

KENDRION INDUSTRIAL BRAKES

EEX Line

Spring-applied single-disc brake IEC Ex

Operating Instruction EX ..E..A00

Types:	EX 14E10A00	EX 16E10A00	EX 24E10A00	EX 26E10A00
	EX 14E11A00	EX 16E11A00	EX 24E11A00	EX 26E11A00
	EX 14E13A00	EX 16E13A00	EX 24E13A00	EX 26E13A00
	EX 14E16A00	EX 16E16A00	EX 24E16A00	EX 26E16A00
	EX 14E19A00	EX 16E19A00	EX 24E19A00	EX 26E19A00
	EX 14E24A00	EX 16E24A00	EX 24E24A00	EX 26E24A00

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1. General information

1.1 Introduction

These operating instructions describe the operating principle and features of spring-applied single disc brake types EX ..E..A00. The safety information provided in this manual must be strictly observed during the set-up of the machine (e.g. motor) and during the start-up, operation and maintenance of the spring-applied brake.


Should any queries arise with respect to torques, torque variations, mounting position, wear, wear reserve, switching work, break-in conditions, release range, ambient conditions and the like, please contact Kendrion (Villingen) and ask for clarification before starting to use the brake. Spring-applied disc brakes are not ready-to-use devices, but are intended to be incorporated into or assembled with other equipment. Consequently, these brakes will be referred to as **components** in the following sections.

1.2 Standards and directives

The state-of-the-art brakes have been designed, built and tested in accordance with the requirements of DIN VDE 0580 concerning electromagnetic devices and components.


The brakes are intended for use in dust and potentially explosive atmospheres. Brake versions protected to IP 56 are only designed for use in potentially explosive atmospheres. The brakes are approved to the ATEX Directive (94/9/EC).

Approvals:



dust & explosion protection II
II 2G Ex de IIC T5
II 2D Ex tD A21 IP67 T100°C
IECEX BVS 11.0025X
DMT 02 ATEX E 122 X

Option:



explosion protection II
II 2G Ex de IIC T5
IP56
IECEX BVS 11.0025X
DMT 02 ATEX E 122 X

Being classified as "electromagnetic components", spring-applied brakes are also subject to the Low Voltage Directive 2014/35/EU. The user is required to employ suitable switching devices and controls to ensure use of the brakes in accordance with EMC Directive 2014/30/EU.

1.3 Declaration of Incorporation (in accordance with Annex II, part 1, Section B of Machinery Directive 2006/42/EC)

We hereby declare that the products below comply with the essential health and safety requirements specified in Annex I of Machinery Directive 2006/42/EC:

Annex I General Principles and Sections 1.1.2, 1.1.3, 1.1.5, 1.3.2, 1.5.1

The partly completed machinery must not be put into service until the final machinery into which it is to be incorporated has been declared in conformity with the provisions of Machinery Directive 2006/42/EC. The relevant technical documentation required for the partly completed machinery has been compiled in accordance with Annex VII, part B of Machinery Directive 2006/42/EC. The manufacturer undertakes to submit an electronic copy of the relevant technical documentation compiled for the partly completed machinery if reasonably requested by national authorities.

Manufacturer: Kendrion (Villingen) GmbH Wilhelm-Binder-Str. 4-6 78048 Villingen-Schwenningen Germany	Person authorized to compile the documentation: Dominik Hettich Kendrion (Villingen) GmbH Wilhelm-Binder-Str. 4-6 78048 Villingen-Schwenningen Germany
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Applied harmonized standards and other technical standards and regulations:


EN 60529	Enclosure protection ratings
DIN VDE 0580	Electromagnetic devices and components
IEC 60079-0:2004	Electrical apparatus for explosive gas atmospheres (General requirements)
IEC 60079-1:2007	Electrical apparatus for explosive gas atmospheres (Flameproof enclosures "d")
IEC 60079-7:2006	Electrical apparatus for explosive gas atmospheres (Increased safety "e")
IEC 61241-0:2004	Electrical apparatus for use in the presence of combustible dust (General requirements)
IEC 61241-1:2004	Electrical apparatus for use in the presence of combustible dust (Protection by enclosures "tD")

Product: Electromagnetically released spring-applied single-disc brake

Types: EX 14E10A00 EX 16E10A00 EX 24E10A00 EX 26E10A00
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Kendrion (Villingen) GmbH

Villingen
13/03/2020

Authorized signatory: 
Dominik Hettich
(Head of Development)

1.4 Declaration of Conformity

1.4.1 Directive 94/9/EC (equipment and protective systems intended for use in potentially explosive atmospheres)

We hereby declare that the products below, specifically the product versions brought into circulation, have been designed and built in accordance with the requirements of Directive 94/9/EC (ATEX Directive). This declaration will cease to be valid if modifications are made to the product without prior permission from the manufacturer.

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Germany

Person authorized: Dominik Hettich
Kendrion (Villingen) GmbH
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78048 Villingen-Schwenningen
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EX 14E24A00 EX 16E24A00 EX 24E24A00 EX 26E24A00

Certification authority: DEKRA EXAM GmbH
Dinnendahlstr. 9
44809 Bochum
Germany

IECEx certificate: IECEx BVS 11.0025X

EC type approval certificate: DMT 02 ATEX E122 X

Kendrion (Villingen) GmbH
Villingen
13/03/2020

Authorized signatory: 
Dominik Hettich
(Head of Development)

1.4.2 Directives 2014/35/EU (Low Voltage Directive) and 2011/65/EU (RoHS Directive)

We hereby declare that the products below, specifically the product versions brought into circulation, have been designed and built in accordance with the requirements of Directives 2014/35/EU (Low Voltage Directive) and 2011/65/EU (RoHS Directive). The products are classified as category 11 equipment subject to Directive 2011/65/EU (RoHS Directive). This declaration will cease to be valid if modifications are made to the product without prior permission from the manufacturer.

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Kendrion (Villingen) GmbH

Villingen
13/03/2020

Authorized signatory:


Dominik Hettich
(Head of Development)

1.5 Manufacturer's liability

The manufacturer will not assume any responsibility for damage caused by failure to use the products in accordance with their intended use or by failure to observe safety information and other instructions provided in this manual. The information in this manual was correct and up-to-date before going to print. The information contained herein shall not entitle users to raise claims with respect to components purchased at an earlier date.

2. Product description

2.1 Operating principle

The spring-applied single-disc brake is designed to operate dry. The force generated by an electromagnetic field is utilized to overcome the braking effect produced by the spring force.

The spring-applied single-disc brake engages in unpowered condition and releases when AC voltage is applied. The form-fit connection between the friction disc and hub and the connection of the hub with the machine shaft (e.g. motor shaft) ensure that the torque generated by the spring-applied single-disc brake (brake torque) is reliably transmitted to the machine (motor). Explosion-protected spring-applied single-disc brakes are characterized by the fact that all components that may ignite explosive mixtures are placed in an enclosure. This enclosure is designed to withstand the specified test pressure in case the mixture explodes inside the enclosure. It also ensures that mixtures outside the enclosure are not affected by the explosion.

2.2 Brake design

The solenoid housing (1.1) of the spring-applied single-disc brake accommodates the firmly fitted field coil (1.2) with flying leads. The flying leads are connected to the connecting terminal (19) inside the junction box (25). The flange (3) and friction plate (33) are screwed to the solenoid housing (1.1) by means of socket head cap screws (22). The solenoid housing (1.1) is pressure-sealed by a cover (7) that is attached with socket head cap screws (20). Owing to the spring force generated by the compression springs (4 & 35), the friction disc (5) is pressed over the armature (2) against the friction plate (33) and flange (3) to generate the braking effect of the spring-applied brake. The friction disc (5) and hub (17), which constitute the rotating part of the spring-applied brake, are connected with the shaft to be braked. The friction disc (5) features a square socket and can be moved on the hub (17) in axial direction. Spacer sleeves (6) are provided to adjust the air gap 's'. The customer-specific connecting cable can be introduced into the junction box (25) through a cable gland (30) (M20x1.5). When AC voltage is applied to the built-in bridge rectifier of the spring-applied single-disc brake, the force of the electromagnetic field thus generated counteracts the spring force. The armature (2) is released and the braking action is neutralized. The shaft to be braked is not exposed to any axial force by the brake. The spring-applied single-disc brake is equipped with a redundant thermoswitch system (2x2 thermoswitches) (11 & 12) and with a microswitch (13)¹⁾. The microswitch (13)¹⁾ is provided to prevent machine (e.g. motor) start-up before the brake has been released. The four (2x2) thermoswitches (11 & 12) are connected in series with the microswitch (13)¹⁾. They interrupt the control circuit of the machine (e.g. motor) as soon as the maximum permitted brake temperature is exceeded. When using brakes with hand release (29), openings must be provided in the part enclosing the brake (e.g. fan cover) so that the hand release can be installed. The hand release (29)²⁾ allows the brake to be released manually (e.g. in case of power failure).

¹⁾ Brake types with microswitch.

²⁾ Brake types with hand release.

List of reference numerals in Fig. 9/1:					
1.1	Solenoid housing	13.3	Angle	25	Junction box
1.2	Field coil	13.4	Countersunk screw	26	Cover
2	Armature	13.5	Plate	27	Socket head cap screw
3	Flange	13.6	Socket head cap screw	28	Spring washer
4	Compression spring	13.7	Connecting cable (microswitch)	29	Hand release
5	Friction disc	14	Circlip (outer ring)	29.1	Cam
6	Spacer sleeve	15	Circlip (inner ring)	30	Cable gland
7	Cover	16	O-ring	30.1	Cap nut
8	Mounting surface	17	Hub	30.2	Connector sleeve
9	Flat seal	18	Deep groove ball bearing	30.3	Sealing ring
10	Mounting screw	19	Connecting terminal	31	Locknut
11	Thermoswitch (2 switches)	20	Socket head cap screw	32	Socket head cap screw
12	Thermoswitch (2 switches)	21	Spring washer	33	Friction plate
13	Microswitch	22	Socket head cap screw	34	Rating plate
13.1	Locknut	23	Spring washer	35	Compression spring
13.2	Set screw	24	O-ring	36	Duct

Table 8/1: List of reference numerals for spring-applied single-disc brake

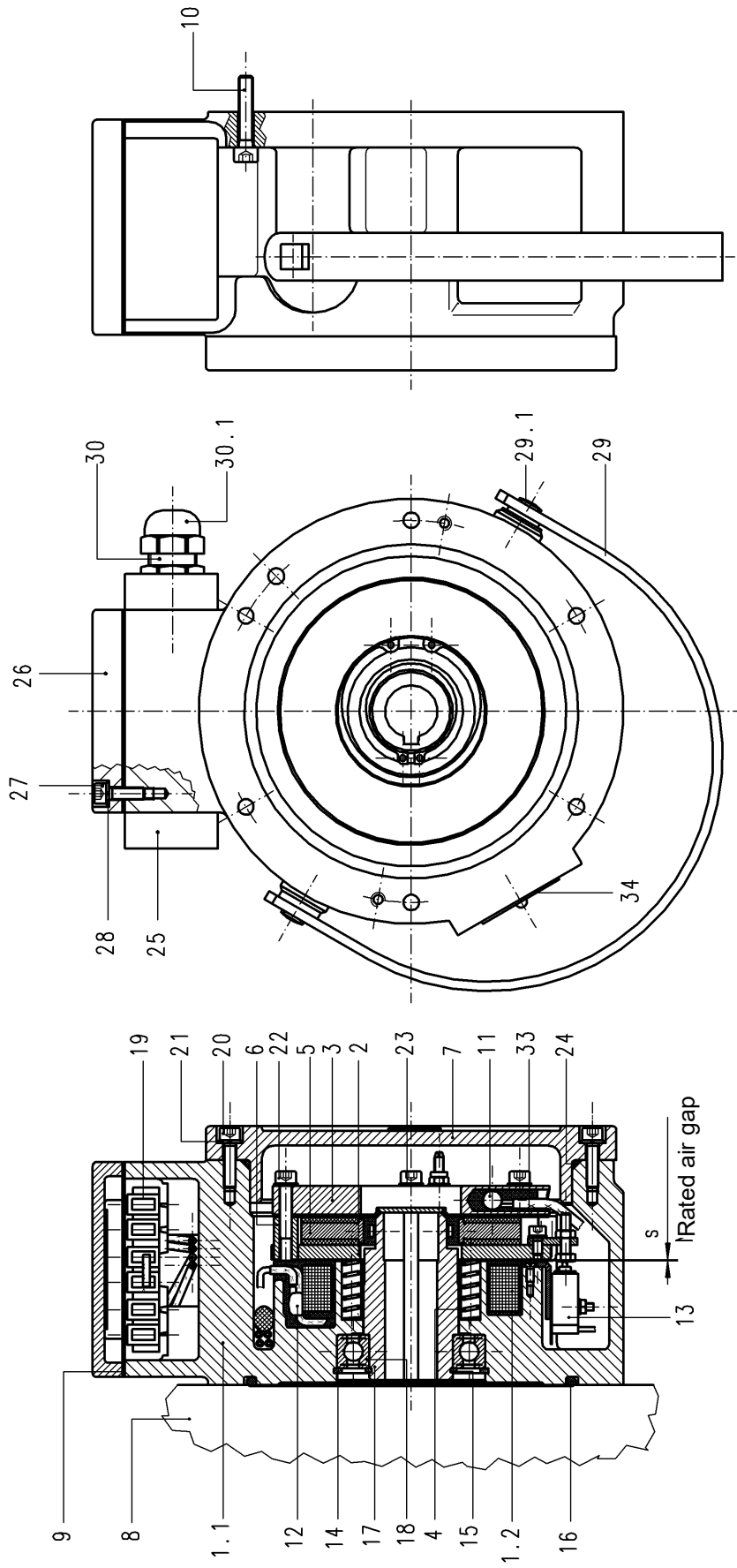
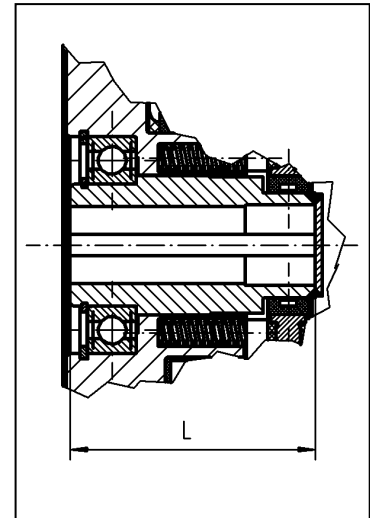


Fig. 9/1: Spring-applied single-disc brake EX 26E..A00

3. Installation

3.1 Mechanical installation

Slip the hub (17) of the spring-applied single-disc brake on a shaft (tolerance h6) provided with a feather key to DIN 6885, sheet 1. As the hub (17) is firmly fitted to the brake, it need not be axially secured on the machine shaft (e.g. motor shaft). Ensure that no radial forces act on the deep groove ball bearing (18) during installation and operation (vertical installation, if possible) and that the hub (17) is not exposed to any permanent axial force (e.g. exerted by shaft shoulder) after installation has been completed. The spring-applied brake is centred through the deep groove ball bearing (18) of the hub (17). Mounting screws (10) are provided to attach the spring-applied single-disc brake to the mounting surface (8) of the machine (e.g. motor). Before starting installation work, insert the O-ring (16) into the groove provided in the solenoid housing (1.1). Tighten the mounting screws (10) evenly in several steps and make sure not to exceed the specified tightening torque (see Table 10/1).



Note!

Ensure that the deep groove ball bearing (18) is not distorted during installation of the spring-applied single-disc brake and that the shaft rotates easily when the brake is released. Check that there are no grinding sounds.

	Size					
	10	11	13	16	19	24
L [mm]	70	70	90	90	100	100
M _A [Nm]	9.7	9.7	24	24	45	45

Table 10/1: Hub (17) dimensions; tightening torques for mounting screws (10)

Check that the mounting surface (8) meets the following requirements before installing the brake:

- Axial runout relative to the shaft end to DIN 42955-N (measuring radius = hole circle)
- Material: steel, aluminium, cast iron – with excellent thermal conductivity
- absence of oil and grease;

Radial runout of the shaft end relative to the mounting surface (8) to DIN 42955-N



Attention!

The specified axial runout of the mounting surface (8) relative to the shaft end and the specified radial runout of the shaft end must be strictly observed in order not to reduce the reliability and service life of the spring-applied single-disc brake. Before installing the brake, the shaft end must be slightly brushed with a high temperature grease (e.g. Copaslip). This is essential to facilitate brake removal if maintenance work needs to be carried out at a later date.



Attention!

The M_A tightening torque specified for the mounting screws (10) must be strictly observed. The screws (10) must be tightened evenly in several steps.

3.2 Installation of the hand release (29) (only brake types with hand release)

Insert the hand release handle (29) into the square socket of the two cams (29.1) that are firmly fitted to the circumference of the solenoid housing (1.1). Ensure that the handle is correctly positioned. The mechanical release forces F and the maximum permitted release forces (actuation forces) F_{max} are specified in Table 11/1.



Note!

Machinery-specific regulations and requirements (e.g. for hoists, cranes and elevators) must be observed when using brakes with hand release (29). The hand release (29) must not be used to release (open) the brake during normal operation.



Caution!

The brake torque can be neutralized manually by means of the hand release (29). Consequently, the brake must be installed in such a way that any unintentional actuation of the hand release (29) is excluded and reliable brake operation is ensured.

	Size					
	10	11	13	16	19	24
Release force F [N]	approx. 18	approx. 35	approx. 45	approx. 90	approx. 85	approx. 170
Max. permitted release force F_{max} [N]	50	50	125	125	240	240

Table 11/1: Release force F , max. permitted release force F_{max} of hand release (29)

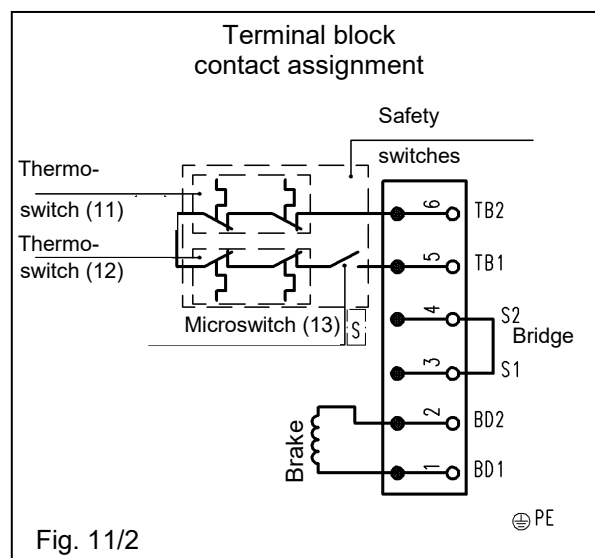
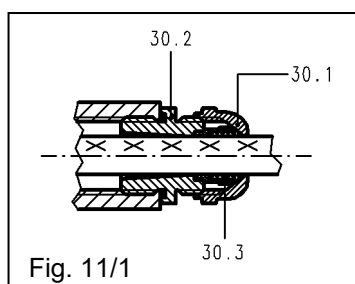


Warning!

Check that the mechanical hand release (29) is in a central position (see Fig. 9/1) when not in use. This is crucial to ensure reliable brake engagement. Otherwise, the full braking effect of the spring-applied single-disc brake may not be reached. In this case, the machine (e.g. motor) must be stopped immediately and must not be restarted until correct operation of the hand release (29) and automatic return of the release handle in its central position (see Fig. 9/1) has been ensured.

3.3 Electrical connection and operation

Connect the spring-applied brake to a DC power source via terminals 1 (BD1) and 2 (BD2) of the terminal block (19) (see Fig. 11/2). Connect the customer-specific connecting cable to the terminal block (19) by means of a cable gland (30) (M20x1.5). Remove the cover (26) of the junction box (25) so that the individual strands of the connecting cable can be connected to the terminal block (19). The connector sleeve (30.2) of the cable gland (30) is firmly screwed to the solenoid housing (1.1) when delivered (see Fig. 11/1, $M_A = 12$ Nm). Tighten the cap nut (30.1) to a tightening torque of $M_A = 12$ Nm to seal, clamp (clamping range 7...13 mm) and strain-relieve the customer-specific connecting cable. After completion of these steps, reinstall the cover (26) of the junction box (25).





Attention!

When fixing the cover (26) to the junction box (25), the M_A tightening torques for the socket head cap screws specified in Table 16/1 must be strictly observed. The flat seal (9) and spring washer (28) must be installed as shown in Fig. 9/1.

The supply voltage can be rectified by means of a bridge rectifier or half-wave rectifier or by using a combination of the two rectifier types. Various rectifier types are available (see examples in Table 12/1) to allow the brake to be connected directly to an AC power source. Depending on the brake size and torque, voltage ripple due to intermittent power supply may cause brake humming or incorrect brake operation. Perfect brake operation must be ensured by the user or system manufacturer by providing suitable electrical controls.

Rectifier series	Rectifier type	Rated input voltage range U_1/VAC (40-60 Hz)	Output voltage U_2/VDC	Max. output current	
				R-load I/ADC	L-load I/ADC
32 07.22B.0	half-wave	0-500 ($\pm 10\%$)	$U_1 \cdot 0.445$	1.6	2.0
32 07.23B.0	bridge	0-400 ($\pm 10\%$)	$U_1 \cdot 0.890$	1.6	2.0
32 17350E..	overexcitation bridge \Rightarrow half-wave	48-525 ($\pm 10\%$)	$U_1 \cdot 0.890 / U_1 \cdot 0.445$	2.3	3
32 17.2.B..	overexcitation bridge \Rightarrow half-wave	110-230 ($\pm 10\%$) 220-415 ($\pm 10\%$)	$U_1 \cdot 0.890 / U_1 \cdot 0.445$	1.2 0.8	1.5 1.0

The relevant rectifier specification sheets must be observed!

Table 12/1: Recommended rectifiers for single-phase AC voltage supply

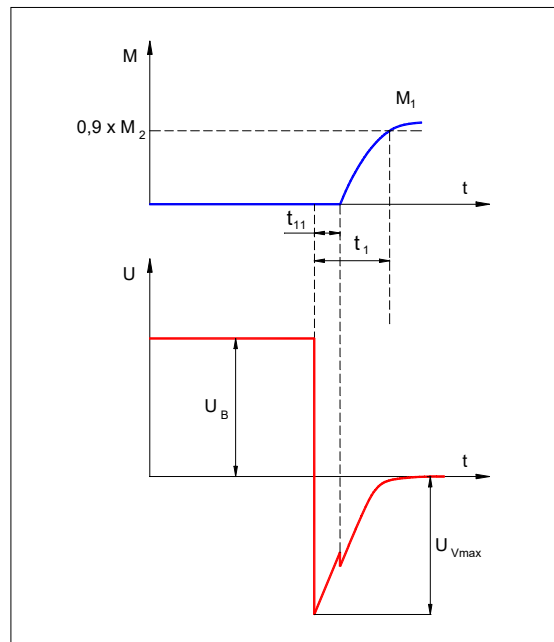
3.3.1 DC power supply

The figure to the right shows the voltage curve after the field coil (1.2) has been de-energized.



Attention!

The peak voltage U_{Vmax} during disconnection without protective circuit may reach **several thousand volts** in the millisecond region. This may cause irreversible damage to the field coil (1.2), switching contacts and electronic components. Sparking will occur on the switch during disconnection. Consequently, a protective circuit must be provided to reduce the current during disconnection and to limit the voltage. If Kendrion rectifiers are used (see Table 12/1), the protective circuit required for the built-in electronic components and field coil (1.2) is included in the rectifier. This does not apply to the external contacts required for DC side switching as there would be no galvanic isolation of the external contact.



U_B operating voltage (coil voltage)
 U_{Vmax} disconnection voltage



Attention!

Sensitive electronic components (e.g. logical components) may also be damaged by the lower voltage.

3.3.2 AC power supply

Direct brake connection to an AC power source is only possible if a rectifier is used. Wiring of the brake in case of single-phase AC power supply must be performed in the same way as with three-phase voltage. The coupling times vary depending on the switching type (DC side switching or AC side switching).

Half-wave rectification:

In case of half-wave rectification, the U_2 coil voltage is lower by factor 0.445 than the rectifier input voltage. Half-wave rectifiers produce voltage with high residual ripple which, depending on the brake size, may slightly reduce the switching times when compared to bridge rectifiers. Due to the shorter switching times and the lower coil voltage, half-wave rectifiers are generally preferred to bridge rectifiers. However, brake humming may occur when small size brakes are used.

Bridge rectification:

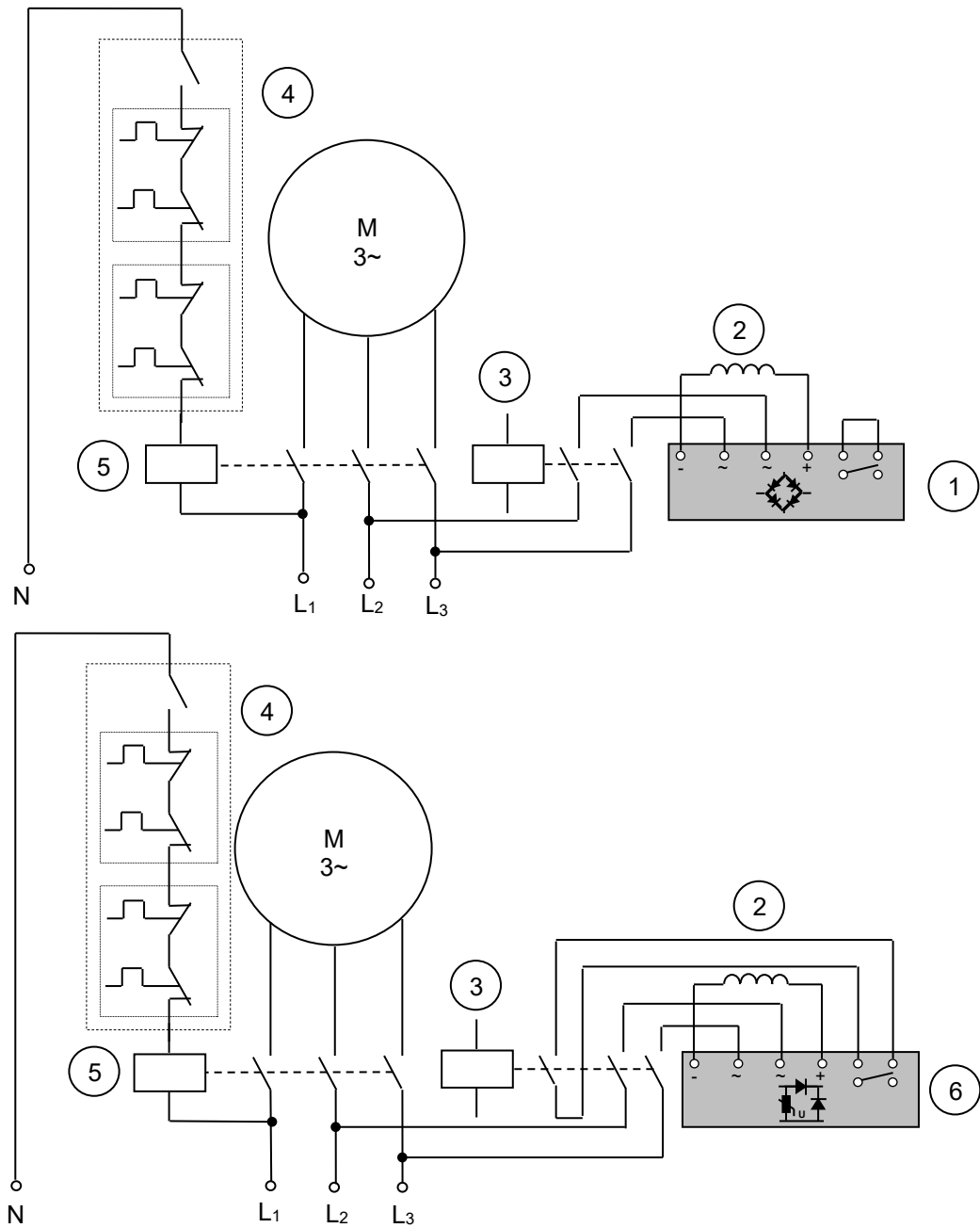
Bridge rectifiers provide voltage with minimum residual ripple. This means that brake humming can be avoided even if small size brakes are used. In case of bridge rectification, the U_2 coil voltage is lower by factor 0.89 than the rectifier input voltage.

AC side switching:

In case of AC side switching, the switching contact for the spring-applied single-disc brake is provided on the AC voltage side directly before the bridge rectifier. It must be considered, however, that the bridge rectifier with its free-wheel diode may extend the coupling time significantly (by factor 5 or over) after AC voltage has been removed. The disconnection times remain unchanged.

DC side switching:

In case of DC side brake switching, an auxiliary contact is provided on the brake contactor, for example. This auxiliary contact is designed to interrupt the power supply on the DC side.



- | | |
|--|--|
| ① Half-wave or bridge rectifier | ② Brake field coil (1.2) |
| ③ Control relay for brake | ④ Safety switches
(microswitch contacts (only brake types with microswitch (13) and thermoswitches (11 & 12)) |
| ⑤ Control relay for machine (e.g. motor) | ⑥ Half-wave or bridge rectifier with DC side disconnection |

Fig. 14/1: Suggested wiring of brake and safety switches (circuit diagram)



Attention!

To avoid damage (e.g. burns or fusing of contacts) to the external circuitry in case of DC side brake switching, additional protection elements (e.g. varistors, spark arresters, etc.) are necessary.



Warning!

Work on the brake must only be carried out by suitably qualified personnel. Make sure that no voltage is applied during brake connection. The specifications on the rating plate and the information provided in the circuit diagram in the terminal box or in the operating instructions must be strictly observed.



Warning!

The brake is a DC operated system. Permanent voltage variations on the power source of the electromagnetic brake must be limited to +/-10% of the rated voltage.

The following checks must be carried out when connecting the brake:

- Check that the connecting cables are suitable for the intended use and for the voltage and amperage of the brake.
- Check that the connecting cables are secured with screws, clamps or other suitable fixtures to avoid interruptions in the power supply.
- Check that the connecting cables are long enough for the intended use and that suitable torsion, strain and shear relief features as well as bending protections are provided.
- Check that the PE conductor (only for protection class I) is connected to the earthing point.
- Check that no foreign matter, dirt or humidity is trapped inside the terminal box.
- Check that unused cable entries and the terminal box are suitably sealed to ensure compliance with the protection class requirements to EN 60529.

3.3.3 Microswitch (13) and thermoswitch (11 & 12) connection

The four (2x2) thermoswitches (11 & 12) and the microswitch (13) provided to control the release status of the spring-applied single-disc brake are factory-connected in series. These safety switches (microswitch (13) and thermoswitches (11 & 12)) must be tied into the control circuit of the machine (e.g. motor) (see Fig. 14/1). This is necessary to ensure that the microswitch (13) prevents machine (e.g. motor) start-up before the brake has been released. The four (2x2) thermoswitches (11 & 12) connected in series with the microswitch (13) interrupt the control circuit of the machine (e.g. motor) as soon as the temperature measured at the individual measuring points of the thermoswitches (field coil (1.2) and flange (3)) exceeds the maximum permitted temperature. The cover (26) of the junction box (25) must be removed to allow the connecting cable of the safety switches (microswitch (13) and thermoswitches (11 & 12)) to be installed. The customer-specific connecting cable for the safety switches can be introduced into the junction box (25) of the spring-applied single-disc brake through the cable gland (30) (M20x1.5) provided (see Section 3.3). The cable strands must be connected to terminals 5 (TB1) and 6 (TB2) of the terminal block (19) (see Section 3.3). After completion of these steps, reinstall the cover (26) of the junction box (25).



Attention!

When fixing the cover (26) to the junction box (25), the M_A tightening torques for the socket head cap screws (27) specified in Table 16/1 must be strictly observed.

	Size					
	10	11	13	16	19	24
M _A tightening torque [Nm] for socket head cap screws (20) of cover (7)	5.6	5.6	24	24	45	45
M _A tightening torque [Nm] for socket head cap screws (22) of flange (3)	7.6	7.6	9.7	9.7	24	24
M _A tightening torque [Nm] for socket head cap screws (27) of junction box (25) cover (26)	3	3	3	3	3	3

Table 16/1: Tightening torques for socket head cap screws



Note!

Machinery-specific regulations and requirements (e.g. for hoists, cranes and elevators) must be observed when using brakes with microswitches (13).



Warning!

The motor circuitry must be protected in such a way that no unintentional motor start-up can occur when the microswitch (13) contact closes.



Note!

The suggested brake wiring solution with microswitch (13) shown in Fig. 14/1 is based on the general recommendations for wiring electromagnetic components in electrical machinery (e.g. motors) without load torque impact. When the brake is used for applications during which a load torque is generated, the system user is responsible to ensure correct and safe wiring of the microswitch (13) and spring-applied single-disc brake.

3.4 Electromagnetic compatibility

As required by the German Electromagnetic Compatibility Act (EMVG), electromagnetic compatibility is essential to ensure immunity to external electromagnetic fields and conducted interference. Furthermore, the emission of electromagnetic fields and line-conducted interference during brake operation must be minimized. Since the brake features depend on the circuitry and operation, a declaration of conformity with the applicable EMC standard can only be furnished for the wiring type, but not for a specific brake. The spring-applied single-disc brakes in the EX ..E..A00 series are designed for industrial applications to which the following EMC standards apply: Generic Immunity Standard EN 61000-6-2 and Generic Emission Standard EN 61000-6-3 / EN 61000-6-4. Other applications may be subject to different generic standards which must be considered by the manufacturer of the overall system. The requirements in terms of electromagnetic compatibility of devices and components are determined by basic standards derived from the generic standards. Brake wiring recommendations will be provided in the following sections to ensure compliance with the individual basic standards that are relevant for industrial brake use and other applications. Please refer to the specification sheets for additional information on electromagnetic compatibility, especially with respect to the recommended electronic rectifiers specified in Section 3.3.

Immunity according to EN 61000-4:

EN 61000-4-2 Electrostatic discharge:

The spring-applied single-disc brakes EX ..E..A00 comply at least with severity level 3 without requiring additional measures. The recommended rectifiers specified in Section 3.3 conform to severity level 3 without additional measures.

EN 61000-4-3 Electromagnetic fields:

The brakes comply at least with severity level 3 without requiring additional measures. The recommended rectifiers conform to severity level 3 without additional measures.

EN 61000-4-4 Fast transients (burst):

The brakes comply at least with severity level 3 without requiring additional measures. The recommended rectifiers conform to severity level 3. When using rectifiers of the 32 17.2.B.. series, which conform to severity level 3, a temporary slight voltage increase may occur which, however, will not interfere with the rectifier function.

EN 61000-4-5 Surge:

The brakes comply at least with severity level 3 without requiring additional measures. The recommended rectifiers conform to severity level 3 without additional measures.

EN 61000-4-9 Pulse magnetic fields, EN 61000-4-10 Damped oscillatory magnetic fields:

Since the operating magnetic fields of the electromagnetic brakes are stronger many times over than interference fields, the brake function will remain unaffected. The brakes comply at least with severity level 4. The recommended rectifiers conform at least to severity level 3.

EN 61000-4-11 Voltage dips, short interruptions, and short supply voltage variations:

a) Voltage interruptions:

Brakes that comply with the requirements of DIN VDE 0580 are de-energized after the specified switching times at the latest. The switching time depends on the control and mains conditions (e.g. generator effect of running down motors). Voltage interruptions of shorter duration than the response delay specified by DIN VDE 0580 will not cause any malfunctions. The user must ensure that any consequential damage is avoided (e.g. motor start-up before the brake has been released caused by phase failure in the case of two-phase energized motors or by the slipping of an electromagnetically engaged system due to torque drop). The functional reliability of the electromagnetic brake and its electronic accessories remains unaffected if the aforementioned consequential damage is avoided.

b) Voltage dips and short supply voltage variations:

Electromagnetically released systems:

Voltage dips and supply voltage variations to below 60% of the rated voltage and lasting longer than the response delay specified by DIN VDE 0580 may cause the brake to be de-energized temporarily. Consequential damage as described under a) above must be avoided by the user by taking adequate precautions.

Electromagnetically engaged systems:

Voltage dips and supply voltage variations to below the minimum tolerance threshold will cause torque reductions. The user is required to take adequate precautions to avoid consequential damage.

Radio interference suppression in accordance with EN 55011:

The brakes and the built-in electronic rectifier are classified as Group 1 equipment in accordance with EN 55011. As far as the emissions from this equipment are concerned, one distinguishes between field guided radiated interference and line-conducted interference.

a) Radiated interference:

When operated with DC voltage or rectified 50/60Hz AC voltage, all brakes comply with the limit values applicable to Class B equipment.

b) Conducted interference:

If the brakes are connected to a 50/60Hz AC power source, no additional interference suppression measures are required to ensure compliance with the limit values applicable to Class A equipment as the built-in rectifier is equipped with interference suppression components. Interference caused during switching operations of the electromagnetic component is generally attributable to the inductive load. Where necessary, assemblies designed to limit the disconnection voltage (e.g. anti-parallel diode) or voltage limiting components (e.g. varistors, suppressor diodes, resistance diodes and the like) can be installed. However, such components will inevitably change the switching times of the brake and increase the generated noise level.

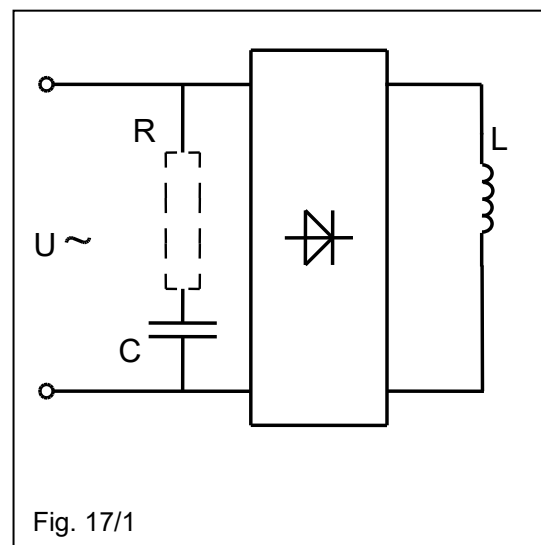


Fig. 17/1

The built-in rectifier is equipped with free-wheel diodes and/or varistors to limit the disconnection voltage. If the brake is used in connection with other electronic accessories, the user is responsible to ensure compliance with EMC requirements. Compliance with applicable standards concerning the design and operation of components, sub-assemblies or equipment employed shall not relieve the user and manufacturer of the overall system from their obligation to furnish proof of conformity of the overall system with such standards.

Rectifier series	Rated input voltage range U ₁ /VAC (40-60Hz)	DC at L-load (ADC)	Capacitor nF (VAC)
Half-wave rectifier 32 07.22B.0	up to 500 (+10%)	up to 2.0	no additional interference suppression measures required
Bridge rectifier 32 07.23B.0	up to 400 (+10%)	up to 2.0	no additional interference suppression measures required
Overexcitation rectifier 32 17350E..	48 - 525	up to 3	no additional interference suppression measures required
Overexcitation rectifier 32 17.2.B..	110 - 230 220 - 415	up to 1.5 up to 1.0	no additional interference suppression measures required

Table 18/1

Input voltage rectifier (VAC)	Recommended disconnection voltage for DC side switching (V)
250	700
440	1200
550	1500
630	1700

Table 18/2

3.5 Start-up



Warning!

The functional check of the brake must not be performed unless the machine (e.g. motor) has been switched off and secured against accidental or unintentional start-up.

The following checks must be carried out:

Check compliance with the specifications provided on the rating plate with respect to the mounting position and protection class. Provided that the mounting surface (mounting side) (8) for the spring-applied single-disc brake is closed, no further measures need to be taken to ensure compliance with the required protection class. If the mounting surface (mounting side) (8) is open, adequate sealing must be provided in accordance with the installation procedure E76 00A0030 000 recommended by Kendrion. In this case, the maximum possible protection rating is IP 56. After connection of the brake, a functional test must be performed to check that the friction disc (5) runs smoothly. For this purpose, turn the shaft while the brake is energized and the machine (e.g. motor) is unpowered. After completion of mounting, all necessary covers and guards must be installed.

Specifications on rating plate (order-specific, example brake type EX 26E11A00):

VOLTAGE FREQUENCY	VARIANT NUMBER (4-DIGIT)	Certification codes: (to IEC 60079-0)
ORDER NUMBER (PIECE NUMBER AS ORDER)	HIGHEST BREAKING CAPACITY	II 2G group II equipment; category 2G (gas atmospheres); zones 1 and 2
TYP NUMBER	NOMINAL TORQUE	II 2D group II equipment; category 2D (combustible dust atmospheres); zones 21 and 22
NOMINAL VOLTAGE	NOMINAL CURRENT	IP67 T100°C IP 67 protection; max. surface temperature 100°C
		Ex de IIC T5 flameproof enclosure; increased safety; group II equipment (electrical equipment for use in potentially explosive atmospheres except for underground mines); classification C (gas and vapour atmospheres); temperature class T5
IDENTIFICATION OF CERTIFICATION	INDEX OFFERT DRAWING	tD A21 protection (by enclosures) in the presence of combustible dust according to method A for zone 21
OPTIONAL SEE ORDER	CE- IDENTIFICATIONS NUMBER	DMT 02 certification authority and certification year
EC-TYPE DECLARATION		ATEX E 122 X certification number
PRODUCTION DATE AND SHORT SIGN CONTROLLER		IECEX BVS 11.0025X

Type: EX 26E11A00 | Var.: 0001 | M_n: 20 Nm
 Serial-No: F0000451/P4/01 | P_{max}: 270 kJ/h
 205 V - Hz | 0,27 A
 II 2G Ex de IIC T5; II 2D Ex tD A21 IP67 T100°C
 IECEX BVS 11.0025X | CE No. 0158
 DMT 02 ATEX E 122 X
 Test: 29.07.2014 Gr | Idx.: g
 KENDRION
 D-78048 VS-Villingen
 DO NOT OPEN UNDER VOLTAGE!
 NICHT, UNTER SPANNUNG ÖFFNEN!

Zone 1: occasional explosion hazard
 Zone 2: occasional explosion hazard for short periods
 Zone 21: occasional explosion hazard caused by combustible dust in normal operation
 Zone 22: explosion hazard caused by combustible dust unlikely to occur in normal operation; if it does only for short periods

Note: The product number of the spring-applied single-disc brake consists of the type number followed by the version number, e.g. EX 26E11A00-0001.



Warning!

Before starting the machine (e.g. motor) test run without driven components, the feather key (if used) must be secured in such a way that it cannot be hurled out. The shaft must not be exposed to load torques. Before the machine is re-started, the brake must be de-energized.



Caution!

The brake surface temperature may reach up to 100°C. Heat-sensitive parts such as conventional cables or electronic components must not be fixed to or be in contact with these surfaces. If necessary, suitable protections and hand guards must be installed to avoid accidental contact with hot surfaces! If the shaft needs to be turned during set-up operations while the machine (e.g. motor) is switched off, the brake must be released electromagnetically or by means of the hand release (29).



Attention!

High-voltage tests performed during brake installation within an overall system or during start-up must be carried out in such a way that damage to the built-in electronic accessories is avoided. The limits for high-voltage tests and follow-up tests specified by DIN VDE 0580 must be observed.

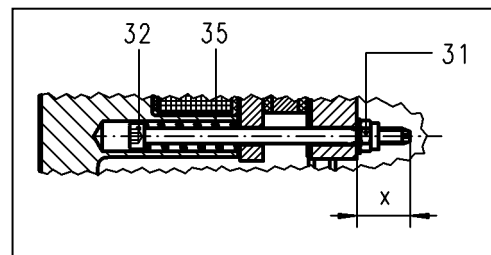


Attention!

Check that the brake has been connected in accordance with the specifications provided on the rating plate before it is put into operation. Even short-term operation outside the specified supply voltage limits may cause irreversible damage to the brake or electronic accessories. Such damage may not be apparent immediately. DC side brake switching without protective circuit as described in Section 3.4 will cause damage to electronic rectifiers, electronic accessories, switching contacts and to the field coil (1.2).

3.6 M₂ rated torque adjustments

The brakes are factory-adjusted to the M₂ rated torque (as specified in the purchase order). The factory-adjusted M₂ rated torque is specified on the rating plate (33) of the brake. In case fine adjustment is required, the M₂ rated torque can be continuously reduced. However, increasing the M₂ rated torque is not allowed. In order to adjust the torque, proceed as follows: Loosen the socket head cap screws (20) provided on the cover (7) and remove the cover (7). Screw in the socket head cap screw (32) clockwise by means of a screwdriver, making sure to secure the nut (31) in such a way that it cannot turn. Fine adjustment must be carried out by tightening the socket head cap screws (32) evenly in several steps. Check that the requirements in terms of the minimum length of projection x_{min} (see Table 20/1) of the socket head cap screw (32) from the flange (3) are met. The change in the M₂ rated torque resulting from these adjustments is specified in Table 20/1. The factory-set nominal value (approximate value) of the length of projection x_{nom} (see Table 20/1) is marked on the flange.



	Size					
	10	11	13	16	19	24
$\Delta M_2/mm$ [Nm]	0.5	0.65	4	7.5	7.5	10
x_{nom} [mm]	10.5	10.5	11.5	11	11	11
x_{min} [mm]	7.5	7.5	9	9	9	9

Table 20/1: Change in the M₂ rated torque from 1 mm axial adjustment of the socket head cap screw (32); minimum permitted projection x_{min}



Warning!

Any adjustment of the rated torque must be performed by the manufacturer or by authorized specialist personnel.

4. Maintenance

4.1 Checks and service

The spring-applied single-disc brake does not require any particular maintenance except that the friction disc (5) must be replaced when worn (see "Technical specifications" for information on the maximum air gap s_{max}) and that the safety switches (microswitch (13)³⁾ and thermostats (11 & 12) need to be checked. These service and maintenance measures must be performed during the general inspection of the electric machine (e.g. motor). Make sure that the spring-applied brake is unpowered and that the explosion protection is not interfered with when carrying out service and maintenance work. When opening the flameproof enclosed solenoid housing (1.1) to replace the friction disc (5), for example, the safety information provided in this manual must be strictly observed. Always check that the flameproof gaps are in perfect condition. Do not use spare parts other than original spares supplied by the manufacturer of the spring-applied brake.



Warning!

In case the explosion protection features of the spring-applied brake are damaged during maintenance or repair work, the brake must be checked by an authorized expert before it can be reused. Any measures required to restore explosion protection must be performed by the manufacturer or by authorized repair shops (see Section 12).

Brake removal from the machine (e.g. motor):

Loosen the socket head cap screws (27) provided on the cover (26) of the junction box (25) and remove the cover (26). Disconnect the strands of the connecting cables (field coil (1.2) and safety switches) from the terminal block (19). Unscrew the cap nut (30.1) of the cable gland (30) and remove the connecting cables from the junction box (25). Loosen the mounting screws (10). Remove the brake from the shaft with the two pull-off threads provided on the solenoid housing (1.1) and by means of socket head cap screws (e.g. in accordance with ISO 4762).

Checking the air gap 's':

Loosen the socket head cap screws (20) provided on the cover (7) and remove the cover (7). Place a measuring bridge with dial gauge on the flange (3) to measure the air gap 's'. Position the measuring tip of the micrometer screw on the friction disc (5).

Release the spring-applied brake so that the air gap 's' can be determined from the difference between the values indicated by the dial gauge.



Attention!

Temporary electric release of the spring-applied brake is required to allow the air gap 's' to be measured. For information on the electrical connection of the brake to the power source, please refer to Section 3.3.

Friction disc (5) replacement:

Remove the self-locking nut (31) from the socket head cap screws (32). Loosen the socket head cap screws (22) provided on the flange (3) and remove the flange (3). Remove the friction disc (5) from the hub (17) and replace it by a new one.



Attention!

Ensure that the connections of the four thermostats (11 & 12) are not damaged or loosened when removing the flange (3).

³⁾ Brake types with microswitch.

Deep groove ball bearing (18):

When performing maintenance and repair work, check that the deep groove ball bearing (18) rotates smoothly. If the bearing (18) needs to be replaced, follow the instructions on how to remove the brake from the machine (e.g. motor) and on how to open the solenoid housing (1.1). After having removed the friction disc (5), remove the circlips (14 & 15). Push the hub (17) and deep groove ball bearing (18) out of the solenoid housing (1.1) and remove the bearing (18) from the hub (17). Before reassembling the spring-applied brake, all components (except for the friction disc (5)) must be cleaned with grease-free cleaners. In order to assemble the individual components, proceed in reverse order of removal. When fine adjusting the M_2 rated torque, make sure that the socket head cap screws (32) project from the flange (3) by the length x_{nom} (approximate value – see Table 19/1). The self-locking nuts (31) (to ISO 10511-04-A2F; 140°C) must be replaced before adjusting the screws.



Attention!

When the spring-applied single-disc brake is mounted to the machine, it is crucial that the mounting screws (10) be tightened applying the M_A tightening torque specified in Table 10/1. The socket head cap screws (20) on the cover (7) and the socket head cap screws (22) must be tightened to the M_A torque specified in Table 16/1. The O-ring (24), spring washer (21 & 28) and flat seal (9) must be installed as shown in Fig. 9/1.



Attention!

Depending on its operating condition, it may no longer be possible to release the spring-applied single-disc brake when the maximum air gap s_{max} (see "Technical specifications") has been exceeded. In this case, the braking action cannot be neutralized.



Warning!

If a hand release (29) is fitted to the brake and the maximum air gap s_{max} (see "Technical specifications") has been exceeded (especially in case of a reduced M_2 rated torque), the hand release (29) may limit the axial movement of the armature (2). This would cause the torque to be reduced down to zero. Whenever carrying out service and maintenance work, check the degree of wear of the friction disc (5) and the air gap 's' and replace the friction disc well before the maximum air gap s_{max} (see "Technical specifications") is reached.

Microswitch (13) adjustment or replacement (relevant only for brake types equipped with microswitch):

The spring-applied single-disc brake must be released electrically before the microswitch (13) can be adjusted. Loosen the socket head cap screws (20) provided on the cover (7) and remove the cover (7). Unscrew the locknut (13.1) and turn the set screw (13.2) clockwise until the microswitch (13) switches (slight audible click or contact closure between contacts 5 and 6 (see Section 3.3)). If the microswitch (13) is in the ON position, it must be turned anticlockwise into the OFF position. After the changeover position has been reached, continue to turn the set screw (13.2) by 60° to 90°. Tighten the locknut (13.1). Make sure the set screw (13.2) position remains unchanged when tightening the locknut. Switch the brake on and off to check that the microswitch is in perfect working order. If the microswitch (13) needs to be replaced (e.g. when the maximum service life (switching operations) has been reached) (see "Technical specifications"), the replacement must be carried out by the manufacturer or by an authorized repair shop due to the complex installation of the microswitch with the four thermoswitches (11 & 12).

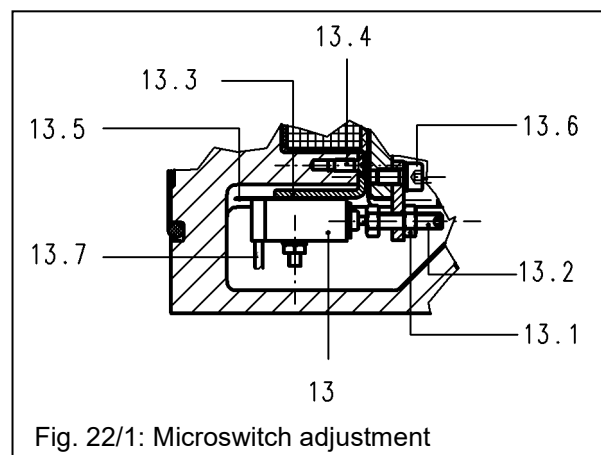


Fig. 22/1: Microswitch adjustment

Thermoswitch replacement (11 & 12):

The thermoswitches (11 & 12) must be replaced when the maximum service life (switching operations) has been reached. Replacement must be carried out by the manufacturer or by an authorized repair shop due to the complex installation of the thermoswitches with the microswitch (13)⁴. The thermoswitches (11 & 12) will only interrupt the control circuit of the machine (e.g. motor) if the maximum permitted operating temperatures (see "Technical specifications") on the measuring points of the thermoswitches (11 & 12) are exceeded. Under normal conditions, the thermoswitches (11 & 12) remain closed during the entire operation of the spring-applied single-disc brake.



Attention!

The socket head cap screws (20) on the cover (7) must be tightened to the M_A torque specified in Table 16/1. The O-ring (24) and spring washer (21) must be installed as shown in Fig. 9/1.

Information on flameproof gaps without thread and flameproof thread gaps:

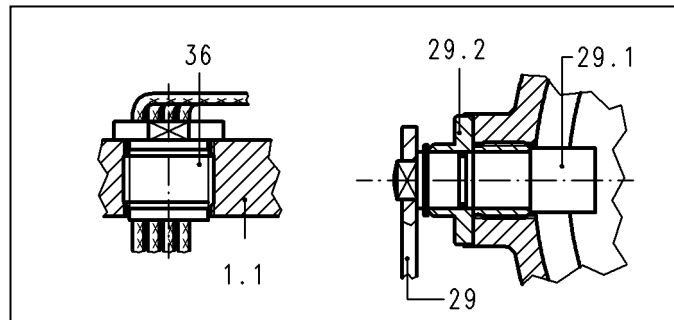
All flameproof gaps are factory-specified. The gap dimensions and surface specifications ($R_a < 6.3 \mu\text{m}$) must be maintained. If gap surfaces are found to be damaged or if gap dimensions are different from those specified, it is crucial that original spare parts are used when performing repair work or replacing individual components. Repair work must be carried out by the manufacturer or by authorized specialists!

Flameproof gaps without thread:

hub (17) / solenoid housing (1.1)
cover (7) / solenoid housing (1.1)
cam (29.1) / sleeve (29.2)

Flameproof thread gaps:

sleeve (29.2) / solenoid housing (1.1)
duct (36) / solenoid housing (1.1)



Caution!

Whenever inspection and maintenance work is carried out, ensure that

- the machine (e.g. motor) is secured against accidental or unintentional start-up.
- no load torque acts on the shaft.
- the lock provided to prevent accidental start-up of the machine (e.g. motor) is removed after completion of inspection and maintenance work.
- all friction surfaces are free from grease and oil. An oily or greasy friction disc (5) cannot be cleaned.
- no swelling or glazing of the friction lining has occurred.

⁴) Brake types with microswitch.

4.2 Spare parts and accessories

Size	Designation, order number			
	Friction disc (5) S	Flat seal (9) S	O-ring (16) S	Mounting screw (10) A
10	73 24111E00400	76 24E11B00044	602633	304046
11	73 24111E00400	76 24E11B00044	602633	304046
13	73 24116E00400	76 24E11B00044	602635	3040071
16	73 24116E00400	76 24E11B00044	602635	304071
19	76 14124E00400 / 76 24124E05400 ⁵⁾	76 24E11B00044	602637	304107
24	76 14124E00400 / 76 24124E05400 ⁵⁾	76 24E11B00044	602637	304107

Table 24/1: Spare parts (S) and accessories (A)



Warning!

Maintenance and repair work and adjustments must be performed by the manufacturer or by authorized repair shops only (see Section 12)!

5. Condition at delivery, transportation and storage

Upon receipt of the shipment, the spring-applied brake must be checked for transit damage before storage. Ordered accessories (mounting screws) are delivered together with the brake. The spring-applied single-disc brake is delivered ready for mounting with factory-adjusted air gap 's'. The M₂ rated torque is factory-adjusted.



Note!

If the brake is not installed immediately upon delivery, it must be stored in a dry, dust-free and vibration-proof place.



Note!

The environmental conditions specified in Table 24/1 and in EN IEC 60721-3-2 / EN IEC 60721-3-1 must be considered during transport and storage of the brake, especially when long-term storage is envisaged. The permissible ambient conditions only apply if the component is stored in the original packaging.

	Environmental conditions	
	Conditions for storage to EN IEC 60721-3-1	Conditions for transport to EN IEC 60721-3-2
Mechanical environmental conditions	1M11	2M4
Climatic environmental conditions	1K21 and 1Z2	2K12
Biological environmental conditions	1B1	2B1
Mechanically active substances	1S11	2S5
Chemically active substances	1C1	2C1

Table 24/1: Environmental conditions for storage and transport as specified in EN IEC 60721-3-1 and EN IEC 60721-3-2

⁵⁾ Friction disc with special friction material for increased switching work W.

6. Emissions

6.1 Noise

The spring-applied single-disc brake produces switching noise during engagement and release. The noise level is determined by the installation conditions, circuitry (e.g. with overexcitation) and air gap. Depending on the mounting position, operating conditions and state of the friction surfaces, audible vibrations (squealing) may be produced during braking.

6.2 Heat

Braking operations and gradual heating of the field coil cause the solenoid housing temperature to increase substantially. Under adverse conditions, the surface temperature may reach up to 100°C.



Caution!

Risk of burns in case of contact with hot surfaces! Suitable covers and hand guards must be installed to provide protection against accidental contact.

7. Troubleshooting

Fault	Cause	Corrective actions
Brake release failure	• Air gap too large	Check the air gap. Install a new friction disc, if necessary.
	• No voltage applied to brake	Check the electrical connection and correct faults, if found.
	• Voltage applied to field coil too low	Check the field coil supply voltage and correct faults, if found.
	• Armature plate blocked mechanically	Eliminate mechanical blocks.
	• Damaged rectifier	Check the rectifier and replace it, if necessary.
	• Damaged field coil	Check the resistance of the field coil. Install a new brake, if necessary.
	• Friction disc thermally overloaded	Install a new friction disc or a new brake, if necessary.
Delayed brake release	• Air gap too large	Check the air gap. Install a new friction disc, if necessary.
	• Voltage applied to field coil too low	Check the field coil supply voltage and correct faults, if found.
Brake engagement failure	• Voltage applied to field coil in unpowered condition too high (residual voltage)	Check whether residual voltage is applied to the field coil and correct faults, if found.
	• Armature plate blocked mechanically	Eliminate mechanical blocks.
Delayed brake engagement	• Voltage applied to field coil too high	Check the field coil supply voltage and correct faults, if found.
Machine (e.g. motor) start-up failure	• Microswitch adjustment error (only brake types with microswitch)	Check the microswitch switching behaviour and adjust the switch, if necessary.
	• Damaged microswitch (only brake types with microswitch)	Check the microswitch and replace it, if necessary.
Brake torque too low	• Air gap too large	Check the air gap. Install a new friction disc, if necessary.
	• Axial armature movement blocked by hand release feature	Check the air gap. Install a new friction disc, if necessary.
	• Oily or greasy friction surfaces	Air gap too large
	• Broken compression spring	Check the spring force. Install a new brake, if necessary.

Table 26/1: Possible faults, causes and corrective actions (list not exhaustive)

8. Safety

The brakes described in these operating instructions have been designed and built on the basis of an analysis of hazards and in accordance with the requirements of the applicable harmonized standards and technical specifications. They correspond to the state of the art and provide maximum safety. However, safety hazards can only be avoided if the user of the equipment takes adequate precautions and makes sure that safety instructions are strictly adhered to. It is the duty of the machine owner to plan these measures and to check their implementation.

The machine owner is required to ensure that:

- the brakes are only used in accordance with their intended use (see Section 2 Product description).
- the brakes are in perfect working order and checked at regular intervals.
- a complete and fully legible copy of these operating instructions is kept available at the place of use of the brakes at all times.
- start-up, maintenance and repair work is only done by authorized and suitably qualified personnel.
- such personnel are kept informed on all relevant occupational safety and environmental protection issues and familiar with these operating instructions and with the safety information contained herein.
- the brakes are not exposed to other strong magnetic fields.

8.1 Intended use

The brakes described in these operating instructions are intended to be mounted to electric machinery, especially electric motors, for use on industrial plant and, more specifically, in potentially explosive atmospheres. The brakes must be used in accordance with the operating requirements detailed in this manual. The rated power limits specified herein must not be exceeded.

8.2 General safety information

Brakes fitted to motors feature hazardous live components and rotating parts and may exhibit hot surfaces. Any work associated with the transport, connection, start-up and periodical maintenance of the brakes must be carried out by authorized and suitably qualified specialist personnel in accordance with EN 50110-1, EN 50110-2, IEC 60364-1. Failure to observe safety, operating and maintenance instructions may cause serious personal injury and severe damage to the equipment. Whenever special measures are required in accordance with the instructions contained herein, such measures should be agreed with the brake manufacturer before the machinery into which the brake is to be incorporated is set up. Should any queries arise with respect to torques, torque variations, installation positions, wear, wear reserve, switching work, break-in conditions, release range, ambient conditions and the like, please contact Kendrion and ask for clarification before using the brake. Retrofitting or modification work to be carried out on the brake is subject to the approval from Kendrion. Accident prevention regulations applying to the specific field of application of the brake must be strictly observed. The brakes described in this manual are **not designed for use as "safety brakes"**. This means that torque reductions caused by factors beyond the user's control cannot be excluded.

8.2.1 Set-up

Requirements in terms of the permitted number of switching operations per hour and the maximum switching work per switching operation (see Fig. 32/1) specified in the technical specifications must be strictly observed during the set-up of machines and plant (inching mode). Failure to observe these instructions may irreversibly diminish the braking effect and cause malfunctions. Normal operating conditions are those specified by DIN VDE 0580. The protection rating conforms to EN 60529. In case of deviations, special measures must be taken after prior consultation with the manufacturer. If vertical brake operation is envisaged, any special requirements must be agreed with the manufacturer. Bear in mind that the friction disc may freeze if ambient temperatures fall below -5°C or if the brake remains unpowered for prolonged periods of time. In this case, special precautions must be taken after consultation with the manufacturer.

8.2.2 Start-up

The brakes must not be put into operation when:

- power supply cables/wires or connections are damaged.
- the solenoid housing or coil sheath is damaged.
- other defects are suspected.

8.2.3 Installation

The voltage level and voltage type specified on the rating plate must be strictly observed when connecting the brakes described in these operating instructions. Sufficient heat dissipation must be ensured when the brake is fitted to or incorporated into other equipment. Adequate precautions must be taken to avoid overvoltage during disconnection or voltage peaks. The magnetic field of the products may cause interference outside the brake or even feedback to the brake in case of adverse installation conditions. Should you have queries concerning mounting and fitting conditions, please contact the brake manufacturer and ask for clarification.

Adequate safety measures (DIN 31000; DIN VDE 0100-420) must be taken by the brake user to avoid hazards to persons and animals or damage to equipment caused by:

- direct or indirect effects of electromagnetic fields,
- heated components,
- mobile parts.

8.2.4 Operation

Ensure that live components such as plug contacts or the field coil are not exposed to water. The brake cable connections must not be crushed, squeezed or exposed to mechanical loads. Make absolutely sure that the friction surfaces of the friction elements are not contaminated with grease, oil or other fluids to avoid substantial torque reduction. Bear in mind that the original torque cannot be restored even if the friction surfaces are cleaned after contact with fluids. The gradual brake wear and the resulting torque reduction of spring-applied brakes must be taken into consideration during set-up of the machine/equipment. Due to the diverse ambient conditions in which the brakes may be used, always check that the brake is in perfect working order before start-up. Torque reductions cannot be excluded if the brake is used for applications where only minimum friction work is required. In such cases, the user should ensure that the brake occasionally performs sufficient friction work. Operation of the brake as pure holding brake without friction work is only allowed after prior consultation with the manufacturer. If brakes equipped with hand release are used, the handle of the hand release must only be moved up to the release position in order to avoid deformation or breaks.



Notice!

During brake operation, ensure that the coil temperature does not rise above the permissible limit temperature applicable to the insulating materials of the specified insulation class (see Table 31/1). Fast cooling of the field coil with scavenging air is not allowed. Ensure that the permissible relative humidity range (see Table 32/2) is not exceeded.



Note!

The maximum air gap s_{max} (see Table 31/1 "Technical specifications") must not be exceeded throughout the entire brake service life. (Please refer to Section 4 "Maintenance" for details.)

8.2.5 Maintenance and repair

Brake service, maintenance, repair or replacement must only be carried out by qualified specialist personnel in accordance with EN 50110-1, EN 50110-2, IEC 60364-1. Failure to perform repairs according to requirements may cause serious personal injury or equipment damage. Make sure that no voltage is applied to the brakes when carrying out maintenance work.



Danger!

The warning "DO NOT OPEN WHILE ENERGIZED" affixed to the spring-applied single-disc brake must be strictly observed.

8.3 Warning symbols

Personal injury or equipment damage			
Symbol / Term	Warns against...		Potential risks and hazards
	Danger	imminent personal injury	fatal accidents or serious injury
	Warning	potential risk of serious personal injury	fatal accidents or serious injury
	Caution	potential risk of personal injury	minor injury
	Attention!	potential risk of equipment damage	damage to components or other equipment
Information			
Symbol / Term	Provides information on ...		
	Note	the safe use and operation of the product	

9. Definitions

(based on: DIN VDE 0580:2011-11, not exhaustive)

Switching torque M_1	torque acting on the shaft during brake or clutch slip
Rated torque M_2	switching torque specified by the manufacturer to identify the brake. The rated torque M_2 is the mean value of at least 3 measurements of the maximum switching torque M_1 after completion of the transient response.
Transmissible torque M_4	highest torque that can be applied to the engaged brake or clutch without causing the brake/clutch to slip
Residual torque M_5	torque transmitted by the released brake or clutch
Load torque M_6	torque acting on the drive of the engaged brake or clutch; determined by the power requirement of the driven machine at a given speed
Switching work W	heat generated by friction inside the brake or clutch as a result of the switching operation
Maximum switching work W_{max}	maximum switching work to which the brake or clutch may be exposed
Switching power P	switching work converted into heat per unit of time
Maximum switching power P_{max}	maximum permitted switching work converted into heat per unit of time
Coil ON time t_5	time between power on and power off
Coil OFF time t_6	time between power off and power on
Total cycle time t_7	coil ON time plus coil OFF time
Duty cycle	percentage relationship of coil ON time to total cycle time
Switching operation	one complete switching on and off operation
Switching frequency Z	number of regular switching operations per hour
Response delay during coupling t_{11}	time between power off (releasing systems) or power on (engaging systems) and beginning of torque increase
Rise time t_{12}	time it takes to reach 90% of the M_2 rated torque from the beginning of the torque increase
Coupling time t_1	response delay t_{11} plus rise time t_{12}
Response delay during disconnection t_{21}	time between power on (releasing systems) or power off (engaging systems) and beginning of torque decrease
Fall time t_{22}	time it takes for the torque from the beginning of the torque decrease to fall to 10% of the M_2 rated torque
Disconnection time t_2	response delay t_{21} plus fall time t_{22}
Slip time t_3	time from the beginning of the torque increase up to the end of the braking process (brakes) or until the synchronization torque M_3 has been reached (clutches)
Making time t_4	response delay t_{11} plus slip time t_3 (braking or acceleration time)
Operating condition at operating temperature	condition at which the steady-state temperature is reached. The operating temperature corresponds to the overtemperature according to DIN VDE 0580 plus the ambient temperature. Unless otherwise specified, the ambient temperature is 35°C.
Overtemperature $\Delta\theta_{31}$	difference between the temperature of the electromagnetic device or a part thereof and the ambient temperature
Limit temperatures of coil insulating materials	in accordance with DIN VDE 0580. The individual insulating materials are classified by insulation classes to DIN IEC 60085.
Rated voltage U_N	supply voltage specified by the manufacturer for voltage windings to identify the device or component

Rated current I_B	amperage determined by the manufacturer for the specified operating conditions. Unless otherwise specified, the rated current refers to the rated voltage, 20°C winding temperature and to the rated frequency for a given operating mode of voltage windings.
Rated power P_N	power value to identify the device or component
Rated power at 20°C winding temperature P_B	determined from the rated current of voltage-controlled devices and components and the R_{20} resistance at 20°C winding temperature

10. Technical specifications

Product built and tested to DIN VDE 0580

		Size					
		10	11	13	16	19	24
Rated torque M_2	[Nm]	10	20	50	100	150	270
Max. speed n_{max}	[rpm]	6000	6000	3600	3600	3600	3600
Max. switching power P_{max}	[kJ/h]	270	270	400	400	570	570
Rated power P_N	[W]	56	56	82	82	91	91
Coupling time t_1	[ms]	80	70	110	90	180	140
Disconnection time t_2	[ms]	80	110	170	230	240	350
Moment of inertia J – hub and friction disc	[kgcm ²]	2.5	2.5	21.5	21.5	125	125
Weight m	[kg]	14.5	14.5	29	29	57	57
Rated air gap s	[mm]	0.25 ^{+0.15}	0.25 ^{+0.15}	0.25 ^{+0.25}	0.25 ^{+0.25}	0.25 ^{+0.25}	0.25 ^{+0.25}
Max. air gap s_{max} ⁶⁾	[mm]	0.7	0.7	0.9	0.9	1.1	1.1
Standard rated voltage	[VDC]	205					
Temperature class		T5 (to IEC 60079-0)					
Insulation class		F					
Pollution degree		2					
Protection to EN 60529		IP 67 (brakes with dust & explosion protection II) IP 56 (brakes with explosion protection II)					
Ambient temperature	[°C]	-20 to +45					
Brake type		dynamic brake					
Available rated torques M_2	[Nm]	7.5 – 10	12.5 – 20	25 – 50	58 – 100	113 – 150	160 – 270

Table 32/1: Technical specifications

Technical specifications	
Max. rated voltage [VAC]	250
Max. current load [A]	2
Min. service life (switching operations)	3000000
Movement differential (nominal) [mm]	0.05
Min. overtravel [mm]	0.2
Contact type	normally open (NO)
Temperature range [°C]	-20 to +125

Table 32/2: Microswitch specifications (only brake types with microswitch)

6) Max. air gap s_{max} at 70% of rated current. Information on max. air gap s_{max} with reduced M_2 rated torque to be requested from manufacturer.

7) The information in the switch manufacturer's specification sheet must be observed!

	Size					
	10	11	13	16	19	24
Max. rated voltage [VAC]	250					
Rated current (cos φ=1.0) [A]	2.5					
Rated current (cos φ=0.6) [A]	1.5					
Service life (switching operations)	5000					
Contact type	normally closed (NC)					
Nominal temperature (switching temperature) thermoswitch 11 (flange (3)) [°C]	140	140	140	140	148	148
Nominal temperature (switching temperature) thermoswitch 12 (coil (1.2)) [°C]	118	118	100	100	109	109
Min. current [mA]	50					
Switching temperature change as a function of the current load [K]	-2.5 at 1.5 A -8.0 at 2.5A					

Table 33/1: Thermoswitch specifications

Rated operating conditions	
Rated voltage tolerance	±10%
Frequency range	±1% of rated frequency
Ambient temperature ϑ_{13} [°C]	-20 to +45 (to IEC / EN 60079-0)
Relative humidity	30% to 80% within ambient temperature range
Other climatic environmental conditions	3Z2 and 3Z4 to EN 60721-3-3
Mechanical environmental conditions	3M8 to EN 60721-3-3
Biological environmental conditions	3B1 to EN 60721-3-3
Mechanically active substances	3S2 to EN 60721-3-3
Chemically active substances	3C1 to EN 60721-3-3
Installation height	up to 2000 m a.m.s.l.

Table 33/2: Rated operating conditions for spring-applied single-disc brake

Explanations on the technical specifications:

W_{max} (maximum switching work) is the switching work that must not be exceeded during braking operations at max. 1500 rpm. Braking operations at speeds greater than 1500 rpm substantially reduce the maximum permitted switching work per switching operation. Such operation must be agreed with the manufacturer. The maximum switching power P_{max} is the switching work W that can be converted by the brake per hour. In case of applications where the number of switching operations per hour is $Z > 1$, Fig. 32/1 applies (W_{max} as a function of the number of switching operations per hour Z). The P_{max} and W_{max} values are approximate values; they apply to applications where the brake is mounted between the B-face end shield of the motor and the motor fan or attached to the motor. The specified times apply to the following conditions: DC side (separate) brake switching, operating temperature, rated voltage, and rated air gap. All values are mean values that are subject to variation. In case of AC side brake switching, the coupling time t_1 is substantially longer. The specified rated torques M_2 characterize the torque level of the brakes. Depending on the application the brake is used for, the switching torque M_1 and the transmissible torque M_4 may differ from the specified M_2 values. The switching torque M_1 depends on the speed (rpm). If the friction surfaces are contaminated with oil or grease the transmissible torque M_4 and the switching torque M_1 may drop. The technical specifications apply after the break-in process has been completed (see Table 33/1). Vertical brake operation is only allowed after prior consultation with the manufacturer.

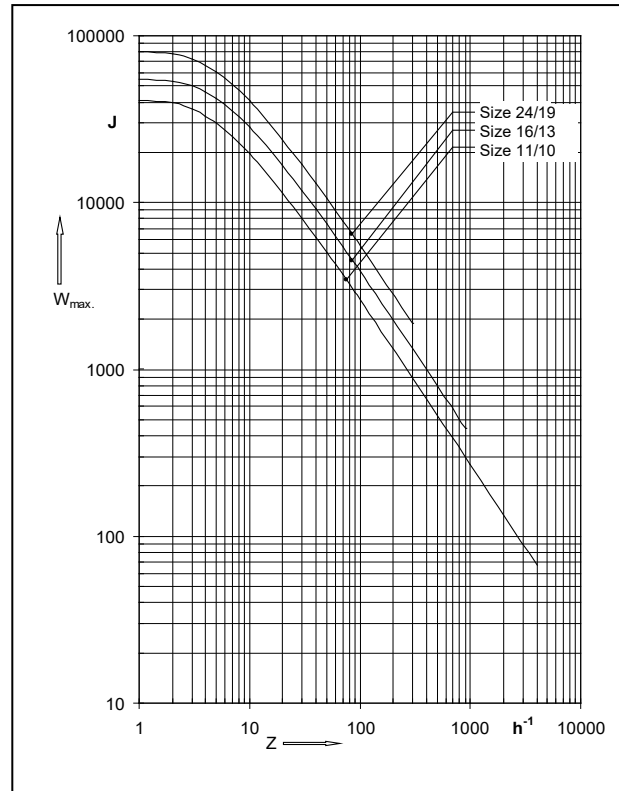


Fig. 34/1: Max. switching work W_{max} per switching operation as a function of the number of switching operations per hour Z ; (values based on $n=1500$ rpm)

	Size					
	10	11	13	16	19	24
Speed n [rpm]	300	300	150	150	100	100
Coil ON time t_5 [s]	4.5	11	9	20	13	25
Coil OFF time t_6 [s]	1.5	1.5	1.5	1.5	1.5	1.5
Break-in period t_{tot} [min]	approx. 2	approx. 2	approx. 2	approx. 2	approx. 2	approx. 2

Table 34/1: Break-in process parameters for the spring-applied single-disc brake

Note: A current level corresponding to 70% of the rated current is reached when the brake is operated at 90% of the rated voltage and at a coil temperature of 90°C.

The required operating conditions specified in Table 32/2 and the information provided in the **EEX LINE specification sheet** and offer drawing for the specific brake types must be observed during operation of the spring-applied single-disc brake.

Specifications subject to change without notice!

11. Product versions (types)

Versions:	EX 14E..A00	spring-applied single-disc brake without microswitch and without hand release
	EX 16E..A00	spring-applied single-disc brake without microswitch, with hand release
	EX 24E..A00	spring-applied single-disc brake with microswitch, without hand release
	EX 26E..A00	spring-applied single-disc brake with microswitch and hand release

Note: The "." wildcard stands for the size of the spring-applied single-disc brake.
Available sizes are: 10, 11, 13, 16, 19, 24.

12. Product number / type number / version number

The product number to be quoted in purchase orders and required to identify the brake version consists of the type number followed by the 4-digit version number. Individual brake types may be available in different versions. So the version number identifies the relevant brake model.

Example:

Type number: EX 26E11A00

Version number: 0001

Product number: EX 26E11A00-0001

13. Specialist repair shops

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14. Revision history

Date of issue	Changes
01/08/2014	New issue.
13/03/2020	Operating instructions revised in content. Updated layout (design) of operating instructions.

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