8 BE Brake

8.1 Description

General information

On request, SEW-EURODRIVE motors and gearmotors are supplied with an integrated mechanical brake. The brake is a DC-operated electromagnetic disk brake that is released electrically and applied using spring force. The brake is applied in case of a power failure. It meets the basic safety requirements.

The brake can also be released mechanically if equipped with manual brake release. Two options are available for manual brake release:

1. With automatic manual brake release (..HR); a hand lever is supplied.
2. With lock-type manual brake release (..HF), a setscrew is supplied.

The brake is controlled by a brake controller that is either installed in the motor wiring space or the control cabinet.

A main advantage of brakes from SEW-EURODRIVE is their very short design. The integrated construction of the brakemotor permits particularly compact and sturdy solutions.

Description

The brake is installed on the B-end and integrated in the motor.

It is an electromagnetic, spring-loaded brake powered by energized DC voltage via a rectifier. It uses the two-coil system by SEW-EURODRIVE.

The new BE brake is designed as a modular system and a patent has been applied for. It is generally low-noise.

The principle of the modular brake on a friction disk begins from motor size DR.90. In the smaller DR.71 and DR.80 motors, the brake operates according to the principle of the BM(G), i.e. "brake integrated" directly on the endshield.

The modular brake allows for mounting one of up to three brake sizes to a motor. The B-side endshield is to be regarded like a connecting flange that accommodates the BE pre-mounted on a friction disk.

Although the integrated brake is mounted on a complete brake endshield, it can be dimensioned to suit specific requirements just like the modular brake.

8.2 Principles of the BE brake

Basic structure

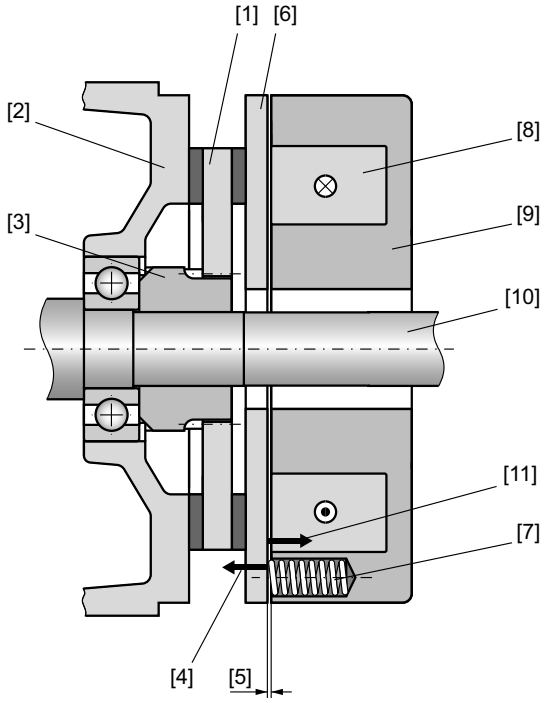
The SEW brake is an electromagnetic disk brake with a DC coil that releases electrically and brakes using spring force. The system meets all fundamental safety requirements: The brake is applied automatically if the power fails.

The principal parts of the brake system are the brake coil itself [8] (accelerator coil + coil section = holding coil), comprising the magnet [9] with an encapsulated winding and a tap, the moving pressure plate [6], the brake springs [7], the brake disk [1] and the brake endshield [2].

A characteristic feature of SEW brakes is their very short length. The integrated design of the SEW brakemotor makes for particularly compact and sturdy solutions.

Basic function

In contrast to other disk brakes with a DC coil, the SEW brakes operate with a two coil system. The pressure plate is forced against the brake disk by the brake springs when the electromagnet is deenergized. The brake is applied to the motor. The type and number of brake springs determines the braking torque. When the brake coil is connected to the appropriate DC voltage, the spring force [4] is overcome by magnetic force [11], thereby bringing the pressure plate into contact with the magnet. The brake disk moves clear and the rotor can turn.



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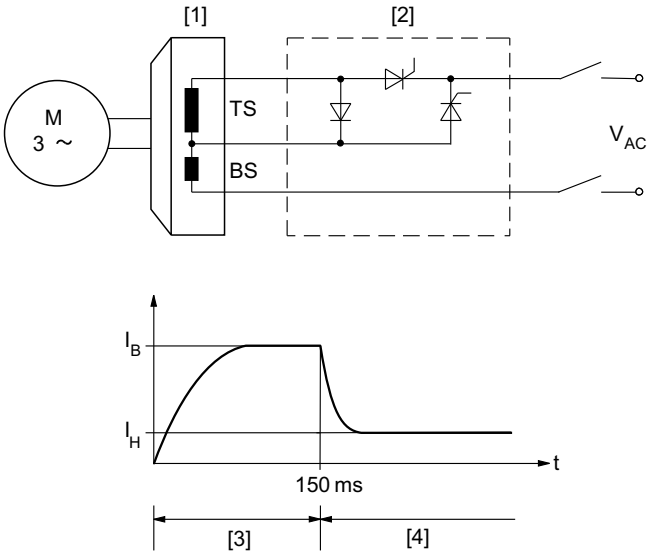
[1] Brake disk
[2] Brake endshield
[3] Carrier
[4] Spring force
[5] Working air gap
[6] Pressure plate
[7] Brake spring
[8] Brake coil
[9] Magnet
[10] Motor shaft
[11] Electromagnetic force

Particularly short response times at switch-on

A special brake control system ensures that only the accelerator coil is switched on first, followed by the holding coil (entire coil). The powerful impulse magnetization (high acceleration current) of the accelerator coil results in a very short response time, particularly in large brakes, without reaching the saturation limit. The brake disk moves clear very quickly and the motor starts up with hardly any braking losses.



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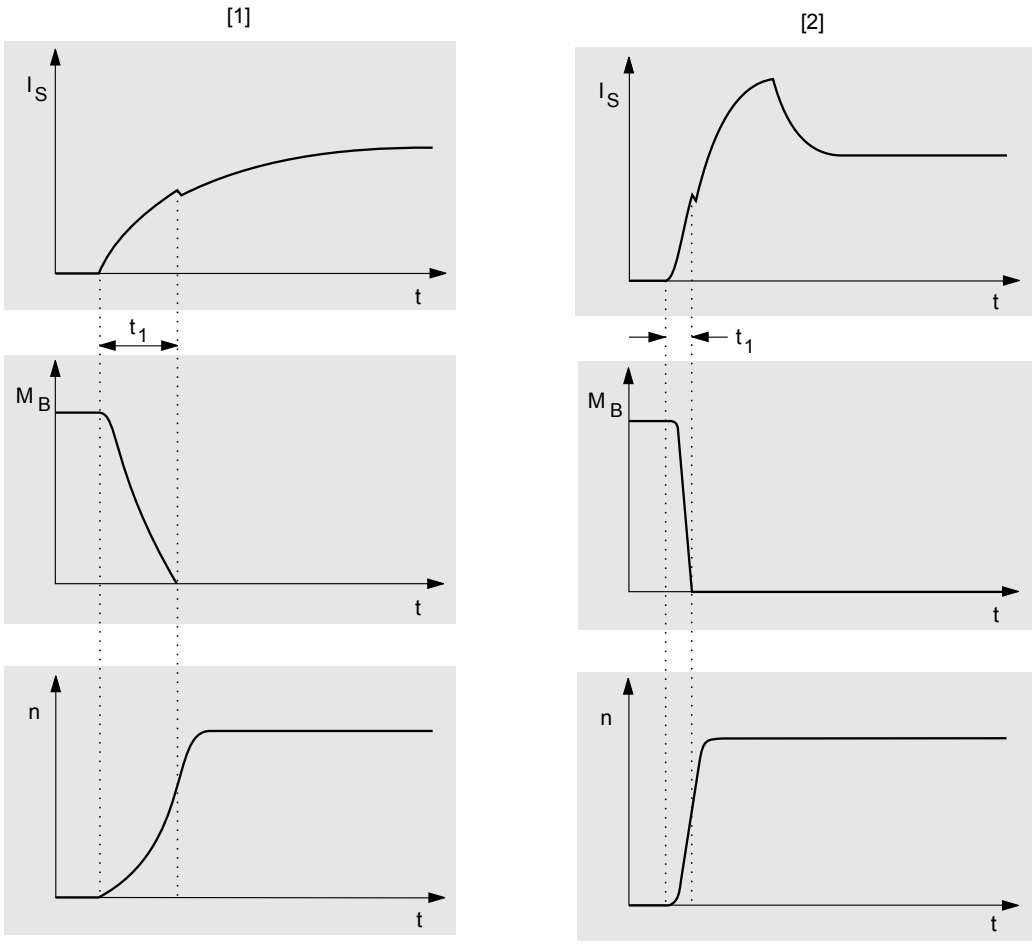
BS Accelerator coil
TS Coil section
[1] Brake
[2] Brake controller
[3] Acceleration
[4] Holding
I_B Acceleration current
I_H Holding current
BS + TS = Holding coil

The particularly short response times of SEW brakes lead to faster motor startup time and minimum start-up heating, which reduces energy consumption and brake wear during startup (see following figure). Benefits for the user: very high switching frequency and a long brake service life.



[1] Switch-on procedure for operation with rectifier without switching electronics

[2] Switch-on procedure for operation with SEW rectifier with switching electronics, e.g. BGE (standard from size BE5)

I_S Coil current

M_B Braking torque

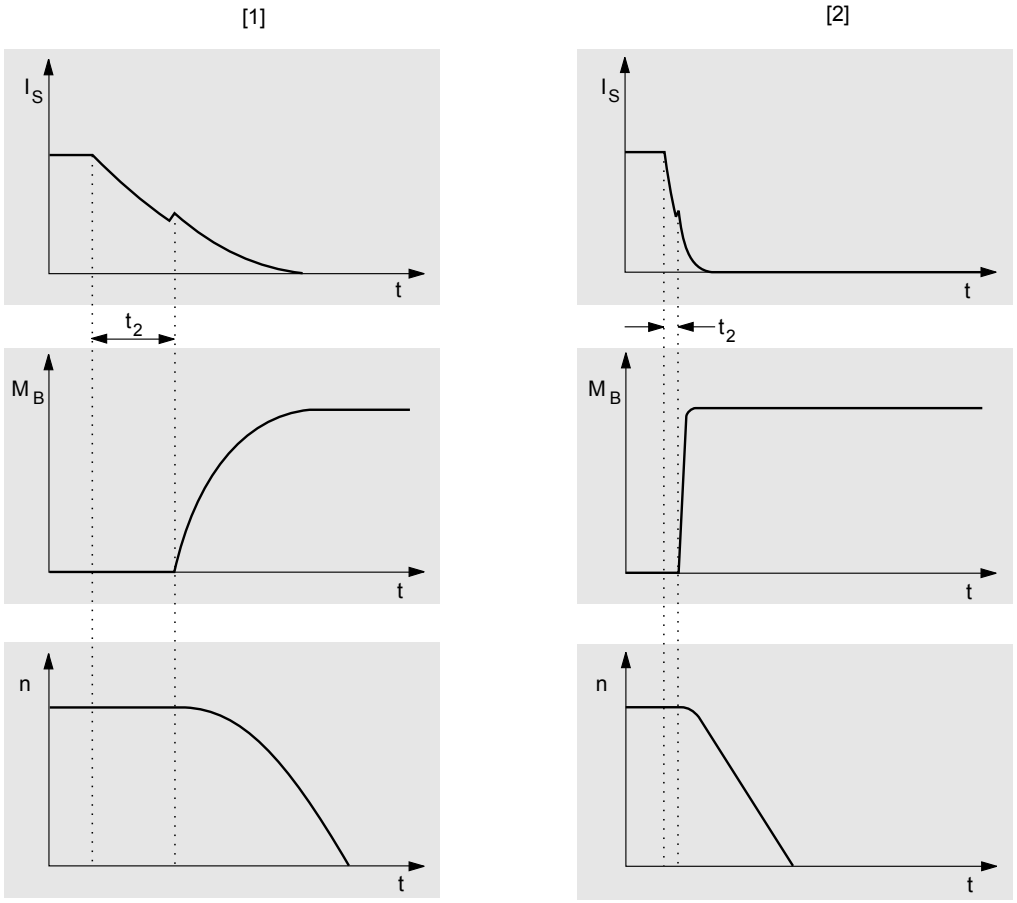
n Speed

t_1 Brake response time

The system switches to the holding coil electronically as soon as the SEW brake has released. The braking magnet is now only magnetized to such an extent (weak holding current) to ensure that the pressure plate is held open with a sufficient degree of safety and minimum brake heating.

Particularly short response times at switch-off

This means de-excitation occurs very rapidly when the coil is switched off, so the brake is applied with a very fast response time, particularly with large brakes. User benefits: Very short braking distance with high repeat accuracy and a high degree of safety, e.g. for applications involving hoist drives.



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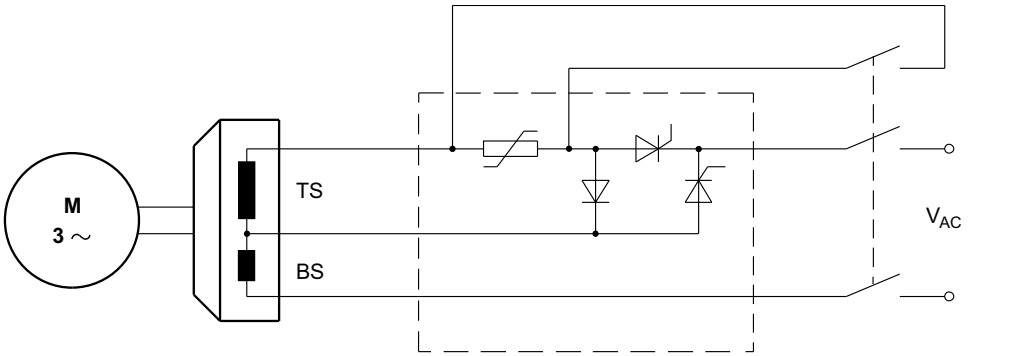
[1] Brake response to cut-off in the AC circuit
[2] Brake response to cut-off in the AC and DC circuits
I_S Coil current
M_B Braking torque
n Speed
t_2 Brake application time

The response time for the application of the brake also depends on how rapidly the energy stored in the brake coil is dissipated when the power supply is switched off. A freewheeling diode is used to dissipate the energy for a cut-off in the AC circuit. The current decays according to an e-function.

The current dissipates much more rapidly via a varistor when the DC and AC circuits are cut-off at the same time as the coil's DC circuit. The response time is significantly shorter. Conventionally, cut-off in the DC and AC circuits is implemented using an additional contact on the brake contactor (suitable for an inductive load).

Under certain conditions, you can also use SR and UR electronic relays for interrupting the DC circuit.



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Particularly quiet Particularly quiet brakemotors are required in many applications in the power range up to approximately 5.5 kW (4-pole) to reduce noise pollution. SEW-EURODRIVE implements special design measures to meet these requirements as standard for all AC brakemotors without affecting the special dynamic features of the brake system.

Particularly safe Tried and tested design components and brake controls tested in trial applications ensure that the SEW brake has a high degree of operational safety.

8.3 The BE brake in detail

BE brake

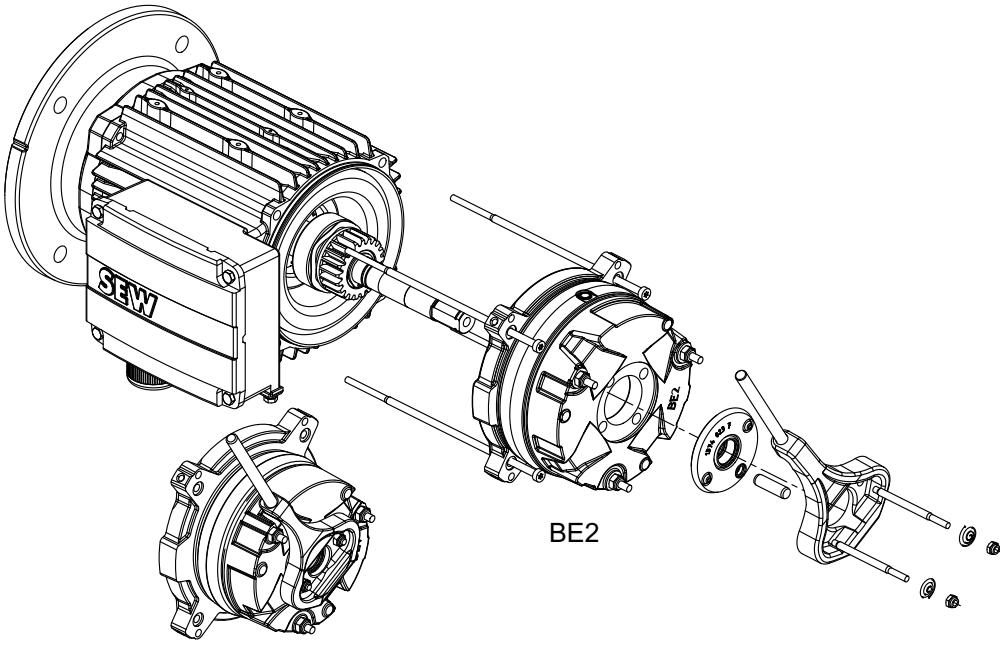
The BE.. brake is used for AC motors DR.71 - DR.315.

Main features of the brake:

- Different brake sizes can be mounted to one motor size
- Brake coil with tap
- Movable pressure plate
- Plug connector for simple electrical connection from BE20
- The number of brake springs determines the braking torque
- Position of the manual brake release can be defined by the user

Integrated design

Integrated design of the brake for motor types up to size DR.80 means the B-side end-shield of the motor is integral part of the brake with a friction surface.



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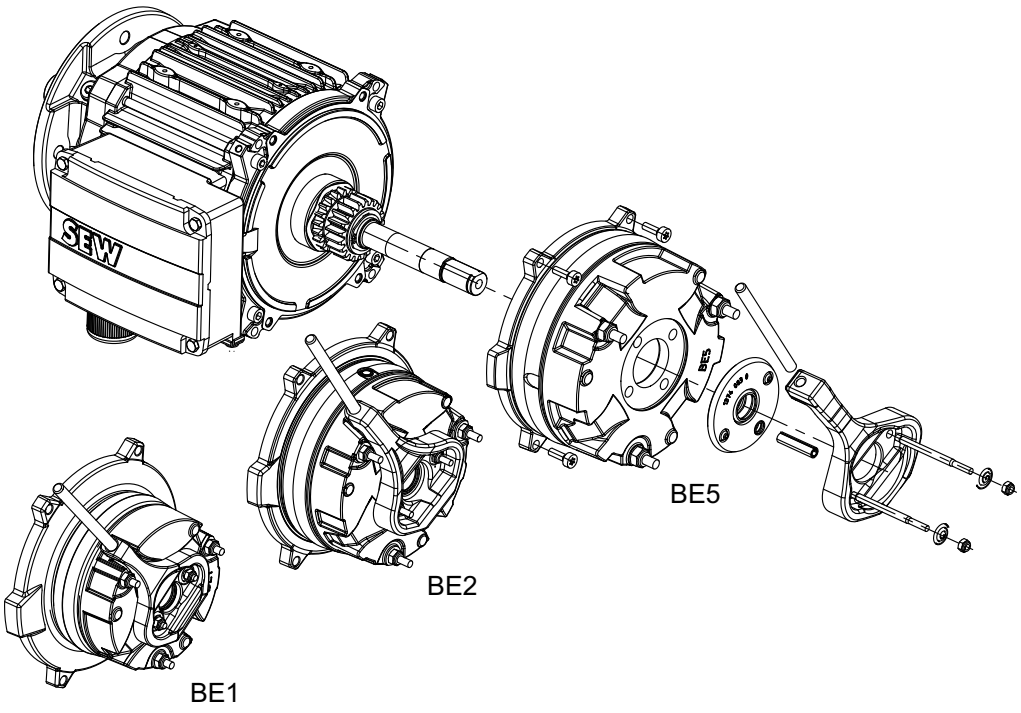
Modular design

The modular design of the brake for motor types from DR.90 means the brake has a separate friction disk. The complete bearing of the motor is maintained even when the brake is removed.



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8.4 General notes on project planning for the brake

The size of the brakemotor and its electrical connection must be selected carefully to ensure the longest possible service life.

The following aspects described in detail must be taken into account:

1. Selecting the brake / brakemotor in accordance with the project planning data, see page 238.
2. Determining the brake voltage, see page 241.
3. Selecting the brake control system and connection type, see page 242.
4. Dimensioning and routing the cable, see page 249.
5. Selecting the brake contactor, see page 250.
6. Important design information, see page 251.
7. Motor protection switch if necessary (to protect the brake coil), see page 252.
8. Brake monitoring diagnostic unit, see page 281.

8.5 Selecting the brake/braking torque according to the project planning data

The mechanical components, brake type and braking torque, are determined when the drive motor is selected. The drive type or application areas and the standards that have to be taken into account are used for the brake selection.

Selection criteria:

- AC motor with one speed / pole-changing motor
- Speed-controlled AC motor with frequency inverter
- Servomotor
- Number of braking operations during service and number of emergency braking operations
- Working brake or holding brake
- Amount of braking torque ("soft braking"/"hard braking")
- Hoist applications
- Minimum / maximum deceleration

Values determined/calculated during brake selection:

Basic specification	Link / supplement / comment
Motor type	Brake type/Brake control system
Braking torque[1)]	Brake springs
Brake application time	Connection type of the brake control system (important for the electrical design for wiring diagrams)
Braking time **Braking distance** **Braking deceleration** **Braking accuracy**	The required data can only be observed if the aforementioned parameters meet the requirements
Braking work **Brake service life**	Maintenance interval (important for service)

1) The braking torque is determined from the requirements of the application with regards to the maximum deceleration and the maximum permitted distance or time.

For detailed information on selecting the size of the brakemotor and calculating the braking data, refer to the documentation "Drive Engineering - Practical Implementation – Project Planning for Drives".

Selecting the brake

The brake suitable for the relevant application is selected by means of the following main criteria:

- Required braking torque
- Required working capacity

Braking torque

The required braking torque is usually selected according to the required deceleration of the application.

The nominal braking torque values of the BE brakes have been determined and checked in accordance with DIN VDE 0580.

The "Brake assignment" show the possible braking torque rating for horizontal and vertical movements, see page 266.

Braking torque in hoist applications

The selected braking torque must be greater by at least factor 2 than the maximum load torque (consider static load).

If the brake is used as a holding brake only (when the drive is standing still), there is no friction to regenerate the brake lining. For such a type of operation, a minimum factor of 2.5 must be assumed for the BE brake.

Working capacity

The working capacity of the brake is determined by the permitted braking work W_1 per braking operation and the total permitted braking work W_{insp} until the next inspection of the brake.

You can determine the permitted braking work per cycle/braking operation W_1 by means of the diagrams "Permitted braking work of the BE brake in hoist applications" on page 274 ff and "Permitted braking work of the BE brake in travel drives" on page 278. For the total permitted braking work W_{insp}, refer to the table "Brake assignment", see page 266.

Permitted number of braking operations until maintenance of the brake:

$$NB = \frac{W_{insp}}{W_1}$$

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Braking work per braking operation:

$$W_1 = \frac{J_{ges} \times n^2 \times M_B}{182.4 \times (M_B \pm M_L)}$$

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NB	= Number of braking operations until service
W_{insp}	= Total braking work until service [J]
W_1	= Braking work per braking operation [J]
J_{tot}	= Total mass moment of inertia (related to the motor shaft) in [kg m^2]
n	= Motor speed [rpm]
M_B	= Braking torque [Nm]
M_L	= Load torque [Nm] (note the sign) +: for vertical upward and horizontal movement -: for vertical downward movement

EMERGENCY STOP features

The BE brake is designed for a brake lining made of organic material. The emergency stop properties must therefore be based on the directions of movement.

1. Brakes for vertical direction of movement

   For hoist applications, the limits of the maximum permitted braking work per braking operation or the maximum permitted total braking work may not be exceeded in case of an emergency stop (values of the maximum braking work in the diagrams on page 274 and subsequent pages at Z=1 [S/h]).

   Please consult SEW-EURODRIVE if you need values for increased EMERGENCY STOP braking work in hoist applications.

2. Brakes for horizontal direction of movement

   For horizontal movements, such as in travel drive applications, higher braking work might be permitted for emergency stop situations if the following conditions A) - D) are fulfilled (values of increased braking work in the diagram on page 278).

   A) Selected braking torque

   Braking torque must be reduced by at least 1 step in relation to the brake size (for an overview of braking torques for travel drives, go to page 267 and subsequent pages).

   Example: BE20 with $M_{B\ max}$ = 200 Nm, reduced to $M_{B\ red}$ = 150 Nm for the travel drive.

   B) Brake wear

   The specific wear of the brake lining increases significantly in case of an emergency stop. It can reach factor 100 under certain circumstances.

   This additional wear must be considered when determining the maintenance cycle.

   C) Braking process

   During the braking process, the effective dynamic braking torque can be reduced due to the heating of the brake lining during braking. In extreme cases, the effective braking torque can be reduced to 60% of the rated value. This must be taken into account when determining the braking distance.

   Example: BE20 with $M_{B\ red}$ = 150 Nm, minimal effective $M_{B\ is}$ = 90 Nm

   D) Braking speed

   A decisive factor for the permitted increased braking work is the speed at which the braking process is triggered. The lower the speed, the higher the permitted braking work.

   Please consult SEW-EURODRIVE to obtain the values.

   - For increased emergency stop braking work in travel drive applications,
   - For brake size BE5 and smaller.

3. Brakes in angular direction of movement

   As the angular movement has a vertical and a horizontal component, the permitted emergency stop braking work is predominantly determined according to 1.

   Please contact SEW-EURODRIVE if you cannot clearly determine the direction of movement as horizontal or vertical.

Standard design

As standard, AC brakemotors DR..BE are supplied with an integrated BG/BGE brake controller for AC connection or a BS/BSG control unit installed in the control cabinet for DC 24 V connection. The motors are delivered completely ready for connection.

Brake size	AC connection	DC 24 V connection
BE05, BE1, BE2	BG	BS
BE5, BE11, BE20	BGE	BSG
BE30, BE32	BGE	--
BE120, BE122	BMP3.1	--

8.6 Determining the brake voltage

The brake voltage should always be selected on the basis of the available AC supply voltage or motor operating voltage. This means the user is always guaranteed the most cost-effective installation for lower braking currents.

In the case of multi-voltage types for which the supply voltage has not been defined when the motor is purchased, the lower voltage must be selected in each case in order to achieve feasible connection conditions when the brake control system is installed in the terminal box.

The standard brake voltages are listed in the following table:

Brake	BE05 - BE20	BE30 - BE122
	Brake voltage	
Voltage range	**AC 220 - 242 / 380 - 420 V**	
Rated voltage	DC 24 V AC 230 V AC 400 V	- AC 230 V AC 400 V

For motor voltage information, refer to page 73 et seq.

Extra-low voltages are often unavoidable for reasons of safety. However, they demand a considerably greater investment in cables, switchgear, transformers as well as rectifiers and overvoltage protection (e.g. for direct DC 24 V supply) than for connection to the supply voltage.

With the exception of BG and BMS, the maximum current flowing when the brake is released is 8.5 times the holding current. The voltage at the brake coil must not drop below 90% of the rated voltage.

8.7 Selecting the brake controller and the connection type

Various brake controllers are available for controlling disk brakes with a DC coil, depending on the requirements and the operating conditions. All brake control systems are fitted as standard with varistors to protect against overvoltage.

The brake control systems are either installed directly on the motor in the wiring space or in the control cabinet. For motors of thermal class 180 (H) and explosion-proof motors, the control system must be installed in the control cabinet.

Brake control system in the wiring space

The supply voltage for brakes with an AC connection is either supplied separately or taken from the supply system of the motor in the wiring space. Only motors with a fixed speed can be supplied from the motor supply voltage. With pole-changing motors and for operation with a frequency inverter, the supply voltage for the brake must be supplied separately.

Furthermore, bear in mind that the brake response is delayed by the residual voltage of the motor if the brake is powered by the motor supply voltage. The brake application time t_2I specified in the technical data for cut-off in the AC circuit applies to a separate supply only.

Wiring space of the motor

The following tables list the technical data of brake control systems for installation in the motor wiring space and the assignments with regard to motor size and connection technology. The different housings have different colors (= color code) to make them easier to distinguish.

Motor size DR.71-DR.225

Type	Function	Voltage	Holding current I_{Hmax} [A]	Type	Part number	Color code
BG	One-way rectifier	AC 230 - 575 V	1.4	BG 1.4	827 881 4	Black
		AC 150 - 500 V	1.5	BG 1.5	825 384 6	Black
		AC 24 - 500 V	3.0	BG 3	825 386 2	Brown
BGE	One-way rectifier with electronic switching	AC 230 - 575 V	1.4	BGE 1.4	827 882 2	Red
		AC 150 - 500 V	1.5	BGE 1.5	825 385 4	Red
		AC 42 - 150 V	3.0	BGE 3	825 387 0	Blue
BSR	One-way rectifier + current relay for cut-off in the DC circuit	AC 150 - 500 V	1.0	BGE 1.5 + SR 11	825 385 4 826 761 8	Red -
			1.0	BGE 1.5 + SR 15	825 385 4 826 762 6	Red -
			1.0	BGE 1.5 + SR 19	825 385 4 826 246 2	Red -
		AC 42 - 150 V	1.0	BGE 3 + SR11	825 387 0 826 761 8	Blue -
			1.0	BGE 3 + SR15	825 387 0 826 762 6	Blue -
			1.0	BGE 3 + SR19	825 387 0 826 246 2	Blue -

Table continued on next page.

Type	Function	Voltage	Holding current I_{Hmax} [A]	Type	Part number	Color code
BUR	One-way rectifier + voltage relay for cut-off in the DC circuit	AC 150 - 500 V	1.0	BGE 1.5 + UR 15	825 385 4 826 759 6	Red -
		AC 42 - 150 V	1.0	BGE 3 + UR 11	825 387 0 826 758 8	Blue -
BS	Varistor protection circuit	DC 24 V	5.0	BS24	826 763 4	Aqua
BSG	Electronic switching	DC 24 V	5.0	BSG	825 459 1	White

Type	Variant	Standard terminal box	Integrated plug connector IS	Industrial plug connector IV[1] (AC.., AS.., AM.., AB.., AK.., AD..)
BG	BG1.4 BG1.5 BG3	71 - 100 / BE2	71 - 100 / BE2	71 - 100 / BE2
BGE	BG1.4 BGE1.5 BGE3	71 - 225 / BE32	71 - 132 /BE11	71 - 225 / BE32
BSR	BGE1.5 + SR11 BGE1.5 + SR15 BGE1.5 + SR19 BGE3 + SR11 BGE3 + SR15 BGE3 + SR19	71 - 225 / BE32	71 - 132 /BE11	71 - 225 / BE32
BUR	BGE1.5 + UR15 BGE3 + UR11	71 - 225 / BE32	71 - 132 /BE11	71 - 225 / BE32
BS	BS24	71 - 100 / BE2	71 - 100 / BE2	71 - 100 / BE2
BSG	BSG	71 - 180 / BE20	71 - 132 /BE11	71 - 180 / BE20

1) Observe the permitted current strength of the relevant plug connector

Motor size DR.315

Type	Function	Voltage	Holding current I_{Hmax} [A]	Type	Part number	Color code
BMP	Half-wave rectifier with electronic switching, integrated voltage relay for cut-off in the DC circuit.	AC 230 - 575 V	2.8	BMP 3.1	829 507 7	-

Control cabinet

The following table lists the technical data of brake control systems for installation in the control cabinet and the assignments with regard to motor size and connection technology. The different housings have different colors (= color code) to make them easier to distinguish.

Motor size DR.71-DR.225

Type	Function	Voltage	Holding current I_{Hmax} [A]	Type	Part number	Color code
BMS	One-way rectifier such as BG	AC 230 - 575 V	1.4	BMS 1.4	829 830 0	Black
		AC 150 - 500 V	1.5	BMS 1.5	825 802 3	Black
		AC 42 - 150 V	3.0	BMS 3	825 803 1	Brown
BME	One-way rectifier with electronic switching such as BGE	AC 230 - 575 V	1.4	BME 1.4	829 831 9	Red
		AC 150 - 500 V	1.5	BME 1.5	825 722 1	Red
		AC 42 - 150 V	3.0	BME 3	825 723 X	Blue
BMH	One-way rectifier with electronic switching and heating function	AC 230 - 575 V	1.4	BMH 1.4	829 834 3	Green
		AC 150 - 500 V	1.5	BMH 1.5	825 818 X	Green
		AC 42 - 150 V	3	BMH 3	825 819 8	Yellow
BMP	One-way rectifier with electronic switching, integrated voltage relay for cut-off in the DC circuit	AC 230 - 575 V	1.4	BMP 1.4	829 832 7	White
		AC 150 - 500 V	1.5	BMP 1.5	825 685 3	White
		AC 42 - 150 V	3.0	BMP 3	826 566 6	Light blue
BMK	One-way rectifier with electronic switch mode, DC 24 V control input and separation in the DC circuit	AC 230 - 575 V	1.4	BMK 1.4	829 883 5	Aqua
		AC 150 - 500 V	1.5	BMK 1.5	826 463 5	Aqua
		AC 42 - 150 V	3.0	BMK 3	826 567 4	Bright red
BMV	Brake control unit with electronic switching, DC 24 V control input and fast cut-off	DC 24 V	5.0	BMV 5	1 300 006 3	White

Type	Variant	Standard terminal box	Integrated plug connector IS	Industrial plug connector IV[1] (AC.., AS.., AM.., AB.., AK.., AD..)
BMS	BMS 1.4 BMS 1.5 BMS 3	71 - 100 / BE2	71 - 100 / BE2	71 - 100 / BE2
BME	BME 1.4 BME 1.5 BME 3	71 - 225 / BE32	71 - 132 /BE11	71 - 225 / BE32
BMP	BMP 1.4 BMP 1.5 BMP 3	71 - 225 / BE32	71 - 132 /BE11	71 - 225 / BE32
BMK	BMK 1.4 BMK 1.5 BMK 3	71 - 225 / BE32	71 - 132 /BE11	71 - 225 / BE32
BMH	BMH 1.4 BMH 1.5 BMH 3	71 - 225 / BE32	71 - 132 /BE11	71 - 225 / BE32
BMV	BMV 5	71 - 180 / BE20	71 - 132 /BE11	71 - 180 / BE20

1) Observe the permitted current strength of the relevant plug connector

Motor size DR.315

Type	Function	Voltage	Holding current I_{Hmax} [A]	Type	Part number	Color code
BMP	Half-wave rectifier with electronic switching, integrated voltage relay for cut-off in the DC circuit.	AC 230 - 575 V	2.8	BMP 3.1	829 507 7	-

Brakemotors for special requirements

The SEW modular concept for brakemotors permits a wide variety of versions using electronic and mechanical options. The options include special voltages, mechanical manual brake release, special types of protection, plug connections and special brake control systems.

High switching frequency

A high switching frequency in combination with significant external mass moments of inertia is often a requirement for brakemotors.

In addition to the basic thermal suitability of the motor, the brake needs to have a response time t_1 short enough to ensure that it is already released when the motor starts. At the same time, the acceleration required for the mass moment of inertia also has to be taken into account. Without the usual startup phase when the brake is still applied, the temperature and wear balance of the SEW brake permits a high switching frequency.

Brakes from BE5 are designed for a high switching frequency as standard.

The table below shows that besides BGE (BME) and BSG, the brake control systems BSR, BUR, BMH, BMK and BMP also have properties for shortening the response time in addition to their other functions.

Brake	High switching frequency	
	Brake control system for AC connection	Brake control system for DC 24 V connection
BE05	BGE (BSR, BUR) in terminal box or BME (BMH, BMP, BMK) in control cabinet	BSG in terminal box or BMV and BSG in control cabinet
BE1		
BE2		
BE5		
BE11		
BE20		
BE30		-
BE32		

High stopping accuracy

Positioning systems require high stopping accuracy.

Due to their mechanical principle, the degree of wear on the linings and on-site physical peripheral conditions, brakemotors are subject to an empirically determined braking distance variation of ± 12 %. The shorter the response times, the smaller the absolute value of the variation.

Cut-off in the DC and AC circuits makes it possible to shorten the brake application time t_2II considerably.

Cut-off in the DC and AC circuits with mechanical contact:

In the sections "Motor wiring space" on page 242 and subsequent pages and "Control cabinet" on page 244 and subsequent pages, we have already referred to the possibility of achieving this solution by conventional means by using an extra contact.

Cut-off in the DC and AC circuits with electronic relay in the terminal box:

The BSR and BUR brake control systems offer sophisticated options involving an electronic, wear-free contact with minimum wiring. Both control systems are made up of BGE and either the SR current relay or UR voltage relay.

BSR is only suitable for single-speed motors. BUR can be installed universally if it has a separate power supply.

When ordering the brakemotor, it is sufficient to specify BSR or BUR in conjunction with the motor or brake voltage. The SEW order processing system assigns a suitable relay.

Refer to page 242 and subsequent pages for relay retrofitting options suited to the motor and voltage. The electronic relays can switch up to 1 A brake current and thereby limit the selection to BSR and BUR.

Principle and selection of the BSR brake controller

The BSR brake control system combines the BGE control unit with an electrical current relay. With BSR, the BGE (or BG) is supplied with voltage directly from the terminal board of a single-speed motor, which means that it does not need a special supply cable.

When the motor is disconnected, the motor current is interrupted practically instantaneously and is used for cut-off in the DC circuit of the brake coil via the SR current relay. This feature results in particularly fast brake application despite the remanence voltage at the motor terminal board and in the brake control system.

The brake voltage is defined automatically on the basis of the motor phase voltage without further customer data (e.g. motor 230 V / 400 V, brake 230 V). As an option, the brake coil can also be configured for the line-to-line voltage (e.g. motor 400 V, brake 400 V).

The current relay and brake rectifier are allocated depending on the specified motor and brake voltages when ordering.

The following table shows the allocation of the SR current relay to the rated motor current I_N [A] in Y connection and the maximum holding current of the brake I_{Hmax} [A].

$I_{Hmax} = I_H \times 1.3\ [A_{AC}]$

Current relay	Rated motor current I_N [A] in Y connection	Max. holding current of the brake I_{Hmax} [A]
SR11	0.6 - 10	1
SR15	10 - 50	1
SR19	50 - 90	1

Principle and selection of the BUR brake control system

The BUR brake control system combines the BGE (BG) control unit with an electronic voltage relay. In this case, the BGE control unit has a separate voltage supply because there is no constant voltage at the motor terminal board (pole-changing motors, motor with frequency inverter) and because the remanence voltage of the motor (single-speed motor) would cause a delay in the brake application time. With cut-off in the AC circuit, the UR voltage relay triggers cut-off in the DC circuit of the brake coil almost instantaneously and the brake is applied very quickly.

The brake voltage is defined automatically on the basis of the motor phase voltage without further customer data. Optionally, other brake voltages can be defined in accordance with the following table.

Brake	BUR (BGE + UR..) for brake control system (AC V)													
	23-26	57-62	79-123	124-138	139-193	194-217	218-243	244-273	274-306	307-343	344-379	380-431	432-484	485-542	543-600
BE05															
BE1															
BE2															
BE5															
BE11															
BE20															
BE30															
BE32															

UR15 UR11 Not possible

Increased ambient temperature or restricted ventilation

In addition to the basic considerations, increased ambient temperature, insufficient supply of cooling air and/or thermal class 180 (H) are valid reasons for installing the brake control system in the control cabinet.

Only brake control systems with electronic switching are used in order to ensure reliable switching at higher winding temperatures in the brake.

Use of BGE, BME or BSG is stipulated instead of BG, BMS or DC 24 V direct connection for the special case of "electrical brake release when motor is at standstill".

Special versions of brakemotors for increased thermal loading have to be equipped with brake control systems in the control cabinet.

Low and fluctuating ambient temperatures

Brakemotors for low and fluctuating ambient temperatures e.g for use outdoors, are exposed to the dangers of condensation and icing. Functional limitations due to corrosion and ice can be counteracted by using the BMH brake control with the additional function anti-condensation heating.

The heating function is activated externally. As soon as the brake has been applied and the heating function switched on during lengthy breaks, both coil sections of the SEW brake system are supplied with reduced voltage in an inverse-parallel connection by a thyristor operating at a reduced control factor setting. On the one hand, this practically eliminates the induction effect (brake does not release). On the other hand, the coil system creates heat, which causes a rise in temperature of about 25 K compared to the ambient temperature.

The heating function (via K16 in the sample circuits) must be ended before the brake starts its normal switching function again.

BMH is available for the motor sizes 71 - 225 and is only mounted in the control cabinet.

Brake control system in the control cabinet

The SEW brake control systems are also available for control cabinet installation. The following aspects favor control cabinet installation:

- Unfavorable ambient conditions at the motor (e.g. motor with thermal class 180 H, high ambient temperature > 40 °C, low ambient temperatures etc.)
- Connections with cut-off in the DC circuit by means of a switch contact are less complicated to install in the control cabinet
- Easier access to the brake control system for service purposes

When the brake control system is installed in the control cabinet, 3 cables must always be routed between the brake coil and the control system. An auxiliary terminal strip with 5 terminals is available for connection in the terminal box.

The table below gives an overview of all brake control systems available for control cabinet installation. With the exception of BSG, all units are delivered with housings for top hat rail mounting.

Brake type	Brake control system in the control cabinet	
	For AC connection	For DC 24 V connection
BE05	BMS, BME, BMH, BMP, BMK	BSG BMV
BE1		
BE2		
BE5	BME, BMH, BMP, BMK	
BE11		
BE20		
BE30		-
BE32		
BE120	BMP3.1	
BE122		

Multi-motor operation of brakemotors

Brakes must be switched at the same time in multi-motor operation. The brakes must also be applied together when a fault occurs in one brake.

Simultaneous switching can be achieved by connecting any particular group of brakes in parallel to one brake control system.

When several brakes are connected in parallel to the same brake rectifier, the total of all the operating currents must not exceed the rated current of the brake control system.

	TIP
	If a fault occurs in one brake, all brakes must be cut-off in the AC circuit.

8.8 Dimensioning and routing the cable

a) Selecting the cable

Select the cross section of the brake cable according to the currents in your application. Observe the inrush current of the brake when selecting the cross section. When taking the voltage drop into account due to the inrush current, the value must not drop below 90 % of the rated voltage. The data sheets for the brakes provide information on the possible supply voltages and the result operating currents.

Refer to the table below for a quick source of information for selecting the size of the cable cross sections with regard to the acceleration currents for cable lengths ≤ 50 m.

Brake type	Minimum cross section in mm² (AWG) of the brake cables for cable lengths ≤ 50 m and brake voltage (AC V)					
	24	60 DC24 V	120	184 - 208	230	254 - 575
BE05	10 (8)	2.5 (12)	1.5 (16)			
BE1						
BE2						
BE5	1)	4 (10)				
BE11		10 (8)	2.5 (12)			
BE20						
BE30 / 32						
BE120 / 122						

1) Not available

Values in brackets = AWG (American Wire Gauge)

Wire cross sections of max. 2.5 mm² can be connected to the terminals of the brake control systems. Intermediate terminals must be used if the cross sections are larger.

b) Routing information

Brake cables must always be routed separately from other power cables with phased currents unless they are shielded.

Ensure adequate equipotential bonding between the drive and the control cabinet (for an example, see the documentation Drive Engineering - Practical Implementation "EMC in Drive Engineering").

Power cables with phased currents are in particular

- Output cables from frequency inverters and servo controllers, soft start units and brake units
- Supply cables to braking resistors

8.9 Selection of the brake contactor

In view of the high current loading and the DC voltage to be switched at inductive load, the switchgear for the brake voltage and cut-off in the DC circuit either has to be a special DC contactor or an adapted AC contactor with contacts in utilization category AC 3 to EN 60947-4-1.

It is simple to select the brake contactor for supply system operation:

- For the standard voltages AC 230 V or AC 400 V, a power contactor with a rated power of 2.2 kW or 4 kW for AC-3 operation is selected.
- The contactor is configured for DC-3 operation with DC 24 V.

When the applications require cut-off in the DC and AC circuits for the brake, it is a good idea to install SEW switchgear to perform this task.

Control cabinet installation

Brake rectifiers (BMP, BMV and BMK, see page 244), which perform the cut-off in the DC circuit internally, have been specifically designed for this purpose.

Terminal box installation

The current and voltage relays (SR1x and UR1x), mounted directly on the motor, perform the same task.

Advantages compared to switch contacts:

- Special contactors with four AC-3 contacts are not required.
- The contact for cut-off in the DC circuit is subject to high loads and, therefore, a high level of wear. In contrast, the electronic switches operate without any wear at all.
- Customers do not have to perform any additional wiring. The current and voltage relays are wired at the factory. Only the power supply and brake coil have to be connected for the BMP and BMK rectifiers.
- Two additional conductors between the motor and control cabinet are no longer required.
- No additional interference emission from contact bounce when the brake is cut-off in the DC circuit.

Semi-conductor relay

Semi-conductor relays with RC protection circuits are not suitable for switching brake rectifiers (with the exception of BG and BMS).

8.10 Important design information

a) EMC (Electromagnetic compatibility)

SEW AC brakemotors comply with the relevant EMC generic standards when operated in accordance with their designated use in continuous duty on the supply system.

Additional instructions in the frequency inverter documentation must also be taken into account for operation with frequency inverters.

The EMC instructions in the servo controller documentation must also be taken into account for the operation of SEW servomotors with brake.

You must always adhere to the cable routing instructions (see page 249).

b) Connection type

The electrical design team and, in particular the installation and startup personnel, must be given detailed information on the connection type and the intended brake function.

Maintaining certain brake application times may be relevant to safety. The decision to implement cut-off in the AC circuit or cut-off in the DC and AC circuits must be passed on clearly and unambiguously to the people undertaking the work. The brake application times t_2I specified in the data summary (see page 265) for cut-off in the AC circuit only apply if there is a separate voltage supply. The times are longer if the brake is connected to the terminal board of the motor.

BG and BGE are always supplied wired up for cut-off in the AC circuit in the terminal box. The blue wire on the brake coil must be moved from terminal 5 of the rectifier to terminal 4 for cut-off in the AC and DC circuits. An additional contactor (or SR/UR) must also be connected between terminals 4 and 5.

c) Maintenance intervals

The time to maintenance is determined on the basis of the expected brake wear. This value is important for setting up the maintenance schedule for the machine to be used by the customer's service personnel (machine documentation).

d) Measuring principles

The following points must be observed during service measurements on the brakes:

The values for DC voltage specified in the data sheets only apply if brakes are supplied with DC voltage from an external source without an SEW brake control system.

Due to the fact that the freewheeling arm only extends over the coil section, the DC voltage that can be measured during operation with the SEW brake control system is 10 to 20% lower than the normal one-way rectification when the freewheeling arm extends over the entire coil.

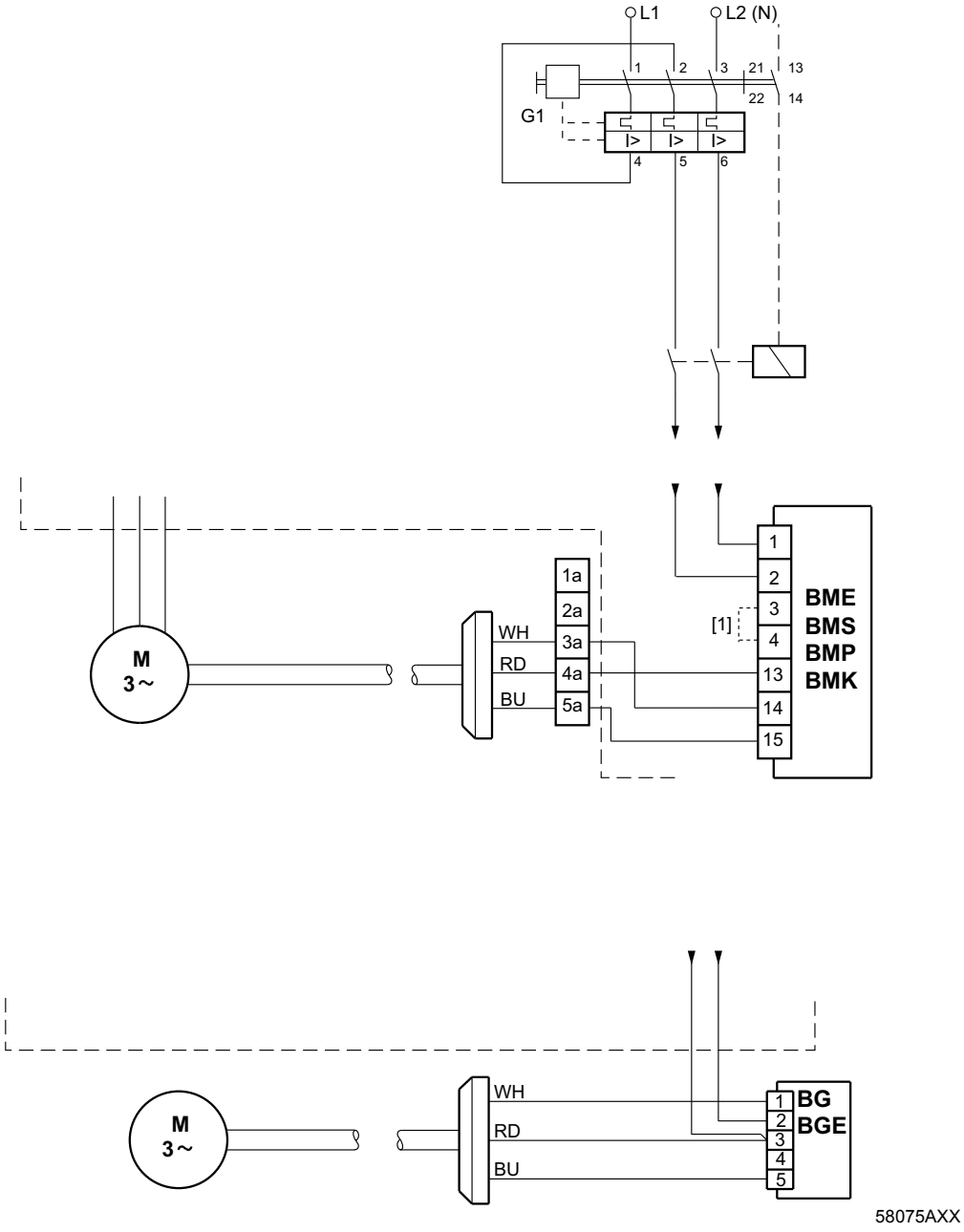
8.11 Motor protection switch

Motor protection switches (e.g. ABB type M25-TM) are suitable as protection against short circuits for the brake rectifier and thermal protection for the brake coil.

Select or set the motor protection switch to 1.1 x $I_{Brake\ holding\ current}$ (r.m.s. value). For holding currents, see page 242 and subsequent pages.

Motor protection switches are suitable for all brake rectifiers in the control cabinet (important: except for the BMH heating function) and in the terminal box with separate voltage supply.

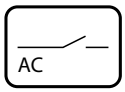
Advantage: Motor protection switches prevent the brake coil from being destroyed when a fault occurs in the brake rectifier or when the brake coil is connected incorrectly (keeps costs resulting from repairs and downtimes low).



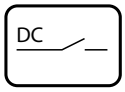
[1] Customers must connect terminals 3 and 4 according to the relevant wiring diagram.

8.12 Block diagrams

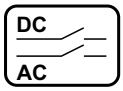
Key



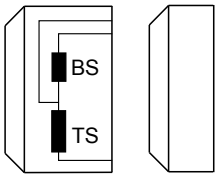
Cut-off in the AC circuit
(Standard application of the brake)



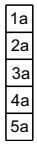
Cut-off in the DC circuit
(rapid brake application)



Cut-off in the DC and AC circuits
(rapid brake application)



Brake
BS = Accelerator coil
TS = Coil section



Auxiliary terminal strip in terminal box

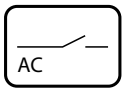
Motor with delta connection

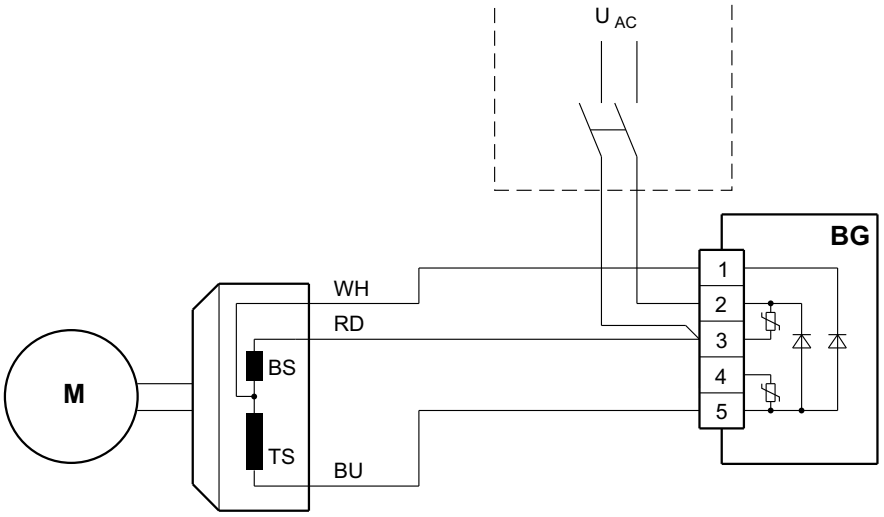
Motor with star connection

Control cabinet limit

WH	White
RD	Red
BU	Blue
BN	Brown
BK	Black

BG brake controller





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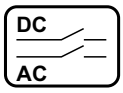

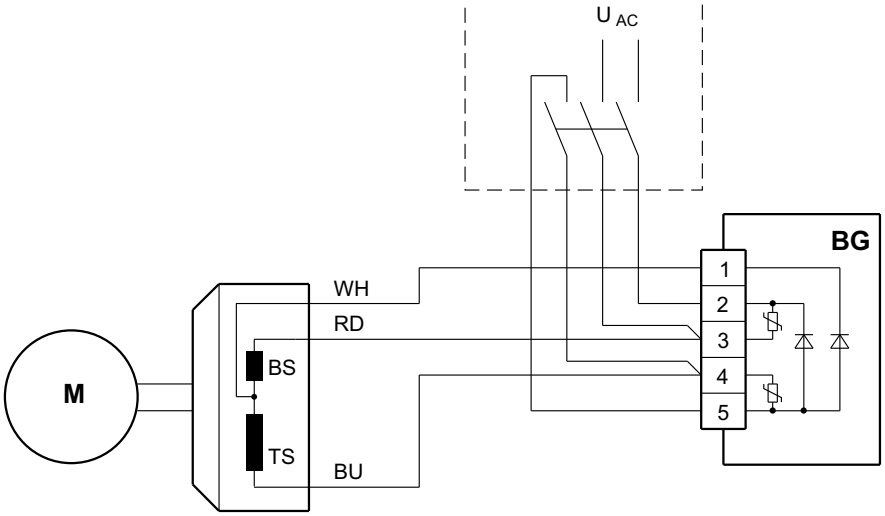

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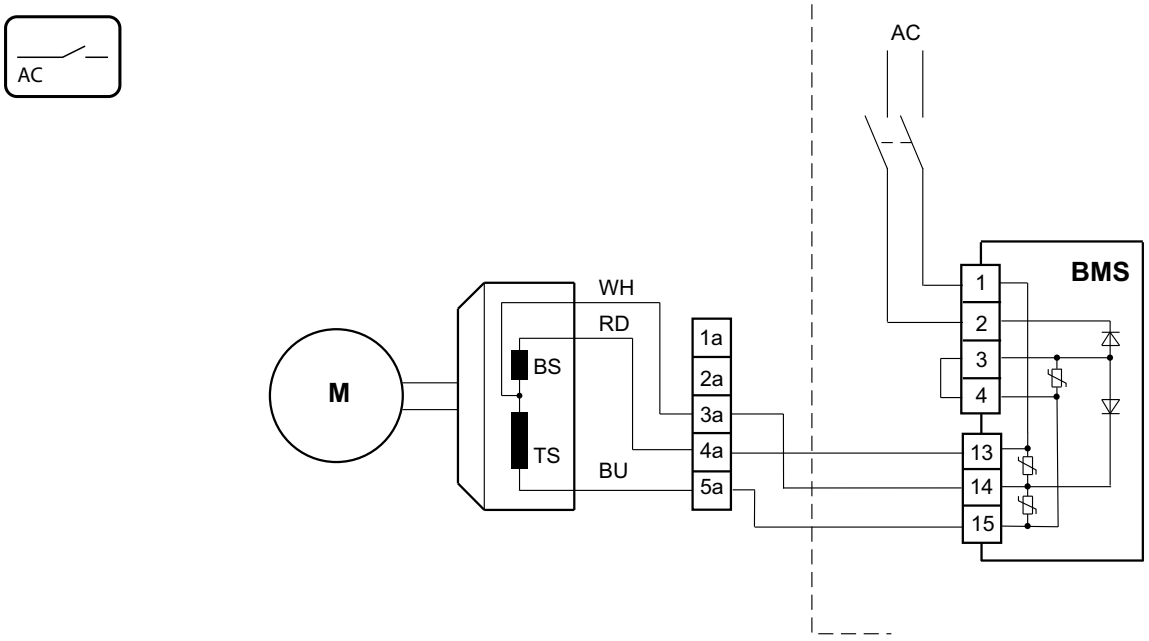
Brake control system BMS



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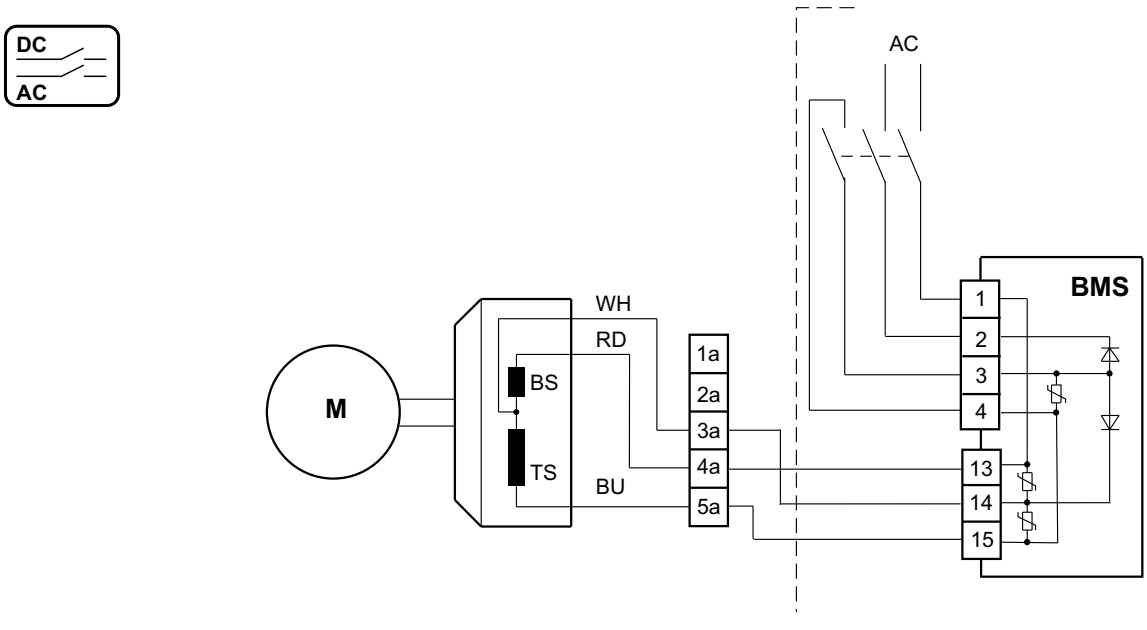

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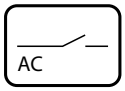
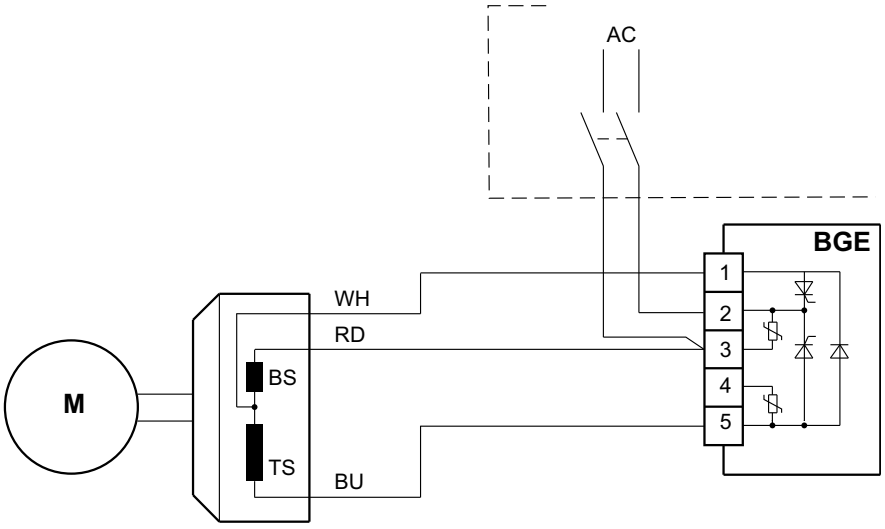
Brake control system BGE





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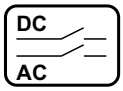
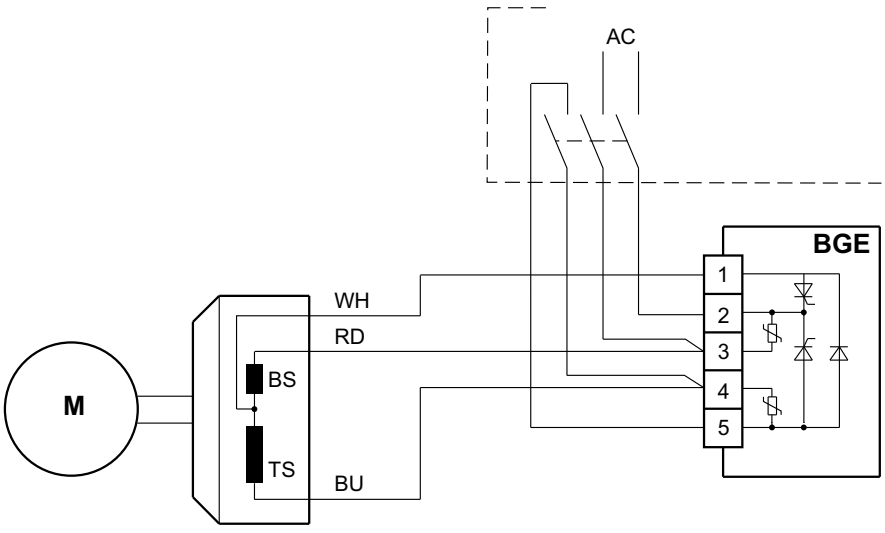
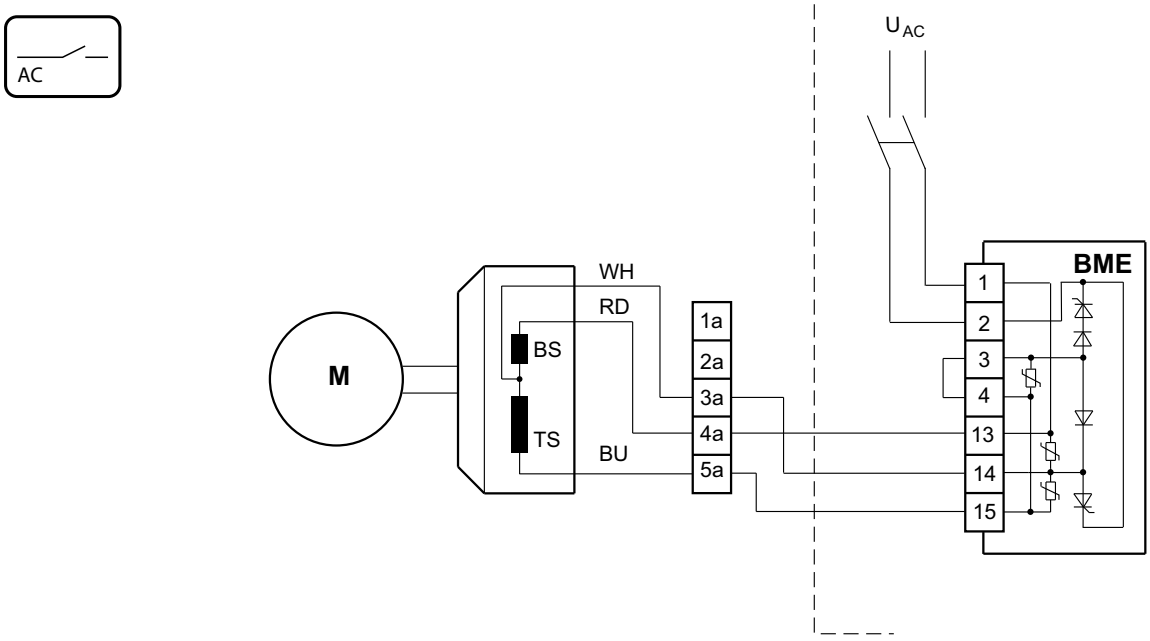




50653BXX

Brake control system BME



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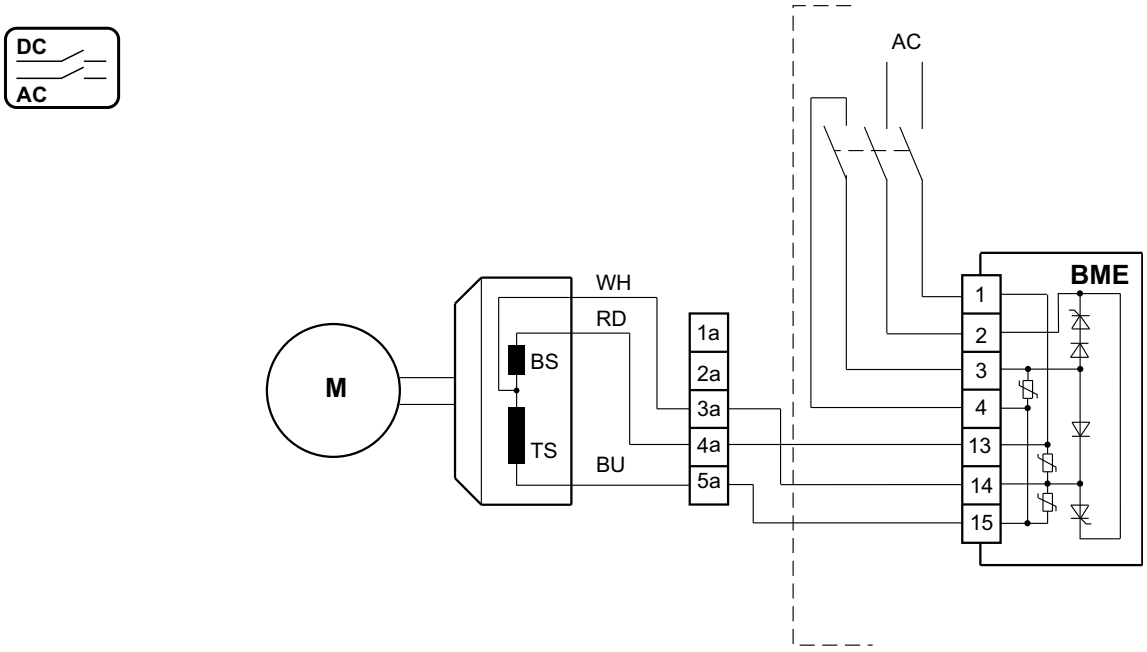

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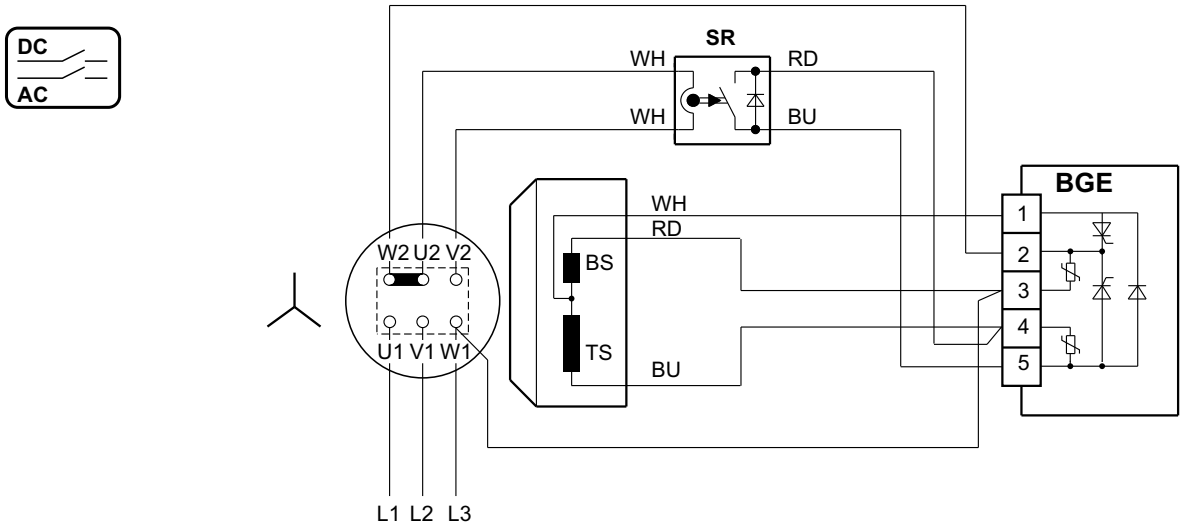
Brake control system BSR

Brake voltage = Phase voltage

Example: Motor 230 V△ / 400 V ⅄, brake AC 230 V



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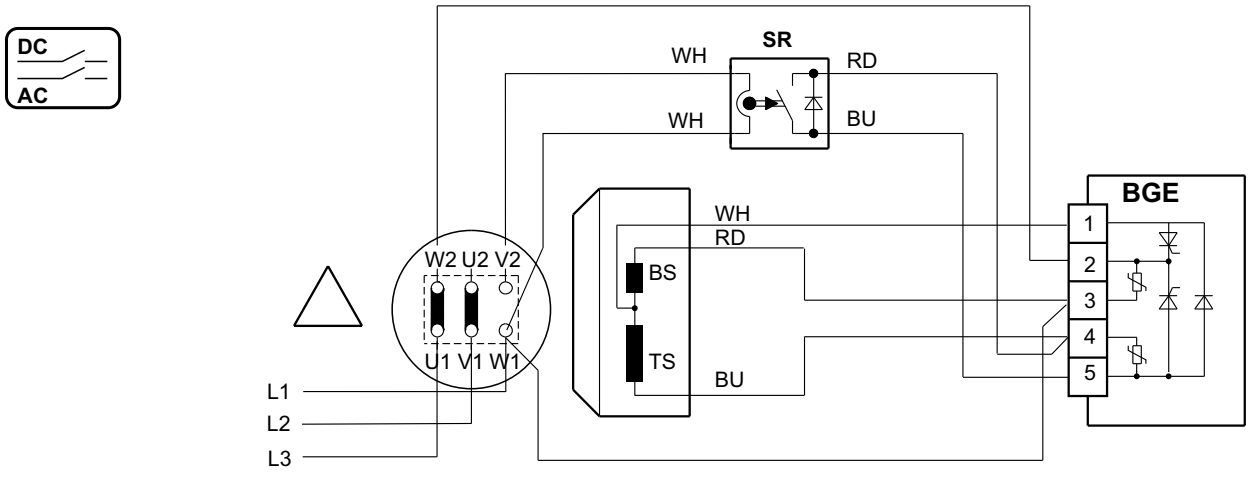
Example: Motor 400 V△ / 690 V ⅄, brake: AC 400 V



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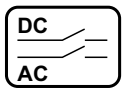
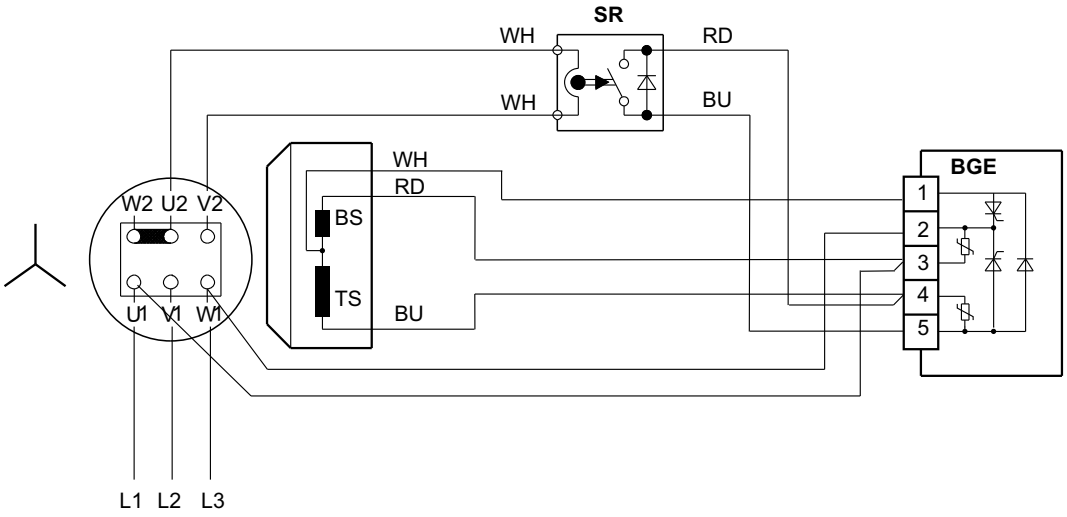
Brake voltage = Phase-to-phase voltage

The input voltage of the brake rectifier corresponds to the line voltage of the motor, e.g. motor: 400 V ⅄, brake: AC 400 V





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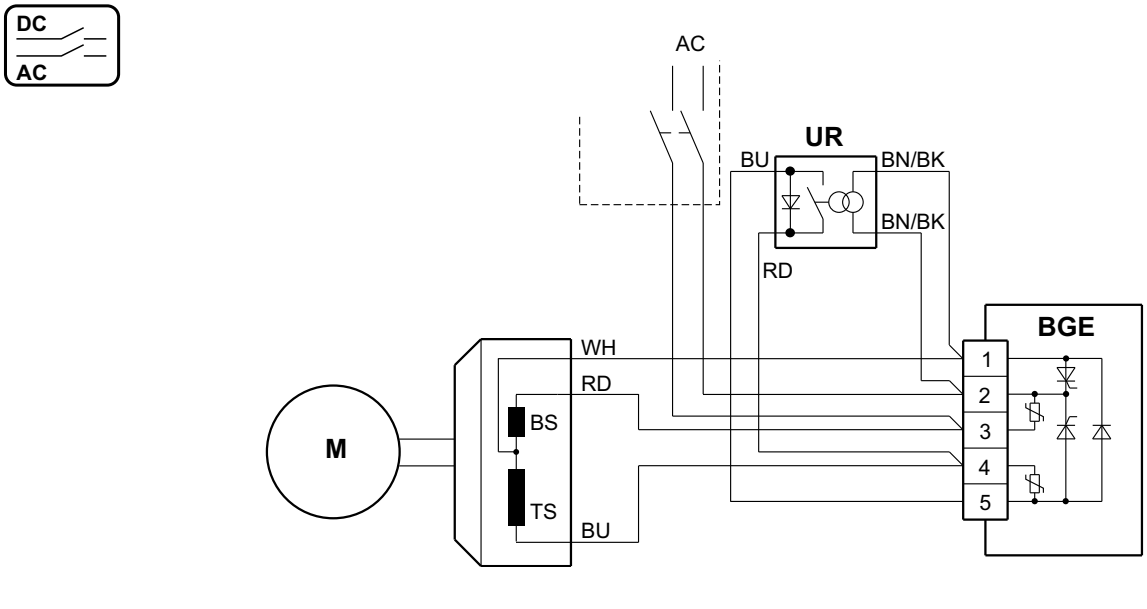
Brake control system BUR



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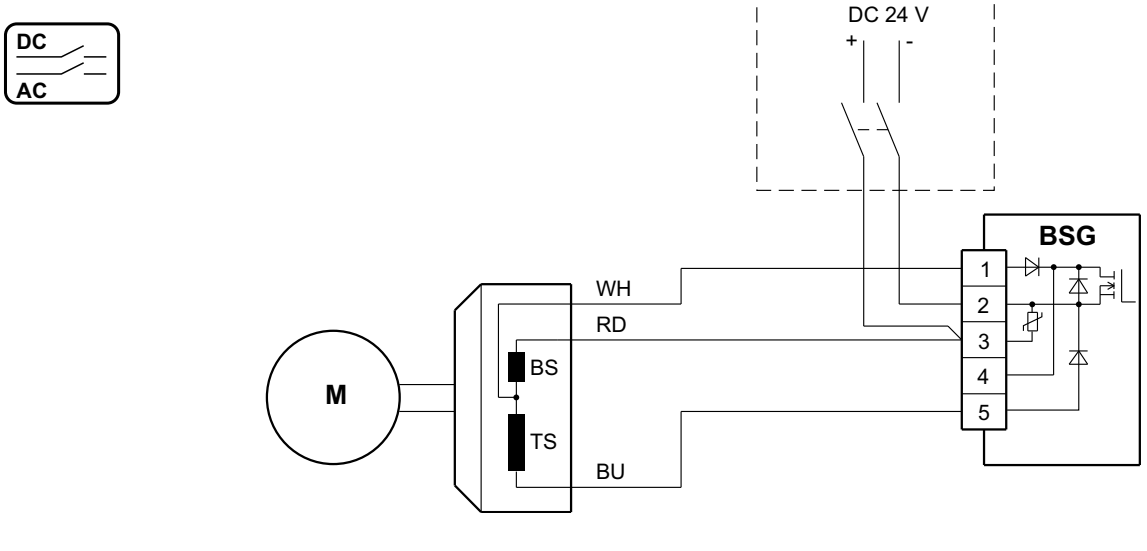
Brake control system BSG



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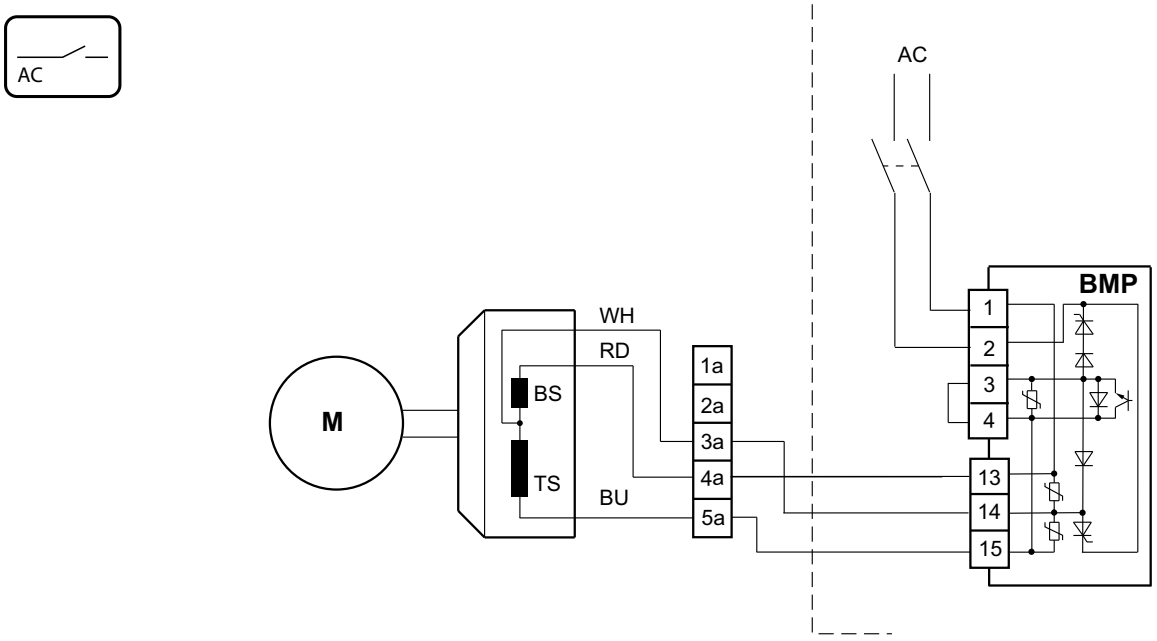
Brake control system BMP



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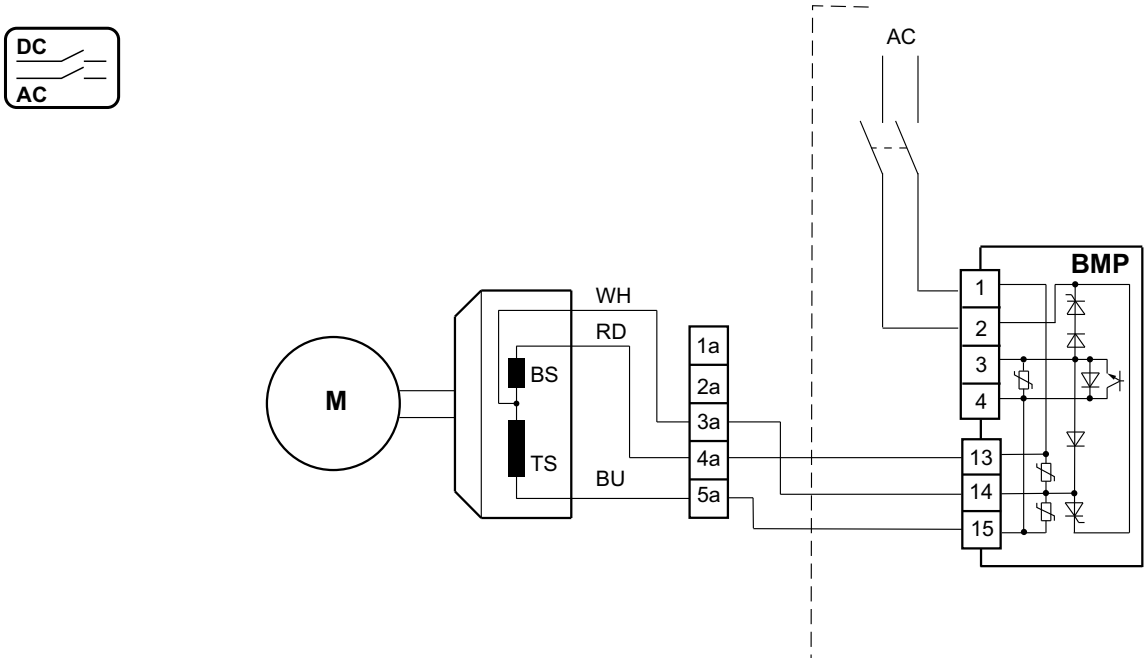

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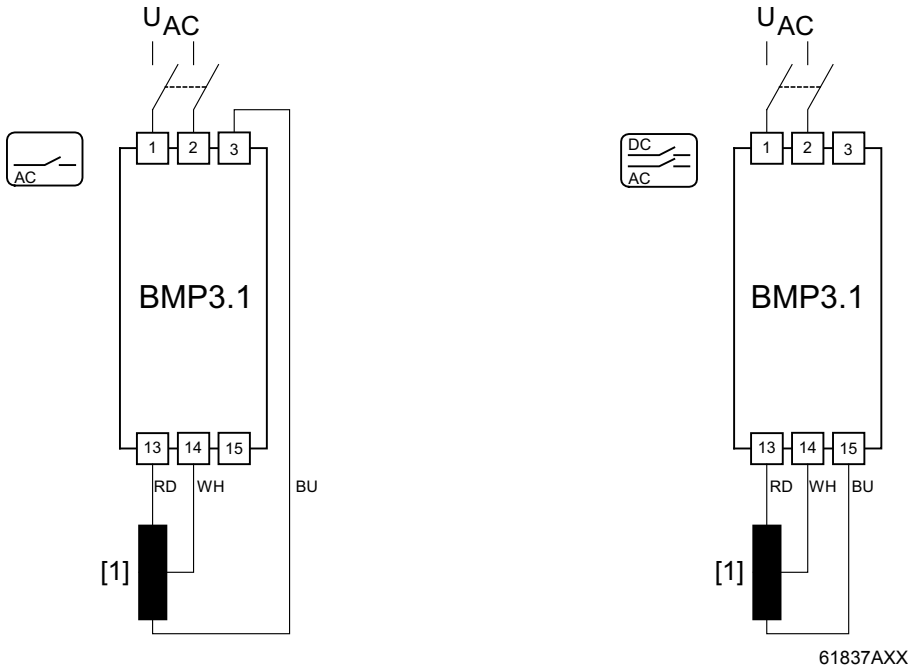
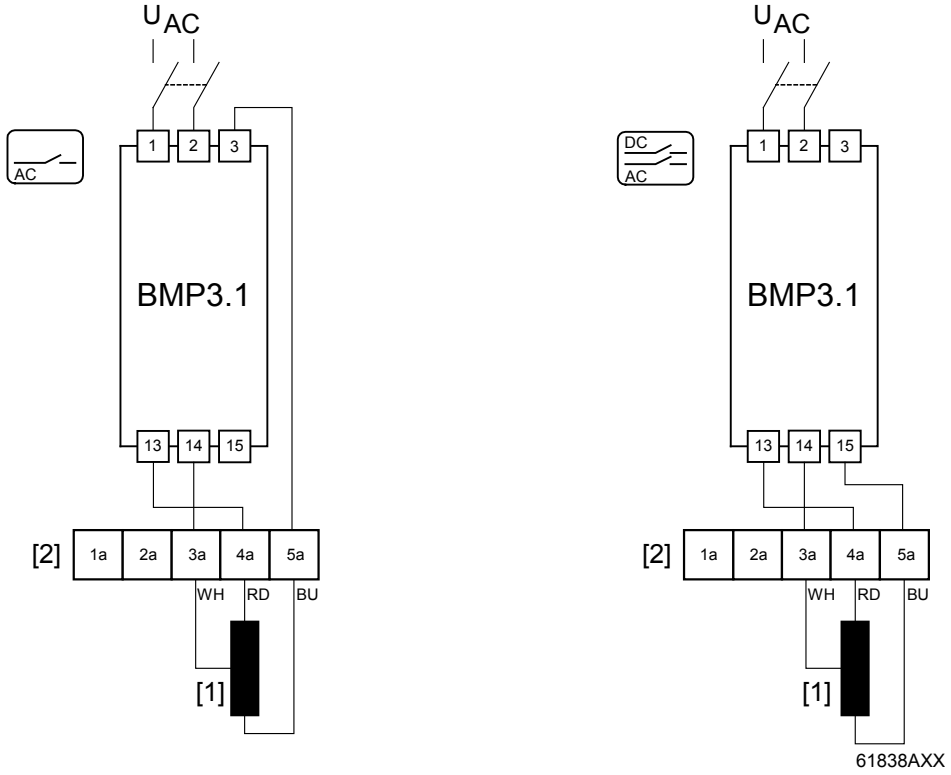
BMP 3.1 brake controller (motor)



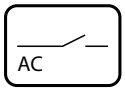
[1] Brake coil

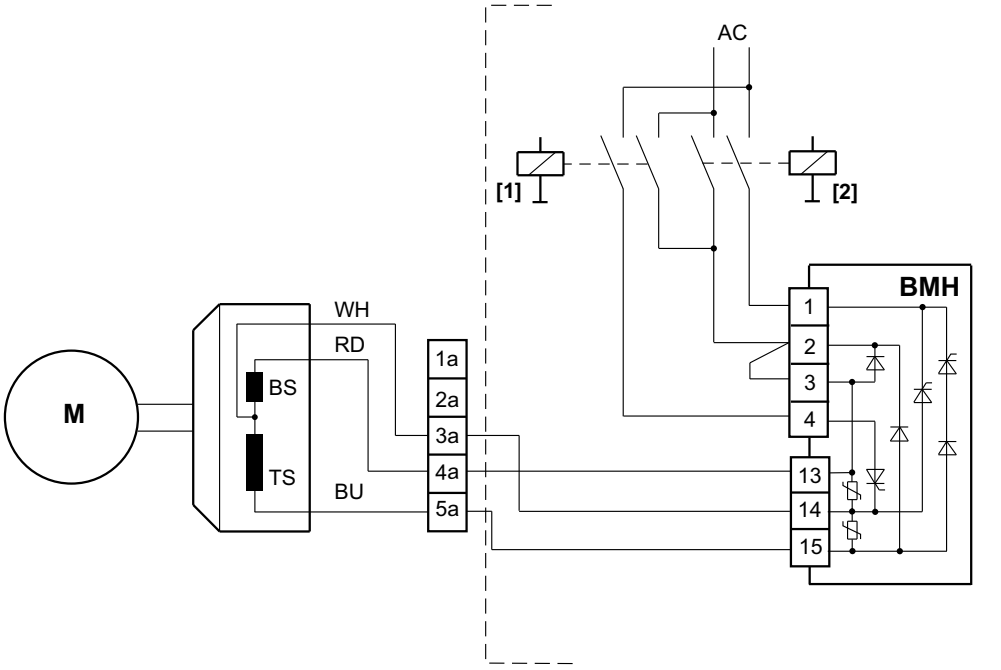
Brake control system BMP 3.1 (control cabinet)



[1] Brake coil
[2] Terminal strip

Brake control system BMH





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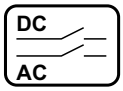
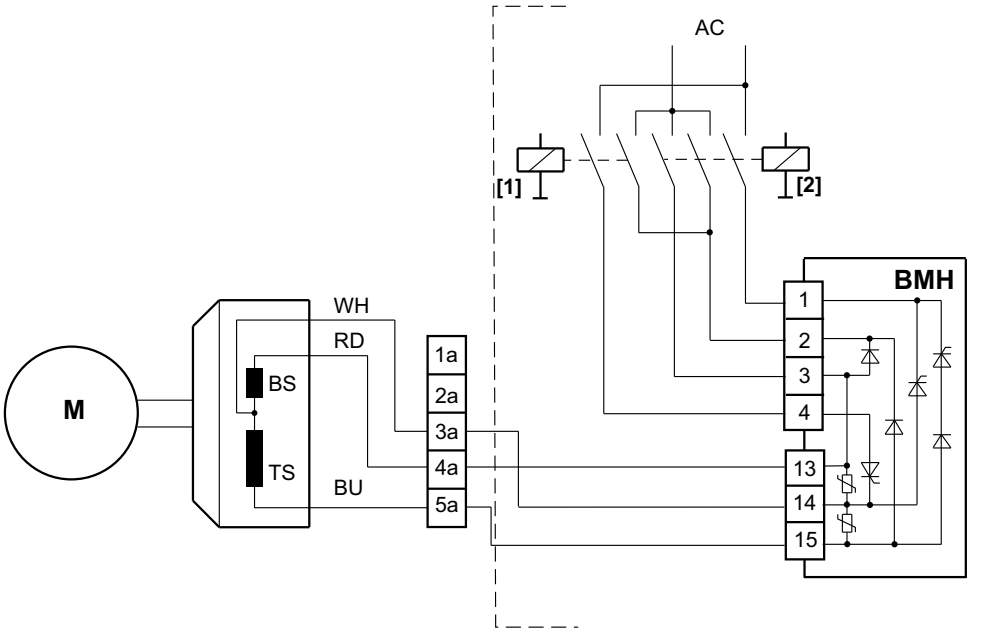
[1] Heating

[2] Ventilation





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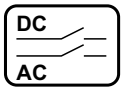
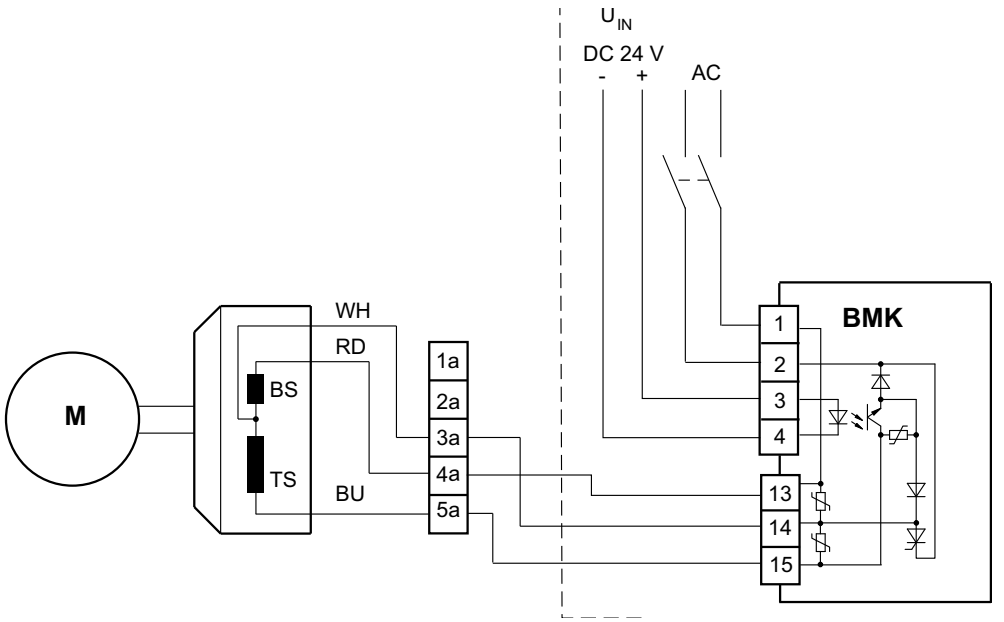
[1] Heating

[2] Ventilation

Brake control system BMK





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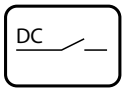
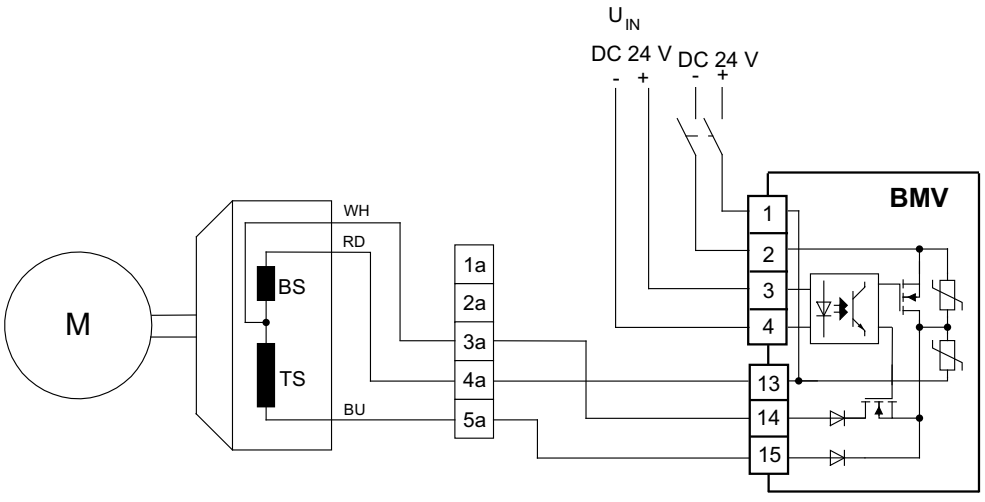
Brake control system BMV





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U_{IN} = Control signal

8.13 Technical data of the BE brake

The following table lists the technical data of the brakes. The type and number of brake springs determines the level of the braking torque. Maximum braking torque $M_{B\ max}$ is installed as standard, unless specified otherwise in the order. Other brake spring combinations can result in reduced braking torque values $M_{B\ red}$.

Brake type	M_{Bmax} [Nm]	Reduced braking torques M_{Bred} [Nm]					W_{insp} [10^6 J]	t_1 [10^{-3}s]		t_2 [10^{-3}s]		P_B [W]
								BG	BGE	t_2II	t_2I	
BE05	5.0	3.5	2.5	1.8	-	-	120	34	15	10	42	32
BE1	10	7.0	5.0	-	-	-	120	55	10	12	76	32
BE2	20	14	10	7.0	-	-	165	73	17	10	68	43
BE5	55	40	28	20/14	-	-	260	-	37	10	70	49
BE11	110	80	55	40	-	-	640	-	41	15	82	76
BE20	200	150	110	80/55	-	-	1000	-	57	20	88	100
BE30	300	200	150	100	75	-	1500	-	60	16	80	130
BE32	600	500	400	300/	200	150	1500	-	60	16	80	130
BE120	1000	800	600	400	-	-	520	-	120	40	130	250
BE122	2000	1600	1200	800	-	-	520	-	120	40	130	250

$M_{B\ max}$ = Maximum braking torque
$M_{B\ red}$ = Reduced braking torque
W_{insp} = Braking work until service
t_1 = Response time
t_2I = Brake application time for cut-off in the AC circuit
t_2II = Brake application time for cut-off in the DC and AC circuit
P_B = Braking power

TIP

The response and application times are recommended values in relation to the maximum braking torque.

8.14 Different brake sizes

Depending on the demands placed on the brake, different brake sizes are available for mounting to the respective motor.

Brake assignment

Hoist (vertical movement)

The table below shows possible assignments of motor and BE brake and possible braking torques for hoist applications:

Motor type	Design	Brake type	W_{insp} [10^6 J]	Braking torque gradation in Nm																									
				1.8	2.5	3.5	5.0	7.0	10	14	20	28	40	55	80	100	110	150	200	300	400	500	600	800	1000	1200	1600	2000
DR.71	Integrated	BE05	120	x	x	x	x																						
		BE1	120				x	x	x																				
DR.80		BE05	120	x	x	x	x																						
		BE1	120				x	x	x																				
		BE2	165					x	x	x	x																		
DR.90	Modular	BE1	120				x	x	x																				
		BE2	165					x	x	x	x																		
		BE5	260							x	x	x	x	x															
DR.100		BE2	165					x	x	x	x																		
		BE5	260							x	x	x	x	x															
DR.112 DR.132		BE5	260							x	x	x	x	x															
		BE11	640										x	x	x		x												
DR.160		BE11	640										x	x	x		x												
		BE20	1000												x		x	x	x										
DR.180		BE20	1000												x		x	x	x										
		BE30	1500													x		x	x	x									
		BE32	1500															x	x	x	x								
DR.200 DR.225		BE30	1500													x		x	x	x									
		BE32	1500															x	x	x	x	x	x						
DR.315		BE120	520																		x		x	x	x				
		BE122	520																					x		x	x	x	

Travel drive (horizontal movement)

The table below shows possible assignments of motor and BE brake and possible braking torques for travel drive applications:

Motor type	Design	Brake type	W_{insp} [10^6 J]	Braking torque gradation in Nm																	
				28	40	55	75	80	100	110	150	200	300	400	500	600	800	1000	1200	1600	2000
DR.112 DR.132	Modular	BE11	640		x	x		x													
DR.160		BE11	640		x	x		x													
		BE20	1000			x		x		x	x										
DR.180		BE20	1000			x		x		x	x										
		BE30	1500				x		x		x	x									
		BE32	1500								x	x	x	x							
DR.200 DR.225		BE30	1500				x		x		x	x									
		BE32	1500								x	x	x	x							
DR.315		BE120	520											x		x	x				
		BE122	520														x		x	x	

8.15 Operating currents for brakes

The following tables list the operating currents of the brakes at different voltages. The following values are specified:

- Inrush current ratio I_B / I_H; I_B = accelerator current, I_H = holding current
- Direct current I_G for direct DC voltage supply
- Rated voltage U_N (rated voltage range)

The accelerator current I_B (= inrush current) only flows for a short time (ca. 150 ms) when the brake is released. When the BG brake control system or direct DC voltage supply is used (only possible to brake size BE2), increased inrush current does not occur.

The values for the holding currents I_H are r.m.s. values. Use suitable measuring instruments for current measurements.

The key for the following tables is listed on page 271.

Brake BE05, BE1, BE2

The current values I_H (holding current) listed in the tables are r.m.s. values. Use appropriate instruments for measuring r.m.s. values. The inrush current (accelerator current) I_B only flows for a short time (ca. 160 ms) when the brake is released. There is no increased inrush current if a BG or BMS brake rectifier is used or if there is a direct DC voltage supply only possible with brakes up to size BE2.

	BE05, BE1	BE2
Max. braking torque $M_{B\ max}$[Nm]	5/10	20
Braking power P_B [W]	32	43
Inrush current ratio I_B/I_H	4	4

Rated voltage U_N		BE05 / 1		BE2	
V_{AC}	V_{DC}	I_H [A_{AC}]	I_G [A_{DC}]	I_H [A_{AC}]	I_G [A_{DC}]
	24	-	1.17	-	1.53
24 (23-26)	**10**	2,25	2.90	2.95	3.80
60 (57-63)	**24**	0.90	1.17	1.18	1.53
120 (111-123)	**48**	0.45	0.59	0.59	0.77
184 (174-193)	**80**	0.29	0.37	0.38	0.49
208 (194-217)	**90**	0.26	0.33	0.34	0.43
230 (218-243)	**96**	0.23	0.29	0.30	0.39
254 (244-273)	**110**	0.20	0.26	0.27	0.34
290 (274-306)	**125**	0.18	0.23	0.24	0.30
330 (307-343)	**140**	0.16	0.21	0.21	0.27
360 (344-379)	**160**	0.14	0.18	0.19	0.24
400 (380-431)	**180**	0.13	0.16	0.17	0.21
460 (432-484)	**200**	0.11	0.14	0.15	0.19
500 (485-542)	**220**	0.10	0.13	0.13	0.17
575 (543-600)	**250**	0.09	0.11	0.12	0.15

Brake BE5, BE11, BE20

The current values I_H (holding current) listed in the tables are r.m.s. values. Use appropriate instruments for measuring r.m.s. values. The inrush current (accelerator current) I_B only flows for a short time (ca. 160 ms) when the brake is released. Direct voltage supply is not possible.

	BE5	BE11	BE20
Max. braking torque $M_{B\ max}$[Nm]	55	110	200
Braking power P_B [W]	49	76	100
Inrush current ratio I_B/I_H	5.8	6.7	7.5

Rated voltage U_N		BE5	BE11	BE20
V_{AC}	V_{DC}	I_H [A_{AC}]	I_H [A_{AC}]	I_H [A_{AC}]
	24	1.67[1)]	2.67[1)]	3.32[1)]
60 (57-63)	**-**	1.28	2.05	2.55
120 (111-123)	**-**	0.64	1.04	1.28
184 (174-193)	**-**	0.41	0.66	0.81
208 (194-217)	**-**	0.36	0.59	0.72
230 (218-243)	**-**	0.33	0.52	0.65
254 (244-273)	**-**	0.29	0.47	0.58
290 (274-306)	**-**	0.26	0.42	0.51
330 (307-343)	**-**	0.23	0.37	0.45
360 (344-379)	**-**	0.21	0.33	0.40
400 (380-431)	**-**	0.18	0.29	0.36
460 (432-484)	**-**	0.16	0.26	0.32
500 (485-542)	**-**	0.15	0.23	0.29
575 (543-600)	**-**	0.13	0.21	0.26

1) I_H [A_{DC}] for operation with BSG or BMV

Brake BE30, BE32

The current values I_H (holding current) listed in the tables are r.m.s. values. Use appropriate instruments for measuring r.m.s. values. The inrush current (accelerator current) I_B only flows for a short time (ca. 160 ms) when the brake is released. Direct voltage supply is not possible.

	BE30, BE32
Max. braking torque $M_{B\ max}$[Nm]	300 / 600
Braking power P_B [W]	130
Inrush current ratio I_B/I_H	8.5

Rated voltage U_N		BE30/BE32
V_{AC}		I_H [A_{AC}]
120 (111-123)		1.66
184 (174-193)		1.05
208 (194-217)		0.94
230 (218-243)		0.84
254 (244-273)		0.75
290 (274-306)		0.67
330 (307-343)		0.59
360 (344-379)		0.53
400 (380-431)		0.47
460 (432-484)		0.42
500 (485-542)		0.37
575 (543-600)		0.33

Brake BE120, BE122

The current values I_H (holding current) listed in the tables are r.m.s. values. Use appropriate instruments for measuring r.m.s. values. The inrush current (accelerator current) I_B only flows for a short time (ca. 400 ms) when the brake is released. Direct voltage supply is not possible.

	BE120	BE122
Max. braking torque $M_{B\ max}$[Nm]	1000	2000
Braking power P_B [W]	250	250
Inrush current ratio I_B/I_H	4.9	4.9

Rated voltage U_N		BE120	BE122
V_{AC}		I_H [A_{AC}]	I_H [A_{AC}]
230 (218-243)		1.78	1.78
254 (244-273)		1.59	1.59
290 (274-306)		1.42	1.42
360 (344-379)		1.12	1.12
400 (380-431)		1.0	1.0
460 (432-484)		0.89	0.89
500 (485-542)		0.80	0.80
575 (543-600)		0.71	0.71

Key

I_B Accelerator current - brief inrush current

I_H Holding current r.m.s. value in the supply cable to the SEW brake rectifier

I_G Direct current with direct DC voltage supply

V_N Rated voltage (rated voltage range)

8.16 Brake coil resistance

Brake BE05, BE1, BE2

	BE05, BE1	BE2
Max. braking torque $M_{B\ max}$[Nm]	5/10	20
Braking power P_B [W]	32	43
Inrush current ratio I_B/I_H	4	4

Rated voltage U_N		BE05 / 1		BE2	
V_{AC}	V_{DC}	R_B	R_T	R_B	R_T
24 (23-26)	**10**	0.78	2.35	0.57	1.74
60 (57-63)	**24**	4.9	14.9	3.60	11
120 (111-123)	**48**	19.6	59	14.4	44
184 (174-193)	**80**	49	149	36	110
208 (194-217)	**90**	62	187	45.5	139
230 (218-243)	**96**	78	235	58	174
254 (244-273)	**110**	98	295	72	220
290 (274-306)	**125**	124	375	91	275
330 (307-343)	**140**	156	470	115	350
360 (344-379)	**160**	196	590	144	440
400 (380-431)	**180**	245	750	182	550
460 (432-484)	**200**	310	940	230	690
500 (485-542)	**220**	390	1180	280	860
575 (543-600)	**250**	490	1490	355	1080

Brake BE5, BE11, BE20

	BE5	BE11	BE20
Max. braking torque $M_{B\ max}$[Nm]	55	110	200
Braking power P_B [W]	49	76	100
Inrush current ratio I_B/I_H	5.8	6.7	7.5

Rated voltage U_N		BE5		BE11		BE20	
V_{AC}	V_{DC}	R_B	R_T	R_B	R_T	R_B	R_T
60 (57-63)	**24**	2.20	10.5	1.22	6.9	0.85	5.7
120 (111-123)	**-**	8.70	42	4.9	27.5	3.4	22.5
184 (174-193)	**-**	22	105	12.3	69	8.5	57
208 (194-217)	**-**	27.5	132	15.5	87	10.7	72
230 (218-243)	**-**	34.5	166	19.5	110	13.5	91
254 (244-273)	**-**	43.5	210	24.5	138	17	114
290 (274-306)	**-**	55	265	31	174	21.5	144
330 (307-343)	**-**	69	330	39	220	27	181
360 (344-379)	**-**	87	420	49	275	34	230
400 (380-431)	**-**	110	530	62	345	42.5	285
460 (432-484)	**-**	138	660	78	435	54	360
500 (485-542)	**-**	174	830	98	550	68	455
575 (543-600)	**-**	220	1050	119	670	85	570

Brake BE30, BE32

	BE30, BE32
Max. braking torque $M_{B\ max}$[Nm]	300 / 600
Braking power P_B [W]	130
Inrush current ratio I_B/I_H	8.5

Rated voltage U_N		BE30, BE32	
V_{AC}		R_B	R_T
120 (111-123)		2.3	17.2
184 (174-193)		5.8	43
208 (194-217)		7.3	54
230 (218-243)		9.2	69
254 (244-273)		11.6	86
290 (274-306)		14.6	109
330 (307-343)		18.3	137
360 (344-379)		23	172
400 (380-431)		29	215
460 (432-484)		36.5	275
500 (485-542)		46	345
575 (543-600)		58	430

Brake BE120, BE122

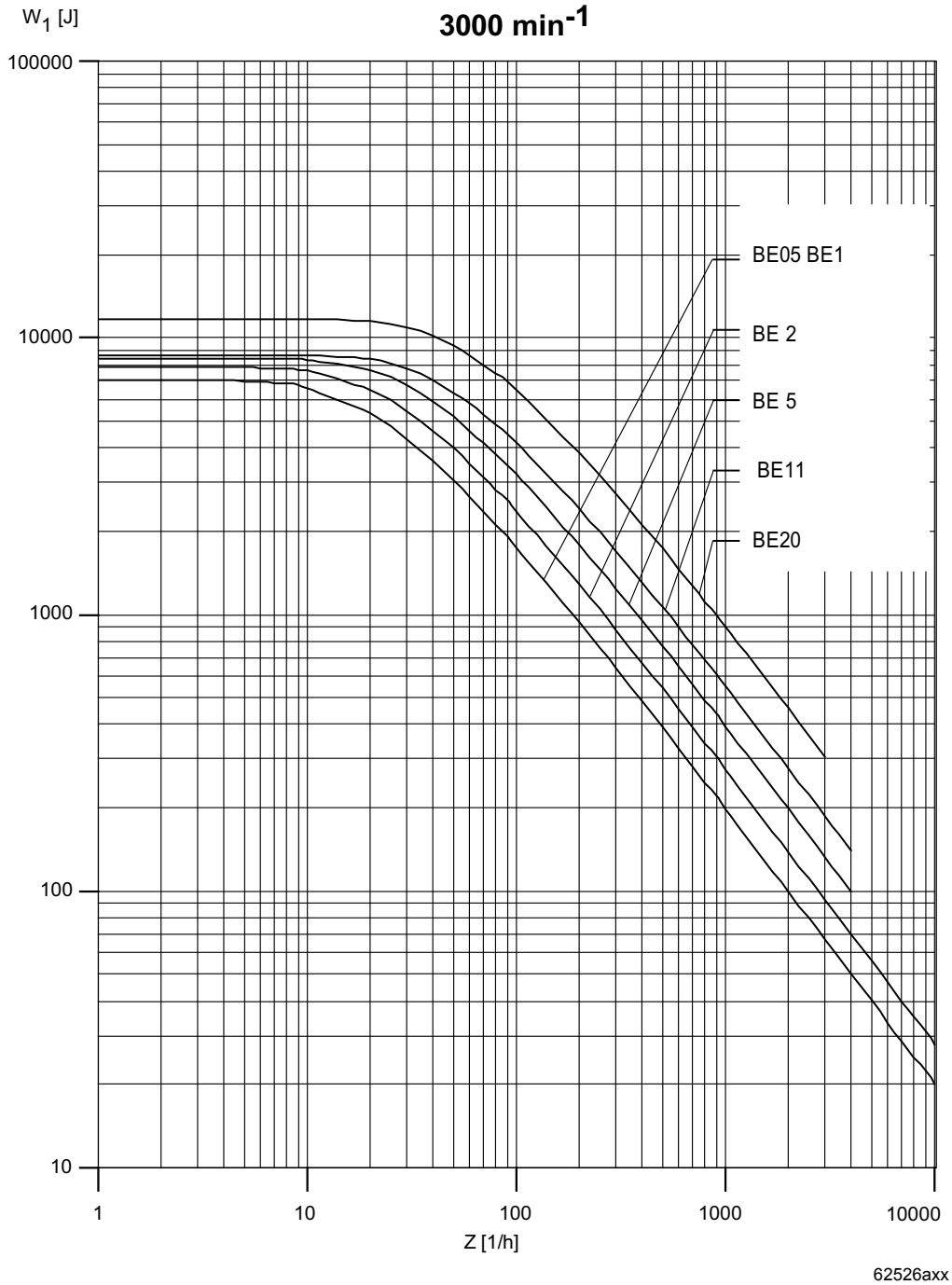
	BE120	BE122
Max. braking torque $M_{B\ max}$[Nm]	1000	2000
Braking power P_B [W]	250	250
Inrush current ratio I_B/I_H	4.9	4.9

Rated voltage U_N		BE120		BE122	
V_{AC}		R_B	R_T	R_B	R_T
230 (218-243)		7.6	29.5	7.6	29.5
254 (244-273)		9.5	37	9.5	37
290 (274-306)		12	46.5	12	46.5
360 (344-379)		19.1	74	19.1	74.0
400 (380-431)		24	93	24	93
460 (432-484)		30	117	30	117
500 (485-542)		38	147	38	147
575 (543-600)		48	185	48	185

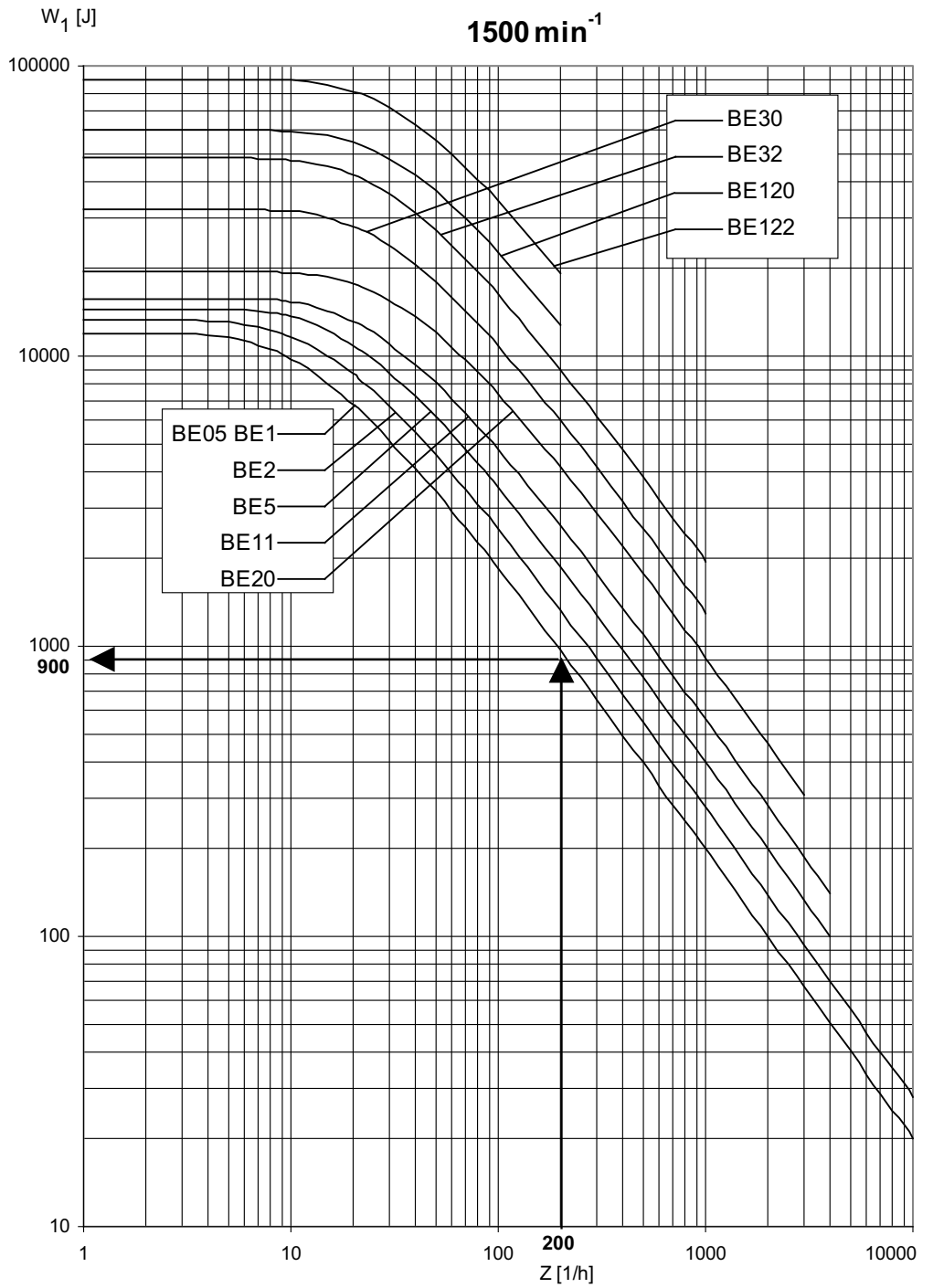
8.17 Permitted braking work of the BE brake for hoist applications

If you are using a brakemotor, you have to check whether the brake is approved for use with the required switching frequency "Z". The following diagrams show the permitted braking work W_1 per braking operation for different brakes and rated speeds. The values are given with reference to the required switching frequency "Z" in cycles per hour (1/h).

BE05, BE1, BE2, BE5, BE11, BE20

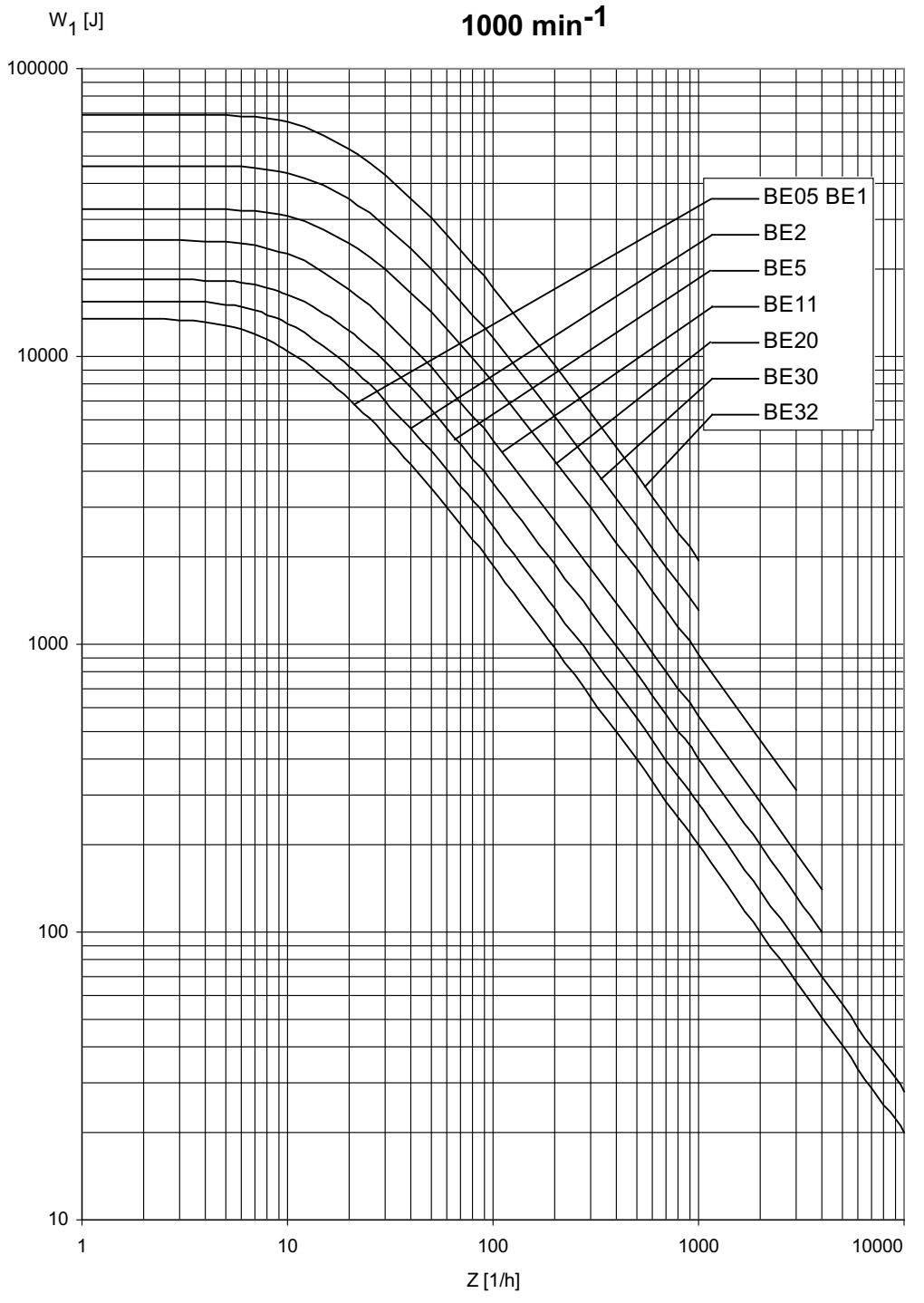


BE05, BE1, BE2, BE5, BE11, BE20, BE30, BE32, BE120, BE122

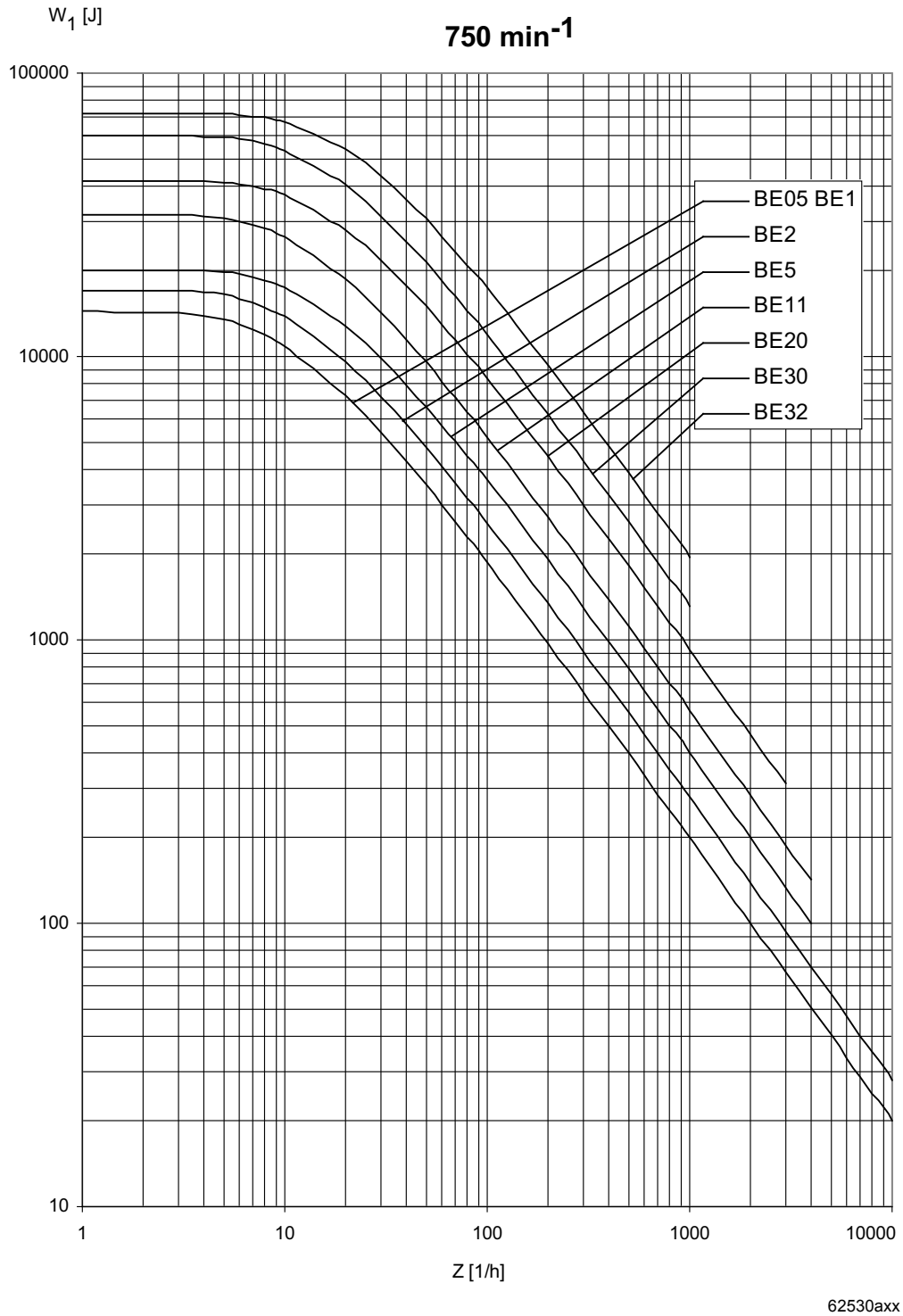


Example: The rated speed is 1500 rpm and brake BE05 is used. At 200 braking operations per hour, the permitted braking work per braking operation is 900 J.

BE05, BE1, BE2, BE5, BE11, BE20, BE30, BE32

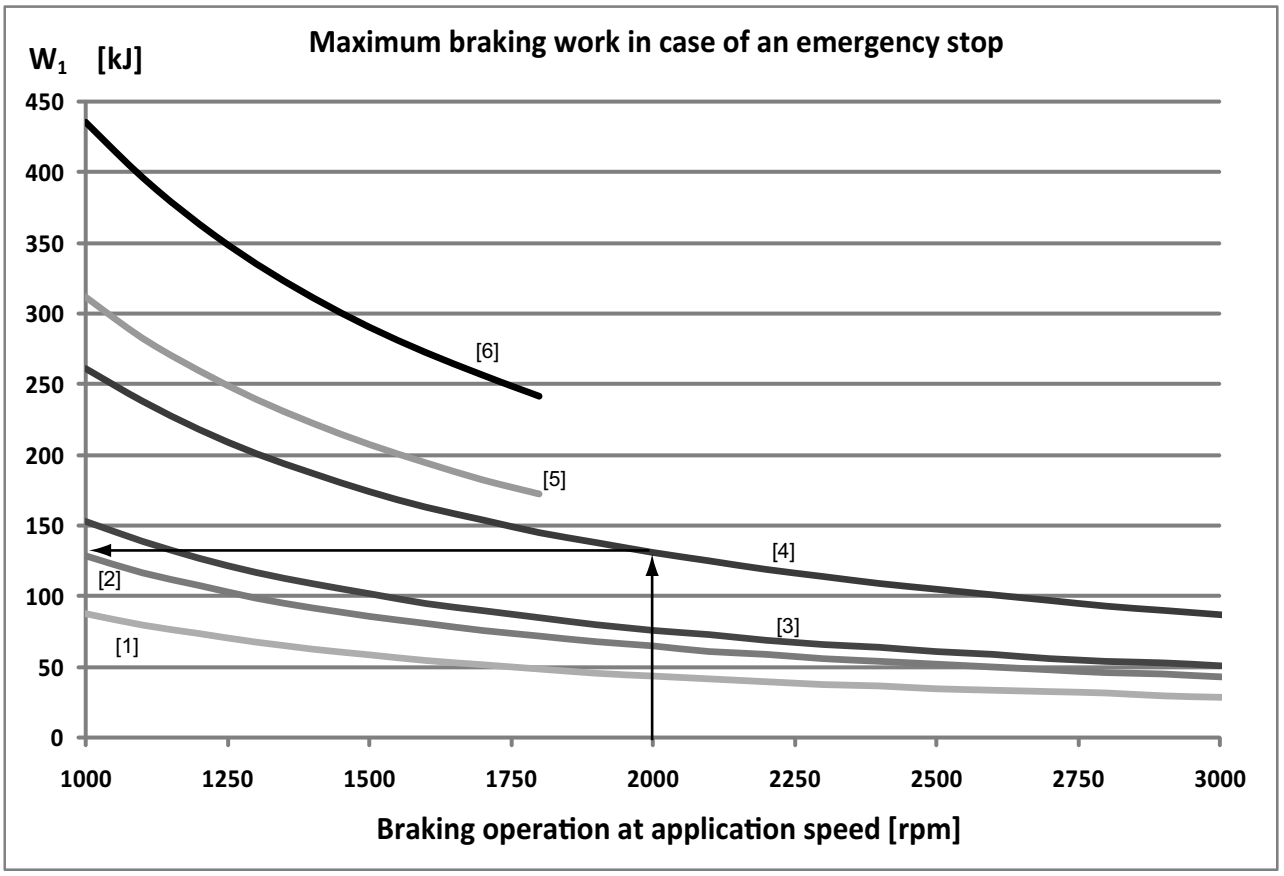


BE05, BE1, BE2, BE5, BE11, BE20, BE30, BE32



8.18 Permitted braking work of the BE brake for travel drive applications

	TIP
	If you use the brakemotor for decelerating a travel drive, you must check whether the brake can supply the braking work required for the brake application speed in an emergency stop situation, see also page 240.



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[1]	BE11	[4]	BE32
[2]	BE20	[5]	BE120
[3]	BE30	[6]	BE122

Example: If the application speed is 2000 rpm, with the BE32 brake the permitted emergency stop braking work per cycle is 135 kJ. Note the emergency stop conditions on page 240.

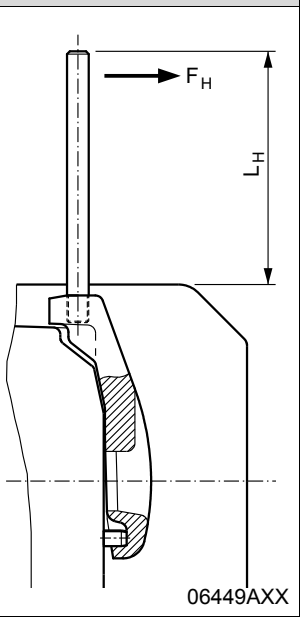
8.19 Braking work, working air gap, braking torques

Brake Type	Braking work until inspection	Working air gap [mm]		Brake disk [mm]	Braking torque settings				
					Braking torque	Type and number of brake springs		Order number of brake springs	
	[10^6 J]	min.[1]	max.	min.	[Nm]	Normal	Blue	Normal	Blue
BE05	120	0.25	0.6	9.0	5.0 3.5 2.5 1.8	2 2 - -	4 2 4 3	0135 017 X	1374 137 3
BE1	120	0.25	0.6	9.0	10 7.0 5.0	6 4 2	- 2 4	0135 017 X	1374 137 3
BE2	165	0.25	0.6	9.0	20 14 10 7.0	6 2 2 -	- 4 2 4	1374 024 5	1374 052 0
BE5	260	0.25	0.9	9.0	55 40 28 20 14	6 2 2 - -	- 4 2 4 3	1374 070 9	1374 071 7
BE11	640	0.3	1.2	10.0	110 80 55 40	6 2 2 -	- 4 2 4	1374 183 7	1374 184 5
BE20	1000	0.3	1.2	10.0	200 150 110 80 55	6 4 3 3 -	- 2 3 - 4	1374 322 8	1374 248 5
BE30	1500	0.3	1.2	10.0	300 200 150 100 75	8 4 4 - -	- 4 - 8 6	0187 4551	1374 435 6
BE32	1500	0.4	1.2	10.0	600 500 400 300 200	8 6 4 4 -	- 2 4 - 8	0187 4551	1374 435 6
BE120	520	0.4	1.2	12.0	1000 800 600 400	8 6 4 4	- 2 4 -	1360 877 0	1360 831 2
BE122	520	0.5	1.2	12.0	2000 1600 1200 800	8 6 4 4	- 2 4 -	1360 877 0	1360 831 2

1) Note when checking the working air gap: Parallelism tolerances on the brake disk may cause deviations of ± 0.15 mm after a test run.

8.20 Actuation force for manual release

In brakemotors with ..HR "Brake with self-reengaging manual brake release" option, you can release the brake manually using the provided lever. The following table specifies the actuation force required at maximum braking torque to release the brake by hand. The values are based on the assumption that you operate the lever at the upper end. The length of that part of the manual lever projecting out of the fan guard is stated as well.

Brake type	Motor size	Actuation force F_H [N]	Lever length L_H [mm]	
BE05	**71**	20	80	
BE05	**80**	20	71	
BE1	**71**	40	80	
BE1	**80**	40	71	
BE1	**90/100**	40	57	
BE2	**80**	80	82	
BE2	**90/100**	80	67	
BE5	**90/100**	200	73	
BE5	**112/132**	200	55	
BE11	**112/132**	230	120	
BE11	**160**	230	96	
BE20	**160**	375	178	
BE20	**180**	375	150	
BE30/32	**180**	500	265	
BE30/32	**200/225**	500	246	

8.21 Brake monitoring diagnostic unit

DUB10A diagnostic unit

DUB10A: Micro switch for function and/or wear monitoring.

DUB10A (Diagnostic Unit Brake) is a diagnostic unit used for reliable monitoring of the brake function and brake lining wear.

Note that function monitoring of the brake does not fulfill a stop category.

Unit designation

/DUB

- For function monitoring
- Or wear monitoring
- Or function and wear monitoring

Description

The function monitoring system signals whether the brake releases properly.

The wear monitoring system signals when the brake has reached a specified wear limit. However, the brake remains functional.

The micro switch is always the same and is used either as normally open contact (function monitoring) or normally closed contact (wear monitoring).

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Technical data

A recoiling micro switch is used as normally closed contact or normally open contact, depending on the task.

The signal can be evaluated by a frequency inverter or higher-level controller.

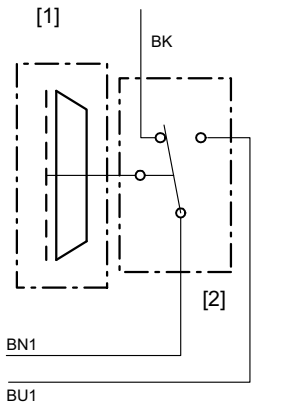
Two sensors allow you to monitor proper brake functioning and lining wear simultaneously.

The DUB10A diagnostic unit can be installed from brake size BE2 on DR.90 to BE122 on DR.315.

Technical data	Value
Operating voltage AC [V] DC [V]	max. 250 24
Rated switching capacity [A]	6 / 0.1 A at 24 V
Mechanical service life [cycles]	50×10^6
Control element material	Stainless steel
Housing material	PA6T/X with fiberglass reinforcement
Degree of protection	IP55
Snap switch mechanism	Flexible tongue made of beryllium-copper with self-cleaning contacts
Tripping force [N]	3.5
Differential travel [mm]	0.1
Temperature range [°C]	-40 to +60
Protection class	II
Can be mounted to	DR.90 BE2 - DR.315 BE122
Connection	Screw contacts on terminal box

Wiring diagrams

Function monitoring



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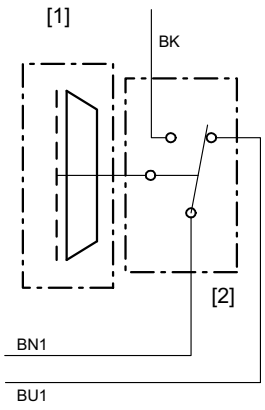
[1] Brake
[2] Micro switch MP321-1MS

Wear monitoring



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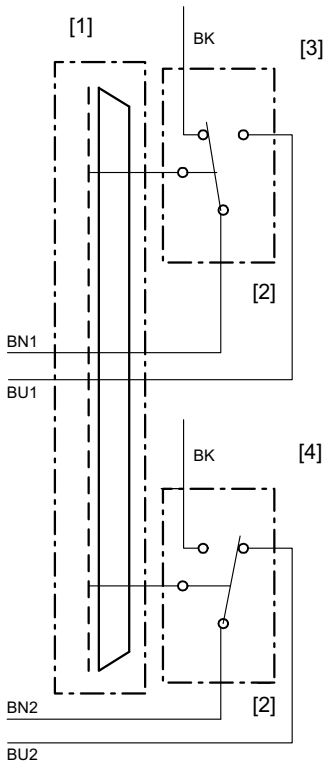
[1] Brake
[2] Micro switch MP321-1MS

Function monitoring + wear monitoring



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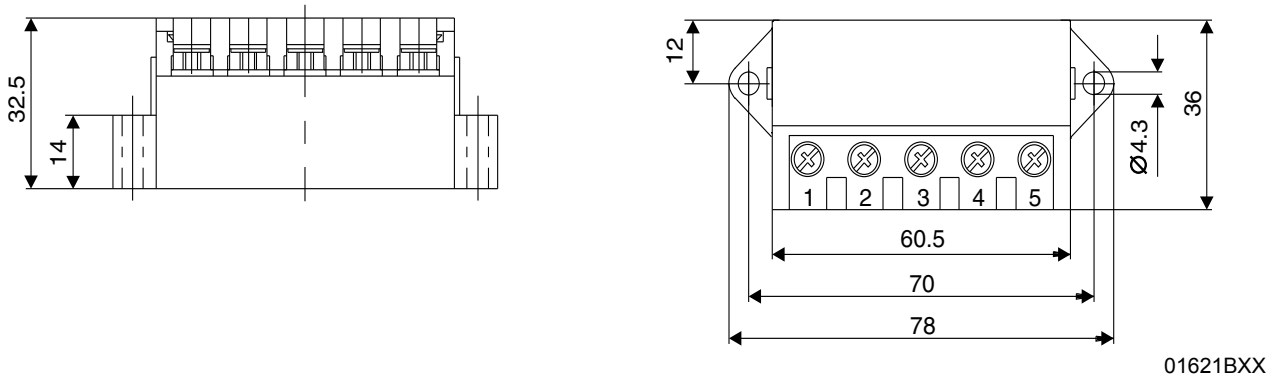
[1] Brake
[2] Micro switch MP321-1MS
[3] Function monitoring
[4] Wear monitoring

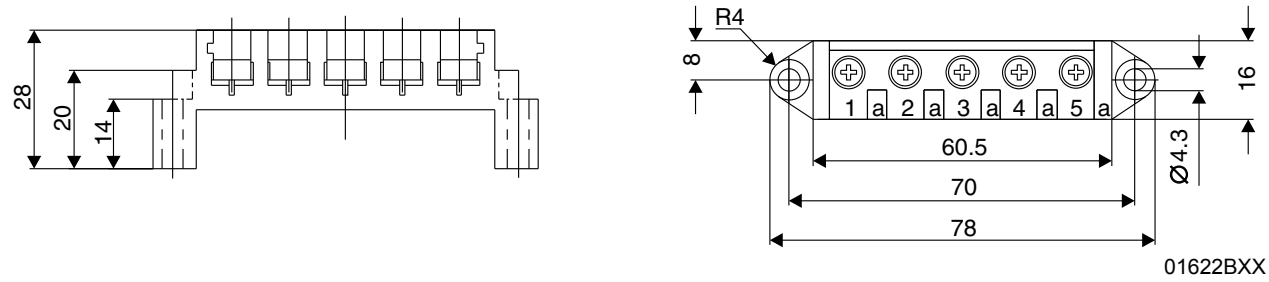
8.22 Dimension sheets for brake controllers

BG1.5, BG3, BGE, BS, BSG

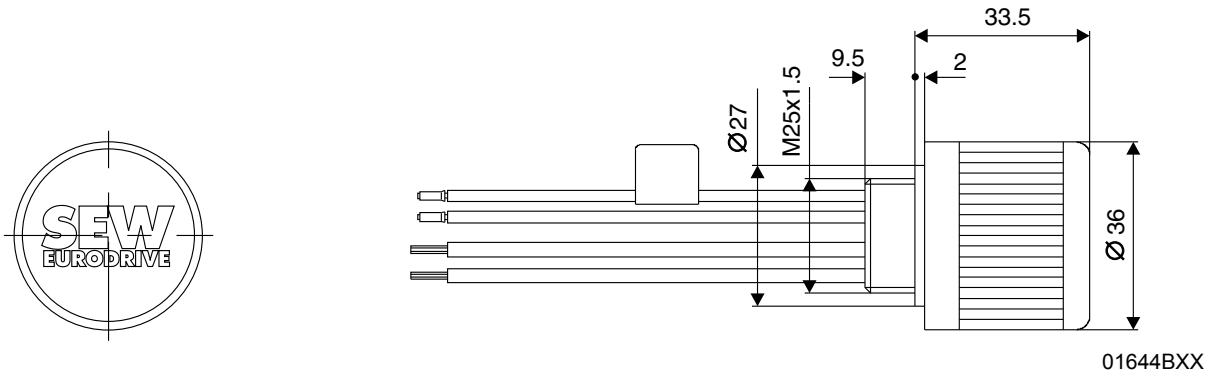


Auxiliary terminal strip

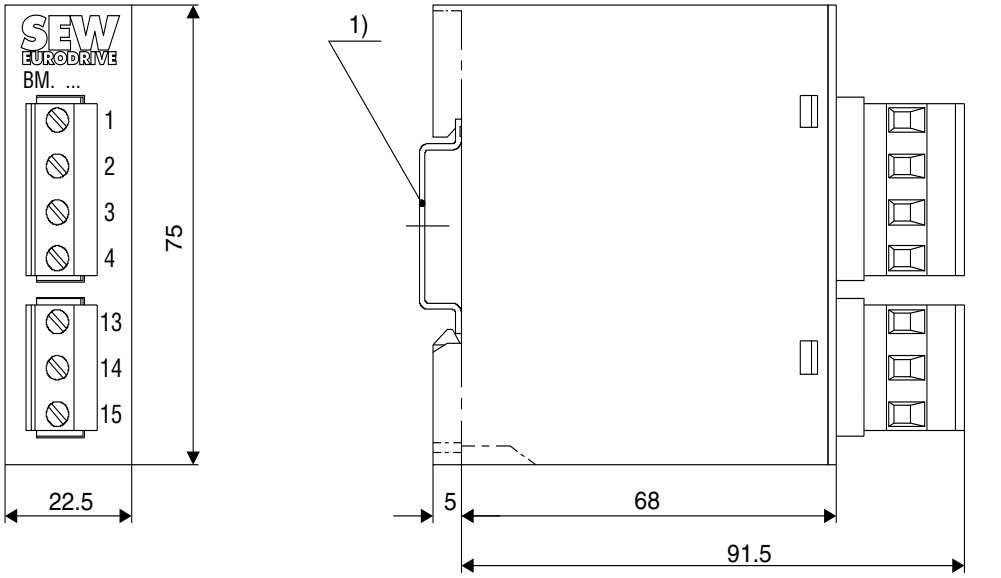
For connection of the brake coil or TF/TH and strip heaters in the wiring space of the motor



SR, UR



BMS, BME, BMH, BMP, BMK, BMV



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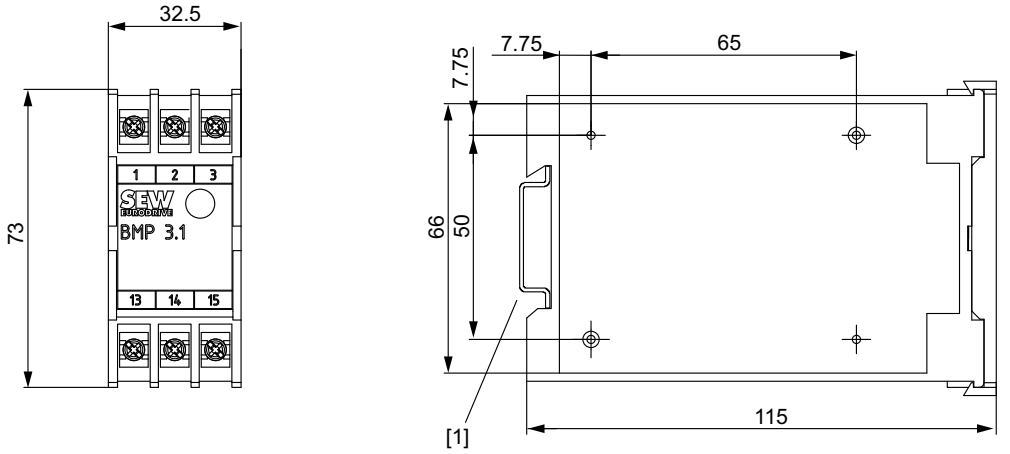
[1] Support rail mounting EN 50022-35-7.5

BMP3.1



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