Drive Technology \ Drive Automation \ System Integration \ Services

SEW Disk Brakes

Edition 11/2008

16668413 / EN

Drive Engineering – Practical Implementation

SEW EURODRIVE

1 Important Information

1.1 Structure of the safety notes

The safety notes in this publication have the following structure:

Symbol	SIGNAL WORD
	Nature and source of danger. Possible consequence(s) if disregarded. • Measure(s) to avoid the danger.

Symbol	Signal word	Meaning	Consequences if disregarded
Example: General danger; Specific danger, e.g. electric shock	DANGER	Imminent danger	Severe or fatal injuries
	WARNING	Possible dangerous situation	Severe or fatal injuries
	CAUTION	Possible dangerous situation	Minor injuries
	NOTICE	Possible damage to property	Damage to the drive system or its environment
	TIP	Useful information or tip. Simplifies handling of the drive system.	

1.2 Copyright

2 Introduction

This publication is designed for project planning engineers who intend to install AC motors, servomotors or geared brakemotors from SEW-EURODRIVE. It provides information on the basic principles, special characteristics, intended use and electrical connection of SEW brakemotors, and also includes sample circuits.

Note that this documentation does not deal with the various safety conditions arising in specific cases, nor with how they can be implemented in the motor control. Project planning engineers are responsible for these aspects of the system.

The working principle and characteristic data of SEW disk brakes are also described in the following SEW-EURODRIVE catalogs:

- Gearmotors
- DR Gearmotors
- DR AC Motors
- DR, CMP Motors
- Synchronous Servo Gearmotors
- Variable Speed Gearmotors
- DTE/DVE Energy-efficient Motors
- ASEPTIC Gearmotors

Detailed information about basic sizing principles can be found in the SEW publication “Drive Planning” from the series “Drive Engineering – Practical Implementation.” All other information relating to drive calculations can also be found in this documentation. The SEW project planning software “SEW Workbench” offers you support in matters relating to configuration.

For information on startup, operation and maintenance, refer to the relevant operating instructions.

3 Principle of SEW Brakes

3.1 Basic design

The SEW brake is an electromagnetic disk brake with a DC coil that is released electrically and braked 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 brake coil body [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].

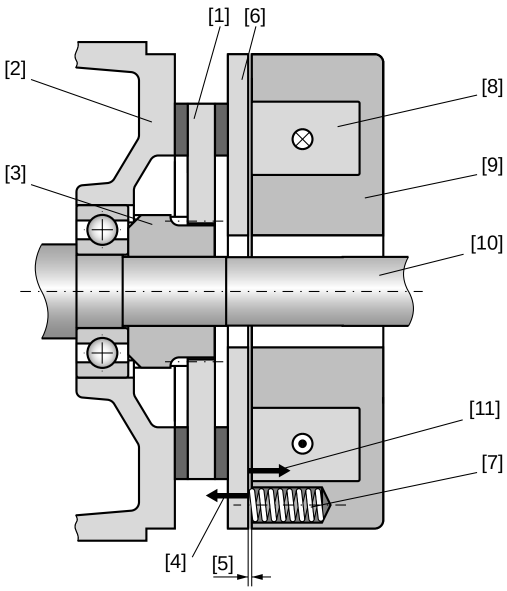
A characteristic feature of SEW brakes is their very short design: the brake endshield is a part of both the motor and the brake. The integrated design of the SEW brakemotor makes for particularly compact and sturdy solutions.

3.2 Basic functions

In contrast to other disk brakes with a DC coil, the SEW brakes operate with a two coil system. The pressure plate [6] is forced against the brake disk [1] by the brake springs [7] when the electromagnet is deenergized. The motor is slowed down. The following brake springs are used as required:

Brake springs with normal spring force:	• Color: black/silver for DT/DV and for DR motors
Brake springs with reduced spring force:	• Color: red for DT/DV motors • Color: blue for DR motors

The number and type of normal brake springs or the combination of normal and reduced brake springs [7] determine the braking torque. When the brake coil [8] is connected to the corresponding DC voltage, the force of the brake springs [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	[5]	Working air gap	[9]	Magnet
[2]	Brake endshield	[6]	Pressure plate	[10]	Motor shaft
[3]	Driver	[7]	Brake spring	[11]	Electromagnetic force
[4]	Spring force	[8]	Brake coil		

3.3 SEW brake systems in detail

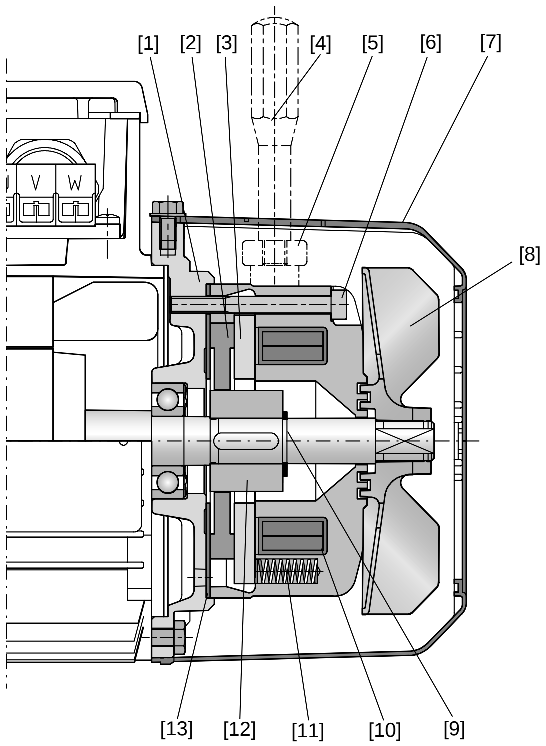
3.3.1 BMG02 brake

The BMG02 brake is used in AC brakemotors of size DT56.

The BMG02 brake is only available as a complete spare part.

Main features of the brake:

- Brake coil with tap
- Preassembled unit
- Movable pressure plate
- The combination of brake springs determines the braking torque



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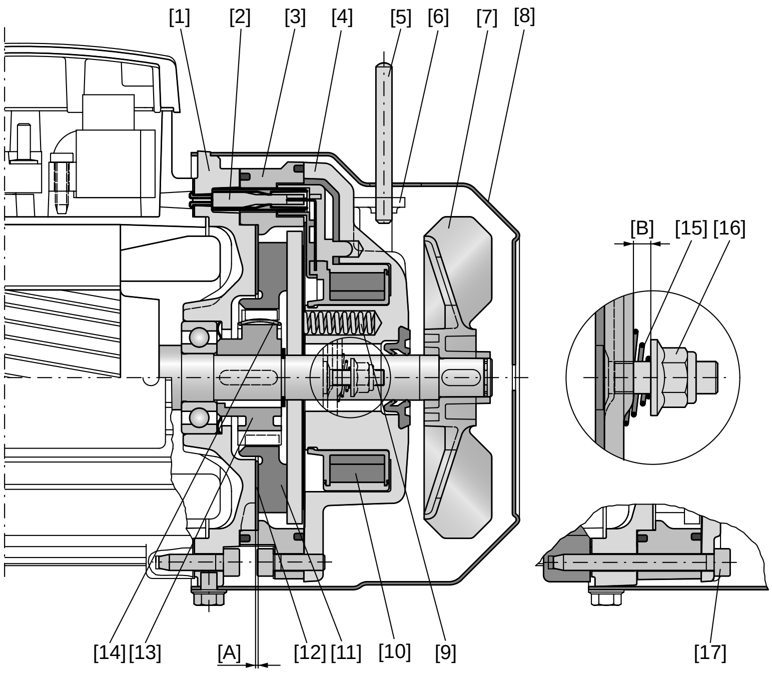
[1]	Brake endshield	[8]	Fan
[2]	Brake disk (complete)	[9]	Circlip
[3]	Pressure plate	[10]	Brake coil
[4]	Hand lever	[11]	Brake spring
[5]	Release lever	[12]	Driver
[6]	Retaining screw	[13]	Friction plate
[7]	Fan guard		

3.3.2 BR03 brake

The BR03 brake is used for size DR63 AC brakemotors. According to the BR principle, the brake can be plugged in mechanically and electrically and is then ready for operation. The BR03 brake is only available as a complete spare part. The guide ring [3] allows for a very compact design.

Main features of the brake:

- Brake coil with tap
- Movable pressure plate
- Plug connector (contact box) for simple electrical bonding
- The combination of brake springs determines the braking torque



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[1]	Brake endshield	[11]	Brake disk
[2]	Contact box	[12]	Friction plate
[3]	Guide ring	[13]	Driver
[4]	Magnet	[14]	Clasp
[5]	Hand lever	[15]	Conical coil spring
[6]	Release lever	[16]	Hex nut
[7]	Fans	[17]	Retaining screws
[8]	Fan guard	[A]	Working air gap
[9]	Brake spring	[B]	Floating clearance of manual brake release
[10]	Brake coil		

3.3.3 BE.. brake

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

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 principle of the modular brake on a friction disk begins starting at motor size DR.90.

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

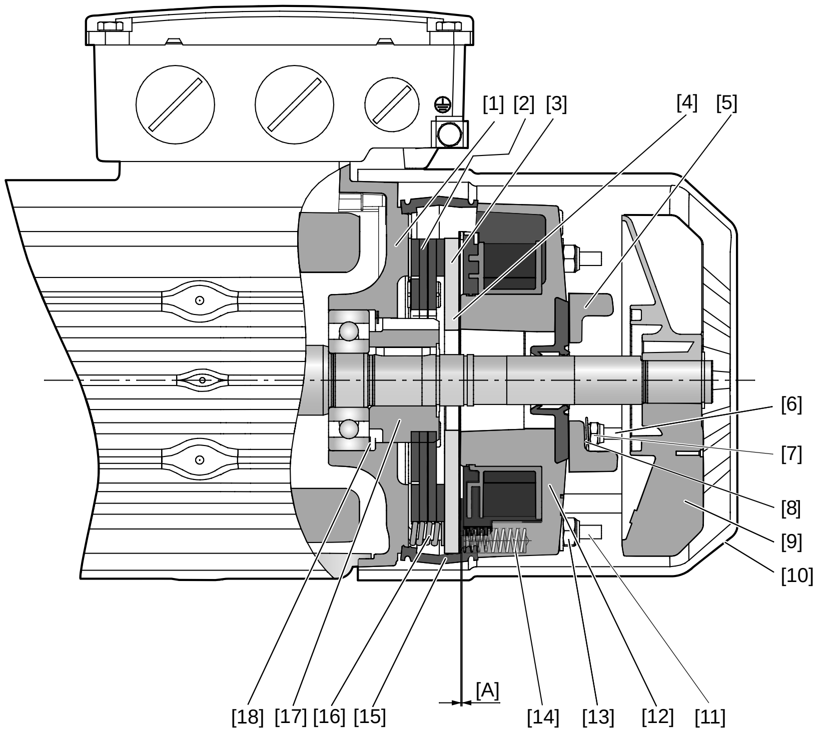
Although the integrated brake is mounted on a complete brake endshield, it can be dimensioned to suit specific requirements, just like the modular brake.

Main features of the brake:

- Various brake sizes can be mounted to each motor size
- Brake coil with tap
- Movable pressure plate
- Plug connector for simple electrical connection, starting at BE20
- The combination of brake springs determines the braking torque
- Position of the manual brake release can be defined by the user

The working air gap [A] is set using the 3 retaining bolts [17] and the corresponding nuts [16], see Technical Data (see page 143).

The following figure shows the BE.. brake for motor types up to size DR.80:



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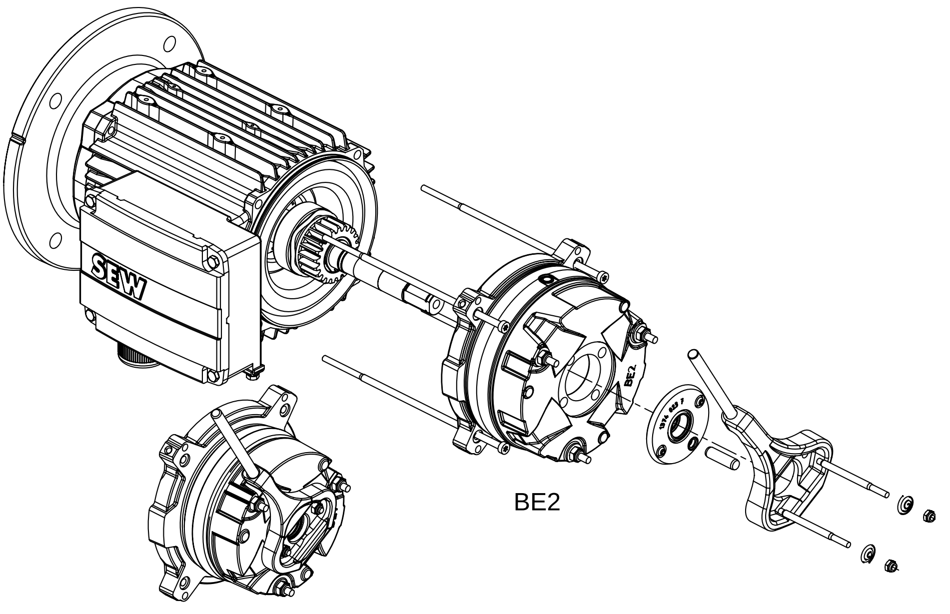
[1]	Brake endshield	[11]	Stud
[2]	Complete brake disk	[12]	Magnet, complete
[3]	Pressure plate	[13]	Hex nut
[4]	Damping plate	[14]	Brake spring (hidden)
[5]	Release lever	[15]	Rubber sealing collar
[6]	Stud	[16]	Counter spring
[7]	Adjusting screw	[17]	Driver
[8]	Conical coil spring	[18]	Shim washer
[9]	Fan	[A]	Working air gap
[10]	Fan guard		

The following figure shows the integral construction of the BE.. brake for motor types up to size DR.80:



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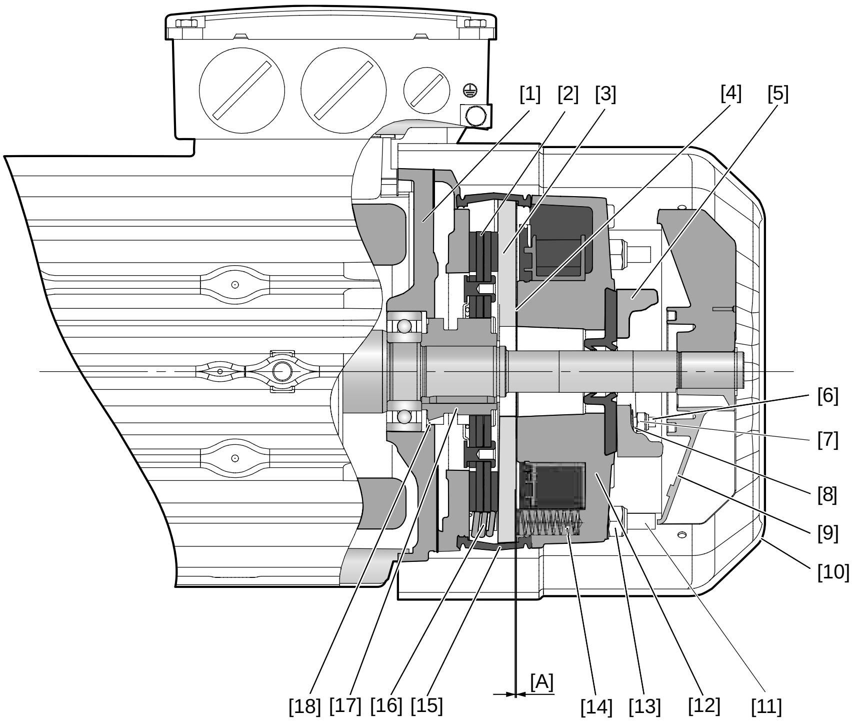
The following figure shows the BE.. brake for motor types from size DR.90:



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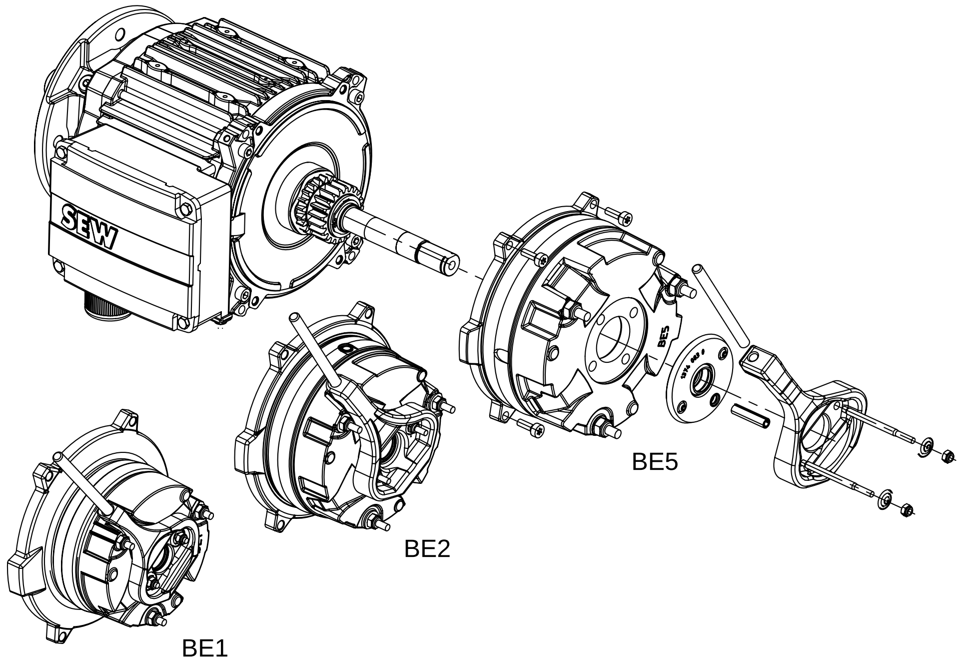
[1]	Brake endshield	[11]	Stud
[2]	Complete brake disk	[12]	Magnet, complete
[3]	Pressure plate	[13]	Hex nut
[4]	Damping plate	[14]	Brake spring (hidden)
[5]	Releasing lever	[15]	Rubber sealing collar
[6]	Stud	[16]	Counter spring
[7]	Adjusting screw	[17]	Driver
[8]	Conical coil spring	[18]	Shim washer
[9]	Fans	[A]	Working air gap
[10]	Fan guard		

The following figure shows the modular construction of the BE.. brake for motor types from size DR.90:



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DUB10A diagnostic unit

As an option, the DUB10A diagnostic unit can be used for the BE.. brake.

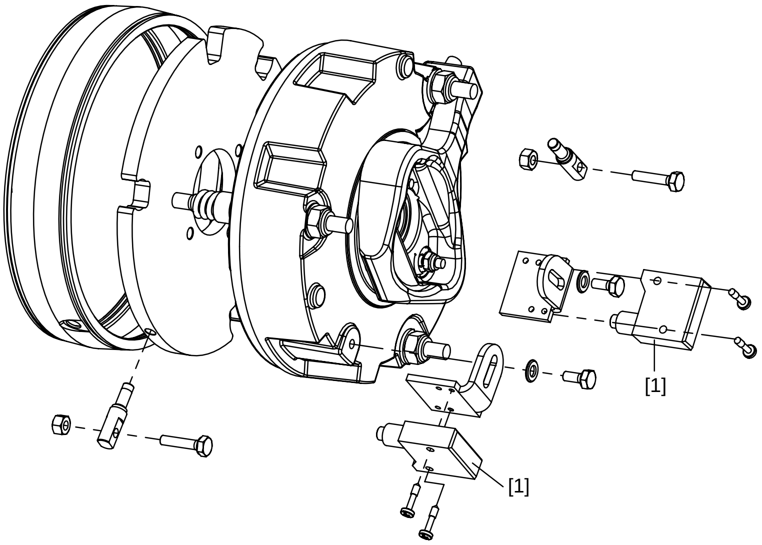
DUB10A (Diagnostic Unit Brake) is a diagnostic unit used for reliable monitoring of the brake function and brake lining wear.

Function monitoring: The function monitoring system signals whether the brake releases properly.

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

Wear and function monitoring: The two integrated microswitches are identical and are set at the factory. They are used as normally open contacts (function monitoring) or as normally closed contacts (wear monitoring).

The figure below shows the BE.. brake with two microswitches:



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[1] Microswitch for wear or function monitoring

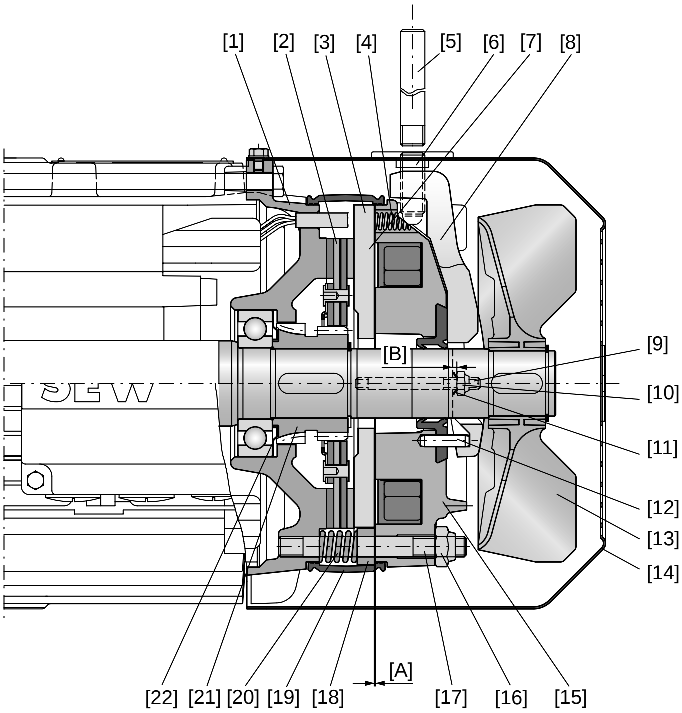
3.3.4 BM(G).. brake

The BM(G).. brake is used in all DT71 - DV280 AC brakemotors, in CT/CV asynchronous servo brakemotors, in gear unit adapters (extended housings) with centrifugal couplings and in VARIBLOC® variable speed gear units.

Main features of the brake:

- Brake coil with tap
- Movable pressure plate
- Brake disk – for motor sizes 180 to 280, also available as double disk brake
- Brake endshield
- The combination of brake springs determines the braking torque

The working air gap [A] is set using the 3 retaining screws [17] and the corresponding nuts [16], see Technical Data (see page 143).



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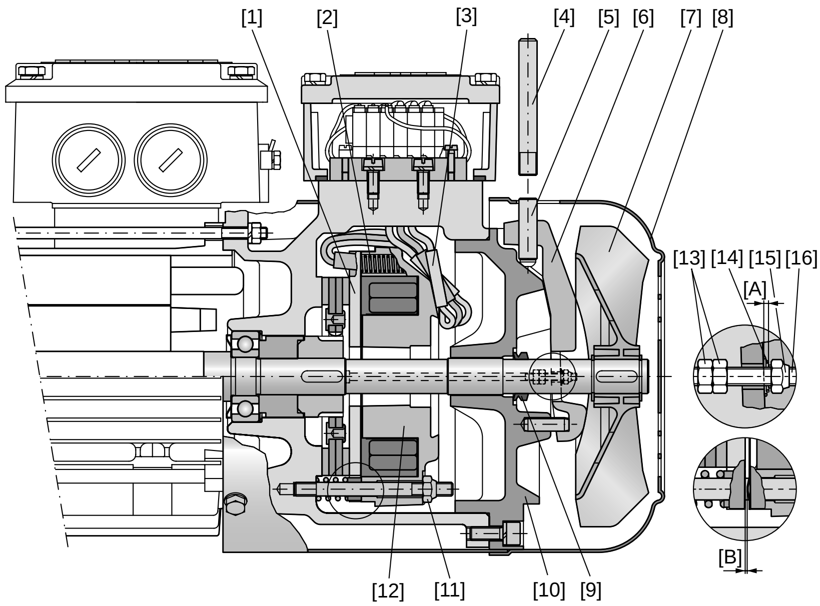
[1]	Brake endshield	[13]	Fan
[2]	Complete brake disk	[14]	Fan guard
[3]	Pressure plate	[15]	Magnet, complete
[4]	Brake spring	[16]	Hex nut
[5]	Hand lever (with non-locking manual brake release HR)	[17]	Stud
[6]	Set screw (only for HF)	[18]	Pressure ring
[7]	Damping plate (only for BMG brakes)	[19]	Rubber sealing collar
[8]	Release lever	[20]	Counter spring
[9]	Stud	[21]	Driver
[10]	Adjusting screw	[22]	Shim washer
[11]	Conical coil spring	[A]	Working air gap
[12]	Dowel pin	[B]	Floating clearance of the manual brake release

3.3.5 BC.. brake

The BC.. brake is installed in eDT..BC explosion-proof AC motors. It is a flameproof brake with protection type EEx d IIB T3. The brake comprises the same basic elements as the BMG brake and is integrated into eDT71..BC – eDT100..BC motors (see page 58). The working air gap is adjusted in the same way as for BMG; see Technical Data (see page 143).



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[1]	Pressure plate	[10]	Housing cover
[2]	Brake spring	[11]	Hex nut
[3]	Cable	[12]	Brake coil body
[4]	Hand lever (only for HR)	[13]	Hex nut
[5]	Setscrew (only for HF)	[14]	Conical coil spring
[6]	Release lever	[15]	Setting nut
[7]	Fan	[16]	Holding bolt or stud
[8]	Fan guard	[A]	Floating clearance of manual brake release
[9]	Gasket	[B]	Working air gap

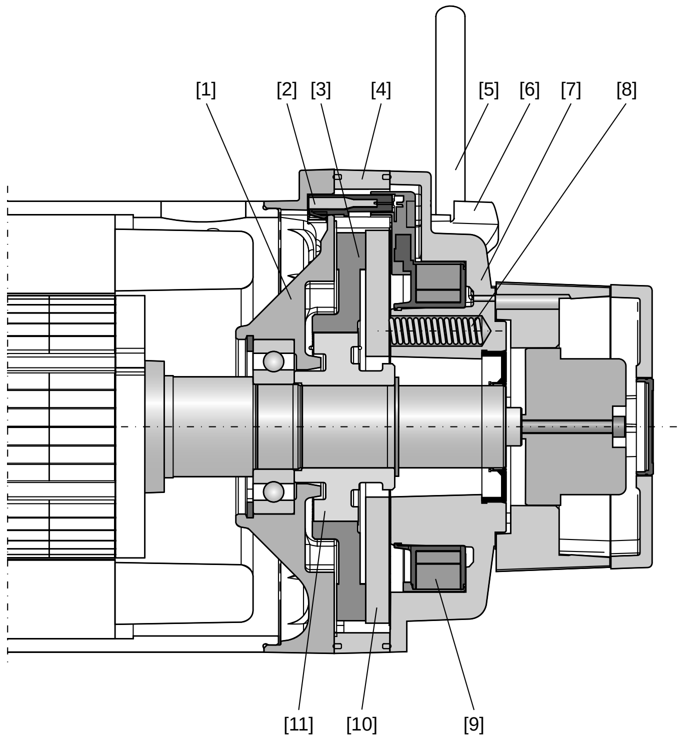
3.3.6 BR.. brake

The BR.. brake is installed in CM...BR synchronous servomotors and DAS...BR ASEPTIC motors. The SEW brakes transfer the braking torque to two friction surfaces. The brake is released when the brake coil [9] is energized with direct current. As a result, the pressure plate [10] is pulled onto the brake coil body. The brake disk [3], which is connected to the motor shaft by a driver [11], is released. When the brake coil is deenergized, the brake springs [8] determine the braking torque generated between the brake disk and the brake bearing end shield [1] or pressure plate.

The BR brake is only available as a complete spare part.

Main features of the brake:

- Brake coil with tap
- Movable pressure plate
- Plug connector (contact box) for simple electrical bonding
- The combination of brake springs determines the braking torque



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[1]	Brake endshield	[7]	Magnet
[2]	Contact box	[8]	Brake spring
[3]	Brake disk	[9]	Brake coil
[4]	Guide ring	[10]	Pressure plate
[5]	Hand lever (not for HF)	[11]	Driver
[6]	Release lever (not installed in ASEPTIC motors)		

3.3.7 BP.. brake

The BP.. brake is installed in CMP40 – CMP100 and CMD55 – CMD138 synchronous servomotors.

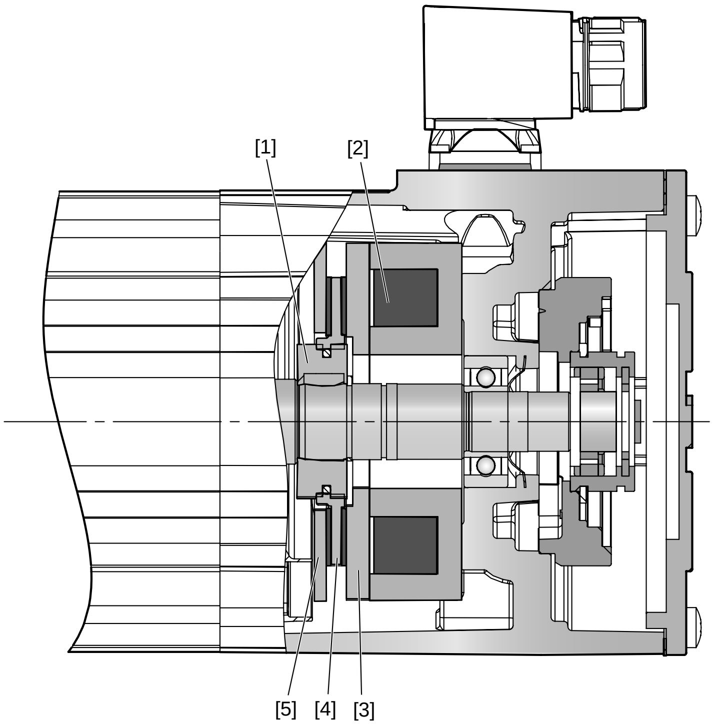
The BP.. holding brake is an electromagnetic disk brake with a DC coil that releases electrically and brakes using spring force.

The brake has a standard supply voltage of DC 24 V and operates with one or two braking torque ratings for each motor size.

The brake cannot be retrofitted and usually operates without brake rectifier or brake control unit.

Main features of the brake:

- Preassembled unit
- Movable pressure plate
- The combination of brake springs determines the braking torque



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[1] Driver
[2] Brake coil
[3] Pressure plate
[4] Brake disk
[5] Friction disk

3.3.8 B.. brake

The B.. brake is used in servo brakemotors of size DFS56. The permanent magnet brake opens electrically and brakes through the force of attraction of the permanent magnets.

The standard voltage supply of the B.. brake is DC 24 V, and it operates with a constant braking torque.

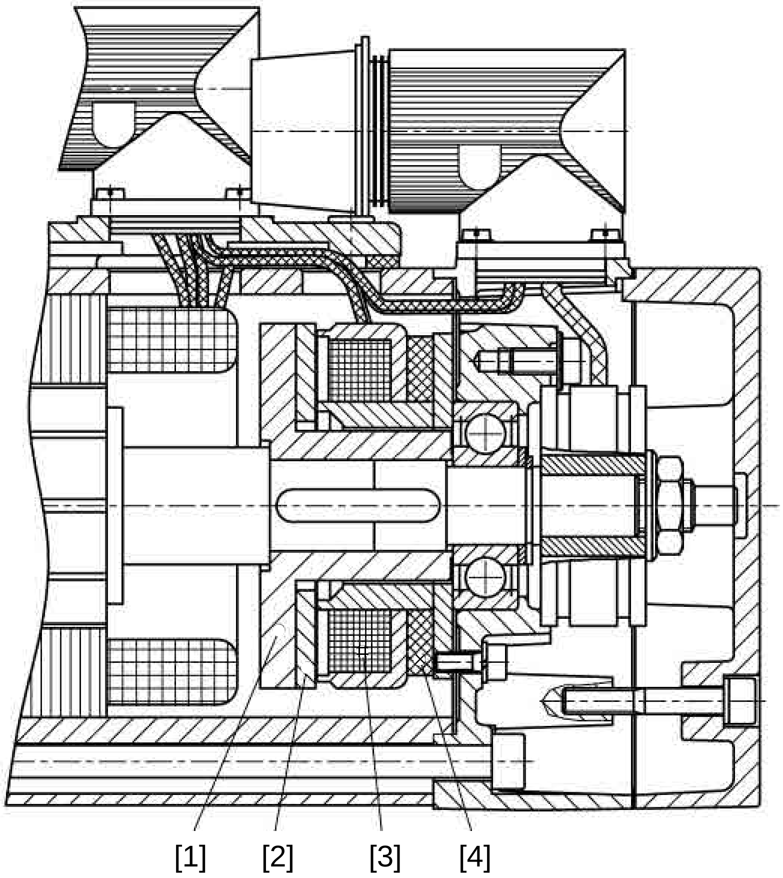
The brake cannot be retrofitted and usually operates without a brake rectifier or a brake control unit.

The version with a braking torque of 2.5 Nm is used on the DFS56M/L motor and the 5 Nm version on the DFS56H motor.

The B.. brake is only available as a complete spare part.

Main features of the brake:

- Preassembled unit
- Movable pressure plate



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[1]	Driver flange	[3]	Brake coil
[2]	Pressure plate	[4]	Permanent magnet

4 Numerous Possibilities Using Modular Brake Controls

The SEW brake system, just like the entire product range of SEW-EURODRIVE, has a modular structure. The modular concept consisting of electronic and mechanical components permits a wide variety of tasks to be accomplished.

In the mechanical range of the modular units, there are various types to be considered, such as adjustable braking torques and additional options.

Electronic components, on the other hand, make different control systems and functions available, such as high-speed excitation or a heating function.

In this way, all SEW brake systems share one basic principle, which is adapted to the broadest variety of possible uses by combining elements from the modular concept.

The following table gives an overview of the possible combinations of brakes and controls and the resulting properties.

	Installation in terminal box					
	BG	BGE	BSR	BUR	BS	BSG
Standard excitation	●	–	O[1)]	O[1)]	●	–
High-speed excitation	–	●	●	●	–	●
Standard application	●	●	–	–	●	–
Rapid application	O[2)]	O[2)]	●	●	–	●
Heating function	–	–	–	–	–	–
Connection, DC 24 V brake	–	–	–	–	●	●
Connection, explosion-proof motors	–	–	–	–	–	●[3)]

1) Standard excitation is only possible for DR63.
2) This combination is only possible together with switch contacts in utilization category AC-3 with SR.. or UR.. for BG and BGE.
3) The BSG brake control must be installed in the control cabinet.

	Installation in control cabinet					
	BMS	BME	BMH	BMP[1)]	BMK	BMV
Standard excitation	●	–	–	–	–	–
High-speed excitation	–	●	●	●	●	●
Standard application	●	●	●	O[2)]	–	–
Rapid application	O[3)]	O[3)]	O[3)]	●	●	●
Heating function	–	–	●	–	–	–
Connection, DC 24 V brake	–	–	–	–	–	●
DC 24 V control input	–	–	–	–	●	●
Connection, explosion-proof motors	●	●	–	–	–	–

1) The BMP brake control can also be in the terminal box with the DR315 motor.
2) This combination is only possible by applying a jumper.
3) This combination is only possible together with contacts in utilization category AC-3.

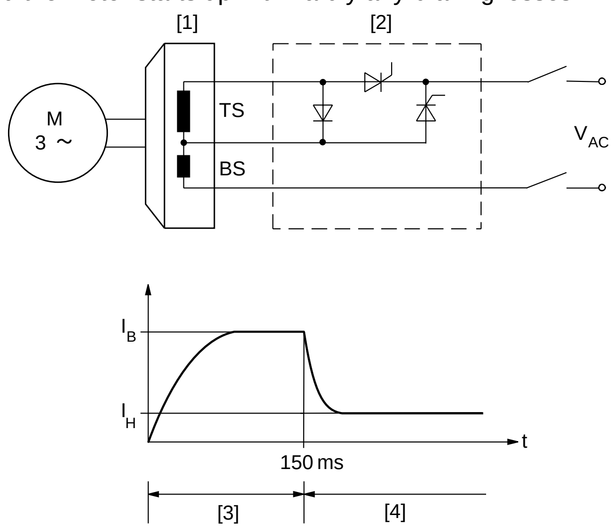
● Possible
O Only possible to a certain extent
– Not possible

The following features are explained in more detail in the next sections:

- Particularly short response times at switch-on
- Particularly short response times at switch-off
- Particularly safe
- High stopping accuracy
- High starting frequency possible
- Low noise level
- High thermal load possible
- Low and fluctuating ambient temperatures possible

4.1 Particularly short response times at switch-on

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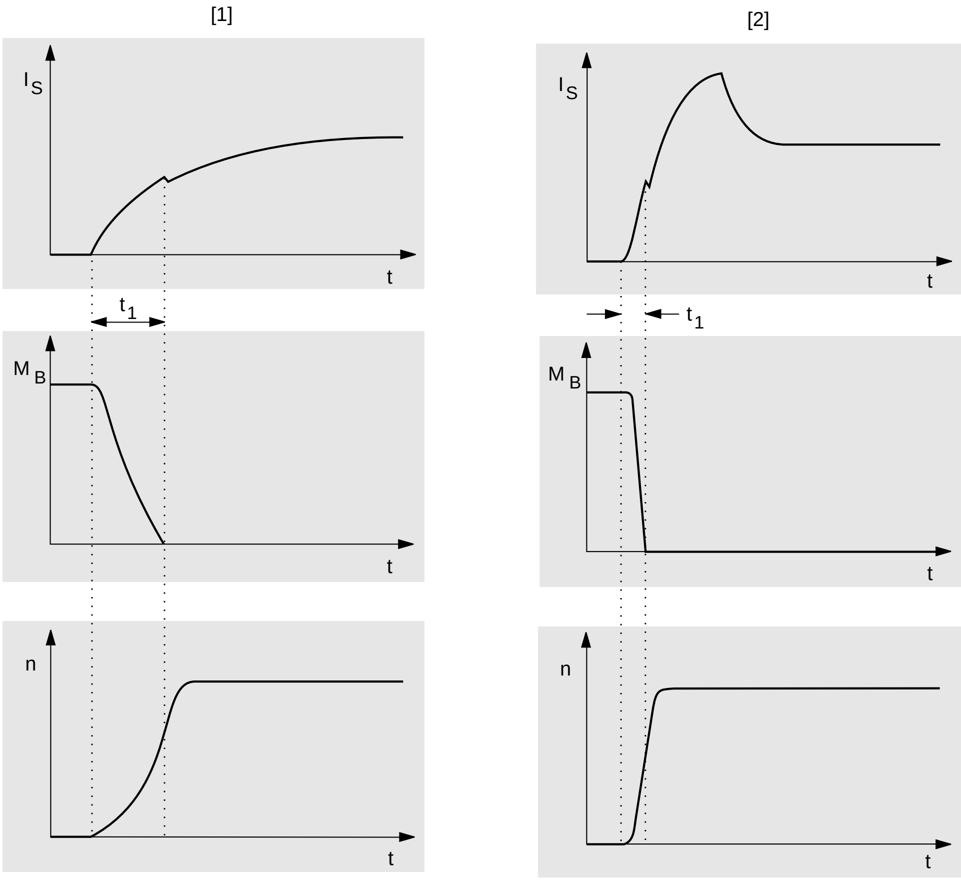
BS Accelerator coil
TS Coil section
[1] Brake
[2] Brake control
[3] Acceleration
[4] Holding
I_B Acceleration current
I_H Holding current
BS + TS = Holding coil

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 starting frequency and a long brake service life.



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[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 DT/DV 112 and from DR..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) as to ensure that the pressure plate is held open with a sufficient degree of safety and minimum brake heating.

Advantages:

- A fast opening of the brake can lead to the motor starting quickly, as the above figure shows. Consequently, the motor starts up only minimally against the closed brake (time up to the end of t_1), reducing the heating up of the motor significantly. This makes it possible to have more cycle times per hour.

4.2 *High starting frequency possible*

Brakemotors often demand a high starting frequency and significant external mass moments of inertia.

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 starting frequency.

Brakes from BMG8 – BMG122 and BE5 – BE122 are designed for a high starting frequency as standard.

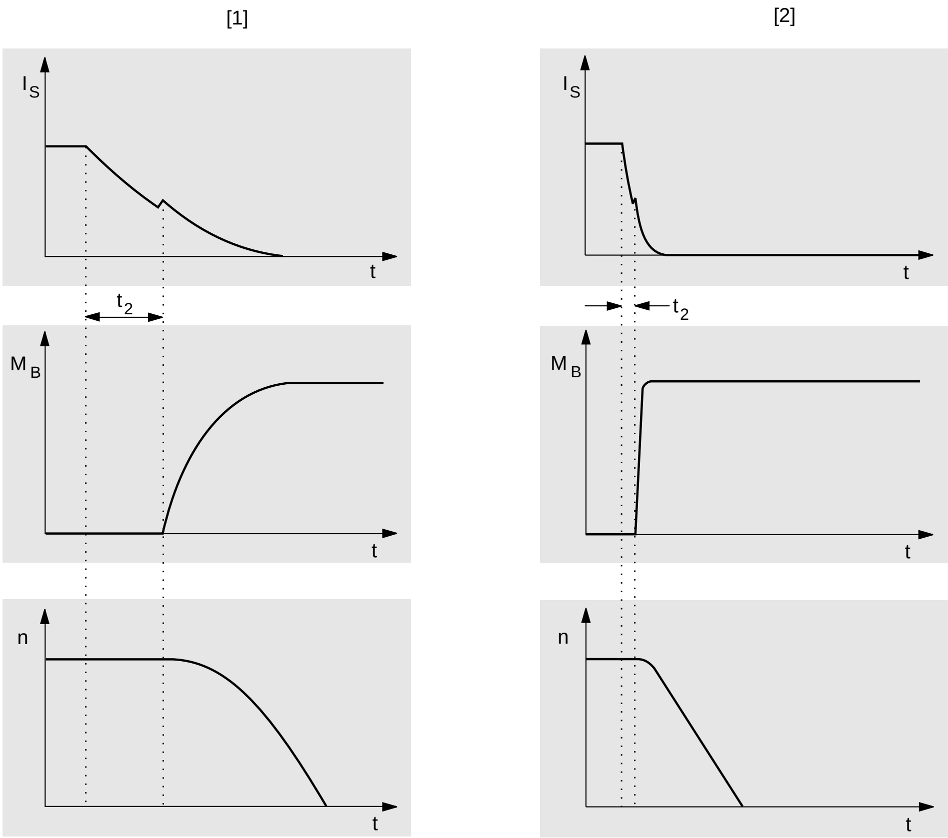
The table below shows that, in addition to BGE (BME) and BSG, the BSR, BUR, BMH, BMK and BMP brake controls also have properties for shortening the response time in addition to their other functions.

Type Brakemotor	High starting frequency	
	Brake control for AC connection	Brake control for DC 24 V connection
DR63..BR	BME (BMH, BMP, BMK) in control cabinet	BSG and BMV in control cabinet
DT71..BMG	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
DT80..BMG		
DT90..BMG		
DV100..BMG		
DV112..BMG		
DV132S..BMG		
DV132M..BM		
DV132ML..BM		
DV160..BM		
DV180..BM		
DV200..BM		
DV225..BM		
DV250..BMG	BGE in terminal box or BME in control cabinet	-
DV280..BMG		

Brake	High starting frequency	
	Brake control for AC connection	Brake control 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	BGE in terminal box or BME in control cabinet	-
BE32		
BE120	BMP3.1 in the terminal box or the control cabinet	
BE122		

4.3 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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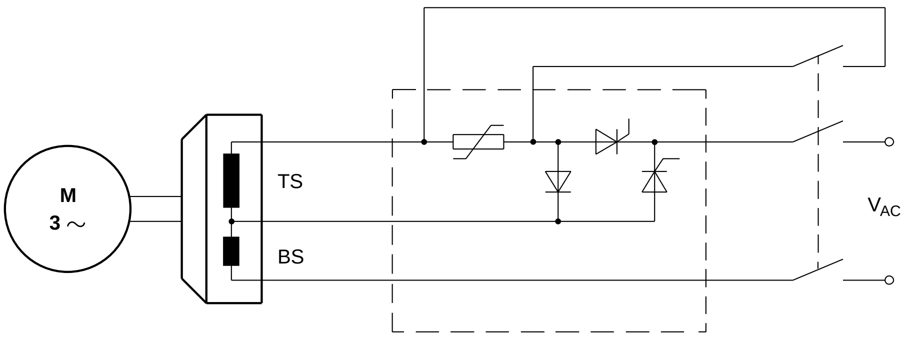
I_S Coil current
M_B Braking torque
n Speed
t_2 Brake application time
[1] Brake response to cut-off in the AC circuit
[2] Brake response to cut-off in the AC and DC circuits

The response time for the application of the brake depends to a significant degree on how rapidly the energy stored in the brake coil is dissipated when the power supply is switched off. A free-wheeling 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).



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Electronics from SEW-EURODRIVE for rapid application of the brake:

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

The SR (current relay) electronic relay is used for constant-speed drives supplied from the motor terminal board.

The UR (voltage relay) electronic relay is used for variable-speed drives with separate voltage supply.

Advantages:

- The faster the magnetic field is dissipated, which causes the braking effect to begin, the earlier the existing movement will be intercepted. In this way, a fast-acting brake increases the safety of the system. For example, hoists can be secured quickly in case of power failure, thus preventing accidents.
- The fast application of the brake also increases the braking and positioning accuracy required in uncontrolled operation.

4.4 High stopping accuracy

Positioning systems require high stopping accuracy.

Due to their mechanical principle, the degree of wear on the linings, and on-site basic physical conditions, brakemotors are subject to an empirically determined braking distance variation of ±12%. The shorter the response times (see page 26), 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_2 considerably.

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

The sections “Basic functions” (see page 8) and “Standard brake control” (see page 31) 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 controls offer particularly elegant possibilities involving an electronic, wear-free contact at the same time as minimum wiring work (see page 33 and following). Both control systems are made up of BGE (BG for size 63) 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 and BUR in conjunction with the motor or brake voltage. The SEW order processing system assigns a suitable relay.

The proper relays for possible retrofitting and those for motor and voltage can be found in the sections “Principle and selection of the BSR/BUR brake control.” The electronic relays can switch up to 1 A brake current, thereby limiting the selection to BSR and BUR.

4.5 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. Due to the fail-safe principle, the brake is closed by spring force if the coil is not under current. Consequently, the brake always goes back to a safe condition in case of power failure.

Advantages:

- The sturdy mechanical components of the brake are designed to withstand several times the rated load. Because of SEW-EURODRIVE's great deal of experience, the brake linings are carefully adapted to meet customer needs and have proven themselves in many years of operation.
- In addition to reliable standard brake controls, one can also select safety-oriented control systems, such as BST (see the publication "Safety-Oriented BST Brake Module").

4.6 Low noise level

Many applications in the power range up to approx. 5.5 kW (4-pole) require particularly quiet brakemotors to reduce noise pollution. SEW-EURODRIVE implements special design measures to meet these requirements as standard for all AC brakemotors up to size DV132S and for all motors from the DR modular series without affecting the special dynamic features of the brake system.

Advantages:

- The surrounding area will not affected by noise caused by brakes. The noise damping does not change the time the brake requires for switching on and off.

  Possible places of use for noise-damping brakes could be, for example, the theater. Because of their quiet application and opening, the brakes would not be heard by the audience.

4.7 High thermal load possible

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

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

The use of BGE, BME or BSG instead of BG, BMS or DC 24 V direct connection is prescribed for the special case represented by "electronic brake release when motor at standstill" for brake sizes BMG05 – BMG4 and brake sizes BE05 – BE2.

Special designs of brakemotors for increased thermal loading must be equipped with brake controls in the control cabinet.

4.8 Low and fluctuating ambient temperatures possible

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, it gives rise to heating in the coil system, increasing the temperature by approx. 25 K in relation 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.

The BMH brake control, which is available for all motor sizes and is installed only in the control cabinet, provides the anti-condensation heating.

Brakes with the BMH brake control can be used in this way with a reduced functional range at temperatures of -40 to +100 °C.

4.9 Direct control using a frequency inverter

The BMK and BMV brake controls serve as units that can be directly controlled using the brake command of a frequency inverter. No other switching elements are required.

BMK and BMV brake controls energize the brake as soon as the power supply and a DC 24 V control signal are present. The releasing and application of the brake occurs with an especially short reaction time.

For safety reasons, all poles must be switched off upon an emergency stop.

5 Brake Controls in Detail

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

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

Various brake controls for installation in the terminal box or in the control cabinet mean that the optimum solution can be found for all applications and conditions.

The standard type is supplied unless particular requirements are made.

5.1 *Standard brake control*

As standard, DT/DV...BM(G) AC brakemotors are supplied with an installed BG/BGE brake control for the AC connection or an installed BS/BSG control unit for the DC 24 V and terminal box connection.

The standard type is delivered ready for connection.

The motor connection voltage and the brake voltage are usually specified by the customer. If no such information is given for the brake voltage, the phase voltage is automatically selected for single-speed motors and the supply voltage for multi-speed motors. The table below lists the standard AC brakemotors.

<table>
<tr><th>Motor type</th><th>AC connection</th><th>DC 24 V connection</th></tr>
<tr><td>DT56..BMG</td><td rowspan="6">BG</td><td rowspan="2">No control unit[1)]</td></tr>
<tr><td>DR63..BR</td></tr>
<tr><td>DT71..BMG</td><td rowspan="4">BS</td></tr>
<tr><td>DT80..BMG</td></tr>
<tr><td>DT90..BMG</td></tr>
<tr><td>DV100..BMG</td></tr>
<tr><td>DV112..BMG</td><td rowspan="10">BGE</td><td rowspan="8">BSG</td></tr>
<tr><td>DV132S..BMG</td></tr>
<tr><td>DV132M..BM</td></tr>
<tr><td>DV132ML..BM</td></tr>
<tr><td>DV160..BM</td></tr>
<tr><td>DV180..BM</td></tr>
<tr><td>DV200..BM</td></tr>
<tr><td>DV225..BM</td></tr>
<tr><td>DV250..BMG</td><td rowspan="2">–</td></tr>
<tr><td>DV280..BMG</td></tr>
<tr><td>DR..BE05 – BE2</td><td>BG</td><td>BS</td></tr>
<tr><td>DR..BE05 – BE2</td><td rowspan="2">BGE</td><td>BSG</td></tr>
<tr><td>DR..BE30 – BE62</td><td>–</td></tr>
<tr><td>DR..BE120 – BE122</td><td>BMP3.1</td><td>–</td></tr>
</table>

1) The overvoltage protection must be implemented by the customer, for example using varistors.

For brake applications with higher starting frequencies, different brake controls are used.

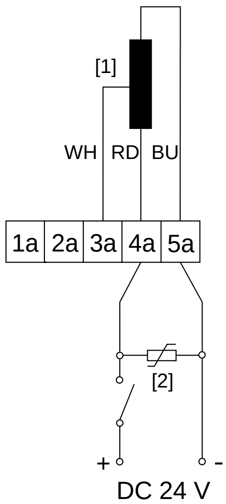
Either cut-off in the AC circuit or cut-off in both the DC and AC circuits is possible with standard versions for AC connection.

The brake voltage can either be supplied separately (particularly with multi-speed motors) or taken directly from the motor terminal board (with single-speed motors).

The response times t_2I for cut-off in the AC circuit (see page 106) apply to the separate power supply. With the terminal board connection, switching the motor off with remanent energization leads to a further delay before the brake is applied.

The specified brake controls have powerful overvoltage protection for the brake coil and switching contact.

No brake control is supplied with the standard version for DC 24 V voltage supply of DT56..BMG and DR63..BR motors. The customer must install suitable overvoltage protection.



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[1] Brake coil
[2] Varistor
WH = White
RD = Red
BU = Blue

Example: Varistor for protecting the brake coil

Varistor type	Manufacturer
SIOV-S10 K300	EPCOS

5.2 Principle and selection of the BSR brake control

The BSR brake control combines the BGE control unit with an electrical current relay. With BSR, the BGE (BG for DR63) 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 residual voltage at the motor terminal board and in the brake control (see page 67).

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 allocation of current relay and brake rectifier is made in the order depending on the specified motor and brake voltages.

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

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

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

5.3 *Principle and selection of the BUR brake control*

The BUR brake control combines the BGE (BG for DR63) control unit with an electronic voltage relay. In this case, the BGE (BG for DR63) control unit has a separate voltage supply because there is no constant voltage at the motor terminal board (multi-speed motors, motor with frequency inverters) 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 especially 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 according to the following table.

Motor	BUR (BGE + UR..) for brake control (AC V)																				
	40 - 58	59 - 66	67 - 73	74 - 82	83 - 92	93 - 104	105 - 116	117 - 131	132 - 147	148 - 164	165 - 185	186 - 207	208 - 233	234 - 261	262 - 293	294 - 329	330 - 369	370 - 414	415 - 464	465 - 522	523 - 690
DR63..BR		UR11	UR11	UR11	UR11	UR11	UR11	UR11	UR11	UR15	UR15	UR15	UR15	UR15	UR15	UR15	UR15	UR15	UR15	UR15	
DT71D..BMG				UR11	UR11	UR11	UR11	UR11	UR11	UR15	UR15	UR15	UR15	UR15	UR15	UR15	UR15	UR15	UR15	UR15	
DT80N..BMG				UR11	UR11	UR11	UR11	UR11	UR11	UR15	UR15	UR15	UR15	UR15	UR15	UR15	UR15	UR15	UR15	UR15	
DT80K..BMG				UR11	UR11	UR11	UR11	UR11	UR11	UR15	UR15	UR15	UR15	UR15	UR15	UR15	UR15	UR15	UR15	UR15	
DT90S..BMG							UR11	UR11	UR11	UR15	UR15	UR15	UR15	UR15	UR15	UR15	UR15	UR15	UR15	UR15	
DT90L..BMG							UR11	UR11	UR11	UR15	UR15	UR15	UR15	UR15	UR15	UR15	UR15	UR15	UR15	UR15	
DV100M..BMG							UR11	UR11	UR11	UR15	UR15	UR15	UR15	UR15	UR15	UR15	UR15	UR15	UR15	UR15	
DV100L..BMG							UR11	UR11	UR11	UR15	UR15	UR15	UR15	UR15	UR15	UR15	UR15	UR15	UR15	UR15	
DV112M..BMG										UR15	UR15	UR15	UR15	UR15	UR15	UR15	UR15	UR15	UR15	UR15	
DV132S..BMG										UR15	UR15	UR15	UR15	UR15	UR15	UR15	UR15	UR15	UR15	UR15	
DV132M..BM												UR15	UR15	UR15	UR15	UR15	UR15	UR15	UR15	UR15	
DV132ML..BM												UR15	UR15	UR15	UR15	UR15	UR15	UR15	UR15	UR15	
DV160M..BM												UR15	UR15	UR15	UR15	UR15	UR15	UR15	UR15	UR15	
DV160L..BM															UR15	UR15	UR15	UR15	UR15	UR15	
DV180M..BM															UR15	UR15	UR15	UR15	UR15	UR15	
DV180L..BM															UR15	UR15	UR15	UR15	UR15	UR15	
DV200L..BM															UR15	UR15	UR15	UR15	UR15	UR15	
DV225S..BM															UR15	UR15	UR15	UR15	UR15	UR15	
DV225M..BM															UR15	UR15	UR15	UR15	UR15	UR15	

Motor sizes DV250/DV280 cannot be combined with a UR.

Motor	BUR (BGE + UR..) for brake control (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
DR..BE05			UR15	UR15	UR11	UR11	UR11	UR11	UR11	UR11	UR11	UR11	UR11	UR11	
DR..BE1			UR15	UR15	UR11	UR11	UR11	UR11	UR11	UR11	UR11	UR11	UR11	UR11	
DR..BE2			UR15	UR15	UR11	UR11	UR11	UR11	UR11	UR11	UR11	UR11	UR11	UR11	
DR..BE5				UR15	UR11	UR11	UR11	UR11	UR11	UR11	UR11	UR11	UR11	UR11	
DR..BE11							UR11	UR11	UR11	UR11	UR11	UR11	UR11	UR11	
DR..BE20							UR11	UR11	UR11	UR11	UR11	UR11	UR11	UR11	
DR..BE30									UR11	UR11	UR11	UR11	UR11	UR11	
DR..BE32									UR11	UR11	UR11	UR11	UR11	UR11	

UR11 UR15 Not possible

Brake sizes BE60 – BE122 cannot be combined with a UR.

5.4 Brake control in the control cabinet

The SEW brake controls 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 for service purposes

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

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

Brakemotor type	Brake control in the control cabinet	
	for AC connection	for DC 24 V connection
DR63..BR03	BMS, BME, BMH, BMP, BMK	BSG BMV
DT71..BMG		
DT80..BMG		
DT90..BMG		
DV100..BMG		
DV112..BMG	BME, BMH, BMP, BMK	
DV132S..BMG		
DV132M..BM		
DV132ML..BM		
DV160..BM		
DV180..BM		
DV200..BM		
DV225..BM		
DV250..BMG	BME	-
DV280..BMG		
DR..BE05	BMS, BME, BMH, BMP, BMK	BSG BMV
DR..BE1		
DR..BE2		
DR..BE5	BME, BMH, BMP, BMK	
DR..BE11		
DR..BE20		
DR..BE30		–
DR..BE32		
DR..BE120	BMP3.1	
DR..BE122		

5.4.1 Control cabinet

The following table lists the technical data of brake controls 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.

Type	Function	Voltage	Holding current I_{Hmax} [A]	Type	Part number	Color code
BMS	One-way rectifier 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 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 switching, DC 24 V control input and cut-off in the DC circuit	AC 230...575 V	1.4	BMK 1.4	829 833 5	Water blue
		AC 150...500 V	1.5	BMK 1.5	826 463 5	Water blue
		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	13000063	White

The following table only applies to size 315 DR motors:

Type	Function	Voltage	Holding current I_{Hmax} [A]	Type	Part number	Color code
BMP	One-way 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	

NOTE

For the BMK und BMV brake controls, it is imperative that the power supply is switched off for all the poles during emergency stop functions.

5.5 *Brake control 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. The supply can come from the motor supply voltage only when motors with a fixed speed are used. The supply voltage for the brake must be supplied separately with multi-speed motors and for operation with a frequency inverter.

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 for cut-off in the AC circuit, specified in the brake’s technical data, applies to a separate supply only.

5.5.1 Wiring space

The following table lists the technical data of brake controls 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.

Type	Function	Voltage	Holding current I_{Hmax} [A]	Type	Part number	Color code
BG	One-way rectifier	AC 90...500 V	1.2	BG 1.2	826 992 0	Black
		AC 230...575 V	1.4	BG 1.4	827 881 4	Black
		AC 24...500 V	2.4	BG 2.4	827 019 8	Brown
		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 90...500 V	1.0	BG1.2 + SR 11	826 992 0 + 826 761 8	
		AC 42...87 V	1.0	BG2.4 + SR 11	827 019 8 + 826 761 8	
		AC 150...500 V	1.0	BGE 1.5 + SR 11	825 385 4 + 826 761 8	
			1.0	BGE 1.5 + SR 15	825 385 4 + 826 762 6	
			1.0	BGE 1.5 + SR 19	825 385 4 + 826 246 2	
		AC 42...150 V	1.0	BGE 3 + SR11	825 387 0 + 826 761 8	
			1.0	BGE 3 + SR15	825 387 0 + 826 762 6	
			1.0	BGE 3 + SR19	825 387 0 + 826 246 2	
BUR	One-way rectifier + voltage relay for cut-off in the DC circuit	AC 90...150 V	1.0	BG 1.2 + UR 11	826 992 0 + 826 758 8	
		AC 42...87 V	1.0	BG 2.4 + UR 11	827 019 8 + 826 758 8	
		AC 150...500 V	1.0	BG 1.2 + UR 15	826 992 0 + 826 759 6	
		AC 150...500 V	1.0	BGE 1.5 + UR 15	825 385 4 + 826 759 6	
		AC 42...150 V	1.0	BGE 3 + UR 11	825 387 0 + 826 758 8	
BS	Varistor overvoltage protection	DC 24 V	5.0	BS24	826 763 4	Water blue
BSG	Electronic switching	DC 24 V	5.0	BSG	825 459 1	White

The following table only applies to DR motors of the size 315:

Type	Function	Voltage	Holding current I_{Hmax} [A]	Type	Part number	Color code
BMP	One-way 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	

5.6 Multi-motor operation of brakemotors

Brakes must be switched at the same time in multi-motor operation and must also apply 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.

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.

NOTICE

Defective brake rectifier

Device damage

- In case of a fault in one brake, switch off all brakes.

6 Project Planning Information

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

When doing this, pay attention to the following points:

- Select the brake and the braking torque in accordance with the project planning data (motor selection)
- Determine the brake voltage
- Dimension and route the cable
- Select brake contactor
- Important design information
- Motor protection switch if necessary to protect the brake coil

6.1 Select the brake and the braking torque in accordance with the project planning data (motor selection)

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

Selection criteria:

- AC motor with one speed/multi-speed 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
- Level of braking torque (“soft braking”/“hard braking”)
- Hoist applications
- Minimum/maximum deceleration

6.1.1 What is defined/determined during motor selection:

Basic specification	Link/addition/comment
Motor type	Brake type/brake control
Braking torque[1)]	Brake springs
Brake application time	Connection type of the brake control (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**	Adjustment time (important for service)

1) The braking torque is determined from the requirements of the application with regard 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 volume “Project Planning for Drives” from the series “Drive Engineering - Practical Implementation.”

6.1.2 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 braking torque is usually selected according to the required deceleration.

Braking torque in hoist applications

The selected braking torque must be greater than the maximum load torque by at least factor 2. When using the brake purely as a holding brake without any braking work, a minimum factor of 2.5 must be observed due to the lack of regeneration opportunity for the brake linings.

Working capacity

The brake’s ability to function is determined by the following criteria:

- Permitted work done W_{max} per braking operation
- Total permitted braking work W_{Insp} until inspection/maintenance of the brake

The permitted work done W_{max} and the total permitted braking work W_{Insp} can be determined using the diagrams in the “Technical Data” section.

Permitted number of braking operations until inspection/maintenance of the brake:

$$Z = \frac{W_{Inst}}{W_1}$$

The following equation is shown in a simplified form, without considering the degree of efficiency. A more detailed equation, which includes the efficiency, and further information can be found in the volume “Project Planning for Drives” from the series “Drive Engineering – Practical Implementation.”

Braking work per braking operation for $W_1 \le W_{max}$:

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

Z	= Number of braking operations until inspection/maintenance
W_{Insp}	= Total permitted braking work until inspection/maintenance in J
W_1	= Braking work per braking operation in J
J_{tot}	= Total mass moment of inertia (on the motor shaft) in kgm^2
n	= Motor speed
M_B	= Braking torque in Nm
M_L	= Load torque in Nm (observe the +/- character) +: for vertical upward and horizontal movement -: for vertical downward movement

6.1.3 Emergency stop features

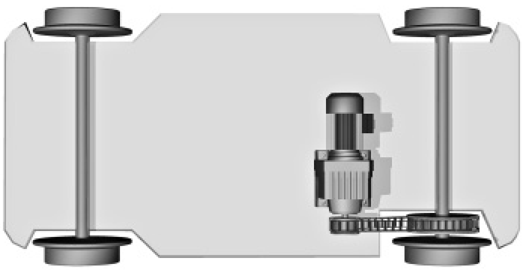
In hoist applications, the limits of the permitted maximum work done (including emergency stops) may not be exceeded. In other applications, such as in travel drives with reduced braking torques, significantly higher values are permitted, depending on the specific case. Please consult SEW-EURODRIVE if you need values for increased EMERGENCY STOP braking work.

6.1.4 Practical example

In the following project planning example, the drive has already been configured. Now the braking data is checked together with the motor:

- Starting frequency
- Braking torque
- Braking work

The equations used are explained in detail in the volume “Project Planning for Drives” from the series “Drive Engineering - Practical Implementation.”



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Reference data:

- **Drive:**
  R77 DRS100M4BE5/Z

- **Application:**
  Horizontal movement with load
  Pulsing/load cycles every 24 seconds
  Braking torque approx. 2 x load torque

- **Gear unit:**
  Output torque approx. M_a = 550 Nm
  Service factor f_B = 1.5
  Output speed n_a = 48 rpm
  Reduction ratio i = 29
  Torque transmission without an overhung load (via coupling)
  External mass moment of inertia at the gear unit J = 25.23 kgm^2
  Overall efficiency of the system and gear unit η = 0.9

- **Brakemotor:**
  Rated power P_N = 3 kW
  Rated speed n_N = 1400 rpm
  Rated torque = 20.5 Nm
  Braking torque M_B = 40 Nm
  Mass moment of inertia J_{Mot_BE} = 0.0062 kgm^2
  Mass inertia of the flywheel fan J_Z = 0.0135 kgm^2
  Cyclic duration factor CDF = 60%
  BGE type of rectifier

The permitted starting frequency of the motor must be determined before the braking work is calculated. This prevents the motor from attaining excessively high temperatures. The starting frequency is 24 seconds per pulsing for a cyclic duration factor of 60%. This means that the motor starts up every 24 seconds and then brakes. For one hour, this means there is a starting frequency of:

$$Z_{present} = \frac{3600 s}{24 h s} = 150 \frac{1}{h}$$

The formula for calculating the starting frequency for horizontal movements is:

$$Z_P = Z_0 \times \frac{1 - \frac{M_L}{M_H \times \eta}}{\frac{J_M + J_Z + \frac{J_X}{\eta}}{J_M}} \times K_P$$

Z_P	= Maximum permitted starting frequency in one hour
Z_0	= Starting frequency per hour according to the catalog data
M_L	= Static load torque in Nm
M_H	= Acceleration torque of the motor in Nm
η	= Efficiency
J_M	= Mass inertia of the motor in kgm^2
J_Z	= Mass inertia of the flywheel fan in kgm^2
J_X	= External mass inertia reduced on motor shaft in kgm^2
K_P	= Calculation factor

Now the factors that are still missing can be determined.

Starting frequency Z_0 (from catalog):

Observe that the value Z_0 must be reduced by a factor of 0.8 because of the flywheel fan.

$$Z_0 = 8500 \frac{1}{h} \times 0.8 = 6800 \frac{1}{h}$$

Static load torque M_L (from the appendix):

$$M_L = \frac{M_a}{i} = \frac{550\,Nm}{29} = 19\,Nm$$

Acceleration torque M_H (from the catalog):

$$M_H = M_{rated} \times \frac{M_H}{M_{rated}} = 20.5\,Nm \times 2.4 = 49.2\,Nm$$

External mass moment of inertia J_X from the appendix:

$$J_x = \frac{J}{i^2} = \frac{25.23\,kgm^2}{29^2} = 0.03\,kgm^2$$

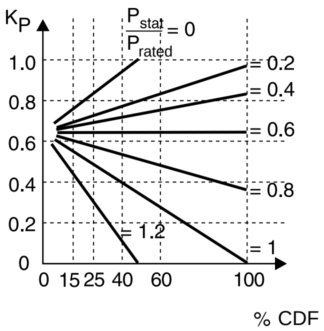
Calculation factor K_P (from the catalog):

The static power consumption after the start-up must be considered for this calculation factor.

$$\frac{P_{stat}}{P_{rated}} = \frac{2 \times \pi \times n \times M_L}{60 \times P_N} = \frac{2 \times \pi \times 1400 \times 19\,W}{60 \times 3000\,W} = 0.93$$

For a cyclic duration factor (cdf) of = 60%, the following diagram results:

$K_P = 0.38$



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K_P	= Calculation factor
CDF	= Relative cyclic duration factor
P_{Stat}	= Power requirement after start-up in kW (static power) in kW
P_{rated}	= Rated power in kW

Now Z_P can be calculated:

$$Z_P = 6800 \times \frac{1 - \frac{19}{49.2 \times 0.9}}{\frac{0.0062 + 0.0135 + \frac{0.03}{0.9}}{0.0062}} \times 0.38 \frac{1}{h} = 172 \frac{1}{h}$$

The following condition will be checked:

The calculated maximum starting frequency must be higher than the one actually present: $Z_P > Z_{present}$

In the example being discussed, this means that the condition $172\frac{1}{h} > 150\frac{1}{h}$ is OK.

The motor can therefore maintain the required cycle time without overheating.

Now the brake itself will be checked. The BE5 brake can deliver up to 55 Nm of braking torque, but it is set to 40 Nm (ca. 2 x M_L). The braking torque is therefore OK. Then check whether the resulting braking work per braking operation is not too high.

The braking work is calculated as follows:

$$W_B = \frac{M_B}{M_B + M_L \times \eta} \times \frac{(J_M + J_Z + J_X \times \eta) \times n_M^2}{182.5}$$

W_B = Braking work per braking operation in J
M_B = Braking torque in Nm
M_L = Static load torque
η = Efficiency
J_M = Mass inertia of the motor in kgm^2
J_Z = Mass inertia of the flywheel fan in kgm^2
J_X = External mass inertia, reduced on motor shaft, in kgm^2
n_M = Motor speed in rpm
182.5 = Conversion factor

NOTE

In the formula for braking work, a "+" is in the denominator of the first fraction. This only applies for horizontal and rotary motion as well as upwards vertical movement. A "-" must be there for vertical movement downwards. The difference in the braking work required for vertically upwards movement and that for vertically downwards movement is very large.

$$W_B = \frac{40}{40 + 19 \times 0.9} \times \frac{(0.0062 + 0.0135 + 0.03 \times 0.9) \times 1400^2}{182.5} = 351J$$

For vertical downwards, the result would be 876 J instead of 351 J; that is, 2.5 times as much!

Furthermore, the following condition must be met:

The maximum braking work per braking operation must be greater that the braking work actually occurring: $W_{max} > W_B$

W_{max} = Maximum permitted braking work in J

The maximal permitted braking work can be determined based on the diagram for braking work (see page 133) (diagram for rated speed, 1,500 rpm, curve BE5, $Z_{present}$ = 150 per hour).

The following value can be derived from the diagram: W_{max} = 2,200 J.

This step satisfies the condition 2,200 J > 351 J.

Therefore, the brake can withstand the load from the resulting braking work.

The service life of the brake lining until the next inspection/maintenance can now be calculated:

$$L_B = \frac{W_{inst}}{W_B \times Z_{present}} = \frac{260 \times 10^6 \times J\,h}{351 \times 150 \times J} = 4938\,h$$

After about 4,940 hours, the maximum permitted air gap will be reached. The brake must now be set to the minimum air gap again as described in the operating instructions.

As an alternative to the available BE5 brake, it is possible under certain circumstances to use the BE2 brake. For this, the required braking torque M_B must be ≤ 20 Nm. Their maximum braking work W_{max} (1,600 J) is sufficient if the peripheral conditions are the same.

6.2 Determine 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 versions 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 is installed in the terminal box.

Extra-low voltages are often unavoidable for reasons of safety. However, they require a considerably greater investment in cables, switchgear, transformers/power-supply units as well as rectifiers and overvoltage protection (e.g. for direct DC 24 V supply) than is the case for line voltage supply connections.

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.

NOTICE

Uncontrolled application of the brake.

Potential damage to property.

- Use larger cable cross sections.
- Use high-capacity switchgear and transformers/power supplies.
- Use a larger rectifier.

6.3 Dimensioning and routing the cable

a) Dimensioning 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 due to the inrush current into account, the value must not drop below 90% of the rated voltage. The data sheets for the brakes (see Technical Data) provide information on the possible supply voltages and the resulting operating currents.

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

BMG02, BR03, BM(G)05 – 122:

Brake type	Minimum cable cross section of the brake cables in mm² (AWG) for cable lengths ≤ 50 meters and brake voltage (AC V)							
	42	48	56 DC 24 V	110	125-153	175-200	230	254-500
BMG02	1.5 (16)	1.5 (16)	1.5 (16)	1.5 (16)	1.5 (16)	1.5 (16)	1.5 (16)	1.5 (16)
BR03	1.5 (16)	1.5 (16)	1.5 (16)	1.5 (16)	1.5 (16)	1.5 (16)	1.5 (16)	1.5 (16)
BMG05	2.5 (14)	1.5 (16)	1.5 (16)	1.5 (16)	1.5 (16)	1.5 (16)	1.5 (16)	1.5 (16)
BMG1	2.5 (14)	2.5 (14)	1.5 (16)	1.5 (16)	1.5 (16)	1.5 (16)	1.5 (16)	1.5 (16)
BMG2	2.5 (14)	2.5 (14)	2.5 (14)	1.5 (16)	1.5 (16)	1.5 (16)	1.5 (16)	1.5 (16)
BMG4	4 (12)	2.5 (14)	2.5 (14)	1.5 (16)	1.5 (16)	1.5 (16)	1.5 (16)	1.5 (16)
BMG8	Not available	Not available	4 (12)	1.5 (16)	1.5 (16)	1.5 (16)	1.5 (16)	1.5 (16)
BM15	Not available	Not available	10 (8)	2.5 (14)	1.5 (16)	1.5 (16)	1.5 (16)	1.5 (16)
BM30 - 62	Not available	Not available	10 (8)	2.5 (14)	2.5 (14)	1.5 (16)	1.5 (16)	1.5 (16)
BMG61-122	Not available	Not available	Not available	Not available	Not available	Not available	2.5 (14)	1.5 (16)

BE05 – BE122:

Brake type	Minimum cable cross section of the brake cables in mm² (AWG) for cable lengths ≤ 50 meters and brake voltage (AC V)					
	24	60 DC 24 V	120	184 - 208	230	254 - 575
BE05	10 (8)	1.5 (16)	1.5 (16)	1.5 (16)	1.5 (16)	1.5 (16)
BE1	10 (8)	1.5 (16)	1.5 (16)	1.5 (16)	1.5 (16)	1.5 (16)
BE2	10 (8)	2.5 (14)	1.5 (16)	1.5 (16)	1.5 (16)	1.5 (16)
BE5	Not available	4 (12)	1.5 (16)	1.5 (16)	1.5 (16)	1.5 (16)
BE11	Not available	10 (8)	2.5 (14)	1.5 (16)	1.5 (16)	1.5 (16)
BE20	Not available	10 (8)	2.5 (14)	1.5 (16)	1.5 (16)	1.5 (16)
BE30 / 32	Not available	Not available	2.5 (14)	1.5 (16)	1.5 (16)	1.5 (16)
BE120 / 122	Not available	Not available	Not available	Not available	1.5 (16)	1.5 (16)

Values in brackets = AWG (American Wire Gauge)

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

b) Routing information:

- Unless they are shielded, brake supply cables must always be routed separately from other power cables with phased currents.
- Ensure adequate equipotential bonding between the drive and the control cabinet (for an example, see “EMC in Drive Engineering” from “Drive Engineering – Practical Implementation”).

In particular, power cables with phased currents include:

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

6.4 Selecting the brake contactor

NOTICE

Switching the DC voltage using unsuited contacts.

Possible damage to the brake rectifier.

- As switchgear for the brake voltage and the DC voltage cut-off, use either special direct current contactors or adapted AC contactors in utilization category AC-3 according to EN 60947-4-1.

The brake contactor for mains operation is selected as follows:

- 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 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.

6.4.1 Control cabinet installation

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

6.4.2 Terminal box installation

The current and voltage relays (SR1x and UR1x), which are 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 the direct current separation is subjected to heavy loads and, therefore, to a high degree of wear. The electronic switches, however, function without any wear.
- Customers do not have to perform any additional wiring. Current and voltage relays are delivered already wired from the factory. For BMP and BMK rectifiers, only the power supply and the brake coils have to be connected.
- 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.

6.4.3 Semi-conductor relay

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

NOTICE

Brake no longer releases.

Device damage.

- Brakes which are optimized for the accelerator function may not be operated with the semiconductor RC suppressor circuit.

6.5 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 connected to mains power.

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 a brake.

The instructions on laying cables (see page 47) must always be adhered to.

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 reaction times t_2I (see page 106 and following pages) for cut-off in the AC circuit apply only 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 from 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 (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.

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-EURODRIVE brake control is 10% to 20% lower than the normal one-way rectification when the freewheeling arm extends over the entire coil.

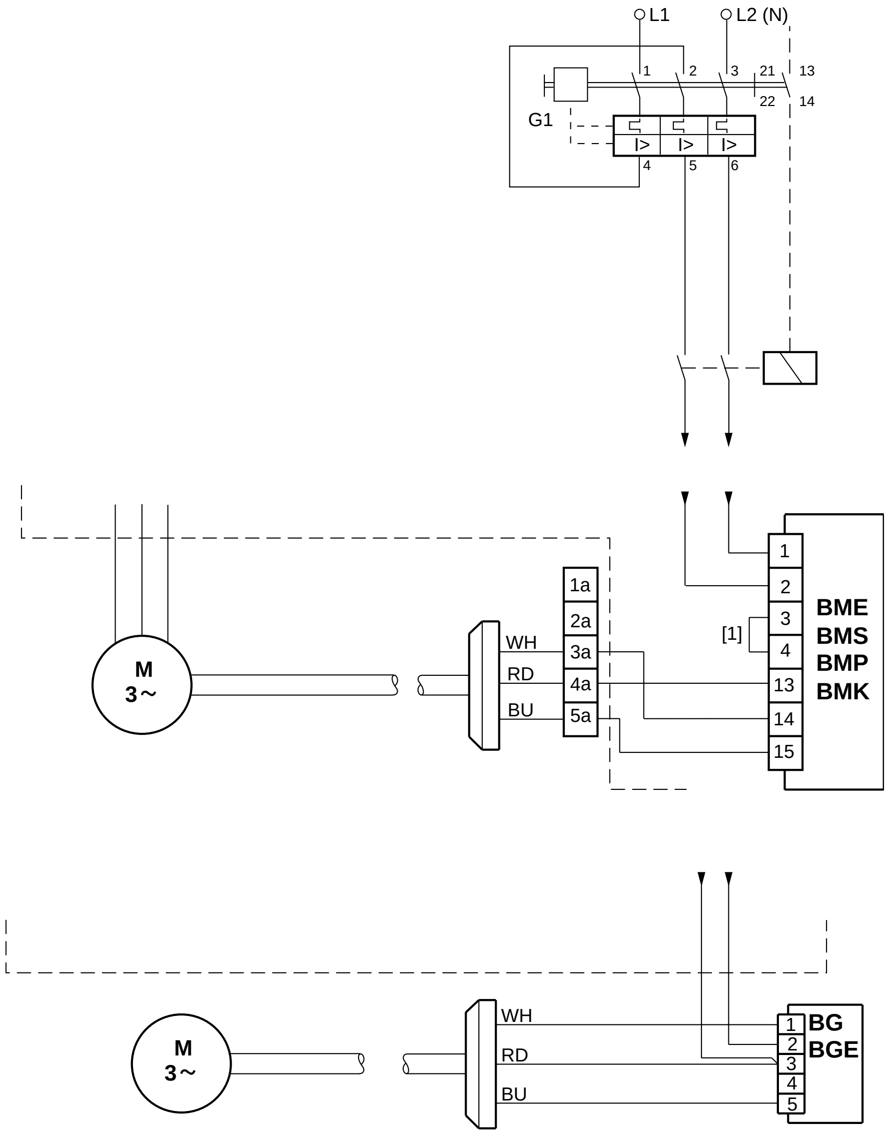
6.6 Motor protection switch

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 and set the motor protection switch to 1.1 x $I_{Brake\ holding\ current}$ (r.m.s. value). Holding currents can be found in the section "Operating currents for brakes" (see page 114).

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).



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[1] Customers are responsible for connecting terminals 3 and 4.

7 DR/DT/DV...BM(G) and DR..BE AC Brakemotors with Frequency Inverters

7.1 Overview

CAUTION

System stop because the brake no longer releases.

Injuries.

- The voltage supply to the brake must always be routed separately.

The supply voltage cannot be taken from the terminal board of the motor due to the variable motor supply voltage.

Under normal circumstances in the frequency inverter mode of the motor, the mechanical brake only has the characteristics of a holding brake for holding a position which has been reached and of a security brake for an emergency (emergency stop). Consequently, its size is determined by a defined number of emergency stop braking operations of the drive at full load from maximum speed.

The brake command is always issued to the frequency inverter simultaneously with the stop command without any delay. It is beneficial and recommended for this command to be generated by the frequency inverter itself. Internal interlocks in the frequency inverter ensure that the precise moment is selected. This allows the load to be safely taken over by the mechanical brake, thereby avoiding, for example, any sag on hoist drives.

The table below gives an overview of all brake controls possible in conjunction with frequency inverter supply to the motor.

Brakemotor type	Terminal box installation	Control cabinet installation
DR63..BR03	BG, BUR No control unit	BMS, BME, BMP, BMH BSG, BMV
DT71..BMG	BG, BGE, BUR BSG	BMS, BME, BMP, BMH BSG, BMV
DT80..BMG		
DT90..BMG		
DV100..BMG		
DV112..BMG	BGE, BUR BSG	BME, BMP, BMH BSG, BMV
DV132S..BMG		
DV132M..BM		
DV132ML..BM		
DV160..BM		
DV180..BM		
DV200..BM		
DV225..BM		
DV250..BMG	BGE	BME
DV280..BMG		
DR..BE05 – BE20	BGE (BUR), BSG	BME (BMH, BMP), BMV, BSG
DR..BE30 – BE32	BGE	BME
DR..BE120 – BE122	BMP 3.1	BMP 3.1

7.2 Additional documentation

For further information and detailed technical data, refer to the following documentation:

- “Gearmotors” catalog
- “MOVIDRIVE® A” system manual and catalog
- “MOVIDRIVE® B” system manual and catalog
- “MOVITRAC® 07” system manual and catalog

8 DFS56..B, CMP..BP, CMD.. BP und CM..BR Servomotors with Brake

8.1 Overview

DFS56..B

Brake B of the DFS servomotor is a permanent magnet brake with a standard supply voltage of DC 24 V. It operates with an unchanging braking torque of 2.5 Nm (DFS56M and DFS56L) and 5 Nm (DFS56H). The brake cannot be retrofitted and operates without a brake rectifier or a brake control unit. The overvoltage protection must be implemented by the customer, for example using varistors. The brake can be used in all speed classes.

The following figure shows the wiring diagram:

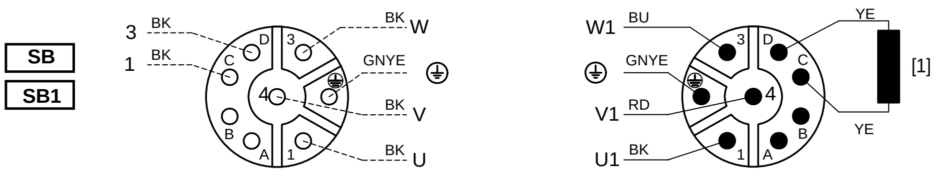
1677465739

[1] Brake coil

CMP40..BP – CMP100..BP und CMD55..BP – CMD138..BP

The BP brake of CMP and CMD servomotors is a spring-loaded brake with a standard supply voltage of DC 24 V. It operates with an unchanging braking torque. The brake cannot be retrofitted and operates without a brake rectifier or a brake control unit. The overvoltage protection must be implemented by the customer, for example using varistors. The use of the brake is speed-dependant and must be considered when planning the project.

The following figures show the wiring diagrams:



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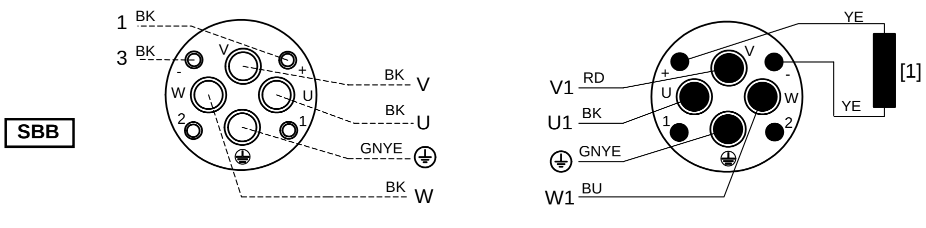
[1] Brake coil



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[1] Brake coil

CM71..BR - CM112..BR

The BR brakes of the CM71 to CM112..BR servomotors can be supplied with voltage from the control cabinet via a separate plug connector or via terminal boxes.

The B-side integration of the brake into the motor housing makes for a particularly compact design. Servomotors can also be supplied with the "manual brake release" option.

The various brake controls and the possibility to connect to AC 110 V, AC 230 V, AC 400 V, AC 460 V as well as to DC 24 V mean that this characteristic emergency stop and holding brake can also be used in all applications involving highly dynamic qualities.

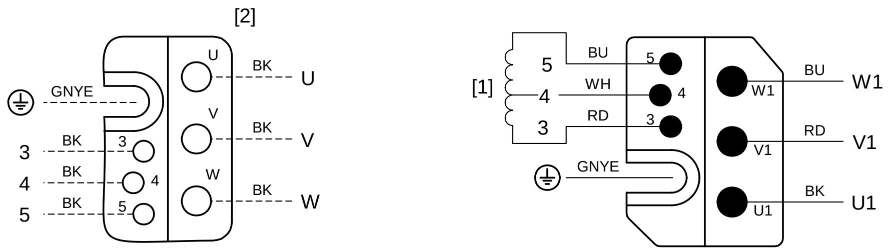
Supplying the brake with DC voltage directly without the SEW switching electronics is not approved.

With servo drives, the brake command is generated in the MOVIAXIS® or MOVIDRIVE® servo inverter and is used for switching the brake with a suitable brake contactor.

Depending on the motor type, the BR brakes are available with two braking torques, M_{B1} and M_{B2}. The higher braking torque (2 to 3 x M_0) is used for hoist operation for reasons of safety.

With this brake, as well, the size is determined by the required number of possible emergency braking operations at full load from maximum speed.

The following figure shows the wiring diagram:



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[1] Brake coil

[2] The shield of the control cores and the complete shield is connected in the connector on the metal housing.
Color coding according to SEW cable

8.2 Standard brake control

Brake controls for CM motors are designed for control cabinet installation.

The following table shows the brake controls available:

Servomotor with brake type	Brake control	
	AC connection	DC 24 V
DFS56..B	–	Direct voltage supply
CMP40..BP – CMP100..BP CMD55..BP – CMD138..BP		Direct voltage supply or BMV
CM71..BR CM90..BR CM112..BR	BME, BMP, BMH, BMK	BSG/BMV

8.3 Additional documentation

For further information and detailed technical data, refer to the following documentation:

- “Servo Gearmotors” catalog
- “MOVIAXIS®” catalog and project planning manual
- “MOVIDRIVE®” catalog
- “Drive Engineering – Practical Implementation” – “Servo technology”

9 DAS... BR ASEPTIC Motors with Brake

9.1 Overview

The BR brake for ASEPTIC motors is designed for applications that must be cleaned regularly. Consequently, ASEPTIC motors have a very smooth surface, and the option of manual release is not available for the brakes.

Due to the fact that all frequency inverter types can be used and the possibility of connecting to AC 110 V, AC 230 V, AC 400 V, AC 460 V as well as DC 24 V, all the options of a standard AC brakemotor are available with DAS motors.

- Brakes BR1 and BR2
- No manual brake release
- No adjustment required

9.2 Standard brake control

Motor type	Brake control	
	AC connection	DC 24 V connection
DAS80..BR **DAS90..BR** **DAS100..BR**	BG	No control unit[1]

1) The overvoltage protection must be implemented by the customer, for example using varistors.

9.3 Brake control options

Motor type	Terminal box installation	Installation in control cabinet
DAS80..BR **DAS90..BR** **DAS100..BR**	BG, BGE without control unit, BSG, BSR, BUR	BMS, BME, BMP, BMK, BMH,BMV, BSG

9.4 Additional documentation

For further information and detailed technical data, refer to the following documentation:

- “ASEPTIC Gearmotors” catalog

10 eDT 71D4 BC05/H./TF – eDT 100L4 BC2/H./TF Explosion-proof AC Brakemotors

10.1 Overview

eDT...BC.. explosion-proof AC brakemotors with protection type “increased safety” operate with an integrated, flameproof brake. This combination has been certified by the Acceptance Institute of the German Federal Office of Engineering Physics at Brunswick [*Abnahmeinstitut Physikalisch-Technische Bundesanstalt (PTB) Braunschweig*] and operates, according to the BMG brake principle, with the values given in the “Technical Data” section (see page 106).

The brake controls in the table below are approved (only for control cabinet installation) when wired in accordance with the “Connection diagram” section on the following page. It is also essential to have thermal monitoring of the motor and the brake by means of positive temperature coefficient thermistors with an approved trip switch bearing the PTB certification 3.53 -PTC A.

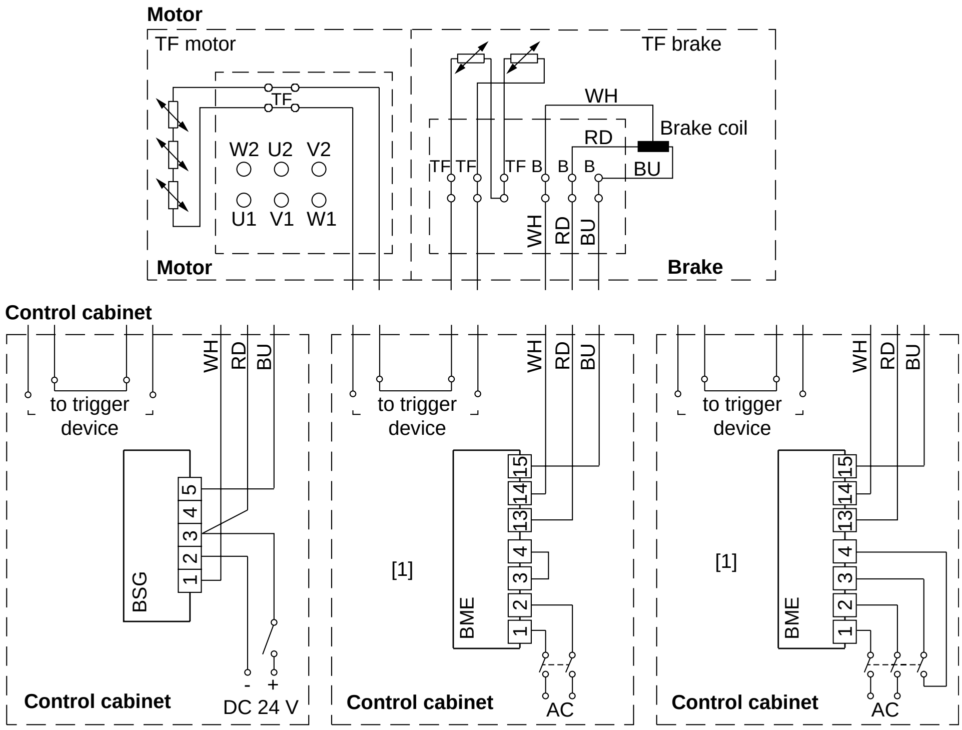
10.2 Brake control

External measures must be taken to ensure that the brake command is issued at the same time as the motor is switched off.

Explosion-proof brake-motor type	Brake control for	
	AC connection	DC 24 V connection
eDT 71 - 100..BC	BME	BSG

10.2.1 Connection diagram

The following illustration shows the connection diagram for the BC05 and BC2 brakes:



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BSG brake control for DC 24 V voltage supply	BME brake rectifier, cut-off in the AC circuit, standard application of the brake	BME brake rectifier, cut-off in the AC and DC circuits, fast brake application

See the DC V brakemotor nameplate for AC voltage requirements.

Switch contacts in utilization category AC-3 according to EN 60947.

[1] Alternatively for connection to AC voltage

10.3 Additional documentation

For further information and detailed technical data, refer to the following documentation:

- “Explosion-Proof AC Motors” catalog

11 Brakes in VARIBLOC® Variable Speed Gear Units

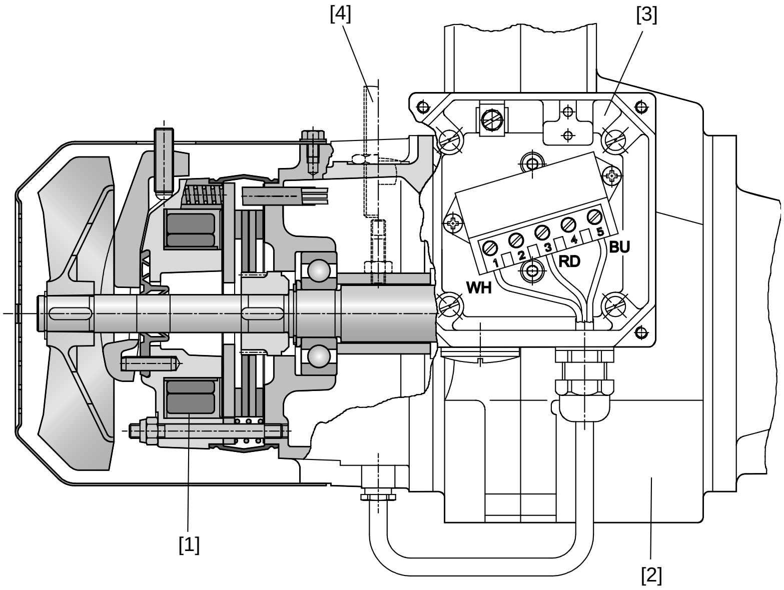
11.1 Overview

In view of the V-belt connection between the motor and gear unit, mounting the brake on the motor as a holding and safety brake is not permitted in many applications.

Consequently, there is a version for VARIBLOC® VU/VZ 01 - 41 with a brake on the driven variable pulley. The corresponding brake controls are installed in a special terminal box on the variable speed gear unit.

The following table provides information on the basic data for VARIBLOC® variable speed gear units with a mounted brake and lockable manual brake release as a standard feature.

VARIBLOC® Variable speed gear unit Type	Motor Power range [kW]	Brake type	Maximum braking torque [Nm]	Brake control (standard)	
				AC	DC 24 V
VU/VZ 01 BMG/HF	0.25 ... 0.75	BMG05	5	BG	BS
VU/VZ 11 BMG/HF	0.37 ... 1.5	BMG1	10	BG	BS
VU/VZ 21 BMG/HF	0.37... 3.0	BMG2	20	BG	BS
VU/VZ 31 BMG/HF	1.5 ... 5.5	BMG4	40	BG	BS
VU/VZ 41 BMG/HF	3.0 ... 11.0	BMG8	75	BGE	BSG



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[1] Brake bearing flange with integrated brake (complete)
[2] Variable speed gear unit
[3] Terminal box with brake control
[4] IG voltage encoder

11.2 Additional documentation

For further information and detailed technical data, refer to the following documentation:

- “Variable Speed Gearmotors” catalog

12 Brakes in Adapters with Hydraulic Centrifugal Coupling

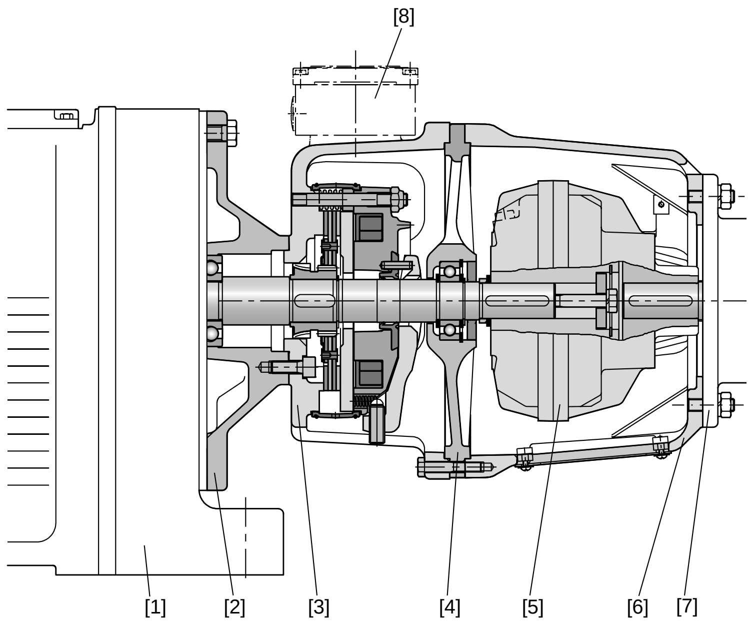
12.1 Overview

Adapters with hydraulic centrifugal coupling are also equipped with brakes if there are special requirements for stopping the machine rapidly and safely while avoiding any reverse motion of the drive shaft when the motor is at standstill. The brake controls are installed in a special terminal box on the extended housing.

If a second brake is required in the driveline, the hydraulic centrifugal coupling can be replaced by a fixed coupling as a special design.

The following table provides information on the basic data of adapters with hydraulic centrifugal coupling and brake as a standard feature.

Adapter with brake + centrifugal coupling type	Brakes	Maximum Braking torque [Nm]	Brake control (standard)	
			AC	DC 24 V
AT3.../BMG	BMG8	55	BGE	BSG
AT4.../BMG	BMG8	55		
AT5.../BM	BM 30	250		



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[1] Gear unit
[2] Basic flange (complete)
[3] Brake bearing flange with installed brake, complete
[4] Bearing flange
[5] Hydraulic centrifugal coupling
[6] Extended housing (complete)
[7] Motor
[8] Terminal box

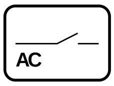
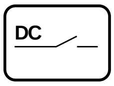
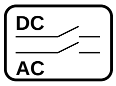
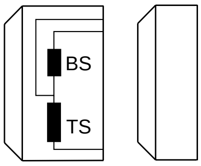
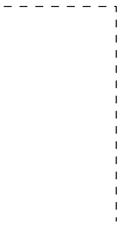
12.2 Additional documentation

For further information and detailed technical data, refer to the following documentation:

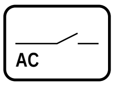
- "Gear Units" catalog

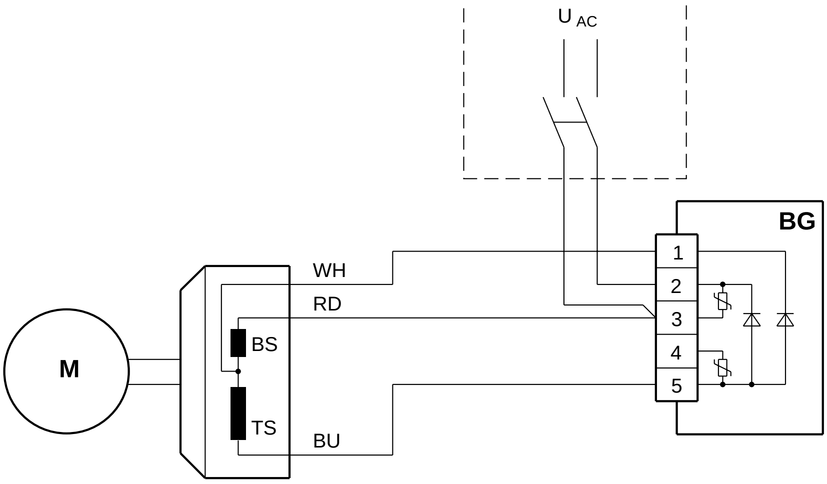
13 Block Diagrams

13.1 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 design
	Motor with delta connection
	Motor with star connection
	Control cabinet limit
WH	White
RD	Red
BU	Blue
BN	Brown
BK	Black

13.2 BG brake control





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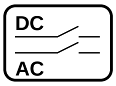
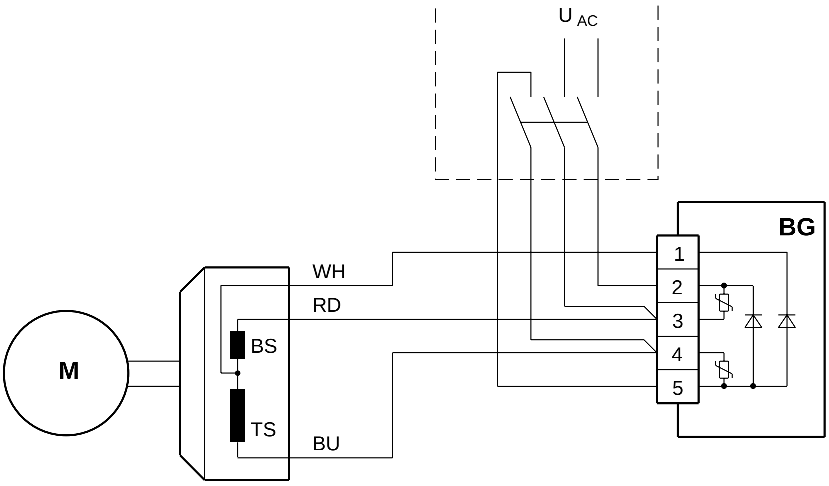
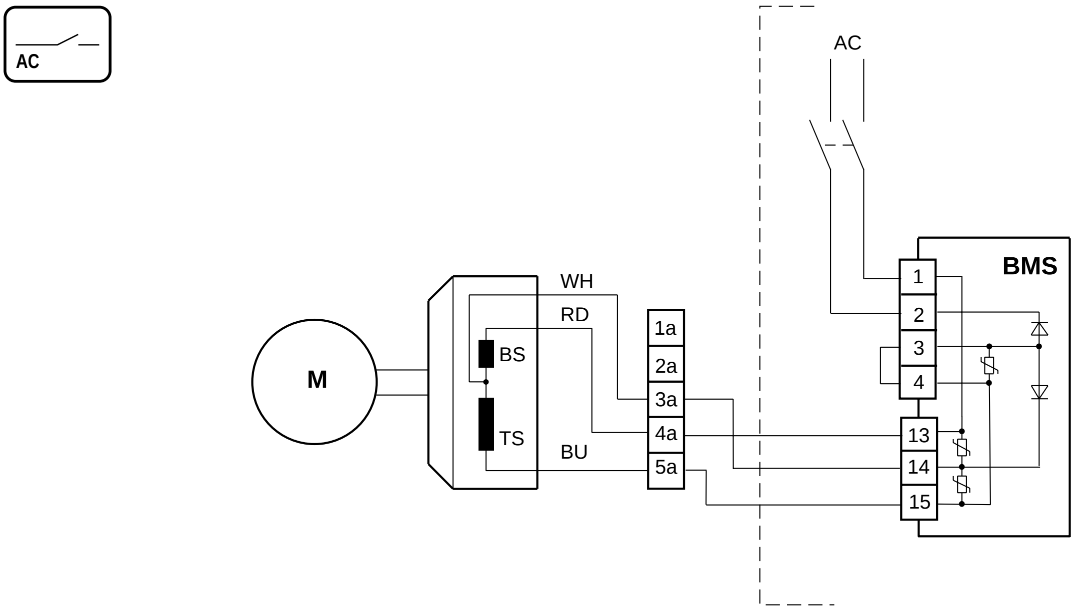




1164288267

13.3 BMS brake control



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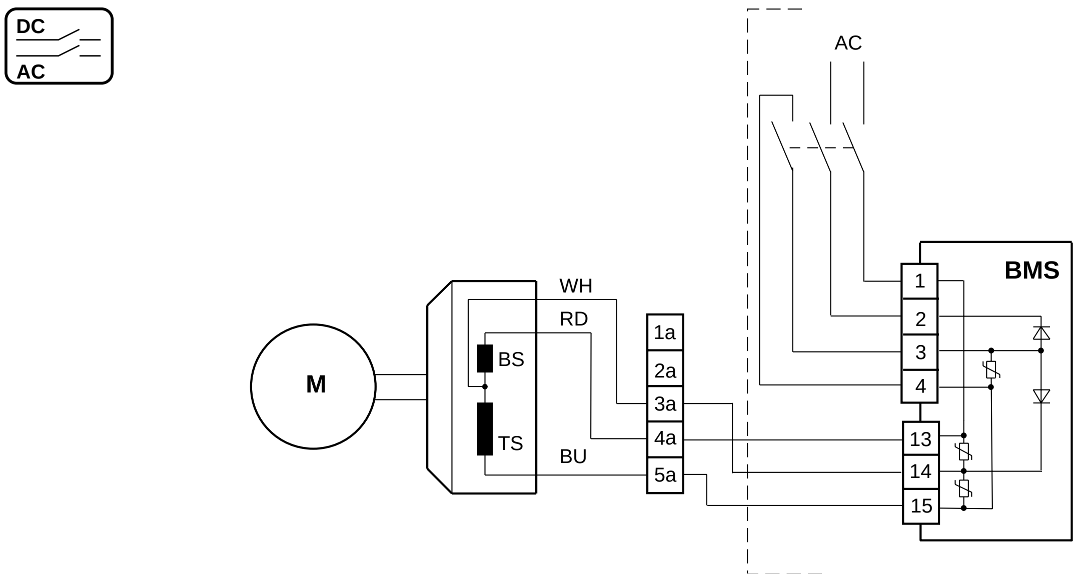
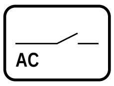
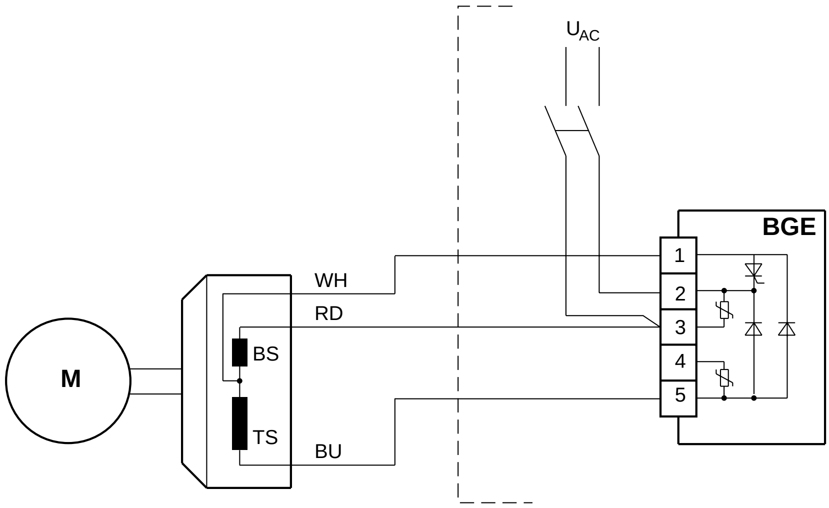


1164312587

13.4 BGE brake control





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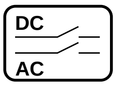
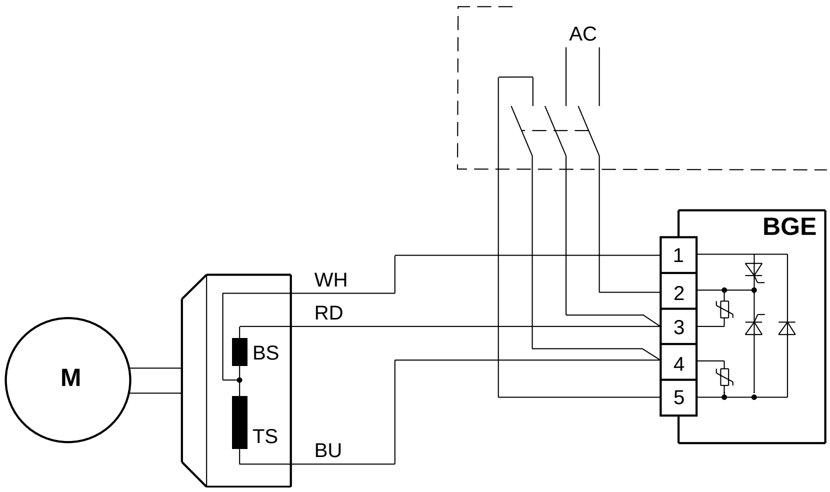
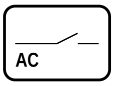
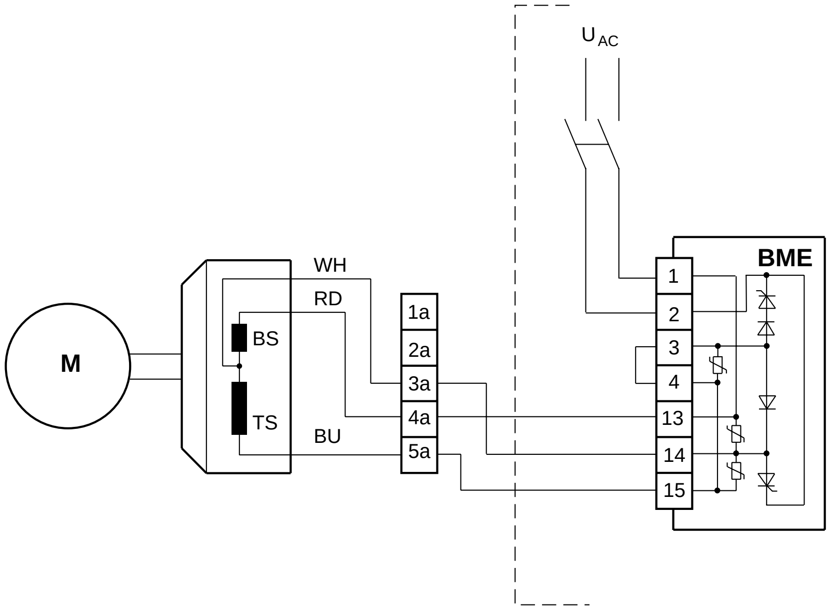




1164293131

13.5 BME brake control





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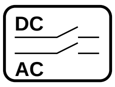

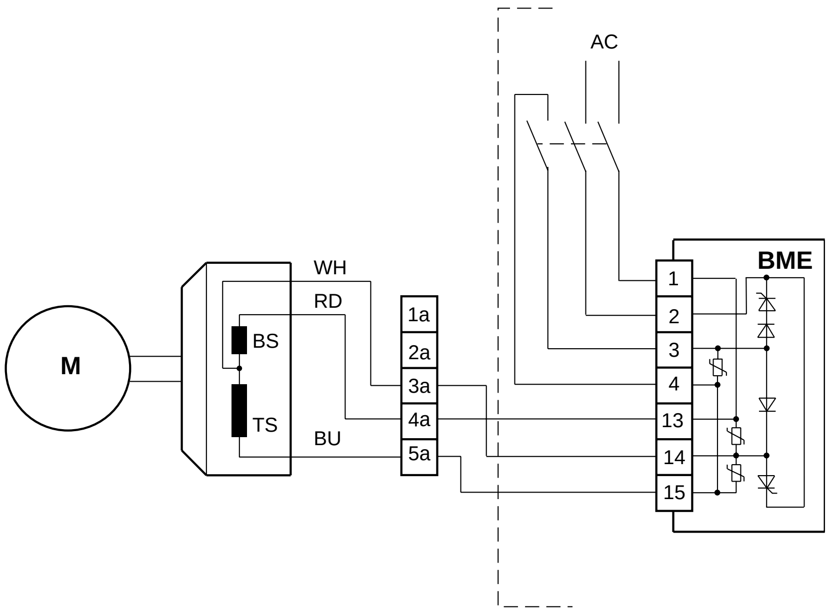

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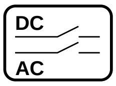
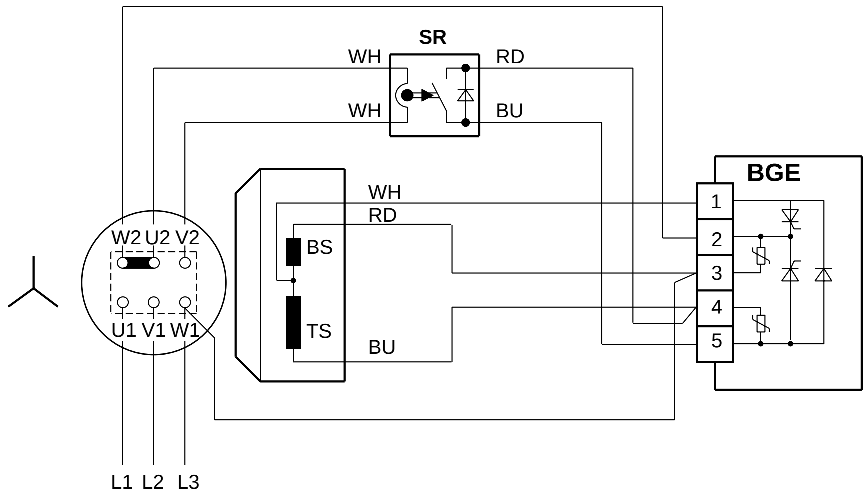
13.6 BSR brake control

Brake voltage = Phase voltage

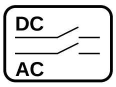
Example: Motor 230 V △ / 400 V ⅄, brake AC 230 V

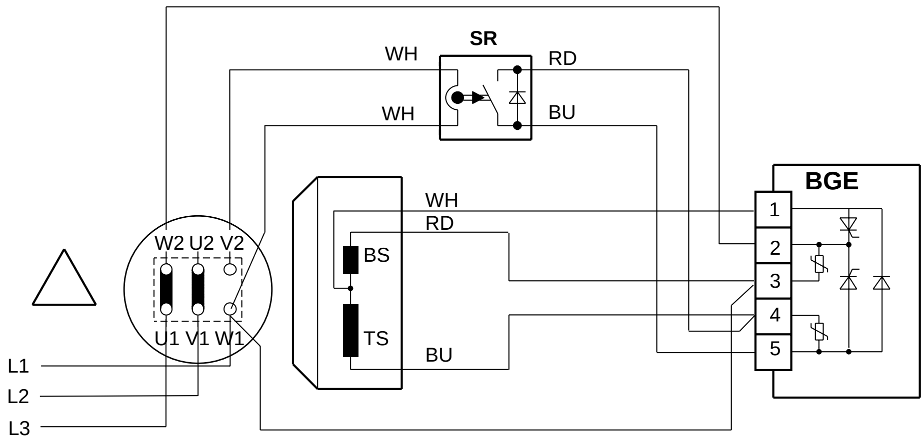




1163992075

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





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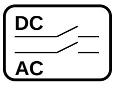
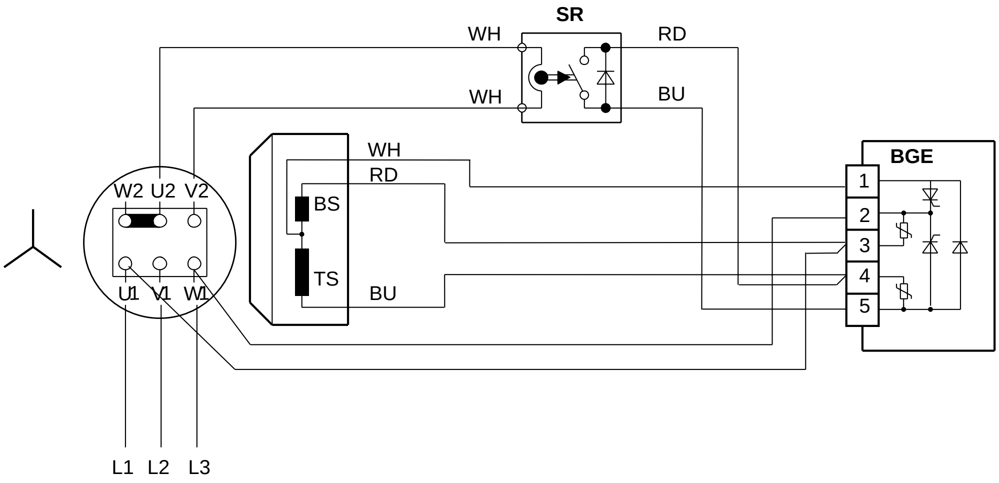
Brake voltage = Phase-to-phase voltage

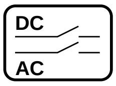
The input voltage of the brake rectifier corresponds to the line voltage of the motor, e.g. motor: 400 V ⅄, brake: AC 400 V

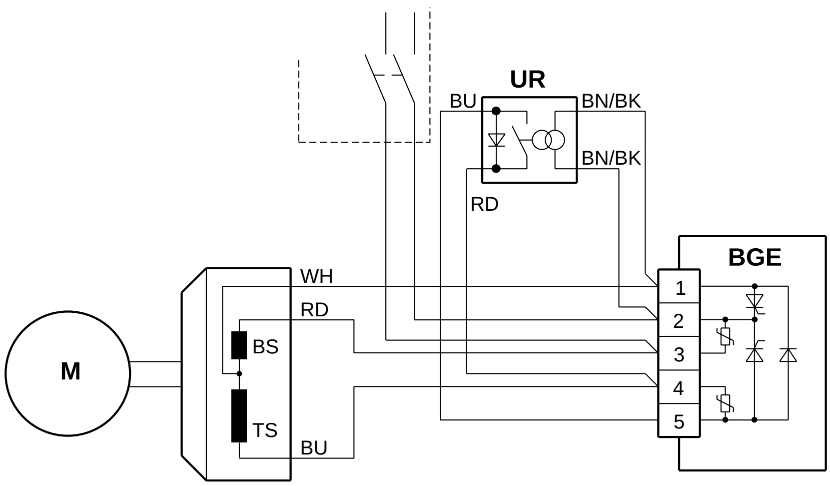




1164324747

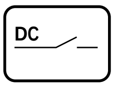
13.7 BUR brake control

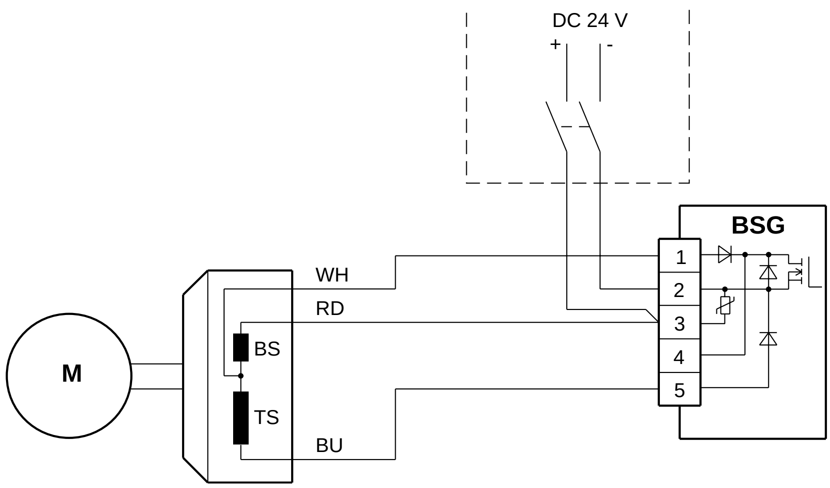




1164327179

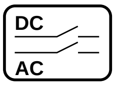
13.8 BSG brake control

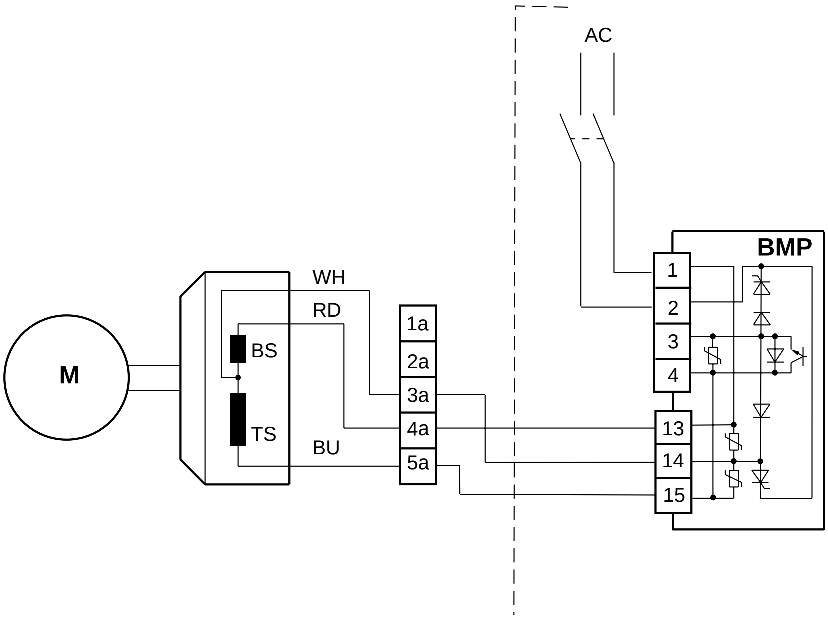




1164329611

13.9 BMP brake control





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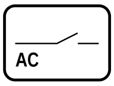
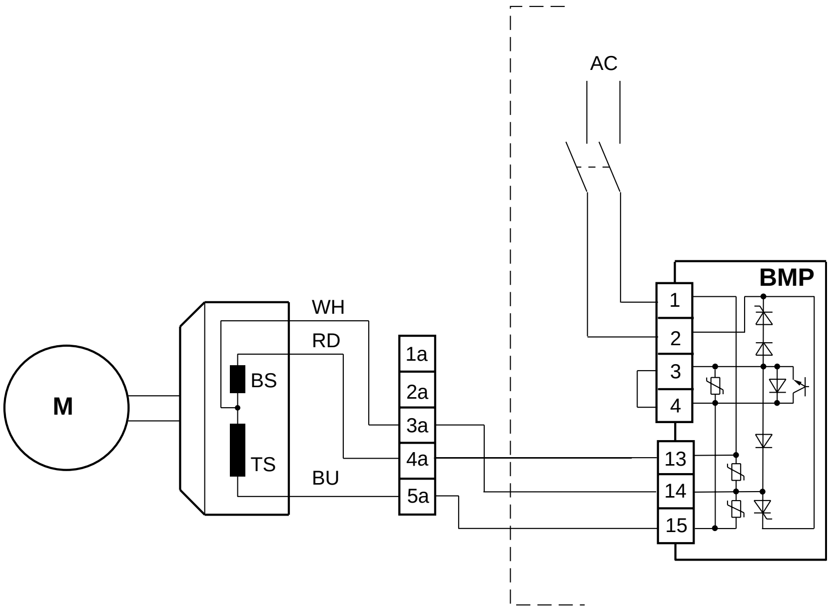
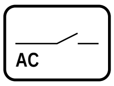
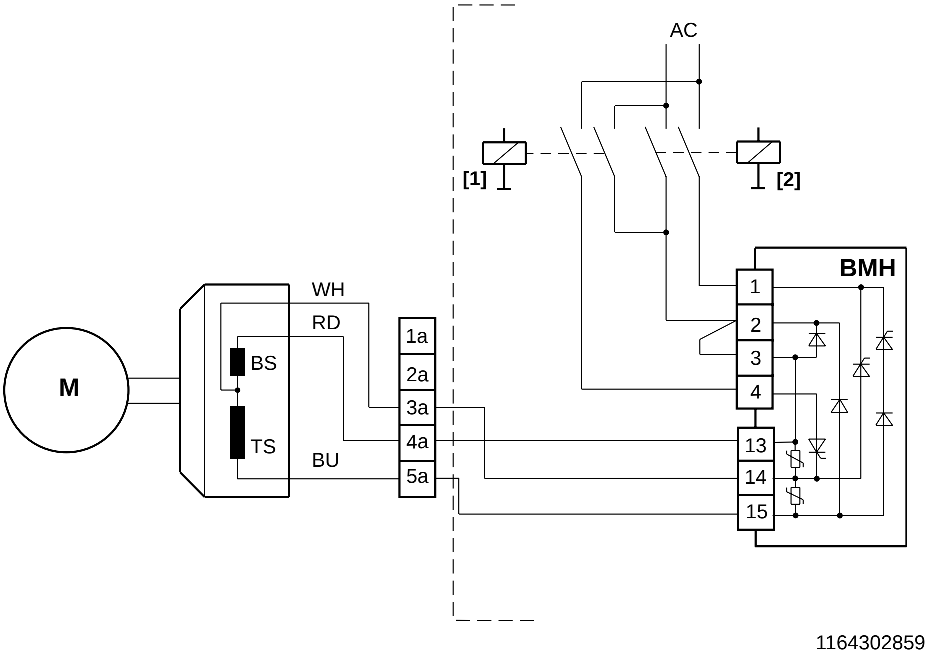




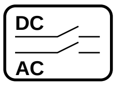
1164310155

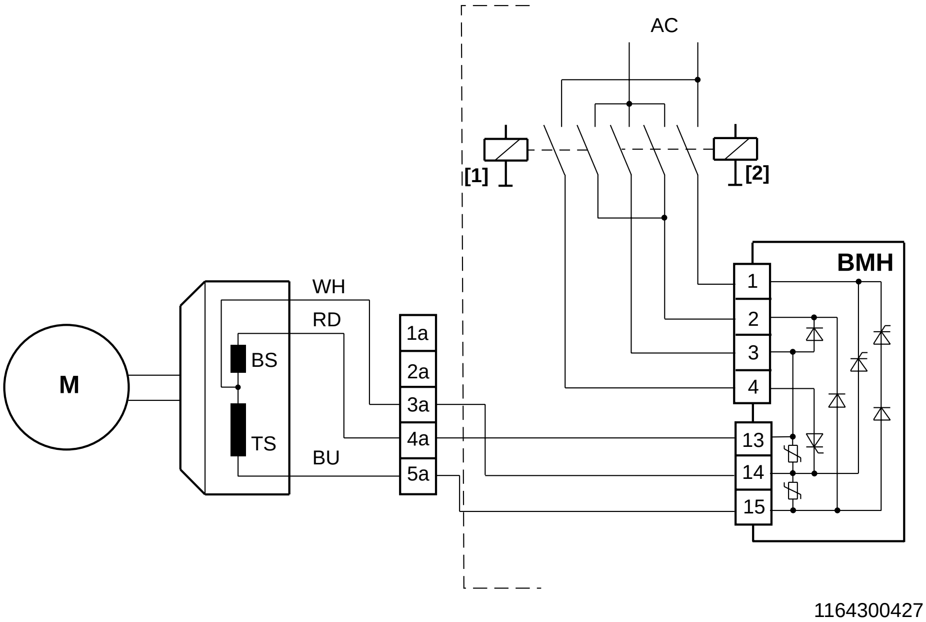
13.10 BMH brake control





[1] Heating
[2] Release

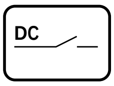


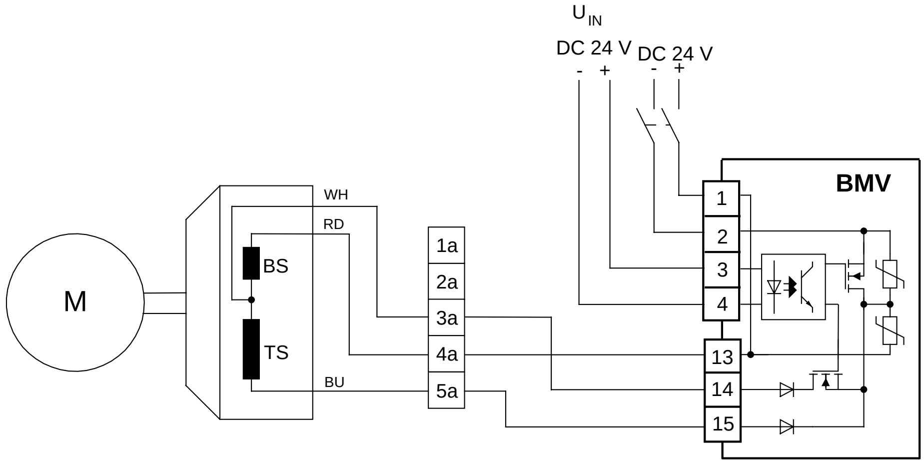


[1] Heating
[2] Release

13.11 BMV brake control

The following illustration shows the connection of a three-wire brake:





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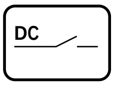
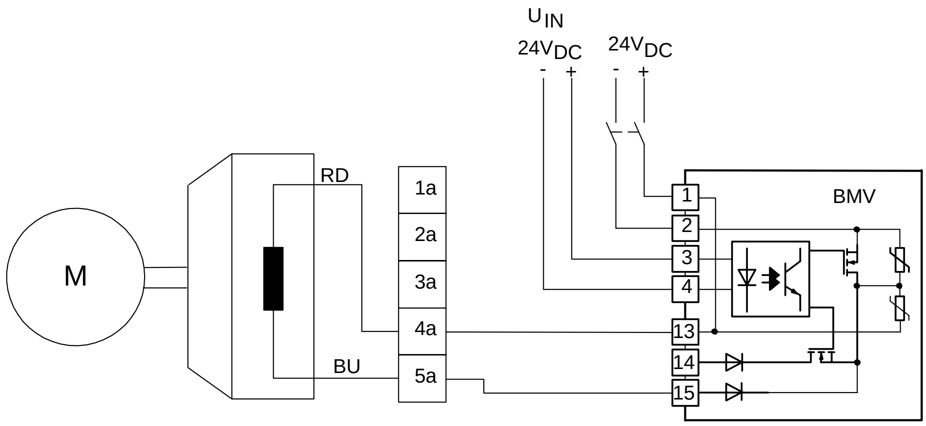
V_{IN} = control signal

The following illustration shows the connection of a two-wire brake:





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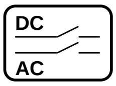
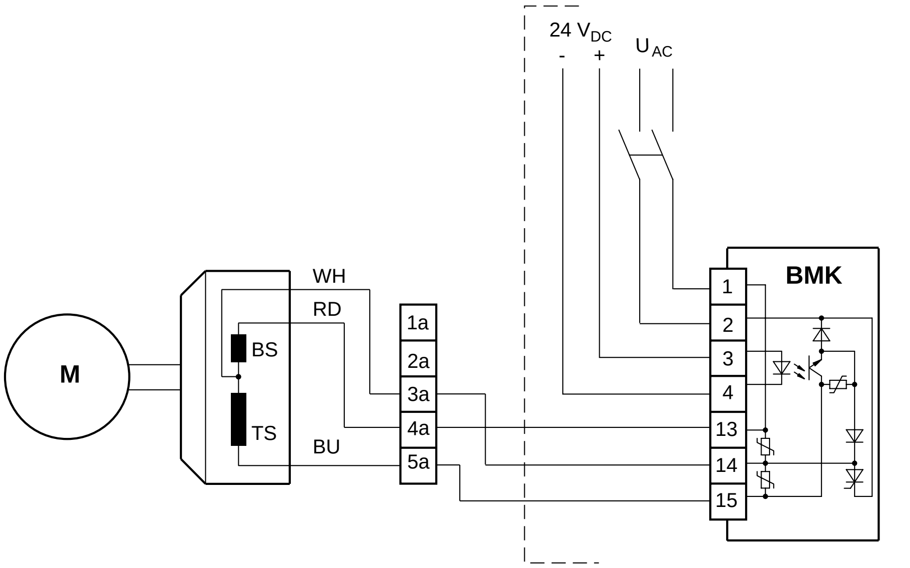
13.12 BMK brake control





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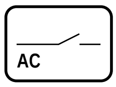
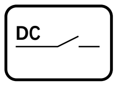
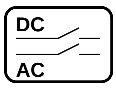
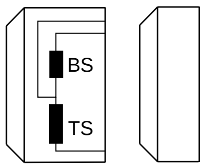
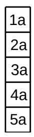
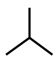
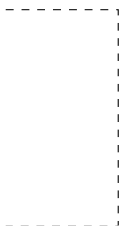
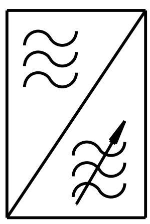
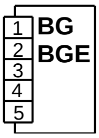
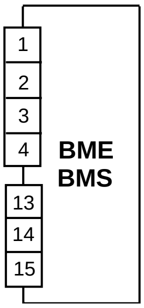
14 Sample Circuits

14.1 Key

Observe the following points when connecting the brake:

- Apply voltage (see nameplate) to release the brake, contacts operate in parallel with the motor contactor.
- Contact rating of the brake contactors AC 3 according to EN 60947-4-1

	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 design
	Motor with delta connection
	Motor with star connection
	Control cabinet limit
	Frequency inverters

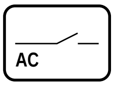
	Brake control type BG, BGE for installation in the motor terminal box
	Brake control type BME, BMS for installation in the control cabinet
WH	White
RD	Red
BU	Blue
BN	Brown
BK	Black

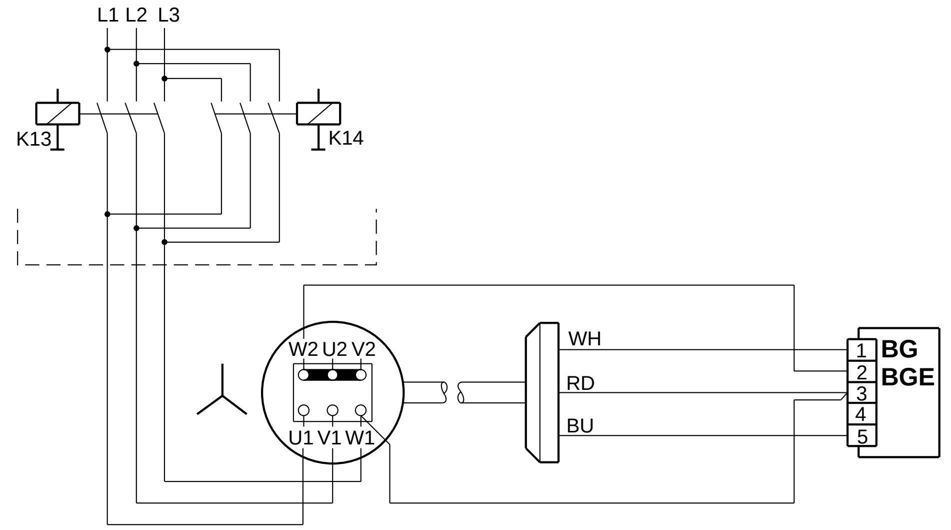
14.2 AC motors with one speed

14.2.1 BG, BGE in terminal box, supply from motor terminal board

Brake voltage = Phase voltage

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





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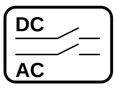
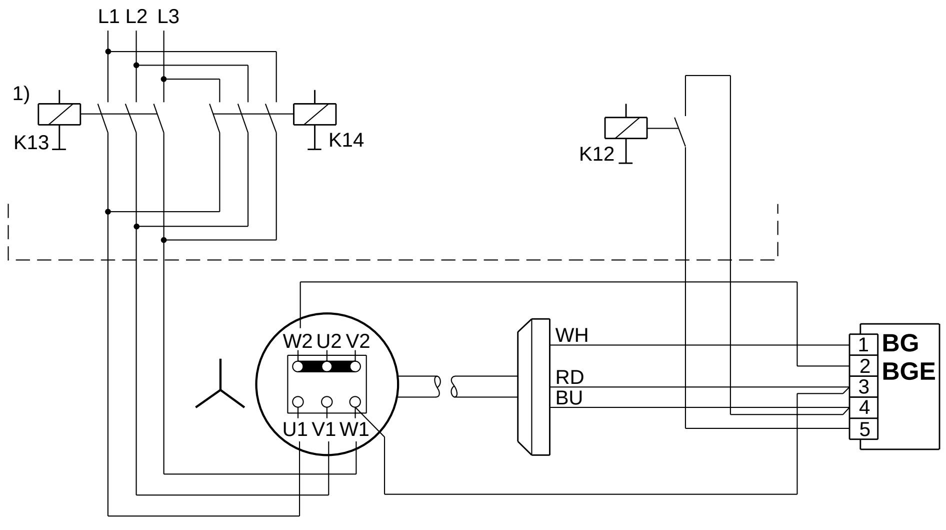




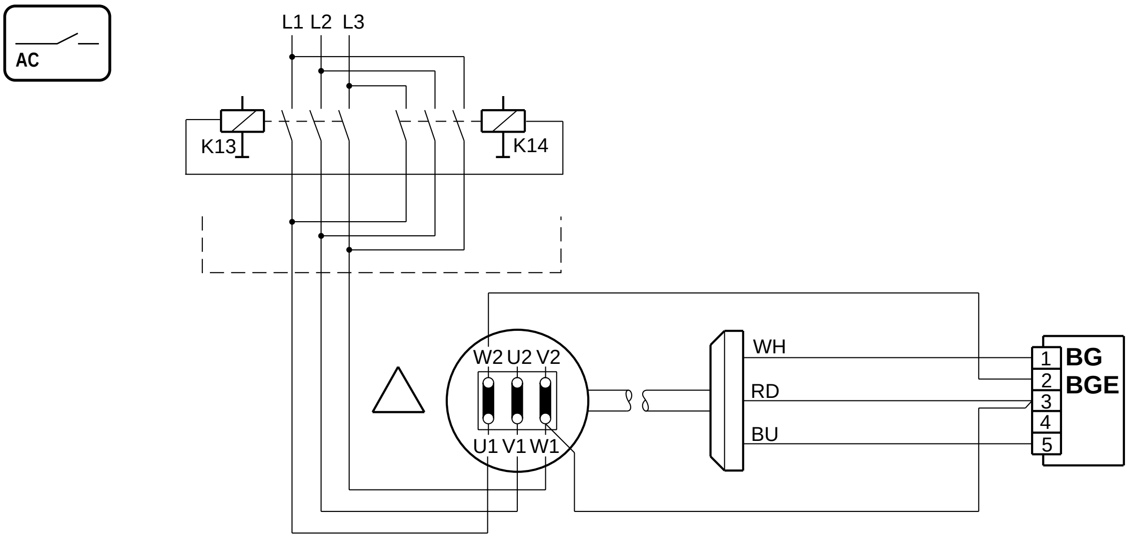
1165203595

[1] K12 is connected at the same time as K13 or K14 (direction of rotation)

14.2.2 BG, BGE in terminal box, supply from motor terminal board

Brake voltage = Phase voltage

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



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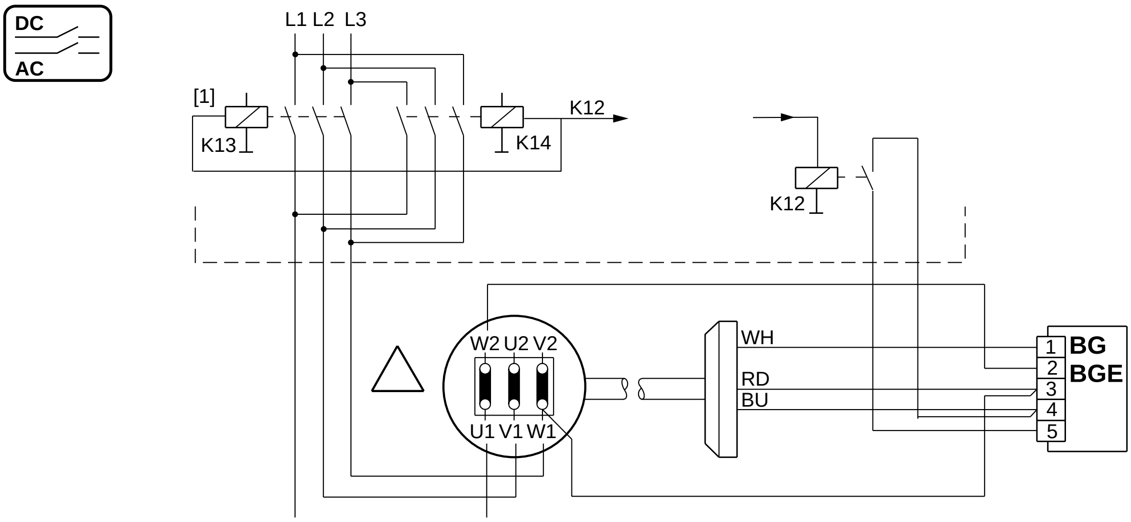


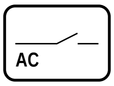
1165230347

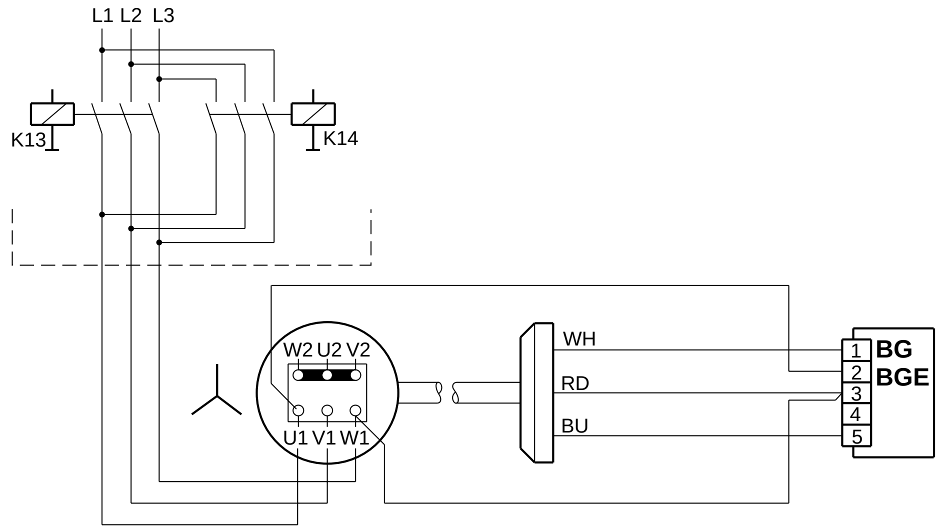
[1] K12 is connected at the same time as K13 or K14 (direction of rotation)

14.2.3 BG, BGE in terminal box, supply from motor terminal board

Brake voltage = Phase-to-phase voltage

Example: Motor 400 V ⅄, brake AC 400 V





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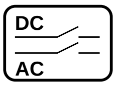

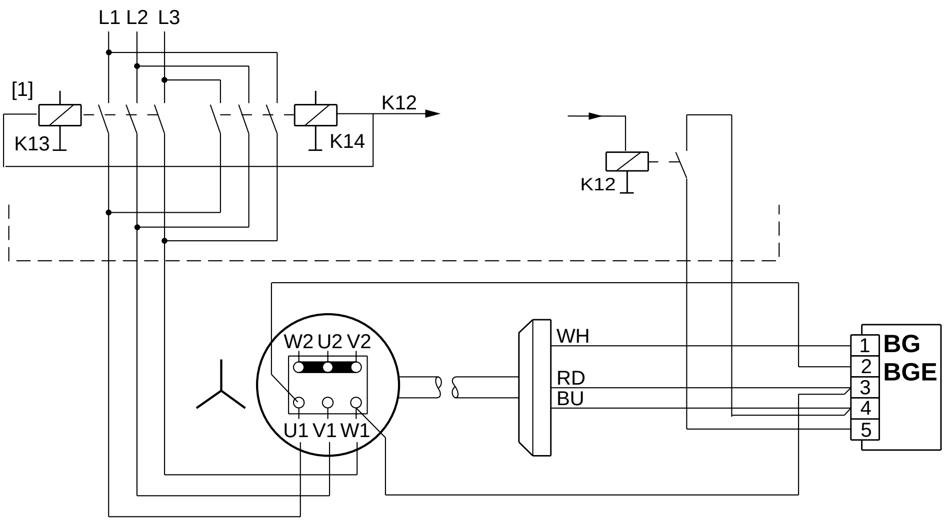

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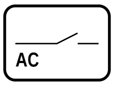
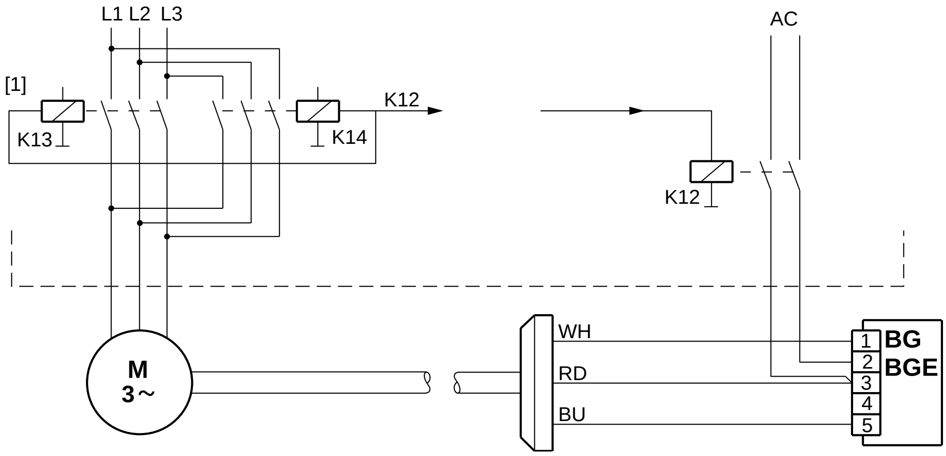
[1] K12 is connected at the same time as K13 or K14 (direction of rotation)

14.2.4 BG, BGE in terminal box, external supply





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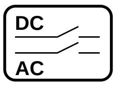

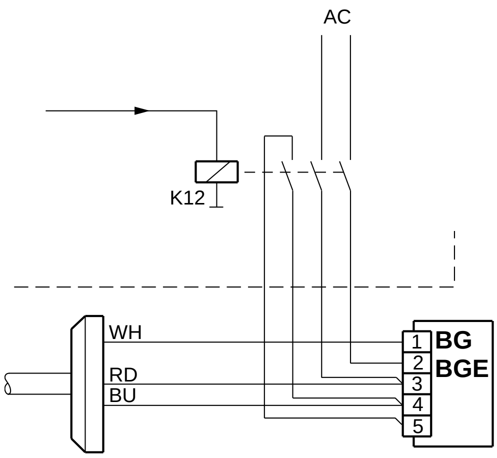

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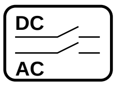
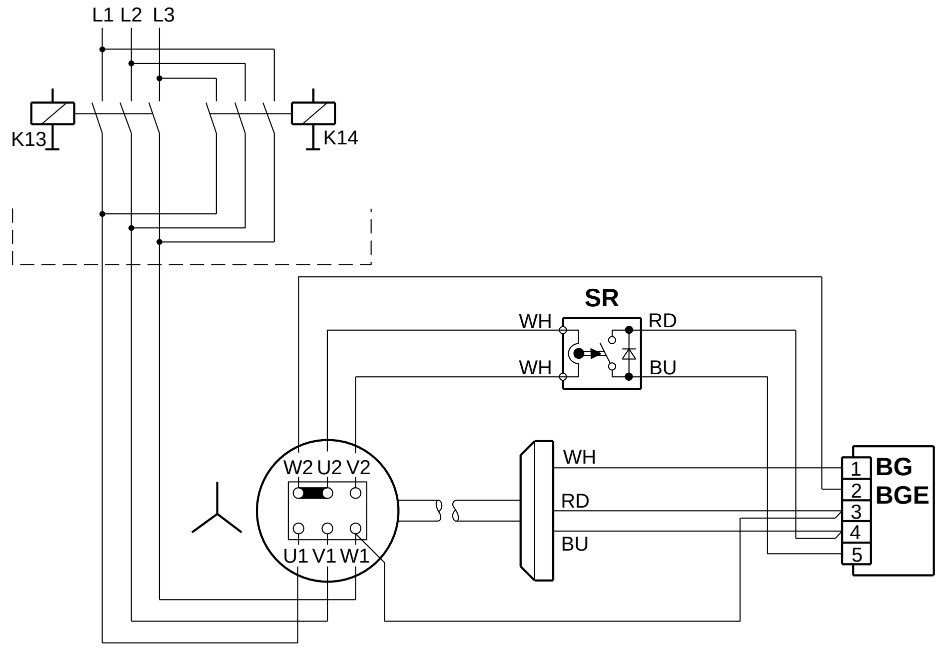
14.2.5 BSR in the terminal box

Brake voltage = Phase voltage

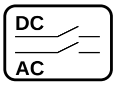
Example: Power supply 400 V, motor 230 V △ / 400 V ⅄, brake AC 230 V

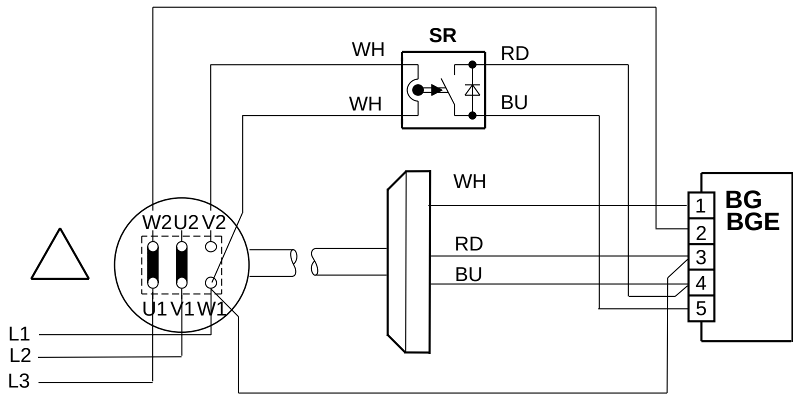




1165206027

Example: 400 V power supply, 400 V motor △ / 690 V ⅄, AC 400 V brake

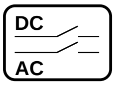


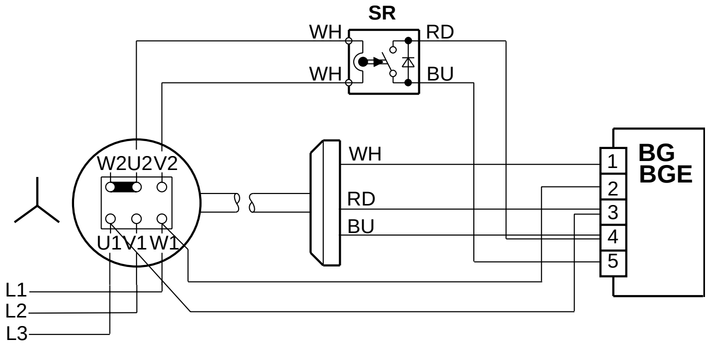


1165210891

Brake voltage = Phase-to-phase voltage

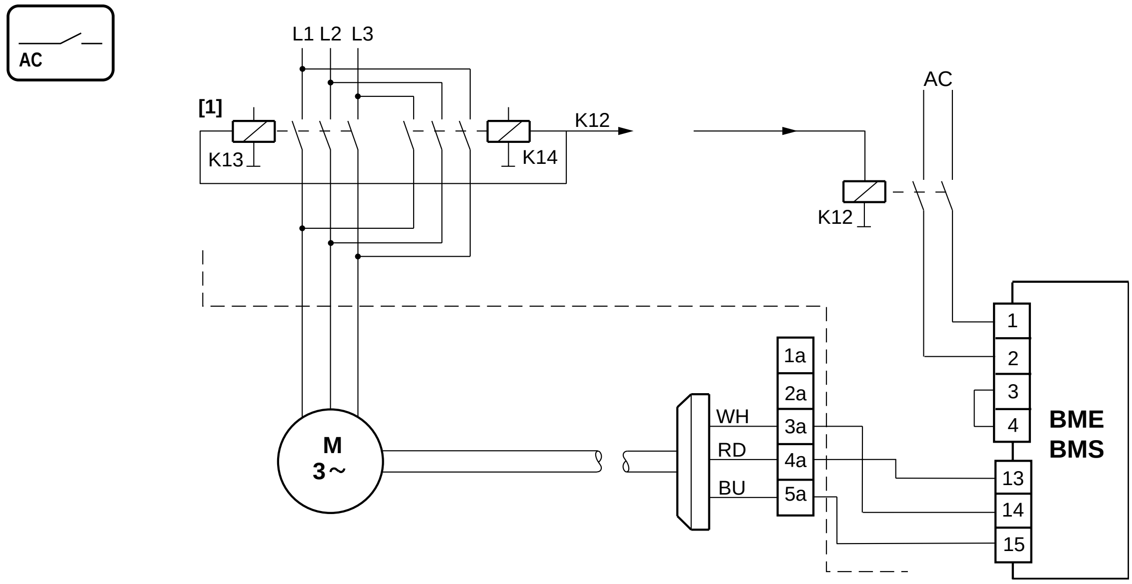
Example: 400 V power supply, 400 V motor ⅄, AC 400 V brake



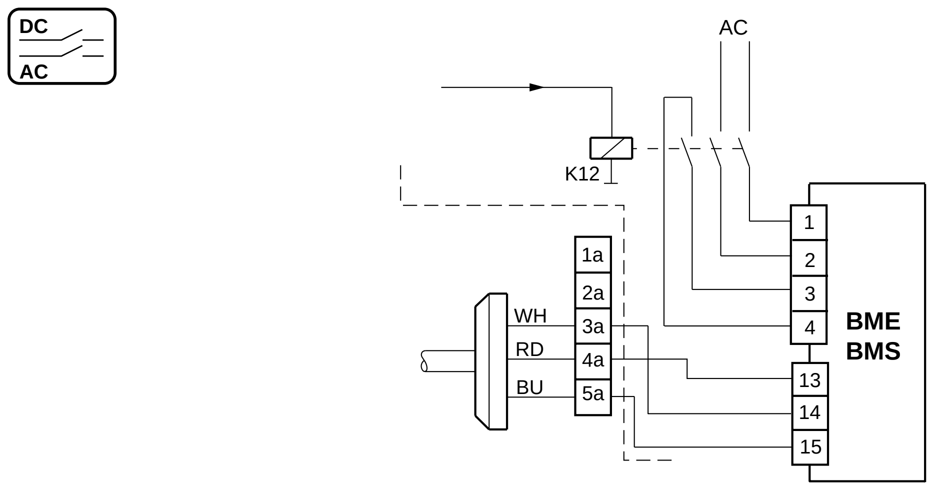


1165223051

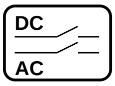
14.2.6 BMS, BME, BMP in control cabinet

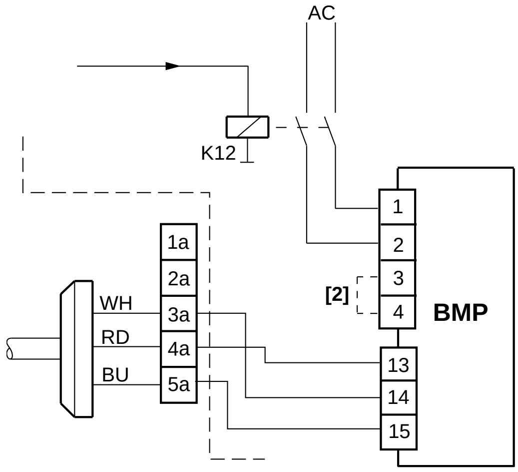


1165240075



1165242507

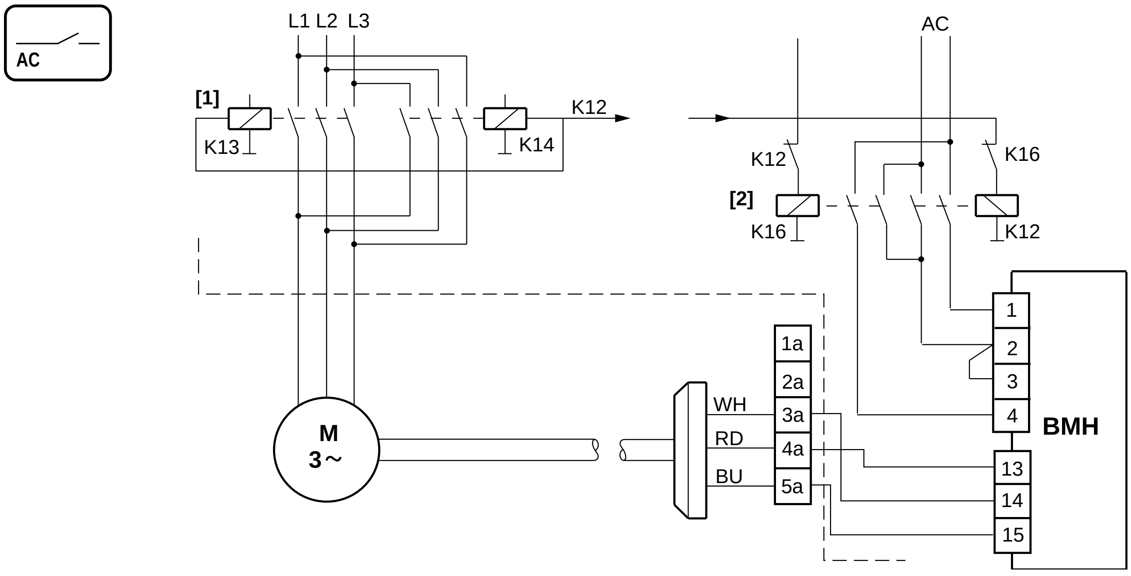




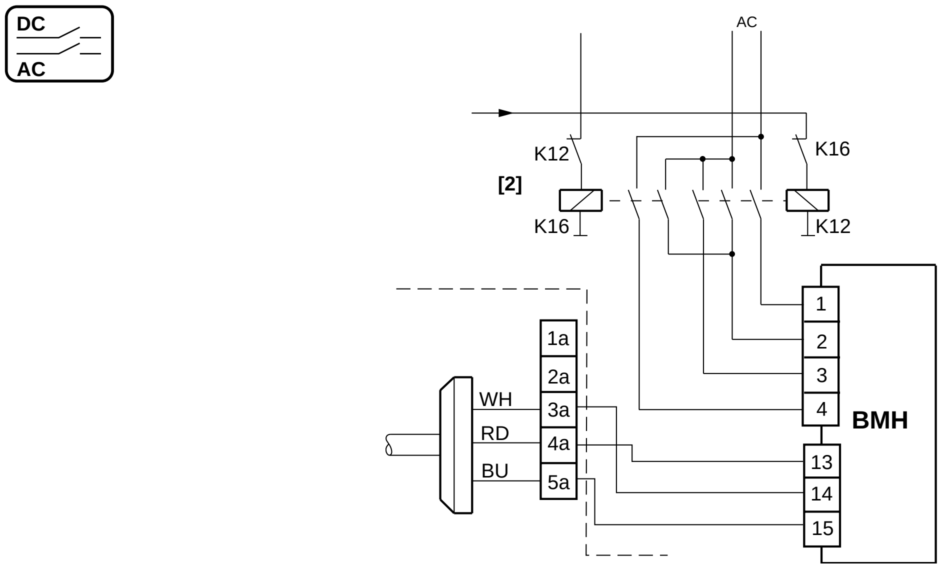
1165244939

[1] K12 is connected at the same time as K13 or K14 (direction of rotation)
[2] Change jumper or normally open contact from 3 to 4 if switching is to be in the AC circuit only

14.2.7 BMH in the control cabinet



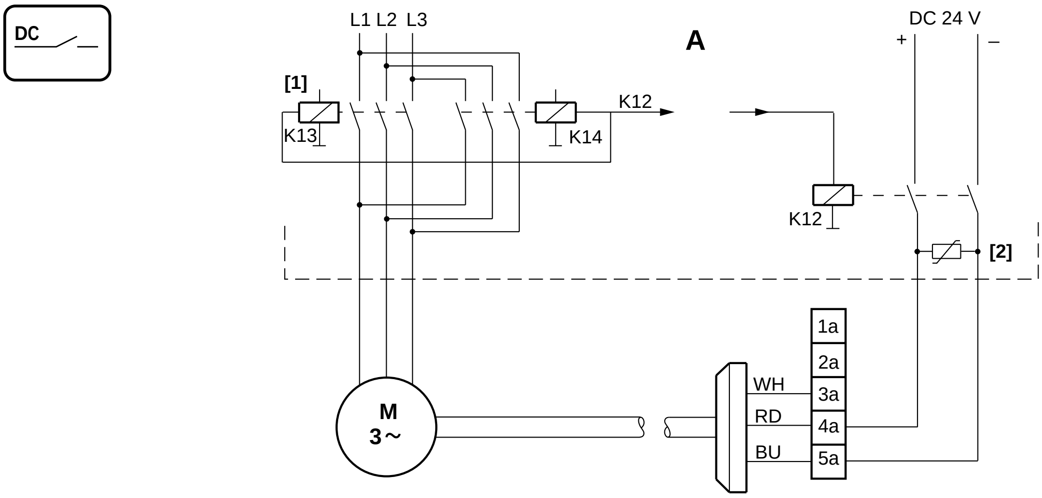
1165247371



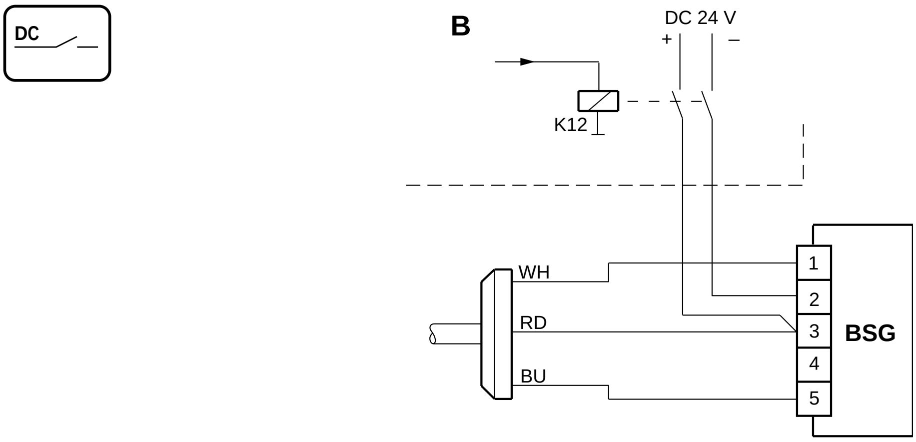
1165249803

[1] K12 is connected at the same time as K13 or K14 (direction of rotation)
[2] K16 must be operated to heat the brake. K16 is locked with K12. Heating mode only for longer breaks (see project planning specifications).

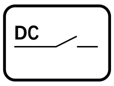
14.2.8 Brake control, DC 24 V

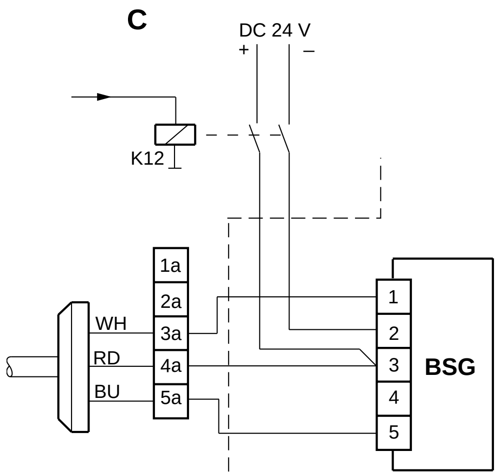


1165252235



1165254667



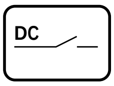


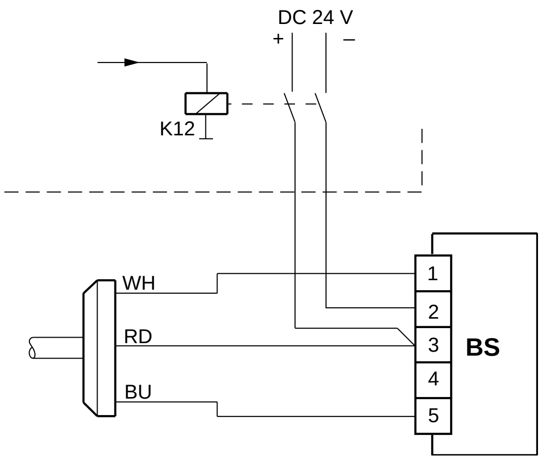
1165257099

A Standard for brakemotor sizes 56 + 63 with DC 24 V brake without BSG control unit
B Standard for brakemotor sizes 112 to 225 with BSG in terminal box
C For brakemotor sizes 71 to 225 with BSG in control cabinet
[1] K12 is connected at the same time as K13 or K14 (direction of rotation)
[2] Protection circuit against switching overvoltages to be installed by the customer

14.2.9 BS varistor overvoltage protection

For brakemotors 71-100, brake DC 24 V

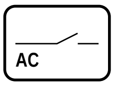


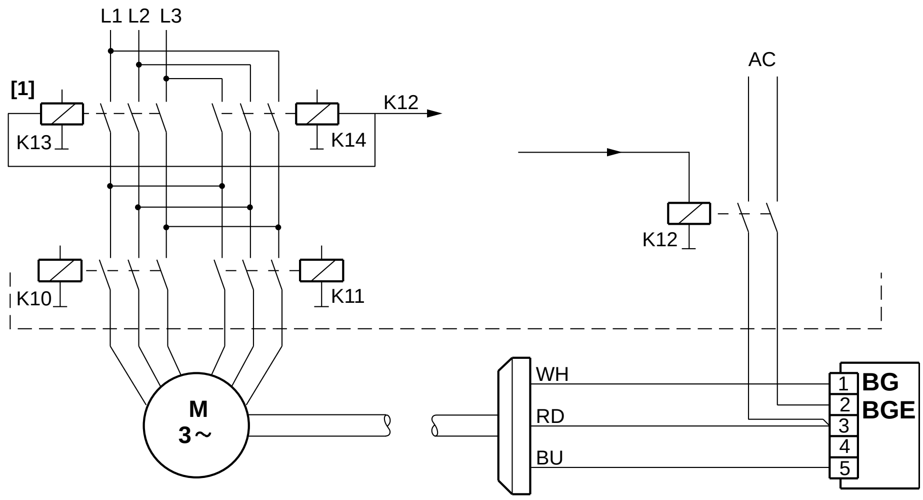


1165213323

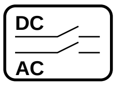
14.3 Multi-speed motors

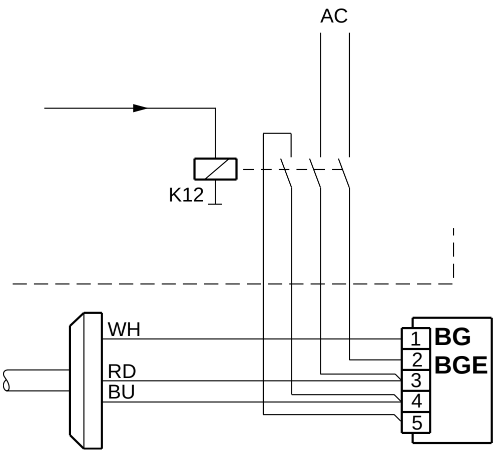
14.3.1 BG, BGE in terminal box, multi-speed motor (separate winding)





1165468939



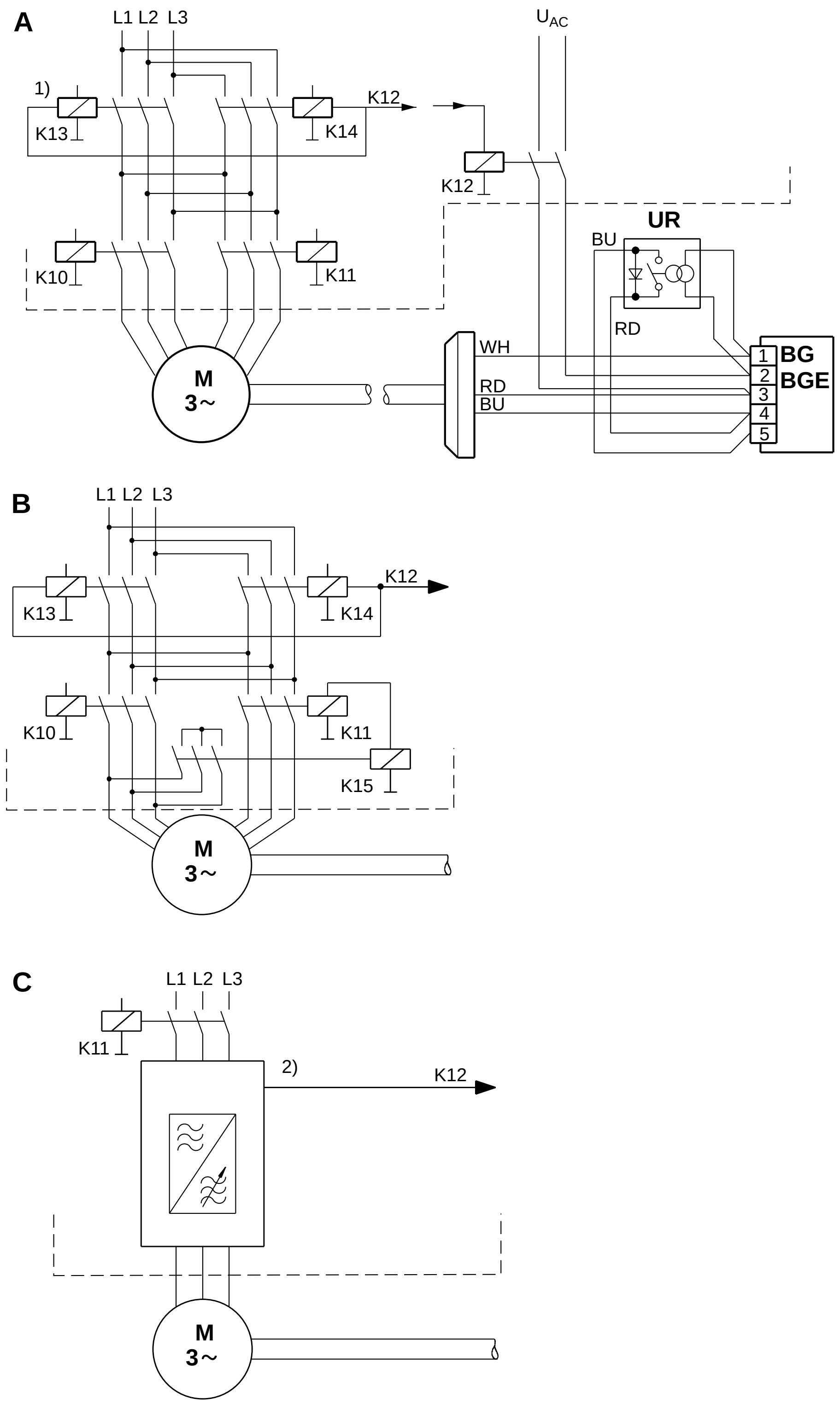


1165389707

[1] K12 is connected at the same time as K13 or K14 (direction of rotation).

14.3.2 BUR with multi-speed and speed-controlled AC motors

DC
AC

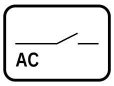


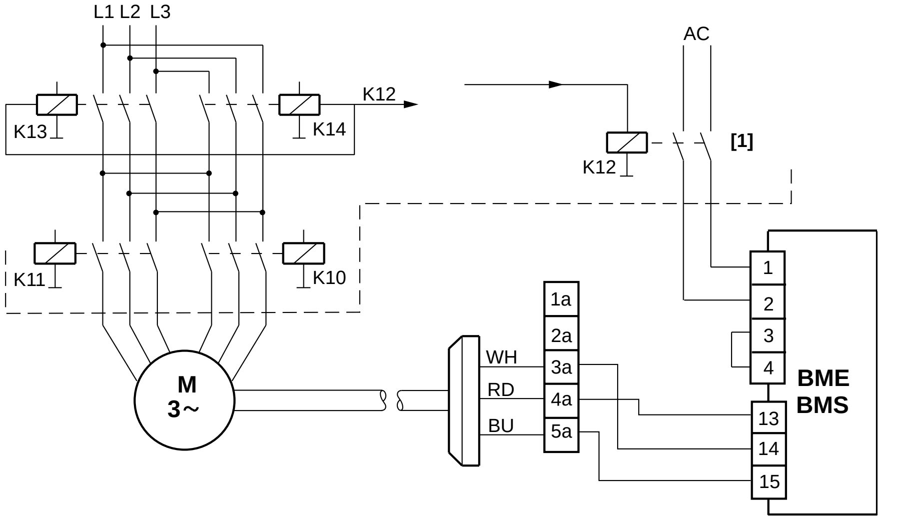
1165208459

A Separate winding
B Dahlander connection
C With frequency inverter

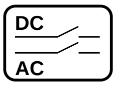
[1] Voltage supply to the brake via separate supply cable. Connection to motor terminal board not permitted.
[2] Output brake command

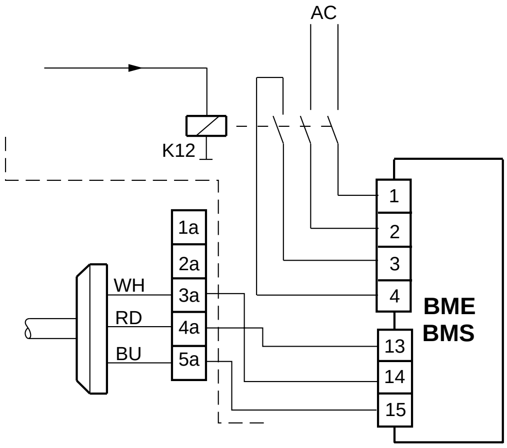
14.3.3 BMS, BME, BMP in control cabinet, multi-speed motor (separate winding)



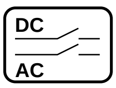


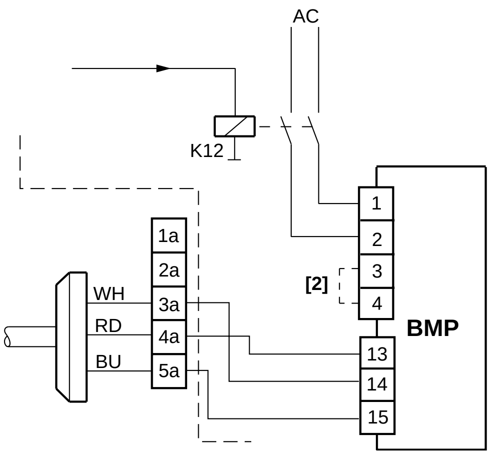
1165259531





1165261963

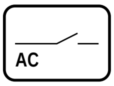


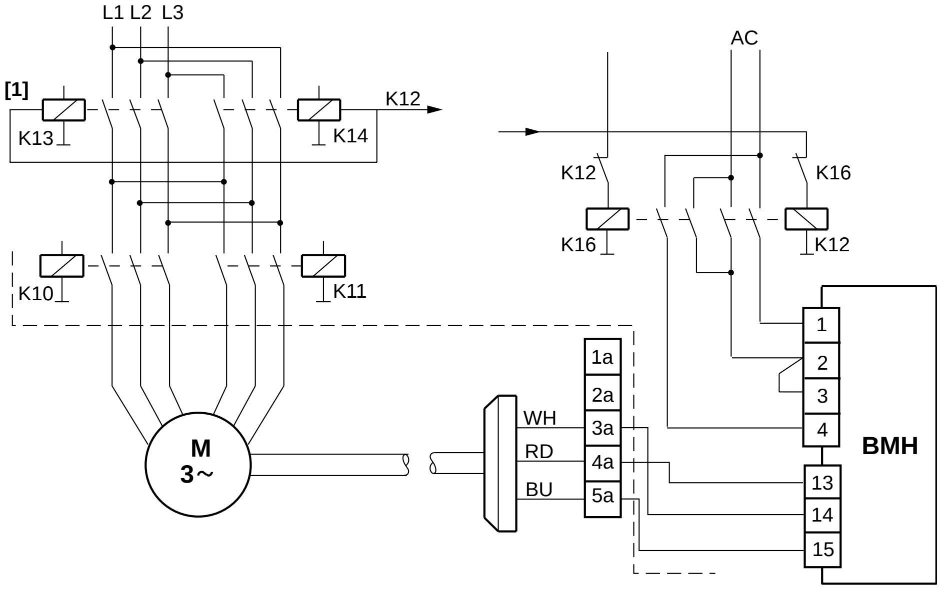


1165264395

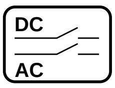
[1] K12 is connected at the same time as K13 or K14 (direction of rotation).
[2] Change jumper or NO contact from 3 to 4 if switching is to be in the AC circuit only.

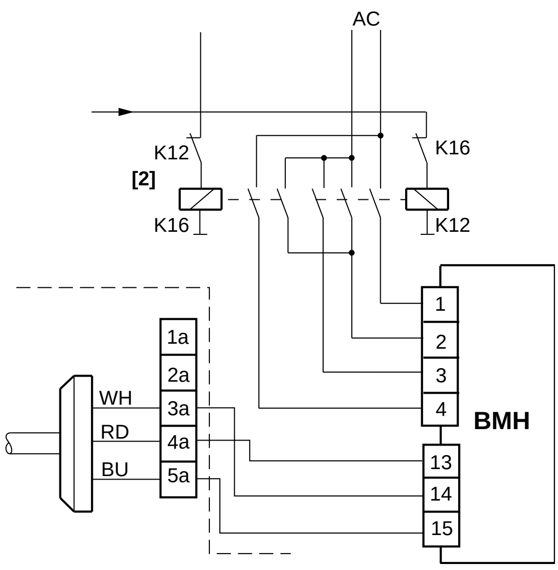
14.3.4 BMH in control cabinet, multi-speed motor (separate winding)





1165266827

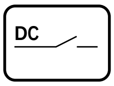


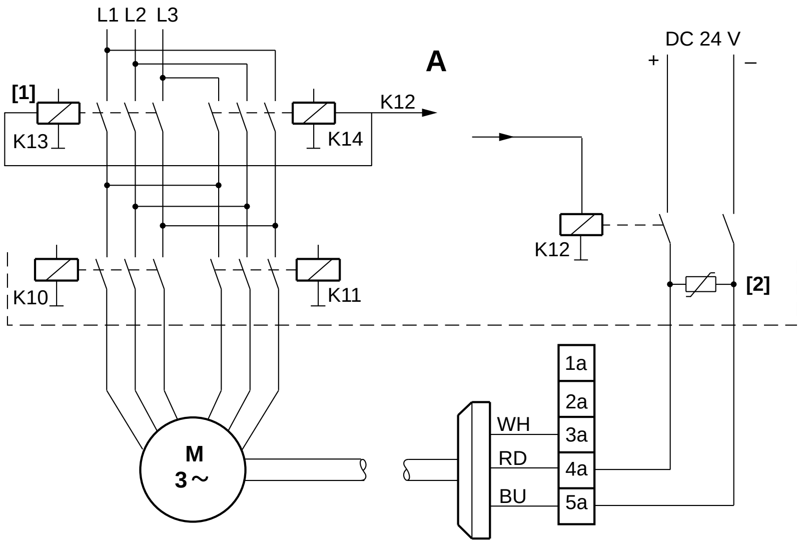


1165269259

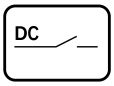
[1] K12 is connected at the same time as K13 or K14 (direction of rotation).
[2] K16 must be operated to heat the brake. K16 is locked with K12. Heating mode only for longer breaks (see project planning specifications).

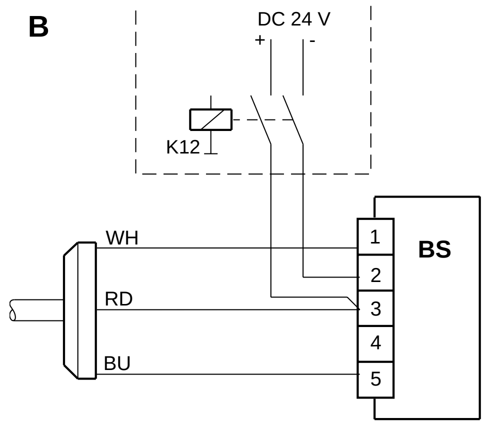
14.3.5 Brake control DC 24 V, multi-speed motor (separate winding)





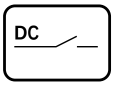
1165271691

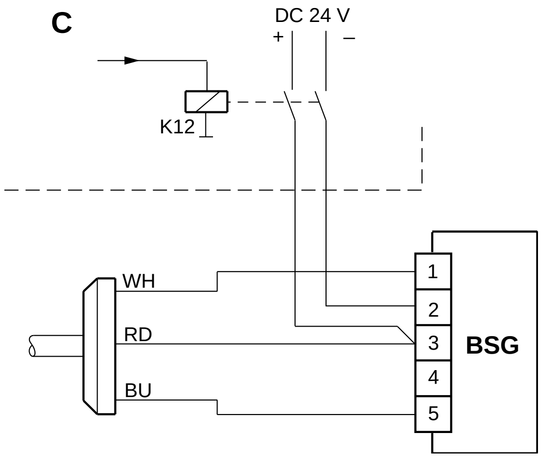




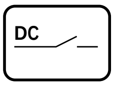
1165274123

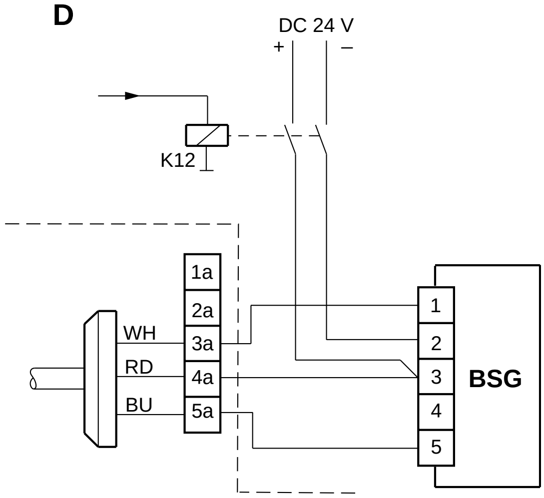
A Standard for brakemotor size 63 with DC 24 V brake
B Standard for brakemotor sizes 71 to 100 with BS in terminal box
[1] K12 is connected at the same time as K13 or K14 (direction of rotation)
[2] Protection circuit against switching overvoltages to be installed by the customer





1165276555

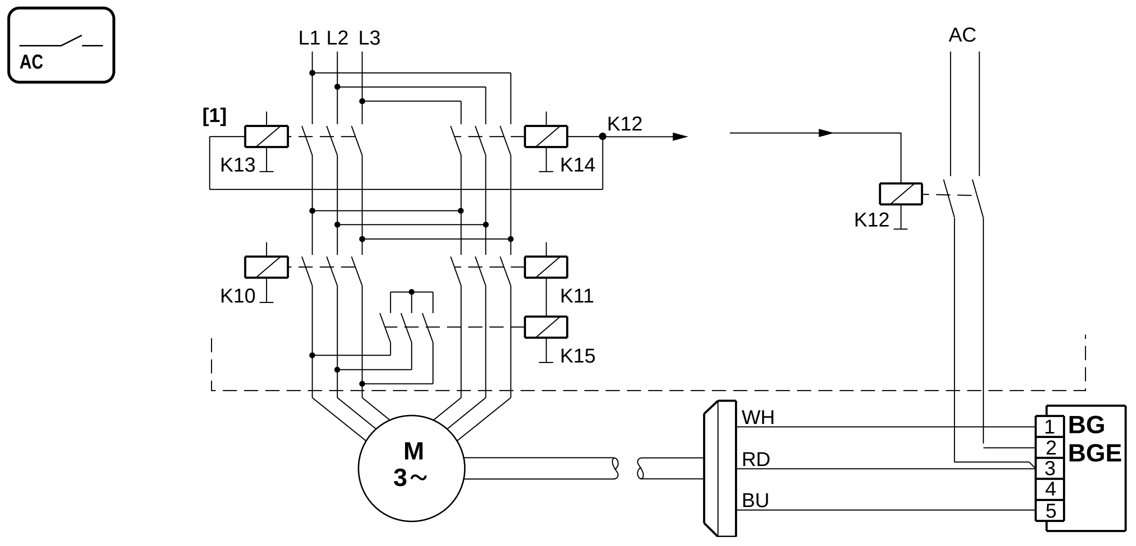




1165278987

C Standard for brakemotor sizes 112 to 225 with BSG in terminal box
D For brakemotor sizes 71 to 225 with BSG in control cabinet

14.3.6 BG, BGE in terminal box, multi-speed motor (Dahlander)



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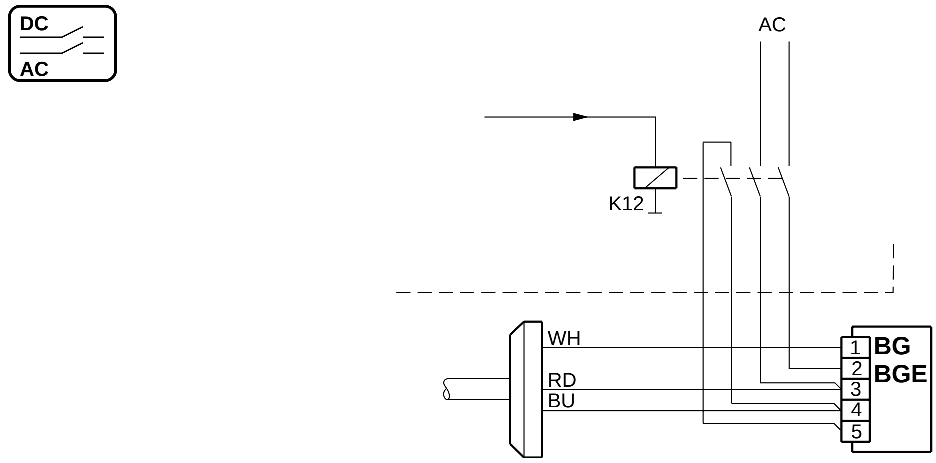
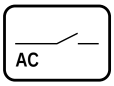
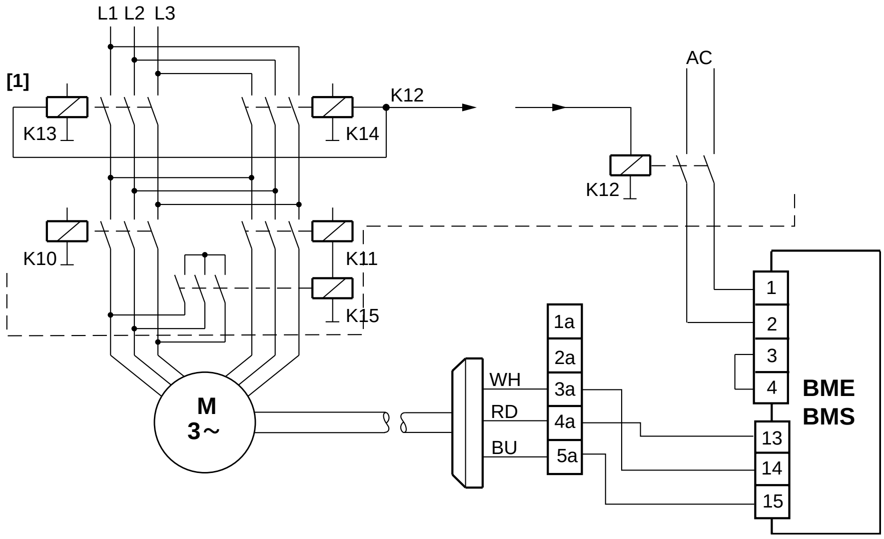


1165283851

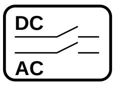
[1] K12 is connected at the same time as K13 or K14 (direction of rotation).

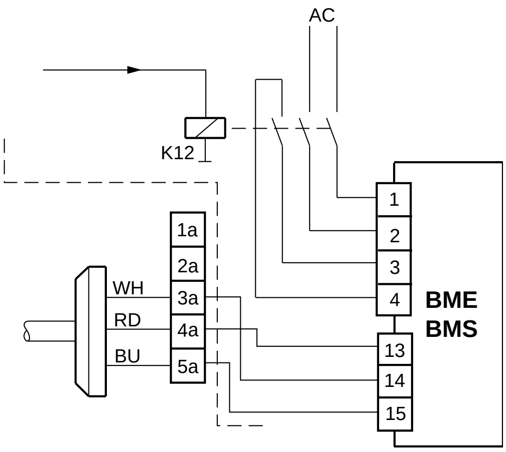
14.3.7 BMS, BME, BMP in control cabinet, multi-speed motor (Dahlander)



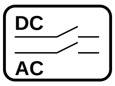


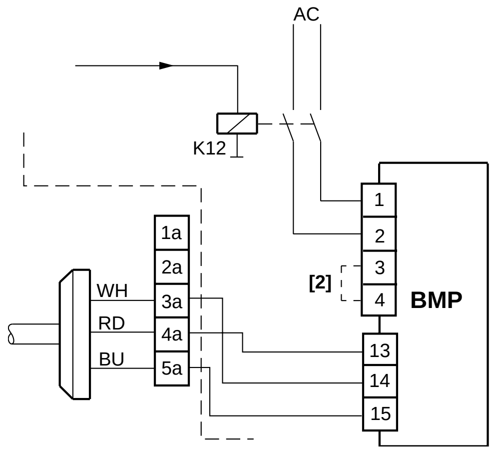
1165286283





1165288715

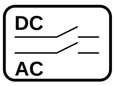


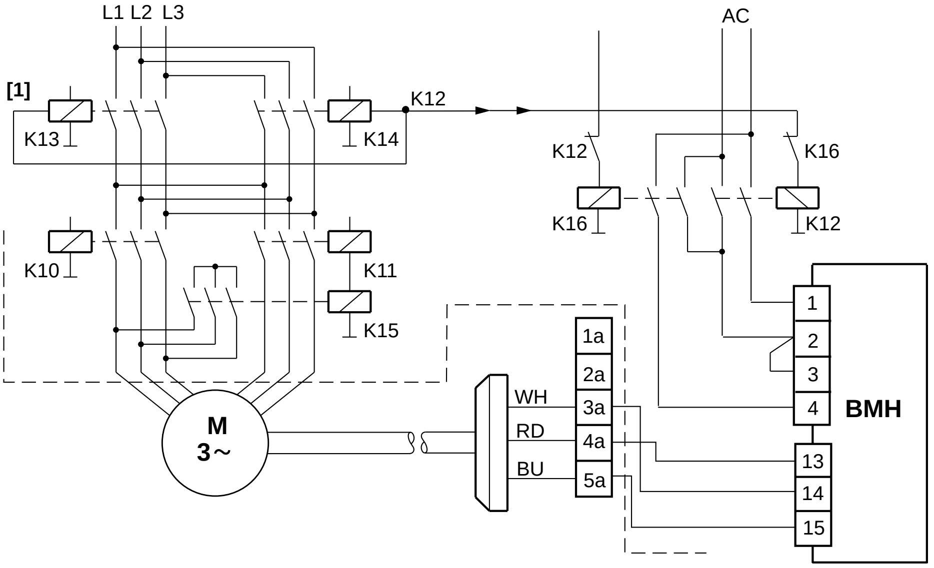


1165291147

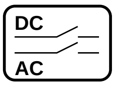
[1] K12 is connected at the same time as K13 or K14 (direction of rotation).
[2] Change jumper or normally open contact from 3 to 4 if switching is to be in the AC circuit only.

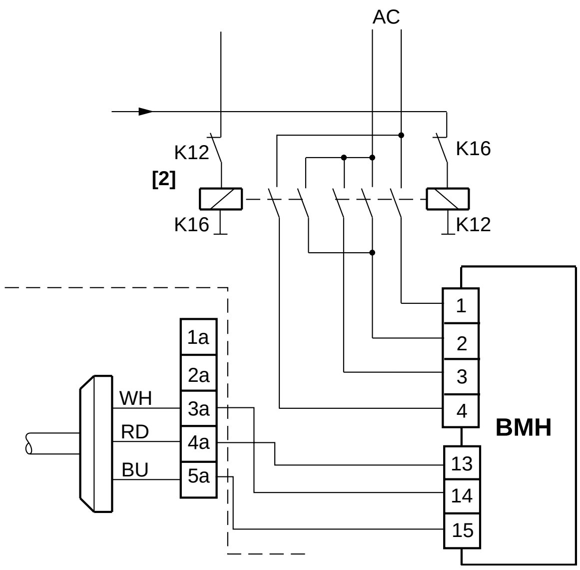
14.3.8 BMH in control cabinet, multi-speed motor (Dahlander)





1165293579

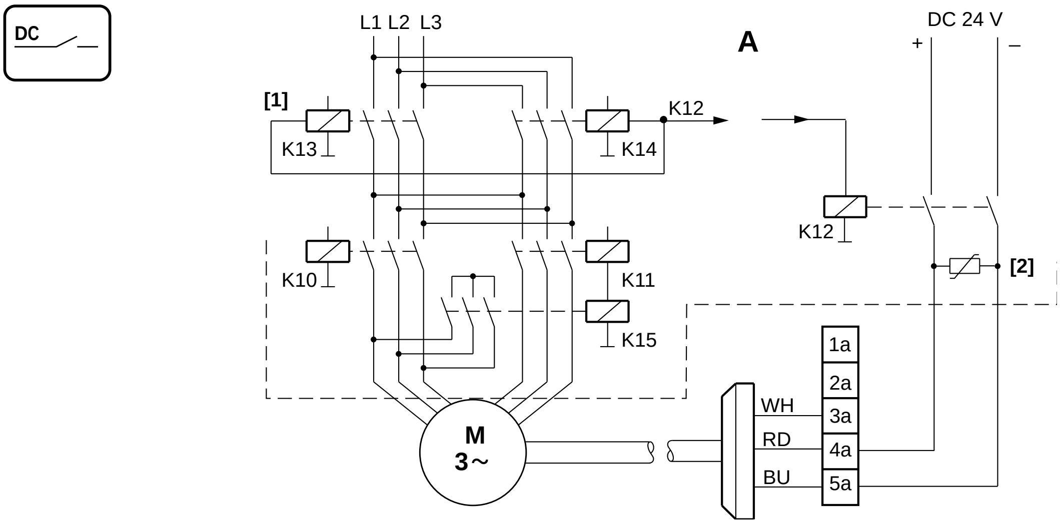




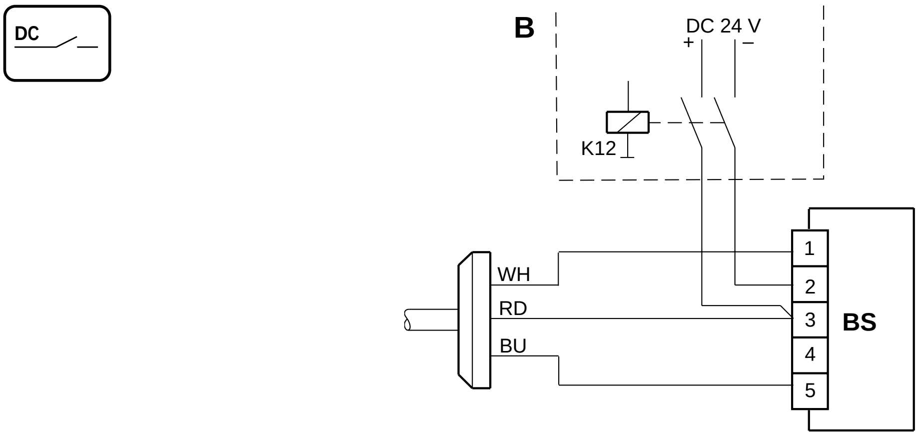
1165296011

[1] K12 is connected at the same time as K13 or K14 (direction of rotation).
[2] K16 must be operated to heat the brake. K16 is locked with K12. Heating mode only for longer breaks (see project planning specifications).

14.3.9 Brake control, DC 24 V, multi-speed motor (Dahlander)

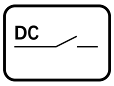


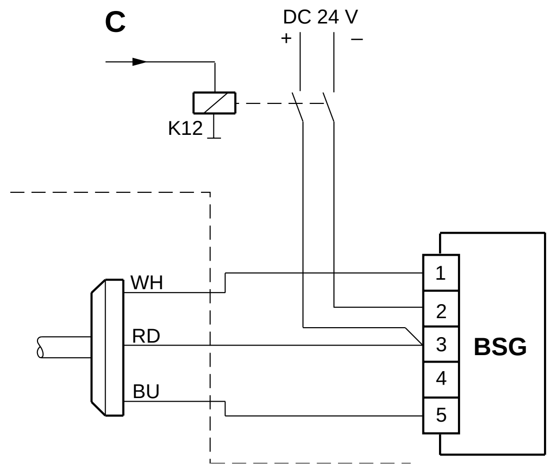
1165298443



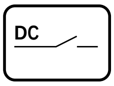
1165300875

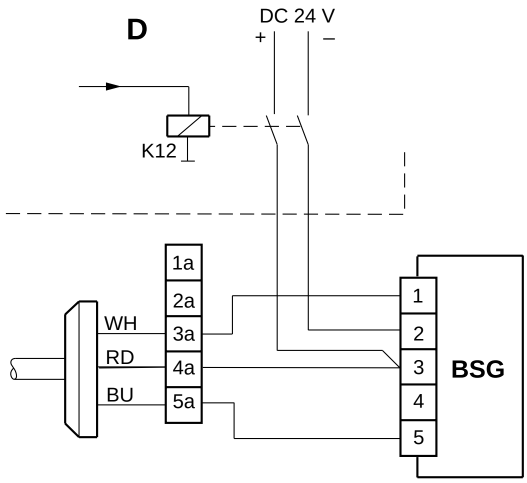
A Standard for brakemotor size 63 with DC 24 V brake
B Standard for brakemotor sizes 71 to 100 with BS in terminal box
[1] K12 is connected at the same time as K13 or K14 (direction of rotation)
[2] Protection circuit against switching overvoltages to be installed by the customer





1165225483



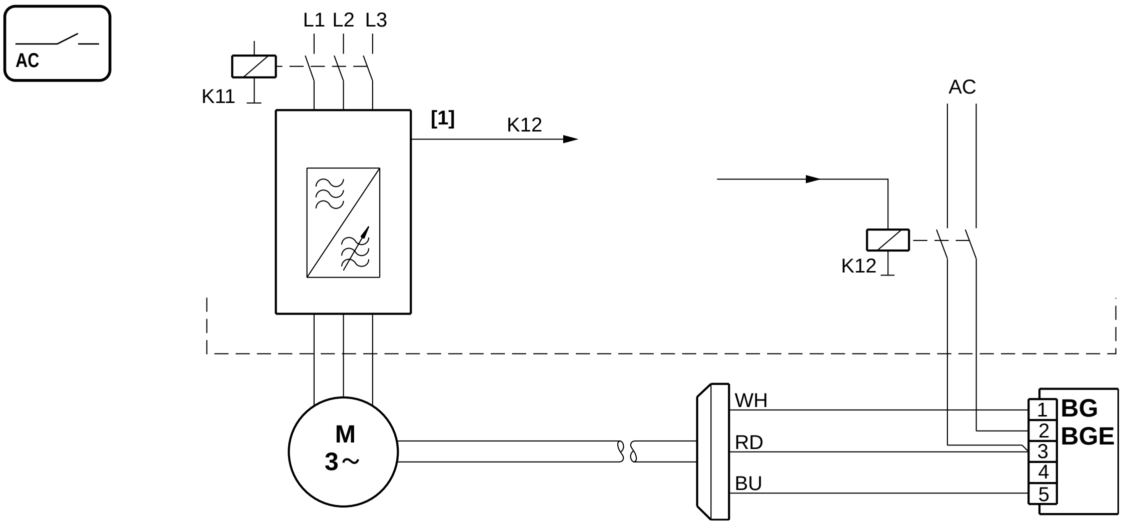


1165303307

C   Standard for brakemotor sizes 112 to 225 with BSG in terminal box
D   For brakemotor sizes 71 to 225 with BSG in control cabinet

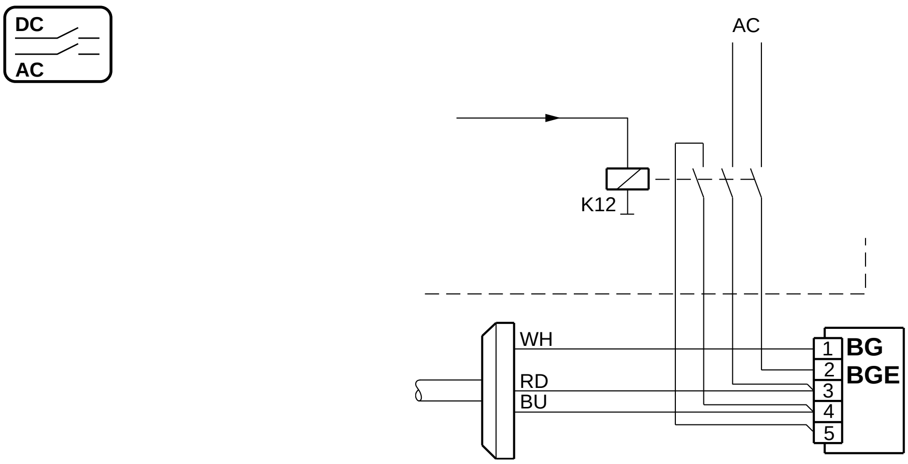
14.4 AC motors with frequency inverter

14.4.1 BG, BGE in terminal box, AC motor with frequency inverter



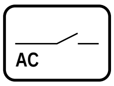
1165305739

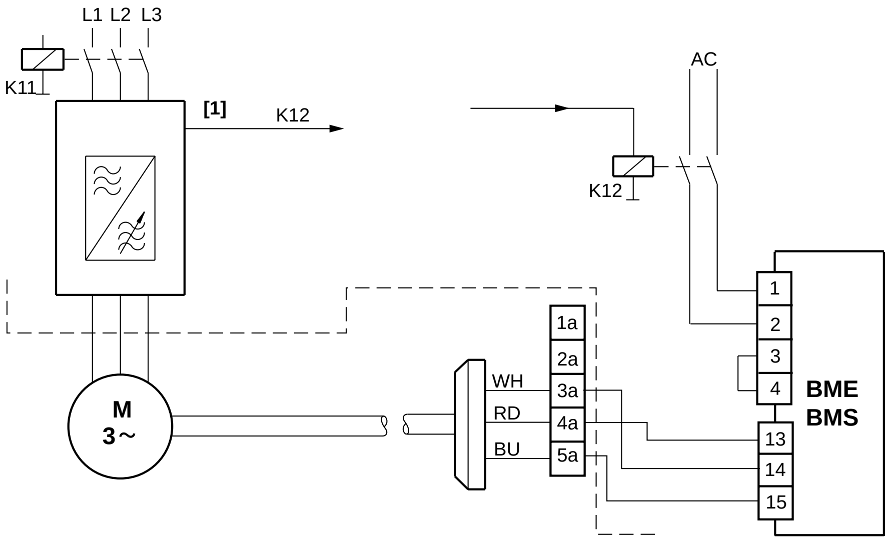
[1] Output brake command



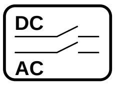
1165308171

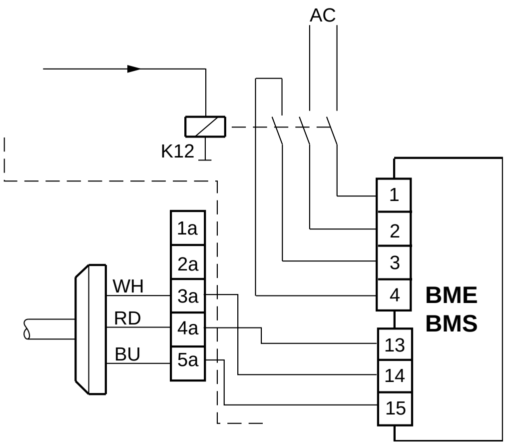
14.4.2 BMS, BME, BMP in control cabinet, AC motor with frequency inverter



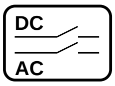


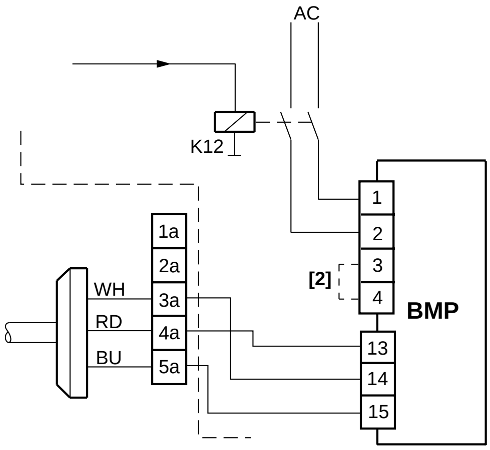
1165310603





1165313035

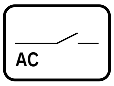


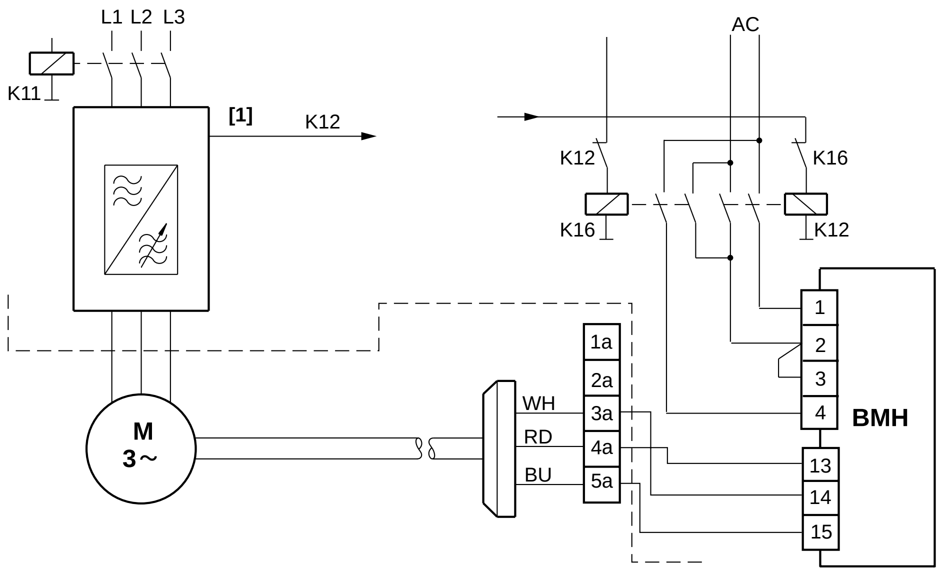


1165315467

[1] Output brake command
[2] Change jumper or NO contact from 3 to 4 if switching is to be in the AC circuit only

14.4.3 BMH in control cabinet, AC motor with frequency inverter





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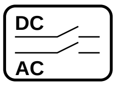
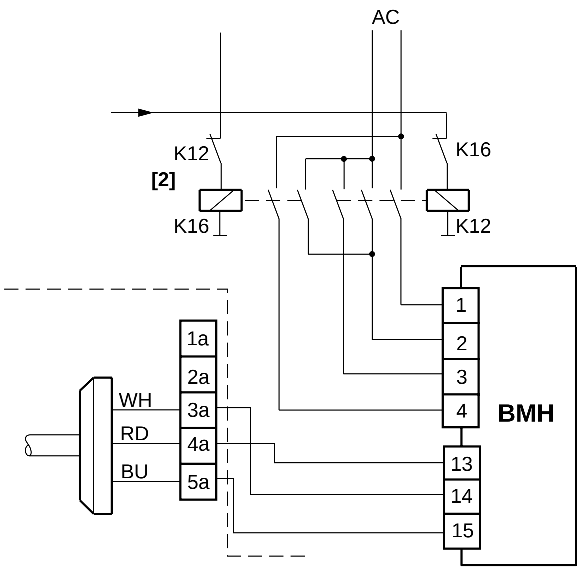
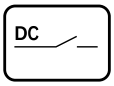


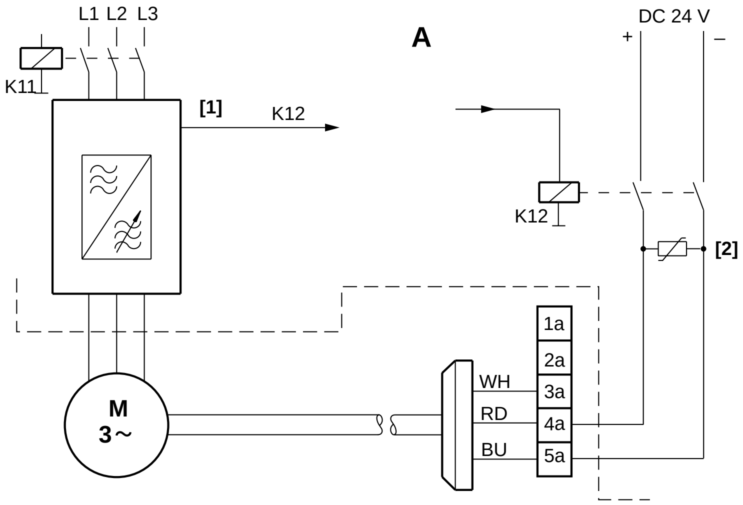


1165320331

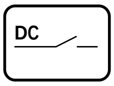
[1] Output brake command
[2] K16 must be operated to heat the brake. K16 is locked with K12. Heating mode only for longer breaks (see project planning specifications).

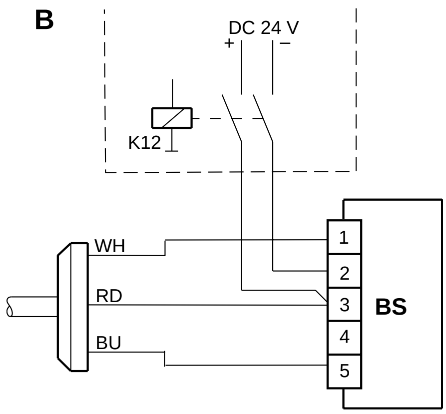
14.4.4 Brake control, DC 24 V, AC motor with frequency inverter



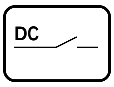


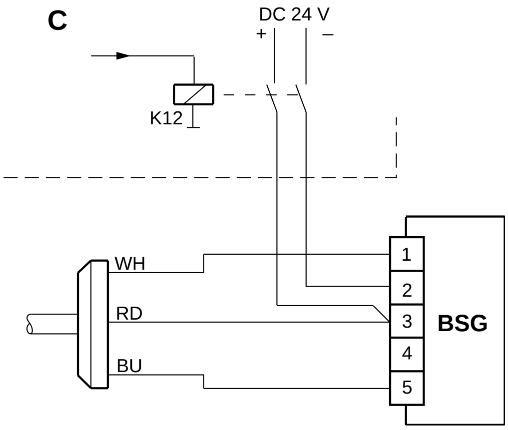
1165322763





1165325195

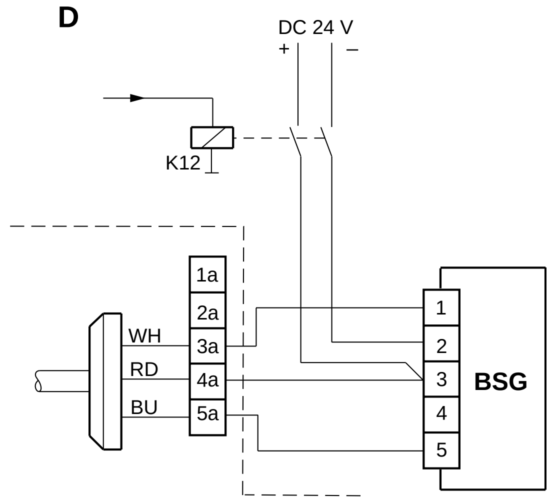




1165327627

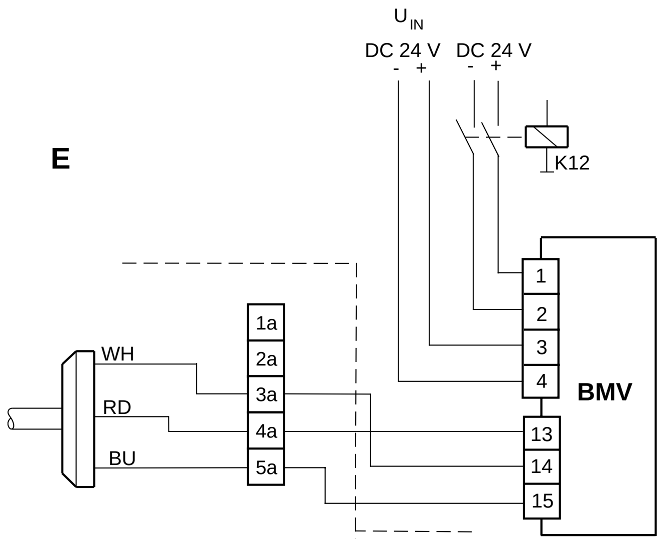
A Standard for brakemotor size 63 with DC 24 V brake
B Standard for brakemotor sizes 71 to 100 with BS in terminal box
C Standard for brakemotor sizes 112 to 225 with BSG in terminal box
[1] K12 is switched by the brake output
[2] Protection circuit against switching overvoltages to be installed by the customer

DC



1165330059

DC

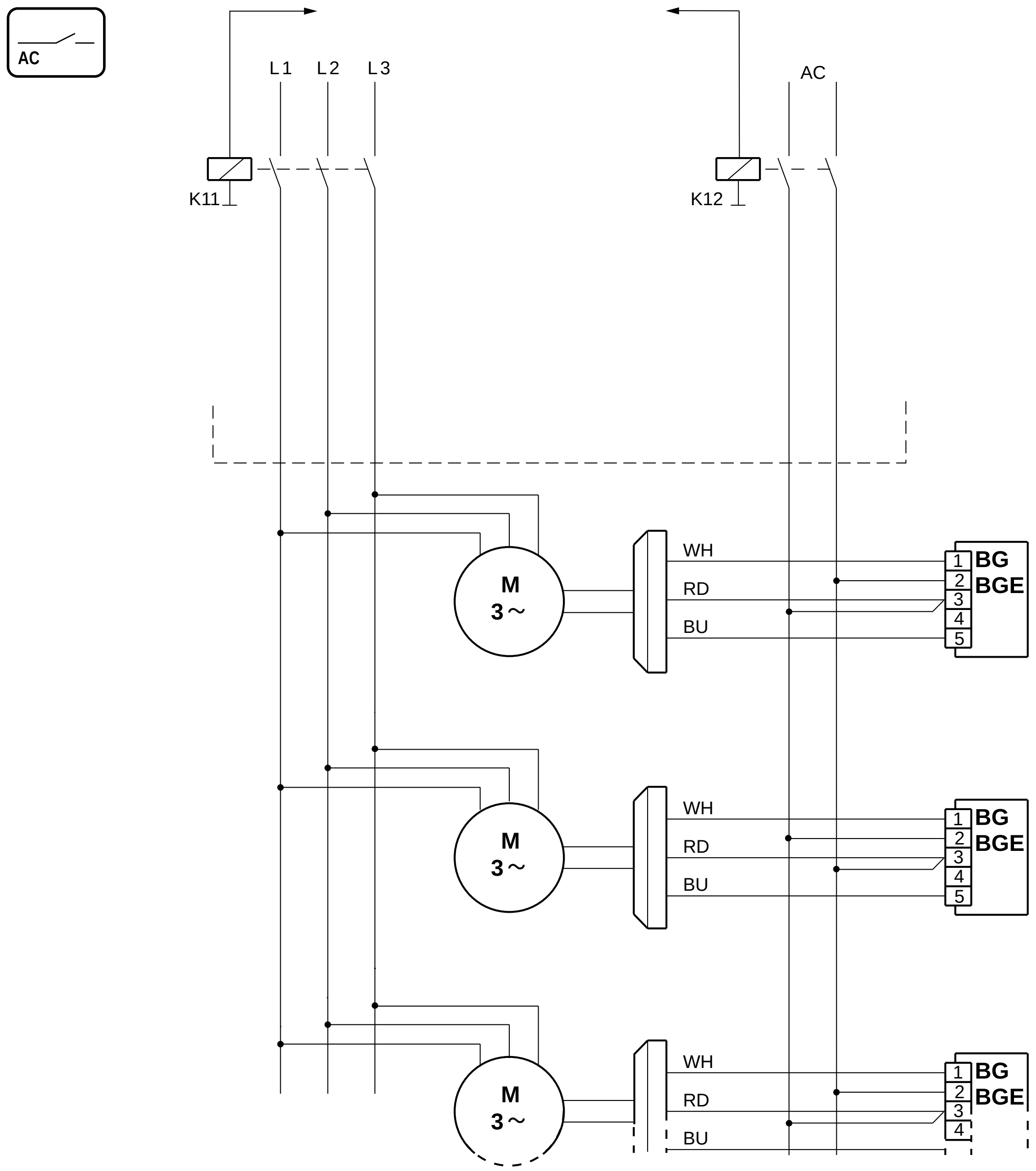


1165334923

D For brakemotor sizes 71 to 225 with BSG in control cabinet
E For brakemotor sizes 71 to 225 with BMV in control cabinet
V_{IN} = control signal

14.5 Multi-motor operation

14.5.1 Inverse-parallel connection of several BGs, BGEs in the terminal box to jointly switched supply voltage



1165916939

15 Technical Data

15.1 BR / BM(G) / BE brake for AC motors, asynchronous servomotors

The following table lists the technical data of the brakes. The type and number of brake springs used determines the level of the braking torque. Unless specified otherwise in the order, the braking torque M_B is double the rated motor torque M_N. Other brake spring combinations can produce the reduced braking torque values $M_{B\ red}$.

Brake Type	**For motor size**	**$M_{B\ max}$ [Nm]**	**Reduced braking torques $M_{B\ red}$ [Nm]**							**W_{Insp} [10^6J]**	**t_1 [10^{-3}s]**		**t_2 [10^{-3}s]**		**P_B [W]**
											t_1II	**t_1I**	**t_2II**	**t_2I**	
BMG02	**DT56**	1.2	0.8							15	–	28	10	100	25
BR03	**DR63**	3.2	2.4	1.6	0.8					200	–	25	3	30	26
BMG05	**DT71/80**	5.0	4	2.5	1.6	1.2				120	20	30	5	35	32
BMG1	**DT80**	10	7.5	6						120	20	50	8	40	36
BMG2	**DT90/DV100**	20	16	10	6.6	5				260	30	90	15	80	40
BMG4	**DV100**	40	30	24						260	35	130	15	80	50
BMG8	**DV112M**	55	45	37	30	19	12.6	9.5		600	30	–	12	60	70
	DV132S	75	55	45	37	30	19	12.6	9.5	600	35	–	10	50	70
BM15	**DV132M**	100	75	50	35	25				1000	40	–	14	70	95
	DV132ML/ DV160M	150	125	100	75	50	35	25		1000	50	–	12	50	95
BM30	**DV160L**	200	150	125	100	75	50			1500	55	–	18	90	120
	DV180M/L	300	250	200	150	125	100	75	50	1500	60	–	16	80	120
BM31	**DV200/225**	300	250	200	150	125	100	75	50	1500	60	–	16	80	120
BM32[1)]	**DV180M/L**	300	250	200	150	100				1500	55	–	18	90	120
BM62[1)]	**DV200/225**	600	500	400	300	250	200	150	100	1500	60	–	16	80	120
BMG61	**DV250/280**	600	500	400	300	200				2500	90	–	25	120	195
BMG122[1)]	**DV250/280**	1200	1000	800	600	400				2500	90	–	25	120	195

1) Double disk brake

Motor Type	**With brake type**	**$M_{B\ max}$ [Nm]**	**Reduced braking torques $M_{B\ red}$ [Nm]**							**W_{Insp} [10^6J]**	**t_1 [10^{-3}s]**		**t_2 [10^{-3}s]**		**P_B [W]**
											t_1II	**t_1I**	**t_2II**	**t_2I**	
BE05	**DR71 DR80**	5.0	3.5	2.5	1.8					120	15	34	10	42	32
BE1	**DR71 DR80 DR90**	10	7.0	5.0						120	10	55	12	76	32
BE2	**DR80 DR90/100**	20	14	10	7.0					165	17	73	10	68	43
BE5	**DR90/100 DR112/132**	55	40	28	20	14				260	37	–	10	70	49
BE11	**DR112/132 DR160**	110	80	55	40					640	41	–	15	82	76

Table continued on next page.

Motor Type	With brake type	$M_{B\ max}$ [Nm]	Reduced braking torques $M_{B\ red}$ [Nm]								W_{Insp} [10^6J]	t_1 [10^{-3}s]		t_2 [10^{-3}s]		P_B [W]
												t_1II	t_1I	t_2II	t_2I	
BE20	**DR160** **DR180**	200	150	110	80						1000	57	–	20	88	100
BE30	**DR180** **DR200/225**	300	200	150	100						1500	60	–	16	80	130
BE32[1)]	**DR180** **DR200/225**	600	500	400	300	200	150				1500	60	–	16	80	130
BE60	**DR200/225** **DR250/280**	600	500	400	300	200					2500	90	–	25	120	195
BE62[1)]	**DR200/225** **DR250/280**	1000	800	600	400						2500	90	–	25	120	195
BE120	**DR250/280** **DR315**	1000	800	600	400						2500	120	–	40	130	250
BE122[1)]	**DR315**	2000	1600	1200	800						2500	120	–	40	130	250

1) Double disk brake

$M_{B\ max}$	Maximum braking torque
$M_{B\ red}$	Reduced braking torque
W_{Insp}	Braking work until inspection/maintenance
t_1I	Response time for standard excitation
t_1II	Response time for high-speed excitation
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 circuits
P_B	Electrical power loss

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

15.2 BC brake for explosion-proof AC motors

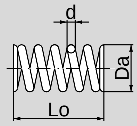
Brake	For motor size	$M_{B\ max}$ [Nm]	Reduced braking torque $M_{B\ red}$ [Nm]						W_{Insp} [10^6J]	t_1II [10^{-3}s]	t_2		P_B [W]
											t_2II [10^{-3}s]	t_2I [10^{-3}s]	
BC05	**eDT71/80**	7.5	6	5	4	2.5	1.6	1.2	60	20	8	40	29
BC2	**eDT90/100**	30	24	20	16	10	6.6	5	130	35	15	80	41

$M_{B\ max}$	Maximum braking torque
$M_{B\ red}$	Reduced braking torque
W_{Insp}	Braking work until inspection/maintenance
t_1II	Response time for high-speed excitation
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 circuits
P_B	Electrical power loss

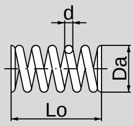
The response and application times are guide values in relation to the maximum braking torque.

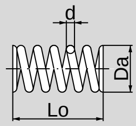
15.3 BM(G)/BR03/BC/BE braking torque

The following table gives an overview of braking torques as well as the type and number of brake springs for the BR.., BM(G).. and BC.. brakes:



Brake	Mounting on motor	Braking torque	Number and type of brake springs		Part (order) no. and brake spring dimensions									
					Normal				Part no. brake spring	Red				Part no. brake spring
		[Nm]	Normal	Red	Lo	Da	d	w		Lo	Da	d	w	
BR03	**DR63**	3.2	6	–	32	7	0.9	13.5	01858157	32	7	0.65	13.5	01858734
		2.4	4	2										
		1.6	3	–										
		0.8	–	6										
BMG05	**DT71/80**	5	3	–	30	7.6	1.3	14	0135017X	31.8	7.6	0.9	14	01350188
		4	2	2										
		2.5	–	6										
		1.6	–	4										
		1.2	–	3										
		0.8	–	2										
BMG1	**DT80**	10	6	–										
		7.5	4	2										
		6	3	3										
		5	3	–										
BC05	**eDT71/80**	7.5	4	2										
		6	3	3										
		5	3	–										
		4	2	2										
		2.5	–	6										
		1.6	–	4										
		1.2	–	3										
BMG2	**DT90/ DV100**	20	3	–	40.4	9.6	1.9	14	01351508	40.7	9.6	1.4	14	01351516
		16	2	2										
		10	–	6										
		6.6	–	4										
		5	–	3										
BMG4	**DV100**	40	6	–										
		30	4	2										
		24	3	3										
		20	3	–										
BC2	**eDT90/100**	30	4	2	40.4	9.6	1.9	14		40.7	9.6	1.4	14	
		24	3	3										
		20	3	–										
		16	2	2										
		10	–	6										
		6.6	–	4										
		5	–	3										

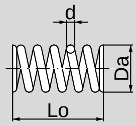
Brake	Mounting on motor	Braking torque	Number and type of brake springs		Part (order) no. and brake spring dimensions 									
					Normal				Part no. brake spring	Red				Part no. brake spring
		[Nm]	Normal	Red	Lo	Da	d	w		Lo	Da	d	w	
		75	6	–										
		55	4	2										
		45	3	3										
BMG8	**DV112M DV132S**	37	3	–	46.1	11	2.5	14	01848453	48	11	1.8	15	01355708
		30	2	2										
		19	–	6										
		12.6	–	4										
		9.5	–	3										
		150	6	–										
		125	4	2										
		100	3	3										
BM15	**DV132M DV132ML DV160M**	75	3	–		14.3	3.2	12	01844865	56.6	14.3	2.4	13	01844873
		50	–	6										
		35	–	4										
		25	–	3										
		300	8	–										
		250	6	2										
		200	4	4										
BM30	**DV160L DV180**	150	4	–										
		125	2	4										
		100	–	8										
		75	–	6										
		50	–	4	52									
		300	8	–										
		250	6	2										
		200	4	4		19.2	3.6	10	01874551	51.7	19.2	3.0	11	01874578
BM31	**DV200 DV225**	150	4	–										
		125	2	4										
		100	–	8										
		75	–	6										
		50	–	4										
		300	4	–										
		250	2	4										
BM32[1)]	**DV180**	200	–	8										
		150	–	6										
		100	–	4										



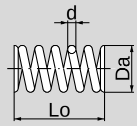
Brake	Mounting on motor	Braking torque [Nm]	Number and type of brake springs: Normal	Number and type of brake springs: Red	Part (order) no. and brake spring dimensions: Normal Lo	Normal Da	Normal d	Normal w	Part no. brake spring	Red Lo	Red Da	Red d	Red w	Part no. brake spring
BM62[1)]	**DV200 DV225**	600	8	–	52	19.2	3.6	10	01874551	51.7	19.2	3.0	11	01874578
		500	6	2										
		400	4	4										
		300	4	–										
		250	2	4										
		200	–	8										
		150	–	6										
		100	–	4										
BMG61	**DV250 DV280**	600	8	–	59.7	24	4.8	8	01868381	59.5	24	4.0	9.5	0186839x
		500	6	2										
		400	4	4										
		300	4	–										
		200	–	8										
BMG122[1)]	**DV250 DV280**	1200	8	–										
		1000	6	2										
		800	4	4										
		600	4	–										
		400	–	8										

1) Double disk brake

The following table gives an overview of braking torques as well as the type and number of brake springs for the BE... brakes:



Brake	Braking torque [Nm]	Number and type of brake springs: Normal	Number and type of brake springs: Blue	Part (order) no. and brake spring dimensions: Normal Lo	Normal Da	Normal d	Normal w	Part no. brake spring	Blue Lo	Blue Da	Blue d	Blue w	Part no. brake spring
BE05	5	2	4	30	7.6	1.3	14	0135017X	31.3	7.6	1.0	15	13741373
	3.5	2	2										
	2.5	–	6										
	1.8	–	3										
BE1	10	6	–										
	7.0	4	2										
	5.0	2	4										
BE2	20	6	–	36.7	8.3	1.5	1.5	13740245	37.2	8.3	1.3	13.5	13740520
	14	2	4										
	10	2	2										
	7.0	–	4										
BE5	55	6	–	43.7	11.2	2.2	13	13740709	43.5	11.2	2.0	13	13740717
	40	2	4										
	28	2	2										
	20	–	4										
	14	–	3										
BE11	110	6	–	50.7	13.3	2.9	12.5	13741837	51.3	13.3	2.6	12.5	13741845
	80	2	4										
	55	2	2										
	40	–	4										
BE20	200	6	–	59.8	15.3	3.6	12.5	13743228	64.1	15.3	2.8	14.5	13742485
	150	4	2										
	110	3	3										
	80	3	–										
BE30	300	8	–	52	19.2	3.6	10	01874551	51.7	19.2	3.0	11	13744356
	200	4	4										
	150	4	–										
	100	–	8										
BE32[1)]	600	8	–										
	500	6	2										
	400	4	4										
	300	4	–										
	200	–	8										
	150	–	6										

Brake	Braking torque	Number and type of brake springs		Part (order) no. and brake spring dimensions 									
				Normal				Part no. brake spring	Blue				Part no. brake spring
	[Nm]	Normal	Blue	Lo	Da	d	w		Lo	Da	d	w	
BE60	600	8	–	59.7	24	4.8	8	01868381	59.5	24	4.0	9.5	13745204
	500	6	2										
	400	4	4										
	300	4	–										
	200	–	8										
BE62[1]	1200	8	–										
	1000	6	2										
	800	4	4										
	600	4	–										
	400	–	8										
BE120	1000	8	–	80.2	32	6.0	9	13608770	80.2	32	4.8	9.5	13608312
	800	6	2										
	600	4	4										
	400	4	–										
BE122[1]	2000	8	–										
	1600	6	2										
	1200	4	4										
	800	4	–										

1) Double disk brake

15.4 B / BR / BP brake for synchronous servo motors

The following table shows the technical data of SEW brakes. The type and number of brake springs used determines the level of the braking torque. Unless specified otherwise in the order, the maximum braking torque M_{B1} is installed as standard.

Motor type	M_{B1} [Nm]	M_{B2} [Nm]	W_{Insp} [10^6J]	t_1II [10^{-3}s]	t_1I [10^{-3}s]	t_2II [10^{-3}s]	t_2I [10^{-3}s]
DS56M /B	2.5	–	–	7	–	–	5
DS56L /B	2.5	–	–	7	–	–	5
DS56H /B	5	–	–	8	–	–	5
CM71S /BR	10	5	60	20	–	40	100
CM71M /BR	14	7	60	25	–	30	90
CM71L /BR	14	10	60	30	–	20	90
CM90S /BR	28	14	90	30	–	35	120
CM90M /BR	40	20	90	35	–	25	90
CM90L /BR	40	28	90	40	–	25	90
CM112S /BR	55	28	180	35	–	35	100
CM112M /BR	90	40	180	40	–	25	80
CM112L /BR	90	55	180	40	–	25	80
CM112H /BR	90	50	180	40	–	25	80
CMP40 /BP **CMD55 /BP**	0.95	–	7	–	20	10	–
CMP50 /BP **CMD70 /BP**	4.3	3.1	10.2	–	40	10	–
CMP63 /BP **CMD93 /BP**	9.3	7	16	–	60	10	–
CMP71 /BP	14	7	19.5	–	60	20	–
CMP80 /BP **CMD138 /BP**	31	16	28	–	75	20	–
CMP100 /BP	47	24	33	–	130	20	–

M_{B1} Maximum braking torque

M_{B2} Reduced braking torque

W_{Insp} Braking work until inspection/maintenance

t_1II Response time for high-speed excitation

t_1I Response time for standard excitation

t_2II Brake application time for cut-off in the AC and DC circuits (for DS56, CMP and CMD motors, cut-off only in the direct current circuit)

t_2I Brake application time for cut-off in the AC circuit

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

15.5 Operating currents for brakes

The following tables list the operating currents of the brakes at differing 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 with direct DC voltage supply
- Rated voltage V_N (rated voltage range)

The accelerator current I_B (= inrush current) flows only for a short time (approx. 150 ms) when the brake is released. When the BG brake control or direct DC voltage supply is used (only possible to motor sizes DV100 or DR..BE2), increased inrush current does not occur.

The values for the holding currents I_H are r.m.s. values.

15.5.1 BMG02, BR03 brake

	BMG02	BR03
Motor size	DT56	DR63
Max. braking torque [Nm]	1.2	3.2
Electr. power loss P_B [W]	25	26
Inrush current ratio I_B/I_H	–	4

Rated voltage V_N		BMG02		BR03	
AC V	DC V	I_H [AC A]	I_G [DC A]	I_H [AC A]	I_G [DC A]
	24	–	0.72	–	0.95
24 (23-26)	**10**	–	–	1.96	2.47
42 (40-45)	**18**	–	–	1.06	1.34
48 (46-50)	**20**	–	–	0.94	1.18
53 (51-56)	**22**	–	–	0.84	1.06
60 (57-63)	**24**	–	–	0.75	0.95
67 (64-70)	**27**	–	–	0.67	0.84
73 (71-78)	**30**	–	–	0.59	0.74
85 (79-87)	**36**	–	–	0.53	0.67
92 (88-98)	**40**	–	–	0.475	0.59
110 (99-110)	**44**	–	–	0.42	0.53
120 (111-123)	**48**	–	–	0.375	0.48
133 (124-138)	**54**	–	–	0.335	0.42
147 (139-154)	**60**	–	–	0.300	0.38
160 (155-173)	**68**	–	–	0.265	0.34
184 (174-193)	**75**	–	–	0.24	0.30
208 (194-217)	**85**	–	–	0.210	0.26
230 (218-243)	**96**	0.14	0.18	0.190	0.24
254 (244-273)	**110**	–	–	0.168	0.21
290 (274-306)	**125**	–	–	0.149	0.19
318 (307-343)	**140**	–	–	0.133	0.16

Table continued on next page.

Rated voltage V_N		BMG02		BR03	
AC V	DC V	I_H [AC A]	I_G [DC A]	I_H [AC A]	I_G [DC A]
360 (344-379)	**150**	-	-	0.119	0.15
400 (380-431)	**170**	0.08	0.10	0.109	0.14
460 (432-500)	**190**	0.07	0.09	0.094	0.11

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 for DC voltage supply with rated voltage V_N

V_N Rated voltage (rated voltage range)

15.5.2 BMG05 / 1 / 2 / 4 brake

	BMG05	BMG1	BMG2	BMG4
Motor size	DT71/80	DT80	DT90/DV100	DV100
Max. braking torque [Nm]	5	10	20	40
Electr. power loss P_B [W]	32	36	40	50
Inrush current ratio I_B/I_H	4	4	4	4

Rated voltage V_N		BMG05		BMG1		BMG2		BMG4	
AC V	DC V	I_H [AC A]	I_G [DC A]	I_H [AC A]	I_G [DC A]	I_H [AC A]	I_G [DC A]	I_H [AC A]	I_G [DC A]
	24		1.38		1.54		1.77		2.20
24 (23-25)	**10**	2.0	3.3	2.3	3.7	–	–	–	–
42 (40-46)	**18**	1.18	1.74	1.26	1.94	1.43	2.25	1.87	2.80
48 (47-52)	**20**	1.05	1.55	1.13	1.73	1.28	2.00	1.67	2.50
56 (53-58)	**24**	0.94	1.38	1.00	1.54	1.146	1.77	1.49	2.20
60 (59-66)	**27**	0.83	1.23	0.89	1.37	1.01	1.58	1.33	2.00
73 (67-73)	**30**	0.74	1.10	0.80	1.23	0.90	1.41	1.18	1.76
77 (74-82)	**33**	0.66	0.98	0.71	1.09	0.80	1.25	1.05	1.57
88 (83-92)	**36**	0.59	0.87	0.63	0.97	0.72	1.12	0.94	1.40
97 (93-104)	**40**	0.53	0.78	0.56	0.87	0.64	1.00	0.84	1.25
110 (105-116)	**48**	0.47	0.69	0.50	0.77	0.57	0.90	0.752	1.11
125 (117-131)	**52**	0.42	0.62	0.45	0.69	0.51	0.80	0.66	1.00
139 (132-147)	**60**	0.37	0.55	0.400	0.61	0.450	0.70	0.59	0.88
153 (148-164)	**66**	0.33	0.49	0.355	0.55	0.405	0.63	0.53	0.79
175 (165-185)	**72**	0.30	0.44	0.32	0.49	0.36	0.56	0.47	0.70
200 (186-207)	**80**	0.265	0.39	0.28	0.43	0.32	0.50	0.42	0.62
230 (208-233)	**96**	0.235	0.35	0.25	0.39	0.285	0.44	0.375	0.56
240 (234-261)	**110**	0.210	0.31	0.225	0.35	0.255	0.40	0.335	0.50
290 (262-293)	**117**	0.187	0.28	0.200	0.31	0.23	0.35	0.300	0.44
318 (294-329)	**125**	0.166	0.25	0.178	0.27	0.2	0.31	0.265	0.39
346 (330-369)	**147**	0.148	0.22	0.159	0.24	0.18	0.28	0.235	0.35
400 (370-414)	**167**	0.132	0.20	0.142	0.22	0.161	0.25	0.210	0.31
440 (415-464)	**185**	0.118	0.17	0.126	0.19	0.143	0.22	0.187	0.28

Table continued on next page.

Rated voltage V_N		BMG05		BMG1		BMG2		BMG4	
AC V	DC V	I_H [AC A]	I_G [DC A]	I_H [AC A]	I_G [DC A]	I_H [AC A]	I_G [DC A]	I_H [AC A]	I_G [DC A]
500 (465-522)	**208**	0.105	0.15	0.113	0.17	0.128	0.20	0.167	0.25
575 (523-585)	**233**	0.094	0.14	0.10	0.15	0.114	0.17	0.149	0.22

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)

15.5.3 BMG8, BM15 / 30 / 31 / 32 / 62 brake

	BMG8	BM15	BM30 / 31; BM32 / 62
Motor size	DV112/132S	DV132M-160M	DV160L-225
Max. braking torque [Nm]	75	150	600
Electr. power loss P_B [W]	70	95	120
Inrush current ratio I_B/I_H	6.3	7.5	8.5

Rated voltage V_N		BMG8	BM15	BM30 / 31; BM32 / 62
AC V	DC V	I_H [AC A]	I_H [AC A]	I_H [AC A]
	24	2.77[1)]	4.15[1)]	4.00[1)]
42 (40-46)	–	2.31	3.35	–
48 (47-52)	–	2.10	2.95	–
56 (53-58)	–	1.84	2.65	–
60 (59-66)	–	1.64	2.35	–
73 (67-73)	–	1.46	2.10	–
77 (74-82)	–	1.30	1.87	–
88 (83-92)	–	1.16	1.67	–
97 (93-104)	–	1.04	1.49	–
110 (105-116)	–	0.93	1.32	1.78
125 (117-131)	–	0.82	1.18	1.60
139 (132-147)	–	0.73	1.05	1.43
153 (148-164)	–	0.66	0.94	1.27
175 (165-185)	–	0.59	0.84	1.13
200 (186-207)	–	0.52	0.74	1.00
230 (208-233)	–	0.46	0.66	0.90
240 (234-261)	–	0.41	0.59	0.80
290 (262-293)	–	0.36	0.53	0.71
318 (294-329)	–	0.33	0.47	0.63
346 (330-369)	–	0.29	0.42	0.57
400 (370-414)	–	0.26	0.37	0.50
440 (415-464)	–	0.24	0.33	0.44
500 (465-522)	–	0.20	0.30	0.40
575 (523-585)	–	0.18	0.26	0.36

1) Direct current for operation with BSG

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

I_B Accelerator current – brief inrush current

V_N Rated voltage (rated voltage range)

15.5.4 BMG61 / 122 brake

	BMG61	BMG122
Motor size	DV250M...280	
Max. braking torque [Nm]	600	1200
Electr. power loss P_B [W]	195	
Inrush current ratio I_B/I_H	6	

Rated voltage V_N AC V	BMG61 / 122 I_H [AC A]
208 (194-217)	1.50
230 (218-243)	1.35
254 (244-273)	1.20
290 (274-306)	1.10
318 (307-343)	1.00
360 (344-379)	0.85
400 (380-431)	0.75
460 (432-484)	0.65
500 (485-542)	0.60
575 (543-600)	0.54

I_B Accelerator current – brief inrush current
I_H Holding current, r.m.s. value in the supply cable to the SEW brake rectifier
V_N Rated voltage (rated voltage range)

15.5.5 B / BR1 / 2 / 8 brake

	B		BR1	BR2	BR8
Motor size	DFS56M/L	DFS56H	CFM71	CFM90	CFM112
Maximum braking torque [Nm]	2.5	5	20	40	90
Electr. power loss P_B [W]	10.8	13.4	45	55	75
Inrush current ratio I_B/I_H	–	–	4.0	4.0	6.3

Rated voltage V_N		B		BR1		BR2	BR8
[AC V]	[DC V]	I_G [DC A]	I_G [DC A]	I_H [AC A]	I_G [DC A]	I_H [AC A]	I_H [AC A]
	24	0.5	0.56	–	1.5	1.7	2.6
110 (99-110)		–	–	0.71	–	0.9	1.2
230 (218-243)		–	–	0.31	–	0.39	0.53
400 (380-431)		–	–	0.18	–	0.22	0.29
460 (432-484)		–	–	0.16	–	0.21	0.26

I_H Holding current, r.m.s. value in the supply cable to the SEW brake rectifier
I_B Accelerator current – brief inrush current
I_G Direct current with direct DC voltage supply
P_B Electrical power loss in W
V_N Rated voltage (rated voltage range)

15.5.6 BP01 – BP5 brake

	BP01	BP04	BP09	BP1	BP3	BP5
Motor size	CMP40 CMD55	CMP50 CMD70	CMP63 CMD93	CMP71	CMP80 CMD138	CMP100
Maximum braking torque [Nm]	0.95	4.3	9.3	14	31	47
Electr. power loss P_B [W]	7	10.7	16	19.5	25	33
Rated voltage V_N [DC V]	**BP01 I_G [DC A]**	**BP04 I_G [DC A]**	**BP09 I_G [DC A]**	**BP1 I_G [DC A]**	**BP3 I_G [DC A]**	**BP5 I_G [DC A]**
24	0.29	0.45	0.67	0.81	1.04	1.38

I_G Direct current with direct DC voltage supply

P_B Electrical power loss in W

V_N Rated voltage (rated voltage range)

15.5.7 BE05 – BE2 brake

		BE05 / 1		BE2	
Motor size		DR71 DR80	DR71 DR80 DR90	DR80 DR90/100	
Maximum braking torque [Nm]		5	10	20	
Electr. power loss P_B [W]		32		43	
Inrush current ratio I_B/I_H		4		4	
Rated voltage V_N		**BE05 / 1**		**BE2**	
[AC V]	**[DC V]**	I_H **[AC A]**	I_G **[DC A]**	I_H **[AC A]**	I_G **[DC A]**
24 (23-26)	**10**	2.25	2.9	2.95	3.8
60 (57-63)	**24**	0.9	1.17	1.18	1.53
120 (111-123)	**48**	0.45	0.59	0.59	0.77
184 (174-193)	**80**	0.285	0.37	0.375	0.485
208 (194-217)	**90**	0.255	0.33	0.335	0.43
230 (218-243)	**96**	0.225	0.295	0.3	0.385
254 (244-273)	**110**	0.2	0.265	0.265	0.345
290 (274-306)	**125**	0.18	0.235	0.24	0.305
330 (307-343)	**140**	0.161	0.21	0.21	0.275
360 (344-379)	**160**	0.143	0.186	0.189	0.245
400 (380-431)	**180**	0.127	0.166	0.168	0.215
460 (432-484)	**200**	0.114	0.148	0.15	0.194
500 (485-542)	**220**	0.101	0.132	0.134	0.172
575 (543-600)	**250**	0.09	0.118	0.119	0.154

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

I_B Accelerator current – brief inrush current

I_G Direct current with direct DC voltage supply

P_B Electrical power loss in W

V_N Rated voltage (rated voltage range)

15.5.8 BE5 – BE122 brake

	BE5	BE11	BE20	BE30/32		BE60/62		BE120/122	
Motor size	DR90/100 DR112/132	DR112/DR132 DR160	DR160 DR180	DR180 DR200/225		DR200/225 DR250/280		DR250 /280 DR315	DR315
Maximum braking torque [Nm]	55	110	200	300	600	600	1200	1000	2000
Electr. power loss P_B [W]	49	77	100 s	120		195		250	
Inrush current ratio I_B/I_H	5.7	6.6	7	8.5		6		4.9	

Rated voltage V_N		**BE5**		**BE11**		**BE20**		**BE30/32**		**BE60/62**		**BE120/122**	
[AC V]	**[DC V]**	I_H **[AC A]**	I_G **[DC A]**	I_H **[AC A]**	I_G **[DC A]**	I_H **[AC A]**	I_G **[DC A]**	I_H **[AC A]**	I_G **[DC A]**	I_H **[AC A]**	I_G **[DC A]**	I_H **[AC A]**	I_G **[DC A]**
	24	–	1.67	–	2.67	–	3.32	–	–	–	–	–	–
60 (57-63)		1.28	–	2.05	–	2.55	–	–	–	–	–	–	–
120 (111-123)		0.64	–	1.04	–	1.28	–	1.66	–	–	–	–	–
184 (174-193)		0.41	–	0.66	–	0.81	–	1.05	–	–	–	–	–
208 (194-217)		0.365	–	0.59	–	0.72	–	0.94	–	1.6	–	–	–
230 (218-243)		0.325	–	0.52	–	0.65	–	0.84	–	1.43	–	1.78	–
254 (244-273)		0.29	–	0.465	–	0.58	–	0.75	–	1.28	–	1.59	–
290 (274-306)		0.26	–	0.415	–	0.51	–	0.67	–	1.19	–	1.42	–
330 (307-343)		0.23	–	0.37	–	0.455	–	0.59	–	1.03	–	1.26	–
360 (344-379)		0.205	–	0.33	–	0.405	–	0.61	–	0.92	–	1.12	–
400 (380-431)		0.183	–	0.295	–	0.365	–	0.47	–	0.82	–	1.0	–
460 (432-484)		0.163	–	0.265	–	0.325	–	0.42	–	0.72	–	0.89	–
500 (485-542)		0.145	–	0.325	–	0.29	–	0.375	–	0.64	–	0.8	–
575 (543-600)		0.13	–	0.215	–	0.26	–	0.335	–	–	–	0.71	–

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

I_B Accelerator current – brief inrush current

I_G Direct current with direct DC voltage supply

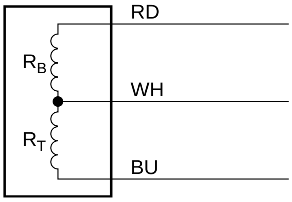
P_B Electrical power loss in W

V_N Rated voltage (rated voltage range)

15.6 Brake coil resistance

15.6.1 BMG02 / BR03

Voltage V_N		BMG02		BR03	
AC V	**DC V**	R_B	R_T	R_B	R_T
	24	8.46	24.2	6.0	18.0
24 (23-26)	**10**			0.95	2.8
42 (40-45)	**18**			3.0	8.9
60 (57-63)	**24**			6.0	18.0
110 (99-110)	**44**			19.0	56.5
120 (111-123)	**48**			23.9	71.2
133 (124-138)	**54**			30.1	89.6
208 (194-217)	**85**			75.6	225
230 (218-243)	**96**	121	345	95.2	283
254 (244-273)	**110**			120	357
290 (274-306)	**125**			151	449
318 (307-343)	**140**			190	565
360 (344-379)	**150**			239	712
400 (380-431)	**170**	374	1070	301	896
460 (432-484)	**190**	576	1650	379	1128



R_B Accelerator coil resistance at 20°C in Ω
R_T Coil section resistance at 20°C in Ω
V_N Rated voltage (rated voltage range)
RD Red
WH White
BU Blue

15.6.2 BE05, BE1, BE2 brake

Rated voltage V_N		BE05/1		BE2	
AC V	**DC V**	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	11.0
120 (111-123)	**48**	19.6	59.0	14.4	44.0
184 (174-193)	**80**	49.0	149	36.0	110
208 (194-217)	**90**	61.0	187	45.5	139
230 (218-243)	**96**	78.0	235	58.0	174
254 (244-273)	**110**	98.0	295	72.0	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	290	870
575 (543-600)	**250**	490	1490	365	1100

15.6.3 BE5, BE11, BE20 brake

Rated voltage V_N		BE5		BE11		BE20	
AC V	**DC V**	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	42.0	4.90	27.5	3.4	22.5
184 (174-193)	**–**	22.0	105	12.3	69.0	8.5	57.0
208 (194-217)	**–**	27.5	132	15.5	87.0	10.7	72.0
230 (218-243)	**–**	34.5	166	19.5	110.0	13.5	91.0
254 (244-273)	**–**	43.5	210	24.5	138.0	17.0	114.0
290 (274-306)	**–**	55.0	265	31.0	174.0	21.5	144.0
330 (307-343)	**–**	69.0	330	39.0	220.0	27.0	181.0
360 (344-379)	**–**	87.0	420	49.0	275.0	31.5	190.0
400 (380-431)	**–**	110	530	62.0	345.0	34.0	230.0
460 (432-484)	**–**	138	660	78.0	435.0	54.0	360.0
500 (485-542)	**–**	174	830	98.0	550.0	68.0	455.0
575 (543-600)	**–**	220	1050	119.0	670.0	85.0	570.0

15.6.4 BE30, BE32 brake

Rated voltage V_N		BE30 / BE32	
AC V	**DC V**	R_B	R_T
120 (111-123)	–	2.30	17.2
184 (174-193)	–	5.8	43.0
208 (194-217)	–	7.3	54.0
230 (218-243)	–	9.2	69.0
254 (244-273)	–	11.6	86.0
290 (274-306)	–	14.6	109
330 (307-343)	–	18.3	137
360 (344-379)	–	23.0	146
400 (380-431)	–	29.0	215
460 (432-484)	–	36.5	275
500 (485-542)	–	46.0	345
575 (543-600)	–	58.0	430

15.6.5 Brake BE60, BE62

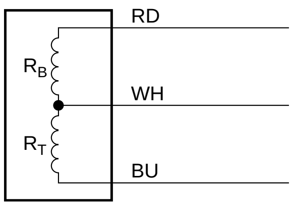
Rated voltage V_N		BE60 / BE62	
AC V	**DC V**	R_B	R_T
230 (218-243)	–	5.0	41.0
254 (244-273)	–	6.3	52.0
290 (274-306)	–	5.6	64.0
360 (344-379)	–	12.6	101
400 (380-431)	–	15.8	128
460 (432-484)	–	19.9	163
500 (485-542)	–	25.5	205

15.6.6 Brake BE120, BE122

Rated voltage V_N		BE120 / BE122	
AC V	**DC V**	R_B	R_T
230 (218-243)	–	7.6	29.5
254 (244-273)	–	9.5	37.0
290 (274-306)	–	12.0	46.5
330 (307-343)	–	15.2	58.7
360 (344-379)	–	19.1	74.0
400 (380-431)	–	24.0	93.0
460 (432-484)	–	30.0	117
500 (485-542)	–	38.0	147
575 (543-600)	–	48.0	185

15.6.7 BMG05 / BMG1 / BMG2 / BMG4 brake

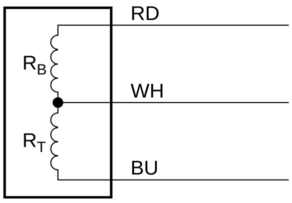
Voltage V_N		BMG05		BMG1		BMG2		BMG4	
AC V	**DC V**	R_B	R_T	R_B	R_T	R_B	R_T	R_B	R_T
	24	4.4	13.4	3.9	12.1	3.4	10.2	2.7	8.2
24 (23-25)	**10**	0.70	2.14	0.63	1.88	-	-	-	-
42 (40-46)	**18**	2.8	8.5	2.5	7.6	2.1	6.5	1.7	5.2
48 (47-52)	**20**	3.5	10.7	3.1	9.6	2.7	8.1	2.2	6.5
56 (53-58)	**24**	4.4	13.4	3.9	12.1	3.4	10.2	2.7	8.2
110 (105-116)	**48**	17.6	53.4	15.6	48.1	13.6	40.5	10.9	32.7
125 (117-131)	**52**	22.1	67.2	19.7	60.6	17.1	51.0	13.7	41.1
139 (132-147)	**60**	27.9	84.6	24.8	76.2	21.5	64.3	16.9	51.8
175 (165-185)	**72**	44.2	134	39.3	121	34.1	102	27.4	82.0
200 (186-207)	**80**	55.6	169	49.5	152	42.9	128	34.5	103
230 (208-233)	**96**	70.0	213	62.3	192	54.0	161	43.4	130
240 (234-261)	**110**	88.1	268	78.4	241	68.0	203	54.6	164
290 (262-293)	**117**	111	337	98.7	304	85.6	256	68.8	206
318 (294-329)	**125**	140	424	124	382	108	322	86.6	259
346 (330-369)	**147**	176	534	157	481	136	405	109	327
400 (370- 414)	**167**	221	672	197	608	171	510	137	411
440 (415-464)	**185**	279	846	248	762	215	643	173	518
500 (465-522)	**208**	351	1066	312	960	271	809	218	652
575 (523-585)	**233**	442	1341	393	1208	341	1018	274	820



R_B Accelerator coil resistance at 20°C in Ω
R_T Coil section resistance at 20°C in Ω
V_N Rated voltage (rated voltage range)
RD Red
WH White
BU Blue

15.6.8 BMG8 / BM15 / BM30 / 31 / 32 / 62 brake

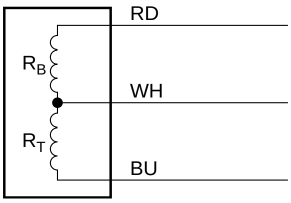
Voltage V_N		BMG8		BM15		BM30 / 31 / 32 / 62	
AC V	**DC V**	R_B	R_T	R_B	R_T	R_B	R_T
	24	1.4	7.5	0.8	5.0	0.67	5.0
42 (40-46)		0.90	4.7	0.5	3.2	-	-
48 (47-52)		1.1	5.9	0.6	4.0	-	-
56 (53-58)		1.4	7.5	0.8	5.0	0.6	4.2
110 (105-116)		5.7	29.8	3.1	20.1	2.2	16.8
125 (117-131)		7.1	37.5	3.9	25.3	2.8	21.1
139 (132-147)		9.0	47.2	4.9	31.8	3.5	26.6
175 (165-185)		14.2	74.8	7.8	50.5	5.6	42.1
200 (186-207)		17.9	94.2	9.8	63.5	7.1	53.0
230 (208-233)		22.5	119	12.4	80.0	8.9	66.7
240 (234-261)		28.3	149	15.6	101	11.2	84.0
290 (262-293)		35.7	188	19.6	127	14.1	106
318 (294-329)		44.9	237	24.7	160	17.8	133
346 (330-369)		56.5	298	31.1	201	22.3	168
400 (370-414)		71.2	375	39.2	253	28.1	211
440 (415-464)		89.6	472	49.3	318	35.4	266
500 (465-522)		113	594	62.1	401	44.6	334
575 (523-585)		142	748	78.2	505	56.1	421



R_B Accelerator coil resistance at 20°C in Ω
R_T Coil section resistance at 20°C in Ω
V_N Rated voltage (rated voltage range)
RD Red
WH White
BU Blue

15.6.9 BMG61 / 122 brake

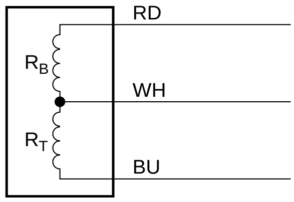
Voltage V_N	BMG61 / 122	
AC V	R_B	R_T
208 (194-217)	4.0	32.6
230 (218-243)	5.0	41.0
254 (244-273)	6.3	51.6
290 (274-306)	7.9	65
318 (307-343)	10.0	81.8
360 (344-379)	12.6	103
400 (380-431)	15.8	130
460 (432-484)	19.9	163
500 (485-542)	25.1	205
575 (543-600)	31.6	259



R_B Accelerator coil resistance at 20°C in Ω
R_T Coil section resistance at 20°C in Ω
V_N Rated voltage (rated voltage range)
RD Red
WH White
BU Blue

15.6.10 BR1 / BR2 / BR8 brake

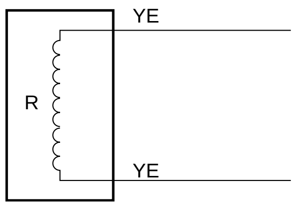
Voltage V_N		BR1		BR2		BR8	
AC V	**DC V**	R_B	R_T	R_B	R_T	R_B	R_T
	24	3.7	11.2	3.3	9.8	1.49	7.6
110 (98-110)		11.8	35.4	10.5	31	4.7	24.1
230 (217-242)		59.2	178	52.6	156	23.5	121
400 (385-431)		187	561	158	469	73.1	375
460 (432-484)		236	707	199	590	90.3	463



R_B Accelerator coil resistance at 20°C in Ω
R_T Coil section resistance at 20°C in Ω
V_N Rated voltage (rated voltage range)
RD Red
WH White
BU Blue

15.6.11 BP01 – BP5 brake

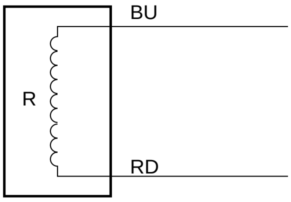
Voltage V_N	BP01	BP04	BP09	BP1	BP3	BP5
DC V	**R**	**R**	**R**	**R**	**R**	**R**
24	84	56.5	35	29.4	20.5	17.3



R Resistance at 20°C in Ω
V_N Rated voltage
YE Yellow

15.6.12 B.. brake

Voltage V_N DC V	DFS56M/L R	DFS56H R
24	53.2	43.1



R Resistance at 20°C in Ω
V_N Rated voltage
BU Blue
RD Red

15.7 Coils and rectifier data for BC.. brakes, category 2G/2D (zone 1/21), protection type deIIB/IP65

	BC05	BC2
Motor size	eDT 71	eDT 90/100
Max. braking torque [Nm]	7.5	30
Electr. power loss P_B [W]	29	41
Inrush current ratio I_B/I_H	4	4

Rated voltage V_N		BC05		BC2	
AC V	**DC V**	I_H [AC A]	I_G [DC A]	I_H [AC A]	I_G [DC A]
	24	1.1	0.86	1.57	1.13
200 (186-207)	**80**	0.24	0.31	0.31	0.44
230 (208-233)	**96**	0.21	0.27	0.28	0.40
240 (234-261)	**110**	0.19	0.24	0.25	0.35
290 (262-293)	**117**	0.17	0.22	0.23	0.32
346 (330-369)	**147**	0.13	0.18	0.18	0.24
400 (370-414)	**167**	0.12	0.15	0.15	0.22
440 (415-464)	**185**	0.11	0.14	0.14	0.20
500 (465-500)	**208**	0.10	0.12	0.12	0.17

P_B Electr. power loss in W
I_H Holding current
I_G Direct current in the brake coil
I_B/I_H Inrush current ratio
V_N Rated voltage (rated voltage range)

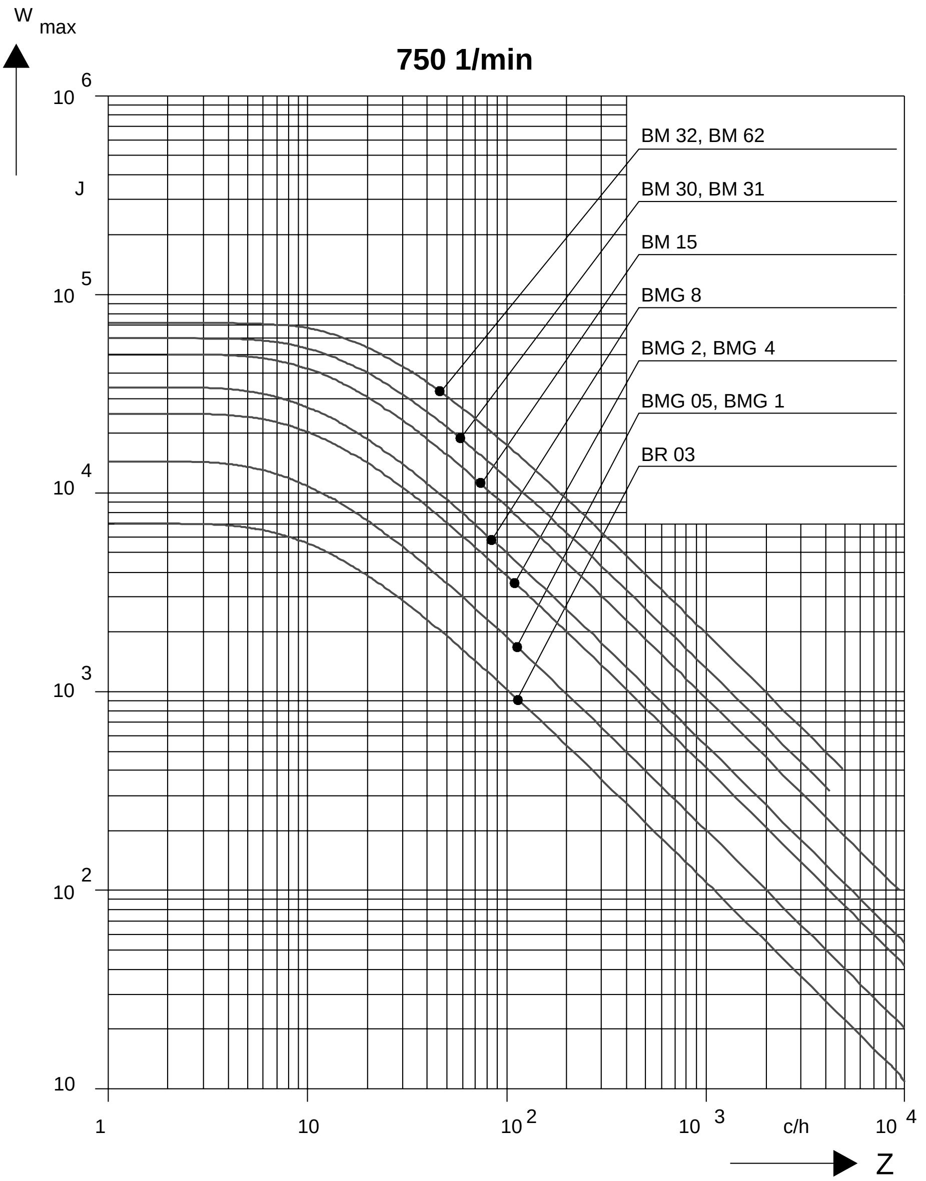
The following table shows the resistances of the BC.. brakes:

Voltage V_N		BC05		BC2	
AC V	**DC V**	R_B	R_T	R_B	R_T
	24	4.8	14.9	3.4	10.3
200 (186-207)		60.5	187	42.5	130
230 (217-242)		76.7	235	53.5	164
240 (234261)		95.5	296	67.4	206
290 (262-293)		121	373	84.8	259
318 (294-329)		152	470	107	327
346 (330-369)		191	591	134	411
400 (385-431)		241	744	169	518
440 (4415-464)		303	937	213	652
500 (465-500)		382	1178	268	822

15.8 Permitted work done by BM(G) brake, BR03 for AC motors, asynchronous servomotors

If you are using a brakemotor, you must check whether the brake is approved for use with the required starting frequency Z. The following diagrams show the approved work done W_{max} per cycle for the various brakes and rated speeds. The values are given with reference to the required starting frequency Z in cycles/hour (1/h).

Example: The rated speed is 1,500 rpm (see diagram for 1,500 rpm) and brake BM 32 is used. At 200 cycles per hour, the permitted work done per cycle is 9,000 J.



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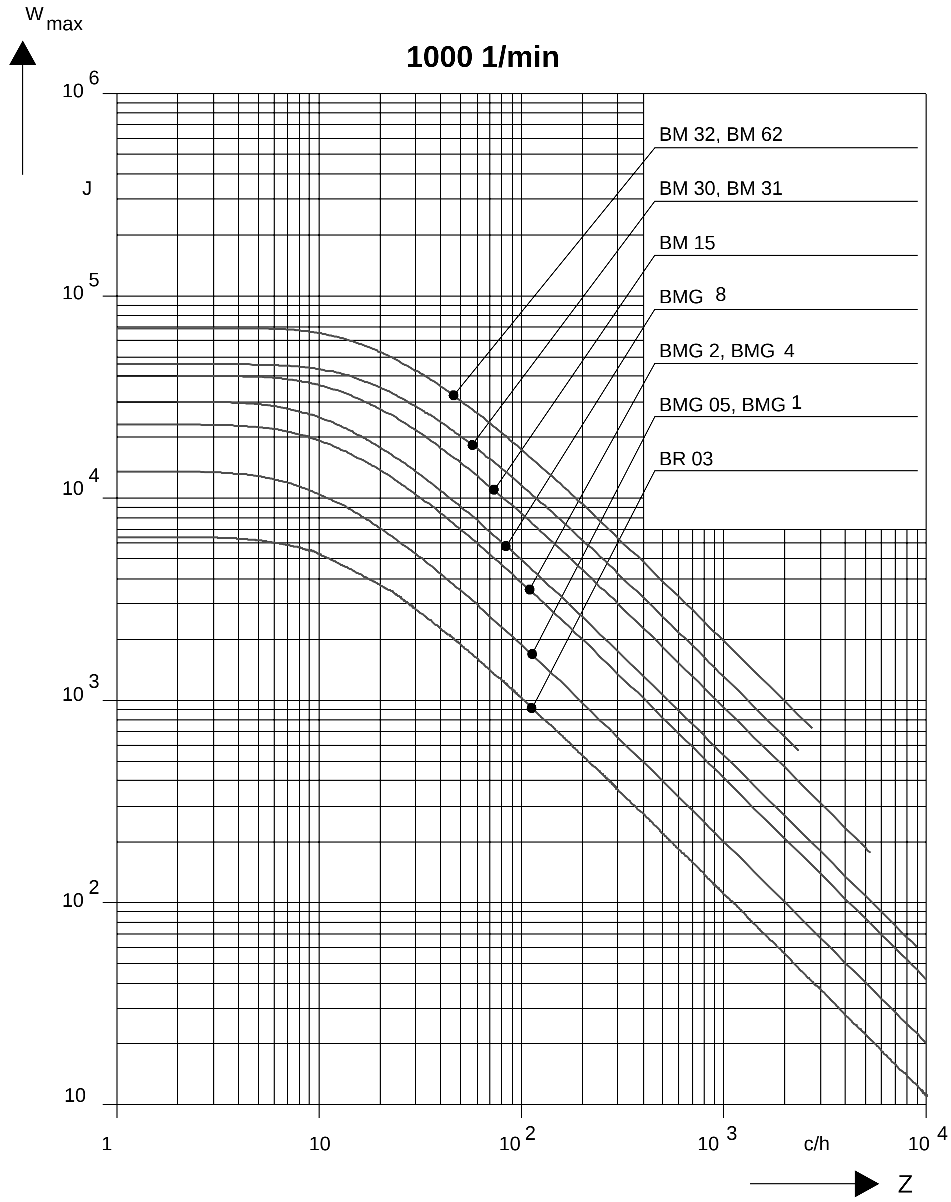
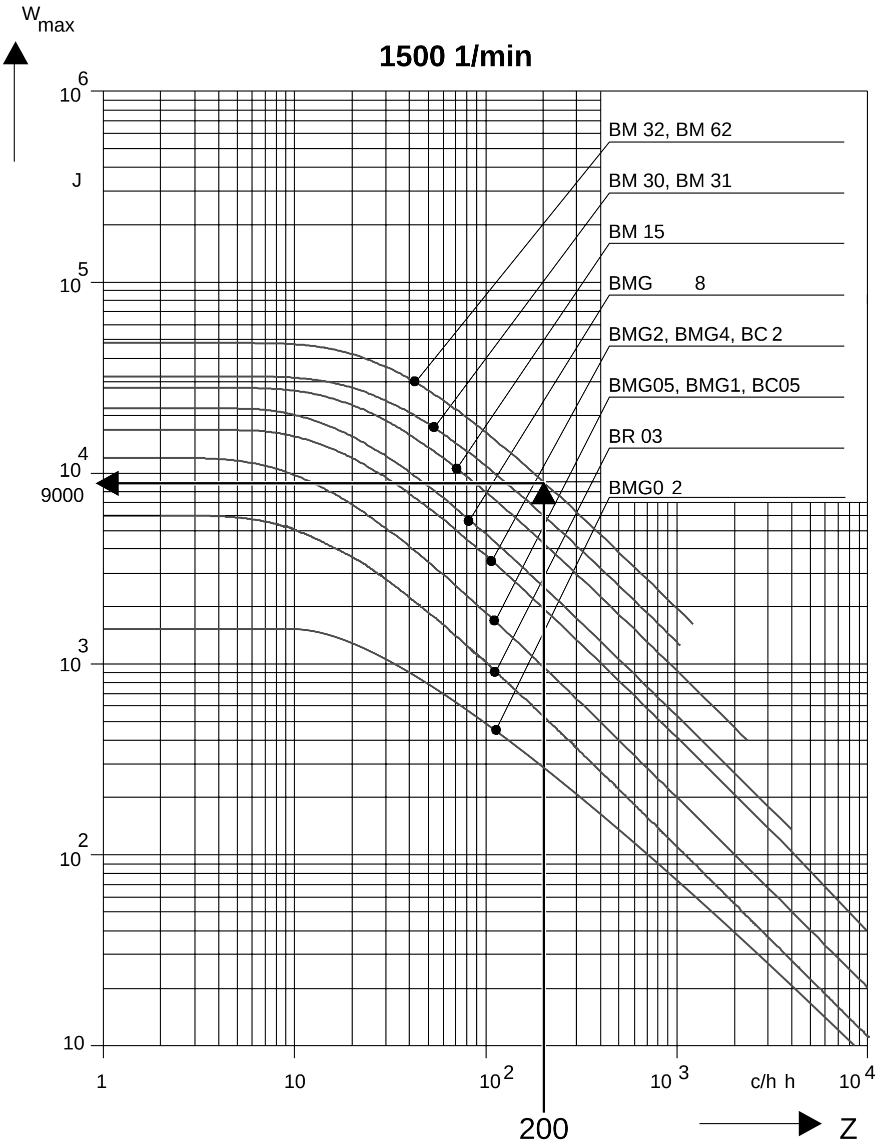
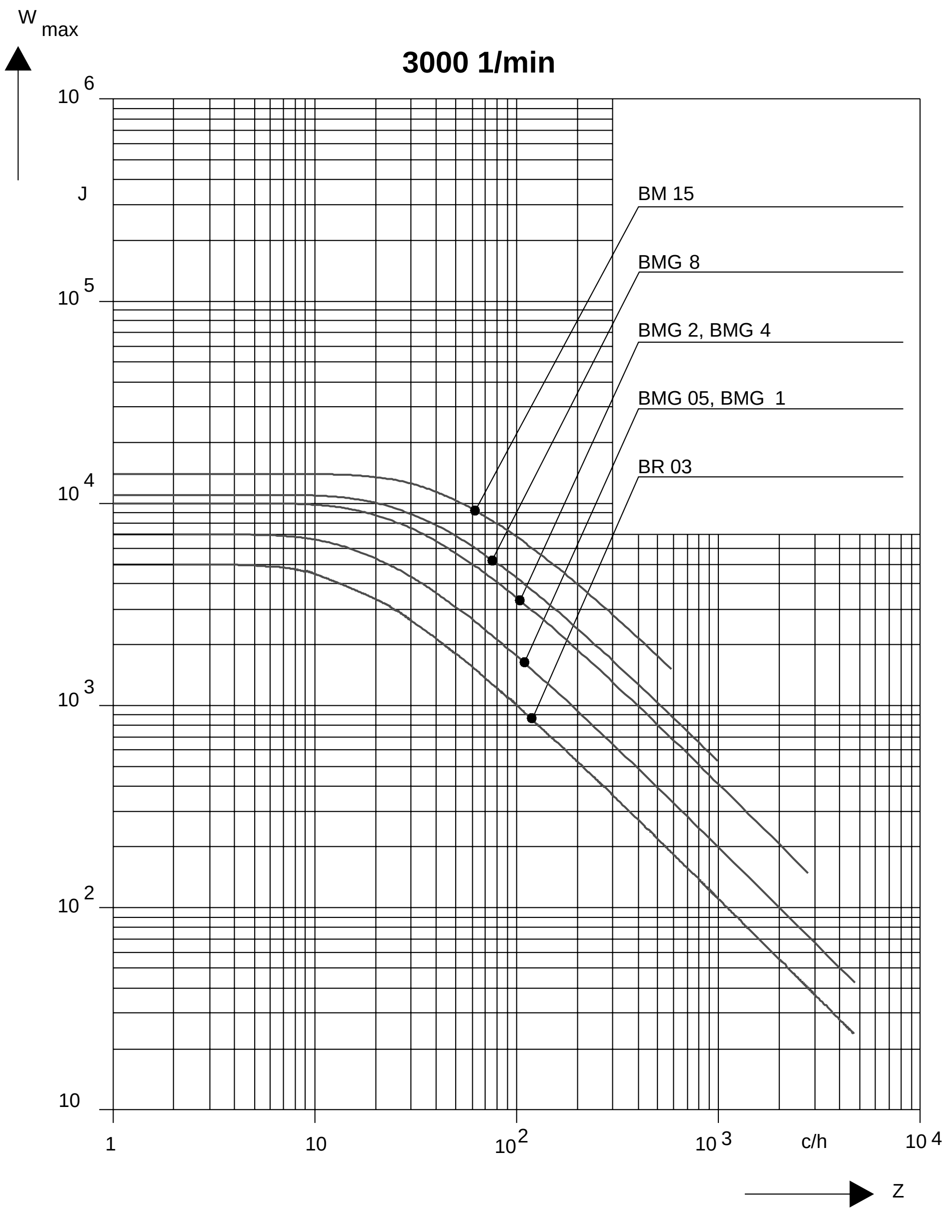

W max
J
1000 1/min
10 6
10 5
10 4
10 3
10 2
10
1
10
10 2
10 3
c/h
10 4
Z
BM 32, BM 62
BM 30, BM 31
BM 15
BMG 8
BMG 2, BMG 4
BMG 05, BMG 1
BR 03

1541735179


W max
J
1500 1/min
BM 32, BM 62
BM 30, BM 31
BM 15
BMG 8
BMG2, BMG4, BC 2
BMG05, BMG1, BC05
BR 03
BMG0 2
9000
200
c/h h
Z

1541740043



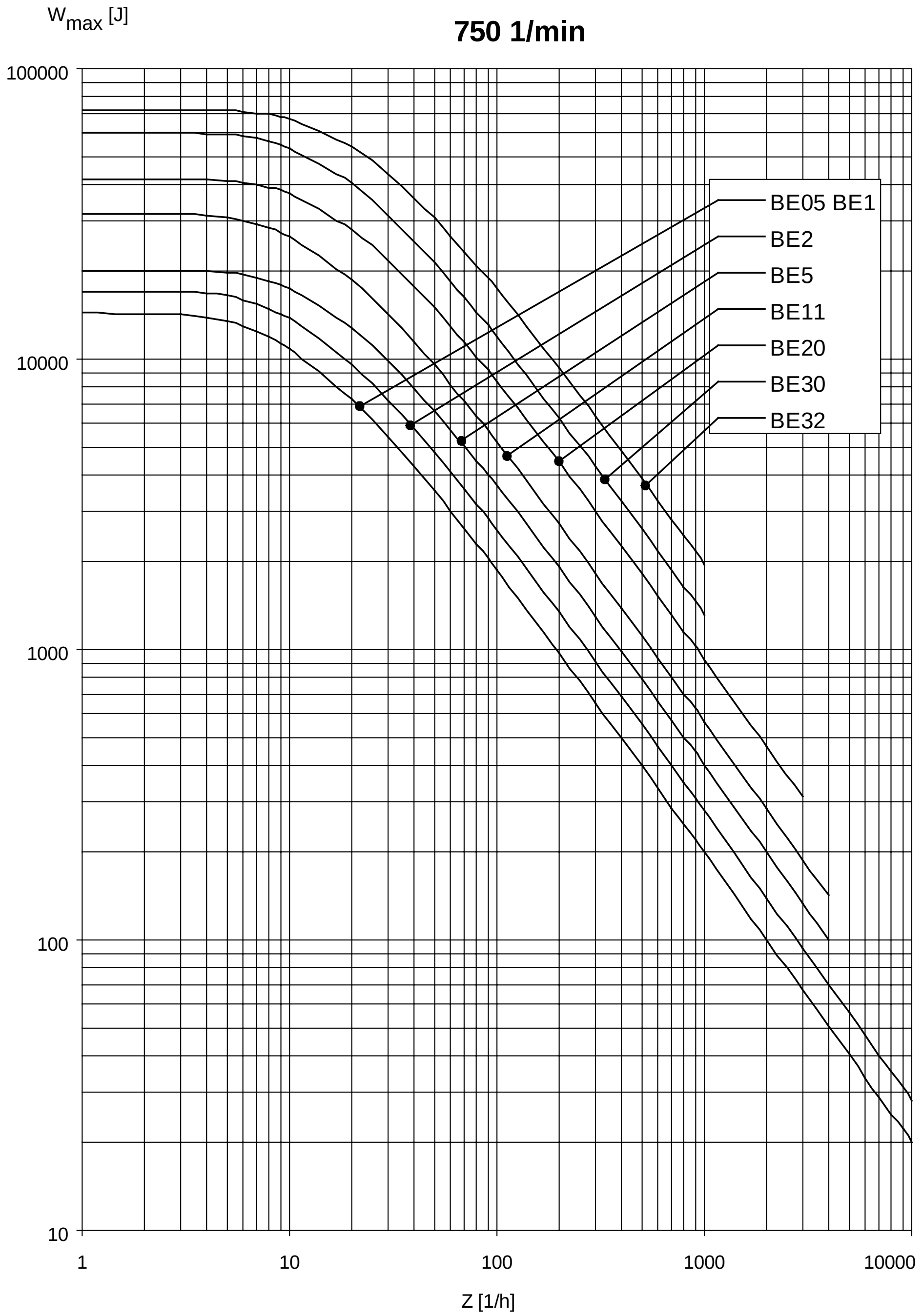
1542536075

15.8.1 BMG61, BMG122

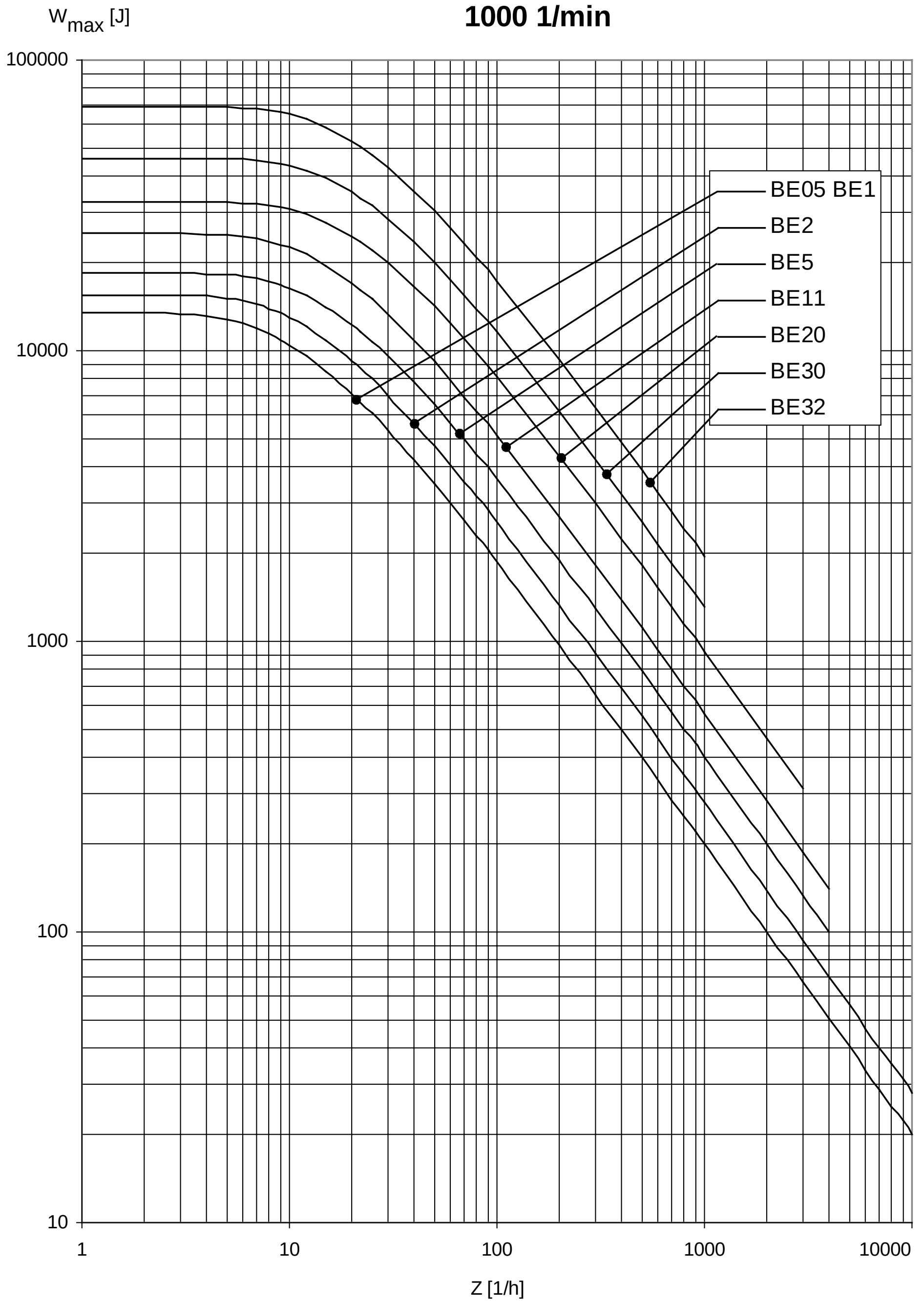
Contact SEW-EURODRIVE for the values for the permitted work done by BMG61 and BMG122 brakes.

15.9 Permitted work done by the BE brake for AC motors

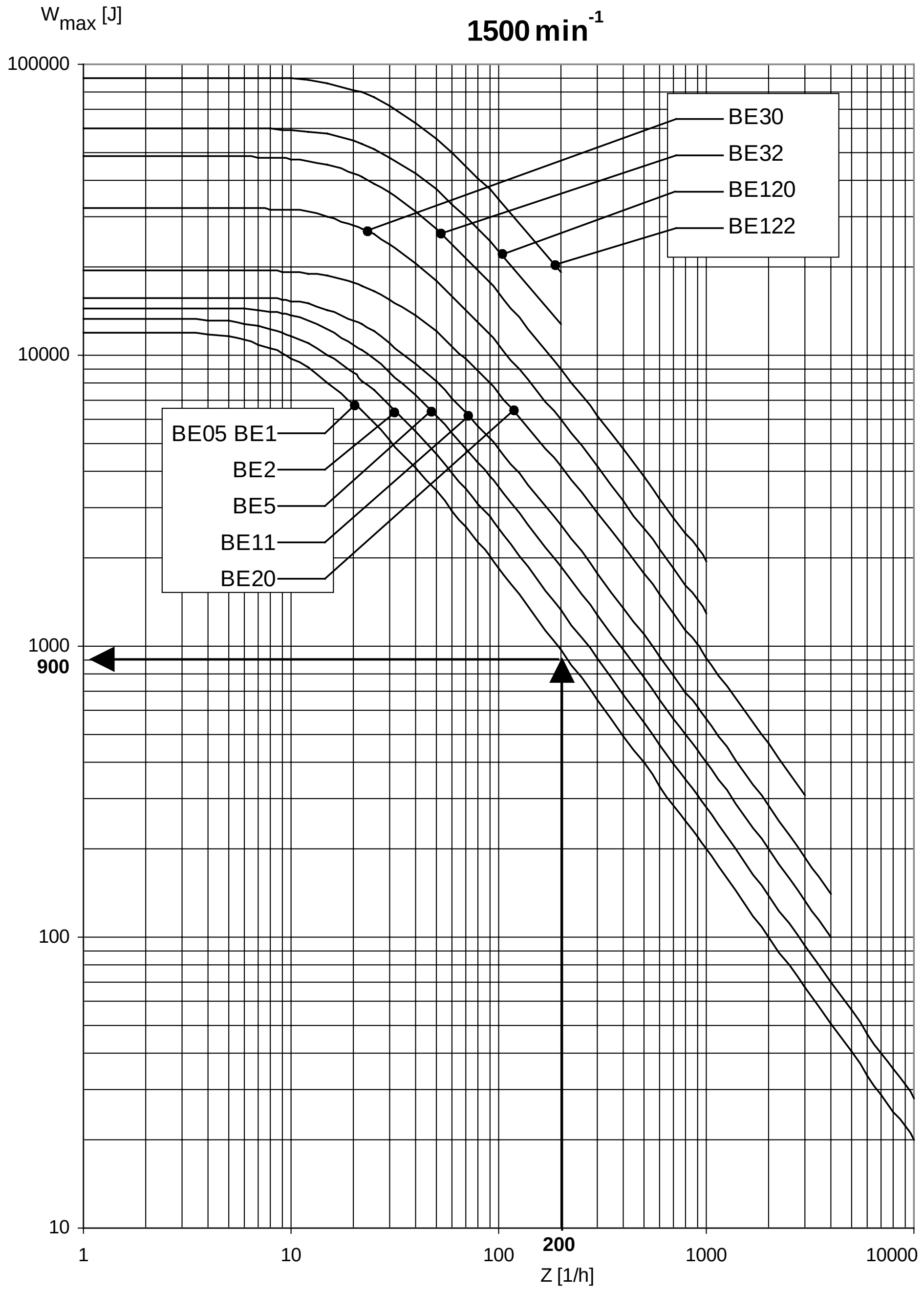
If you are using a brakemotor, you must check whether the brake is approved for use with the required starting frequency Z. The following diagrams show the approved work done W_{max} per cycle for the various brakes and rated speeds. The values are given with reference to the required starting frequency Z in cycles/hour (1/h).



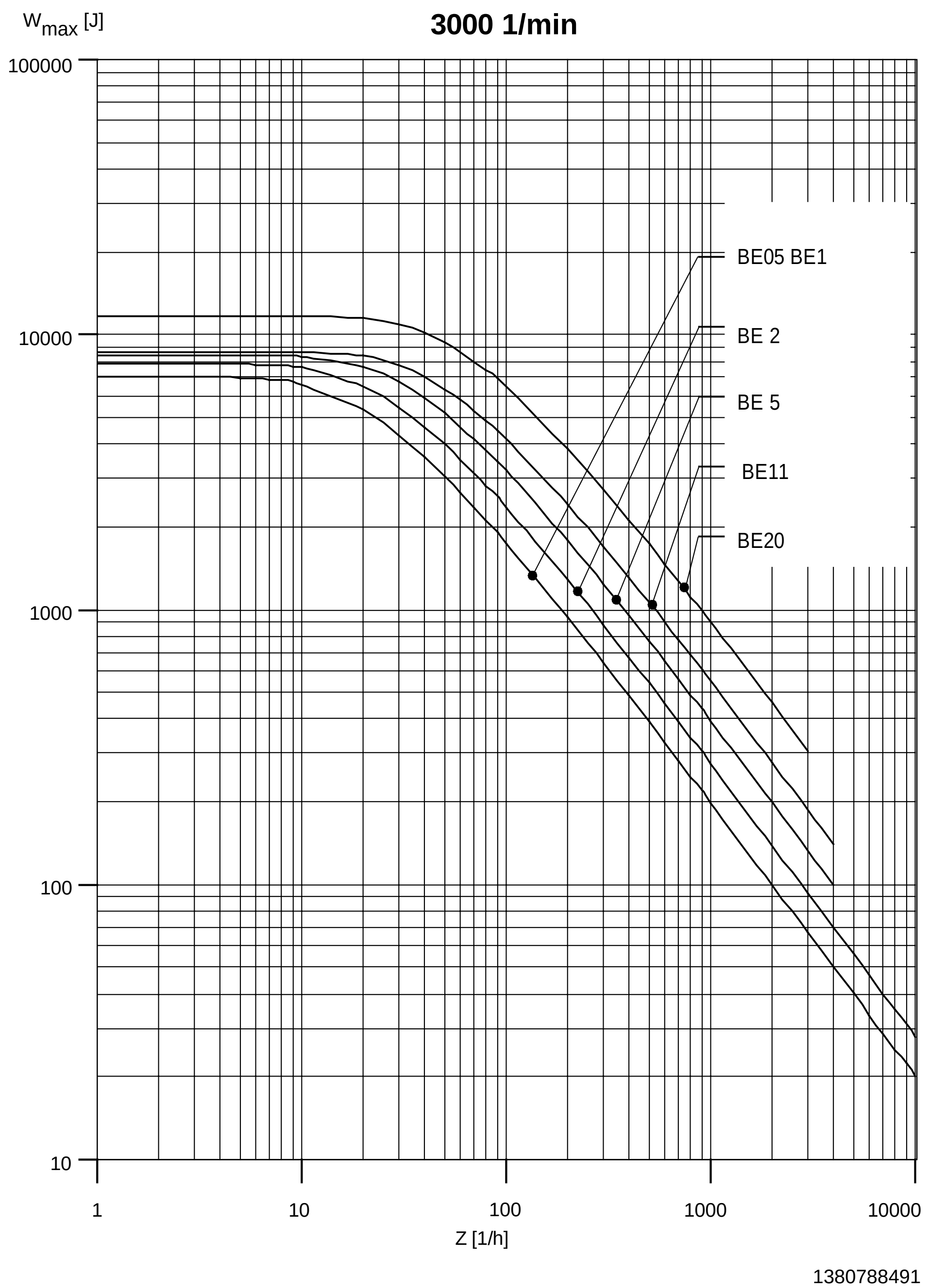
1380742795


W_{max} [J]
1000 1/min
100000
10000
1000
100
10
1
10
100
1000
10000
Z [1/h]
BE05 BE1
BE2
BE5
BE11
BE20
BE30
BE32

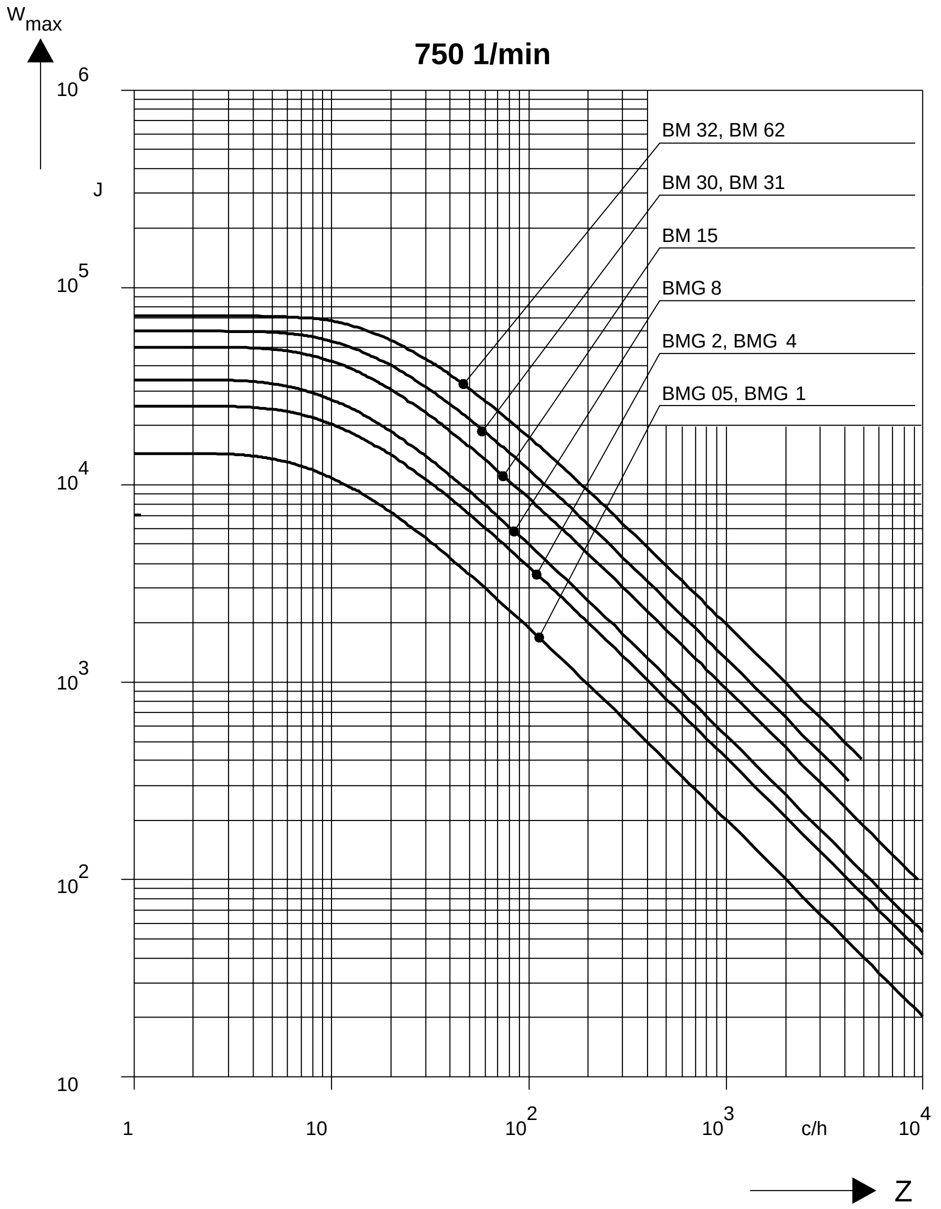
1380786059


W_{max} [J]
1500 min⁻¹
100000
10000
1000
900
100
10
1
10
100
200
1000
10000
Z [1/h]
BE30
BE32
BE120
BE122
BE05 BE1
BE2
BE5
BE11
BE20

1380745227


3000 1/min
W_{max} [J]
100000
10000
1000
100
10
1
10
100
1000
10000
Z [1/h]
BE05 BE1
BE 2
BE 5
BE11
BE20
1380788491

15.10 Permitted work done by BM(G) brake, for AC motors in category 3G (zone 2), protection type nA



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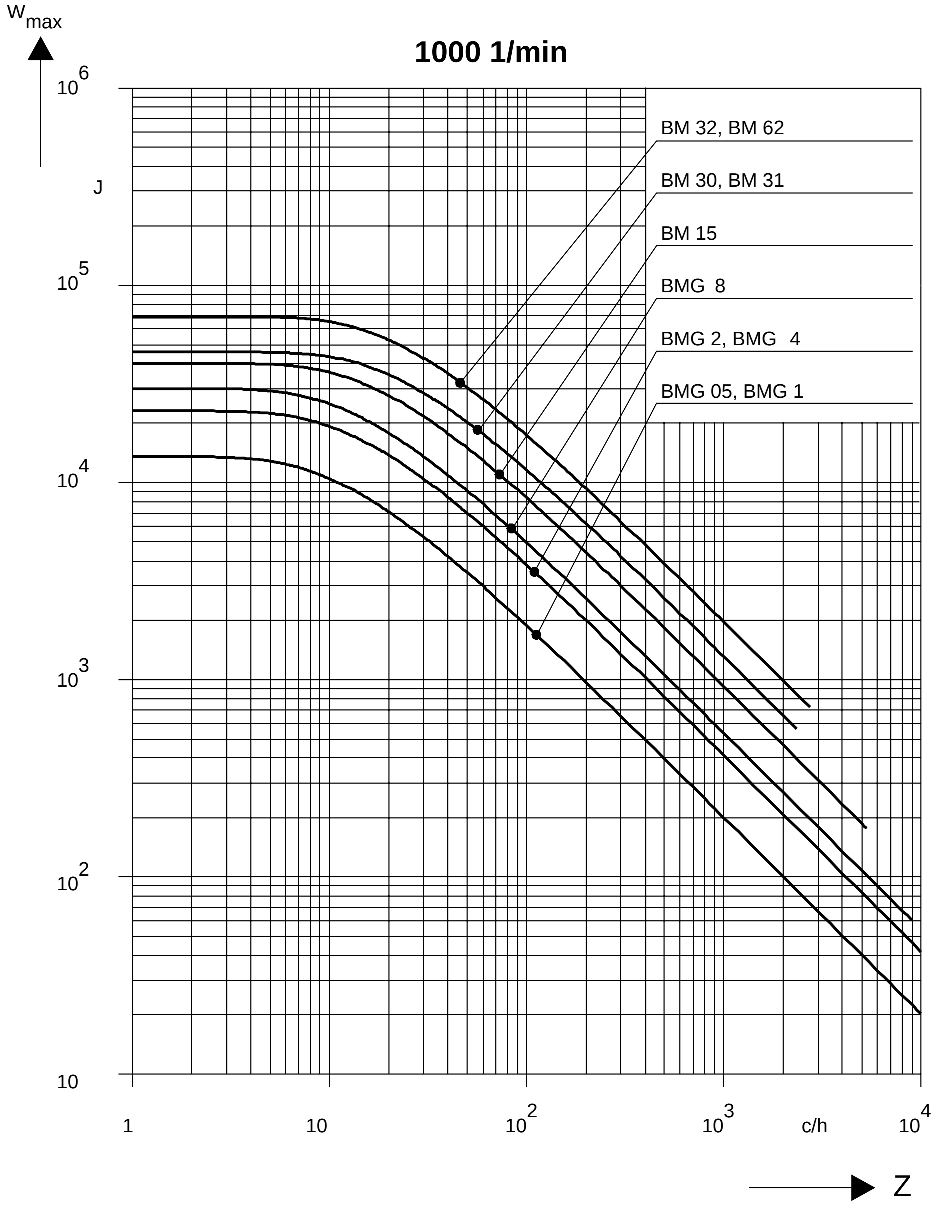
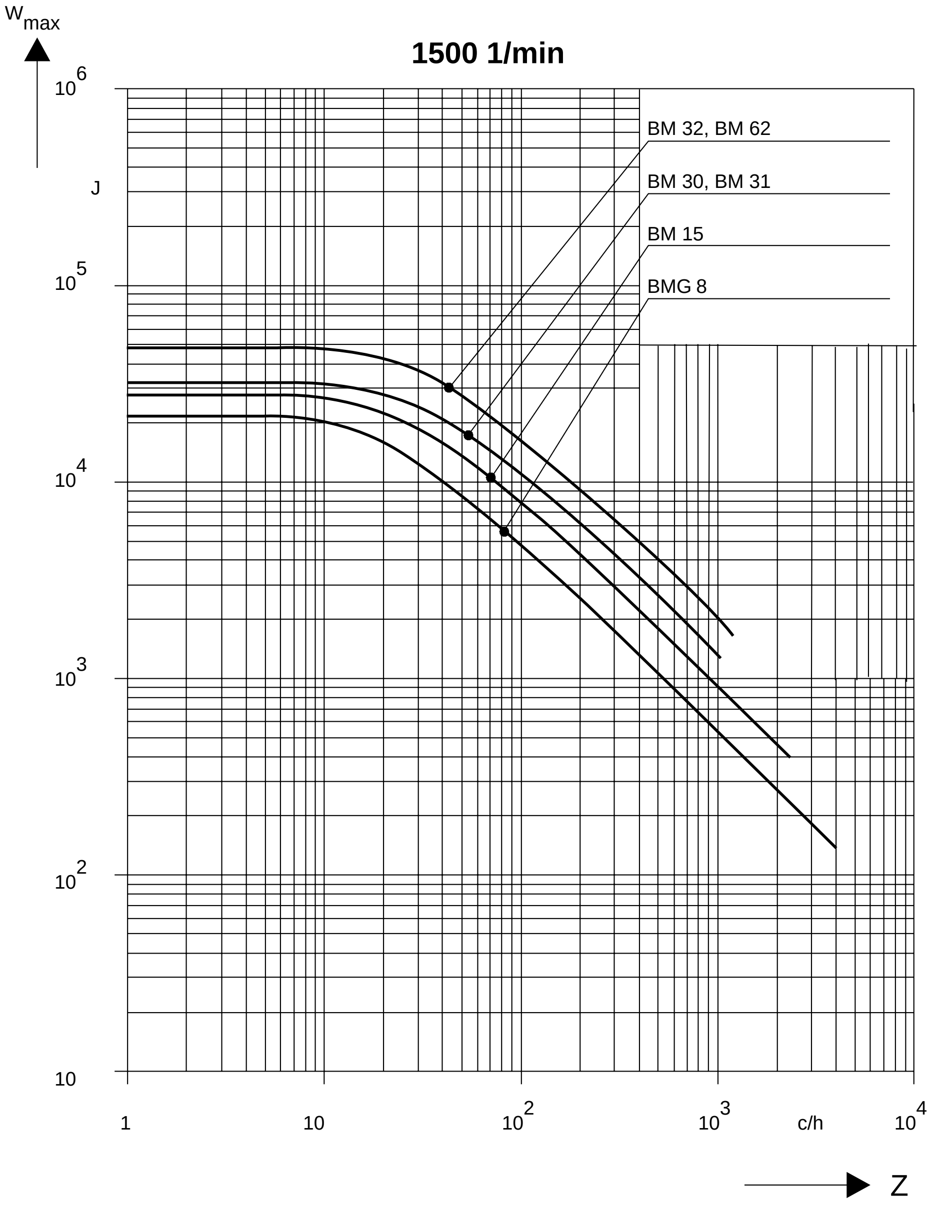
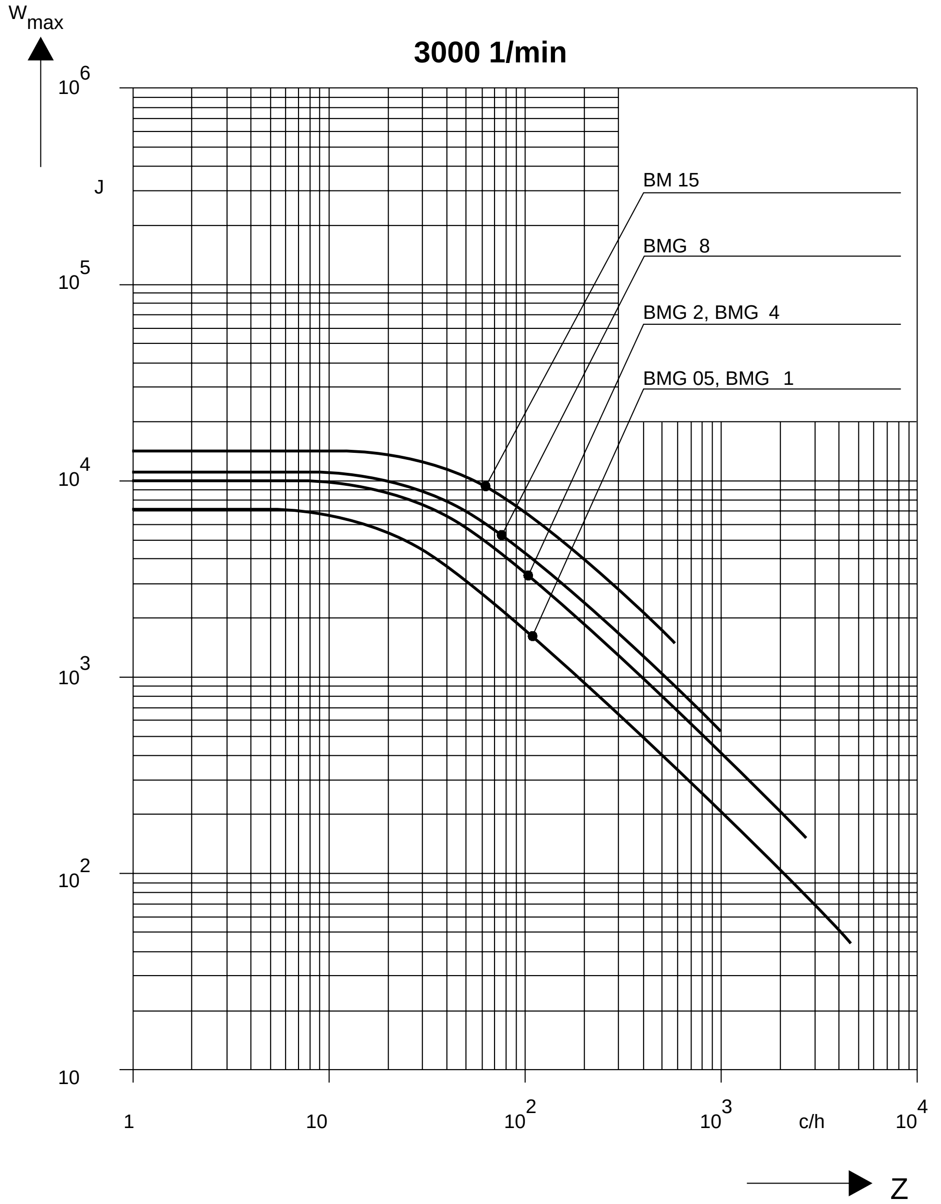

W_max
1000 1/min
J
10^6
10^5
10^4
10^3
10^2
10
1
10
10^2
10^3
c/h
10^4
BM 32, BM 62
BM 30, BM 31
BM 15
BMG 8
BMG 2, BMG 4
BMG 05, BMG 1
Z

1542598027


W$_{max}$
1500 1/min
J
10^6
10^5
10^4
10^3
10^2
10
BM 32, BM 62
BM 30, BM 31
BM 15
BMG 8
1
10
10^2
10^3
c/h
10^4
Z

1542544395


3000 1/min
Wmax
J
10^6
10^5
10^4
10^3
10^2
10
BM 15
BMG 8
BMG 2, BMG 4
BMG 05, BMG 1
1
10
10^2
10^3
c/h
10^4
Z

1542541963

15.11 Friction work

15.11.1 BP.. brake

The following table shows the permitted friction work and the maximum speed (emergency stop) for BP.. brakes:

Brake type	Permitted friction work per cycle [kJ]	Permitted friction work per hour [kJ]	Total permitted friction work [MJ]	Max. speed [rpm]
BP01	0.4	4.8	1.0	6000
BP04	0.6	7.2	1.5	6000
BP09	1.0	10	2.5	6000
BP1	1.4	16.8	3.5	6000
BP3	2.2	26.4	5.5	4500
BP5	3.6	43.2	9.0	4500

15.11.2 BR.. brake

The following table shows the permitted friction work and the maximum speed (emergency stop) for BR.. brakes:

Brake type	Total permitted friction work [MJ]	Max. speed [rpm]
BR1	60	6000
BR2	90	6000
BR8	180	4500

Speed [rpm]	Brake type	Braking torque [Nm]	Maximum permitted friction work per cycle [kJ]
2000	BR1	5	22
		7	20
		10	18
		14	15
	BR2	14	24
		20	19.5
		28	17
		40	10.5
	BR8	28	48
		40	44
		55	32
		90	18

Speed [rpm]	Brake type	Braking torque [Nm]	Maximum permitted friction work per cycle [kJ]
3000	BR1	5	20
		7	18
		10	14
		14	11
	BR2	14	20
		20	15
		28	10
		40	4.5
	BR8	28	36
		40	32
		55	18
		90	7
4500	BR1	5	16
		7	14
		10	10
		14	6
	BR2	14	15
		20	9
		28	5
		40	3
	BR8	28	22
		40	18
		55	11
		90	4
6000	BR1	5	No friction work permitted
		7	
		10	
		14	
	BR2	14	No friction work permitted
		20	
		28	
		40	

Up to 10 emergency stops per hour are permitted.

15.12 Working air gap for SEW brakes

Motor size DT/DV	Brake type	Working air gap [mm]	
		Min.[1)]	Max.
71/80	**BMG05, BC05**	Min. 0.25	Max. 0.6
80	**BMG1, BC05**		
90/100	**BMG02, BC2**		
100	**BMG4, BC2**		
112/132S	**BMG8**	Min. 0.3	Max. 1.2
132M/160M	**BM15**		
160L/180	**BM30**		
200/225	**BM31**		
250/280	**BMG61**		
180	**BM32**[2)]	Min. 0.4	Max. 1.2
200/225	**BM62**[2)]		
250/280	**BMG122**[2)]		

1) The measured value can differ from the specified value by 0.15 mm after the test run
2) Double disk brake

Brake type for DR.. motors	Working air gap [mm]	
	Min.[1)]	Max.
BE05	0.25	0.6
BE1		
BE2		
BE5		0.9
BE11	0.3	1.2
BE20		
BE30		
BE32[2)]	0.4	
BE60	0.3	
BE62[2)]	0.4	
BE120		
BE122[2)]	0.5	

1) The measured value can differ from the specified value by 0.15 mm after the test run
2) Double disk brake

An air gap setting is not required for BR and BP brakes.

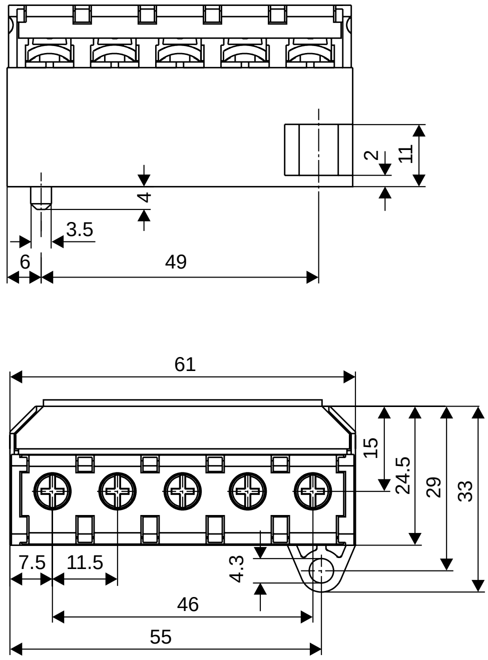
15.13 DUB10A brake monitoring

The following table shows the technical data for the DUB10A brake monitoring:

Technical data	Unit	Value
Operating voltage	AC V DC V	Max. 250 24
Rated switching capacity	A	6 at AC 250 V
Mechanical service life	Cycle times	50×10^6
Contact material		Silver
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 movement	mm	0.1
Temperature range	°C	–40 ... +80
Protection class		II
Can be mounted to		DR.90 BE2 ... DR.315 BE122
Connection		Screw contacts on terminal box

15.14 Dimensions of brake controls

15.14.1 BG1.2, BG2.4



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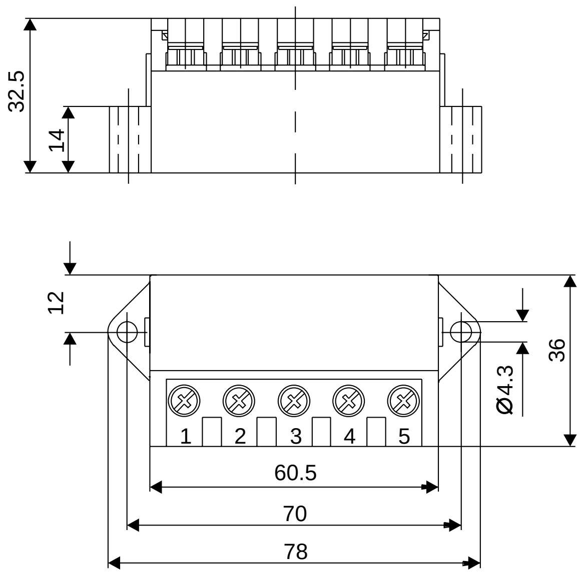
15.14.2 BG1.5, BG3, BGE 1.5, BGE 3, BS, BSG



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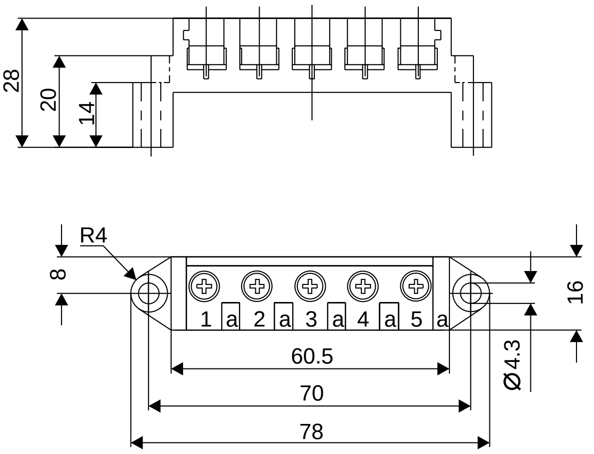
15.14.3 Auxiliary terminal strip

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



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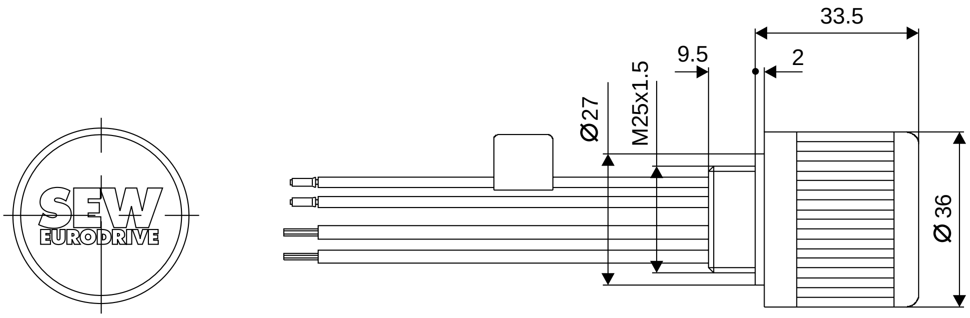
15.14.4 SR, UR



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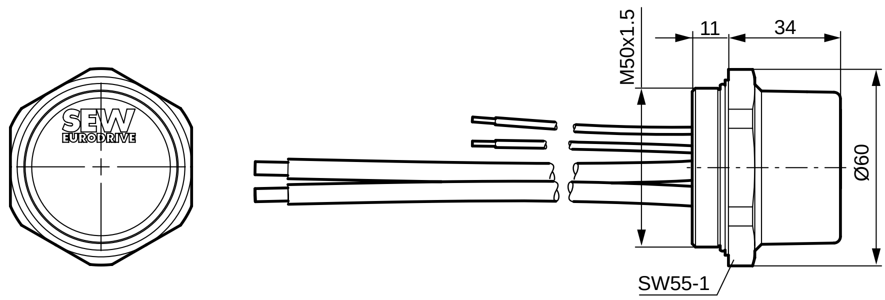
15.14.5 SR19



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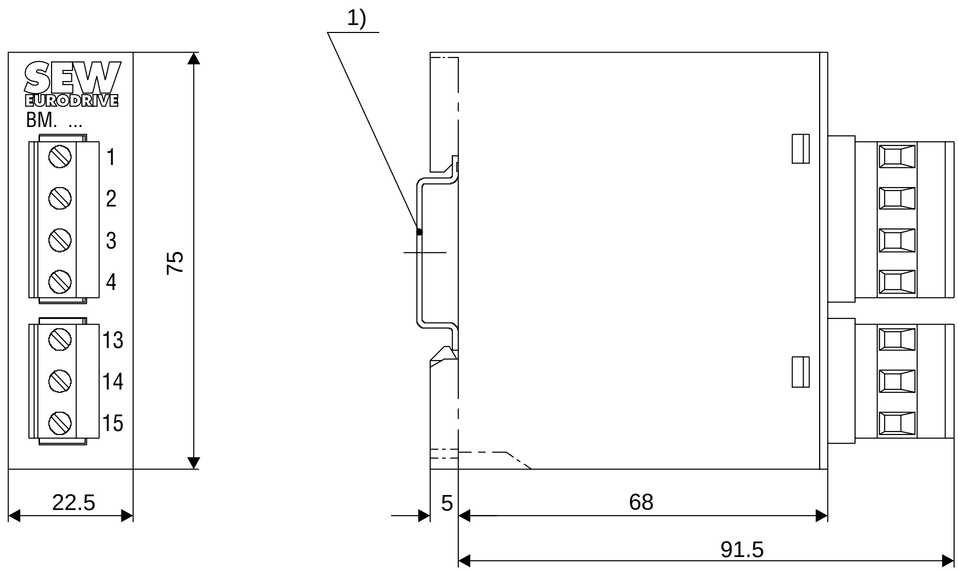
1) With reducing sleeve to M50x1.5

15.14.6 BMS, BME, BMH, BMP, BMK, BMV



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

16 Explanation of Abbreviations

Characters	Unit	Meaning
AWG		American Wire Gauge
BS		Accelerator coil
BU		Blue
CDF	%	Cyclic duration factor
I_B	A	Inrush current
I_H	A	Holding current
I_B/I_H	–	Inrush current ratio
I_G	A	Direct current in the brake coil
I_{Hmax}	A	Maximum holding current
I_S	A	Coil current
M_B	Nm	Braking torque
$M_{B\ red}$	Nm	Reduced braking torque
$M_{B\ max}$	Nm	Maximum braking torque
M_{B1}	Nm	Maximum braking torque for servomotors
M_{B2}	Nm	Minimum braking torque for servomotors
n	min^{-1}	Speed
R_B	Ω	Accelerator coil resistance at 20°C
R_T	Ω	Coil section resistance at 20°C
P_B	W	Brake coil power consumption at 20°C
t_1	ms	Brake response time
t_1I	ms	Response time of the brake for standard excitation
t_1II	ms	Response time of the brake for high-speed excitation
t_2	ms	Brake application time
t_2I	ms	Brake application time with cut-off in the AC circuit with separate brake current supply
t_2II	ms	Brake application time with cut-off in the AC and DC circuits
TS		Coil section
V_N	V	Rated voltage
W_{Insp}	MJ	Total permitted braking work until inspection/maintenance of the brake
W_{max}	J	Maximum permitted work done per cycle
W_1	J	Braking work per brake application
WH		White
RD		Red
w	–	Number of turns in the spring
YE		Yellow

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