your reliable partner

Electromagnetic safety brakes

ROBA-stop®-M
Type 891._ _ _._
Sizes 2 – 500

Issue status 2021-11

Patents applied for

Translation of the Original Operational Instructions
B.8.1.DE

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

(B.8.1.EN)

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.

Contents:

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Safety and Guideline Signs

DANGER

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

WARNING

Possibly dangerous situation, which can lead to severe physical injuries or to death.

CAUTION

Danger of injury to personnel and damage to machines.

Please Observe!
Guidelines on important points.

Guidelines on the Declaration of Conformity
A conformity evaluation has been carried out for the product (electromagnetic safety brake) in terms of the EU Low Voltage Directive 2014/35/EU. The Declaration of Conformity is laid out in writing in a separate document and can be requested if required.

Guidelines on the EMC Directive (2014/30/EU)
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 Machinery 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 the machine accords with the regulations stated in the directive.

Guidelines on the EU Directive 2011/65/EU (RoHS II) with 2015/863/EU (RoHS III – from 22 July 2019)
These restrict the use of certain hazardous substances in electrical and electronic devices as well as in products / components (category 11), the proper operation of which is dependent on electric currents and electromagnetic fields. **Our electromagnetic products / components fulfill the requirements laid down in the RoHS Directive(s), taking into account the valid exceptions (according to Appendix III and IV RoHS (2011/65/EU) with delegated Directives (EU) 2018/739-741 from 01.03.2018 for Category 11 – until 21 July 2024) and comply with the RoHS.**

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 2014/34/EU.

Guidelines on the REACH Regulation (EC) No. 1907/2006
of the European Parliament and of the Council Concerning the Registration, Evaluation, Authorization and Restriction of Chemicals. This regulates the manufacture, placing on the market and use of chemical substances in preparations, under certain conditions also pertaining to substances in products. *mayr*® power transmission exclusively manufactures products (articles: clutches/couplings, electric motors, brakes and the appropriate rectifiers) in accordance with the definition in Article 3 Section 3 of the REACH Regulation. In some products (ROBA-stop®, Sizes 2 – 11, Type 8 - -.- - -.- / ROBA-stop®-M, Sizes 2 – 500, Type 891.- - -.- / ROBA-stop®-silenzio®, Sizes 4 – 8, Type 896.- - -.- - / ROBA®-topstop®, Sizes 100 – 260, Type 899-.- - - - -), shoulder screws are installed which are made from a copper alloy containing up to 2.5 % by weight lead. Products made from copper and copper alloys do not fall within the area of applicability of Regulation (EC) No. 1272/2008 of the European Parliament and Council Concerning the Classification, Labeling and Packaging of Substances and Mixtures (CLP Regulation) and are therefore not subject to the classification and labeling obligations. We would like to point out that the proportion of lead used here is not prohibited according to the REACH Regulation. It is merely necessary to declare the use of this substance.

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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 lines 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 risk assessment required 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-energized, disengaged 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 connection 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 brake.
- ❒ 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 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 countermeasures.

Dimensioning

Attention!

When dimensioning the brake, please take into consideration whether a load torque is present when selecting the protection.

- ❒ Load torques reduce the deceleration torque available.
- ❒ Load torques may increase the output speed:
  - ❒ during a possible processing time in the controls
  - ❒ during the brake downtime

When calculating the friction work, please observe that the brake nominal torque is subject to a tolerance.

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Climate Conditions

The ROBA-stop®-M is suitable for applications with an ambient temperature of between -20 °C and +40 °C.

CAUTION

Reduction in braking torque possible

Condensation can form on the brake and cause a loss in braking torque:

- ❒ due to fast changes in temperature
- ❒ at temperatures of around or under freezing point

The user is responsible for taking appropriate countermeasures (e.g. forced convection, heating, drain screw).

CAUTION

Brake malfunction possible

Condensation can form on the brake and cause malfunctions:

- ❒ at temperatures around or under freezing point, the brake can freeze over and not release any more.

The user is responsible for taking appropriate countermeasures (e.g. forced convection, heating, drain screw).

The system function must be checked by the user after longer downtimes.

- ❒ At high temperatures and in high humidity or with occurring dampness, the rotor can seize up to the armature disk or the bearing shield / the flange plate after longer downtimes.

Intended 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.

Grounding 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 protective conductor (PE) on the fixed installation. If the basic insulation fails, no contact voltage will remain. Please carry out a standardised inspection of the protective conductor connections to all contactable metal parts!

Class of Insulation F (+155 °C)

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

Protection

IP54:
When installed, dust-proof and protected against contact as well as against water spray from any direction (dependent on customer-side mounting method).

IP66 (Type 891._ _ 4.1):
Dust-proof and protected against contact as well as against strong jet water from a nozzle 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 °C up to +60 °C.
- ❒ Do not store in direct sunlight or UV light.
- ❒ Do not store aggressive, corrosive substances (solvents / acids / lyes / salts / oils / etc.) near to the brakes.

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

Storage acc. DIN EN 60721-3-1 (including the limitations / additions described above): 1K3; 1Z1; 1B1; 1C2; 1S3; 1M1

Handling

Before installation, the brake must be inspected and found to be in proper condition.
The brake function must be inspected both **once attachment 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**.
- ❒ **Protection circuit:** When using DC-side switching, the coil must be protected by a suitable protection 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 may be 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 operating current are sufficient. Depending on the application, the switching contact can also be protected by other protection 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.

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Standards, Directives and Regulations Used

DIN VDE 0580	Electromagnetic devices and components, general specifications
2014/35/EU	Low Voltage Directive
CSA C22.2 No. 14-2010	Industrial Control Equipment
UL 508 (Edition 17)	Industrial Control Equipment
EN ISO 12100	Safety of machinery – General principles for design - Risk assessment and risk reduction
DIN EN 61000-6-4	Interference emission
DIN EN 61000-6-2	Interference immunity

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!

CE Identification

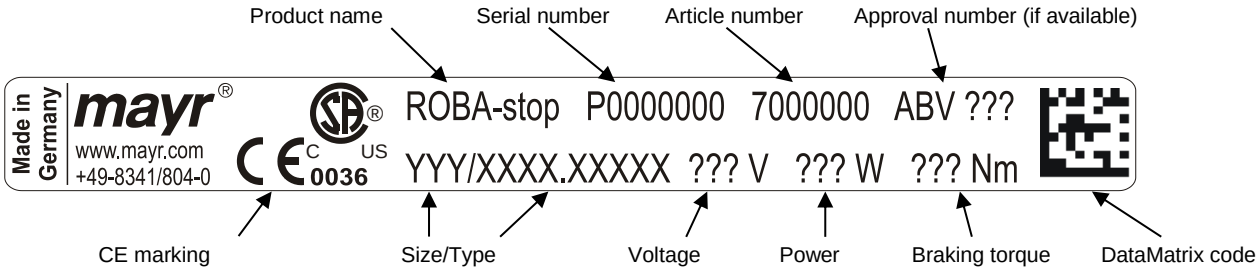
CE according to the Low Voltage Directive 2014/35/EU

Conformity Markings

C SP US in terms of the Canadian and American approval

Identification

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



(CE identification with ID number of the respective inspection authority, only for type examination tested brakes)

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Safety-relevant Applications

Brakes which are used in safety-related applications are to be selected in accordance with the risk assessment EN ISO 12100 and furthermore in accordance with EN ISO 13849-1 through identification of the safety function.

This is in principle the task of the system manufacturer.

Roba-stop®-M standard designs with safety parameters:

Type 891.10_._ Nominal torque holding brake
Type 891.50_._ Nominal torque holding brake
Type 891.01_._
Type 891.02_._
Type 891.03_._
Type 891.07_._
Type 891.08_._

Safety parameters can be requested if required.
In case of deviating designs, please consult with mayr® power transmission directly.

Definition of the Braking Torques

Static braking torque

Effectively averaged, fully developed torque for slipping brake with smallest speed values.
Guideline value: n = 3 [rpm]

Dynamic braking torque

Effectively averaged, fully developed torque in a braking procedure from the output speed up to standstill.

For correct evaluation, a sufficient slip time is required (sliding speed between 1 m/s and 10 m/s).
The permitted friction work and speed values must not be exceeded.

Run-in procedure / Conditioning of the friction lining pairing

The stated brake nominal torques are valid for a run-in / conditioned state of the friction lining pairing in standard climate conditions.

Conditioning of the friction lining pairing	
Conditioning is necessary	❑ in new condition
	❑ during the operation of the system
Please carry out conditioning of the friction lining pairing through dynamic braking procedures of the system.	**Recommendation:** Approx. Please carry out approx. 5 dynamic braking procedures ❑ at 50 % of the permitted speed n_{max} ❑ at 25 % of the permitted friction work $Q_{r\ zul.}$
❑ A generally valid definition of the parameters required for the conditioning is not possible due to the different application possibilities. ❑ The frequency of the friction lining pairing conditioning and the torque inspection must be determined by **the user** depending on the application.	
Regular conditioning is not possible	Dimension with a correspondingly higher safety **Recommendation: Si ≥ 2.0** Please observe: The dynamic dimensioning must be taken into account separately
EMERGENCY STOP	After brake run-in procedure!

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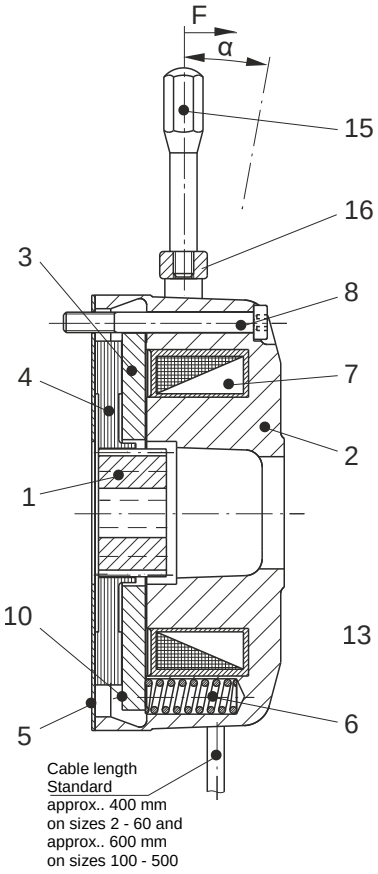

Fig. 1

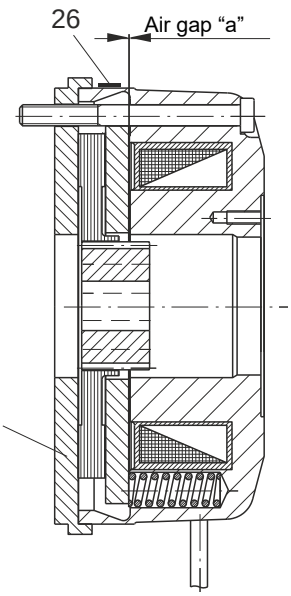

Fig. 2

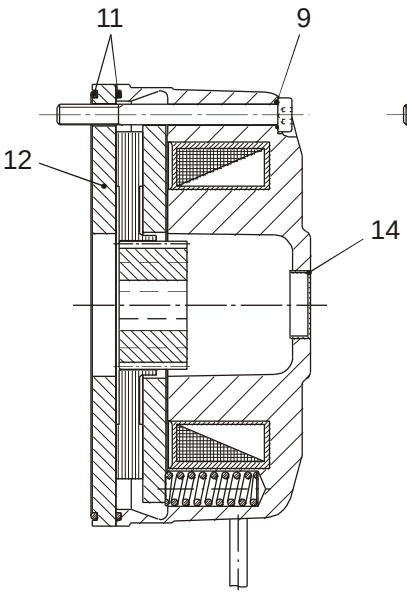

Fig. 3

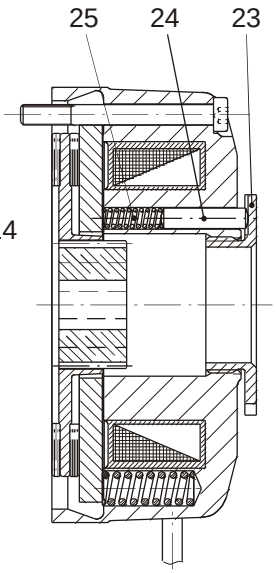

Fig. 4

Parts List (Only use mayr® original parts)

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

Technical Data (Independent of Size)

Nominal voltages:	24 V/104 V/180 V/207 V
Protection:	IP54
Protection (Type 891._ _ _.1):	IP66
Duty cycle:	max. 100 %
Ambient temperature:	-20 °C up to +40 °C

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Table 1: Technical Data (Dependent on Size)

Size	Standard brake Type 891._ 1_ . _			Holding brake Type 891.10 _ . _/891.50_._			Reference speed	Electrical nominal power	Electrical Connection Cross-section	Mass without flange plate, without hand release
	Idle speed			Idle speed						
	Maximum speed			Maximum speed						
	Nominal torque M2	n_{max}		Nominal torque M2	n_{max}					
	[Nm]	[rpm]		[Nm]	[rpm]		[rpm]	[W]	[mm2]	[kg]
2	2	6000	9000	4	6000	9000	6000	19	2 x 0.56	0.76
4	4	5000	8800	8	5000	9000	5000	25	2 x 0.56	1.1
8	8	4000	7000	16	4000	9000	4000	29	2 x 0.56	1.8
16	16	3500	5600	32	3500	9000	3000	38	2 x 0.88	3.4
32	32	3000	4700	64	3000	7800	1500	46	2 x 0.88	4.5
60	60	3000	7200	100	3000	7300	1500	69	2 x 0.88	7.4
100	100	3000	6200	180	3000	6200	1500	88	2 x 0.88	13.6
150	150	4200	5400	280	3000	5400	750	98	2 x 0.88	19.2
250	250	3600	4700	460	2500	4700	750	120	2 x 0.88	33.3
500	500	3000	3800	900 [1)]	2000	3800	750	152	2 x 0.88	38

[1)] Brake operation only possible with overexcitation.

Table 2: Technical data (dependent on size)

Size	Nominal air gap "a" +0.1 / -0.05	Max. permitted air gap "a" after wear	Inspection dimension "x"	Number of turns "Y" of the hexagon nuts (19)	Fixing screw Item 8 (Fig. 1)				Tightening torque
					Design without flange plate		Design with flange plate		
	(Fig. 2)	(Fig. 2)	(Fig. 5)	(Fig. 5)	(Item 12/13)	DIN EN ISO	(Item 12/13)	DIN EN ISO	
	[mm]	[mm]	[mm]						[Nm]
2	0.15	0.4	0.9 $^{+0.1}$	1.7	3 x M4 x 45	4762	3 x M4 x 50	4762	2.5
4	0.15	0.4	0.9 $^{+0.1}$	1.7	3 x M4 x 45	4762	3 x M4 x 50	4762	2.5
8	0.2	0.45	1.1 $^{+0.1}$	1.5	3 x M5 x 50	4762	3 x M5 x 55	4762	5.0
16	0.2	0.7	1.6 $^{+0.1}$	2.0	3 x M6 x 60	4762	3 x M6 x 65	4762	9.0
32	0.2	0.7	1.8 $^{+0.1}$	2.0	3 x M6 x 60	4762	3 x M6 x 70	4762	9.0
60	0.25	0.8	2.2 $^{+0.1}$	2.0	3 x M8 x 75	4762	3 x M8 x 85	4762	22
100	0.3	0.9	2.2 $^{+0.1}$	1.6	3 x M8 x 80	4762	3 x M8 x 90	4762	22
150	0.3	0.9	2.2 $^{+0.1}$	1.6	3 x M8 x 100	4762	3 x M8 x 110	4762	22
250	0.35	0.95	2.4 $^{+0.1}$	1.5	3 x M10 x 110	4762	3 x M10 x 130	4762	45
500	0.4 +0.2	1.0	2.4 $^{+0.1}$	1.5	6 x M10 x 110	4762	6 x M10 x 130	4762	45

Table 3: Technical data (dependent on size)

Size	Hand release force [N] at		Release angle "α"	Min. width of the counter friction surface	Tightening torque shoulder screw Item 10 (Fig. 1)	Through hole (coil carrier back) [mm]		
	Type 891.0/2	Type 891.1 891.5	[°]	[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} [kgm²]		Friction work $Q_{r\ 0.1}$ (per 0.1 mm wear)	Friction work $Q_{r\ ges.}$ (max. possible friction work related to nominal air gap)	Rotor thickness "New condition"	Minimum rotor thickness (limit value for braking torque 100 %)
	Type 891.0_ _._	Type 891.2_ _._	[J]	[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	–	110 x 10 6	590 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	–	120 x 10 6	720 x 10 6	15.5	14.9
250	61.82 x 10 -4	–	130 x 10 6	780 x 10 6	17	16.4
500	222.6 x 10 -4	–	170 x 10 6	1700 x 10 6	18.5	17.9

The stated values $Q_{r\ 0.1}$ and $Q_{r\ ges.}$ are only reference values for specific friction work values < 0.5 J/mm² 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 $Q_{r\ ges.}$ (max. possible friction work related to nominal air gap)	Rotor thickness "new"
	[kgm2]	[J]	[J]	[mm]
32	4.48 x 10 -4	30 x 10 6	45 x 10 6	10.4
60	6.74 x 10 -4	50 x 10 6	100 x 10 6	11.15
100	16.54 x 10 -4	60 x 10 6	144 x 10 6	14.0
150	31.68 x 10 -4	40 x 10 6	160 x 10 6	15.5
250	61.82 x 10 -4	50 x 10 6	220 x 10 6	17
500	222.6 x 10 -4	70 x 10 6	350 x 10 6	18.5

Table 5a: Technical Data (Dependent on Size)

Size	Valid for holding brakes Type 891.5_ _._			
	Mass moment of inertia J Hub + rotor on d_{max}	Friction work $Q_{r\ 0.1}$ (per 0.1 mm wear)	Friction work $Q_{r\ ges.}$ (max. possible friction work related to nominal air gap)	Rotor thickness "new"
	[kgm2]	[J]	[J]	[mm]
2	0.13 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	0.60 x 10 -4	13 x 10 6	13 x 10 6	6.9
16	1.58 x 10 -4	20 x 10 6	20 x 10 6	8.0

The stated values $Q_{r\ 0.1}$ and $Q_{r\ ges.}$ are only reference values for specific friction work values < 0.5 J/mm² and sliding speeds < 10 m/s.

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Table 6: Technical Data (Dependent on Size)

Size	Permitted hub bores for standard brake Type 891.0_ _._ und 891.2_ _._				Permitted hub bores for holding brake Type 891.10 _._/891.50 _._			
	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 Type 891._8_._

Table 7: Technical data (dependent on size)

Size	Braking torque [Nm] with tolerance +40% / -20% [4]							
	Type 891._8_._	Type 891._7_._	Standard brake Type 891._1_._	Type 891._2_._	Type 891._3_._	Type 891._4_._	Type 891._5_._	Holding brake Type 891.10_._ 891.50_._
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	50	41	30	21	100
100	125	110	100	85	70	50		180
150	210	180	150	125	100	75		280
250	340	290	250	215	180	125		460
500	700 [3]	600	500	400	350	250	200	900 [3]

[3] Brake operation only possible with overexcitation.
[4] For restricted braking torque tolerances please contact *mayr*® power transmission.

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.

Function

The ROBA-stop®-M brake is a spring applied, electromagnetic safety brake.

Spring applied function (brake):
In de-energized 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 function (release):
Due to the magnetic force of the coil in the coil carrier (2), the armature disk (3) is attracted against the spring pressure 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 brake brakes reliably and safely in the event of a power switch-off, a power failure or an EMERGENCY STOP.

Scope of Delivery / State of Delivery

Please check the scope of delivery as well as the state of delivery immediately after receiving the goods.
mayr® will take no responsibility for belated complaints.
Please report transport damage immediately to the deliverer.
Please report incomplete delivery and obvious defects immediately to the manufacturer.

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Installation Conditions

- ❑ The eccentricity of the shaft end in relation to the mounting pitch circle must not exceed 0.2 mm.
- ❑ The positional 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 grinding of the rotor (4) and to overheating.
- ❑ The tolerances of the hub bore (1) 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 must 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.

For holding brakes: (Task: Holding application with EMERGENCY STOP function)	Surface quality in the friction area of the friction surface between Ra = 1.6 µm up to Ra = 3.2 µm
For dynamic applications: (Task: Frequent dynamic braking)	Surface quality in the friction area of the friction surface Ra = 1.6 µm.

Attention!
When machining grey cast iron, please make sure that the cast tips are removed.

- ❑ 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 up 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.
- ❒ Protect the rotor from rusting up / seizing up against the bearing shield / the flange plate (customer-side). We recommend tried and tested anti-corrosion measures for the mounting surface:
  - ❑ dry, oil-free phosphate layers
  - ❑ Hard chromium and nitriding

Run-in Procedure

Please carry out conditioning of the friction lining pairing before initial operation of the system (see “Run-in procedure / Conditioning of the friction lining pairing”, page 6)

Installation (Figs. 1 and 2)

5.1. Mount the hub (1) onto the shaft, bring it into the correct position and secure it axially (e.g. using a locking ring).

5.2. If necessary (dependent on Type), insert the O-ring (11) into the axial groove of the flange plate (12).

5.3. 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 holes in the machine wall).

In the delivery of Sizes 150 and 250, three additional (shorter) cap screws are included in addition to the fixing screws (8). The customer must use these additional screws for attaching the flange plate (12/13) only when personal protection in accordance with the B 10d value is required. For this, 3 stepped bores can be found in the flange plates. Tightening torque like Item 8 of the respective size acc. Table 3.

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

5.5. If necessary, install the hand release acc. section 8 on page 12.

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

5.7. 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.

5.8. Secure the brake evenly all around using the cap screws (8) incl. the bonded seals (9 / dependent on Type) **with a torque wrench and a tightening torque (acc. Table 2)**.

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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:
(Attention: 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).

CAUTION

It is possible that the thrust springs relax suddenly.

This might lead to internal and external bruising.

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), if necessary using an auxiliary tool, 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.

6.3. Replace the thrust springs (6).

Attention:

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).
(Please observe the tightening torque acc. Table 2).

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 energizing the brake or manually with the hand release (dependent on Type).

The braking torque is not achieved until after the run-in procedure has been carried out.

See page 6 “Definition of the braking torques”.

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-energized.

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

8.4. Only on sealed hand release (Type 891. _ _ _ .1):
Push the intermediate plates (22) 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 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".

CAUTION

An uneven adjustment dimension on the hand release or incorrect adjustment can cause the brake to malfunction or the braking function to be lost.

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

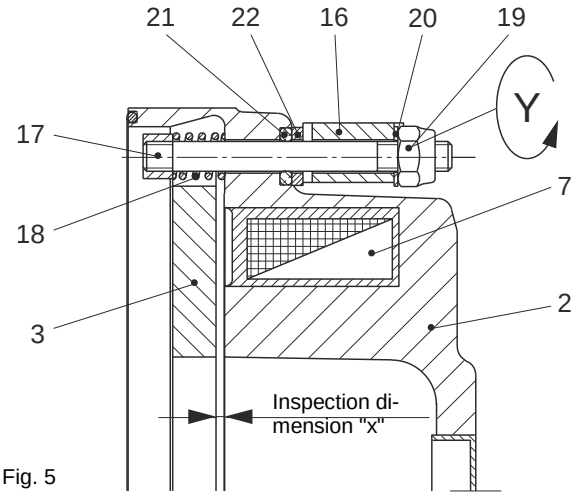

Fig. 5

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

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Switching Times

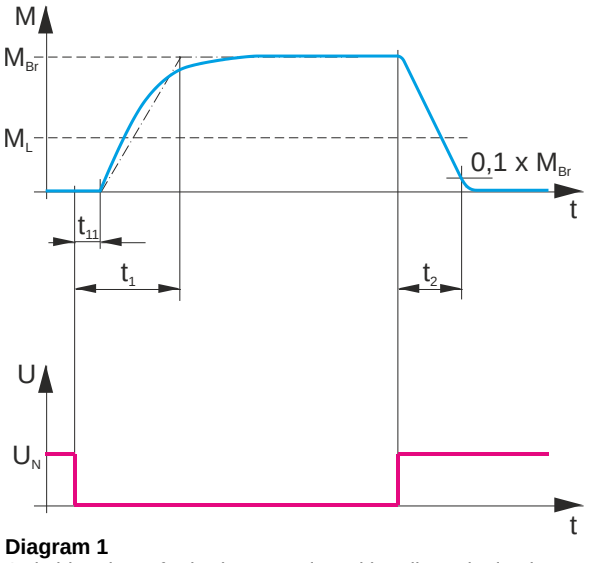

Diagram 1
Switching times for brake operation with coil nominal voltage

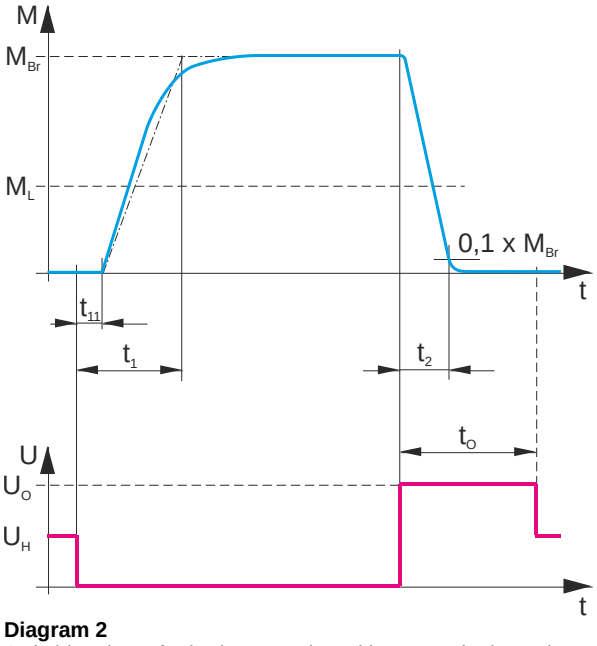

Diagram 2
Switching times for brake operation with overexcitation voltage

Key

M_{Br}	=	Braking torque	M_L	=	Load torque
t_1	=	Connection time	t_{11}	=	Response delay on connection
t_2	=	Separation time			
t_O	=	Overexcitation time	U_N	=	Coil nominal voltage
U_H	=	Holding voltage	U_O	=	Overexcitation voltage

Table 8: Switching times

The values stated in the table are mean values which refer to the nominal air gap and the nominal torque on a warm brake.

Switching times [1]				Size									
				2	4	8	16	32	60	100	150	250	500
Nominal torque Type 891._1_._		M2	[Nm]	2	4	8	16	32	60	100	150	250	500
Connection time	DC-side switching	t1	[ms]	10	18	20	30	50	55	68	80	100	100
	AC-side switching	t1	[ms]	100	160	220	320	400	500	640	730	1100	1100
Response delay on connection	DC-side switching	t11	[ms]	6	12	16	25	35	35	38	40	50	30
	AC-side switching	t11	[ms]	80	130	175	240	300	350	400	450	700	700
Separation time [2]		t2	[ms]	33	36	54	84	120	180	216	264	348	480
Nominal torque Type 891._2_._		M2	[Nm]	1.7	3.4	6.8	13.5	27	51	85	125	215	400
Connection time	DC-side switching	t1	[ms]	16	29	32	48	80	88	109	128	160	160
	AC-side switching	t1	[ms]	160	256	352	512	640	800	1024	1168	1760	1760
Response delay on connection	DC-side switching	t11	[ms]	9.6	19	26	40	56	56	61	64	80	48
	AC-side switching	t11	[ms]	128	208	280	384	480	560	640	720	1120	1120
Separation time		t2	[ms]	24	26	39	61	87	130	157	191	252	348
Nominal torque Type 891._3_._		M2	[Nm]	1.4	2.8	5.5	11	22	42	70	100	180	350
Connection time	DC-side switching	t1	[ms]	22	40	44	66	110	121	150	176	220	220
	AC-side switching	t1	[ms]	220	352	484	704	880	1100	1408	1606	2420	2420
Response delay on connection	DC-side switching	t11	[ms]	13	26	35	55	77	77	84	88	110	66
	AC-side switching	t11	[ms]	176	286	385	528	660	770	880	990	1540	1540
Separation time		t2	[ms]	21	23	34	53	75	113	135	165	218	300

1) Standard brakes with braking torque adjustment Type 891._4_._ and Type 891._5_._ have significantly longer connection times t1 and must not be used for switching-time relevant applications.

2) The separation time t_2 of holding brakes is 1.4 times longer than the separation time of standard brakes (Type 891._1_._).

3) Value for operation with overexcitation

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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). Operation can take place with alternating voltage using a rectifier or another suitable DC power supply. The connection possibilities can vary dependent on the brake equipment. Please follow the exact connections according to the Wiring Diagram. The manufacturer and the user must observe the applicable regulations and standards (e.g. DIN EN 60204-1 and DIN VDE 0580). Their observance must be guaranteed and double-checked!

Grounding Connection

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

The reliable operational behavior 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

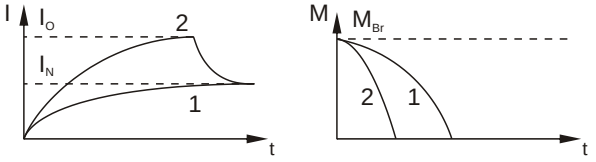
When the voltage is switched on, a magnetic field is built up in the brake coil, which attracts the armature disk to the coil carrier and releases the brake.

Field build-up with normal excitation

If the magnetic coil is energized with nominal voltage, the coil current 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 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_O**

Increased wear, and therefore an increasing air gap as well as coil heating lengthen the separation times 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_O 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 Diagram “Separation time t_2 of the brake dependent on the spring configuration”.

➔ Spring force (braking torque adjustment) < 100 %:
The overexcitation time t_O is less than the doubled separation time t_2 on each brake size.
Example: Spring configuration Type 891._5_._ => Separation time t_2 = 50 %
--> Overexcitation time t_O = 200 % x 50 % = 100 % t_2

➔ Spring force (braking torque adjustment) = 100 %:
The overexcitation time t_O is the doubled separation time t_2 on each brake size.

➔ Spring force (braking torque adjustment) > 100 %:
The overexcitation time t_O is higher than the doubled separation time t_2 on each brake size.
Example: Spring configuration Type 891._8_._ => Separation time t_2 = 120 %
--> Overexcitation time t_O = 200 % x 120 % = 240 % t_2

$P \leq P_N$
The coil capacity P must not be larger than P_N. Otherwise the coil may fail due to thermic overload.

Key and Calculations:

P	[W]	RMS coil capacity dependent on switching frequency, overexcitation, reduction in capacity and duty cycle $P = \frac{P_O \times t_O + P_H \times t_H}{T}$
P_N	[W]	Coil nominal capacity (catalogue values, Type tag)
P_O	[W]	Coil capacity on overexcitation $P_O = \left(\frac{U_O}{U_N}\right)^2 \times P_N$
P_H	[W]	Coil capacity at reduced capacity $P_H = \left(\frac{U_H}{U_N}\right)^2 \times P_N$
t_O	[s]	Overexcitation time
t_H	[s]	Time of operation with reduction in capacity
t_{on}	[s]	Time with voltage
t_{off}	[s]	Time without voltage
T	[s]	Total time ($t_O + t_H + t_{off}$)
U_O	[V]	Overexcitation voltage (bridge voltage)
U_H	[V]	Holding voltage (half-wave voltage)
U_N	[V]	Coil nominal voltage

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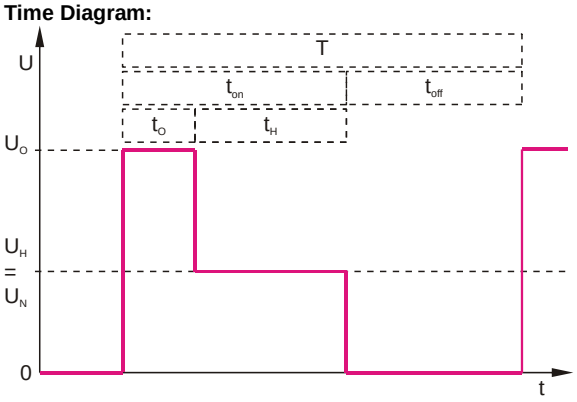
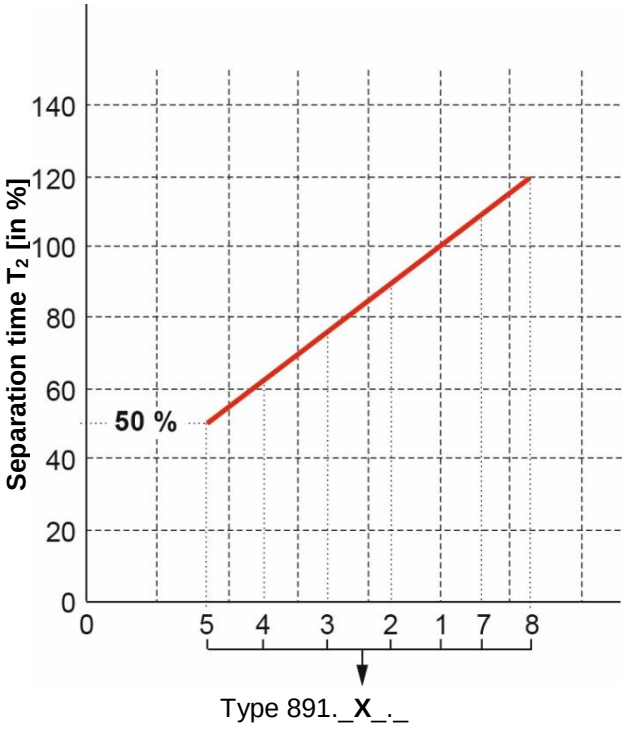
Time Diagram:



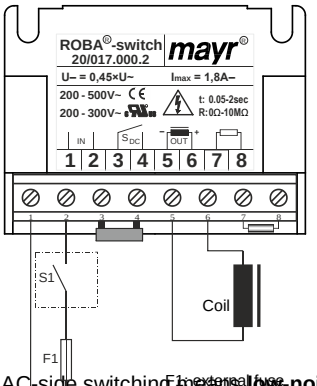
For brakes that do not require overexcitation, the holding voltage U_H may be reduced to 50 % of the nominal voltage U_N, e.g. in case of power reduction to reduce the coil temperature.

Diagram: Separation time t_2 of the brake dependent on the spring configuration



Magnetic Field Removal

AC-side Switching

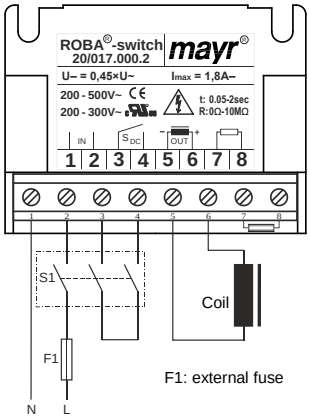


The power circuit is interrupted in front of the rectifier. The magnetic field slowly reduces. This delays the rise in braking torque.

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 (approx. 6-10 times longer than with DC-side disconnection), use for non-critical braking 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 can 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 operation)**; however, louder switching noises.

Protection circuit

When using DC-side switching, the coil must be protected by a suitable protection circuit according to VDE 0580, which is integrated in *mayr*®-DC voltage modules. 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 operating current are sufficient. Depending on the application, the switching contact can also be protected by other protection 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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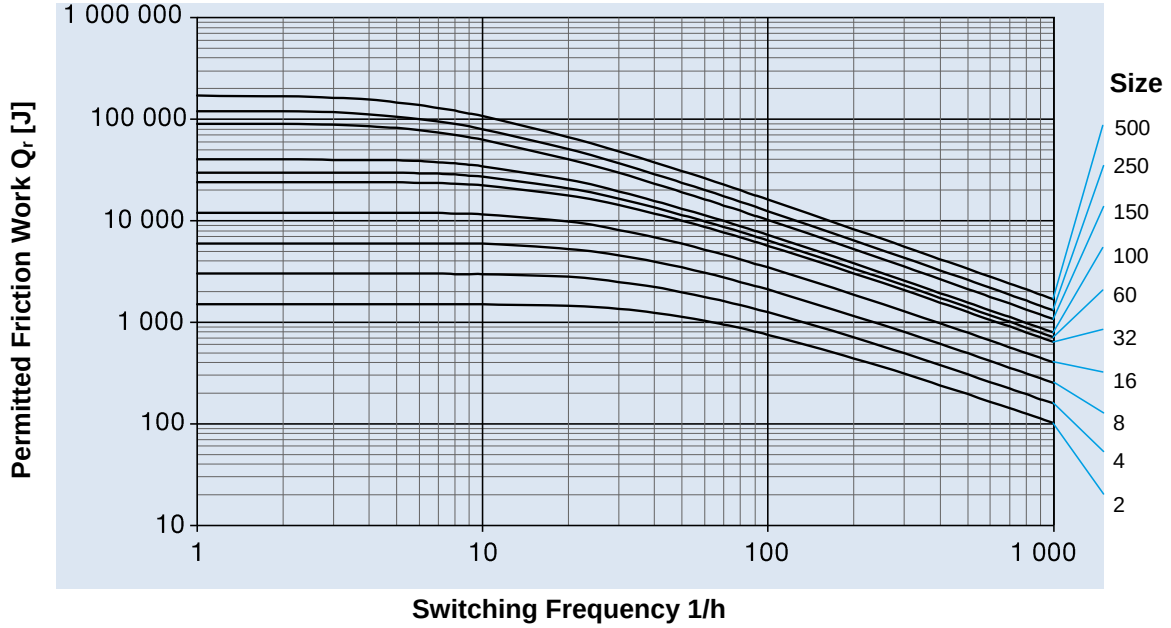
Permitted Brake Friction Work

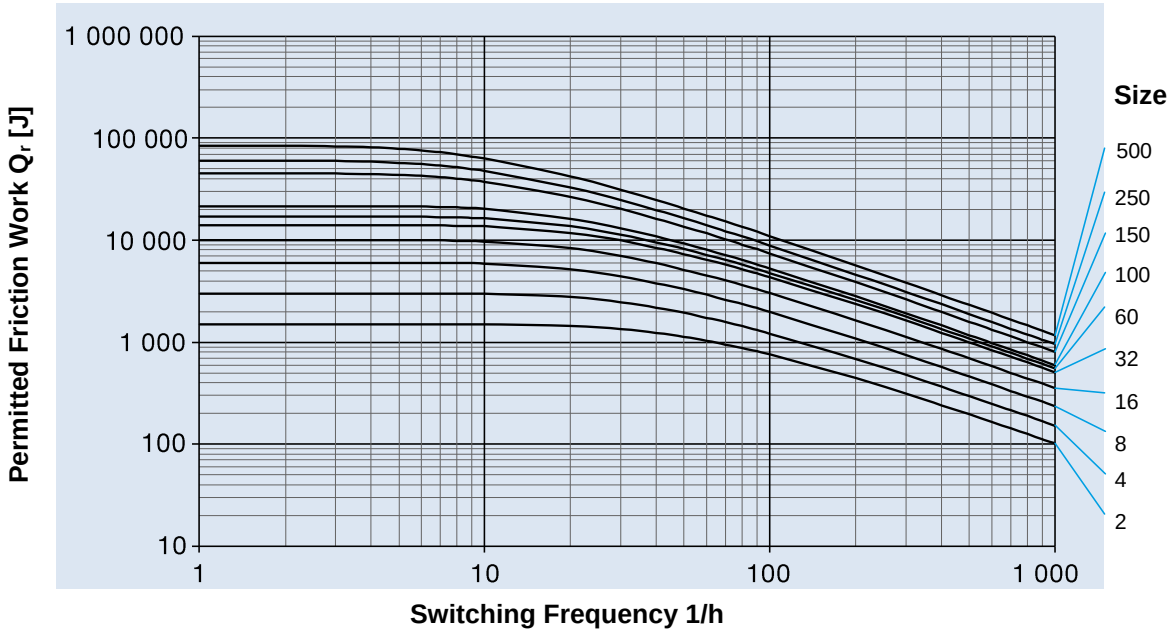
The permitted friction work values dependent on the switching frequency shown in the characteristic curves must not be exceeded, not even in EMERGENCY STOP operation.
The following diagrams show the permitted friction work values Qr referring to the respective switching frequency for the various brake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

Friction Power Diagram 1
for Type 891.01_._ and Type 891.21_._ (Standard brake) at reference speed n_{ref}

(see Technical Data)



Friction Power Diagram 2
for Type 891.01_._ and Type 891.21_._ (Standard brake) at Maximum speed n_{max}



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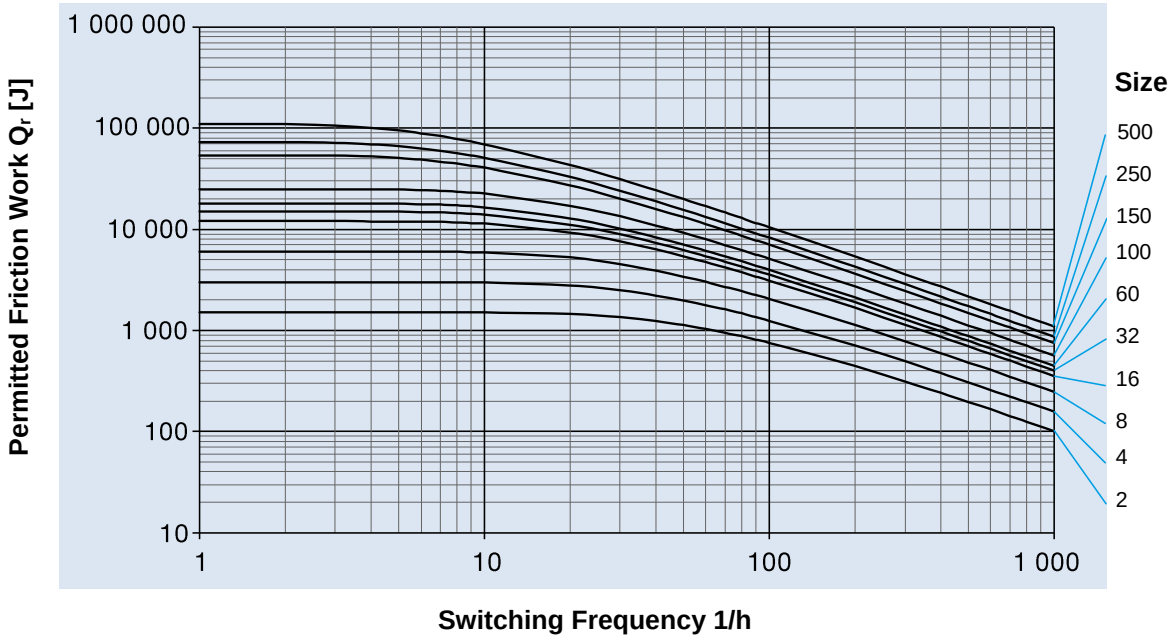
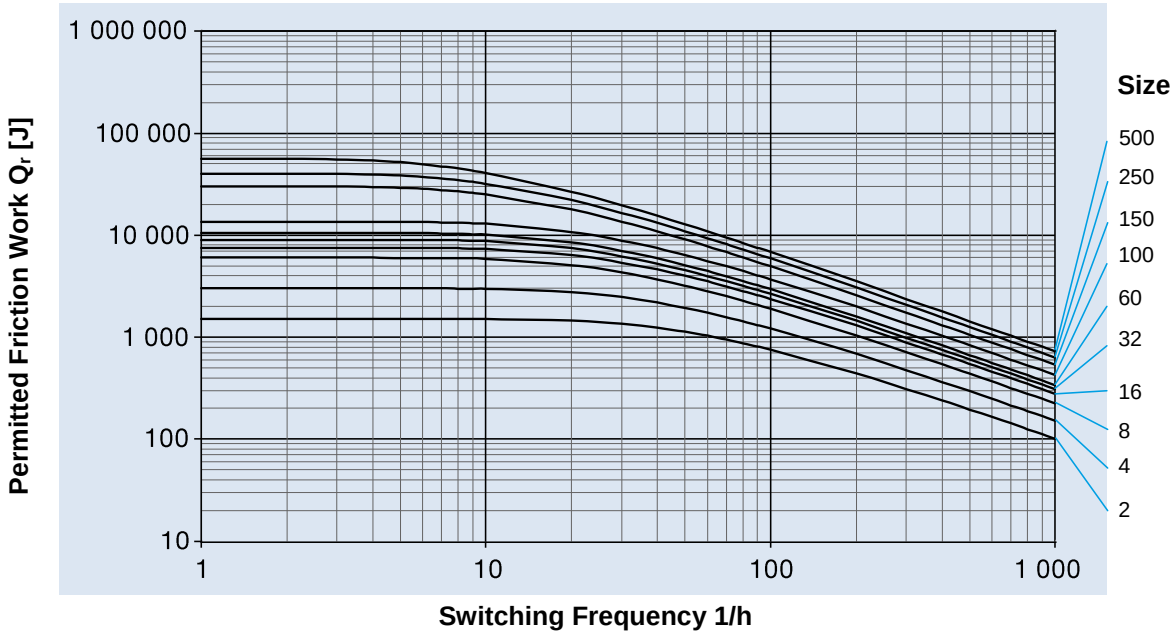
Friction Power Diagram 3
for Type 891.10_._ /891.50_._ (Holding brake) at reference speed n_{ref}



Friction Power Diagram 4
for Type 891.10_._ /891.50_._ (Holding brake) at Maximum speed n_{max}



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Air Gap Inspection (only Size 500)

The air gap can be inspected via a feeler gauge after removing the screw plug (A). The feeler gauge must be inserted at least 40 mm deep (see Fig. 6), so that the distance between the armature disk (3) and the coil carrier (2) can be measured.

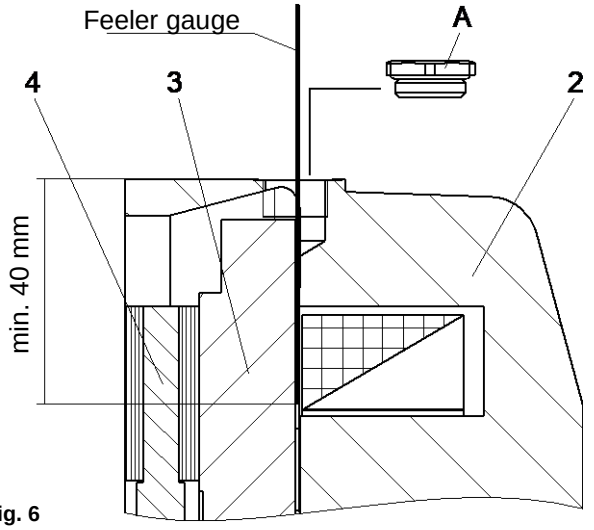

Fig. 6

Maintenance

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

ROBA-stop®-M brakes are largely maintenance-free. The friction lining pairing is robust and wear-resistant. This ensures a particularly long service lifetime of the brake.
The friction lining is subject to functional wear in case of **EMERGENCY STOP** and during regular conditioning of the friction lining pairing.
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 by replacing the rotor.
The quality of the counter friction surface must be checked.
The wear condition of the rotor (4) is determined by measuring the release voltage or the rotor thickness on a dismantled brake acc. Table 4/5. On size 500 there is an air gap inspection opening. This means that the heavy brake does not have to be dismantled.
The release voltage may be up to max. 90 % of the nominal voltage on a warm brake.

If the wear is monitored by a ROBA®-brake-checker DC voltage module, the limit values are determined electrically and may deviate from the wear values.

We recommend the following regular inspection intervals:

Once a year

- ❑ Inspection of the air gaps (brake in de-energized condition)

Twice a year or after 1000 operating hours

- ❑ Inspection of the rotor thickness (wear)
- ❑ Inspection of the toothings of the rotor (4) and the hub (1) for increased backlash and damage and to make sure they move easily.

Sizes	The max. permitted rotor torsional backlash on the hub
2 – 16 Type 891.5	0.9 °
2 – 32	0.5 °
60 – 500	0.3 °

Inspection on an 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 surface of the motor plate for plane parallelism and wear (excessive scoring).
- ❑ Clean the brake

Wear

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.

Replacement of the rotor/ of the rotors

- ❑ after having reached the maximum air gap or
- ❑ In safety-critical applications (without cyclical brake test) at the latest after 6 years of operating the system

Conditioning of the friction lining pairing during operation

In order to maintain the brake torque in holding applications, the friction lining pairing must be conditioned regularly. This must be carried out in the form of dynamic braking procedures. Afterwards, the brake torque must be checked (see “Run-in procedure / Conditioning of the friction lining pairing”, page 6).

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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.

13.1 Remove the fixing screws (8).

13.2 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.

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

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

13.5 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 scoring. If necessary, replace the armature disk (3) and the flange plate (12/13).

(Procedural method as described in sections 6.2 and 6.4).

13.6 Measure the rotor thickness of the new rotor (4) and compare it to the values stated in Table 4.

13.7 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.

13.8 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 pull-in distance for the armature disk (3). Unpermittedly high wear relaxes the thrust springs (6), leading to a drop in torque. The permitted wear is stated in Tables 4 and 5.

Information on the Components

The **friction material** contains different inorganic and organic compounds, which are integrated into a system of hardened binding agents and fibers.

Possible hazards:
No potential dangers have been recognized so far when the brake is used according to its intended purpose. When conditioning of the friction lining pairing (new condition) and also in case of EMERGENCY STOP braking actions, functional wear can occur (wear on the friction linings).
On open brake designs, fine dust can be emitted.

Classification: Hazardous property
Attention: H-classification: H372

Protective measures and rules of behavior:

- ❑ Do not inhale dusts
- ❑ Vacuum the dusts at the point of origin

  Pre-requisites for the suction device
  - ❑ tested suction devices,
  - ❑ tested filters acc. DIN EN 60335-2-69 for dust classes H;
  - ❑ maintenance of the suction devices and
  - ❑ filter replacement at regular intervals
- ❑ If local dust suction is not possible or is insufficient, the entire work area must be ventilated using appropriate technology.

Additional information:

This friction lining is not a dangerous product in terms of the EC Directive

Cleaning the Brake

Do not clean the brake using compressed air, brushes or similar devices!

- ❑ Wear safety gloves / safety goggles
- ❑ Use a suction system or wet towels to clean off the brake dust.
- ❑ Do not inhale brake dust
  - ❑ In case of dust formation, a dust mask FFP 2 is recommended.

Disposal

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

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

Products which have not been disassembled can be disposed of under Code No. 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 aluminum components:
Non-ferrous metals (Code No. 160118)

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

Brake rotor (plastic carrier with friction lining):
Brake linings (Code No. 160112)
Plastic (Code No. 160119)

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

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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 of 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 of 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 thermally overloaded	Check coil capacity; check insulation resistance
	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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Slipping; permanent grinding of the brake under load; increase in friction work	Braking torque too low	Brake run-in procedure not carried out	Carry out a run-in procedure
		Do not carry out regular conditioning	Carry out conditioning of the friction pairing
		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 behavior 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 pull-in distance due to unpermitted wear	Wear inspection; replace the rotor
		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 rotor
	Motor starts up against closed brake	Excessive brake attraction 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 behavior	Check protection against environmental influences
	Deviations, adjustment dimensions, 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

mayr® will take no responsibility or guarantee for replacement parts and accessories which have not been delivered by *mayr*®, or for damage resulting from the use of these products.

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