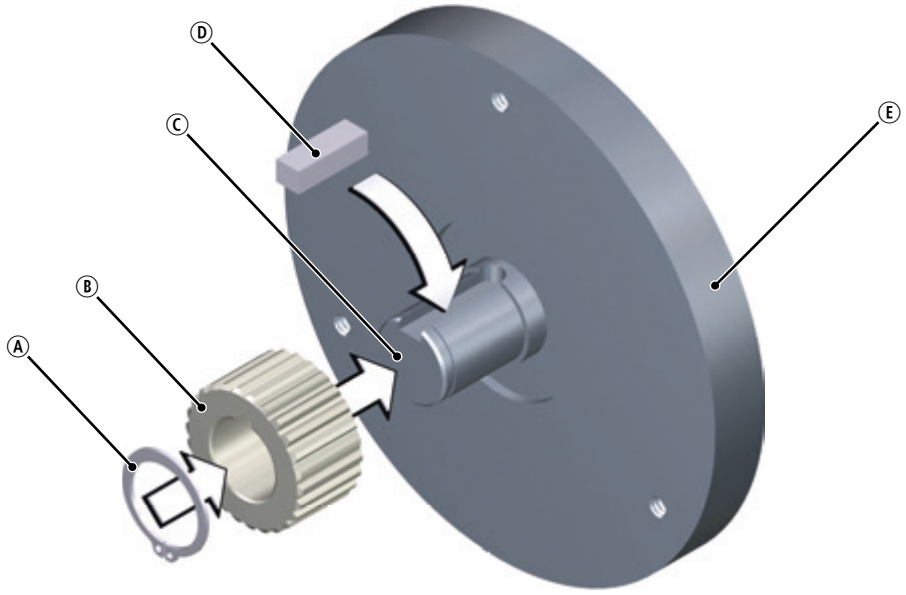


Fig. 5: **Mounting the hub**

Ⓐ Circlip	Ⓑ Hub	Ⓒ Shaft
Ⓓ 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

Notice

To maintain the rated air gap, you must keep the rotor and stator combined together as delivered!

5.5.1 Mounting the BFK557-06 to -12

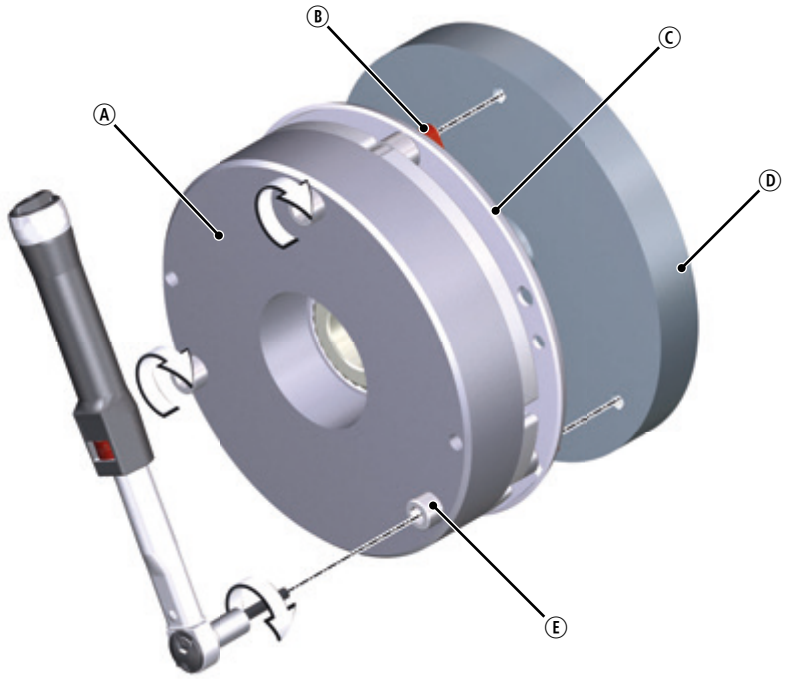


Fig. 6: **Mounting for sizes 06 to 12**

Ⓐ Spring-applied brake
Ⓑ Mounting protection (rubber ring)
Ⓒ Friction plate (optional)
Ⓓ End shield
Ⓔ Socket-head cap screw for fastening the brake

1. Push the spring-applied brake on the hub.
2. Tighten the socket-head cap screws slightly to attach the brake (screws should have just gripped).

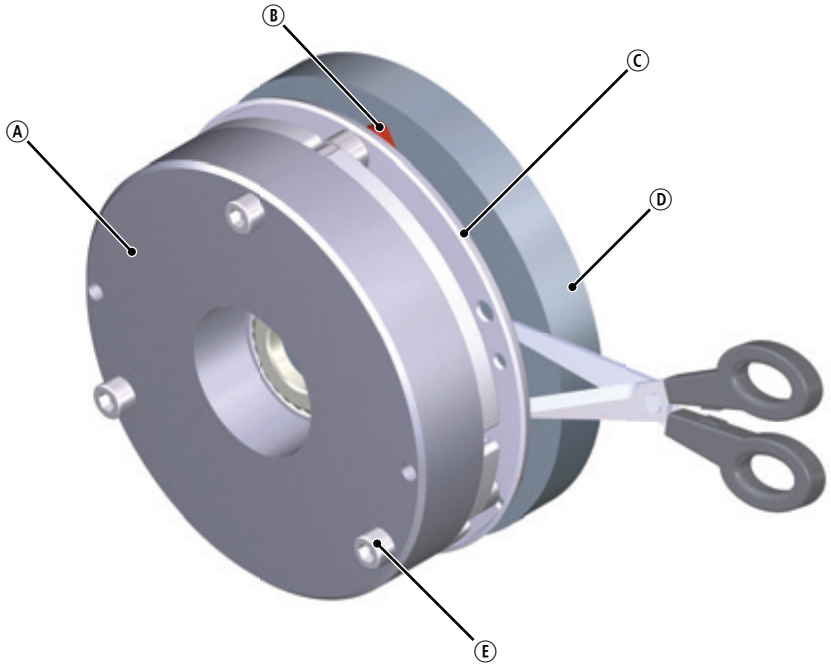


Fig. 7: **Remove the assembly aid**

Ⓐ Spring-applied brake
Ⓑ Assembly lock (rubber ring)
Ⓒ Friction plate (optional)
Ⓓ End shield
Ⓔ Socket-head cap screw for fastening the brake

3. Remove the assembly lock (the rubber ring).
4. Screw the spring-applied brake to the end shield using the cap screws. Use a torque wrench (refer to the Mounting data, Page 16 table for the tightening torques).

5.5.2 Assembly of the flange

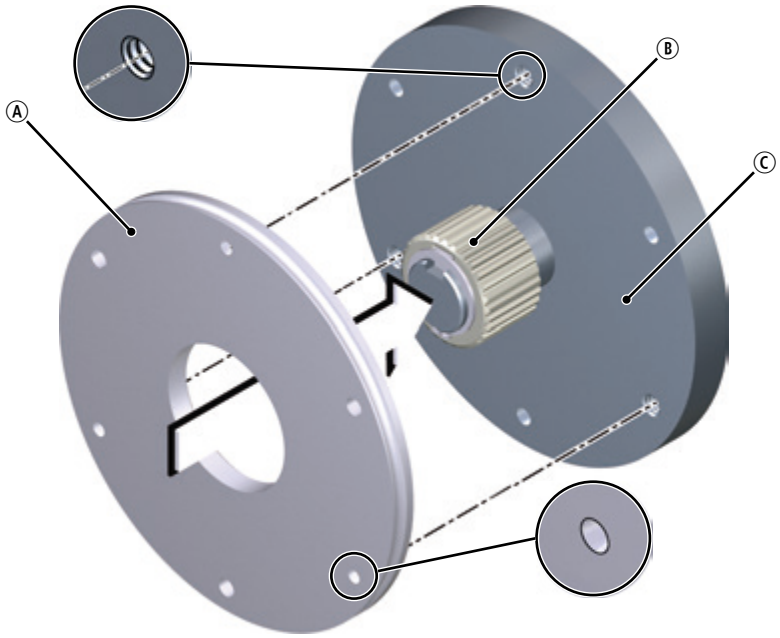


Fig. 8: **Mounting the flange**

Ⓐ Flange Ⓑ Hub Ⓒ End shield

1. Place the flange against the end shield.
2. Align the through holes in the flange to the threads of the fastening bore holes in the end shield.
3. The further work steps are identical with the assembly of the brake as described in the chapter Mounting the BFK557-06 to -12, Page 25.

5.5.3 Mounting the cover ring

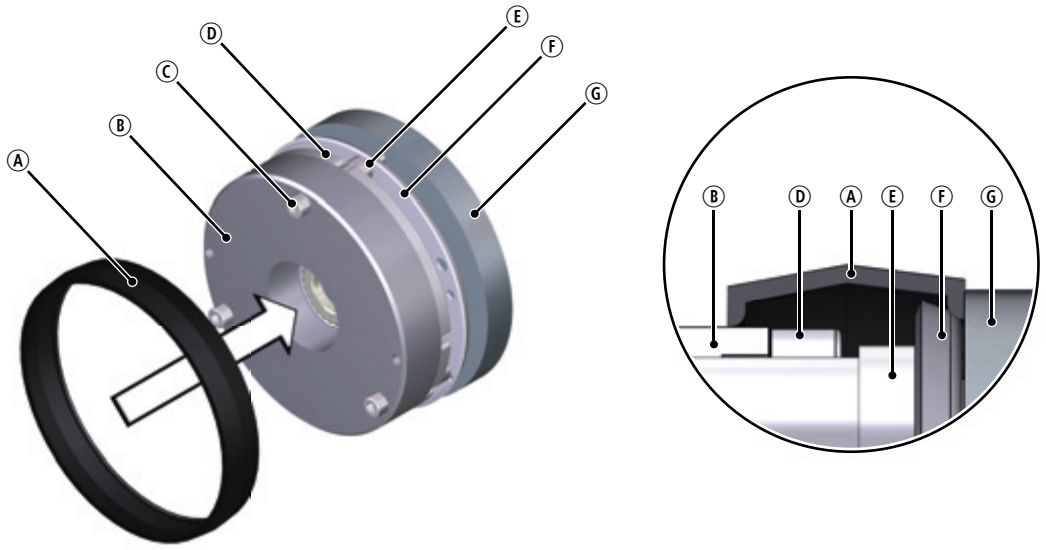


Fig. 9: **Assembly of the cover ring with friction plate**

Ⓐ Cover ring
Ⓑ Stator
Ⓒ Socket-head cap screw
Ⓓ Armature plate
Ⓔ Sleeve bolt
Ⓕ Friction plate
Ⓖ End shield

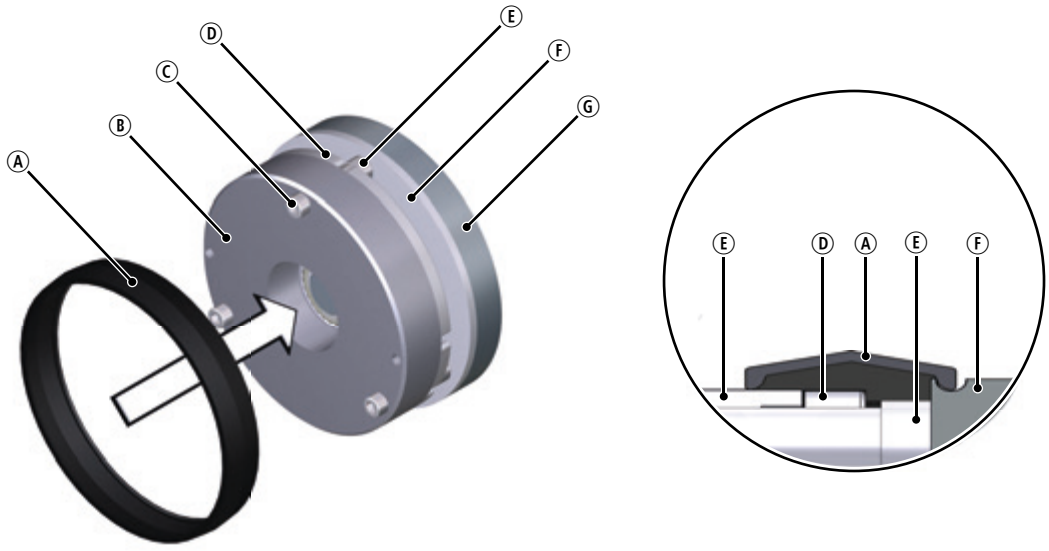


Fig. 10: **Assembly of the cover ring with flange**

Ⓐ Cover ring
Ⓑ Stator
Ⓒ Socket-head cap screw
Ⓓ Armature plate
Ⓔ Sleeve bolt
Ⓕ Flange
Ⓖ End shield

NOTICE

The cover ring may only be used in conjunction with a flange or friction plate!

1. Pull the cables through the cover ring.
2. Slide the cover ring over the stator.
3. Press the corresponding lips of the cover ring into the groove of the flange. If a friction plate is used, the lip must be pulled over the edging.

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

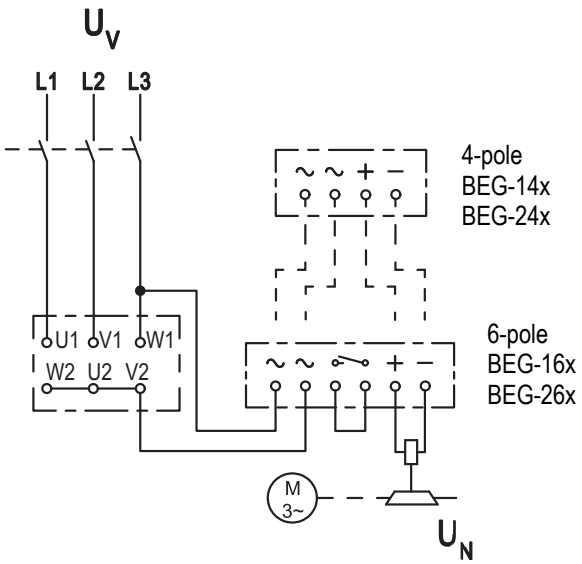


Fig. 11: **Supply: Phase-neutral**

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]

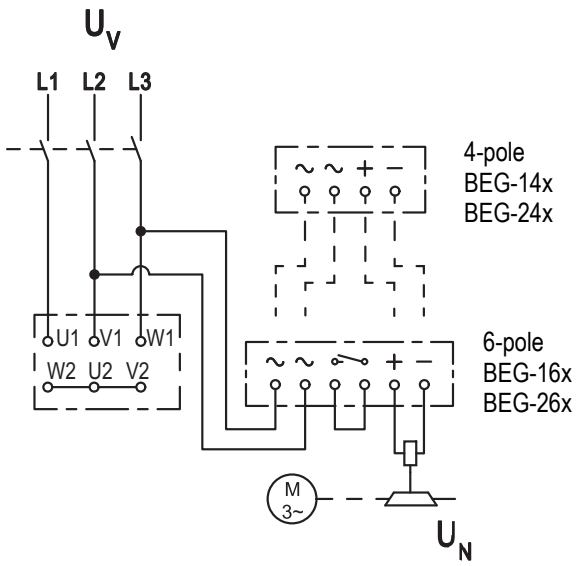


Fig. 12: **Supply: Phase-phase**

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.

6.1.2 DC switching at the motor – fast engagement

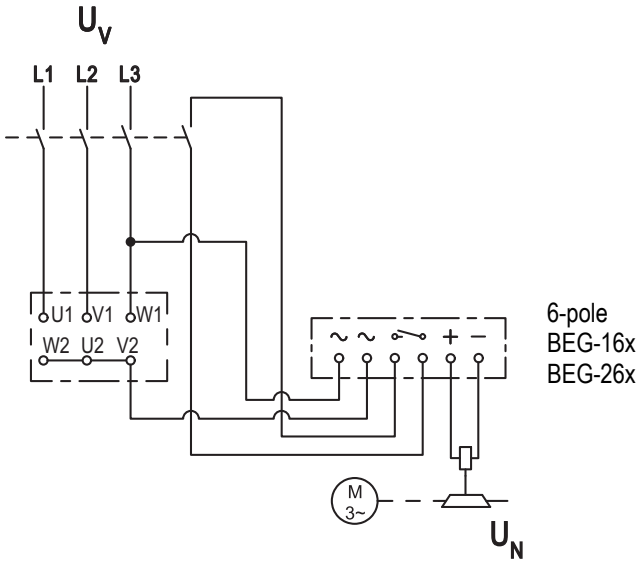


Fig. 13: **Supply: Phase-neutral**

Bridge rectifiers

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

Half-wave rectifiers

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

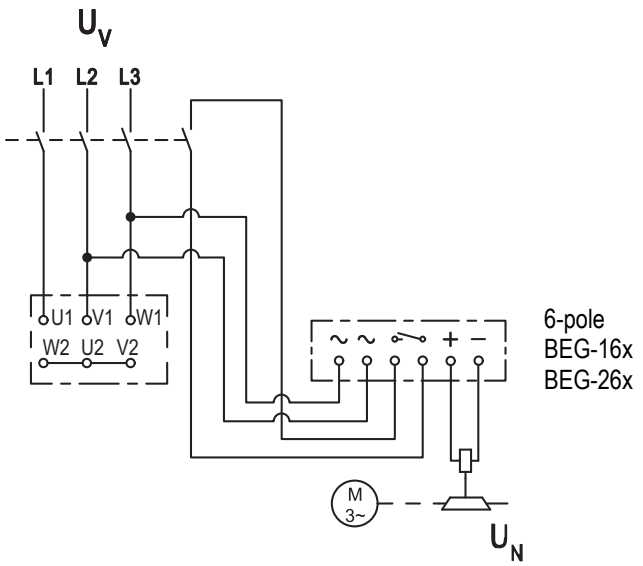


Fig. 14: **Supply: Phase-phase**

Bridge rectifier [1)]

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

Half-wave 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

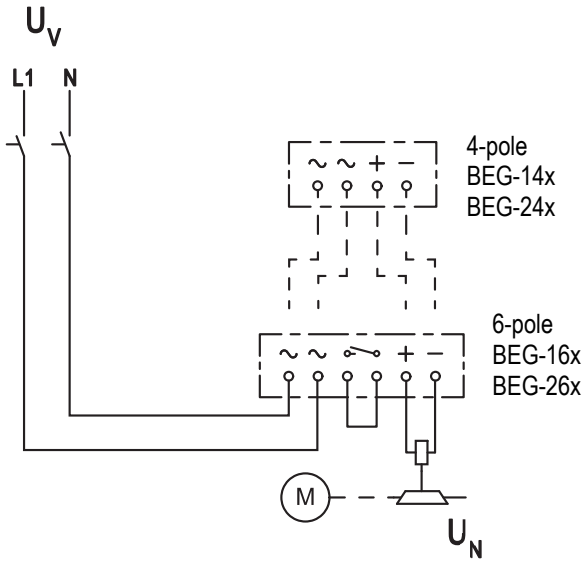


Fig. 15: **Supply: Phase-N**

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

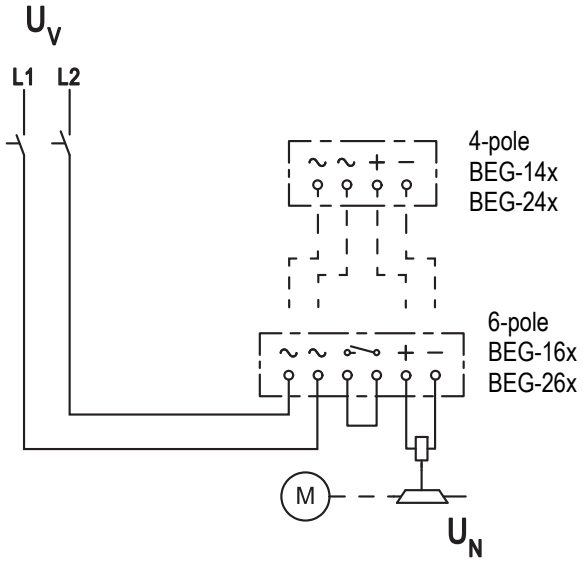


Fig. 16: **Supply: Phase-phase**

Bridge rectifier [1]	Half-wave rectifiers
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

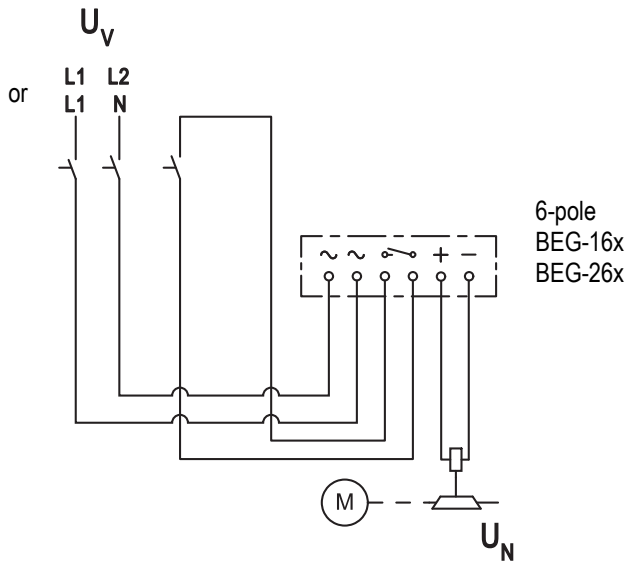


Fig. 17: **Supply: Phase-phase or phase-N via 6-pole rectifier**

Bridge rectifier [1)]

BEG-16x: U_N [V DC] = 0.9 • U_V [V AC]

Half-wave rectifiers

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.

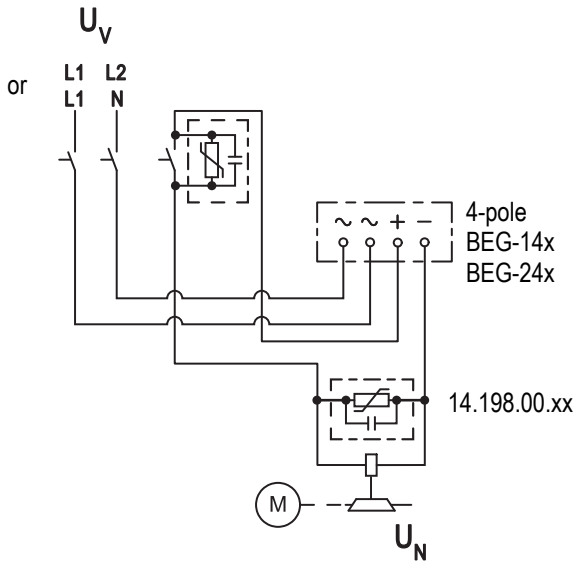


Fig. 18: **Supply: Phase-phase or phase-N via 4-pole rectifier**

Bridge rectifier [1)]

BEG-14x: U_N [V DC] = 0.9 • U_V [V AC]

Half-wave rectifiers

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 Minimum bending radius for the brake connection cable

Size	Wire cross-section	Minimum bending radius
06	AWG 20	27.5 mm
08		
10		
12		

Tab. 7: **Minimum bending radius for the brake connection cable**

6.3 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, Page 32) is limited by an integrated overvoltage protection at terminals 5 and 6.

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

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

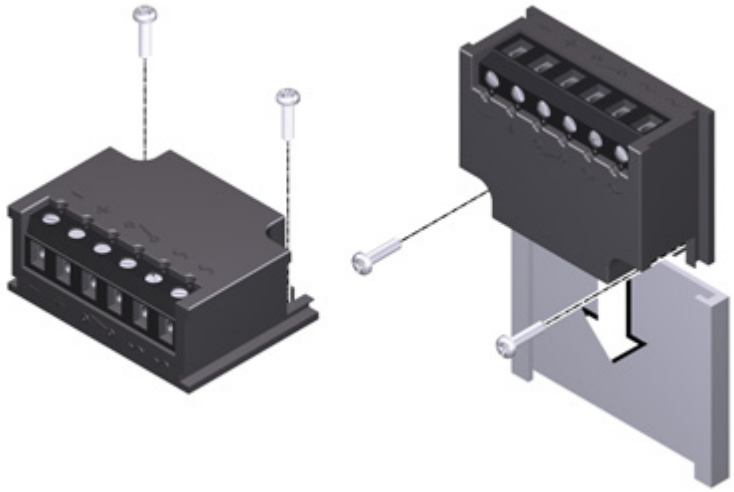


Fig. 19: **BEG-561 fastening options**

6.3.2 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)

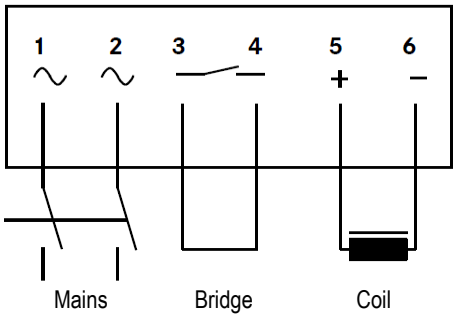
Type	Input voltage U_1 (40 Hz – 60 Hz)			Max. current I_{max}		Over-excitation period t_{ue} (± 20 %)		
	Min.	Rated	Max.	Bridge	half-wave	at $U_{1\ min}$	at $U_{1\ Nom}$	at $U_{1\ max}$
	[V~]	[V~]	[V~]	[A]	[A]	[s]	[s]	[s]
BEG-561-255-030	160	230	255	3.0	1.5	0.430	0.300	0.270
BEG-561-255-130						1.870	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. 8: **Data for bridge/half-wave rectifier type BEG-561**

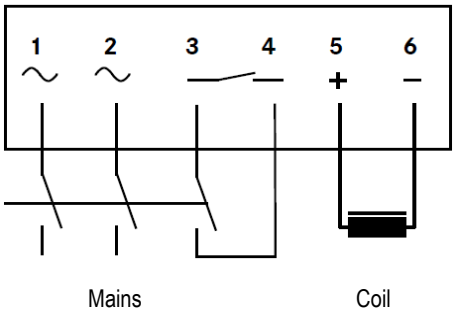
6.3.3 Reduced switch-off times

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



6.3.4 Permissible current load at ambient temperature

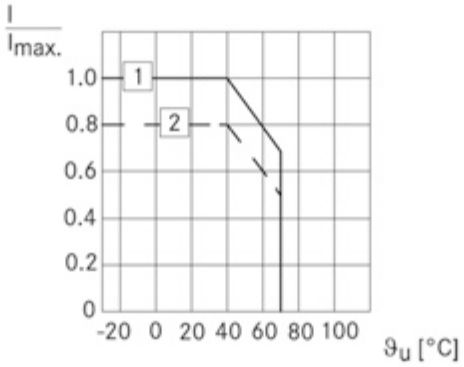


Fig. 20: **Permissible current load**

① If screwed to metal surface (good heat dissipation)

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

7 Commissioning and operation

7.1 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 IP54 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.
- The breakaway torque may increase after long downtimes in humid environments where temperatures vary.
- The brakes are dimensioned in such a way that the specified rated torques are reached safely after a short run-in period

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.

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.

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, Page 48. 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 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, Page 48). 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.

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

Tab. 9: **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 42 in the chapter Verschleiß von Federkraftbremsen, Page 42. 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.

When there is low friction work for each switching operation, the brake's mechanical components may also limit the service life. The rotor-hub connection, the springs, the armature plate and the sleeves are particularly subject to operational wear.

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

⚠ WARNING

In safety-relevant applications that have periodic torque surges (e.g. due to dynamic braking processes), the rotors must always be replaced after 2 million cycles or 10 years at the latest.

Versions	Holding brakes with emergency stop
BFK557	▮ at least every 2 years
	▮ after 1 million cycles of holding brake operations, at the latest
	▮ The brake must be replaced after 10,000 emergency stops at the latest; depending on your particular load conditions, the wear limit may be reached much earlier.

8.3 Maintenance

Notice

Brakes that have defective armature plates, springs, flanges or defective or worn rotors 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.

8.3.1 Checking the components

Simplified inspection/ maintenance with the mounted brake	▮ Check release function and control	Refer to Release / voltage, Page 44
	▮ Measure air gap (if necessary, replace brake)	Refer to Checking the air gap, Page 44
Extended inspection/ maintenance after removal of brake	▮ Check the play of the rotor gear teeth (replace worn-out rotors)	Refer to Brake replacement, Page 45
	▮ Check for breaking out of the torque support at the sleeve bolts and the armature plate	
	▮ Check the springs for damage	
	▮ Check the armature plate and flange or counter friction surface – Thermal damage (dark blue tarnish) – Flatness depending on the size – Max. run-in depth = rated air gap for the size	 Refer to the Design of end shield and shaft, Page 22 table. Refer to the General data, Page 15 table.

8.3.2 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 near the fastening screws using a feeler gauge. (Refer to table General data, Page 15 for the values.)
2. Compare the measured air gap with the value for the max. permissible air gap s_{Lmax} . (Refer to the General data, Page 15 table for the values.)
3. Replace the brake if necessary.

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.

Notice

To maintain the rated air gap, you must keep the rotor and stator combined together as delivered! No adjustment should be made to the air gap!

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. 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.
7. Mount the new brake and tighten the screws evenly to the prescribed tightening torque (refer to chapter Mounting data, Page 16).
8. Re-connect the connection cables.
9. Put the brake back into operations.
10. If necessary, deactivate the mechanical shutdown of the system.

Notice

After replacing the brake, the original braking torque will not be reached until the run-in operation for the friction surfaces has been completed.

8.4 Spare parts list

Sizes 06 to 12

Fig. 21: **Spring-applied brake INTORQ BFK557 - sizes 06 to 12**

	Designation	Variant
Ⓐ	Hand-release	▮ Size
Ⓑ	Complete brake	▮ Size ▮ Brake torque ▮ Voltage ▮ with hand-release ▮ without hand-release ▮ Bore diameter ▮ Keyway according to DIN 6885/1
Ⓒ	Hub	▮ Size ▮ Bore diameter ▮ Keyway according to DIN 6885/1
Ⓓ	Friction plate	▮ Size
Ⓔ	Flange	▮ Size
Ⓕ	Cover ring	▮ Size

Electrical accessories

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

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 Coil data for the values. If resistance is too low, replace the complete stator. ▮ 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 a defective cable.
	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.
Brake cannot be released, air gap is not zero	Air gap too big	▮ For spring-applied brake Kendrion INTORQ BFK557-06 ... 12, replace the brake.

Fault	Cause	Remedy
Rotor is too thin	The brake has not been replaced in time	▮ For spring-applied brake Kendrion INTORQ BFK557-06 ... 12, replace the 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 defective	Select a connection with a proper fuse.

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