KENDRION

KENDRION INDUSTRIAL BRAKES

SERVO SLIM LINE

Spring-applied single-disc brake

Operating Instructions SL 500..A00

Types:			
	SL 50003A00	SL 50007A00	SL 50205A00
	SL 50004A00	SL 50009A00	SL 50207A00
	SL 50005A00	SL 50010A00	SL 50209A00

PRECISION. SAFETY. MOTION.

Contents

Document information:

Issued by: Kendrion (Villingen) GmbH
Replaces document: -
Document type: translation of original German operating instructions BA SL 500..A00
Document title: BA SL 500..A00 Englisch

Last updated: 13/03/2020
Replaces the issue dated: -
Document status: released

1. General

1.1 Introduction

These operating instructions describe the operating principle and features of the spring-applied single-disc brake types SL 500..A.. and SL 502..A... The information and safety messages provided in this manual must be strictly observed during the set-up of the machine (e.g. motor) or installation and during the putting into service, use and maintenance of the spring-applied single-disc.

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 (Villingen) and ask for clarification before starting to use the brake. Spring-applied brakes are not ready-to-use products, but are intended to be incorporated into or assembled with machinery. Consequently, they will be referred to as **components** in the following sections.

1.2 Manufacturer

Kendrion (Villingen) GmbH
Wilhelm-Binder-Str. 4-6
78048 Villingen-Schwenningen
Germany
Tel: +49 (0)7721 877-1417
Email: sales-ids@kendrion.com

Kendrion (China) Co., Ltd.
Factory Building No. 2
17 Su Hong East Road
215026 Suzhou Industrial Park
Suzhou, P.R. China
Tel: +86 (0)512 8398-1819
Email: CHN@kendrion.com

1.3 Product, types, versions and product numbers

Product: Electromagnetically released spring-applied single-disc brake

Types: SL 50003A00 SL 50004A00 SL 50005A00 SL 50007A00 SL 50009A00 SL 50010A00
SL 50205A00 SL 50207A00 SL 50209A00 SL 50210A00

Types	Version number	Product number [1)]	Versions
SL 50003A00	XXXX	SL 50003A00-XXXX	transmissible torque M_4
SL 50004A00	XXXX	SL 50004A00-XXXX	rated voltage U_N
SL 50005A00	XXXX	SL 50005A00-XXXX	hub (7) version
SL 50007A00	XXXX	SL 50007A00-XXXX	hub (7) bore
SL 50009A00	XXXX	SL 50009A00-XXXX	
SL 50010A00	XXXX	SL 50010A00-XXXX	

Table 3/1: List of SL 500..A00 spring-applied single-disc brake types and versions (hub (7) to be mounted with its cylindrical part facing away from the magnet housing (1.1) (see Fig. 13/1))

Types	Version number	Product number [1)]	Versions
SL 50205A00	XXXX	SL 50205A00-XXXX	transmissible torque M_4
SL 50207A00	XXXX	SL 50207A00-XXXX	rated voltage U_N
SL 50209A00	XXXX	SL 50209A00-XXXX	hub (7) version
SL 50210A00	XXXX	SL 50210A00-XXXX	hub (7) bore

Table 3/2: List of SL 502..A00 spring-applied single-disc brake types and versions (hub (7) to be mounted with its cylindrical part preferably facing the magnet housing (1.1) (see Fig. 13/2))

[1)] Please refer to Section 12 for more details on the product number.

1.4 Standards and directives

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

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

1.5 Conventions used in these operating instructions

The conventions used in these operating instructions for the representation of information make the manual easier to read and understand. The conventions are listed in Table 4/1.

Conventions / Examples	Type of information	Meaning
Table 4/1	Table	Reference to information provided in a table
Fig. 4/1	Figure	Reference to information provided in a figure
•	Numbered items	Tasks or steps to be performed and/or additional information
Section 2.1	Section	Reference to one or more sections
[1)]	Footnote	Additional information
(1.2)	Reference numeral	Reference to an item in a figure or table, accompanied by additional information relating to the designation or identification of a component part
(MGB1, MGB)	Addition	Supplementary information
..	Wildcard	Wildcard for different brake sizes
XXXX	Wildcard	Wildcard for different versions
Components	Highlighting (bold text)	Highly relevant information

Table 4/1: Conventions used for the representation of information

Special conventions used for the representation of safety messages and safety-related information are explained in Section 2.1.

1.6 Manufacturer's liability

The manufacturer will not assume any responsibility for damage caused by failure to use the components 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.

1.7 Relevant documents

- Offer drawings SL 500..A00-O
- Offer drawings SL 502..A00-O

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

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

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

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

Manufacturer:

Kendrion (Villingen) GmbH
Wilhelm-Binder-Str. 4-6
78048 Villingen-Schwenningen
Germany
Tel: +49 (0)7721 877-1417

Kendrion (China) Co., Ltd.
Factory Building No. 2
17 Su Hong East Road
215026 Suzhou Industrial Park
Suzhou, P.R. China
Tel: +86 (0)512 8398-1819

Person authorised to compile the documentation:

Dominik Hettich
Kendrion (Villingen) GmbH
Wilhelm-Binder-Str. 4-6
78048 Villingen-Schwenningen
Germany

Applied harmonised standards and other technical standards and regulations:

EN 60529	Enclosure protection ratings
DIN VDE 0580	Electromagnetic devices and components
EN ISO 12100	Safety of machinery - General principles for design - Risk evaluation and risk reduction

Product: Electromagnetically released spring-applied single-disc brake

Types: SL 50003A00 SL 50004A00 SL 50005A00 SL 50007A00 SL 50009A00 SL 50010A00
SL 50205A00 SL 50207A00 SL 50209A00 SL 50210A00

Kendrion (Villingen) GmbH Villingen 13/03/2020 Authorised signatory: .....

Dominik Hettich
(Head of Development)

1.9 EU Declaration of Conformity

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

Manufacturer:

Kendrion (Villingen) GmbH
Wilhelm-Binder-Str. 4-6
78048 Villingen-Schwenningen
Germany
Tel: +49 (0)7721 877-1417

Kendrion (China) Co., Ltd.
Factory Building No. 2
17 Su Hong East Road
215026 Suzhou Industrial Park
Suzhou, P.R. China
Tel: +86 (0)512 8398-1819

Authorised representative:

Dominik Hettich
Kendrion (Villingen) GmbH
Wilhelm-Binder-Str. 4-6
78048 Villingen-Schwenningen
Germany

Applied harmonised standards and other technical standards and regulations:

EN 60529	Enclosure protection ratings
DIN VDE 0580	Electromagnetic devices and components
EN ISO 12100	Safety of machinery - General principles for design - Risk evaluation and risk reduction

Product: Electromagnetically released spring-applied single-disc brake

Types: SL 50003A00 SL 50004A00 SL 50005A00 SL 50007A00 SL 50009A00 SL 50010A00
SL 50205A00 SL 50207A00 SL 50209A00 SL 50210A00

Kendrion (Villingen) GmbH Villingen 13/03/2020

Authorised signatory: .....

Dominik Hettich
(Head of Development)

2. Safety

The components 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 machine owner takes adequate precautions and makes sure that safety instructions are strictly adhered to. It is the duty of the machine owner to plan these measures and to check their implementation.

The machine owner is required to ensure that:

- the components are only used in accordance with their intended use (see Section 2.2 (Intended use) and Section 3 (Product description)).
- the components 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 components at all times.
- putting into service, maintenance and repair are only performed 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 components are not exposed to other strong magnetic fields.

IMPORTANT

READ THESE OPERATING INSTRUCTIONS CAREFULLY
BEFORE STARTING TO USE THE PRODUCTS

KEEP THESE OPERATING INSTRUCTIONS IN A SAFE PLACE FOR FUTURE REFERENCE

2.1 Symbols, signs and signal words in safety messages

Safety messages that warn users of potential risks of personal injury or property damage or indicate other important information are highlighted by the safety alert symbols, information signs and signal words shown in Table 7/1.

Personal injury			
Symbol	**Signal word**	**Indicates...**	**Potential consequences**
	**DANGER**	an imminent hazardous situation which, if not avoided, will result in death or serious injury	Death or serious injury
	WARNING	a potentially hazardous situation which, if not avoided, could result in death or serious injury	Death or serious injury
	CAUTION	a potentially hazardous situation which, if not avoided, could result in minor or moderate injury	Minor or moderate injury
Property damage			
Symbol	**Signal word**	**Indicates...**	**Potential consequences**
	**NOTICE**	potential property damage or environmental damage	Damage to the component or to the environment
Information			
Symbol	**Signal word**	**Provides…**	
	**IMPORTANT**	information on the safe use and operation of the component	

Table 7/1: Safety alert symbols, information signs and signal words used in safety messages

Structure and colour of hazard alerting, non-hazard alerting and instructional safety messages

Hazard alerting safety messages (potential personal injury):

Signal word: DANGER

Hazard type and source

- Potential consequences if not avoided
- Hazard prevention measures

Signal word: WARNING

Hazard type and source

- Potential consequences if not avoided
- Hazard prevention measures

Signal word: CAUTION

Hazard type and source

- Potential consequences if not avoided
- Hazard prevention measures

Non-hazard alerting safety messages (potential property damage):

Signal word: NOTICE

Type and source of potential property damage

- Potential consequences if not avoided
- Property damage prevention measures

Instructional safety messages:

Signal word: IMPORTANT

Information for the safe use and operation of the component

Other warning signs used:

Symbol	Warning	Symbol	Warning
	Magnetic field hazard		Hot surface hazard
	Electricity hazard		Hand injury hazard

Table 8/1: Specific warning signs used in this manual

2.2 Intended use

The brakes described in these operating instructions are intended to be incorporated into electric motors for use in industrial installations.

IMPORTANT

The components must be used in accordance with the operating requirements detailed in these operating instructions. The specified rated power limits must not be exceeded. Operation in potentially explosive or firedamp atmospheres is not allowed.

2.3 General safety information

Brakes mounted to motors feature hazardous live components and rotating parts and may exhibit hot surfaces. Any work associated with the transport, connection, putting into service and periodical maintenance of the brakes must be carried out by authorised and suitably qualified specialist personnel in accordance with EN 50110-1, EN 50110-2, IEC 60364-1. Failure to observe safety, operating and maintenance instructions may cause serious personal injury and property damage. Whenever special measures are required in accordance with the instructions contained herein, such measures should be agreed with the brake manufacturer before setting up the machinery into which the brake is to be incorporated. 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 the manufacturer 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 (Villingen). Accident prevention regulations applying to the specific field of application of the brake must be strictly observed.

IMPORTANT

The components described in this manual are **not designed for use as "safety brakes"**. This means that negative effects on the brake torque (e.g. brake torque variations, reduced brake torque constancy) arising from adverse ambient conditions that are beyond the user's control (e.g. higher ambient temperatures or humidity, contaminated ambient air etc.) cannot be ruled out. In such cases the system user is required to ensure that the spring-applied single-disc brake is subjected to a break-in process at regular intervals to achieve the full braking effect. The break-in process parameters specified in Table 41/2 apply.

2.3.1 Set-up

Requirements in terms of the permissible number of switching operations per hour and the maximum switching work per switching operation specified in the technical specifications (see Table 40/1) must be strictly observed during the set-up of machinery and installations (jog mode). Failure to observe these instructions may irreversibly diminish the braking effect and cause malfunctions. The rated operating conditions are those specified by DIN VDE 0580. The protection rating conforms to EN 60529. In case of deviations, special measures must be taken after prior consultation with the brake manufacturer. If vertical brake operation is envisaged, any special requirements must be agreed with the brake 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 brake manufacturer.

2.3.2 Putting into service

Do not use or operate the components if:

- power supply cables/wires or connections are damaged.
- the magnet housing (1.1) or field coil (1.2) sheath is damaged.
- other defects are suspected.

DANGER

Electricity hazards from incorrect electrical connection of the component!

- Fatal electric shock hazard.
- All work must be performed by qualified specialist personnel only. Check that no voltage is present before connecting the component to the power supply. 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.

2.3.3 Installation

The voltage level and voltage type specified on the rating plate must be strictly observed when connecting the components described in these operating instructions. The brake must be mounted in such a way that sufficient heat dissipation is ensured. Adequate precautions must be taken to avoid overvoltage during turn-off or voltage peaks. The magnetic field of the brake 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 (to DIN 31000 / DIN VDE 0100-420) must be taken by the brake user to avoid hazards to persons and animals or property damage caused by:

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

2.3.4 Operation

Ensure that live components such as the wire leads (1.3), field coil (1.2) and similar parts 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 linings 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 wear of the friction linings and the resulting brake torque reduction of spring-applied brakes must be taken into consideration in the set-up of the machinery or installation. Due to the diverse ambient conditions in which the brakes may be used, always check that the brake is in perfect working order before start-up. Torque reductions may occur if the brake is used for applications where only minimum friction work is required. In such cases, the user should ensure that the brake occasionally performs sufficient friction work.

The components are factory-treated with a corrosion inhibitor to provide basic corrosion protection during storage and operation in dry environments (no condensation).

IMPORTANT

The maximum air gap s_{max} (see Table 40/1 – Technical specifications) must not be exceeded throughout the entire brake service life. Please refer to Section 5 (Maintenance, repair, replacement) for details. The brake torque may drop if the spring-applied single-disc brake has been stored for a prolonged period of time. Torque reductions may also occur during the brake service life as a result of adverse factors in the brake environment (see Section 2.3) or if the brake is only used as holding brake. In this case, the brake user should ensure that a break-in process as specified in Table 41/2 is conducted at regular intervals.

NOTICE

Risk of damage to the field coil (1.2) in case of brake operation beyond the permissible limits!

- Release of the spring-applied single-disc brake may no longer be possible.
- Potential malfunction of the motor.

- During brake operation, ensure that the coil temperature does not rise above the permissible limit temperature applicable to the insulating materials of the specified insulation class (see Table 40/1 – Technical specifications). Fast cooling of the field coil with scavenging air is not allowed. Ensure that the permissible relative humidity range (see Table 41/1) is not exceeded.

DANGER

Electromagnetic field hazards during brake operation!

- Indirect effects of electromagnetic fields may cause disturbances and failures of cardiac pacemakers and other implants. Serious or even fatal injury hazard.

- Keep at a safe distance from the component during operation.

2.3.5 Maintenance, repair and replacement

Brake service, maintenance, repair or replacement must only be carried out by qualified specialist personnel in accordance with EN 50110-1, EN 50110-2, IEC 60364-1. Failure to perform repairs according to requirements may cause serious personal injury or property damage. Make sure that the components are unpowered when carrying out maintenance work.

3. Product description

3.1 Operating principle

The spring-applied single-disc brakes in the Servo Slim Line series are intended for direct installation in electric servo motors. The brakes are 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. This is because the magnetic force generated by the electromagnetic field offsets the spring force of the compression springs (3), causing the armature (2) to move axially towards the magnet housing (1.1) of the brake.

When the brake is engaged, the spring force produced by the compression springs (3) causes the friction disc (5) to be clamped between the armature (2) and flange (6), thus generating the braking action. The brake is connected with the motor shaft (11) by means of a centrally arranged hub (7). The servo motor shaft (11) to be braked is not exposed to any axial loads exerted by the spring force of the compression springs (3).

3.2 Brake design

The magnet housing (1.1) of the spring-applied single-disc brake accommodates the firmly fitted field coil (1.2) with power supply wire leads (1.3). The wire leads (1.3) of the field coil (1.2) exit from the circumference of the magnet housing (1.1) or from its rear side. A heat-shrink tube (1.4) is provided to protect the wire leads (1.3). The compression springs (3) located in the magnet housing (1.1) press the armature (2) against the friction disc (5). The spline connection between the friction disc (5) and the hub (7) ensures that the friction disc (5) is connected with the hub (7) in a tangentially fixed position with minimum circumferential backlash, while movement in axial direction is possible. As a result, the friction disc is pressed against the flange (6) to generate the braking effect of the spring-applied single-disc brake. The rated air gap s_N of the brake is factory-adjusted by means of the bushes (4). The bushes (4) are firmly connected with the magnet housing (1.1) and flange (6). They ensure that the armature (2) is kept in a fixed tangential position.

The brake is mounted to the motor end shield (8) using two [2] or three mounting screws (9 or 10) (see Fig. 13/1 and Fig. 13/2). Depending on the specific brake version, the spring-applied single-disc brake is flange mounted (see Fig. 13/1) or face mounted (see Fig. 13/2) to the motor end shield (8). The magnet housing (1.1) has through-holes for flange mounting of the brake (see Fig. 13/1). Brake versions designed for face mounting [3] have mounting threads on the rear side of the magnet housing (1.1) (see Fig. 13/2).

The hub (7) and motor shaft (11) can be firmly assembled by interference fit (see Section 4.1.2) or by means of a feather key (see Section 4.1.3).

List of reference numerals in Fig. 13/1, Fig. 13/2, Fig. 14/1, Fig. 14/2 and Fig. 14/3			
1.1	Magnet housing	7	Hub
1.2	Field coil	8	Motor end shield (mounting surface)
1.3	Wire leads	9	Mounting screws for flange mounting
1.4	Heat-shrink tube	10	Mounting screws for face mounting [3]
2	Armature	11	Motor shaft
3	Compression springs	12	Motor bearing
4	Bushes	13	Feather key
5	Friction disc	14	Countersunk screw
6	Flange	15	Rating plate
		16	Circlip for (short-version) hub

Table 12/1: List of reference numerals of spring-applied single-disc brake

[2] Brake sizes 03 and 04.
[3] Brake sizes 05, 07, 09, 10.

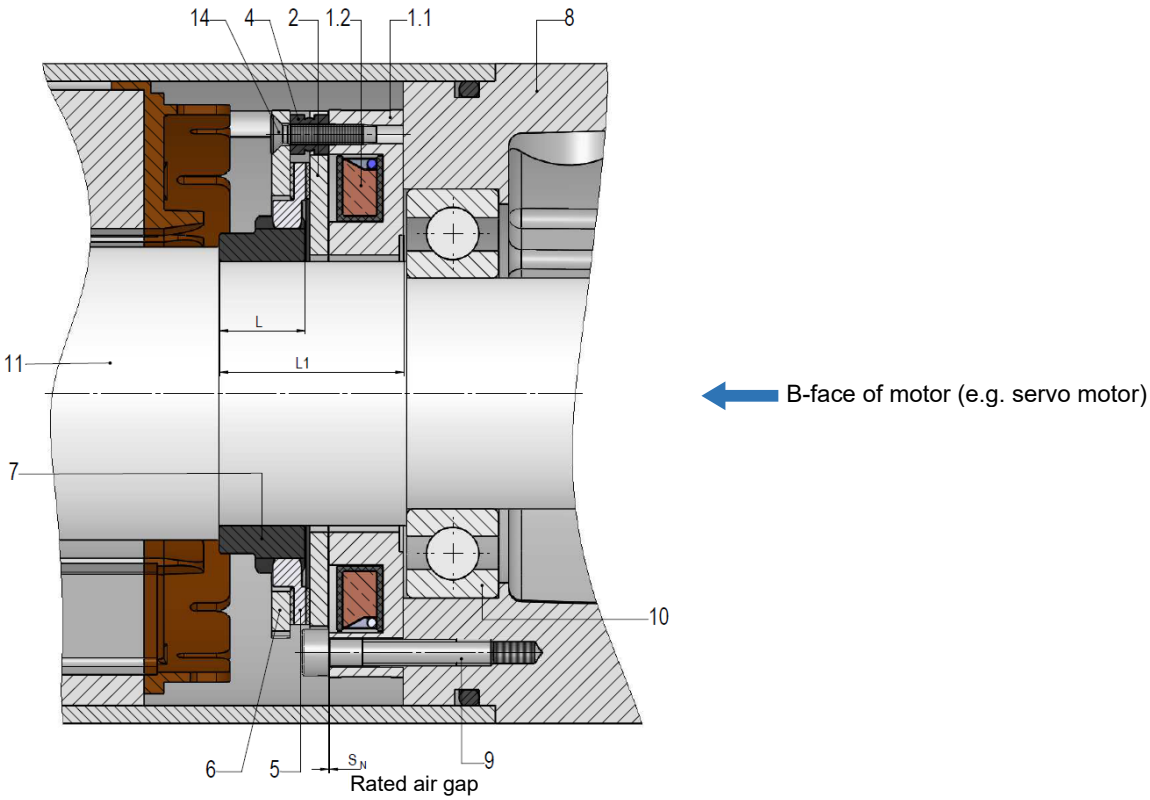


Fig. 13/1: Flange mounting of spring-applied single-disc brake SL 500..A00 (example) to the motor (e.g. servo motor); contact of hub (7) with stop shoulder of motor shaft (11); assembly of hub (7) and motor shaft (11) by interference fit (see Section 4.1.2)

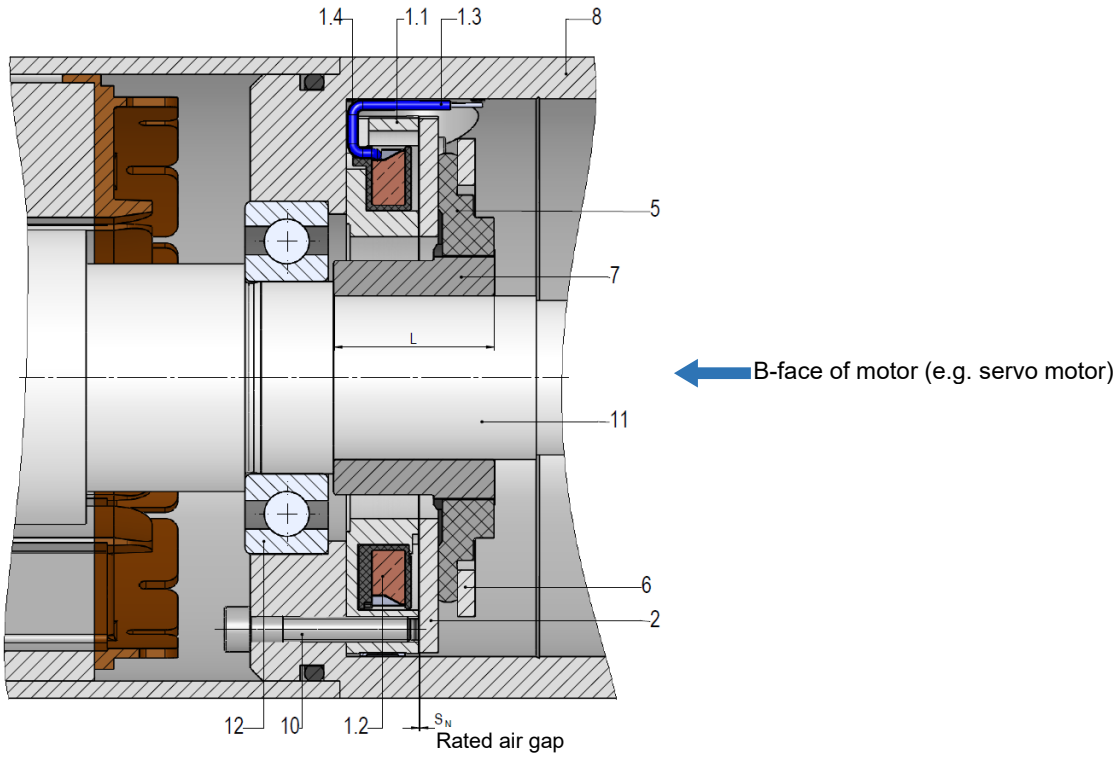


Fig. 13/2: Face mounting of spring-applied single-disc brake SL 502..A00 (example) to the motor (e.g. servo motor); contact of hub (7) with stop shoulder of motor shaft (11); assembly of hub (7) and motor shaft (11) by interference fit (see Section 4.1.2)

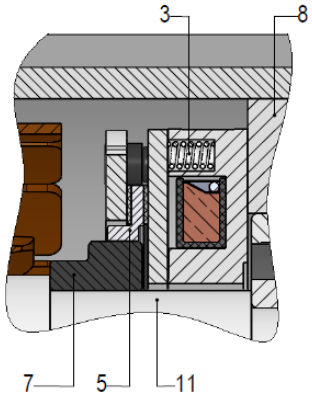


Fig. 14/1: Interference fit assembly of hub (7) and motor shaft (11)

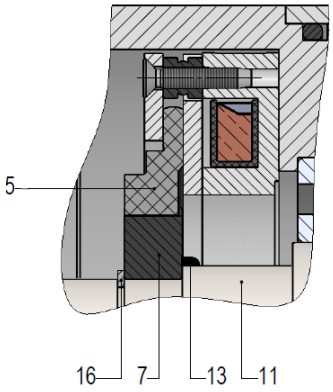
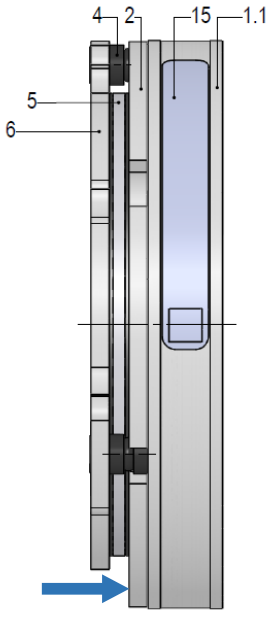
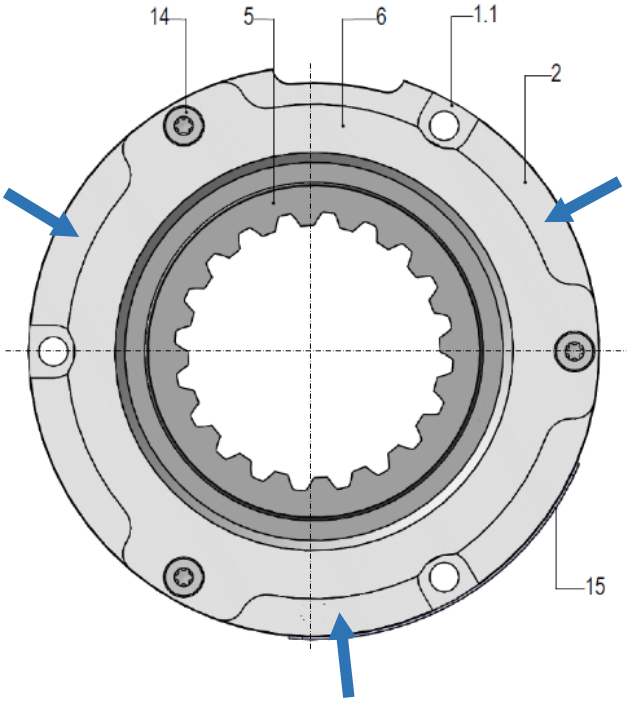


Fig. 14/2: Feather key assembly of hub (7) and motor shaft (11)



Measuring points on front side along armature (2) circumference for measurement of air gap ‘s’



Measuring points (x3 offset by approx. 120°) on front side along armature (2) circumference for measurement of air gap ‘s’

Fig. 14/3: Location of the measuring points (arrow marks) for measuring the air gap ‘s’ of brake type SL 502..A00 (example), shown without hub (7)

4. Installation

4.1 Mechanical installation

4.1.1 General information for mechanical brake installation

The brakes can be installed in the motor (e.g. servo motor) by mounting them either to the A-face or B-face motor end shield. If the brake is mounted to the B-face end shield of the servo motor, flange mounting (Fig. 13/1) or face mounting (Fig. 13/2) is possible.

Brake type SL 500..A00 can be fixed to the inside of the B-face end shield of the motor (e.g. servo motor) by face mounting [4)] or flange mounting (see Fig. 13/1). In this case, flange mounting of the brake as shown in Fig. 13/1 is preferred, requiring the magnet housing (1.1) to be positioned on the inside of the motor end shield (8). The mounting screws (9) are used to fasten the brake on the flange side as shown in Fig. 13/1.

Brake type SL 502..A00 can be fixed to the outside of the B-face end shield of the motor (e.g. servo motor) by face mounting [4)] (see Fig. 13/2) or flange-mounting. In this case, the magnet housing (1.1) is positioned on the outside of the B-face motor end shield (8) using the hub (7). The mounting screws (10) are used to fasten the brake on the face side as shown in Fig. 13/2. In case of flange mounting, the mounting screws (9) are used instead.

IMPORTANT

The M_A tightening torques of the mounting screws (9, 10) for flange or face mounting are specified in Table 15/1. If the M_A tightening torques specified in the offer drawing are different from those listed in Table 15/1, the specifications in the offer drawing shall prevail. To ensure secure fastening of the brake in case of face mounting to the motor end shield (8), the mounting screws (10) must be tightened to the magnet housing (1.1) observing both the maximum possible thread reach as well as the required minimum thread reach values specified in Table 15/1. Socket head cap screws (not supplied) to ISO 4762, property class 8.8, are recommended for both mounting options and for all mounting screws (9 or 10).

	Brake size					
	03	04	05	07	09	10
Max. possible thread reach [mm]	-	-	-	8	8	8
Min. required thread reach [mm]	4.5	4.5	3.5	3.5	6.5	9.5
Mounting screw (10) thread (face mounting)	-	-	-	M4 (x3)	M4 (x3)	M4 (x3)
M_A tightening torque [Nm] for mounting screws (10)	-	-	-	3	3	3
Mounting screw (9) thread (flange mounting)	M2 (x2)	M2 (x2)	M3 (x3)	M4 (x3)	M4 (x3)	M4 (x3)
M_A tightening torque [Nm] for mounting screws (9)	0.4	0.4	1.2	3	3	3

Table 15/1: Threads of mounting screws (9, 10); M_A tightening torques for mounting screws (9, 10) for flange or face mounting; minimum and maximum thread reach for face mounting; tightening torques tolerance ±10%

[4)] Brake sizes 05, 07, 09, 10.

NOTICE

Risk of damage to the brake or mounting screws (9, 10) if the M_A tightening torque is too high!

- Release of the spring-applied single-disc brake may no longer be possible.
- Potential breakage of the mounting screws (9, 10).

- The M_A tightening torques specified for the mounting screws (9, 10) (Table 15/1) must be strictly observed. Tighten the mounting screws (9 ,10) evenly in several steps.

NOTICE

Risk of damage to the wire leads (1.3) and motor shaft (11) in case of incorrect brake mounting!

- Putting into service of the spring-applied single-disc brake and motor may not be possible.

- During machine installation, the wire leads (1.3) of the field coil (1.2) must be connected as specified by the machine manufacturer. Avoid damage to the wire leads (1.3), e.g. by kinking the lead insulation.

IMPORTANT

The minimum thread reach of the mounting screws (9) used for flange mounting of the brake to the motor end shield (8) must be dimensioned by the brake user in such a way that the M_A tightening torques (see Table 15/1) specified for the mounting screws (9) can be securely applied. The assembled brake components, especially the friction surfaces of the friction disc (5), must be free of grease and oil during operation. Ensure that lubricants or similar substances cannot seep from the bearing into the brake. (Sealed bearings can be used to prevent lubricant leaks.) The rated air gaps s_N (see Table 40/1 – Technical specifications) are factory-adjusted by means of the bushes (4). Minor axial bearing play after completion of motor assembly will not affect the safe and reliable operation of the spring-applied single-disc brake.

IMPORTANT

The friction discs (5) are factory-centred and firmly locked inside the brake to facilitate axial brake assembly with the motor shaft (11). The spring-applied single-disc brake should not be released electromagnetically until installation has been completed and the brake has been put into service and checked. Install the wire leads (1.3) during overall motor assembly as specified by the motor manufacturer. Avoid damage to the wire leads (1.3) e.g. by kinking the lead insulation.

To ensure perfect brake operation, check that the motor end shield (mounting surface (8) and the motor shaft (11) meet the following requirements before starting to install the brake:

- Axial runout (simple runout) relative to motor shaft (11) max. 0.1 mm
  (measuring point = pitch circle diameter of brake, measurement to EN 50347)
- Positional deviation of the fastening threads in the motor end shield (8) for flange mounting of the brake: max. Ø 0.2 mm; reference element: axis of motor shaft (11)
- Positional deviation of the mounting bores in the motor end shield (8) for face mounting of the brake: max. Ø 0.5 mm; reference element: axis of motor shaft (11)
- Material: steel, aluminium, cast iron – with excellent thermal conductivity
- Absence of oil and grease
- Surface hardness min. 100 HB, surface roughness Rzmax 16

IMPORTANT

The maximum permissible positional deviation of the fastening threads (flange mounting) or mounting bores (face mounting) in the motor end shield must not be exceeded. This is crucial to prevent the friction disc (5) from rubbing along the bushes (4) during operation and to allow the brake to be mounted to the motor end shield.

IMPORTANT

Magnetic interference fields may affect reliable brake operation. Consequently, the brake should always be installed outside the reach of magnetic interference fields.

WARNING

Hazards from brake failure caused by incorrect design of the motor shaft (11)!

- Uncontrolled movements of the motor shaft (11) may cause injury hazards if persons are present within the confines and/or working range of the installation.
- Uncontrolled **extremely fast** movements of the motor shaft (11) may cause death if persons are present within the confines and/or working range of the installation.

- The brake user is required to ensure that the tolerance, strength and quality of the motor shaft (11) (in case of interference fit assembly of the hub (7) with the motor shaft (11)) and the type of feather key (if used for hub/shaft assembly) are suitable to achieve reliable transmission of the generated brake torques from the hub (7) to the motor shaft (11) over the entire brake service life.
- Ensure that the brake is mounted correctly and with maximum care.

NOTICE

Risk of wear and/or failure of the feather key connection of the hub (7) and motor shaft (11) caused by incorrect design of the motor shaft (11)!

- Potential reduction of brake service life.
- Potential malfunction of the motor.

- The brake user is required to ensure that the tolerance, strength and quality of the motor shaft (11) (in case of interference fit assembly of the hub (7) with the motor shaft (11) and the type of feather key (if used for hub/shaft assembly) are suitable to achieve reliable transmission of the generated brake torques from the hub (7) to the motor shaft (11) over the entire brake service life.

4.1.2 Brake mounting with hub (7) – interference fit assembly

The hub (7) and servo motor shaft (11) can be firmly assembled by interference fit (shrink fit or force fit). If the hub (7) is assembled with the motor shaft (11) by shrink fitting, the hub (7) needs to be heated to the required joining temperature. This is done taking account of the component tolerances of the motor shaft (11) and hub (7) (hub bore tolerance as specified in brake offer drawing). Once heated, the hub is slipped onto the motor shaft (11) until it stops at the stop shoulder (see Fig. 14/1) of the motor shaft (11). The shrink fit is achieved after the hub (7) has cooled down. If the hub (7) is assembled with the motor shaft (11) by force fitting, the hub (7) needs to be pressed onto the motor shaft (11) in axial direction.

To ensure reliable assembly of the motor shaft (11) and hub (7), the shaft has to meet the requirements specified in Table 18/ (in accordance with DIN 7190-1:2017-02):

	Brake size					
	03	04	05	07	09	10
Shaft tolerance	s6	s6	s6	s6	s6	s6
Max. surface roughness Rzmax [mm]	3	3	3	3	3	3
Motor shaft diameter (solid shaft) [mm]	5.5 – 6.5	6 – 10.5	7.5 – 14	8.5 – 25	25 – 40	28.5 – 55
Motor shaft diameter (hollow shaft) [mm] (min. 2 mm hollow shaft wall thickness)	-	-	16 – 20	21 – 25	19.5 – 40	28.5 – 55
Motor shaft (11) material properties	steel, modulus of elasticity E = 210000 N/mm^2; min. yield point R_e = 325 N/mm^2; surface free of oil and grease					

Table 18/1: Motor shaft (11) requirements for assembly of hub (7) by interference fit

Apart from assembling the hub (7) and motor shaft, the entire brake must be positioned on the inside of the motor end shield (8) and fixed by means of two [5] or three mounting screws (9 or 10) from the flange side (see Fig. 13/1) or face side (see Fig. 13/2). This is done in a separate mounting procedure. For information on the M_A tightening torques of the mounting screws (9 or 10) for flange or face [6] mounting, please refer to Table 15/1 and/or to the offer drawing.

The final third mounting procedure involved in the overall motor assembly process entails coupling the hub (7) with the friction disc (5) of the spring-applied brake. This is achieved by inserting the motor shaft (11) with the externally toothed hub (7) into the internally toothed friction disc (5) (see Fig. 13/1) and installing the complete motor assembly as specified by the motor manufacturer.

IMPORTANT

Check that you feel no resistance when sliding the friction disc (5) along the hub (7) in axial direction and that the axial position L1 of the hub (7) (see Table 18/ & Fig. 13/1) is maintained after the brake has been mounted inside the servo motor.

	Brake size					
	03	04	05	07	09	10
Hub (7) length L	4.1	4.7	8.5	10	13	13
Axial hub (7) position L1 [mm]	16,3 ±0.2	17 ±0.3	20.8 ±0.3	23.8 ±0.3	28 ±0.3	28 ±0.3

Table 18/2: Length and axial position of hub (7)

[5] Brake sizes 03 and 04.
[6] Brake sizes 05, 07, 09, 10.

4.1.3 Brake mounting with hub (7) – feather key / keyway assembly

Instead of assembling the hub (7) and servo motor shaft (11) by interference fit, it is also possible to use a feather key according to DIN 6885, sheet 1, to join the parts in a tangentially fixed position. In an initial mounting step, the complete brake without hub (7) must be positioned on the outside of the motor end shield (8) and fixed by means of two [7] or three mounting screws (9 or 10) from the flange side or face side [8] (see Fig. 13/1 or Fig. 13/2). The M_A tightening torques for the mounting screws (9, 10) are specified in Table 15/1.

Before installing the motor shaft (11) in the servo motor, the feather key (14) must be placed into the keyway machined into the motor shaft (11). After that, the motor end shield (8) and the motor shaft (11) can be mounted to the preassembled motor unit following the instructions provided by the motor manufacturer. In the final third step of the mounting procedure the hub (7) is slipped onto the motor shaft (11) provided with the feather key (14) and secured permanently in axial direction by means of a stop shoulder on the motor shaft (11) or by using a circlip (16). Check that you feel no resistance when sliding the friction disc (5) along the hub (7) in axial direction and that the axial position L1 of the hub (7) (see Table 19/1) is maintained after the brake has been mounted inside the servo motor.

	Brake size					
	03	04	05	07	09	10
Hub (7) length L	4.1	4.7	5.7	6.8	8.6	10
Axial hub (7) position L1 [mm]	16,3 ±0.2	17 ±0.3	18 ±0.3	20.6 ±0.3	23.5 ±0.3	25 ±0.3

Table 19/1: Length and axial position of hub (7)

IMPORTANT

The brake user is required to ensure that the tolerance, strength and quality of the motor shaft (11) and the type of feather key used (14) are suitable to achieve reliable transmission of the generated brake torques from the hub (7) to the motor shaft (11). In order to avoid any undesired play of the feather key connection during brake operation, which would cause the keyway to wear out, the length of the feather key (14) must be dimensioned in such a way that transmission of the brake torques to the motor shaft (11) takes place along the entire length L of the hub (7) (see Table 19/1).

[7] Brake sizes 03 and 04.
[8] Brake sizes 05, 07, 09, 10.

4.2 Electrical connection

4.2.1 Brake connection

The spring-applied single disc brake must be connected directly to a DC power source, connecting the wire leads (1.3) to the power supply. The specifications on the rating plate (16) must be observed. Connection to an AC power source is only possible by means of a bridge or half-wave rectifier (only possible with brake sizes 09 and higher). Various Kendrion rectifier types (see Table 20/1 – list not exhaustive) can be provided for this purpose.

IMPORTANT

During operation, any contact of the wire leads (1.3) with the rotating armature (2) or other rotating parts must be avoided. Depending on the brake size and torque, voltage ripple due to intermittent power supply may cause humming or incorrect operation. Reliable operation must be ensured by the user or system manufacturer by providing suitable electrical controls.

Rectifier series	Rectifier type	Rated input voltage range U_1 (±10%) [VAC] (40 – 60 Hz)	Output voltage U_2 [VDC]	Max. output current I [ADC]
32 07103B53	Bridge	0 – 240	$U_1 \cdot 0.89$	0.8
32 07103B50	Bridge	0 – 500		0.7
32 07102B53	Half-wave	0 – 240	$U_1 \cdot 0.445$	0.5
32 07102B50	Half-wave	0 – 500		0.5
The relevant rectifier specification sheets must be observed!				

Table 20/1: Recommended rectifiers for single-phase AC voltage supply

4.2.2 DC power supply

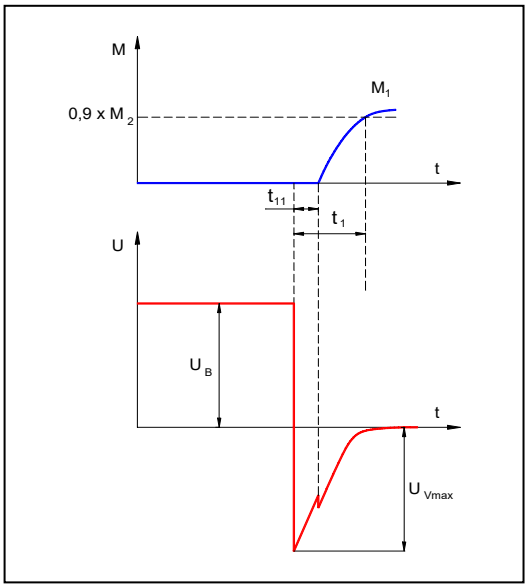
The figure to the right shows the voltage curve after the field coil (1.2) has been de-energised without protective circuit (torque curve and times t_{11} and t_1 as specified in DIN VDE 0580).

NOTICE

Risk of damage to or destruction of the brake field coil (1.2) from overvoltage!

- Release of the spring-applied single-disc brake may no longer be possible.
- Potential malfunction of the motor.

- The peak voltage U_{Vmax} during turn-off without protective circuit may reach **several thousand volts** in the millisecond region. This may cause irreversible damage to the field coil (1.2), switching contacts and electronic components. Sparking will occur on the switch during turn-off. Consequently, a protective circuit must be provided to reduce the current during turn-off and to limit the voltage. The maximum permissible overvoltage during turn-off is 1500 V.



U_B operating voltage (coil voltage)
U_{Vmax} turn-off voltage

NOTICE

Risk of damage to or destruction of electronic components from overvoltage!

- Release of the spring-applied single-disc brake may no longer be possible.
- Potential malfunction of the motor.

- The maximum permissible overvoltage during turn-off is 1500 V. If Kendrion rectifiers are used (see Table 20/1), 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. Sensitive electronic components (e.g. logical components) may also be damaged by the lower voltage.

4.2.3 DC power supply via PWM control

It is possible to control the power supply to the brake by pulse-width modulation (PWM) in order to enhance brake operation. Pulse-width modulation allows to control the voltage supplied to the brake over an extensive input voltage and temperature range or to keep the voltage level constant. This enables temporary electronic overexcitation of the brake. As a result, the pull-in behaviour of the armature and, consequently, the brake opening performance are significantly improved and the brake service life is extended. After the selected overexcitation time has elapsed, the voltage is reduced to holding voltage by an electronic module. With this solution, the brake operating temperature can be significantly reduced, providing substantial energy savings. Specific PWM control modules are available from Kendrion for this purpose (see Table 21/1). Fast turn-off (see Table 21/1) is possible as an option to reduce coupling times or closing times (see definitions in Section 10).

PWM type	Functional principle	Rated input voltage U_1 [9] [VDC] (±20%)	Max. output current $I_Ü$ / I_H [11] (ADC)	Frequency f [kHz]	Fast turn-off	Holding voltage U_H [VDC] at RT [10] (±5%)
34 10125C02	PWM	24 – 48	4 / 2	17	no	12
34 70125C02	PWM	24 – 48	4 / 2	17	yes	12
The relevant specification sheets for the specific PWM module must be observed!						

Table 21/1: Recommended PWM module types for brake operation by pulse-width modulation

4.2.4 AC power supply

Direct brake connection to an AC power source is only possible if a rectifier is used. The coupling times (DIN VDE 0580) and/or closing 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 U_1. Half-wave rectifiers produce voltage with high residual ripple which, depending on the brake size, may slightly reduce the disconnection times (DIN VDE 0580) when compared to bridge rectifiers. Due to the shorter disconnection times (and the lower coil voltage), half-wave rectifiers are generally preferred to bridge rectifiers. However, brake humming may occur when small size brakes are used.

Bridge rectification:
Bridge rectifiers provide voltage with minimum residual ripple. This means that brake humming can be avoided even if small size brakes are used. In case of bridge rectification, the U_2 coil voltage is lower by factor 0.89 than the rectifier input voltage U_1.

[9] Rated voltage U_N of component.
[10] RT = 20°C ambient (room) temperature.
[11] $I_Ü$ = overexcitation current, I_H = holding current.

AC side switching:
If AC side switching is used as shown in a), the rectifier is connected in parallel with the motor connecting cables, e.g. inside the motor terminal box. It must be considered, however, that the motor may act as a generator after AC voltage has been removed and thus extend the coupling and closing times (see definitions in Section 10) significantly (by factor 5 or over). The disconnection and opening times (see definitions in Section 10) remain unchanged. As an alternative, the rectifier can be connected directly to two phases of the input voltage supply for AC side switching of the brake as shown in b). This leads to substantially longer coupling or closing times (see definitions in Section 10) compared to DC side switching as shown in c).

DC side switching:

In case of DC side brake switching as shown in c), 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.

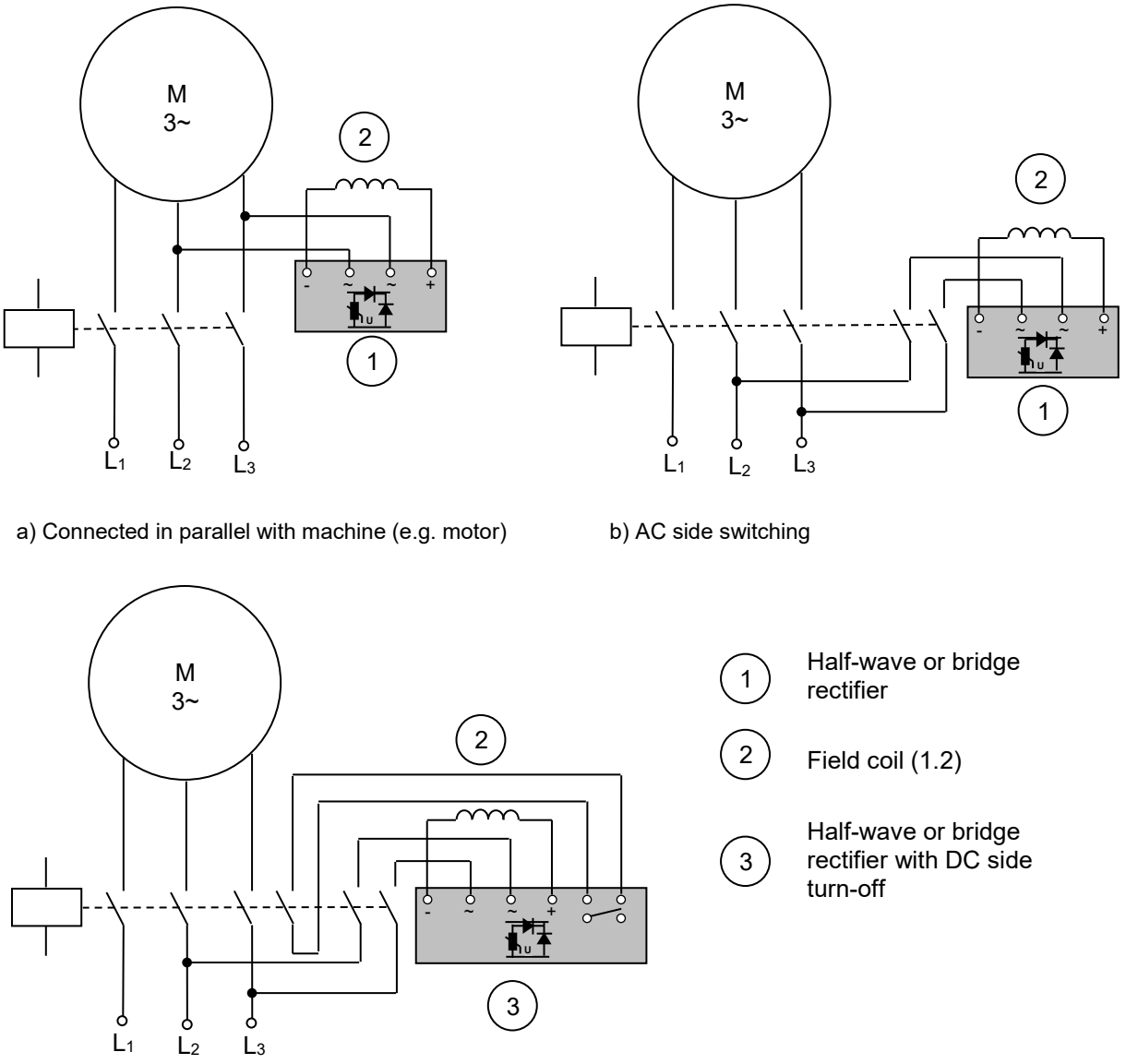


Fig. 22/1: Brake connection options (e.g. in motor terminal box)

NOTICE

Risk of damage to or destruction of electronic components and the brake field coil (1.2) if protection measures are insufficient or inadequate!

- Release of the spring-applied single-disc brake may no longer be possible.
- Potential malfunction of the motor.

- 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 fusing of contacts.

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.

DANGER

Electricity hazards from incorrect electrical connection of the component!

- Fatal electric shock hazard.

- All work must be performed by qualified specialist personnel only. Check that no voltage is present before connecting the component to the power supply. 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.

NOTICE

Risk of damage to the field coil (1.2) from incorrect electrical connection of the component!

- Release of the spring-applied single-disc brake may no longer be possible.
- Putting into service of the spring-applied single-disc brake and motor may not be possible.

- The brake is a DC operated system. The permissible permanent voltage variations on the power source of the electromagnetic brake are specified in Table 41/1.

4.3 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 spring-applied single-disc brakes in the SL 500..A00 and SL 502..A00 series are designed for industrial applications to which the following EMC standards apply: Generic Immunity Standard EN 61000-6-2 and Generic Emission Standard EN 61000-6-3 / EN 61000-6-4. Other applications may be subject to different generic standards which must be considered by the manufacturer of the installation. The requirements in terms of electromagnetic compatibility of devices and components are determined by basic standards derived from the generic standards. Wiring recommendations will be provided in the following sections to ensure compliance with the individual basic standards that are relevant for industrial 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 4.2.1.

Immunity according to EN 61000-4:

EN 61000-4-2 Electrostatic discharge:
The brakes comply at least with severity level 3 without requiring additional measures. The recommended rectifiers specified in Section 4.2.1 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 specified in Section 4.2.1 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 specified in Section 4.2 conform to severity level 3 without additional measures.

EN 61000-4-5 Surge:
The brakes comply at least with severity level 3 without requiring additional measures. The recommended rectifiers specified in Section 4.2.1 conform to severity level 3 without additional measures.

EN 61000-4-9 Pulse magnetic fields, EN 61000-4-10 Damped oscillatory magnetic fields:
Since the operating magnetic fields of the electromagnetic brakes are stronger many times over than interference fields, the brake function will remain unaffected. The brakes comply at least with severity level 4. The recommended rectifiers specified in Section 4.2.1 conform to severity level 3 without additional measures.

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 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 energised motors or by the slipping of an electromagnetically engaged system due to torque drop). The functional reliability of the electromagnetic component and its electronic accessories remains unaffected if the aforementioned consequential damage is avoided.

b) Voltage dips and short supply voltage variations:
Electromagnetically released systems:
Voltage dips and supply voltage variations to below 60% of the rated voltage and lasting longer than the response delay specified by DIN VDE 0580 may cause the brake to be de-energised temporarily. Consequential damage as described under a) above must be avoided by the user by taking adequate precautions.
Electromagnetically engaged systems:
Voltage dips and supply voltage variations to below the minimum tolerance threshold will cause torque reductions. The user is required to take adequate precautions to avoid consequential damage.

Radio interference suppression in accordance with EN 55011:
The brakes and the 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. 25/1 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 4.2.1 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, the recommended values listed in Table 26/1 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 turn-off 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 4.2 are equipped with free-wheel diodes and/or varistors to limit the turn-off 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 26/2.

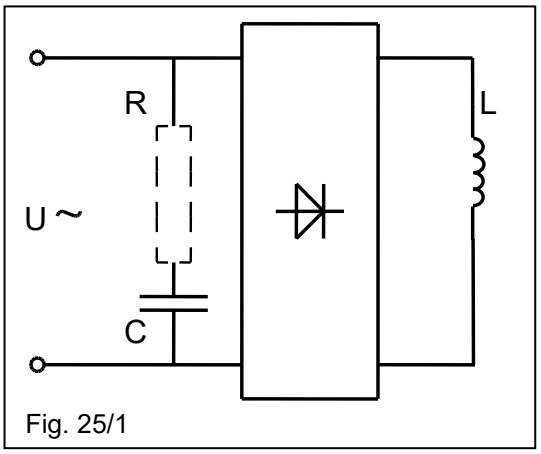


Fig. 25/1

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 installation from their obligation to furnish proof of conformity of the installation with such standards.

Rectifier series	Rated input voltage range U_1 (±10%) [VAC] (40 – 60 Hz)	Max. output current I_2 [ADC]	Capacitor C / U [nF / VAC]
32 07103B53	0 – 240	0.8	No capacitor required
32 07103B50	0 – 500	0.7	
32 07102B53	0 – 240	0.5	
32 07102B50	0 – 500	0.5	

Table 26/1: Recommended measures to comply with the limit values for class A equipment according to EN 55011

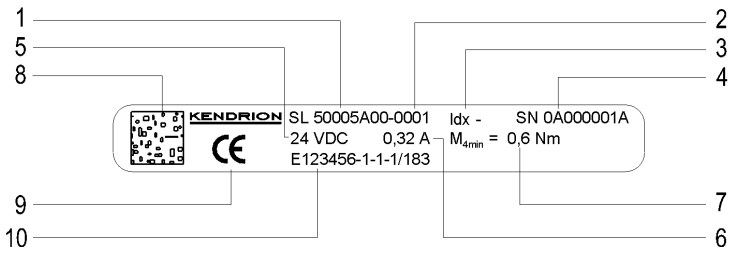
Max. rectifier operating voltage [VAC]	Recommended turn-off voltage in case of DC side switching [V]
250	300
440	300
550	300

Table 26/2: Recommended turn-off voltage in case of DC side switching for rectifiers specified in Table 20/1

4.4 Putting into service

Check compliance with the specifications provided on the rating plate (16) with respect to the mounting position and protection class. After the brake has been connected to the power source, a functional test must be performed to check that the friction disc (5) is not blocked. For this purpose, turn the motor shaft (11) while the brake is energised and the motor is unpowered. After completion of mounting, all necessary covers and guards must be installed. If necessary (e.g. after a prolonged storage period), a break-in process must be conducted in accordance with the parameters specified in Table 41/2.

Specifications on rating plate (order-specific, example brake type SL 50005A00-0001):



1	Type number
2	Version number (4-digit)
3	Offer drawing index
4	Series number (9-digit)
5	Rated voltage
6	Rated current
7	Transmissible torque
8	2D data matrix code (ECC Level 200) Kendrion DMC
9	CE mark
10	Production ID code with manufacturing date (year and month, 3-digit)

Note: The product number of the spring-applied single-disc brake consists of the type number followed by the version number, e.g. SL 50005A00-0001.

DANGER

Electricity hazards from incorrect electrical connection of the component!

- Fatal electric shock hazard.
- All work must be performed by qualified specialist personnel only. Check that no voltage is present before connecting the component to the power supply. The specifications on the rating plate and the information provided in the circuit diagram in the motor terminal box or in the operating instructions must be strictly observed.

CAUTION

Hazards from contact with rotating parts (e.g. motor shaft (11) etc.) during operation of the spring-applied single-disc brake and/or motor!

- Physical injury hazard (e.g. chafing, cuts etc.) to hands and limbs.
- Functional testing of the brake must not be performed unless the machine (e.g. motor) has been turned off and secured so that it cannot be turned back on inadvertently or by unauthorised persons. Do not touch rotating parts (e.g. motor shaft (11) etc.).

CAUTION

Hazards from contact with loose parts during operation of spring-applied single-disc brake and/or motor!

- Physical injury hazard (e.g. cuts etc.) to limbs and other parts of the body.
- Before starting the motor test run without driven components, the feather key (if used) must be secured in such a way that it cannot be hurled out. Ensure that the motor shaft (11) is not exposed to load torques. Ensure that the brake is unpowered before restarting the motor.

CAUTION

Hazards from contact with hot parts during operation of the spring-applied single-disc brake!

- Injury hazard (e.g. skin burns) to hands, limbs and other parts of the body.
- Depending on the operating state of the brake, its surface temperature may rise to over 60°C. If necessary, suitable protections and hand guards must be installed to avoid accidental contact with hot surfaces.
- Wear protective gloves, if necessary.

NOTICE

Risk of property damage caused by hot parts during operation of the spring-applied single-disc brake!

- Release of the spring-applied single-disc brake may no longer be possible.
- Irreversible damage to heat-sensitive parts (e.g. cables) may occur.
- Putting into service of the spring-applied single-disc brake and motor may not be possible.
- The brake surface temperature may rise to over 60°C. Heat-sensitive parts such as conventional cables or electronic components must not be fixed to or be in contact with hot surfaces.

NOTICE

Risk of damage to or destruction of the brake field coil (1.2) if the high-voltage test is not performed correctly!

- Release of the spring-applied single-disc brake may no longer be possible.
- Putting into service of the spring-applied single-disc brake and motor may not be possible.
- High-voltage tests performed when mounting the brake in an installation or when putting the brake into service 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.

NOTICE

Risk of damage to the field coil (1.2) from incorrect electrical connection of the component!

- Release of the spring-applied single-disc brake may no longer be possible.
- Putting into service of the spring-applied single-disc brake and motor may not be possible.

- Check that the brake has been connected in accordance with the specifications provided on the rating plate before it is put into service. 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 4.3 will cause damage to electronic rectifiers, electronic accessories, switching contacts and to the field coil (1.2).

5. Maintenance, repair, replacement

5.1 Maintenance

The spring-applied single-disc brake does not require any particular maintenance except that the air gap ‘s’ must be measured and the power connections and overall appearance of the brake must be checked at regular intervals. Replace the spring-applied single-disc brake when the maximum operating air gap s_{Bmax} is reached (see Table 40/1 – Technical specifications and definition in Section 10). The hub (7) need not be replaced.

IMPORTANT

An opening can be provided in the motor housing to insert a feeler gauge (see Section 9, Tools and measuring instruments for installation, maintenance and troubleshooting) in order to measure the air gap ‘s’ between the magnet housing (1.1) and armature (2).

If the brake is not operated for a long period of time, the brake torque may drop. A short break-in process (see Table 41/2) will restore correct and reliable brake operation.

Test feature	Test scope / procedure
Air gap ‘s’	The air gaps ‘s’ can be checked when the brake is mounted to the motor or not. Use a measuring probe (Table 36/1) or similar instrument to measure the stroke of the armature (2) at three measuring points offset by 120° when the brake is closed and open. The location of the measuring points is shown in Fig. 14/3. The arithmetic mean of the three measuring values gives the size of the air gap ‘s’. **IMPORTANT** Replace the brake when the maximum operating air gap s_{Bmax} is reached (see Table 40/1 – Technical specifications and definition in Section 10). The air gap ‘s’ cannot be adjusted. A new brake must be mounted as described in Section 4. To put the new brake into service, follow the instructions in Section 4.4.
Power supply connections and overall visual appearance of brake	Check the wire leads (1.3) and mechanical brake components for damage. Replace the brake if any defects are suspected. If dirt has accumulated in the brake due to friction lining abrasion or similar phenomena, clean the affected surfaces with oil-free compressed air or by means of a brush. **IMPORTANT** A new brake must be mounted as described in Section 4. To put the new brake into service, follow the instructions in Section 4.4.

Table 30/1: Test features and test procedures

DANGER

Electricity hazards from incorrect electrical connection or disconnection of the component!

- Fatal electric shock hazard.
- All work must be performed by qualified specialist personnel only. Check that no voltage is present before connecting or disconnecting the component to/from the power supply. The specifications on the rating plate and the information provided in the circuit diagram in the terminal box of the machine (e.g. motor) or in the operating instructions must be strictly observed.

WARNING

Hazards from neutralisation of the braking effect in case the maximum permissible air gap s_{max} is exceeded!

- Uncontrolled movements of the motor shaft (11) may cause injury hazards if persons are present within the confines and/or working range of the installation.
- Uncontrolled **extremely fast** movements of the motor shaft (11) may cause death if persons are present within the confines and/or working range of the installation.

- Depending on the brake operating condition, the braking effect (brake function) may be compromised or even lost when the maximum air gap s_{max} (see Table 40/1) is exceeded. Replace the component at the latest when the maximum air gap s_{max} (see Table 40/1) is reached.

WARNING

Hazards from insufficient braking effect in case of contamination of surfaces involved in the friction process of the spring-applied single-disc brake!

- Uncontrolled movements of the motor shaft (11) may cause injury hazards if persons are present within the confines and/or working range of the installation.
- Uncontrolled **extremely fast** movements of the motor shaft (11) may cause death if persons are present within the confines and/or working range of the installation.

- Ensure that all surfaces involved in the friction process are free of grease and oil.
- Ensure that no swelling or glazing of the friction lining (if used) has occurred.

CAUTION

Hazards from contact with rotating parts (e.g. motor shaft (11) etc.) during operation of the spring-applied single-disc brake and/or motor!

- Physical injury hazard (e.g. chafing, cuts etc.) to hands and limbs.

- Functional testing of the brake must not be performed unless the motor has been switched off and secured against accidental or unintentional start-up. Do not touch rotating parts (e.g. motor shaft (11) etc.).
- After completion of inspection and maintenance operations, remove the lock provided to prevent accidental start-up of the machine (e.g. motor).

NOTICE

Risk of brake damage caused by incorrect maintenance!

- The correct function and operation of the spring-applied single-disc brake may be compromised.
- Putting into service of the spring-applied single-disc brake and motor may not be possible.

- Any tests conducted to confirm correct function, operational safety and reliability of the spring-applied single-disc brake must be performed with extreme caution and by qualified specialist personnel only.

5.2 Brake repair and replacement in case of failure

If a failure occurs or the maximum air gap s_{max} (see Table 40/1 – Technical specifications and definition in Section 10) is reached, brake replacement by the motor manufacturer is imperative. The brake cannot be repaired.

DANGER

Electricity hazards from incorrect electrical connection of the component!

- Fatal electric shock hazard.

- All work must be performed by qualified specialist personnel only. Check that no voltage is present before connecting the component to the power supply. 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.

DANGER

Hazards from incorrect brake replacement!

- Uncontrolled movements of the motor shaft (11) may cause injury hazards if persons are present within the confines and/or working range of the installation.
- Uncontrolled **extremely fast** movements of the motor shaft (11) may cause death if persons are present within the confines and/or working range of the installation.

- The motor must be turned off by the manufacturer's service and/or maintenance personnel before starting to replace the brake. Brake replacement must not be performed unless the machine (e.g. motor) has been turned off and secured so that it cannot be turned back on inadvertently or by unauthorised persons. Do not touch rotating parts (e.g. motor shaft (11) etc.).

WARNING

Hazards from neutralisation of the braking effect in case the maximum permissible air gap s_{max} is exceeded!

- Uncontrolled movements of the motor shaft (11) may cause injury hazards if persons are present within the confines and/or working range of the installation.
- Uncontrolled **extremely fast** movements of the motor shaft (11) may cause death if persons are present within the confines and/or working range of the installation.

- Depending on the brake operating condition, the braking effect (brake function) may be compromised or even lost when the maximum air gap s_{max} (see Table 40/1) is exceeded. Replace the component at the latest when the maximum air gap s_{max} (see Table 40/1) is reached.

NOTICE

Risk of damage to the brake or mounting screws (9, 10) if the M_A tightening torque is too high!

- Release of the spring-applied single-disc brake may no longer be possible.
- Potential breakage of the mounting screws (9, 10).

- The M_A tightening torques specified for the mounting screws (9, 10) (Table 15/1) must be strictly observed. Tighten the mounting screws (9, 10) evenly in several steps.

NOTICE

Risk of brake damage in case the maximum permissible air gap s_{max} is exceeded!

- Release of the spring-applied single-disc brake may no longer be possible.
- Potential thermal overloading of the spring-applied single-disc brake.
- Potential thermal overloading of the motor.

- Replace the spring-applied single-disc brake at the latest when the maximum air gap s_{max} is reached (see Table 40/1 – Technical specifications and definition in Section 10). The air gap 's' cannot be adjusted.

IMPORTANT

Brake replacement must be performed in accordance with the specific maintenance instructions provided by the manufacturer of the machine (e.g. motor). The instructions provided in Section 4 (Installation) of this manual must also be observed.

5.3 Spare parts and accessories

Individual spare parts or accessories are not available for the spring-applied single-disc brake.

6. Condition at delivery, transport and storage

The spring-applied single-disc brake is delivered ready for mounting.

The rated air gap s_N is factory-adjusted. The friction disc (5) is factory-mounted in a centred position between the armature (2) and flange (6) and firmly locked when the brake circuit is closed.

Upon receipt of the shipment, the brake must be checked for transit damage before storage. If the brake is not installed immediately upon delivery, it must be stored in a dry, dust-free and vibration-proof place.

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

Table 33/1: Environmental conditions for storage and transport as specified in EN IEC 60721-3-1 and EN IEC 60721-3-2

IMPORTANT

The environmental conditions specified in Table 33/1 and in EN IEC 60721-3-2 / EN IEC 60721-3-1 must be considered during transport and storage of the brake, especially when long-term storage is envisaged. The specified environmental conditions apply only if the brake is stored in its original packaging.

7. Emissions

7.1 Noise

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

7.2 Heat

Braking operations and gradual heating of the field coil (1.2) cause the magnet housing (1.1) temperature to increase substantially. Under adverse conditions, the surface temperature may rise to well over 60°C.

CAUTION

Hazards from contact with hot parts during operation of the spring-applied single-disc brake!

- Injury hazard (e.g. skin burns) to hands, limbs and other parts of the body.
- Depending on the operating state of the brake, its surface temperature may rise to over 60°C. If necessary, suitable protections and hand guards must be installed to avoid accidental contact with hot surfaces.
- Wear protective gloves, if necessary.

8. Troubleshooting

Fault	Cause	Corrective actions
Brake release failure	• Air gap too large	Check the air gap. Install a new brake, if necessary.
	• No voltage applied to brake	Check the power connections and correct faults, if found.
	• Voltage applied to field coil (1.2) too low	Check the supply voltage of the field coil (1.2) and correct faults, if found.
	• Damaged rectifier	Replace the rectifier.
	• Damaged field coil (1.2)	Check the resistance of the field coil (1.2). Install a new brake, if necessary.
	• Irreversible thermal damage of friction disc (5) lining	Install a new brake.
	• Power supply connection defects	Check the power supply connection. Install a new brake, if necessary.
Delayed brake release	• Air gap too large	Check the air gap. Install a new brake, if necessary.
	• Voltage applied to field coil (1.2) too low	Check the supply voltage of the field coil (1.2) and correct faults, if found.
Brake engagement failure	• Voltage applied to field coil (1.2) in unpowered condition too high (residual voltage)	Check whether residual voltage is applied to the field coil (1.2) and correct faults, if found.
	• Armature (2) blocked mechanically	Eliminate mechanical blocks. Install a new brake, if necessary.
Delayed brake engagement	• Voltage applied to field coil (1.2) too high	Check the supply voltage of the field coil (1.2) and correct faults, if found.
	• Defective protective circuit of field coil (1.2)	Check the protective circuit and replace defective components, if necessary.
Brake torque too low	• Air gap too large	Check the air gap. Install a new brake, if necessary.
	• Surface(s) involved in friction process contaminated with oil, grease or dirt	Install a new brake.
	• Thermal damage to friction disc (5) linings	Install a new brake.

Table 35/1: Possible faults, causes and corrective actions (list not exhaustive)

9. Tools and measuring instruments for installation, maintenance and troubleshooting

Special tools and measuring instruments are required for installation (Section 4), maintenance (Section 5.1) and troubleshooting (Section 8, list of potential faults not exhaustive). The individual tools and instruments and their applications are described in Table 36/1.

Tools, measuring instruments	Description	Application
	Calibrated torque wrench and Allen key for mounting screws (9, 10) to ISO 4762	Precise torque-controlled tightening and loosening of the brake mounting screws (9, 10) (see Section 4).
	Allen key for mounting screws (9,10)	Tightening and loosening of the brake mounting screws (9, 10) (see Section 4).
	Feeler gauges	Checking and measuring the air gap ‘s’ of the spring-applied single-disc brake (see Section 5.1).
	Measuring probes and dial gauges	Alternative instruments for checking and measuring the air gap ‘s’ of the spring-applied single-disc brake (see Section 5.1).
	Multimeter (voltage, current, resistance)	Measuring the supply voltage and ohmic resistance of the field coil (1.2) (see Section 8).

Table 36/1: Tools and measuring instruments for installation, maintenance and troubleshooting

IMPORTANT

Tests, service and maintenance operations to be performed on the brake must be carried out by the motor manufacturer’s qualified service personnel. The specific maintenance instructions provided by the motor manufacturer must take account of the requirements specified in Section 5.1 (Maintenance) of these operating instructions.

10. Definitions

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

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

Rated voltage U_N	supply voltage specified by the manufacturer for voltage coils 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

Other definitions (not included in DIN VDE 0580) applicable to spring-applied single-disc brakes:

Opening time t_o	time it takes for the brake to open mechanically (see chart in Fig. 39/1)
Closing time t_{c1}	time it takes for the brake to close mechanically (see chart in Fig. 39/1)
Activation time t_{c2}	time it takes for the brake to close mechanically and for the full holding torque to be reached almost completely (see chart in Fig. 39/1)
Transmissible torque M_{4min}	lowest static torque (holding torque) of the brake at the specified rated operating conditions
Operating air gap s_B	air gap range in closed condition at which the brake can be operated provided that the technical specifications are complied with
Air gap s	air gap of closed brake
Rated air gap s_N	air gap when the brake or clutch is new
Max. air gap s_{max}	maximum air gap at which the brake (just about) still opens
Opening voltage U_1	voltage at which the brake opens
Coupling voltage U_3	voltage at which the brake closes
Holding voltage U_4	voltage at which the brake must remain open

The switching times (disconnection time t_2 and coupling time t_1) 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 profile (see Fig. 39/1) instead of using the DIN VDE 0580 definitions.

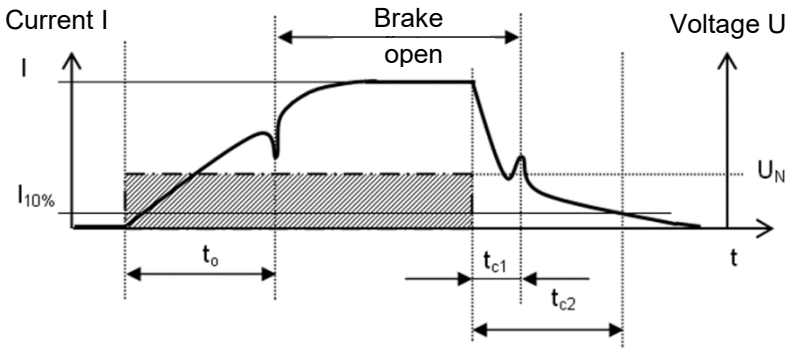


Fig. 39/1: Definition of switching times for (static) holding operation

11. Technical specifications

Product built and tested to DIN VDE 0580

	Brake size					
	03	04	05	07	09	10
Min. transmissible torque M_{4min} [Nm]	0.3	0.3	0.6	1.7	4.0	5.0
Transmissible torque M_4 [Nm]	0.4	0.4	1.0	2.4	5.0	6.5
Rated power P_N [W]	5.8	8.3	10.3	11.4	14	20
Standard rated voltage U_N [VDC]	12	24				
Overexcitation rated voltage $U_{ÜN}$ [VDC] [12)]	24	-				
Overexcitation time t_{OE} [ms] [12)]	200	-				
Max. limit speed n_G [rpm]		8000		6000		
Max. speed n_n [rpm]	6000	6000	5000	4000	3000	3000
Max. switching work W_{1max} (Z=20/h) [J]	0.5	5	20	50	250	300
Max. number of emergency stops Z_{total} with W_{1max}	200					
Max. total switching work W_{total} [kJ]	0.1	1	4	10	50	60
Rated air gap s_N [mm]	0.06 – 0.1	0.06 – 0.1	0.07 – 0.11	0.08 – 0.12	0.08 – 0.12	0.1 – 0.14
Max. operating air gap s_{Bmax} [mm]	0.15	0.15	0.15	0.18	0.18	0.21
Max. air gap s_{max} (at 65% of rated current) [mm]	tbd	tbd	tbd	tbd	tbd	tbd
Max. closing time t_{c1} [ms]	tbd	tbd	30	40	50	tbd
Max. opening time t_o [ms]	tbd	tbd	8	9	15	tbd
Opening voltage U_1 [VDC]	12					
Coupling voltage U_3 [VDC]	1					
Holding voltage U_4 [VDC]	9.6					
Mass moment of inertia J of friction disc SL 500..A00 [10^{-4} kgcm^2]	5	11.5	44	183	475	1324
Mass moment of inertia J of friction disc SL 502..A00 [10^{-4} kgcm^2]	-	-	tbd	198	755	tbd
Weight (without hub) m [kg]	70	90	140	300	470	670
Duty cycle [%]	100%					
Insulation class	F					
Pollution degree	2					
Protection rating	IP00					
Brake type	holding brake with emergency stop function					

Table 40/1: Technical specifications

[12)] Brake size 03 operation only with PWM module.

	Rated operating conditions
Rated voltage tolerance	±10%
Frequency range	±1% of rated frequency
Ambient temperature ϑ_{13} [°C]	-10 to +100
Relative humidity	30% to 80% within ambient temperature range
Other climatic environmental conditions	3Z2 and 3Z4 to EN 60721-3-3
Mechanical environmental conditions	3M8 to EN 60721-3-3
Biological environmental conditions	3B1 to EN 60721-3-3
Mechanically active substances	3S2 to EN 60721-3-3
Chemically active substances	3C2 to EN 60721-3-3
Installation height	up to 2000 m a.m.s.l.

Table 41/1: Required operating conditions for spring-applied single-disc brakes

	Brake size					
	03	04	05	07	09	10
Speed n [rpm]	tbd	tbd	380	370	tbd	tbd
Coil ON time t_5 [s]	tbd	tbd	3	3	tbd	tbd
Coil OFF time t_6 [s]	tbd	tbd	1	1	tbd	tbd
Break-in period t_{total} [s]	tbd	tbd	64	64	tbd	tbd

Table 41/2: Break-in process parameters for the spring-applied single-disc brake after installation and during brake service life

Explanations on the technical specifications:

W_{1max} (maximum switching work) is the switching work that must not be exceeded during braking operations at maximum speed n_n. The maximum number of switching operations (emergency stops) Z per hour and the maximum permissible switching work W_{1max} are specified in Table 40/1. The W_{1max} values are approximate values. They apply to built-in brakes without any additional cooling and to emergency stops. The specified minimum transmissible torque M_{4min} is the lowest static brake torque at the specified operating conditions (see Table 41/1). The specified transmissible torque M_4 characterises the torque level of the brake. Depending on the application the brake is used for, the switching torque M_1 and the effective transmissible torque M_4 may differ from the specified M_4 values. The switching torque M_1 depends on the speed (rpm). If the friction surfaces are contaminated with oil, grease or dirt and the ambient temperatures are below or above the specified range, the effective transmissible torque M_4 and the switching torque M_1 may drop. The technical specifications apply after the break-in process has been completed with the specified break-in parameters (see Table 41/2). Vertical brake operation is only allowed after prior consultation with the brake manufacturer.

Specific explanations of the terms opening voltage, coupling voltage and holding voltage:

Opening voltage U_1:

The defined maximum opening voltage U_1 values apply under the following conditions:

- 20°C field coil temperature
- Operation at rated air gap s_N according to Table 40/1

Coupling voltage U_3 and holding voltage U_4:

The defined minimum coupling voltage U_3 values and the defined maximum holding voltage U_4 values apply under the following conditions:

- 20°C field coil temperature

Specific explanations of the opening and closing times:

Opening time t_o and closing time t_c:
The defined maximum values of the opening time t_o and closing time t_c apply under the following conditions:

- Operation at rated voltage U_N within the permissible voltage range as specified in Table 41/1
- Up to 155°C field coil temperature
- Operation at maximum operating temperature ϑ_{13} as specified in Table 41/1
- Operation up to maximum operating air gap s_{Bmax} as specified in Table 40/1
- Operation with varistor (type SIOV-S14K30)

In case of AC side brake switching, the closing time t_{c1} is substantially longer.

The rated operating conditions specified in Table 41/1 and the technical specifications in Table 40/1 must be strictly observed during operation of the spring-applied single-disc brakes.

The information in the relevant offer drawings of the specific brake types must be strictly observed!

IMPORTANT

If there is any conflict between the information provided in the offer drawing and the information given in Section 10 of these operating instructions, the offer drawing shall prevail.

Specifications subject to change without notice!

12. Product number / type number / version number

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

Example:

Type number: SL 50005A00 Version number: 0002 (version without hub)

Product number: SL 50005A00-0002

13. Specialist repair shops

Kendrion (Villingen) GmbH
Wilhelm-Binder-Str. 4-6
78048 Villingen-Schwenningen
Germany
Tel: +49 (0)7721 877-1417

Kendrion (China) Co., Ltd.
Factory Building No. 2
17 Su Hong East Road
215026 Suzhou Industrial Park
Suzhou, P.R. China
Tel. +86 (0)512 83981819

14. Revision history

Date of issue	Changes
13/03/2020	First issue

KENDRION

Kendrion (Villingen) GmbH

Wilhelm-Binder-Straße 4-6
78048 Villingen-Schwenningen
Germany

Tel: +49 7721 877-1417
Fax:+49 7721 877-1462

sales-ids@kendrion.com
www.kendrion.com

PRECISION. SAFETY. MOTION.