INTORQ

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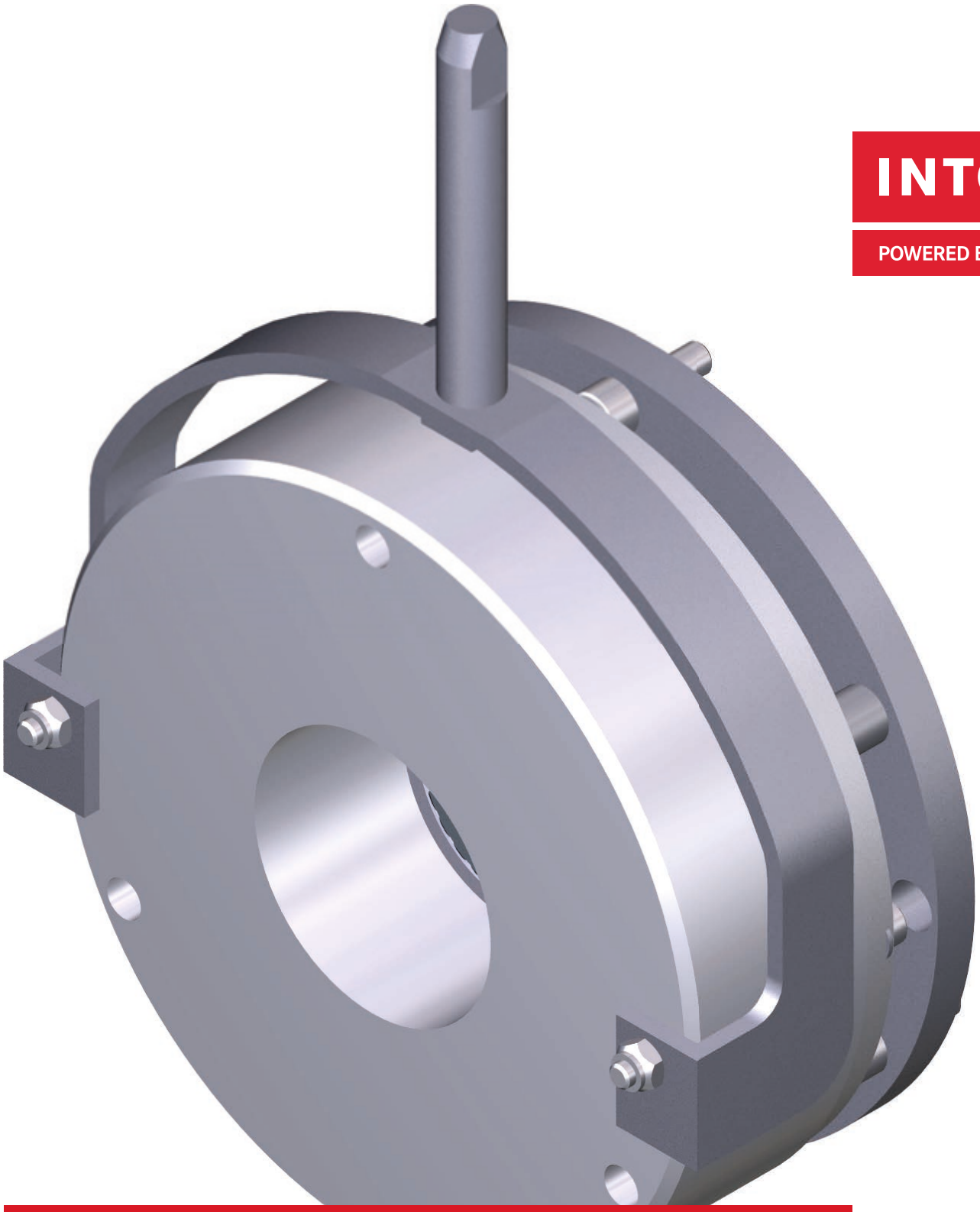


INTORQ BFK457

Spring-applied brake with electromagnetic release

Translation of the Original Operating Instructions

www.kendrion.com

Document history

Material number	Version			Description
399720	1.0	09/1997	TD09	First edition for the series
399720	1.1	07/2000	TD09	Address changed, Change of rated data
13053267	2.0	09/2002	TD09	All chapters: Complete editorial revisions. Extension of the operating manual to cover sizes 10 – 16, sizes 06 and 08 changed to new design principle with spacer bushings. Change of company name. Incorporation of the basic and compact versions
13231528	3.0	09/2007	TD09	Change of company name to INTORQ. Completely revised, including the sizes 01 and 02
13343901	4.0	07/2010	TD09	Changed values of the braking torques and rotation speeds
13343901	4.1	07/2011	TD09	Updated cover
13343901	4.2	03/2012	TD09	Additions to the Maintenance chapter. Updated the connection diagrams in the "Electrical installation" chapter. Changed the tightening torques, brake torques and rotation speeds in the Rated Data chapter.
13343901	5.0	04/2013	TD09	Added notice for spare parts list. Added the Spare parts ordering section. Inserted "Size of socket-head cap screws" table. Notice for mounting the basic version. Notice for shaft-hub connection
13343901	6.0	01/2015	SC	Restructured FM. Unified connection diagrams
13343901	7.0	02/2016	SC	Update
13343901	8.0	12/2018	SC	Migration to ST4
13343901	9.0	01/2022	SC	Change of company name to Kendrion INTORQ Changes to Chapters 3.1.2 and 5.1 Supplements to Chapters 6.7 and 8.2

Legal regulations

Liability

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

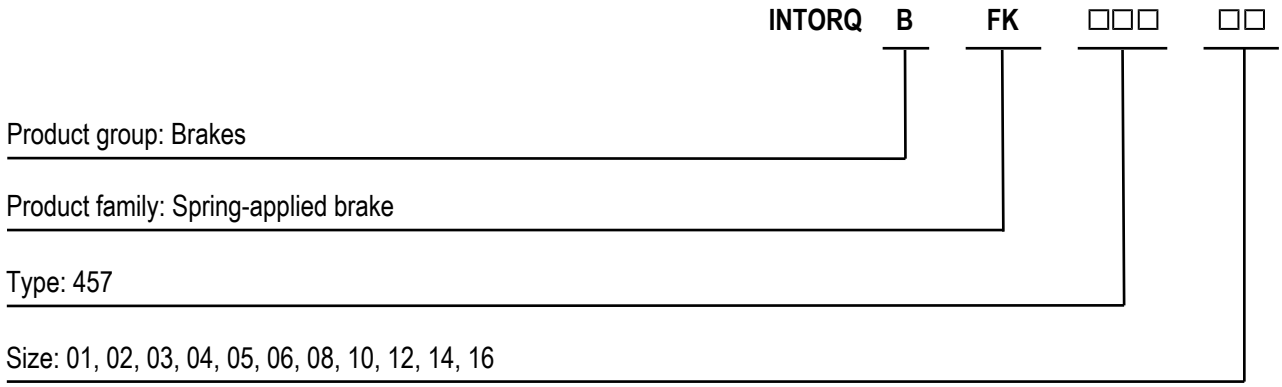
Warranty

Notice

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

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

Product key



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: BFK457-□□ = BFK457-10
	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}
t_3	ms	Slipping time, operation time of the brake (according to t_{11}) until standstill

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

2 Safety instructions

2.1 General safety instructions

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

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

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

2.2 Disposal

The Kendrion INTORQ components are made of various differing materials.

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

3 Product description

3.1 Proper and intended usage

3.1.1 Standard applications

Kendrion INTORQ components are intended for use in machinery and facilities. They may only be used for purposes as specified in the order and confirmed by Kendrion INTORQ. The Kendrion INTORQ components may only be operated under the conditions specified in these Operating Instructions. They may never be operated beyond their specified performance limits. The technical specifications (refer to Technical specifications, Page 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 Basic and Compact variants, layout and functionality of the INTORQ BFK457 spring-applied brake.

3.2.1 Basic module

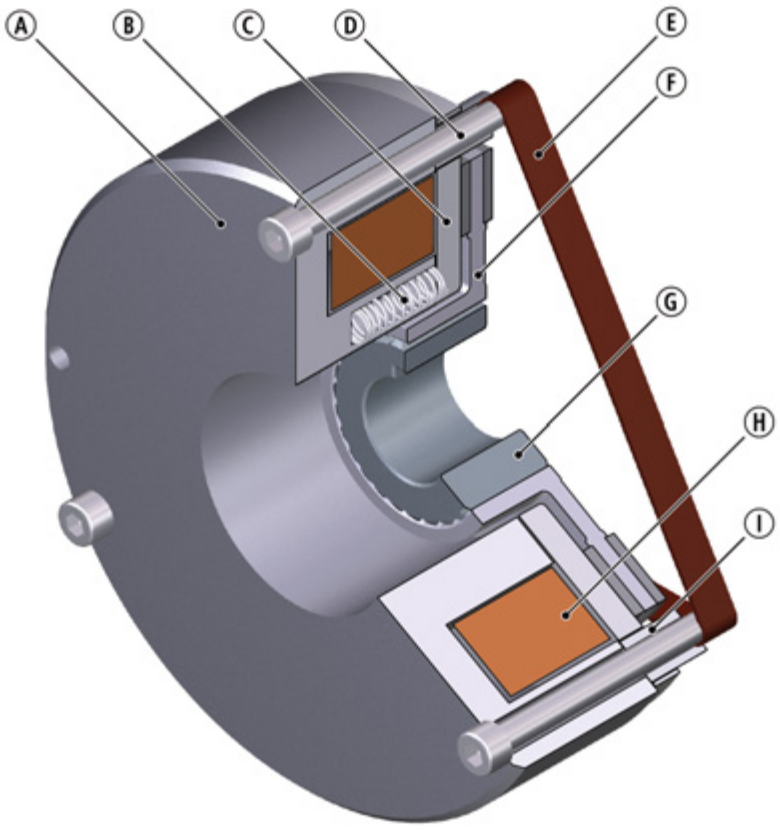


Fig. 1: **Design of the INTORQ BFK457 spring-applied brake: Basic module (complete stator) + rotor + flange**

Ⓐ Stator	Ⓑ Pressure spring	Ⓒ Armature plate
Ⓓ Socket-head cap screw	Ⓔ Elastic band (shipping bracket)	Ⓕ Rotor
Ⓖ Hub	Ⓗ Coil	Ⓘ Spacer

3.2.2 Compact module

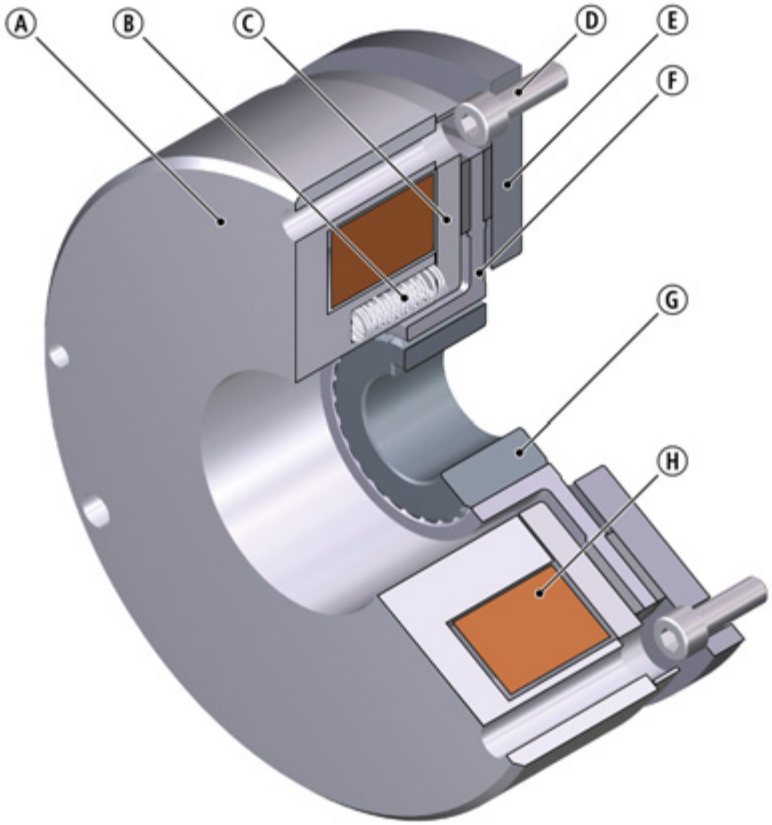


Fig. 2: **Design of the INTORQ BFK457 spring-applied brake: Compact module (complete stator) + rotor + flange**

Ⓐ Stator
Ⓑ Pressure spring
Ⓒ Armature plate
Ⓓ Socket-head cap screw
Ⓔ Flange
Ⓕ Rotor
Ⓖ Hub
Ⓗ 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, 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 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:
  - Without additional protective measures, this brake complies with protection class IP00. Contact the Kendrion INTORQ sales department for information about using special protective measure to increase the protection class.
- Ambient temperature:
  - -20 °C to +40 °C (Standard)

4.2 Characteristics

Size	Rated brake torque at Δn=100 rpm	Air gap		Moment of inertia of rotor	Weight of brake	
	M_K	S_{LN} [1)]	S_{Lmax}	J_{Rotor}	Compact	Basic
	[Nm]	[mm]	[mm]	[kg cm²]	[kg]	[kg]
01	0.12	$0.1^{+0.08/-0.05}$	0.35	0.0025	0.2	-
	0.25		0.23			-
02	0.25		0.35	0.010	0.25	-
	0.5		0.23			-
03	0.5	$0.15^{\pm0.1}$	0.4	0.021	0.4	-
	1		0.3			-
04	1		0.4	0.058	0.55	-
	2		0.3			-
05	2		0.4	0.105	0.8	-
	4		0.3			-
06	4	$0.2^{\pm0.1}$	0.6	0.130	1.1	0.9
	6		0.4			
08	8		0.6	0.450	1.9	1.5
	12		0.45			

Size	Rated brake torque at Δn=100 rpm	Air gap		Moment of inertia of rotor	Weight of brake	
	M_K	S_{LN} [1]	S_{Lmax}	J_{Rotor}	Compact	Basic
	[Nm]	[mm]	[mm]	[kg cm²]	[kg]	[kg]
10	16	0.3 ±0.1	0.7	2.000	3.8	3.0
	23		0.5			
12	32		0.8	4.500	5.7	4.7
	46		0.5			
14	60		0.8	6.300	8.6	7.1
	90		0.5			
16	80		0.9	15.000	12.0	10.0
	125		0.6			

Tab. 1: **General data**

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

Size	Outer diameter	Screw hole circle		Minimum thread depth of motor end shield		Tightening torque
		Diameter (Ø)	Thread[1]	Basic	Compact	M_A
	[mm]	[mm]		[mm]	[mm]	[Nm]
01	37	32	2x M2.5	-	4	0.7
02	47	40	2x M3	-		1.3
03	56	48	3x M3	-	6	
04	65	58		-		
05	75	66	3x M4	-	7	3.0
06	84	72		11	8	
08	102	90	3x M5	14	11	5.9
10	130	112	3x M6		14	10.1
12	150	132				
14	165	145	3x M8	16	16	24.6
16	190	170				

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 Mounting data, Page 16 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 !

Size	Braking torque at Δn_0 [Nm]			Max. rotation speed Δn_{0max}
	1500	3000	Max.	[rpm]
01	0.11	0.10	0.09	5000
02	0.23	0.21	0.18	
03	0.45	0.42	0.35	
04	0.89	0.82	0.68	
05	1.76	1.62	1.34	
06	3.5	3.2	3.0	6000
	5.2	4.8	4.4	
08	6.8	6.2	5.8	5000
	10.2	9.3	8.8	
10	13.3	12.2	11.7	4000
	19.1	17.5	16.8	
12	25.9	23.7	23.4	3600
	37.3	34	33.6	
14	48	43.8	43.2	
	72	65.7	64.8	
16	63.2	57.6	56.0	
	98.8	90	87.5	

Tab. 3: **Brake torques**

Size	Electrical power P_N	Rated voltage U_N	Rated current I_N	Coil resistance R_N
	[W]	[V]	[A]	[Ω] ±8%
01	5	24 205	0.21	115.3
			0.02	8413
02	6.6		0.28	87.3
			0.03	6372
03	9		0.38	64.0
	8.2		0.04	5128
04	11.5		0.48	50.1
	10		0.048	4205
05	13		0.54	44.3
			0.06	3184.2
06	20		0.83	28.8
			0.10	2101
08	25		1.17	20.57
			0.12	1681
10	30		1.25	19.2
	33		0.16	1273
12	40		1.67	14.4
			0.20	1051
14	50	24 42 205	2.08	11.52
	53		1.26	33.28
	55		0.27	764
16	55		2.29	10.47
	55		1.31	32.07
	56		0.27	765

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.

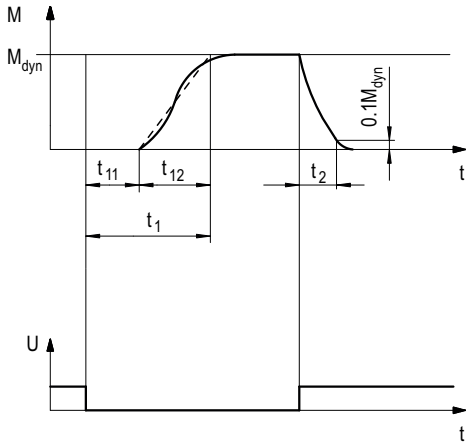


Fig. 3: **Operating/switching times of the spring-applied brakes**

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

Size	Rated brake torque at Δn=100 rpm M_K [1)]	Q_E [1)]	S_{hue}	Operating times [2)]			
				DC-side engagement			Disengaging
				t_{11}	t_{12}	t_1	t_2
	[Nm]	[J]	[1/h]	[ms]	[ms]	[ms]	[ms]
01	0.12	200	160	2	9	11	17
02	0.25	400	125	3	5	8	
03	0.5	800	100	5	7.5	12.5	18
04	1	1200	90	9	9	18	23
05	2	1800	80	10	16	26	35
06	4	3000	79	29	19	48	37
08	8	7500	50	60	35	95	42
10	16	12000	40	35	60		100
12	32	24000	30	45	53	98	135
14	60	30000	28	50	57	107	240
16	80	36000	27	71	50	121	275

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.

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

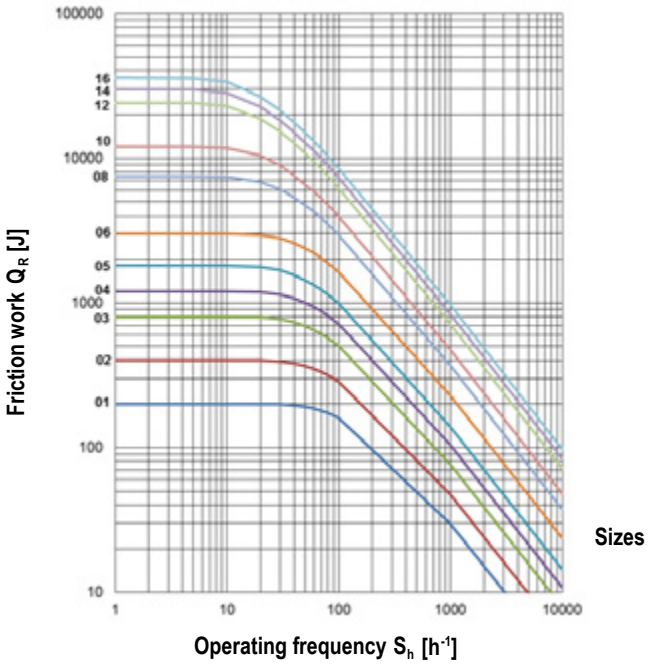


Fig. 4: **Friction work as a function of the operating frequency**

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

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

The permissible operating frequency S_{hmax} depends on the friction work Q_R (refer to Figure Friction work / operating frequency, Page 21). At a pre-set operating frequency S_h, the permissible friction work is Q_{Smax}.

Notice

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

4.5 Electromagnetic compatibility

Notice

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

NOTICE

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

If the spring-applied brake uses a rectifier of another manufacturer for the switching, it may become necessary to connect a spark suppressor in parallel with the AC voltage. Spark suppressors are available on request, depending on the coil voltage.

4.6 Emissions

Heat

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

Noise

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

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

4.7 Labels on product

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

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

Kendrion INTORQ	Manufacturer
00412802	ID number
BFK457-10	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
Pieces	Qty. per box
33 W	Rated power
Compact	Module
17.01.22	Packaging date
Anti-rust packaging: keep friction surface free of grease!	Addition
CE	CE mark

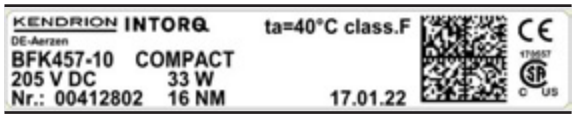


Fig. 6: **Name plate (example)**

Kendrion INTORQ	Manufacturer
ta = 40°C	Permissible ambient temperature
class. F	Insulation class F
BFK457-10	Type (refer to Product key, Page 3)
Compact	Module
205 V DC	Rated voltage
33 W	Rated power
No. 00412802	ID number
16 NM	Rated torque
17.01.22	Date of manufacture
	Data matrix code
C US	CSA/CUS acceptance
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.
- Threaded holes with minimum thread depth: refer to Mounting data, Page 16
- 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		
14		Rz10	0.05	< 0.10	
16			0.08		

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

Size	Torque wrench	Insert for hexagonal socket (Allen) screws
		
	Measuring range	Wrench width
	[Nm]	[inch]
01	0.3 to 4	2 x ¼ square 50 mm long
02		2.5 x ¼ square 50 mm long
03		
04		
05		3 x ¼ square 55 mm long
06	1 to 12	
08		4 x ¼ square 55 mm long
10		5 x ¼ square 180 mm long
12		
14	20 to 100	6 x ¼ square 140 mm long
16		

NOTICE

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

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.

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 03 – 16: Tensile strength R_m > 460 N/mm²
  - Size 01 and 02: Tensile strength R_m > 500 N/mm²

NOTICE

Square hubs must be used for sizes 01 and 02!

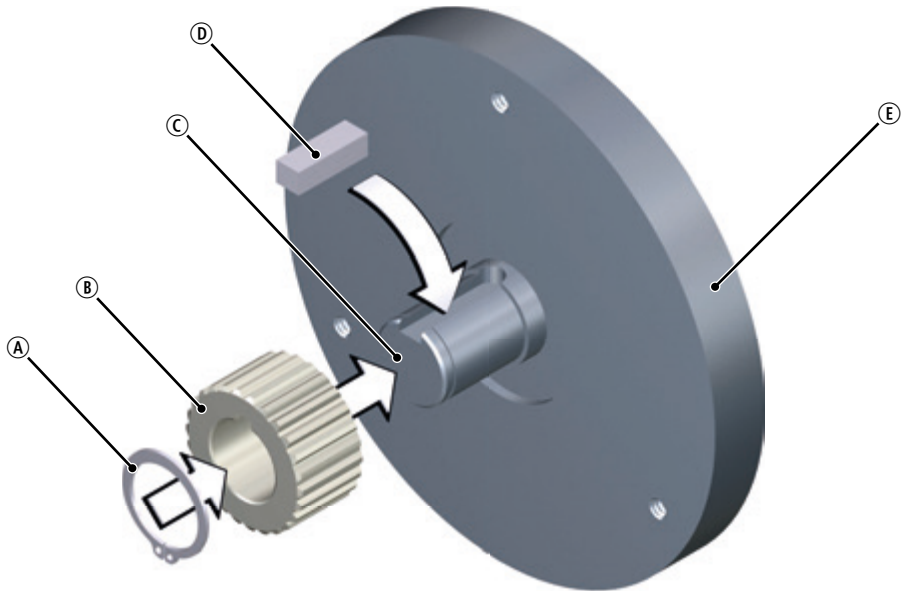


Fig. 7: **Mounting the hub**

Ⓐ 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

5.5.1 Mounting the BFK457-06 to 16 – Basic version

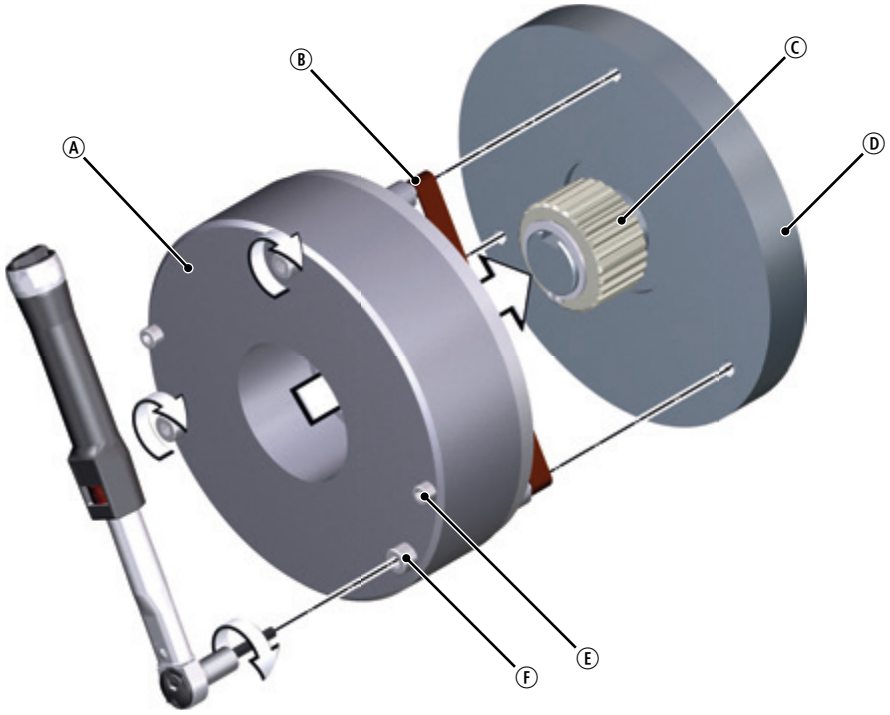


Fig. 8: **Mounting sizes 06 to 16 – Basic version**

Ⓐ Spring-applied brake	Ⓑ Transport locking mechanism (rubber ring)	Ⓒ Hub
Ⓓ End shield	Ⓔ Socket-head cap screw for transport protection	Ⓕ 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).
3. Remove the transport lock (the rubber ring).
4. Screw on the spring-applied brake evenly to the end shield using the cap screws. Use a torque wrench (refer to the Mounting data, Page 16 table for the tightening torques).

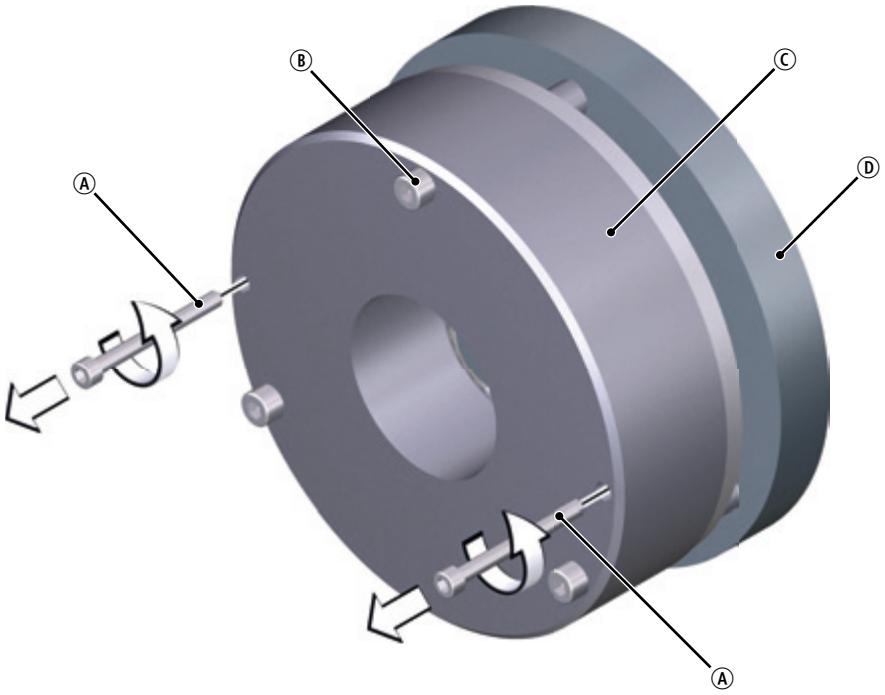


Fig. 9: **Remove the socket-head cap screws (for the transport lock).**

Ⓐ Socket-head cap screw for transport protection
Ⓑ Socket-head cap screw for fastening the brake
Ⓒ Spring-applied brake
Ⓓ End shield

5. Remove the socket-head cap screws (for the transport lock).

Size	Socket-head cap screws (for the transport lock).
06	2 x M4 x 30
08	2 x M5 x 35
10	2 x M5 x 40
12	2 x M5 x 45
14	2 x M6 x 60
16	2 x M6 x 60

Notice

The socket-head cap screws (for the transport lock) must be removed evenly to ensure trouble-free operations (so that the armature plate does not tilt).

5.5.2 Mounting the BFK457-01 to 16 – Compact version

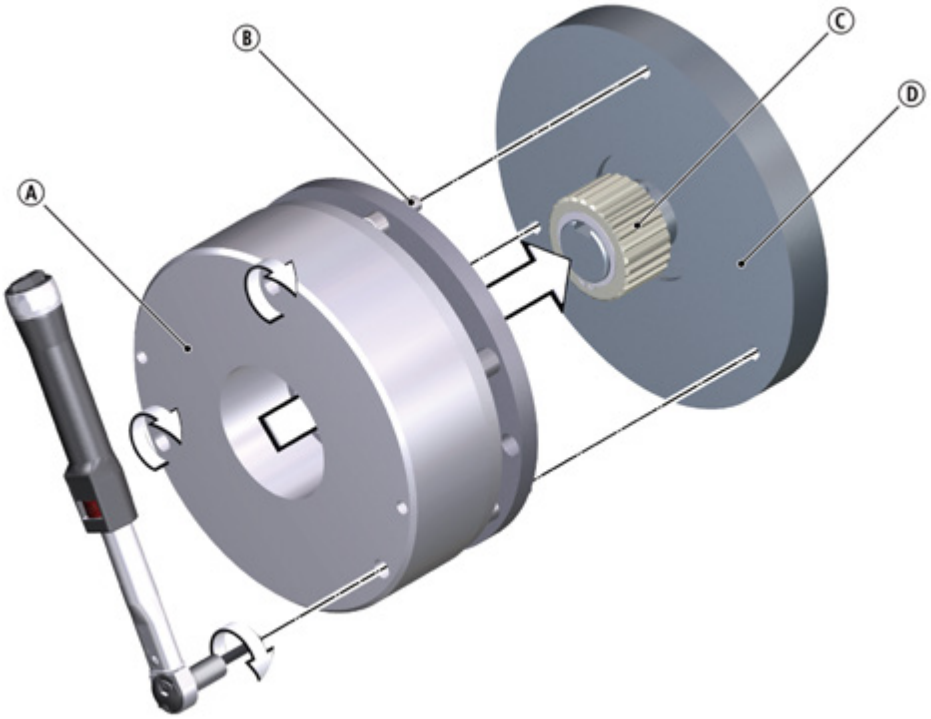


Fig. 10: **Mounting sizes 01 to 16 – Compact version**

Ⓐ Spring-applied brake Ⓑ Socket-head cap screw Ⓒ Hub
Ⓓ End shield

1. Push the spring-applied brake on the hub.
2. Screw on the spring-applied brake evenly to the end shield using the built-in cap screws. Use a torque wrench (refer to the Mounting data, Page 16 table for the tightening torques).
3. Only for sizes 01 to 05: Remove the transport lock (the rubber ring).

6 Electrical installation

Important notices and information

⚠ 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

Circuit 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

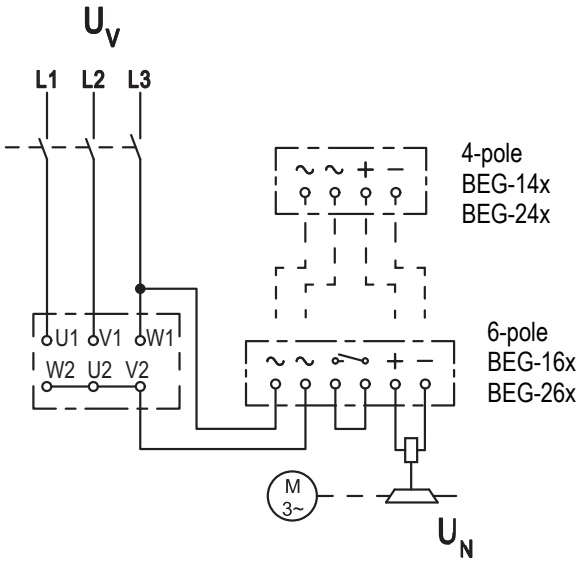


Fig. 11: **Supply: Phase-neutral**

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]

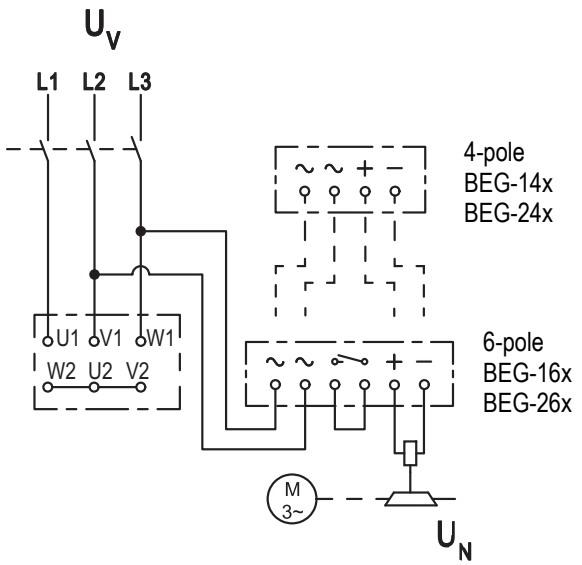


Fig. 12: **Supply: Phase-Phase**

Bridge rectifier [1)]

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

Half-wave rectifiers

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

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

6.1.2 DC switching at the motor – fast engagement

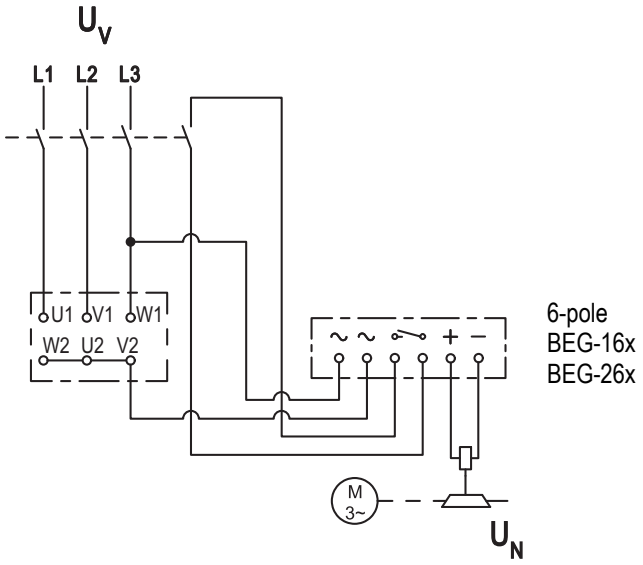


Fig. 13: **Supply: Phase-neutral**

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]

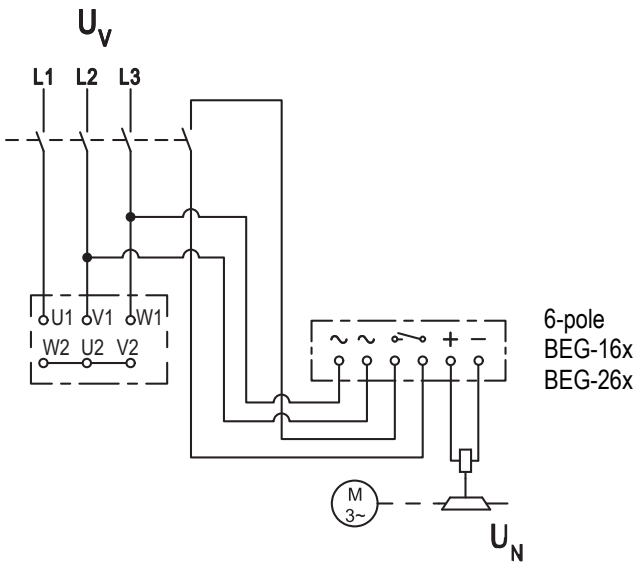


Fig. 14: **Supply: Phase-Phase**

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

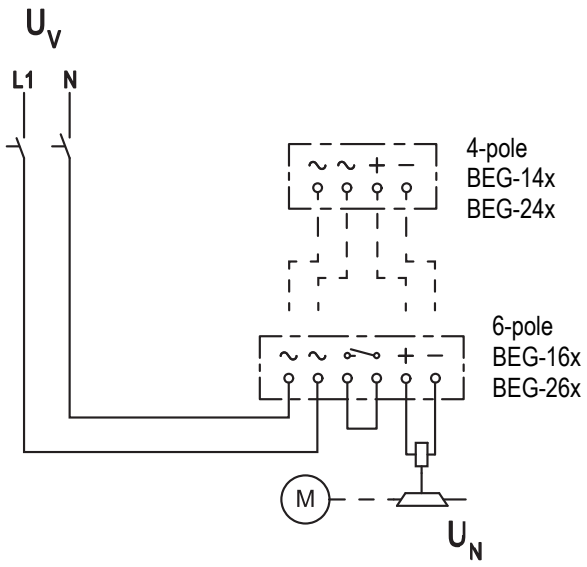


Fig. 15: **Supply: Phase-N**

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]

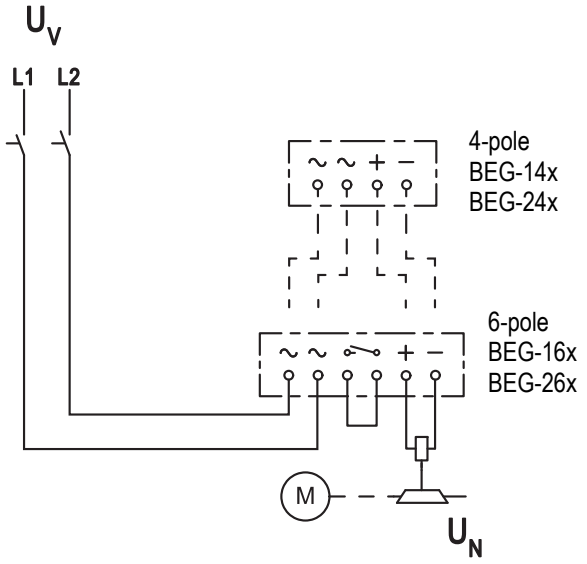


Fig. 16: **Supply: Phase-Phase**

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

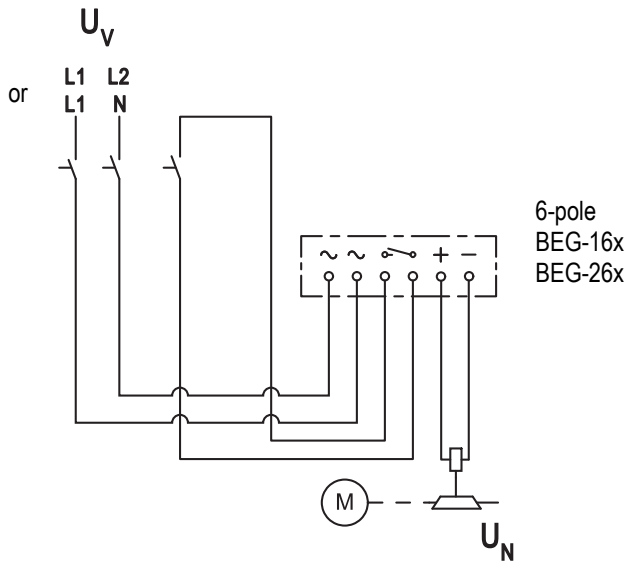


Fig. 17: **Supply: Phase-phase or phase-N via 6-pole rectifier**

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.

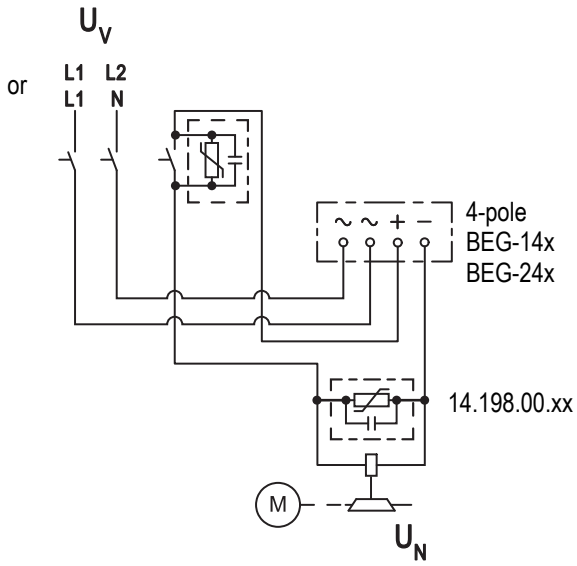


Fig. 18: **Supply: Phase-phase or phase-N via 4-pole rectifier**

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
01	AWG 26	- (single wire strand)
02		
03		
04	AWG 22	- (single wire strand)
05		
06	AWG 20	27.5 mm
08		
10		
12		
14		
16	AWG 20	45.6 mm

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) is limited by an integrated overvoltage protection at terminals 5 and 6.

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

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	01 to 16 Compact 06 to 16 Basic
BEG-561-255-130				
BEG-561-440-030-1	400	180	-	

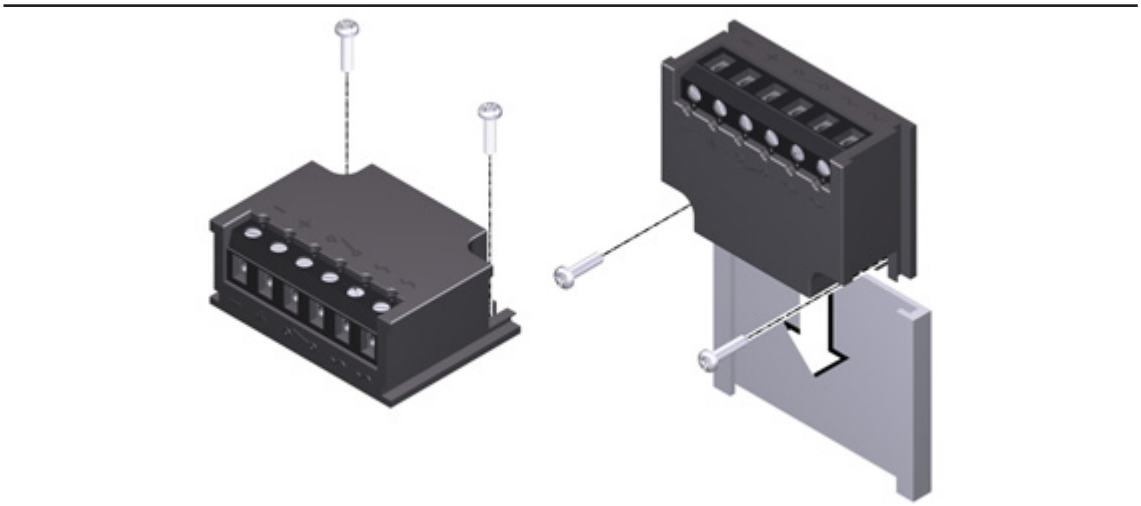


Fig. 19: **BEG-561 fastening options**

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

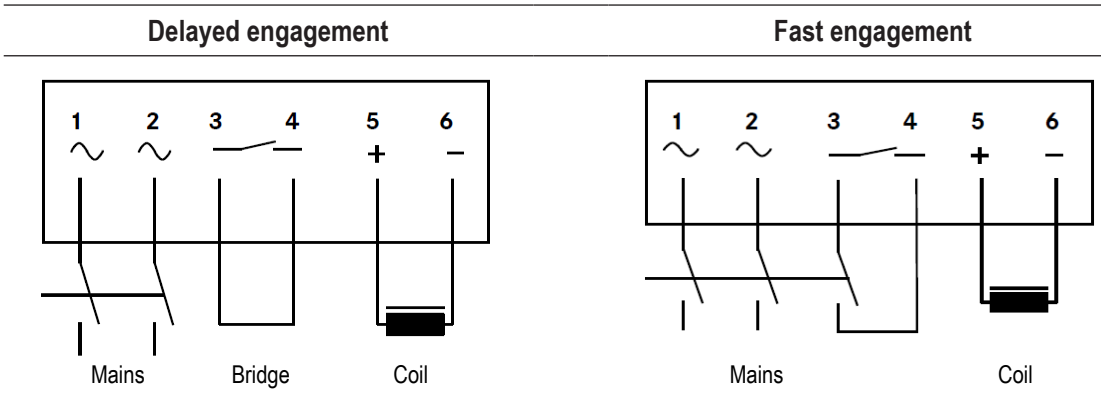
U_1 input voltage (40 – 60 Hz)

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

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.



6.3.4 Permissible current load at ambient temperature

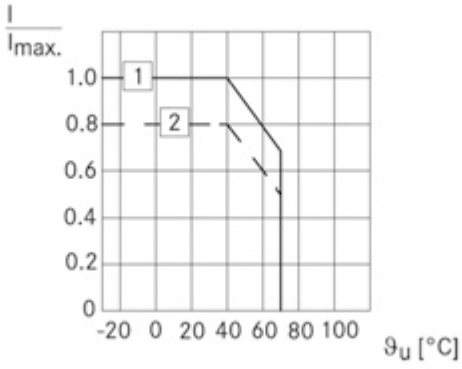


Fig. 20: **Permissible current load**

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.

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, Page 50. 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 50). 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. Perform a test braking procedure; if necessary, reduce the braking torque (depending on your specifications and requirements)

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 shocks in backlash during reversals between armature plate and distance sleeve	Breaking out of the armature plate and distance sleeve	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 43 in the chapter Verschleiß von Federkraftbremsen, Page 43. 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
BFK457	▮ 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.

8.3.1 Checking the components

With mounted brake	▮ Check release function and control	Refer to Release / voltage, Page 46
	▮ Measure the air gap (and adjust if required)	Refer to Checking the air gap, Page 45
	▮ Thermal damage of armature plate or flange (dark-blue tarnishing)	
After removing the brake	▮ Check the play of the rotor gear teeth (replace worn-out rotors)	Refer to Replacing the brake (basic version), Page 47 and Replacing the brake (compact version), Page 46.
	▮ Check for breaking out of the armature plate and distance sleeve	
	▮ Check the springs for damage	
	▮ Check the armature plate and flange or end shield – 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 25 table. Refer to the Characteristics, 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 the General data, Page 15 table 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. If necessary, replace the rotor (only for the basic version BFK457-06 – 16) or replace the complete brake (only for the compact version BFK457-01 – 16).

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 Replacing the brake (compact version)

⚠ DANGER

Danger: rotating parts!

Switch off the voltage. The brake must be free of residual torque.
Your system should be mechanically immobilized in the event that it could start moving when the brake is released.

1. Remove the connection cables.
2. Loosen the screws evenly and then remove them.
3. Pay attention to the connection cable during this step! Remove the complete brake from the end shield.
4. Pull the brake off the hub.
5. Check the hub's gear teeth.
6. Replace the hub if wear is visible.
7. Check the function of the brake as described in the Release / voltage, Page 46 section. Mount a new brake if necessary.
8. Reconnect the connection cable and put the brake back into operations.
9. If necessary, deactivate the mechanical shutdown of the system.

8.3.5 Replacing the brake (basic version)

⚠ 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.

NOTICE

The brake is made up of individual components!

When disassembling the brake, the socket-head cap screws (refer to Figure Remove the socket-head cap screws (for the transport lock)., Page 29) must be screwed into the stator and the armature plate. These hold the springs and screws in the "complete stator" component together.

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 (refer to Installing the hub onto the shaft, Page 27) whenever wear is visible.
7. Check the end shield's friction surface. Replace the friction surface on the end shield when there is clearly visible scoring at the running surface. In case of strong scoring on the end shield, rework the friction surface.
8. Measure the rotor thickness of the new rotor and the head thickness of the sleeve bolts (use a caliper gauge).
9. Install the new brake as described in the section Mounting sizes 06 to 16 – Basic version, Page 28.
10. Re-connect the connection cables.
11. Put the brake back into operations.
12. 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

Compact design

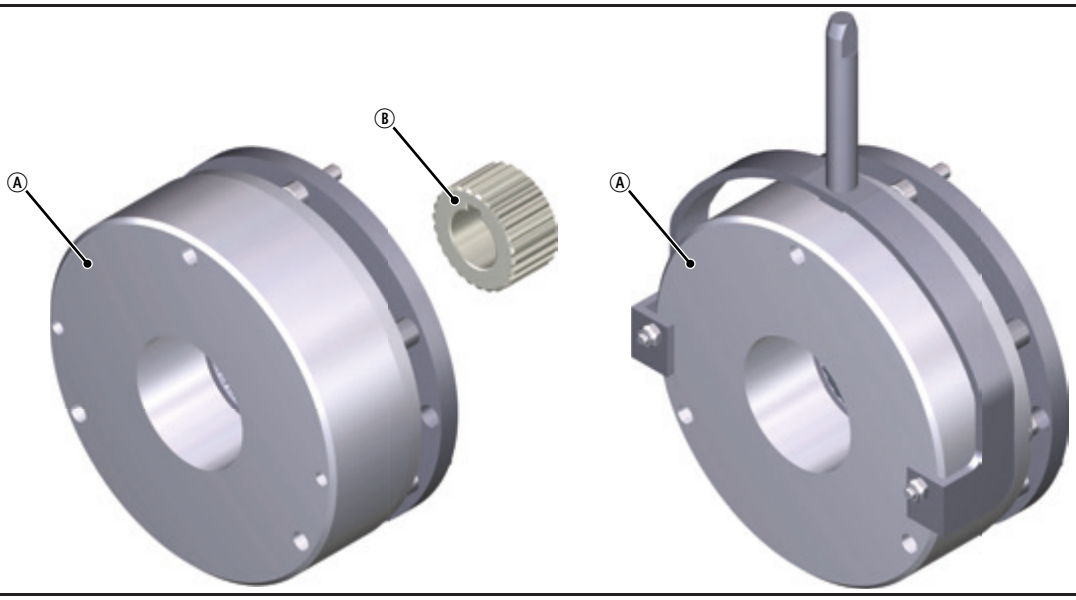


Fig. 21: **Spring-applied brake INTORQ BFK457– Compact version**

	Designation	Variant
Ⓐ	Brake / Brake with hand-release	▮ Size ▮ Voltage ▮ Brake torque ▮ Hand-release
Ⓑ	Hub	▮ Size

Basic version

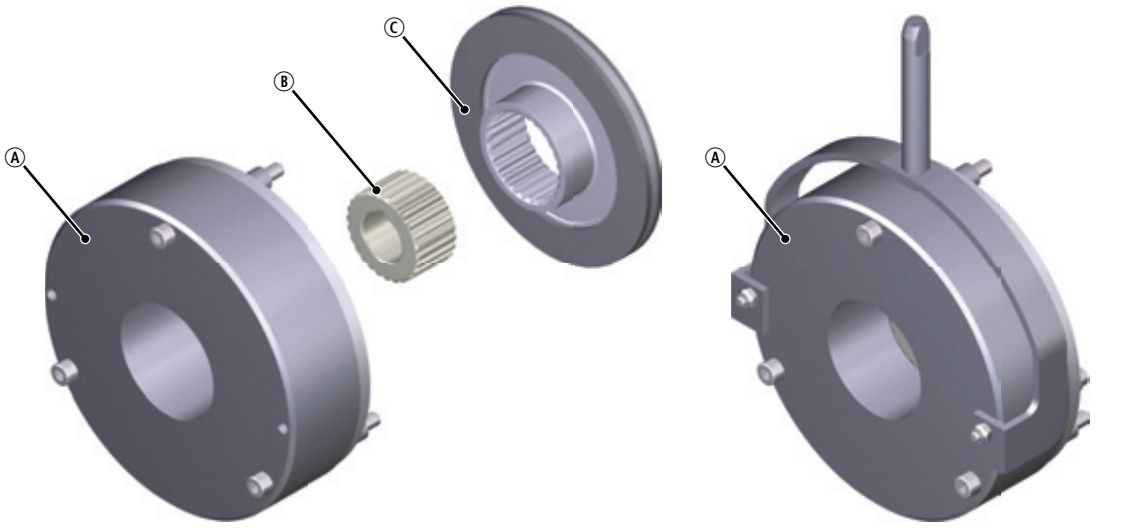


Fig. 22: **Spring-applied brake Kendrion INTORQ BFK457 – Basic version**

	Designation	Variant
Ⓐ	Compete stator / Complete stator with hand-release	▮ Size ▮ Voltage ▮ Brake torque ▮ Hand-release
Ⓑ	Hub	▮ Size
Ⓒ	Complete rotor	▮ 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	01 to 16 Compact 06 to 16 Basic
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 General data, Page 15 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.

Fault	Cause	Remedy
Brake cannot be released, air gap is not zero	Air gap too big	▮ For the spring applied brake INTORQ BFK457-06 ... 16: replace the basic rotor. ▮ For the INTORQ BFK457-06 ... 16 Compact spring-applied brake: replace the complete brake.
Rotor is too thin	Rotor has not been replaced in time	▮ For the spring applied brake INTORQ BFK457-06 ... 16: replace the basic rotor. ▮ For the INTORQ BFK457-06 ... 16 Compact spring-applied brake: replace the complete brake.
Voltage too high	Brake voltage does not match the rectifier	Adjust rectifier and brake voltage to each other.
Voltage too low	Brake voltage does not match the rectifier	Adjust rectifier and brake voltage to each other.
	Defective rectifier diode	Replace the defective rectifier with a suitable undamaged one.
AC voltage is not mains voltage	Fuse is missing or defective	Select a connection with a proper fuse.

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