GKN LAND SYSTEMS

Stromag Dessau
safety in motion

PRODUCT CATALOGUE

Clutches >
and Brakes

BZFM V7 Brake
for Standard Electric Motors, general industrial applications

GKN LAND SYSTEMS

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safety in motion

ENGINEERING >THAT MOVES THE WORLD

Applications

✓ Holding- and working brake variations for general industry

✓ Usable for standard electric motors

Standard Features

Coil Body with coil	:	Thermal class 155 (F), special surface protection
Armature disc	:	Special protection: nitrocarburated
Brake disc	:	Special protection: nitrocarburated
Friction lining carrier	:	Rigidly fixed on motor shaft via fitting key, zinc coated
Friction lining	:	Axially flexible friction pads in the friction lining carrier allow a high tolerance when fixing friction lining carrier on the shaft thus simplifying the mounting on brake assembly.
Adjusting Ring	:	A simple reduction of the brake torque up to a value of 55 % is possible.
Adjusting screws	:	Several possible screws – type wear re-adjustment
Fixings screws	:	Included in delivery, zinc coated
Flying Leads	:	0,5 metre long

Optional Extras

✓ Micro switch to monitor switching states or wear monitoring (from size 6,3)

✓ Hand release lever

Switching modules

✓ Half wave rectifier

✓ Full wave rectifier

✓ Quick switching units

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Advantages

✓ Torque range 2,7 - 380 Nm

✓ Simple assembly to motor, no dismantling of brake required

✓ Completely pre-mounted and adjusted

✓ All surfaces are corrosion resistant

✓ Compact, simple construction with high heat capacity

✓ The fitted friction pads form an interrupted friction face thus resulting in good air circulation and heat dissipation.

✓ Less wear due to high stability of the friction material

✓ Delivered in run-in and torque tested condition

✓ Simple torque adjustment with adjusting ring

✓ As a standard, prepared for hand lever mounting – retrofit possible without any problems

✓ Free from axial loads when braking and running

✓ Suitable for vertical mounting, please consult GKN Stromag Dessau GmbH

✓ Proven reliable design

✓ Facilities to design to customer's special requirements

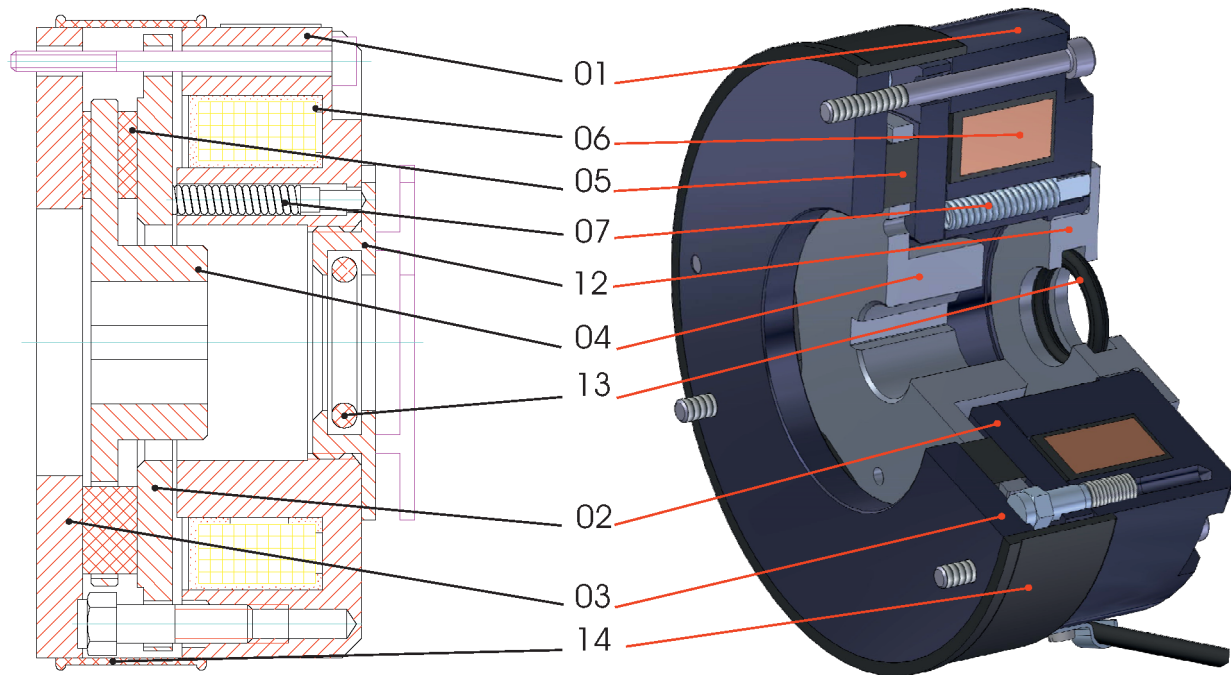✓ Protection IP 44 by rubber collar and seal ring on through-going shaft

Voltages available

✓ Usual voltage: 24 V DC, 103 V DC, 190 V DC, 207 V DC and 240 V DC,
Other voltages on request.

✓ Coils available to suit: AC – supplies with Half and Full wave rectification.

✓ We suggest the following alternative - Customer to take standard voltage with rectifier which GKN Stromag Dessau can provide.

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Designation of individual components

01	Coil body	06	Coil
02	Armature disc	07	Compression spring
03	Brake disc	12	Adjusting ring
04	Friction lining carrier	13	Seal ring
05	Friction lining	14	Rubber collar

Brake operation

The brake **BZFM V7** is a spring loaded electromagnetic double-face brake which brakes without current and is released electromagnetically.

The coil body (01) contains a coil (06) which is potted with a synthetic resin compound in accordance with thermal class 155, (max. limit of temperature 155°C).

If the coil (06) is not excited, the springs (07) which are situated in the internal and external pole, press the armature disc (02) against the floating formatted friction lining carrier (04). Thus is firmly clamped between the torsion-protected armature disc (02) and the brake disc (03) and thus prevented from rotating. The braking effect is transmitted from the friction lining via the carrier with friction lining (04) and a feather key to the shaft. If the coil (06) is connected to a direct voltage as specified on the identification plate or about a Stromag rectifier set to a alternating voltage, the magnetic force will draw the armature disc (02) to the coil body (01) against the spring pressure (07). The friction lining is released, the braking is cancelled and the brake is released.

✓ **Micro Switch**

Standard option available from size 6,3 up to 25, Inboard Proving Switch, one common contact, one normally open contact and one normally closed contact. This can be interlocked with motor contactor for parking brake duty, i.e. brake release before starting motor.

✓ **Brake termination**

Flyaway leads, usually 0,5 meter long.

✓ **Emergency release by means of hand lever release**

Optionally the brake can be equipped with a hand release lever allowing the manual release by means of a hand lever. The brake is prepared for hand lever mounting – retrofit is possible without any problems.

✓ **Brake flange**

Counter-friction face mounted to the motor on B-side.

✓ **Adjusting ring**

A simple reduction of the brake torque up to a value of 55 % is possible.

✓ **Adjusting screws**

The air gap of the brake can be re-adjusted several times until the lower wear limit of them friction lining is achieved.
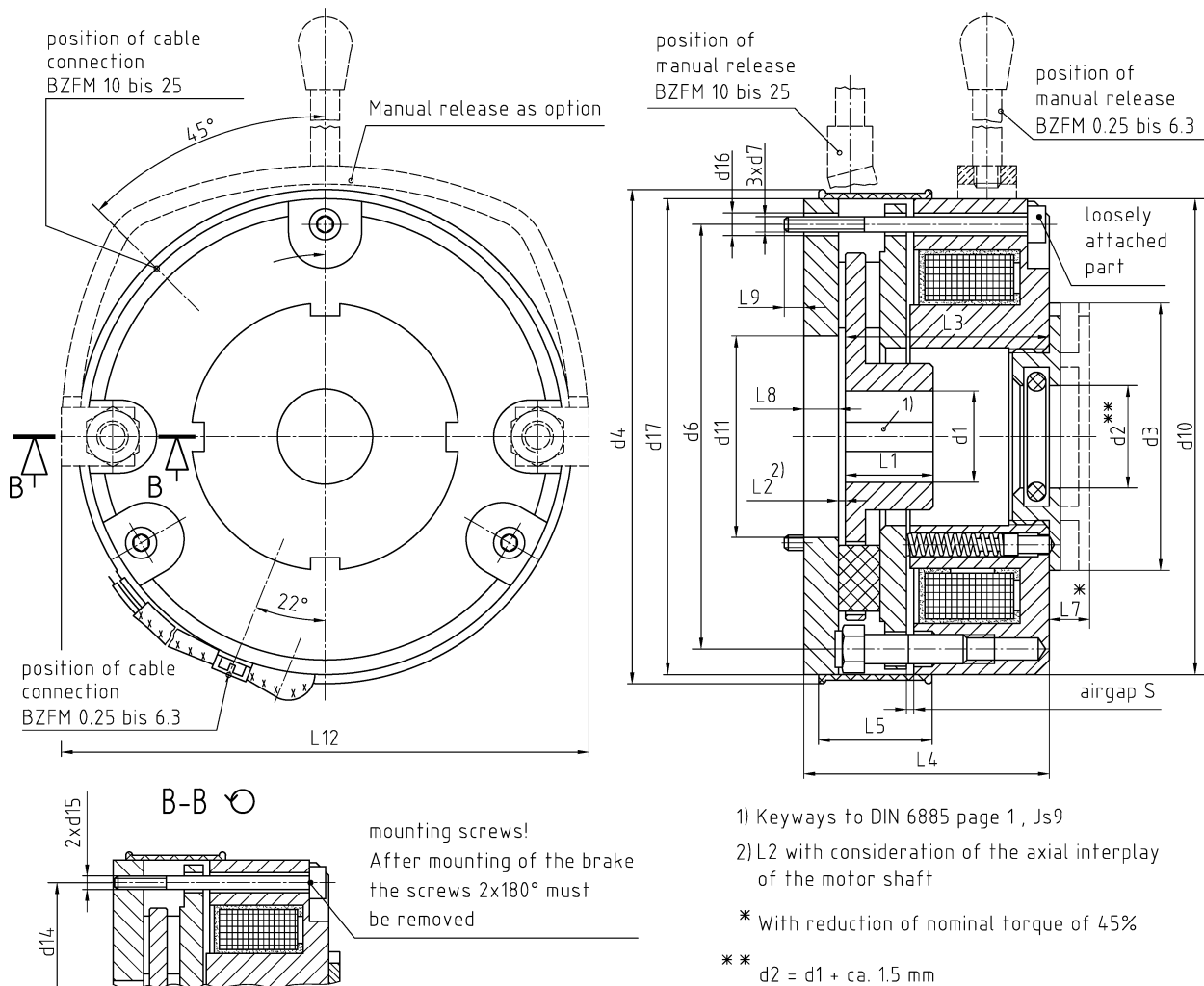
List of dimensions

Tabelle 1: *technical data*

Size BZFM V7	M_{SN} Nm	$M_{\ddot{U}}$ Nm	n_0 min^{-1}	n_{zn} min^{-1}	airgap min/max mm	W kJ	P_{vn} kW	J kgm^2	m kg
0,25	2,7	3	3600	2900	0,25 / 0,4	4	0,01	0,00004	1,5
0,63	5,7	6,25	3600	2900	0,3 / 0,5	6	0,015	0,00009	2,1
1,6	12,5	13,5	3600	2900	0,3 / 0,5	9	0,02	0,00020	3,0
2,5	24,5	27	3600	2900	0,3 / 0,5	13	0,028	0,00030	5,0
4	33,6	37	3600	2900	0,3 / 0,6	16	0,033	0,00046	6,3
6,3	59	65	3600	2900	0,4 / 0,7	22	0,046	0,00070	9,3
10	113	125	3600	2900	0,4 / 0,7	32	0,09	0,00250	14,8
16	220	250	3600	2900	0,4 / 0,7	48	0,11	0,00450	22,0
25	345	380	3600	1450	0,4 / 0,7	60	0,14	0,00870	31,6

BZFM V7
Electromagnetic Spring-Applied Brake

M_{SN}	:	switchable nominal torque at $1m/s$ frictional speed to DIN VDE 0580 (applies to dry operation with an oil- and grease-free friction lining after running-in)
$M_{\ddot{U}}$	:	transmissible static nominal torque without slip, to DIN VDE 0580 (applies to dry operation with an oil- and grease-free friction lining after running-in)
n_0	:	maximum idling speed
n_{zn}	:	admissible switching speed
P_k	:	excitation output at 20°C
P_{vn}	:	nominal braking capacity (S4-40 % I.O.)
W	:	switch work per switching operation for $z = 1 - 5h^{-1}$
J	:	mass moment of inertia of rotating parts
m	:	weight
mode of operation	:	S1, S2, S4-40 % I.O.
thermal class	:	155 (F) in accordance with DIN VDE 0580
AC-control	:	via rectifier

1) Keyways to DIN 6885 page 1 , Js9

2) L2 with consideration of the axial interplay of the motor shaft

* With reduction of nominal torque of 45%

** d2 = d1 + ca. 1.5 mm

position of cable connection BZFM 10 bis 25

Manual release as option

position of cable connection BZFM 0.25 bis 6.3

position of manual release BZFM 10 bis 25

position of manual release BZFM 0.25 bis 6.3

loosely attached part

airgap S

B-B

mounting screws!
After mounting of the brake the screws 2x180° must be removed

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BZFM V7
Electromagnetic Spring-Applied Brake

Tabelle 2: *table of dimensions (all dimensions in mm)*

Size BZFM V7	0.25	0.63	1.6	2.5	4.0	6.3	10	16	25
$d1_{min}$ (H7)	10	10	15	15	20	25	32	40	40
$d1_{bevorzugt}$ (H7)	11/12	12/15	16/20	20/22	22/25	30/32	35/38/40	45/48	45/50/55
$d1_{max}$ (H7)	12	15	22	25	28	35	45	50	60
$d3$	48	55	64	73	80	86	98	115	134
$d4$ (H7)	91	106	118	136	152	166	193	224	262
$d6$ (H7)	74,5	89	100	116	130	144	164	194	228
$d7$	M4	M4	M4	M5	M6	M6	M10	M10	M12
$d10$	85	100	112	130	146	160	185	216	254
$d11$ (H9)	28	40	50	55	65	80	65	95	130
$d14$	73	87,5	100	116	130	144	162	196	228
$d15$	M4	M4	M4	M6	M6	M6	M10	M10	M12
$d16$	4,3	4,3	4,3	5,4	6,4	6,4	10,25	10,25	12,2
$d17$	85	100	112	130	146	160	185	216	254
$L1$	20	20	20	25	30	30	35	40	50
$L2$	1,5	1,5	1,5	1,8	1,8	1,8	2,0	2,0	2,0
$L3$	36,2	37,7	44,7	53,6	56,5	62,9	82,2	90,2	92,4
$L4$	44,7	46,2	53,2	64,4	68,3	74,6	96	106	109
$L5$	26	26	26	32	32	34	52	52	52
$L7^*$ (ca.)	6	5,9	7,2	8,2	8,2	9,6	8,4	8,4	7,3
$L8$	7	7	7	9	10	10	11,5	13,5	14,5
$L9$	6	6,3	6,8	11,6	12	9,3	14	23	14,6
$L12$	95	109,5	122	144	162	176	210	247	294
Kabellänge	400	425	480	550	585	615	560	650	790

Tabelle 3: *electrical data apply to DC (other voltages on request)*

Size BZFM V7	$U_N = 24V$ $P_K[W]$	$U_N = 103V$ $P_K[W]$	$U_N = 190V$ $P_K[W]$	$U_N = 207V$ $P_K[W]$	$U_N = 240V$ $P_K[W]$
0,25	20	16	23	22	24
0,63	23	20	26	25	27
1,6	32	13,5	37	35	36
2,5	40	27	43	41	44
4	48	37	59	56	60
6,3	65	65	74	70	75
10	83	86	92	91	94
16	102	100	123	114	125
25	142	123	135	127	133

manual release BZFM 0.25 up to 6.3

manual release BZFM 10 up to 25

lever (loosely attached part)

release

release

setting dimension 0.6

setting dimension 0.6
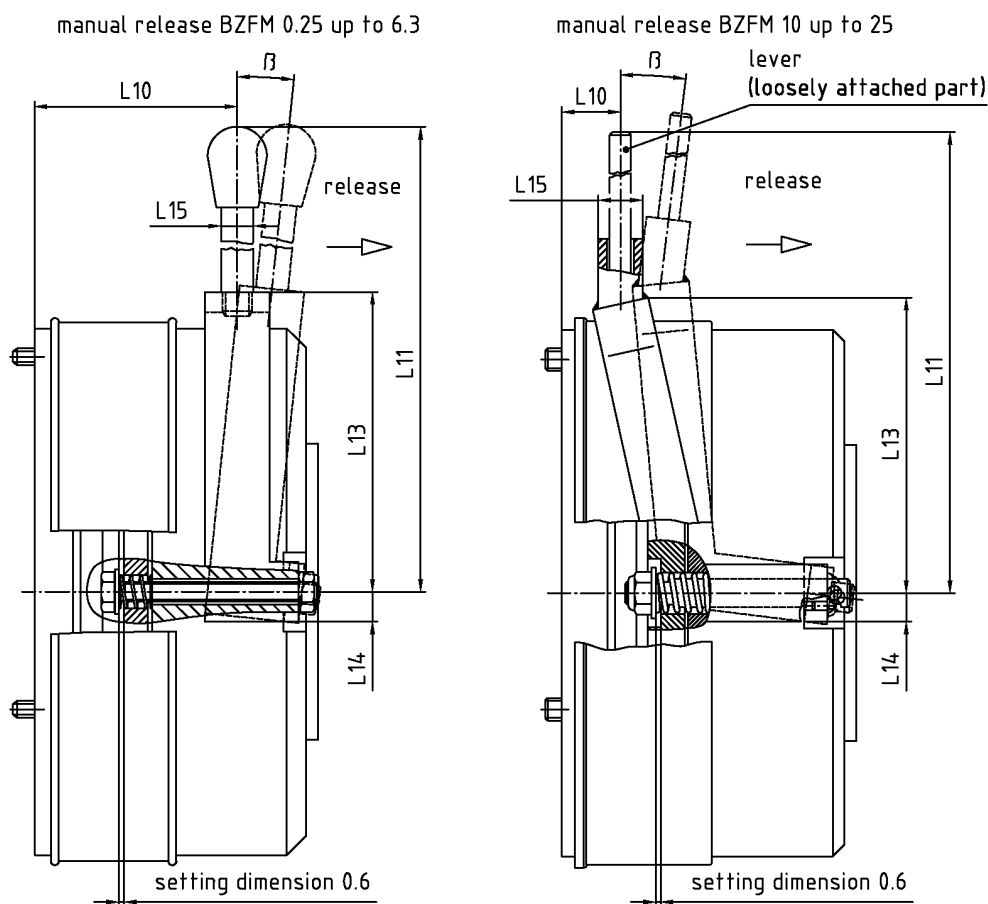
Tabelle 4: *table of dimensions for hand release lever (all dimensions in mm)*

Size BZFM V7	0.25	0.63	1.6	2.5	4.0	6.3	10	16	25
$L10$	31	33	39	46,5	49,5	54,7	14,5	10,5	11,5
$L11$	113,5	120,5	126	154	162	169	420	440	460
$L13$	48,5	55,5	61	74	82	89	100	122,5	147,5
$L14$	6	6	6	8	8	8	10	12,5	12,5
$L15$	8	8	8	10	10	10	14	14	14
β	6°	7°	7°	5°	5,5°	6°	7,4°	6°	6,4°

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Example of designation

BZFM   10   V7   103 VDC   38H7   MS

brake type ———
brake size ———
brake variant ———
nominal voltage ———
bore diameter with key way ———
with microswitch ———

Calculations

$M_1 = 0,9 M_{SN}$

$0,1 M_{SN}$

$n = 0$
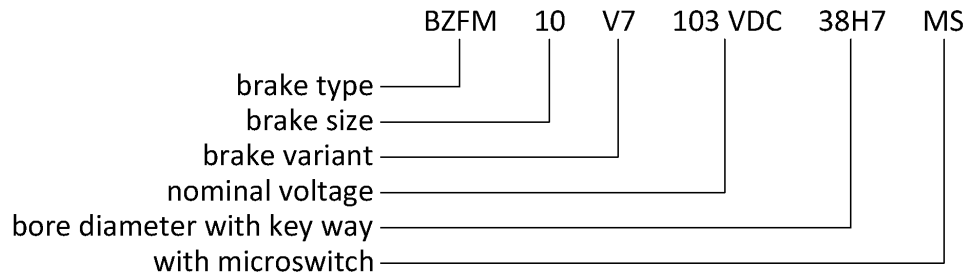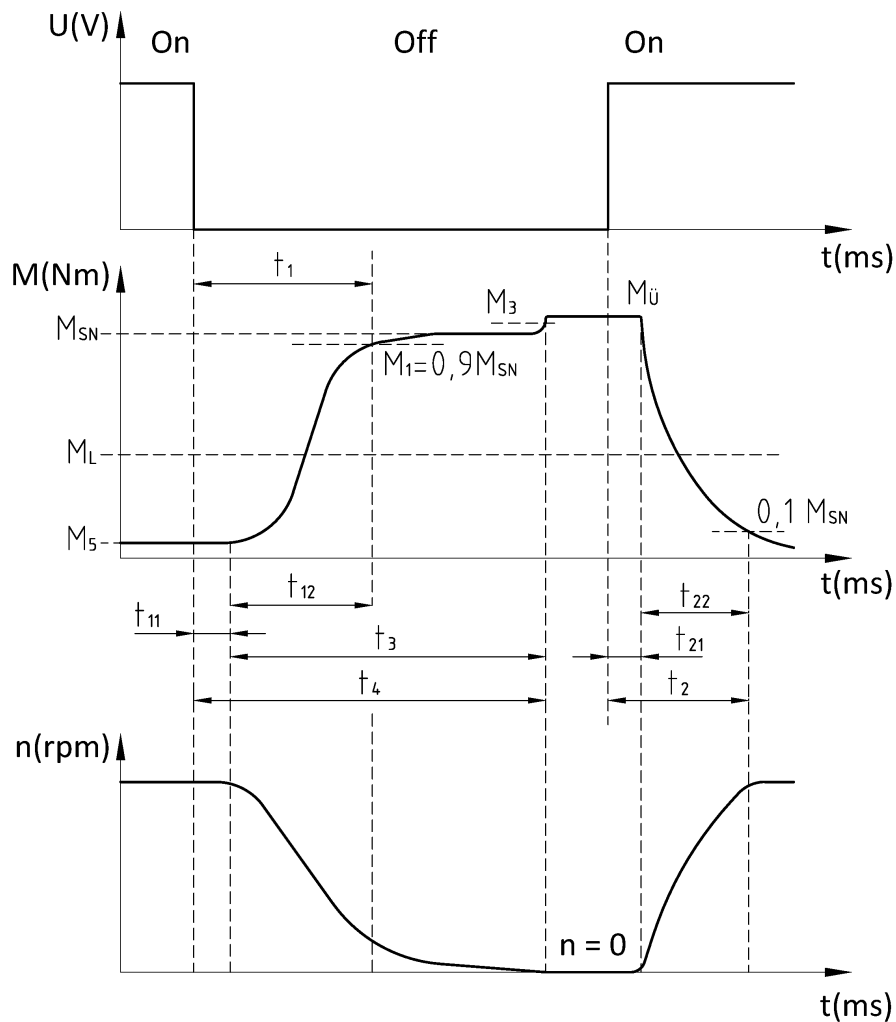
Abbildung 1: *The diagram shows the time response of an electromagnetic spring - applied brake as defined by the VDE regulations 0580*

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M_1 = switchable torque $[Nm]$

The switchable (dynamic) torque is the torque which can be transmitted by a brake under slip condition depending on the friction coefficient and at working temperature. ($M_1 = 0,9 M_{SN}$)

M_3 = synchronization torque $[Nm]$

The synchronization torque is the torque which arises for a short time after finishing the switching process .

$M_{\ddot{U}}$ = transmissible torque $[Nm]$

The transmissible (static) torque is the max. torque that can be applied to a brake without the risk of slipping.

M_{SN} = switchable nominal torque $[Nm]$

The switchable nominal torque is the dynamic torque as stated in the catalogue at a frictional speed of 1 m/sec.

M_L = load torque $[Nm]$

$+M_L$ for acceleration, $-M_L$ for deceleration. The load torque should always be considered with relative safety factors.

M_5 = no - load torque (drag torque) $[Nm]$

The no - load torque is the torque which the brake transmits at working temperature when free running.

M_A = decelerating torque $[Nm]$

The decelerating torque results from the addition (substraction for lifting gear during lowering) of the switchable torque and load torque.

Operation times

The operation times shown in the diagram are based on the example of a brake actuated by loss of electrical current. The basic characteristic is also applicable to brakes with alternate methods of operation.

The time delay t_{11} is the time from the instant of de - energization (actuation) to the commencement of the torque build - up (of no importance for d.c. switching). The torque build - up time t_{12} is the time from the commencement of torque build - up to the attainment of 90% of the switchable nominal torque M_{SN}. The switching time t_1 is the sum of the time delay and torque build - up time:

$$t_1 = t_{11} + t_{12}$$

The time delay t_{21} is the time from energization (actuation) to the commencement of the torque will decrease. The fall time t_{22} is the time from the commencement of the torque decrease to 10% of the switchable nominal brake torque M_{SN}. The switching time t_2 is the sum of the time delay and the fall time:

$$t_2 = t_{21} + t_{22}$$

To decrease the switching times of electromagnetic spring - applied brakes, special switching is required. Please ask for particular information. The switching times stated in the dimensional tables apply to d.c. switching, working temperature and nominal voltage without special switching techniques.

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Nomenclature

A_R	cm^2	Friction surface
m	kg	Mass
Q	$Joule(J)$	Heat quantity
Q_h	$Watt(W)$	Heat per hour
c	$\dfrac{kJ}{kgK}$	Specific heat steel $c = 0,46\dfrac{kJ}{kgK}$ cast iron $c = 0,54\dfrac{kJ}{kgK}$
n	rpm	Speed
t_A	s	Braking time
t_S	s	Slipping time

Mass moment of inertia $J\ [kgm^2]$

The mass moment of inertia J stated in the formula is the total mass moment of inertia of all the masses to be retarded referred to the brake.

Reduction of moments of inertia

The reduction of moments of inertia is calculated from the formula

$$J_1 = J_2 * (\frac{n_2}{n_1})^2 \qquad [kgm^2]$$

Moments of inertia of linear masses

The equivalent moment of inertia J_{Ers} for a linear mass m and a velocity v referred to the brake speed n is calculated from the formula

$$J_{Ers} = 91 * m(\frac{v}{n})^2 \qquad [kgm^2]$$

$$[v = m/s] \qquad [n = rpm] \qquad [m = kg]$$

Torque considerations for the brake

The mean torque of the driving or driven machine may be calculated from

$$M = 9550 * \frac{P}{n} \qquad [Nm]$$

$$[P = kW] \qquad [n = rpm]$$

If the system includes gearing, all torques must be referred to the brake shaft. Depending on the type and functioning of the driving or driven machine resp. shock and peak loads are an important factor for the determination of brake sizes. If precise deceleration times are required a sufficient decelerating torque must already been taken into account when selecting the brake size on the torque rating. Considering the load torque direction, the following switchable nominal torque M_{SN} of a brake is attained ($+M_L$ for lifting devices when lowering).

$$M_{SN} = M_A \pm M_L$$

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When expressing the decelerating torque M_A by means of the pulse principle, we obtain after corresponding conversion

acceleration by load	**brake support by load**

$$M_A = J * \frac{d\omega}{dt} \qquad [Nm] \qquad\qquad M_A = J * \frac{d\omega}{dt} \qquad [Nm]$$

$$M_{SN} = \frac{J * n}{9,55 * t_a} + M_L \qquad [Nm] \qquad\qquad M_{SN} = \frac{J * n}{9,55 * t_a} - M_L \qquad [Nm]$$

$$t_A = \frac{J * n}{9,55 * (M_{SN} - M_L)} \qquad [s] \qquad\qquad t_A = \frac{J * n}{9,55 * (M_{SN} + M_L)} \qquad [s]$$

It is assumed that the dynamic torque is achieved instantaneously.
Note that the dynamic torque decreases with the speed.

Considerations of dissipated energy

For all operations at speed with slip, dissipated energy is generated in the brake which is transformed into heat. The admissible amount of dissipated energy resp. power capacity must not be exceeded in order to avoid any inadmissible heating. Often the selection of the brake size upon the torque requirement only is not sufficient. Therefore it must always be checked whether the heat capacity of the brake is sufficient. Generally the dissipated energy in a brake, slipping at time dt with its dynamic torque M_S at an angular speed ω_S is:

$$dQ = M_S * \omega_S * dt$$

With ω_S and conversion by means of the pulse principle the following dissipated energy amount is determined for a single deceleration process with existing load torque

acceleration by load	**brake support by load**

$$Q = \frac{M_{SN}}{M_{SN} - M_L} * \frac{J * n^2}{182000} \qquad [kJ] \qquad\qquad Q = \frac{M_{SN}}{M_{SN} + M_L} * \frac{J * n^2}{182000} \qquad [kJ]$$

If a brake slips with constant slipping speed under operation, the dissipated energy is calculated from the formula

$$Q = 0,105 * 10^{-3} * M_S * n_S * t_S \qquad [kJ]$$

Working brake:
The brake has to brake a shaft with switching frequency "X" from speed "Y" to speed zero and has to hold it.

Holding brake with emergency stop function:
The brake actuates with shaft speed zero and has to hold; in case of emergency, however, it must be able to brake from shaft speed "Y" to zero.

BZFM V7

Electromagnetic Spring-Applied Brake

Permissible Heat Capacity at 3000 rpm

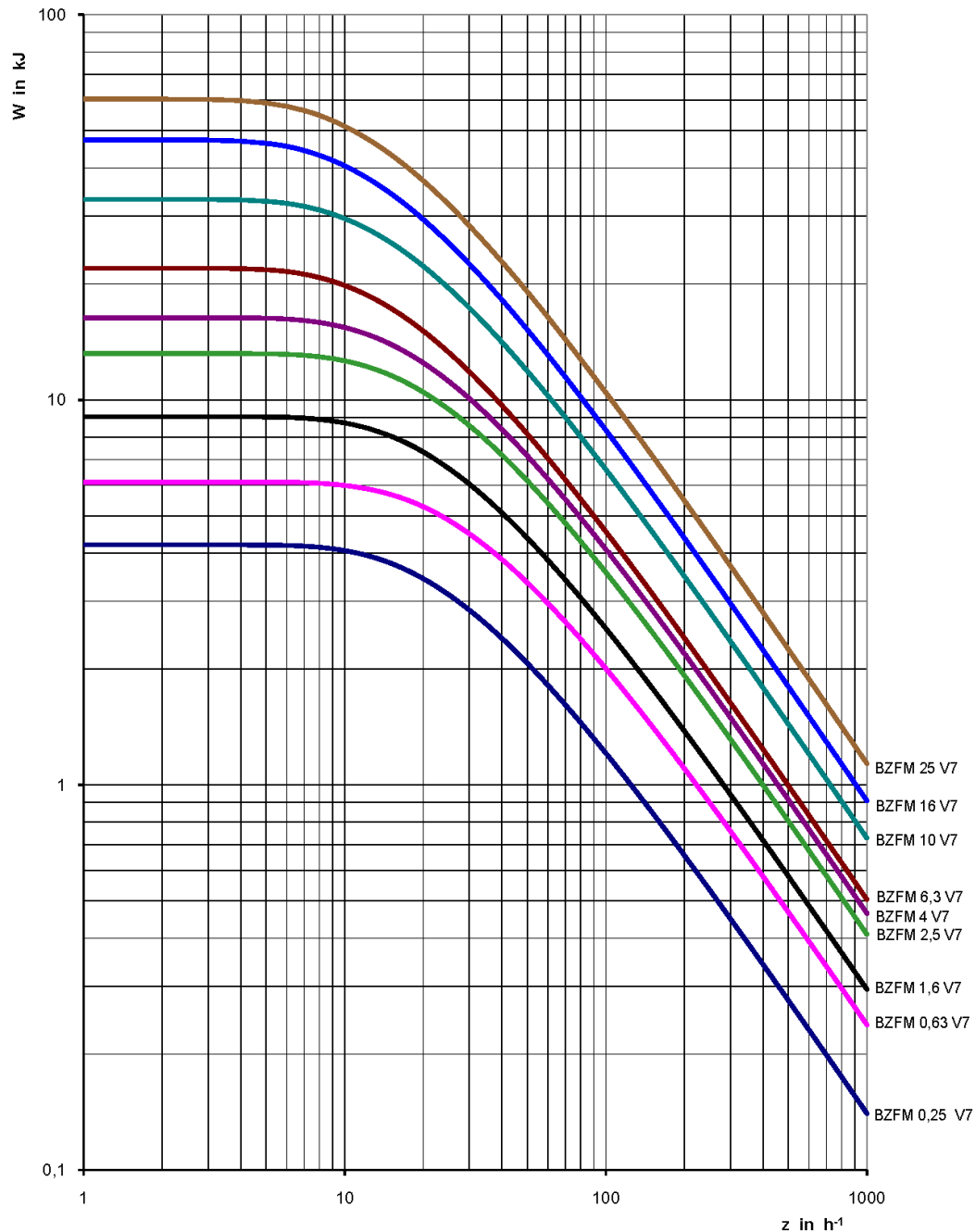W $[kJ]$ Switching operations z $[\frac{1}{h}]$ operations per hour

Abbildung 2: *Heat capacity of series BZFM V7 n = 3000 rpm **. By known operations and number of operations per hour the brake size can be obtained.*
Example: W = 10 kJ/operation und z = 10 operations/hour Size BZFM 1.6 V7

** permissible switching operations per switching at other speed ratings on request

Questionnaire to allow the determination of spring applied brakes

DRIVING MACHINE		
Frequency controlled motor		
Pole changing motor		
Constant speed motor		
Other motor types		
Nominal and maximum power		kW
Nominal and maximum speed		rpm
Maximum torque (i.e. breakdown torque)		Nm
DRIVEN MACHINE		
Slewing system		
Hoisting system		
Trolley or gantry system		
Winch system		
People transporting system		
Other application		
BRAKE TYPE GENERALLY		
Working and emergency brake		
Holding brake with emergency characteristic		
CALCULATION DATA		
Nominal braking speed		rpm
Emergency braking speed (i.e. max. possible overspeed at hoisting drives)		rpm
Load torque at nominal braking speed		Nm
Load torque at emergency braking speed		Nm
Maximum possible load torque		Nm
Number of braking operations per hour at nominal / required speed (incl. load data)		
Number of braking operations per required time unit at emergency speed (incl. maximum load data)		
Moment of inertia of the parts moved by the motor or braked by the brake (motor, gearbox, winch etc.)		kgm^2
Demanded switching cycles of the brake		
Ambient temperature		$°C$
Protection class or short description of environmental conditions Marine, port, in house		
Options Microswitch, rectifier, switching unit, terminal box, heater or other		

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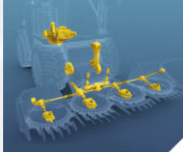
Agriculture >   Construction >   Industry >

FROM POWER SOURCE >
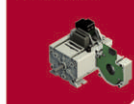
Couplings >   Clutches >   Gearboxes >   Driveshafts >

Brakes >   Controls >   eDrives >   Wheels >

> TO POWER APPLIED

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