STROMAG
A REGAL REXNORD BRAND

PRODUCT
CATALOG

NFF BRAKE

FOR COMPACT INDUSTRIAL AND CRANE APPLICATIONS WITH A HIGH PROTECTION AGAINST HARSH ENVIRONMENTS

Regal Rexnord MARINE SOLUTIONS

Stromag

Founded in 1932, Stromag has grown to become a globally recognized leader in the development and manufacture of innovative power transmission components for industrial drivetrain applications. Stromag engineers utilize the latest design technologies and materials to provide creative, energy-efficient solutions that meet their customer's most challenging requirements.

Stromag's extensive product range includes flexible couplings, disc brakes, limit switches, an array of hydraulically, pneumatically, and electrically actuated brakes, and a complete line of electric, hydraulic and pneumatic clutches.

Stromag engineered solutions improve drivetrain performance in a variety of key markets including energy, off-highway, metals, marine, transportation, printing, textiles, and material handling on applications such as wind turbines, conveyor systems, rolling mills, agriculture and construction machinery, municipal vehicles, forklifts, cranes, presses, deck winches, diesel engines, gensets and stage machinery.

VISIT US ON THE WEB AT **STROMAG.COM**

VISIT US ON THE WEB AT **REGALREXNORD.COM**

Applications

- Holding- and Working brake variations for industrial applications
- Usable for dockside-, harbour and marine crane brake suitable for seawater environment

Standard features

Coil body with coil	Thermal class 155, nitrocarburated and postoxidated
Outer body	Manufactured in sea water proof aluminium with large inspection holes prepared for hand release lever with sealed bearings
Armature plate	Special protection: nitrocarburated and postoxidated
Brake flange	Special protection: nitrocarburated and postoxidated
Friction lining	Low wear rate with low torque fade over a high range of temperature. High thermal capacity
End Cover	Manufactured in sea water proof aluminium with provision for standstill heater
Hub	Nitrocarburated and postoxidated
Fixings screws	All stainless steel
Flying leads	1 metre long
Seals	For high protection

Optional extras

- Simple adjustment with adjusting ring
- Hand release lever
- Tacho / Endcover provision
- Terminal box
- Micro switch to monitor switching states or wear monitoring
- Standstill heater

Switching modules

- Half wave or full wave
- Quick switching units
- Built in terminal box
- Attached for mounting into the motor terminal box

NFF – Electromagnetic Spring-Applied Brake

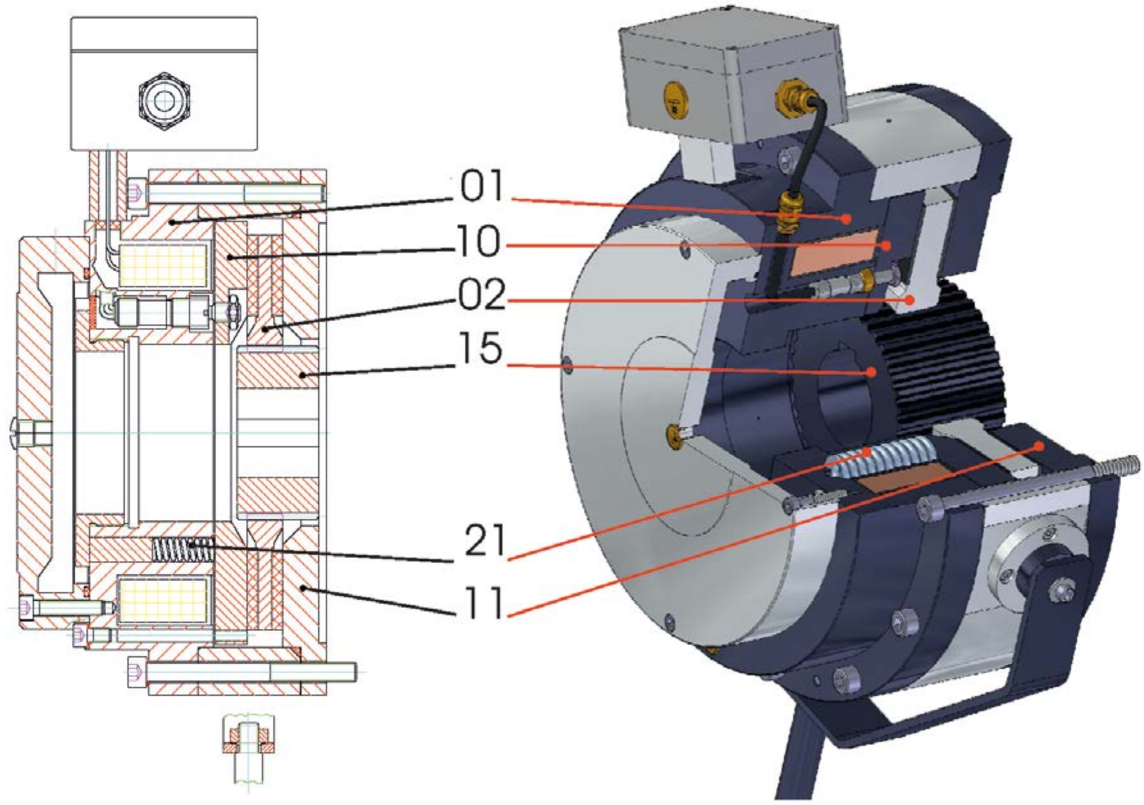
Advantages

- Comprehensive range 20 - 10,000 Nm
- Simple assembly to motor, no dismantling of brake required
- Concentricity through body for tacho fixing
- No setting required when changing armature disc and friction disc
- Compatibility of consumable spares
- Simple maintenance, once only adjustment by shim removal
- Positive feel hand release mechanism
- Proven reliable design
- Sealed inspection holes for air gap or lining wear
- Extremely low inertia
- High heat dissipation
- Free from axial loads when braking and running
- Suitable for vertical mounting, please consult Stromag Dessau GmbH
- Many optional extras available
- Facilities to design to customer's special requirements
- Protection available up to IP 66 (in installed state)
- "Asbestos free" linings as standard

Voltages available

- Voltages: 24 V DC, 103 V DC, 190 V DC and 207 V DC, other voltages (e.g. 110 V DC) on request.
- Coils available to suit: AC – supplies with integral Half and Full wave rectification.
- We suggest the following alternative – Customer to take standard voltage with rectifier which Stromag can provide.

Designation of individual components



01) Coil body with coil
11) Brake flange
02) Friction disc with friction lining
15) Pinion
10) Armature dise
21) Compression spring

Brake operation

Brakes should be switched on the DC side. (This will achieve fastest response times).

Brakes are fail-safe i.e. Spring-Applied. Power on to release.

When the coil is energized, the magnetic flux attracts the armature disc (10) to the coil body, this compresses the springs (21) and releases the friction disc with friction lining (02) and the brake is released.

When the coil is de-energized the compression springs (21) push the armature disc (10) axially against the friction disc with friction lining (02). This is clamped between the armature disc (10) and the brake flange (11) thereby preventing rotation. The braking effect is transmitted through the friction disc with friction lining (02) to the shaft by way of a splined driving hub (15).

Micro switch

Optional availability, 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, ie. brake release before starting motor.

Brake termination

Three standard versions:

- Flying leads, usually 1 meter long through PG cable gland in coil body.
- IP 66 Terminal box, for easy connection and removal,
- Versions for AC supply with built-in full wave or half wave rectification inside the terminal box.

Emergency hand release lever

No setting is required over maximum lining wear, special bearing mechanism for easy operation and positive feel, emergency jacking screws available if hand release lever not supplied.

Brake flange

Manufactured to suit our brake and your motor.

Standstill heater

Inboard standstill heater can be provided.

Tacho / Encoder

Connections for Tacho / Encoder can be provided as optional extras.

Special surface finishes

Most of the components can be treated with a protective surface coating for arduous environments;

e.g. Dockside Cranes / Deck mounting etc.

List of dimensions

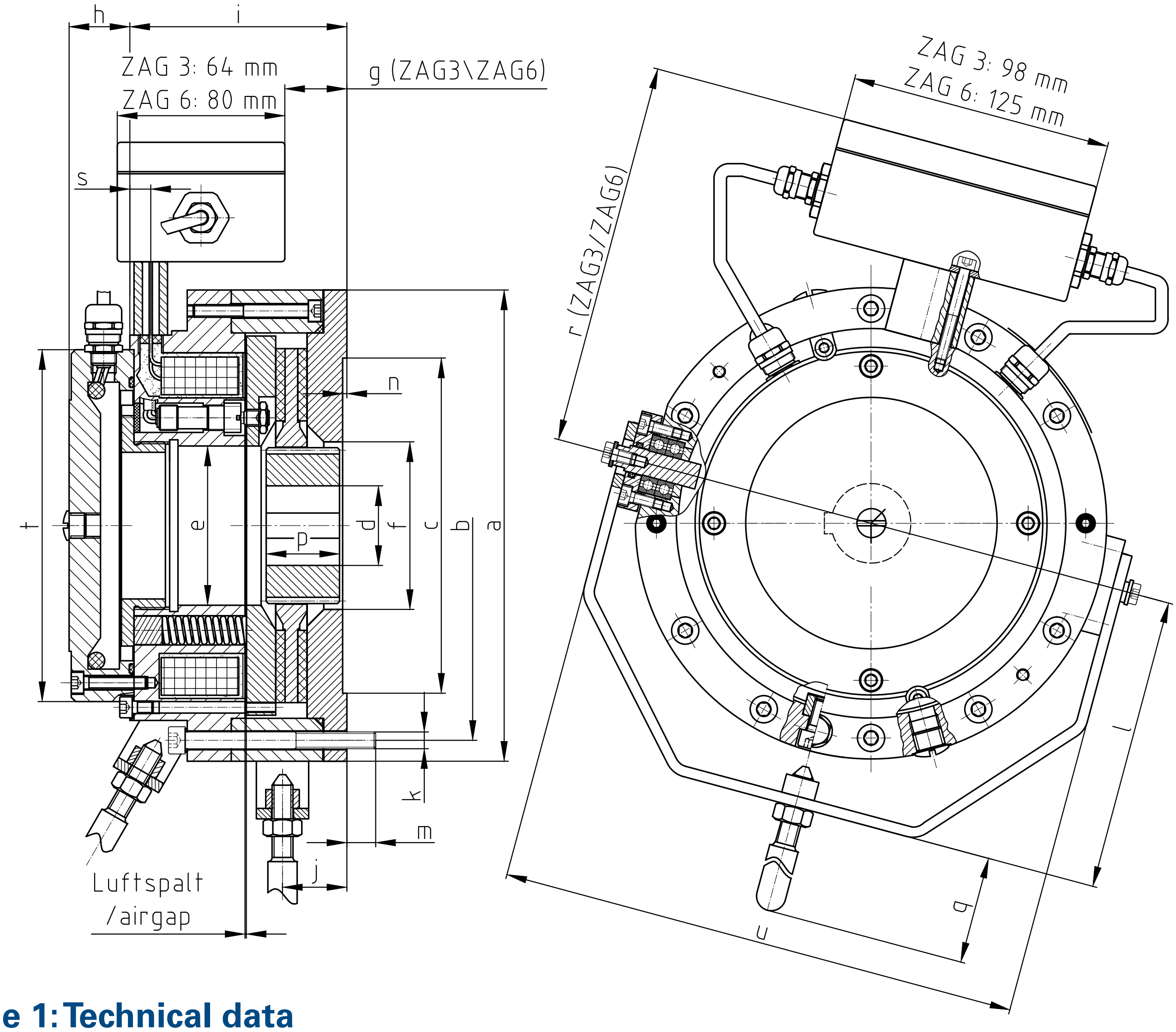


Table 1: Technical data

Size NFF	M_{SN} Nm	$M_{Ü}$ Nm	n_o rpm	n_{zn} rpm^{-1}	U_n * V DC	P_k W	airgap min/max	W kJ	P_{vn} kW	J kgm²	m kg
2	20	22	5300	3000	103	89.9	0.6/1.0	25	0.080	0.0004	6.3
4	40	44	4900	3000	103	90.7	0.6/1.0	30	0.067	0.00043	10.4
6.3	63	70	6500	3000	103	113.9	0.6/1.2	65	0.103	0.0008	13
10	100	110	6500	2500	103	110.4	0.6/1.2	75	0.110	0.00125	14
16	160	175	6000	2400	103	115.8	0.6/1.2	120	0.124	0.0034	21
25	250	275	5600	2100	103	136.6	0.6/1.2	150	0.149	0.0043	30
40	400	440	4900	1800	103	212.9	0.6/1.3	250	0.170	0.01212	38
63	630	700	4500	1500	103	227.3	0.6/1.5	320	0.249	0.01463	58
100	1000	1100	3900	1300	103	277.6	0.6/1.6	450	0.270	0.04171	85.5
160	1600	1750	3200	1000	103	353.5	0.6/1.6	450	0.325	0.14821	133
250	2500	2750	2800	900	207	367.0	0.6/1.8	700	0.400	0.23515	157
400	4000	4400	2400	800	207	400.9	0.6/1.8	750	0.482	0.43412	286
630	6300	7000	2100	700	207	489.6	0.6/1.8	820	0.601	1.01607	363
1000	10000	11000	1800	650	207	535.5	0.6/2.1	1030	0.587	1.56099	612

* other voltages on request

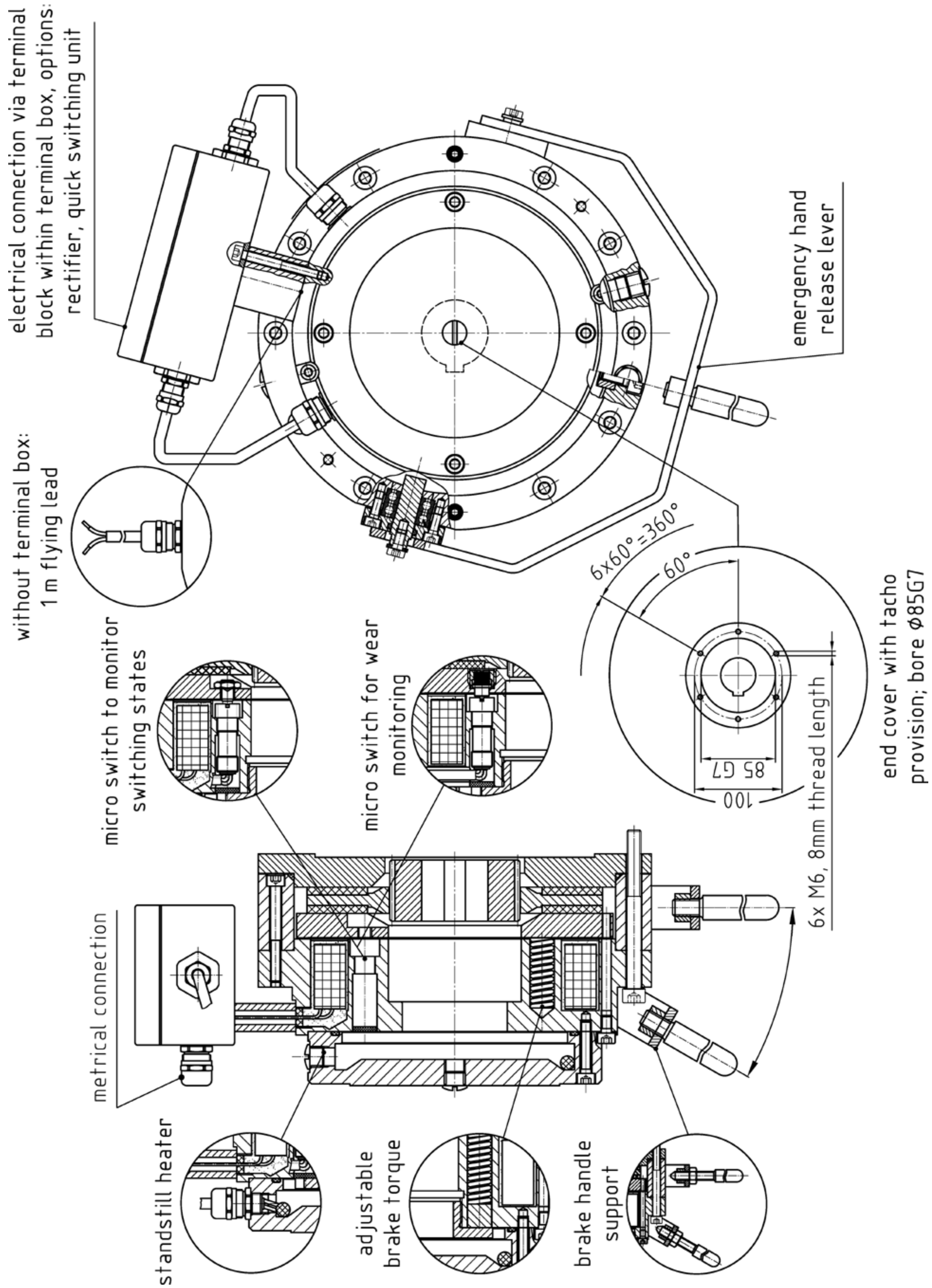
M_{SN}	Switchable nominal torque at 1m/s frictional speed to DIN VDE 0580 (applies to dry operation with an oil- and grease-free friction lining after running-in)
$M_{Ü}$	Transmissible static nominal torque without slip, to DIN VDE 0580 (applies to dry operation with an oil- and grease-free friction 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

Table 2: List of dimensions (all dimensions in mm)

Size NFF	2	4	6.3	10	16	25	40	63	100	160	250	400	630	1000
a	150	165	175	190	225	250	270	314	350	440	500	560	650	750
b	135	152	162	175	190	225	250	292	325	418	472	530	620	710
cH 8	120	140	140	160	180	200	220	240	270	340	390	460	530	600
dH 7	25	30	40	40	45	50	60	60	80	110	120	130	140	160
e	53	55	55	65	76	78.5	90	96	125	200	215	240	270	300
f	47	80	80	65	80	90	105	120	158	220	255	280	320	330
$g_{ZAG\ 3}$	15	29	32.6	36	44	61	81	82.6	108	-	-	-	-	
$g_{ZAG\ 6}$	-	15	18.6	22	30	47.2	67	68.6	94	108.8	116.7	152	148.2	188.4
h	30	33	29	27	29	30	32	32	32	33	30	33	33	32
i	73.5	89.6	94.6	96	104	121	141	145	168	182.6	191	226	225	265
j	20.9	28	29	29	32	39	40	45	54	57	-	-	-	-
k (6x)	M5	M6	M6	M6	M8	M8	M8	M10	M10	M12	M16	M16	M16	M20
l	95	110	110	123	140	150	170	200	220	290	-	-	-	-
m	10.5	7.8	13	14	14	13	14.2	19.5	19	24.4	21.4	26.3	30	30
n	2.5	2.5	2.5	3.5	3.5	3.5	4	4	5	5.5	5	5	6	6
p	24	28	30	30	35	45	45	55	75	125	130	150	185	210
q	110	110	110	110	110	150	150	250	500	95	-	-	-	-
$r_{ZAG\ 3}$	113.5	122	126.5	140	157	163	177	194	212	-	-	-	-	-
$r_{ZAG\ 6}$	-	145	149.5	163.5	178	186	199	217	234.5	285.5	312.5	344.5	384	437
s	8.5	10.5	10	10	10	10	10	12	10	10	10	10	10	10
t	123	140	150	146	168	172	184	230	255	255	255	320	320	400
u	179.5	198	201	216	251	276	300	343	408	480	-	-	-	-

Keyways to DIN 6885/1

Optional accessories



Example of designation

NFF	Brake type
10	Brake size
38H7	Bore diameter with keyway
(Dm15)	Bore diameter, prebored
24 VDC	Nominal voltage
SR	With adjusting ring
HL	With hand release lever
MS	With microswitch
KK	With terminal box
GR	With rectifier
HZ	With standstill heater
SB	With quick switching unit

Calculations

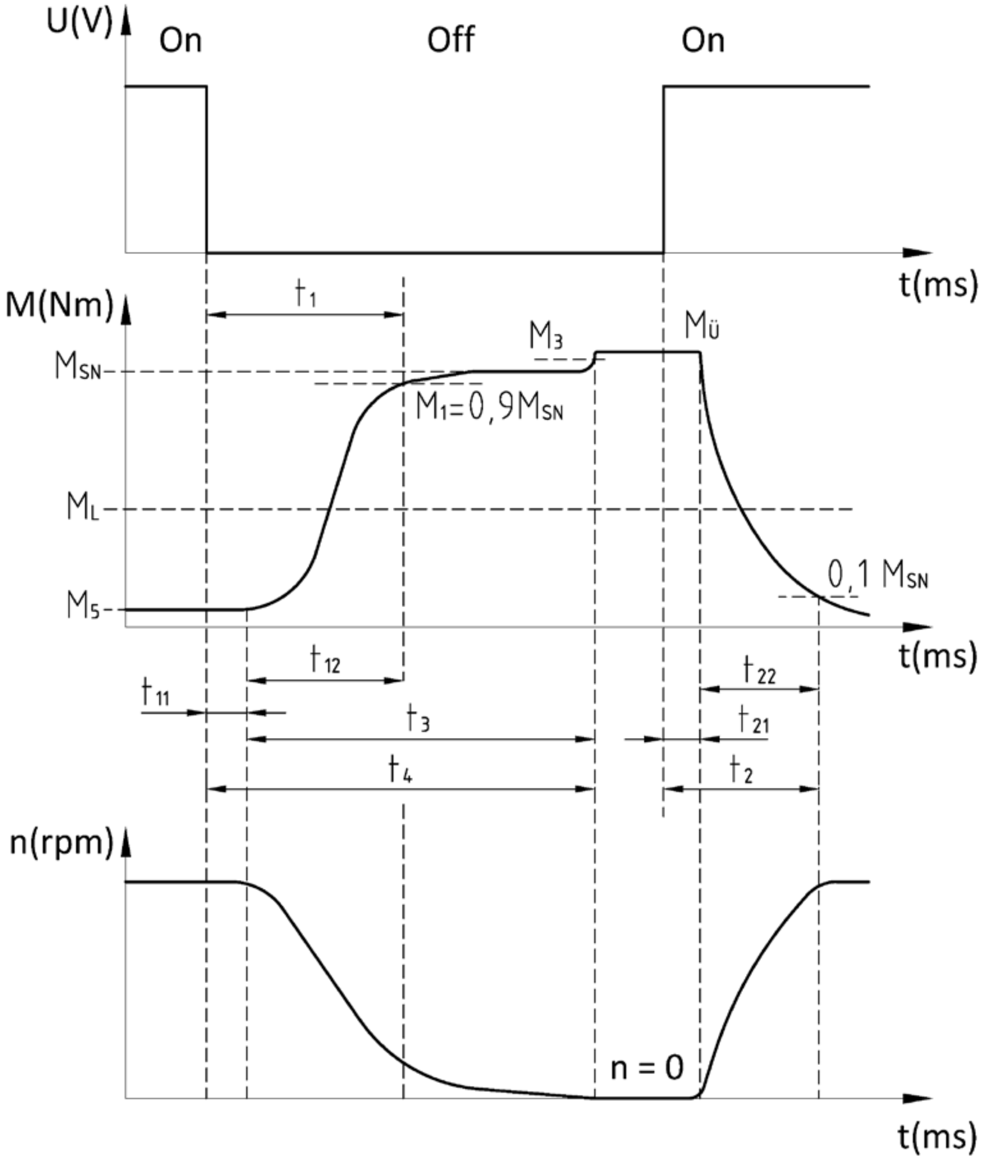


Figure 1:
The diagram shows the time response of an Electromagnetic Spring-Applied Brake as defined by VDE regulations 0580

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, 9M_{SN})

M_3 = Synchronization torque [Nm]

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

$M_ü$ = 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-Aplied 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.

Nomenclature

A_R	cm^2	Friction surface	
m	kg	Mass	
Q	Joule(J)	Heat quantity	
Q_h	Watt(W)	Heat per hour	
c	$\frac{kJ}{kgK}$	Specific heat	**Steel** $c = 0,46 \frac{kJ}{kgK}$ **Cast iron** $c = 0,54 \frac{kJ}{kgK}$
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

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

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

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

$$[v = m/s] \quad [n = min^{-1}] \quad [m = kg]$$

Torque considerations for the brake

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

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

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

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).

Acceleration by load	Brake support by load
$M_{SN} = M_A + M_L$	$M_{SN} = M_A - M_L$

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
$M_A = J * \frac{d\omega}{dt}$ [Nm]	$M_A = J * \frac{d\omega}{dt}$ [Nm]
$M_{SN} = J * \frac{J * n}{9,55 * t_A} + M_L$ [Nm]	$M_{SN} = J * \frac{J * n}{9,55 * t_A} - M_L$ [Nm]
$t_A = \frac{J * n}{9,55 * (M_{SN} - M_L)}$ [s]	$t_A = \frac{J * n}{9,55 * (M_{SN} + M_L)}$ [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
$Q = \frac{M_{SN}}{(M_{SN} - M_L)} * \frac{J * n^2}{182.000}$ [kJ]	$Q = \frac{M_{SN}}{(M_{SN} + M_L)} * \frac{J * n^2}{182.000}$ [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.

Permissible heat capacity at 1500 rpm

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

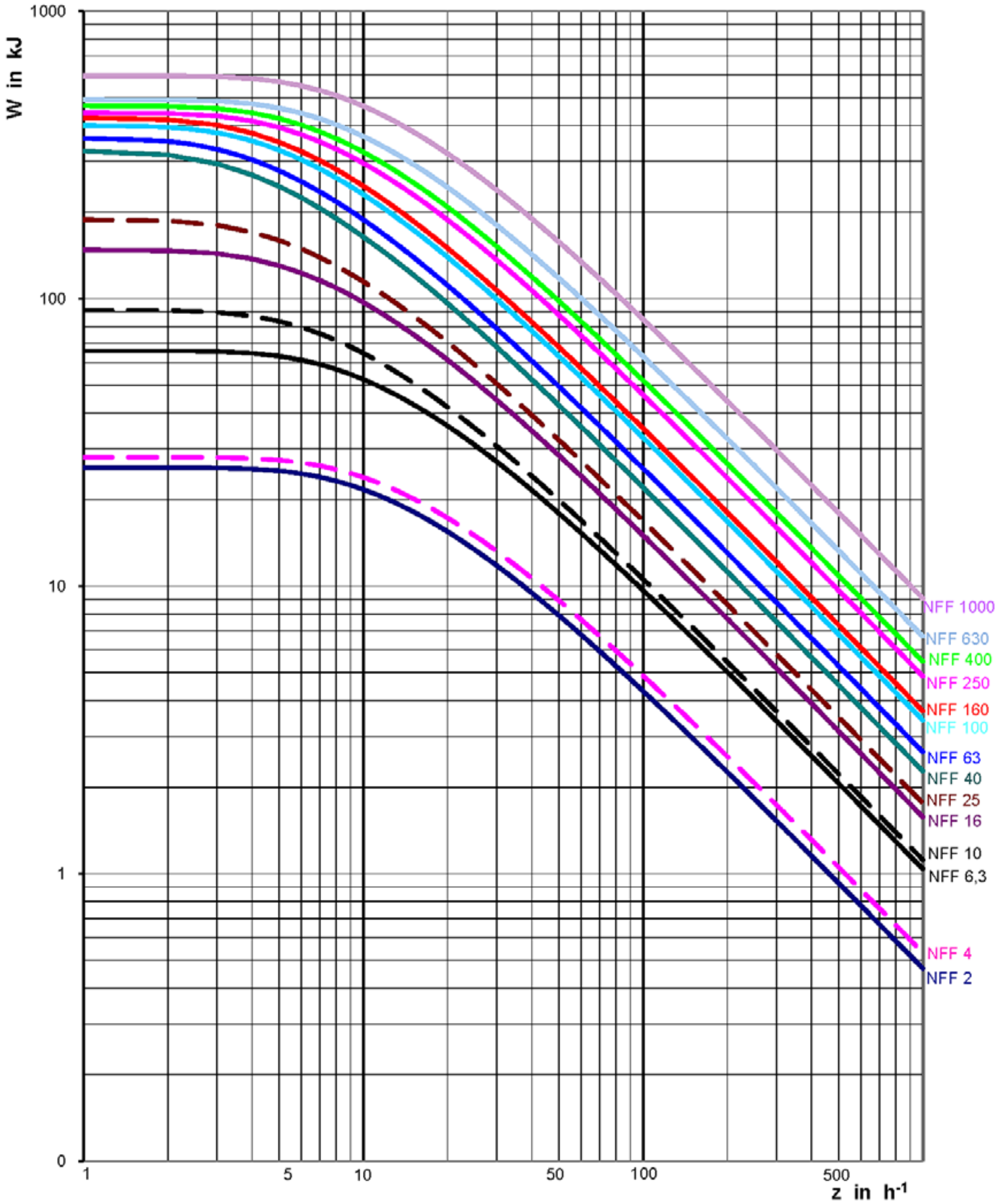


Figure 2: Heat capacity of series NFF n =1500 rpm **.
By known operations and number of operations per hour the brake size can be obtained.

Example: W = 100 kJ/operation and z = 10 operations/hour choose the size NFF 25

** 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 Nominal and maximum speed Maximum torque (i.e. breakdown torque)		kW rpm Nm

DRIVEN MACHINE

Slewing system Hoisting system Trolley or gantry system Winch system People transporting system Other application		

BRAKE TYPE

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		

Stromag Facilities

Europe

Germany

Hansastraße 120
59425 Unna - Germany
+49 (0) 23 03 102 0

Clutches & Brakes, Couplings, Geared Cam Limit Switches, Discs

France

Avenue de l'Europe
18150 La Guerche sur L'Aubois - France
+33 (0)2 48 80 72 72

Disc Brakes & Drum Brakes

Great Britain

Ampthill Road
Bedford, MK42 9RD - UK
+44 (0)1234 324347

Electromagnetic Clutches & Brakes, Industrial Caliper Brakes

North America

USA

31 Industrial Park Road
New Hartford, CT 06057 - USA
860-238-4783

Electromagnetic Clutches & Brakes

300 Indiana Highway 212
Michigan City, IN 46360 – USA
219-874-5248

Couplings

2800 Fisher Rd.
Wichita Falls, TX 76302 - USA
940-723-3400

Geared Cam Limit Switches, Industrial Caliper & Drum Brakes

South America

Brasil

Avenida João Paulo Ablas, 2970
Jardim da Glória, Cotia - SP,
06711-250 - Brasil
+55 (11) 4615-6300

Flexible Couplings, Bearing Isolators, and Coupling Guards

Asia Pacific

China

T40B -5, No. 1765 Chuan Qiao Road
Pudong 201206, Shanghai - China
Tel +86 21-60580600

Clutches & Brakes, Electromagnetic Clutches & Brakes, Couplings, Industrial Caliper & Drum Brakes, Discs, Geared Cam Limit Switches

India

Gat No.: 448/14, Shinde Vasti, Nighoje
Tal Khed, Pune- 410 501
+91 2135 622100

Clutches & Brakes, Electromagnetic Clutches & Brakes, Couplings, Industrial Caliper & Drum Brakes, Discs, Geared Cam Limit Switches, Wind Brakes

Renewable Energy

Denmark

Jernbanevej 9
5882 Vejstrup
+45 63 255 255

Wind Brakes

Scan to see all the brands of Regal Rexnord

STROMAG™
A REGAL REXNORD BRAND
www.stromag.com

P-8357-SG-A4 11/23