Installation and Operational Instructions for ROBA-stop®-stage Type 8070. _ _ _ _ _ Sizes 8 – 200

(E102 03 000 000 4 EN)

Translation of the Original Operational Instructions

Design according to drawing number
E102 03 000 000 210 for Size 8
E102 04 000 000 210 for Size 16
E102 05 000 000 210 for Size 32
E102 06 000 000 110 for Size 64
E102 07 000 000 110 for Size 100
E102 08 000 000 210 for Size 200

Please read these Operational Instructions carefully and follow them accordingly!

Ignoring these Instructions can lead to lethal accidents, malfunctions, brake failure and 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:

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.

Attention Possible property damage can be the consequence.

Please Observe!
Guidelines on important points.

Certification

Conformity test certificate: CA 740

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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
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 (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 hereby 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 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.

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.
- ❒ Use of the brake in extreme environmental conditions or outdoors, directly exposed to the weather, is not permitted.
- ❒ The brake system is designed for a relative duty cycle of 50 % / intermittent periodic duty S3.
- ❒ 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 that 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 keep in mind that the nominal torque is subject to a tolerance depending on the speed of the brake (see Table 2 "Graduation of the Nominal Braking Torque", page 8).

For dimensioning the brake, technical standards must be taken into account. For stage technology in Europe, for example, this would be DIN EN 17206. This technical standard specifies, among other things, a test load of 125 % (25 % additional load on the live load) for the static test and a test load of 110 % (10 % additional load on the live load) for the dynamic test. The braking system must be designed for this increased load.

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Climate Conditions

The electromagnetic brake is suitable for mounting / operation on electromotive elevator machinery in enclosed places of installation with an ambient temperature of between -5 °C and +40 °C.
At temperatures < 10 °C there is an increase in switching noise.

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 rotors can seize up to the friction surfaces after longer downtimes.

CAUTION

Temperatures of over 70 °C on the brake mounting flange can have a negative effect on the switching times, the braking torque levels and the noise damping behavior.

Intended Use

Use according to the intended purpose is prohibited until it has been determined that the machine / system accords with the EC Directive 2006/42/EC (machinery directive).

mayr ®-brakes have been developed, manufactured and tested in compliance with the DIN VDE 0580 standard and in accordance with the EU machinery directive as electromagnetic components. During installation, operation and maintenance of the product, the requirements for the standard must be observed.

The ROBA-stop®-stage brakes are intended for use in theatre stage technical equipment.

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 with cover) IP30: Protected against penetration of solid foreign bodies > 2.5 mm diameter. No protection against water.

(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 -5 °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 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): 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.

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Safety Regulations

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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.
- ❒ Take precautions **against freeze-up of the friction surfaces** in high humidity and at low temperatures.

Standards, Directives and Regulations Used and To Be Applied

DIN VDE 0580	Electromagnetic devices and components, general specifications
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
DGUV Regulation 17	(previously BGV C1) Accident prevention regulation for theatre stage technical systems
DIN EN 17206	(previously DIN 56950-1) Entertainment technology - Lifting and load-bearing equipment for stages and other production areas in the entertainment industry - Specifications for general requirements
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

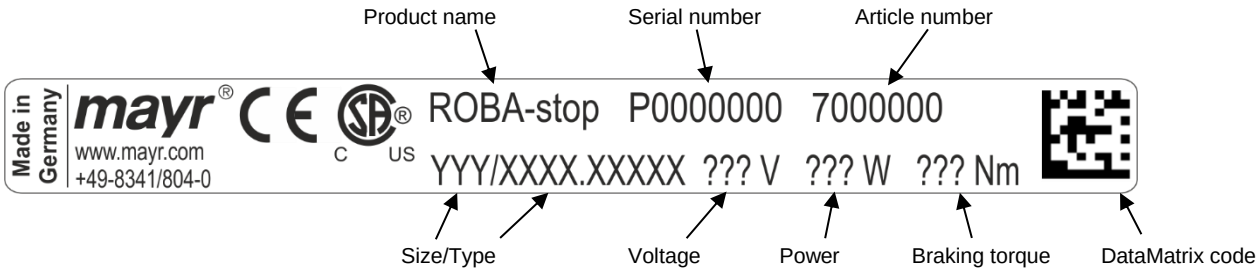
CE in accordance with the Low Voltage Directive 2014/35/EU (only in case of voltages > 75 V DC) and / or the RoHS Directive 2011/65/EU with 2015/863/EU

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:



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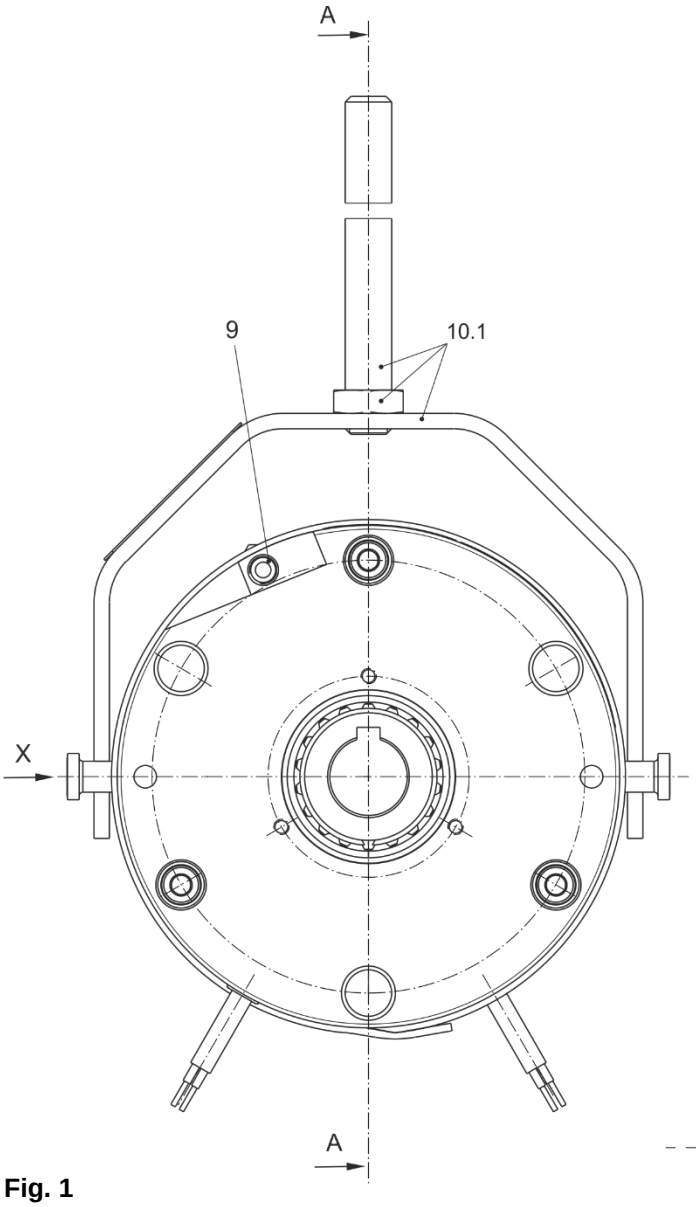

Fig. 1

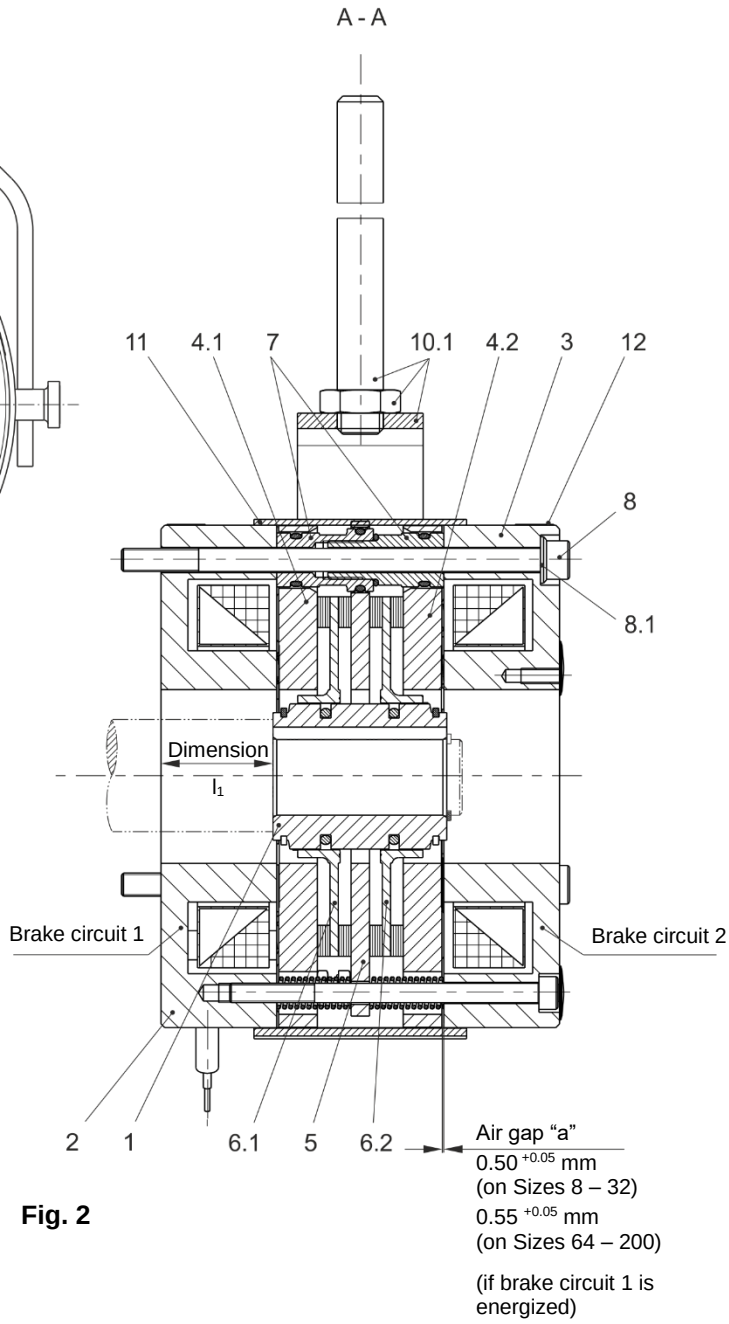

Fig. 2

Detail “X”
Hand release
Release angle approx. 25°

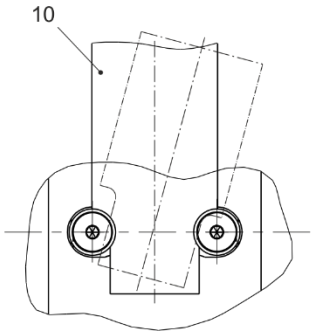

Fig. 3

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

Item	Name	Pcs.
1	Hub	1
2	Coil carrier 1 assembly with magnetic coil	1
3	Coil carrier 2 assembly with magnetic coil	1
4.1	Armature disk 1	1
4.2	Armature disk 2	1
5	Intermediate disk	1
6.1	Rotor 1	1
6.2	Rotor 2	1
7	Distance bolts	6
8	Cap screw	3
8.1	Washers	3
9	Release monitoring with proximity switch (page 12)	1
9.1	Proximity switch (page 12)	1
10	Hand release [1)]	1
10.1	Hand release bracket assembly	1
11	Cover	1
12	Type tag	1
13	Wear monitoring with proximity switch (dependent on Type) (page 13)	1
13.1	Proximity switch (page 13)	1
13.3	Adjusting screw (page 13)	

1) Hand release (10) must be ordered separately if required.

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Table 1: Technical Data

Size			8		16		32		64		100		200	
Nominal braking torque M_N (+60 %)	maximum	[Nm]	16		32		64		120		200		365	
	reduced	[Nm]	13		28		58		100		180		310	
	minimum	[Nm]	10		24		52		80		160		260	
Maximum speed 1)		[rpm]	5000		5000		5000		4700		4100		3400	
Nominal voltage		[V]	24	207	24	207	24	207	24	207	24	207	24	207
Coil capacity (nominal power at 20 °C)		[W]	2 x 36	2 x 35	2 x 28	2 x 33	2 x 41	2 x 45	2 x 50	2 x 55	2 x 58	2 x 63	2 x 76	2 x 78
Inductivity per coil		[H]	1.3	96	3	160	2.8	167	2.5	152	2.9	177	2.5	171
Electrical connection			2 x AWG18											
Nominal air gap "a" (+0.05)		[mm]	0.5		0.5		0.5		0.55		0.55		0.55	
Max. permitted air gap "a"		[mm]	1.0		1.0		1.0		1.0		1.0		1.0	
Switching noises in new condition (AC-side switching)			< 60 dB(A)											
Protection (mechanical)			IP30											
Protection (electrical)			IP54											
Protection of the proximity switch			IP67											
Weight		[kg]	4.55		6.87		10.43		15.28		20.6		30.95	
Mass moment of inertia (2 rotors + hub)		[kgm²]	0.00009		0.00022		0.00060		0.00105		0.00234		0.00698	
Duty cycle Intermittent periodic duty			50 % S3											
Fixing screw Item 8	Number of pieces		3		3		3		3		3		3	
	Thread		M5		M6		M6		M8		M8		M10	
	Length	[mm]	100		110		120		140		150		170	
	Property class		8.8		8.8		10.9		10.9		10.9		10.9	
	Tightening torque	[Nm]	5		9		13.2		32		36		71	
Ambient temperature		[°C]	-5 to +40											

1) Please observe the percentage reduction of the nominal braking torque depending on the speed according to Table 2 "Graduation of the Nominal Braking Torque".

Table 2: Graduation of the Nominal Braking Torque

Size			8	16	32	64	100	200
Percentage reduction of the nominal braking torque dependent on the speed		[%]	100	100	100	100	100	100
	up to speed	[rpm]	2500	2000	1600	2000	1800	1500
		[%]	85	85	85	80	80	80
	up to speed	[rpm]	3600	2800	2400	3000	2500	2200
		[%]	-	-	70	70	70	70
	up to speed	[rpm]	-	-	3400	3200	2800	2400
		[%]	70	70	60	60	60	60
	up to speed	[rpm]	5000	5000	5000	4700	4100	3400

Table 3: Max. Permitted Friction Work

Size		8					16					32				
Speed	[rpm]	1250	2500	3500	4000	5000	1000	2000	2900	4000	5000	850	1700	2500	3400	5000
Max. permitted friction work	[J]	15000	12000	6000	4500	2400	28000	24000	19000	4000	4000	44000	38000	26000	9000	9000

Size		64					100					200				
Speed	[rpm]	800	1500	2200	3000	4700	750	1500	2000	2500	4100	700	1500	1900	2200	3400
Max. permitted friction work	[J]	56000	40000	34000	23000	23000	85000	64000	46000	36000	36000	92000	65000	48000	41000	41000

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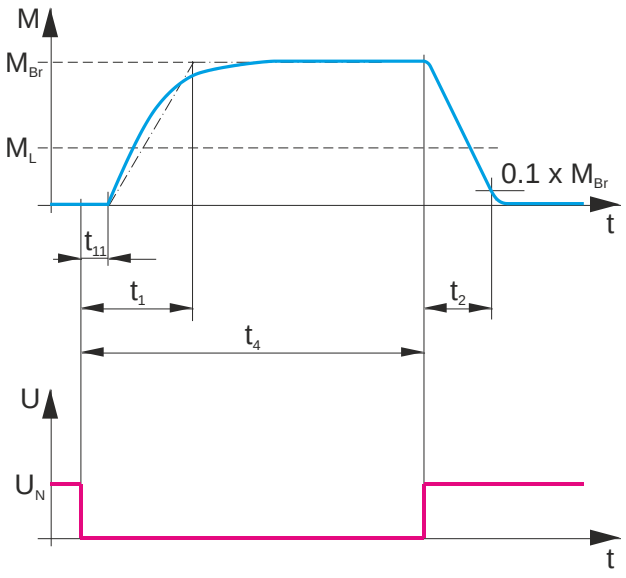
Table 4: Switching Times

Size	Nominal braking torque [Nm]	Switching times [ms]					
		Attraction	Drop-out AC		Drop-out DC		
	M_N	t_2	t_{11}	t_1	t_{11}	t_{50} *	t_{90} *
8	**16**	55	140	310	20	25	30
	10	40	160	330	25	30	36
16	**32**	90	190	370	23	30	36
	24	75	240	420	27	35	40
32	**64**	130	240	450	29	38	46
	52	110	270	500	33	42	52
64	**120**	180	240	520	40	50	65
	80	150	330	590	50	60	75
100	**200**	210	320	600	46	64	85
	160	190	370	700	58	68	90
200	**365**	250	400	750	55	75	120
	260	220	480	820	70	85	135

* Referring to the nominal braking torque

The specified switching times are guideline values which are subject to tolerances, at nominal voltage, nominal air gap and room temperature. They can only be achieved using the respective correct electrical wiring. This also refers to the protection circuit for brake control and the response delay times of all control components. If the brake is operated using overexcitation, the respective switch-on and switch-off times for overexcitation must be taken into account.
The use of varistors for spark quenching increases the DC-side switching times.

Torque-Time Diagram



Key

M_{Br}	=	Braking torque
M_L	=	Load torque / test load according to EN 17206
t_{11}	=	Response delay on connection
t_{50}	=	Connection time until reaching 50 % of the nominal braking torque M_N
t_{90}	=	Connection time until reaching 90% of the nominal braking torque M_N
t_1	=	Connection time
t_2	=	Separation time
t_4	=	Slip time + t_{11}
U_N	=	Coil nominal voltage

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Installation and Operational Instructions for ROBA-stop®-stage Type 8070. _ _ _ _ _ Sizes 8 – 200

(E102 03 000 000 4 EN)

Application

- ROBA-stop®-stage brake for use as a holding brake with occasional EMERGENCY STOP braking actions.
- The max. permitted speed and friction work (see Technical Data) must be observed.

Design

The ROBA-stop®-stage brake is a spring applied, electromagnetically releasing dual circuit safety brake, which applies a defined braking effect after the voltage is switched off or after a voltage failure.

Function

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

Spring applied function (brake):
In de-energized condition, thrust springs press against the armature disks (4.1 and 4.2). The rotors (6.1 and 6.2) are held between the armature disks (4.1 and 4.2) and the intermediate disk (5) .
The braking torque is introduced into the drive line (shaft) via the toothings of the rotors (6.1 and 6.2) and the hub (1).

Electromagnetic function (release):
Due to the magnetic force of the coils in the coil carriers (2 and 3), the armature disks (4.1 and 4.2) are attracted against the spring pressure to the coil carriers (2 and 3).
The brake is released and the rotors (6.1 and 6.2) with the hub (1) can rotate freely.

Safety brakes:
The ROBA-stop®-stage 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

The ROBA-stop®-stage brake is manufacturer-assembled ready for installation and set to the braking torque specified on order.

The release monitoring device (9) and the wear monitoring device (13 / dependent on Type) are mounted and set manufacturer-side.

The following are included loose in delivery:
- Cap screws (8)
- Washers (8.1)
- Hand release (10 / must be ordered separately if required)

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.

Adjustment

The brakes are equipped manufacturer-side with the respective springs for the braking torque stated on the Type tag (12). Adjustment is not necessary. Adaptions or modifications are not permitted as a rule. This rule also applies to the manufacturer-side adjusted noise damping. The proximity switches are also adjusted manufacturer-side. Despite great care during the manufacturer-side adjustment, re-adjustment might be necessary after installation due to transportation and handling.
Please observe the sections Release Monitoring and Wear Monitoring.

Noise Damping

The noise damping was set and adjusted manufacturer-side. However, this component is subject to aging dependent on the application or operating conditions (torque adjustment, switching frequency, ambient conditions, system vibrations etc.).
Replacing the damping element is only permitted at the *mayr*® site of manufacture.

Installation Conditions

Dimension l_1 = 29.5 mm for Size 8,
dimension l_1 = 29 mm for Size 16,
dimension l_1 = 29.5 mm for Size 32,
dimension l_1 = 34 mm for Size 64,
dimension l_1 = 36 mm for Size 100,
dimension l_1 = 39 mm for Size 200,
must be observed (see Fig. 2, page 6).

- Shaft tolerance: h6
- 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 **0.065 mm** acc. DIN 42955 R.
  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 on the rotors (6.1 and 6.2) and to overheating.

Installation

The brake is delivered manufacturer-assembled including the centered hub (1).
For additional safety, we recommend applying Loctite 243 into the threaded holes for fastening the brake.

1. Push the entire brake with the hub (1) over the shaft with key (fixing holes should align with the bores in the machine wall).
2. Insert the cap screws (3 x Item 8) with the washers (8.1) into the coil carrier (3) and screw evenly into the machine wall until the brake is lying against it.
3. Tighten the cap screws (8) all around evenly **using a torque wrench to a tightening torque acc. Table 1**.
4. Secure the hub using a locking ring.

Air Gap Inspection

1. Energize the coil carrier 1 (Item 2).
2. Check air gap “a” between the armature disk (Item 4.2 / brake circuit 2) and the coil carrier (3), see Fig. 2. The nominal air gap acc. Table 1 must be given.
3. On reaching the maximum air gap acc. Table 1 due to wear, the brake must be replaced (see section „Maintenance” on page 16).

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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 must take place via DC voltage with a low ripple content, e.g. via a bridge rectifier or with another suitable DC 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.

Supply Voltage Requirements

In order to minimise noise development of the released brake, it must only be operated via DC voltage with low ripple content. AC current operation can take place using a bridge rectifier or another suitable DC power supply. Supplies whose output voltages have a high ripple content (e.g. a half-wave rectifier, a switch-mode mains adaptor, ...) are not suitable for operation of the brake.

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 disks (4.1 or 4.2) and the coil carriers (2 or 3) (dependent on the wear condition of the linings).

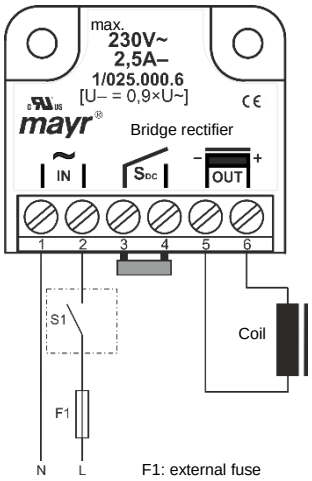
Magnetic Field Build-up

When the voltage is switched on, a magnetic field is built up in the brake coils, which attracts the armature disks (4.1 and 4.2) to the coil carriers (2 and 3) and releases the brake.

Brake release can only be guaranteed if both coil carriers (2 and 3) are energized.

Magnetic Field Removal

AC-side switching

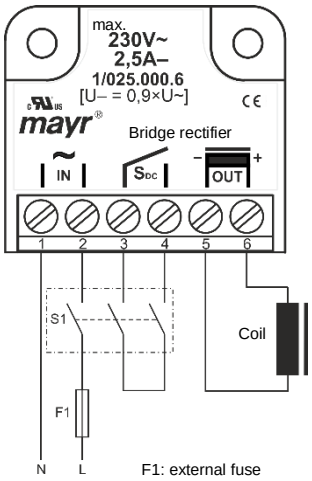


The power circuit is interrupted in front of the rectifier. The magnetic field slowly reduces. This delays the rise in braking torque.

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

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Release Monitoring (9)

Only one proximity switch for release monitoring (9) is required per ROBA-stop®-stage brake, which is mounted onto the brake 2 (Fig. 4).

The ROBA-stop®-stage brakes are supplied with a manufacturer-side installed and adjusted release monitoring unit (see Fig. 4). The proximity switch (9.1) emits a signal for every brake condition change: "brake opened or brake closed"

The customer is responsible for a signal evaluation of both conditions.

From the point at which the brake is energized, a time span of three times the separation time must pass before the switch signal on the release monitoring is evaluated.

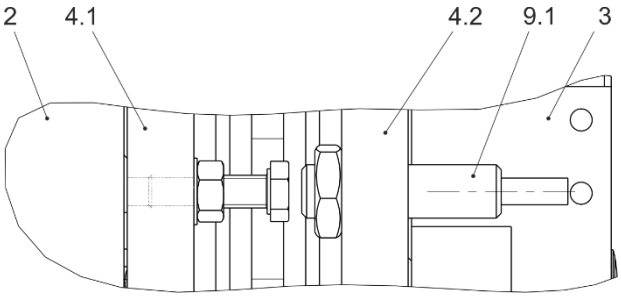


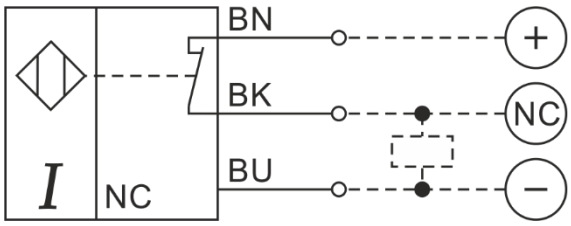
Fig. 4

Function

When the magnetic coil is energized in the coil carriers (2 and 3), the armature disks (4.1 and 4.2) are attracted to the coil carriers (2 and 3). The proximity switch (9.1) emits a signal, the brake is released.

When actuating the hand release (10), a switching signal of the release monitoring device (9) cannot be guaranteed.

Proximity Switch (9.1) Wiring Diagram



Technical Data of the Proximity Switch (9.1/13.1)

Switching function	NC contact
Output type	PNP
Operating voltage U_B	5 ... 30 VDC
Switching frequency f	0 ... 6000 Hz
Reverse voltage protection	protected against reverse voltage
Short-circuit protection	synchronizing
Operating current I_L	0 ... 100 mA
No-load current I_0	≤ 10 mA
Delay prior to availability t_v	≤ 100 ms
Switching condition display	LED, yellow
Duration of use (T_M)	20 a
Ambient temperature	-40 ... +85 °C
Conductor cross-section	0.14 mm²
Protection	IP67
Standards	EN 60947-5-2:2007 EN 60947-5-2/A1:2012

Customer-side Inspection after Attachment

Please inspect the release monitoring unit (9):

Brake de-energized ➔ Signal "OFF",

Brake energized ➔ Signal “ON”

Proximity switches cannot be guaranteed fail-safe. Therefore, please ensure appropriate access for replacement or adjustment.

If a replacement or new adjustment of the proximity switch (9.1) is required by the customer, separate adjustment instructions stating the article or serial number of the respective brake can be requested from the manufacturer.

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Wear Monitoring (13) (Option, dependent on Type)

Only one proximity switch for wear monitoring (13) is required per ROBA-stop®-stage brake, which is mounted onto the brake 1 (Fig. 5).

The ROBA-stop®-stage brakes are supplied with a manufacturer-side installed and adjusted wear monitoring unit (13).

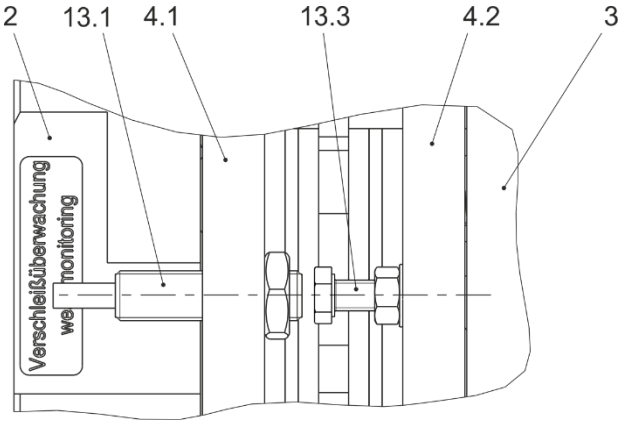


Fig. 5

Function

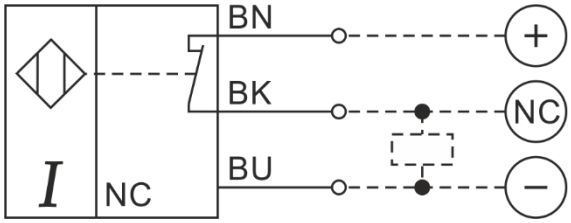
Due to wear on the rotors (6.1 and 6.2), the air gap “a” between the coil carrier (3) and the armature disk (4.2) increases (air gap measurement is performed when brake circuit 1 is energized), or the distance between the proximity switch (13.1) and the adjusting screw (13.3) decreases.

Once the maximum air gap of 1.0 mm has been reached, the proximity switch (13.1) contact switches over, the signal is interrupted.

The brakes must be replaced. Factory overhaul is possible.

The customer is responsible for a signal evaluation.

Proximity Switch (13.1) Wiring Diagram



For technical data of the proximity switch (13.1), please see section “Release Monitoring (9)” on page 12.

Proximity switches cannot be guaranteed fail-safe. Therefore, please ensure appropriate access for replacement or adjustment.

If a replacement or new adjustment of the proximity switch (13.1) is required by the customer, separate adjustment instructions stating the article or serial number of the respective brake can be requested from the manufacturer.

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Hand Release (10) (Emergency Release) (Option / Figs. 1 – 3)

ROBA-stop®–stage brakes are spring applied brakes.
Electrical release of the brakes is not possible on power failure.
However, on power failure, the brake can be released mechanically using the hand release bracket (10.1), an optional part of the delivery, as follows:

- ❑ Insert the open end of the hand release bracket (10.1) up to its limit between the sleeves projecting out of the cover (11) on both sides.
- ❑ Following this, the brake can be emergency-released by carefully and slowly swinging the hand release bracket, during which a residual torque of approx. 5 % of the set braking torque can occur.

When actuating the hand release (10), a switching signal of the release monitoring device (9) cannot be guaranteed.

DANGER

If the conveyor system starts to move too quickly, please swing the hand release bracket (10.1) back again.

After finishing the procedure, please remove the hand release bracket (10.1).

Table 5: Release Angle, Release Force

Size	Release angle [°]	Release force [N]
8	approx. 25 (releasing in both directions is possible)	approx. 40
16		approx. 75
32		approx. 130
64		approx. 140
100		approx. 180
200		approx. 240

Braking Torque

The (nominal) braking torque is the torque effective in the shaft train on slipping brakes, with a sliding speed of 1 m/s referring to the mean friction radius.
The brake is loaded statically when used as a service brake and loaded dynamically in EMERGENCY STOP operation.
Respectively, there are different speed values for the friction material, which in practice also leads to different friction values and therefore braking torques.
Amongst other things, the braking torque is dependent on the respective quality / condition of the friction surfaces (conditioning). Therefore, bedding in of the brake linings on newly installed brakes or on rotor replacement when mounted is required, taking into account the permitted loads: The following applies as a reference value for the bedding in of new brake linings. The load in new condition may not be more than 50 % of the max. friction work, acc. Technical Data. This process is to be carried out at reduced speed, approx. 30 % of the operating speed.
If the bedding in should take place under works-specific conditions, we ask you to contact us, so that we can provide the appropriate parameters.
Friction materials develop their optimum effect only under speed at the appropriate contact pressure, as continuous regeneration of the friction surface then takes place (torque consistency).
Permanent grinding of the rotors can lead to overheating / damage to the brake linings, and therefore to a drop in braking torque.
Furthermore, friction materials are subject to aging, which is also influenced, among other things, by higher temperatures and other ambient influences. We recommend regular inspection of the braking torque (1 x per year) including the respective dynamic braking actions as a refresher.

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Brake Inspection (before brake initial operation)

- ❑ **Air gaps inspection (Fig. 2)**
  Measure the air gap “a” (brake 1 energized) several times on the circumference between the armature disk (4.2) and the coil carrier (3). The nominal air gap acc. Table 1 must be given.
- ❑ **Braking torque inspection**
  Please compare the requested braking torque with the torque stated on the Type tag (12).
- ❑ **Release function inspection**
  by energizing both brake circuits, the brake is residual torque-free.
- ❑ **Switch function inspection of the release monitoring (9) with proximity switch** (see page 12)
- ❑ **Hand release function inspection (option)**
  By deflecting the hand release bracket (10.1) manually, the friction linings are relieved. The brake is free but for a residual torque of approx. 5 % of the set braking torque.

The braking torque is not achieved until after the run-in procedure (approx. 2 – 3 EMERGENCY STOP braking actions) has been carried out.

Dual Circuit Brake Functional Inspection

The ROBA-stop®-stage brake is equipped with a double safety (redundant) braking system. This means that, should one brake circuit fail, the braking effect is still maintained.

Testing both brake circuits together and the individual circuits must be carried out as follows:

DANGER

When carrying out brake circuit tests, under no circumstances are persons allowed to be under the moving loads. Please observe the accident prevention regulations.
If the conveyor shows a significantly longer braking distance during the single circuit test than during the test of both brake circuits, the respective energized brake circuit must also be de-energized immediately.
The dual circuit braking function is not guaranteed.
Shut down the conveyor, dismantle the brake if necessary and check it (air gap, switching function of the release monitoring, braking torque and drive dimensioning).
Please observe the warning in the section „Maintenance”.

Testing both brake circuits with test load from nominal speed:

1. Energize both brake circuits and put the drive into operation.
2. Trigger an emergency stop (de-energize both circuits) and check the stopping distance.

Inspection brake circuit 1:

1. Energize brake circuits 1 and 2 and put the drive into operation.
2. De-energize brake circuit 1 (= EMERGENCY STOP) and inspect the stopping distance. The stopping distance must be only slightly longer than when testing both brake circuits.
3. De-energize brake circuit 2.

Inspection brake circuit 2:

1. Energize brake circuits 1 and 2 and put the drive into operation.
2. De-energize brake circuit 2 (= EMERGENCY STOP) and inspect the stopping distance. The stopping distance must be only slightly longer than when testing both brake circuits.
3. De-energize brake circuit 1.

Attention

If a single circuit inspection is carried out that differs from the above description, the load may "sag".
This could be the case if a brake circuit of a drive loaded with the test load is energized. When a brake circuit is released, there may be a brief drop in braking torque just below the nominal torque.

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Maintenance

ROBA-stop®-stage brakes are largely maintenance-free. The rotors (6.1 and 6.2) are robust and wear-resistant, which leads to a long service lifetime of the brake. However, the rotors (6.1 and 6.2) are subject to functional wear. Therefore, the air gaps and the proximity switch (9.1) function must be checked at least 1 x per year.

A functional inspection of the brake must be carried out after longer downtimes.

DANGER

When replacing the brake, please observe!
The brake must be load-free on hoist drives.
Otherwise there is a danger of load crashes.

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.

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 / proximity 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 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)

Seals, O-rings, V-seals, elastomers, terminal boxes (PVC):
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.

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Malfunctions / Breakdowns

Malfunction	Possible Causes	Solutions
Brake does not release	❑ Incorrect voltage on rectifier ❑ Rectifier failure ❑ Air gap too large (worn rotors) ❑ Coil interrupted	❑ Apply correct voltage ❑ Replace rectifier ❑ Replace brake ❑ Replace brake
Brake engagement delayed on EMERGENCY STOP	❑ Brake is switched AC-side	❑ Switch DC-side
Release monitoring does not switch	❑ Brake does not release ❑ Defective proximity switch	❑ Solution as above ❑ Replace the proximity switch (manufacturer-side)

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