Technical Information Sheet — 77 100 . . A00

Spring-applied multiple-disc brake
Ready for fitting or for mounting
for D.C. operation
with sintered discs for dry running

This spring-applied brake is an electromagnetic device intended for dry running, where the dynamic effect of an electromagnetic field is exploited to compensate the braking effect produced by the spring. The brake grips in absence of current and releases under current. It is principally possible to operate the brake in vertical position.
If necessary, it is possible to eliminate the braking effect mechanically by means of an additional hand release.

CE

The brake complies to the regulations for low tension 73/23/EWG. The observance of the EMV regulation 89/336/EWG is to be ensured by the user through corresponding switching devices and/or controls. When using the recommended BINDER fittings, refer to the corresponding Technical Information Sheet for the observance of the respective EMV regulations.
The products have been manufactured and tested to DIN VDE 0580 October 1994.
When using the brakes, please observe the "General Technical Information" (please refer to current BINDER catalogue regarding Drive Engineering) and the "Operating Instructions 77 100..A00".

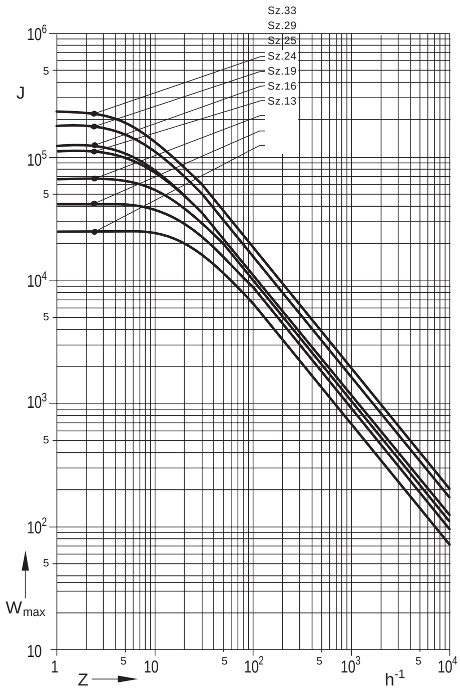
Standard nominal voltages:
24 V–, 102 V–, 178 V –.
Brake with silicon rectifier:
230 or 400 V 1 ~ 40 ... 60 Hz

Protection IP 54
(IP 55 if mounted under fan cowl; in case of through shaft, adjustment ring must be sealed).
Increased protection against corrosion possible.

Insulation Class: F

Connections:
Litz wires
Adapter box for rectifier
One-way rectifier

Maximum switching effort per switching operation W_{max} in relation to the switching number per hour Z
(values valid for n = 1500 min^{-1})



Bridge rectifier
Over-excitation rectifier

Explanations regarding connections:
With silicon rectifier
The excitation winding is rated, depending whether the operating current is 230 or 400V A.C., at 102 or 178 V D.C.

With silicon rectifier with over-excitation
The excitation winding is rated, depending whether the operating current is 230 or 400 V A.C., at 102 or 178 V D.C. The over-excitation, that is limited in time (double nominal tension of the brake), will cause a reduction of the disconnection time t_2 to about 40 %.

Type 77 10019A00
with hand release

Microswitch:
Protective lid for microswitch starting size 16 ... 25.
Explanations regarding microswitch:
The attached microswitch is rated at 250 V1~/15 A or at 24 V-/6A. In the control line of the motor contactor it will prevent the motor from starting if the brake is not released.

Centering shoulder:
for attachment of pilot generator (standard for size 13 to 25)

Accessories:
Hand release
Fixing bolts

Subject to design modifications.

Please observe ordering data.

Technical Data

The response times are valid for D.C. switching under operating temperature, nominal tension, and nominal air gap. The values indicated are average values, underlying straying. In case of A.C. switching, the coupling time t_1 will increase its value approx. by 6.
The time from the switching on of the current up to the reduction of the torque to 10 % of the nominal torque M_2 represents the disconnection time t_2. The coupling time t_1 is the time starting with the disconnection of the current up to reaching the nominal torque M_2.
The maximum switching energy P_{max} is the switching effort W that can be achieved by the brake within one hour. Please refer to the diagram for the values of the maximum switching effort per switching operation W_{max}. The values of P_{max} and W_{max} are reference values and are valid for the integration between the B-end shield and the motor fan or for mounting onto motors. All data are valid for mounting or attachment on horizontal shafts. In case of vertical operation, reduce P_{max} and W_{max} down to 90 %.
The torque can be modified via the adjustment ring on the back of the brake (please refer to diagram in Operating Instructions 77 100 .. A 00).
The values indicated for the nominal torque M_2 will be reached in a run-in state at operating temperature and during dry running. The values of the switching moment M_1 depend on the speed.
The torque will be reduced on oily or greasy friction surfaces.

Size	Nominal torque (Standard)		Lowest and highest possible nominal torque with largest (E_{max}) and smallest (E_{min}) clearance of adjustment ring	Residual torque	Max. Rotation	Max. switching energy Attachment	Mounting	Nominal energy		Response times Coupling time	Disconnection time	Inertia torque Hub and inside disc	Service life (Reference value)	Weight Basic brake Type 77 100 ..
	M_2 at	n	M_2 min - max	M_5	n_{max}	P_{max}	P_{max}	P_N	P_S	t_1	t_2	J	W_{tot}	m
	Nm	min^{-1}	Nm	Nm	min^{-1}	kJ/h	kJ/h	W	VA	ms	ms	kgcm^2	MJ	kg
13	25	250	17.5 - 27.5	0.05	4500	460	720	38	69	50	160	6.25	103	5.4
16	50	250	25 - 55	0.1	3800	570	930	60	96	80	200	20	347	10.2
19	100	250	50 - 110	0.2	3200	640	1090	75	120	100	270	40	463	14.8
24	200	100	100 - 220	0.5	2500	700	1190	109	195	200	330	95	852	31.1
25	300	80	150 - 330	0.7	2500	740	1210	109	195	250	350	135	700	32.6
29[1])	400	80	200 - 440	1	2100	1000	1700	185	320	300	480	250	1300	58.3
33[1])	800	80	400 - 880	2	1800	1300	1980	230	400	450	600	650	2500	93.4

[1]) The brake sizes 29 and 33 are only available with over-excitation rectifier for A.C. connections.

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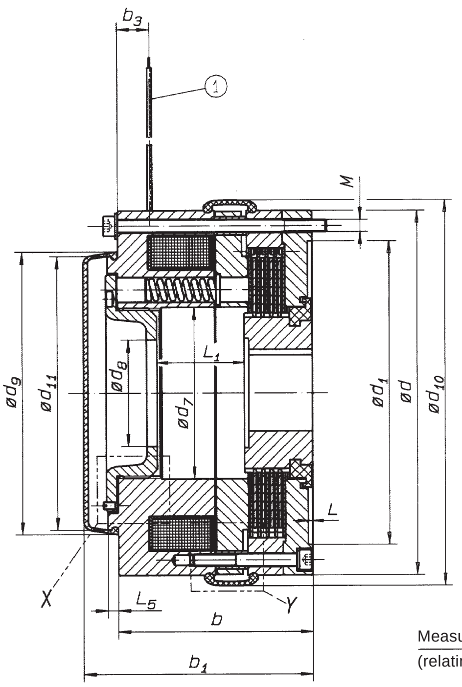

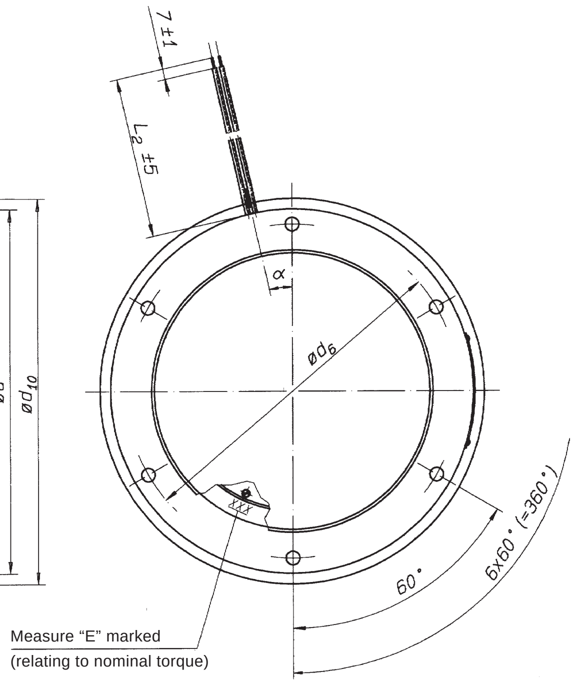

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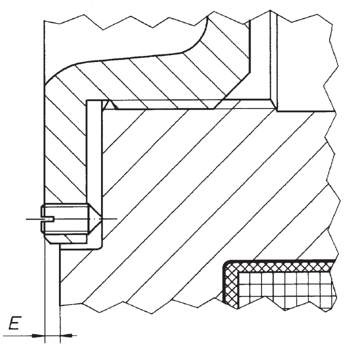

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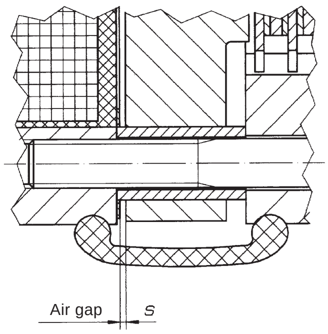
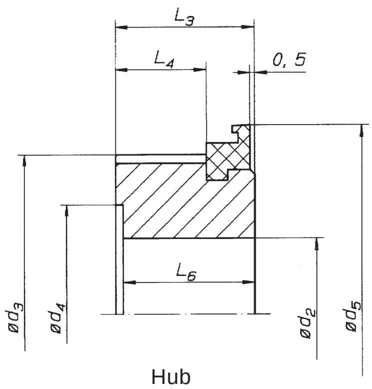
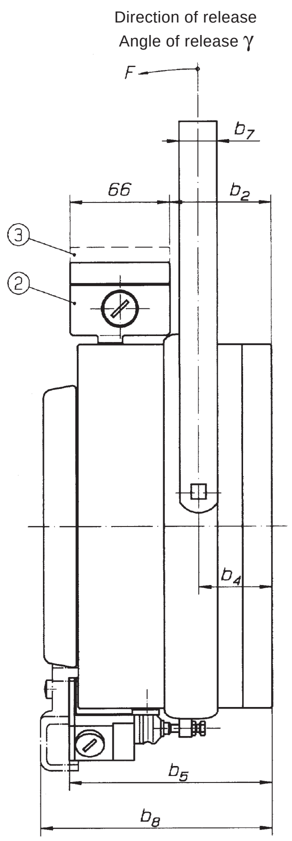
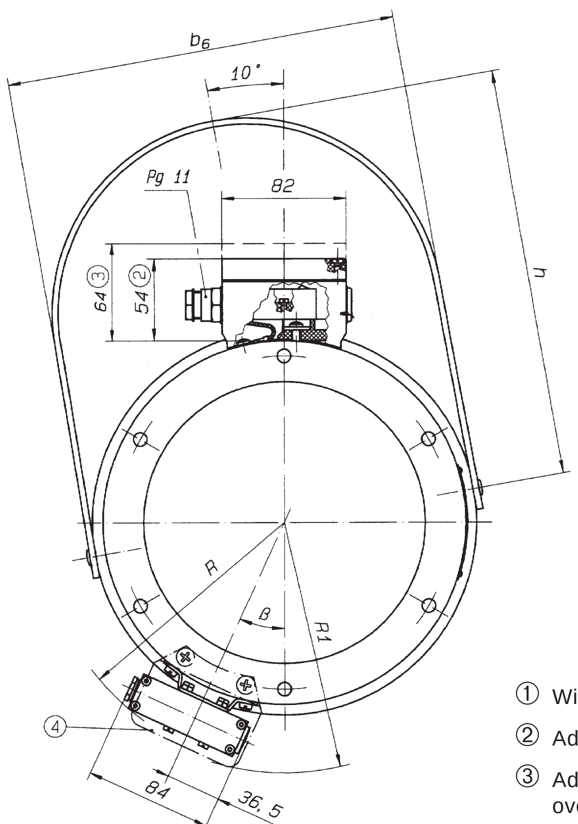




Hub





① With litz wires

② Adapter box with low lid (standard)

③ Adapter box with high lid only with over-excitation rectifier

④ Protective lid

Dimensions (mm):

Sz.	d	d1 (H9)	d2 (H7) min / max	d3	d4	d5	d6	d7	d8	d9 ca.	d10 ca.	d11 (j7) Centr.-∅	b	b1 ca.	b2	b3	b4	b5	b6
13	135	110	12 / 35	65	48	76	120	65.8	54	99	146	93	73.5	90	23.5	9	27.5	106	155
16	165	140	20 / 45	75	60	88	150	79.2	67	129	178	125	90	108	40	9	32	111	187
19	190	160	25 / 55	90	72	107	170	92.2	79	152	204	148	102	120	52	9.5	35.5	115.5	216
24	240	200	30 / 75	105	–	124.5	220	113	90	176	258	170	120	143	59	21	39.5	129	266
25	240	200	30 / 75	105	–	124.5	220	113	90	176	258	170	128	151	67	21	48	137	266
29	290	240	35 / 85	125	–	145.5	267	136	100	238	315	210[1])	154	177	89	26	53	144	316
33	330	275	40 / 95	140	–	161.5	300	152	115	238	356	225[1])	179	202	112	28	60.5	154.5	358

Sz.	b7	b8	h	L	L1	L2 Standard	L3	L4	L5	L6	M	R	R1	E_{max}	E_{min}	s	α	β	$\gamma^{+5°}$	F [N]
13	20	–	161	2.5	32.5	100	25	16	5	24	6 × M 5	111	–	4.6	3.0	$0.5^{+0.2}$	15°	15°	16°	15
16	20	115	203	2.5	40.5	100	28	19	5	26.5	6 × M 6	125	130	4.6	2.4	$0.6^{+0.2}$	15°	26.5°	15°	40
19	20	127	224	3	49.5	100	31	21.5	5	30	6 × M 6	137	142	5.6	3.8	$0.6^{+0.3}$	15°	25°	16°	50
24	25	145	269	3	48	100	45	30	7	–	6 × M 8	161	165	5.2	2.8	$0.7^{+0.3}$	7°	25°	20°	55
25	25	153	269	3	56	100	45	30	7	–	6 × M 8	161	165	5.0	3.1	$0.9^{+0.3}$	7°	25°	20°	55
29	30	–	328	5	75	100	52	34	8	–	6 × M 10	186	–	3.4	1.4	$1.1^{+0.3}$	6.5°	134.5°	21°	90
33	30	–	377	5	94	100	58	38	8	–	6 × M 12	205	–	4.1	1.9	$1.1^{+0.3}$	7°	135°	22°	180

The hub bore $d2_{min}$ is mated - for reasons of sturdiness - to the torque and to the use of shaft material having a tenacity of 500 N/mm². The hub can be delivered with smaller bore for special applications.

Normal keyway according to DIN 6885, Sheet 1, tolerance field JS 9.
[1]) Centering shoulder not in series

Ordering Example Spring-applied multiple-disc brake

77 100 [. .] A00/ [. . .] V/ [.] / [.] / [. . .] Nm / [. . .] mm

Size according to chart

Standard supply voltage
DC: 24, 102, 178 V
AC: 230, 400 V (only possible for connections item 4 and 5)

Connections
1 = with litz wire, length 100 mm (standard)
2 = with litz wire, length 750 mm
3 = Adapter box with clamp
4 = Adapter box with rectifier
5 = Adapter box with over-excitation rectifier, with high lid

0 = Without microswitch
1 = With microswitch
2 = With microswitch and protective lid (for sizes 16 to 25)

Range of nominal torque [Nm]	Standard [Nm]
Sz.13: M_2 = 17.5 - 27.5	25
Sz.16: M_2 = 25 - 55	50
Sz.19: M_2 = 50 - 110	100
Sz.24: M_2 = 100 - 220	200
Sz.25: M_2 = 150 - 330	300
Sz.29: M_2 = 200 - 440	400
Sz.33: M_2 = 400 - 880	800

Smaller bore of adjustment ring as d8 (in mm steps)

Centering shoulder for tachometer attachment for size 29 or size 33

Any values other than "standard" at extra cost.

Ordering example Hub

71 101 [. .] C1900 [.] / [. .] H7/ [. .]

Size according to chart

0 = with seal
1 = without seal

Bore diameter d2 in mm (standard)
Sz. 13: ∅ 20, ∅ 24, ∅ 25, ∅ 28, ∅ 30
Sz. 16: ∅ 24, ∅ 25, ∅ 28, ∅ 30, ∅ 40
Sz. 19: ∅ 30, ∅ 38, ∅ 40, ∅ 42, ∅ 45
Sz. 24: ∅ 40, ∅ 42, ∅ 45, ∅ 48, ∅ 50 [1])
Sz. 25: ∅ 40, ∅ 42, ∅ 45, ∅ 48, ∅ 50 [1])
Sz. 29: ∅ 45, ∅ 50, ∅ 55, ∅ 60
Sz. 33: ∅ 45, ∅ 50, ∅ 55, ∅ 60
Groove DIN 6885, Sheet1, JS9

or primary bore = GB

[1]) Size 24 and 25 identical, please order size 24.

Accessories

Sz.	Hand release	Fixing bolts Screw size	Order no.	Number
13	71 101 13E00940	DIN 912 - M 5 × 85 - 8.8	304 035	6
16	71 101 16E00940	DIN 912 - M 6 × 100 - 8.8	304 060	6
19	71 101 19E00940	DIN 912 - M 6 × 120 - 8.8	304 062	6
24	71 101 24E00940	DIN 912 - M 8 × 130 - 8.8	304 088	6
25	71 101 24E00940	DIN 912 - M 8 × 140 - 8.8	304 090	6
29	71 101 29E00940	DIN 912 - M 10 × 170 - 8.8	304 123	6
33	71 101 33E00940	DIN 912 - M 12 × 200 - 8.8	304 150	6

KENDRION
BINDER MAGNETE

Operating Instructions

with list of piece parts
for spring-applied multiple-disc brakes
for D.C. operation

77 100 . . A00

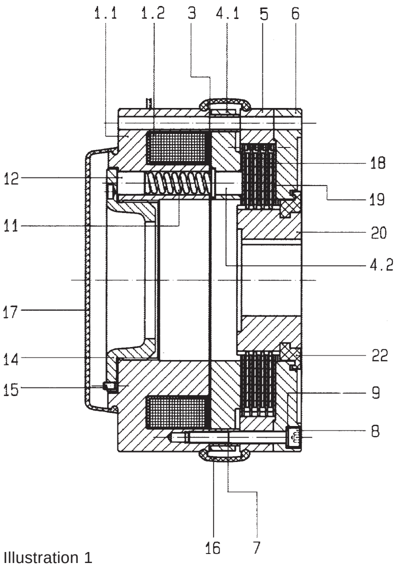


Illustration 1

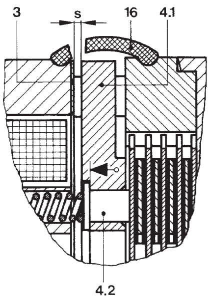
1.1	Magnet casing	11	Pressure spring
1.2	Excitation winding	12	Setbolt
3	Antiadhesive disc	14	Adjustment ring
4.1	Armature	15	Setscrew
4.2	Bolt	16	Sealing cover
5	Annular gear	17	Covering
6	Flange	18	Inside disc
7	Distance bushing	19	Outside disc
8	Cheese-head screw	20	Hub
9	Seal	22	Seal

Construction and Operating Principle

The magnet casing (1.1) of the spring-applied brake comprises the permanently fitted excitation winding (1.2) and is connected to the annular gear (5) and the flange (6) by means of 3 or 6 screws (8). The springs (11) press the disc package via the bolts (4.2) that are loosely held within the armature (4.1); the disc package consists of the outside discs (19) with external toothing, guided within the annular gear (5), and of the inside discs (18) with internal toothing, guided on the hub (20). The hub is thus brought to a standstill. As soon as the excitation winding (1.2) is energised on, the magnet casing (1.1) attracts the armature (4.1) which is fixed on the distance bushings (7) between magnet casing (1.1) and annular gear (5). The bolts (4.2) are thus lifted against the force of the pressure springs (11): the disc package is released and the braking effect relaxed. As the spring-applied brake is a closed system, no forces will be exerted externally in the axial direction. The brake is protected against dust and water by the covering (17), the sealing cover (16), and the seal (22).

Assembly

The spring-applied brake is delivered, ready for fitting. It needs not be dismantled for mounting. The sintered discs (18) with internal toothing are kept in their position by the force of the springs (11) and are already positioned with one tooth opposite the other to allow an easy insertion of the hub (20). In order to prevent the sintered discs (18) from slipping out of this position, only energise the excitation winding (1.2) of the brake if the hub (20) is inserted.



3	Antiadhesive disc
4.1	Armature
4.2	Bolt
16	Sealing cover
s	Air gap

Illustration 2

After the exchange of the set of discs and also for monitoring purposes of wear, strip the sealing cover (16), when the brake is mounted but not under current, in order to measure the air gap s (for measures please refer to chart 1). Slide two screw drivers offset at 180° between the annular gear (5) and the armature (4.1) and push the weight of the armature uniformly in direction of arrow, i.e. in opposite direction of the attachment side, until the armature (4.1) rests on the bolt (4.2). It is now possible to **measure the air gap** with a thickness gauge between the armature (4.1) and the antiadhesive disc (3) at two different spots at least.

Slip the hub (20) onto the shaft already prepared and equipped with a feather key as per DIN 6885, Sheet 1, and secure axially (by means of a shaft shoulder, circlip or similar). Take care that the outside front surface of the hub (20) and the resting surface of the flange (6) are on one level.

The brake itself is screwed onto a motor flange or on a casing wall.

Take care not to exceed the values indicated on chart 1 for the 6 cheese-head screws (8) when tightening them. As extremely long screws as per DIN 912 are needed and these are not always available everywhere, they may be supplied together with the brake, if ordered.

For brakes with increased protection against corrosion or increased type of protection that are operated outside, place seals (e.g. Cu-seals) under the heads of the fixing bolts. Furthermore, seal the resting surface of the brake using a luting agent.

The brake is centered on the neck of the flange or on the wall. However, do not hammer the brake with hard blows onto the centering shoulder, or else the parts made of magnetic soft iron will be damaged; rather provide a tolerance allowing the brake to be slipped on easily. We recommend to use h9 or e9 as tolerance for the centering shoulder (tolerance of the centering turned groove on flange (6) of brake H9). Allowed variation in exact centering with regard to shaft and thus to the hub is 0.2 mm at the most. The maximum allowed eccentricity of the shaft is of 0.05 mm.

A dislocation of the axial position of the hub caused by tolerances in serial production of, for example, the motor end shield and shaft should only have an effect towards the inside of the brake; or else, the function of the seal (22) will be impaired. For allowed tolerance, please refer to chart 1 (end play).

It is generally possible to use the brake in a vertical position. Forcing springs, incorporated in the standard version, ensure the use of the brake almost without residual torque in its released state.

For brakes with mechanical hand release, remove the hand release lever during operation; this will prevent the release lever from disturbing the exact braking due to its own weight or due to the accelerations it underlies when the brake is applied. If you do not want to remove the lever, place it so that it hangs down without encumbrance when the brake is applied.

Chart 1

Brake size		**13**	**16**	**19**	**24**	**25**	**29**	**33**
Cheese-head screw with hexagon socket	DIN 912 8.8	M 5 x 85	M 6 x 100	M 6 x 120	M 8 x 130	M 8 x 140	M 10 x 170	M 12 x 200
Tightness of cheese-head screw	Nm	4	8	8	12	12	18	28
New value of air gap s	mm	0.5...0.7	0.6...0.8	0.6...0.9	0.7...1	0.9...1.2	1.1...1.4	1.1...1.4
Max. air gap s_{max}	mm	1	1.7	1.7	1.8	1.8	2.3	2.5
Max. adm. end play of hub	mm	1	1	1	1.2	1.2	1.2	1.2

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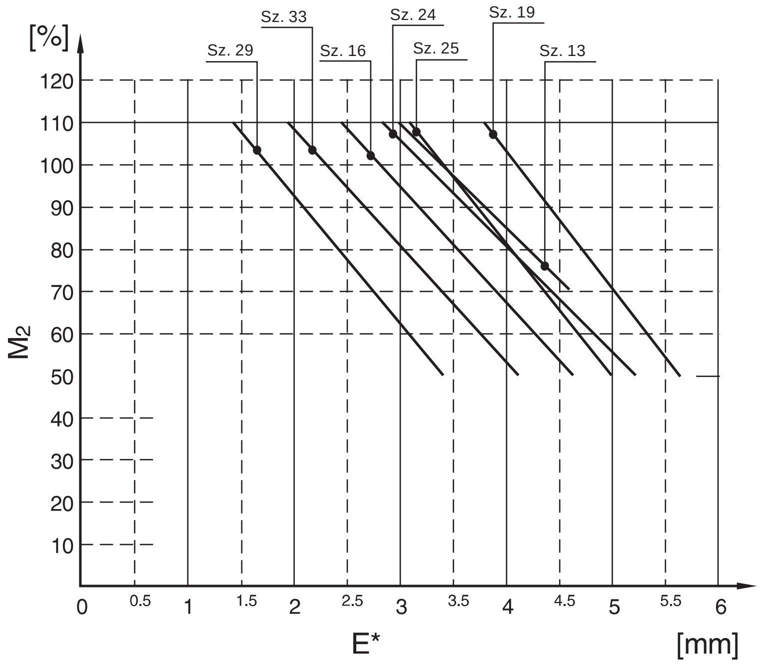
Setting of Torque

The brakes, when delivered, are set to standard nominal torque as per Technical Information Sheet or as ordered (100 %, please refer to diagram). Refer to the nameplate for the nominal torque M_2 set at the factory. The pre-set nominal torque of the brake is secured by means of a setscrew (15) in the adjustment ring (14).
After untightening the setscrew (15), it is possible to turn the adjustment ring (14) by using a pin spanner. Refer to the diagram to adjust the nominal torque to a new value. Please take care not to exceed the maximum and minimum clearance of the adjustment ring (refer to measure "E").

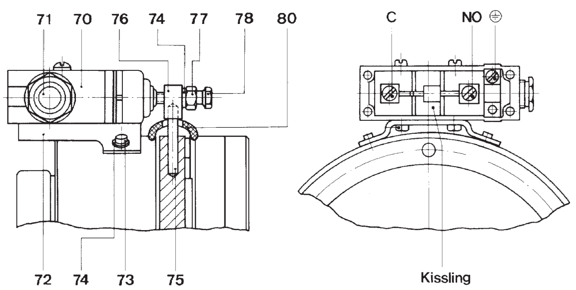
Nominal torque M_2 = f (clearance of adjustment ring E)



*) The clearances of the adjustment ring are reference values and may stray by ± 10 %.

Microswitch

When releasing the brake (excitation winding energised), the control circuit is closed via the contacts (*NO*) and (*C*) (illustration 3).



70 Microswitch
71 Packing bolt
72 Clip
73 Cheese-head screw
74 Crown gear
75 Spiral pin
76 Bolt
77 Hexagon nut
78 Hexagon screw
80 Sealing cover

Illustration 3 Brake with microswitch
Spare switch: Kissling ES V 500 - 918 IP 65
C (Common) = common contact
NO (Normally open) = make contact

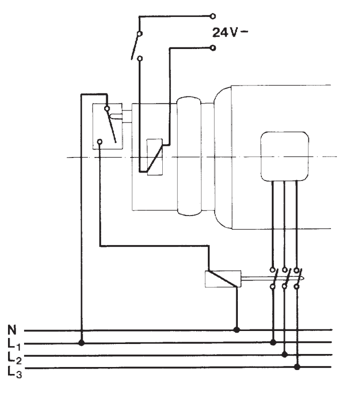
Centering Shoulder for Attachment of Tachometer

The centering diameter d_{11} is aligned, at the factory, with regard to the brake flange diameter d_1 with a concentric running tolerance of max. 0.1 mm for the sizes 13 …25. For the sizes 29 and 33, the centering shoulder is turned on and aligned as desired. The adjustment ring bore has a serial diameter of d8.

Adjustment of Microswitch

Release brake electrically, loosen fixing nut (77), turn hexagon screw (78) clockwise until microswitch switches (you can hear a soft clicking or see the lamps turning on above *NO* [Normally open] and *C* [Common]). Should the switch be ON, turn it counterclockwise into the OFF position. From the changeover position, continue turning the hexagon screw (78) as follows:
for brake size 13 by 110°
for brakes size 16…33 by 140°.
Then tighten fixing nut (77) again. Take care that the screw (78) is well locked after tightening. Check the function of the microswitch by turning it on and off.

Switching of the microswitch within the control circuit



Dismantling the Brake and Replacement of Spare Parts

(Reference numbers according to illustrations 1 and 5) When dismantling the brake, proceed as follows: Remove the covering (17), loosen setscrew (15), twist out the adjustment ring (14) as well as the cheese-head screws (8). The brake is now dismantled with all its piece parts. Before assembling them again, clean all piece parts in a commercially available cleansing agent without fatty substances. Slightly lubricate the thread of the adjustment ring (14), setbolts (12), pressure springs (11), and bolts (4.2). When twisting the adjustment ring (14) back into place, please observe the extent by which the ring overlaps the collar (marked on collar). The setscrew (15) must now be adjacent to the number on the magnet casing (1.1). But the setscrew (15) may not rest on a setbolt (12). This is the only way of getting back to the pre-set torque. When using the brake with a tachometer attachment, re-align the concentricity (please refer to centering shoulder for tachometer attachment).
Spare parts that you might need can be taken from the illustrations 3 and 5 as well as 6 to 9 and ordered by defining type and number of the spring-applied brake.

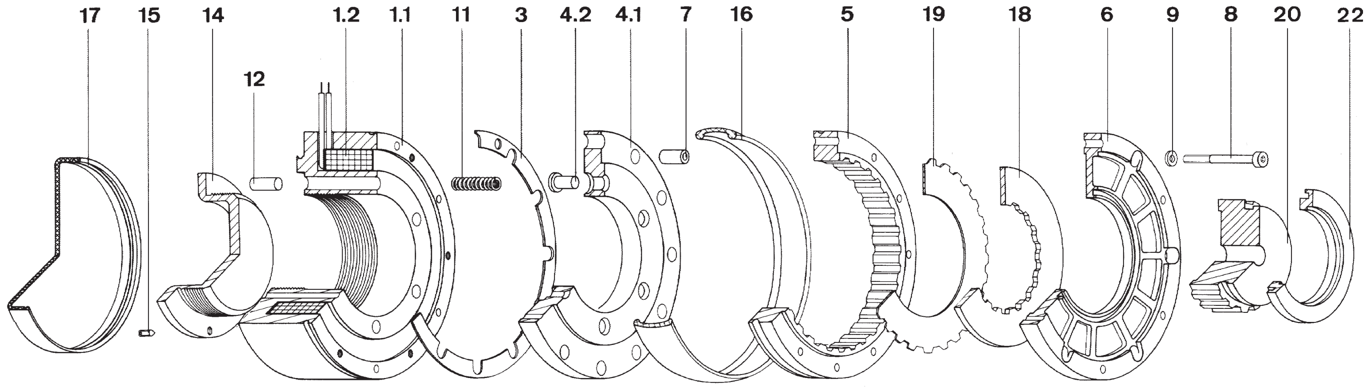


Illustration 5 Basic brake

1.1 Magnet casing
1.2 Excitation winding
3 Antiadhesive disc
4.1 Armature
4.2 Bolt
5 Annular gear
6 Flange
7 Distance bushing
8 Cheese-head screw
9 Seal
11 Pressure spring
12 Setbolt
14 Adjustment ring
15 Setscrew
16 Sealing cover
17 Covering
18 Inside disc
19 Outside disc
20 Hub
22 Seal

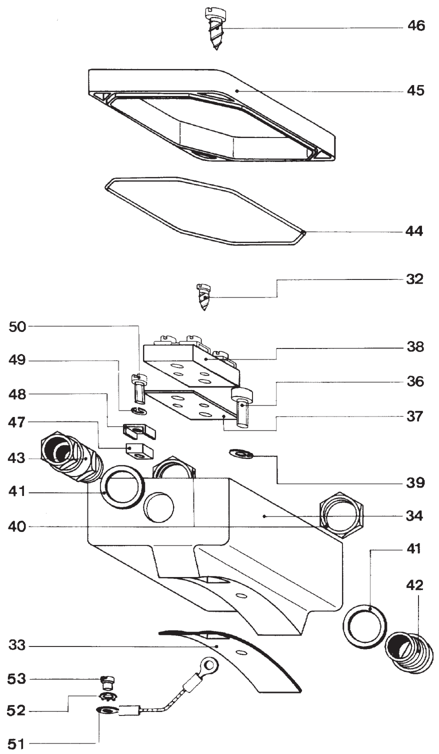


Illustration 6 Adapter box

32 Pan head tapping screw
33 Seal
34 Box
36 Cheese-head screw
37 Spacer
38 Connection
39 Washer
40 Hexagon nut
41 Sealing washer
42 Screw plug
43 Packing bolt
44 Lubricating cord
45 Lid
46 Pan head tapping screw
47 Plate
48 Clamping clip
49 Split washer
50 Cheese-head screw
51 Line
52 Crown gear
53 Cheese-head screw

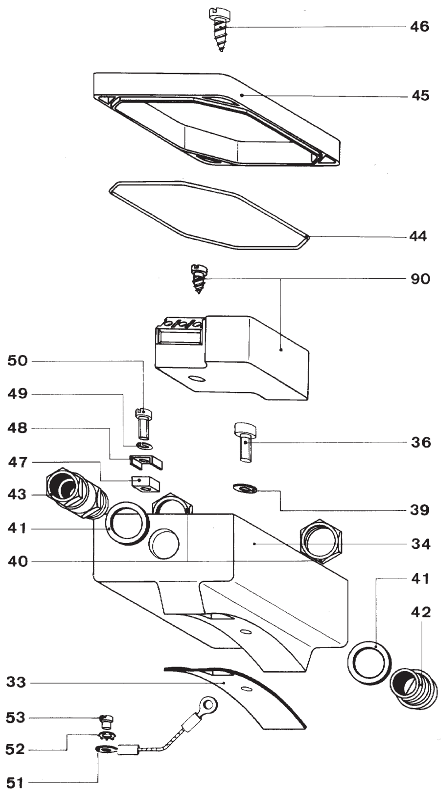


Illustration 7 Adapter box with silicon rectifier

33 Seal
34 Box
36 Cheese-head screw
39 Washer
40 Hexagon nut
41 Sealing washer
42 Screw plug
43 Packing bolt
44 Lubricating cord
45 Lid
46 Pan head tapping screw
47 Plate
48 Clamping clip
49 Split washer
50 Cheese-head screw
51 Line
52 Crown gear
53 Cheese-head screw
90 Rectifier unit

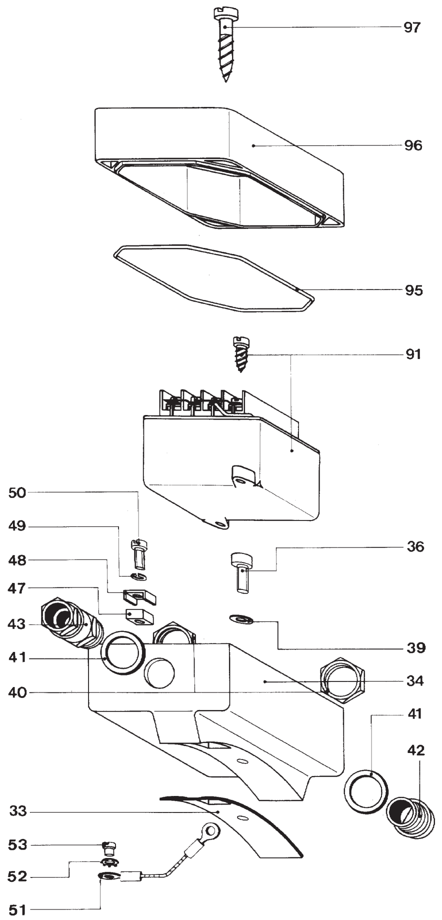


Illustration 8 Adapter box with rectifier with over-excitation

33 Seal
34 Box
36 Cheese-head screw
39 Washer
40 Hexagon nut
41 Sealing washer
42 Screw plug
43 Packing bolt
47 Plate
48 Clamping clip
49 Split washer
50 Cheese-head screw
51 Line
52 Crown gear
53 Cheese-head screw
91 Rectifier unit
95 Lubricating cord
96 Lid
97 Pan head tapping screw

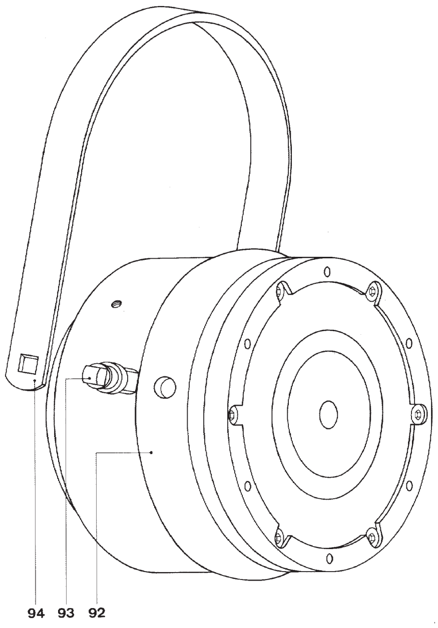
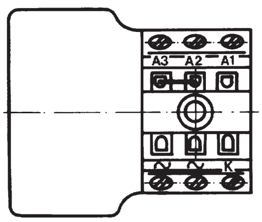


Illustration 9   Hand release
92 Sealing cover
93 Cams
94 Leve

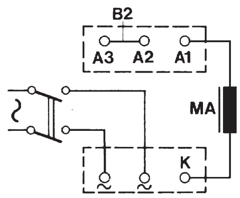
Rectifier Connections

Depending on the type of connection (please refer to illustrations), there might be a modification of the coupling time t_1 of the brake, e.g. normal or reduced coupling time.

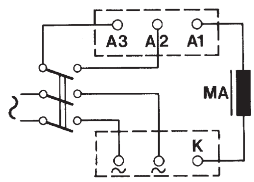
The spring-applied brakes with integrated silicon rectifier may be switched as follows, depending on the coupling time needed:



llustration 10



Circuit I



Circuit II

a) Silicon rectifier in one-way circuit Illustration 10.

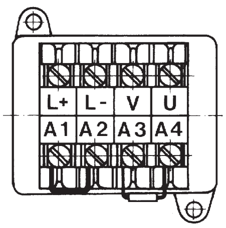
Circuit I for normal coupling time:
Operation is effected as per circuit diagram under A.C. and the brake (MA) is connected to the clamps K and A1. The bridge B2 between A2 and A3 is not to be removed.

Circuit II for reduced coupling time:
The brake operates under A.C. and D.C. and connected to the clamps K and A1. The bridge B2 is removed.

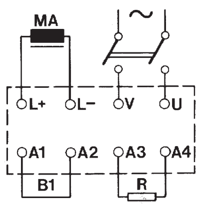
b) Silicon rectifier with over-excitation Illustration 11.

This rectifier allows to reduce the disconnection time t_2 of the brakes down to approx. 40 % of the listed value. It consists of a rectifier in bridged circuit with thyristor and timer.
After the over-excitation time has elapsed, the bridge rectifier is switched to one-way rectification and thus the direct current to 102 V (with 230 V 1~) or
178 V (with 400 V 1~).
The over-excitation time may be chosen between 0.12 and 1.76 seconds by exchanging the resistor R as per the following formula:

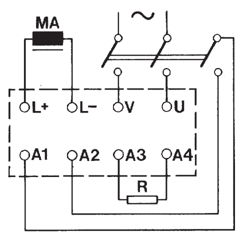
$$R \approx \frac{t_{ü} \cdot 150\ k\Omega\ -\ 16.5\ k\Omega\ s}{1.76\ s\ -t_{ü}}$$



llustration 11



Circuit I



Circuit II

Circuit I for normal coupling time:
The brake only operates under A.C., and is connected to the clamps L+ and L-. The clamps A1 and A2 are bridged with bridge B1.

Circuit II for reduced coupling time:
The brake operates under A.C. and D.C. and is connected to the clamps L+ and L-. The bridge B1 is to be removed.

Discs with Bracing Springs

For the outside discs with bracing springs take care that the discs are in the right sequence and position when mounting them (please refer to illustration 12 to 16). Make sure that the indications on the illustrations (especially for the positioning of the springs) are clearly observed for the respective brake size, as the assortment of the outside discs varies. Always place one inside disc between two outside discs.

The indications on the illustrations 12 to 16 have the following meaning:

○ disc (without springs)
● disc (springs upwards) front side
⊙ disc (springs downwards) back side

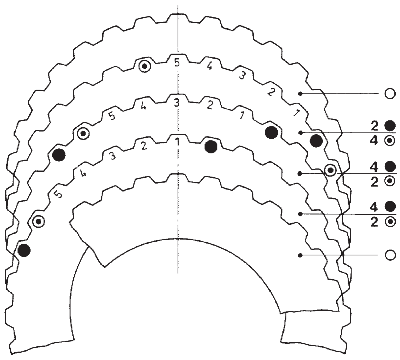


Illustration 12
Brake sizes 13 and 16

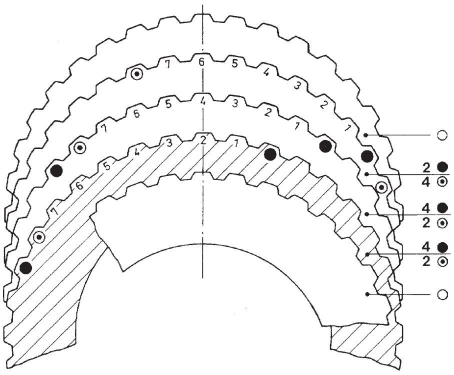


Illustration 13
Brake sizes 19 and 24
Disc with shaded lines is not needed for brake size 24.

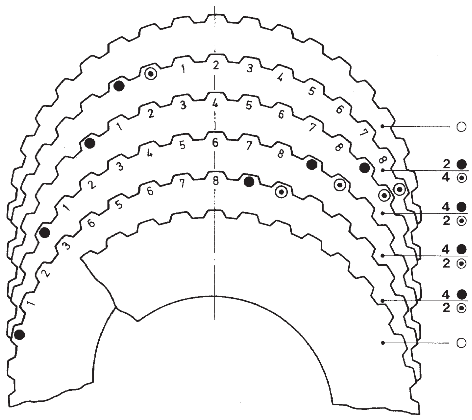


Illustration 14
Brake size 25

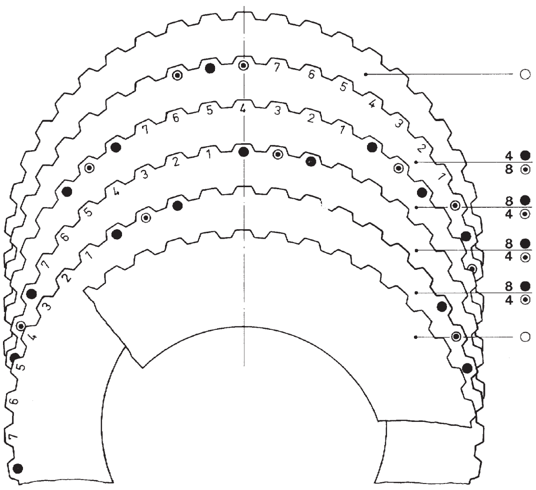


Illustration 15
Brake size 29

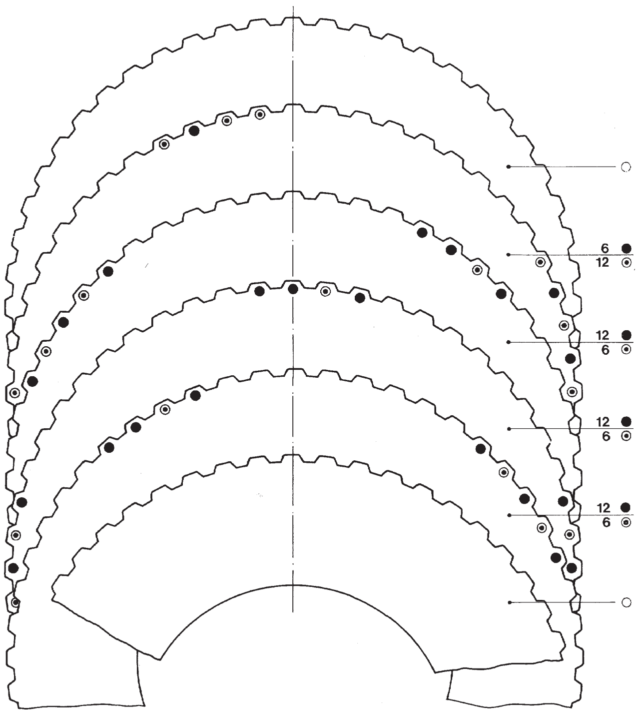


Illustration 16
Brake size 33