

Translation of the Original Operational Instructions

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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Safety and Guideline Signs

DANGER



Immediate and impending danger, 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 EU Directives



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 and the RoHS 2011/65/EU with 2015/863/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) through January 19, 2027, and the Machinery Regulation (EU) 2023/1230 from January 20, 2027

The product is a component for installation into machines according to the Machinery Directive 2006/42/EC through January 19, 2027, and the Machinery Regulation (EU) 2023/1230 from January 20, 2027.

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 for Category 11) 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 (REACH). This regulation governs the manufacture, placing on the market and use of chemical substances in preparations and, under certain conditions, also of substances in finished products.

mayr® power transmission exclusively manufactures products (articles: overload clutches, shaft couplings, electromagnetic brakes / clutches, permanent magnet motors and the appropriate control modules / rectifiers) in accordance with the definition in Article 3 of the REACH Regulation.

mayr® power transmission is aware of its responsibility towards the environment and society. As a matter of precaution, we pay attention to particularly critical substances in the supply chain and strive to avoid using any such substances completely or to replace them in the near future.

In compliance with Article 33 of the REACH Regulation, we would like to inform you that in our overload clutches and shaft couplings, electromagnetic brakes / clutches as well as permanent magnet motors, subcomponents with a lead content of > 0.1% are or may be used. These are manufactured from raw materials such as machining steel / copper alloys (e.g. brass, bronze) or aluminum alloys.

Besides high-melting-point (HMP) solders (electronics), this also affects integrated machine elements as well as standard parts (screws / nuts / set screws / pins / etc.) among others, provided that the relevant standards allow this.

For example, lead can occur as an alloying element with more than 0.1 mass percent, based on the respective total mass, in screws and set screws of the following property classes: 4.6, 4.8, 5.8, 6.8, 04, 4, 5, 6, 14H, 17H, 22H, 33H, 45H.

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 on the Classification, Labeling and Packaging of Substances and Mixtures (CLP Regulation) and are therefore not subject to the classification and labeling obligations.

To our knowledge, when used for their intended purpose and disposed of correctly (recycling), the contained substances pose no threat to health or environment.

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.

Installation and Operational Instructions for ROBA-stop® M brake Type 891._ _ _._ Size 2000

(B.8.1.3.EN)

Guidelines on UK Directives / Conformity

Products / components from *mayr*® power transmission fulfill the requirements for the British economic area due to currently identical UK and EU directives.

In addition to the CE identification, the UKCA identification is attached to the product.

The UK Declaration of Conformity is available in a separate document.

Directives under EU Law	Directives under UK Law
Machinery Directive 2006/42/EC	Supply of Machinery (Safety) Regulations UK 2008 No. 1597
EMC Directive 2014/30/EU	Electromagnetic Compatibility Regulations UK 2016 No. 1091
EU Low Voltage Directive 2014/35/EU	Electrical Equipment (Safety) Regulations UK 2016 No. 1101
RoHS II 2011/65/EU	The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations UK 2012 No. 3032

Guidelines on EU and UK REACH

According to the European Union (Withdrawal) Act 2018, the EU REACH Regulation was transposed into UK law on January 1, 2021, and is known as UK REACH.

REACH and related legislation have been replicated in the UK with the necessary changes to make it workable in a domestic context.

The fundamental principles of the EU REACH Regulation have been retained in UK REACH.

The remarks on the information obligation according to UK-REACH correspond in content to the REACH Regulation (EC) No. 1907/2006.

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 specialist personnel are allowed to work on the components.

They must be familiar with the dimensioning, transport, installation, inspection of the brake equipment, 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.



The brake provides no single error reliability. If an error occurs, this can lead to the failure of the safety function.



Switching noises, noises, and smells during dynamic braking actions; protective measures by the user may be necessary, e.g., hearing protection

Guidelines for Electromagnetic Compatibility (EMC)

In accordance with the EMC directive 2014/30/EU, the individual components produce no emissions. However, functional components e.g. mains-side energization 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, bedding-in condition / conditioning of the brake linings 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 brakes are designed for a relative duty cycle of 100 %.
- ☐ The braking torque is dependent on the current bedding-in condition of the brake. Bedding in / conditioning of the friction linings is necessary.
- ☐ 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 any other 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 seize up in corrosive ambient conditions and / or after longer downtimes.
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.

Safety Regulations

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

Climate Conditions

The electromagnetic brake is suitable for applications with an ambient temperature of between -20 °C and +40 °C.



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).



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 standardized 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

(mechanical) IP54 for Types 891._ _ _._2:

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

(mechanical) IP66 for Types 891._ _ _._1:

When installed, dust-proof and protected against contact as well as against strong 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 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 +40 °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 clutches.

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): classes 1K21; 1Z1; 1B1; 1C2; 1S11; 1M11

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 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.
- ☐ 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.
- ☐ When used in a saltwater environment: Please contact mayr® power transmission.

Installation and Operational Instructions for ROBA-stop® M brake Type 891._ _ _._ Size 2000

(B.8.1.3.EN)

Safety Regulations

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

Standards, Directives and Regulations Used and To Be Applied

DIN VDE 0580	Electromagnetic devices and components, general specifications
DIN EN 61140	Protection against electric shock - Common aspects for installation and equipment
DIN EN IEC 63000	Technical documentation for the assessment of electrical and electronic equipment regarding the restriction of hazardous substances
DIN EN IEC 60529	Degrees of protection provided by enclosures (IP Code)
2014/35/EU	Low Voltage Directive
2011/65/EU	RoHS II - Directive
2015/863/EU	RoHS III- 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:

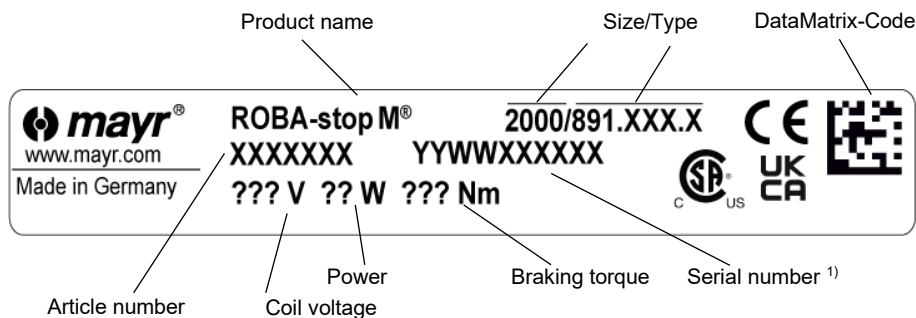
- the Installation and Operational Instructions are ignored or neglected.
- the brakes are used inappropriately.
- the brakes are modified.
- the brakes are worked on unprofessionally.
- the brakes are handled or operated incorrectly.

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!

Identification

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



1) Serial number

Year of manufacture	Calender week	Sequential number
YY	WW	XXXXXX

CE Identification



according to the Low Voltage Directive 2014/35/EU (only for voltage DC > 75 V) and/or RoHS Directive 2011/65/EU with 2015/863/EU

UKCA Identification



according to the Low Voltage Directive UK 2016 No. 1101 (only for voltage DC > 75 V) and/or RoHS Directive UK 2012 No. 3032

Conformity Markings



in terms of the Canadian and American approval

c US

01/07/2026 GF/MB

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Installation and Operational Instructions for ROBA-stop® M brake Type 891. _ _ _ _ Size 2000

(B.8.1.3.EN)

Brake illustrations

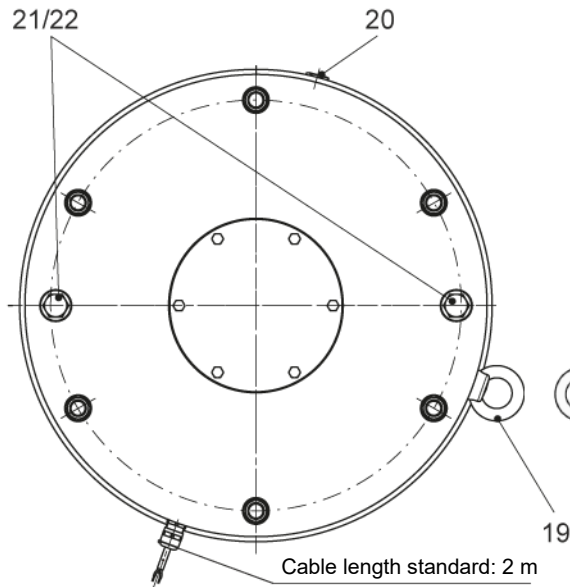


Fig. 1
(Sealed design IP66)

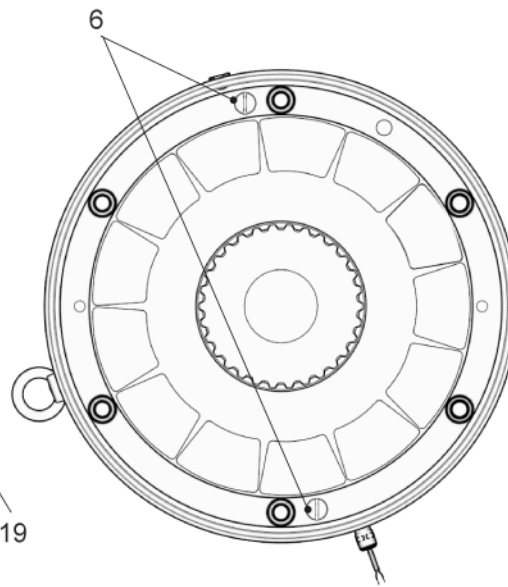


Fig. 2
(Design without flange plate)

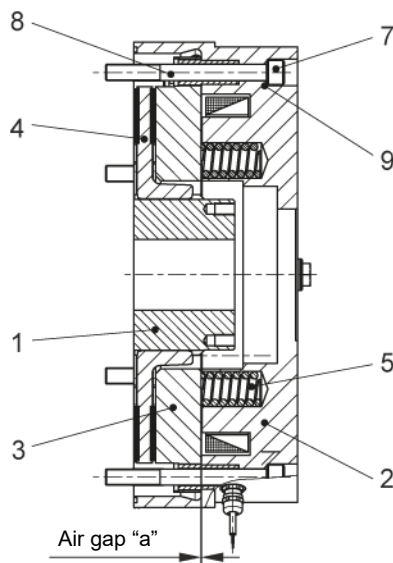


Fig. 3
(Design without flange plate)

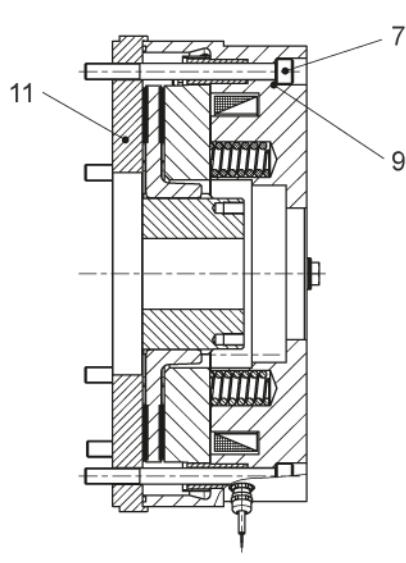


Fig. 4
(Design with tachometer flange plate)

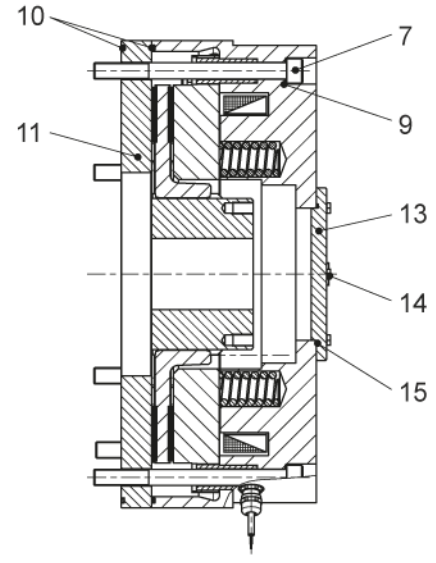


Fig. 5
(Sealed design with flange plate IP66)

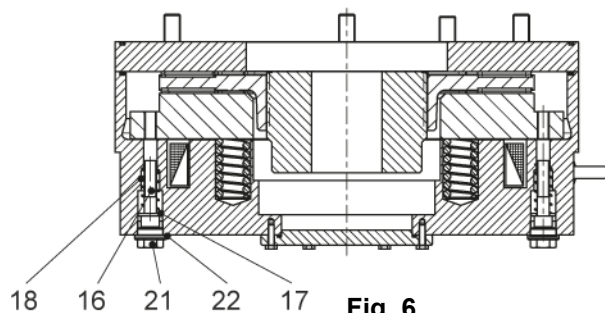


Fig. 6
(Design with emergency hand release)

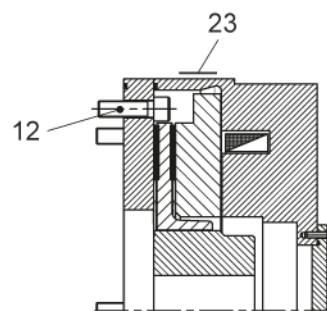


Fig. 7
(Design with flange plate IP66)

Installation and Operational Instructions for ROBA-stop® M brake Type 891._____ Size 2000

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Parts List (Only use mayr® original parts)

Item	Name		Pcs.
1	Hub		1
2	Coil carrier assembly (with magnetic coil)		1
3	Armature disk		1
4	Rotor		1
5	Thrust spring	(braking torque)	Dependent on Type
6	Flat headed screw	M12 x 32	2
7	Cap screw	M16 x 170 (only for design without a flange plate)	6
	Cap screw	M16 x 190 (only for design with a flange plate)	6
8	Bushing		6
9	Bonded seal	D16.7 x 24 x 1.5	6
10	O-ring	D435 x 4 (only on Type 891.____.1 without flange plate)	1
	O-ring	D435 x 4 (only on Type 891.____.1 with flange plate)	2
11	Flange plate standard	(for Type 891.____.2)	1
	Flange plate sealed	(for Type 891.____.1)	1
12	Cap screw	M16 x 55 (only for design with flange plate)	2
13	Sealing cover	(only on Type 891.____.1)	1
14	Hexagon head screw	M6 x 20 (only on Type 891.____.1)	6
15	O-ring	D100 x 3 (only on Type 891.____.1)	1
16	Cap screw	M12 x 55 (only for design with emergency hand release)	2
17	Washer	A13 (only for design with emergency hand release)	2
18	Thrust spring	(only for design with emergency hand release)	2
19	Eyebolt	M12	1
20	Screw plug	M16 x 1.5	1
21	Screw plug	M26 x 1.5	2
22	Copper sealing ring	D26 x 31 x 2	2
23	Type tag		1



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.

Installation and Operational Instructions for ROBA-stop® M brake Type 891._ _ _ _ Size 2000

(B.8.1.3.EN)

Table 1: Technical Data

			Standard brake 891.01._ _	Holding brake 891.1 _ _
Nominal braking torque	M _N	[Nm]	2000	3500
Braking torque tolerance		[%]	-20 / +40	-20 / +40
Speed range	n	[rpm]	0 - 500	0 - 750
Reduction of braking torque tolerance	M _N	[%]	-30 / +40	-30 / +40
Speed range	n	[rpm]	500 – 1000	750 – 1000
Reduction of braking torque tolerance	M _N	[%]	-35 / +40	-
Speed range	n	[rpm]	1000 - 1500	-
Reduction of braking torque tolerance	M _N	[%]	-45 / +40	-
Speed range		[rpm]	1500 - 2500	-
Idle speed		[rpm]	2600	2600
Reference speed	n _{ref}	[rpm]	500	500
Nominal voltages DC	U _N	[V]	104/180/207	
Electrical nominal power	P _N	[W]	192	
Overexcitation voltage	U _O	[V]	207	
Holding Voltage	U _H	[V]	180	
Electrical power on overexcitation	P _O	[W]	972	
Electrical power at holding voltage	P _H	[W]	128	
Overexcitation time	t _O	[s]	2	
Electrical connection, cross-section		[mm ²]	2 x 0.88	
Weight without flange plate		[kg]	183	
Nominal air gap "a" +0.2 (Fig. 3)		[mm]	0.5	
Max. permitted air gap "a" after wear (Fig. 3)		[mm]	1.5	1.3
Fixing screw Item 7 (Fig. 3) for design without flange plate (Item 11)			6 x M16 x 170	
Fixing screw Item 7 (Figs. 4 and 5) for design with flange plate (Item 11)			6 x M16 x 190	
Cap screws Item 12 (Fig. 7) for flange plate (Item 11)			2 x M16 x 55	
Tightening torque Item 6		[Nm]	30 Nm	
Tightening torque Item 7		[Nm]	200 Nm	
Tightening torque Item 12		[Nm]	200 Nm	
Mass moment of inertia (hub + rotor bei d _{max})	J _{R+N}	[10 ⁻⁴ kgm ²]	1251	
Friction work per 0.1 mm wear	Q _{r 0.1}	[10 ⁶ J]	110	106
Friction work (max. possible friction work related to nominal air gap)	Q _{r ges}	[10 ⁶ J]	850	650
Rotor thickness "new" (-0.08 mm)		[mm]	21.5	
Minimum rotor thickness (limit value at nominal braking torque)		[mm]	17.4	17.9
Permitted hub bores (with keyway acc. DIN 6885)		[mm]	80 – 110	
Min. Width of the counter friction surface		[mm]	35	
Through hole (coil carrier back)		[mm]	130 H8	
Protection for Type 891._ _ _ .2			IP54	
Protection for Type 891._ _ _ .1			IP66	
Ambient temperature		[°C]	-20 to +40	



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 speeds < 500 rpm.

Installation and Operational Instructions for ROBA-stop® M brake Type 891._ _ _._ Size 2000

(B.8.1.3.EN)

Table 2: Braking Torque Graduations

Braking torque [Nm] with tolerance +40 % / -20 %							
Type 891.08._ _	Type 891.07._ _	Nominal braking torque Type 891.01._ _	Type 891.02._ _	Type 891.03._ _	Type 891.04._ _	Type 891.05._ _	Holding brake Type 891.10._ _
2500	2200	2000	1600	1400	1000	800	3500

Installation and Operational Instructions for ROBA-stop® M brake Type 891._ _ _ _ Size 2000

(B.8.1.3.EN)

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 (5) press against the armature disk (3). The rotor (4) is held between the armature disk (3) and the flange plate (11 / dependent on Type) or the customer-side machine wall via frictional locking.

The braking torque is introduced into the drive line via the tooth-
ing 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 brakes:

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.

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 (7) 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 **0.125 mm** acc. 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 150 °C must not be exceeded.
- ❑ The rotor (4) and brake surfaces must be oil and grease-free.
- ❑ The toothings of the hub (1) and the rotor (4) must not be oiled or greased.
- ❑ Friction value-increasing surface treatments are not permitted.

- ❑ A suitable counter friction surface (flange surface) made of steel or grey cast iron must be provided for the rotor (4). Sharp-edged interruptions on the friction surfaces must be avoided.
Surface quality in the friction area of the friction surface between Ra = 1.6 µm up to Ra = 3.2 µm.



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

- ❑ 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 = 300 N/mm² should be used.
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 cap screws (7) are tightened to the tightening torque acc. Table 1.
- ❑ 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

Installation (Figs. 1 and 2)

1. Mount the hub (1) onto the shaft, bring it into the correct position and secure it axially (e.g. using a locking ring).
2. If necessary (dependent on Type), insert the O-ring (10) into the axial groove of the flange plate (11).
3. If necessary (dependent on Type), guide the flange plate (Item 11 / on Type 891._ _ _ _1 incl. O-ring (10)) over the shaft and secure it to the machine wall using 2 cap screws (12) with a **tightening torque see Table 1**.
Please make sure that the bores in the flange plate (11) and the threaded holes in the machine wall align.
4. Measuring the rotor thickness (see Table 1 for the nominal dimension in new condition).
5. Push the rotor (4) onto the hub (1) by hand (the rotor collar should be facing away from the machine wall or flange plate (11)).
The rotor toothing must lie over the entire length of the hub (1).
Make sure that the toothing moves easily.
6. If necessary (dependent on Type), insert the O-ring (10) into the axial groove of the coil carrier (2).
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 flange plate (11) or the machine wall).
The flat headed screws (Item 6 / Fig. 2) prevent the individual components from falling apart.
They do not affect the brake function and must not be removed during installation.
8. Secure the brake evenly all around using the cap screws (7) incl. the bonded seals (9) **with a torque wrench and a tightening torque see Table 1**.
9. Check the air gap, see chapter "air gap inspection".

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 (5) in the coil carrier (2) (see Table 2). The respective thrust spring set for the requested braking torque adjustment (acc. Table 2) is to be installed at the place of manufacture.

If installation by the user is unavoidable, the required thrust spring set must be ordered stating the exact construction size and braking torque adjustment values.

Thrust Springs (5) Replacement: (Attention: The brake must be load-free)

In order to replace the thrust springs (5), the brake must be unscrewed from the motor bearing shield or from the machine wall.

1. Remove the fixing screws (7).
2. Unscrew the flat headed screws (6) from the coil carrier (2) and remove the armature disk (3).



It is possible that the thrust springs relax suddenly.

This might lead to internal and external bruising.

The thrust springs (5) press against the armature disk (3). In order to remove the flat headed screws (6), 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 (5).

Observe the installation position of the armature disk (3), or ensure that no thrust springs (5) fall out.

3. Replace the thrust springs (5).



Attention

Insert the new thrust spring set in symmetrical order.

4. Place the armature disk (3) onto the coil carrier (2) or the thrust springs (5) (observe installation position).
5. Press the armature disk (3) down against the spring force and screw in the flat headed screws (6) up to their limits using a **tightening torque see see Table 1**.
6. Screw the brake onto the motor bearing shield or the machine wall using fixing screws (7).

Observe the tightening torque—see Table 1!

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

The stated brake nominal torque is valid for a run-in / conditioned state of the friction lining pairings in standard climate conditions.

- ☐ Please carry out conditioning of the friction lining pairings before initial operation of the system.
- ☐ Please carry out conditioning of the friction lining pairings during operation of the system (see chapter "Maintenance").
- ☐ EMERGENCY STOP only after brake run-in procedure

Brake Inspection (before brake initial operation)

➔ Braking torque inspection:

Please compare the requested braking torque with the braking torque stated on the Type tag (23).

➔ Inspect the air gaps "a":

Check air gap "a" (brake de-energized).

The nominal air gap "a" acc. Table 1 must be given.

➔ Release function inspection

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

The braking torque is not achieved until the run-in procedure has been completed. See chapter "Definition of the Braking Torques".

Emergency Hand Release Actuation (Fig. 6)

DANGER



Before actuating the emergency hand release, ensure that the brake is load-free.

- 8.1. Remove the screw plugs (Item 21 / wrench opening 22) incl. copper sealing rings (22) on the brake facing-side, so that both cap screws (16) become accessible.
- 8.2. Slowly and evenly screw in both cap screws (16) using two hexagon socket wrenches, wrench opening 10 against the pressure of the thrust springs (18) up to their limits into the armature disk (3) until the brake releases.
- 8.3. Once the emergency hand release has been actuated, both cap screws (16) are completely screwed out of the armature disk (3) again and the openings are closed again using the screw plugs (21) and copper sealing rings (22).

DANGER



If both cap screws (16) are not completely screwed out of the armature disk (3) again, the function of the brake can no longer be guaranteed.

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Torque-Time Diagram

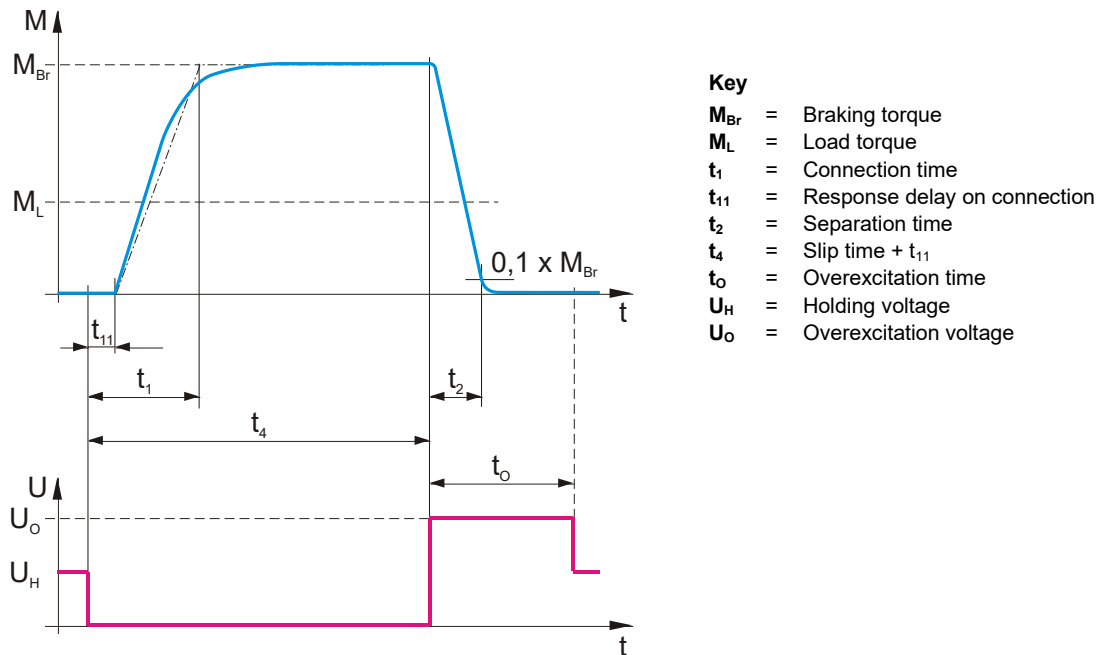


Table 3: Switching Times

The values stated in the table are mean values which refer to the nominal air gap and the nominal torque or braking torque (100 %) on a warm brake. For other braking torque adjustments, see the Diagram, refer to the diagram "Separation time t_2 dependent on the spring configuration"

Nominal torque Type 891._1._._ (100 %)		M_2	[Nm]	2000
Connection time	DC-side switching	t_1	[ms]	360
	AC-side switching	t_1	[ms]	1320
Response delay on connection	DC-side switching	t_{11}	[ms]	140
	AC-side switching	t_{11}	[ms]	940
Separation time ²⁾		t_2	[ms]	1100
Nominal torque Type 891._2._._ (80 %)		M_2	[Nm]	1600
Connection time	DC-side switching	t_1	[ms]	470
	AC-side switching	t_1	[ms]	1700
Response delay on connection	DC-side switching	t_{11}	[ms]	230
	AC-side switching	t_{11}	[ms]	1270
Separation time		t_2	[ms]	808
Nominal torque Type 891._3._._ (70%)		M_2	[Nm]	1400
Connection time	DC-side switching	t_1	[ms]	470
	AC-side switching	t_1	[ms]	1730
Response delay on connection	DC-side switching	t_{11}	[ms]	270
	AC-side switching	t_{11}	[ms]	1400
Separation time		t_2	[ms]	730

Standard brakes with braking torque adjustment Type 891._4._._ and Type 891._5._._ have significantly longer connection times t_1 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._._).

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Electrical Connection and Wiring



The brake must be operated with overexcitation.

DC current is necessary for operation of the brake. The coil nominal voltage is indicated on the Type tag as well as on the brake body and is designed according to the DIN IEC 60038 ($\pm 10\%$ tolerance).

The brake must only be released with overexcitation ($U_0 = 2 \times U_N$) (e.g. using a ROBA®-switch or -multiswitch fast acting rectifier or phase demodulator). 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

Depending on the nominal voltage and/or identification in the technical documents, the brake is designed for Protection Class I or Protection Class III. In accordance with VDE 0580 Item 4.6, the grounding connection can be made directly or indirectly on the magnetic coil body.

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!

The grounding contact acts as a protective ground.

Protection class III:

The brake's supply and thus protection against electric shock takes place via the Safety Extra Low Voltage PELV/SELV (see EN61140 Items 6.7-6.8 and 7.5) The requirements of the machine and device standards (for example, IEC 60204-1 or similar) must be observed.

The grounding contact acts as the functional ground and serves to prevent electromagnetic disturbance or potential equalization, for example. For the protective conductor connection, marked connection points are available in the terminal box (15).



Fuse Element

To protect against damage from short circuits, please add suitable fuse elements to the mains cable/supply line.

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.

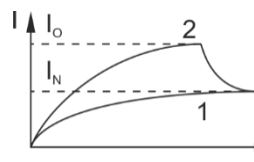
Field build-up with normal excitation

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.

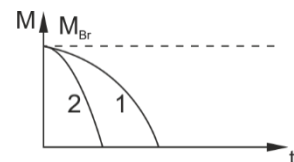
Field build-up with overexcitation

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 ROBA®-(multi)switch fast acting rectifier and phase demodulator work on this principle.

Current path



Braking torque path



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_0

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 must be selected as overexcitation time t_0 on overexcitation.

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 on page 15 "Separation time t_2 of the brake dependent on the spring configuration".

→ Spring force (braking torque adjustment) < 100 %:

The overexcitation time t_0 is less than the doubled separation time t_2 .

Example: Spring configuration Type 891._5_ => Separation time $t_2 = 40\%$

$$\rightarrow \text{Overexcitation time } t_0 = 200\% \times 40\% = 80\% t_2$$

→ Spring force (braking torque adjustment) = 100 %:

The overexcitation time t_0 is the doubled separation time t_2 .

→ Spring force (braking torque adjustment) > 100 %:

The overexcitation time t_0 is higher than the doubled separation time t_2 .

Example: Spring configuration Type 891._8_ => Separation time $t_2 = 140\%$

$$\rightarrow \text{Overexcitation time } t_0 = 200\% \times 140\% = 280\% t_2$$

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** RMS coil capacity P



$$P \leq P_N$$

The coil capacity P must not be larger than P_N . Otherwise the coil may fail due to thermal overload.

Key and Calculations:

P	[W]	RMS coil capacity dependent on switching frequency, overexcitation, reduction in capacity and duty cycle
		$P = \frac{P_0 \times t_0 + P_H \times t_H}{T}$
P_N	[W]	Coil nominal capacity (catalogue values, Type tag)
P_0	[W]	Coil capacity on overexcitation
		$P_0 = \left(\frac{U_0}{U_N}\right)^2 \times P_N$
P_H	[W]	Coil capacity at reduced capacity
		$P_H = \left(\frac{U_H}{U_N}\right)^2 \times P_N$
t_0	[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 ($t_0 + t_H + t_{off}$)
U_0	[V]	Overexcitation voltage (bridge voltage)
U_H	[V]	Holding voltage (half-wave voltage)
U_N	[V]	Coil nominal voltage

Time Diagram

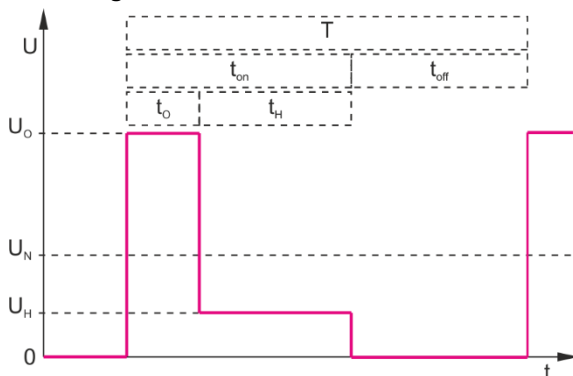
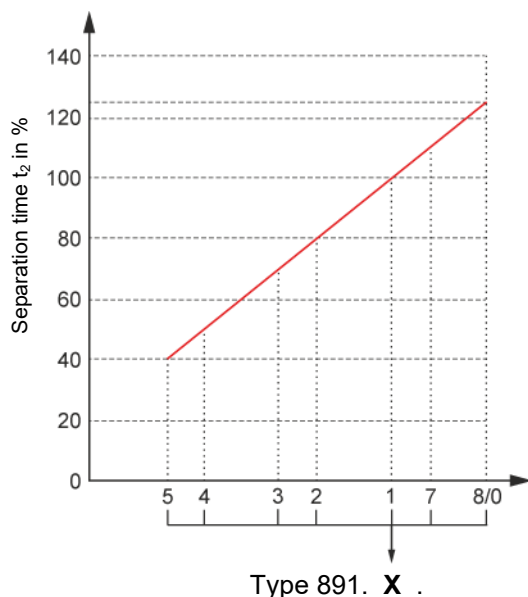
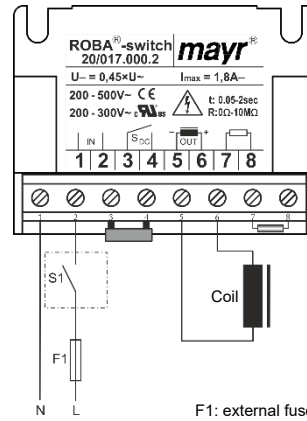


Diagram: Separation time t_2 of the brake dependent on the spring configuration



Magnetic Field Removal

AC-side Switching

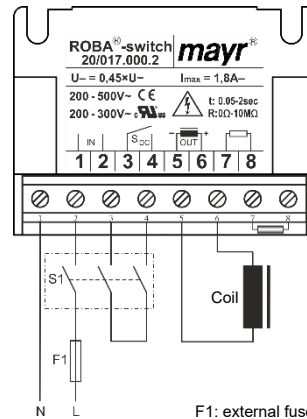


The power circuit is interrupted in front of the rectifier. The magnetic field slowly reduces. This delays the rise in braking torque.

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 switching 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*®-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 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.

Air Gap Inspection

The air gap can be inspected via a feeler gauge. The feeler gauge must be inserted at least 50 mm deep (see Fig. 8), so that the distance between the armature disk (3) and the coil carrier (2) can be measured.

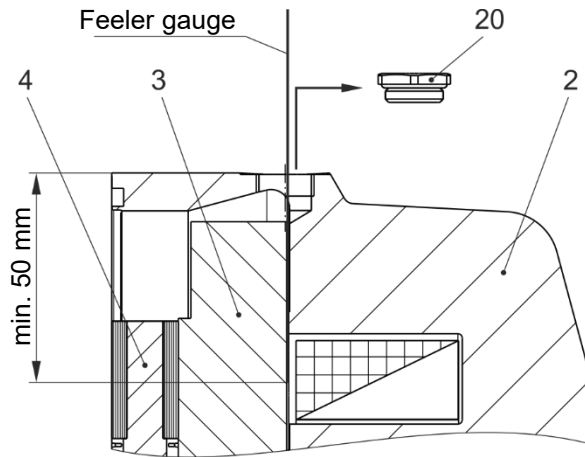


Fig. 8

Maintenance

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

The brake is not a wear-free component. 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) can be specified by:

- ☐ Checking the air gap (see above).
Max. permitted air gap see Table 1
- ☐ Measuring the rotor thickness on the dismantled brake.
See Table 1 for the minimum rotor thickness.

We recommend the following regular inspection intervals:

Once a year

- Inspection of the air gap (brake in de-energized condition) see chapter „Air Gap Inspection“.

Twice a year or after 1000 operating hours

- Inspection of the rotor thickness (wear).
- Inspection of the toothing of the rotor (4) and hub (1) for ease of movement, increased backlash, and damage.
Max. permitted rotor torsional backlash on the hub → 0.3° (equals approx. 0.95 mm on the circumference).
Inspection on an engaged brake and load-free output by turning the motor shaft.
- Inspection of the armature disk (3) and the counter friction surface for plane parallelism and wear (excessive formation of grooves).
If necessary, replace the armature disk (3) and the flange plate (11).
See the chapter „Replacing the Rotor (4)“.
- Inspection of the armature disk (3) and the flange plate (11) for plane parallelism and wear (excessive scoring).
- Clean the brake.

Replacement of the rotor

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

To be determined by the user

The frequency of the friction lining pairing conditioning and the torque inspection must be determined by the user depending on the application.

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.

If regular brake conditioning in holding applications is not possible, a higher level of security must be used for dimensioning. (Recommendation: $S_i = 2.0 \Rightarrow$ Please observe: The dynamic dimensioning must be taken into account separately)

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.



In applications with high wear, frequent cleaning is necessary. The system operator must ensure that the cleaning cycles are performed frequently enough!

See „Cleaning the Brake“

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Replacing the Rotor (4)

Before replacing the rotor

- ☐ Clean the brake.



Please observe the "Cleaning the Brake"

- ☐ Measure the rotor thickness of the new rotor (4). The "Rotor thickness new" dimension (see Table 1) must be given



DANGER 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/machine wall or from the flange plate (11).

Replacing the Rotor (4):

1. Remove the fixing screws (7).
2. Remove and clean the brake; see the section "Cleaning the brake"
3. Remove the rotor (4) from the hub (1) and replace it.
4. Check the armature disk (3) and the counter friction surface for signs of wear and plane parallelism 0.08 mm. There must be no excessive formation of grooves. If necessary, replace the armature disk (3) and the flange plate (11). When armature disk (3) replacement is necessary, please proceed as follows:
 - 4.1. Unscrew the flat headed screws (6) from the coil carrier (2) and remove the armature disk (3).
Attention: The thrust springs (5) press against the armature disk (3). In order to remove the flat headed screws (6), the armature disk (3) must be pressed against the coil carrier (2) to avoid immediate relaxation of the thrust springs (5).
Observe the installation position of the armature disk (3), and ensure that no thrust springs (5) fall out.

CAUTION



Danger of injury

- 4.2. Place the armature disk (3) onto the coil carrier (2) or the thrust springs (5) (observe installation position).
 - 4.3. Press the armature disk (3) down against the spring force and screw in the flat headed screws (6) up to their limits using a **tightening torque see Table 1**.
5. For further procedure, please see section „Installation“ page 11.
6. For brake inspection and run-in procedure, see page 12.



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 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 (5), leading to a drop in torque.

Replacing the armature disk (3)



When replacing the armature disk (3), be sure to reinstall the previously installed springs correctly.

- ☐ Restore to as-delivered condition!
- ☐ An additional functional test is required

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 grinding in the brake linings (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 (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 (asbestos free) is not a dangerous product in terms of the EU Directive.

Cleaning the Brake



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

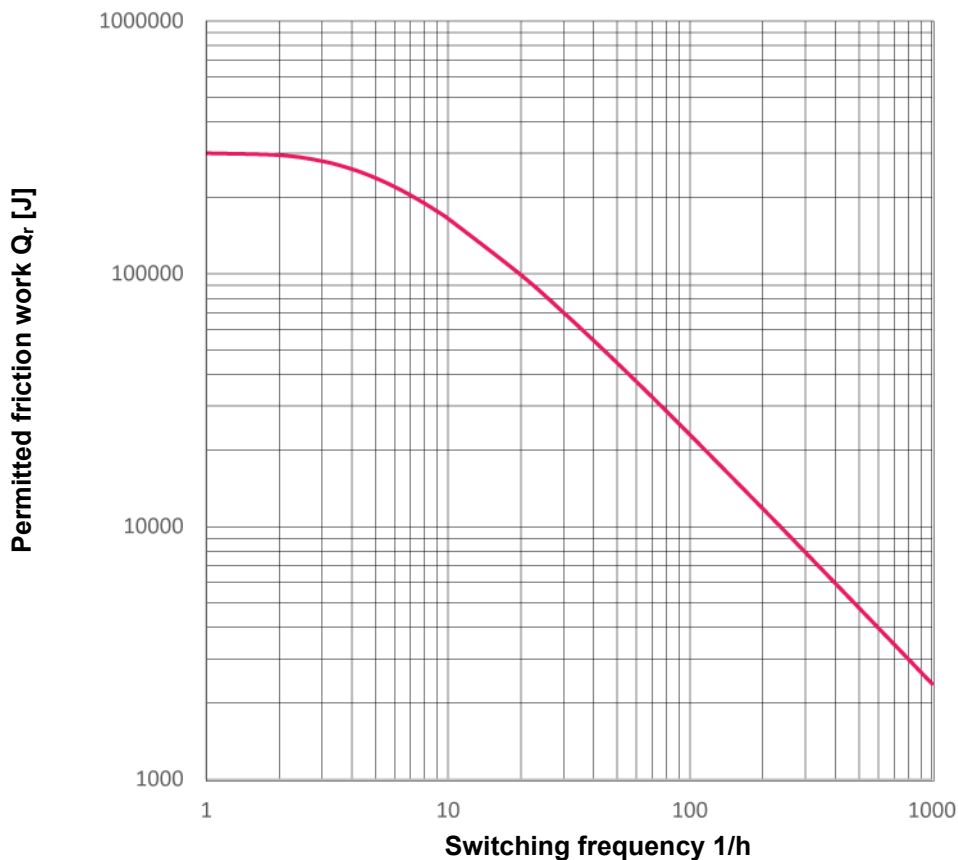
- ☐ Wear safety gloves / safety goggles.
- ☐ Use a suction system or wet towels to clean off the brake dust.
- ☐ Do not inhale brake dust.
- ☐ In case of dust formation, a dust mask FFP 2 is recommended.

In applications with high wear, frequent cleaning is necessary. The system operator must ensure that the cleaning cycles are performed frequently enough.

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

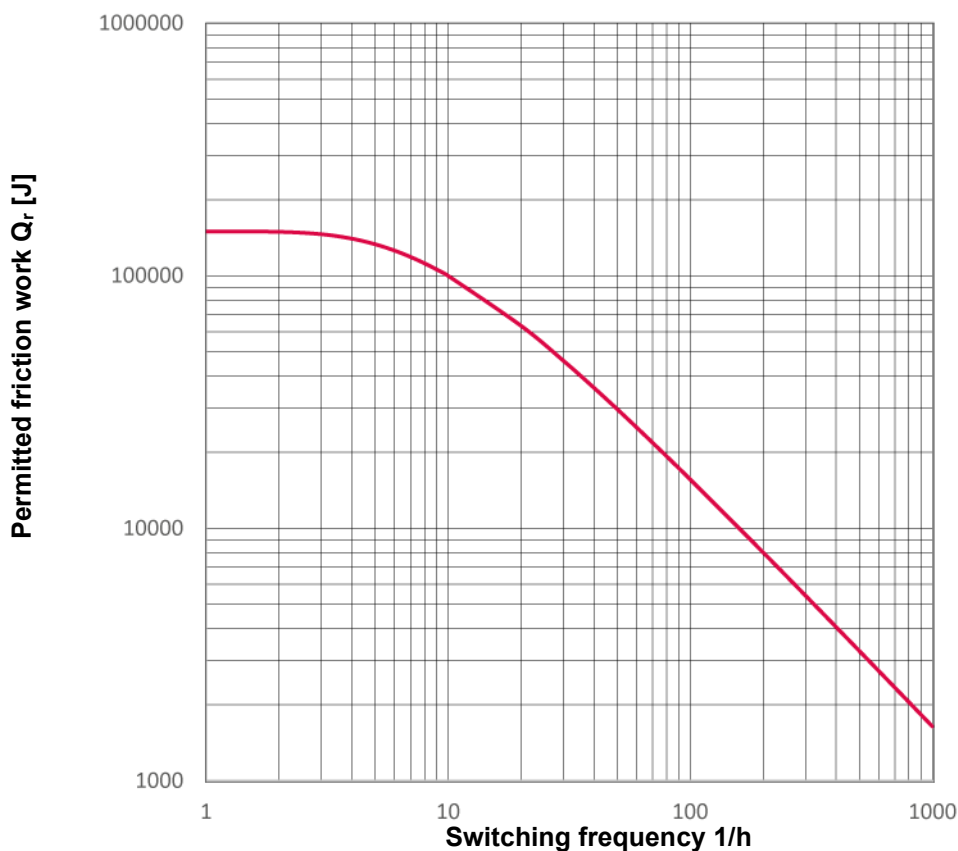


Permitted Brake Friction Work

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 Q_r referring to the respective switching frequency for the various brake types and rated speeds.

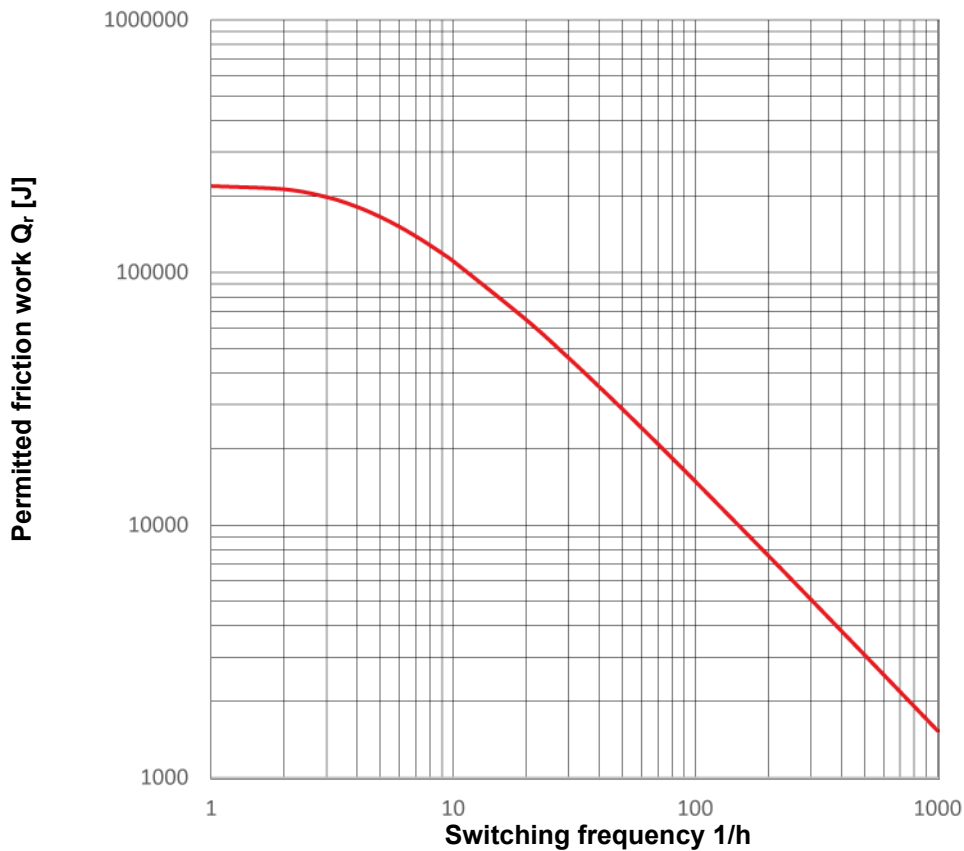
Friction Power Diagram 2 for Type 891.01._._/891.21._._ (Standard brake) at maximum speed n_{max}



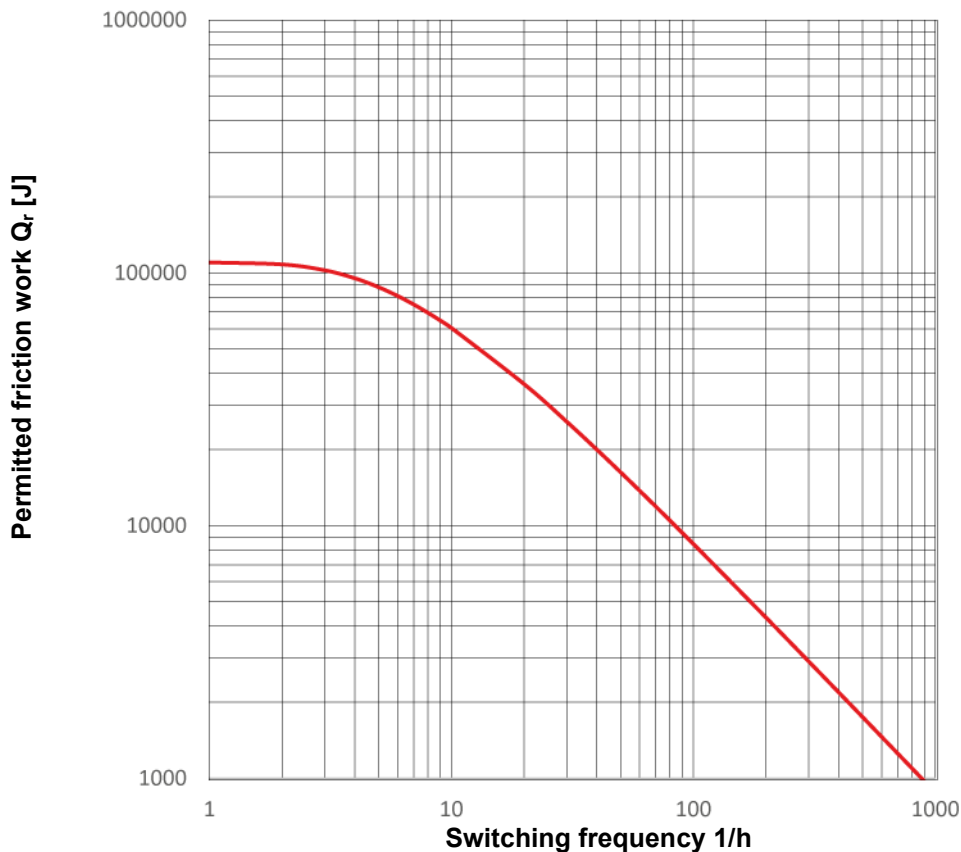
Installation and Operational Instructions for ROBA-stop® M brake Type 891._ _ _ _ Size 2000

(B.8.1.3.EN)

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



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



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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 / Switch):

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 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)

Seals, O-rings, V-seals, elastomers:

Plastic (Code No. 160119)

Guidelines on the WEEE Directive 2012/19/EU

Avoidance of waste from electrical and electronic devices and the reduction of such waste through recycling.

Our electromagnetic products (brakes, clutches) as well as the components required to control them (rectifiers) are frequently used in electrical and electronic devices within the appropriate area of application of WEEE, independent of the applicable product categories.

The stated products do not fall within the area of application of this Directive. They have been classified as electromagnetic / electronic components (VDE 0580) or as electronic equipment (DIN EN 50178), and have been determined for installation in devices for "use in accordance with the intended purpose". Only products which are to be viewed as devices in terms of the Directive and not as parts or components are subject to registration obligations.

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
		Contamination of the hub or rotor toothing due to abraded or worn particles	Check the hub and rotor toothing; maintain suitable maintenance intervals
		Wear, damage, deformation or breakage of the hub and rotor toothing	
	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

Installation and Operational Instructions for ROBA-stop® M brake Type 891._ _ _._ Size 2000

(B.8.1.3.EN)

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	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 max. permitted 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
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 attachment, emergency hand release, actuation lever, screws	Check the guidelines and values according to the information in the Installation and Operational Instructions



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