Gearless Lift Machine
WSG-S3
Operating Instructions

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Gearless Lift Machines

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WSG-S3.4
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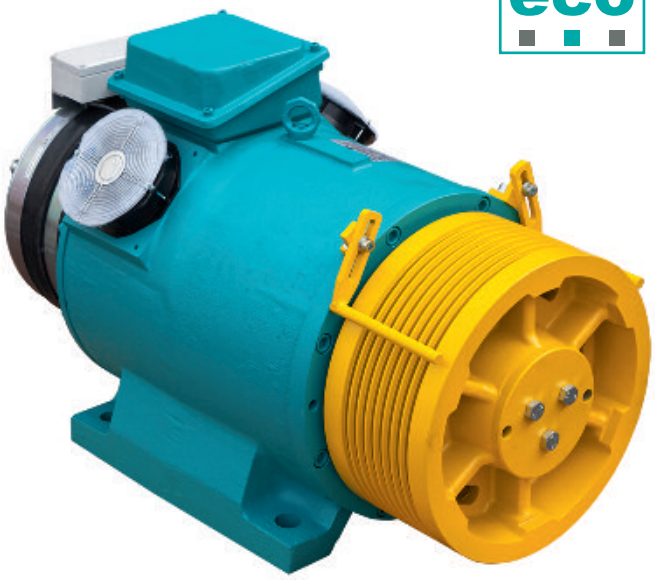

Translation of the Original Operating Instructions

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Gearless Lift Machine
WSG-S3
Operating Instructions

These operating instructions are applicable to lift machines:

WSG - S3.4 - ....
WSG - S3.5 - ....
WSG - S3.6 - ....

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1. General information

1.1. About this operating manual

The purpose of this operating manual is to ensure that any work on WSG-S3 lift machines is carried out safely. Please regard it as part of the product and keep it within easy reach.

All persons working on or with WSG-S3 lift machines must have read and understood this operating manual.

1.2. Intended use

WSG-S3 lift machines are intended for use as gearless drives for rope lifts. They may only be used for their intended purpose and with all safety devices in proper working order.

They may only be operated under the conditions described in this manual and with due regard to their performance limits.

1.3. Scope of delivery

The WSG-S3 lift machines are customised to meet individual requirements. The exact scope of delivery can be found in the accompanying documentation.

1.4. Warranty and liability

Our "Conditions of Sale and Delivery" shall apply for all our supplies and services.

Any warranty claims must be made immediately upon discovery of the deficiency or defect.

We do not accept any warranty or liability claims for personal injury or property damage resulting from one or more of the following causes

- Improper use of the WSG-S3 lift machine
- Improper installation, commissioning, operation or maintenance
- Operation of the WSG-S3 with defective and/or inoperative safety or protective devices
- Non-compliance with the instructions contained in the operating manual or other documentation supplied
- Unauthorised construction modifications to the WSG-S3
- Insufficient monitoring of parts subject to wear
- Repairs carried out improperly
- Emergencies caused by external forces or force majeure

2. Safety instructions

2.1. General

WSG-S3 lift machines are not ready-to-use products; they may only be operated after they have been installed in lift systems and their safe operation has been ensured by taking the appropriate measures.

WSG-S3 lift machines are intended for use in an enclosed, lockable operating area to which only qualified personnel and personnel authorised by the customer have access.

Qualified personnel

Only qualified personnel are authorised to perform any planning, installation or maintenance work, and this must be done in accordance with the relevant instructions. The personnel must be trained for the job and must be familiar with the installation, assembly, commissioning and operation of the product.

2.2. Format of the safety instructions

The safety instructions contained in this operating manual are presented in a standardised format.

They comprise a **danger symbol + signal word + instruction text**. The danger symbol indicates the type of danger, the signal word specifies the severity of the danger, and the instruction text describes the danger and explains how to avoid it.

Danger symbols

	Risk of electric shock		Property damage
	General danger		Information

Signal words

- **Danger** Serious injuries or death will result
- **Warning** Serious injuries or death may result.
- **Caution** Minor to moderate injuries may result.
- **Notice** Property damage may result.
- **Information** Points out useful information.

2.3. Safety precautions

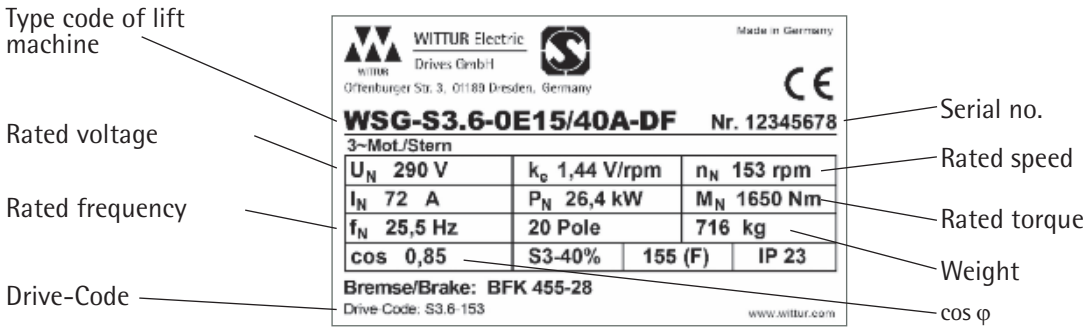
- Check the proper functioning of the motor and the brake after installing the machine.
- Repairs may only be carried out by the manufacturer or an authorised repair agency. Unauthorised opening and tampering may result in injuries to persons and property.
- The machines are not designed for direct connection to the three-phase system but are to be operated via an electronic frequency converter. Direct connection to the mains may damage the motor beyond repair.
- High surface temperatures may occur on the external parts of the machine. Therefore, no temperature-sensitive parts may be in contact with these parts or attached to them. Protection against accidental contact should be provided, if required.
- The EU type-examined fail-safe brakes provided are designed only for a limited number of emergency braking operations. They must not be used as working brakes.
- If the motor is not energised, no torque is produced. This may result in uncontrolled acceleration of the lift, if the brakes are released. Therefore, the motor winding should be short-circuited to produce a speed-dependent braking torque while the motor is not supplied with current. (Use the main contacts for short-circuiting as rated motor current may be flowing.) The motor must never be short-circuited while it is energised.
- High voltages are present at the terminal connections during the operation of synchronous motors.

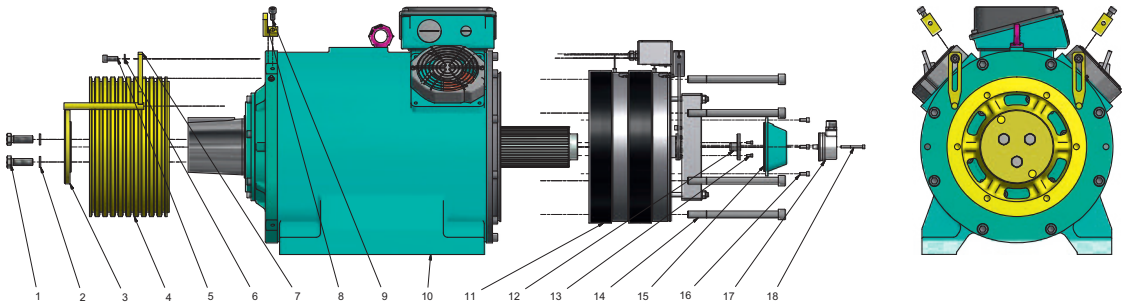
3. Product description

The compact gearless WSG-S3 synchronous lift machines are designed for traction sheave lifts. They are distinguished by their high efficiency, extremely low noise and excellent operating characteristics.

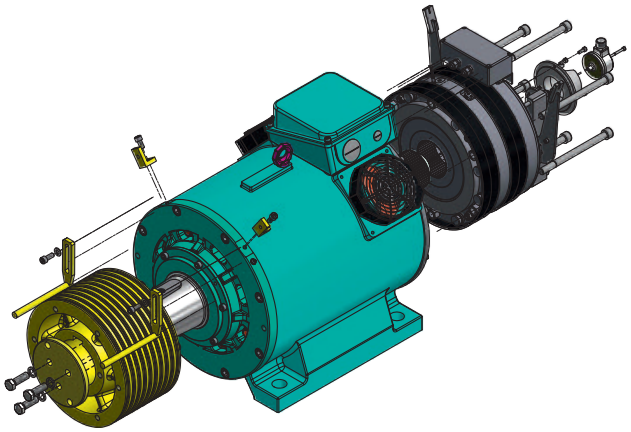
The machines can be supplied for several rated speeds, which can be further adapted to meet individual customer requirements. The machine comprises a frame, the synchronous motor, the traction sheave, and the typetested safety brake, which can be used to prevent uncontrolled upward movement of the car.

The nameplate of the lift machine is on the motor frame.





Item	Part	WSG-S3
1	Bolts (3x)	DIN 933 - M16x50
2	Lock washers (3x)	NL 16-DIN 25201
3	Pressure disc	
4	Traction sheave	
5	Bolts (2x)	DIN 912 - M10x25
6	Washers (2x)	DIN 125 - A 10,5
7	Rope slip-off guard (2x)	
8	Elbows (2x)	
9	Bolts (2x)	DIN 912 - M10x20
10	Frame	
11	Brake	BFK 455-28
12	Plug-in shaft	
13	Screws (3x)	DIN 912 - M4x10
14	Bolts (6x)	DIN 912 M16x210
15	Clamping sleeve	
16	Screws (4x)	DIN 912 - M6x12
17	Measuring system	
18	Schraube	DIN 912 M5x50



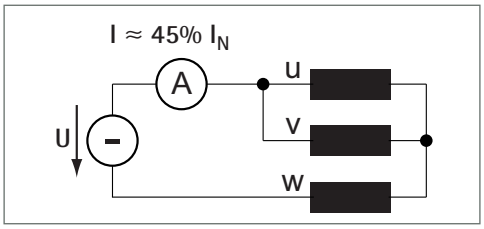
4. Transport and storage

- The lift machines leave the factory in perfect condition after being tested.
- Make a visual check for any external damage immediately upon their arrival on site. If any damage is found to have occurred in transit, make a notice of claim in the presence of the carrier. If appropriate, do not put these machines into operation.
- Observe the relevant safety regulations and take the centre of gravity into account when handling the lift machines.
- Check that the eyebolts are tightly fitted before using them.
- Do not expose the motor to any shocks or impact.

Warning The eyebolts are designed for the specified machine weight, i.e. additional loads must not be applied. Danger of breakage!

Storage

- Store the motors only in closed, dry, dust-free, well-ventilated and vibration-free rooms (storage temperature: -20°C to 60°C). Do not store lift machines in the open air. Bright parts are not sufficiently preserved to withstand extended periods of exposure.
- Avoid excessive storage periods (recommendation: max. one year).
- After prolonged storage (>3 months), rotate the motor in both directions at a low speed (< 20 min^{-1}) to allow the grease to distribute evenly in the bearings.
- Measure the insulation resistance before initial operation of the machine. If the value has dropped below 1kΩ per volt of rated voltage, the winding needs to be dried (insulation meter voltage: 1,000 V DC).
- This can be done, for instance, with hot air, in a drying oven, or by applying a DC voltage to the motor connections. Make sure that the voltage selected does not exceed the values shown in the figure "Drying the winding". Let the temperature rise to about 70 – 80°C and maintain it for several hours.



Drying the winding

Unpacking

- Dispose of the packaging material in an environmentally friendly manner or reuse it.
- Any special transport aids or shipping braces are left with the customer.

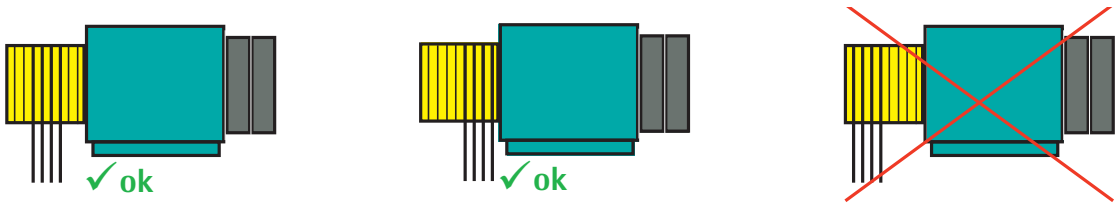
5. Installation

5.1. Setting up

Danger

Be sure to use calculations to check the base frame or foundation loads before installing the lift machine.

- The machines can be used in lift systems with or without a machine room
- The permissible uneveness of the mounting surface is 0.1 mm. The mounting surface must be sufficiently distortion-resistant and stable to accommodate the forces occurring in the system.
- The rope force can be applied to the lift machine in any direction
- The machine must be mounted on vibration dampers for vibration damping
- No welding work may be performed on the lift machine, nor is it permissible to use the machine as a mass point for welding work. This might cause irreparable damage to the bearings and magnets.
- If there are more grooves on the traction sheave than the number of ropes used, position the ropes either in the centre of the traction sheave or towards the motor end.



- The measuring system is only accessible from the rear side. Therefore, leave enough space between the wall and the rear side of the machine or ensure that the machine can be moved away from the wall.

Warning

Cover the machine and especially the brakes when doing any machining or dust-producing work in the shaft or machine room.

Securing the machine

- Fasten the machine using bolts
  - 6 x **M 30 bolts (strength class 8.8; tightening torque: 1,100 Nm)** in case of using the threaded holes or
  - 4 x **M 30 bolts (strength class 8.8; tightening torque: 1,100 Nm)** in case of using the mounting holes.
- After completing the adjusting work or after a breakdown, tighten all the fastening bolts of the machine, using the specified torque .
- Lift machines are generally equipped with rope slip-off guards. After putting the ropes in place, adjust them so that the distance between the rope and the rope slip-off guard does not exceed 1.5 mm.
- If the lift machine is not installed at the head of the machine room as is usually the case, it may be necessary to modify the fitting of the rope slip-off guard to fulfill the requirements of EN 81-20 . Optional rope slip-off guards are available for this purpose.

When using the machine in a shaft, please take into account the patent situation.

Ambient conditions

- The following ambient conditions must be ensured on site

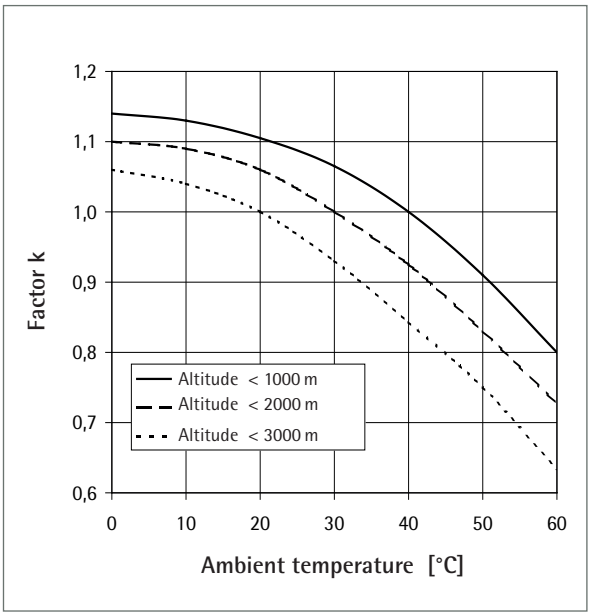
  Altitud: max. 1,000 m a.s.l.

  Ambient temperature: -5°C ... 40 °C

  Max. rel. humidity: 85% at 20°C
  (no moisture condensation)

- Install the machine so that ventilation is not obstruct, ed, i.e. sufficient heat dissipation by convection and radiation must be ensured.
- The torque and power values indicated in the technical data apply to the above ambient temperatures and altitudes. In the case of a deviating altitude and/or temperature, the reduction factors k shown in the diagram "Ambient conditions" must be used.

$$M_{permiss} = k * M_N$$
$$P_{permiss} = k * P_N$$



5.2. Electrical connection

5.2.1. General

Warning

The electrical connection may only be made by a qualified electrician.

- Before starting any work on the machines, ensure that the lift machine or system is properly isolated.

Before making any electrical connections check that

- the connecting cables are suitable for their specific application and for the relevant voltages and currents.
- sufficiently dimensioned connecting cables, torsion, strain and shear relief, as well as anti-kink protection are provided
- the protective conductor is connected to the earthing terminal
- there are no foreign bodies, dirt or moisture in the terminal boxes
- cable entries not in use and the terminal box itself are tightly sealed to prevent the ingress of dust or splashing water.

Caution

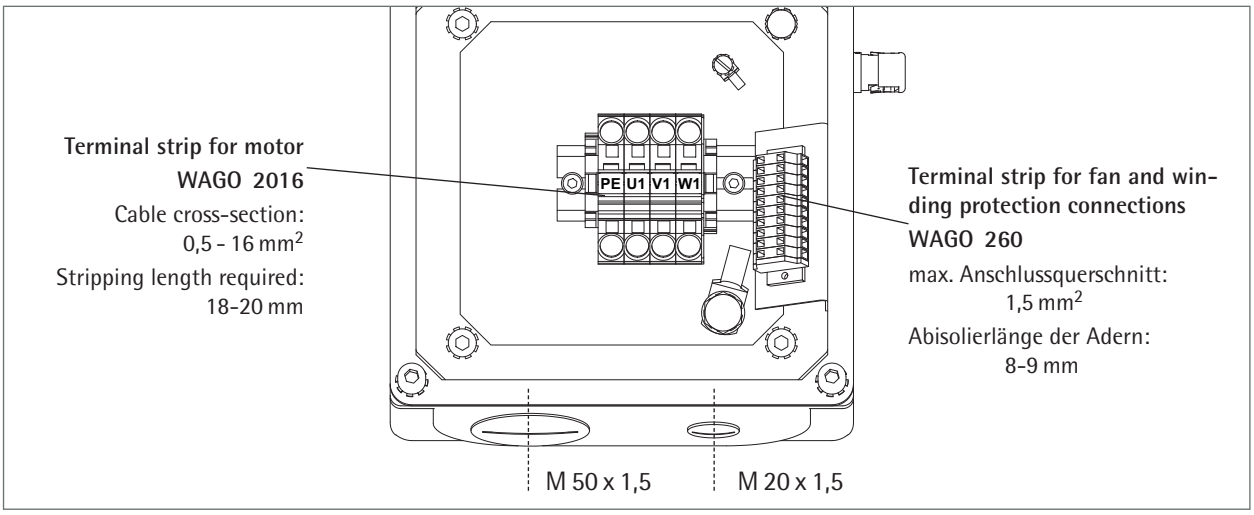
The insulation system of the motors is designed such that they can be connected to a converter with a maximum DC link voltage $U_{link\ max}$ up to max. 700 V DC.

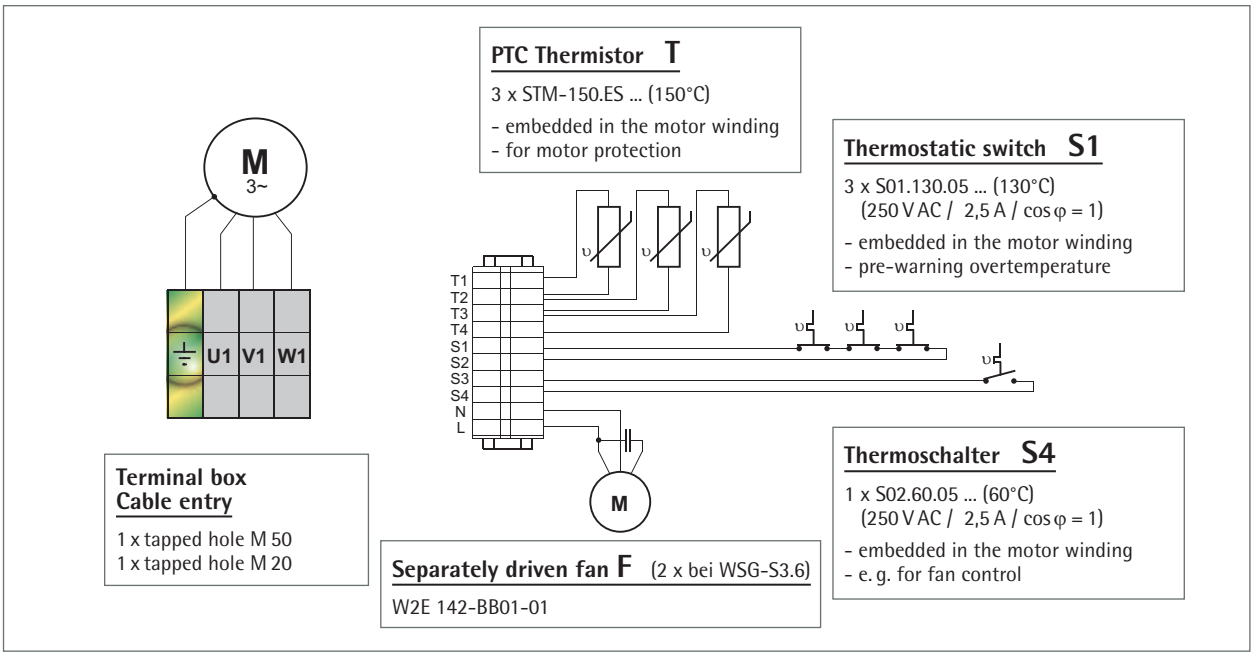
$U_{link\ max}$ is the maximum value of the DC link voltage which is only transient and approximately equivalent to the inception voltage of the braking chopper or of the energy recovery unit.

The maximum permissible rate of voltage rise (dU/dt) at the motor terminals is 4kV/µs. The overvoltage at the motor terminals must not exceed 1.56 kV. It may be necessary to use motor current filters or reactors to achieve these values.

5.2.2. Motor connection / Winding protection / Fan

- The electrical connection of the motor, the brake and the winding sensors is made in the terminal box located on the motor.
- The motor cable must be shielded. Ensure that the cable shield contacts the frame over a large area at both ends.
- The motor phases U1, V1 and W1 must be connected correctly to the corresponding phases of the converter; they must not be interchanged.
- We recommend using a converter with a switching frequency of 12 kHz.
- The thermocouples installed in the winding such as PTC resistor detectors and thermostatic switches must be evaluated in the control system or the frequency converter to protect the motor from overheating.
- The separately driven fan must be properly connected and operated. If required, it can be switched in dependence of the temperature by means of thermal switch S4 (relay must be used).





Cable cross-section required:

The currents specified under the machine data refer to duty type S3-40%. This must be taken into account when selecting the cable cross-section required. The continuous r.m.s. value required for the selected cable is approximated from:

$$I_{\text{r.m.s. (cable).}} \approx I_{\text{N (motor, S3-40%)}} / 1{,}58$$

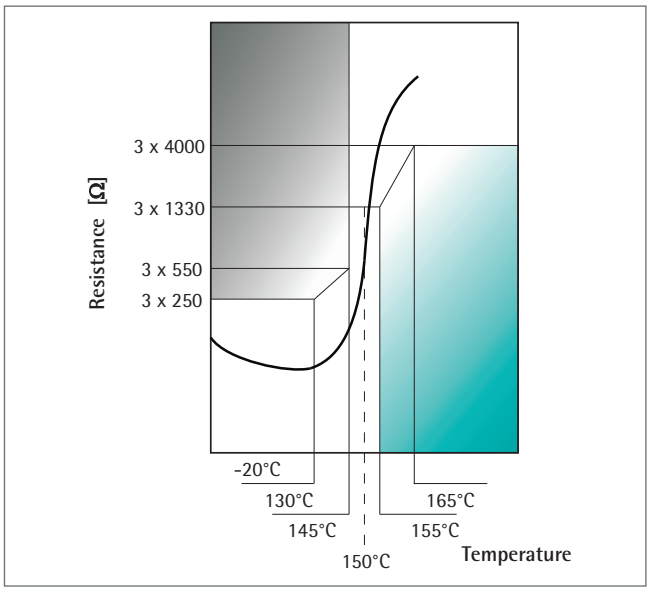
The table on the right gives the **standard values** for the current-carrying capacity of PVC cables at a maximum ambient temperature of 40°C.

Cable cross-section required	Permissible max. current (r.m.s. value)	Permissible max. motor current I_N (S3 - 40%)
1.0 mm²	13.1 A	20.7 A
1.5 mm²	15.7 A	24.8 A
2.5 mm²	22.6 A	35.7 A
4.0 mm²	29.6 A	46.7 A
6.0 mm²	38.3 A	60.5 A
10.0 mm²	53.1 A	83.9 A

PTC thermistors

The maximum operating voltage of the PTC thermistors is not allowed to exceed 25 V DC !

To achieve the maximum precision, the measurement voltage per PTC thermistor must not exceed 2.5 V DC.



Short-circuiting the motor terminals

- The motor terminals of the synchronous lift machines, type WSG, can be short-circuited, if required, to brake the lift machine faster.
- However, this is only permissible at speeds less than or equal to the rated speed of the respective motor.

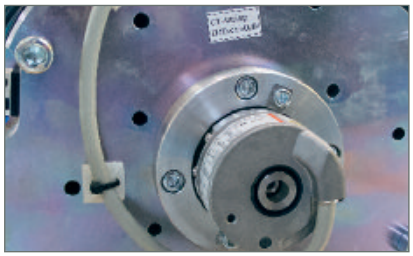
5.2.3. Speed/Position measuring system

- The basic version of the lift machines is equipped with an sendix 8.5873 SineCosine encoder from Kübler GmbH. The encoder is connected by cable (length: 10m) with open wire ends (no plug).
- Alternatively, the machines can be equipped with ECN 413 or ERN 487 encoders (from Heidenhain GmbH). We can also provide other measuring systems on request.
- Use a shielded cable to connect the Heidenhain measuring systems to the converter system. We recommend the use of our cable sets, which can be supplied as an accessory.

STOP Caution

The measuring system of WSG lift machines with a synchronous motor (WSG) is matched to the associated converter. Do not change the adjustment, as this may make it impossible to use the motor. On the measuring system housing there is a label showing the "offset angle" and the inverter type.

The offset angle depends on the converter used.



Measuring system Sendix 8.5873

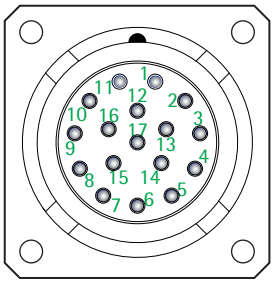
Number of sine-cosine periods per rotation: 2048
Operating voltage: 5 V
Data interface: BISS

Core	Signal
white	0 V (Up)
brown	U_p
green	Clock +
yellow	Clock -
grey	DATA +
pink	DATA -
blue	SET
red	DIR
black	A +
violet	A -
grey-pink	B +
red-blue	B -
shield	shield

Measuring system ECN 413

Number of sine-cosine periods per rotation: 2048
Operating voltage: 5 V
Data interface:: SSI or ENDAT

Pin	Signal
1	U_p Sensor
4	0 V Sensor
7	U_p
8	Clock +
9	Clock -
10	0 V (U_p)
11	inner shield
12	B +
13	B -
14	DATA +
15	A +
16	A -
17	DATA -



Pin contacts of flanged connector socket (exterior)

5.2.4. Brake

- Please refer also to the operating instructions for the brake.
- The brakes are supplied with DC voltage by the overexcitation rectifiers, which are supplied separately or in the terminal box.
- Only the overexcitation rectifiers which are included in our scope of supply are to be used for the brake activation.
- Repeated switching of the brake magnets during the overexcitation period must be avoided as this will result in overloading of the brake control unit. Therefore, a minimum brake operating time of approx. 1.5 – 2 s should be maintained, especially during an inspection or commissioning drive.
- To reduce the switch-off time, switching can be effected from the DC side. However, switching must also be performed from the AC side at the same time ! (Wiring with a varistor as shown in the circuitry suggestion on page 15!)

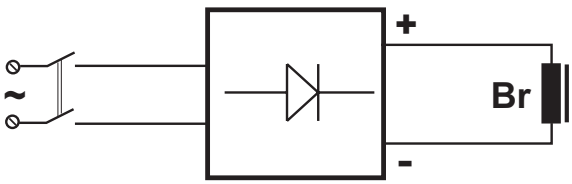
Note on the use of DC/AC side switching:

AC side switching is recommended for normal operation, since the lift machine is then decelerated in a controlled manner to zero speed and the switching noise of the brake is negligible.

When braking in the event of a breakdown (emergency stop) or during an inspection drive, the switching should be performed from the DC side, since this ensures a faster braking effect with the car being stopped earlier. We therefore recommend the use of 2 separate contactors for the brake control circuitry, one of which switches at the DC side, the other at the AC side.

AC side switching

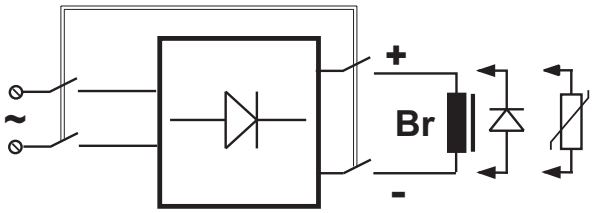
- Low-noise switching of the brake
- No protective measures required for switching contact
- Slow application of the brake.



Attention: schematic diagram!

DC side switching

- Noisy switching
- Burn-up protection for switching contact required (e.g. varistor, free-wheeling diode)
- Fast application of the brake.



Attention: schematic diagram!

Monitoring the brakes

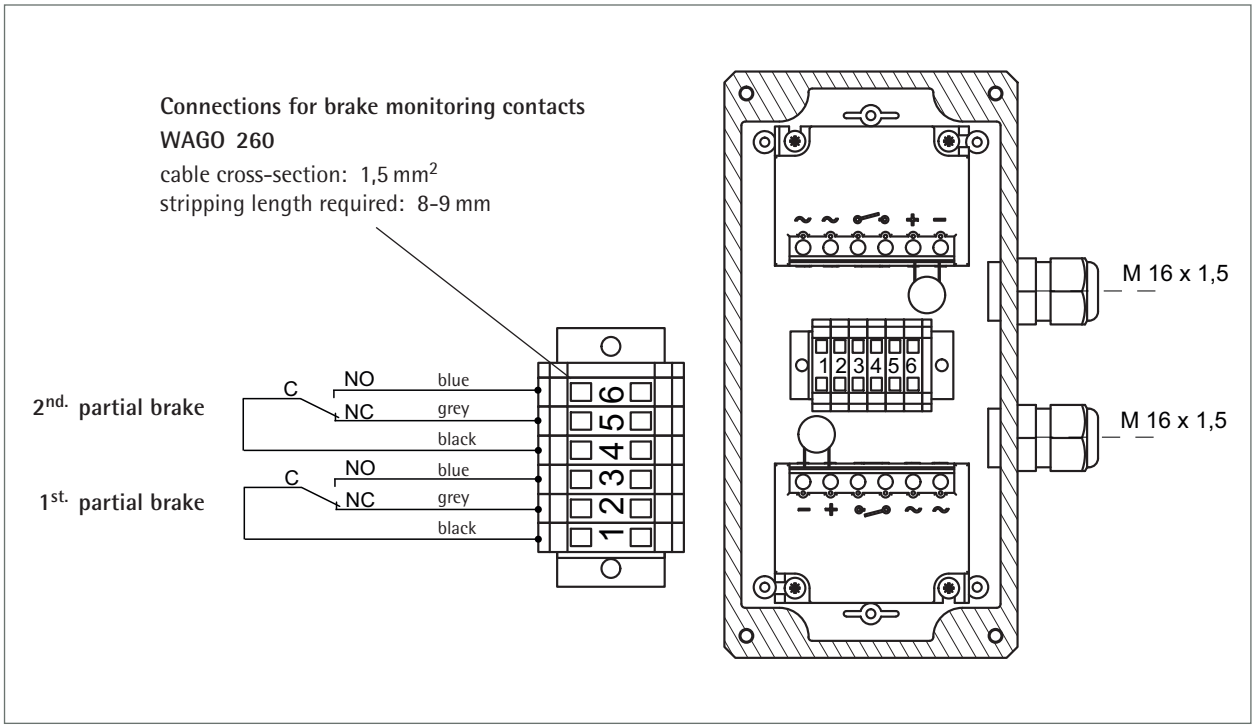
- The switching states of the brakes are monitored by means of dust-proof microswitches with gold contacts. Both the n.c. and the n.o. contact connections are available.

Warning

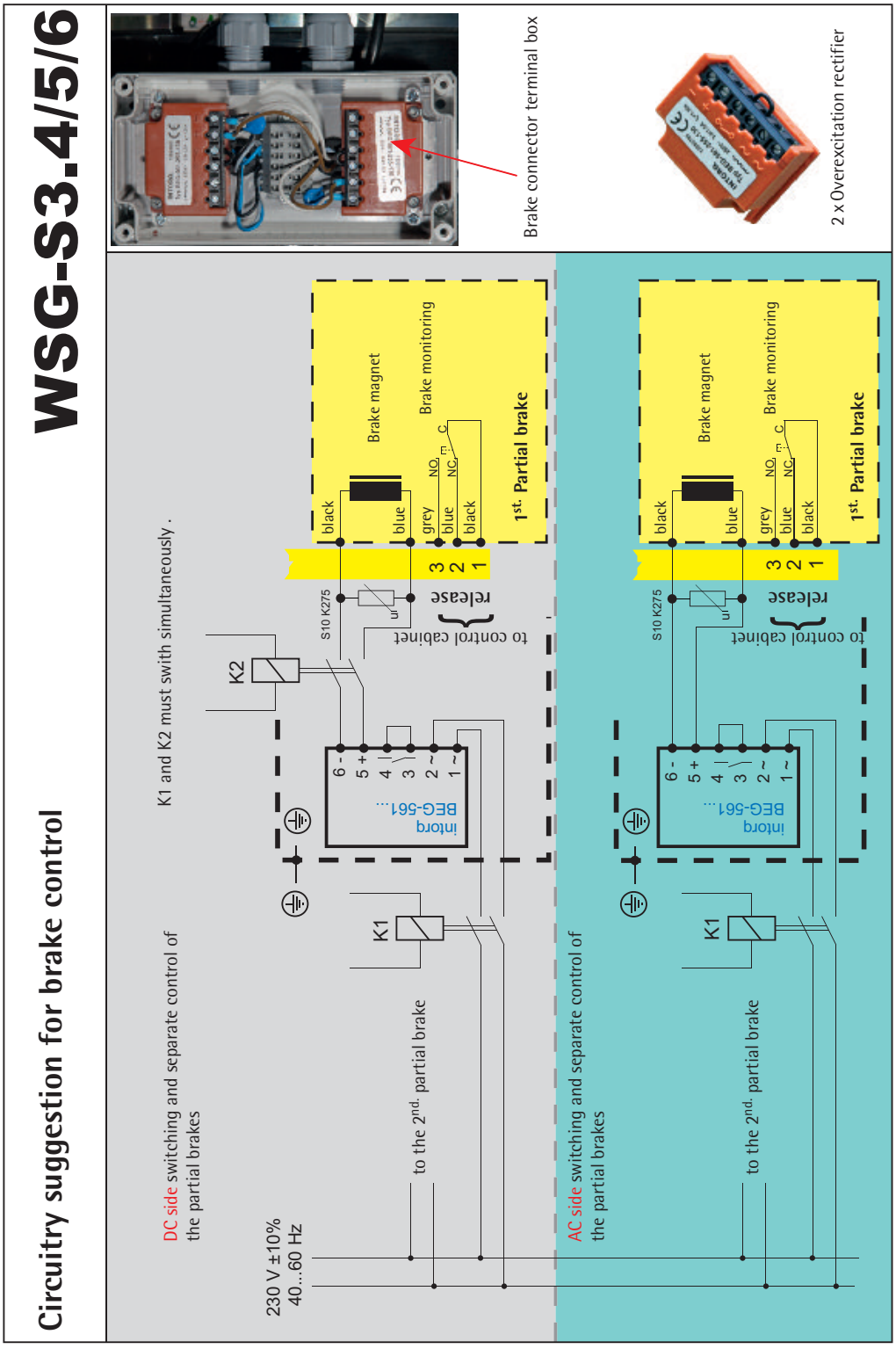
The microswitches must be evaluated separately for each partial brake to ensure compliance with the requirements of the type examination.

Connection of the brakes

The brake solenoids, the brake control units and the monitoring contacts are connected to the mains in the brake terminal box.



Circuitry suggestion for brake control WSG-S3



6. Commissioning

The following points should be checked or completed:

- Check that all performance and application data specified on the name plate of the machine are consistent with your application.
- Have all securing, auxiliary and installation tools been removed from the danger area?
- Check that the lift machine is being used for its intended purpose – comply with the permissible ambient conditions.
- Check that the lift machine has been properly fastened with the fastening bolts – have the bolts been tightened to the specified torque and secured?
- Has the motor been properly connected, including the motor protection? Has the PE terminal been properly connected? Is the potential equalisation with the machine frame ensured?
- Check the proper functioning of the temperature monitoring devices (e.g. by interrupting the temperature monitoring circuit).
- Check the brake connection and the proper functioning of the brake monitoring switches.
- Ensure that the brake operates correctly; perform a brake test using one partial brake.
- Has the measuring system been properly connected?
- Check that the offset value indicated on the measuring system agrees with the value set on the converter.
- Is the rope slip-off guard properly tightened and adjusted?

An initial function test of the motor and the brake, together with the converter, should be performed before the ropes are put in place.

If the motors are being operated at no shaft load (no ropes put in place) for an extended period of time, abnormal noise may occur resulting from the bearing type used

Half-load test

If the motor winding is short-circuited with the control system deactivated, a speed-dependent braking torque will be produced, even at low speeds. Therefore, the short-circuiting should be deactivated during the half-load test. It is imperative for it to be reactivated after the test.

7. Operation and maintenance

7.1. General

- The regulations concerning operation, maintenance and inspection pursuant to the applicable safety regulations for lift construction such as DIN EN 81-20, DIN EN 81-50, LD 2014/33/EU and other relevant regulations are to be strictly observed.
- The operator is responsible for ensuring that the motor is installed properly and in accordance with the safety requirements, as well as for its inspection and maintenance as specified in the applicable regulations.
- The proper maintenance of gearless lift machines requires adequately trained specialist personnel and special devices and tools.
- Repairs other than those described in these operating instructions are not to be carried out by the lift fitter/maintenance technician for liability reasons.

Bolt/screw tightening torques

- When performing any work on the machine or replacing parts, make sure that the specified bolt/screw strength class and the tightening torques are observed (see table).
- Secure the bolts/screws with "omnifit 100" or a similar product against accidental loosening.

Dimension	Tightening torque [Nm]		
Strength class	8.8	10.9	12.9
M4	2,8	4,1	4,8
M5	5,5	8,1	9,5
M6	9,6	14	16
M8	23	34	40
M10	46	67	79
M12	79	115	135
M16	195	290	340
M20	395	560	660
M24	680	970	1150

7.2. Maintenance intervals

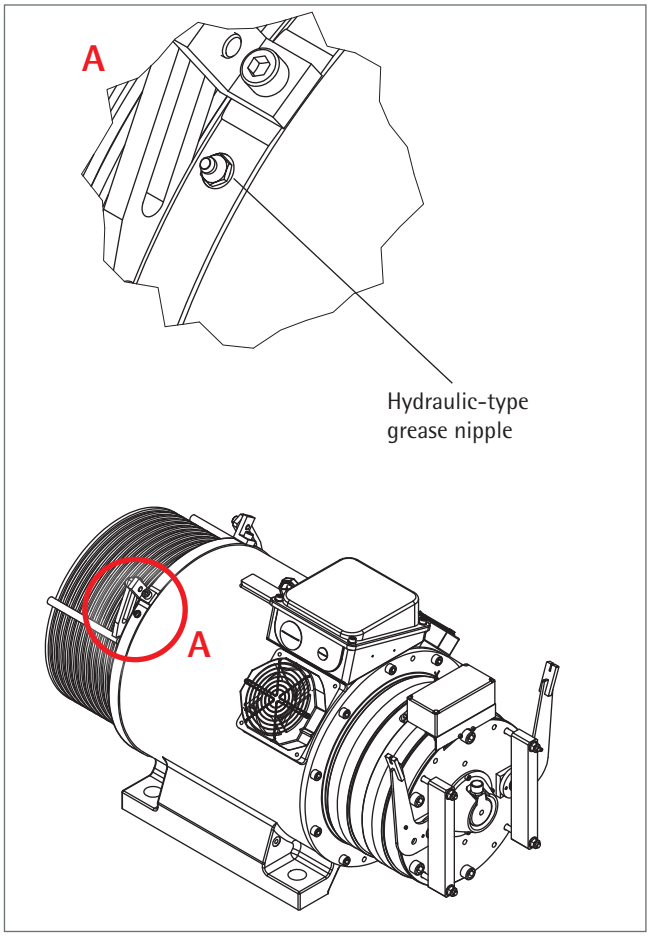
Check the brake air gap	every six months	see the brake operating instructions
Check the proper functioning of the brakes and the brake monitoring switches	every six months	see the brake operating instructions
Check the bearing noise	every six months	
Regrease the bearings	see section 7.3	
Check the traction sheave for wear	every six months	
Make a visual check of the fasteningbolts/screws on the frame, brake and traction sheave	every six months	see section 7.1.
Check the electrical cables	every six months	see section 5.2.
Check the rope slip-off guard	every six months	
Check the guards and safety devices for their condition and safe functioning	every six months	
Clean the external machine surfaces; clean the fan filter mats	as required	see section 7.4.

7.3. Regreasing the bearings

Relubricate the main bearing after about 7,000 hours of operation, using a KP 2 N-30 to DIN 51 502 grease such as Wälalit LZ 2 or Klüberlub BE 41-542 (approx. 50 g on DE).

Use a conventional grease gun and press the grease into the hydraulic-type grease nipple to DIN 71 412 AM 10x1.

The relubricating points are provided on the D-end shields of the machine.



7.4. Filter mats

Remove the two screws from the protective screen. Then remove the screen and filter to clean or replace the filter mats.

Warning Do this work only with the fan switched off as the rotating fan wheel could be dangerous.

7.5. Replacing the traction sheave

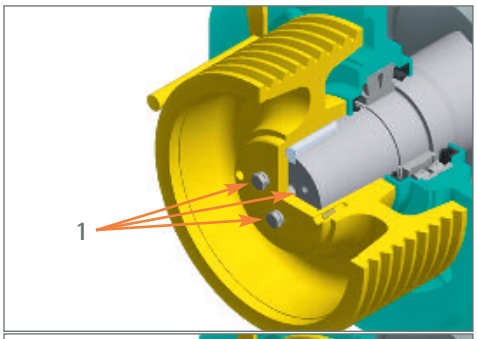
Warning The traction sheave can work loose if it is not properly installed.

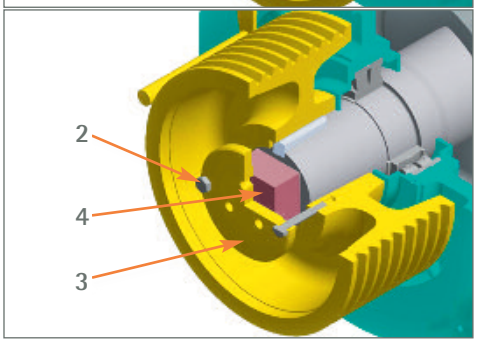
Necessary tools

- Hoisting equipment
- Torque wrench (M 16)
- Spacer (15 ... 20 mm)
- Cleaning cloth

Disassembly

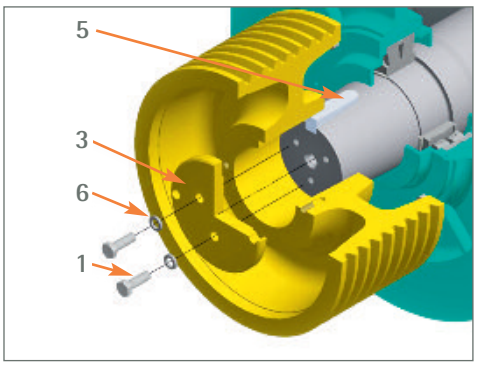
- Disconnect the system and safeguard against accidental restarting.
- Secure the car and the counter-weight.
- Remove the rope slip-off guards and the rope guards, if provided.
- Relieve the load on the traction sheave; remove the ropes.
- Support the traction sheave by means of a hoisting gear.
- Remove the three M 16 bolts (1) at the pressure disc and the pressure disc itself.
- Insert two fastening bolts (2) into the outer hole circle of the pressure disc (3) and into the traction sheave.
- Insert a spacer (4) between the pressure disc and the shaft journal.
- Pull off the traction sheave from the tapered shaft seats by tightening the bolts evenly.





Assembly

- Clean the traction sheave and the motor shaft.
- Support the traction sheave by means of a hoisting gear.
- Insert the feather key (5) into the shaft end.
- Slide the traction sheave onto the motor shaft.
- Fit the pressure disc (3) to the traction sheave and fasten it using three pairs of NORD-LOCK washers (6) and M 16x50-8,8 bolts (1). Tighten the bolts alternately around the circle in three torque steps (70, 140 and 210 Nm) as far as they will go.
  Tightening torque: 210 Nm
- Replace the ropes and reinstall the rope slip-off guard.

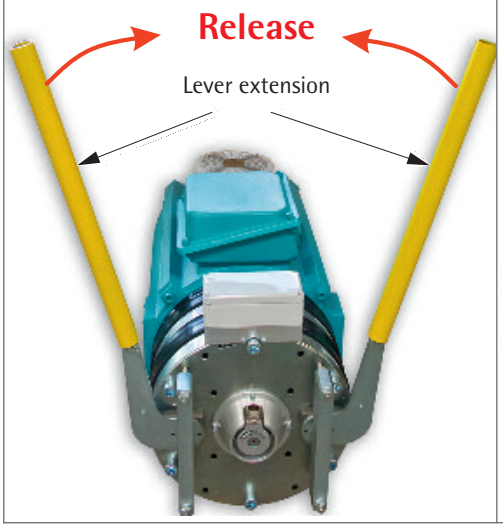
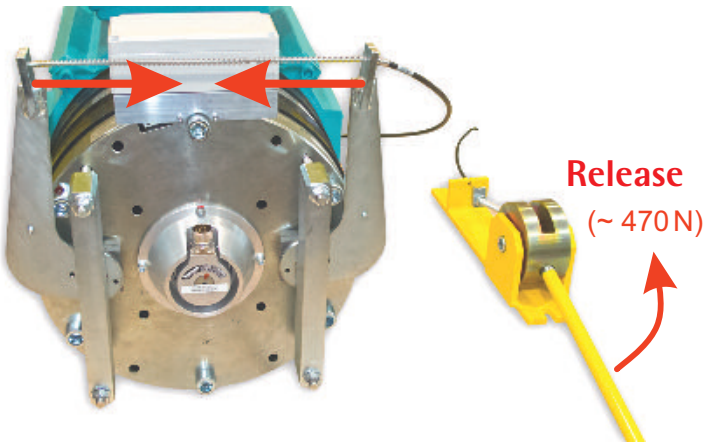


7.6. Emergency evacuation

Danger All actions for evacuation in case of emergency have to be done by qualified service personnel.

Manually operated evacuation in case of emergency

- The brakes can be opened manually by using the lifting levers (option)
- Two different options can be chosen (shown in the following pictures):

Manual lifting rods (machine room):	Brake manual release remotelly controlled:
	

- Is the brake opened manually, the cabin moves in the direction of the higher weight. In case of balance, the cabin has to be weighted down with suitable additional mass.
- The motor winding has to be short-circuited via the motor contactors. With the short circuit the motor creates a brake torque, which is dependent on the motor speed. This prevents an uncontrolled acceleration of the elevator.
- It is possible that the brake torque which is created by the motor short circuit is not enough to limit the speed of the elevator. Therefore the cabin speed has to be observed carefully during the evacuation and if needed, the evacuation has to be stopped.
- When the cabin has reached the next floor, the manually opened brake is closed again. The rescue of the trapped persons in the cabin can begin.

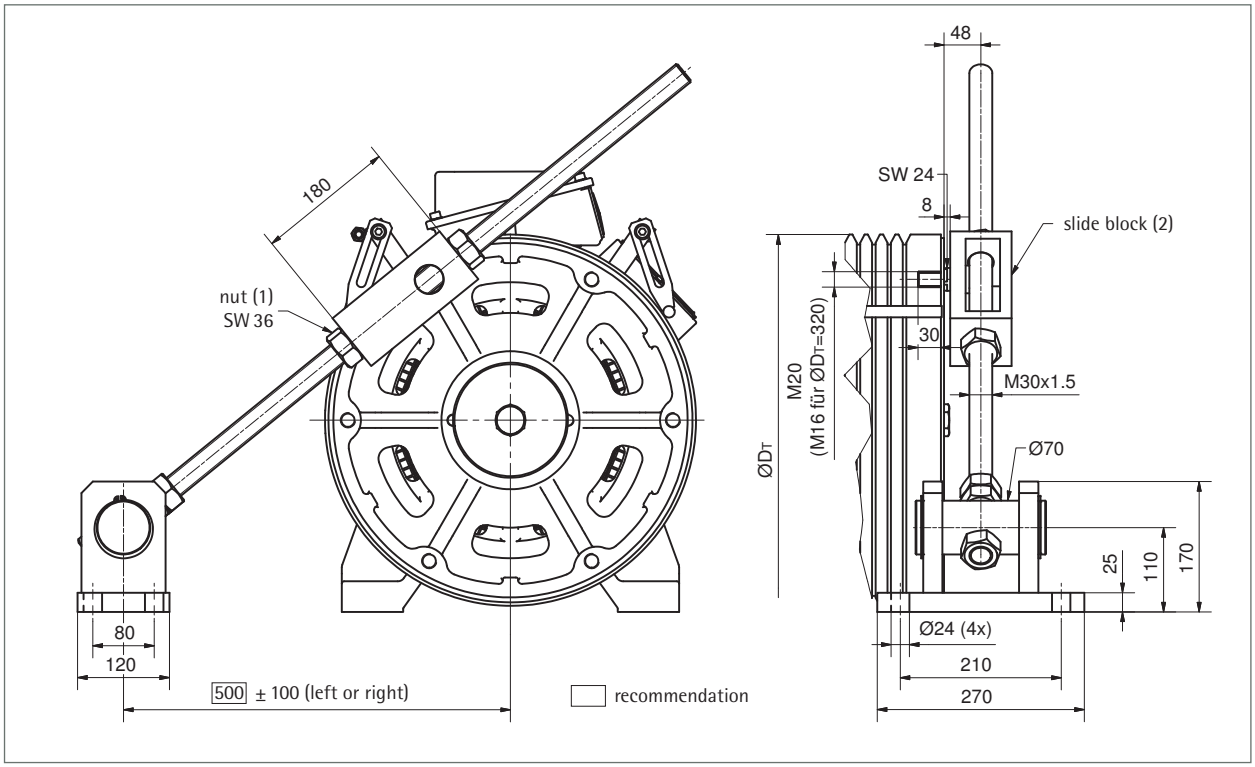
Warning When the evacuation is finished, the initial state has to be restored. Especially the lever extensions have to be removed.

Electrically operated evacuation in case of emergency

- The electrical opening of the brakes is done using the power grid or an UPS.
- The operating instructions of the controller, the inverter or the evacuation unit with UPS have to be followed!

- For cases such as lift failure or the car being caught by the safety device, a mechanical return motion device can be used to move the lift manually. The use of the return motion device is shown in the drawing.
- Bolt the bearing block to a cross-beam at the recommended spacing. The cross-beam is firmly connected to the lift machine. When fitting the device, a switching command "electrical supply disconnected" must be activated.
- Then screw the threaded bolt tightly into an appropriately positioned threaded hole in the traction sheave. While releasing the brakes, either electrically or manually, the slide block can be displaced by turning the corresponding nuts. This turns the traction sheave.
- The bolt can then be moved to a new hole in the traction sheave, if required.

Warning The lift must be braked when changing the bolt.



7.7. Testing the brake system to EN 81

The brake system should be tested with the car about halfway down the shaft. If any motor short-circuit connections have been made, these should be deactivated so that the brake effect can be tested independently.

Overload

- The brake system should be tested by interrupting the power supply to the motor and brake system with the car moving downward at rated speed and 1.25 times the rated load. The brake system must be capable of decelerating the car.

Failure of a brake

- If one brake fails, the brake system must still be capable of decelerating the car sufficiently during its downward travel at rated load and rated speed.
- When simulating the failure of one brake, the other brakes must be kept open separately, even if the safety circuit is open. This should be done using suitable electric circuitry or by hand.
- This state must not be maintained in the long term!
- Observe the lift during this test. If it does not decelerate, close the open brake circuit immediately.

Separate operation of the individual brakes

- The only method by which the partial brakes can be released separately is through electrical control. The brakes can be activated/deactivated quickly using individual control buttons.

Monitoring the brakes

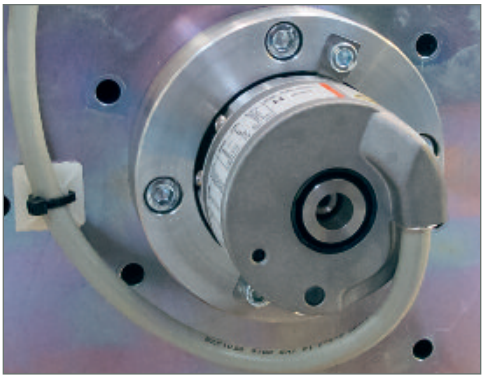
- Check the brake monitoring switches individually. No car travel must be permitted if a microswitch signal is missing or a wrong signal operates.

7.8. Replacing the measuring system

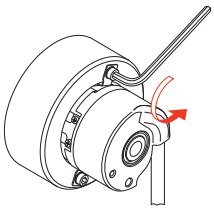
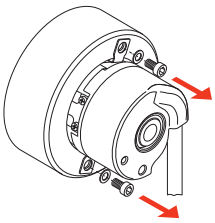
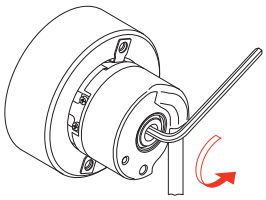
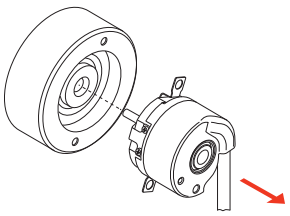
The measuring system is only accessible from the rear side of the motor.

See the mounting instructions for the Kübler encoder.

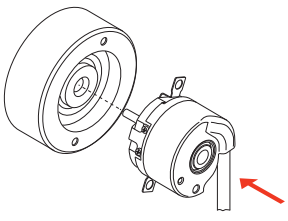
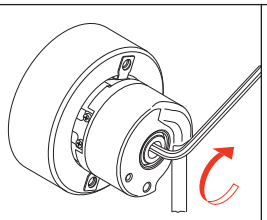
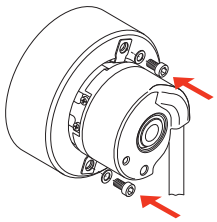
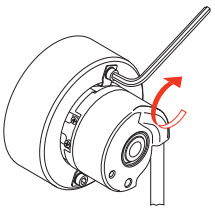
Disassemble the measuring system only if this is necessary because of a defect. Remember to readjust the offset value after reassembly (see the converter operating instructions).



Disassembly

			
1. Loosen 2 x bolts.	**2.** Remove 2 x bolts with washers.	**3.** Loosen fixing bolt.	**4.** Unscrewing the fixing bolt causes the encoder to disengage from the motor shaft.

Assembly

			
1. Screw the fixing bolt into the motor shaft. This causes the encoder to be drawn into the cone.	**2.** Tighten the fixing bolt with $3^{+0.5}$ Nm.	**3.** Attach the encoder with 2 x bolts and washers.	**4.** Tighten the 2 x bolts.

Subject to changes without notice !

7.9. Trouble shooting

Fault	Possible cause	Remedy
Motor does not start, operates out of control or develops no torque	• Motor not connected in proper phase sequence	• Connect motor correctly
	• Measuring system not properly connected	• Connect measuring system correctly
	• Converter parametrisation incorrect	• Check converter parametrisation
	• EMC disturbance	• Carry out shielding and earthing measures as described by the converter manufacturer
	• Measuring system offset angle incorrectly set	• Check measuring system offset angle
	• Measuring system defective	• Replace measuring system
Motor noise	• Bearing defective	• Notify customer service
	• Converter parametrisation incorrect	• Check converter parametrisation
Braking system does not release	• Braking system is not supplied with voltage	• Check electrical connection
	• Brake magnet voltage too low	• Check braking voltage supply voltage
	• Brake shoes mechanically blocked	• Remove mechanical blocking
	• Overexcitation rectifier defective	• Replace overexcitation rectifier
Delay in braking system release	• Overexcitation rectifier defective	• Replace overexcitation rectifier
Braking system does not engage	• Brake shoe mechanically blocked	• Remove mechanical blocking
Delay in engaging of braking system	• Switch-off time too short with AC side switching	• Brake control using DC side switching of the overexcitation rectifier
Brake makes loud switching noise	• DC side switching of the brake in "normal operation"	• Change over to brake control by AC side switching in "normal operation"
	• Brake air gap too large	• Adjust brake air gap
Braking torque too low	• Brake friction surface or brake linings dirty.	• Clean friction surface / brake linings
	• Foreign bodies between friction surface and brake lining	• Remove foreign bodies
	• Brake friction surface or brake lining have come into contact with oily or greasy materials	• Replace brake lining, clean brake drum thoroughly
	• Load torque too high	• Reduce load torque

8. Type code

Example:	W	S	G-	S3	.	6	-	0	E	19	/	40A	-	DF
	W	**S**	**G-**	**S3**	**.**	**Z3**	**-**	**X1**	**X2**	**X3 X4**	**/**	**X5 X6 X7**	**-**	**X8 X9**

Customer specific identifier

S = Synchronous motor

G = gearless
U = gearless; UL-CSA approved

Frame size

Z3: Overall length:
3 overall lengths are available;
identified by: 4, 5, 6

X1: Customer specific identifier

X2: Motor voltage:
E: serie „ECO", suitable for converter supply using a link voltage of 500 .... 620 V

X3 X4: Rated speed:
z.B. *11: 119 min^{-1} (with D_T = 320 mm v = 1.0 m/s, suspension 2:1)*
19: 191 min^{-1} (with D_T = 400 mm v = 2.0 m/s, suspension 2:1)
29: 298 min^{-1} (with D_T = 320 mm v = 2.5 m/s, suspension 2:1)
06: 60 min^{-1} (with D_T = 320 mm v = 1.0 m/s, suspension 1:1)

X5 X6 X7: Traction sheave design
(Traction sheave diameter; width, groove design, groove geometry)

X8 X9: Variant code (brake, measuring system, modifications)
DZ: dual-curcuit brake; measuring system Sendix 8.5873-2048 lnkr. - BISS-Interface
DE: dual-curcuit brake; measuring system ECN 413-2048 incr. - SSI-interface
HE: dual-curcuit brake with manual release; measuring system ECN 413-2048 incr. - SSI interface
DF: dual-curcuit brake; measuring system ECN 413-2048 incr. - ENDAT-interface
DG: dual-curcuit brake; measuring system ERN 487-2048 incr.

9. Technical data

Duty type:	S3 - 40 % ED
Traction sheave:	dia. 320, 400, 480 or dia. 520 mm
Traction sheave hard-nesse:	at least 220 HB 30
DE bearing:	self-aligning roller bearing
NDE bearing:	ball bearing
Permissible shaft load:	63 kN
Drive motor:	synchronous motor
Number of pole pairs:	10
Thermal class:	155 (F)
Degree of protection:	IP 23
Winding protection:	triple PTC 150°C triple therm. switch (NC contact)130°C therm. switch (NO contact) 60°C

Site conditions

Max. altitude:	max. 1,000 m (derating required at higher altitudes)
Ambient temperature:	-5°C ... +40°C
Max. rel. humidity:	85 % at 20°C (no moisture cendensation)

Dual-circuit fail-safe brake

Type:	BFK 455-28		
WSG-	**S3.4**	**S3.5**	**S3.6**
Braking torque:	2 x 1200 Nm	2 x 1800 Nm	2 x 2065 Nm
Air gap s_B:	$0.4^{\pm 0,05}$ mm (new air gap)		
Max. air gap $s_{B\ max}$:	0.7 mm		
Holding voltage:	103 V DC		
Holding current:	2 x 1.06 A		
Overexcitation voltage:	205 V DC		
Overexcitation current:	2 x 2.12 A		

Brake control units

Type:	BEG-561-255-130 from Intorq GmbH (accessories)
Operating voltage:	U_N = 230 V AC (± 10 %), 40... 60 Hz
Dimensions:	52 x 22 x 38 (w x h x l)

Brake monitoring contacts

Contact rating:	12 - 30 V DC / 0.01 - 0.1 A
Min. contact current:	10 mA
Mechanical life of contacts:	2 x 10^6 switching operations

Separately driven fan (1x for WSG-S3.4/5 and 2x for WSG-S3.6)

Type:	W2E 142-BB01-01
Operating voltage:	230 V / 50/60 Hz
Current consumption:	0.12/0.13 A

motor		WSG-S3.4						WSG-S3.5						WSG-S3.6					
torque S3-40%	M_N [Nm]	900						1200						1650					
max. torque	M_{max} [Nm]	1800						2400						3200					
brake torque	M_{br} [Nm]	2 x 1200						2 x 1800						2 x 2065					
traction sheave	Ø D_T [mm]	320			400			320			400			320			400		
for loads up to *)	Q [kg]	1600			up to 1275			2050			1600			2750			2500		
suspension		table applies for 2:1																	
Motor currents applicable to 500 ... 620 V DC link voltage (serie „ECO")	v [m/s]	n_N [rpm]	P_N [kW]	I_N [A]	n_N [rpm]	P_N [kW]	I_N [A]	n_N [rpm]	P_N [kW]	I_N [A]	n_N [rpm]	P_N [kW]	I_N [A]	n_N [rpm]	P_N [kW]	I_N [A]	n_N [rpm]	P_N [kW]	I_N [A]
	0,63	75	7,1	21,5	60	5,7	18,0	75	9,4	25,5	60	7,5	21,5	75	13,0	39,0	60	10,4	32,5
	1,0	119	11,2	30,0	95	9,0	25,5	119	15,0	37,0	95	11,9	31,0	119	20,6	55,0	95	16,4	47,0
	1,6	191	18,0	45,0	153	14,4	37,0	191	24,0	59,5	153	19,2	45,5	191	33,0	85,5	153	26,4	72,0
	2,0	239	22,5	58,0	191	18,0	45,0	239	30,0	70,5	191	24,0	59,5	239	41,3	104,5	191	33,0	85,5
	2,5	298	28,1	68,0	239	22,5	58,0	298	37,4	86,0	239	30,0	70,5	-	-	-	239	41,3	104,5
	3,0	-	-	-	286	27,0	68,0	-	-	-	286	35,9	86,0	-	-	-	-	-	-

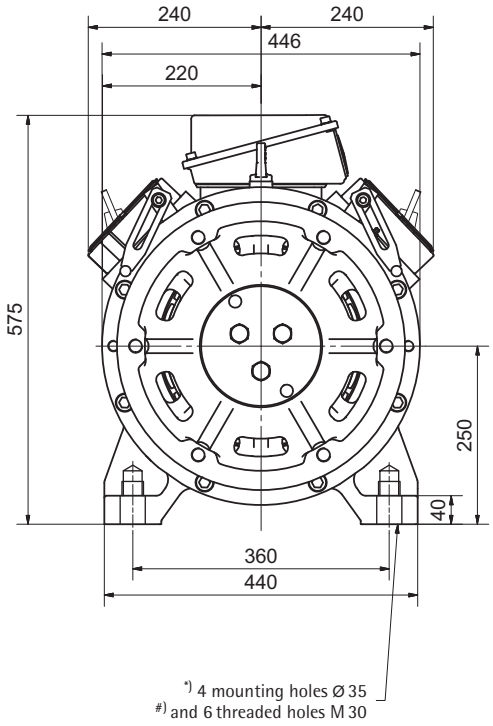
*) Reference values. Achievable nominal load depends on specific lift system data.

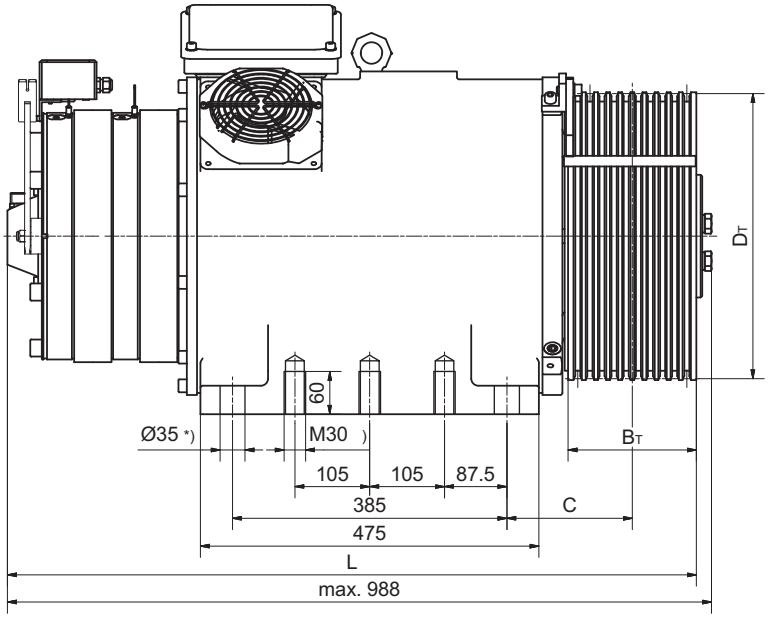
The table is applicable to an overall shaft efficiency of approx. 73..85 % (counterweight: 50 %). It lists a standard selection of machines. The lift and project data will be adapted to actual site conditions and may deviate from the above values.

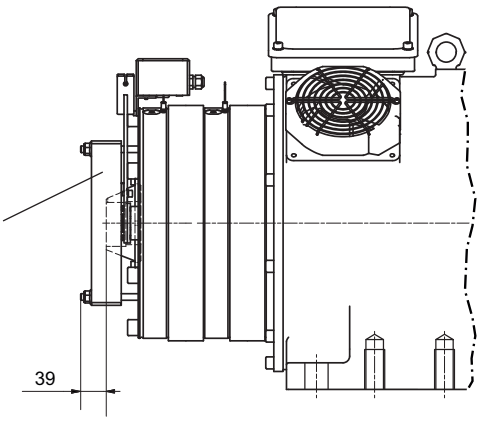
motor		WSG-S3.4						WSG-S3.5						WSG-S3.6					
torque S3-40%	M_N [Nm]	900						1200						1650					
max. torque	M_{max} [Nm]	1800						2400						3200					
brake torque	M_{br} [Nm]	2 x 1200						2 x 1800						2 x 2065					
traction sheave	Ø D_T [mm]	480			520			480			520			480			520		
for loads up to *)	Q [kg]	1050			950			1350			1250			2000			1800		
suspension		table applies for 2:1																	
Motor currents applicable to 500 ... 620 V DC link voltage (serie „ECO")	v [m/s]	n_N [rpm]	P_N [kW]	I_N [A]	n_N [rpm]	P_N [kW]	I_N [A]	n_N [rpm]	P_N [kW]	I_N [A]	n_N [rpm]	P_N [kW]	I_N [A]	n_N [rpm]	P_N [kW]	I_N [A]	n_N [rpm]	P_N [kW]	I_N [A]
	0,63	50	4,7	18,0	46	4,3	18,0	50	6,3	21,5	46	5,8	21,5	50	8,6	32,5	46	7,9	32,5
	1,0	80	7,5	25,5	73	6,9	21,5	80	10,1	31,0	73	9,2	25,5	80	13,8	47,0	73	12,6	39,0
	1,6	127	12,0	37,0	118	11,1	30,0	127	16,0	45,5	118	14,8	37,0	127	21,9	72,0	118	20,4	55,0
	2,0	160	15,1	45,0	147	13,9	37,0	160	20,1	59,5	147	18,5	45,5	160	27,6	85,5	147	25,4	72,0
	2,5	200	18,8	58,0	184	17,3	45,0	200	25,1	70,5	184	23,1	59,5	200	34,6	104,5	184	31,8	85,5
	3,0	239	22,5	58,0	220	20,7	58,0	239	30,0	70,5	220	27,6	70,5	239	41,3	104,5	220	38,0	104,5
	3,5	279	26,3	68,0	257	24,2	68,0	279	35,1	86,0	257	32,3	86,0	-	-	-	-	-	-

Subject to changes without notice !

10. Dimension drawing





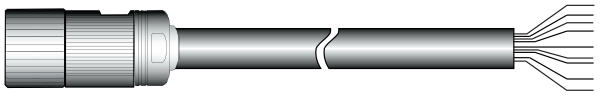
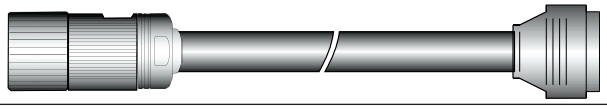
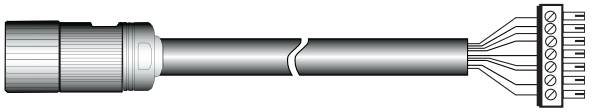
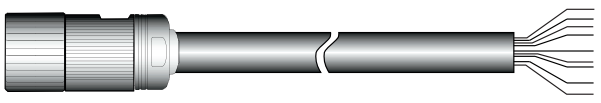


In case of a mounted manual release lever the motor lengthen by 39 mm.

motor	WSG-	S3.4				S3.5				S3.6			
	Ø D_T	320	400	480	520	320	400	480	520	320	400	480	520
	B_T	180		195		180		195		180		195	
	L	970		985		970		985		970		985	
	C	176		183,5		176		183,5		176		183,5	
weight	m_G [kg]	619	636	670	692	669	686	720	742	699	716	750	772
inertia	J_G [kgm^2]	1,7	2,6	4,6	6,4	1,9	2,8	4,8	6,6	2,0	2,9	4,9	6,7
shaft loads up to	F_S [kN]	63											

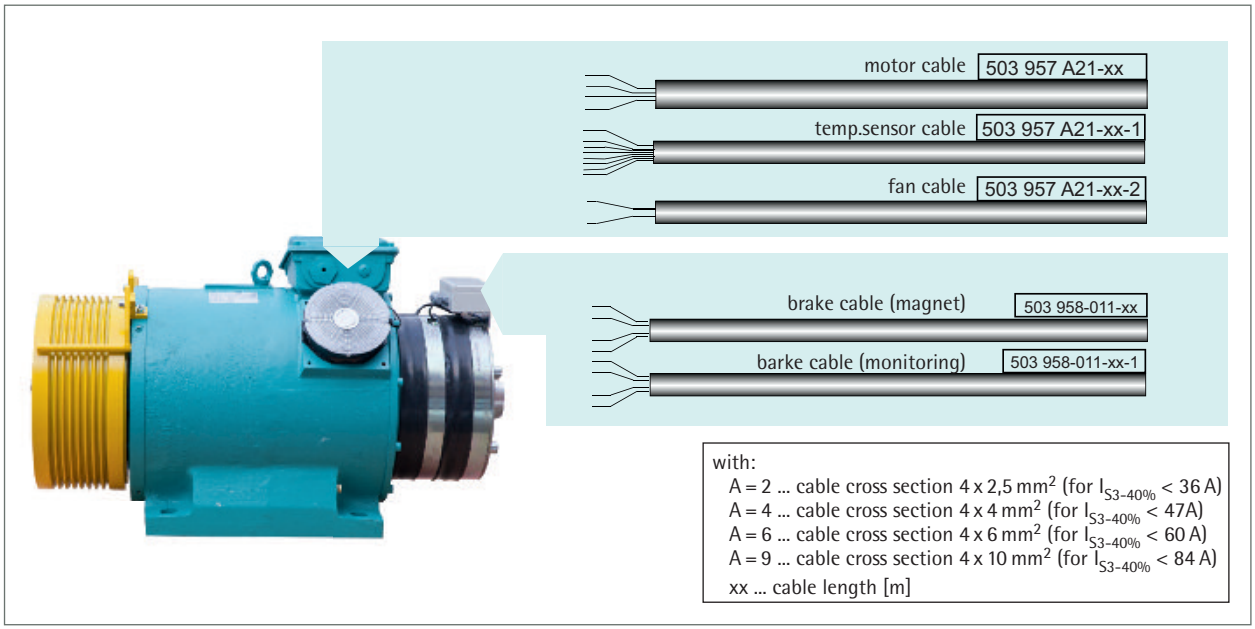
11. Accessories

11.1. Connecting cable for measuring systems

	Inverter type	recom. encoder system	recommended measurement system cable
	E-Pack Arkel ARCODE	ECN 413 (EnDat / SSI)	503 325 021 xx
	D-Pack Arkel ADrive CT unidrive SP	ECN 413 (EnDat / SSI)	502 452 021 xx
	emotron/ Dietz DSV 5445	ECN 413 (EnDat / SSI)	501 112 022 xx
	Fuji Frenic	ECN 413 (EnDat)	502 679 022 xx
	KEB F5	ECN 413 (EnDat)	502 363 022 xx
	LTi DRiVes Lust CDD 3000	ECN 413 (SSI)	505 677 022 xx
	RST Elektronik FRC	ECN 413 (EnDat)	508 752 022 xx
	GEFRAN (SIEI) AVY-L-M	ERN 487	503 499 022 xx
	Vacon NXP	ECN 413 (EnDat)	503 289 021 xx
	Yaskawa/ Omron L7 Telemecanique/ Schneieder Altivar 71	ECN 413 (EnDat)	503 715 022 xx
	Ziehl-Abegg 2SY/3BF	ECN 413 (EnDat / SSI)	508 749 022 xx

xx... cable length [m]

11.2. Cable set for motor and brake

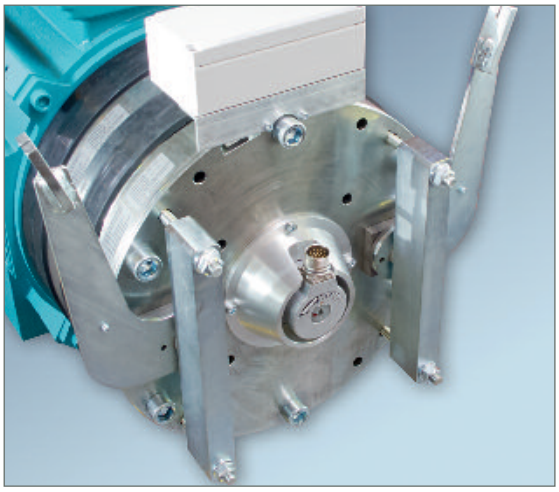


11.3. Brake manual release

As an option the brake is available with a manual release. Brake with or without manual release as specified with the order. No possibility for retrofit !

The necessary manual release lever including the Bowden cable for releasing can be delivered, if required.

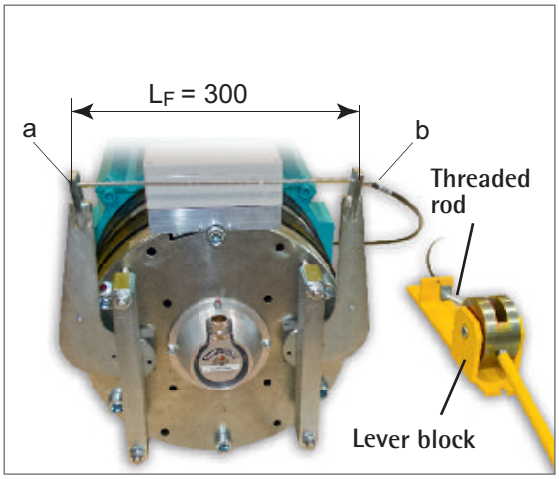
The standard length of the Bowden cable is 3 m. Other lengths on request.



Installation:

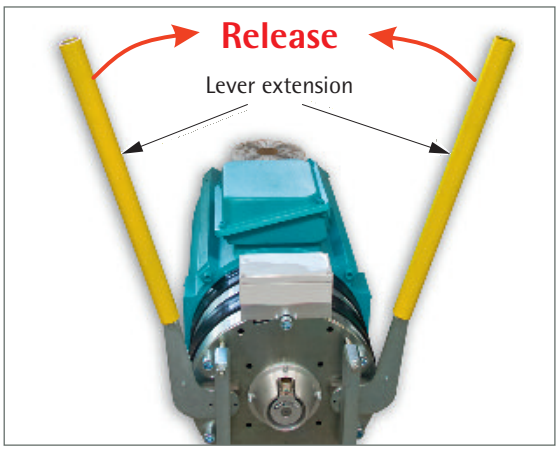
Install the manual brake releasing device with the brake disconnected from the power supply.

- Lock the car and the counterweight. Ensure that the required safety measures are observed for the lift system.
- Install the lever block.
- Insert the Bowden cable into the brake lever (a and b) and the lever block . Adjusting of the Bowden cable on the lever block. Set L_F = **300 mm** on the lever block with the assistance of threaded rod.
  Do not actuate the lever block !
- Perform a functional test (at least three times).



The Bowden cable has to be installed in wide arcs only (bending radius > 0.5 m, if possible).
Put no loops !

Alternatively, another simple version of the manual releasing device is available for lifts with a machine room.



12. Spare parts

Item	Part	Description
Motor		
01	traction sheave	acc. machine nameplate type code X5 X6 X7
02	Measuring system (depending on spec.)	ECN 413 / SSI / 2048 incr. / clamping ring ECN 413 / ENDAT / 2048 Inkr. / clamping ring ERN 487 / 2048 Inkr. / clamping ring
Brake system		
04	Overexcitation rectifier	BEG-561-255-130
05	Micro switch (brake monitoring)	ET 37 74 210 0807
06		

WITTUR Electric Drives GmbH

EU-Konformitätserklärung
EU Declaration of Conformity

im Sinne der EU-Richtlinie Niederspannung (2014/35/EU)
as defined by the EU Low Voltage Directive (2014/35/EU)

Der Hersteller
The manufacturer

WITTUR Electric Drives GmbH
Offenburger Straße 3
D-01189 Dresden
Deutschland / Germany

erklärt hiermit, dass die folgenden Produkte
certifies that the following products

Produktbezeichnung:
Product designation:

Asynchronmotoren *Asynchronous motors*	DS☐ 1, DS☐ 3
Synchronmotoren *Synchronous motors*	DS☐ 2, DS☐ 4, DG☐ 4, DU☐ 4, DG☐ 6, DU☐ 6, WSG, K☐ 8, T☐ 8
Sondermotoren *Custom-made motors*	4HX, 6PX, QPX

den Bestimmungen der EU-Richtlinie 2014/35/EU entsprechen.
are in conformity with the specification of the EU Directive 2014/35/EU.

Erklärung zur EMV-Richtlinie (2014/30/EU)
Bei Netzbetrieb an sinusförmiger Wechselspannung erfüllen die Motoren die Anforderungen der EU-Richtlinie „Elektromagnetische Verträglichkeit" 2014/30/EU unter Berücksichtigung der Normen EN 61000-6-1..4.

Statement relating to EMC Directive (2014/30/EU)
When connected to a sinus-shaped a.c. voltage system, the motors conform to the requirements of the EC Directive "Electromagnetic compatibility" 2014/30/EU, including those specified in standards EN 61000-6-1...4.

Folgende Normen sind angewandt:
The following standards are in use:

EN / IEC 60 204-1:	Sicherheit von Maschinen; Elektrische Ausrüstung von Maschinen; Teil 1: Allg. Anforderungen *Safety of machinery - Electrical equipment of machines. Part 1: General requirements*
EN / IEC 60 034:	Drehende elektrische Maschinen *Rotating electrical machines*
EN ISO 12 100:	Sicherheit von Maschinen - Allgemeine Gestaltungsleitsätze, Risikobeurteilung und Risikominimierung *Safety of machinery - General principles for design, risk assessment and risk reduction*

Dresden, 2016-06-02
(Ort, Datum)
(Place, date)

Markus Weber
Geschäftsführer
Managing Director

i.V.
Steffen Mann
Leiter Entwicklung/Konstruktion
Head of Development/Construction

EC_06_2016

TÜV SÜD
Industrie Service

Mehr Sicherheit.
Mehr Wert.

Report
on the review of calculation documents

Customer: WITTUR Electric Drives GmbH
Offenburger Strasse 3
01189 Dresden

Subject of inspection: Traction sheave shaft for lift machines,
types xSG-S3.X - conical shaft end

Datum: 07.05.2013

Unsere Zeichen:
IS-FT1-DRE/Dmü

Dokument:
xSG-S3.X_kon_en.docx

Das Dokument besteht aus
2 Seiten.
Seite 1 von 2

Inspection order: Review of the traction sheave shaft calculation

Specification: DIN 743
Shafts and axles; calculation of load capacity

Scope:
- Review of the calculations to ensure compliance with the specification
- Review of the calculation results
- Review of the calculation documents to ensure compliance with the data in the drawings

Inspector: Dipl.-Ing. Thoralf Mühre l
Technical Expert

Certified System SWISS TS ISO 9001

Industrie Service

1. Calculation documents

The following technical documents were to be reviewed:
- Calculation documents S3FE2.DOCX pages 1 to 5 dated 12/04/2013, incl. Annexes 1.1 to 1.3.
- Drawing no. 512 765 (Revision Äm 165/12, 03/07/2012).

2. Technical data

The data which are of relevance to the calculation are specified as follows in the calculation document S3FE2.DOCX :

– max. shaft load:	70.0 kN
– max. magnetic pull:	3.0 kN
– traction sheave weight:	71.0 kg
– rotor weight:	58.5 kg

3. Results of the review

The calculations submitted were drawn up in compliance with the specification.

The values determined in the safety verification calculation were confirmed by performing a control calculation.

The data in drawing no. 512 765 comply with the values relevant for the calculation.

4. Comments

The review did not cover verification of the rotor hub/shaft, traction sheave/shaft and key shrink fits, or of the bearing life.

The Inspector

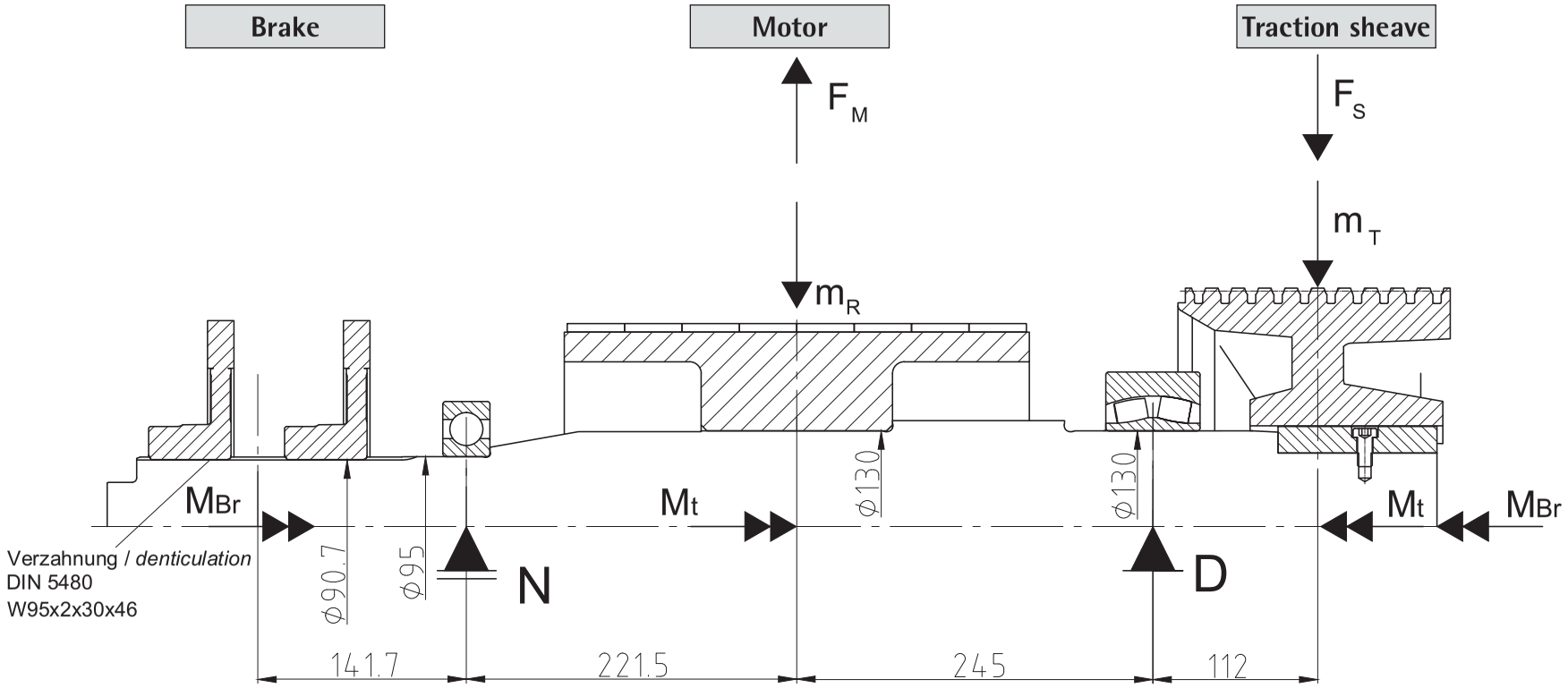
Thoralf Mühren

Thoralf Mührel

TÜV SÜD Industrie Service GmbH
Fördertechnik

Traction sheave shaft (Annex - calculation of the shaft)

Re:
WSG-S3



Werkstoff: Stahl DIN EN 10083-1 - 42CrMo4
Material: steel DIN EN 10083-1 - 42CrMo4

WITTUR Electric Drives GmbH
Offenburger Str. 3
01189 Dresden
Germany
info@wittur-edrives.de
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ZERTIFIKAT ◆ CERTIFICATE ◆ 認証証書 ◆ СЕРТИФИКАТ ◆ CERTIFICADO ◆ CERTIFICAT

Industrie Service

EU TYPE-EXAMINATION CERTIFICATE

According to Annex IV, Part A of 2014/33/EU Directive

Certificate No.:	EU-BD 881
Certification Body of the Notified Body:	TÜV SÜD Industrie Service GmbH Westendstr. 199 80686 Munich - Germany Identification No. 0036
Certificate Holder:	INTORQ GmbH & Co. KG Wülmser Weg 5 31855 Aerzen - Germany
Manufacturer of the Test Sample: (Manufacturer of Serial Production – see Enclosure)	INTORQ GmbH & Co. KG Wülmser Weg 5 31855 Aerzen - Germany
Product:	Braking device acting on the shaft of the traction sheave, as part of the protection device against overspeed for the car moving in upwards direction and braking element against unintended car movement
Type:	BFK455-28
Directive:	2014/33/EU
Reference Standards:	EN 81-20:2014 EN 81-50:2014 EN 81-1:1998+A3:2009
Test Report:	EU-BD 881 of 2016-03-18
Outcome:	The safety component conforms to the essential health and safety requirements of the mentioned Directive as long as the requirements of the annex of this certificate are kept.
Date of Issue:	2016-03-18
Date of Validity:	from 2016-04-20

TÜV SÜD Industrie Service GmbH 00 36 Notified Body

Werner Rau
Certification Body "lifts and cranes"

TÜV®

Annex to the EC Type-Examination Certificate
No. EU-BD 881 of 2016-03-18

Industrie Service

1 Scope of application

1.1 Use as braking device – part of the the protection device against overspeed for the car moving in upwards direction – permissible brake torque and tripping rotary speed

1.1.1 Permissible brake torque when the braking device acts on the shaft of the traction sheave while the car is moving upward

Permissible brake torque (Nm)	Maximum tripping rotary speed of the traction sheave (rpm)
2 x 1200 = 2400	455
2 x 1700 = 3400	
2 x 1800 = 3600	
2 x 2065 = 4130	

1.1.2 Maximum tripping speed of the overspeed governor and maximum rated speed of the lift

The maximum tripping speed of the overspeed governor and the maximum rated speed of the lift must be calculated on the basis of the traction sheave's maximum tripping rotary speed as outlined below taking into account traction sheave diameter and car suspension.

$$v = \frac{D_{TS} \times \pi \times n}{60 \times i}$$

v	=	Tripping (rated) speed (m/s)
D_{TS}	=	Diameter of the traction sheave from rope's center to rope's center (m)
π	=	3,14
n	=	Rotary speed (rpm)
i	=	Ratio of the car suspension

1.2 Use as braking element – part of the protection device against unintended car movement (acting in up and down direction) – permissible brake torque, tripping rotary speed and characteristics

1.2.1 Nominal brake torque and response times with relation to a brand-new brake element

Nominal brake torque* [Nm]	Maximum tripping rotary speed [rpm]	Maximum response times** [ms] with / without overexcitation			Brake control [parallel or serial]	Overexcitation at [x- fold non-release voltage]
		t_{10}	t_{50}	t_{90}		
2 x 1200 = 2400	255	160 / 197	214 / 252	267 / 306	parallel	2-fold
2 x 1200 = 2400	455	189 / 207	290 / 295	390 / 382	serial	1,43-fold
2 x 1700 = 3400	455	61 / 73	123 / 136	184 / 199	parallel	2-fold
2 x 1800 = 3600	455	59 / 70	110 / 122	160 / 174	parallel	2-fold
2 x 2065 = 4130	255	89 / 108	158 / 177	226 / 247	parallel	2-fold

Explanations:

* **Nominal brake torque:** Brake torque assured for installation operation by the safety component manufacturer.

** **Response times:** t_X time difference between the drop of the braking power until establishing X% of the nominal brake torque, t_{50} optionally calculated $t_{50}= (t_{10}+ t_{90})/2$ or value taken from the examination recording

1.2.2 Assigned execution features

Type of powering / deactivation	continuous current / continuous current end
Nominal air gap	0.45 mm
Damping elements	YES

2 Conditions

2.1 Above mentioned safety component represents only a part at the protection device against overspeed for the car moving in upwards direction and unintended car movement. Only in combination with a detecting and triggering component in accordance with the standard (two separate components also possible), which must be subjected to an own type-examination, can the system created fulfil the requirements for a protection device.

2.2 The installer of a lift must create an examination instruction to fulfil the overall concept, add it to the lift documentation and provide any necessary tools or measuring devices, which allow a safe examination (e. g. with closed shaft doors).

2.3 The manufacturer of the drive unit must provide calculation evidence that the connection traction sheave – shaft – brake disc and the shaft itself is sufficiently safe, if the brake disc is not a direct component of the traction sheave (e. g. casted on). The shaft itself has to be statically supported in two points.

The calculation evidence must be enclosed with the technical documentation of the lift.

2.4 The setting of the brake torque has to be secured against unauthorized adjustment (e. g. sealing lacquer).

2.5 The identification drawing no. 5018294 or 5019746 including stamp dated 2016-03-18 shall be included to the EU type-examination for the identification and information of the general construction and operation and distinctness of the approved type.

2.6 The EU type-examination certificate may only be used in combination with the corresponding annex and enclosure (List of authorized manufacturer of the serial production). The enclosure will be updated immediately after any change by the certification holder.

3 Remarks

3.1 In the scope of this type-examination it was found out, that the brake device also functions as a brake for normal operation, is designed as a redundant system and therefore meets the requirements to be used also as a part of the protection device against overspeed for the car moving in upwards direction and as braking element as part of the protection device against unintended car movement.

3.2 Checking whether the requirements as per section 5.9.2.2 of EN 81-20:2014 (D) have been complied with is not part of this type examination.

3.3 Other requirements of the standard, such as reduction of brake moment respectively brake force due to wear or operational caused changes of traction are not part of this type examination.

3.4 This EU type-examination certificate was issued according to the following standards:

- EN 81-1:1998 + A3:2009 (D), Annex F.7 and F.8
- EN 81-20:2014 (D), part 5.6.6.11, 5.6.7.13
- EN 81-50:2014 (D), part 5.7 and 5.8

3.5 A revision of this EU type-examination certificate is inevitable in case of changes or additions of the above mentioned standards or of changes of state of the art.

Enclosure to the EU Type-Examination Certificate
No. EU-BD 881 of 2016-03-18

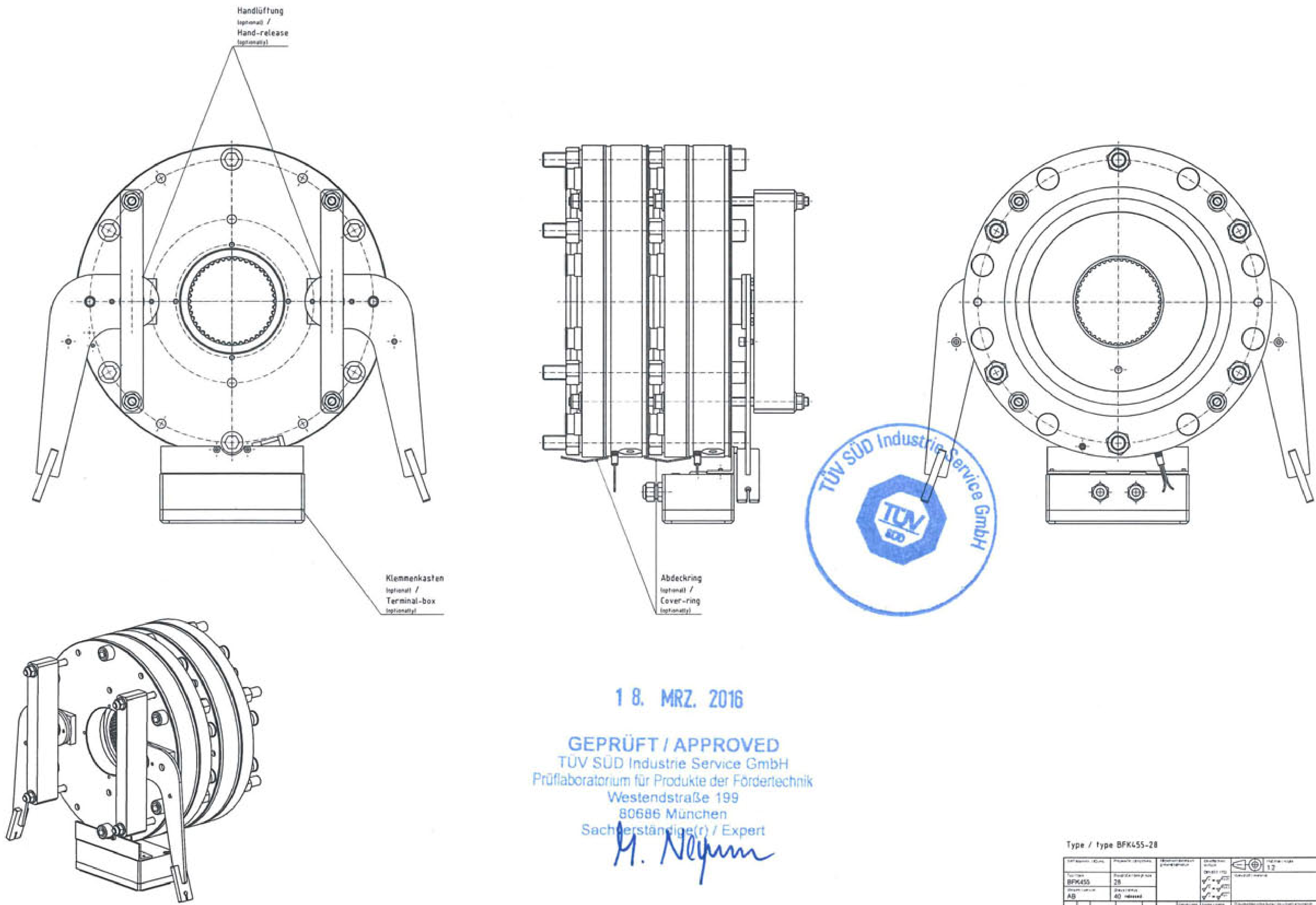
Industrie Service

Authorised Manufacturer of Serial Production – Production Sites (valid from: 2016-03-18):

Company INTORQ GmbH & Co. KG
Address Wülmser Weg 5
31855 Aerzen – Germany

Company INTORQ (Shanghai) Co., Ltd.
Address No. 600, Xin Yuan Nan Road
Building no.6 / Zone B
Nan Hui District, Lingang
201306 Shanghai - P.R. China

- END OF DOCUMENT -



1 8. MRZ. 2016

GEPRÜFT / APPROVED
TÜV SÜD Industrie Service GmbH
Prüflaboratorium für Produkte der Fördertechnik
Westendstraße 199
80686 München
Sachverständige(r) / Expert

TÜV SÜD Industrie Service GmbH

Type / type BFK455-28

Typ / type	BFK455
Baugröße	28
Status	40 released
Version	AB

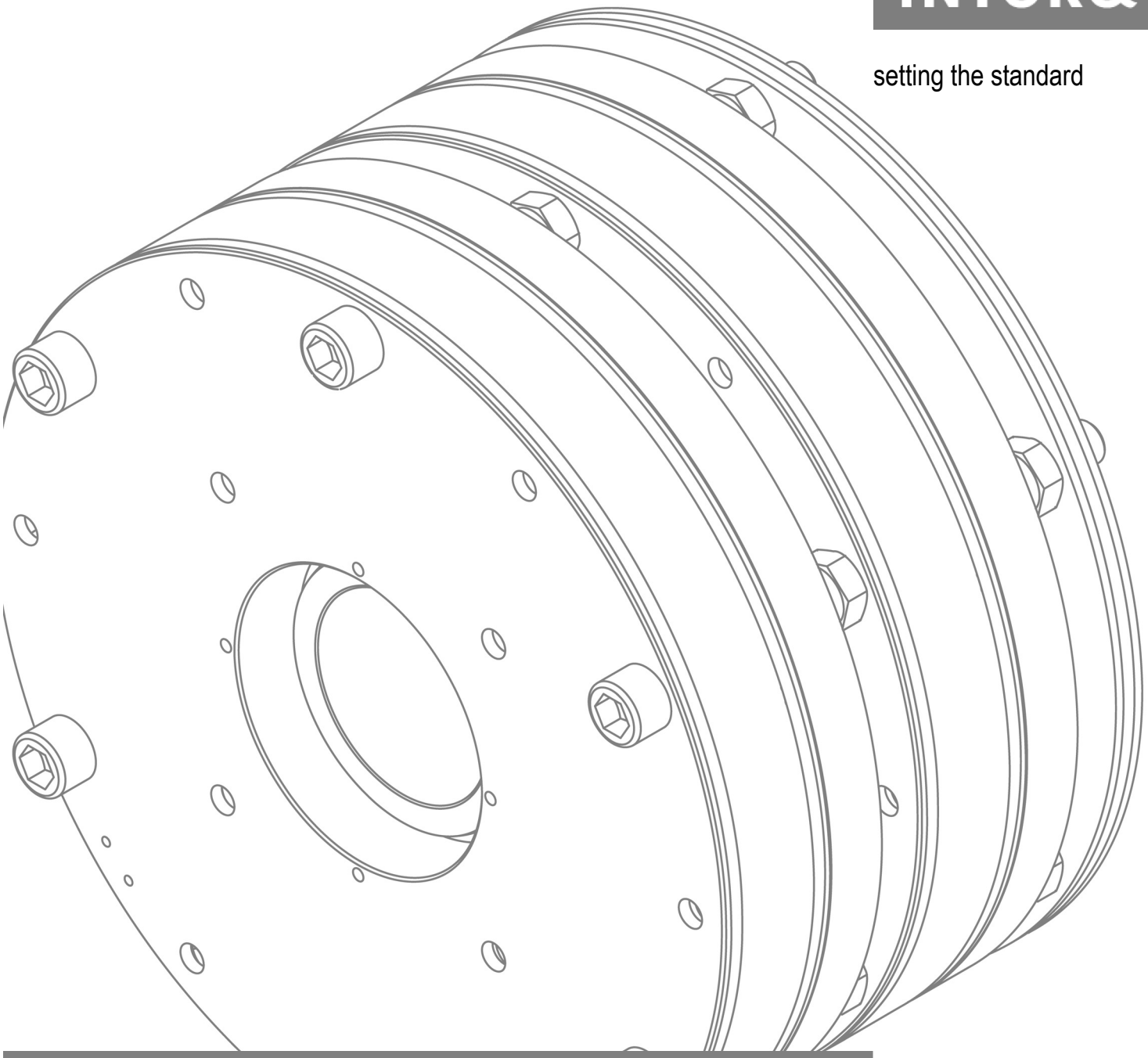
Federkraftbremse
Spring-op-brake

INTORQ

5019746

INTORQ

setting the standard



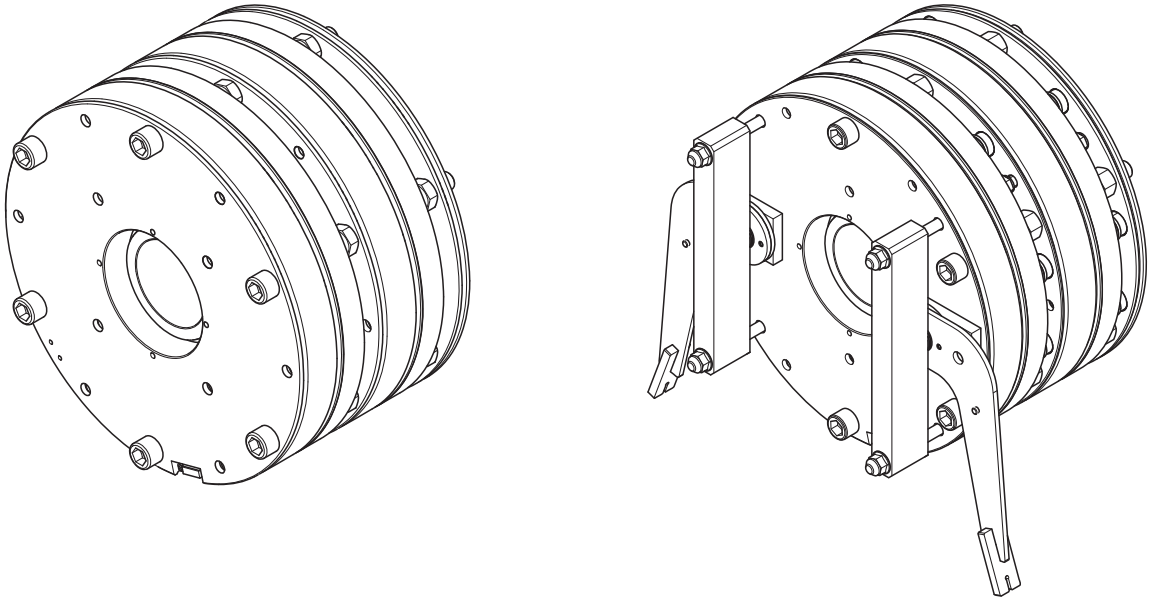
INTORQ BFK455-28

Electromagnetically Released Spring-Applied Brake

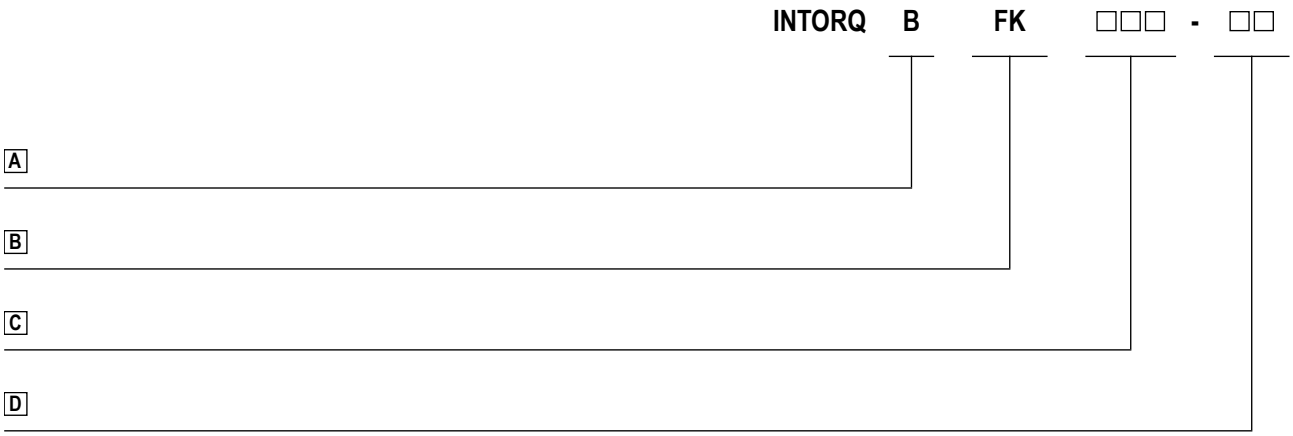
Translation of the Original Operating Instructions

www.intorq.com

This documentation applies to the:



Product key



Legend for the product key

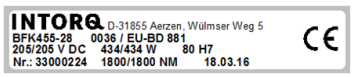
INTORQ BFK455

A	Product group	Brakes
B	Product type	Spring-applied brake
C	Type	455
D	Size	28

Not coded: Supply voltage, hub bore, options

Identification

Packaging label			Example
Manufacturer		Type number	
Type (see product key)		Bar code	
Designation		Qty. per box	
Rated/holding voltage	Rated torque		
Rated/holding power	Hub diameter	Packaging date	
Model identification		CE mark	
Note			

Name plate			Example
Manufacturer		CE mark	
Type (see product key)	EC-type examination identification		
Rated/holding voltage	Rated/holding power	Hub diameter	
Type number	Rated torque	Date of manufacture	

Label product traceability	Example
Type (see product key)	
Type number	
Serial number	
Manufacturer	

Notes

The brake is marked with the following labels, which have to be observed:

for the holding voltage	for setting the air gap
Lüftspannung Release voltage: 205 V DC Haltespannung: Holding voltage: 103 V DC Nur mit BEG-561-255-130 betreiben! Only use with BEG-561-255-130! Nr./No. 33000224	DE: Den nach der Erstinstallation eingestellten Luftspalt nicht verstellen! EN: Do not re-adjust the air-gap after the first installation! FR: Ne plus regler l'entrefer après la première installation!

Document history

Material number	Version			Description
33000756	1.0	05/2011	TD09	First edition
33000756	1.1	05/2012	TD09	Change in telephone and fax number Front and back page new Addition of the EC type test number Supplemented by chapter “Project planning notes” Supplemented by chapter “Wear of spring-applied brakes”
33002468	2.0	03/2013	TD09	Amended by new chapter on manual release installation Tables of dimensions and switching times were changed Supplement for spare parts list and the spare parts order
33002468	3.0	04/2013	TD09	Limitation of the adjustability Note on the suppressor circuit added to the “Electrical installation” chapter Values for characteristic torque 2x2065 Nm added to “Dimensions” table
33002468	4.0	01/2015	SC	Restructured FM
33002468	4.1	11/2015	SC	Changing the model identification test numbers
33002468	5.0	04/2016	SC	Updates Changing the model identification test numbers

Contents

1 Preface and general information

1.1 About these Operating Instructions

- These Operating Instructions will help you to work safely with the spring-applied brake with electromagnetic release. They contain safety instructions that must be followed.
- All persons working on or with the electromagnetically released spring-applied brakes must have the Operating Instructions available and observe the information and notes relevant for them.
- The Operating Instructions must always be in a complete and perfectly readable condition.

1.2 Terminology used

Term	In the following text used for
Spring-applied brake	Electromagnetically Released Spring-Applied Brake
Drive system	Drive systems with spring-applied brakes and other drive components

1.3 Conventions in use

This document uses the following styles to distinguish between different types of information:

Spelling of numbers	Decimal separator	Point	The decimal point is always used. For example: 1234.56
Symbols	Page reference	🕮	Reference to another page with additional information For example: 🕮 16 = refer to page 16
	Wildcard	□	Wildcard for options, selections For example: BFK458-□ □ = BFK458-10
	Note		Important notice about ensuring smooth operations or other key information.

1.4 Abbreviations used

Letter symbol	Unit	Designation
F_R	N	Rated frictional force
I	A	Current
I_H	A	Holding current, at 20 °C and holding voltage
I_L	A	Release current, at 20 °C and release voltage
I_N	A	Rated current, at 20 °C and rated voltage
M_A	Nm	Tightening torque of fixing screws
M_{dyn}	Nm	Braking torque at a constant speed of rotation
M_K	Nm	Rated torque of the brake, rated value at a relative speed of rotation of 100 rpm
n_{max}	rpm	Maximum occurring speed of rotation during the slipping time t_3
P_H	W	Coil power during holding, after voltage change-over and 20 °C
P_L	W	Coil power during release, before voltage change-over and 20 °C
P_N	W	Rated coil power, at rated voltage and 20 °C
Q	J	Quantity of heat/energy
Q_E	J	Maximally permissible friction energy for one-time switching, thermal parameter of the brake
Q_R	J	Braking energy, friction energy
Q_{Smax}	J	Maximally permissible friction energy for cyclic switching, depending on the switching frequency
R_N	Ohms	Rated coil resistance at 20 °C
S_h	1/h	Switching frequency: the number of switching operations evenly spread over the time unit
S_{hue}	1/h	Transition switching frequency, thermal parameter of the brake
S_{hmax}	1/h	Maximum permissible switching frequency, depending on the friction energy per switching operation
s_L	mm	Air gap: the lift of the armature plate while the brake is switched
s_{LN}	mm	Rated air gap
s_{Lmin}	mm	Minimum air gap
s_{Lmax}	mm	Maximum air gap
t_1	ms	Engagement time, sum of the delay time and braking torque - rise time $t_1 = t_{11} + t_{12}$
t_2	ms	Disengagement time, time from switching the stator until reaching 0.1 M_{dyn}
t_3	ms	Slipping time, operation time of the brake (according to t_{11}) until standstill

Letter symbol	Unit	Designation
t_{11}	ms	Delay during engagement (time from switching off the supply voltage to the beginning of the torque rise)
t_{12}	ms	Rise time of the braking torque, time from the start of torque rise until reaching the braking torque
t_{ue}	s	Over-excitation time
U	V	Voltage
U_H	V DC	Holding voltage, after voltage change-over
U_L	V DC	Release voltage, before voltage change-over
U_N	V DC	Rated coil voltage; in the case of brakes requiring a voltage change-over, U_N equals U_L

1.5 Safety instructions and notices

The following icons and signal words are used in this document to indicate dangers and important safety information:

Safety instructions

Structure of safety instructions:

	SIGNAL WORD
 	**Icon** Indicates the type of danger **Signal word** Characterizes the type and severity of danger **Note** Describes the danger **Possible consequences** ▮ List of possible consequences if the safety instructions are disregarded **Protective measure** ▮ List of protective measures to avoid the danger

Danger level

	**DANGER**
	DANGER indicates a hazardous situation which, if not avoided, will result in death or serious injury.

	**WARNING**
	WARNING indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

	**CAUTION**
	CAUTION indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

	**NOTICE**
	Notice about a harmful situation with possible consequences: the product itself or surrounding objects could be damaged.

1.6 Scope of delivery

After receipt of the delivery, check immediately whether the items delivered match the accompanying papers. INTORQ does not accept any liability for deficiencies claimed subsequently.

- Claim visible transport damage immediately to the deliverer.
- Claim visible deficiencies or incomplete deliveries immediately to INTORQ GmbH & Co. KG.

1.7 Disposal

The spring-applied brake consists of different types of material.

- Recycle the metal and plastic parts.
- Ensure professional disposal of assembled circuit boards according to the applicable environmental regulations.

1.8 Drive systems

Labelling

Drive systems and components are unambiguously designated by the indications on the nameplate.

Manufacturer: INTORQ GmbH & Co. KG, Wülmser Weg 5, D-31855 Aerzen, Germany

- The spring-applied INTORQ brake is also delivered in single modules which can then be put together by the customer according to their requirements. The specifications – particularly the packaging label, nameplate and type code – apply to a complete stator.
- The labelling is not included when modules are delivered individually.

1.9 Legal regulations

Liability

- The information, data and notes in these Operating Instructions met the state of the art at the time of printing. Claims referring to drive systems which have already been supplied cannot be derived from this information, illustrations and descriptions.
- We do not accept any liability for damage and operating interference caused by:
  - inappropriate use
  - unauthorised modifications to the product
  - improper work on or with the drive system
  - operating errors
  - disregarding the documentation

Warranty

- Terms of warranty: Refer to the terms of sale and delivery for INTORQ GmbH & Co. KG.
- Warranty claims must be made to INTORQ immediately after the defects or faults are detected.
- The warranty is void in all cases when liability claims cannot be made.

2 Safety instructions

2.1 General safety instructions

- INTORQ components:
  - ... must only be used as directed.
  - ... must not be commissioned if they are noticeably damaged.
  - ... must not be technically modified.
  - ... must not be commissioned if they are incompletely mounted or connected.
  - ... must not be operated without the required covers.
  - ... can include live (current-carrying) as well as moving or rotary parts during operation according to their degree of protection. Surfaces may be hot.
- For INTORQ components:
  - ... the documentation must always be kept at the installation site.
  - ... only permitted accessories are allowed to be used.
  - ... only original spare parts of the manufacturer are allowed to be used.
- Follow all specifications and information found in the corresponding enclosed documentation.
  These must be followed to maintain safe, trouble-free operations and to achieve the specified product characteristics.
- Only qualified, skilled personnel are permitted to work on and with INTORQ components.
  According to IEC 60364 or CENELEC HD 384, qualified, skilled personnel are persons:
  - ... who are familiar with the installation, mounting, commissioning, and operation of the product.
  - ... who have the qualifications necessary for their occupation.
  - ... who know and apply all regulations for the prevention of accidents, directives, and laws relevant on site.
- Risk of burns!
  - Surfaces may be hot during operation! Provide for protection against accidental contact.
- Risk of injury due to a rotating shaft!
  - Wait until the motor is at standstill before you start working on the motor.
- The friction lining and the friction surfaces must never contact oil or grease since even small amounts reduce the braking torque considerably.
- The brake is designed for operation under the environmental conditions that apply to IP54 protection. Because of the numerous possibilities of using the brake, it is still necessary to check the functionality of all mechanical components under the corresponding operating conditions.

2.2 Application as directed

- INTORQ components:
  - ... are intended for use in machinery and systems.
  - ... must only be used for the purposes ordered and confirmed.
  - ... must only be operated under the ambient conditions prescribed in these Operating Instructions.
  - ... must not be operated beyond their corresponding power limits.

Any other use or excessive usage is considered improper!

Usage conditions for the INTORQ spring-applied brake

- Humidity: no restrictions
  - In the event of condensation or moisture formation: provide for appropriate ventilation to ensure that all components will dry quickly.
- Ambient temperature:
  -5 °C to +40 °C
- At high humidity and low temperature:
  - Take measures to protect the armature plate and rotor from freezing.
- Protect the electrical connections against any contact or touching.

3 Technical specifications

3.1 Product description

Versions

Basic module

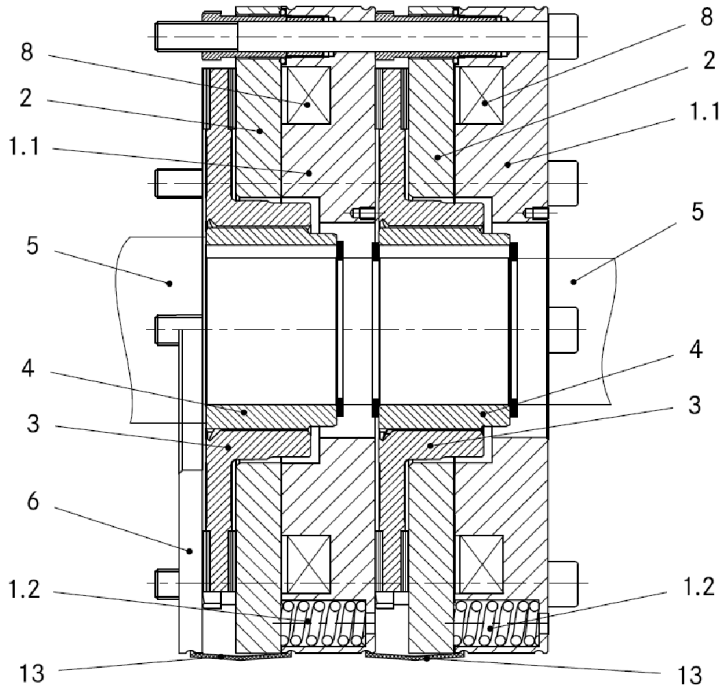


Fig. 1 Design of a BFK455 spring-applied brake

1.1	Stator	3	Complete rotor	6	Flange
1.2	Pressure springs	4	Hub	8	Coil
2	Armature plate	5	Shaft	13	Cover ring

3.1.1 General information

The spring-applied brake is designed for converting mechanical work and kinetic energy into heat energy. Due to the static braking torque, loads can be held at standstill. Emergency braking is possible at high speed of rotation. The wear increases as the switching energy increases (operating speeds 📖 17).

The BFK455 spring-applied brake is a double-disk brake with four friction surfaces. The braking torque is applied through two separate braking circuits, both electrical and mechanical, via several compression springs (1.2) in the form of generated friction. The brake circuits are released electromagnetically. Due to its division into two brake circuits, the brake is particularly suitable for applications such as lift systems and stage/platform technology. The brake can be selected based on the rated torque for one brake circuit. The second brake circuit meets the requirement for redundancy.

The division of the brake circuits is done using two separate armature disks (2) with their corresponding compression springs (1.2) and electromagnetic coils (8). Each brake circuit can be operated individually due to the separate supply lines for each stator and armature plate (📖 36).

Each brake circuit has a micro-switch which monitors the switching state of the spring-applied brake. Using the associated switching device, the supply voltage (AC voltage) is rectified and, when the brake is released, lowered after a short period of time. This results in a reduction of the average electrical power of the brake.

The stator (1.1) is supplied in heat class F. The limit temperature of the coils (8) is 155 °C. The BFK455 spring-applied brake is designed for a maximum operating time of 60 % with holding current reduction.

Certificate

Type	Characteristic torque [Nm]	EC-type examination certificate		
		Directive 95/16/EC	UCM	Directive 2014/33 EU
BFK455-28	2 x 1200	ABV 881/2	ESV 881/2	EU-BD 881
	2 x 1700, 2 x 1800			
	2 x 2065			

3.1.2 Brake

During the braking procedure, the pressure springs (1.2) use the armature plate (2) to press the rotor (3) (which can be shifted axially on the hub (4)) against the friction surface. The asbestos-free friction linings ensure high braking torque and low wear. The braking torque is transmitted between the hub (4) and the rotor (3) via gear teeth.

3.1.3 Brake release

When the brakes are applied, an air gap "s_L" is present between the stator (1.1) and the armature plate (2). To release the brake, the coil of the stator (1.1) is energised with the DC voltage provided. The resulting magnetic flux works against the spring force to draw the armature plate (2) to the stator (1.1). This releases the rotor (3) from the spring force and allows it to rotate freely

3.1.4 Release monitoring

The spring-activated brake has a micro-switch for each braking circuit to monitor the switching state. When the brake is released, the micro-switches toggle. This means that it is possible to prevent the drive from being operated when the brake is closed. The micro-switches can be connected as both normally open and also normally closed.

To check that the micro-switches function correctly, we recommend testing the switching status (refer to table 6) in both the released and applied braking states.

3.1.5 Encapsulated design (optional)

This design not only avoids the penetration of spray water and dust, but also the spreading of abrasion particles outside the brake. This is achieved by:

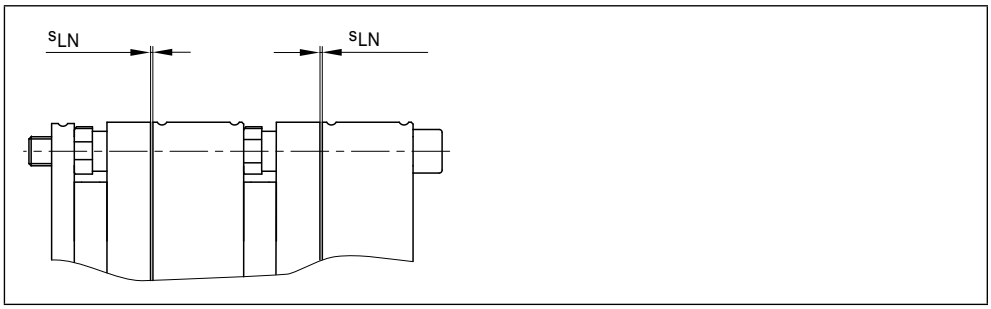
- a cover seal over the armature plate and rotor.

3.1.6 Project planning notes

- The brakes are dimensioned in such a way that the given rated torques are reached safely after a short run-in process.
- However, since the organic friction linings used do not all have identical properties and because environmental conditions can vary, deviations from the specified braking torques are possible. These must be taken into account in the form of appropriate dimensioning tolerances. Increased breakaway torque is common in particular after long downtimes in humid environments where temperatures vary.
- If the brake is used as a pure holding brake without dynamic load, the friction lining must be reactivated regularly.

3.2 Rated data

3.2.1 Dimensions



Type	Rated torque	Air gap		Permitted wear	Rotor thickness		Weight complete stator
	[NM]	$s_{LN}{}^{+0.05}$ [mm]	$s_{Lmax.}$ [mm]	[mm]	min. [mm]	max. [mm]	m [kg]
BFK455-28	2 x 1100	0.4	0.7	0.3	17.7	18	46
	2 x 1200						
	2 x 1700						
	2 x 1800						
	2 x 2065		0.6	0.2	17.8		

Type	Pitch circle		Fixing screws DIN 912		Minimum thread depth		Tightening torque	
			without flange	with flange	without flange	with flange	without flange	with flange
	∅ [mm]	Thread	[mm]	[mm]	[mm]	[mm]	M_A [Nm]	M_A [Nm]
BFK455-28	314	M16	6 x M16x210	6 x M16x220	25	22.5	206	265

Tab. 1: Dimensions of the BFK455-28

CAUTION

- The minimum thread depth of the end shield must be maintained! 🕮 Tab. 1.
- If the required thread depth is not maintained, the fixing screws may run onto the root. This has the effect that the required pre-load force is no longer established – the brake is no longer securely fastened!

3.2.2 Electrical data

Type	Voltage		Power		Coil resistance	Current
	Release ±10%	Holding ±10%	Brake release	Holding		
	U_L [V DC]	U_H [V DC]	P_N [W]	P_H [W]	R_N ± 5% [Ω]	I_L [A]
BFK455-28	103	52	2 x 434	2 x 108.5	2 x 24.5	2 x 4.21
	205	103			2 x 97	2 x 2.12
	360	180			2 x 298.6	2 x 1.21

Tab. 2: Coil power ratings of the BFK455-28

3.3 Rated data (design data)

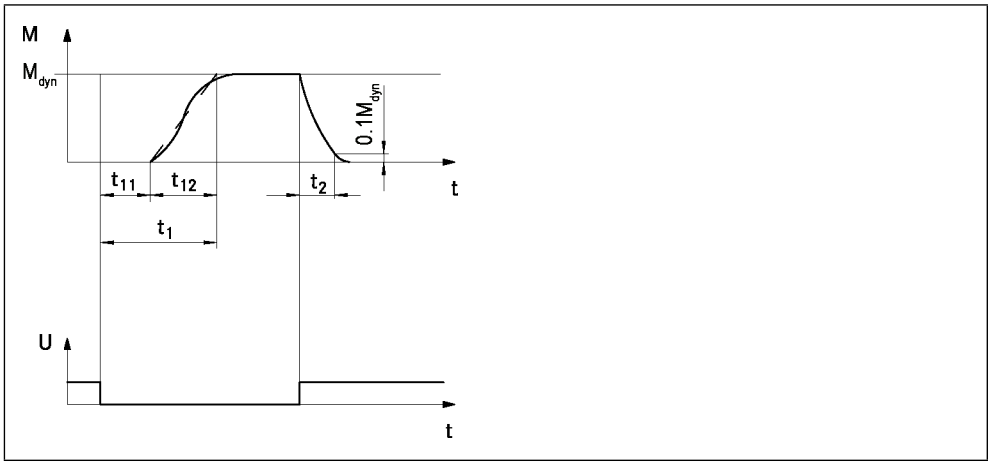


Fig. 2 Operating/switching times of the spring-applied brakes

- t_1 Engagement time
- t_2 Disengagement time (up to M = 0.1 M_{dyn})
- M_{dyn} Braking torque at a constant speed of rotation
- t_{11} Reaction delay of engagement
- t_{12} Rise time of the braking torque
- U Voltage

Type	Rated torque[1]	Max. permitted switching energy	Transitional switching frequency	Switching times [ms][2] at s_{LN} and 0.7 I_N				Max. speed[3]
				Engaging DC side[4]			Disengaging	
	M_K	Q_E	S_{hue}	t_{11}	t_{12}	t_1	t_2	$n_{max.}$
	[Nm]	[J]	[1/h]					[rpm]
BFK455-28	2 x 1100	360000	7	80	220	300	370	455
	2 x 1200			60		280		255
	2 x 1700			20		240	480	455
	2 x 1800							
	2 x 2065			30		250	460	255

Tab. 3: Switching energy - switching frequency - switching times

1) **Minimum brake torque with run-in friction components at Δn=100 rpm**

2) **Typical values**

3) **Max. speed according to EC-type examination certificate (for higher speeds, consultation with the manufacturer is required)**

4) **Measured with induced voltage limitation of -800 V DC**

Engagement time

The transition from a brake-torque-free state to a holding-braking torque is not free of time lags.

For emergency braking, short engagement times for the brake are absolutely essential. The DC switching in connection with a suitable spark suppressor must therefore be provided.

- The engagement times apply for **DC switching** with a spark suppressor.
  - Spark suppressors are available for the rated voltages.
  - Connect the spark suppressors in parallel to the contact. If this switching is not admissible for safety reasons (e.g. with hoists and lifts), the spark suppressor can also be connected in parallel to the brake coil.
  - Circuit proposals: 📖 36
- If the drive system is operated with a frequency inverter so that the brake will not be de-energised before the motor is at standstill, AC switching is also possible (not applicable to emergency braking).

NOTICE

If the brake is using AC-side switching, the engagement times increase approximately by a factor of 5 (refer to 📖 35 for connection).

Disengagement time

The disengagement time is the same for DC and AC switching. The specified disengagement times always refer to control using over-excitation.

3.4 Switching energy / switching frequency

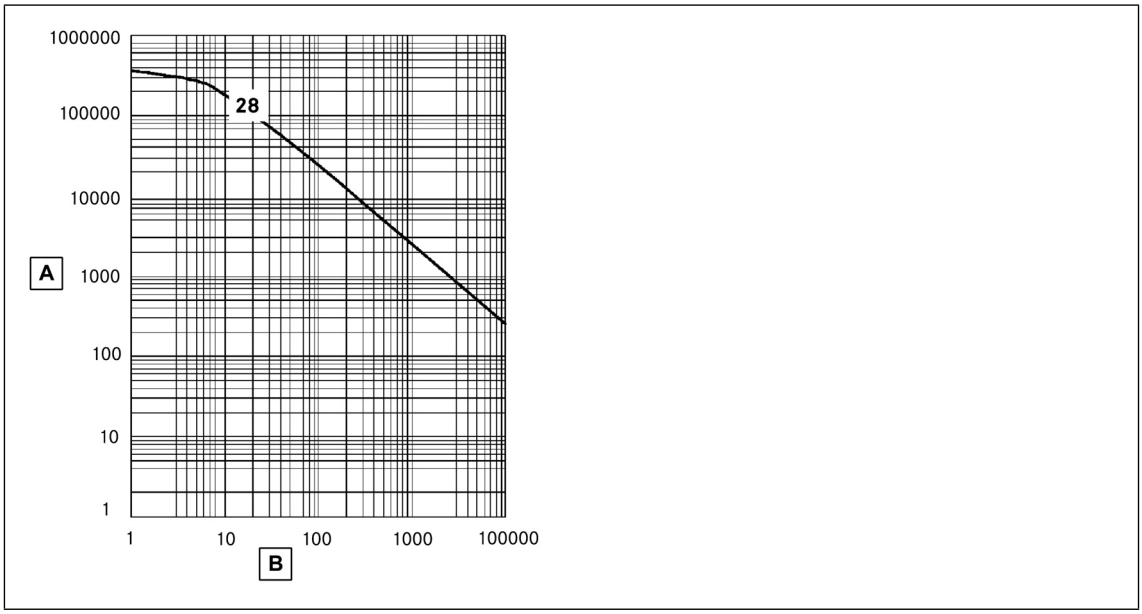


Fig. 3 Switching energy as a function of the switching frequency

A Switching energy Q [J]

B Switching frequency S_h [1/h]

$$S_{hmax} = \frac{-S_{hue}}{\ln\left(1 - \frac{Q_R}{Q_E}\right)}$$

$$Q_{smax} = Q_E\left(1 - e^{\frac{-S_{hue}}{S_h}}\right)$$

The permissible switching frequency S_{hmax} depends on the amount of heat Q_R (refer to Figure 3). At a preset switching frequency S_h, the permissible amount of heat is Q_{Smax}.

With high speeds of rotation and switching energy, the wear increases strongly, because very high temperatures occur at the friction surfaces for a short time.

3.5 Emissions

Electromagnetic compatibility

NOTICE
The user must ensure compliance with EMC Directive 2014/30/EU using appropriate controls and switching devices.

If an INTORQ rectifier is used for the DC switching of the spring-applied brake: If the switching frequency exceeds five switching operations per minute, the use of a mains filter is required.

If the spring-applied brake uses a rectifier from another manufacturer for the switching, it may become necessary to connect a spark suppressor in parallel with the AC voltage. Spark suppressors are available on request, depending on the coil voltage.

Heat

Since the brake converts kinetic energy as well as mechanical and electrical energy into heat, the surface temperature varies considerably, depending on the operating conditions and possible heat dissipation. Under unfavourable conditions, the surface temperature can reach 130 °C.

Noise

The switching noise during engagement and disengagement varies depending on the air gap, braking torque and brake size.

Depending on the natural oscillation after installation, operating conditions and state of the friction surfaces, the brake may squeak during braking.

Miscellaneous

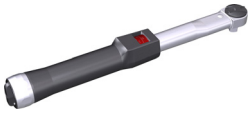
The abrasion of the friction parts produces dust.

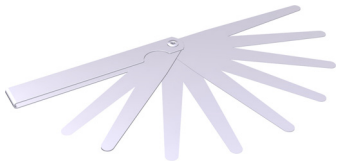
4 Mechanical installation

4.1 Important notes

	NOTICE
	The toothed hub and screws must not be lubricated with grease or oil.

4.2 Necessary tools

Type	**Torque wrench Bit for hexagon socket screws**		**Open-jawed spanner**
			
	Measuring range [Nm]	**Wrench width [mm]**	**Adjustment tubes - wrench size [mm]**
BFK455-28	40 - 40	14	24

Multi-meter	**Caliper gauge**	**Feeler gauge**
		

4.3 Assembly

4.3.1 Important notes

Brake size	Minimum requirements: Use as counter friction surface				
	Material[1)]	Evenness [mm]	Axial run-out [mm]	Roughness	Miscellaneous
28	S235 JR C15 EN-GJL-250	< 0.1	0.1	Rz10	▮ Threaded holes with minimum thread depth 📖 16 ▮ Free of grease and oil

Tab. 4: Counter friction face design of the end shield

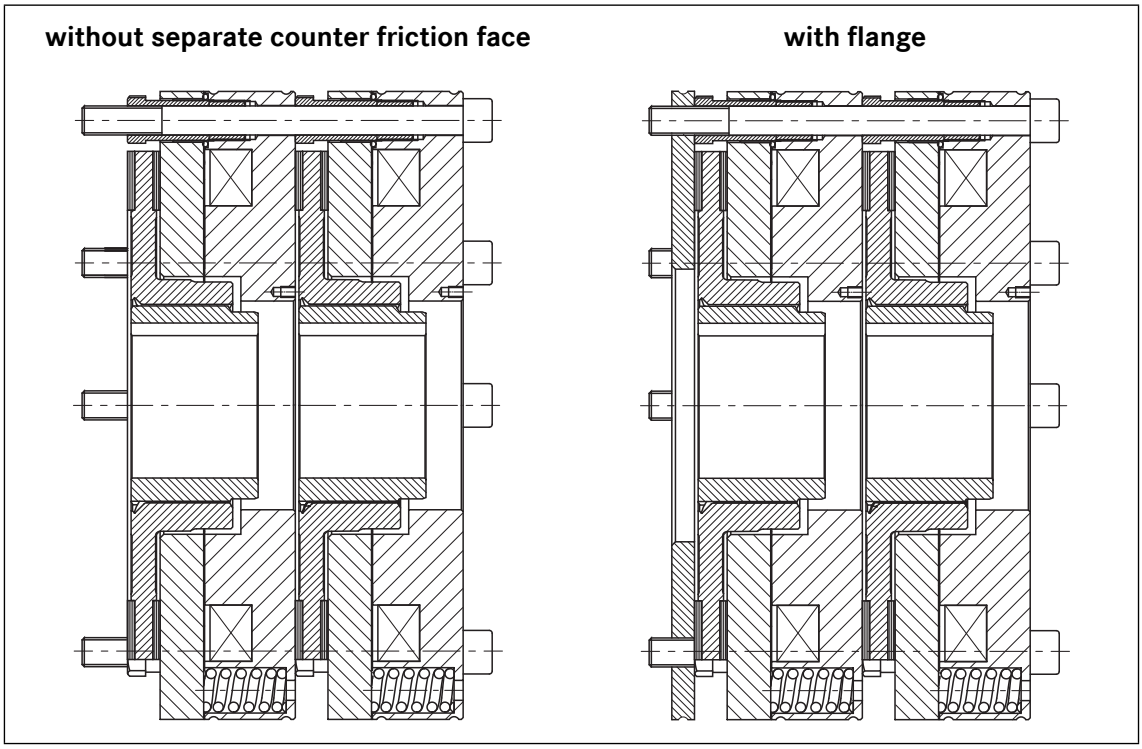
1) **For other materials, please consult with INTORQ.**

The diameter of the shaft shoulder must not be greater than the tooth root diameter of the hub.

4.3.2 Preparation

1. Unpack the spring-applied brake.
2. Check for completeness.
3. Check the nameplate data (especially the rated voltage).

4.3.3 Overview



4.4 Installation

	NOTICE
	The toothed hub and screws must not be lubricated with grease or oil.

NOTICE

When you have ordered a version with flange, attach the hub first (📖 23), then continue with the “Assembly of the counter friction faces”.

4.4.1 Brake assembly

Mounting the first hub onto the shaft

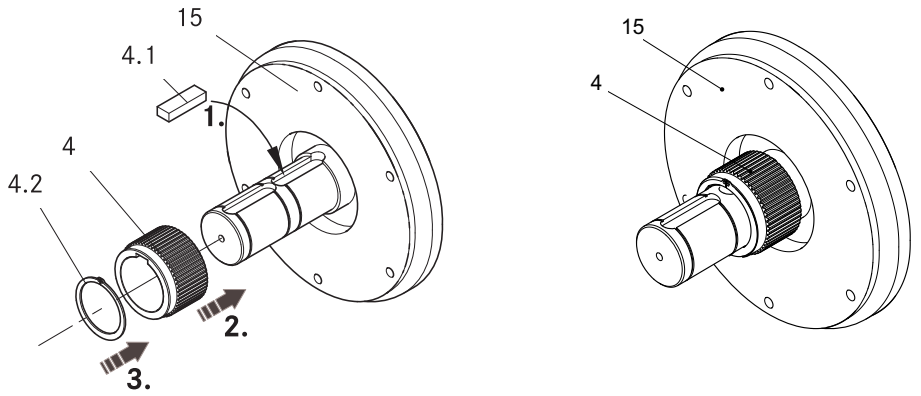


Fig. 4

4 Hub 4.1 Key 15 End shield

1. Insert the key (4.1) into the shaft.
2. Press the first hub (4) onto the shaft.
3. Secure the hub (4) against axial displacement (for example, by using a circlip (4.2)).

	NOTICE
	For reverse operations, we recommend also glueing the hub to the shaft.

Assembly of the counter friction faces

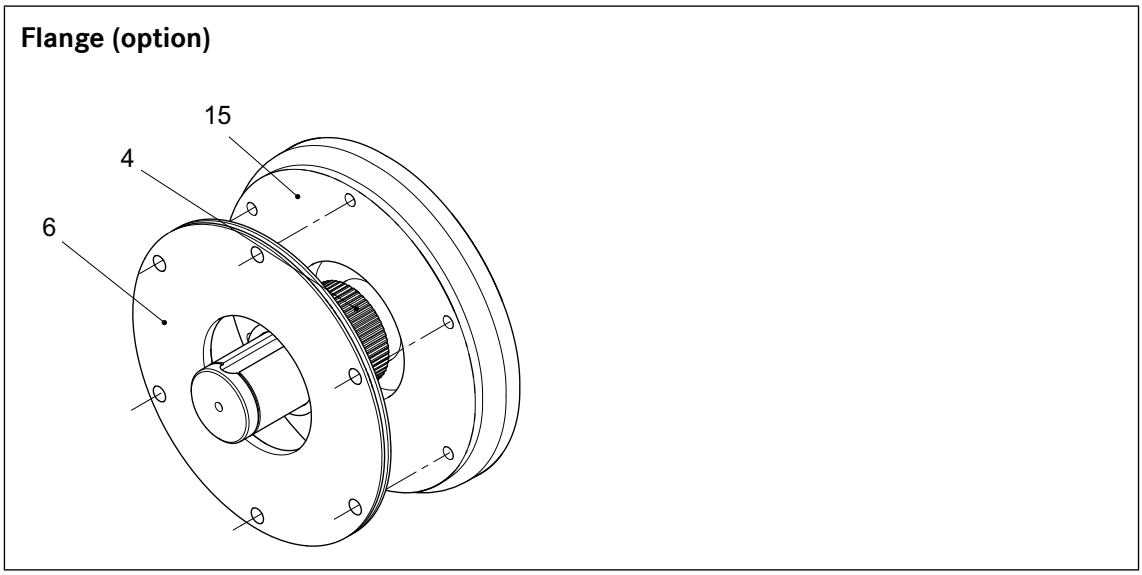


Fig. 5 Assembly of the flange

4 Hub
6 Flange
15 End shield

4. Hold the flange (6) to the end shield (15).
5. Align the through holes in the flange to the threads of the fastening bore holes.

In the following sections, only assembly for the version with flange will be described.

Assembly of the first rotor

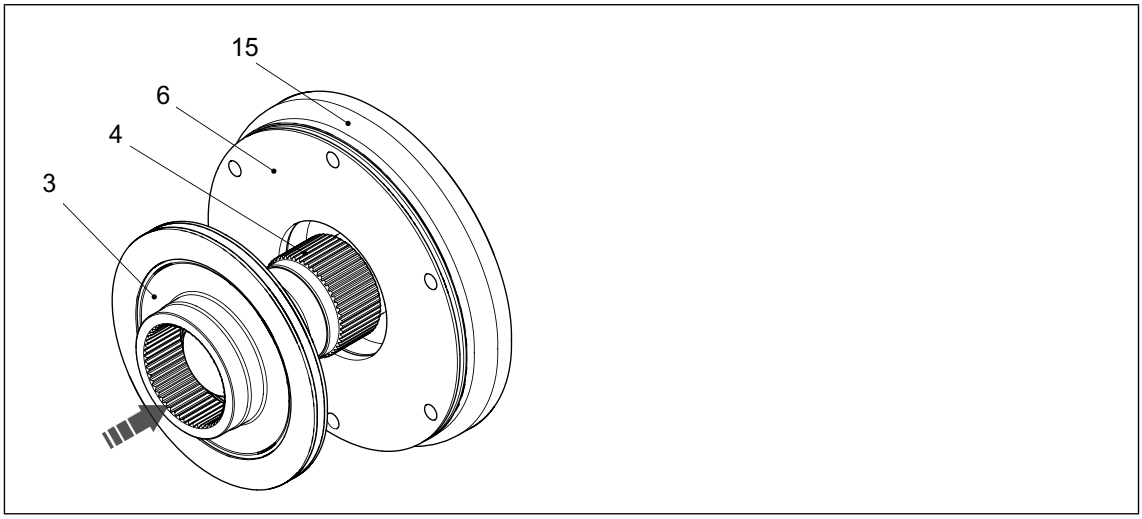


Fig. 6 Mounting of the rotor

3 Rotor
4 Hub
6 Flange
15 End shield

6. Push the rotor (3) onto the hub (4) and check whether it can be moved by hand.

	NOTICE
	Only in the case of rotors with mounting paste on their gear teeth: ▮ Remove cover films from both front ends of the rotor. ▮ Protect friction surfaces against contact with mounting paste! ▮ After the mounting, excessive mounting paste must be removed properly!

Installation of the second hub onto the shaft

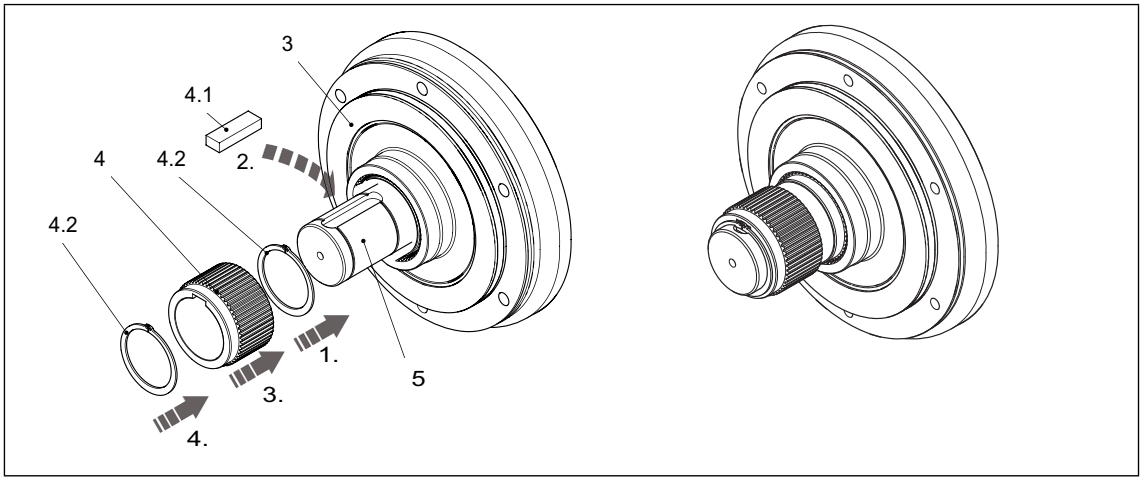


Fig. 7 Mounting of the second hub

4	Hub	3	Complete rotor	4.2	Circlip
5	Shaft	4.1	Key		

7. Insert second key (4.1) into the shaft (5) if required.
8. Press second hub (4) onto the shaft (5).
9. Secure hub (4) against axial displacement, e.g. by using a circlip (4.2).

Assembly of the first stator

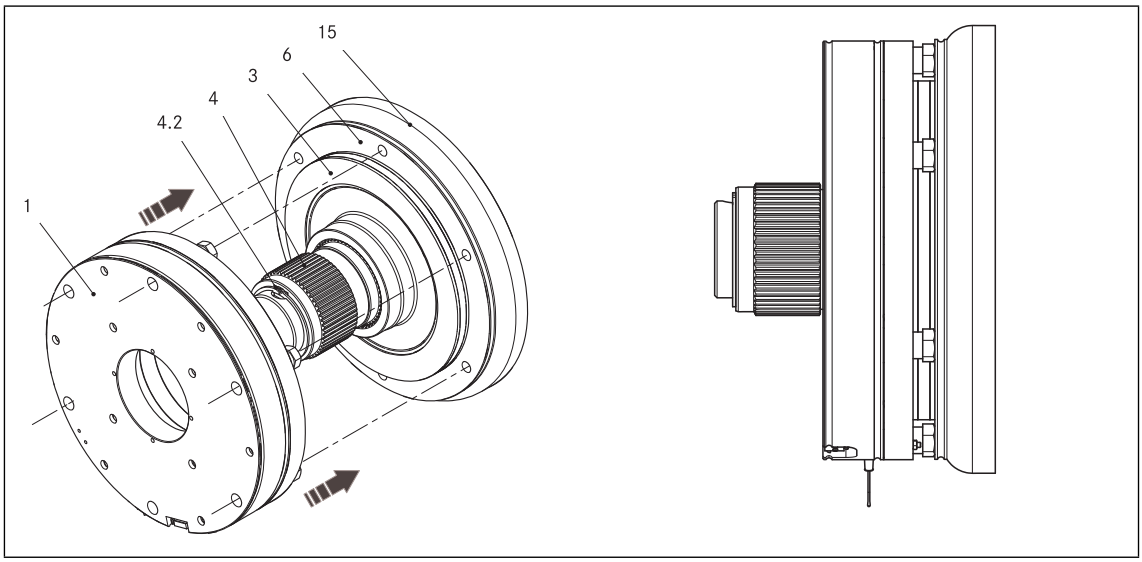


Fig. 8 **Assembly of the stator**

1	Stator, complete	4	Hub	6	Flange
3	Shaft	4.2	Circlip	15	End shield

10. Push the complete stator onto the shaft.
11. Align the through holes in the complete stator (1) to the threads of the fastening bore holes.

Assembly of the second rotor

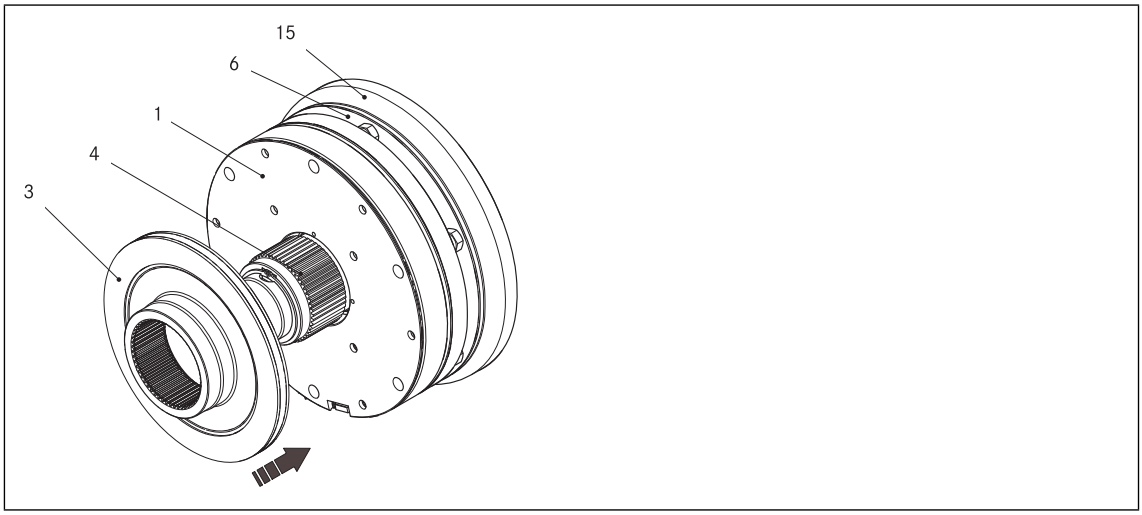


Fig. 9 **Mounting of the rotor**

1	Stator, complete	4	Hub	15	End shield
3	Complete rotor	6	Flange		

12. Push the complete rotor (3) onto the hub (4) and check whether it can be moved by hand.

	NOTICE
	Only in the case of rotors with mounting paste on their gear teeth: ▮ Remove cover films from both front ends of the rotor. ▮ Protect friction surfaces against contact with mounting paste! ▮ After the mounting, excessive mounting paste must be removed properly!

NOTICE
If a manual release is to be installed, the procedure described in section 4.5.2 (Step 2) must be carried out **now**!

Assembly of the second stator

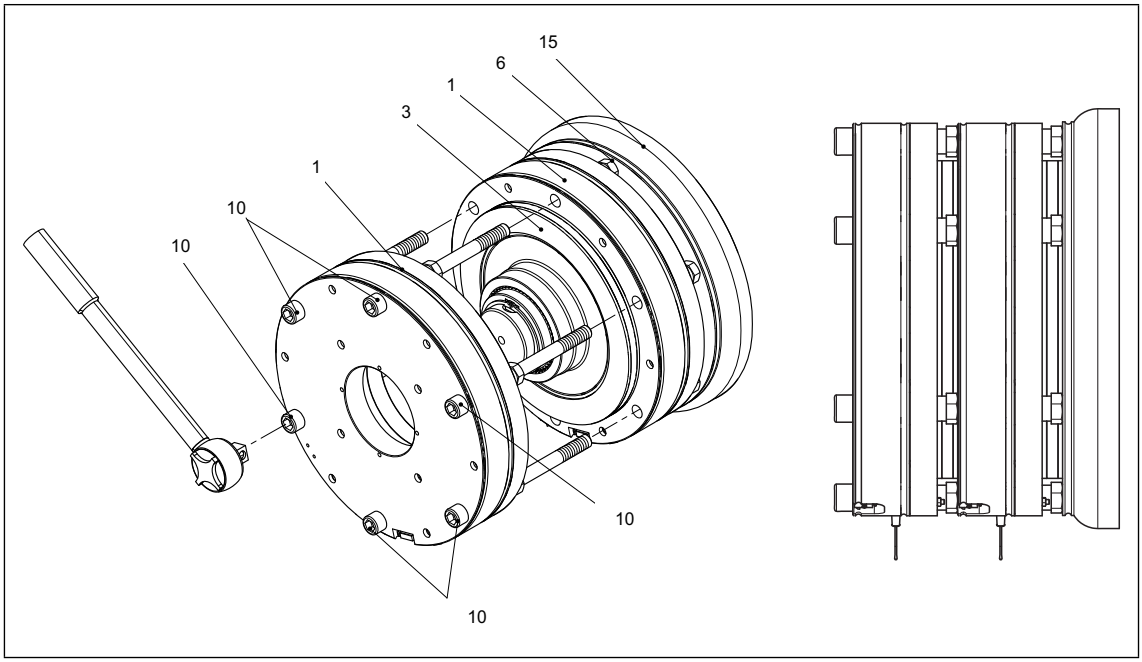


Fig. 10 Assembly of the stator

1	Stator, complete	6	Flange	15	End shield
3	Complete rotor	10	Fixing screws		

13. Push the complete stator onto the shaft.
14. Align the through holes in the complete stator (1) to the threads of the fastening bore holes in the first stator.
15. Evenly tighten the brake with the six socket head cap screws (10) included in the scope of supply in several runs using a torque key.
16. Establish the electrical connection and energize the brake (📖 35).
17. Use a torque key to re-tighten the supplied fixing screws (10) with the required tightening torque (📖 16).
18. Switch off the power.

4.4.2 Check the air gap

DANGER

Danger: rotating parts!
Switch off the voltage. The brake must be free of residual torque.

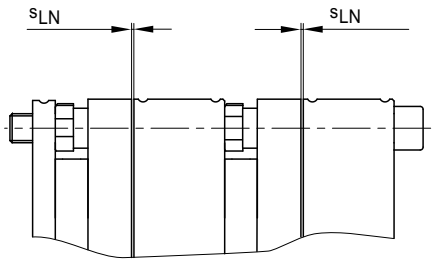


Fig. 11 Check the air gap

1. Check the air gap near the screws (10) by means of a feeler gauge. Compare the measured values to the values for "s_{LN}" in the table (16).

NOTICE
Do not insert feeler gauge more than 10 mm between armature plate (2) and stator (1.1)!

If the measured value "s_L" is outside the tolerance of "s_{LN}", set the dimension:

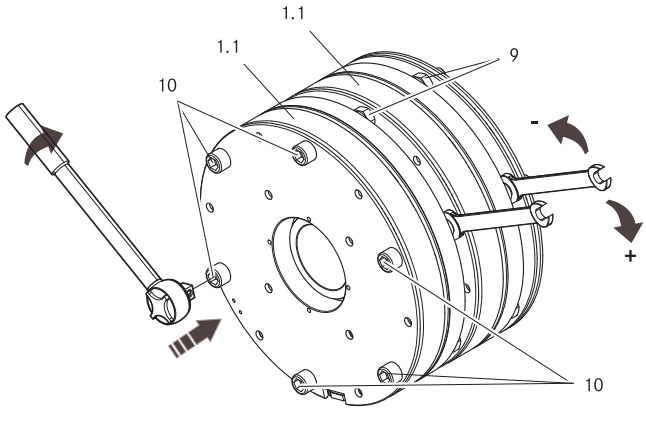


Fig. 12 Adjusting the air gap during the initial installation

2. Loosen the bolts (10).

NOTICE
First correctly adjust the air gap with every 2nd bolt (10) / sleeve bolt (9)! The other three sleeve bolts should be screwed into the stator so that they do not touch the flange or the bearing shield. Then repeat the process with the other three bolts (10).

3. Slightly turn the sleeve bolts (9) using an open end spanner.
   - If the air gap is too large, screw into the stator (1.1).
   - If the air gap is too small, screw them out of the stator (1.1).
   - A 1/6 turn will change the air gap by approximately 0.15 mm.
4. Tighten the screws (10) (for torques, see table 16).
5. Check the air gap "s_L" near the screws (10) using a feeler gauge, ("s_{LN}" 16).
6. Repeat the adjustment procedure if the deviation of "s_{LN}" is too large.

4.5 Manual release

NOTICE

- The manual release is designed for activation via a Bowden cable.
- For activation without a Bowden cable, the lever has to be extended.
- An individual brake circuit can only be released electrically.

The manual release is mounted when the double-spring-applied brake is installed. No power is applied to the brake.

1. Mount the first rotor (3), the first complete stator (1), and the second rotor (3A) according to section 4.4.1, steps 1 through 12 (23 and 26).

4.5.1 Components of the manual release

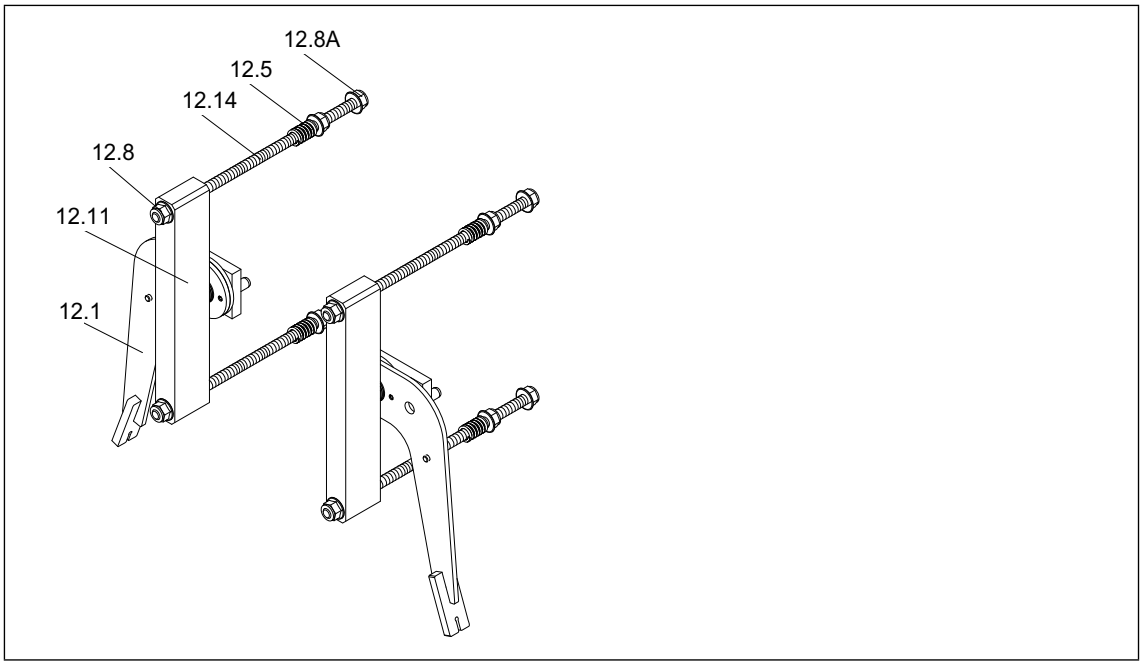


Fig. 13 Manual release

12.1 Manual release lever	12.8 Lock nut	12.14 Tension rod
12.5 Pressure spring	12.11Clip	

4.5.2 Installing the manual release

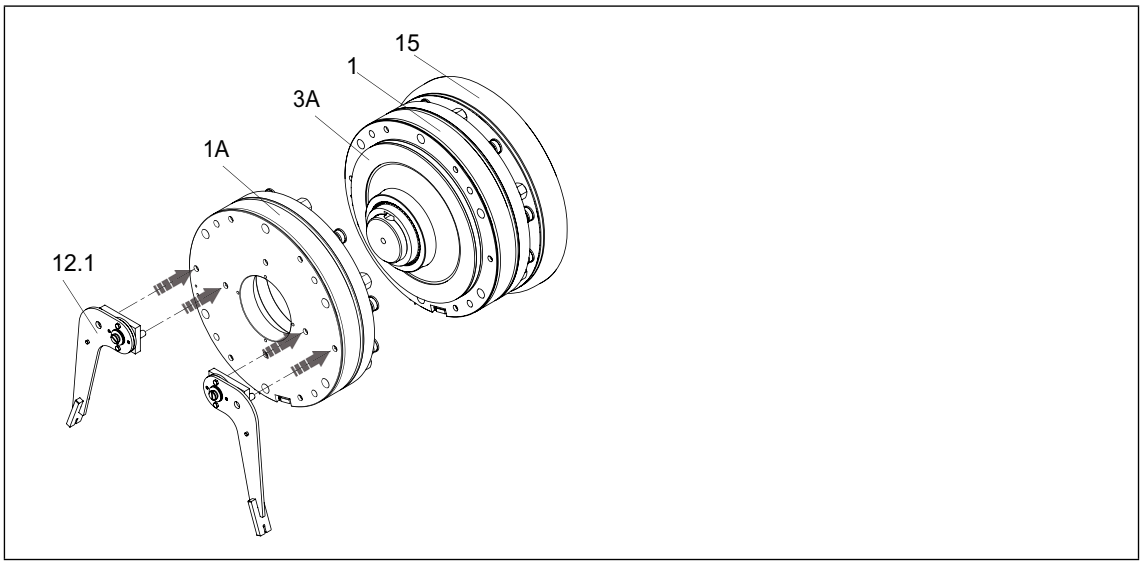


Fig. 14 Applying the manual release lever

2. Put both levers completely (12.1) onto the second stator (1A). To do this, push in the plates' pins into the corresponding holes of the stator (using a suitable tool).

NOTICE
The plates are not symmetric. The pin with the greater distance from the axis of rotation must be oriented towards the outside. The lever must also face outwards.

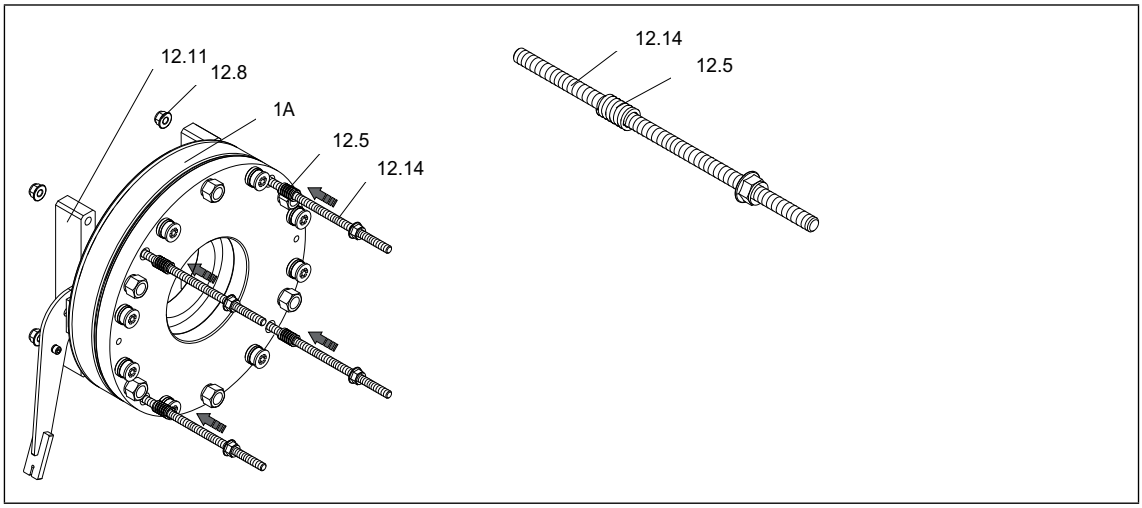


Fig. 15 Installation of the tension rods

3. Assemble four pre-assembled tension rods (12.14) with one spring (12.5) each

Carry out steps 4 and 5 separately for each side of every lever.

4. From the armature plate end, plug one pair of pre-assembled tension rods (12.14) each into the provided bore holes (Ø11 mm) of the complete stator (1A). Insert the springs (12.5) of the tension rod into the clearing hole of the armature plate (Ø16.5 mm) in the process.

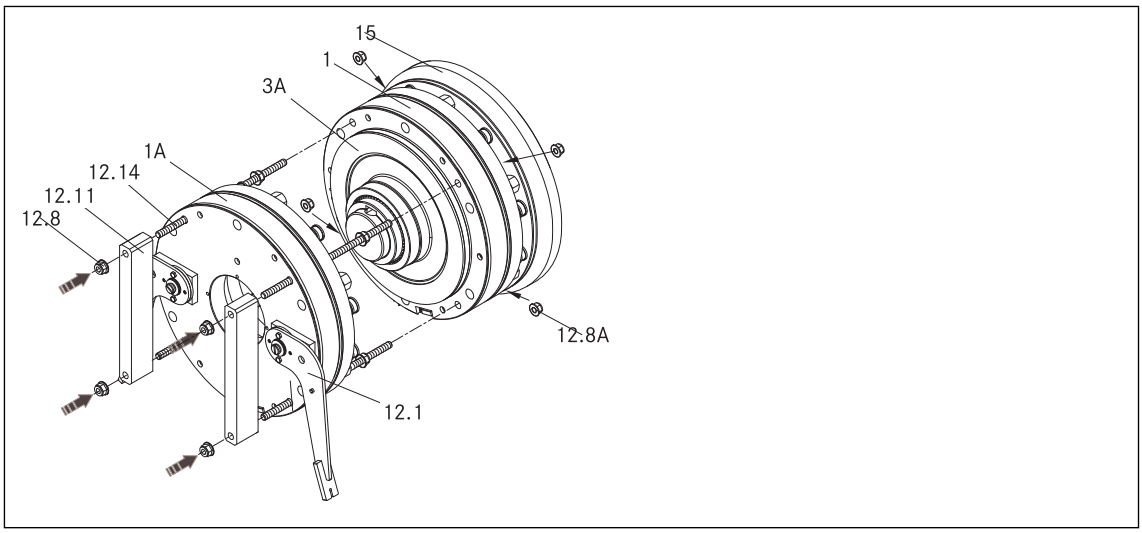


Fig. 16 Assembly parts

5. Attach the clips (12.11) with the bore holes (Ø12 mm) to the tension rods (12.14) and tighten them with the lock nuts (12.8). The blind holes (Ø17 mm) are now pointing in the direction of the stator and the screw heads of the manual release levers are completely sunk into the clips (12.11).
6. Position the second complete stator (1A) in front of the complete stator (1). Insert the pre-assembled tension rods (12.14) into the through holes (Ø12 mm) of the first complete stator (1) in the process.

	NOTICE
	Tension rods must not be bent!

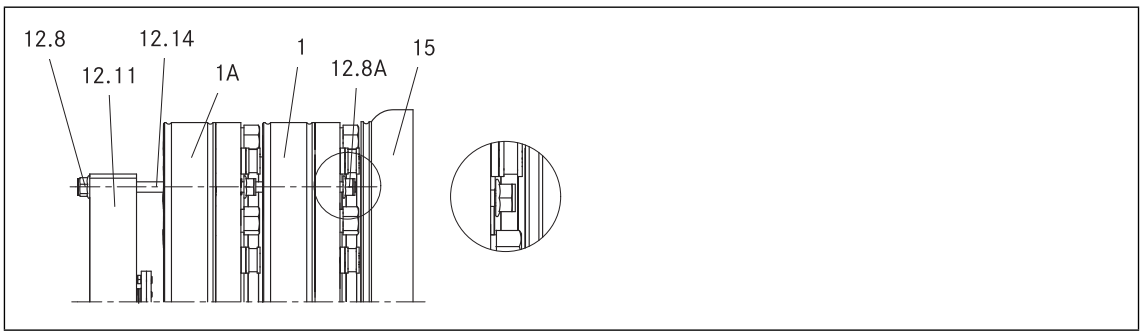


Fig. 17 Pre-assembly of the brake with manual release on the motor

7. Screw four lock nuts (12.8A) between the motor end shield and the complete stator (Pos.1) onto the tension rods (12.14) up to the point where the back side of the lock nut aligns with the top of the tension rod.
8. Evenly tighten the brake with the six socket head cap screws (10) included in the scope of supply in several runs using a torque key (as shown in Figure 17).

9. Establish the electrical connection and energize the brake (📖 35).
10. Use a torque key to re-tighten the supplied fixing screws (10) with the required tightening torque (📖 16).
11. Switch off the power.

4.5.3 Checking the air gap

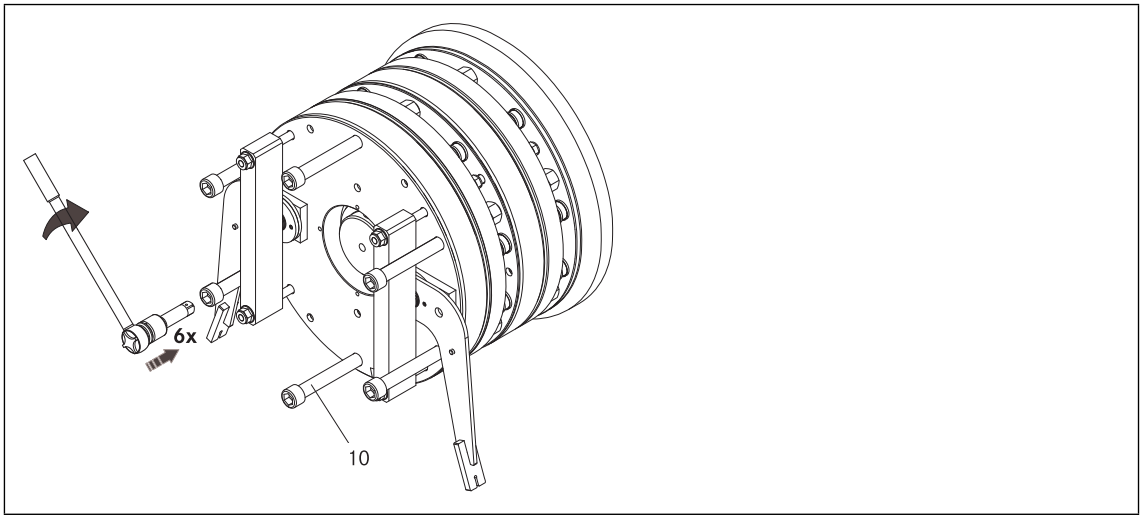


Fig. 18 Checking the air gap

12. Check the air gap using a feeler gauge and correct it if necessary (s_{LN} = 0.4 +0.05 mm) according to Figures 11 and 12.

4.5.4 Setting the manual release

	NOTICE
	For setting the manual release, always lock the pre-assembled hexagon nut of the tension rod (12.14) against rotation and rotate the lock nuts at the ends of the tension rod only.

Carry out steps 13 and 14 separately for each side of every lever

13. Tighten the lock nuts (pos. 12.8) on the clips (12.11) evenly until the nuts of the tension rod are in contact with the armature plate of the second stator (1A) (there should be noticeable resistance). While tightening, make sure that the clips (12.11) are parallel to the rear of the stator (1A). (Check using a caliper gauge.) If there are dimensional differences where X > 0.1 mm (see Figure 19), this should be corrected by loosening the lock nut (12.8) at the smaller dimension and tightening the lock nut (12.8) at the larger dimension until the clips (12.11) are adjusted in parallel to the back of the brakes (as shown in Figure 19).
14. Evenly tighten the lock nuts on the motor end shield side up to the point where the nuts of the tension rod are in contact with the armature plate of the first stator (1) (tangible resistance).
15. Loosen the lock nuts (12.8) at the clips (12.11) by a ¾ revolution (270°).

Carry out steps 16 and 17 separately for each side of every lever.

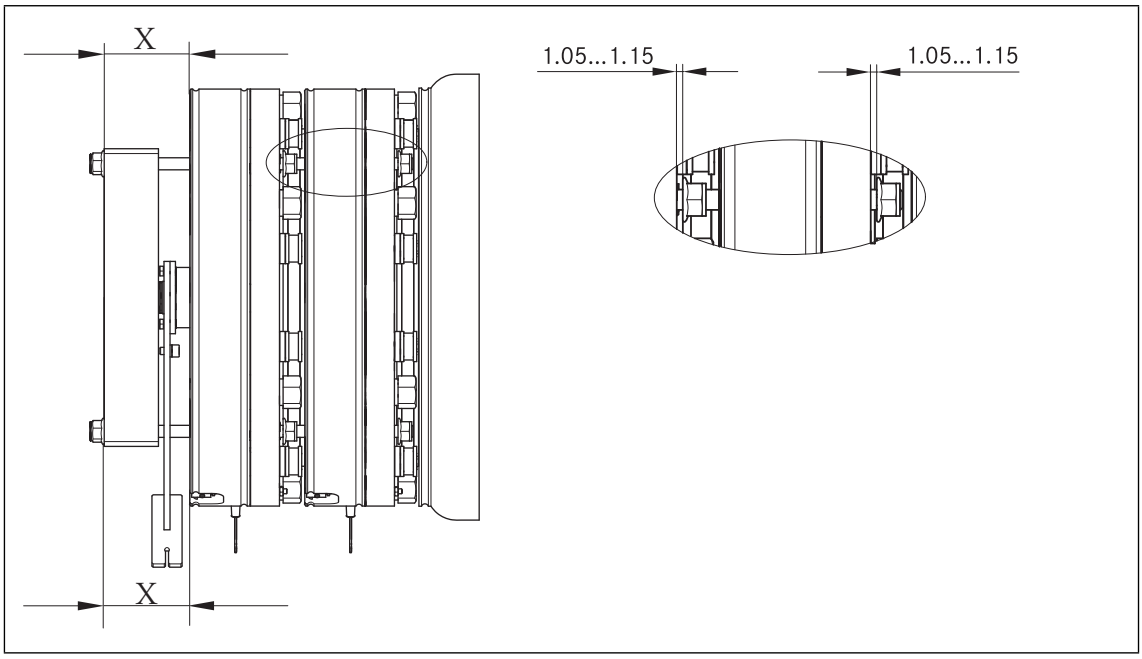


Fig. 19 Test dimensions and reference dimensions

16. Check of the correct setting (nominal dimension 1.05 ... 1.15 mm):
    - For this purpose, position two feeler gauges of the same thickness (e.g. 1.1 mm) for each tension rod between the hexagon nuts and the complete stator and ensure that the feeler gauges can be easily moved.
17. Correct the setting if necessary until both feeler gauges can be moved by the same force.
18. Check that the manual release functions properly. Attach pipe sections onto the levers and press them together to check whether the motor shaft can rotate freely.
19. Connect the Bowden cable (not included in this delivery) and pull until the motor shaft can be freely rotated.

NOTICE
The actuation force between the Bowden cable's hanging points is approximately 900 N. The actual pull force required may be higher depending on the characteristics and position of the cable.

4.6 Cover ring assembly

	NOTICE
	Brakes without flange require a groove at the end shield for the lip of the cover seal.

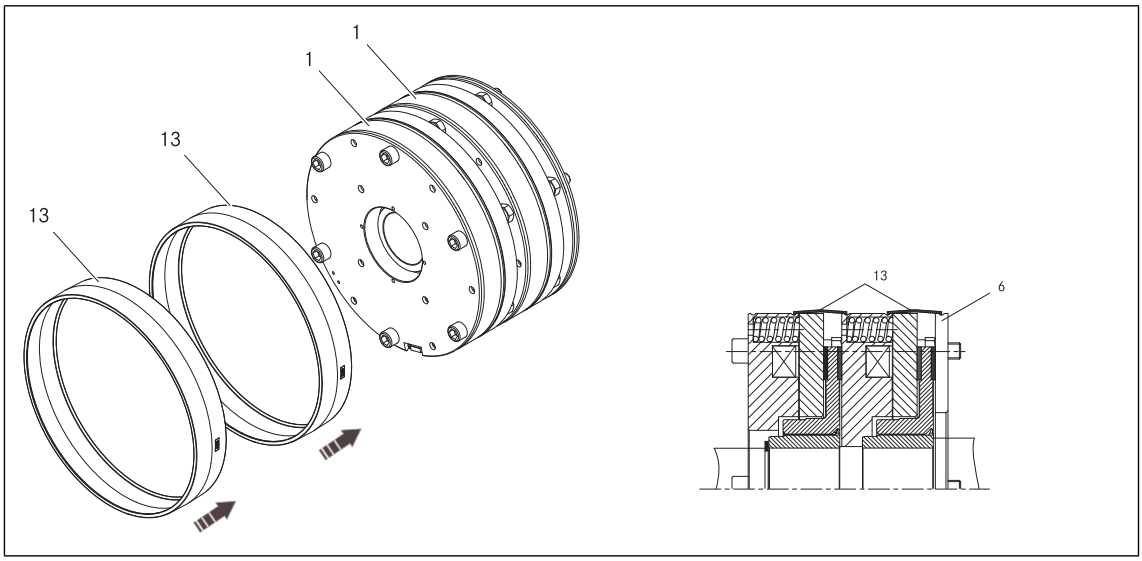


Fig. 20 Cover ring assembly

1 Stator, complete 6 Flange 13 Cover ring

1. Disconnect electrical connection.
2. Pull cables through the cover rings (13).
3. Push cover rings (13) over the complete stators (1).
4. Press the lips of the first cover ring (13) into the groove of the complete stator (1) and flange (6) / end shield.
5. Press the lips of the second cover ring into the groove of the first and second complete stator (1).
6. Re-establish the electrical connection.

	NOTICE
	Cover ring with condensation drain hole: Attach the cover ring so that condensation can drain through the hole.

5 Electrical installation

5.1 Important notes

DANGER

There is a risk of injury by electrical shock!

- The electrical connections must only be made by skilled personnel!
- Only carry out connection work when no voltage is applied (no live parts)! There is a risk of unintended start-ups or electric shock.

NOTICE

- Make sure that the supply voltage corresponds to the data on the nameplate.
- Voltages must be adjusted to the local environment!

NOTICE

- If an emergency stop is carried out without the required suppressor circuit, the control unit may be destroyed.
- Observe the correct polarity of the suppressor circuit!

NOTICE

- To functionally test the individual brake circuits, the power supply must be able to be switched off individually. For a new over-energizing during switch-on, it is also necessary to open switches K1/K3.
- The protective circuitry contained in the INTORQ switching device BEG-561-□□□-□□□ (terminals 3 and 4) is not permitted for use in the lift system. The protective circuitry must be connected parallel to the brake coil (📖 36).

NOTICE

- Only operate the brake with a holding current reduced to 25 % of P_{max} !
- You can use the INTORQ switching device BEG-561-□□□-□□□ for this purpose.

5.1.1 Switching suggestions

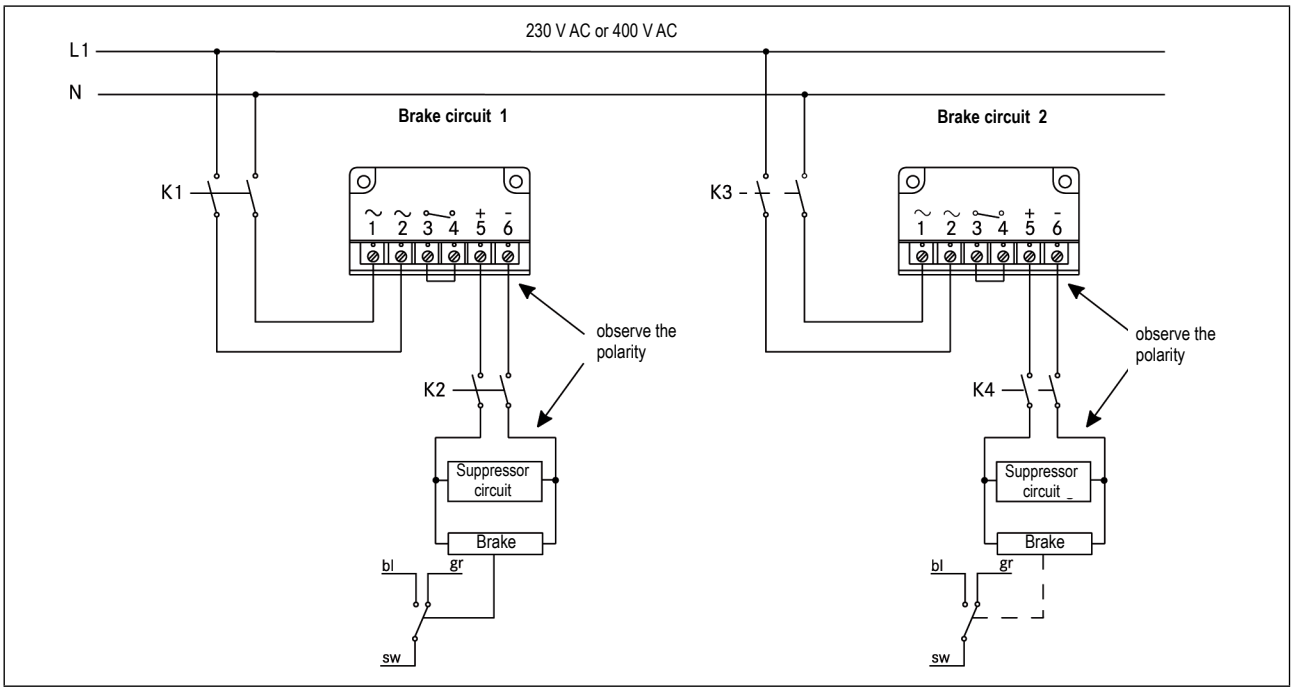


Fig. 21 INTORQ BFK455 connection diagram

Switching on

- K2/K4 must be switched on **before or at the same time** as K1/K3!

Switching off

- Normal - AC switching
  - K2/K4 remain closed
  - K1/K3 open
- Emergency stop - DC switching
  - K1/K3 and K2/K4 are opened at the same time

NOTICE

Recommended current load for the micro-switches

- DC current: 10 mA ... 100 mA at 12 V
- AC current: 10 mA ... 5 A at 12 V / max. 250 V
- Suppressor circuit: the limit voltage impacts the switching times (📖 17).

5.2 Bridge/half-wave rectifier (optional)

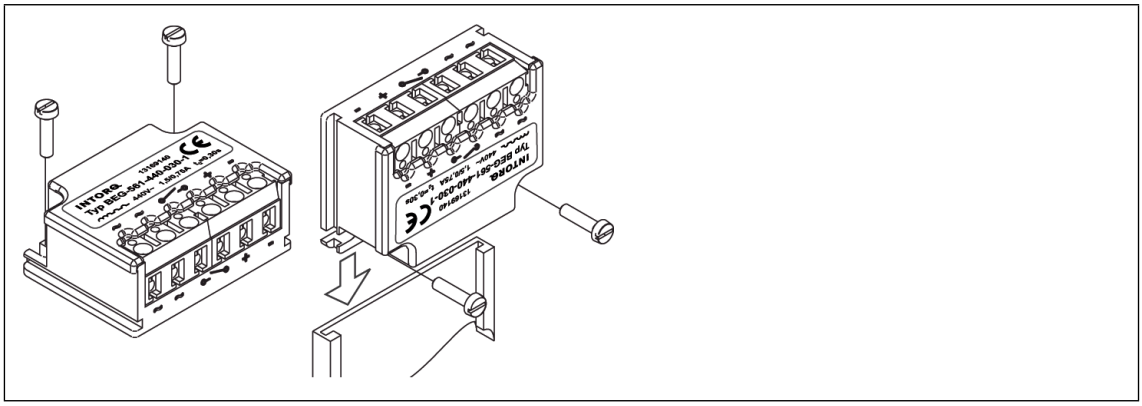
BEG-561-□□□-□□□

The bridge/half-wave rectifiers are used to supply electromagnetic DC spring-applied brakes which are approved for the use with such rectifiers. Other use is only permitted with the approval of INTORQ.

Once a set over-excitation time has elapsed, the bridge/half-wave rectifiers switch over from bridge rectification to half-wave rectification.

5.2.1 Assignment: Bridge/half-wave rectifier - brake size

Rectifier type	Supply voltage [V AC]	Coil voltage Release / holding [V DC]	Assigned brake
BEG-561-255-130	230 ±10%	205 / 103	BFK455-28 (205 V)
BEG-561-440-130	400 ±10%	360 / 180	BFK455-28 (360 V)



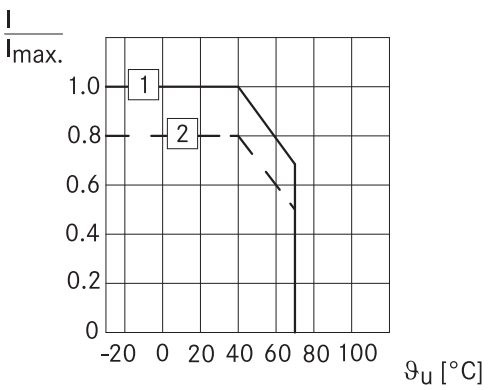
5.2.2 Technical specifications

Rectifier type	Bridge / half-wave rectifier
Output voltage for bridge rectification	0.9 x U_1
Output voltage for half-wave rectification	0.45 x U_1
Ambient temperature (storage/operation) [°C]	-25 – +70

Type	Input voltage U_1 (40 Hz ... 60 Hz)			Max. current I_{max}		Over-excitation time t_{ue} (± 20%)		
	Min. [V ~]	Rated [V ~]	max. [V ~]	Bridge [A]	half-wave [A]	at $U_{1\ min}$ [s]	at $U_{1\ Nom}$ [s]	at $U_{1\ max}$ [s]
BEG-561-255-130	160	230	255	3.0	1.5	1.870	1.300	1.170
BEG-561-440-130	230	400	440	3.0	1.5	2.300	1.300	1.200

Tab. 5: Data for bridge/half-wave rectifier type BEG-561

5.2.3 Permissible current load at ambient temperature



1 For screw assembly with metal surface (good heat dissipation)

2 For other assembly (e.g. adhesive)

5.3 Electrical connection

DANGER

There is a risk of injury by electrical shock!

The brake must only be electrically connected when no voltage is applied!

NOTICE

Compare the coil voltage of the stator to the DC voltage of the installed rectifier.

6 Commissioning and operation

6.1 Important notes

DANGER

- The live connections and the rotating rotor must not be touched.
- The drive must not be running when checking the brake.

6.2 Function checks before commissioning

6.2.1 Functional checks

Brake with micro-switch

DANGER

Danger: rotating parts!
The brake must be free of residual torque. The motor must not run!

DANGER

There is a risk of injury by electrical shock!
Live connections must not be touched.

1. The switching contact for the brake must be open.
2. Remove two bridges from the motor terminals to de-energise the motor.
   - Do not switch off the voltage supply to the brake.

NOTICE

If the brake is connected to the neutral point of the motor, the PE conductor must also be connected to this point.

3. Apply DC voltage to the brake.
4. Measure the AC voltage at the motor terminals. The measured level must be zero.
5. Close the switching contact for the brake.
   - The brake is released.

6. Measure the DC voltage at the brake:
   - The measured DC voltage after the over-excitation time (see bridge/half-wave rectifier, 📖 36) must correspond to the holding voltage (see table 5). A deviation of ±10 % is permissible.
7. Check the air gap "s_L".
   - It must be zero and the rotor must rotate freely.
8. Check the switching status of the micro-switch (see table 6).
9. Open the switching contact for the brake.
   - The brake is applied.
10. Check the switching status of the micro-switch (see table 6).
11. Switch off DC voltage for the brake.
12. Screw the bridges onto the motor terminals.
13. If necessary, remove the neutral conductor from the neutral point (step 2).

Contact type	Connection	Brake released	Micro-switch closed
NC contact	black / grey	yes	no
		no	yes
NO contact	black / blue	yes	yes
		no	no

Tab. 6: Switching status of the micro-switch

The preparations for commissioning are completed.

6.3 Commissioning

1. Switch on the drive system.
2. Carry out a braking test.

6.4 During operation

	**DANGER**
	Danger: rotating parts! The running rotor must not be touched.

	**DANGER**
	There is a risk of injury by electrical shock! Live connections must not be touched.

- Checks must be carried out regularly. Pay special attention to:
  - unusual noises or temperatures
  - loose attachment elements
  - the condition of the electrical cables
- The armature plate must be tightened and the rotor must move without residual torque.
- Measure the DC voltage at the brake.
  - The measured DC voltage after the over-excitation time (see bridge/half-wave rectifier, 📖 36) must correspond to the holding voltage (see table 5). A deviation of ±10 % is permissible.
- If faults occur once, go through the troubleshooting table in chapter 8. If the fault cannot be fixed or eliminated, please contact your customer service.

7 Maintenance and repair

7.1 Wear of spring-applied brakes

INTORQ spring-applied brakes are wear-resistant and designed for long maintenance intervals. The friction lining and braking mechanism are subject to operational wear. For safe and trouble-free operation, the brake must be checked at regular intervals or replaced, if necessary 📖 43.

	NOTICE
	The air gap must not be re-adjusted after it has been correctly adjusted during the initial installation of the brake on the motor! This could result in a loss of braking torque.

The table below shows the different causes of wear and their impact on the components of the spring-applied brake. The influential factors must be quantified so that the service life of the rotor and brake can be calculated and so the prescribed maintenance intervals can be specified accurately. The most important factors in this context are the applied friction energy, the initial speed of rotation of braking and the switching frequency. If several of the causes of friction lining wear occur in an application at the same time, the influencing factors should be added together when the amount of wear is calculated.

Component	Cause	Effect	Influencing factors
Friction lining	Braking during operation	Wear of friction lining	Friction work
	Emergency stops		
	Overlapping wear during start and stop of drive		
	Active braking via the drive motor with support of brake (quick stop)		
	Starting wear in case of motor mounting position with vertical shaft, even when the brake is not applied		Number of start-stop cycles
Armature plate and flange	Rubbing of brake lining	Armature plate and flange are run in	Friction work
Gear teeth of brake rotor	Relative movements and shocks between brake rotor and brake shaft	Wear of gear teeth (primarily on the rotor side)	Number of start-stop cycles
Brake support	Load reversals and jerks in the backlash between the armature plate and guide pins	Breaking of armature plate and guide pins	Number of start/stop cycles, braking torque
Springs	Axial load cycle and shear stress of springs through radial backlash on reversal of armature plate	Reduced spring force or fatigue failure	Number of switching operations of brake

Tab. 7: Causes for wear

7.2 Inspections

To ensure safe and trouble-free operations, the spring-applied brakes must be checked at regular intervals and, if necessary, replaced. Servicing will be easier at the plant if the brakes are made accessible. This must be considered when installing the drives in the plant.

Primarily, the required maintenance intervals for industrial brakes result from their load during operation. When calculating the maintenance interval, all causes for wear must be taken into account, 📖 42. For brakes with low loads (such as holding brakes with emergency stop function), we recommend a regular inspection at a fixed time interval. To reduce costs, the inspection can be carried out along with other regular maintenance work in the plant.

Failures, production losses or damage to the system may occur when the brakes are not serviced. Therefore, a maintenance strategy that is adapted to the particular operating conditions and brake loads must be defined for every application. For the spring-applied brakes, the maintenance intervals and maintenance operations listed in the table below must be followed. The maintenance operations must be carried out as described in the detailed descriptions.

7.2.1 Maintenance intervals

<table>
<tr><th>Type</th><th colspan="4">Time interval</th></tr>
<tr><td></td><td colspan="2">for service brakes:</td><td colspan="2">for holding brakes with emergency stop:</td></tr>
<tr><td rowspan="6">BFK455-28</td><td colspan="2">▮ according to service life calculation
▮ or else every six months
▮ after 4000 operating hours at the latest</td><td colspan="2">▮ at least every two years
▮ after 1 million cycles at the latest</td></tr>
<tr><td colspan="4">Maintenance</td></tr>
<tr><td colspan="2">Inspections with assembled brake:</td><td colspan="2">Inspections after the brake has been removed:</td></tr>
<tr><td>▮ Check release function and control</td><td>📖 44</td><td>▮ Check the play of the rotor gear teeth (replace worn-out rotors)</td><td>📖 45</td></tr>
<tr><td>▮ Measure the air gap</td><td>📖 45</td><td>▮ Check for breaking out of the torque support at the sleeve bolts and the armature plate</td><td></td></tr>
<tr><td>▮ Measure the rotor thickness (replace rotor if required)
▮ Check for thermal damage of the armature plates or flange (dark-blue tarnishing)</td><td>📖 45</td><td>▮ Check the springs for damage
▮ Check the armature plate and flange or bearing shield
- Levelness < 0.1 mm
- Max. run-in depth = rated air gap for the size</td><td></td></tr>
</table>

7.2.2 Release / voltage

1. Start motor and control system!

	DANGER
	Danger: rotating parts! The running rotor must not be touched.

	DANGER
	There is a risk of injury by electrical shock! Live connections must not be touched.

2. Observe the air gap "s_L" when the drive is running. It should be zero.
3. Measure the DC voltage at the brake.
   - After the over-excitation time (see bridge/half-wave rectifier, 📖 36), the measured DC voltage must correspond to the holding voltage (📖 37). A deviation of ±10 % is permissible.

7.3 Maintenance

NOTICE
Brakes with defective armature plates, socket head cap screws, springs or counter friction faces must always be replaced completely. Observe the following for inspections and maintenance works:

- Contamination by oils and greases should be removed using brake cleaner, or the brake should be replaced after determining the cause. Dirt and particles in the air gap between the stator and the armature plate endanger the function and should be removed.
- After replacing the rotor, the original braking torque will not be reached until the run-in operation for the friction surfaces has been completed. After replacing the rotor, the run-in armature plates and counter friction faces have an increased initial rate of wear.

7.3.1 Check the rotor thickness

	DANGER
	Danger: rotating parts! The motor must not run during the check.

1. Stop the motor and control system!
2. Remove the motor cover and remove the cover ring, if present.
3. Measure the rotor thickness using a caliper gauge.
4. Compare the measured rotor thickness with the minimally permissible rotor thickness, 📖 16.
5. If required, replace the rotor completely (📖 45).

7.3.2 Check the air gap

	DANGER
	Danger: rotating parts! The motor must not run during the check.

1. Stop the motor and control system!
2. Measure the air gap "s_L" near the fixing screws between the armature plate and the stator using a feeler gauge.
3. Compare the measured air gap with the maximum permitted air gap "s_{Lmax}" (📖 16).
4. If required, replace both rotors completely.

7.3.3 Replacing the rotor

	DANGER
	Danger: rotating parts! The brake must be free of residual torque.

1. Switch off voltage!
2. Disconnect the connection cable.
3. Loosen the screws evenly and remove them completely.
4. Remove the complete stator from the bearing shield. Pay attention to the connection cable.
5. Pull the complete rotor from the hub.
6. Check the gear teeth of the hub.
7. Replace the hub if it is worn.
8. Check the friction surface on the bearing shield. In case of strong scoring at the flange, replace the flange. In case of strong scoring on the bearing shield, rework the friction surface.
9. Measure the rotor thickness (new rotor) and head height of the sleeve bolts with a caliper gauge.
10. Calculate the distance between the stator and the armature plate as follows:

    Distance = rotor thickness + $s_{LN\ -\ head\ height}$

    ("s_{LN}" 📖 16)
11. Unscrew the sleeve bolts evenly until the calculated distance between the stator and armature plate is reached.
12. Install and adjust the new complete rotor and stator (📖 23).
13. Reconnect the connection cable.

7.4 Spare-parts list

- Only parts with item numbers are available.
  - The item numbers are only valid for the standard design.
- Please include the following information with the order:
  - Order number of the brake
  - Position number of the spare part

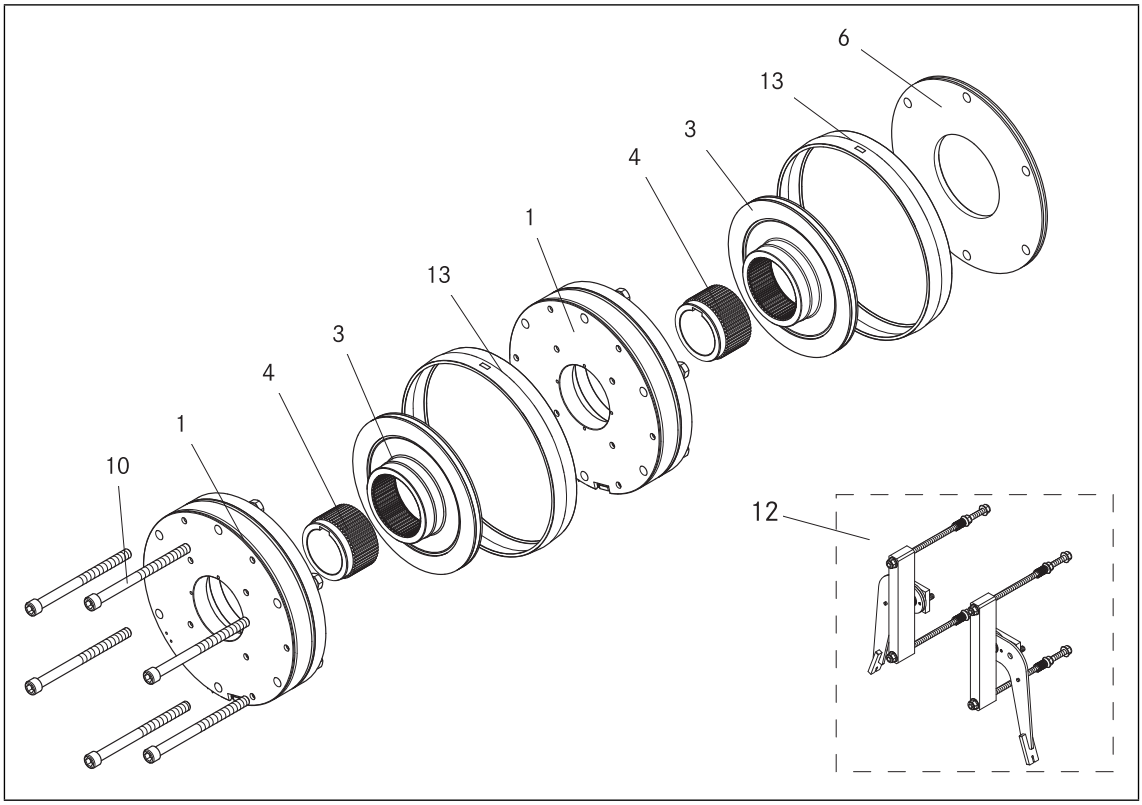


Fig. 22 BFK455-28 spring-applied brake

Item	Designation	Variant
1	Stator, complete	Voltage
3	Complete rotor Rotor, complete noise-reduced	
4	Hub	Bore diameter
6	Flange	
10	Fixing screws Socket head cap screw set, DIN912	for mounting to the motor for flange with through hole
12	Complete manual release	
13	Cover ring	

7.5 Ordering spare parts

Stator, complete

Size	☐ 28
Voltage	☐ 103 V / 52 V ☐ 205 V / 103 V ☐ 360 V / 180 V
Braking torque	_____ Nm (see torque gradation)
Cable length	☐ Standard (1000 mm)
Armature plate	☐ Standard
Micro-switch	☐ Monitoring the switching function

Components

Rotor	☐ Aluminium ☐ Noise-reduced (rotor with sleeve)
Hub	_____ mm (for hole diameter, see dimensions)
Fixing screw set	☐ For mounting ☐ For mounting with flange
Counter friction face	☐ Flange
Seal	☐ Cover ring
Complete manual release	☐

Electrical accessories
Rectifier type: Selection see chapter 5.2.1

Rectifier	☐ BEG-561-255-130 ☐ BEG-561-440-130

8 Troubleshooting and fault elimination

If any malfunctions should occur during operations, please check for possible causes based on the following table. If the fault cannot be fixed or eliminated by one of the listed measures, please contact customer service.

Fault	Cause	Remedy
Brake cannot be released, air gap is not zero	Coil interruption	▮ Measure the coil resistance using a multimeter: - If resistance is too high, replace the complete stator.
	Coil has contact to earth or between windings	▮ Measure coil resistance with multimeter: - Compare measured value with rated resistance. - Values: 📖 17 - If resistance is too low, replace the complete stator. ▮ Check coil for short circuit to ground using a multimeter: - Replace the complete stator if short circuit to ground is detected. ▮ Check brake voltage (see “defective rectifier, voltage too low”).
	Wiring defective or incorrect	▮ Check and correct. - Check cable for continuity using a multimeter: ▮ Replace the complete stator if a cable is defective.
	Defective or incorrect rectifier	▮ Measure rectifier DC voltage using a multimeter. If DC voltage is zero: ▮ Check AC rectifier voltage. If AC voltage is zero: - Switch on power supply. - Check fuse. - Check wiring. If AC voltage is OK: - Check rectifier. - Replace the defective rectifier. If DC voltage is too low: - Check rectifier. - If diode is defective, use a suitable new rectifier. ▮ Check coil for inter-turn fault or short circuit to ground. ▮ If the rectifier defect occurs again, replace the entire stator, even if you cannot find any fault between turns or short circuit to ground. The fault may occur later during heating-up.
	Incorrect micro-switch wiring	Check the wiring of the micro-switch and correct it.
	Micro-switch incorrectly set	Replace the complete stator and make a complaint about the setting of the micro-switch to the manufacturer.
Brake cannot be released, air gap is not zero	Air gap “s_L” is too large	▮ For adjustable brakes: - Readjust air gap. ▮ For non-adjustable brakes: - Replace all rotors.

Fault	Cause	Remedy
Rotor cannot rotate freely	Air gap "s_L" too small	Readjust the air gap "s_L" (📖 28).
Rotor thickness too small	Rotor has not been replaced in time	Replace the rotor (📖 45).
Voltage is not zero during functional test (6.2.2 or 6.2.3)	Incorrect micro-switch wiring	Check and correct the wiring of the micro-switch.
	Micro-switch defective or incorrectly set	Replace the complete stator and return the defective complete stator to the manufacturer.
Voltage too high	Brake voltage does not match the rectifier	Adjust rectifier and brake voltage to each other.
Voltage too low	Brake voltage does not match the rectifier	Adjust rectifier and brake voltage to each other.
	Defective rectifier diode	Replace defective rectifier with a suitable undamaged one.
AC voltage is not mains voltage	Fuse is missing or defective	Select a connection with proper fusing.
	Incorrect micro-switch wiring	Check and correct the wiring of the micro-switch.
	Micro-switch defective or incorrectly set	Replace the complete stator and return the defective complete stator to the manufacturer.

Notes

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