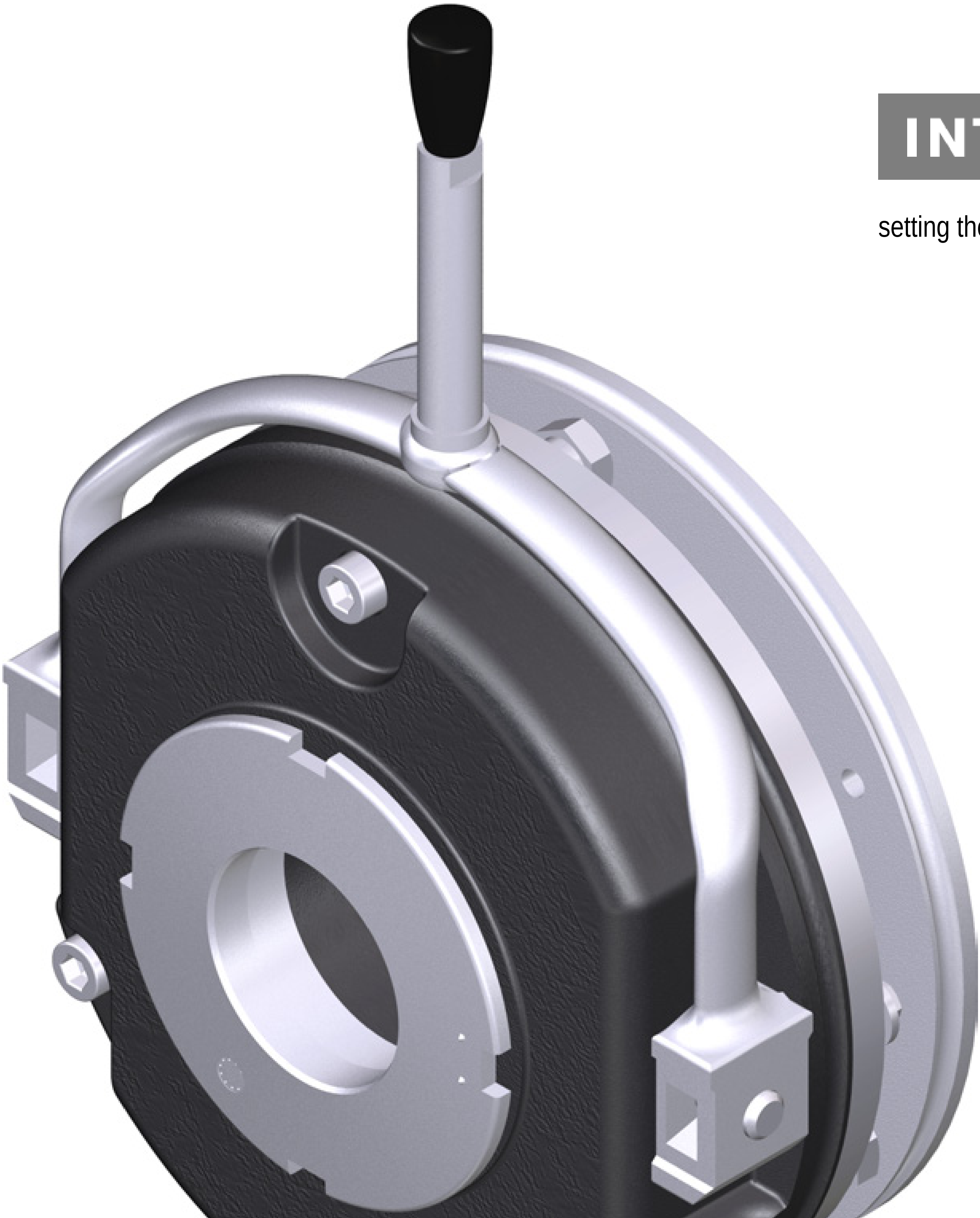


setting the standard

INTORQ BFK458

Spring-applied brake with electromagnetic release

Translation of the Original Operating Instructions

www.intorq.com

Document history

Material number	Version			Description
405520	1.0	08/1998	TD09	First edition for the series
405520	1.1	05/2000	TD09	Address revision Changed values of brake torques, table 1 and table 3 Supplemented table 4, switching times
460730	2.0	11/2002	TD09	All chapters: Complete editorial revision Changed company name Changed values of brake torques Changed drawings: Fig. 12, Fig. 13, Fig. 14, Fig.15 and Fig. 16 New: Chapter 7.4 "Spare parts list for double spring-applied brake"
13040626	2.1	02/2005	TD09	Changed company name to INTORQ
13284675	3.0	12/2008	TD09	Changed the tightening torques Supplemented table 5 Revision of Chapter 3.5 Supplemented Chapters 7.1 and 7.2
13284675	3.1	01/2010	TD09	Changed the maintenance intervals for holding brakes with emergency stop
13343893	4.0	07/2010	TD09	Changed values o f the braking torques and rotation speeds (📖 table 3)
13343893	4.1	05/2012	TD09	Changed strength grade of the fastening screws
13343893	5.0	10/2013	TD09	Complete revision
13343893	6.0	09/2015	SC	Restructured FM, harmonized connection diagrams, revised graphics
13343893	6.1	11/2015	SC	Revision of Chapter 8.4 Spare parts list
13343893	7.0	02/2016	SC	Update
13343893	8.0	03/2017	SC	Update, add Project Planning Notes

Refer to www.intorq.de for the latest version of these operating instructions.

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
  - unauthorised modifications to the product
  - improper work on or with the drive system
  - operating errors
  - disregarding the documentation

Warranty

NOTICE
The warranty conditions can be found in the terms and conditions of 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.

Spring-applied brakes of type BFK458-06...25

Design E	Design N
	
	Double spring-applied brake
	

Product key

INTORQ B FK □□□ - □□ □

Product group: Brakes

Product family: Spring-applied brake

Type: 458

Size: 06, 08, 10, 12, 14, 16, 18, 20, 25

Design/type:
E - adjustable (brake torque can be reduced via torque adjustment ring)
N - not adjustable
L – not adjustable, LongLife design

Not coded: Connection voltage, hub bore hole, options

Checking the 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.

NOTICE
Labelling of drive systems and individual components

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

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
Symbols	Page reference	🕮	Reference to another page with additional information For example: 🕮16 = refer to page 16
	Wildcard	□	Wildcard for options, selections For example: BFK458-□□ = BFK458-10
	Note		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:

Safety instructions

Structure of safety instructions:

	SIGNAL WORD
	Icon Indicates the type of danger **Signal word** Characterises 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

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

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

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

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

1.4 Terminology used

Term	In the following text used for
Spring-applied brake	Spring-applied brake with electromagnetic release
Drive system	Drive systems with spring-applied brakes and other drive components
Cold Climate Version (CCV)	Version of the spring-applied brake suited for particularly low temperatures

1.5 Abbreviations used

Letter symbol	Unit	Designation
F_R	N	Rated frictional force
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 fastening 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	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_m	N/mm^2	Tensile strength
R_N	Ohms	Rated coil resistance at 20 °C
R_z	µm	Averaged surface roughness
S_h	1/h	Switching frequency: the number of switching operations evenly spread 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

Letter symbol	Unit	Designation
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
s_{HL}	mm	Air gap for hand-release
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
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	Overexcitation 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 INTORQ components when you notice they are damaged.
- Never make any technical changes to INTORQ components.
- Never operate INTORQ components when they are incompletely mounted or incompletely connected.
- Never operate INTORQ components without their required covers.
- Only use accessories that have been approved by INTORQ.
- Only use original spare parts from the manufacturer.

Keep in mind the following during operations:

- Depending on the degree of protection, INTORQ components may have both live (voltage carrying), moving and rotating parts. Such components require the appropriate safety mechanisms.
- Surfaces can become hot during operation. Take the 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 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 spring-applied brake consists of different types of material.

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

3 Product description

3.1 Application as directed

INTORQ's spring-applied brakes are intended for use in machines and systems. They may only be used for purposes as specified in the ordered and confirmed by INTORQ. The spring-applied brakes 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 (📖 16) must be considered for proper and intended usage. Any other usage is consider improper and prohibited.

3.2 Layout

This chapter describes the variants, layout and functionality of the INTORQ BFK458 spring-applied brake. The basic module E is adjustable (the braking torque can be reduced using the torque adjustment ring). The special feature for basic module L (with an identical design) is the more durable materials (torque support, guide pins, toothed intermediate ring, friction lining and gear teeth). The double spring-applied brake design is especially useful in redundant braking applications.

3.2.1 Basic module E

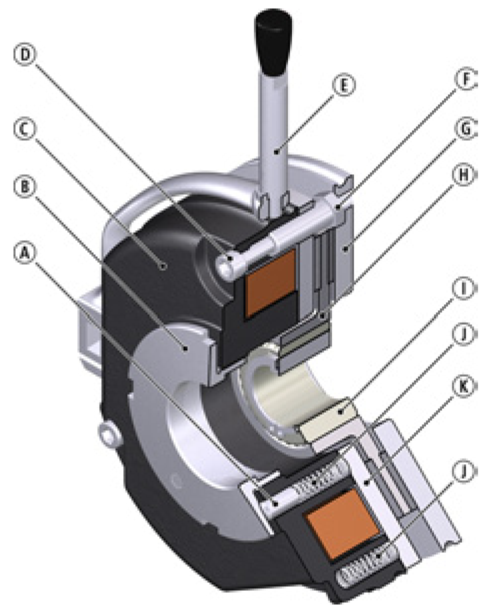


Abb. 1 Design of the INTORQ BFK458 spring-applied brake: Basic module E (complete stator) + rotor + hub + flange

Ⓐ Tappet	Ⓑ Torque adjustment ring	Ⓒ Stator
Ⓓ Socket head cap screw	Ⓔ Hand-release (optional)	Ⓕ Sleeve bolt
Ⓖ Flange	Ⓗ Rotor	Ⓘ Hub
Ⓙ Pressure spring	Ⓚ Armature plate	

3.2.2 Basic module N

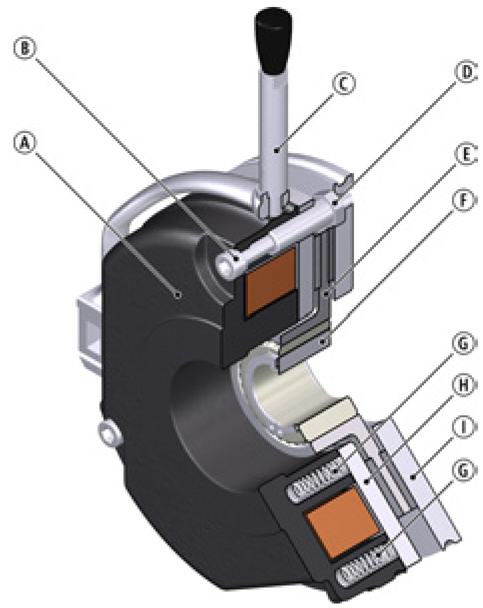


Fig. 2 Design of the INTORQ BFK458 spring-applied brake: Basic module N (complete stator) + rotor + hub + flange

Ⓐ Stator	Ⓑ Socket head cap screw	Ⓒ Hand-release (optional)
Ⓓ Sleeve bolt	Ⓔ Rotor	Ⓕ Hub
Ⓖ Pressure spring	Ⓗ Armature plate	Ⓘ Flange

3.2.3 Basic module L

Description of the LongLife design:

- Armature plate with low backlash and reinforced torque support
- Pressure springs with guide pins for protection against shearing forces
- Aluminium rotor with toothed intermediate ring: Low-wear friction lining and low-wear gear teeth.

The LongLife design can be configured modularly for sizes 6 to size 12 in combination with the specified rated torques. The specifications are as follows:

- The stator corresponds to the design N.
- Rear bores and extensions are not possible.
- A micro-switch in the size 12 is not configurable.

3.2.4 Double spring-applied brake

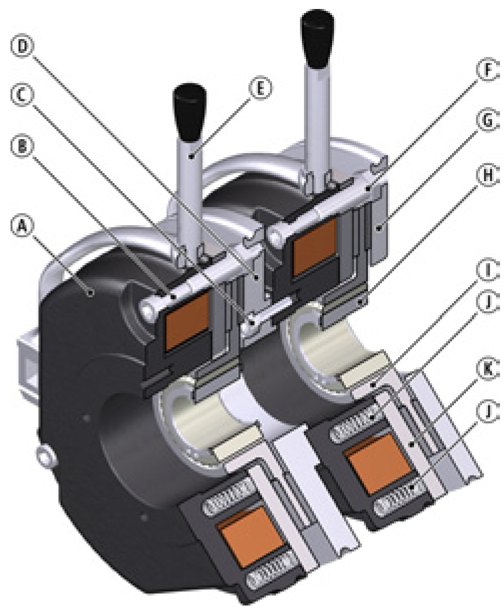


Fig. 3 **Design of the INTORQ BFK458 spring-applied brake: Basic module N, doubled design with intermediate flange**

Ⓐ Stator	Ⓑ Socket head cap screw	Ⓒ Screw for intermediate flange
Ⓓ Intermediate flange	Ⓔ Hand-release (optional)	Ⓕ Sleeve bolts
Ⓖ Flange	Ⓗ Hub	Ⓘ Rotor
Ⓙ Pressure spring	Ⓚ Armature plate	

Function

This brake is an electrically releasable spring-applied brake with a rotating brake disc (rotor) that is equipped on both sides with friction linings. In its de-energised 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 an operating brake, and as an emergency stop brake for high speeds.

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

In addition to the powerful standard friction linings, there are alsospecial friction linings for a range of different applications, such as those with high wear resistance or an increased friction coefficient.

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.

Brake torque reduction

For the basic module E, the spring force and thus the brake torque can be reduced by unscrewing the central torque adjustment ring.

Project planning notes

- When designing a brake for specific applications, torque tolerances, the limiting speeds of the rotors, the thermal resistance of the brake, and the effect of environmental influences must all be taken into account.
- The brakes are dimensioned in such a way that the specified rated torques are reached safely after a short run-in period.
- However, as 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 any dynamic load, the friction lining must be reactivated regularly.

3.3 Optional configuration

3.3.1 Hand-release (optional)

To temporarily release the brake when there is no electricity available, a hand-release function is available as an option. The hand-release can be retrofitted (for installation information, refer to 🕮 41).

3.3.2 Optional micro-switch

The micro-switch is used for the release monitoring or for wear monitoring. The user is responsible for arranging the electrical connection for this optional micro-switch.

- Usage for the (air) release monitoring: The motor will start only after the brake has been released. This enables the micro-switch to monitor for errors (e.g. when the motor does not start because of a defective rectifier, if there are broken connection cables, defective coils, or an excessive air gap).
- Usage for monitoring wear: The brake and motor are supplied with no power when the air gap is too large.

3.3.3 Optional encapsulated design

This design not only prevents the penetration of spray water and dust, but also the spreading of abrasion particles outside the brake. This is achieved by the following enclosures:

- A cover ring over the armature plate and rotor.
- Cover plate
- Shaft sealing ring (can be supplied for continuous shaft).

3.3.4 Optional CCV

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

4 Technical specifications

Possible applications of the INTORQ spring-applied brake

- Degree of protection:
  - 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.
- Ambient temperature:
  - -20 °C to +40 °C (standard)
  - -40 °C to +40 °C (Cold Climate Version: CCV)

NOTICE
Please observe that engagement times and disengagement times change depending on the brake torque.

4.1 Brake torque reduction

Size	06	08	10	12	14	16	18	20	25
Rated torque M_K [Nm] of the brake, rated value at a relative speed of rotation of 100 rpm								80 E	
	1.5 E	3.5 N/E			25 N/E	35 N/E	65 N/E	115 N/E	175 N/E
	2 N/E	4 E	7 N/E	14 N/E	35 N	45 N/E	80 N/E	145 N/E	220 N
	2.5 N/E	5 N/E	9 N/E	18 N/E	40 N/E	55 N/E	100 N/E	170 N/E	265 N/E
	3 N/E	6 N/E	11 N/E	23 N/E	45 N/E	60 N/E	115 N/E	200 N/E	300 N/E
	3.5 N/E	7N/E	14 N/E	27 N/E	55 N/E	70 N/E	130 N/E	230 N/E	350 N/E
	4 N/E	8 N/E	16 N/E	32 N/E	60 N/E	80 N/E	150 N/E	260 N/E	400 N/E
	4.5 N/E	9N/E	18 N/E	36 N/E	65 N/E	90 N/E	165 N/E	290 N/E	445 N/E
	5 E	10 E	20 E	40 E	75 N/E	100 N/E	185 N/E	315 N/E	490 N/E
	5.5 E	11 E	23 N/E	46 N/E	80 N/E	105 N/E	200 N/E	345 N/E	530 N/E
	6 N/E	12 N/E				125 N/E	235 N/E	400 N/E	600 N/E
Torque reduction per latch-in position [Nm] for design E	0.2	0.35	0.8	1.3	1.7	1.6	3.6	5.6	6.2

Tab. 1:
N Braking torque for the N design (without torque adjustment ring)
E Braking torque for the E design (with torque adjustment ring)
L LongLife design

Operating brake (s_{Lmax} approx. 2.5 x s_{LN})

Standard braking torque

Holding brake with emergency stop ($s_{Lmax.}$ approx. 1.5 x s_{LN})

For basic module E, the brake torque can be reduced using the torque adjustment ring in the stator. The torque adjustment ring can be unscrewed to the maximum protrusion of "$h_{Emax.}$" (17 and 57).

4.2 Rated data

Size	Rated brake torque at $\Delta n=100$ rpm [%]	Braking torque at Δn_0 [rpm] [%] 1500	3000	maximum	Max. rotation speed Δn_{0max} for horizontal mounting position [rpm]
06	100	87	80	74	6000
08		85	78	73	5000
10		83	76		4000
12		81	74		3600
14		80	73	72	
16		79	72	70	
18		77	70	68	
20		75	68	66	
25		73	66		3000

Tab. 2: Rated data for braking torques, depending on the speed and permissible limiting speeds

Size	s_{LN} +0.1 mm -0.05 mm [mm]	$s_{Lmax.}$ Operating brake [mm]	$s_{Lmax.}$ Holding brake [mm]	Max. adjustment, Permissible Wear path [mm]	Rotor thickness min.[1] [mm]	Rotor thickness max. [mm]	Protrusion Torque adjustment ring $h_{Emax.}$ [mm]
06	0.2	0.5	0.3	1.5	4.5	6.0	4.5
08					5.5	7.0	
10					7.5	9.0	7.5
12	0.3	0.75	0.45	2.0	8.0	10.0	9.5
14				2.5	7.5		11
16				3.5	8.0	11.5	10
18	0.4	1.0	0.6	3.0	10.0	13.0	15
20				4.0	12.0	16.0	17
25	0.5	1.25	0.75	4.5	15.5	20.0	19.5

Tab. 3: Rated data for air gap specifications

[1] The friction lining is dimensioned so that the brake can be adjusted at least 5 times.

<table>
<tr><th rowspan="2">Size</th><th rowspan="2">Screw hole circle

∅ [mm]</th><th rowspan="2">Screws
for the flange mount
DIN EN ISO 4762 (8.8)

[1]</th><th rowspan="2">Minimum depth
of the clearing holes
(in end shield)

[mm]</th><th colspan="2">Tightening torque
±5%</th></tr>
<tr><th>Screws
[NM]</th><th>Complete lever
[NM]</th></tr>
<tr><td>06</td><td>72</td><td>3 x M4</td><td>0.5</td><td>3.0</td><td rowspan="2">2.8</td></tr>
<tr><td>08</td><td>90</td><td>3 x M5</td><td>1</td><td>5.9</td></tr>
<tr><td>10</td><td>112</td><td>3 x M6</td><td>2</td><td rowspan="2">10.1</td><td rowspan="2">4.8</td></tr>
<tr><td>12</td><td>132</td><td>3 x M6</td><td>3</td></tr>
<tr><td>14</td><td>145</td><td rowspan="2">3 x M8</td><td>1.5</td><td rowspan="3">24.6</td><td rowspan="2">12</td></tr>
<tr><td>16</td><td>170</td><td>0.5</td></tr>
<tr><td>18</td><td>196</td><td>4 x M8[2]</td><td>0.8</td><td rowspan="2">23</td></tr>
<tr><td>20</td><td>230</td><td>4 x M10[2]</td><td>2.1</td><td rowspan="2">48</td></tr>
<tr><td>25</td><td>278</td><td>6 x M10[3]</td><td>5</td><td>40</td></tr>
</table>

Tab. 4: Rated data for the screw set for flange mounting

[1] The screw length depends on the material and the thickness of the customer's mounting surface.
[2] The thread in the mounting surface is offset by 30° in reference to the centre axle of the hand-release lever.
[3] Hex head screw according to DIN EN ISO 4017 - 8.8.

Size	Pitch Hole circle ∅ [mm]	Screw set for mounting to the flange	Minimum depth of the clearing hole [mm]	Screw set for mounting onto the motor/friction plate	Screw set for flange with through hole
06	72	3 x M4x35	0.5	3 x M4x40	3 x M4x45
08	90	3 x M5x40	1	3 x M5x45	3 x M5x50
10	112	3 x M6x50	2	3 x M6x55	3 x M6x65
12	132	3 x M6x55	3	3 x M6x60	3 x M6x70
14	145	3 x M8x65	1.5	3 x M8x70	3 x M8x80
16	170	3 x M8x70	0.5	3 x M8x80	3 x M8x90
18	196	6 x M8x80	0.8	6 x M8x90	-
20	230	6 x M10x90	2.1	6 x M10x100	-
25	278	6 x M10x100	5	6 x M10x110	-

Tab. 5: Rated data for the screw set for brake mounting

Size	Screw hole circle		Screw set for mounting Double flange on stator, complete DIN EN ISO 4762 strength grade 8.8 (10.9)	Thread depth in the magnet housing	Tightening torque ±5%
	∅ [mm]	Thread	(4 pieces)	[mm]	[NM]
06	37.7	4 x M4	M4x16	10	3.0
08	49	4 x M5	M5x16	12	5.9
10	54				
12	64		M5x20		
14	75	4 x M6	M6x20		10.1
16	85		M6x25	15	
18	95	4 x M8	M8x25	17	24.6
20	110	4 x M10	M10x25	20	48
25	140		M10x30 - **10.9**		71

Tab. 6: Rated data for the screw set, intermediate flange installation for double spring-applied brake

Size	Electrical power P_{20} 1) [W]	Coil voltage U [V]	Coil resistance R_{20} ±8 % [Ω]	Rated current I_N [A]
06	20	24	28.8	0.83
		96	460.8	0.21
		103	530.5	0.194
		170	1445	0.114
		180	1620	0.111
		190	1805	0.105
		205	2101	0.098
08	25	24	23	1.04
		96	368	0.26
		103	424.4	0.242
		170	1156	0.147
		180	1296	0.138
		190	1444	0.131
		205	1681	0.121

Tab. 7: Rated data for coil power

Size	Electrical power P_{20} 1) [W]	Coil voltage U [V]	Coil resistance R_{20} ±8 % [Ω]	Rated current I_N [A]
10	30	24	19.2	1.25
10	31	96	297.3	0.322
10	32	103	331.5	0.31
10	30	170	963.3	0.176
10	32	180	1013	0.177
10	30	190	1203	0.157
10	33	205	1273	0.160
12	40	24	14.4	1.66
12	40	96	230.4	0.41
12	40	103	265.2	0.388
12	40	170	722.5	0.235
12	40	180	810	0.222
12	40	190	902.5	0.210
12	40	205	1051	0.195
14	50	24	11.5	2.08
14	50	96	184.3	0.52
14	53	103	200.2	0.514
14	50	170	578	0.294
14	53	180	611.3	0.294
14	50	190	722	0.263
14	53	205	792.9	0.258
16	55	24	10.5	2.29
16	55	96	167.6	0.573
16	56	103	189.5	0.543
16	55	170	525.5	0.323
16	55	180	589.1	0.305
16	60	190	601.7	0.315
16	56	205	750.5	0.292

Tab. 7: Rated data for coil power

Size	Electrical power P_{20} [1)] [W]	Coil voltage U [V]	Coil resistance R_{20} ±8 % [Ω]	Rated current I_N [A]
18	85	24	6.8	3.54
		96	108.4	0.885
		103	124.8	0.825
		170	340	0.5
		180	387.2	0.472
		190	424.7	0.447
		205	494.4	0.414
20	100	24	5.76	4.16
		96	92.2	1.04
		103	106.1	0.970
		170	289	0.588
		180	324	0.55
		190	328.2	0.578
		205	420.3	0.487
25	110	24	5.24	4.58
		96	83.8	1.14
		103	96.5	1.06
		170	262.7	0.647
		180	294.6	0.611
		190	328.2	0.578
		205	382.1	0.536

Tab. 7: Rated data for coil power

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

4.3 Switching times

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

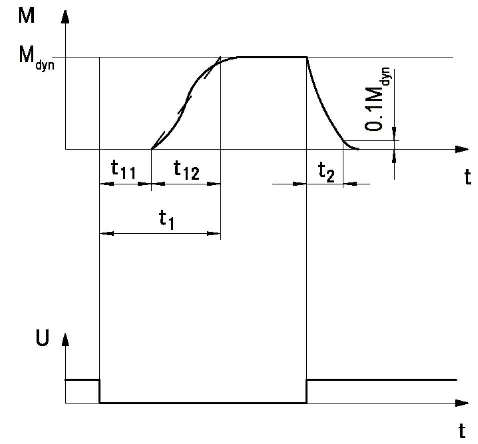


Fig. 4 Operating/switching times of the spring-applied brakes

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

Size	Rated torque M_K [Nm]	Q_E [J][1)]	S_{hue} [1/h]	Switching times [ms] [2)]			
				DC-side engagement			Disengage
				t_{11}	t_{12}	t_1	t_2
06	4	3000	79	15	13	28	45
08	8	7500	50	15	16	31	57
10	16	12000	40	28	19	47	76
12	32	24000	30	28	25	53	115
14	60	30000	28	17	25	42	210
16	80	36000	27	27	30	57	220
18	150	60000	20	33	45	78	270
20	260	80000	19	65	100	165	340
25	400	120000	15	110	120	230	390

Tab. 8: Switching energy - operating frequency - operating times

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

2) These switching times are specified for usage of 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 DC-side switching: A braking torque reduction via the torque adjustment ring prolongs the engagement time and reduces the disengagement time. An anti-magnetic pole shim is available when there is excessive prolongation. This plate is installed between the stator and the armature plate. The plate reduces the engagement time and prolongs the disengagement time.

Engagement time for AC-side switching: The engagement time is significantly prolonged (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: 📖 46.

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 INTORQ rectifiers and rated voltage.

4.4 Switching energy / operating frequency

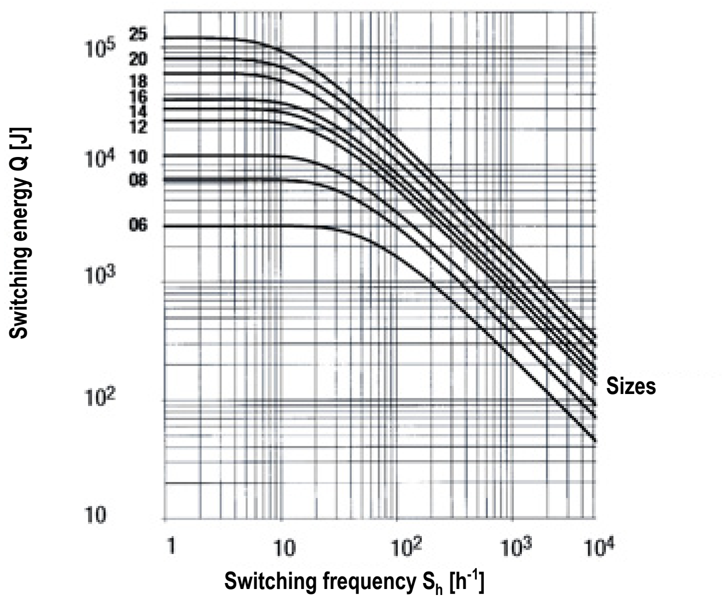


Fig. 5 Switching energy as a function of the switching frequency

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

The permissible switching frequency S_{hmax} depends on the amount of heat Q_R (refer to Figure 5). At a pre-set switching frequency S_h, the permissible amount of heat is Q_{Smax}.

NOTICE
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.

4.5 Electromagnetic compatibility

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

	NOTICE
!	If an 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 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" and the brake size.

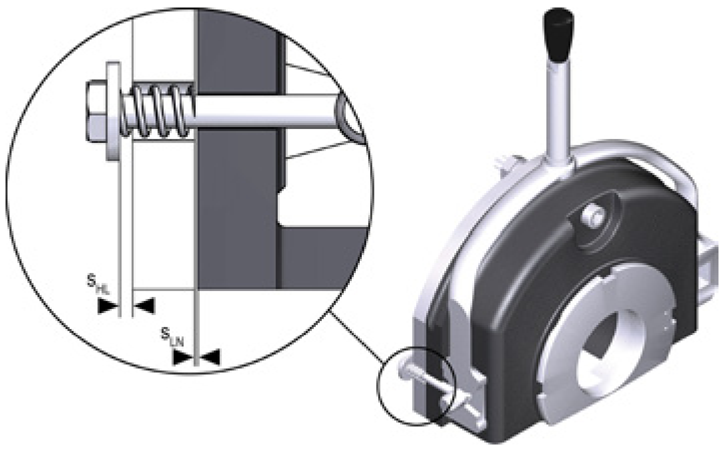
Depending on the natural oscillation after installation, operating conditions and the state of the friction surfaces, the brake may squeak during braking.

4.7 Hand-release

The hand-release mechanism is used to release the brake by hand and can be retrofitted.

The hand-release springs back to its original position automatically after operation. The hand-release requires an additional air gap "s_{HL}" in order to function; this is factory-set prior to delivery. Check for the dimension "s_{HL}" after the installation.

Size	s_{LN} $^{+0.1}_{-0.05}$ (mm)	s_{HL} $^{+0.1}$ (mm)
06		
08	0.2	1
10		
12		
14	0.3	1.5
16		
18	0.4	2
20		
25	0.5	2.5



Tab. 9: Adjustment setting for hand-release

4.8 Labels on product

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

Fig. 6 Packaging label (example)

INTORQ	Manufacturer
IIIIIIIIIIIIIIIIIII	Bar code
BFK458-12E	Type (see product key)
SPRING-APPLIED BRAKE	Designation of the product family
No. 15049627	Type No.
24 V DC	Rated voltage
32 NM	Rated torque
1 piece	Qty. per box
C US	CSA_CUS acceptance
40 W	Rated power
20 H7	Hub diameter
02.06.15	Packaging date
Anti-rust packaging: keep friction surface free of grease!	Addition
CE	CE mark

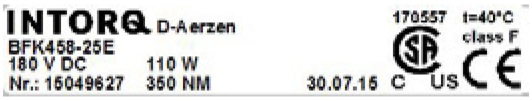


Fig. 7 Name plate (example)

INTORQ	Manufacturer
170557 C US	CSA_CUS acceptance
t=40°C	Ambient temperature
BFK458-25E	Type (see product key)
Class F	Insulation class
180 V DC	Rated voltage
110 W	Rated power
No. 15049627	Type No.
350 NM	Rated torque
30/07/2015	Date of manufacture
CE	CE mark

5 Mechanical installation

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

Important notes

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

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 INTORQ before using other materials; INTORQ's written confirmation is required for such usage.
- The backing plate must be supported by the end shield across the full surface.

Minimum requirements of the end shield

<table>
<tr><th>Size</th><th>Axial run-out [mm]</th><th>Material[1)]</th><th>Flatness [mm]</th><th>Roughness</th><th>Tensile strength R_m [N/mm^2]</th><th>Others</th></tr>
<tr><td>06</td><td>0.03</td><td rowspan="9">S235JR; C15; EN-GJL-250</td><td rowspan="4">< 0.06</td><td rowspan="4">Rz6</td><td rowspan="9">250</td><td rowspan="9">▪ Threaded holes with minimum thread depth 📖 18
▪ Free of grease and oil</td></tr>
<tr><td>08</td><td>0.03</td></tr>
<tr><td>10</td><td>0.03</td></tr>
<tr><td>12</td><td>0.05</td></tr>
<tr><td>14</td><td>0.05</td><td rowspan="5">< 0.10</td><td rowspan="5">Rz10</td></tr>
<tr><td>16</td><td>0.08</td></tr>
<tr><td>18</td><td>0.08</td></tr>
<tr><td>20</td><td>0.08</td></tr>
<tr><td>25</td><td>0.10</td></tr>
</table>

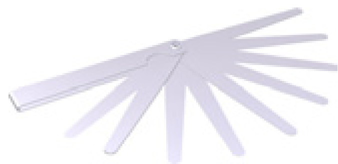
Tab. 10: End shield as counter friction surface

1) Consult with INTORQ before using other materials.

The diameter of the shaft shoulder must not be greater than the tooth root diameter of the hub.

5.1 Tools

<table>
<tr><th rowspan="3">Size</th><th colspan="2">Torque wrench
Insert for hexagonal socket (Allen) screws</th><th colspan="2">Wrench size of open-end wrench
[mm]</th><th>Hook wrench
DIN 1810
design A</th><th>Socket wrench for flange mounting, outer</th></tr>
<tr><td></td><td></td><td colspan="2"></td><td></td><td></td></tr>
<tr><th>Measurement range
[NM]</th><th>Wrench width
[mm]</th><th>Sleeve bolts</th><th>Hand-release screws</th><th>Diameter
[mm]</th><th>Width across flats
[mm]</th></tr>
<tr><td>06</td><td rowspan="4">1 to 12</td><td>3</td><td>8</td><td>7 / 5.5</td><td>45 - 55</td><td>7</td></tr>
<tr><td>08</td><td>4</td><td>9</td><td rowspan="3">10 / 7</td><td>52 - 55</td><td>8</td></tr>
<tr><td>10</td><td rowspan="2">5</td><td rowspan="2">12</td><td>68 - 75</td><td rowspan="2">10</td></tr>
<tr><td>12</td><td rowspan="2">80 - 90</td></tr>
<tr><td>14</td><td rowspan="5">20 to 100</td><td rowspan="4">6</td><td rowspan="4">15</td><td rowspan="2">12 / 8</td><td rowspan="3">13</td></tr>
<tr><td>16</td><td>95 - 100</td></tr>
<tr><td>18</td><td rowspan="3">- / 10</td><td>110 - 115</td></tr>
<tr><td>20</td><td>135 - 145</td><td rowspan="2">17</td></tr>
<tr><td>25</td><td>8</td><td>17</td><td>155 - 165</td></tr>
</table>

Multimeter	Calliper gauge	Feeler gauge
		

5.2 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 rated voltage)!

5.3 Installing the hub onto the shaft

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

NOTICE
Check the tensile strength of the hub material: When operating with high torque, consult with INTORQ and use a steel hub with a higher tensile strength.

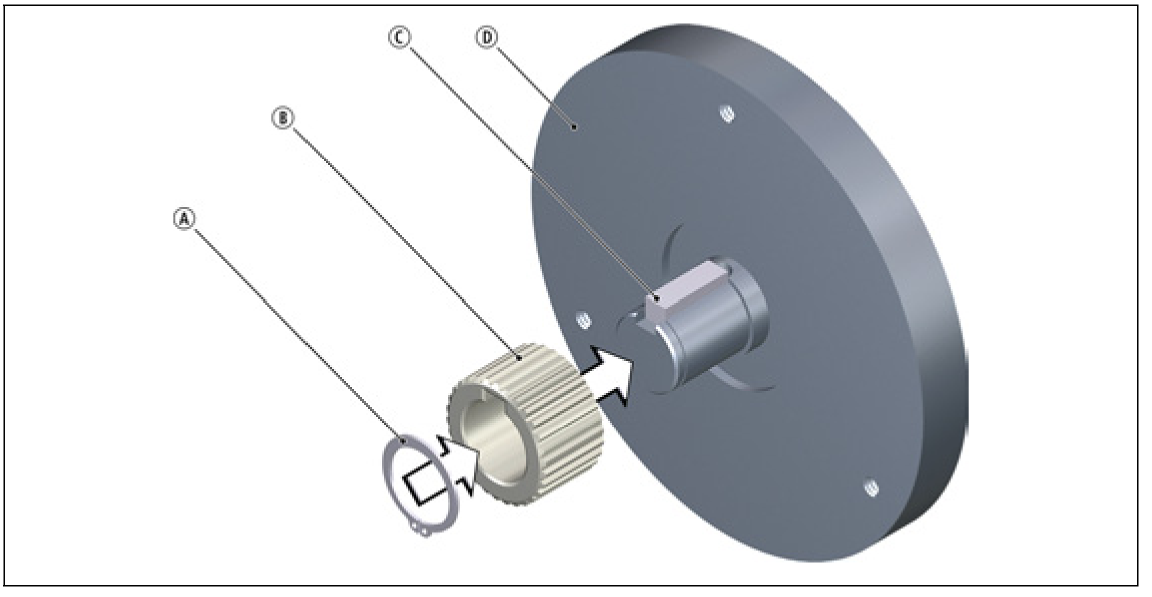


Fig. 8 Mounting the hub onto the shaft

Ⓐ Circlip Ⓑ Hub Ⓒ Key
Ⓓ End shield

1. Press the hub with a moderate amount of force to the shaft.
2. 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.

5.4 Installing the brake

Installing the rotor (without friction plate)

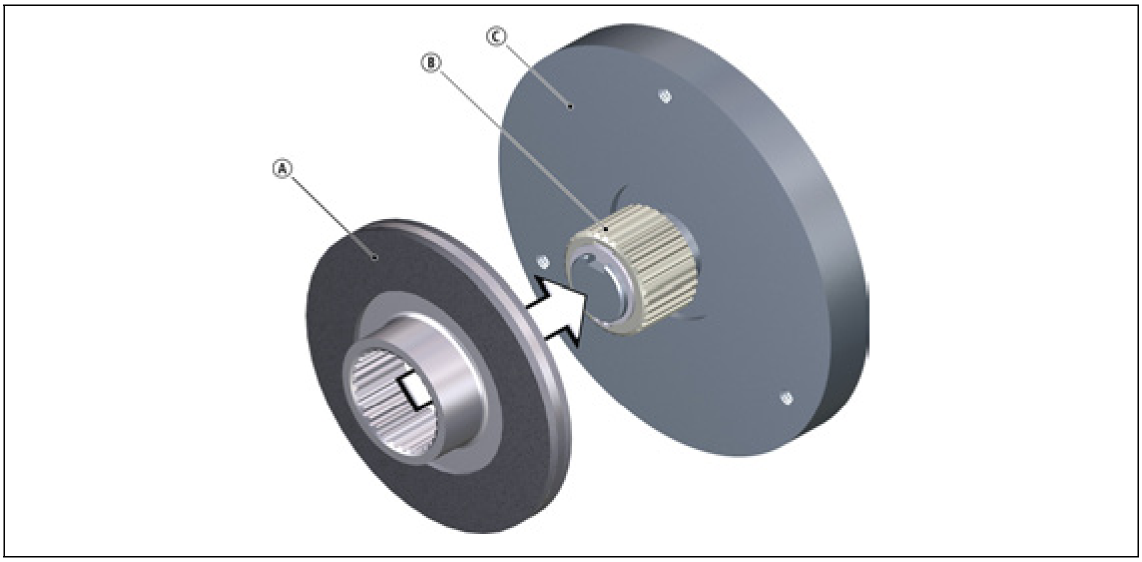


Fig. 9 Assembly of the rotor

Ⓐ Rotor Ⓑ Hub Ⓒ End shield

1. Push the rotor on the hub.
2. Check if the rotor can be moved manually.

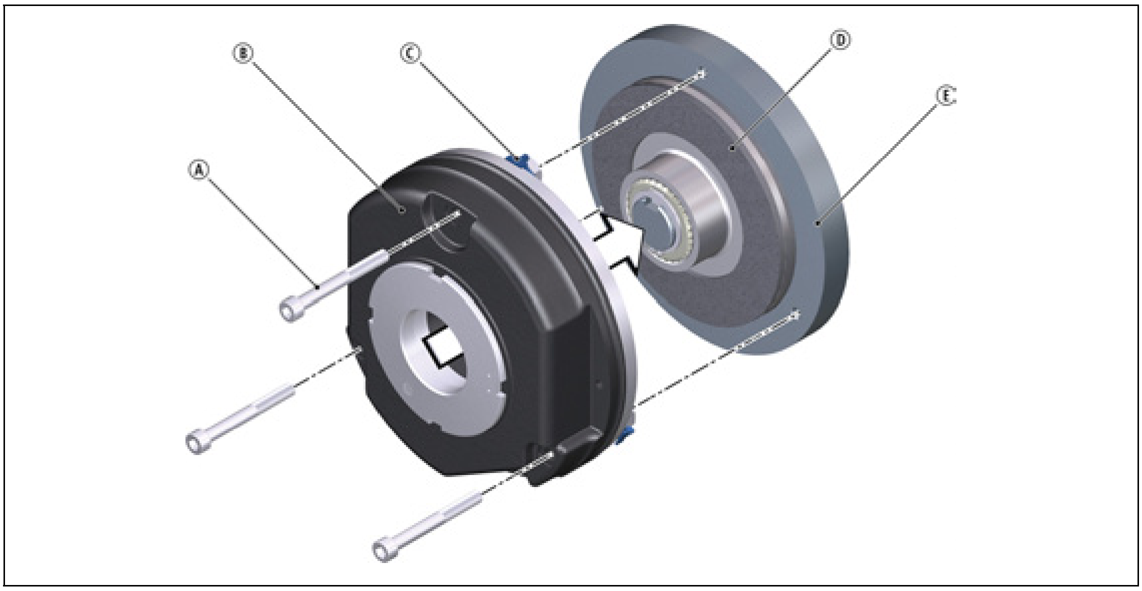


Fig. 10 Mounting the complete stator

Ⓐ Socket head cap screw Ⓑ Stator, complete Ⓒ Terminal clip

Ⓓ Rotor Ⓔ End shield

3. Screw the complete stator to the end shield Use the supplied set of screws and a torque wrench.

4. Remove the terminal clips and dispose of properly.

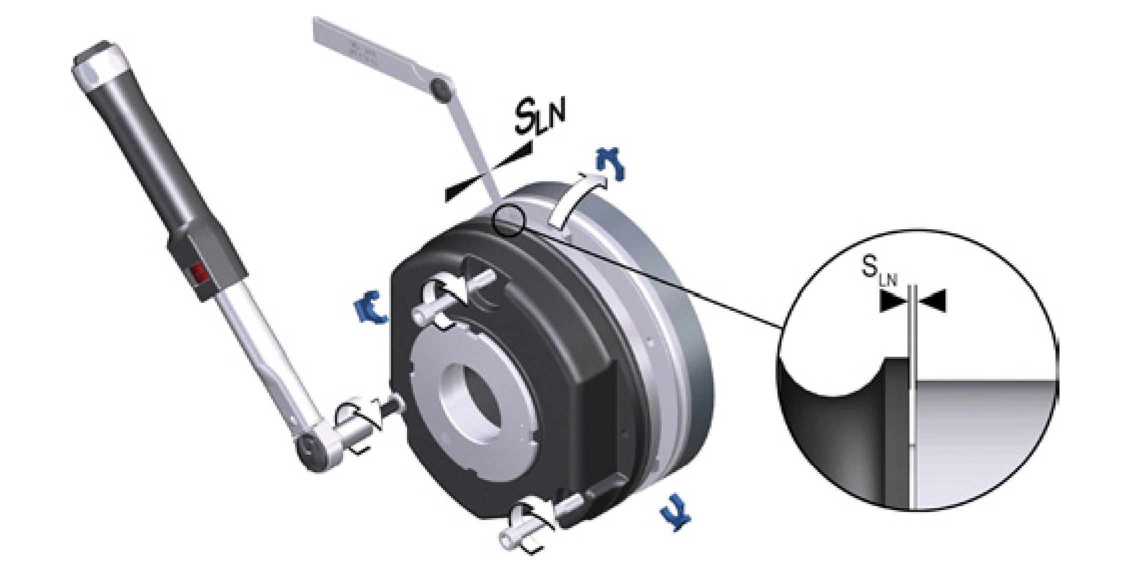


Fig. 11 **Tightening the screws with a torque wrench**

NOTICE
Do not push on the feeler gauge more than 10 mm between the armature plate and the stator!

5. Check the air gap near the screws using a feeler gauge. These values must match the specifications for "s_{LN}" in the table (📖 17).

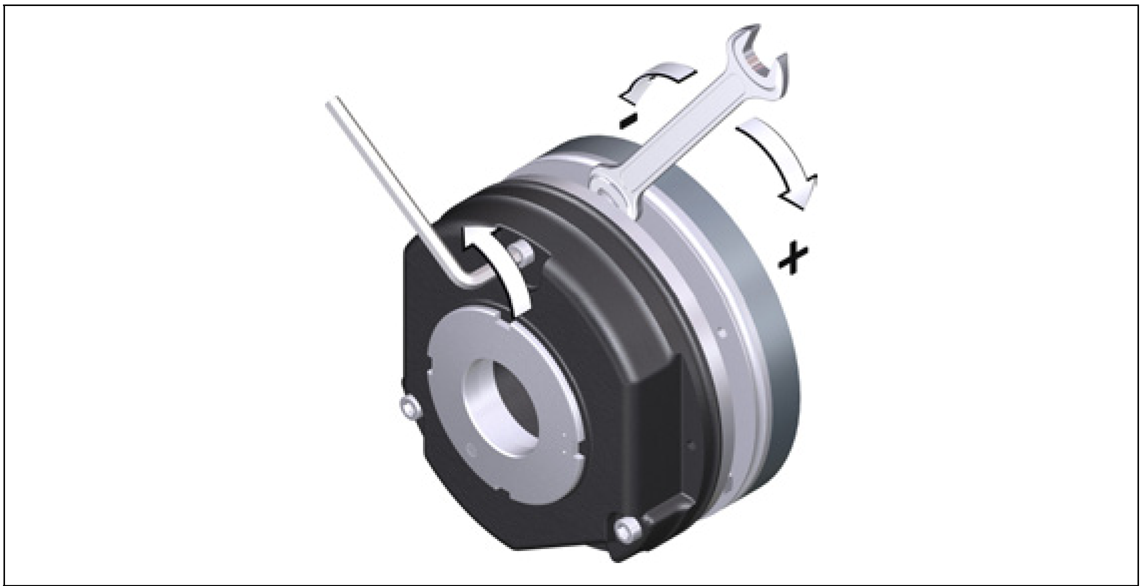


Fig. 12 **Adjusting the air gap**

6. If the measured value "s_L" is outside of the tolerance "s_{LN}", readjust this dimension. Loosen the socket head cap screws slightly and adjust the air gap (turn the sleeve bolts using a wrench).
7. Use a torque wrench to tighten the socket head cap screws (refer to Figure 11).

5.5 Installing the friction plate (optional)

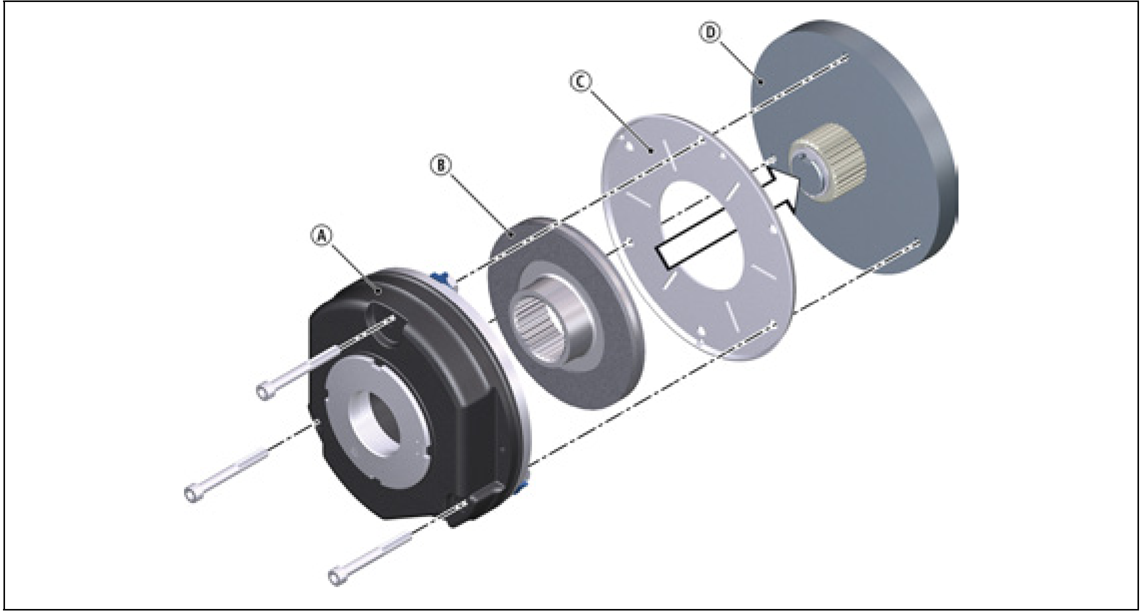


Fig. 13 Mounting the friction plate

Ⓐ Stator Ⓑ Rotor Ⓒ Friction plate

Ⓓ End shield

1. Place the friction plate against the end shield. The lip edging of the friction plate must remain visible!
2. Align the hole circle and the thread along the bore holes.

5.6 Mounting the flange

5.6.1 Mounting the flange without additional screws

	NOTICE
!	When dimensioning the thread depth in the end shield, be sure to take into account the permissible wear path (📖 18).

1. Place the flange against the end shield.
2. Check the hole circle and the threads of the bore holes.
3. Use the proper screw set (📖 32 and 63) to mount the brake.

5.6.2 Installing the flange (variants: size 06 - 16)

The flange can be screwed to the end shield on the outer hole circle (screw dimensioning is specified in 18).

	NOTICE
	Clearing holes for the screws in the end shield must be behind the threaded screw holes in the flange. Without the clearing holes, the minimal rotor thickness cannot be used. The screws must not press against the end shield.

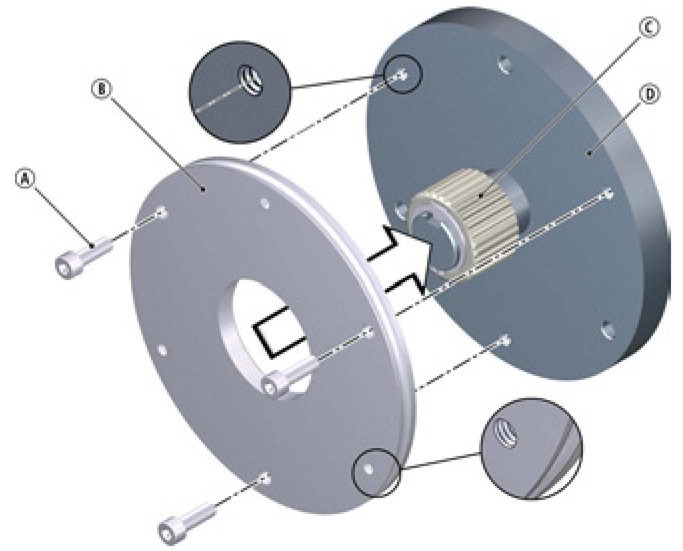


Fig. 14 Flange mounting for sizes 06 – 16:

Ⓐ Screw from the screw set Ⓑ Flange Ⓒ Hub

Ⓓ End shield

1. Make sure that there are clearing holes in the end shield (refer to the table) at the positions of the screws in the stator.
2. Place the flange against the end shield.

	NOTICE
	Tighten the screws evenly (tightening torques: 18).

3. Use the three screws to screw the flange to the end shield.
4. Check the height of the screw heads. The screw heads must not be higher than the minimum rotor thickness. Use screws according to the table (Tab. 4).

NOTICE
When mounting the flange, the various size classes must be distinguished:
sizes 06 – 16, 18 – 20 and 25 are mounted differently.

5.6.3 Installing the flange (variants: size 18 - 20)

The flange can be screwed to the end shield on the outer hole circle (refer to 🕮 Tab. 4).

	NOTICE
!	■ Clearing holes for the screws in the end shield must be behind the threaded screw holes in the flange. Without the clearing holes, the minimal rotor thickness cannot be used. The screws must not press against the end shield. ■ For sizes 18 and 20, the mounting surface threading must be angled at 30° to the centre axis to the hand-release lever.

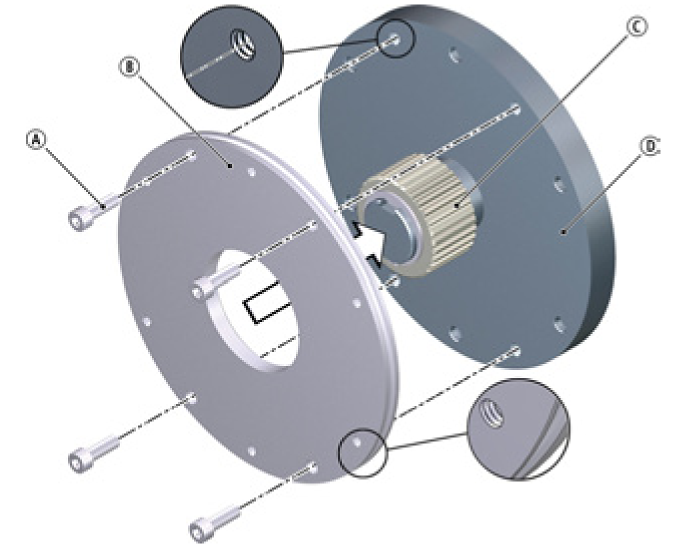


Fig. 15 Flange mounting for sizes 18 – 20:

Ⓐ Screw from the screw set Ⓑ Flange Ⓒ Hub

Ⓓ End shield

1. Place the flange against the end shield.
2. Check the hole circle and the threads of the bore holes .

	NOTICE
!	Tighten the screws evenly (tightening torques: 🕮 18).

3. Use the four screws to screw the flange to the end shield.
4. Check the height of the screw heads. The screw heads must not be higher than the minimum rotor thickness. Use screws according to the table (🕮 Tab. 4).

5.6.4 Installing the flange (variants: size 25)

The flange can be screwed to the end shield on the outer hole circle (refer to 🕮 Tab. 4).

	NOTICE
!	▪ Clearing holes for the screws in the end shield must be behind the threaded screw holes in the flange (refer to Chapter 3.2). Without the clearing holes, the minimal rotor thickness cannot be used. The screws must not press against the end shield. ▪ For size 25, the mounting surface threading must be angled at 30° to the centre axis to the hand-release lever.

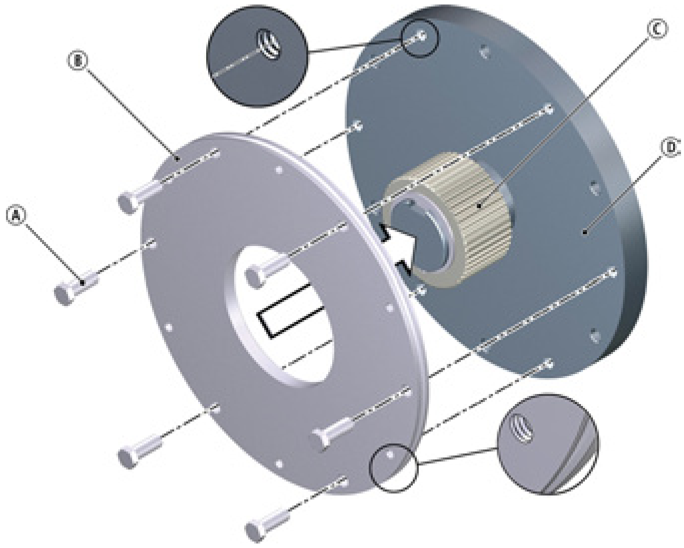


Fig. 16 Flange mounting for size 25

Ⓐ Hex screw Ⓑ Flange Ⓒ Hub
Ⓓ End shield

1. Place the flange against the end shield.
2. Check the hole circle and the threads of the bore holes .

	NOTICE
!	Tighten the screws evenly (tightening torques: 🕮 18).

3. Use the six screws to screw the flange to the end shield.
4. Check the height of the screw heads. The screw heads must not be higher than the minimum rotor thickness. Use screws according to the table (🕮 Tab. 4).

5.7 Installing the double spring-applied brake

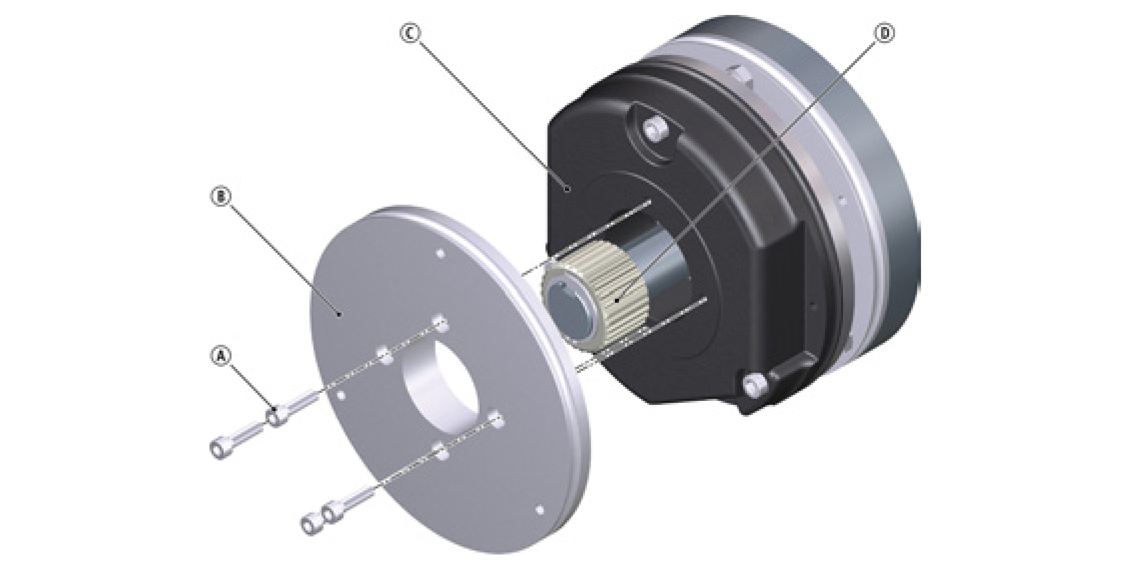


Fig. 17 Installing the intermediate flange

Ⓐ Screw from the screw set Ⓑ Intermediate flange Ⓒ Rear stator

Ⓓ Front hub

❗	**NOTICE**
	When installing the double spring-applied brake, use screws with the required strength grade. Screw them in with the proper tightening torque as specified in Tab. 6, 📖 19).

Required: The front hub has to be mounted on the shaft!

1. Mount the intermediate flange with the four screws in the threads of the rear magnet housing.

All other steps for mounting the front brake are carried out as described in Chapter 5.4.

❗	**NOTICE**
	With the double spring-applied brake design, when working with braking torques which are greater than the standard braking torque, you need to check the screws connecting the front brake.

5.8 Cover ring assembly

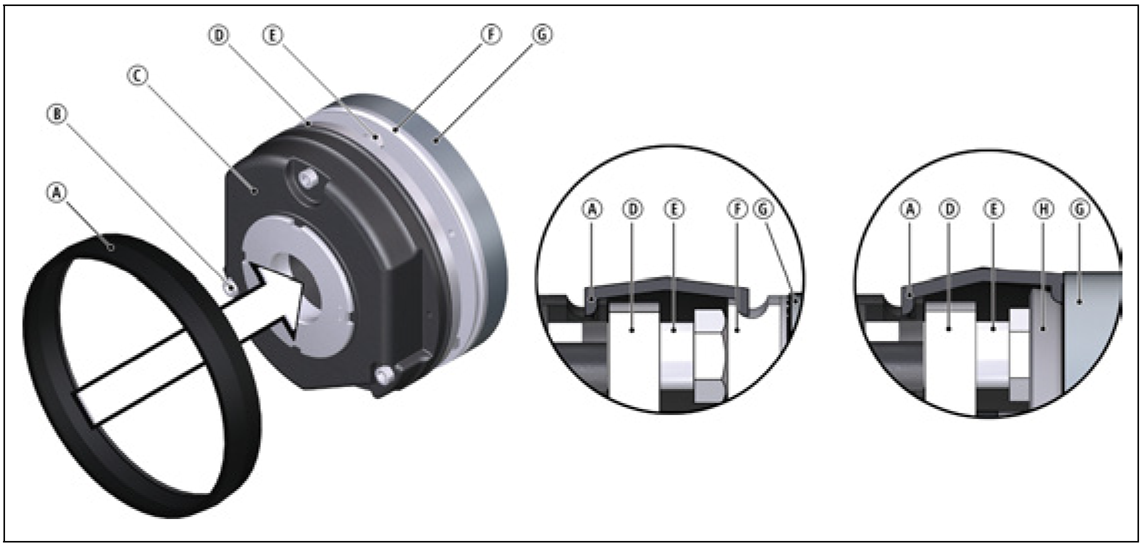


Fig. 18 Cover ring assembly

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

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

5.9 Installing the shaft sealing ring

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

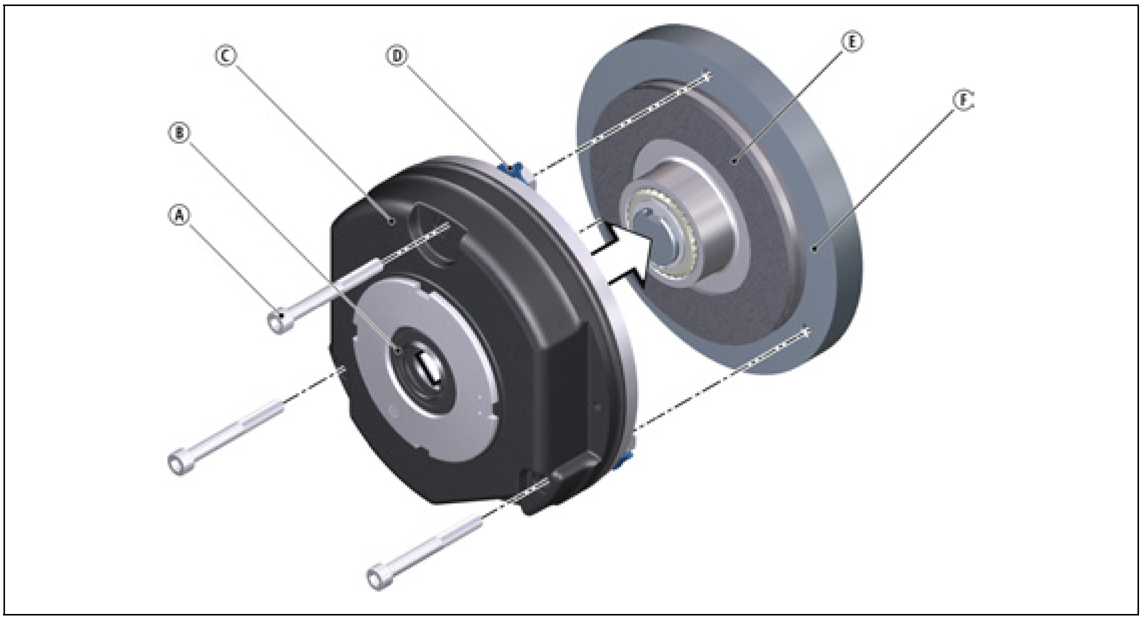


Fig. 19 Installing the shaft sealing ring

Ⓐ Socket head cap screw
Ⓑ Shaft sealing ring
Ⓒ Stator, complete
Ⓓ Terminal clip
Ⓔ Rotor
Ⓕ End shield

NOTICE
Please note the following for the design "brake with shaft sealing ring in torque adjustment ring":

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

5.10 Installing the hand-release (retrofitting)

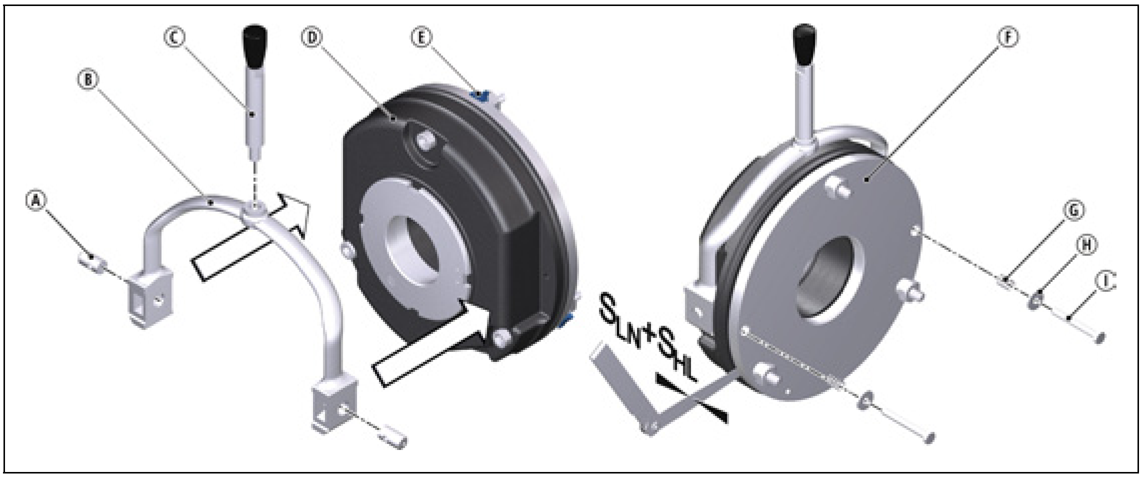
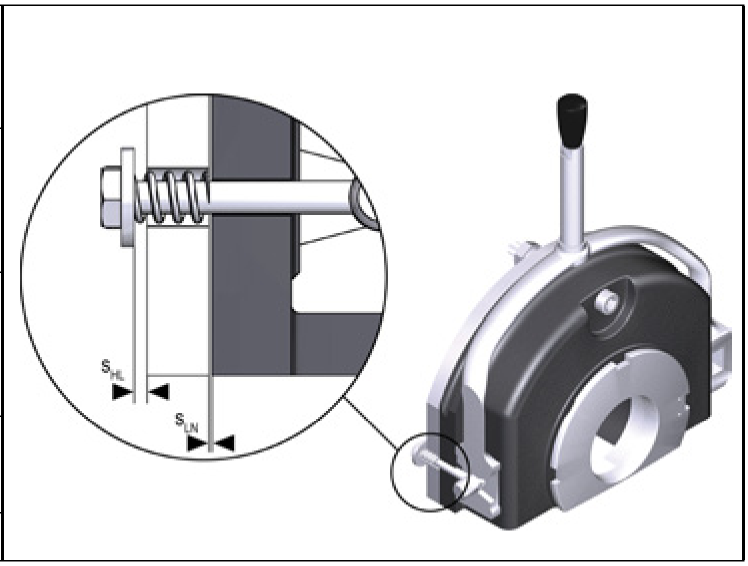


Fig. 20 Assembly of the hand-release BFK458

Ⓐ Pin Ⓑ Yoke Ⓒ Lever
Ⓓ Stator Ⓔ Terminal clip Ⓕ Armature plate
Ⓖ Pressure spring Ⓗ Washer Ⓘ Hexagon head screw

1. Insert pin into the bore holes of the yoke.
2. Insert the pressure springs in the bores of the armature plate.
3. Push the hex head screw through the pressure spring in the armature plate and through the bore hole in the stator.
4. Screw the hex head screws into the yoke pins.
5. Tighten the hex head screws to fasten the armature plate against the stator.
6. Remove the terminal clips and dispose of properly.
7. Set the gap "s_{LN} + s_{HL}" evenly using the hex head screws and the feeler gauge. Refer to Tab. 11 for the values for the dimension "s_{LN} + s_{HL}".

Size	s_{LN} $^{+0.1}_{-0.05}$ (mm)	s_{HL} $^{+0.1}$ (mm)
06		
08	0.2	1
10		
12		
14	0.3	1.5
16		
18	0.4	2
20		
25	0.5	2.5



Tab. 11: Adjustment setting for hand-release

6 Electrical installation

Important notes

	DANGER
	There is a risk of injury by electrical shock! ▮ The electrical connections may only be made by trained electricians! ▮ Make sure that you switch off the electricity before working on the connections! There is a risk of unintended start-ups or electric shock.

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

6.1 Electrical connection

Circuit suggestions

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

6.2 AC switching at the motor – extremely delayed engagement

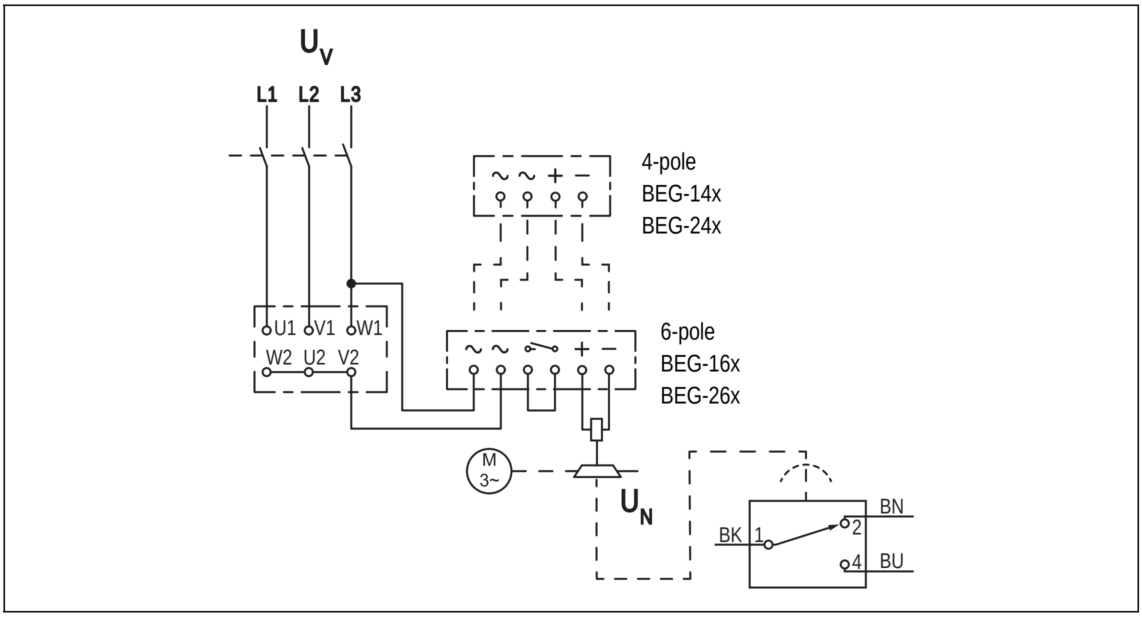


Fig. 21 Supply: Phase-neutral

Bridge rectifier

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

Half-wave rectifier

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

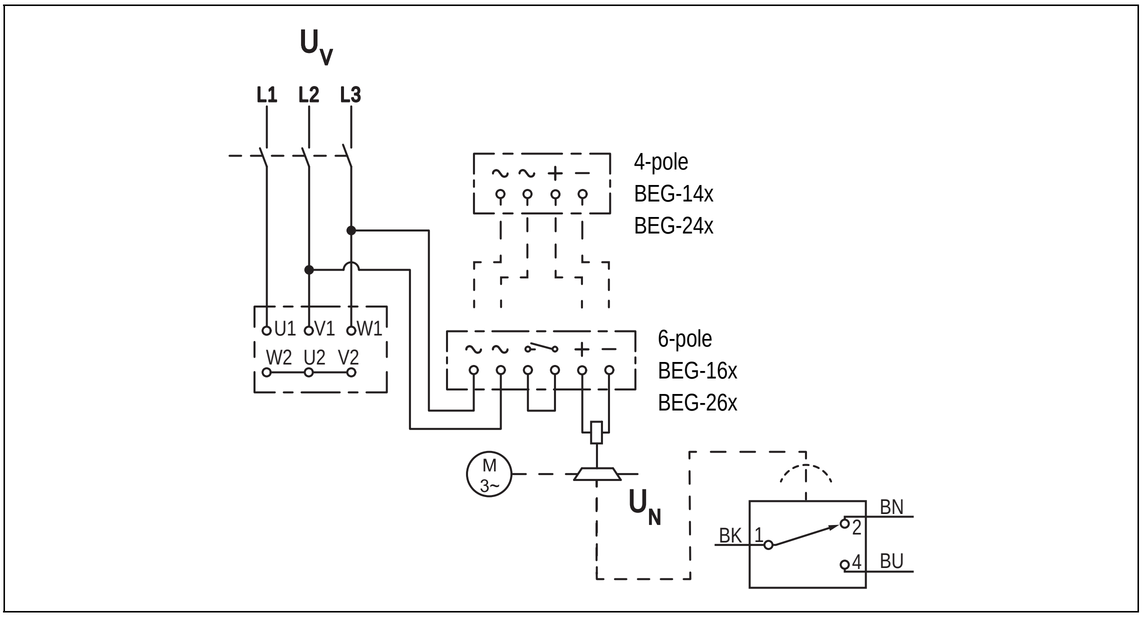


Fig. 22 Supply: Phase-phase

Bridge rectifier[1)]

BEG-1xx: U_N [VDC]=0.9 • U_V [VAC]

Half-wave rectifier

BEG-2xx: U_N [VDC]=0.45 • U_V [VAC]

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

6.3 DC switching at the motor – fast engagement

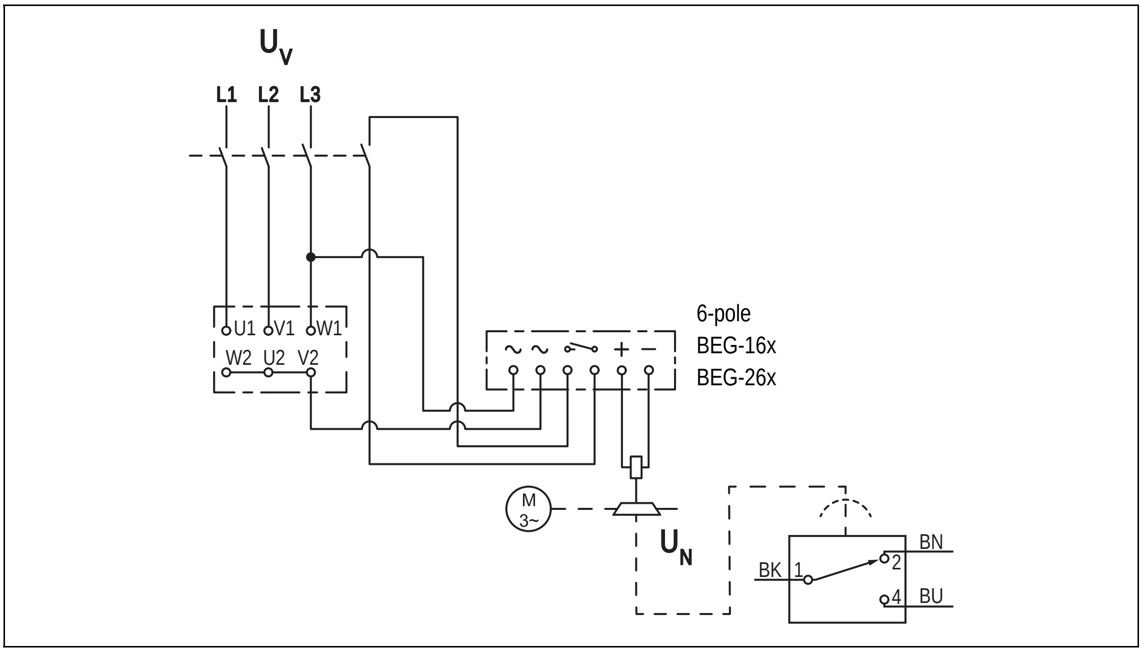


Fig. 23 Supply: Phase-neutral

Bridge rectifier

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

Half-wave rectifier

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

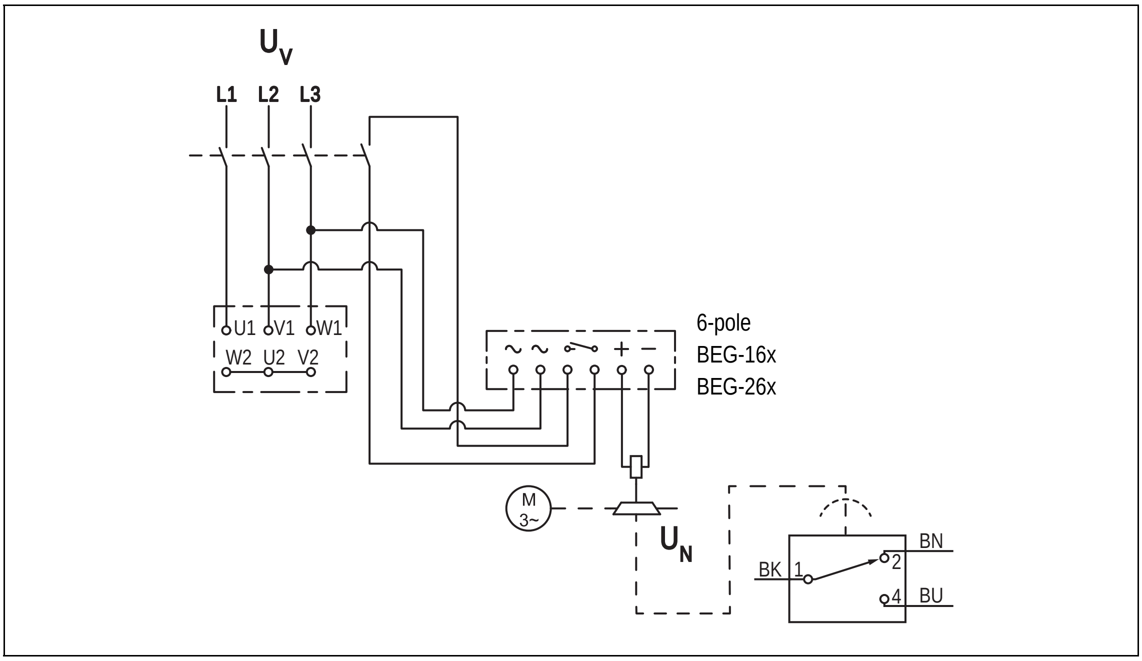


Fig. 24 Supply: Phase-phase

Bridge rectifier[1)]

BEG-1xx: U_N [VDC]=0.9 • U_V [VAC]

Half-wave rectifier

BEG-2xx: U_N [VDC]=0.45 • U_V [VAC]

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

6.4 AC switching at mains – delayed engagement

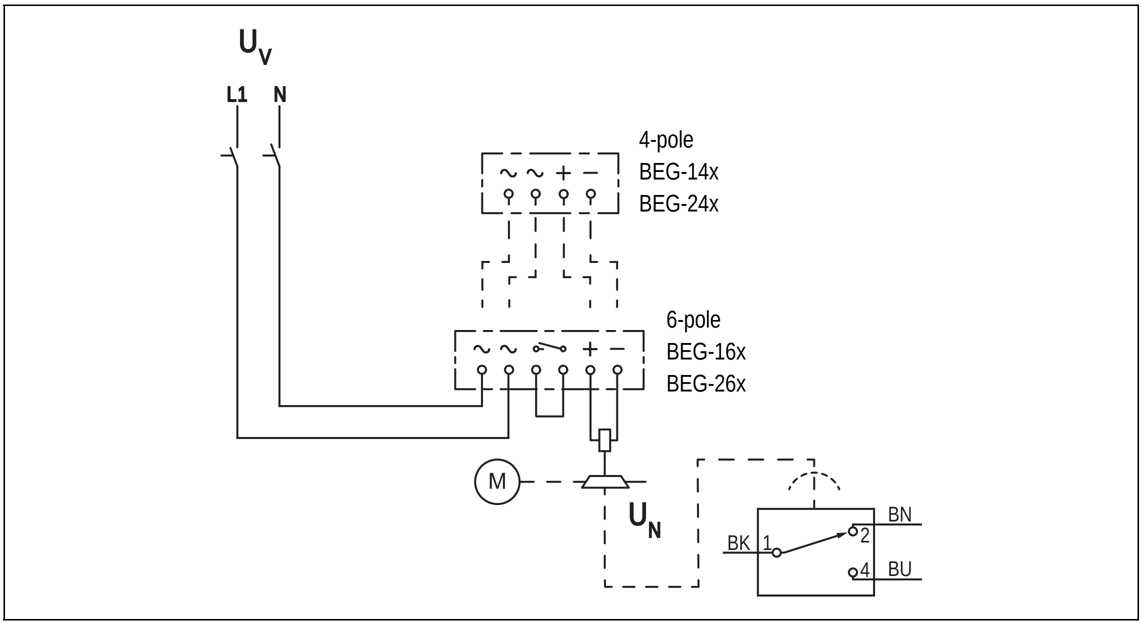


Fig. 25 Supply: Phase-N

Bridge rectifier

BEG-1xx: U_N [VDC]=0.9 • U_V [VAC]

Half-wave rectifier

BEG-2xx: U_N [VDC]=0.45 • U_V [VAC]

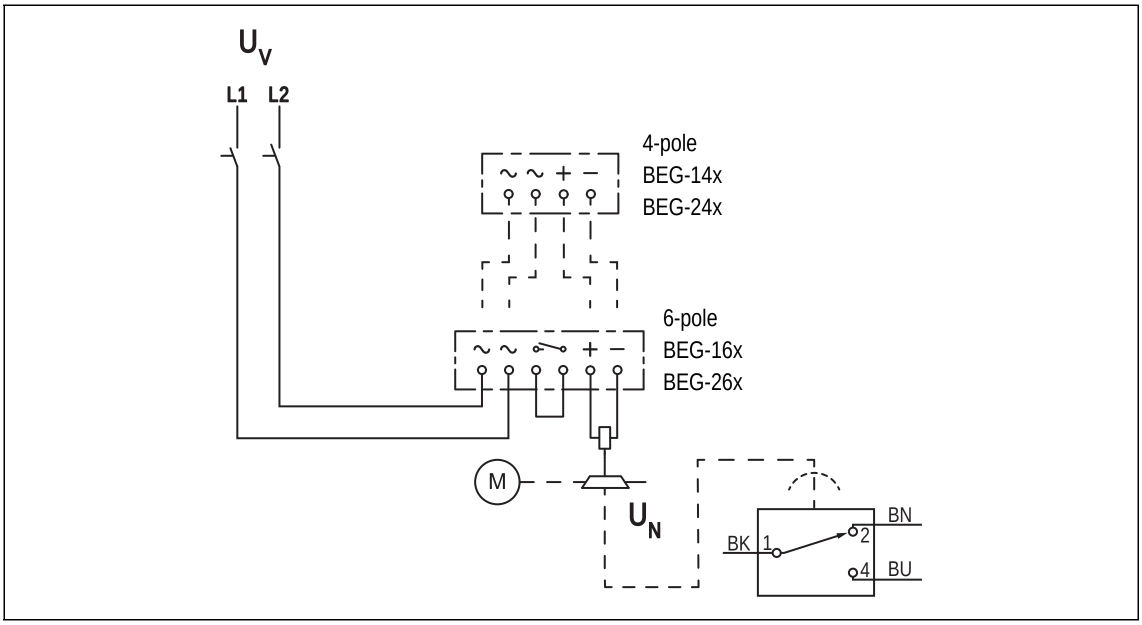


Fig. 26 Supply: Phase-phase

Bridge rectifier[1)]

BEG-1xx: U_N [VDC]=0.9 • U_V [VAC]

Half-wave rectifier

BEG-2xx: U_N [VDC]=0.45 • U_V [VAC]

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

6.5 DC switching at mains – fast engagement

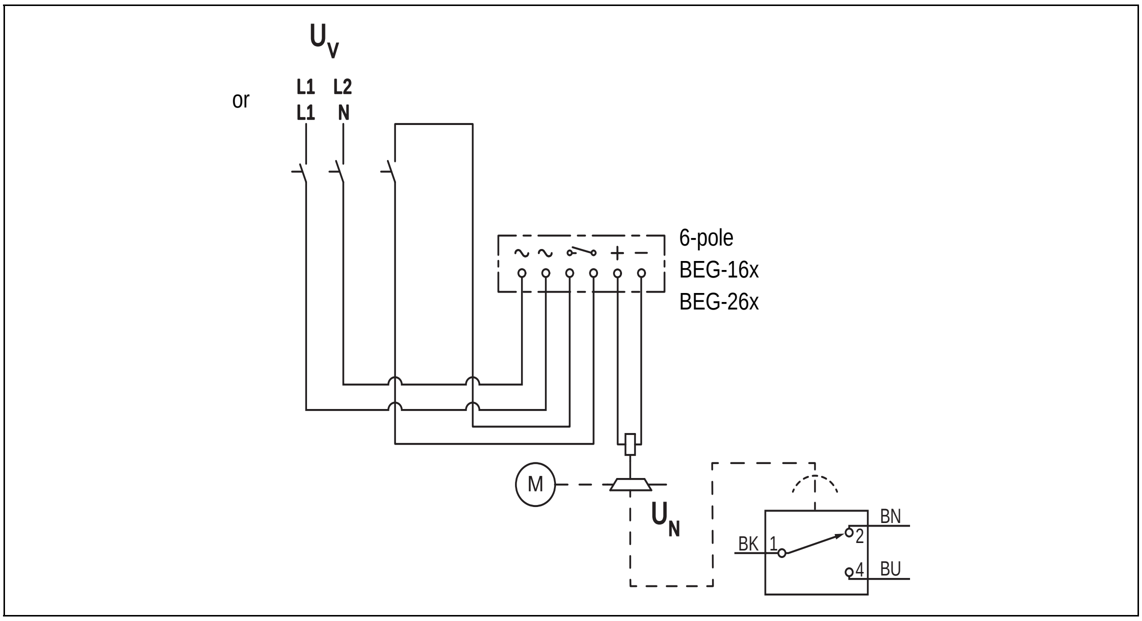


Fig. 27 Supply: Phase-phase or phase-N via 6-pole rectifier

Bridge rectifier[1)]	Half-wave rectifier
BEG-16x: U_N [VDC]=0.9 • U_V [VAC]	BEG-26x: U_N [VDC]=0.45 • U_V [VAC]

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

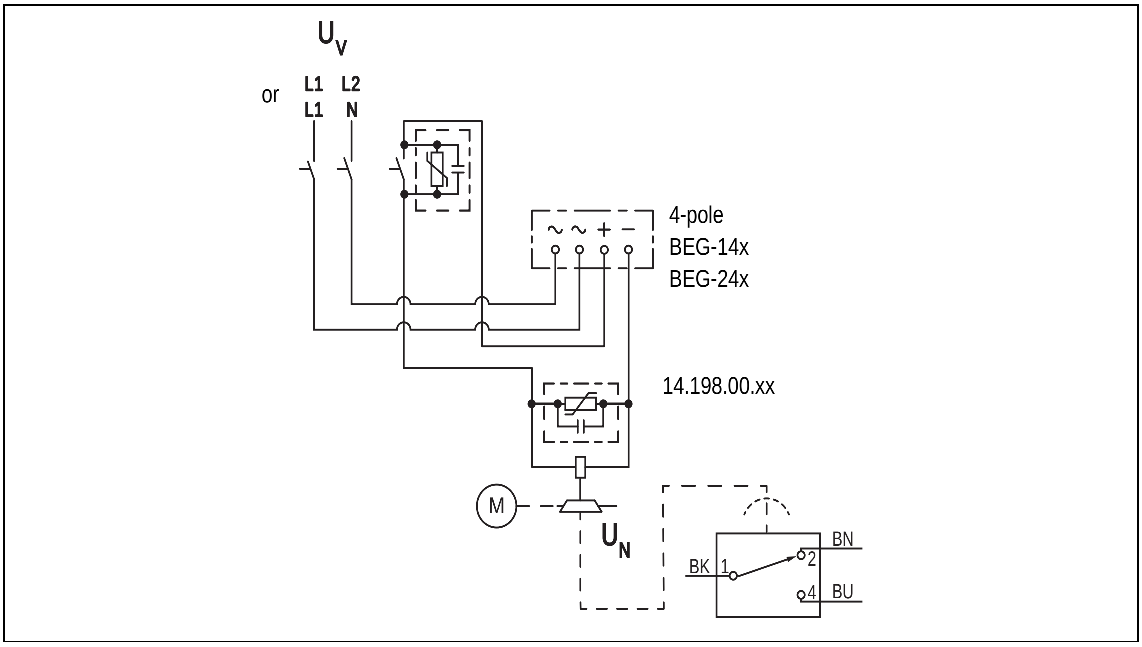


Fig. 28 Supply: Phase-phase or phase-N via 4-pole rectifier

Bridge rectifier[1)]	Half-wave rectifier
BEG-14x: U_N [VDC]=0.9 • U_V [VAC]	BEG-24x: U_N [VDC]=0.45 • U_V [VAC]

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.

6.6 Minimum bending radius for the brake connection line

Brake size	Wire cross-section	Minimum bending radius
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
18		
20		
25		

Tab. 12: Minimum bending radius for the brake connection line

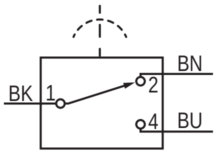
6.7 Technical specifications for the micro-switch

The brake can be equipped with a micro-switch for monitoring the release or wear. The micro-switch can be integrated into the circuit as an NO or NC contact.

As of June 2012, a new small micro-switch (with UL acceptance) is in use, which is perfectly adapted to the contour of the brake. The old switch design can be converted by connecting an adapter to the same threaded holes.

Design	Micro-switch
3-pole connection line	3 x 0.34 mm² (AWG22) black / brown / blue
	D = 4.8 mm, black, CSA Style 2517/105° Length: 1000 mm
Contacts	Silver
Current carrying capacity 250 V AC	Max. 3 A
Current carrying capacity 30 V DC	Max. 3 A
Minimum load at 24 V DC	10 mA
Temperature range:	-40 °C to +85 °C
Protection class	IP67

Tab. 13: Technical specifications for the micro-switch



Switching states	$s_L = 0$	s_{LN}	s_{Lmax} (-0.1)
Check of air gap	1 - 4	1 - 2	1 - 2
Monitoring wear	1 - 4	1 - 4	1 - 2

Tab. 14: Switching states of the mechanical micro-switches

6.8 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 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 located in the DC circuit of the brake. The induction voltage peak for DC switching (see "DC switching - fast engagement" circuit diagram) is limited by an integrated overvoltage protection at terminals 5 and 6.

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

Rectifier type	Connection voltage	Overexcitation		Holding current reduction	
		Coil voltage	Size	Coil voltage	Size
	[V AC]	[V DC]		[V DC]	
BEG-561-255-030	230	103	06 – 16	205	06 – 14
BEG-561-255-130			–		16 – 25
BEG-561-440-030-1	400	180	06 – 25	–	–

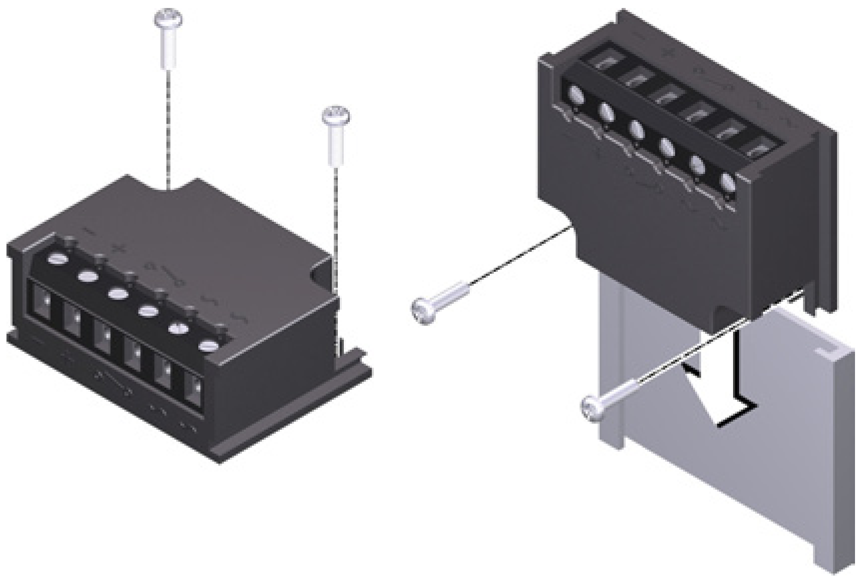


Fig. 29 BEG-561 fastening options

6.8.2 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

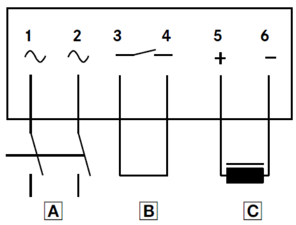
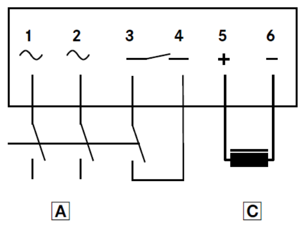
Type	**Input voltage U_1 (40 Hz – 60 Hz)**			**Max. current I_{max}**		**Over-excitation period t_{ue} (± 20 %)**		
	Min. [V ~]	**Rated [V ~]**	**Max. [V ~]**	**Bridge [A]**	**half-wave [A]**	**at $U_{1\,min}$ [s]**	**at $U_{1\,Nom}$ [s]**	**at $U_{1\,max}$ [s]**
BEG-561-255-030	160	230	255	3.0	1.5	0.430	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. 15: Data for bridge/half-wave rectifier type BEG-561

U_1 input voltage (40 – 60 Hz)

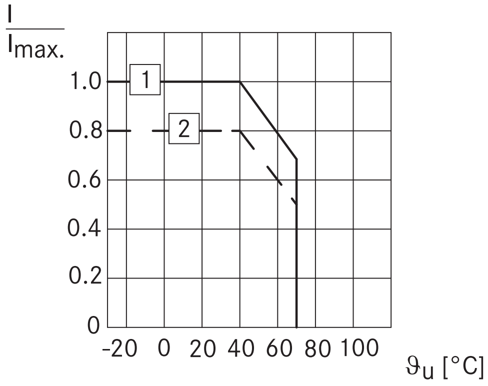
6.8.3 Reduced switch-off times

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.

Delayed engagement	**Fast engagement**
	

A Mains B Bridge C Coil

6.8.4 Permissible current load at ambient temperature



1 For screw assembly with metal surface (good heat dissipation)

2 For other assembly (e.g. adhesive)

7 Commissioning and operation

Possible applications of the INTORQ spring-applied brake

	NOTICE
	In case of high humidity: If condensed water and moisture are present, provide for the 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.

7.1 Protect the electrical connections against any contact or touching.

Important notes

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

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

- The brake is designed for operation under the environmental conditions that apply to IP54 protection. Because of the numerous possibilities of using the brake, it is still necessary to check the functionality of all mechanical components under the corresponding operating conditions.

NOTICE
Functionality for different operating conditions
- The brakes are dimensioned in such a way that the specified rated torques are reached safely after a short run-in period.
- However, as 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.

> **NOTICE**
> **Operation without dynamic loads (functioning as a pure holding brake)**
> - If the brake is used as a pure holding brake without any dynamic load, the friction lining must be reactivated regularly.

7.2 Function checks before commissioning

7.2.1 Function check of brake without micro-switch

If a fault or malfunction arises during the function check, you can find important information for troubleshooting in the troubleshooting table 66. If the fault cannot be fixed or eliminated, please contact your customer service.

7.2.2 Release / voltage check for brakes without micro-switch

1. Remove the two bridges from the motor terminals.
   - Do **not** disconnect the supply voltage from the brake.
   - When the rectifier is connected to the neutral point of the motor: **also** connect the neutral conductor to this connection.
2. Switch the power on.
3. 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.
4. Check the air gap "s_L". The air gap must be zero and the rotor must rotate freely.
5. Switch the power off.
6. Connect the bridges to the motor terminals. Remove the extra neutral conductor.

7.2.3 Release / voltage check for brakes with micro-switch

Required: The switching contact for the brake must be open.

1. Make sure that the brake's switch contact is opened.
2. Remove the two bridges from the motor terminals.
   - Do **not** disconnect the supply voltage from the brake.
   - When the rectifier is connected to the neutral point of the motor: **also** connect the neutral conductor to this connection.
3. Turn on the DC voltage for the brake.
4. Measure the AC voltage at the motor terminal. The AC voltage must be zero.
5. Close the switching contact for the brake.
   - The brake is released.

6. Measure the DC voltage at the brake.
   - Compare the measured DC voltage with the voltage indicated on the name plate. A deviation of ± 10% is permitted.
7. Check the air gap "s_L". The air gap must be zero and the rotor must rotate freely.

7.2.4 Micro-switch – checking for wear

Required: Do not turn off the power supply for the brake; the power must be switched on twice during this testing procedure.

1. Remove the two bridges from the motor terminals.

NOTICE
When connecting the rectifier to the neutral point of the motor, the PE conductor must also be connected to this point.

2. Adjust the air gap to "s_{Lmax}". Description: 📖 33.
3. Switch the power on.
4. Measure the AC voltage at the motor terminals and measure the DC voltage at the brake. Both the AC and the DC voltages must be zero.
5. Switch the power off.
6. Adjust the air gap to "s_{LN}". Description: 📖 33.
7. Switch the power on.
8. Measure the AC voltage at the motor terminal. It must be the same as the mains voltage.
9. Measure the DC voltage at the brake.
   - Compare the measured DC voltage with the voltage indicated on the name plate. A deviation of ± 10% is permitted.
10. Check the air gap "s_L". The air gap must be zero and the rotor must rotate freely.
11. Switch off the brake current.
12. Screw the bridges back onto the motor terminals.
13. Remove the additional neutral conductor again.

7.2.5 Testing the hand-release functionality

	NOTICE
	This operational test is to be carried out additionally!

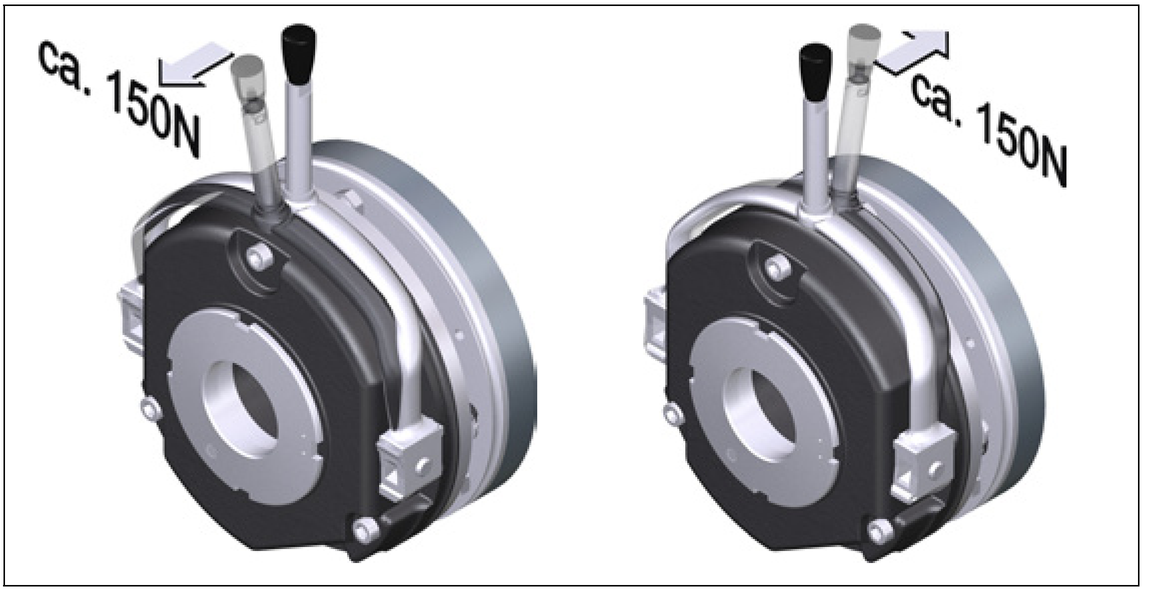


Fig. 30 Turning direction of the lever

1. Make sure that the motor and brake are de-energised.
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!

The preparations for commissioning are completed.

NOTICE

If faults or malfunctions occur, refer to the the error search table (📖 66). If the fault cannot be fixed or eliminated, please contact your customer service.

7.3 Commissioning

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.
- Make sure that the armature plate is tightly attached 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%!

7.4.1 Brake torque reduction

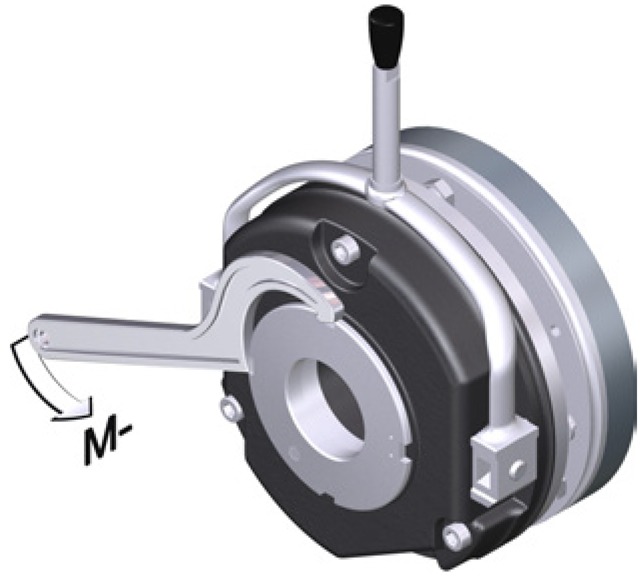


Fig. 31 Reducing the brake torque

1. Use a hook wrench to turn the torque adjustment ring counter-clockwise. This reduces the braking torque.
   - Note the correct position of the tappet notches on the torque adjustment ring: Only the latched-in positions are permitted. It is forbidden to operate the brake when the notches are adjusted between these latched-in positions! (Values f or the brake torque reduction for each latched-in position: 📖 16).
   - Observe the max. permissible projection ("h_{Emax}") of the torque adjustment ring over the stator (the values for "h_{Emax} 📖 17).

⚠	⚠ **DANGER**
	The reduction of the braking torque does not increase the max. permissible air gap. "$s_{L\ max.}$". Do not change the hand-release setting for designs with hand-release.

Operating procedures

The friction lining and the friction surfaces must never contact oil or grease since even small amounts reduce the braking torque considerably.

8 Maintenance and repair

8.1 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 that 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 operating 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 surface	Rubbing and friction of the brake lining	Run-in of armature plate and counter friction surface	Friction work
Gear teeth of brake rotor	Relative movements and shocks between brake rotor and brake shaft	Wear of gear teeth (primarily on the rotor side)	Number of start/ stop cycles
Armature plate support	Load reversals and jerks in the backlash between armature plate, adjustment tubes and guide 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. 16: 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 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, 📖 58. 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.

8.2.1 Maintenance intervals

Designs	Operating brakes	Holding brakes with emergency stop:
BFK458-□□ E / N BFK458-□□ L	▮ according to the service life calculation ▮ or else every six months ▮ after 4000 operating hours at the latest	▮ at least every 2 years ▮ after 1 million cycles at the latest* ▮ plan shorter intervals for frequent emergency stops

* Attention: 10 million cycles for the L design

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 ▮ Measure the air gap (adjust if required) ▮ Measure the rotor thickness (replace rotor if required) ▮ Thermal damage of armature plate or flange (dark-blue tarnishing)	📖 61 📖 61 📖 60
After removing the brake	▮ Check the play of the rotor gear teeth (replace worn-out rotors)	📖 62
	▮ 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 end shield - Flatness depending on the size - Max. run-in depth = rated air gap for the size	 📖 29 📖 17

8.3.2 Check the rotor thickness

⚠	⚠ **DANGER**
	Danger: rotating parts! The motor must **not** be running when checking the rotor thickness.

1. Remove the fan cover.
2. Remove the cover ring, when present.
3. Measure the rotor thickness using a calliper gauge. For the friction-plate design: observe the edging on outer diameter of friction plate.
4. Compare the measured rotor thickness with the minimum permissible rotor thickness (values: 📖 17). If the measured rotor thickness is insufficient, the rotor must be replaced completely.
   Description: 📖 62.

8.3.3 Check 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 (values: 📖 17).
2. Compare the measured air gap to the value for the max. permissible air gap "s_{Lmax}" (values: 📖17).
3. Adjust the air gap to "s_{LN}" (📖 61).

8.3.4 Release / voltage

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

	DANGER
	There is a risk of injury by electrical shock! 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.
   - The DC voltage measured after the overexcitation period (see bridge/half-wave rectifier) must be half the voltage indicated on the name plate. The deviation must be less than ± 10%.

8.3.5 Adjusting the air gap

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

	NOTICE
	Please observe when mounting the flange design with additional screws: Clearing holes for the screws in the end shield must be behind the threaded screw holes in the flange. Without the clearing holes, the minimal rotor thickness cannot be used. The screws must not press against the end shield.

1. Loosen the screws (Figure 12).
2. Screw the sleeve bolts (using a open-end wrench) further into the stator. A 1/6 turn will decrease the air gap by approximately 0.15 mm.
3. Re-tighten the screws (torque: 📖 18).
4. Check the "s_L" near the screws using a feeler gauge (s_{LN}: 📖 17).

8.3.6 Replacing the rotor

	DANGER
	Danger: rotating parts! Switch off the voltage. The brake must be free of residual torque.

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 stator from the end shield.
4. Pull the rotor off the hub.
5. Check the hub's gear teeth.
6. Replace the hub if 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 flange. 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 calliper gauge).
9. Calculate the distance between the stator and the armature plate as follows:

Distance = rotor thickness + s_{LN} - bolt head thickness

"s_{LN}" 📖 17

10. Unscrew the sleeve bolts evenly until the calculated distance between the stator and armature plate is reached.
11. You can now install and adjust the new rotor and the complete stator (📖32).
12. Re-connect the connection cables.

8.4 Spare parts list

Spring-applied brake INTORQ BFK458-06 to 25

Fig. 32 Spring-applied brake INTORQ BFK458-06 to 25

	Designation	Variant
Ⓐ	Hand-release	
Ⓑ	Cap	
Ⓒ	Shaft sealing ring	
Ⓓ	Screw set: DIN EN ISO 4762 - 8.8 in various designs and lengths	▪ for mounting to the flange ▪ for mounting to the motor / friction plate ▪ for flange with through hole
Ⓔ	Complete stator, module E Complete stator, module N	Voltage / braking torque
Ⓕ	Complete rotor	Aluminium rotor
		Aluminium rotor with sleeve - Noise-reduced design
Ⓖ	Hub	Bore diameter [mm] keyway according to DIN 6885/1
Ⓗ	Friction plate	
Ⓘ	Flange Hard chrome-plated flange	
Ⓙ	Centring flange (tacho flange)	
Ⓚ	Cover ring	
	Brake cover (degree of protection corresponds to IP65)	
	Terminal box as mounting kit	

Double spring-applied brake INTORQ BFK458-06 to 25

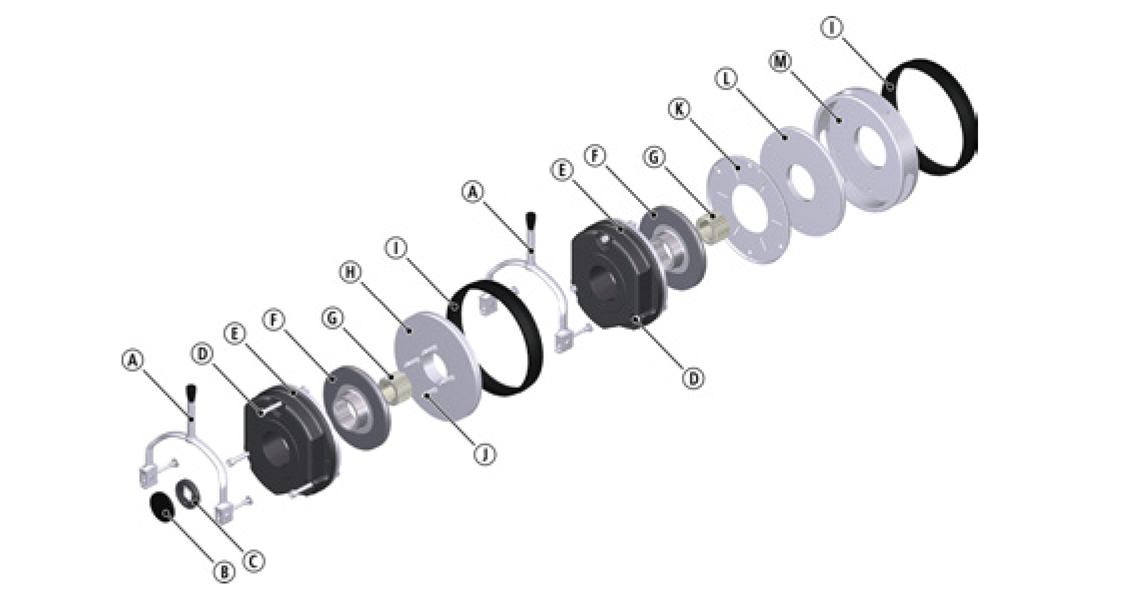


Fig. 33 Double spring-applied brake INTORQ BFK458-06 to 25

	Designation	Variant
Ⓐ	Hand-release with standard lever	Mounting kit
Ⓑ	Cap	Basic module N
Ⓒ	Shaft sealing ring	Shaft diameter on request
Ⓓ	Screw set DIN EN ISO 4762 - 8.8 in various designs and lengths	▪ for mounting to the flange ▪ for mounting to the motor / friction plate ▪ for flange with through hole
Ⓔ	Complete stator, module N	Voltage / braking torque - Optionally with rear threads
Ⓕ	Complete rotor	Aluminium rotor
		Aluminium rotor with sleeve - Noise-reduced design
Ⓖ	Hub with standard bore	Bore diameter [mm] keyway according to DIN 6885/1
Ⓗ	Intermediate flange, double spring-applied brake	
Ⓘ	Cover ring	
Ⓙ	Screw set; socket head cap screw DIN EN ISO 4762 8.8 / size 25 10.9	for intermediate flange, double spring-applied brake
Ⓚ	Friction plate	
Ⓛ	Flange Hard chrome-plated flange	
Ⓜ	Centring flange (tacho flange)	

Electrical accessories

Bridge / half-wave rectifier	Connection voltage	Over-excitation		Holding current reduction	
		Coil voltage	Size	Coil voltage	Size
	[V AC]	[V DC]		[V DC]	
BEG-561-255-030	230	103	06 – 16	205	06 – 14
BEG-561-255-130			–		16 – 25
BEG-561-440-030-1	400	180	06 – 25	–	–

9 Troubleshooting and eliminating faults

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
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 📖 19 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 cable for continuity using a multimeter - Replace 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 - Diode defective - install an appropriate undamaged rectifier. ▮ Check coil for inter-turn fault or short circuit to ground. ▮ If the rectifier defect occurs again, replace the entire spring-applied brake, even if you cannot find any fault between turns or short circuit to ground. The error may only occur on warming up.
Brake cannot be released, air gap is not zero	Incorrect micro-switch wiring	Check the wiring of the micro-switch and correct it.
	Micro-switch incorrectly set	Replace the complete stator and make a complaint about the setting of the micro-switch to the manufacturer.
	Air gap "s_L" is too large	Adjust the air gap: 📖 61.

Fault	Cause	Remedy
Rotor cannot rotate freely	Wrong setting of hand-release	Check the dimension s_{LN} +s_{HL} with the brake energised. The dimension must be the same on both sides. If necessary, correct 41.
	Air gap "s_L" too small	Check air gap "s_L" and adjust if necessary (61).
Rotor thickness too small	Rotor has not been replaced in time	Replace the rotor (62).
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 is missing or defective	Select a connection with proper fusing.

Notes

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