EEX LINE

Operating Instructions 76 ..E..B00

Spring-applied single-disc brake with dust and explosion protection II

Types:
76 14E10B00 76 16E10B00 76 24E10B00 76 26E10B00
76 14E11B00 76 16E10B00 76 24E11B00 76 26E11B00
76 14E13B00 76 16E13B00 76 24E13B00 76 26E13B00
76 14E16B00 76 16E16B00 76 24E16B00 76 26E16B00
76 14E19B00 76 16E19B00 76 24E19B00 76 26E19B00
76 14E24B00 76 16E24B00 76 24E24B00 76 26E24B00
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Industrial Drive Systems
Replaces the issue dated: 6 June 2008
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1. General information

1.1 Introduction

These Operating Instructions describe the operating principle and features of the 76 ..E..B00 series of Kendrion Binder spring-applied single-disc brakes. 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, installation position, wear, wear reserve, switching work, break-in conditions, release range, ambient conditions and the like, please contact Kendrion Binder and ask for clarification before starting to use the brake. Kendrion Binder spring-applied single-disc brakes in the 76 ..E..B00 series are not ready-to-use devices, but are intended to be incorporated into or assembled with other equipment.

1.2 Standards and directives

The state-of-the-art spring-applied 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 hazardous and potentially explosive atmospheres. Brake versions protected to IP 56 are only designed for use in explosion hazardous areas. The brakes are approved to the ATEX Directive (94/9/EC).

Approvals:
- dust and explosion protection II
  - II 2G Ex de IIC T5
  - II 2D Ex tD A21 IP67 T100°C
  - DMT 02 ATEX E 122 X

Option:
- dust explosion protection II
  - II 2G Ex de IIC T5
  - IP56
  - DMT 02 ATEX E 122 X

Being classified as "electromagnetic components", spring-applied brakes are not subject to the Low Voltage Directive and must not bear a CE mark of conformity. The user is required to employ suitable switching devices and controls to ensure use of the brakes in accordance with EMC Directive 2004/108/EC. A CE mark in accordance with the ATEX Directive (94/9/EC) is affixed to the brakes.

1.3 EC Declaration of Conformity

in accordance with Directive 94/9/EC:

We hereby declare that the products specified below have been developed and manufactured in accordance with the requirements of Directive 94/9/EC.

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

EC type approval certificate: DMT 02 ATEX E 122 X

Manufacturer: Kendrion Binder Magnete GmbH
Industrial Drive Systems
Mönchweilerstr. 1
78048 Villingen-Schwenningen
Germany

Applied standards and directives:
- EN 60529 Enclosure protection ratings
- DIN VDE 0580 Electromagnetic devices and components
- EN 60079-0:2006 Electrical apparatus for explosive gas atmospheres (General requirements)
- EN 60079-1:2004 Electrical apparatus for explosive gas atmospheres (Flameproof enclosures "d")
- EN 60079-7:2007 Electrical apparatus for explosive gas atmospheres (Increased safety "e")
- EN 61241-0:2006 Electrical apparatus for use in the presence of combustible dust (General requirements)
- EN 61241-1:2004 Electrical apparatus for use in the presence of combustible dust (Protection by enclosures "tD")
1.4 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, Annex I 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 Binder Magnete GmbH
Industrial Drive Systems
Mönchweilerstr. 1
78048 Villingen-Schwenningen
Germany

Person authorised to compile the documentation: Kendrion Binder Magnete GmbH
Industrial Drive Systems
Mönchweilerstr. 1
78048 Villingen-Schwenningen
Germany

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

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 utilised to overcome the braking effect produced by the spring force. The spring-applied single-disc brake engages in unpowered condition and releases when DC 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 characterised 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 Structure

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 connector box (25). The flange (3) and friction plate (33) are screwed to the solenoid housing (1.1) by means of machine screws (22). The cover (7) is fixed to the solenoid housing (1.1) by means of machine screws (20) to obtain a pressure-sealed assembly. Owing to the spring force generated by the compression springs (4 and 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 allow the air gap 's' to be adjusted. The customer-specific connecting cable can be fed into the connector box (25) through a cable gland (30) (M20x1.5). When DC voltage is applied to the built-in field coil (1.2) of the spring-applied single-disc brake, the spring force is overcome by the dynamic effect of the electromagnetic field. This causes the armature (2) to be released and the braking effect to be neutralised. 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 and 12) and with a microswitch (13) 1). The microswitch (13) is provided to prevent machine (e.g. motor) start-up before the brake has been released. The four (2x2) thermoswitches (11 and 12) are connected in series with the microswitch (13) and 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) to allow the hand release lever to be installed. The hand release (29) 2) allows the brake to be released manually (e.g. in case of power failure).

Key to figures:

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

1) brake types with microswitch
2) brake types with hand release
3. Installation

3.1 Mechanical installation

The spring-applied single-disc brake must be slipped with its hub (17) onto 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). Make sure 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 by means of the deep groove ball bearing (18) of the hub (17). Fixing screws (10) are provided to allow the spring-applied single-disc brake to be screwed to the fixing surface (8) of the machine (e.g. motor). Before starting installation work, the O-ring (16) must be inserted into the corresponding groove provided in the solenoid housing (1.1). Make sure the fixing screws (10) are tightened evenly in diametrically opposite sequence and that the specified tightening torques (see Table 7/1) are not exceeded.

Note!

Make sure 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 no grinding sounds can be heard.

<table>
<thead>
<tr>
<th>Size</th>
<th>10</th>
<th>11</th>
<th>13</th>
<th>16</th>
<th>19</th>
<th>24</th>
</tr>
</thead>
<tbody>
<tr>
<td>L [mm]</td>
<td>70</td>
<td>70</td>
<td>90</td>
<td>90</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Mₘ [Nm]</td>
<td>9.7</td>
<td>9.7</td>
<td>24</td>
<td>24</td>
<td>45</td>
<td>45</td>
</tr>
</tbody>
</table>

Table 7/1: Hub dimensions (17); tightening torques of fixing screws (10)

Check that the fixing 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, cast iron, aluminium – with excellent thermal conductivity
- Absence of oil and grease

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

Attention!

The specified axial runout of the fixing surface (8) relative to the shaft end and the specified radial runout of the shaft end relative to the fixing surface (8) 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 allow the brake to be easily removed if maintenance work needs to be carried out at a later date.

Attention!

The Mₘ tightening torque specified for the fixing screws (10) must be strictly observed. The screws (10) must be tightened evenly in diametrically opposite sequence.
3.2 Installation of the hand release (29) (brakes types with hand release)

The lever of the hand release (29) must be inserted into the square socket of the two cams (29.1) which are firmly fitted to the circumference of the solenoid housing (1.1). Make sure the lever is correctly positioned. The mechanical release forces \( F \) and the maximum permitted release forces (actuation forces) \( F_{\text{max}} \) are specified in Table 8/1.

**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 the brake during normal operation.

**Caution!**

The brake torque can be neutralised manually by means of the hand release feature (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.

<table>
<thead>
<tr>
<th>Size</th>
<th>Release force ( F ) [N]</th>
<th>Max. permitted release force ( F_{\text{max}} ) [N]</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>approx. 18</td>
<td>50</td>
</tr>
<tr>
<td>11</td>
<td>approx. 35</td>
<td>50</td>
</tr>
<tr>
<td>13</td>
<td>approx. 45</td>
<td>125</td>
</tr>
<tr>
<td>16</td>
<td>approx. 90</td>
<td>125</td>
</tr>
<tr>
<td>19</td>
<td>approx. 85</td>
<td>240</td>
</tr>
<tr>
<td>24</td>
<td>approx. 170</td>
<td>240</td>
</tr>
</tbody>
</table>

Table 8/1: Release force \( F \), max. permitted release force \( F_{\text{max}} \) of hand release (29)

**Warning!**

Check that the mechanical hand release (29) is in a central position (see Fig. 6/1) 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 hand release lever in its central position (see Fig. 6/1) has been ensured.
3.3 Electrical connection and operation

The spring-applied brake must be connected to a DC power source via jumpers 1 (BD1) and 2 (BD2) on the connecting terminal (19) (see Fig. 9/2). The customer-specific connecting cable must be connected to the terminal (19) by means of a cable gland (30) (M20x1.5). Remove the cover (26) of the connector box (25) so that the individual strands of the connecting cable can be connected to the terminal. The connector sleeve (30.2) of the cable gland (30) is firmly screwed to the solenoid housing (1.1) when delivered (see Fig. 9/1, MA = 12 Nm). The cap nut (30.1) must be tightened to a tightening torque of MA = 12 Nm to seal, clamp (clamping range 7…13 mm) and strain-relieve the customer-specific connecting cable. After completion of these steps, the cover (26) of the connector box (25) must be reinstalled.

⚠️ Attention!

When fixing the cover (26) to the connector box (25), the MA tightening torques of the machine screws specified in Table 13/1 must be strictly observed. The flat seal (9) and spring washer (28) must be installed as shown in Fig. 6/1.

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 versions are available (see examples in Table 9/1) 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.

<table>
<thead>
<tr>
<th>Rectifier series</th>
<th>Rectifier type</th>
<th>Rated input voltage range U1/VAC (40-60 Hz)</th>
<th>Output voltage U2/VDC</th>
<th>Max. output current R-load I/ADC</th>
<th>Max. output current L-load I/ADC</th>
</tr>
</thead>
<tbody>
<tr>
<td>32 07.22B.0</td>
<td>half-wave</td>
<td>0-500 (±10%)</td>
<td>U1 • 0.445</td>
<td>1.6</td>
<td>2.0</td>
</tr>
<tr>
<td>32 07.23B.0</td>
<td>bridge</td>
<td>0-400 (±10%)</td>
<td>U1 • 0.890</td>
<td>1.6</td>
<td>2.0</td>
</tr>
<tr>
<td>32 17350E..</td>
<td>overexcitation bridge⇒half-wave</td>
<td>48-525 (±10%)</td>
<td>U1 • 0.890 / U1 • 0.445</td>
<td>2.3</td>
<td>3</td>
</tr>
<tr>
<td>32 17.2.B..</td>
<td>overexcitation bridge⇒half-wave</td>
<td>110-230 (±10%) / 220-415 (±10%)</td>
<td>U1 • 0.890 / U1 • 0.445</td>
<td>1.2</td>
<td>0.8</td>
</tr>
</tbody>
</table>

Specific rectifier specification sheets must be observed!

Table 9/1: 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-energised.

⚠️ **Attention!**

The peak voltage $U_{\text{Vmax}}$ during disconnection without protective circuit may reach **several thousand V** 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. The maximum permitted overvoltage during disconnection is 1500 V. If Kendrion Binder rectifiers are used (see Table 9/1), 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.

⚠️ **Attention!**

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

3.3.2 AC power supply

Direct connection of the spring-applied single-disc brake 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 allows brake humming to 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

**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.
Fig. 11/1: Suggested wiring of brake and safety switches (circuit diagram)

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

In case of DC side switching, the brake must be provided with a protective circuit to avoid overvoltage. Additional protective elements (e.g. varistors, spark arresters, etc.) must be installed to avoid damage such as burns or welded contacts.

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 and 12) connection

The four (2x2) thermoswitches (11 and 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 and 12)) must be tied into the control circuit of the machine (e.g. motor) (see Fig. Fig. 11/1). This is to ensure that the microswitch (13) prevents any start-up of the machine (e.g. motor) before the spring-applied single-disc brake has been released. The four (2x2) thermoswitches (11 and 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 connector box (25) must be removed to allow the connecting cable of the safety switches (microswitch (13) and thermoswitches (11 and 12)) to be installed. The customer-specific connecting cable for the safety switches can be fed into the connector 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 with the connecting terminal (19) (see Section 3.3, Fig. 9/2). After completion of these steps, the cover (26) of the connector box (25) must be reinstalled.

Attention!

When fixing the cover (26) to the connector box (25), the Mₘₐₜ tightening torques of the machine screws specified in Table 13/1 must be strictly observed.
### Table 13/1: Tightening torques of machine screws

<table>
<thead>
<tr>
<th></th>
<th>Size 10</th>
<th>11</th>
<th>13</th>
<th>16</th>
<th>19</th>
<th>24</th>
</tr>
</thead>
<tbody>
<tr>
<td>$M_a$ tightening torque [Nm] of machine screws (20) for cover (7)</td>
<td>5.6</td>
<td>5.6</td>
<td>24</td>
<td>24</td>
<td>45</td>
<td>45</td>
</tr>
<tr>
<td>$M_a$ tightening torque [Nm] of machine screws (22) for flange (3)</td>
<td>7.6</td>
<td>7.6</td>
<td>9.7</td>
<td>9.7</td>
<td>24</td>
<td>24</td>
</tr>
<tr>
<td>$M_a$ tightening torque [Nm] of machine screws (27) for cover (26) of connector box (25)</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
</tbody>
</table>

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

#### Note!

The suggested wiring of the spring-applied single-disc brake with microswitch (13) shown in Fig. 11/1 is based on the generally accepted recommendations for the connection of electromagnetic components used in electric 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 minimised. 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 76 ..E..B00 series of spring-applied single-disc brakes are designed for industrial applications to which the following EMC standards apply: Generic Immunity Standard VKE 0839, part 6-2 (EN 61000-6-2), and Generic Emission Standard VDE 0839, part 81-2 (EN 50081-2). 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 in the 76 ..E..B00 series 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.

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-energised 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 damage is avoided (e.g. motor start-up before the brake has been released caused by phase failure in the case of two-phase energised 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 provided that any 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-energised temporarily. 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 recommended electronic rectifiers 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 50/60 Hz AC voltage, all brakes comply with the limit values
   applicable to Class B equipment.

b) Conducted interference:
   When connected to a DC power source, the electromagnetic brakes meet the limit values applicable
to Class A equipment. If the brakes are connected to a 50/60 Hz AC power source and equipped with electronic
rectifiers or other electronic controls, interference suppression measures as shown in Fig. 15/1 must be
taken to ensure compliance with the limit values applicable to Class A equipment. Interference suppression capacitors should be used which must be
dimensioned to suit the connection data of the electromagnetic components and the specific mains
conditions. The recommended rectifiers specified in Section 3.3 are CE mark certified in accordance with the
EMC Directive. They have built-in interference suppression components and comply at least with the
requirements of EN 55011 for Class A equipment, unless otherwise specified in the specification sheet.
When brakes are used with the specified rectifiers or with other types of rectifiers, the recommended
values listed in Table 16/1 should be observed. Interference suppression components should be
installed as close as possible to the consumer. 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. The rectifiers specified in Section 3.2 are equipped with free-wheel diodes and/or varistors to limit
the disconnection voltage. In case of DC side switching, a varistor rated for the type-specific maximum
operating voltage and connected in parallel with the field coil (1.2) limits the peak voltage to the values
specified in Table 16/2.

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.
<table>
<thead>
<tr>
<th>Rectifier type</th>
<th>Rated input voltage range U1/VAC (40-60 Hz)</th>
<th>DC at L-load (ADC)</th>
<th>Capacitor (nF(VAC))</th>
</tr>
</thead>
<tbody>
<tr>
<td>Half-wave rectifier 32 07.22B.0</td>
<td>up to 500 (+10%)</td>
<td>up to 2.0</td>
<td>no additional interference suppression measures required</td>
</tr>
<tr>
<td>Bridge rectifier 32 07.23B.0</td>
<td>up to 400 (+10%)</td>
<td>up to 2.0</td>
<td>no additional interference suppression measures required</td>
</tr>
<tr>
<td>Overexcitation rectifier 32 17350E..</td>
<td>48-525</td>
<td>up to 3</td>
<td>no additional interference suppression measures required</td>
</tr>
<tr>
<td>Overexcitation rectifier 32 17.2.B..</td>
<td>110-230 220-415</td>
<td>up to 1.5 up to 1.0</td>
<td>no additional interference suppression measures required</td>
</tr>
</tbody>
</table>

Table 16/1

<table>
<thead>
<tr>
<th>Rectifier Input voltage (VAC)</th>
<th>Recommended disconnection voltage for DC side switching (V)</th>
</tr>
</thead>
<tbody>
<tr>
<td>250</td>
<td>700</td>
</tr>
<tr>
<td>440</td>
<td>1200</td>
</tr>
<tr>
<td>550</td>
<td>1500</td>
</tr>
<tr>
<td>630</td>
<td>1700</td>
</tr>
</tbody>
</table>

Table 16/2
3.5 Set-up and 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 fixing 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 fixing surface (mounting side) (8) is open, adequate sealing must be provided in accordance with the Kendrion Binder recommended installation procedure E76 00A0030 000. In this case, the maximum possible protection rating is IP 56. After connection of the brake, an operational test must be performed to check that the friction disc (5) runs smoothly. For this purpose, turn the shaft (while the brake is energised and the machine (e.g. motor) is unpowered). Install the required guards and protections after completion of installation.

**Specifications on rating plates (example):**

| 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 |

Certification codes:
(to EN 60079-0)

- **II 2G** group II equipment; category 2G (gas atmospheres); zones 1 and 2
- **II 2D** group II equipment; category 2D (combustible dust atmospheres); zones 21 and 22
- **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
- **tD A21** protection by enclosures for use in the presence of combustible dust according to method A for zone 21
- **DMT 02** certification authority and certification year
- **ATEX E 122 X** certification number
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 (e.g. motor) is re-started, the brake must be de-energised.

Caution!

The brake surface temperature may rise to over 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 lever (29).

Caution!

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 \( M_2 \) rated torque adjustments

The brakes are factory-adjusted to the \( M_2 \) rated torque (as specified in the purchase order). The \( M_2 \) rated torque is specified on the rating plate (33) of the brake. In case fine adjustment is required, the \( M_2 \) rated torque can be continuously reduced. However, it must not be increased. In order to adjust the torque, proceed as follows: Loosen the machine screws (20) provided on the cover (7) and remove the cover (7). Screw in the machine 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 uniformly on all machine screws (32). Check that the requirements in terms of the minimum length of projection \( x_{\text{min}} \) (see Table 18/1) of the machine screw (32) from the flange (3) are met. The change in the \( M_2 \) rated torque resulting from these adjustments is specified in Table 18/1. The factory-set nominal value (approximate value) of the length of projection \( x_{\text{nom}} \) (see Table 18/1) is marked on the flange.

<table>
<thead>
<tr>
<th>( \Delta M_2 )/mm [Nm]</th>
<th>10</th>
<th>11</th>
<th>13</th>
<th>16</th>
<th>19</th>
<th>24</th>
</tr>
</thead>
<tbody>
<tr>
<td>( x_{\text{nom}} )/mm</td>
<td>10.5</td>
<td>10.5</td>
<td>11.5</td>
<td>11</td>
<td>11</td>
<td>11</td>
</tr>
<tr>
<td>( x_{\text{min}} )/mm</td>
<td>7.5</td>
<td>7.5</td>
<td>9</td>
<td>9</td>
<td>9</td>
<td>9</td>
</tr>
</tbody>
</table>

Table 18/1: Change in the \( M_2 \) rated torque from 1 mm axial adjustment of the machine screw (32); permitted projection \( x_{\text{min}} \)

Warning!

Any adjustment of the rated torque must be performed by the manufacturer’s authorised 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 $s_{\text{max}}$) and that the safety switches (microswitch (13) ¹ and thermoswitches (11 and 12)) must be checked at regular intervals. These 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 maintenance work. When opening the flameproof enclosed solenoid housing (1.1) to allow the friction disc (5) to be replaced, 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.

¹) brake types with microswitch

⚠️ 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 authorised expert. Any measures required to restore explosion protection must be performed by the manufacturer or by authorised repair shops (see Section 12).

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

Loosen the machine screws (27) provided on the cover (26) of the connector box (25) and remove the cover (26). Disconnect the strands of the connecting cables (field coil (1.2) and safety switches) from the connecting terminal (19). Unscrew the cap nut (30.1) of the cable gland (30) and remove the connecting cables from the connector box (25). Loosen the fixing 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 machine screws (e.g., in accordance with ISO 4762).

Checking the air gap 's':

Loosen the machine 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 machine screws (32). Loosen the machine 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!

Make sure that the connections of the four thermoswitches (11 and 12) are not damaged or loosened when removing the flange (3).
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, proceed as described above under "Brake removal from the machine (e.g. motor)" and "Opening the solenoid housing (1.1)". After having removed the friction disc (5), remove the circlips (14 and 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 machine screws (32) project from the flange (3) by the length $x_{\text{nom}}$ (approximate value – see Table 18/1) marked on the flange (3). 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 fixing screws (10) be tightened applying the $M_5$ tightening torque specified in Table 7/1. The machine screws (20) on the cover (7) and the machine screws (22) must be tightened to the $M_\alpha$ torque specified in Table 13/1. The O-ring (24), spring washer (21 and 28) and flat seal (9) must be installed as shown in Fig. 6/1.

⚠️ 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 $s_{\text{max}}$ (see "Technical specifications") has been exceeded. In this case, the braking effect cannot be neutralised.

⚠️ Warning!

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

Microswitch (13) adjustment or replacement (only brakes with microswitch):

The spring-applied single-disc brake must be released electrically to allow the microswitch (13) to be adjusted. Loosen the machine 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 ON position, it must be turned anticlockwise to OFF. 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"), such work must be carried out by the manufacturer or by an authorised repair shop due to the difficult installation of the microswitch with the four thermoswitches (11 and 12).
Thermoswitch replacement (11 and 12)

The thermoswitches (11 and 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 authorised repair shop due to the difficult installation of the thermoswitches with the microswitch (13) 1). The thermoswitches (11 and 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 and 12) are exceeded. Under normal conditions, the thermoswitches (11 and 12) remain closed during the entire operation of the spring-applied single-disc brake.

1) brake types with microswitch

Attention!

The machine screws (20) provided on the cover (7) must be tightened to the Mₘₐₜ torque specified in Table 13/1. The O-ring (24) and spring washer (21) must be installed as shown in Fig. 6/1.

Information on flameproof gaps without thread and flameproof thread gaps

All flameproof gaps are factory-specified. The gap dimensions and surface specifications (Ra < 6.3 μm) 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 authorised 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, check that

- the machine (e.g. motor) is secured against accidental or unintentional start-up.
- no load torque is applied to 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.
- the friction lining has not swollen or turned vitreous.
4.2 Spare parts and accessories

<table>
<thead>
<tr>
<th>Type</th>
<th>Friction disc (5)</th>
<th>Flat seal (9)</th>
<th>O-ring (16)</th>
<th>Fixing screw (10)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>73 24111E00400</td>
<td>76 24E11B00044</td>
<td>602633</td>
<td>304046</td>
</tr>
<tr>
<td>11</td>
<td>73 24111E00400</td>
<td>76 24E11B00044</td>
<td>602633</td>
<td>304046</td>
</tr>
<tr>
<td>13</td>
<td>73 24116E00400</td>
<td>76 24E11B00044</td>
<td>602635</td>
<td>3040071</td>
</tr>
<tr>
<td>16</td>
<td>73 24116E00400</td>
<td>76 24E11B00044</td>
<td>602635</td>
<td>304071</td>
</tr>
<tr>
<td>19</td>
<td>76 14124E00400</td>
<td>76 24E11B00044</td>
<td>602637</td>
<td>304107</td>
</tr>
<tr>
<td>24</td>
<td>76 14124E00400</td>
<td>76 24E11B00044</td>
<td>602637</td>
<td>304107</td>
</tr>
</tbody>
</table>

Table 22/1: Spare parts (S) and accessories (A)

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

⚠️ Warning!

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

5. Condition at delivery

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

ℹ️ Note!

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

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 installation position, operating conditions and quality of the friction surfaces, clearly audible vibrations (squeaking) 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 rise to well over 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

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

Table 23/1: 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 harmonised 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 the safety instructions are strictly adhered to.

The user 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 authorised 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 assembled with machines, in particular 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 authorised and suitably qualified personnel (in accordance with VDE 0105; IEC 364). 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 Binder 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 Binder. 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. 30/1) 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. The operating conditions at normal rating specified in these Operating Instructions refer to DIN VDE 0580. The protection type is based on EN 60529. In case of deviations from these requirements, special precautions may have to be taken after consultation with the brake 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 Set-up and 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 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 VDE 0848, part 4; DIN 31000/VDE 1000; DIN VDE 0100, part 0420) 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

Make sure 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 liquids 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 liquids. The gradual brake wear and the resulting torque reduction of spring-applied brakes must be taken into consideration during set-up. 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.

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 lever are used, the lever must only be moved up to the release position in order to avoid deformation or breaks.

Note!

The maximum air gap $s_{\text{max}}$ (see Table 29/1 "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

Repair work must only be carried out by suitably qualified personnel (definition to IEC 364). 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 ENERGISED" affixed to the spring-applied single-disc brake must be strictly observed.
### 8.3 Warning symbols

#### Personal injury or equipment damage

<table>
<thead>
<tr>
<th>Symbol / Term</th>
<th>Warns against...</th>
<th>Potential risks and hazards</th>
</tr>
</thead>
<tbody>
<tr>
<td>Danger</td>
<td>imminent personal injury</td>
<td>fatal accidents or serious injury</td>
</tr>
<tr>
<td>Warning</td>
<td>potential risk of serious personal injury</td>
<td>fatal accidents or serious injury</td>
</tr>
<tr>
<td>Caution</td>
<td>potential risk of personal injury</td>
<td>minor injury</td>
</tr>
<tr>
<td>Attention</td>
<td>potential risk of equipment damage</td>
<td>damage to the components or other equipment</td>
</tr>
</tbody>
</table>

#### Information

<table>
<thead>
<tr>
<th>Symbol / Term</th>
<th>Provides information on...</th>
</tr>
</thead>
<tbody>
<tr>
<td>Note</td>
<td>the safe use and operation of the product</td>
</tr>
</tbody>
</table>
9. Definitions

(based on: DIN VDE 0580 July 2000, 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 $W_{\text{max}}$  
- 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 $P_{\text{max}}$  
- 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 synchronisation 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 $\Delta \theta_{21}$
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 85.

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

<table>
<thead>
<tr>
<th>Size</th>
<th>10</th>
<th>11</th>
<th>13</th>
<th>16</th>
<th>19</th>
<th>24</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated torque $M_2$ [Nm]</td>
<td>10</td>
<td>20</td>
<td>50</td>
<td>100</td>
<td>150</td>
<td>270</td>
</tr>
<tr>
<td>Max. speed $n_{\text{max}}$ [rpm]</td>
<td>6000</td>
<td>6000</td>
<td>3000</td>
<td>3000</td>
<td>3000</td>
<td>3000</td>
</tr>
<tr>
<td>Max. switching power $P_{\text{max}}$ [kJ/h]</td>
<td>270</td>
<td>270</td>
<td>400</td>
<td>400</td>
<td>570</td>
<td>570</td>
</tr>
<tr>
<td>Rated power $P_N$ [W]</td>
<td>56</td>
<td>56</td>
<td>82</td>
<td>82</td>
<td>91</td>
<td>91</td>
</tr>
<tr>
<td>Coupling time $t_1$ [ms]</td>
<td>80</td>
<td>70</td>
<td>110</td>
<td>90</td>
<td>180</td>
<td>140</td>
</tr>
<tr>
<td>Disconnection time $t_2$ [ms]</td>
<td>80</td>
<td>110</td>
<td>170</td>
<td>230</td>
<td>240</td>
<td>350</td>
</tr>
<tr>
<td>Moment of inertia – hub and friction disc $J$ [kg cm$^2$]</td>
<td>2.5</td>
<td>2.5</td>
<td>21.5</td>
<td>21.5</td>
<td>125</td>
<td>125</td>
</tr>
<tr>
<td>Weight $m$ [kg]</td>
<td>14.5</td>
<td>14.5</td>
<td>29</td>
<td>29</td>
<td>57</td>
<td>57</td>
</tr>
<tr>
<td>Rated air gap $s$ [mm]</td>
<td>0.25$^{+0.12}$</td>
<td>0.25$^{+0.12}$</td>
<td>0.25$^{+0.15}$</td>
<td>0.25$^{+0.15}$</td>
<td>0.25$^{+0.2}$</td>
<td>0.25$^{+0.2}$</td>
</tr>
<tr>
<td>Max. air gap $s_{\text{max}}$</td>
<td>0.7</td>
<td>0.7</td>
<td>0.9</td>
<td>0.9</td>
<td>1.1</td>
<td>1.1</td>
</tr>
</tbody>
</table>

Table 29/1: Technical specifications

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

<table>
<thead>
<tr>
<th>Technical specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. rated voltage [VDC]</td>
</tr>
<tr>
<td>Temperature class</td>
</tr>
<tr>
<td>Insulation class</td>
</tr>
<tr>
<td>Pollution degree</td>
</tr>
<tr>
<td>Protection to EN 60529</td>
</tr>
<tr>
<td>Ambient temperature [°C]</td>
</tr>
<tr>
<td>Brake type</td>
</tr>
<tr>
<td>Available rated torques $M_2$ [Nm]</td>
</tr>
</tbody>
</table>

Table 29/2: Microswitch specifications (only brakes with microswitch)
<table>
<thead>
<tr>
<th></th>
<th>10</th>
<th>11</th>
<th>13</th>
<th>16</th>
<th>19</th>
<th>24</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. rated voltage [VAC]</td>
<td></td>
<td></td>
<td></td>
<td>250</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rated current (cos ϕ=1.0) [A]</td>
<td></td>
<td></td>
<td></td>
<td>2.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rated current (cos ϕ=0.6) [A]</td>
<td></td>
<td></td>
<td></td>
<td>1.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Service life (switching operations)</td>
<td></td>
<td></td>
<td></td>
<td>5000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contact type</td>
<td></td>
<td>normally closed</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nominal temperature (switching temperature) thermostwitch 11 (flange (3)) [°C]</td>
<td></td>
<td>140</td>
<td>140</td>
<td>140</td>
<td>140</td>
<td>148</td>
</tr>
<tr>
<td>Nominal temperature (switching temperature) thermostwitch 12 (coil (1.2)) [°C]</td>
<td></td>
<td>118</td>
<td>118</td>
<td>100</td>
<td>100</td>
<td>109</td>
</tr>
<tr>
<td>Min. current [mA]</td>
<td></td>
<td></td>
<td>50</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Switching temperature change as a function of the current load [K]</td>
<td></td>
<td></td>
<td>-2.5 at 1.5 A</td>
<td>-8.0 at 2.5 A</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 30/2: Thermoswitch specifications

**Explanations on the technical specifications:**

$W_{\text{max}}$ (maximum switching work) is the switching work that must not be exceeded during braking operations at max. 1500 rpm. Braking operations at >1500 rpm substantially reduce the maximum permitted switching work per switching operation. Such operation is only allowed after prior consultation with the manufacturer. The maximum switching power $P_{\text{max}}$ 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. 30/1 ($W_{\text{max}}$ as a function of the number of switching operations per hour $Z$) applies. The $P_{\text{max}}$ and $W_{\text{max}}$ 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 $M_2$ characterise 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 31/1). Vertical brake operation is only allowed after prior consultation with the manufacturer.

![Fig. 30/1: Max. switching work $W_{\text{max}}$ per switching operation as a function of the number of switching operations per hour $Z$ (values based on n=1500 rpm)](image-url)
<table>
<thead>
<tr>
<th>Size</th>
<th>10</th>
<th>11</th>
<th>13</th>
<th>16</th>
<th>19</th>
<th>24</th>
</tr>
</thead>
<tbody>
<tr>
<td>Speed ( n ) [rpm]</td>
<td>300</td>
<td>300</td>
<td>150</td>
<td>150</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Coil ON time ( t_5 ) [s]</td>
<td>4.5</td>
<td>11</td>
<td>9</td>
<td>20</td>
<td>13</td>
<td>25</td>
</tr>
<tr>
<td>Coil OFF time ( t_6 ) [s]</td>
<td>1.5</td>
<td>1.5</td>
<td>1.5</td>
<td>1.5</td>
<td>1.5</td>
<td>1.5</td>
</tr>
<tr>
<td>Break-in period ( t_{tot} ) [min]</td>
<td>approx. 2</td>
<td>approx. 2</td>
<td>approx. 2</td>
<td>approx. 2</td>
<td>approx. 2</td>
<td>approx. 2</td>
</tr>
</tbody>
</table>

Table 31/1: Break-in process parameters for the spring-applied single-disc brake

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

The required operating conditions specified in **DIN VDE 0580** and the information provided in the **EEX LINE specification sheet** and layout drawing must be observed during operation of the spring-applied single-disc brake!

**Specifications subject to change without notice!**

**11. Product versions (types)**

Versions:  
76 14E..B00 spring-applied single-disc brake without microswitch and hand release  
76 16E..B00 spring-applied single-disc brake without microswitch, with hand release  
76 24E..B00 spring-applied single-disc brake with microswitch, without hand release  
76 26E..B00 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. Authorised repair shops for maintenance work**

**Kendrion Binder Magnete GmbH**  
**Industrial Drive Systems**  
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78048 Villingen-Schwenningen  
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Tel. +49 (0)7721 877-1417  
Fax +49 (0)7721 877-1462

**United Kingdom**  
**Kendrion Binder Magnete (UK) Ltd.**  
Huddersfield Road, Low Moor  
Bradford, West Yorkshire, BD12 0TQ  
Tel. +44 (0)1274 601111  
Fax +44 (0)1274 691093