



INTORQ

setting the standard

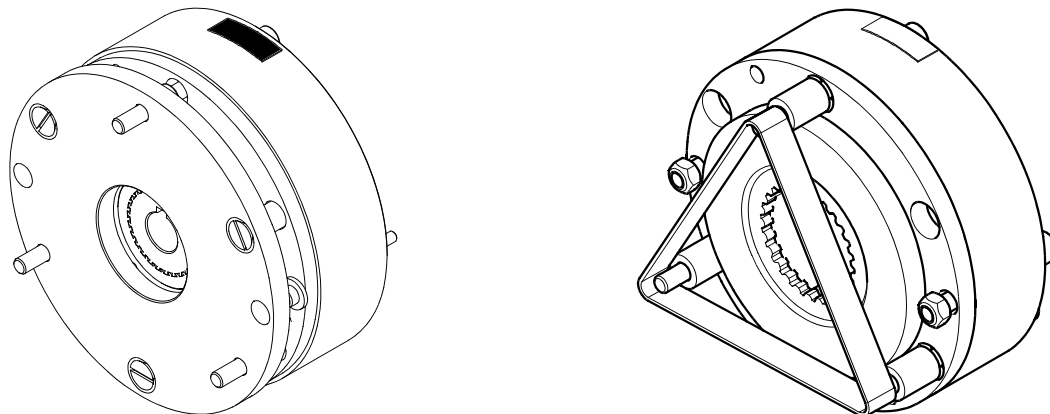
INTORQ BFK457

Electromagnetically Released Spring-Applied Brake

Translation of the Original Operating Instructions

www.intorq.com

This documentation applies to the:



Product key

INTORQ B FK □□□ - □□

A

B

C

D

Legend for INTORQ BFK457 product key

A	Product group	Brakes
B	Product type	Spring-applied brake
C	Type	457
D	Size	01, 02, 03, 04, 05, 06, 08, 10, 12, 14, 16

Not coded: Supply voltage, hub bore, options

Identification

Packaging label		Example
Manufacturer	Bar code	
Type (see product key)	Type number	
Designation	Quantity per box	
Rated voltage	Rated torque	
Rated power	Packaging date	
Design		
Addition	CE mark	

Nameplate			Example
Manufacturer	Model identification	CE mark	
Type (see product key)		Design	
Designation			
Rated voltage		Rated power	
Type number		Rated torque	
		Date of manufacture	

Document history

Material number	Version			Description
397954	1.0	09/1997	TD09	First edition for the series
397954	1.1	07/2000	TD09	Address revision Change of rated data
13228613	2.0	09/2002	TD09	All chapters: Complete editorial revision Sizes 10 - 16 added to the Operating Instructions Sizes 06 and 08 modified for new design with spacer bushing Change of company name Added the basic and compact design
13228613	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 (3.2)
13343901	4.1	07/2011	TD09	Updated cover
13343901	4.2	03/2012	TD09	Supplementation of the chapter "Maintenance" Updated the connection diagrams in the "Electrical installation" chapter. Changed the tightening torques, brake torques and rotation speeds in the Rated Data chapter.

Material number	Version			Description
13343901	5.0	04/2013	TD09	Notice regarding spare parts list has been supplemented Supplemented chapter of spare parts order Added the "Socket head cap screw sizes" table Notice for installing the basic version Notice for the shaft-hub connection
13343901	6.0	01/2015	SC	Restructured FM Harmonized connection diagrams
13343901	7.0	02/2016	SC	Updates

You can access the latest version of the Operating Instructions at www.intorq.de

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1 Preface and general information

1.1 About these Operating Instructions




- These Operating Instructions will help you to work safely with the spring-applied brake with electromagnetic release. They contain safety instructions that must be followed.
- All persons working on or with the electromagnetically released spring-applied brakes must have the Operating Instructions available and observe the information and notes relevant for them.
- The Operating Instructions must always be in a complete and perfectly readable condition.

1.2 Terminology used

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

1.3 Conventions in use

This document uses the following styles to distinguish between different types of information:

Spelling of numbers	Decimal separator	Point	The decimal point is always used. For example: 1234.56
Symbols	Page reference		Reference to another page with additional information For example:  16 = refer to page 16
	Wildcard	<input type="checkbox"/>	Wildcard for options, selections For example: BFK458- <input type="checkbox"/> <input type="checkbox"/> = BFK458-10
	Note		Important notice about ensuring smooth operations or other key information.

1.4 Abbreviations used

Letter symbol	Unit	Designation
I	A	Current
I_H	A	Holding current, at 20 °C and holding voltage
I_L	A	Release current, at 20 °C and release voltage
I_N	A	Rated current, at 20 °C and rated voltage
M_A	Nm	Tightening torque of fixing screws
M_{dyn}	Nm	Braking torque at a constant speed of rotation
M_K	Nm	Rated torque of the brake, rated value at a relative speed of rotation of 100 rpm
n_{max}	rpm	Maximum occurring speed of rotation during the slipping time t_3
P_H	W	Coil power during holding, after voltage change-over and 20 °C
P_L	W	Coil power during release, before voltage change-over and 20 °C
P_N	W	Rated coil power, at rated voltage and 20 °C
Q	J	Quantity of heat/energy
Q_E	J	Maximally 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 switching frequency
R_m	N/mm ²	Tensile strength
R_N	Ohms	Rated coil resistance at 20 °C
R_z	µm	Average surface roughness
S_h	1/h	Switching frequency: the number of switching operations evenly spread over the time unit
S_{hue}	1/h	Transition switching frequency, thermal parameter of the brake
S_{hmax}	1/h	Maximum permissible switching frequency, depending on the friction energy per switching operation
s_L	mm	Air gap: the lift of the armature plate while the brake is switched
s_{LN}	mm	Rated air gap
s_{Lmin}	mm	Minimum air gap
s_{Lmax}	mm	Maximum air gap
t_1	ms	Engagement time, sum of the delay time and braking torque - rise time $t_1 = t_{11} + t_{12}$
t_2	ms	Disengagement time, time from switching the stator until reaching 0.1 M_K
t_3	ms	Slipping time, operation time of the brake (according to t_{11}) until standstill




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

1.5 Safety instructions and notices








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

Safety instructions

Structure of safety instructions:

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

Danger level

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

1.6 Scope of delivery

After receipt of the delivery, check immediately whether the items delivered match the accompanying papers. INTORQ does not accept any liability for deficiencies claimed subsequently.

- Claim visible transport damage immediately to the deliverer.
- Claim visible deficiencies or incomplete deliveries immediately to INTORQ GmbH & Co. KG.

1.7 Disposal

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

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

1.8 Drive systems

Labelling

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

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

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

1.9 Legal regulations

Liability

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

Warranty

- Terms of warranty: Refer to the terms of sale and delivery for INTORQ GmbH & Co. KG.
- Warranty claims must be made to INTORQ immediately after the defects or faults are detected.
- The warranty is void in all cases when liability claims cannot be made.

2 Safety instructions

2.1 General safety instructions

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

2.2 Application as directed

■ INTORQ components:

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

Any other use or excessive usage is considered improper!

Usage conditions for the INTORQ spring-applied brake

■ Humidity: no restrictions

- In the event of condensation or moisture formation: provide for appropriate ventilation to ensure that all components will dry quickly.

■ Ambient temperature:

-20 °C to +40 °C (standard)

■ At high humidity and low temperature:

- Take measures to protect the armature plate and rotor from freezing.

■ Protect the electrical connections against any contact or touching.

■ No explosive or aggressive atmosphere.

3 Technical specifications

3.1 Product description

3.1.1 Structure and function

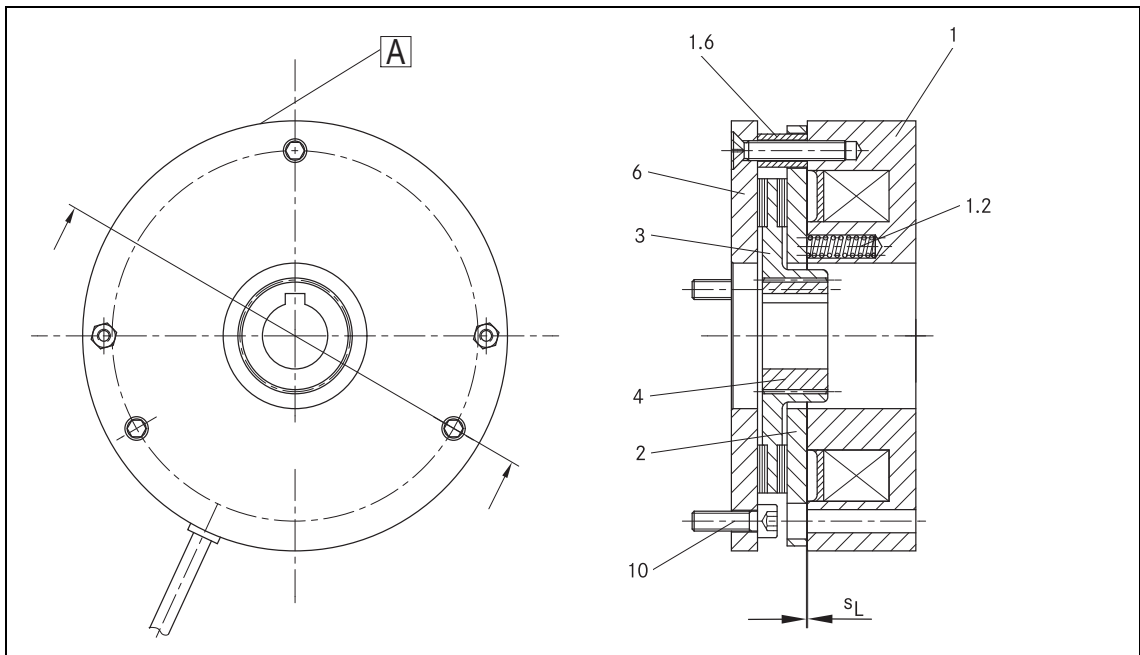


Fig. 1 Spring-applied brake BFK457-01...16 Compact, completely mounted with rotor and flange

A Sticker nameplate

- | | | |
|----------------------|------------------|---|
| 1 Stator | 2 Armature plate | 6 Flange |
| 1.2 Pressure springs | 3 Complete rotor | 10 Socket head cap screw, DIN EN ISO 4762 |
| 1.6 Spacer bushing | 4 Hub | |

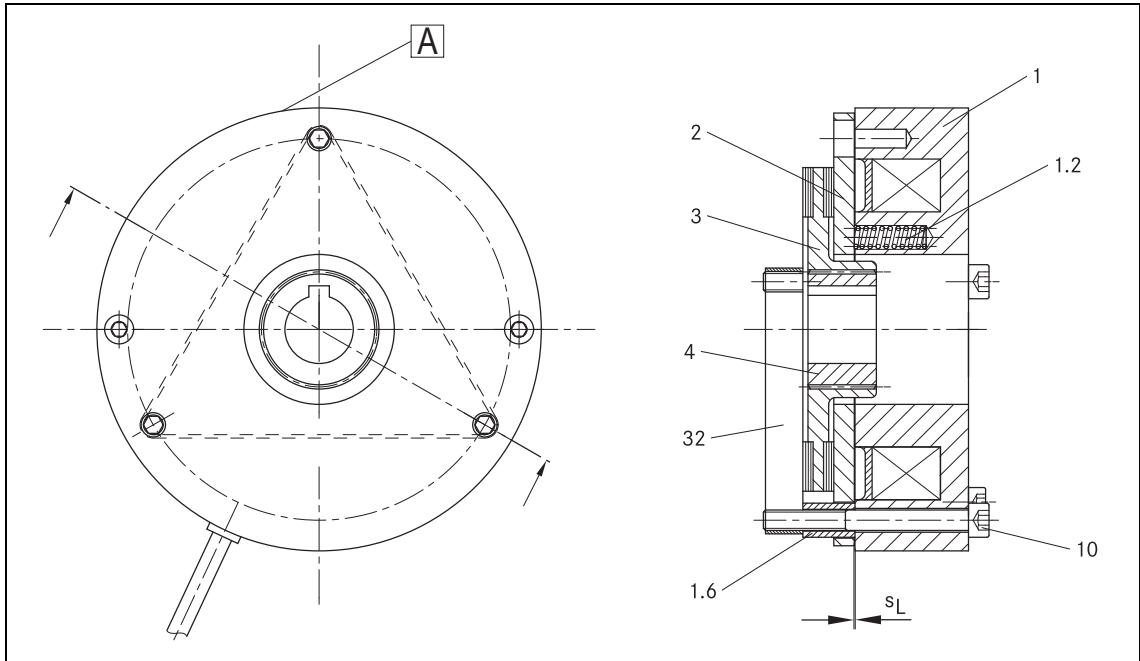


Fig. 2 Construction of a spring-applied brake BFK457-06...16 Basic, stator complete with rotor

A Sticker nameplate

1 Stator	2 Armature plate	6 Flange
1.2 Pressure springs	3 Complete rotor	10 Socket head cap screw, DIN EN ISO 4762
1.6 Spacer bushing	4 Hub	32 Elastic band (for securing during transport)

This spring-applied brake is a single-disk brake with two friction surfaces. The braking torque is generated by several pressure springs (1.2) by friction locking. The braking circuits are released electromagnetically.

The spring-applied brake converts mechanical work and kinetic energy into heat energy. Due to the static braking torque, loads can be held at standstill. Emergency braking is possible at high rotations speeds (refer to operating speeds 16). The wear increases as the switching energy increases. Remember that the coefficient of friction and thus the braking torque is dependent on the rotation speed.

Spacer bushings (1.6) are used for this spring-applied brake.



NOTICE

Re-adjust the air gap:

- BFK457 size 06 ... 16 Basic
 - Adjustment not possible.
 - When the wear limit is reached, replace the **rotor**.
- BFK457 size 01 ... 16 Compact
 - Adjustment not possible.
 - When the wear limit is reached, replace the **brake**.

3.1.2 Brake

During the braking procedure, the inner and outer springs (1.2) use the armature plate (2) to press the rotor (3) (which can be shifted axially on the hub (4)) against the friction surface. The asbestos-free friction linings ensure high braking torque and low wear. The braking torque is transmitted between the hub (4) and the rotor (3) via gear teeth.

3.1.3 Brake release

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

3.1.4 Project planning notes

- The brakes are dimensioned in such a way that the given rated torques are reached safely after a short run-in process.
- However, since the organic friction linings used do not all have identical properties and because environmental conditions can vary, deviations from the specified braking torques are possible. These must be taken into account in the form of appropriate dimensioning tolerances. Increased breakaway torque is common, in particular after long downtimes in humid environments where temperatures vary.
- If the brake is used as a pure holding brake without dynamic load, the friction lining must be reactivated regularly.

3.2 Rated data

Type	Rated brake torque at $\Delta n=100$ rpm M_K [Nm]	Air gap, s_L		Moment of inertia of the rotor [kg cm ²]	Weight of brake		
		Rated ¹⁾ [mm]	max. [mm]		Compact [kg]	Basic [kg]	
BFK457-01	0.12	0.1 ^{+0.08} _{-0.05}	0.35	0.0025	0.2	-	
	0.25		0.23				
BFK457-02	0.25		0.35	0.010	0.25	-	
	0.5		0.23				
BFK457-03	0.5	0.15 ±0.1	0.4	0.021	0.4	-	
	1		0.3				
BFK457-04	1		0.4	0.058	0.5	-	
	2		0.3				
BFK457-05	2		0.4	0.105	0.7	-	
	4		0.3				
BFK457-06	4		0.2 ±0.1	0.6	0.130	1.1	0.9
	6			0.4			
BFK457-08	8			0.6	0.450	1.9	1.5
	12			0.45			
BFK457-10	16	0.3 ±0.1	0.7	2.000	3.8	3.0	
	23		0.5				
BFK457-12	32		0.8	4.500	5.7	4.7	
	46		0.5				
BFK457-14	60		0.8	6.300	8.6	7.1	
	90		0.5				
BFK457-16	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.

Type	Outer diameter [mm]	Pitch circle		Minimum thread depth of motor end shield		Tightening torque M _A [Nm]	
		∅ [mm]	Thread	Basic [mm]	Compact [mm]		
BFK457-01	37	32	2 x M2.5	–	4	0.7	
BFK457-02	47	40	2 x M3	–			
BFK457-03	58	48	3 x M3	–	6	1.3	
BFK457-04	67	58		–			
BFK457-05	77	66	3 x M4	–	7	3.0	
BFK457-06	84	72		11	8		
BFK457-08	102	90	3 x M5	14	11	5.9	
BFK457-10	130	112	3 x M6		14	14	10.1
BFK457-12	150	132					
BFK457-14	165	145	3 x M8	16	16	24.6	
BFK457-16	190	170					

Tab. 2: Installation data

Fixing screws (socket head cap screws according to DIN ISO4762) are included in the scope of delivery.

	 CAUTION
	<ul style="list-style-type: none"> ■ The minimum thread depth of the end shield must be maintained!  Tab. 2. ■ If the required thread depth is not maintained, the fixing screws may run onto the root. This has the effect that the required pre-load force is no longer established – the brake is no longer securely fastened! ■ The material of the end shield must have a tensile strength of $R_m \geq 250 \text{ N/mm}^2$!

Type	Braking torque at Δn_0 [Nm]			Max. rotation speed Δn_{0max} [rpm]
	1500	3000	Max.	
BFK457-01	0.11	0.10	0.09	5000
BFK457-02	0.23	0.21	0.18	
BFK457-03	0.45	0.42	0.35	
BFK457-04	0.89	0.82	0.68	
BFK457-05	1.76	1.62	1.34	
BFK457-06	3.5	3.2	3.0	6000
	5.2	4.8	4.4	
BFK457-08	6.8	6.2	5.8	5000
	10.2	9.3	8.8	
BFK457-10	13.3	12.2	11.7	4000
	19.1	17.5	16.8	
BFK457-12	25.9	23.7	23.4	3600
	37.3	34	33.6	
BFK457-14	48	43.8	43.2	
	72	65.7	64.8	
BFK457-16	63.2	57.6	56.0	
	98.8	90	87.5	

Tab. 3: Characteristic torques

Type	Electrical power P _N [W]	Voltage U [V]	Rated current I _N [A]	Coil resistance R _N [Ω]		
				Rated	max.	min.
BFK457 -01	5	24 205	0.21	115.3	121.1	109.5
			0.02	8413	8883.7	7992.4
BFK457 -02	6.6		0.28	87.3	91.7	82.9
			0.03	6372	6690.6	6053.4
BFK457 -03	9		0.38	64.0	67.2	60.8
BFK457 -04	11.5		0.04	5128	5384.4	4871.6
			0.48	50.1	52.6	47.6
BFK457 -05	13		0.06	4205	4415.3	3994.8
			0.54	44.3	46.5	42.1
BFK457 -06	20		0.06	3184.2	3343.4	3025
			0.83	28.8	30.24	27.36
BFK457 -08	28		0.10	2101	2269	19.33
			0.12	1681	1807	1555
BFK457 -10	30		0.12	1681	1807	1555
			0.16	1273	1356	1191
BFK457 -12	40		1.25	19.2	20.16	18.24
		0.20	1051	1082	1019	
BFK457 -14	50	1.67	14.4	14.83	13.97	
		0.27	764	787	741	
		2.08	11.52	11.87	11.17	
BFK457 -16	55	1.26	33.28	34.28	33.28	
		0.27	764	787	741	
		2.29	10.47	10.78	10.16	
BFK457 -16	55	1.31	32.07	33.03	31.11	
		0.27	765	787	742	
		2.29	10.47	10.78	10.16	

Tab. 4: Coil data

3.3 Switching times

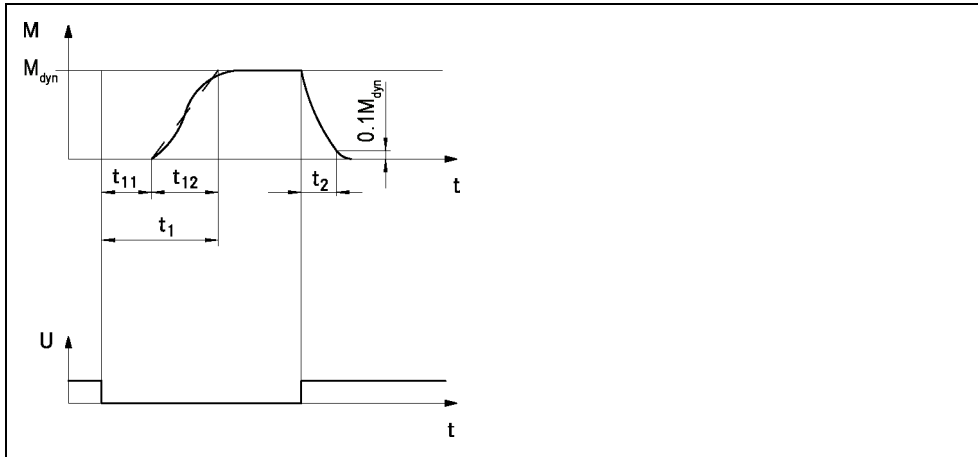


Fig. 3 Operating/switch times of the spring-applied brakes

- t_1 Engagement time
- t_{11} Reaction delay of 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

Type	Brake torque Rated value at $\Delta n=100$ rpm $M_K^{1)}$ [Nm]	Switching energy per one switch Q_E [J]	Transitional switching frequency S_{hue} [1/h]	Switching times [ms] at s_{LN} and $0.7 I_N$			
				Engage DC side			Disengage t_2
				t_{11}	t_{12}	t_1	
BFK457 -01	0.12	200	160	2	9	11	17
BFK457 -02	0.25	400	125	3	5	8	
BFK457 -03	0.5	800	100	5	7.5	12.5	18
BFK457 -04	1	1200	90	9	9	18	23
BFK457 -05	2	1800	80	10	16	26	35
BFK457 -06	4	3000	79	29	19	48	37
BFK457 -08	8	7500	50	60	35	95	42
BFK457 -10	16	12000	40	35	60		100
BFK457 -12	32	24000	30	45	53	98	135
BFK457 -14	60	30000	28	50	57	107	240
BFK457 -16	80	36000	27	71	50	121	275


Tab. 5: Switching energy - switching frequency - switching times

¹⁾ Minimum braking torque when all components are run in

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 switching in connection with a suitable spark suppressor must therefore be provided.

- The engagement times apply for **DC switching** with a spark suppressor.
 - Spark suppressors are available for the rated voltages.
 - Connect the spark suppressors in parallel to the contact. If this switching is not admissible for safety reasons (e.g. with hoists and lifts), the spark suppressor can also be connected in parallel to the brake coil.
 - Circuit proposals:  30
- If the drive system is operated with a frequency inverter so that the brake will not be de-energised before the motor is at standstill, AC switching is also possible (not applicable to emergency braking).

Disengagement time

The disengagement time is not influenced by DC and AC switching operations. The disengagement time can be shortened by using special equipment for fast-response excitation or over-excitation.

3.4 Switching energy / switching frequency

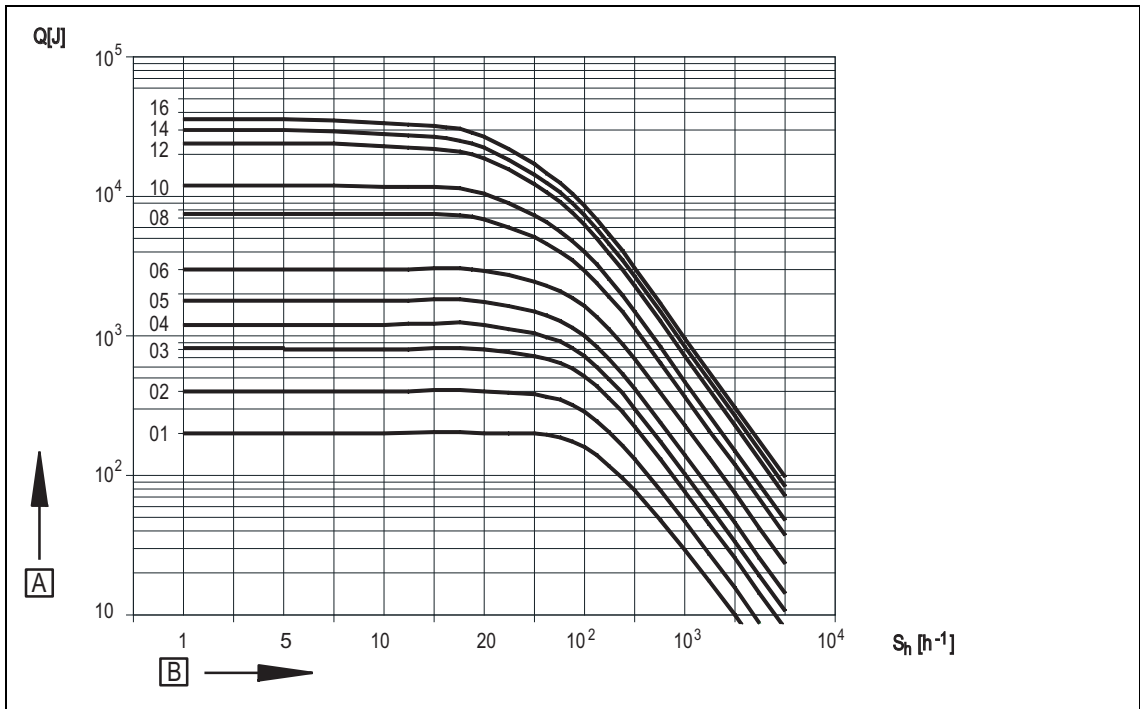


Fig. 4 Switching energy as a function of the switching frequency

A Switching energy

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

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

3.5 Emissions

Electromagnetic compatibility

**NOTICE**

The user must ensure compliance with EMC Directive 2004/108/EC using appropriate controls and switching devices.

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

If the spring-applied brake uses a rectifier from 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.

Heat

Since the brake converts kinetic energy as well as mechanical and electrical energy into heat, the surface temperature varies considerably, depending on the operating conditions and possible heat dissipation. Under unfavourable conditions, the surface temperature can reach 130 °C.

Noise

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


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

Miscellaneous

The abrasion of the friction parts produces dust.

4 Mechanical installation


4.1 Important notes

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

4.1.1 Design of end shield and motor shaft



- Comply with the mentioned minimum requirements regarding the end shield and the motor shaft to ensure a correct function of the brake.
- The diameter of the shaft shoulder must not be greater than the tooth root diameter of the hub.
- The form and position tolerances apply only to the materials mentioned. Contact INTORQ if you are using other materials.
- The brake flange must be supported by the end shield across the full surface.




Design of the end shield

Brake size	Minimum requirements: Use as counter friction surface					Miscellaneous
	Material	Evenness [mm]	Axial run-out [mm]	Roughness		
				without flange	with flange	
06	S235JR; C15; EN-GJL-250	0.03	0.05	Rz 6	Rz 16	<ul style="list-style-type: none"> ■ Threaded holes with minimum thread depth  17 ■ Free of grease and oil
08						
10						
12		0.05		Rz 10		
14						
16				0.08		

Tab. 6: End shield as counter friction surface

4.1.2 Necessary tools

Type	Torque wrench  Measuring range [Nm]	Bit for hexagon socket screws  Wrench size [inch]
BFK457 -01	0.3 - 4	2 x 1/4" square 50 mm long
BFK457 -02		2.5 x 1/4" square 50 mm long
BFK457 -03		
BFK457 -04		
BFK457 -05		3 x 1/4" square 55 mm long
BFK457 -06	0.5 - 13	4 x 1/4" square 55 mm long
BFK457 -08		
BFK457 -10	3 - 40	5 x 1/2" square 180 mm long
BFK457 -12		
BFK457 -14	20 - 100	6 x 1/2" square 140 mm long
BFK457 -16		

Multi-meter	Caliper gauge	Feeler gauge
		

4.2 Assembly

4.2.1 Preparation

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

4.3 Installing the hub onto the shaft



NOTICE

The customer is responsible for constructing the shaft-hub connection. Make sure that the bearing length of the key is identical to the length of the hub.

- Tensile strength of the hub material:
 - Sizes 03 - 16: Tensile strength $R_m > 460 \text{ N/mm}^2$
 - Sizes 01/02: Tensile strength $R_m > 500 \text{ N/mm}^2$

	NOTICE
	Square hubs must be used for sizes 01 and 02!

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

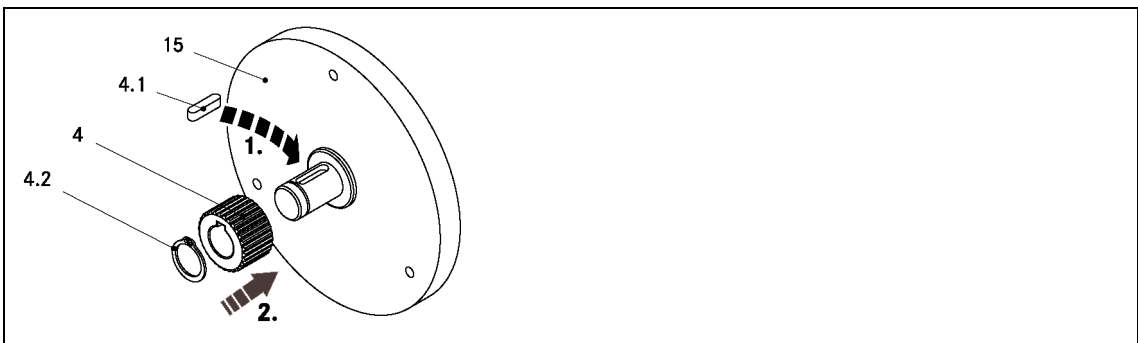


Fig. 5 Installing the hub onto the shaft

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

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

4.4 Installing the brake

BFK457-01...16, compact design

1. Installing the hub (4) (📖 26).
2. Push the spring-applied brake (1) onto the hub (4).
3. In order to attach, screw the spring-applied brake (1) onto the end shield (15) using the integrated socket head cap screws (10).
 - Use a torque wrench to tighten the socket head cap screws (10) evenly (refer to 📖 17 for torque).

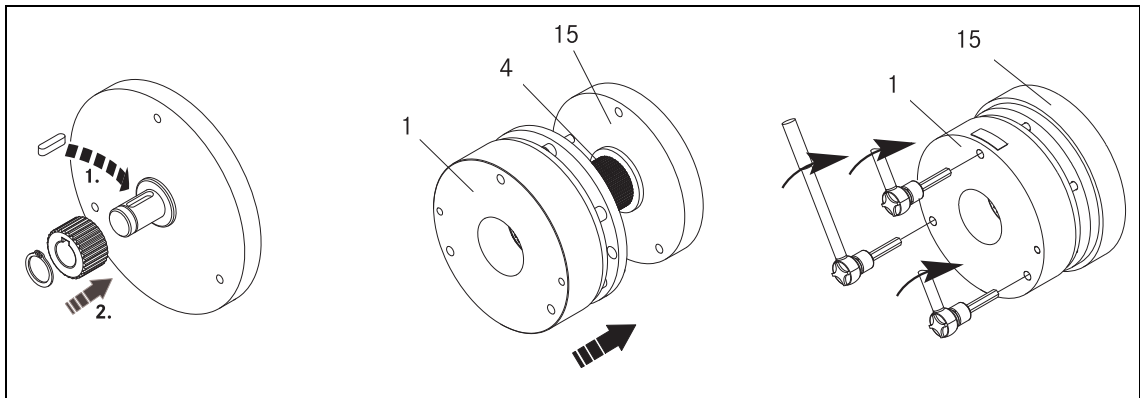


Fig. 6 Installing the compact version



BFK457-06...16, basic design

1. Installing the hub (4) (📖 26).
2. Push the spring-applied brake (1) onto the hub (4).
3. Tighten the socket head cap screws (10) slightly to fix the brake (screws should just bite). Remove the transport protection (rubber band 32).
4. Use a torque wrench to tighten the socket head cap screws (10) evenly (refer to 📖 17 for torque).
5. Remove the socket head cap screws (10.1) for the transport protection device.

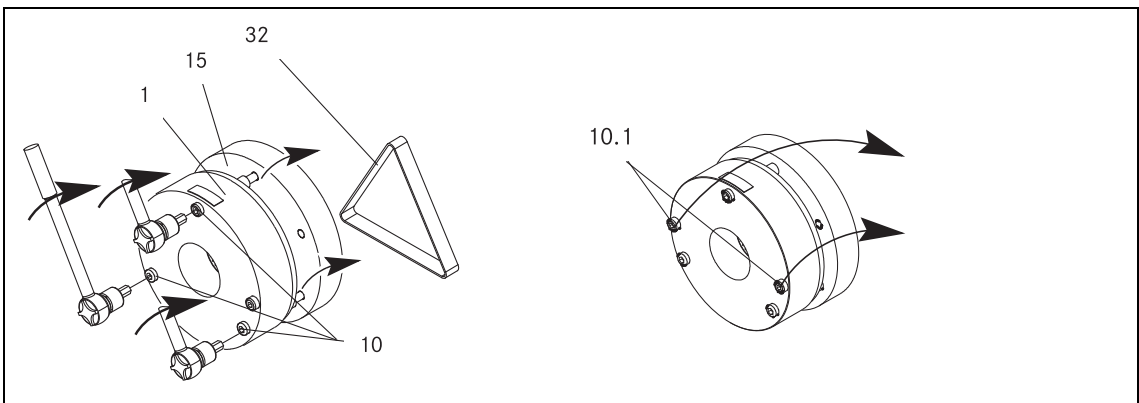
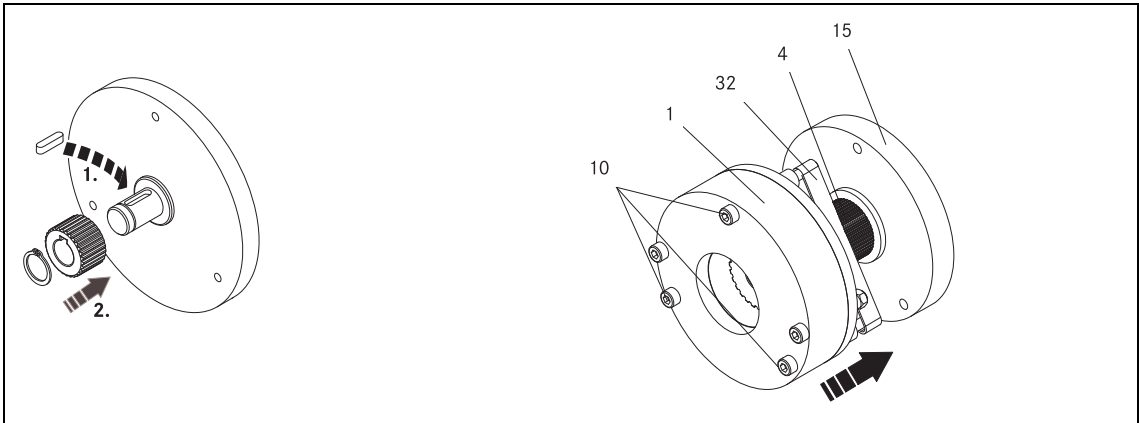
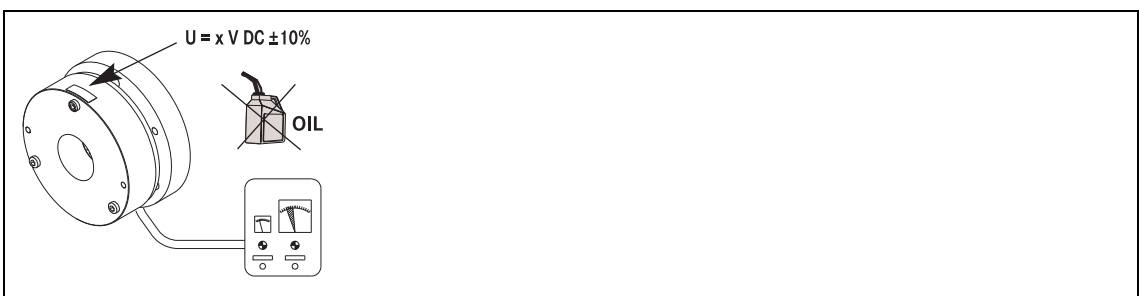


Fig. 7 Installing the basic version



NOTICE



The socket head cap screws (10.1) must be removed evenly to ensure trouble-free operations (so that the armature plate does not tilt).





Type	Size of socket head cap screw, position 10.1
BFK457-06	2 x M4 x 30
BFK457-08	2 x M5 x 35
BFK457-10	2 x M5 x 40
BFK457-12	2 x M5 x 45
BFK457-14	2 x M6 x 60
BFK457-16	2 x M6 x 60

5 Electrical installation

5.1 Important notes


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

	NOTICE
	<ul style="list-style-type: none"> ■ Make sure that the supply voltage corresponds to the data on the nameplate. ■ If an emergency stop is carried out without the required suppressor circuit, the control unit may be destroyed. ■ Observe the correct polarity of the suppressor circuit!


NOTICE
 Compare the coil voltage of the stator to the DC voltage of the installed rectifier.

5.2 Electrical connection

Circuit suggestions

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

AC switching at the motor - extremely delayed engagement

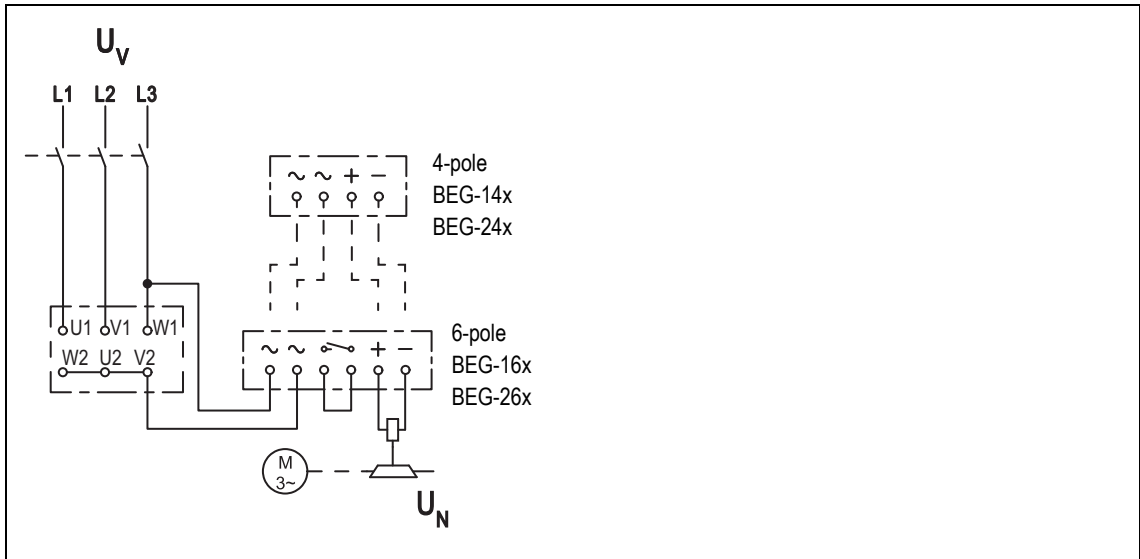


Fig. 8 Supply: Phase-neutral

Bridge rectifier

$$\text{BEG-1xx: } U_N [\text{VDC}] = 0.9 \cdot \frac{U_V}{\sqrt{3}} [\text{VAC}]$$

Half-wave rectifier

$$\text{BEG-2xx: } U_N [\text{VDC}] = 0.45 \cdot \frac{U_V}{\sqrt{3}} [\text{VAC}]$$

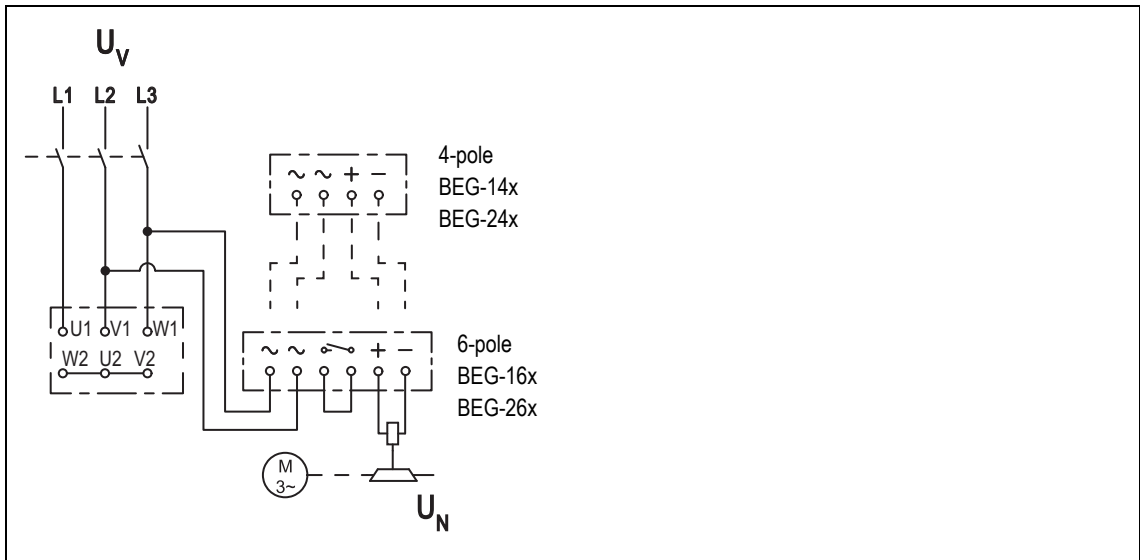


Fig. 9 Supply: Phase-phase

Bridge rectifier*

$$\text{BEG-1xx: } U_N [\text{VDC}] = 0.9 \cdot U_V [\text{VAC}]$$

Half-wave rectifier

$$\text{BEG-2xx: } U_N [\text{VDC}] = 0.45 \cdot U_V [\text{VAC}]$$

* Not recommended for most regional/national high-voltage mains systems

DC switching at the motor – fast engagement

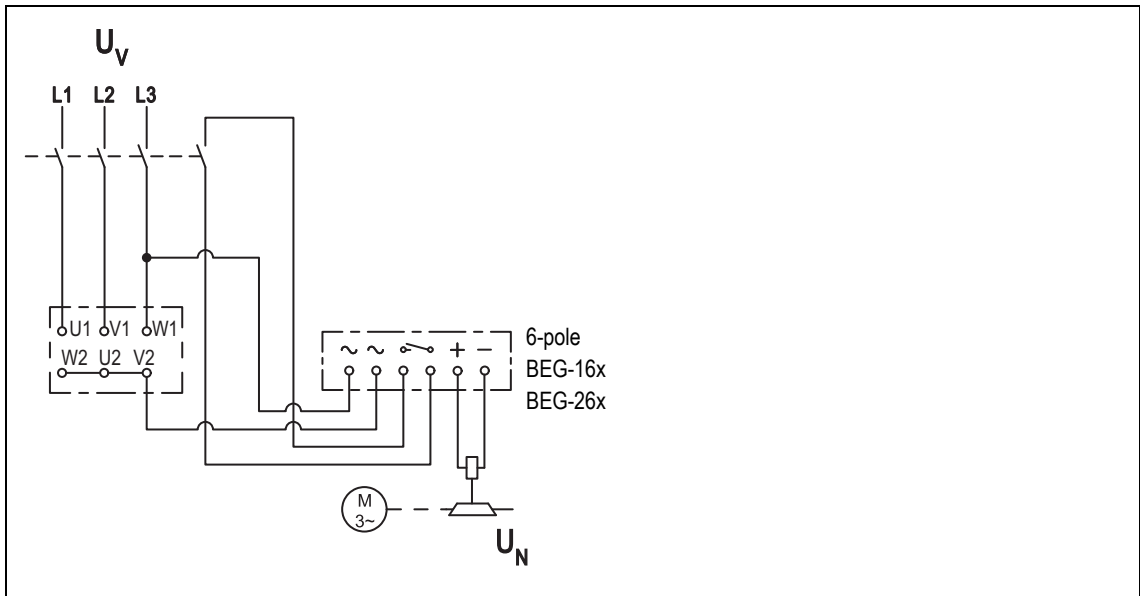


Fig. 10 Supply: Phase-neutral

Bridge rectifier

$$\text{BEG-1xx: } U_N [\text{VDC}] = 0.9 \cdot \frac{U_V}{\sqrt{3}} [\text{VAC}]$$

Half-wave rectifier

$$\text{BEG-2xx: } U_N [\text{VDC}] = 0.45 \cdot \frac{U_V}{\sqrt{3}} [\text{VAC}]$$

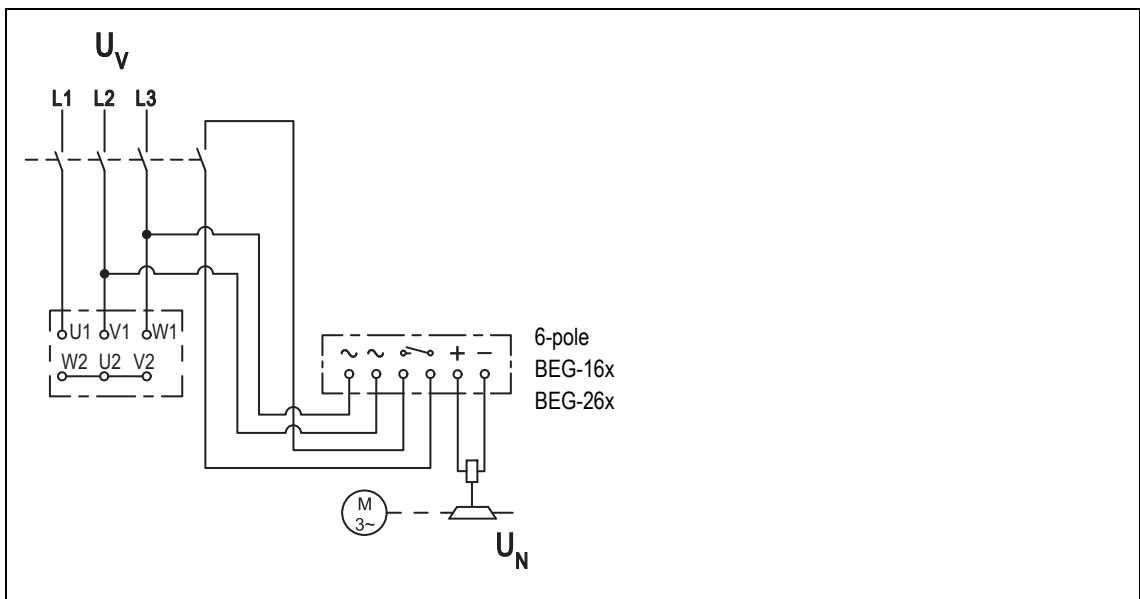


Fig. 11 Supply: Phase-phase

Bridge rectifier

$$\text{BEG-1xx: } U_N [\text{VDC}] = 0.9 \cdot U_V [\text{VAC}]$$

Half-wave rectifier

$$\text{BEG-2xx: } U_N [\text{VDC}] = 0.45 \cdot U_V [\text{VAC}]$$

* Not recommended for most regional/national high-voltage mains systems

AC switching at mains - delayed engagement

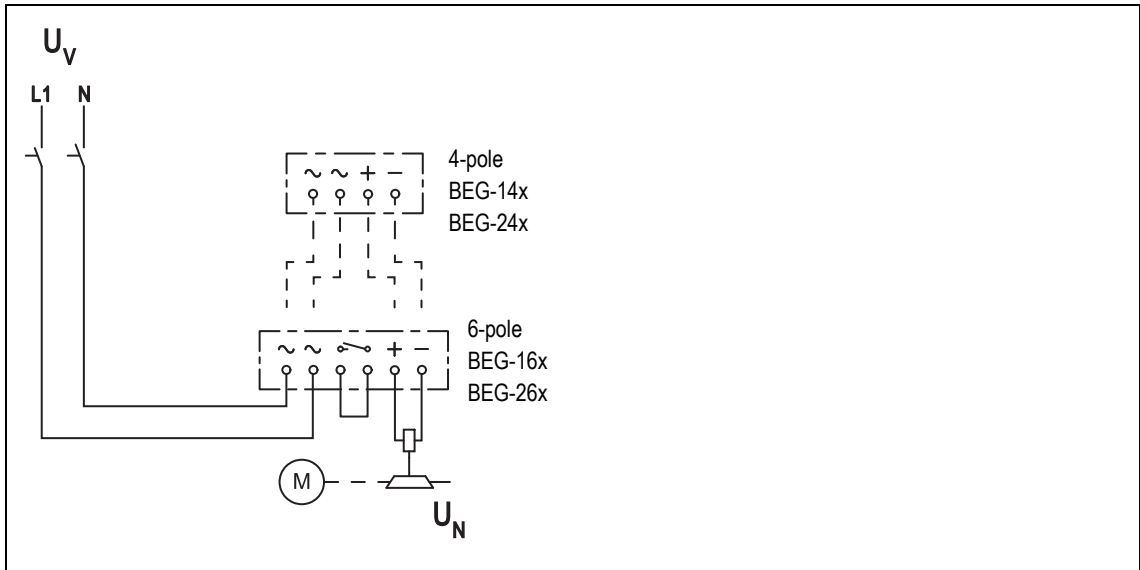


Fig. 12 Supply: Phase-N

Bridge rectifier

BEG-1xx: $U_N \text{ [VDC]} = 0.9 \cdot U_V \text{ [VAC]}$

Half-wave rectifier

BEG-2xx: $U_N \text{ [VDC]} = 0.45 \cdot U_V \text{ [VAC]}$

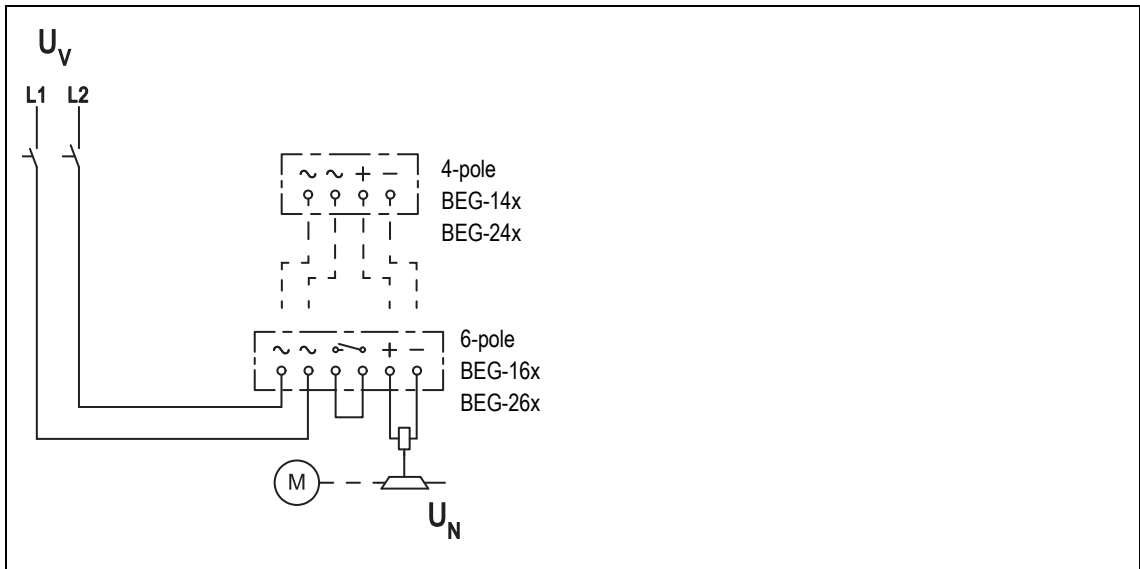


Fig. 13 Supply: Phase-phase

Bridge rectifier*

BEG-1xx: $U_N \text{ [VDC]} = 0.9 \cdot U_V \text{ [VAC]}$

Half-wave rectifier

BEG-2xx: $U_N \text{ [VDC]} = 0.45 \cdot U_V \text{ [VAC]}$

* Not recommended for most regional/national high-voltage mains systems

DC switching at mains - fast engagement

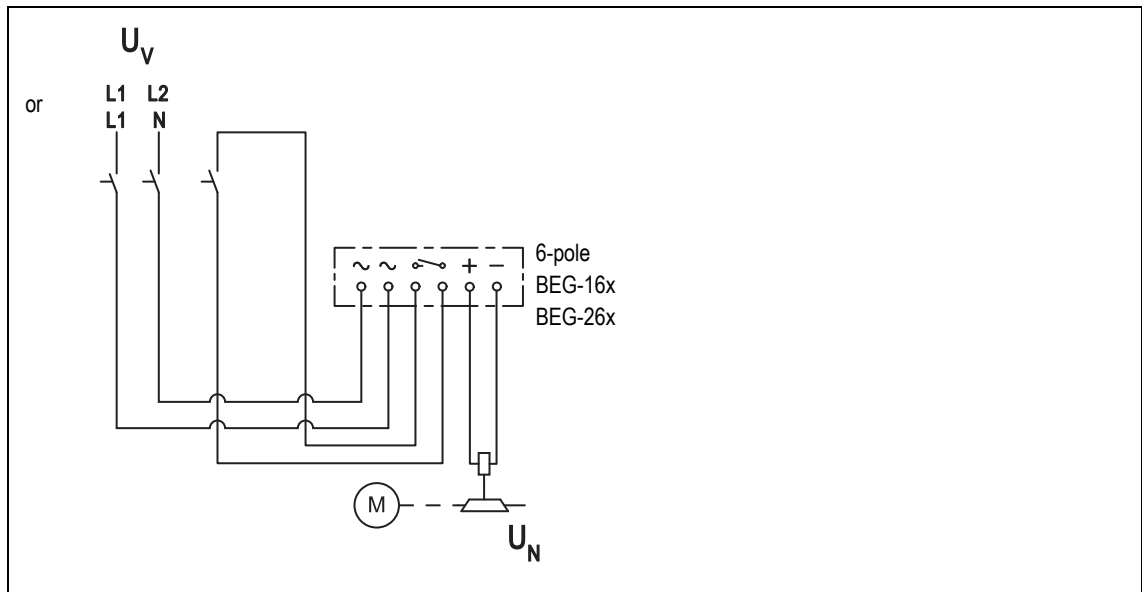


Fig. 14 Supply: Phase-phase or phase-N via 6-pole rectifier

Bridge rectifier*

Half-wave rectifier

BEG-16x: $U_N \text{ [VDC]} = 0.9 \cdot U_V \text{ [VAC]}$

BEG-26x: $U_N \text{ [VDC]} = 0.45 \cdot U_V \text{ [VAC]}$

* For most regional/national high-voltage mains systems, this only makes sense for supplies on L1 and N.

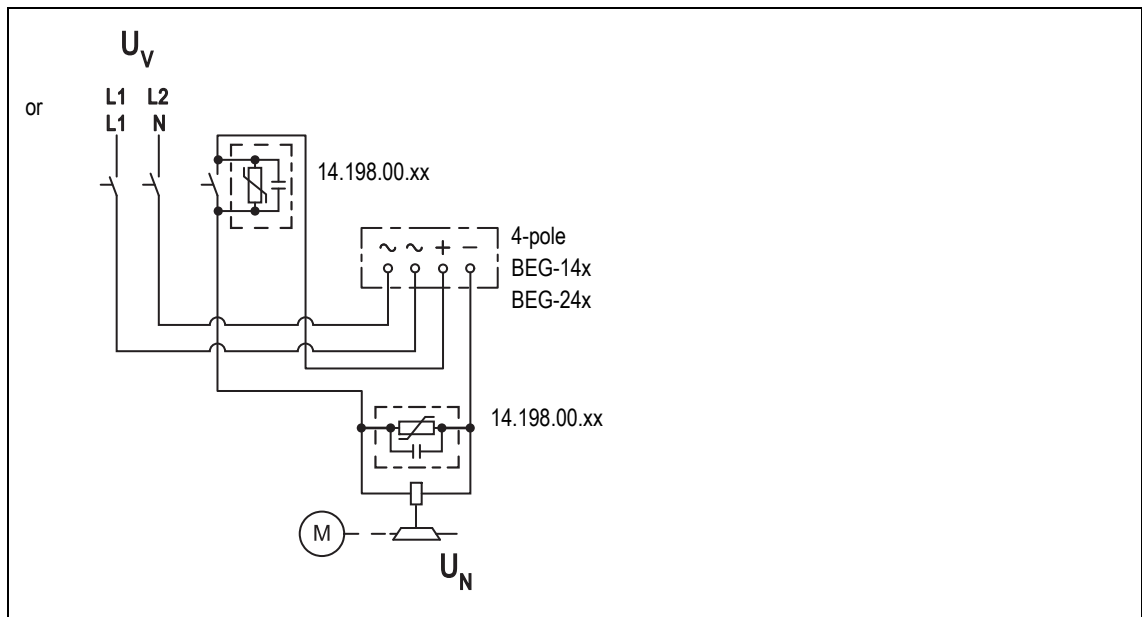


Fig. 15 Supply: Phase-phase or phase-N via 4-pole rectifier

Bridge rectifier*

Half-wave rectifier

BEG-14x: $U_N \text{ [VDC]} = 0.9 \cdot U_V \text{ [VAC]}$

BEG-24x: $U_N \text{ [VDC]} = 0.45 \cdot U_V \text{ [VAC]}$

Spark suppressor:

14.198.00.xx (required once, select position)

* For most regional/national high-voltage mains systems, this only makes sense for supplies on L1 and N.

5.3 Minimum bending radius for the brake connecting cable

Brake 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	8 x 5.3 = 42.4 mm
08		
10	AWG 18	8 x 5.5 = 44.0 mm
12		
14		
16	AWG 16	8 x 6.0 = 48.0 mm

5.4 Bridge/half-wave rectifier (optional)

BEG-561-□□□-□□□

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

Once a set over-excitation time has elapsed, the bridge/half-wave rectifiers switch over from bridge rectification to half-wave rectification. Depending on the design of the load, an improvement of the switching behaviour or a reduction in performance is possible.

5.4.1 Assignment: Bridge/half-wave rectifier - brake size

Rectifier type	Supply voltage [V AC]	Coil voltage Release / holding [V DC]	Assigned brake
BEG-561-255-030	230 ±10%	205 / 103	BFK457-01...16 Compact BFK457-06...16 Basic
BEG-561-255-030			
BEG-561-255-030			
BEG-561-255-030			
BEG-561-255-130			
BEG-561-255-130			
BEG-561-440-030-1	400 ±10%	360 / 180	
BEG-561-440-030-1			
BEG-561-440-030-1			
BEG-561-440-030-1			
BEG-561-440-130			
BEG-561-440-130			
BEG-561-440-130			

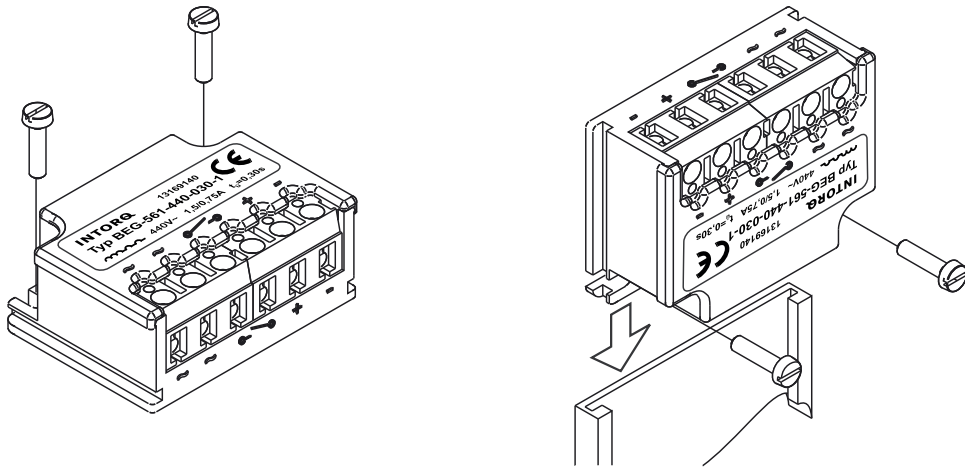


Fig. 16 BEG-561 attachment options

5.4.2 Technical specifications

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

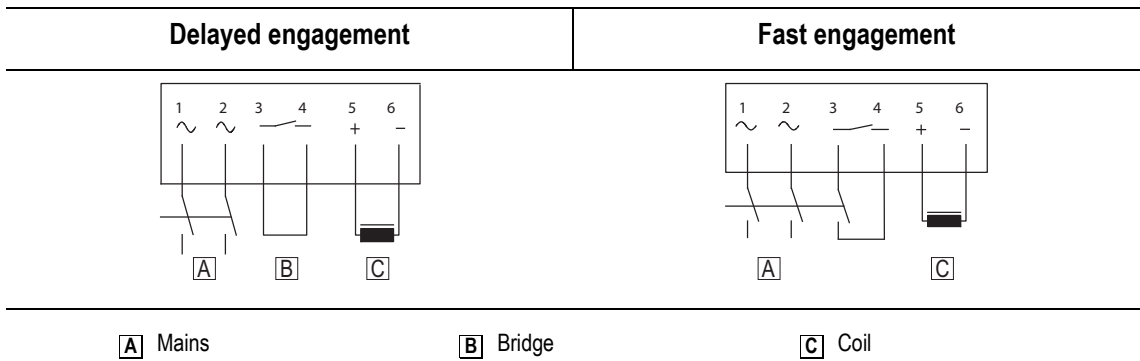
Type	Input voltage U_1 (40 Hz ... 60 Hz)			Max. current I_{max}		Over-excitation time t_{ue} ($\pm 20\%$)		
	Min. [V ~]	Rated [V ~]	max. [V ~]	Bridge [A]	half-wave [A]	at U_{1min} [s]	at U_{1Nom} [s]	at U_{1max} [s]
BEG-561-255-030	160	230	255	3.0	1.5	0.430	0.300	0.270
BEG-561-255-130						1.870	1.300	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. 7: Data for bridge/half-wave rectifier type BEG-561

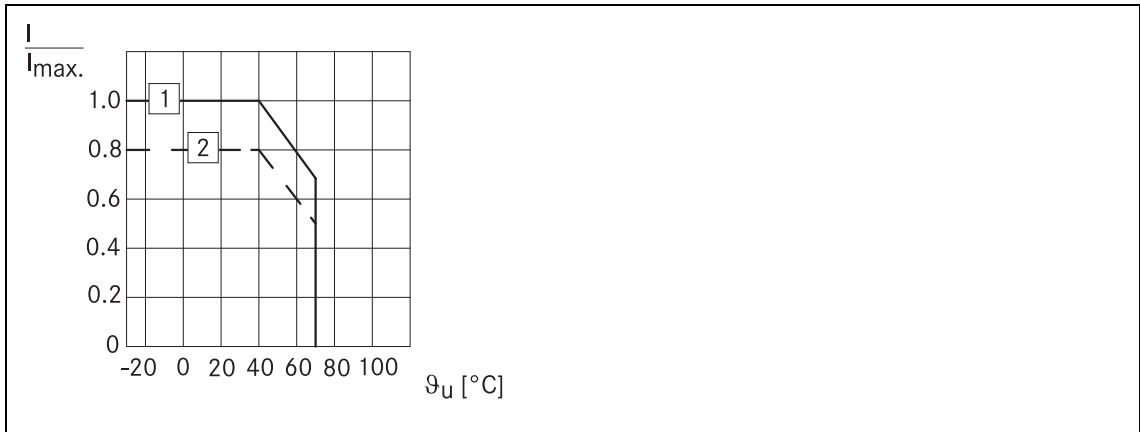
U_1 input voltage (40 ... 60 Hz)

5.4.3 Reduced switch-off times

AC switching must also be carried out for DC switching (fast engagement)! Otherwise, there will be no over-excitation when it is switched back on.





5.4.4 Permissible current load at ambient temperature







- 1 For screw assembly with metal surface (good heat dissipation)
- 2 For other assembly (e.g. adhesive)

6 Commissioning and operation

6.1 Important notes



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

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

	 CAUTION
	<p>Danger: hot surfaces. Do not touch!</p>

- The brakes are dimensioned in such a way that the specified rated torques are normally reached safely after a short run-in process.
- However, since the organic friction linings used do not all have identical properties and because environmental conditions can vary, deviations from the specified braking torques are possible. These must be taken into account in the form of appropriate dimensioning tolerances. Increased breakaway torque is common, in particular after long downtimes in humid environments where temperatures vary.
- Check the braking torque when the brake is being used on the customer's friction surfaces.
- If the brake is used as a pure holding brake without dynamic load, the friction lining must be reactivated regularly.

6.2 Function checks before commissioning



	 DANGER
	There is a risk of injury by electrical shock! The brake must only be electrically connected when no voltage is applied!



6.2.1 Checking the voltage

Connection diagram:  30

1. Remove two bridges from the motor terminals.
 - Do not switch off the voltage supply to the brake.
2. The switching contact for the brake must be open.
3. Apply DC voltage to the brake.
4. Measure the AC voltage at the motor terminals. The measured level must be zero.
5. Close the switching contact for the brake.
6. Measure the AC voltage at the motor terminals.
 - It must be the same as the mains voltage.
7. Measure the DC voltage at the brake:
 - The DC voltage measured after the over-excitation time (see bridge/half-wave rectifier) must be half the voltage indicated on the nameplate. A deviation of 10 % is permissible.
8. Check the air gap "s_L".
 - It must be zero and the rotor must rotate freely.
9. Open the switching contact for the brake.
10. Screw the bridges onto the motor terminals.

6.2.2 Release / Release check

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

	 WARNING
	The brake must be free of residual torque. The motor must not run!

1. Remove two bridges from the motor terminals. Do not switch off the DC voltage supply to the brake. When connecting the rectifier to the neutral point of the motor, the PE conductor must also be connected to this point.
2. Connect the mains supply.
3. Measure the DC voltage at the brake.
 - Compare the DC voltage with the voltage indicated on the nameplate. A deviation of 10 % is permissible.
4. Check the air gap "s_L". It must be zero and the rotor must rotate freely.
5. Switch off the current.
6. Screw the bridges onto the motor terminals. Remove any additional PE conductor.


The preparations for commissioning are completed.

If faults occur, refer to the the error search table at  50. If the fault cannot be fixed or eliminated, please contact your customer service.

6.3 Commissioning

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

6.4 During operation

- Checks must be carried out regularly. Pay special attention to:
 - unusual noises or temperatures
 - loose attachment elements
 - the condition of the electrical cables
- The armature plate must be tightened and the rotor must move without residual torque.
- Measure the DC voltage at the brake.
 - Compare the DC voltage with the voltage indicated on the nameplate. A deviation of ± 10 % is permissible.
- If faults or malfunctions occur, refer to the the error search table ( 50). If the fault cannot be fixed or eliminated, please contact your customer service.

7 Maintenance and repair

7.1 Wear of spring-applied brakes


The table below shows the different causes of wear and their impact on the components of the spring-applied brake. The influential factors must be quantified so that the service life of the rotor and brake can be calculated and so the prescribed maintenance intervals can be specified accurately. The most important factors in this context are the applied friction energy, the initial speed of rotation of braking and the switching frequency. If several of the causes of friction lining wear occur in an application at the same time, the influencing factors should be added together when the amount of wear is calculated.

Component	Cause	Effect	Influencing factors
Friction lining	Braking during operation	Wear of 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)		
	Starting 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 face	Rubbing and friction of the brake lining	Run-in of armature plate and counter friction face	Friction work
Gear teeth of brake rotor	Relative movements and shocks between brake rotor and brake shaft	Wear of gear teeth (primarily on the rotor side)	Number of start-stop cycles
Brake support	Load reversals and jerks in the backlash between armature plate, adjustment tubes and guide pins	Breaking of armature plate, adjustment tubes and guide pins	Number of start/stop cycles, braking torque
Springs	Axial load cycle and shear stress of springs through radial backlash on reversal of armature plate	Reduced spring force or fatigue failure	Number of switching operations of brake

Tab. 8: Causes for wear

7.2 Inspections

To ensure safe and trouble-free operations, the spring-applied brakes must be checked at regular intervals and, if necessary, replaced. Servicing will be easier at the plant if the brakes are made accessible. This must be considered when installing the drives in the plant.

Primarily, the required maintenance intervals for industrial brakes result from their load during operation. When calculating the maintenance interval, all causes for wear must be taken into account,  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 plant.

Failures, production losses or damage to the system may occur when the brakes are not serviced. Therefore, a maintenance strategy that is adapted to the particular operating conditions and brake loads must be defined for every application. For the spring-applied brakes, the maintenance intervals and maintenance operations listed in the table below must be followed. The maintenance operations must be carried out as described in the detailed descriptions.

7.2.1 Maintenance intervals

Time interval	for operating brakes:	for holding brakes with emergency stop:
	<ul style="list-style-type: none"> ■ according to service life calculation ■ or else every six months ■ after 4000 operating hours at the latest 	<ul style="list-style-type: none"> ■ at least every two years ■ after 1 million cycles at the latest

7.3 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.



Inspections with assembled brake	■ Check release function and control	45
	■ Measure air gap (if necessary, replace rotor / brake)	46 / 45
	■ Thermal damage of armature plate or flange (dark-blue tarnishing)	
Inspections after removing the brake	■ Check the play of the rotor gear teeth (replace worn-out rotors)	46
	■ 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 bearing shield <ul style="list-style-type: none"> - Evenness size 06 ... 12 < 0.06 mm - Evenness size 14 + 16 < 0.1 mm - Max. run-in depth = rated air gap for the size 	



7.3.1 Air gap

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

1. Measure the air gap “ s_L ” between armature plate and rotor using a feeler gauge (refer to Values 16).
2. Compare the measured air gap with the maximum permitted air gap “ s_{Lmax} ” (refer to Values 16).
3. If necessary, replace rotor (only for basic version BFK457-06...16) or replace complete brake (only for compact version BFK457-01...16).

7.3.2 Release / voltage



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



	 WARNING
	Danger: rotating parts! The running rotor must not be touched.

1. Observe the brake functionality while the drive is operating. The armature plate must be tightened and the rotor must move without residual torque.
2. Measure the DC voltage at the brake.
 - The DC voltage measured after the over-excitation time (see bridge/half-wave rectifier) must be half the voltage indicated on the nameplate. A deviation of 10 % is permissible.

7.3.3 Brake replacement



Compact design

	 WARNING
	Danger: rotating parts! The brake must be free of residual torque.



1. Disconnect the connection cable.
2. Unbolt the fastening screws and remove the brake from the end shield. Pay attention to the connection cable.
3. Pull brake from hub.
4. Check the gear teeth of the hub. If you notice wear, dismount and replace the hub.
5. Check the brake function according to the description of the inspection given in chapter  43.
6. If necessary, install new brake.
7. Reconnect the connection cable.
8. Recommission the brake,  39.

7.3.4 Replacing the rotor



Basic version


	 WARNING
	<p>Danger: rotating parts! Switch off the voltage. The brake must be free of residual load torque.</p>

1. Disconnect the connection cable.

	NOTICE
	<p>The brake is made up of individual components! When disassembling the brake, the socket head cap screws (10.1) ( 28) must be screwed into the magnetic section and the armature disk. These hold the springs and screws in the “complete stator” module together.</p>

Type	Size of socket head cap screw, position 10.1
BFK457-06	2 x M4 x 30
BFK457-08	2 x M5 x 35
BFK457-10	2 x M5 x 40
BFK457-12	2 x M5 x 45
BFK457-14	2 x M6 x 60
BFK457-16	2 x M6 x 60

2. Unbolt the fastening screws and remove the brake from the end shield. Pay attention to the connection cable.
3. Pull rotor from hub.
4. Check the gear teeth of the hub. If you notice wear, dismount and replace the hub.
5. Check friction surfaces.
 - In case of strong scoring at the flange, replace the flange.
 - In case of strong scoring on the bearing shield, rework the friction surface.
6. Measure the rotor thickness using a caliper gauge and compare the results with the values stated in chapter 3.2. Replace the rotor if necessary.
7. Check the brake function ( 42).
8. If necessary, install a new brake.
9. Reconnect the connection cable.
10. Recommission the brake, ( 39).

	<p>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.</p>
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7.4 Spare-parts list

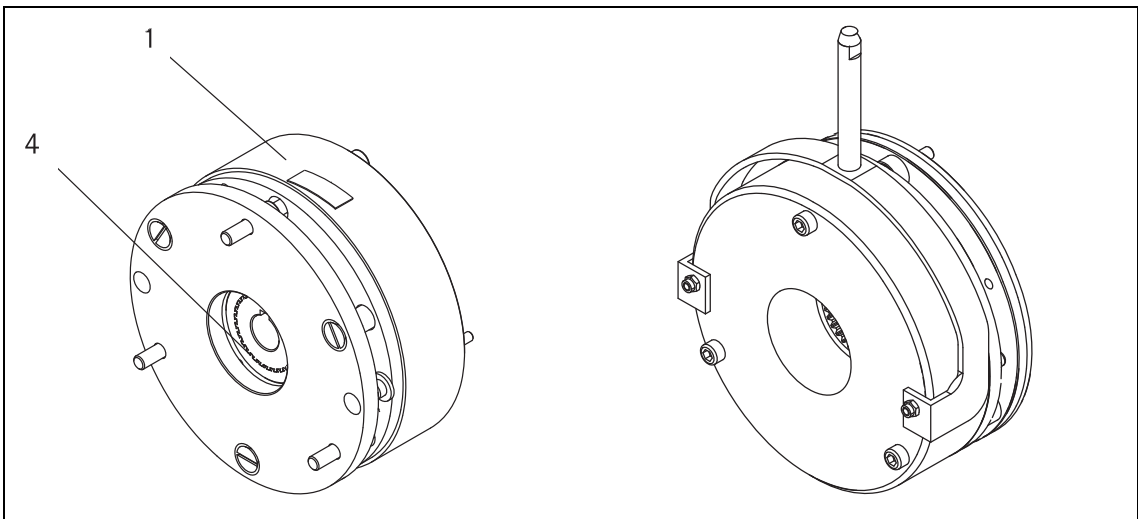
- Only parts with item numbers are available.
 - The item numbers are only valid for the standard design.
- Please include the following information with the order:
 - Order number of the brake
 - Position number of the spare part

Compact design



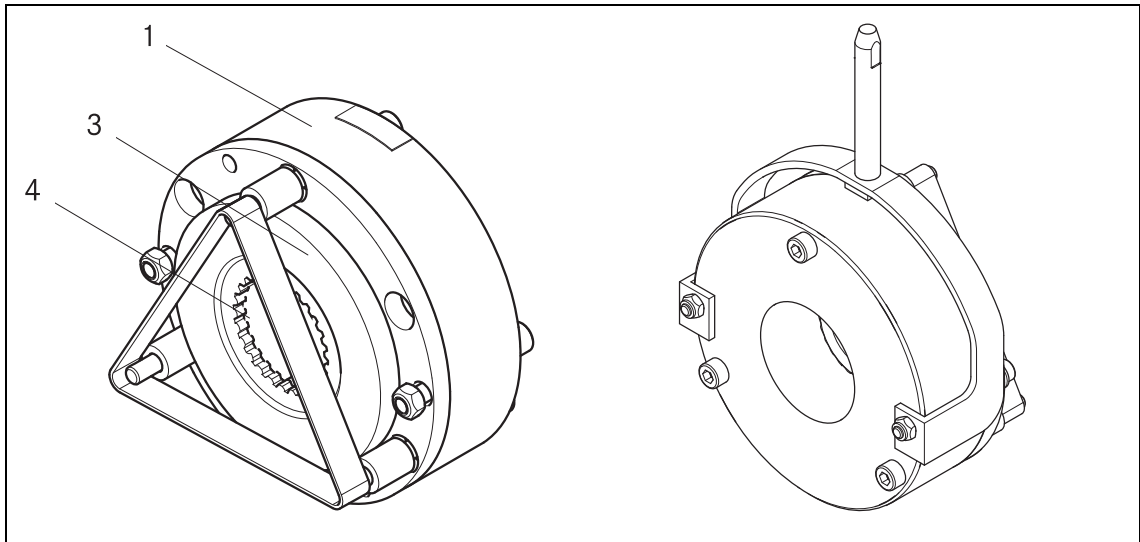
NOTICE

If the level of permitted wear (📖 16) has been reached, the complete brake must be replaced when you are using the compact version.



Item	Designation	Variant		
		Size	Voltage	Brake torque
1	Complete spring-applied brake	Size	Voltage	Brake torque
4	Hub	Size	-	-

Basic version



Item	Designation	Variant		
		Size	Voltage	Brake torque
1	Complete spring-applied brake	Size	Voltage	Brake torque
3	Rotor	Size	–	–
4	Hub	Size	–	–

7.5 Ordering spare parts

BFK457-□□ spring-applied brake

Identification _____ Order number of the brake (refer to nameplate)

Design **Compact** completely assembled with rotor and flange
 Compact completely assembled with hand release

Size 01 02 03 04 05
 06 08 10 12 14 16

Voltage 24 V 205 V 42 V (sizes 14 and 16)

Hub _____ mm (for hole diameter, see dimensions)

Design **Basic** stator, complete with rotor
 Basic stator, completely assembled with hand release

Size 06 08 10 12 14 16

Voltage 24 V 205 V 42 V (sizes 14 and 16)

Rotor Noise-reduced

Hub _____ mm (for hole diameter, see dimensions)

Size		01	02	03	04	05	06	08	10	12	14	16
Brake torque [NM]	<input type="checkbox"/>	0.12	0.25	0.5	1	2	4	8	16	32	60	80
	<input type="checkbox"/>	0.25	0.5	1	2	4	6	12	23	46	90	125

8 Troubleshooting and fault elimination

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

Fault	Cause	Remedy
Spring-applied brake cannot be released; the air gap is not zero	Coil interruption	<ul style="list-style-type: none"> ■ Measure the coil resistance using a multimeter: <ul style="list-style-type: none"> - If resistance is too high, replace the complete spring-applied brake.
	Coil has contact to earth or between windings	<ul style="list-style-type: none"> ■ Measure the coil resistance using a multimeter: <ul style="list-style-type: none"> - Compare the measured resistance with the nominal resistance. Refer to the rated data (📖 16) for the values. If resistance is too low, replace the complete stator. ■ Check the coil for short to ground using a multimeter: <ul style="list-style-type: none"> - 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	<ul style="list-style-type: none"> ■ Check and correct ■ Cable for continuity using a multimeter <ul style="list-style-type: none"> - Replace defective cable.
	Rectifier defective or incorrect	<ul style="list-style-type: none"> ■ Measure rectifier DC voltage using a multimeter. If DC voltage is zero: <ul style="list-style-type: none"> ■ Check AC rectifier voltage. If AC voltage is zero: <ul style="list-style-type: none"> - Switch on power supply - Check fuse - Check wiring If AC voltage is OK: <ul style="list-style-type: none"> - Check rectifier - Replace the defective rectifier - Diode is defective; use a suitable new rectifier ■ Check the coil for winding short or ground short. ■ 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.
	Air gap too big	Spring-applied brake INTORQ BFK457-01...16, replace rotor.
Rotor thickness too small	Spring-applied brake not replaced in time	Replace the spring-applied brake (📖 26) and 📖 27

Fault	Cause	Remedy
Voltage too high	Brake voltage does not match the rectifier	Adjust rectifier and brake voltage to each other.
Voltage too low	Brake voltage does not match the rectifier	Adjust rectifier and brake voltage to each other.
	Defective rectifier diode	Replace defective rectifier with a suitable undamaged one.
AC voltage is not mains voltage	Fuse missing or defective	Select a connection with proper fusing.

Notes

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