Installation and Operational Instructions for ROBA-stop®-M brake Type 891. _ _ _ . _ Sizes 2 - 500

(B.8.1.GB)

Please read these Operational Instructions carefully and follow them accordingly!

Ignoring these Instructions may lead to malfunctions or to brake failure, resulting in damage to other parts.
These Installation and Operational Instructions (I + O) are part of the brake delivery.
Please keep them handy and near to the brake at all times.

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Guidelines on the Declaration of Conformity
A conformity declaration has been carried out for the product (electromagnetic safety brake) according to the Low Voltage Directive 2006/95/EC. The conformity declaration is set out in writing in a separate document and can be requested if required.

Guidelines on the EMC Directive (2004/108/EC)
The product cannot be operated independently according to the EMC directive.
Due to their passive state, brakes are also non-critical equipment according to the EMC.
Only after integration of the product into an overall system can this be evaluated in terms of the EMC.
For electronic equipment, the evaluation has been verified for the individual product in laboratory conditions, but not in the overall system.

Guidelines on the Machinery Directive (2006/42/EC)
The product is a component for installation into machines according to the Machine Directive 2006/42/EC.
The brakes can fulfil the specifications for safety-related applications in coordination with other elements.
The type and scope of the required measures result from the machine risk analysis. The brake then becomes a machine component and the machine manufacturer assesses the conformity of the safety device to the directive.
It is forbidden to start use of the product until you have ensured that all applicable EU directives and directives for the machine or system into which the product has been installed have been fulfilled.

Guidelines on the ATEX Directive
Without a conformity evaluation, this product is not suitable for use in areas where there is a high danger of explosion.
For application of this product in areas where there is a high danger of explosion, it must be classified and marked according to directive 94/9/EC.

Safety and Guideline Signs

DANGER

Immediate and impending danger which can lead to severe physical injuries or to death.

Please Observe!
Guidelines on important points.

CAUTION

Danger of injury to personnel and damage to machines.

According to German notation, decimal points in this document are represented with a comma (e.g. 0,5 instead of 0.5).

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Safety Regulations

These Safety Regulations are user hints only and may not be complete!

General Guidelines

DANGER

Danger of death!
Do not touch voltage-carrying cables and components .

Brakes may generate further risks, among other things:

Hand injuries

Danger of seizure

Contact with hot surfaces

Magnetic fields

Severe injury to people and damage to objects may result if:

- ❒ the electromagnetic brake is used incorrectly.
- ❒ the electromagnetic brake is modified.
- ❒ the relevant standards for safety and / or installation conditions are ignored.

During the required risk assessment when designing the machine or system, the dangers involved must be evaluated and removed by taking appropriate protective measures.

To prevent injury or damage, only professionals and specialists are allowed to work on the devices. They must be familiar with the dimensioning, transport, installation, initial operation, maintenance and disposal according to the relevant standards and regulations.

Before product installation and initial operation, please read the Installation and Operational Instructions carefully and observe the Safety Regulations. Incorrect operation can cause injury or damage.
At the time these Installation and Operational Instructions go to print, the electromagnetic brakes accord with the known technical specifications and are operationally safe at the time of delivery.

- ❒ Technical data and specifications (Type tags and documentation) must be followed.
- ❒ The correct connection voltage must be connected according to the Type tag and wiring guidelines.
- ❒ Check electrical components for signs of damage before putting them into operation. Never bring them into contact with water or other fluids.
- ❒ Please observe the EN 60204-1 requirements for electrical connection when using in machines.

Only carry out installation, maintenance and repairs in a de-energised, released state and secure the system against inadvertent switch-on.

Guidelines for Electromagnetic Compatibility (EMC)

In accordance with the EMC directives 2004/108/EC, the individual components produce no emissions. However, functional components e.g. mains-side energisation of the brakes with rectifiers, phase demodulators, ROBA®-switch devices or similar controls can produce disturbance which lies above the allowed limit values.
For this reason it is important to read the Installation and Operational Instructions very carefully and to keep to the EMC directives.

Application Conditions

The catalogue values are guideline values which have been determined in test facilities. It may be necessary to carry out your own tests for the intended application. When dimensioning the brakes, please remember that installation situations, braking torque fluctuations, permitted friction work, run-in behaviour and wear as well as general ambient conditions can all affect the given values. These factors should therefore be carefully assessed, and alignments made accordingly

- ❒ Mounting dimensions and connecting dimensions must be adjusted according to the size of the brake at the place of installation.
- ❒ The magnetic coils are designed for a relative duty cycle of 100 %.
- ❒ The braking torque is dependent on the present run-in condition of the brakes.
- ❒ The brakes are only designed for dry running. The torque is lost if the friction surfaces come into contact with oil, grease, water or similar substances or foreign bodies.
- ❒ The surfaces of the outer components have been zinc phosphated manufacturer-side to form a basic corrosion protection.

CAUTION

The rotors may rust up and block in corrosive ambient conditions and/or after long periods of storage.
The user is responsible for taking appropriate counter measures.

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Ambient Temperature: – 20 °C up to + 40 °C

CAUTION

At temperatures of around or under freezing point, condensation can strongly reduce the torque, or the rotors can freeze up. The user is responsible for taking appropriate counter measures.

Appointed Use

mayr ®-brakes have been developed, manufactured and tested in compliance with the DIN VDE 0580 standard and in accordance with the EU Low Voltage Directive, as electromagnetic components. During installation, operation and maintenance of the product, the requirements for the standard must be observed.
mayr ®-brakes are for use in machines and systems and must only be used in the situations for which they are ordered and confirmed. Using them for any other purpose is not allowed!

Earthing Connection

The brake is designed for Protection Class I. This protection covers not only the basic insulation, but also the connection of all conductive parts to the PE conductor on the fixed installation. If the basic insulation fails, no contact voltage will remain. Please carry out a standardized inspection of the PE conductor connections to all contactable metal parts!

Insulation Material Class F (+155 °C)

The insulation components on the magnetic coils are manufactured at least to insulation material class F (+155 °C).

Protection

(mechanical) IP54 for Types 891._ _ _ .0/2/3:
When installed, dust-proof and protected against contact as well as against water spray from any direction (dependent on customer-side mounting method).

(mechanical) IP65 for Types 891._ _ _ .1:
When installed, dust-proof and protected against contact as well as against jet water from a nozzle coming from any direction (dependent on customer-side mounting method).

(electrical) IP54: Dust-proof and protected against contact as well as against water spray coming from any direction.

Brake Storage

- ❒ Store the brakes in a horizontal position, in dry rooms and dust and vibration-free.
- ❒ Relative air humidity < 50 %.
- ❒ Temperature without major fluctuations within a range from – 20 °up to +60°C.
- ❒ Do not store in direct sunlight or UV light.
- ❒ Do not store aggressive, corrosive substances (solvents / acids / lyes / salts etc.) near to the brakes.

For longer storage of more than 2 years, special measures are required (please contact the manufacturer).

Handling

Before installation, the brake must be inspected and found to be in proper condition.
The brake function must be inspected both **once installation has taken place** as well as **after longer system downtimes**, in order to prevent the drive starting up against possibly seized linings.

User-implemented Protective Measures:

- ❒ Please cover moving parts to protect **against injury through seizure**.
- ❒ Place a cover on the magnetic part to protect **against injury through high temperatures**.
- ❒ **Protective circuit:** When using DC-side switching, the coil must be protected by a suitable protective circuit according to VDE 0580, which is integrated in *mayr* ®-rectifiers. To protect the switching contact from consumption when using DC-side switching, additional protective measures are necessary (e.g. series connection of switching contacts). The switching contacts used should have a minimum contact opening of 3 mm and should be suitable for inductive load switching. Please make sure on selection that the rated voltage and the rated operation current are sufficient. Depending on the application, the switching contact can also be protected by other protective circuits (e.g. *mayr* ® spark quenching unit, half-wave and bridge rectifiers), although this may of course then alter the switching times.
- ❒ Install additional protective measures **against corrosion** if the brake is subject to extreme ambient conditions or is installed in open air conditions, unprotected from the weather.
- ❒ Take precautions **against freeze-up of the friction surfaces** in high humidity and at low temperatures.

Regulations, Standards and Directives Used:

DIN VDE 0580	Electromagnetic devices and components, general directives
2006/95/EC	Low voltage directive
CSA C22.2 No. 14-2010	Industrial Control Equipment
UL 508 (Edition 17)	Industrial Control Equipment

Please Observe the Following Standards:

DIN EN ISO 12100-1 and 2	Machine safety
DIN EN ISO 14121-1	Risk assessment
DIN EN 61000-6-4	Noise emission
DIN EN 61000-6-2	Interference immunity
EN 60204-1	Electrical machine equipment

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Liability

The information, guidelines and technical data in these documents were up to date at the time of printing. Demands on previously delivered brakes are not valid.
Liability for damage and operational malfunctions will not be taken if:

- the Installation and Operational Instructions are ignored or neglected.
- the brakes are used inappropriately.
- the brakes are modified.
- the brakes are worked on unprofessionally.
- the brakes are handled or operated incorrectly.

Guarantee

- ❒ The guarantee conditions correspond with the Chr. Mayr GmbH + Co. KG sales and delivery conditions.
- ❒ Mistakes or deficiencies are to be reported to *mayr*® at once!

Conformity Markings

The product confirms to the CE according to the low voltage directive 2006/95/EC

CSA/UL in terms of the Canadian and American standards

Identification

mayr® components are clearly marked and described on the Type tag:

Manufacturer
mayr®
Name/Type
Article number
Serial number

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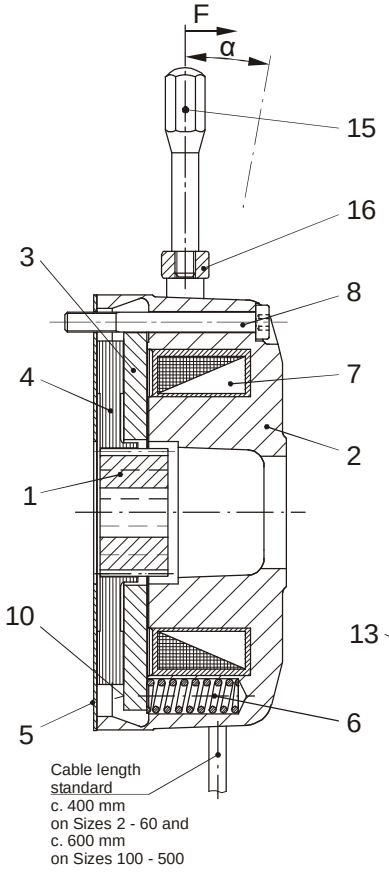

Fig. 1

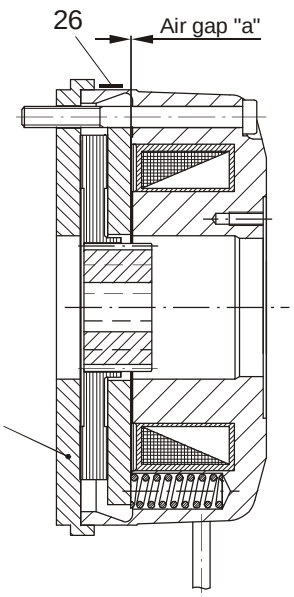

Fig. 2

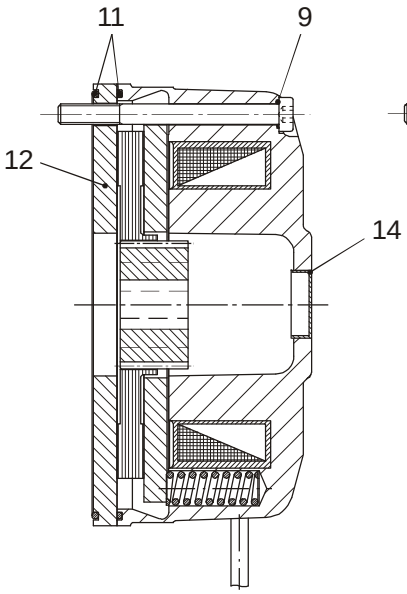

Fig. 3

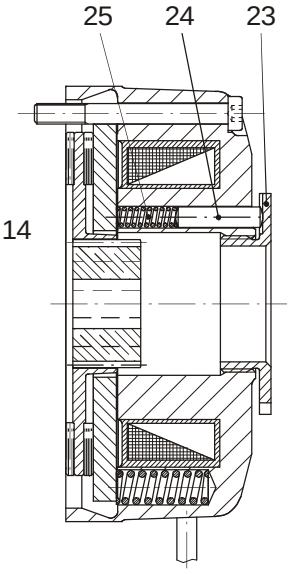

Fig. 4

Parts List (Only use *mayr* ® original parts)

1 Hub
2 Coil carrier with magnetic coil (7)
3 Armature disk
4 Rotor
5 Friction disk
6 Thrust spring (torque)
7 Magnetic coil
8 Cap screw
9 Flat sealing ring (Type 891._ _ _.1)
10 Shoulder screw (not shown)
11 O-ring (Type 891._ _ _.1)
12 Flange plate sealed (Type 891._ _ _.1)
13 Flange plate tacho brake
14 Plug (only for Sizes 8 to 500)
15 Hand release rod
16 Switch bracket
17 Threaded bolt (see page 10, Fig. 5)
18 Thrust spring (hand release; see page 10, Fig. 5)
19 Hexagon nut (see page 10, Fig. 5)
20 Washer (see page 10, Fig.5)
21 O-ring (see page 10, Fig.5)
22 Intermediate plate (see page 10, Fig.5)
23 Adjusting screw (central torque adjustment)
24 Parallel pin (central torque adjustment)
25 Thrust spring (central torque adjustment)
26 Type tag

Technical Data

Nominal voltages:	24 V / 104 V / 180 V / 207 V
Protection:	IP54
Protection (Type 891._ _ _.1):	IP65
Duty cycle:	max. 100 %
Ambient temperature:	-20 ℃ up to +40 ℃

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Table 1: Technical Data (Dependent on Size)

Size	Nominal torque Standard brake Type 891._ 1 _ . _ M_2 [Nm]	Nominal torque Holding brake Type 891.10 _ . _ M_2 [Nm]	Max. speed [rpm]	P_{nom} electrical nominal power [W]	Electrical connection cross-section [mm^2]	Mass without flange plate, without hand release [kg]
2	2	4	6000	19	2 x 0,56	0,76
4	4	8	5000	25	2 x 0,56	1,1
8	8	16	4000	29	2 x 0,56	1,8
16	16	32	3500	38	2 x 0,88	3,4
32	32	64	3000	46	2 x 0,88	4,5
60	60	100	3000	69	2 x 0,88	7,4
100	100	180	3000	88	2 x 0,88	13,6
150	150	250	1500	98	2 x 0,88	19,2
250	250	450	1500	120	2 x 0,88	33,3
500	500	800 [1)]	1500	152	2 x 0,88	38

[1)] Brake operation from 700 Nm only possible with overexcitation.

Table 2: Technical Data (Dependent on Size)

Size	Nominal air gap "a" +0,1 / -0,05 (Fig. 2) [mm]	Maximum permitted air gap "a" after wear (Fig. 2) [mm]	Inspection dimension "x" (Fig. 5) [mm]	Number of rotations "Y" for hexagon nuts (19) (Fig. 5)	Fixing screw Item 8 (Fig. 1)				
					Design without flange plate (Items 12/13)	DIN	Design with flange plate (Items 12/13)	DIN	Tightening torque [Nm]
2	0,15	0,4	0,9 $^{+0,1}$	1,7	3 x M4 x 45	6912	3 x M4 x 50	EN ISO 4762	2,5
4	0,15	0,4	0,9 $^{+0,1}$	1,7	3 x M4 x 45	6912	3 x M4 x 50	EN ISO 4762	2,5
8	0,2	0,45	1,1 $^{+0,1}$	1,5	3 x M5 x 50	6912	3 x M5 x 55	6912	5,0
16	0,2	0,7	1,6 $^{+0,1}$	2,0	3 x M6 x 60	6912	3 x M6 x 65	6912	9,0
32	0,2	0,7	1,8 $^{+0,1}$	2,0	3 x M6 x 60	6912	3 x M6 x 70	EN ISO 4762	9,0
60	0,25	0,8	2,2 $^{+0,1}$	2,0	3 x M8 x 75	6912	3 x M8 x 85	EN ISO 4762	22
100	0,3	0,9	2,2 $^{+0,1}$	1,6	3 x M8 x 80	EN ISO 4762	3 x M8 x 90	EN ISO 4762	22
150	0,3	0,9	2,2 $^{+0,1}$	1,6	3 x M8 x 100	EN ISO 4762	3 x M8 x 110	EN ISO 4762	22
250	0,35	0,95	2,4 $^{+0,1}$	1,5	3 x M10 x 110	EN ISO 4762	3 x M10 x 130	EN ISO 4762	45
500	0,4 +0,2	1,0	2,4 $^{+0,1}$	1,5	6 x M10 x 110	EN ISO 4762	6 x M10 x 130	EN ISO 4762	45

Table 3: Technical Data (Dependent on Size)

Size	Hand release force [N] for		Release angle "α"	Min. width of the counter friction surface	Screw shoulder tightening torque Item 10 (Fig. 1)	Through holes (coil carrier back) [mm]		
	Type 891.0/2	Type 891.1	[°]	[mm]	[Nm]	Type 891._ _ _.0	Type 891._ _ _.1	Type 891._ _ _.2
2	20	26	6	5	0,5	16,5	Brake closed	23,5 H7
4	35	45	7	6	0,5	18	Brake closed	28,5 H7
8	70	90	7	6	1,5	22	22 H8	32,5 H7
16	100	125	7	7	2,0	33	22 H8	40,5 H7
32	130	170	8	8	2,0	36	28 H8	52,5 H7
60	220	300	10	8	3,5	38	32 H8	60 H7
100	260	340	12	10	8,0	48	42 H8	75,5 H7
150	290	350	13	12	8,0	55	48 H8	82,5 H7
250	350	430	10	14	18,5	65	52 H8	92 H7
500	310	470	10	19	18,5	85	62 H8	131 H7

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Table 4: Technical Data (Dependent on Size)

Size	Valid for Standard Brakes Type 891.0_ _._ and 891.2_ _._					
	Mass moment of inertia J hub + rotor on d_{max} [kgm^2]		Friction work $Q_{r\,0,1}$ (per 0,1 mm wear)	Friction work $Q_{r\,tot}$ (max. possible friction work in relation to nominal air gap)	Rotor thickness "new"	Minimum rotor thickness (limit value for braking torque 100 %)
	Type 891.0 _ _._	Type 891.2 _ _._	[J/0,1]	[J]	[mm]	[mm]
2	0,12 x 10^{-4}	0,1 x 10^{-4}	35 x 10^{6}	95 x 10^{6}	6,05	5,8
4	0,21 x 10^{-4}	0,17 x 10^{-4}	40 x 10^{6}	100 x 10^{6}	6,05	5,8
8	0,67 x 10^{-4}	0,58 x 10^{-4}	65 x 10^{6}	162 x 10^{6}	6,9	6,65
16	1,74 x 10^{-4}	1,53 x 10^{-4}	100 x 10^{6}	500 x 10^{6}	8,0	7,5
32	4,48 x 10^{-4}	4,1 x 10^{-4}	130 x 10^{6}	600 x 10^{6}	10,4	9,9
60	6,74 x 10^{-4}	–	130 x 10^{6}	700 x 10^{6}	11,15	10,6
100	16,54 x 10^{-4}	–	140 x 10^{6}	840 x 10^{6}	14,0	13,4
150	31,68 x 10^{-4}	–	150 x 10^{6}	950 x 10^{6}	15,5	14,9
250	61,82 x 10^{-4}	–	160 x 10^{6}	1000 x 10^{6}	17	16,4
500	222,6 x 10^{-4}	–	200 x 10^{6}	2000 x 10^{6}	18,5	17,9

The stated values $Q_{r\,0,1}$ and $Q_{r\,tot}$ are only approximate values for specific friction work < 0,5 J/mm^2 and sliding speeds < 10 m/s.

Table 5: Technical Data (Dependent on Size)

Size	Valid for Holding Brakes Type 891.1_ _._			
	Mass moment of inertia J hub + rotor on d_{max}	Friction work $Q_{r\,0,1}$ (per 0,1 mm wear)	Friction work $Q_{r\,tot}$ (max. possible friction work in relation to nominal air gap)	Rotor thickness "new"
	[kgm^2]	[J/0,1]	[J]	[mm]
2	0,12 x 10^{-4}	7 x 10^{6}	7 x 10^{6}	6,05
4	0,21 x 10^{-4}	8 x 10^{6}	8 x 10^{6}	6,05
8	0,67 x 10^{-4}	13 x 10^{6}	13 x 10^{6}	6,9
16	1,74 x 10^{-4}	20 x 10^{6}	20 x 10^{6}	8,0
32	4,48 x 10^{-4}	30 x 10^{6}	45 x 10^{6}	10,4
60	6,74 x 10^{-4}	65 x 10^{6}	130 x 10^{6}	11,15
100	16,54 x 10^{-4}	70 x 10^{6}	170 x 10^{6}	14,0
150	31,68 x 10^{-4}	75 x 10^{6}	300 x 10^{6}	15,5
250	61,82 x 10^{-4}	80 x 10^{6}	350 x 10^{6}	17
500	222,6 x 10^{-4}	100 x 10^{6}	500 x 10^{6}	18,5

The stated values $Q_{r\,0,1}$ and $Q_{r\,tot}$ are only approximate values for specific friction work < 0,5 J/mm^2 and sliding speeds < 10 m/s.

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Table 6: Technical Data (Dependent on Size)

Size	Permitted hub bores for standard brake Types 891.0_ _._ and 891.2_ _._				Permitted hub bores for holding brake Type 891.10 _._			
	Keyway – JS9		Keyway – P9		Keyway – JS9		Keyway – P9	
	DIN 6885/1	DIN 6885/3	DIN 6885/1	DIN 6885/3	DIN 6885/1	DIN 6885/3	DIN 6885/1	DIN 6885/3
2	8 – 13	13 – 15	8 – 13	13 – 15	8 – 13	13 – 15	8 – 13	13 – 15
4	10 – 13	13 – 15	10 – 13	13 – 15	10 – 13	13 – 15	10 – 13	13 – 15
8	11 – 18	18 – 20	11 – 18	18 – 20	11 – 18	18 – 20	11 – 18	18 – 20
16	14 – 22	22 – 25	14 – 20	20 – 22	14 – 22	22 – 25	14 – 20	20 – 22
32	19 – 30	–	19 – 28	28 – 30	19 – 30	–	19 – 28	28 – 30
60	22 – 32	32 – 35	22 – 32	–	22 – 32	32 – 35	22 – 32	–
100	24 – 42	42 – 45	24 – 42	42 – 45	24 – 42	42 – 45	24 – 42	42 – 45
150	30 – 45	45 – 50	30 – 45	45 – 50	30 – 45	45 – 50	30 – 45	45 – 50
250	40 [2] – 55	55 – 60	40 [2] – 50	50 – 55	40 – 55	–	40 – 50	50 – 55
500	50 [2] – 75	75 – 80	50 [2] – 75	75 – 80	50 – 75	–	50 – 75	–

[2] Minimum bore not permitted for braking torque adjustment = 125 %.

Table 7: Technical Data (Dependent on Size)

Size	Braking torque [Nm] with tolerance							
	+30 % / -10 %							+ 40 % / -20 %
	125 % Type 891._8_._	112 % Type 891._7_._	Standard brake 100 % Type 891._1_._	84 % Type 891._2_._	68 % Type 891._3_._	50 % Type 891._4_._	34 % Type 891._5_._	Holding brake Type 891.10_._
2	2,5	2,2	2	1,7	1,4	1	0,7	4
4	5	4,5	4	3,4	2,8	2	1,4	8
8	10	9	8	6,8	5,5	4	2,8	16
16	20	18	16	13,5	11	8	5,5	32
32	40	36	32	27	22	16	11	64
60	75	68	60	51	42	30	21	100
100	125	110	100	85	70	50	35	180
150	185	165	150	125	100	75	50	250
250	312	280	250	215	180	125	90	450
500	700 [3]	560	500 [4]	400	350	250	200	800 [5]

[3] Brake operation as holding brake.
[4] Braking torque tolerance = +40 % / -20 % (slight grinding necessary).
[5] Brake operation from 700 Nm only possible with overexcitation.

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(B.8.1.GB)

1. Design

ROBA-stop®-M brakes are spring applied, electromagnetic safety brakes, which apply a defined braking effect after the voltage is switched off or after a voltage failure.

2. Function

ROBA-stop®-M brakes are spring applied, electromagnetic safety brakes.

Spring applied function (brake):
In de-energised condition, thrust springs (6) press against the armature disk (3). The rotor (4) is held between the armature disk (3) and the friction disk (5), the flange plate (12 or 13 / dependent on Type) or the customer-side machine wall via frictional locking.
The braking torque is introduced into the drive line via the toothing of the rotor (4) and the hub (1).

Electromagnetic (release):
Due to the magnetic force of the coil in the coil carrier (2), the armature disk (3) is attracted against the spring force to the coil carrier (2). The brake is released and the brake rotor (4) with the hub (1) can rotate freely.

Safety brake function:
The ROBA-stop®-M brakes reliably and safely in the event of a power switch-off, a power failure or an EMERGENCY STOP.

3. State of Delivery

Please check the state of delivery immediately!
mayr® will take no responsibility for belated complaints.
Please report transport damage immediately to the deliverer.
Please report incomplete delivery and obvious defects to the manufacturer.

4. Installation Conditions

- ❑ The eccentricity of the shaft end in relation to the fixing pitch circle must not exceed 0,2 mm.
- ❑ The position tolerance of the threads for the cap screws (8) must not exceed 0,2 mm.
- ❑ The axial run out deviation of the screw-on surface to the shaft must not exceed the permitted axial run out tolerance of **0,08 mm** for Sizes 2 to 8, of **0,1 mm** for Sizes 16 to 250, and of **0,125 mm** for Size 500, according to DIN 42955.
  The reference diameter is the pitch circle diameter for securement of the brakes.
  Larger deviations can lead to a drop in torque, to continuous slipping on the rotor (4) and to overheating.
- ❑ The hub bore (1) tolerances and the shaft must be selected so that the hub toothing (1) is not widened. Widening of the toothing leads to the rotor (4) jamming on the hub (1) and therefore to brake malfunctions.
  Recommended hub – shaft tolerance H7/k6.
  The max. permitted joining temperature of 200 °C mu st not be exceeded.
- ❑ The rotor (4) and brake surfaces must be oil and grease-free.
- ❑ A suitable counter friction surface (steel or cast iron) must be used. Sharp-edged interruptions on the friction surfaces must be avoided. Recommended surface quality in the area of the friction surface Ra = 1,6 µm.
  Customer-side mounting surfaces made of grey cast iron are to be rubbed down additionally with fine sandpaper (grain ≈ 400).
- ❑ The toothings of the hub (1) and the rotor (3) must not be oiled or greased.
- ❑ Friction value-increasing surface treatments are not permitted.
- ❑ Dimensioning of the key connection according to the requirements shaft diameter, transmittable torque and operating conditions must be carried out. For this, the corresponding user data must be known or the customer must carry out the dimensioning according to the valid calculation basis DIN 6892.
  For the calculation, a hub quality
  of Re = 230 N/mm^2 should be used for Sizes 2 and 4 and
  of Re = 300 N/mm^2 should be used for Sizes 8 to 500.
  The length of the key should lie over the entire hub.
- ❑ For the dimensioning of the key connections, the permitted tensions common in machine construction must be considered. During initial operation, check whether the key is inserted correctly and whether the brake is secured to the correct tightening torque acc. Table 2.
- ❑ Please abstain from using cleaning agents containing solvents, as they could affect the friction material.
- ❑ During longer downtimes, we recommend the use of suitable corrosion protection measures for the mounting surface (e.g. zinc-phosphate coating) until initial operation.

5. Installation (Figs. 1 and 2)

5.1. Mount the hub (1) onto the shaft, bring it into the correct position (the length of the key should lie over the entire hub) and secure it axially (e.g. using a locking ring).

5.2. If necessary (dependent on Type), guide the friction disk (5) or flange plate (12/13) over the shaft and attach it to the machine wall (observe the bore alignments in the friction disk (5) or flange plate (12/13) to the threaded bores in the machine wall).

5.3. Measure the rotor thickness and compare with the values in Tables 4/5. Push the rotor (4) by hand onto the hub (1) (the rotor collar should be facing away from the machine wall or the friction disk (5) or the flange plate (12/13)).
The rotor toothing must lie over the entire length of the hub (1).
Check that the toothing moves easily.
Do not cause damage.

5.4. If necessary, install the hand release acc. section 8 on page 10.

5.5. If necessary (dependent on Type), insert the O-ring (11) into the axial groove of the coil carrier (2).

5.6. Push the rest of the brake over the hub (1) and the rotor collar (4) (the fixing holes should align with the bores on the friction disk (5), the flange plate (12/13) or the machine wall).
The shoulder screws (10) prevent the individual components from falling apart.
They do not affect the brake function and must not be removed during installation.

5.7. Secure the brake evenly all around using the cap screws (8) inc. the manufacturer-side mounted flat sealing rings (9 / dependent on Type) with a torque wrench and a tightening torque (acc. Table 2).

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6. Braking Torque Adjustment

The ROBA-stop®-M brakes are set manufacturer-side to the braking torque stipulated on order.
Different braking torque adjustments can be made using different spring configurations (6) in the coil carrier (2) (see Table 7).
The respective thrust spring set (6) for the requested braking torque adjustment (acc. Table 7) is to be installed at the place of manufacture.
If installation by the user is unavoidable, the required thrust spring set (6) must be ordered stating the exact construction size and braking torque adjustment values.

Thrust Springs (6) Replacement:
(Warning: The brake must be load-free)

In order to replace the thrust springs (6), the brake must be unscrewed from the motor bearing shield or from the machine wall.

6.1. Remove the fixing screws (8).

6.2. Unscrew the shoulder screws (10) from the coil carrier (2) and remove the armature disk (3).
Warning: The thrust springs (6) press against the armature disk (3). In order to remove the shoulder screws (10), the armature disk (3) must be pressed against the coil carrier (2) to avoid immediate relaxation of the thrust springs (6). Observe the installation position of the armature disk (3), or ensure that no thrust springs (6) fall out.

CAUTION

Danger of injury

6.3. Replace the thrust springs (6).
Warning: Insert the new thrust spring set (6) in symmetrical order.

6.4. Place the armature disk (3) onto the coil carrier (2) or the thrust springs (6) (observe installation position; use fixing screws (8) as a centring aid if necessary on Sizes 2 - 60).

6.5. Press the armature disk (3) down against the spring force and screw in the shoulder screws (10) up to their limits using a tightening torque acc. Table 3.

6.6. Screw the brake onto the motor bearing shield or the machine wall using fixing screws (8).
(Observe the tightening torque acc. Table 2).

7. Brake Inspection (before brake initial operation)

- **Braking torque inspection:**
  Please compare the requested braking torque with the torque stated on the Type tag (26).
- **Carry out a release inspection:**
  by energising the brake or manually
  using the hand release (dependent on Type).

The full set braking torque is not achieved until after the run-in procedure has been carried out.
The braking torque (switching torque) is the torque effective in the shaft train on slipping brakes, with a sliding speed of 1 m/s referring to the mean friction radius
(acc. DIN VDE 0580/07.2000).

8. Hand Release Installation (see Figs. 1 and 5)

For Type 891._ _ _.1, installation of the hand release is only possible if a request for hand release is stated on the brake order form (completely enclosed coil carrier (2)).

CAUTION

For hand release installation, the brake must be dismantled and de-energised.

Procedural Method:

8.1. Put the thrust springs (18) onto the threaded bolts (17). The threaded bolts (17) come manufacturer-side assembled with a key as tension element and secured with adhesive up to Size M60. This connection must not be loosened.

8.2. Push the threaded bolts (17) with thrust springs (18) from the inside (you should be facing the magnetic coil (7)) into the hand release bores in the coil carrier (2).

8.3. Push the O-rings (21) (only on sealed hand release, Type 891._ _ _.1) over the threaded bolts (17) and insert them into the coil carrier (2) recesses. Avoid crushing the O-rings (21).

8.4. Push the intermediate plates (22) (only on sealed hand release, Type 891._ _ _.1) over the threaded bolts (17).

8.5. Mount the switch bracket (16), add the washers (20) and lightly screw on the self-locking hexagon nuts (19).

8.6. Tighten both hexagon nuts (19) until the armature disk (3) lies evenly against the coil carrier (2).

8.7. Loosen both hexagon head nuts (19) by "Y" turns (see Table 2), thereby producing an air gap between the armature disk (3) and the coil carrier (2). This gives you inspection dimension "x".
Warning: An uneven adjustment dimension on the hand release can cause the brake to malfunction.

8.8. After installing the release cover, screw the hand release bar (15) into the switching bracket (16) and tighten it.
The hand release bar (15) must be protected against loosening using a screw-securing product, e.g. Loctite 243.

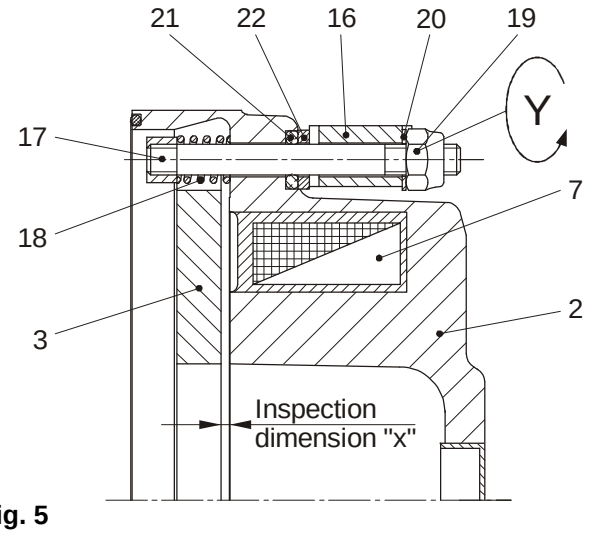

Fig. 5

The inspection dimension "x" (Fig. 5) is only used for hand release adjustment in dismantled condition.

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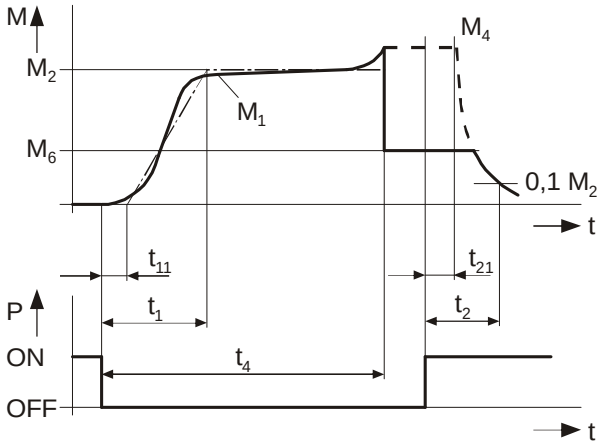
9. Switching Times

Torque-Time Diagram



Key:

M_1 = Switching torque
M_2 = Nominal torque (characteristic torque)
M_4 = Transmittable torque
M_6 = Load torque
t_1 = Connection time
t_{11} = Response delay on connection
t_2 = Separation time
t_{21} = Response delay on separation
t_4 = Slipping time + t_{11}

Table 8: Switching Times

Size	Connection time t_1 (DC switching) [ms]	Connection time t_1 (AC switching) [ms]	Separation time t_2 [ms]	Response delay on connection t_{11} (DC switching) [ms]	Response delay on separation t_{21} [ms]
2	10	100	28	6	4
4	18	160	30	12	5
8	20	220	45	16	6
16	30	320	70	25	12
32	50	400	100	35	20
60	55	500	150	35	23
100	68	640	180	38	25
150	80	730	220	40	30
250	100	1100	290	50	35
500	100	1100	400	30	50

These values are mean values referring to a nominal air gap and a nominal torque (100 %) on a warm brake.
For other braking torque adjustments, see the Diagram on page 13: "Separation time t_2 dependent on the spring configuration".

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10. Electrical Connection and Wiring

DC current is necessary for operation of the brake. The coil voltage is indicated on the Type tag as well as on the brake body and is designed according to the DIN IEC 60038 (± 10 % tolerance). AC current operation can take place using a rectifier or another suitable DC power supply. Dependent on the brake equipment, the connection possibilities can vary. Please follow the exact connections according to the Wiring Diagram. The manufacturer and the user must observe the applicable directives and standards (e.g. DIN EN 60204-1 and DIN VDE 0580). Their observance must be guaranteed and double-checked!

Earthing Connection

The brake is designed for Protection Class I. This protection covers not only the basic insulation, but also the connection of all conductive parts to the PE conductor on the fixed installation. If the basic insulation fails, no contact voltage will remain. Please carry out a standardized inspection of the PE conductor connections to all contactable metal parts!

Device Fuses

To protect against damage from short circuits, please add suitable device fuses to the mains cable.

Switching Behaviour

The operational behaviour of a brake is to a large extent dependent on the switching mode used. Furthermore, the switching times are influenced by the temperature and the air gap between the armature disk and the coil carrier (dependent on the wear condition of the linings).

Magnetic Field Build-up

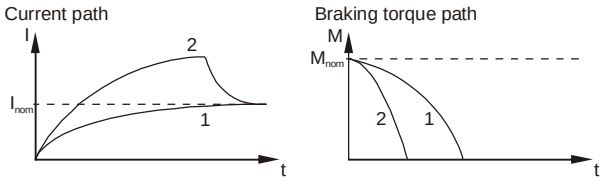
When the voltage is switched on, a magnetic field is built up in the brake coil, which attracts the armature disk to the coil carrier and releases the brake.

Field Build-up with Normal Excitation

If the magnetic coil is energised with nominal voltage, the coil voltage does not immediately reach its nominal value. The coil inductivity causes the current to increase slowly as an exponential function. Accordingly, the build-up of the magnetic field takes place more slowly and the braking torque drop (curve 1) is also delayed.

Field Build-up with Overexcitation

A quicker and safer drop in braking torque is achieved if the coil is temporarily placed under a higher voltage than the nominal voltage, as the current then increases more quickly. Once the brake is released, it needs to be switched over to the nominal voltage (curve 2). The relationship between overexcitation and separation time t_2 is roughly indirectly proportional, meaning that at doubled nominal voltage the separation time t_2 for release of the brake is halved. The ROBA®-(multi)switch fast acting rectifier and phase demodulator work on this principle.



Operation with overexcitation requires an inspection of :
- the required overexcitation time*
- as well as the RMS coil capacity** with a cycle frequency higher than 1 cycle per minute.

*** Overexcitation time t_{over}**

Increased wear, and therefore an increasing air gap as well as coil heating lengthen the separation time t_2 for the brake. For this reason, at least double the separation time t_2 at nominal voltage must be selected as overexcitation time t_{over} on each brake size. The spring forces also influence the brake separation times t_2: Higher spring forces increase the separation times t_2 and lower spring forces reduce the separation times t_2.
The changes in the separation times t_2 due to the spring configuration can be seen in the adjoining Diagram.

➔ Spring force (braking torque adjustment) < 100 %:
The overexcitation time t_{over} is less than the doubled separation time t_2 on each brake size.
Example: Braking torque adjustment = 34 % --> separation time t_2 = 50 %
--> overexcitation time t_{over} = 200 % x 50 % = 100 % t_2

➔ Spring force (braking torque adjustment) = 100 %:
The overexcitation time t_{over} equals the doubled separation time t_2 on each brake size.

➔ Spring force (braking torque adjustment) > 100 %:
The overexcitation time t_{over} is higher than the doubled separation time t_2 on each brake size.
Example: Braking torque adjustment = 125 % --> separation time t_2 = 120 %
--> overexcitation time t_{over} = 200 % x 120 % = 240 % t_2

$P_{RMS} \leq P_{nom}$
The coil capacity P_{RMS} must not be larger than P_{nom}. Otherwise the coil may fail due to thermal overload.

Calculations:

P_{RMS} [W] RMS coil capacity dependent on switching frequency, overexcitation, reductions in capacity and duty cycle

$$P_{RMS} = \frac{P_{over} \times t_{over} + P_{hold} \times t_{hold}}{t_{tot}}$$

P_{nom} [W] Coil nominal capacity (Catalogue information, Type tag)

P_{over} [W] Coil capacity on overexcitation

$$P_{over} = \left(\frac{U_{over}}{U_{nom}}\right)^2 \times P_{nom}$$

P_{hold} [W] Coil capacity at reduced capacity

$$P_{hold} = \left(\frac{U_{hold}}{U_{nom}}\right)^2 \times P_{nom}$$

t_{over} [s] Overexcitation time
t_{hold} [s] Time of operation with reduction in capacity
t_{off} [s] De-energised time
t_{tot} [s] Total time (t_{over} + t_{hold} + t_{off})
U_{over} [V] Overexcitation voltage (bridge voltage)
U_{hold} [V] Holding voltage (one-way voltage)
U_{nom} [V] Coil nominal voltage

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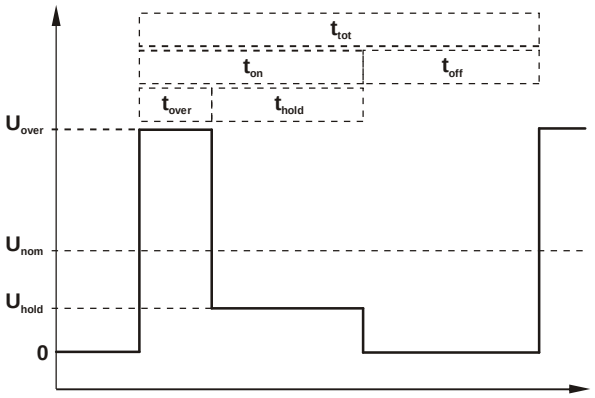
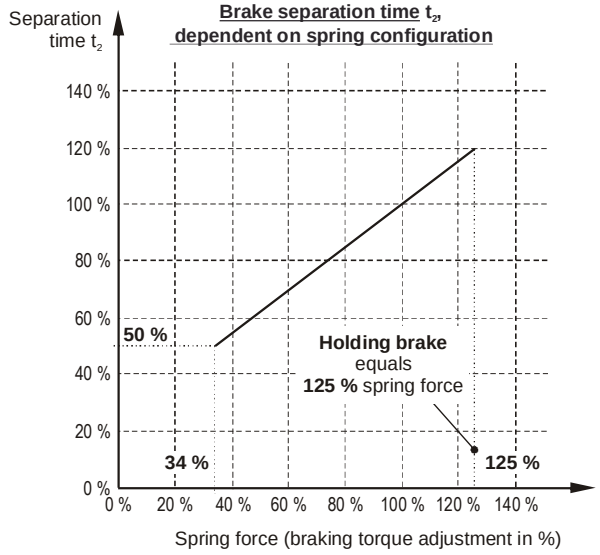
Time Diagram:

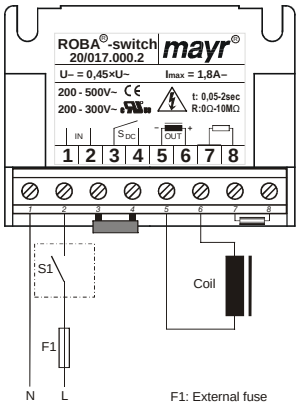


Brake separation time t_2 dependent on the spring configuration



Magnetic Field Removal

AC-side Switching

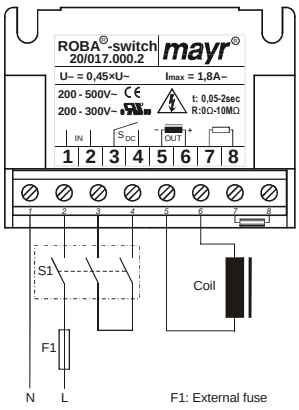


The power circuit is interrupted before the rectifier. The magnetic field slowly reduces. This delays the rise in braking torque.

When switching times are not important, please switch AC-side, as no protective measures are necessary for coil and switching contacts.

AC-side switching means **low-noise switching**; however, the brake engagement time is longer (c. 6-10 times longer than with DC-side switching). Use for non-critical brake times.

DC-side Switching



The power circuit is interrupted between the rectifier and the coil as well as mains-side. The magnetic field reduces extremely quickly. This causes a quick rise in braking torque.

When switching DC-side, high voltage peaks are produced in the coil, which lead to wear on the contacts from sparks and to destruction of the insulation.

DC-side switching means **short brake engagement times** (e.g. for **EMERGENCY STOP**); however, louder switching noises.

Protective Circuit

When using DC-side switching, the coil must be protected by a suitable protective circuit according to VDE 0580, which is integrated in *mayr*® rectifiers. To protect the switching contact from consumption when using DC-side switching, additional protective measures are necessary (e.g. series connection of switching contacts). The switching contacts used should have a minimum contact opening of 3 mm and should be suitable for inductive load switching. Please make sure on selection that the rated voltage and the rated operation current are sufficient. Depending on the application, the switching contact can also be protected by other protective circuits (e.g. *mayr* ®-spark quenching unit, half-wave and bridge rectifiers), although this may of course then alter the switching times.

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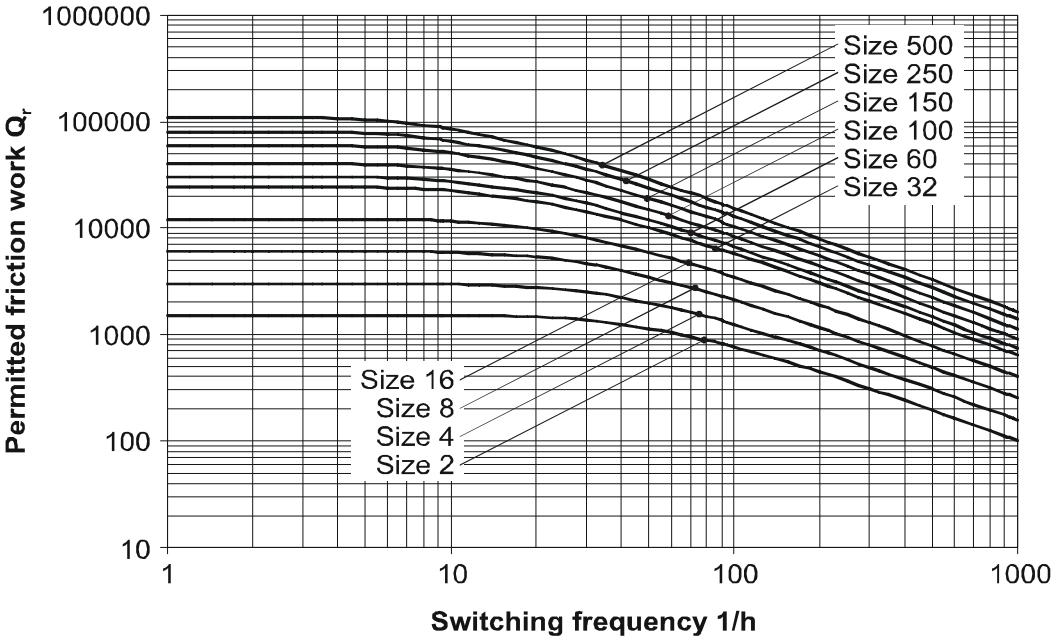
11. Permitted Brake Friction Work

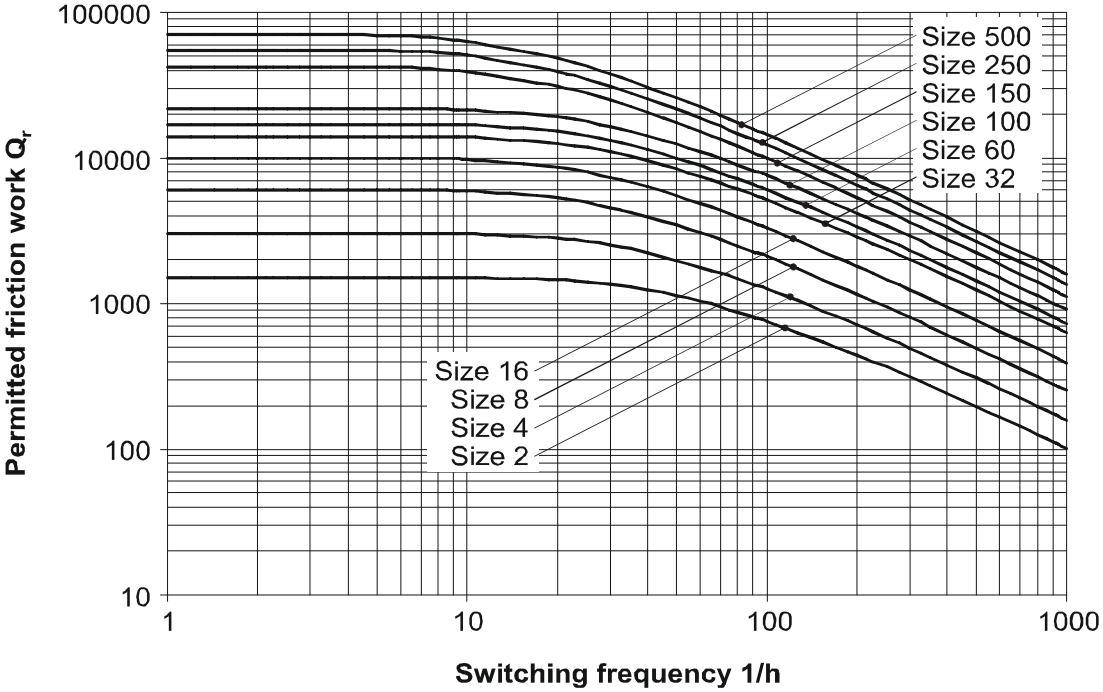
The permitted friction work values dependent on the switching frequency shown in the characteristic curves (pages 14 and 15) must not be exceeded, not even in EMERGENCY STOP operation.
The following diagrams show the permitted friction work values Q_r referring to the respective switching frequency for the various brake sizes and rated speeds (Table 1).

For 60 Hz operation, the max. permitted friction work values must be reduced to 80 %.

Friction Power Diagram 1
for Type 891.01_._ and Type 891.21_._ at 50 % of the Maximum Speed n_{max}



Friction Power Diagram 2
for Type 891.01_._ and Type 891.21_._ at Maximum Speed n_{max}



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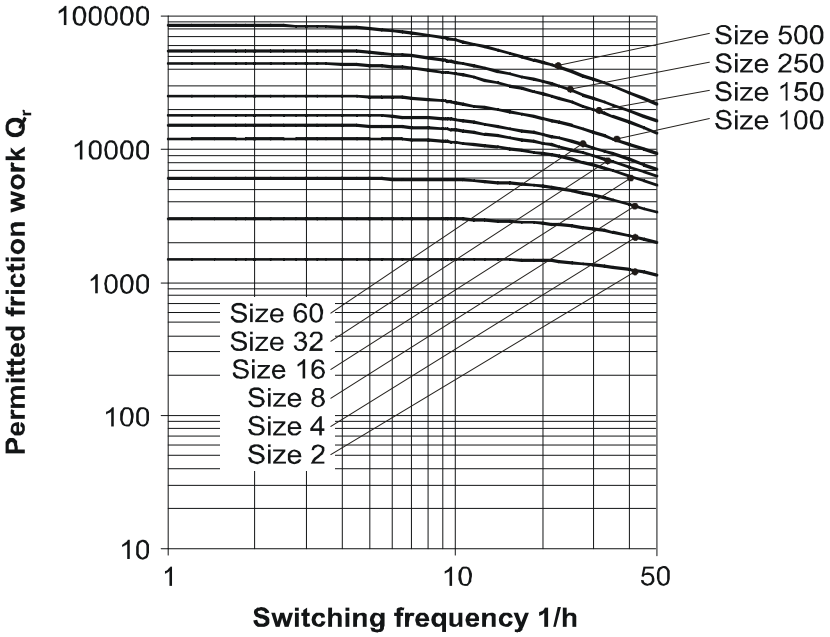
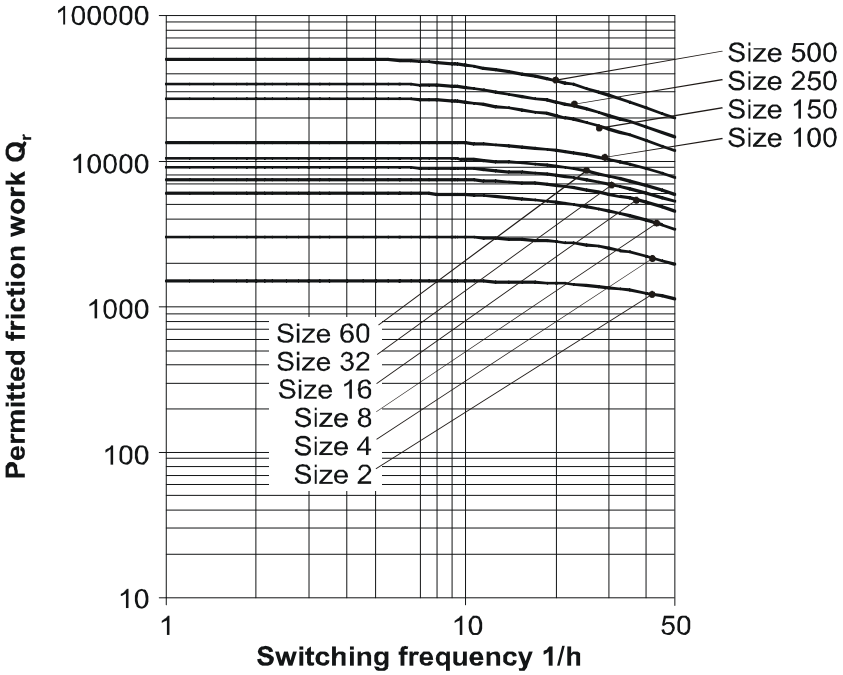
Friction Power Diagram 3
for Type 891.10_._ at 50 % of the Maximum Speed n_{max}



Friction Power Diagram 4
for Type 891.10_._ at Maximum Speed n_{max}



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12. Maintenance

ROBA-stop® -M brakes are mainly maintenance-free.
The rotor (4) is robust and wear-resistant. This ensures a particularly long lifetime. However, its is subject to operational wear. If the rotor (4) does become worn due to the high total friction work, and the function of the brake can no longer be guaranteed, the brake can be re-set to its functional state via rotor replacement.
Please check the quality of the counter friction surface.
The wear condition of the rotor (4) can be specified by measuring the release voltage or by measuring the rotor thickness on the dismantled brake acc. Tables 4/5. On Size 500, there is an air gap inspection opening in order to avoid dismantling the heavy brake.
The release voltage may be up to max. 90 % of the overexcitation voltage on a warm brake.

The amount of wear on the rotor (4) must be examined during the regular inspection intervals:

At least half-yearly or
at the latest after 1000 operating hours.

The inspection should include:

- ❑ Inspection of the rotor thickness (wear).
- ❑ Inspection of the toothings of the rotor (4) and the hub (1) for ease of movement, increased backlash and damage.
  Max. permitted rotor torsional backlash on the hub ,
  Sizes M2 - M32 → 0,5°, Sizes M60 - M500 → 0,3°.
  Inspection of engaged brake and load-free output by turning the motor shaft.
- ❑ Inspection of the armature disk (3) and the flange plate (12/13) or the friction surfaces of the motor plate for plane parallelism and wear (excessive formation of grooves).
- ❑ Clean the brake.

Wear times are influenced by many factors and can vary substantially. The required inspection and maintenance intervals must be calculated individually according to the system manufacturer's planning documentation.

Replacing the Rotor (4):

CAUTION

The brake must be load-free. Please check that it is load-free before de-installation. In order to replace the rotor (4), the brake must be unscrewed from the motor bearing shield or from the machine wall.

12.1 Remove the fixing screws (8).

12.2 Clean the brake
(use an industrial vacuum and wear a dust mask).
For details on the further procedural method, see sections 6.2 and 6.4.
Remove abraded particles using compressed air.

12.3 Remove the rotor (4) from the hub (1).

12.4 Check the hub (1) for damage and replace if necessary.

12.5 Check the armature disk (3) and the counter friction surface for signs of wear and plane parallelism (on Sizes 2 to 60: 0,03 mm, on Sizes 100 to 500: 0,05 mm). There must be no excessive formation of grooves. If necessary, replace the armature disk (3) and the flange plate (12/13). (For procedural method, see sections 6.2 and 6.4).

12.6 Measure the rotor thickness of the new rotor (4) and compare it with the values stated in Tables 4/5.

12.7 Push the rotor (4) onto the hub (1) and check for radial backlash. If there is a larger amount of backlash in the toothing between the hub (1) and the rotor (4), the hub (1) must be removed from the shaft and replaced.

12.8 Screw the brake onto the motor bearing shield or the machine wall using fixing screws (8) (please observe the tightening torque acc. Table 2).

On brakes with reduced braking torque and/or operation with fast-acting rectifiers, unpermittedly high wear values will not be noticed via the brake switching behaviour, as the magnetic coil (7) is, in this case, capable of allowing a very large tension path for the armature disk (3). Unpermittedly high wear relaxes the thrust springs (6), leading to a drop in torque.

13. Disposal

Our electromagnetic brake components must be disposed of separately as they consist of different materials. Please observe the relevant authority regulations. Code numbers may vary according to the disassembling process (metal, plastic and cable).

Electronic components
(Rectifier / ROBA®-switch / Microswitch):

Products which have not been disassembled can be disposed of under the Code 160214 (mixed materials) or components under Code. No. 160216, or can be disposed of by a certified disposal firm .

Brake bodies made of steel pads with coil / cable and all other steel components:
Steel scrap (Code No. 160117)

All aluminium components:
Non-ferrous metals (Code No. 160118)

Brake rotor (steel or aluminium pads with friction linings):
Brake linings (Code No. 160112)

Seals, O-rings, V-seals, elastomers, terminal boxes (PVC):
Plastic (Code No. 160119)

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14. Malfunctions / Breakdowns

Malfunction	Result of Malfunction	Possible Causes	Solutions ❑ The brake must always be dismantled in order to remove damage and malfunctions. ❑ Damaged parts must be replaced in order to solve the respective problem. ❑ The brake must be cleaned before re-installation.
The brake does not release completely; permanent grinding on the rotor	The axial flexibility of the rotor is limited, rotor is jammed axially	Incorrect tolerance constellation on the shaft-hub connection	Check tolerances
		Tolerance errors on the key connection	
		Broken hub due to installation error when mounting	Suitable mounting method
		Poor shaft quality	Check the shaft quality
		Poor key dimensioning	Carry out a key calculation
		Hub toothing dirty due to abraded or worn particles	Check the hub and rotor toothing, maintain suitable maintenance intervals
		Worn, knocked out hub and rotor toothing	
		Toothing breakage	
		Damaged / deformed hub and rotor toothing	
The brake does not release completely; permanent grinding on the rotor	Wiring error on the brake	Incorrect voltage, no DC voltage	Check voltage, observe the wiring guidelines
		Defective electrical wiring	Check electrical wiring
		Defective coil, coil is electrically or thermically overloaded	Check coil capacity; check insulation resistance
The brake does not release completely; permanent grinding on the rotor	Air gap too small in released condition	Due to installation	Air gap inspection
		Penetration of foreign bodies into the brake, in particular magnetisable particles	Check the brake interior for dirt and clean it
		Excessive component temperatures, temperature expansion	Temperature inspection

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14. Malfunctions / Breakdowns

Malfunction	Result of Malfunction	Possible Causes	Solutions ❑ The brake must always be dismantled in order to remove damage and malfunctions. ❑ Damaged parts must be replaced in order to solve the respective problem. ❑ The brake must be cleaned before re-installation.
Slipping, permanent grinding of the brake under load, increase in friction work	Braking torque too low	Incorrect dimensioning	Check the required braking torque
		Incorrect spring configuration	Check the spring configuration; have the brake checked at the place of manufacture
	Drop in braking torque	Excessive wear on the rotor	Wear inspection
		Changes to the friction behaviour on the friction lining due to the maximum sliding speed being exceeded	Check for correct wiring, switching times and dimensioning
	Changes in braking torque	Unpermittedly high friction work, squeaking, type and quality of the counter friction surface	Check for correct wiring, switching times and dimensioning
		Corrosion on the counter friction surface	Check the brake for corrosion
		Ambient influences, oil water, cleaning media, condensation formation	Check protection against environmental influences
		Type and quality of the counter friction surface	Check the counter friction surface
		Extremely low friction speeds	Check the dimensioning
	Brake cannot be released	Excessive tension path due to unpermitted wear	Wear inspection; replace the rotors
		No voltage connection	Check the voltage connection
Increased friction work, brake grinds	Excessively long engagement times	Load accelerates the drive line during the brake engagement time	Check for correct wiring, switching times and dimensioning
	Drop in braking torque	Excessive wear on the rotor	Wear inspection; replace the rotors
	Motor starts up against closed brake	Excessive brake traction times	Check for correct wiring, switching times; check dimensioning; check motor controls
Component breakage	Operating conditions	Oscillations, vibrations, overload, unpermittedly high speeds	Check operating conditions and dimensioning
	Ambient influences, temperature, fluids, media, corrosion	Friction linings sticking, settling or swelling; changes in friction lining friction behaviour	Check that the device is protected from environmental influences
	Deviations, adjustment dimensions and the screw tightening torques	Brake securement, hand release, actuation lever, screws	Check the guidelines and values according to the information in the Installation and Operational Instructions

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