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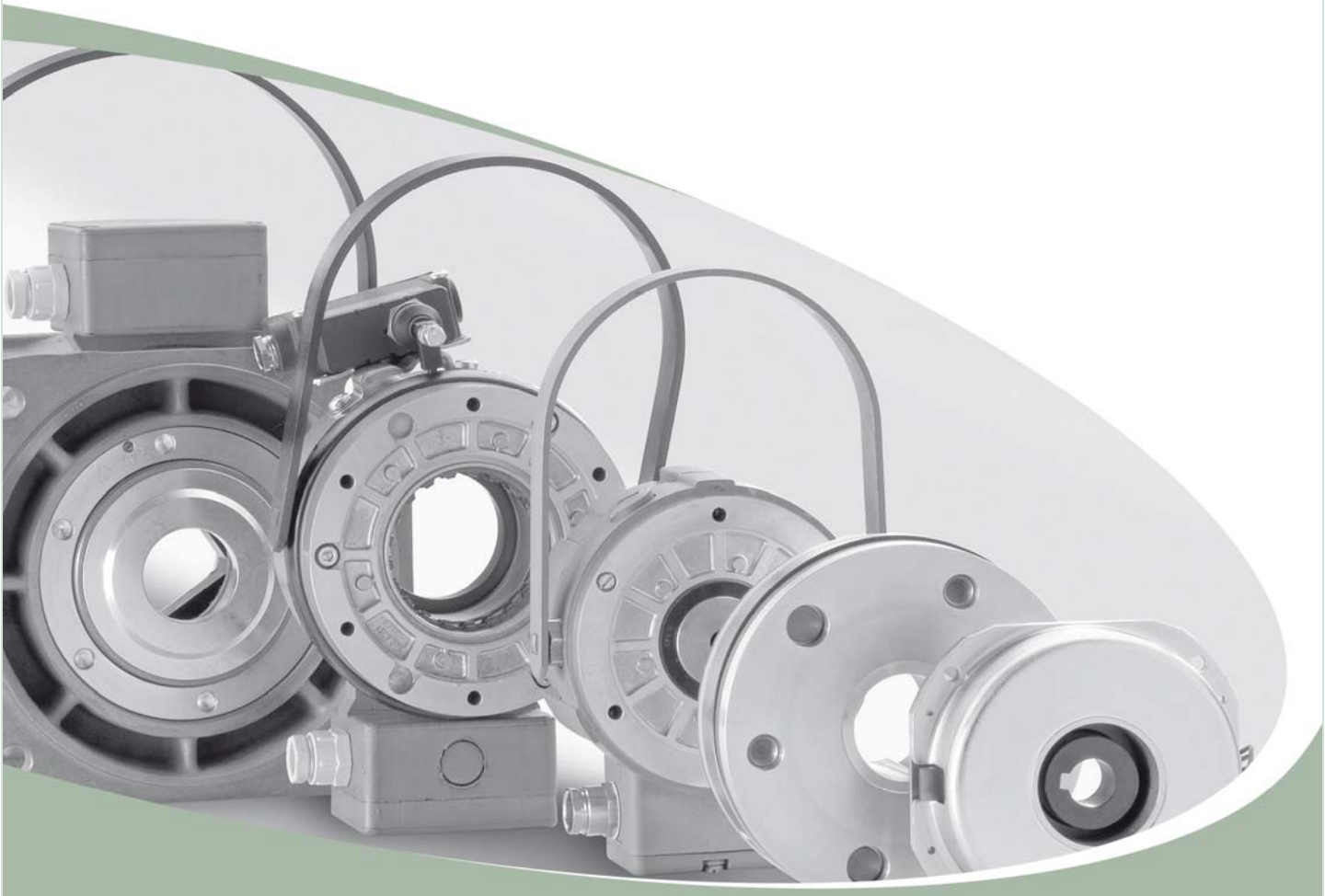

MODULE LINE

Operating Instructions 77 500..B..

Spring-applied single-disc brake module

Types:	77 50013B16	77 50019B15
	77 50024B15	77 50029B15

BINDER

Contents

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1. General information

1.1 Introduction

These Operating Instructions describe the operating principle and features of Kendrion Binder spring-applied single-disc brake modules type 77 500..B...
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 module.
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 brake modules type 77 500..B.. 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. The output side of the spring-applied single-disc brake modules has the same fitting dimensions as the motor end shield. As a result, the brakes are designed as fail-safe holding brakes with emergency stop function for attachment to electric motors.

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. Being classified as "electromagnetic components", spring-applied single-disc brake modules 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.

1.3 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.

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.

Standards and directives:

EN 60529	Enclosure protection ratings
DIN VDE 0580	Electromagnetic devices and components

Products: Electromagnetically released spring-applied single-disc brake module
77 50013B16
77 50019B15
77 50024B15
77 50029B15

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12 Dec. 2013

Authorized signatory: .....

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2. Safety

2.1 Safety and warning symbols / Safety information

Personal injury or equipment damage			
Symbol / Signal word		**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 / Signal word		**Provides information on …**	
	Note	the safe use and operation of the product	

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 user of the machine to plan these measures and to check their implementation.

The user is required to ensure that:

- the brakes are only used in accordance with their intended use (see "Product description" section).
- the brakes are in perfect working order and checked at regular intervals.
- a complete copy of these Operating Instructions is kept available at the place of use of the brakes at all times.
- all applicable local and machinery-specific regulations and requirements are followed.
- 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.
- brake functionality is not interfered with by an external magnetic field.

2.2 Intended use

The brake modules described in these Operating Instructions are intended to be assembled with electric machines, in particular electric motors, for use on industrial equipment. Operation in potentially explosive or firedamp atmospheres is not allowed. The brake modules must be used in accordance with the operating requirements detailed in this manual. The rated power limits specified herein must not be exceeded. Use of the brake modules as service brakes or safety brakes is not permitted.

2.3 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 qualified specialist 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.

2.3.1 Installation

When connecting the brakes described in these Operating Instructions check that the voltage and voltage type comply with the specifications on the rating plate. 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 or damage to equipment caused by:

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

2.3.2 Start-up

The brakes must not be started up when:

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

2.3.3 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.
Check 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 towards the end of the brake service life may cause an approximately 10% torque reduction. This must be taken into consideration in the set-up of the machine or overall system.
Due to the diverse ambient conditions in which the brakes may be used, always check that the brake module is in perfect working order before start-up.
Torque reductions cannot be excluded if the brake module 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.

Note!

The maximum air gap s_{max} (see Table 28/1: air gap s_{nom} and s_{max}) must not be exceeded throughout the entire brake module service life. (Please refer to Section 6 “Maintenance” for details.)

2.3.4 Maintenance and repair

Repair work must only be carried out by qualified specialist 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.

3. Emissions

3.1 Noise

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

3.2 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.

3.3 Electromagnetic compatibility

As required by the German Electromagnetic Compatibility Act (EMVG), electromagnetic compatibility must be guaranteed 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 brake modules type 77 500..B.. 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 use of the brake and some other applications.
For additional information on electromagnetic compatibility, especially with respect to the recommended electronic rectifiers specified in Section 5.3, please refer to the applicable data sheets.

Immunity according to EN 61000-4:

EN 61000-4-2 Electrostatic discharge:
The spring-applied single-disc brake modules comply at least with severity level 3 without requiring additional measures. The recommended rectifiers specified in Section 5.3 conform to severity level 3 without additional measures.

EN 61000-4-3 Electromagnetic fields:
The spring-applied single-disc brake modules 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 spring-applied single-disc brake modules comply at least with severity level 3 without requiring additional measures. The recommended rectifiers conform to severity level 3.

EN 61000-4-5 Surge:
The spring-applied single-disc brake modules 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 spring-applied single-disc brake modules 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:
Spring-applied single-disc brake modules 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 provided that 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 brake modules 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. 9/1 must be taken to ensure compliance with the limit values applicable to Class A equipment.

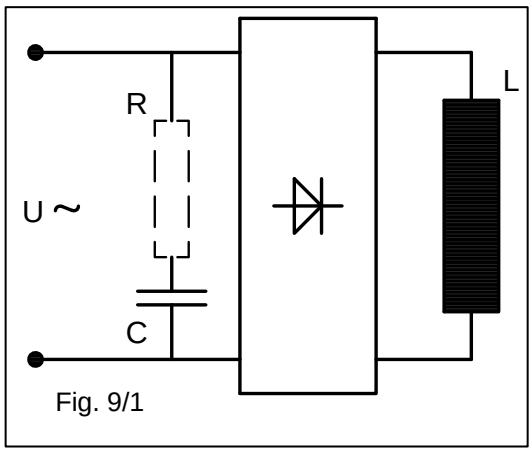


Fig. 9/1

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 5.3 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 sheets. When brakes are used with the specified rectifiers or with other types of rectifiers, the recommended values listed in Table 9/1 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 5.3 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 9/2.

Note!

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 type	Rated input voltage range U_1/VAC (40-60 Hz)	DC at L-load (ADC)	Capacitor (nF/VAC)
Half-wave rectifier 32 07332B40	up to 500 (±10%)	up to 2.0	no additional interference suppression measures required

Table 9/1

Max. rectifier operating voltage (VAC)	Recommended disconnection voltage for DC side switching (V)
250	700

Table 9/2

4. Product description

4.1 Operating principle

The brake module is an electromagnetic component with built-in electromagnetically released spring-applied single-disc brake designed to operate dry. The braking effect is produced by the spring force and neutralized electromagnetically. The brake module with ball bearing supported brake shaft should preferably be mounted to the A-face end shield of electric motors. The brake can also be equipped with an optional hand release so that it can be released manually.

4.2 Design

The solenoid housing (1.1) with the encapsulated field coil (1.2) accommodates the armature (2), friction disc (4) and flange (3). The flange is fixed by means of the cheese head screws (10). The compression springs (7) located in the solenoid housing (1.1) are supported on the adjusting ring (9) and solenoid housing (1.1) by the studs (8) (size 13 brakes: compression springs (7) only). These compression springs generate an axial force that is transmitted to the friction disc (4) through the armature (2). As a result, the friction disc (4) is clamped between the firmly fixed flange (3) and the armature (2) and the braking effect (torque) is produced. Straight pins (5) are provided which act as tangential torque supports for the armature (2) relative to the solenoid housing (1.1).
When DC voltage is applied to the field coil (1.2), the electromagnetic force thus generated causes the armature (2) to be attracted, overcoming the force of the compression springs (7). The friction disc (4) is thus released and the braking effect is neutralized.
As the brake module is a closed system, no forces are transmitted outwards away from the brake. Transmission of the braking force from the axially moveable friction disc (4) to the brake shaft (13) is achieved through the form-fit connection of the square socket in the friction disc with the brake shaft (13), with the brake shaft being rigidly connected with the motor shaft. This applies to size 13, 19 and 24 brakes. When a size 29 brake is used, the friction disc is connected with the brake shaft by means of the teeth provided on the disc and shaft. The ball bearing (15) located between the solenoid housing (1.1) and brake shaft (13) ensures that the brake can be centred relative to the brake shaft (13) and motor shaft when it is mounted to the motor flange. The bearing also absorbs transverse forces that act radially on the brake shaft (13). The ball bearing is factory-sealed.
An additional sealing ring (6) is provided which protects the friction disc (4) against dirt, grease or oil ingress in case the factory-installed ball bearing sealing rings are damaged and ensures that abrasive grit and dust produced by the friction disc cannot escape.
On the drive side, the flange (3) and brake shaft (13) are sealed by the sealing ring (11). The optional hand release (24) allows the spring-applied single-disc brake module to be released manually (e.g. in case of power failure). The brake must be connected directly to the terminals in the connector box (19).
The transmissible torque of the brake module can be changed with the adjusting ring (9). Rubber bolts (18) and an O-ring (26) are provided to reduce the noise and vibration produced by the friction disc (4).

Key to Fig. 11/1:

1.1	Solenoid housing	15	Ball bearing
1.2	Field coil	16	Circlip
2	Armature	17	Screw plug [1]
3	Flange	18	Rubber bolt [2]
4	Friction disc	19	Connector box
5	Straight pin	20	Feather key
6	Sealing ring		
7	Compression spring	22	Sealing washer
8	Stud (not used in size 13 brakes)	23	Cover (2 x arranged at 180°) [3]
9	Adjusting ring (not used in size 13 brakes)	24	Hand release (accessories)
10	Cheese head screw	25	Set screw [1]
11	Sealing ring	26	O-ring [4]
12	Disc	E	Adjusting ring clearance
13	Brake shaft	A	Contact surface motor side
14	Spring washer	B	Contact surface brake shaft (13)

[1] bonded with Loctite 243; installed in brake shaft (13)
[2] accessories for size 19 and 24 brakes; included as standard parts of friction disc (4) in size 13 brakes
[3] only used in brakes without hand release (24)
[4] only in size 29 brakes

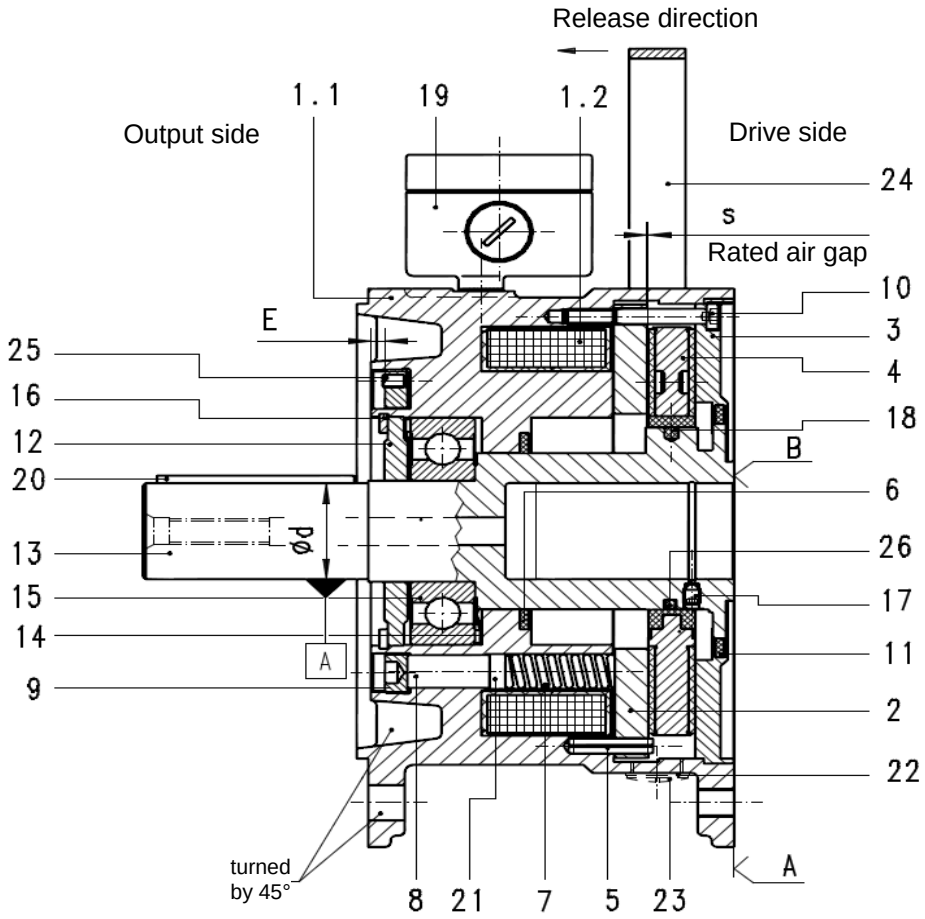
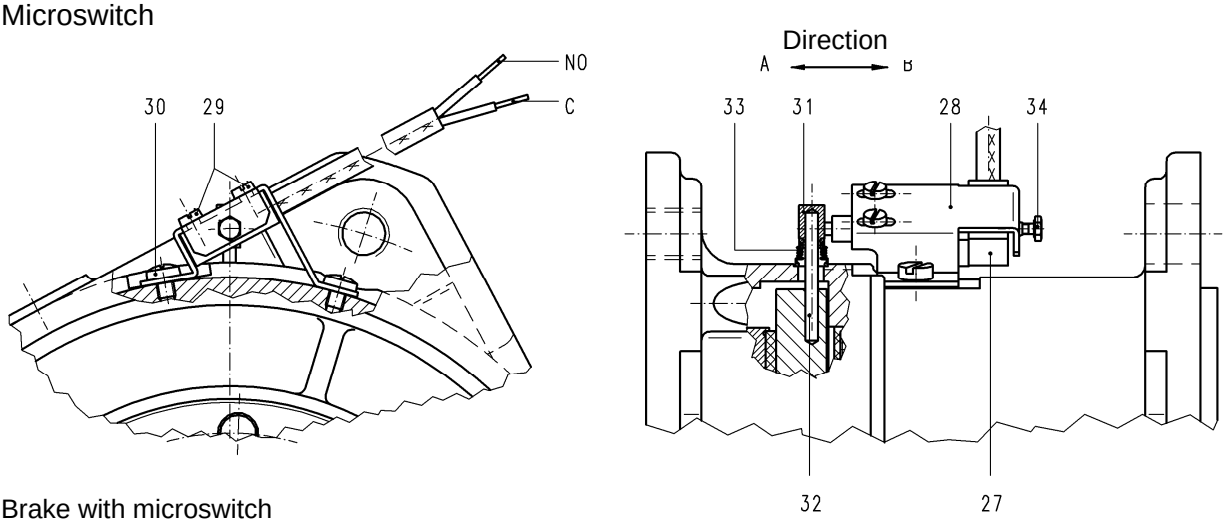


Fig. 11/1: Spring-applied single-disc brake module 77 500..B15

Microswitch



Brake with microswitch

Fig. 11/2: Microswitch installation on spring-applied single-disc brake module 77 500..B15

Key to Fig. 11/2:

27	Microswitch	31	Stud
28	Strap	32	Straight pin
29	Cheese head screw (2x)	33	Bellows
30	Oval head screw (2x)	34	Hexagon head cap screw M2.5x8 (not supplied)

5. Installation

Attention!

Every time the spring-applied single-disc brake module is reassembled, the fixing screws and cheese head screws (10) must be tightened to the M_A tightening torques specified in Table 13/1 and Table 22/1. The adjusting ring (9) must be secured with the set screw (25) (tightening torque M_A = 3 Nm). Loctite 243 must be applied to the set screw (25). When maintenance work is carried out on the connector box (19) (see Section 5.3), the cheese head screws (19.3) must be tightened to M_A = 1.6 Nm when installing the cover (19.1) with the connector box (19). Damage to the seal between the connector box (19) and cover (19.1) must be avoided.

5.1 Mechanical installation

5.1.1 Brake shaft (13) installation

The press-fit connection of the brake shaft (13) with the motor shaft provides reliable transmission of the brake torque. An additional form-fit connection in the form of a feather key, for example, is not allowed. The motor shaft must not have a feather key groove.

Attention!

The fits and surface roughness required for the motor shaft must be chosen by the brake user according to the adjusted transmissible brake torque and must be suitable to ensure reliable transmission of the generated brake torques.

1. Before heating the brake shaft (13), make sure that both the brake shaft (13) and the motor shaft end are dry and free from grease and that the following parts have been removed:
   screw plug (17) – any brake size,
   rubber bolts (18) (accessories) – sizes 19 + 24,
   O-ring (26) (accessories) – size 29.
2. Check the position of the motor shaft contact shoulder relative to the contact surface of the brake on the motor flange and correct it by installing shim rings, if necessary. The permitted tolerance is ± 0.5 mm.
3. Before mounting the brake shaft (13), check the radial runout on the motor shaft end and mark the maximum runout angle on the front face of the motor shaft.
4. After completion of the above operations, the brake shaft (13) must be evenly heated in an electric oven or by means of an inductive heating system until it has reached a temperature of 280°C to 300°C. Once heated, the brake shaft (13) must be slipped onto the motor shaft end until it touches the contact shoulder and secured in axial direction until is has cooled down. Make sure that the brake shaft (13) is mounted in such a way that the radial runout mark is offset by 180° relative to the runout mark on the motor shaft.
5. After the brake shaft has cooled down, screw the screw plug (17) into the brake shaft (13) and secure it with Loctite type 222. This applies to all brake sizes.
6. When rubber bolts (18) are used (size 19 and 24 brakes), insert the bolts (18) into the bores provided in the brake shaft (13) (see Fig. 11/1) after the shaft has cooled down.
7. When using a size 29 brake, insert the O-ring (26) into the groove in the brake shaft (13) (see Fig. 11/1).
8. If rubber bolts (18) (size 19 + 24 brakes) or an O-ring (26) (size 29 brakes) are used, check that they are correctly positioned (rubber bolts (18): rounded end pointing outwards in the bores of the brake shaft (13) square socket; O-ring (26): located in the groove near the brake shaft teeth).
9. During brake mounting, apply talc to the projecting surface of the rubber bolts (18) or O-ring (26) to reduce slip-on forces.

5.1.2 Mounting the brake module to the motor

Attention!

The friction surfaces of the friction disc (4), the guide surfaces of the square socket (size 13, 19, 24 brakes) or the teeth of the friction disc (4) (size 29 brakes) must be free from grease or oil. Do not use any lubricant to improve the axial guide properties of the friction disc (4) and make sure to avoid damage to the sealing rings (6 and 11).

1. Mount the brake module in vertical position with the motor shaft pointing upwards.
2. Close the oil supply bore in the brake shaft (13) with the screw plug (17). Apply Loctite 222.
3. Mount the brake module to the motor by slipping it onto the brake shaft (13) until it makes contact with the motor flange. Ensure that the brake is parallel to the motor shaft and that a form-fit connection is established between the brake shaft (13) and the square socket (size 13, 19, 24 brakes) or with the internal teeth (size 29 brakes) of the friction disc (4).
4. The friction disc (4) is factory-centred in the spring-applied single-disc brake module to ensure easy installation.
5. Slightly tighten the fixing screws after having taken the preliminary assembly steps described above. Ensure that the brake is released electromagnetically after the spring-applied single-disc brake module has been connected (see Section 5.3).
6. Manual brake release by means of an attached hand release (24), for example, is not allowed. To complete brake mounting, use the ball bearing set (accessories).
7. The spring washers (14) must be placed into the solenoid housing (1.1) as shown in Fig. 11/1. Size 13 and 19 brakes require only one spring washer each, whereas size 24 and 29 brakes must be equipped with two spring washers.

Attention!

The brake shaft and ball bearing must not be exposed to any axial shocks. The disc (12) is essential to the correct operation of the brake module and must only be replaced by an original spare part.

8. In order to install the ball bearing (15), pressure must be evenly applied both to the inner and outer rings of the bearing (15) to force it onto the motor shaft until it touches the shaft shoulder of the brake shaft (13). The necessary pressure is generated through a mounting sleeve and the thread provided at the front end of the brake shaft (13).
9. The solenoid housing (1.1) is thus centred through the ball bearing. Proceed to install the disc (12) and circlip (16).

Attention!

The M_A tightening torque (Table 13/1) specified for the fixing screws must be strictly observed. The screws must be tightened evenly in diametrically opposite sequence.

10. Tighten the fixing screws to the M_A tightening torques specified in Table 13/1.

	Size			
	13	19	24	29
M_A tightening torque (fixing screws) [Nm]	42	70	165	165

Table 13/1: M_A tightening torques for fixing screws

5.2 Installation of accessories (not applicable to the brake shaft (13))

Hand release (24) (only applicable to retrofitted hand release):

1. Remove the two covers (23) located opposite each other on the circumference of the solenoid housing (1.1) (see Fig. 14/1).
2. Screw the cams (24.1) with the threaded bush into the bores of the covers (23), making sure they are correctly positioned (see figure to the right). Apply Loctite 243 to secure the cams.
3. Insert the hand release lever (24.2) into the square socket provided in the cams (24.1). The hand release can be operated by pushing the lever (24.2) in one direction (see Fig. 14/1).
4. The mechanical release forces F required to release the brake and the maximum permitted release forces (actuation forces) F_{max} are specified in Table 14/1. The release forces F are based on the highest transmissible (standard) torque (see "Technical specifications").

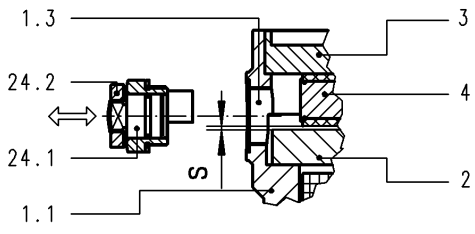


Fig. 14/1: Hand release and air gap control

Key to Fig. 14/1:

1.1	Solenoid housing	4	Friction disc
1.3	Bore for air gap measurement	24.1	Cam (complete)
2	Armature	24.2	Hand release lever
3	Flange	s	Air gap

	Size			
	13	19	24	29
Threaded bush tightening torque M_A [Nm]	20	26	35	35
Release force F [Nm]	80	130	200	240
Max. permitted release force (actuation force) F_{max} [N]	120	180	280	330

Table 14/1: Release force F, max. permitted release force (actuation force) F_{max} of hand release (24), M_A tightening torque of threaded bush of cams (24.1)

Warning!

Check that the mechanical hand release (24) is in a central position (see Fig. 11/1) when not in use. This is crucial to ensure reliable brake engagement. Otherwise, the full braking effect of the spring-applied single-disc brake module 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 (24) and automatic return of the hand release lever in its central position (see Fig. 11/1) has been ensured.

Caution!

The brake torque can be neutralized manually by means of an attached hand release (24). Consequently, the brake must be mounted in such a way that any unintentional actuation of the hand release (24), e.g. by removing the hand release lever, is excluded.

Note!

Machinery-specific regulations and requirements (e.g. for hoists, cranes and elevators) must be observed when using brakes with hand release (24).

Ball bearing set (ball bearing (15), spring washer (14), circlip (16)):

The ball bearing set is required as a second bearing for the motor shaft. The complete ball bearing set must be installed as described in Section 5.1.1.

Rubber bolts (18) (size 19 and 24 brakes), O-ring (26) (size 29 brakes):

To reduce the noise produced by the brake module during operation, rubber bolts (18) (size 19 and 24 brakes) or an O-ring (26) (size 29 brakes) can be installed in the brake shaft (13) as described in Section 5.1.1.

5.3 Electrical connection and operation

Warning!

The brake module 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.

The spring-applied single-disc brake module must be supplied with DC voltage.
Connection to an AC power source is via a half-wave rectifier (19.2). Brakes equipped with a built-in rectifier (19.2) can be connected directly to the AC power source.
The contact assignment is shown in Fig. 16/1.
Brakes equipped with connecting terminal (19.2) must be connected directly to DC voltage. The customer-specific connecting cable must be connected to the terminal (19.2) or built-in rectifier (19.2) by means of a cable gland (M16x1.5 for cross-sections of between 5 and 10 mm.
Remove the cover (19.1) of the connector box (19) so that the individual strands of the connecting cable can be connected to the terminal (19.2) or to the contacts of the built-in rectifier (19.2).

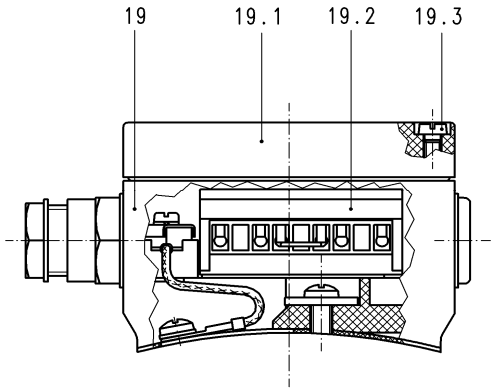


Fig. 15/1: Connector box (19) with terminal (19.2) or rectifier (19.2)

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	Max. output current L-load I/ADC
32 07332B40	half-wave	0-500 (±10%)	U_1 • 0.445	1.6	2.0
Specific rectifier specification sheets must be observed!					

Table 16/1: Rectifier for single-phase AC voltage supply via connecting terminal (19.2)

Attention!

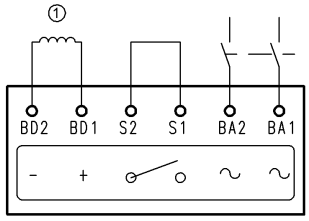
When installing the cover (19.1) and connector box (19), the cheese head screws (19.3) must be tightened to M_A = 1.6 Nm. Damage to the seal between the connector box (19) and cover (19.1) must be avoided.

Brakes equipped with built-in rectifiers (19.2) use half-wave rectification.
The built-in rectifier (19.2) can be wired in such a way that AC side switching (normal coupling time t_1) or DC side switching (short coupling time t_1) is possible (see Fig. 16/1).
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.

Attention!

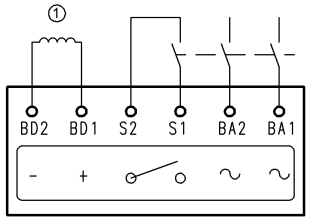
When connecting the rectifier (19.2), the terminals must be tightened to a tightening torque of M_A = 0.4 Nm.

Normal coupling time t_1:



① brake coil

Shorter coupling time t_1:

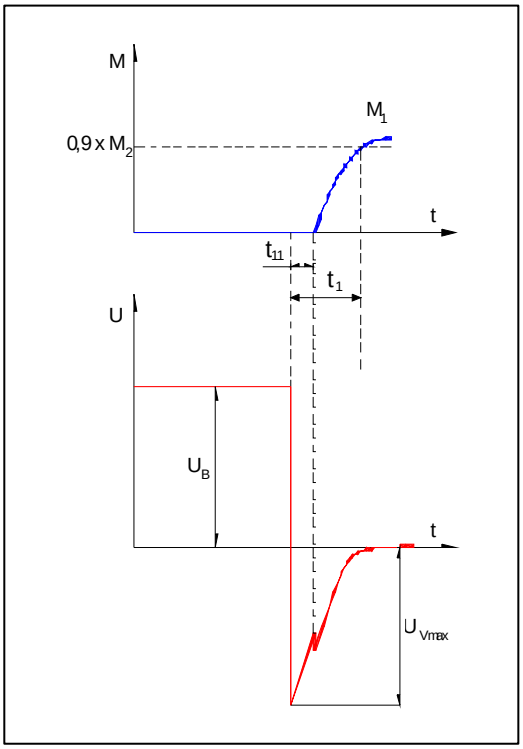


In case of DC side switching, AC side switching is also required.

Fig. 16/1: Rectifier (contact assignment)

5.3.1 DC power supply

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



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

Attention!

The peak voltage U_{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 16/1), the protective circuit required for the built-in electronic components and field coil (1.2) is included in the rectifier and limits the disconnection voltage to approx. 300 V. This also applies to contacts S1 and S2 (DC side disconnection).

Attention!

In case of DC side switching and connection to a DC power source, the brake must be operated 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 fusing of contacts.

Attention!

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

5.3.2 AC power supply

Warning!

Work on the brake must only be carried out by qualified specialist 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.

Direct connection of the spring-applied single-disc brake to an AC power source is only possible if a rectifier is used. The coupling times vary depending on the switching type (DC side switching or AC side switching) (see Section 5.3).

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.

DC side switching:

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

5.3.3 Electrical connection of brake modules with microswitch (27)

Note!

Machinery-specific regulations and requirements (e.g. for hoists, cranes and elevators) must be observed when using brakes with microswitches (27).
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 (27) and brake module.

Warning!

The motor circuit must be protected in such a way that no accidental motor start-up can occur when the microswitch (27) contact closes.

If brakes are equipped with a microswitch (27) to control the release status (released/engaged) of the spring-applied single-disc brake module, the microswitch (27) must be tied into the control circuit of the machine (e.g. motor). This is crucial to ensure that the microswitch (27) prevents start-up of the machine (e.g. motor) before the spring-applied single-disc brake module has been released. The optional microswitch (27) must be ordered together with the brake as it cannot be retrofitted to the brake at a later date. The microswitch (27) is factory-adjusted prior to shipment of the brake module.

5.4 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 (disconnected) and secured against accidental or unintentional start-up.

Attention!

When using machines (e.g. motors) with vertically upward directed shaft end, any ingress of fluids (water or cooling lubricant) into the ball bearing (15) of the brake module must be avoided. The brake module must be mounted in such a way that sufficient heat dissipation is ensured.

Attention!

Check that the brake has been connected in accordance with the specifications provided on the rating plate before it is started. 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 3.3 will cause damage to electronic rectifiers, electronic accessories, switching contacts and to the field coil (1.2).

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-energized.

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!

Attention!

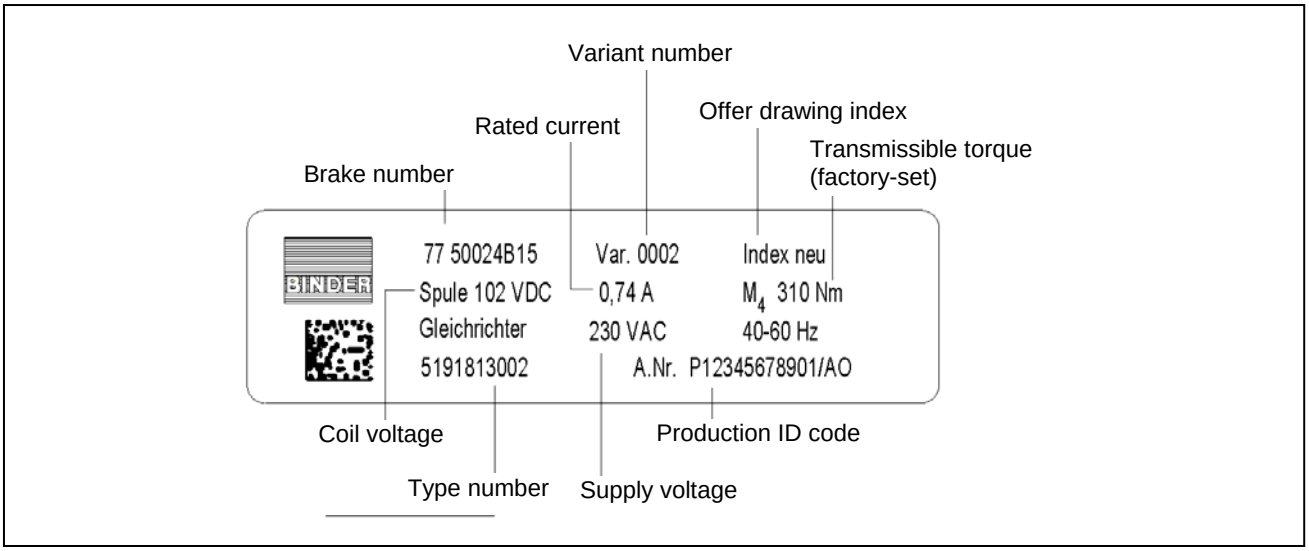
High-voltage tests performed during brake mounting within an overall system or during start-up must be carried out in such a way that damage to the built-in electronic accessories is avoided. The limits for high-voltage tests and follow-up tests specified by DIN VDE 0580 must be observed.

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.
- Ensure that power is supplied separately to the spring-applied single-disc brake module (and not to the motor) and turn the motor shaft while the brake is released to check that the friction disc (4) and brake shaft (13) move smoothly. Proceed to perform a functional test of the axial armature movement.
- Check that the axial and radial runout is within the tolerance range specified in EN 50347-N.
- Information on ball bearing break-in conditions, bearing lubrication intervals etc. is provided in the specification sheets of the bearing manufacturers and in the motor manual.

After completion of mounting, all necessary covers and guards must be installed.

Specifications on rating plates (example):



5.4.1 Manual brake release

Warning!

Extreme caution is advised during manual release (jog mode) of the spring-applied single-disc brake module (e.g. for maintenance work on the machine (e.g. motor) or in case of failure of the regular power supply and use of a UPS system). If the drive system is unbalanced, the load torque may accelerate the drive. The brake user is required to take adequate precautions to ensure that no hazardous situations are caused by the load torque when the brake module is released and engaged in jog mode.

The spring-applied single-disc brake module can be released "manually" by means of a mechanical hand release (24) (accessories). In case of failure of the regular power supply, it is also possible to use a commercial UPS (e.g. UPS battery system) for the electrical release of the brake module. For this purpose, the brake user is required to install a UPS system that complies with the voltage specifications given on the brake module rating plate.

5.5 M_4 transmissible torque adjustments

Attention!

When adjusting the adjusting ring (9) on the basis of the values given in the offer drawing, make absolutely sure that the M_4 transmissible torque is not below the minimum torque required.
The changed adjusting ring clearance "E" must be marked on the bottom of the solenoid housing. The adjusted theoretical M_4 transmissible torque must be entered in the blank field provided on the rating plate of the brake module (see rating plate example).
After adjustment of the M_4 transmissible torque, the brake user is required to ensure that the adjusting ring (9) is secured with the set screw (25), applying a tightening torque of M_A = 3 Nm.
The adjusting ring (9) must be turned in such a way that the set screw (25) can be located between the studs (8). The M_4 torque tolerance is +15%/-5%.

1. The brake modules are factory-adjusted to the standard M_4 transmissible torque specified in the specification sheet. The M_4 transmissible torque applicable at the time of shipment is specified on the rating plate.
2. The torque can be adjusted by means of the adjusting ring (9). After completion of adjustment, the ring must be locked by means of the set screw (25). The adjusting ring clearance "E" (see Fig. 11/1) is marked on the bottom of the solenoid housing near the set screw (25). After having loosened the set screw (25), the M_4 standard torque can be changed by changing the adjusting ring clearance "E" by means of a pin spanner.
3. After having changed the torque, the new adjusting ring clearance "E" must be marked on the solenoid housing. The adjusting ring must be locked by means of the set screw (25), making sure, however, that the set screw is not within the reach of the studs (8).
4. Secure the set screw (25) with Loctite 243, for example.
5. While torque variations only have a minor impact on coupling times t_1, the disconnection time t_2 is reduced proportionally to the torque reduction.

	Size		
	19	24	29
Transmissible torque change ΔM_4/mm [%]	approx. 15	approx. 12	approx. 14
M_4 transmissible torque (standard value) [Nm]	150	310	500
Maximum transmissible torque $M_{4\ max.}$	150	310	500

Table 20/1: Change in the M_4 transmissible torque [%] from 1 mm axial adjustment of the adjusting ring (9); M_4 transmissible torque (standard value) and maximum transmissible torque $M_{4\ max.}$

Note: Torque adjustments are not possible for size 13 brakes.

6. Maintenance

Warning!

Whenever carrying out inspection and maintenance work, 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 (4) cannot be cleaned.
- no swelling of the friction lining has occurred (to be checked by air gap measurement).
- no hardening (glazing) of the friction lining has occurred (only visible when the brake is released).
- the brake module has been switched off and disconnected from the power supply.

6.1 Checks and service

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 Table 28/1: air gap s_{nom} and s_{max}) has been exceeded. In this case, the braking effect cannot be neutralized. This may cause thermal overloading of and irreversible damage to the brake module if the machine (e.g. motor) is started before the brake has been released. Thermal overloading of the machine (e.g. motor) may occur if the machine (e.g. motor) is not started while the brake is still engaged.

1. The spring-applied single-disc brake module does not require any particular maintenance except that the air gap 's' (see Table 28/1: air gap s_{nom} and s_{max}) and the degree of wear of the friction disc (4) must be measured at regular intervals.
2. For this purpose, the brake must be released electromagnetically during motor standstill to allow the air gap 's' between the armature (2) and friction disc (4) to be measured through the threaded bore (1.3) by means of a feeler gauge. The air gap can only be measured after having removed the cover (23) or – when using brakes with hand release – after having removed the hand release lever (24.2) and complete cam assembly (24.1) (see Fig. 14/1).
3. If the maximum air gap s_{max} (see Table 28/1) is reached the friction disc (4) must be replaced to ensure functional reliability and safety of the brake. When replacing the friction disc (4), check the friction surfaces of the armature (2) and flange (3). It is not possible to perform adjustments (air gap adjustments) to compensate for wear.
4. If the ball bearing (15) (accessories) needs to be replaced, make sure to use bearings of the same type or of identical design.
5. The sealing rings (6 and 11) do not require any maintenance. However, they should be replaced every time the brake unit is opened.
6. The new sealing rings (6 and 11) must be glued in place after having cleaned the contact surfaces. To this end, Loctite 480 or an equivalent adhesive must be applied to individual spots on the front face of the solenoid housing (1.1) and on the circumference of the flange (3) before the sealing rings (6 and 11) are inserted and pressed on.

6.2 Brake module removal from motor and replacement of component parts

The following instructions must be strictly followed when replacing individual brake components:

- Centre the friction disc (4) relative to the centre of the brake module.
- Adjust the microswitch (27) when using brakes equipped with microswitch.
- Ensure that the friction disc is free from grease and oil.
- Adjust the required clearance "E" of the adjusting ring (9) (see marking on bottom of solenoid housing).
- Tighten the cheese head screws (10) in the flange (3) to the tightening torques specified in Table 22/1.
- Before removing the brake module from the motor, cautiously remove all components still fitted to the brake shaft (13), such as gear, feather key, etc. Loosen the fixing screws to allow the brake to be removed.

1. After having removed the fixing screws, the brake module can be pulled off the motor shaft by means of a withdrawal device. This device must be applied to the fixing corners on the output side flange of the solenoid housing (1.1) and supported on the front face of the brake shaft (13).
2. To avoid damage to the centring bore in the brake shaft (13), a shim ring can be inserted under the withdrawal device.

Note!

Substantial forces may have to be applied as the ball bearing (15) needs to be pulled off together with the brake module. Extreme caution is advised during these operations. If the brake module is in a horizontal position when removing it from the motor shaft, the brake must be supported in radial direction. Ball bearings (15) must not be reused after removal, regardless of their service life.

1. If individual components of the brake module need to be replaced, loosen the set screw (25) and unscrew the adjusting ring (9) to unload the compression springs (7).
2. Unscrew the cheese head screws (10) so that the flange (3) and all other components can be removed.
3. Use only grease-free cleaning agents to clean the brake components, when necessary. Bear in mind that the friction disc (4) cannot be cleaned. When using brakes equipped with microswitch (27), the armature (2) can only be removed after having taken off the stud (31) and the straight pin (32). Used studs (31) and straight pins (32) must be replaced by new parts after the brake module has been reassembled.

Installation of the brake module must be carried out in reverse order of removal.

	Size			
	13	19	24	29
M_A tightening torques of cheese head screws (10) of flange (3)	5	9	14	22

Table 22/1: M_A tightening torques of cheese head screws (10) for flange (3)

6.3 Microswitch (27) adjustment (only applicable to brake modules with microswitch (27))

Warning!

The motor circuit must be protected in such a way that no accidental motor start-up can occur when the microswitch (27) contact closes. The cheese head screws (29) must be tightened to the specified M_A tightening torques.

When using brake modules equipped with a microswitch (27), the microswitch may need to be adjusted during maintenance and service work.

1. The microswitch can only be adjusted after the brake has been released electrically and the cheese head screws (29) have been slightly loosened. Check whether the microswitch status is "open" or "closed" by using a continuity tester connected to "NO" and "C" (see Fig. 11/2).
2. When "closed", push the microswitch (27) back beyond the change-over point in the direction indicated by "B" (see Fig. 11/2). When "open", screw in the screw (34) (hexagon head cap screw M2.5x8, not supplied) to push the microswitch in the direction indicated by "A" up to the change-over point.
3. At this point, continue to tighten the screw (34) by the adjustment length "L" or by the screw-in angle α specified in Table 23/1 and position it correctly by tightening one of the cheese head screws (29).
4. Secure the second cheese head screw (29) with Loctite type 241 and tighten it (M_A tightening torque specified in Table 23/1). Loosen the first cheese head screw (29), apply Loctite 241 and re-tighten it.
5. Remove the screw (34) after completion of the microswitch adjustment.
6. Switch the brake module on and off to check that the microswitch (27) works correctly.

C = common contact
NO = normally open contact

	Size			
	13	19	24	29
Adjustment length L of screw (34) [mm]	0.11	0.15	0.2	0.2
Screw-in angle α of screw (34) [°]	90	120	160	160
M_A tightening torque of machine screw (29) [Nm]	0.7	0.7	0.7	0.7

Table 23/1: M_A tightening torque of cheese head screws (29), adjustment length L and screw-in angle α of screw (34)

6.4 Brake shaft (13) removal

Caution!

As high pressures are generated during the removal of the brake shaft, personal protection equipment, such as face guards, gloves etc., and protective covers must be used.

Proceed with extreme caution and follow all relevant safety instructions when removing the brake shaft (13). The brake shaft (13) must be removed by means of an oil pressure system (see Fig. 24/1).

1. To this end, a withdrawal device consisting of a forcing screw (37), a forcing pin (35) and an oil injector or oil pump (36) must be used. Remove the screw plug (17) and screw the oil injector or oil pump (36) connection into the oil inlet bore (17.1).
2. Insert the forcing pin (35) on the front face of the brake shaft (13) up to the limit stop and slightly tighten it by means of the forcing screw (37).
3. The pressure oil must be supplied through the oil inlet bore. The oil pressure should be gradually increased to about 60 % of the maximum pressure p_{max}. Then the pressure should be kept constant for about 60 minutes.
4. Proceed to increase the pressure to the maximum oil pressure p_{max}. After the maximum pressure has been reached, screw in the forcing screw (37) smoothly and evenly so that the brake shaft (13) can be pulled off the motor shaft. While removing the brake shaft, the tangential torque arm should be applied to the square socket (size 13, 19, 24 brakes) or to the external teeth of the brake shaft (13) (size 29 brakes). The technical specifications applicable to the brake shaft (13) removal are given in Table 25/1.

Note!

Pressure oil type LHDF900 with a viscosity of 900 mm^2/s at 20°C supplied by SKF can be used, for instance.

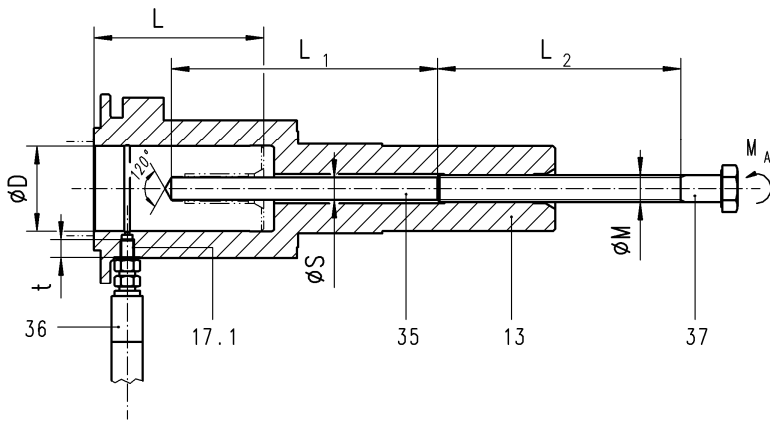


Fig. 24/1: Brake shaft (13) with withdrawal device

Key to Fig. 24/1:

13	Brake shaft	L_1	Forcing pin (35) length
17.1	Oil inlet bore	L_2	Forcing screw (37) thread length
35	Forcing pin	D	Shaft end diameter (motor)
36	Oil pump	S	Forcing pin (35) diameter
37	Forcing screw	M	Forcing screw (37) thread diameter
L	Shaft end length (motor)	M_A	Forcing screw (37) loosening torque

	Size			
	13	19	24	29
Motor shaft height	AH 80	AH 100	AH 132	AH 160
Oil inlet bore / screw-in depth t [mm]	M6/7.5	M6/8	Rp1/8''/9.5	Rp1/8''/10
Oil pressure p_{max} [bar]	1400	1400	1400	1400
Forcing pin (35) length L_1 [mm]	124	124	160	170
Forcing screw (37) thread length L_2 [mm]	130	130	170	170
Forcing pin (35) diameter S [mm]	9.8	9.8	13	17
Forcing screw (37) thread diameter M [mm]	12	12	16	20
Forcing screw tightening torque M_A [Nm]	15	35	60	90
Oil pump / oil injector connection tightening torque M_A [Nm]	4	4	10	10

Table 25/1: Technical specifications for brake shaft (13) removal

7. Motor design

The brake module must be mounted to a motor that complies with the following requirements:

- Motor mounting type IMB5 or IMB35
- Motor shaft end and flange tolerances (axial and radial runout) to EN 50347-R
- Brake module shaft end and flange tolerances to EN 50347-N after mounting to motor
- Motor shaft without feather key due to brake shaft removal from motor shaft by means of an oil pressure system
- The fits and surface roughness depths of the brake shaft bore and motor shaft (Rz<6.3) required to ensure reliable press-fit must be agreed with the brake manufacturer.
- Balancing of the brake shaft with a half key (half key balancing) to DIN ISO 8821

The permitted transverse forces acting on the shaft end of the motor/brake unit and the permitted axial forces are specified in the motor specification sheet.

Note!

Mounting of the brake module to the motor may cause heat build-up on the A-face motor end shield as heat dissipation towards the machine wall is inhibited. Consequently, only fan-cooled motors must be used.

8. Driven components, balancing

The installation and removal of driven components, such as clutch, gear, pulley, etc., on the brake shaft must be carried out using suitable devices and tools. Use the thread in the brake shaft for installation purposes and heat the components prior to assembly, if possible. In order to protect the centring piece and thread in the brake shaft, a shim must be inserted before removing driven components (see Fig. 26/1). The brake shaft is balanced with a half key (half key balancing to DIN ISO 8821). Check that the correct balancing method is used when installing the driven components.

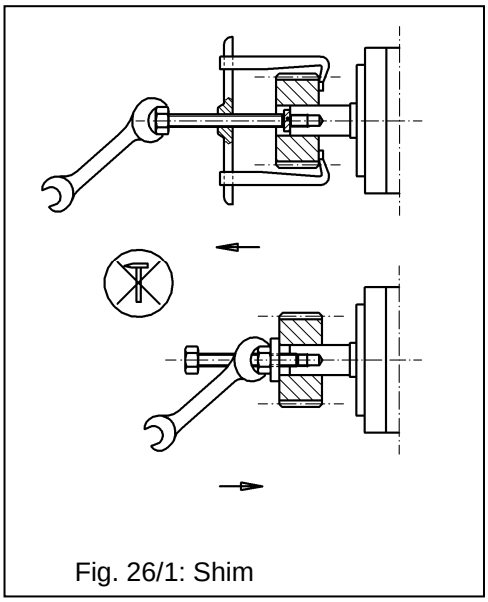


Fig. 26/1: Shim

Note!

General precautions must be taken to prevent accidental contact with driven components. The brake is an electromagnetic device which may generate electromagnetic stray flux. In general, driven components remain unaffected by the presence of such stray flux.

9. Condition at delivery

The brake module is delivered in a preassembled condition with factory-adjusted (standard) transmissible torque M_4. The brake shaft with screw plug, spring washer, ball bearing, circlip, feather key, hand release, rubber bolts (size 19 and 24 brakes) and O-ring (size 29 brakes) are not included in the scope of supply.
The ball bearing set (ball bearing, spring washer, circlip), hand release, brake shaft with screw plug, rubber bolts (size 19 and 24 brakes) or O-ring (size 29 brakes) can be ordered as accessories.
The brake module can be equipped with an optional microswitch.
The friction disc is centred relative to the brake centre to facilitate brake mounting.

Attention!

In order to avoid any shift of the friction disc, the brake unit should only be released electromagnetically or by means of the hand release lever when the friction disc is guided by the brake shaft. Brakes equipped with microswitches are delivered with factory-adjusted microswitch.

Upon receipt of the shipment, the brake must be checked for transit damage before storage.

Ordered accessories are delivered together with the brake.

The spring-applied single-disc brake module is delivered ready for mounting with factory-adjusted M_4 transmissible torque and factory-adjusted rated air gap 's'.

Attention!

The brake module should be transported and stored in vertical position with the output side solenoid housing (1.1) flange pointing upwards. This flange must be provided with eye bolts (e.g. to DIN 580) fixed to two diagonally opposite fixing bores. These eye bolts are required to attach handling equipment secured with nuts for internal transport purposes or for mounting the brake module to the motor.

Note!

If the brake module is equipped with a microswitch, make sure the microswitch is not exposed to shocks and vibrations during brake transport and storage. This is crucial to avoid any changes in the microswitch adjustment. The same applies to the connector box of the brake module. If the brake is not installed immediately upon delivery, it must be stored in a dry, dust-free and vibration-proof place.

10. 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. Install a new brake, if necessary.
	• Damaged rectifier	Check the rectifier and replace it, if necessary.
	• Damaged field coil	Check the field coil resistance. Install a new brake, if necessary.
	• Friction disc thermally overloaded	Install a new friction disc.
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. Install a new brake, if necessary.
Delayed brake engagement	• Voltage applied to field coil too high	Check the field coil supply voltage and correct faults, if found.
Brake torque too low	• Air gap too large	Check the air gap. Install a new friction disc, if necessary.
	• Oily or greasy friction surfaces	Install a new friction disc.
	• Broken compression spring	Install a new brake module.
Microswitch failure	• Damaged microswitch	Install a new microswitch.
	• Adjustment error of microswitch switching point	Readjust the microswitch switching point.

Table 27/1: Possible faults, causes and corrective actions (list not exhaustive)

11. Definitions

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

Transmissible torque M_4 — highest torque that can be applied to the engaged brake or clutch without causing the brake/clutch to slip

Rated voltage U_N — supply voltage specified by the manufacturer for voltage windings to identify the device or component

Rated air gap s — air gap of a new brake

Maximum air gap s_{max} — maximum possible air gap at the wear limit during brake operation

The switching times are defined in DIN VDE 0580. When using static systems (holding operation), the switching times can also be determined on the basis of the current flow (see Fig. 28/1).

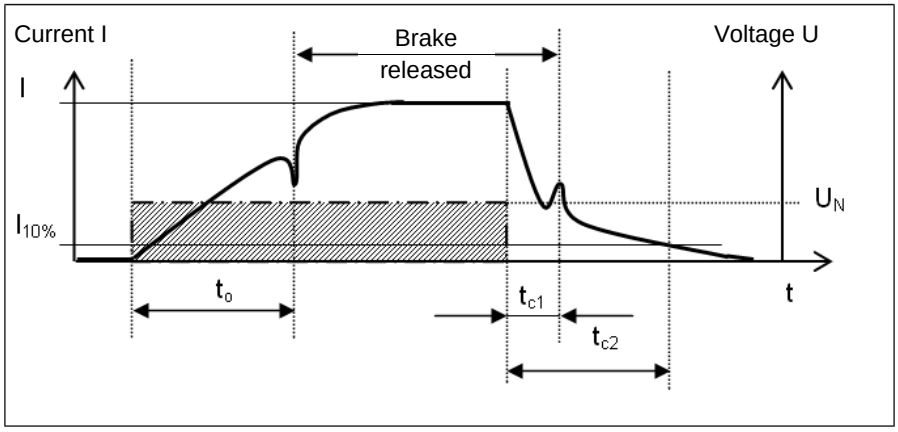


Fig. 28/1: Definition of switching times for (static) holding operation

Definitions:

t_o	opening time (**o**pen) –	brake mechanically open
t_{c1}	closing time (**c**lose) –	brake mechanically closed
t_{c2}	activation time –	brake mechanically closed and full holding torque reached almost completely

12. Technical specifications

	13	19	24	29
Rated air gap s [mm]	$0.3^{+0.2}$	$0.35^{+0.2}$	$0.4^{+0.25}$	$0.45^{+0.25}$
Max. air gap s_{max} (at 70% of rated current) [mm]	0.65	0.8	1.05	1.2

Table 28/1: Air gap s_{nom} and s_{max}

	Size			
	13	19	24	29
Speed n [rpm]	250	125	125	125
Coil ON time t_5 [s]	6	6	6	6
Coil OFF time t_6 [s]	1	1	1	1
Break-in period t_{tot} [min]	3	3	3	3

Table 28/2: Break-in process parameters for the spring-applied single-disc brake module

	Technical specifications
Switching capacity	250 VAC, 5 A
	400 VAC, 1.5 A
	24 VAC, 2 A
Min. switching power	12 VDC, 10 mA
Mech. service life [switching operations]	5×10^7
Contact type	normally open contact
Temperature range [°C]	–40 to +130
Protection	IP 67

Table 29/1: Microswitch specifications

The required operating conditions specified in **DIN VDE 0580** must be observed during operation of the spring-applied single-disc brake module!

Specifications subject to change without notice!

13. Revision history

Date of issue:	**Modifications:**
Issue dated 12 December 2013	Text revisions on page 16 and 17
Issue dated 2 July 2012 (initial issue)	–

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