15 Brakes from SEW-EURODRIVE – DT56, DR63, DV250/280

General

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

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

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

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

A main advantage of brakes from SEW-EURODRIVE is their very short design. The brake bearing end shield is a part of both the motor and the brake. The integrated construction of the brakemotor permits particularly compact and sturdy solutions.

Short response times

A characteristic feature of the brake is the patented two-coil system. This system comprises the accelerator coil BS and the coil section TS. The special SEW-EURODRIVE brake control system ensures that, when the brake is released, the accelerator coil is switched on first with a high current inrush, after which the coil section is switched on. The result is a particularly short response time when releasing the brake. The brake disk moves clear very swiftly and the motor starts up with hardly any brake friction.

This principle of the two coil system also reduces self-induction so that the brake is applied more rapidly. The result is a reduced braking distance. The brake can be switched off in the DC and AC circuit to achieve particularly short response times when applying the brake, for example in hoists.

Emergency stop features

In hoist applications, the limits of the permitted maximum braking work (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.

Brake control

Various brake controllers are available for controlling disk brakes with a DC coil, depending on the requirements and the operating conditions. All brake control systems are fitted as standard with varistors to protect against overvoltage. For detailed information on brakes from SEW-EURODRIVE, refer to the publication "Drive Engineering – Practical Implementation – SEW Disk Brakes."

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

15.1 Principles of the SEW brake

Basic structure

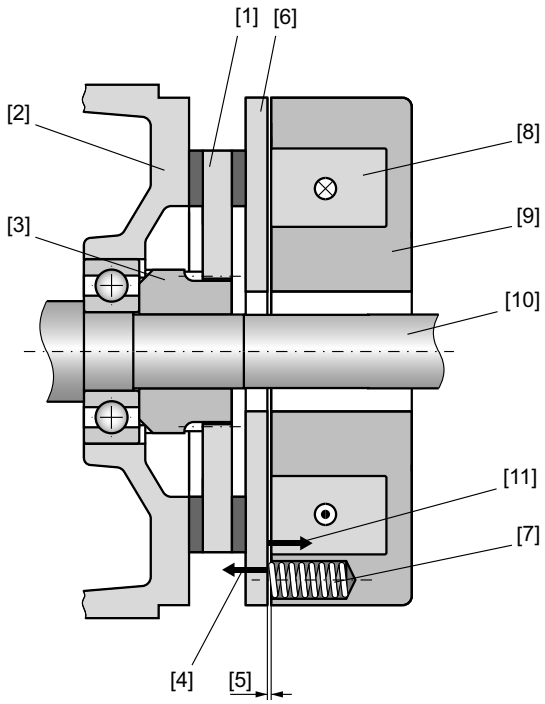
The SEW brake is an electromagnetic disk brake with a DC coil that releases electrically and brakes using spring force. The system meets all fundamental safety requirements: The brake is applied automatically if the power fails.

The principal parts of the brake system are the brake coil itself [8] (accelerator coil + coil section = holding coil), comprising the 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 length: 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.

Basic functions

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



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

Particularly short response times at switch-on

See section "Particularly short response times at switch-on" page 232.

15.2 Details of the SEW brake system

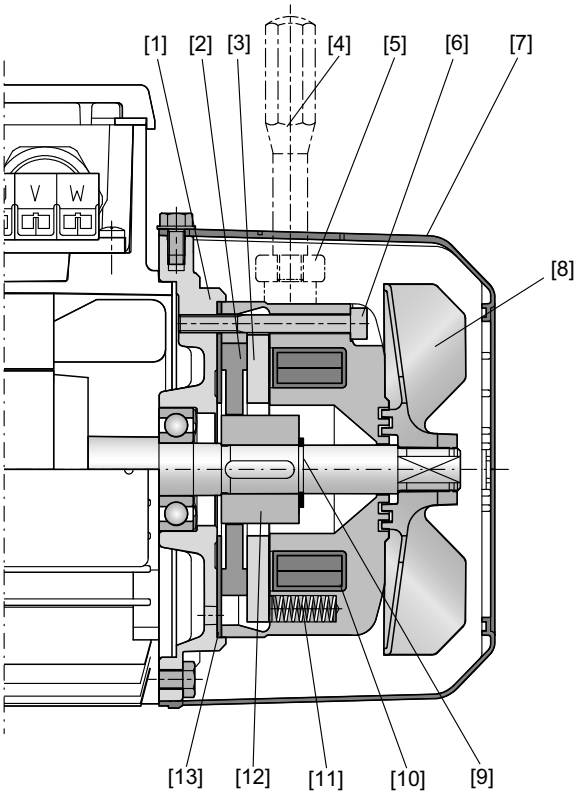
Brake BMG02

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
- Plug connector (contact box) for simple electrical contacting
- The number of brake springs determines the braking torque



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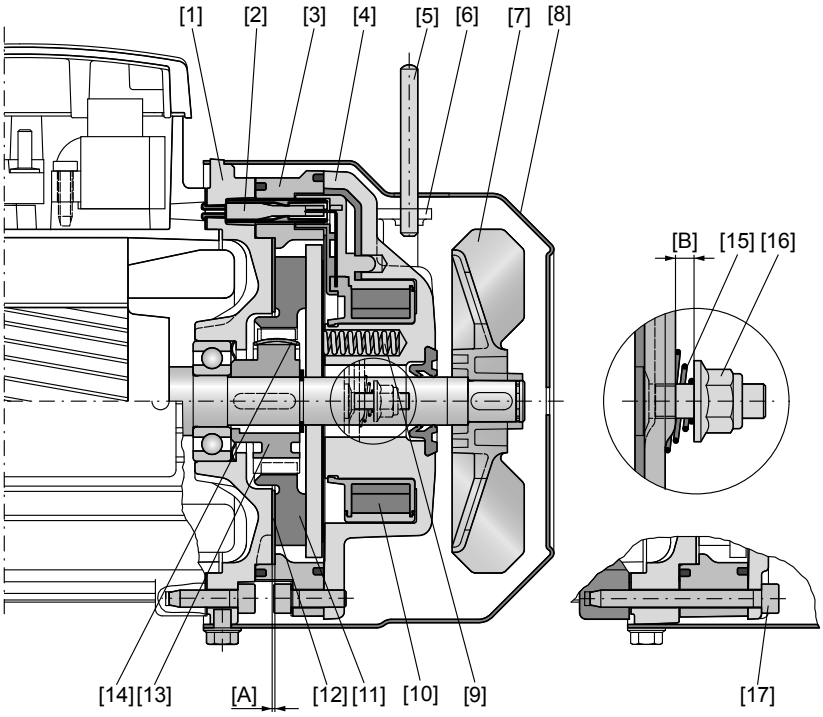
[1] Brake bearing end shield
[2] Brake disk (complete)
[3] Pressure plate
[4] Hand lever
[5] Release lever
[6] Retaining screw
[7] Fan guard
[8] Fan
[9] Retaining ring
[10] Brake coil
[11] Brake spring
[12] Carrier
[13] Friction plate

Brake BR03

The BR03 brake is used in AC brakemotors of size DR63. The BR brake can be installed mechanically or 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 contacting
- The number of brake springs determines the braking torque



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

15.3 Brake control system

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

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

Brake control system in the wiring space

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

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

Motor wiring space

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

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 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 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 protection circuit	DC 24 V	5.0	BS24	826 763 4	Aqua
BSG	Electronic switching	DC 24 V	5.0	BSG	825 459 1	White

Control cabinet

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

Type	Function	Voltage	Holding current I_{Hmax} [A]	Type	Part number	Color code
BMS	One-way rectifier as BG	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 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 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 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 150...500 V	1.5	BMK 1.5	826 463 5	Aqua
		AC 42...150 V	3.0	BMK 3	826 567 4	Bright red
BMV	Brake control unit with electronic switching, DC 24 V control input and fast cut-off	DC 24 V	5.0	BMV	13000063	White

15.4 AC brakemotors DR/DT...BR/BMG

The BR03 brake is only used for size DR63.... For size DT56, BMG is used.

SEW brakemotors are characterized by the fact that the brake is integrated in the motor, resulting in a very short, compact design.

Various brake control systems for installation in the terminal box, with plug connection 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.

Standard brake control system

A standard brakemotor is a brakemotor supplied with a terminal box and, with one exception, with built-in brake control systems. The standard type is delivered ready for connection.

The motor connection voltage and the brake voltage are usually specified by the customer. If the customer does not supply the relevant information, the phase voltage is selected automatically for single-speed motors and the line voltage for pole-changing motors. The table below lists the standard AC brakemotors.

Motor type	AC connection	DC 24 V connection
DT56..BMG	BG	No control unit[1)]
DR63..BR		

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

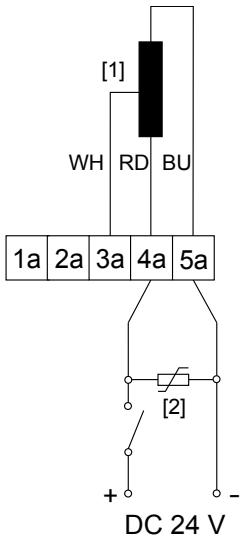
Either cut-off in the AC circuit or cut-off in both the DC and AC circuits is possible with standard types for AC connection.

The brake voltage can either be supplied separately (particularly with pole-changing 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 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 control systems 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
10M 250 VB	Conradty

Brakemotors for special requirements

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

High switching frequency

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

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

Motors DV250..BMG and DV280...BMG are designed for a high switching frequency as standard.

High stopping accuracy

Positioning systems require high stopping accuracy.

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

Cut-off in the DC and AC circuits makes it possible to shorten the brake application time t_2II considerably (see the section "Technical Data" page 455).

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

The section 'Standard brake controller' page 449 already refers to the possibility of achieving this solution by conventional means by using an extra contact.

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

The BSR and BUR brake control systems offer sophisticated options involving an electronic, wear-free contact with minimum wiring. Both control systems are made up of BGE (BG for size 64) and either the SR current relay or UR voltage relay.

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

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

Refer to page 448 ff for relay retrofitting options suited to the motor and voltage. The electronic relays can switch up to 1 A brake current and thereby limit the selection to BSR and BUR.

Principle and selection of the BSR brake control system

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

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

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

The following table takes the brake current and the motor current into account for the assignment of the SR relay.

Motor	BSR (BGE + SR..) for motor voltage (AC V) in W connection																			
	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																					

SR11 SR15 SR19 Not possible

TIP

Motor sizes 250/280 are offered without BSR.

Principle and selection of the BUR brake control system

The BUR brake control system combines the BGE (BG) control unit with an electronic voltage relay. In this case, the BGE (or BG) control unit has a separate voltage supply because there is no constant voltage at the motor terminal board (pole-changing 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 very quickly.

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

Motor	BUR (BGE + UR..) for brake control system (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 UR15 Not possible

	TIP
	Motor sizes 250/280 cannot be combined with a UR.

Increased ambient temperature or restricted ventilation

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

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

Use of BGE, BME or BSG is stipulated instead of BG, BMS or DC 24 V direct connection for the special case of "electrical brake release when motor is at standstill" for motor sizes 71-100.

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

Low and fluctuating ambient temperatures

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

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

BMH is available for all motor sizes and is only mounted in the control cabinet.

Brake control system in the control cabinet

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

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

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

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

Brakemotor type	Brake control system in the control cabinet	
	For AC connection	For DC 24 V connection
DR63..BR03	BMS, BME, BMH, BMP, BMK	BSG BMV
DV250..BMG	BME	-
DV280..BMG		

Multi-motor operation of brakemotors

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

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

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

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

15.5 AC brakemotors DR/DT...BM(G) with frequency inverter

Important: The supply voltage for the brake must always be routed separately. It 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 displays 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 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 control systems 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
DV250..BMG	BGE	BME
DV280..BMG		

15.6 Block diagrams

For block diagrams and a key, see chapter "Brake control block diagrams" on page 253 ff.

15.7 Technical data

Technical data of BR/BMG/BE brakes for DT/DR series AC motors

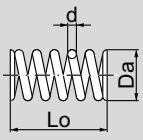
The following table lists the technical data of the brakes. The type and number of brake springs determines the level of the braking torque. Maximum braking torque $M_{B\ max}$ is installed as standard, unless specified otherwise in the order. Other brake spring combinations can result in reduced braking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

Brake Type	For motor size	$M_{B\ max}$ [Nm]	Reduced braking torques $M_{B\ red}$ [Nm]							W [10^6 J]	t_1 [10^{-3}s]	t_2		P_B [W]
												t_2II [10^{-3}s]	t_2I [10^{-3}s]	
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

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

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

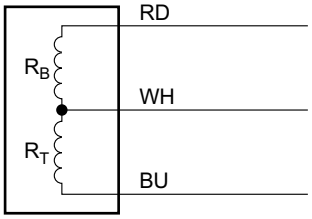
Table for setting different braking torques for type BMG/BR03

Brake	Mounting on motor	Braking torque	Number and type of brake springs		Part (order) no. and brake spring dimensions									
					Normal									
		[Nm]	Normal	Red	Lo	Da	d	w	Part no.	Lo	Da	d	w	Part no. Brake spring
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	2										
		0.8	-	6										
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	**DV250 DV280**	1200	8	-										
		1000	6	2										
		800	4	4										
		600	4	-										
		400	-	8										

Brake coil resistance

BMG02 / BR03

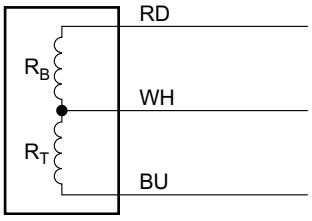
Brake		BMG02		BR03	
Max. braking torque [Nm]		1.2		3.2	
Coil power [W]		25		26	
Voltage V_N		BS	TS	BS	TS
AC V	DC V	R_B	R_T	R_B	R_T
	24	8.46	24.2	6.0	18.0
24 (23-26)	10			0.95	2.8
42 (40-45)	18			3.0	8.9
60 (57-63)	24			6.0	18.0
110 (99-110)	44			19.0	56.5
120 (111-123)	48			23.9	71.2
133 (124-138)	54			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			379	1128
500 (485-542)	217	576	1650		



BS Accelerator coil
TS Coil section
R_B Accelerator coil resistance at 20 °C [Ω]
R_T Coil section resistance at 20 °C [Ω]
U_N Rated voltage (rated voltage range)
RD Red
WH White
BU Blue

BMG61/122

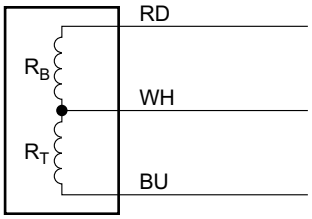
Brake	BMG61/122	
Max. braking torque [Nm]	600 / 1200	
Coil power [W]	195	
V_N	BS	TS
AC V	R_B	R_T
208 (194-217)	4.0	32.6
230 (218-243)	5.0	41.0
254 (244-273)	6.3	51.6
290 (274-306)	7.9	65
318 (307-343)	10.0	81.8
360 (344-379)	12.6	103
400 (380-431)	15.8	130
460 (432-484)	19.9	163
500 (485-542)	25.1	205
575 (543-600)	31.6	259



BS Accelerator coil
TS Coil section
R_B Accelerator coil resistance at 20 °C [Ω]
R_T Coil section resistance at 20 °C [Ω]
U_N Rated voltage (rated voltage range)
RD Red
WH White
BU Blue

BR1 / BR2 / BR8

Brake		BR1		BR2		BR8	
Max. braking torque [Nm]		20		40		90	
Coil power [W]		45		55		75	
Voltage V_N		BS	TS	BS	TS	BS	TS
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	1.4	7.2
110 (98-110)		11.8	35.4	10.5	31	4.4	22.7
230 (217-242)		59.2	178	52.6	156	21.9	114
400 (385-431)		187	561	158	469	69.3	359
460 (432-484)		236	707	199	590	87.2	452

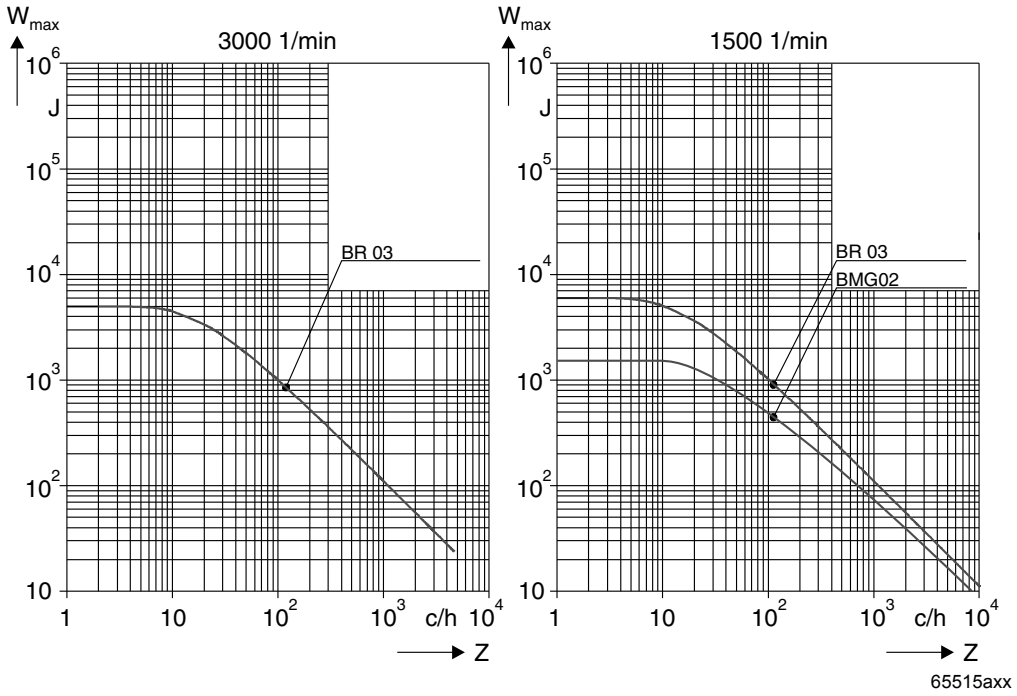


BS Accelerator coil
TS Coil section
R_B Accelerator coil resistance at 20 °C [Ω]
R_T Coil section resistance at 20 °C [Ω]
U_N Rated voltage (rated voltage range)
RD Red
WH White
BU Blue

Permitted braking work of BM(G), BR and BE brakes for AC motors and asynchronous servomotors

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

Example: The rated speed is 1500 min^{-1} and the brake BM 32 is used. At 200 braking operations per hour, the permitted braking work per braking operation is 9000 J.



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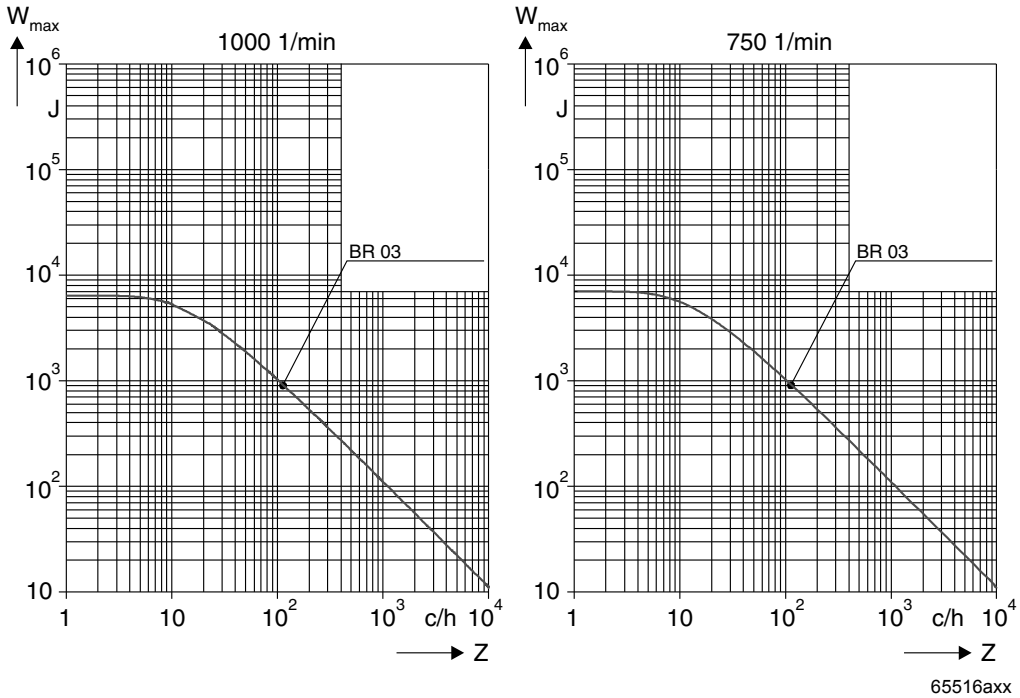

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BMG61, BMG122 Contact SEW-EURODRIVE for the values for the permitted braking work of the BMG61 and BMG122 brakes.

Working air gap for SEW brakes

Motor size	Brake type	Working air gap [mm]	
		New value[1)]	Adjust at
250/280	**BMG122**	min 0.4	max 1.2

1) The measured value can differ from the specified value by 0.1 mm after the test run

	TIP
	An air gap setting is not required for BR brakes.

15.8 Project planning information

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

The following aspects must be taken into account:

- Selection of the brake and braking torque in accordance with the project planning data (motor selection)
- Determining the brake voltage
- Selection of the brake control system and connection type
- Size and routing of the cable
- Selection of the brake contactor
- Design specifications
- Motor protection switch if necessary to protect the brake coil

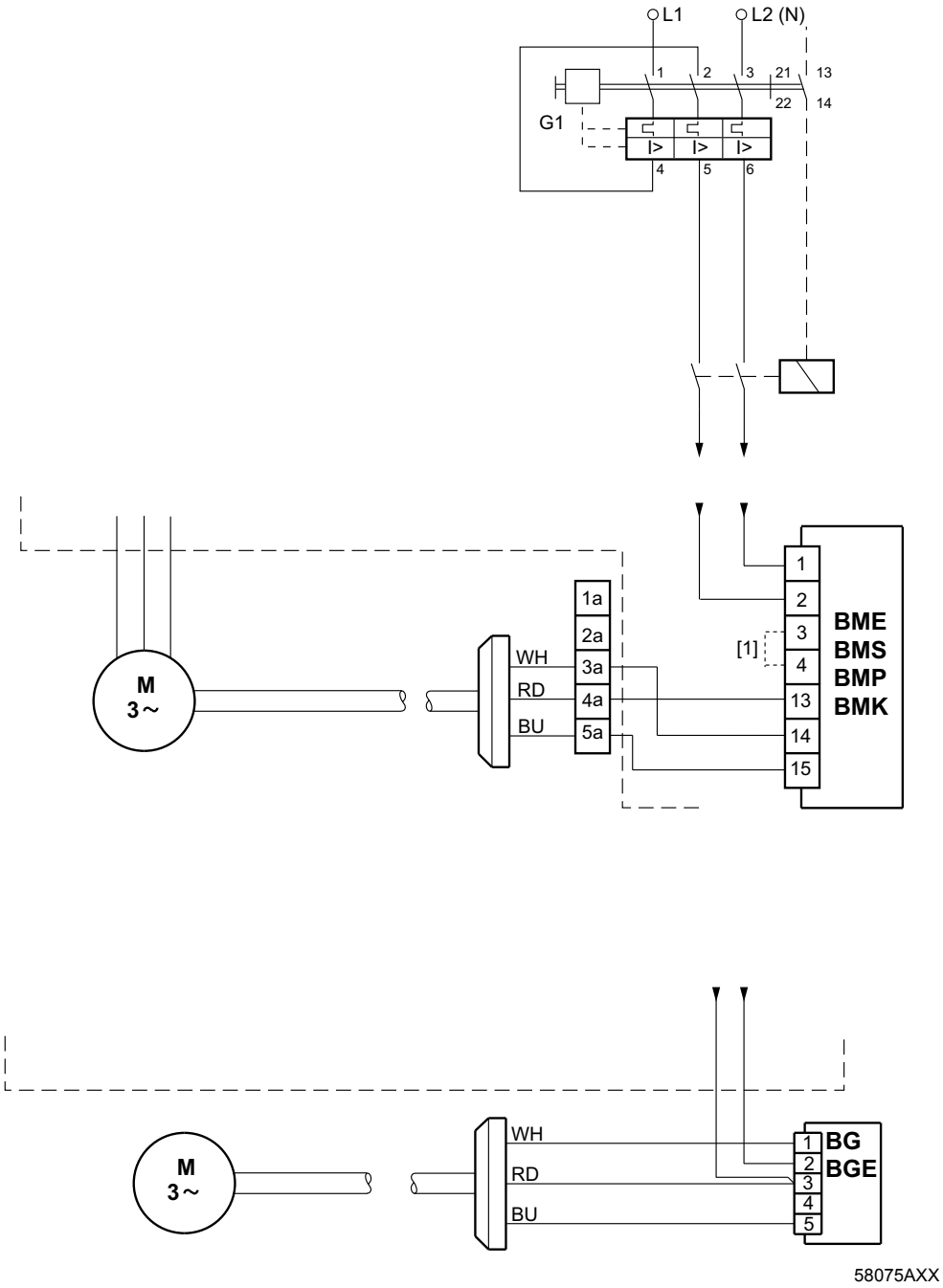
Protective circuit breaker

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

Select or set the motor protection switch to 1.1 x $I_{Brake\ holding\ current}$ (r.m.s. value). For holding currents, see chapter 12.5.

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

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



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

Selection of the brake and 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 or application areas and the standards that have to be taken into account are used for the brake selection.

Selection criteria:

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

Values determined/calculated during motor selection:

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

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

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

Determining the brake voltage

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

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

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

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

Selecting and routing the cable

a) Selecting the cable

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

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

Brake type	Minimum cross section in mm² (AWG) of the brake cables for cable lengths ≤ 50 m and brake voltage (AC V)							
	42	48	56 DC24V	110	125-153	175-200	230	254-500
BR03	2.5 (12)				1.5 (16)			
BMG05								
BMG1								
BMG2								
BMG4	4 (10)							
BMG8	Not available		4 (10)					
BM15			10 (8)	2.5 (12)				
BM 30 - 62								
BMG61-122							2.5 (12)	

Values in brackets = AWG (American Wire Gauge)

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

b) Routing information:

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

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

Power cables with phased currents are in particular

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

Selection of the brake contactor

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

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

- For the standard voltages AC 230 V or AC 400 V, a power contactor with a rated power of 2.2 kW or 4 kW for AC-3 operation is selected.
- The contactor is configured for DC3 operation with DC 24 V.

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

Control cabinet installation

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

Terminal box installation

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

Advantages compared to switch contacts:

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

Semi-conductor relay

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

Important design data

a) EMC (Electromagnetic compatibility)

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

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

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

You must always adhere to the cable routing instructions (see page 26).

b) Connection type

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

Maintaining certain brake application times may be relevant to safety. The decision to implement cut-off in the AC circuit or cut-off in the DC and AC circuits must be passed on clearly and unambiguously to the people undertaking the work.

The brake application times t_2l specified in the data summary (see section "Technical data" page 455**) for cut-off in the AC circuit only apply if there is a separate voltage supply. The times are longer if the brake is connected to the terminal board of the motor.**

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

c) Maintenance intervals

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

d) Measuring principles

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

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

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