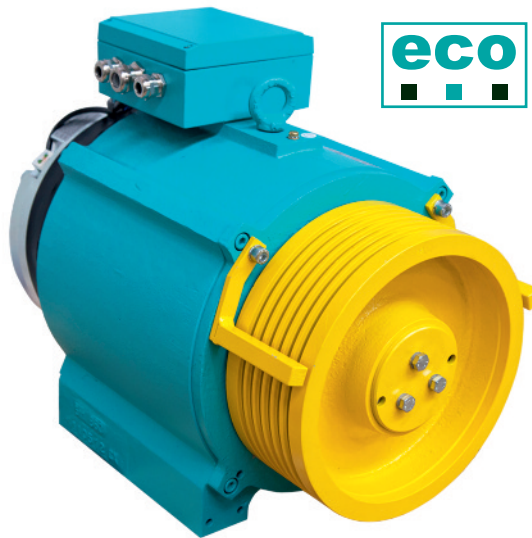


Gearless Lift Machines

WSG-S1.2 WSG-S1.3



English

WITTUR Holding GmbH

Rohrbachstraße 26-30 • D-85259 Wiedenzhausen, Germany
Tel. +49 (0) 81 34/18-0 • Fax +49 (0) 81 34/18-49
<http://www.wittur.com>, E-mail: info@wittur.com

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Gearless Lift Machine

WSG-S1

Operating Instructions

Seite/page 2
Datum/date 23.01.2014
Stand/version 0.12

These operating instructions are applicable to lift machines:

WSG - S1.....

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WITTUR Electric
Drives GmbH



Offenburger Str. 3
D-01189 Dresden
Germany

Tel. +49-(0) 3 51-40 44-0
Fax +49-(0) 3 51-40 44-1 11

info@wittur-edrives.de
www.wittur-edrives.de



WITTUR Electric
Drives GmbH





Gearless Lift Machine

WSG-S1

Operating Instructions

Seite/page 3
Datum/date 23.01.2014
Stand/version 0.12

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EC Declaration of Conformity
Calculation of the traction sheave shaft WSG-S1
Traction sheave shaft WSG-S1
Calculation of the traction sheave shaft WSG-S1 (traction sheave: 160 mm)
Traction sheave shaft WSG-S1 (traction sheave: 160 mm)
EC type-examination certificate
Type-examination certificate (acc. EN 81-1 + A3)
Brake operating instructions



1. General information

1.1. About this operating manual

The purpose of this operating manual is to ensure that any work on WSG-S1 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-S1 lift machines must have read and understood this operating manual.

1.2. Intended use

WSG-S1 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-S1 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-S1 lift machine
- Improper installation, commissioning, operation or maintenance
- Operation of the WSG-S1 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-S1
- 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-S1 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-S1 lift machines are intended for use in an enclosed, lockable machine room 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

Signalworte

- **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 EC 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.

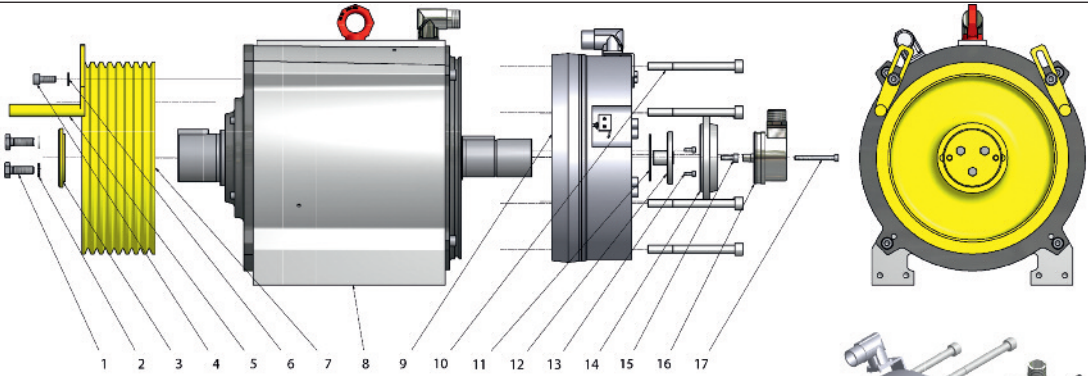
3. Product description

The compact gearless WSG-S1 synchronous lift machines are designed for traction sheave lifts. They are distinguished by their high efficiency, extremely low noise and excellent operating characteristics.

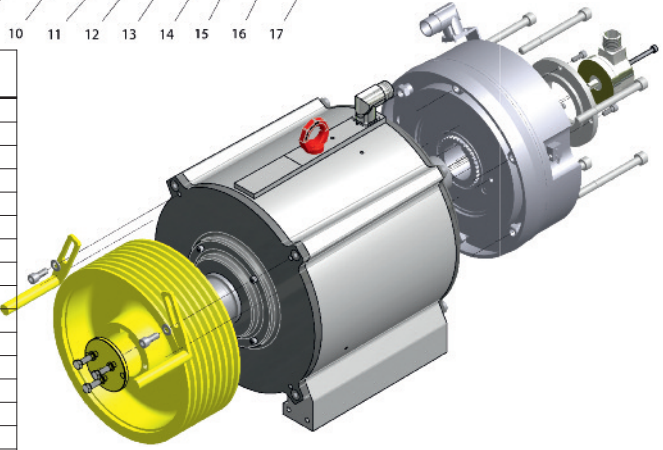
The machines can be supplied for several rated speeds, which can be further adapted to meet individual customer requirements. The machine comprises a frame, the synchronous motor, the traction sheave, and the type-tested safety brake, which can be used to prevent uncontrolled upward movement of the car.

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

Type code of lift machine	 <p>WITTUR Electric Drives GmbH</p> <p>WSG-S1.3-KE15/4L1-DF Nr.01234567</p> <p>3-Mot./Stern</p> <p>U_N 272 V I_N 10,4 A n_N 159 min⁻¹</p> <p>f_N 21,2 Hz P_N 3,8 kW M_N 230 Nm</p> <p>155 (F) S3-40% k_e 1.35 V/min⁻¹</p> <p>IP33 144 kg 16 Pole</p> <p>Bremse/Brake: BFK 464-20S Made in Germany Drive-Code: S1.3-159 www.wittur-drives.de</p>	Serial no.
Rated voltage		Rated speed
Rated frequency		Rated torque
Drive-Code		Weight



Item	Part	WSG-S1
1	Bolts (3x)	M8x25-8.8
2	Lock washers (3x)	NL 8-DIN 25201
3	Pressure disc	
4	Bolts (2x)	DIN 912 - M8x20
5	Rope slip-off guard	
6	Washers (2x)	DIN 125 - A 8,4
7	Traction sheave	
8	Frame	
9	Brake	BFK 464-19S
10	Bolts (6x)	DIN 912 M10x110
11	Locking ring	DIN 471 - 48x1,75
12	Plug-in shaft	
13	Screws (3x)	DIN 912 - M4x10
14	Clamping sleeve	
15	Screws (4x)	DIN 912 - M6x16
16	Measuring system	
17	Cylinder-head screw	DIN 912 M5x50



4. Transport and storage

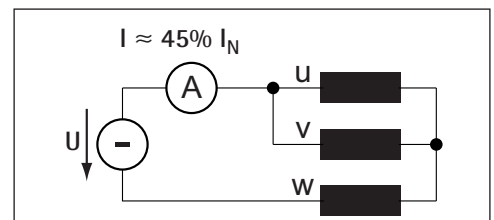
- The lift machines leave the factory in perfect condition after being tested.
- Make a visual check for any external damage immediately upon their arrival on site. If any damage is found to have occurred in transit, make a notice of claim in the presence of the carrier. If appropriate, do not put these 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.



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 ($< 20 \text{ min}^{-1}$) 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 $1 \text{ k}\Omega$ per volt of rated voltage, the winding needs to be dried (insulation meter voltage: $1,000 \text{ VDC}$).
- 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 $70 - 80^{\circ}\text{C}$ 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



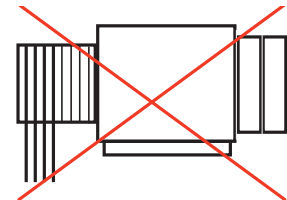
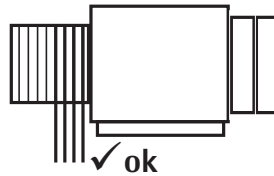
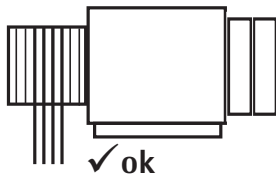
Be sure to use calculations to check the base frame or foundation loads before installing the lift machine.

- The machines can be used in lift systems with or without a machine room.
- 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.



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

- 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.



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

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 obstructed, 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.

$$M_{\text{permiss}} = k * M_N$$

$$P_{\text{permiss}} = k * P_N$$

1,2

Securing the machine

- The rope force can be applied to the lift machine in any direction.
- The machine should be mounted on rubber pads for vibration damping.
- Fasten the machine using 4 M20 bolts (strength class 8.8; tightening torque: 380 Nm).
- After completing the adjusting work or after a breakdown, tighten all the fastening bolts of the machine, using the specified torque.
- The permissible unevenness of the mounting surface is 0.1mm. The mounting surface must be sufficiently distortion-resistant and stable to accommodate the forces occurring in the system.
- 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. Optional rope slip-off guards installed in the foot area of the machine are available for this purpose.

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

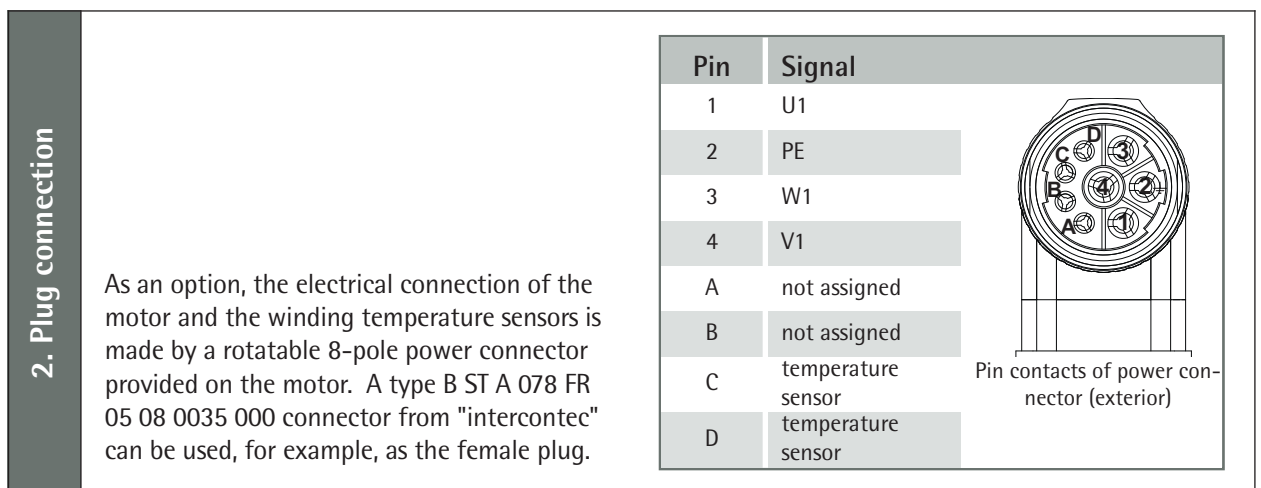
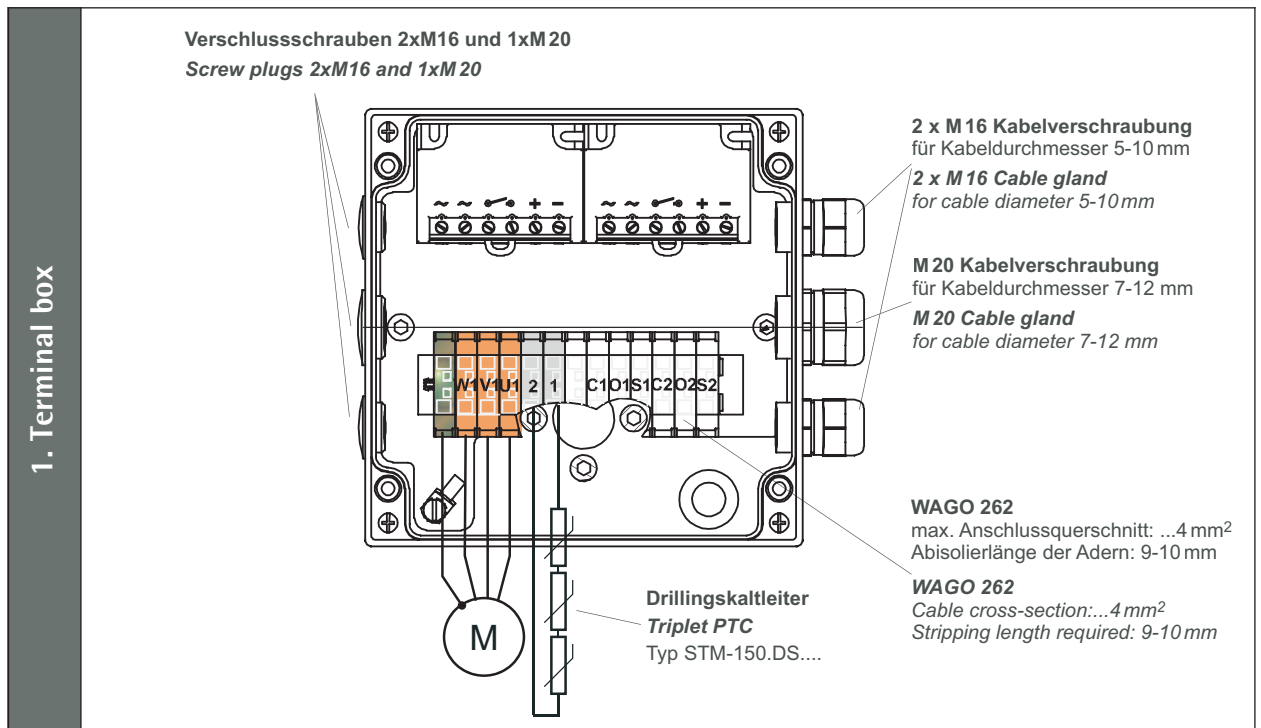
The insulation system of the motors is designed such that they can be connected to a converter with a maximum DC link voltage $U_{link\ max}$ up to max. 700VDC.

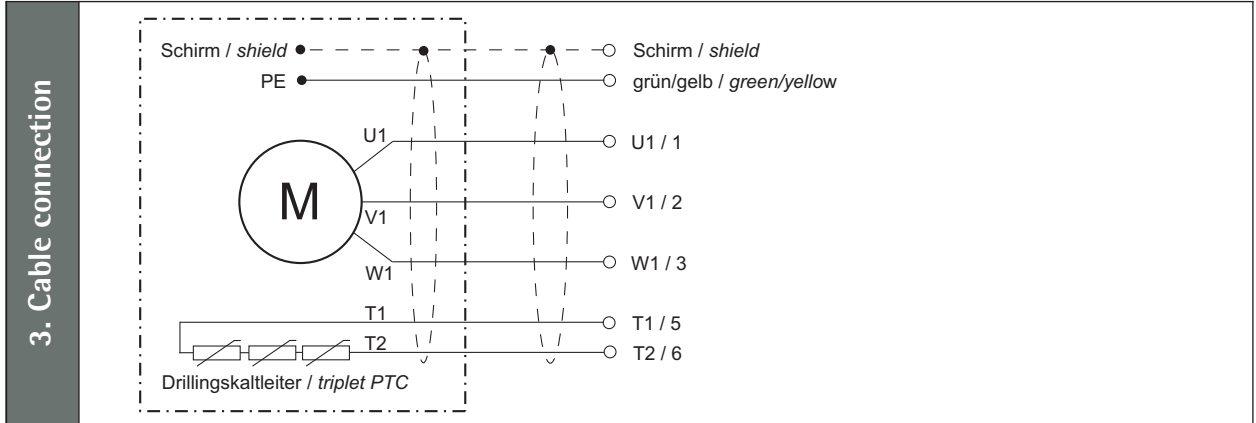
$U_{link\ max}$ is the maximum value of the DC link voltage which is only transient and approximately equivalent to the inception voltage of the braking chopper or of the energy recovery unit.

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

5.2.2. Motor connection / Winding protection

- The electrical connection of the motor and the winding sensors is made in the terminal box, by power connector or by cable (standard length: 5 m).
- 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 PTC resistor embedded in the winding must be evaluated in an appropriate manner in the control system or the frequency converter to protect the motor from overheating.





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:

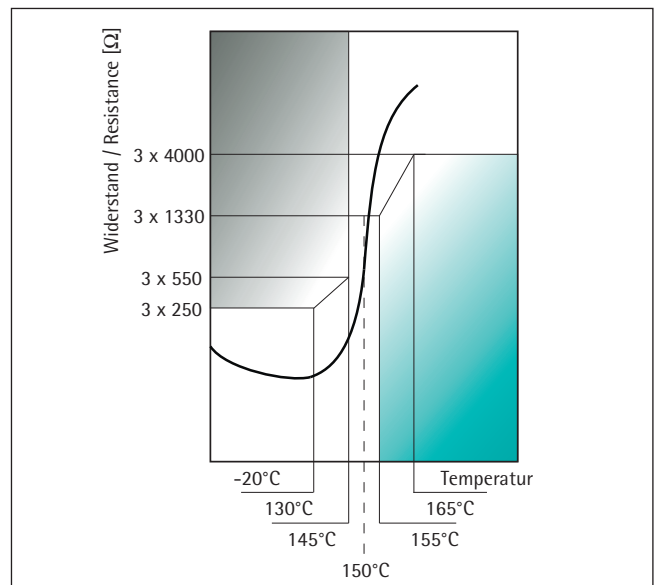
$$I_{\text{r.m.s. (cable)}} \approx I_N (\text{motor, S3-40\%}) / 1,58$$

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	Permissible max. current (r.m.s. value)	Permissible max. motor current I_N (S3 - 40%)
1,0 mm ²	13,1 A	20,7 A
1,5 mm ²	15,7 A	24,8 A
2,5 mm ²	22,6 A	35,7 A
4,0 mm ²	29,6 A	46,7 A

PTC thermistors

The maximum operating voltage of the PTC thermistors is not allowed to exceed 2.5VDC



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 ECN 413 SineCosine encoder from Heidenhain GmbH. The encoder is connected via a 17-pole signal plug connector fitted to the measuring system housing.
- Alternatively, the machines can be equipped with ERN 487 encoders (also from Heidenhain GmbH). We can also provide other measuring systems on request.
- Use a shielded cable to connect the measuring system to the inverter system. We recommend the use of our cable sets, which can be supplied as an accessory.



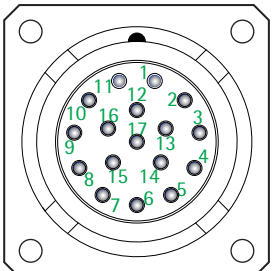
The measuring system of WSG lift machines with a synchronous motor (WSG) is matched to the associated converter. Do not change the adjustment, as this may make it impossible to use the motor. On the measuring system housing there is a label showing the "offset angle" determined at the factory. This value depends on the converter used.



Measuring system ECN 413 / ECN 1313

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

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

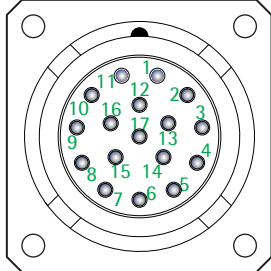


Pin contacts of flanged connector socket (exterior)

Measuring system ERN 487

Number of sine-cosine periods per rotation:: 2048
Operating voltage: 5 V
Commutation signals: 1 sine and cosine signal with 1 per/rotation (Z1 track)

Pin	Signal
1	U _p Sensor
2	R -
3	R +
4	0V Sensor
7	U _p
8	D -
9	D +
10	0V (U _p)
11	inner shield
12	B +
13	B -
14	C +
15	A +
16	A -
17	C -



Pin contacts of flanged connector socket (exterior)

5.2.4. Brake

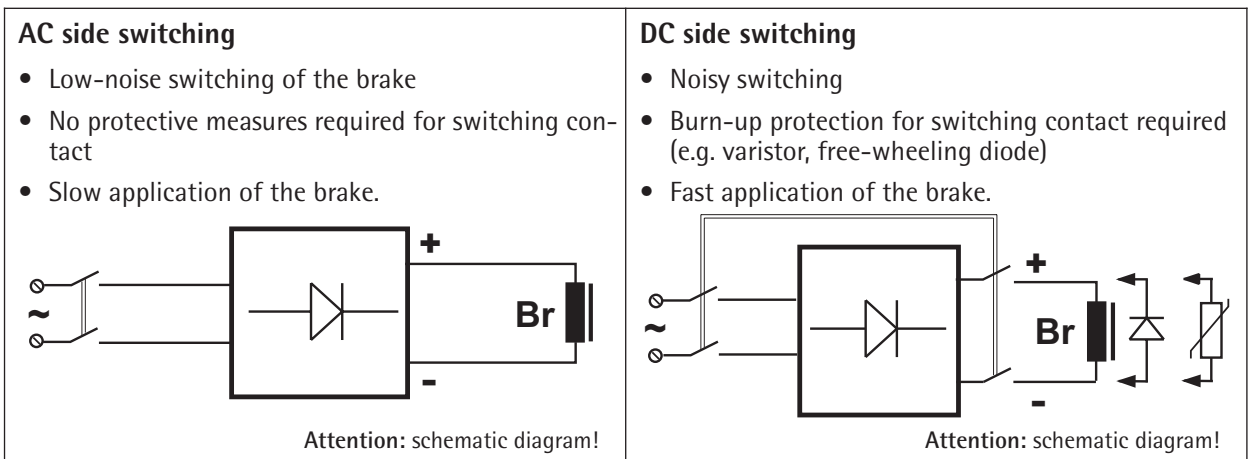
- Please refer also to the operating instructions for the brake.
- The brakes are supplied with DC voltage by the overexcitation rectifiers, which are supplied separately or in the terminal box.
- Only the overexcitation rectifiers which are included in our scope of supply are to be used for the brake activation.
- The terminals for the brake coils and the monitoring contacts are provided in a terminal box or on the plug connector.
- 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.



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.

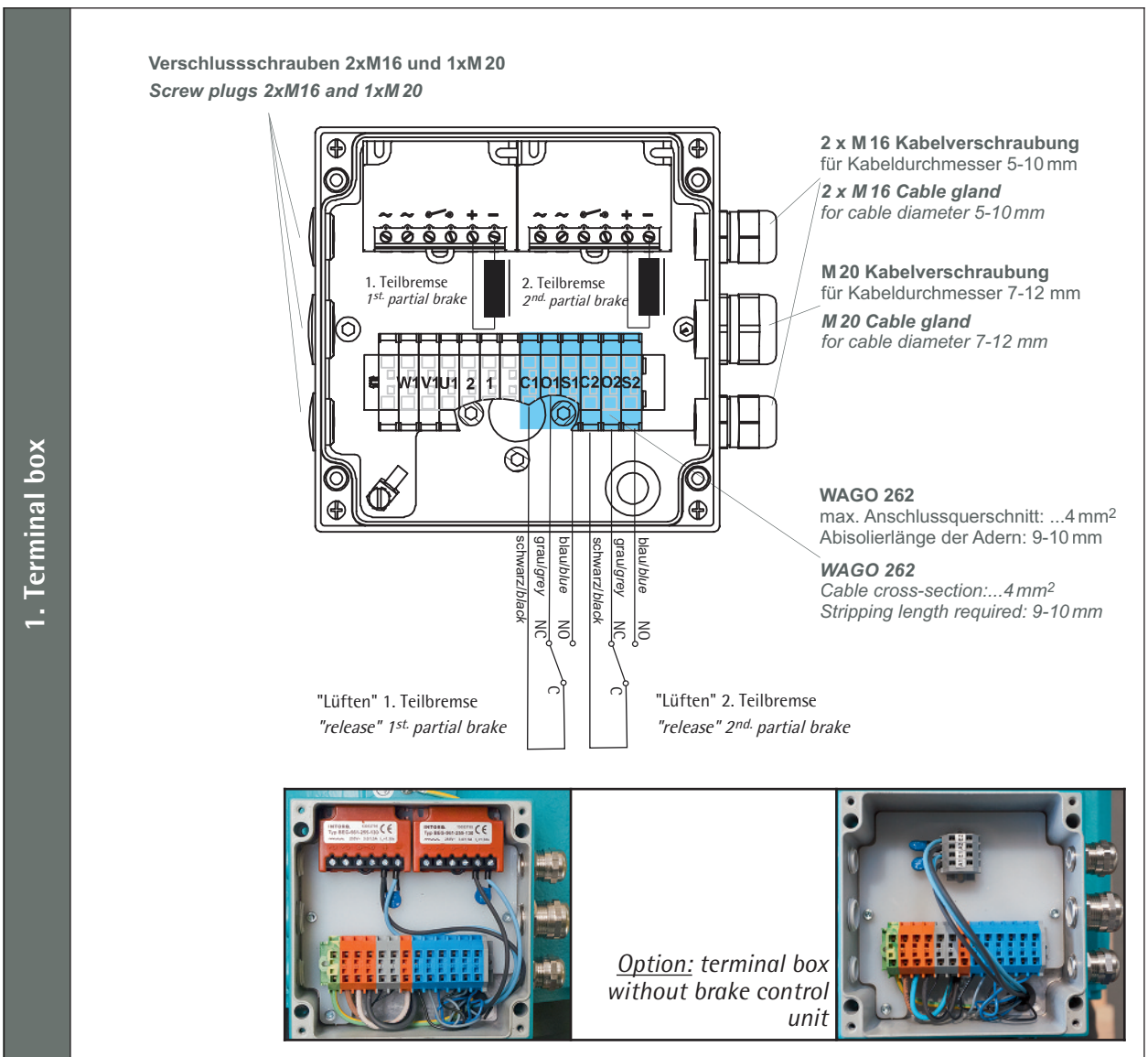


WARNING

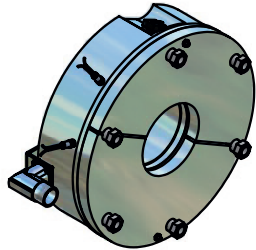
The microswitches must be evaluated separately for each partial brake to ensure compliance with the requirements of the type examination.

Connection of the brakes

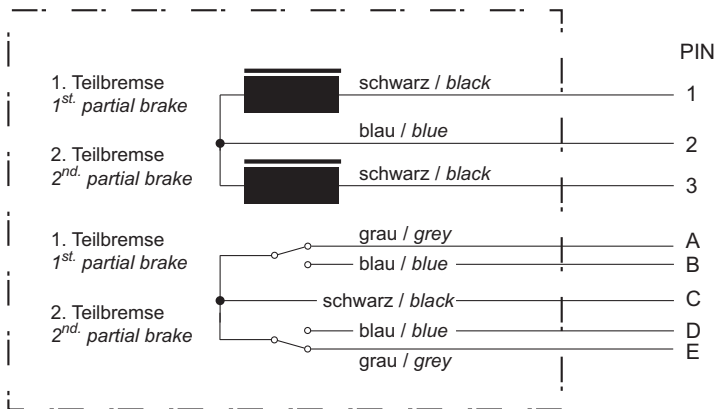
The brake solenoids, the brake control units and the monitoring contacts are connected to the mains in the terminal box, by power connector or by cable (standard length: 5 m).



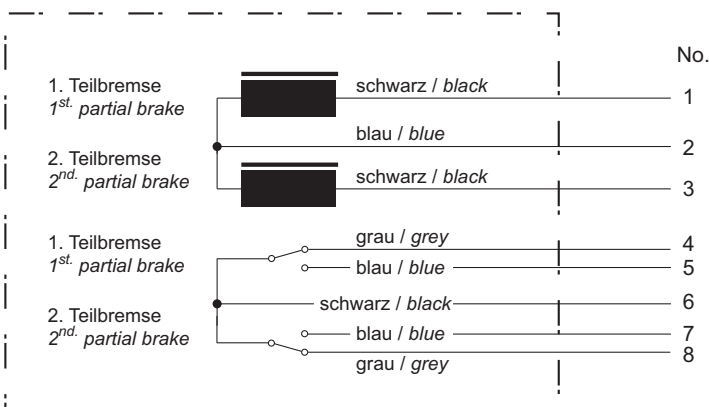
2. Plug connection



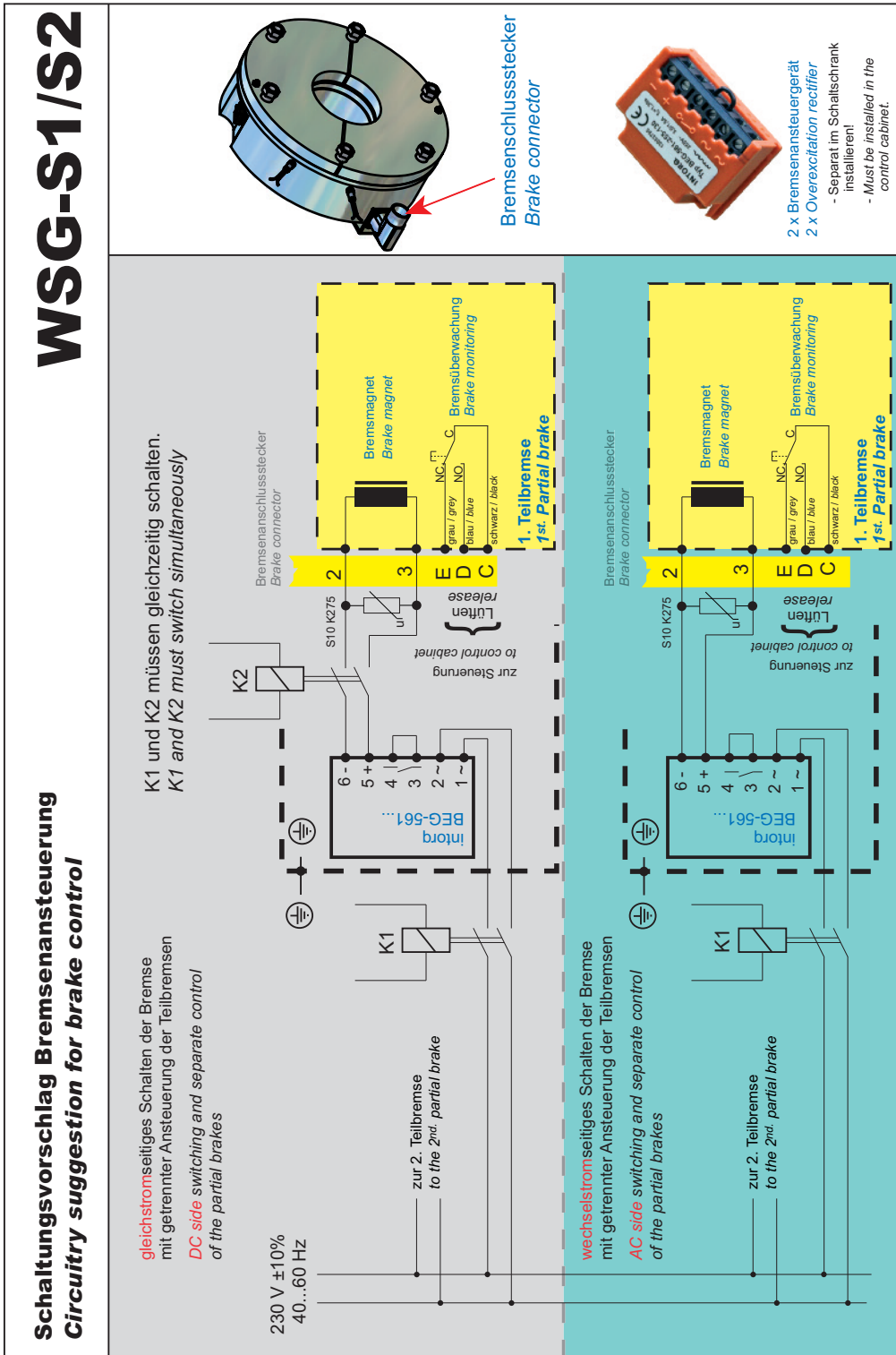
As an option, the electrical connection of the brake made by a 9-pole power connector mounted on the brake. A type B ST A 908 FR11 85 001A 000 connector from "intercontec" can be used, for example, as the female plug.



3. Cable connection



Circuitry suggestion for brake control WSG-S1



6. Commissioning

The following points should be checked or completed:

- Remove all securing, auxiliary and installation tools from the danger area.
- Check that the lift machine is used for its intended purpose and that the permissible ambient conditions are met.
- Check that the lift machine is properly fastened.
- Are all bolts tightened with the specified torque and secured?
- Check the motor connection, especially the earthing.
- Check that the temperature monitoring devices are properly connected and functioning.
- Check that the brakes are properly connected and that the brake monitoring switches are functioning properly.
- Is the measuring system properly connected?
- Check that the offset value indicated on the measuring system agrees with the value set on the converter.
- Check the proper functioning of the brake; perform a braking test using one partial brake.
- 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 DINEN81 "Safety rules for the construction and installation of lifts", Part 1: "Electric lifts", 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]		
	8.8	10.9	12.9
Strength class			
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	as required	

7.3. Regreasing the bearings

The anti-friction bearings have been provided with a grease filling at the factory that is sufficient for the planned service life of the machine. Under normal operating conditions, regreasing is not required or recommended.

7.4. Replacing the traction sheave

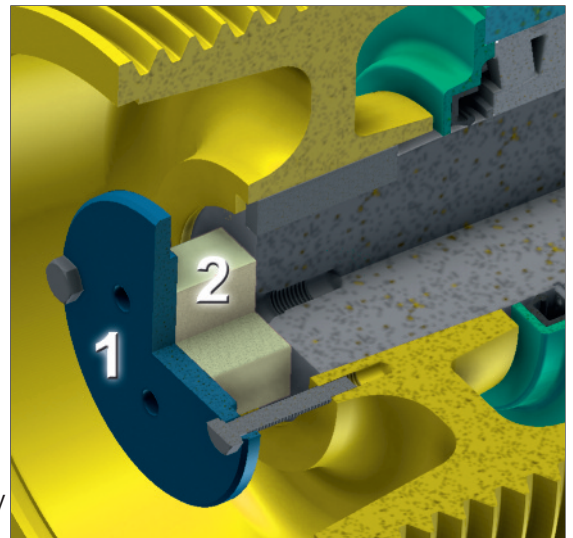


WARNING

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

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 M8 bolts at the pressure disc and the pressure disc itself.
- Insert two fastening bolts into the outer hole circle of the pressure disc (1) and into the traction sheave.
- Insert a 4–7 mm spacer (2) 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 into the shaft end.
- Slide the traction sheave onto the motor shaft.
- Fit the pressure disc to the traction sheave and fasten it using three pairs of NORD-LOCK washers and M8 bolts. Tighten the bolts alternately around the circle in three torque steps (10, 20 and 25 Nm) as far as they will go. **Tightening torque: 25 Nm**
- Replace the ropes and reinstall the rope slip-off guard.

7.5. Emergency evacuation

- The lift design engineer must always provide an electric return motion control or a manual rewinder (please note EN 81-1 / 12.5.2).
- Should a failure occur with the car at rest, the car can be moved with the drive connected to the mains or, in the case of mains failure, to an uninterruptible power supply (UPS), or mechanically under its own load with the emergency brakes temporarily released.
- The brakes are released electrically either from the mains or using a UPS.
- If the brakes are released with the motor deenergised, the motor windings should be short-circuited. This prevents the lift from accelerating in an uncontrolled manner, since the short-circuiting produces a speed-dependent braking torque.
- In the special case of the car being caught by the safety device, it can be released by powering the drive from the mains or a UPS.
- A remote manual releasing device is available as an option.

7.6. Testing the brake system to EN81-1



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. (The connections for the individual coils are accessible in the box.)

Monitoring the brakes

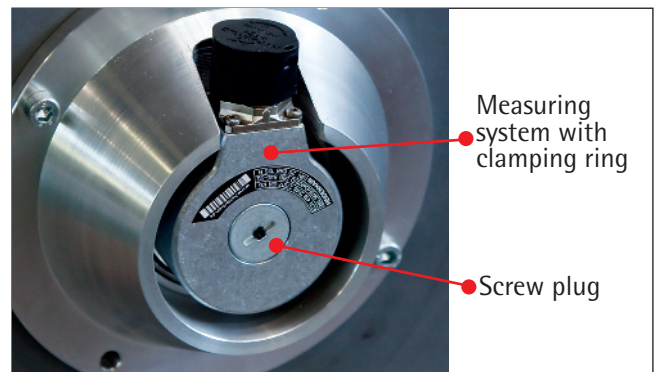
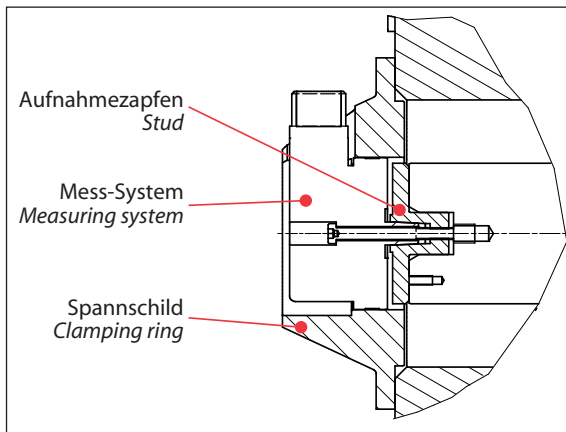
- Check the brake monitoring switches individually. No car travel must be permitted if a microswitch signal is missing or a wrong signal operates.

7.7. Replacing the measuring system

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

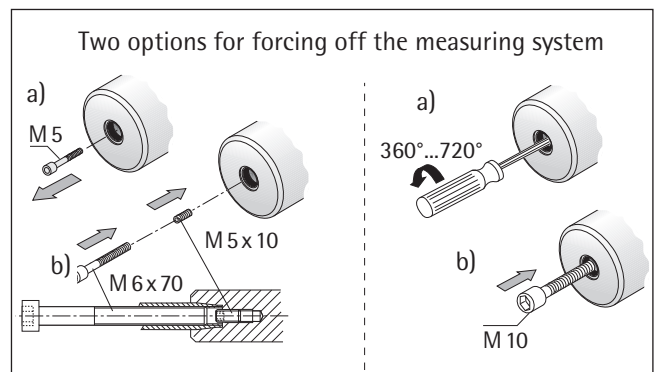
See the mounting instructions for the Heidenhain encoder.

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).



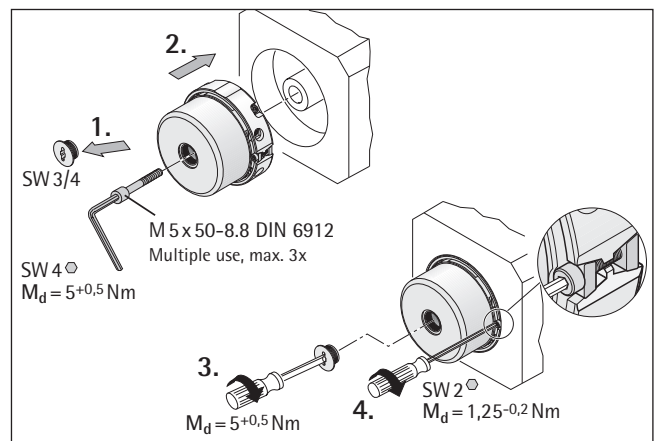
Disassembly

- Remove the screw plug.
- Loosen the clamping ring on the measuring system (2 mm Allen screw, shown in figure "Assembly").
- Force off the measuring system.



Assembly

- Check for true running on the plug-in shaft. (Permissible runout max. 0.02 mm).
- Clean the stud and the measuring system shaft end; do not grease them.



7.8. Trouble shooting

Fault	Possible cause	Remedy
Motor does not start, operates out of control or develops no torque	<ul style="list-style-type: none"> • Motor not connected in proper phase sequence • Measuring system not properly connected • Converter parametrisation incorrect • EMC disturbance • Measuring system offset angle incorrectly set • Measuring system defective 	<ul style="list-style-type: none"> • Connect motor correctly • Connect measuring system correctly • Check converter parametrisation • Carry out shielding and earthing measures as described by the converter manufacturer • Check measuring system offset angle • Replace measuring system
Motor noise	<ul style="list-style-type: none"> • Bearing defective • Converter parametrisation incorrect 	<ul style="list-style-type: none"> • Notify customer service • Check converter parametrisation
Braking system does not release	<ul style="list-style-type: none"> • Braking system is not supplied with voltage • Brake magnet voltage too low • Brake shoes mechanically blocked • Overexcitation rectifier defective 	<ul style="list-style-type: none"> • Check electrical connection • Check braking voltage supply voltage • Remove mechanical blocking • Replace overexcitation rectifier
Delay in braking system release	<ul style="list-style-type: none"> • Overexcitation rectifier defective 	<ul style="list-style-type: none"> • Replace overexcitation rectifier
Braking system does not engage	<ul style="list-style-type: none"> • Brake shoe mechanically blocked 	<ul style="list-style-type: none"> • Remove mechanical blocking
Delay in engaging of braking system	<ul style="list-style-type: none"> • Switch-off time too short with AC side switching 	<ul style="list-style-type: none"> • Brake control using DC side switching of the overexcitation rectifier
Brake makes loud switching noise	<ul style="list-style-type: none"> • DC side switching of the brake in "normal operation" • Brake air gap too large 	<ul style="list-style-type: none"> • Change over to brake control by AC side switching in "normal operation" • Adjust brake air gap
Braking torque too low	<ul style="list-style-type: none"> • Brake friction surface or brake linings dirty. • Foreign bodies between friction surface and brake lining • Brake friction surface or brake lining have come into contact with oily or greasy materials • Load torque too high 	<ul style="list-style-type: none"> • Clean friction surface / brake linings • Remove foreign bodies • Replace brake lining, clean brake drum thoroughly • Reduce load torque

8. Type code

Example: W S G- S1 . 3 - 0 E 15 / 24A - DF

	W	S	G-	Z1 Z2	.	Z3	-	X1	X2	X3 X4	/	X5 X6 X7	-	X8 X9
--	---	---	----	-------	---	----	---	----	----	-------	---	----------	---	-------

Customer specific identifier

S = Synchronous motor

G = gearless

Z1 Z2: Frame size

Z3: Overall length:

2 overall lengths are available;
identified by: 2, 3

X1: Customer specific identifier

X2: Motor voltage:

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

X3 X4: Rated speed:

e.g. 10: 100 min⁻¹ (with D_T = 240 mm v = 0.63 m/s; suspension 2:1)
15: 159 min⁻¹ (with D_T = 240 mm v = 1.0 m/s; suspension 2:1)
25: 255 min⁻¹ (with D_T = 240 mm v = 1.6 m/s; suspension 2:1)

X5 X6 X7: Traction sheave design

(Traction sheave diameter; width, groove design, groove geometry)

X8 X9: Variant code (brake, measuring system, modifications)

DE: dual-circuit brake; measuring system ECN 413-2048 incr. - SSI-interface
DF: dual-circuit brake; measuring system ECN 413-2048 incr. - ENDAT-interface
DG: dual-circuit brake; measuring system ERN 487-2048 incr.

Gearless Lift Machine

WSG-S1

Operating Instructions

Seite/page 24
 Datum/date 23.01.2014
 Stand/version 0.12

9. Technical data

Duty type:	S3 - 40% ED
Traction sheave:	dia.210mm, dia.240mm or dia.320mm
Traction sheave hardness:	mind. 220 HB 30 formbeständige Keilrille HRC55
Typical number of carrying ropes and dia.:	8 x dia. 6,5 mm oder 6 x dia. 8 mm
DE bearing	self-aligning roller bearing
NDE bearing:	ball bearing
Drive motor:	synchronous motor
perm. shaft load:	20 kN
Number of pole pairs:	8
Thermal class:	155 (F)
Degree of protection:	IP33
Overload capability:	2,5-fold (I_{max}/I_N)
Winding protection:	triple PTC 150°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 condensation)

Dual-circuit fail-safe brake

Type:	BFK 464-19S
Max. braking torque:	2 x 280 Nm
Air gap s_B :	0,4±0,05 mm (new air gap)
Max. air gap $s_{B\ max}$:	0,6 mm
Holding voltage:	103 VDC
Holding current:	2 x 0,6 A
Overexcitation voltage:	205 VDC
Overexcitation current:	2 x 1,2 A

Brake control units

Type:	BEG-561-255-130 from Intorq GmbH (accessories)
Operating voltage	$U_N = 230\text{ VAC} (\pm 10\%), 40... 60\text{ Hz}$
Dimensions:	52 x 22 x 38 (w x h x l)

Brake monitoring contacts

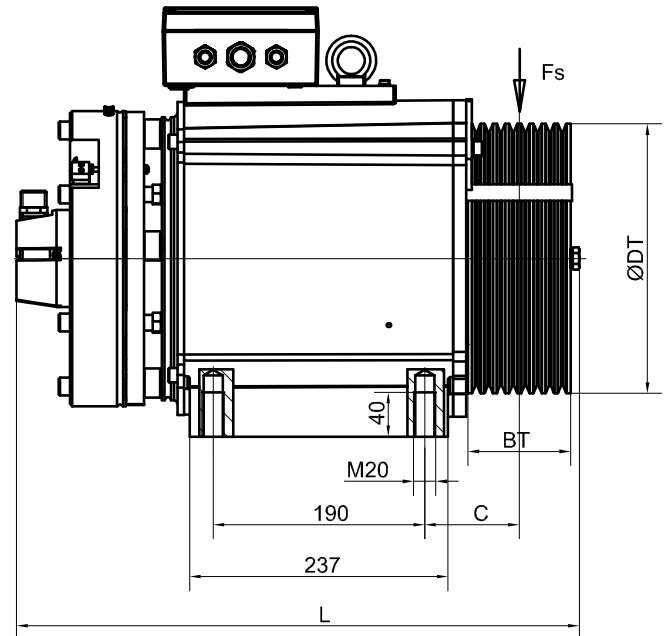
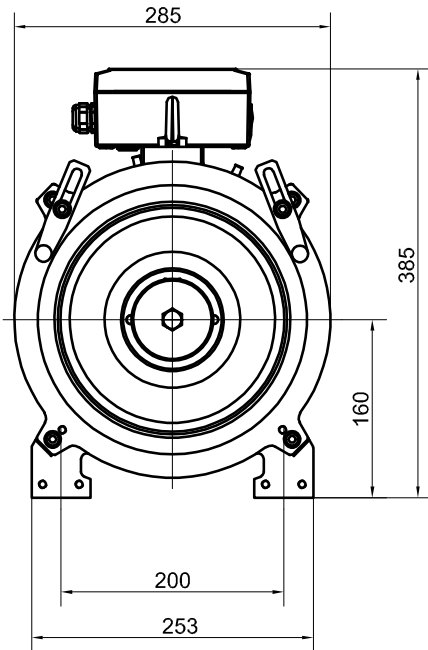
Contact rating	12 - 30 VDC / 0,01 - 0,1 A
Min. contact current	10 mA
Mechanical life of contacts:	2 x 10 ⁶ switching operations

^{*)} 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 / motor		WSG-S1.2						WSG-S1.3					
Drehmoment / torque S3-40%, 240 S/h	M_N [Nm]	170						230					
max. Drehmoment / max. torque	M_{max} [Nm]	425						575					
Treibrscheibe / traction sheave	$\varnothing D_T$ [mm]	240		320		240		320		240		320	
für Nennlasten / for loads ^{*)}	Q [kg]	bis / up to 480		bis / up to 360		bis / up to 630		bis / up to 480		bis / up to 630		bis / up to 480	
Aufhängung / suspension		Tabelle gilt für / table applies for 2:1											
Motorströme gelten für 500...620V Zwischenkreis- spannung („ECO“-Reihe) Motor currents applicable to 500...620V 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]
	0,5	80	1,4	6,1	60	1,1	6,1	80	1,9	6,8	60	1,4	5,6
	0,63	100	1,8	6,1	75	1,3	6,1	100	2,4	7,6	75	1,8	6,8
	1,0	159	2,8	8	119	2,1	6,9	159	3,8	10,4	119	2,9	9,4
	1,6	255	4,5	11,6	191	3,4	9,2	255	6,1	14,5	191	4,6	11,4
1,75				209	3,7	10					209	5	12,5

10. Dimension drawing


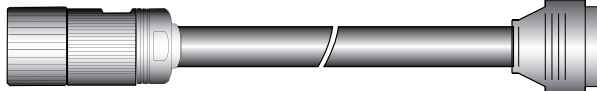

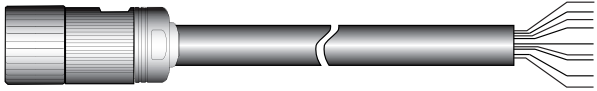


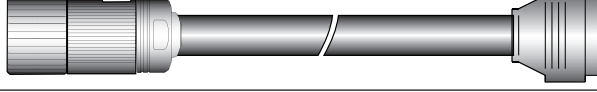

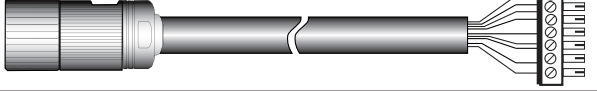
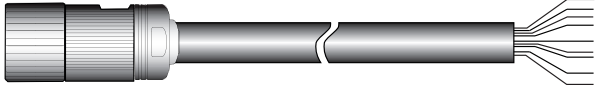



Motor / motor	WSG-	S1.2				S1.3			
		Ø D _T	160	210	240	320	160	210	240
	B _T	130	120	92	105	130	120	92	105
	L	548	525	505	510	548	525	505	510
	C	118,5	99	85	91,5	118,5	99	85	91,5
Masse / weight	m _G [kg]	145,5	141	141	150	145,5	141	141	150
Trägheitsmoment inertia	J _G [kgm ²]	0,16	0,19	0,21	0,43	0,19	0,22	0,24	0,46
Achskraft bis zu shaft loads up to	F _S [kN]	16	20	20	20	16	20	20	20

Motor / motor	WSG-S1.2						WSG-S1.3						
Drehmoment / torque S3-40%, 240 S/h	M _N [Nm]	170						230					
max. Drehmoment / max. torque	M _{max} [Nm]	425						575					
Treibscheibe / traction sheave	Ø D _T [mm]	160			210			160			210		
für Nennlasten / for loads *)	Q [kg]	bis / up to 675			bis / up to 500			bis / up to x			bis / up to 750		
Aufhängung / suspension	Tabelle gilt für / table applies for 2:1												
Motorströme gelten für 500...620V Zwischenkreis- spannung („ECO“-Reihe) Motor currents applicable to 500...620V 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]
	0,5	119	2,1	6,9	91	1,6	6,1	119	2,9	9,4	91	2,2	7,6
	0,63	150	2,7	8	115	2	6,9	150	3,6	10,4	115	2,8	9,4
	1,0	239	4,3	11,6	182	3,2	9,2	239	5,8	14,5	182	4,4	11,4

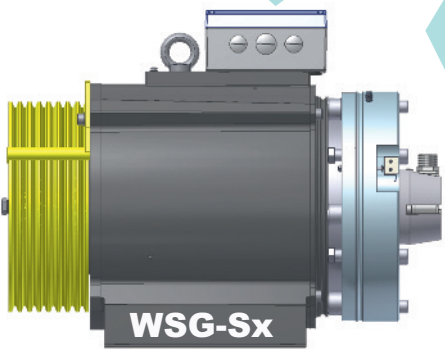
11. Accessories

11.1. Connecting cable for measuring systems

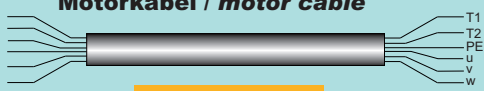
	Inverter type	recom. encoder system	recommended measurement system cable
	ARKEL ADrive CT undrive SP	ECN 413 (EnDat or SSI)	502 452 021 xx
	emotron / Dietz DSV 5445	ECN 413 (EnDat or SSI)	501 112 022 xx
	Flender/Loher L05	ERN 487	503 500 022 xx
	Fuji Frenic	ECN 413 (EnDat)	502 679 022 xx
	KEB F5	ECN 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/ Schneider Altivar 71	ECN 413 (EnDat)	503 715 022 xx
	Ziehl-Abegg 2SY/3BF	ECN 413 (EnDat or SSI)	508 749 022 xx

xx... cable length [m]

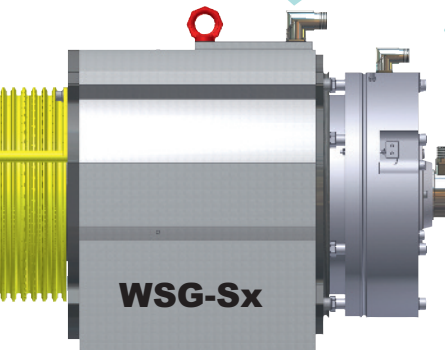
11.2. Cable set for motor and brake



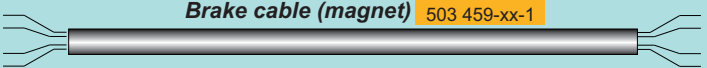
Motorkabel / motor cable



503 458 A21-xx




**Bremsenkabel (Magnet)
Brake cable (magnet)**



503 459-xx-1

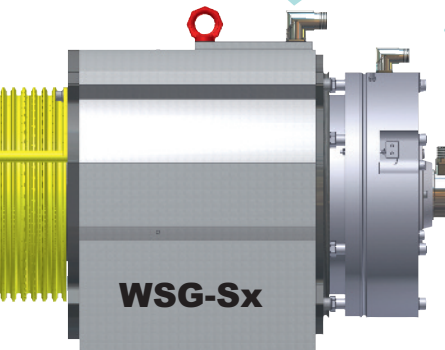
**Bremsenkabel (Überwachung)
Brake cable (monitoring)**



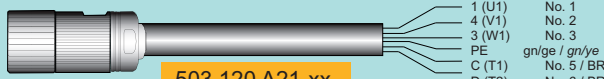
503 459-xx-2

A = 1: 1,5mm² (I_{S3-40%} < 25A)
 A = 2: 2,5mm² (I_{S3-40%} < 35A)
 A = 4: 4,0mm² (I_{S3-40%} < 47A)

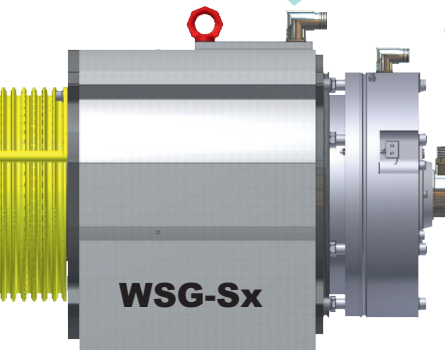
xx - Kabellänge / cable length [m]
 05 - 5m; 10 - 10m; 15 - 15m




Motorkabel / motor cable



503 120 A21-xx



**Bremsenkabel
Brake cable**



503 121 011-xx

A = 1: 1,5mm² (I_{S3-40%} < 25A)
 A = 2: 2,5mm² (I_{S3-40%} < 35A)

xx - Kabellänge / cable length [m]
 05 - 5m; 10 - 10m; 15 - 15m

11.3. Brake manual release

The brake can be fitted with a manual brake releasing device on customer request. The device can also be retrofitted.

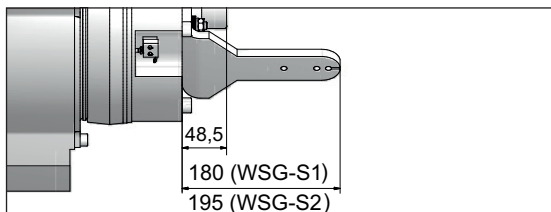
The for releasing necessary manual release lever including Bowden cable can be delivered, if required.

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

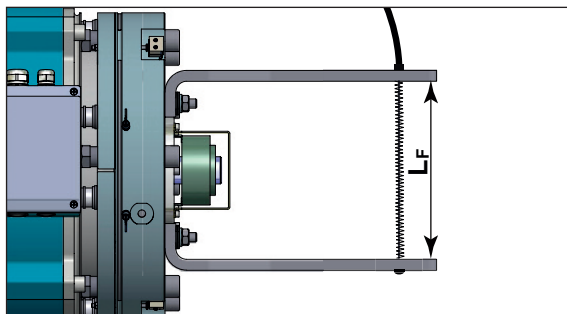
Installation:

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

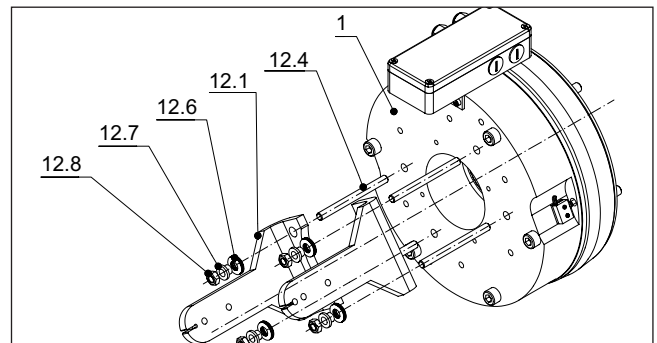
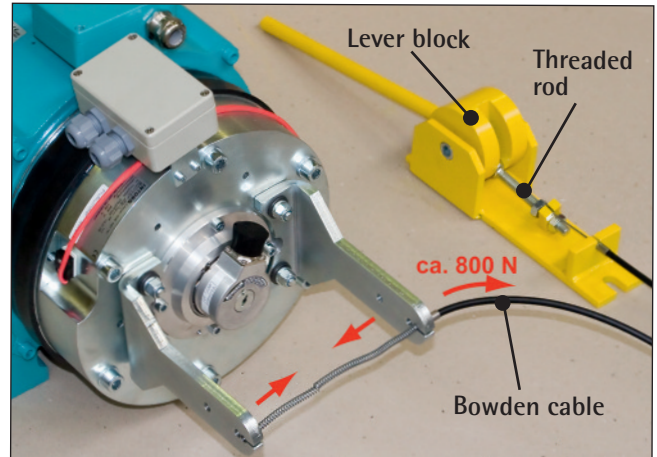
- Lock the car and the counterweight. Ensure that the required safety measures are observed for the lift system.
- Install the manual lifting lever (12.1) on the brake as described in the brake operating instructions.



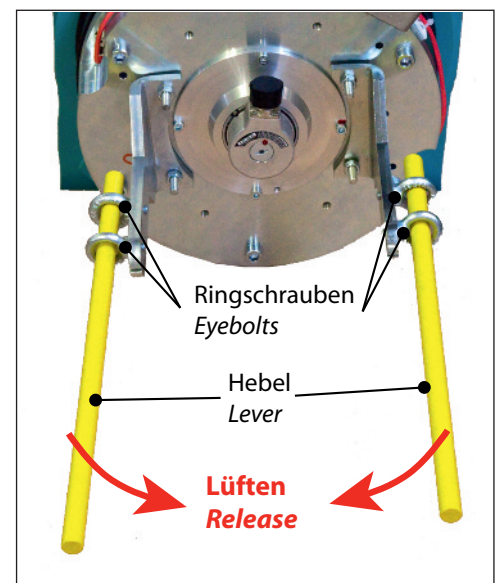
- Install the lever block.
- Insert the Bowden cable into the brake lever and the lever block. Adjusting of the Bowden cable on the lever block. Set $L_F = 115 \text{ mm}$ on the lever block with the assistance of threaded rod. (Do not actuate the lever block !)
- Perform a functional test (at least three times).



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



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

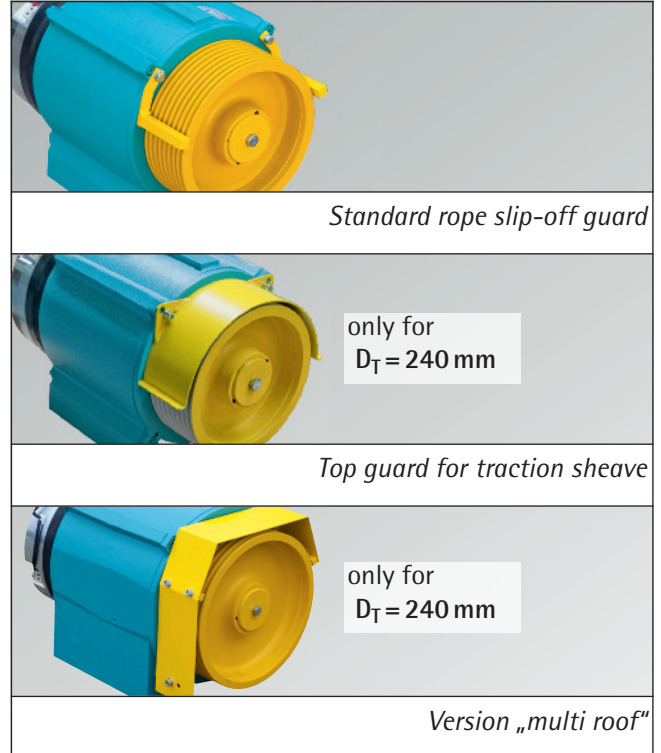


11.4. Rope guards

The standard version of the WSG-S1 is equipped with the rope slip-off guard (5) (see figure "Machine cross-section" on page 7).

In addition, we offer a guard version as shown in the figure "Top guard for traction sheave". This top guard has the double function of a rope slip-off guard and protection of the traction sheave.

Alternatively a version „multi roof“ is available.



11.5. Brake voltage 24/12VDC

Among the standard voltage of the brake coil (205/103V) a variant with 24/12V is available, optionally.



Caution

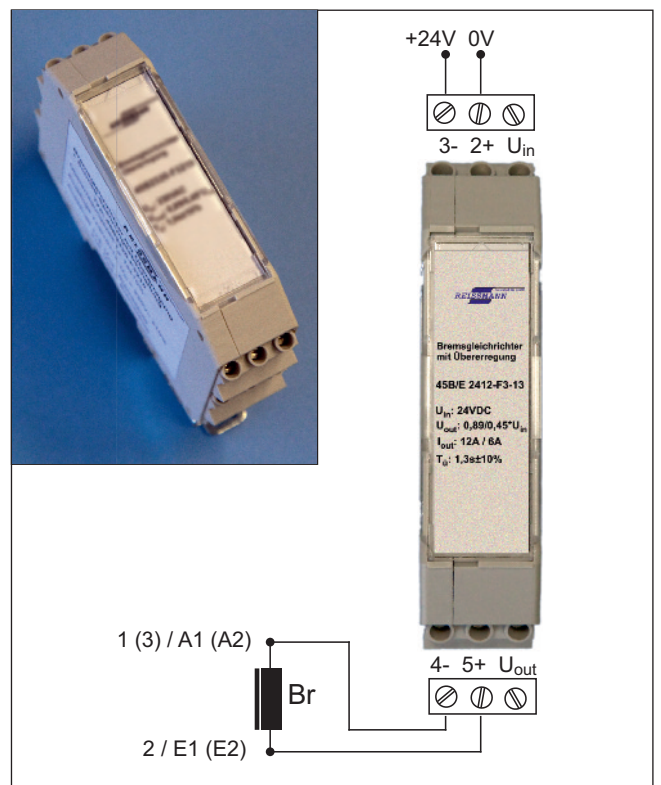
The provided brake control units of type 45B/E 2412-F3-13 have to be used for control (per brake coil one unit). The supply of the devices occurs by d. c. voltage – pay attention to the right polarity!

Dual-circuit fail-safe brake

Type:	WSG-S1	WSG-S2
Holding voltage:	12VDC	
Holding current:	2 x 4,2A	2 x 5,5A
Overexcitation voltage:	24VDC	
Overexcitation current:	2 x 8,5A	2 x 11,0A

Brake control units

Type:	45B/E 2412-F3-13 (from Reissmann GmbH) (accessoires)
Operating voltage	$U_N = 24 \text{VDC} (\pm 10\%)$
Dimensions	68x22.5x95 (for mounting rail to EN 50022)



12. Spare parts

Item	Teil	Bezeichnung
Motor		
01	traction sheave	acc. machine nameplate type code X5X6X7
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



EG-Konformitätserklärung EC Declaration of Conformity

im Sinne der EG-Richtlinie Niederspannung (2006/95/EG)
as defined by the EC Low Voltage Directive (2006/95/EC)

Der Hersteller
The manufacturer

WITTUR Electric Drives GmbH
Offenburger Straße 3
D-01189 Dresden

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

Produktbezeichnung:
Product designation:

Asynchronmotoren
Asynchronous motors

DS□ 1, DS□ 3, SDM, WLG, 2S□ 3, 6S□ 3

Synchronmotoren
Synchronous motors

DS□ 2, DS□ 4, DG□ 4, DU□ 4, DG□ 6, DU□ 6, SDM, TMS 0, WSG

Sondermotoren
Custom-made motors

EPX, 6PX, 4HX, APX, MMX, NPX, OPX, QPX

den Bestimmungen der EG-Richtlinie 2006/95/EG entsprechen.
are in conformity with the specification of the EC Directive 2006/95/EC.

Erklärung zur EMV-Richtlinie (2004/108/EG)

Bei Netzbetrieb an sinusförmiger Wechselspannung erfüllen die Motoren die Anforderungen der EG-Richtlinie „Elektromagnetische Verträglichkeit“ 2004/108/EG unter Berücksichtigung der Normen EN 61000-6-1..4.

Statement relating to EMC Directive (2004/108/EC)

When connected to a sinus-shaped a.c. voltage system, the motors conform to the requirements of the EC Directive "Electromagnetic compatibility" 2004/108/EC, 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 12 100-1: Sicherheit von Maschinen - Allgemeine Gestaltungsleitsätze,
EN ISO 12 100-2 Risikobeurteilung und Risikominimierung
Safety of machinery - General principles for design, risk assessment and risk reduction

Dresden, 2013-12-09

(Ort, Datum)
(Place, date)


Dr. Michael Bork
Geschäftsführer
General Manager


Steffen Mann
Leiter Entwicklung/Konstruktion
Head of Development/Construction



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-S1.2 and xSG-S1.3

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 Mührel
Technical Expert

Datum: 02.04.2013

Unsere Zeichen:
IS-FT1-DRE/Dmü

Dokument:
xSG-S1.2_3_en.docx

Das Dokument besteht aus
2 Seiten.
Seite 1 von 2





1. Calculation documents

The following technical documents were to be reviewed:

- Calculation documents S1KFE0313.DOC pages 1 to 5 dated 14/03/2011, incl. Annexes 1.1 – 1.3.
- Drawing no. 504 194 (Revision Äm 349/11, 01/11/2011).

2. Technical data

The data which are of relevance to the calculation are specified as follows in the calculation document S1KFE0313.DOC:

– max. shaft load (center traction sheave):	20.0 kN
– max. magnetic pull:	1.1 kN
– load torque:	483.0 Nm
– emergency brake torque:	560.0 Nm
– traction sheave weight:	20.0 kg
– rotor weight:	18.5 kg
– brake weight:	10.0 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. 504 194 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

A handwritten signature in blue ink, appearing to read 'Thoralf Mührel'.

Thoralf Mührel



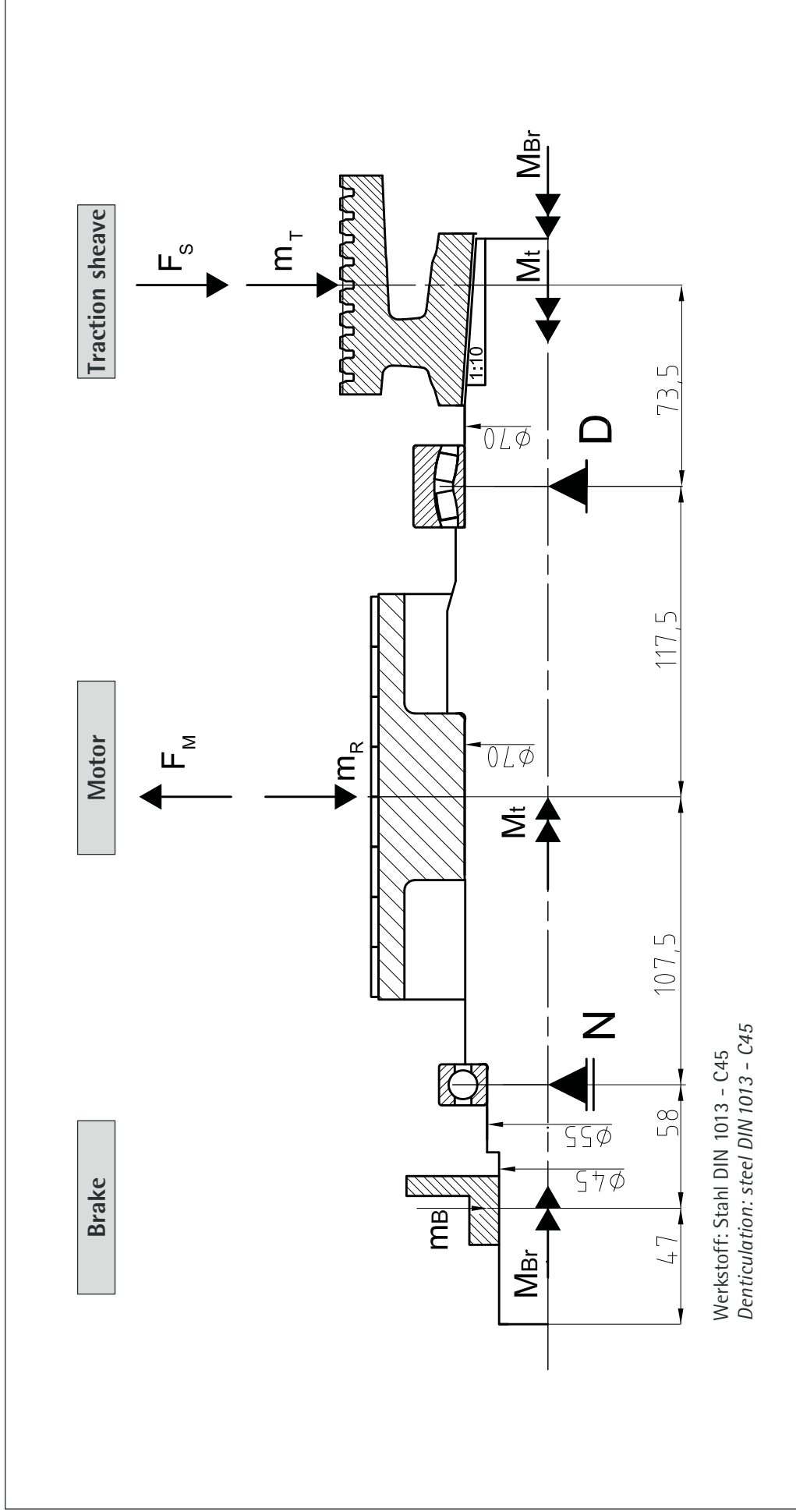
Technical information 01-04/2013

Re:

WSG-S1

Traction sheave shaft

(Annex - calculation of the shaft)



WITTUR Electric
Drives GmbH



Offenburger Str. 3
01189 Dresden
Germany

info@wittur-edrives.de
www.wittur-edrives.de

Phone: +49 (0) 351 40 44-0
Fax: +49 (0) 351 40 44-111

M.S. 04.04.2013



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-S1.X – extended conical shaft end

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 Mührel
Technical Expert

Datum: 06.05.2013

Unsere Zeichen:
IS-FT1-DRE/Dmü

Dokument:
xSG-S1.X_kon_en.docx

Das Dokument besteht aus
2 Seiten.
Seite 1 von 2



1. Calculation documents

The following technical documents were to be reviewed:

- Calculation documents S1KFE0313_TS160.DOC pages 1 to 5 dated 03/04/2013, incl. Annexes 1.1 – 1.3.
- Drawing no. 513 002 (Revision Äm 90/13, 19/03/2013).

2. Technical data

The data which are of relevance to the calculation are specified as follows in the calculation document S1KFE0313_TS160.DOC:

- max. shaft load (center traction sheave):	16.0 kN
- max. magnetic pull:	1.1 kN
- load torque:	483.0 Nm
- emergency brake torque:	560.0 Nm
- traction sheave weight:	20.0 kg
- rotor weight:	18.5 kg
- brake weight:	10.0 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. 513 002 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 Mührel



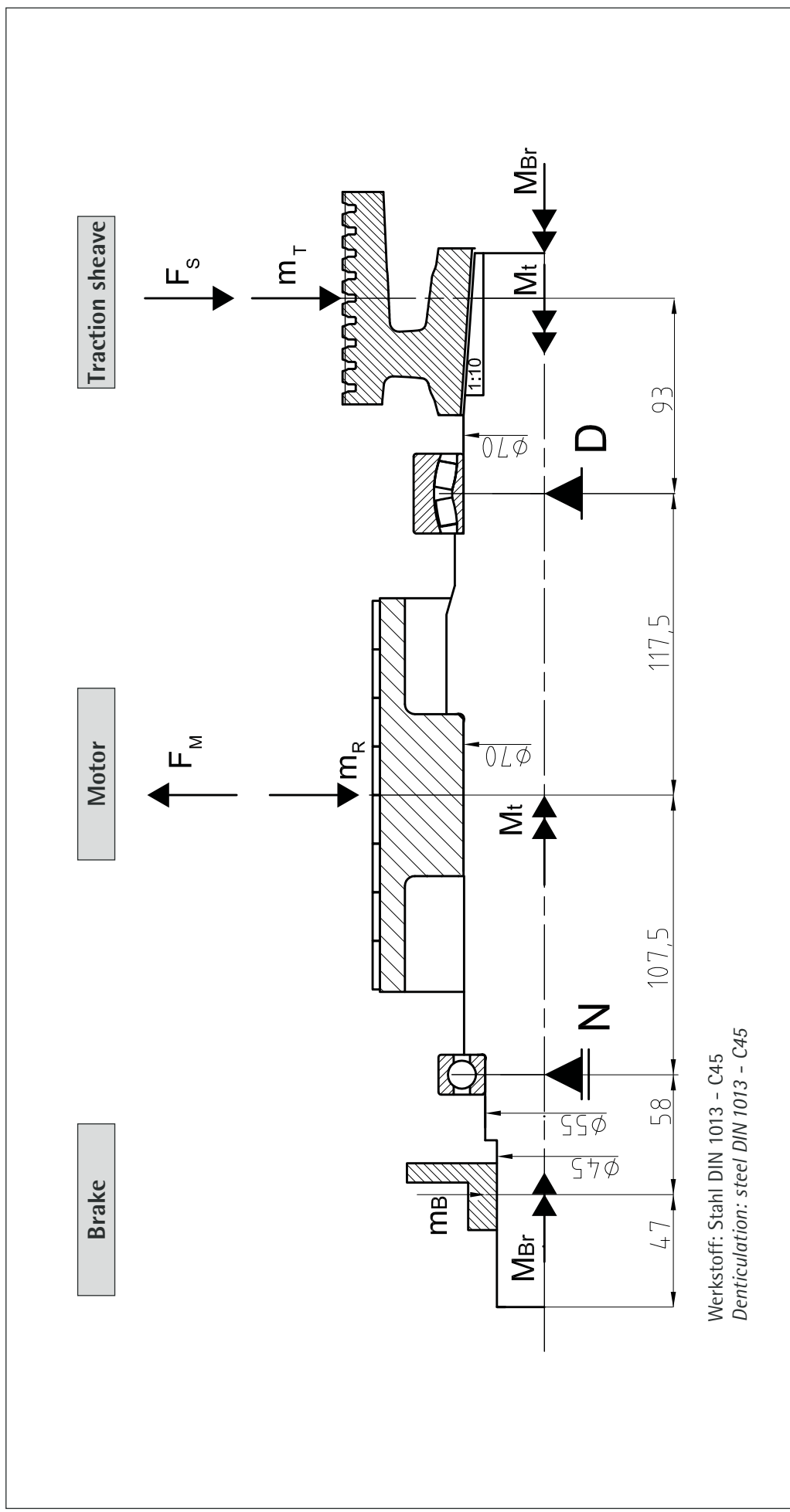
Technical information 03-05/2013

Re:

WSG-S1 (trac. sheave: 160 mm)

Traction sheave shaft

(Annex - calculation of the shaft)



WITTUR Electric
Drives GmbH



Offenburger Str. 3
01189 Dresden
Germany

info@wittur-edrives.de
www.wittur-edrives.de

Phone: +49 (0) 351 40 44-0
Fax: +49 (0) 351 40 44-111

M.S. 16.05.2013



EC type-examination certificate

Certificate no.:	ABV 863
Notified body:	TÜV SÜD Industrie Service GmbH Westendstr. 199 80686 München – Germany
Applicant/ Certificate holder:	INTORQ GmbH & Co. KG Wülmser Weg 5 31855 Aerzen – Germany
Date of application:	2010-11-26
Manufacturer of the test sample:	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
Type:	BFK464-19S
Test laboratory:	TÜV SÜD Industrie Service GmbH Prüflaboratorium für Produkte der Fördertechnik Prüfbereich Aufzüge und Sicherheitsbauteile Westendstr. 199 80686 München – Germany
Date and number of the test report:	2011-02-07 ABV 863
EC-Directive:	95 / 16 / EC
Result:	The safety component conforms to the essential safety requirements of the Directive for the respective scope of application stated on page 1 - 2 of the annex to this EC type-examination certificate.
Date of issue:	2011-02-09

Certification body for lifts and safety components
Identification number: 0036

C. Rührmeyer
Christian Rührmeyer



**Annex to the EC type-examination certificate
no. ABV 863 dated 2011-02-09**

1. Scope of Application

- 1.1 Permissible brake moment when the braking device acts on the shaft of the traction sheave while the car is moving upward 560 Nm
- 1.2 Maximum tripping speed of the overspeed governor and maximum rated speed

The maximum tripping speed and the maximum rated speed must be calculated on the basis of the traction sheaves maximum tripping rotary speed and maximum rated rotary speed as outlined in sections 1.2.1 and 1.2.2 taking into account traction sheave diameter and car suspension.

$$v = \frac{D \times \Pi \times n}{60 \times i}$$

v = speed (m/s)
 D = Diameter of the traction sheave from rope's centre to rope's centre (m)
 Π = 3.14
 n = Rotary speed (min⁻¹)
 i = Ratio of the car suspension

- 1.2.1 Maximum tripping rotary speed of the traction sheave 455 min⁻¹
- 1.2.2 Maximum rated rotary speed of the traction sheave 396 min⁻¹

2. Conditions

- 2.1 Since the brake device represents only a part of the protection device against overspeed for the car moving in upwards direction an overspeed governor as per EN 81-1, paragraph 9.9 must be used to monitor the upward speed and the brake device must be triggered (engaged) via the overspeed governor's electric safety device.

Alternatively, the speed may also be monitored and the brake device engaged by a device other than an overspeed governor as per paragraph 9.9 if the device shows the same safety characteristics and has been type tested.

- 2.2 In order to recognise the loss of redundancy the movement of each brake circuit (each anchors) is to be monitored separately and directly (e.g. by micro switches). If a brake circuit fails to engage (close) while the lift machine is at standstill, next movement of the lift must be prevented.
- 2.3 In cases where the lift machine moves despite the brake being engaged (closed), the lift machine must be stopped at the next operating sequence at the latest and the next movement of the lift must be prevented. (The car may, for example, be prevented from travelling by querying the position of the micro switch which is used to monitor the mechanical movement of the brake circuits, should both brake circuits fail to open).
- 2.4 According to EN 81-1, paragraph 9.10.4 d a braking device must act directly on the traction sheave or on the same shaft on which the traction sheave is situated in the immediate vicinity thereof.

If the braking device does not act in the immediate vicinity of the traction sheave on the same shaft on which the traction sheave is situated, the standard is not complied with. In cases involving shaft failure in the extended area between the traction sheave and the braking device, safety would no longer be ensured by the latter if the lift car made an uncontrolled upward movement.



Shaft failure in the extended area must therefore be ruled out by appropriate design and sufficient dimensioning. In order to eliminate or reduce influencing factors which may lead to failure wherever possible, the following requirements must be satisfied:

- Minimization of bending length between traction sheave and braking device or traction sheave and the next bearing (the next bearing must form part of the drive unit)
- Static defined bearing (e. g. 2-fold borne shaft) otherwise measures are required to obtain a defined loading
- As far as possible, prevention of a reduction in load-bearing capacity in the area of reversed bending stress (reduction in load-bearing capacity caused, for example, by stress concentration and cross-sectional reductions)
- Between traction sheave and braking device the shaft must be continuous (made from one piece)
- Cross-sectional influences on the shaft are only permitted if they act on the following connections: traction sheave – shaft, braking device – shaft, torque of the transmitting component – shaft (situated between traction sheave and braking device).

The manufacturer of the drive unit must provide calculation evidence that the connection traction sheave - shaft and the shaft itself is sufficiently safe. If necessary, evidence must be provided for the intended measures, too (see static undefined bearing).

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

3. Remarks

- 3.1 The braking device exists of two brake circuits. Redundancy requirements necessitate that a sufficient braking effect as outlined in section 12.4.2.1 of EN 81.1 is still maintained if one of the brake circuit fails. It is not assumed that two brake circuits will fail simultaneously.
- 3.2 The permissible brake moment must be applied to the lift system in such a manner that they do not decelerate more than $1 g_n$, if the empty car is moving upwards.
- 3.3 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.
This type examination only refers to the requirements pertaining to brake devices as per EN 81-1, paragraph 9.10.
Checking whether the requirements as per paragraph 12.4 have been complied with is not part of this type examination.
- 3.4 In order to provide identification, information about the basic design and it's functioning and to show which parts have been tested pertaining to the tested and approved type, drawing no. Nr. BFK46419-001 (page 3 of 3) or BFK46419-002 (page 3 of 3) with certification stamp dated 2011-02-09 is to be enclosed with the EC type-examination certificate and the Annex thereto. The installation conditions and connection requirements are presented or described in separate documents (e.g. assembly and operating instructions).
- 3.5 The EC type-examination certificate may only be used in connection with the pertinent annex and the list of the authorized manufacturers (according to enclosure). This enclosure shall be updated and re-edited following information of the certificate holder.



Type-examination certificate

Certificate no.: ESV 863

Certification office: TÜV SÜD Industrie Service GmbH
Westendstr. 199
80686 München - Germany

**Applicant/
certificate holder:** INTORQ GmbH & Co. KG
Wülmser Weg 5
31855 Aerzen - Germany

Date of application: 2011-04-19

Manufacturer of the test sample: INTORQ GmbH & Co. KG
Wülmser Weg 5
31855 Aerzen - Germany

Product: Braking element acting on the shaft of the traction sheave, as a part of the protection device against unintended car movement

Type: BFK464-19S

Test laboratory: TÜV SÜD Industrie Service GmbH
Prüflaboratorium für Produkte der Fördertechnik
Prüfbereich Aufzüge und Sicherheitsbauteile
Westendstr. 199
80686 München - Germany

**Date and
number of the test report:** 2011-09-02
ESV 863

Examination basis: EN 81-1:1998 + A3:2009 (D), issue December 2009

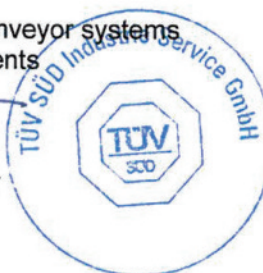
Result: The safety component conforms to the requirements of examination basis for the respective scope of application stated on page 1 - 2 of the annex to this type-examination certificate.

Date of issue: 2011-09-05

Certification office for products of conveyor systems
Lifts and safety components

S. Melzer

p. p. Siegfried Melzer





Annex to the type-examination certificate
no. ESV 863 dated 2011-09-05

1 Scope of application

1.1 Nominal brake torques and response times with relation to a brand-new brake element

Nominal brake torque* [Nm]	Overexcitation [Yes / No]	Maximum response times** [ms]		
		t ₀	t ₅₀	t ₉₀
2 x 280 = 560	No	14	34	54
2 x 280 = 560	Yes	19	39	59

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, t₅₀ optionally calculated t₅₀ = (t₁₀ + t₉₀)/2 or value taken from the examination recording

1.2 Assigned execution features

Type of powering / deactivation	Continuous current / continuous current end
Brake control	Parallel
Nominal air gap	0.45 mm
Damping elements	YES
Overexcitation	double nonrelease voltage
Maximum tripping rotary speed	455 min ⁻¹

2 Conditions

- 2.1 The above mentioned safety component represents only part of a protective equipment against unintended movement of the elevator car. Only in combination with a detecting and triggering component (two separate components also possible), which must be subjected to an own type examination, can the system created fulfil the requirements for a safety component in accordance with Annex F.8, EN 81-1:1998 + A3:2009 (D).
- 2.2 The safety component is used in combination with the brake device as part of the ascending car overspeed protection means and as a drive brake.
- 2.3 The installer of a lift must create an examination instruction in accordance with D.2 p) of EN 81-1:1998 + A3:2009 (D) for lift(s) 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).
- 2.4 The dimension configuration of the lift system must be designed as regards the brake torques in such a way that the permissible value of deceleration does not exceed 1 g_n in either direction. Excluded are decelerations, which are caused by an instantaneous roller safety gear up to a rated speed of the lift system of 0.63 m/s for instance.
- 2.5 The traction and its variance must be taken into account as regards its braking distance (transferable power / torque) and included in the calculation.
- 2.6 For installer of a lift, the compliance of the component with the type examined component and the assured nominal brake torques and response times must be confirmed in writing (e. g., type plate and/or supplement in the declaration of conformity).



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- 2.7 The information evaluation for self-monitoring must prevent an operational starting of the lift in the event of a fault.
- 2.8 According to the norm requirements, the brake element of the protective device must impact directly on the traction sheave or on the same shaft in the immediate vicinity of the traction sheave.

If the brake element does not impact in the immediate vicinity of the traction sheave on the same shaft, on which the traction sheave is also arranged, a deviation from the norm exists. A failure of the shaft in the area between the traction sheave and the brake element must be ruled out using corresponding construction designs and sufficient measurements. The manufacturer of the entire drive must prove the sufficient safety of the connection brake element – shaft and traction sheave – shaft as well as the shaft itself in calculations. This proof must be added to the technical documentation of the lift.

3 Remarks

- 3.1 As part of the type-examination, it was detected that the brake element has a redundant design and that the correct function is monitored by sensors.

The examination of compliance with all requirements under Section 12.4 (EN 81-1:1998 + A3:2009 (D)), deterioration of the brake torques/breaking forces due to wear and tear and the operation-related change of the drive capability are not part of this type examination.

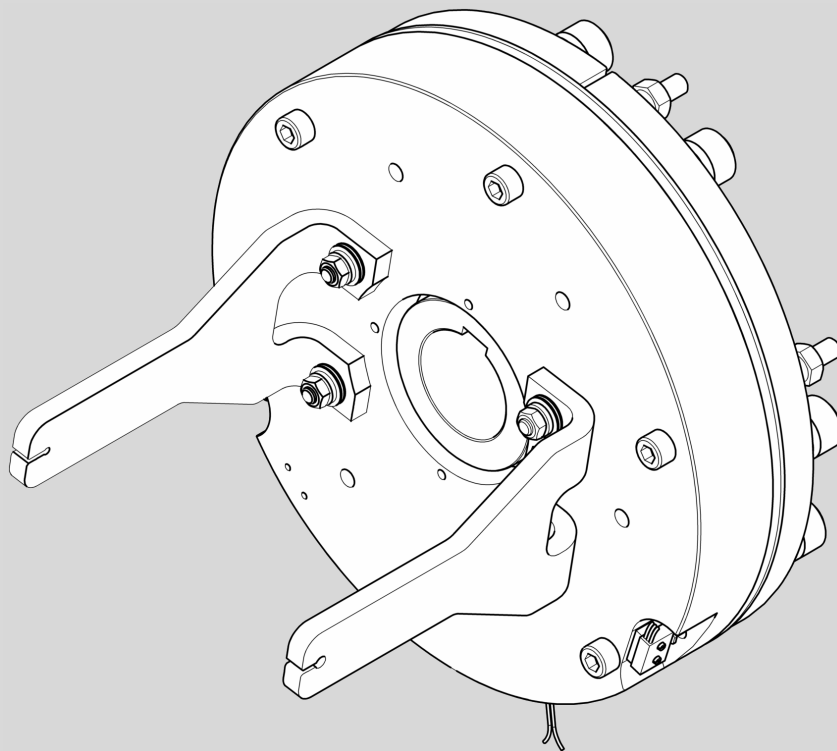
This type-examination refers to the partial requirements for the protection device against unintended car movement only according to EN 81-1:1998 + A3:2009 (D), Section 9.11.

- 3.2 In order to provide identification, information about the basic design and functioning and to show the environmental conditions and connection requirements, drawing with the relevant latest identification from the associated EC type-examination certification ABV 863/X is to be enclosed with the type-examination certificate and the annex thereto.
- 3.3 The type-examination certificate may only be used in connection with the pertinent annex and the list of the authorized manufacturers (according to enclosure of the corresponding EC type-examination certification ABV 863/X).

INTORQ BFK464-18S; 19S; 20S; 25S und 28S INTORQ BFK464-20S.1

Electromagnetically released spring-applied brake

Operating Instructions

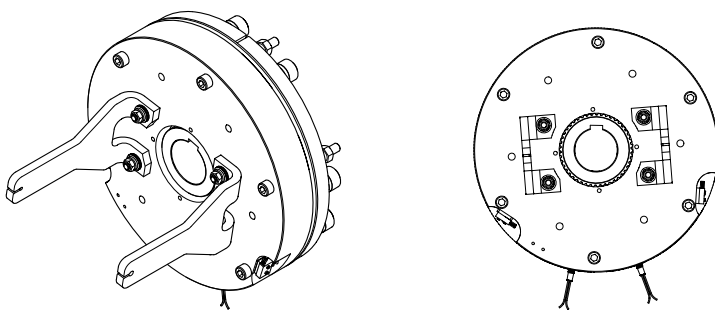


INTORQ

setting the standard

www.intorq.de

This documentation applies to ...

BFK464-18S	
BFK464-19S	
BFK464-20S	
BFK464-20S.1	
BFK464-25S	
BFK464-28S	

BFK464-XX-S-011a.iso/dms

BFK464-XX-S-011.iso/dms

Product key

Product key

INTORQ **B** **FK** -

A	
B	
C	
D	
E	

Legend for INTORQ BFK464-XXS/S.1 product key

A	Product group	Brakes
B	Product family	Spring-applied brake
C	Type	464
D	Size	18, 19, 20, 25, 28
E	Design	S S.1

Not coded: supply voltage, hub bore, options

Identification

Package label			Example		
Manufacturer		Bar code			
Type (see product key)		Type No.			
Name		Quantity per box			
Rated/holding voltage	Rated torque	Packing date			
Rated/holding power	Hub diameter				
Model identification					
Additional information		CE designation			

BFK464-XX-S-013.iso/dms

Nameplate			Example		
Manufacturer	Model identification	CE designation			
Type (see product key)					
Rated/holding voltage	Rated/holding power	Hub diameter			
Type No.	Rated torque	Production date			

BFK464-XX-S-012.iso/dms

Document history

Material number	Version			Description
13349936	1.0	09/2010	TD09	First edition
00000000	2.0	11/2010	TD09	Sizes 19S and 28S have been added Tables in the chapter "Rated data" have been supplemented Important notes in the chapter "Commissioning and operation" have been supplemented

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1 Preface and general information

1.1 About these Operating Instructions

- These Operating Instructions will help you to work safely on and 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	Spring-applied brake with electromagnetic release
Drive system	Drive systems with spring-applied brakes and other drive components



1.3 Conventions used

This documentation uses the following conventions to distinguish different types of information:

Spelling of numbers

Decimal separator	Point	In general, the decimal point is used. For instance: 1234.56
-------------------	-------	---

Icons

Page reference		Reference to another page with additional information For instance:  16 = see page 16
----------------	---	---

1 Preface and general information

1.4 Abbreviations used

Abbreviation	Unit	Designation
P ₂₀	[kW]	Electrical power at 20°C
M _a	[Nm]	Tightening torque
t ₁	[ms]	Engagement time, $t_1 = t_{11} + t_{12}$
t ₂	[ms]	Disengagement time (time from the beginning of the torque drop to reaching 0.1 M _k)
t ₁₁	[ms]	Delay during engagement (time from switching off the supply voltage to the beginning of the torque rise)
t ₁₂	[ms]	Torque rise time
I	[A]	Current
Q	[J]	Calculated friction work per operation
Q _{perm}	[J]	Max. permissible friction work per operation
S _h	[h ⁻¹]	Operating frequency, i.e. the number of periodical brakings
s _{Lü}	[mm]	Rated air gap
s _{hü}	[h ⁻¹]	Transition operating frequency, i.e. the maximally permissible number of brakings per unit time
R ₂₀	[Ohm]	Coil resistance at 20°C
U	[V]	Voltage
n _{max}	[rpm]	Maximum speed

1.5 Scope of supply

- The drive systems are combined individually according to a modular design. The scope of delivery is indicated in the accompanying papers.
- After receipt of the delivery, check immediately whether it corresponds to the accompanying papers. INTORQ does not grant any warranty for deficiencies claimed subsequently. Claim
 - visible transport damage immediately to the forwarder.
 - visible deficiencies / incompleteness immediately to INTORQ GmbH & Co.KG.

1.6 Disposal

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

- Recycle metals and plastics.
- Ensure professional disposal of assembled PCBs according to applicable environmental regulations.

1 Preface and general information

1.7 Drive systems

1.7.1 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

- The spring-applied INTORQ brake is also delivered in single modules and individually combined to its modular design. The data - package labels, nameplate, and type code in particular - apply to the complete stator.
- If single modules are delivered, the labelling is missing.

1.8 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 the information, illustrations and descriptions.
- We do not accept any liability for damage and operating interference caused by:
 - inappropriate use
 - unauthorised modifications to the drive system
 - improper working on and with the drive system
 - operating faults
 - disregarding these Operating Instructions

Warranty

- Terms of warranty: see terms of sale and delivery of INTORQ GmbH & Co. KG.
- Warranty claims must be made to INTORQ immediately after detecting defects or faults.
- The warranty is void in all cases where liability claims cannot be made.

2 Safety instructions

2.1 General safety information

- INTORQ components ...
 - ... must only be applied 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.
 - ... must not be operated without the required covers.
 - ... can hold live 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.
- Observe all specifications given in the attached documentation.
 - This is the prerequisite for safe and trouble-free operation and achieving the specified product features.
- 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 by no means have contact to oil or grease since even small amounts reduce the brake torque considerably.
- The brake is designed for operation under the environmental conditions that apply to IP54. Because of the numerous possibilities of using the brake, it is however necessary to check the functionality of all mechanical components under the corresponding operating conditions.

2 Safety instructions

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 shall be deemed inappropriate!

Possible applications of the INTORQ spring-applied brake

- Humidity: no restrictions
 - In case of formation of condensed water and moisture: 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 armature plate and rotor from freezing.
- Protect electrical connections against contact.


2 Safety instructions

2.3 Notes used

The following pictographs and signal words are used in this documentation to indicate dangers and important information:

Safety instructions




Structure of safety instructions:

 **Danger!**
 Characterises 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.

Pictograph and signal word	Meaning
 Danger!	Danger of personal injury through dangerous electrical voltage Reference to an imminent danger that may result in death or serious personal injury if the corresponding measures are not taken.
 Danger!	Danger of personal injury through a general source of danger Reference to an imminent danger that may result in death or serious personal injury if the corresponding measures are not taken.
 Stop!	Danger of property damage Reference to a possible danger that may result in property damage if the corresponding measures are not taken.

Application notes

Pictograph and signal word	Meaning
 Note!	Important note to ensure troublefree operation
 Tip!	Useful tip for simple handling
	Reference to another documentation

3 Technical data

3.1 Product description

Versions

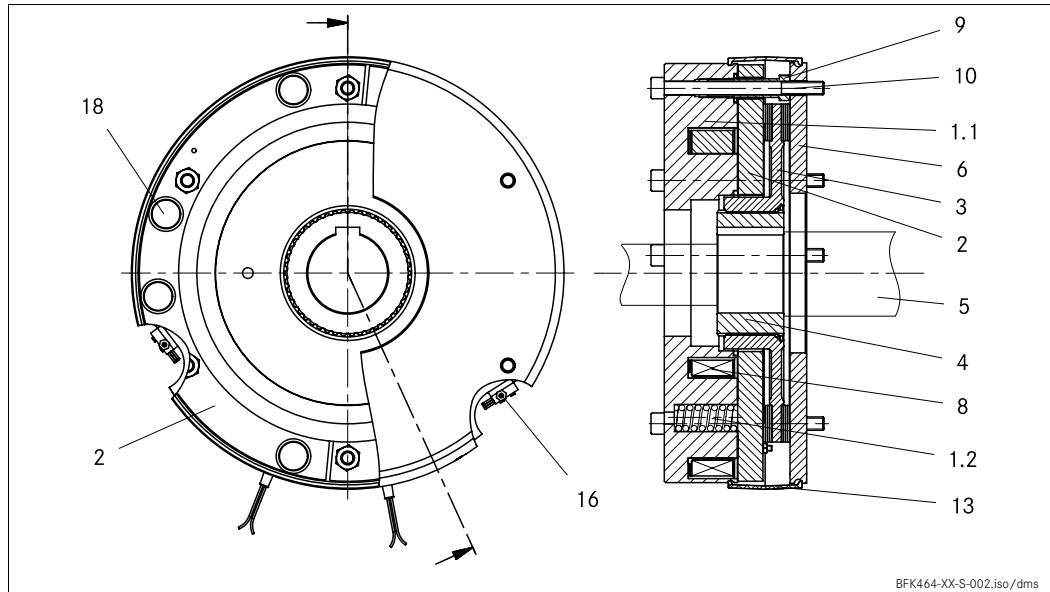




Fig. 1 Aufbau einer Federkraftbremse BFK464-□□S / S.1


1.1	Stator	5	Shaft	10	Cheese head screws
1.2	Compression springs	6	Flange (optional)	13	Cover seal (optional)
2	Armature plate	8	Coil	16	Microswitch
3	Complete rotor	9	Sleeve bolts	18	Noise reducer (optional)
4	Hub				

3 Technical data

3.1.1 General information

The spring-applied brake is designed for the conversion of mechanical work and kinetic energy into heat. For operating speed, see  15 Rated data. Due to the static brake torque, the brake can hold loads without speed difference. Emergency braking is possible at high speed,  15 Rated data. The more friction work, the higher the wear.

The spring-applied brake BFK464 is a single-disk brake with two friction surfaces. The brake torque is generated in two electrically and mechanically separated braking circuits by several compression springs (1.2) by friction. The braking circuits are released electromagnetically. With its two braking circuits, the brake is particularly suitable for lift and stage technology. The brake is selected according to the rated torque for one braking circuit. The second braking circuit fulfills the demand for redundancy.

By dividing the armature plate (2) with the corresponding compression springs (1.2) and electromagnetic coils (8) into two parts, the braking circuits are divided. Through the separate connection cables for each coil group and the armature plate segment, each braking circuit can be switched individually ( 32). Each braking circuit is equipped with a microswitch (16) that monitors the switching status of the spring-applied brake. The supply voltage (AC voltage) is rectified by the corresponding switchgears and after brake release reduced after a short time. In this way, the mean electrical brake power is reduced.

The stator (1) is designed in thermal class F. The limit temperature of the coils (8) is 155°C. The spring-applied brake BFK464 is designed for a maximum operating time of 60 % with holding current reduction.

Certificate

Type	EC type-examination certificate
INTORQ BFK464-18S	ABV (in preparation)
INTORQ BFK464-19S	ABV (in preparation)
INTORQ BFK464-20S	ABV 849
INTORQ BFK464-20S.1	ABV 850
INTORQ BFK464-25S	ABV 851
INTORQ BFK464-28S	ABV (in preparation)

3.1.2 Braking

During braking, the rotor (3), which is axially movable on the hub (4), is pressed against the friction surface - via the armature plates (2) - by means of the springs (1.2). The asbestos-free friction linings ensure a high braking torque with low wear. The braking torque is transmitted between hub (4) and rotor (3) via the splines.

3 Technical data

3.1.3 Brake release

In braked state, there is an air gap "s_{LÜ}" between the stator (1.1) and the armature plate segments (2). To release the brake, the coils (8) of the two magnetic circuits are excited with the DC voltage provided. The magnetic force generated attracts the armature plate segments (2) towards the stator (1.1) against the spring forces. The rotor (3) is then released and can rotate freely.

3.1.4 Release monitoring

The spring-applied brake BFK464 is equipped with one microswitch (16) each per braking circuit for monitoring the switching status. When the braking circuits are released, the microswitches (16) change over. This means that the operation of the drive against the applied brake can be excluded. The microswitches can be connected both as NO and NC contacts.

For checking the correct functioning of the microswitches, we recommend to check the switching status (see Tab. 5) both when the brake is released and when the brake is applied.

3.1.5 Manual release (optional)

Instead of the transport safety bolts usually used, a manual release is optionally available for short-term release when no voltage is applied. The manual release is used for both braking circuits.



Note!

- The manual release is designed for operation using a Bowden cable.
- The braking circuits can only be released electrically.



Tip!

The manual release can be retrofitted, 29.

3.1.6 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,
- a cover in the adjuster nut,
- a shaft seal in the adjuster nut for continuous shafts (option).

3 Technical data

3.1.7 Noise reduction (optional)

In addition to the standard noise reduction, the armature plates can be equipped with noise reducers. Thus, switching noises will be reduced.

3.2 Rated data

3.2.1 Dimensions



BFK464-XX-S-004-a.iso/dms

Type	Air gap		Perm. wear [mm]	Rotor thickness		Weight complete stator m [kg]
	$s_{Lü\text{rated}}^{+0.05}$ [mm]	$s_{Lü\text{max.}}$ [mm]		min. [mm]	max. [mm]	
BFK464-18S	0.4	0.6	0.2	12.7	13	15
BFK464-19S	0.4	0.6	0.2	15.7	16	18.8
BFK464-20S	0.4	0.6	0.2	15.7	16	24.5
BFK464-20S.1	0.4	0.6	0.2	15.7	16	24.5
BFK464-25S	0.4	0.6	0.2	19.7	20	42
BFK464-28S	0.5	0.8	0.3	17.6	18	46

3 Technical data

Type	Pitch circle		Fixing screws DIN 912		Minimum thread depth +1.0 mm		Tightening torque	
	Ø[mm]	Gewinde	ohne Flansch	mit Flansch	ohne Flansch	mit Flansch	ohne Flansch	mit Flansch
			[mm]	[mm]	[mm]	[mm]	M _a [Nm]	M _a [Nm]
BFK464-18S	196	M8	6 x M8x90	6 x M8x105 ¹⁾	17.0	19.5	24.6	36.1
BFK464-19S	220	M10	6 x M10x100	6 x M10x110	24	23	48	48
BFK464-20S	230	M10	6 x M10x100	6 x M10x110	19	18	48	48
BFK464-20S.1	230	M10	6 x M10x100	6 x M10x110	19	18	48	48
BFK464-25S	278	M10	6 x M10x110	6 x M10x130 ¹⁾	18	22.5	48	71
BFK464-28S	314	M16	6 x M16x120	6 x M16x130	30	27.5	206	206

Tab. 1 Dimensions of BFK464-□□S; -20S.1

1) Schraubenfestigkeitsklasse 10.9 mit Unterlegscheiben nach ISO 7089-□-300HV-A2C



Stop!

- The minimum thread depth (see Tab. 1) is required to adjust the brake.
- If the required thread depth is not observed the fixing screws may run into the thread root when adjusting the brake. As a result, the required prestressing force will no longer be built up and the brake will no longer be fixed securely!

3.2.2 Electrical data

Type	Voltage ¹⁾		Power ²⁾		Coil resistance	Current ³⁾
	Release ±10%	Holding ±10%	Release	Holding		
	U [V] DC	[V] DC	P _{max} [W]	P ₂₀ [W]	R _{20±5%} [Ω]	I _{max} [A]
BFK464-18S	205	103	2 x 220	2 x 55	2 x 191	2 x 1.07
BFK464-19S	205	103	2 x 235	2 x 59	2 x 179	2 x 1.15
BFK464-20S	205	103	2 x 256	2 x 64	2 x 164	2 x 1.25
BFK464-20S.1	205	103	2 x 256	2 x 64	2 x 164	2 x 1.25
BFK464-25S	205	103	2 x 300	2 x 75	2 x 140	2 x 1.46
BFK464-28S	205	103	2 x 404	2 x 101	2 x 104	2 x 1.97

Tab. 2 Coil power ratings of BFK464-□□S / -20S.1

- 1) Voltage at 20 °C
- 2) Power at 20 °C
- 3) Current at 20°C during brake release

3 Technical data



3.3 Rated data (selection data)

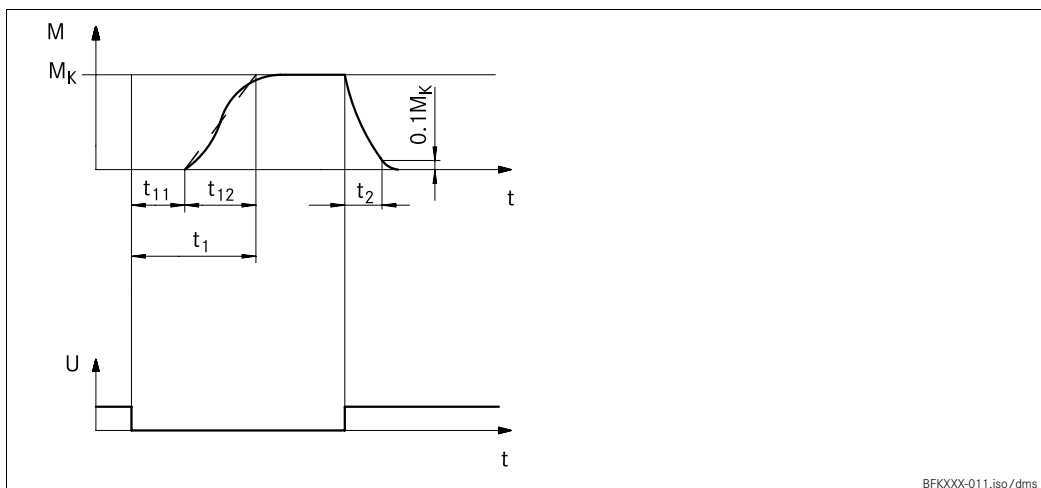


Fig. 2 Operating times of the spring-applied brakes

- t_1 Engagement time
- t_2 Disengagement time (up to $M = 0.1 M_r$)
- M_{rated} Brake torque
- t_{11} Reaction delay during engagement
- t_{12} Rise time of the brake torque
- U Excitation

Type	Rated torque ¹⁾	Max. perm. friction work	Transition operating frequency	Operating times [ms] at $s_{L\u00fcrated}$ and $0.7 I_N$				Max. speed ²⁾
	M_{rated}	Q_E		DC engagement			Disengagement	$n_{max.}$ [rpm]
	[Nm]	[J]		t_{11}	t_{12}	t_1	t_2	
BFK464-18S	2 x 225	60000	20	12	45	57	130	455
BFK464-19S	2 x 280	68000	19					455
BFK464-20S	2 x 275	80000	19	15	80	95	150	455
BFK464-20S.1	2 x 325	80000	19	15	80	95	150	455
BFK464-25S	2 x 600	120000	15	30	65	95	175	455
BFK464-28S	2 x 900	180000	14					455

Tab. 3 Friction work - operating frequency - operating times

- 1) Minimum brake torque when all components are run in with $\Delta n = 100$ rpm
- 2) Max. speed according to EC type-examination certificate (for higher speeds contact the manufacturer)

The transition from the state without braking torque to the steady braking torque is not without delay. The engagement times are valid for switching on the DC side with a spark suppressor (31)). The diagram shows the delay during engagement t_{11} , the rise time of the braking torque t_{12} and the engagement time $t_1 = t_{11} + t_{12}$, as well as the disengagement time t_2 .


Disengagement time

The disengagement time is not influenced by DC or AC switching operations.

3 Technical data

Engagement time

Short brake engagement times are vital for emergency braking. DC switching together with a suitable spark suppressor must therefore be provided.

If the drive system includes a frequency inverter so that the brake is deenergised only when the motor is at standstill, switching on the AC side is also possible (not valid for emergency braking). In this case, engagement times will be approx. 5 times longer, connection  31.

3.4 Operating frequency / friction work

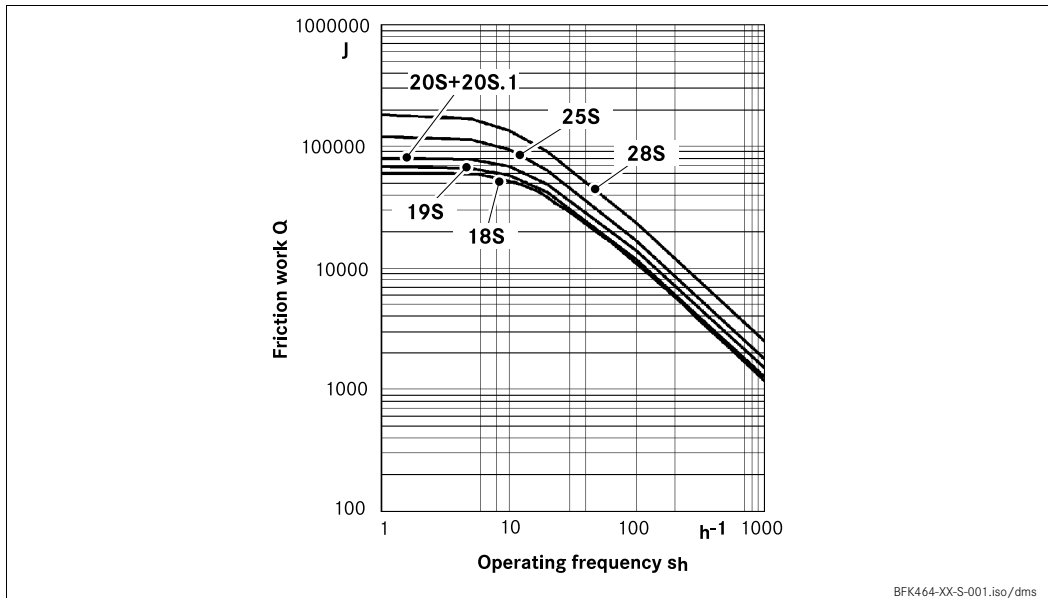


Fig. 3 Friction work as a function of the operating frequency

$$S_{fperm} = \frac{-S_{tf}}{\ln\left(1 - \frac{Q}{Q_E}\right)} \quad Q_{perm} = Q_E \left(1 - e^{\frac{-S_{tf}}{S_f}}\right)$$

The permissible operating frequency "S_{hperm}" depends on the friction work "Q" (see Fig. 3). An operating frequency of "S_h" results in the permissible friction work "Q_{perm}".

With high speed and friction work, the wear increases strongly, because very high temperatures occur at the friction faces for a short time.

3 Technical data

3.5 Emission

Electromagnetic compatibility

**Note!**

The user must ensure compliance with EMC Directive 2004/108/EC using appropriate controls and switching devices.

If an INTORQ rectifier is used for the DC switching of an INTORQ spring-applied brake and if the operating frequency exceeds five switching operations per minute, the use of a mains filter is required. If the INTORQ spring-applied brake uses a rectifier of another manufacturer for the switching, it may become necessary to connect a spark suppressor in parallel with the AC voltage. Spark suppressor according to coil voltage on request.

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 "s_{Lu}" and the brake size.

For switching on the AC side, the switching noise is between approx. 45 and 55 db (A).

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

Others

The abrasion of the friction parts produces dust.

In case of high load, the friction face will become so hot that odours may occur.

4 Mechanical installation

4.1 Important notes



Stop!

Toothed hub and screws must not be lubricated with grease or oil!

4.2 Necessary tools

Type	Torque wrench Insert for hexagon socket screws		Open-jawed spanner		Allen key for transport safety bolts
	Measuring range [Nm]	Wrench size [mm]	Sleeve bolts Wrench size [mm]	Manual release - nuts Wrench size [mm]	Wrench size [mm]
BFK464-18S	20 - 100	6	15	10	5
BFK464-19S		8	17	13	5
BFK464-20S		8	17	13	6
BFK464-20S.1		8	17	13	6
BFK464-25S		8	17	13	6
BFK464-28S	40 - 250	14	24	17	8

* for flange mounting insertion with journal guide


Feeler gauge	Caliper gauge	Multimeter

4 Mechanical installation

4.3 Mounting

4.3.1 Important notes

Minimum requirements of the end shield:

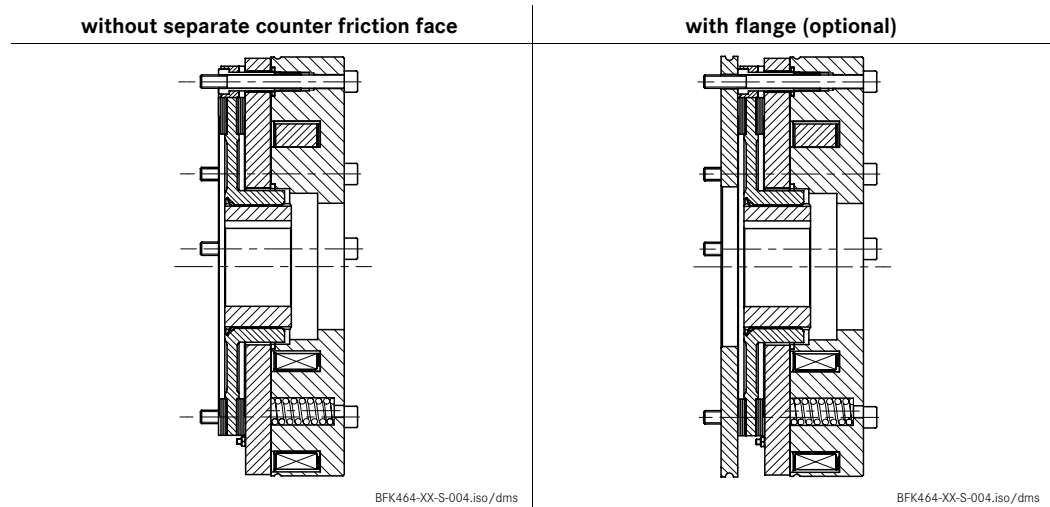
- Material S235 JR , C15 or EN-GJL-250
 - If different materials are used, contact INTORQ.
- Evenness
 - < 0.1 mm
- Axial runout 0.10 mm,
- Roughness Rz 10 to Rz 16
- The threaded holes must have the minimum thread depth, dimensions  15.
- The end shield must be free of grease and oil.
- Minimum requirements of the motor shaft:
 - The diameter of the shaft shoulder must not be bigger than the tooth root diameter of the hub.

4.3.2 Preparation

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

4 Mechanical installation

4.3.3 Overview



4.4 Installation



Stop!

Toothed hub and screws must not be lubricated with grease or oil!



Note!

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

4 Mechanical installation

4.4.1 Installation of the hub onto the shaft

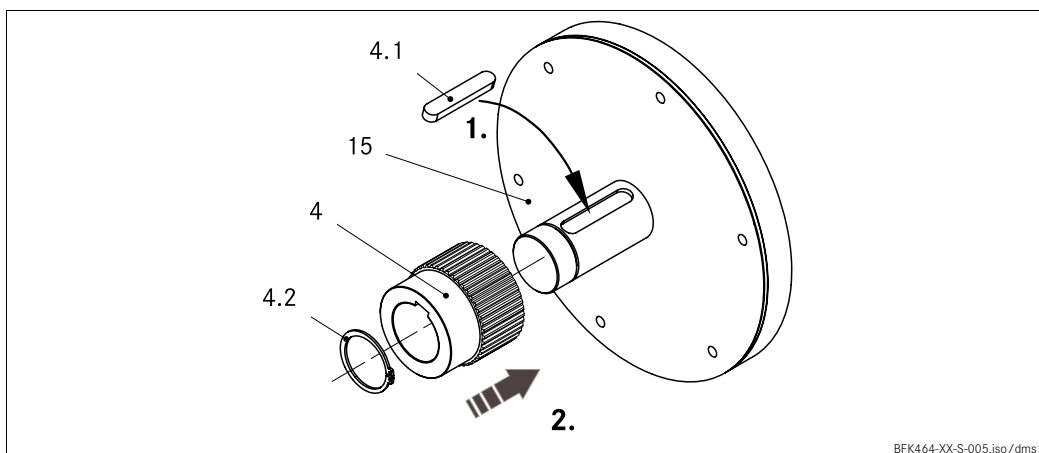


Fig. 4 Installation of the hub onto the shaft

4	Hub	4.2	Circlip
4.1	Keyway	15	End shield

1. Insert keyway (4.1) into the shaft.
2. Press hub (4) onto the shaft.
3. Secure hub against axial displacement, e.g. using a circlip (4.2).



Stop!

In reverse operation, it is recommended to additionally glue the hub to the shaft, (e.g. using Delo-ML 5328)!

4.4.2 Brake assembly

Assembly without counter friction face

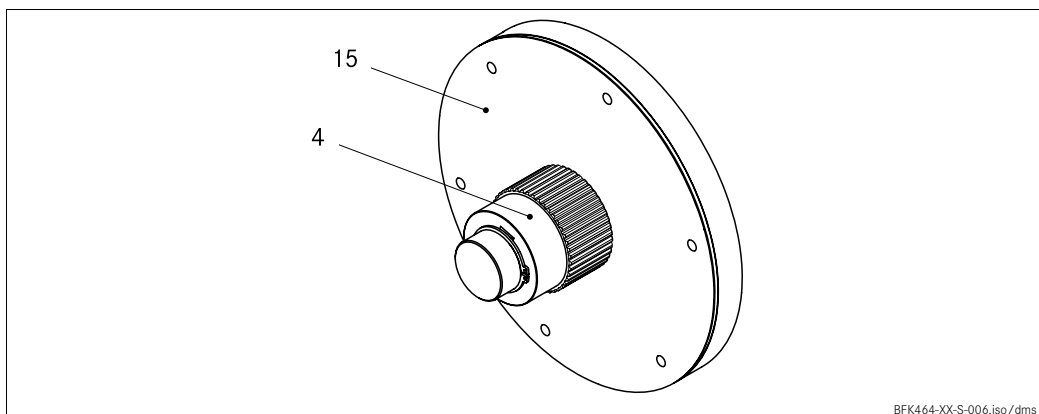


Fig. 5 Assembly without counter friction face

4	Hub
15	End shield

4 Mechanical installation

Assembly of the counter friction faces

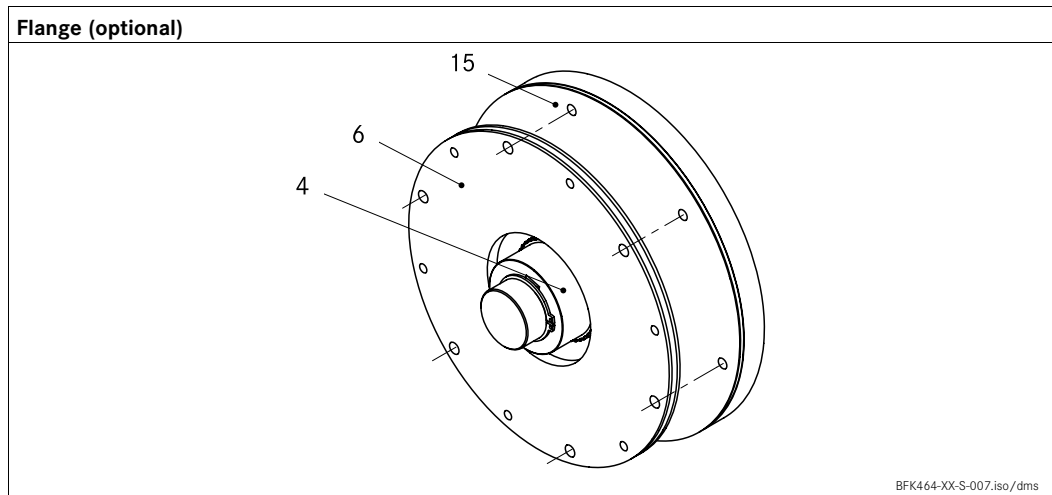


Fig. 6 Assembly of the flange

4 Hub

6 Flange

15 End shield

1. Hold the flange (6) to the end shield (15).
2. Align the through holes in the flange and the threads of the fastening bore holes.

Assembly of the rotor

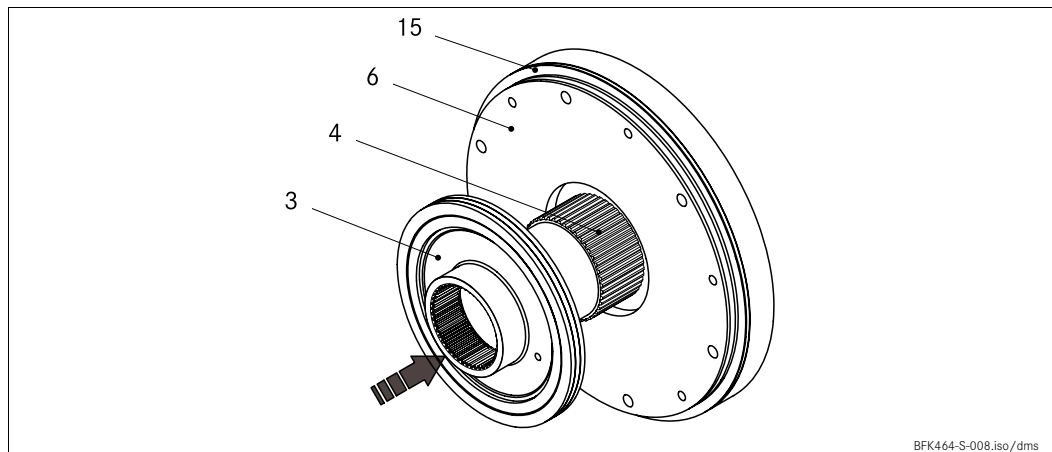


Fig. 7 Assembly of the complete rotor

3 Complete rotor

6 Flange

4 Hub

15 End shield

1. Push the complete rotor (3) onto the hub (4) and check whether it can be moved by hand. Do not use any lubricant!

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

4 Mechanical installation

Assembly of the complete stator

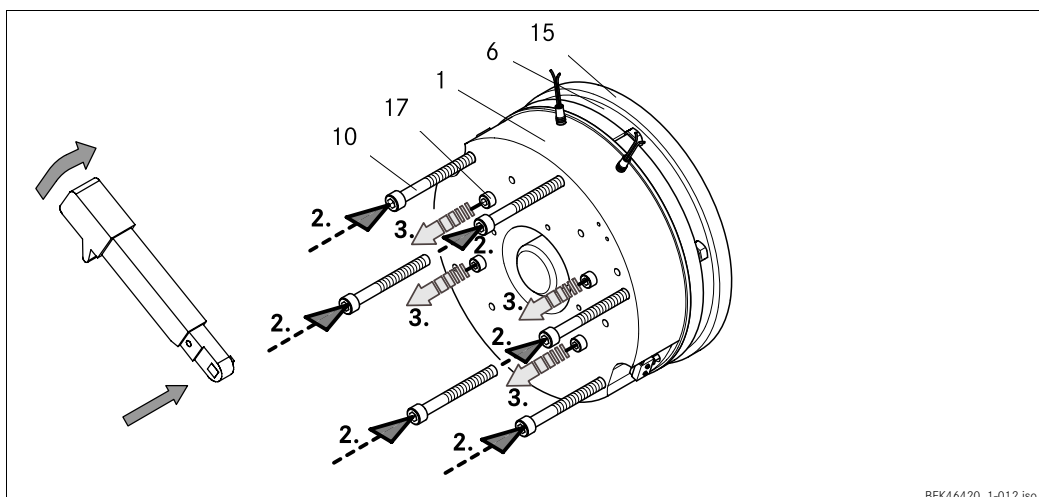


Fig. 8 Assembly of the complete stator

1	Complete stator	15	End shield
6	Flange	17	Transport safety bolts
10	Allen screw		

1. Push the complete stator (1) onto the shaft.
 - For versions with shaft seal, the shaft should be located concentrically to the shaft seal.
2. Screw the complete stator (1) onto the end shield (15) using the screws (10).
3. Remove the transport safety bolts (17; throw away).

4 Mechanical installation

4.4.3 Check air gap

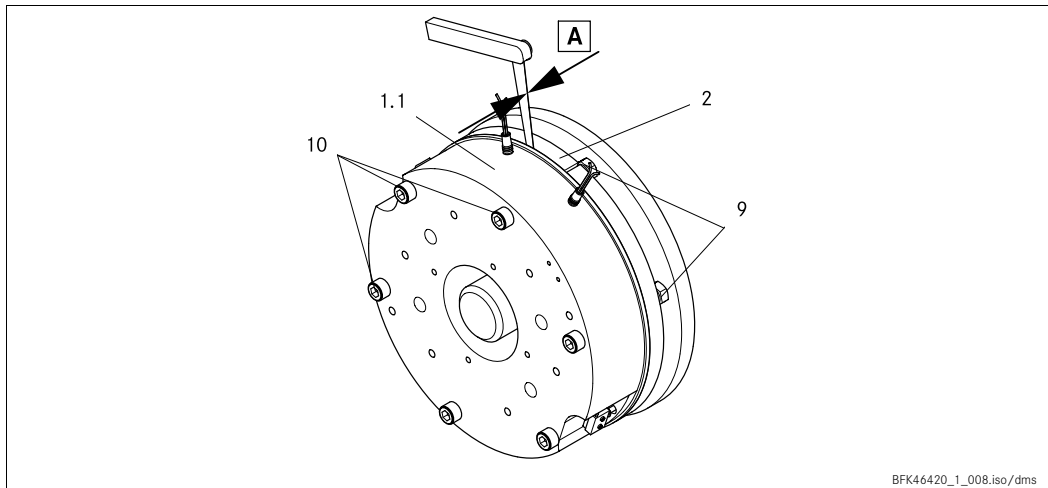


Fig. 9 Checking "s_{Lü}"

1.1 Stator	6 Flange	10 Cheese head screw
2 Armature plate	9 Sleeve bolt	15 End shield

1. Check the air gap "s_{Lü}" near the screws (10) using a feeler gauge and compare the values to the values for "s_{Lü}rated" in the table (📖 15).



Note!

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

If "s_{Lü}" (📖 15) is not within the tolerance, readjust the air gap.

4.4.4 Air gap adjustment



Danger!

Disconnect voltage. The brake must be free of residual torque.

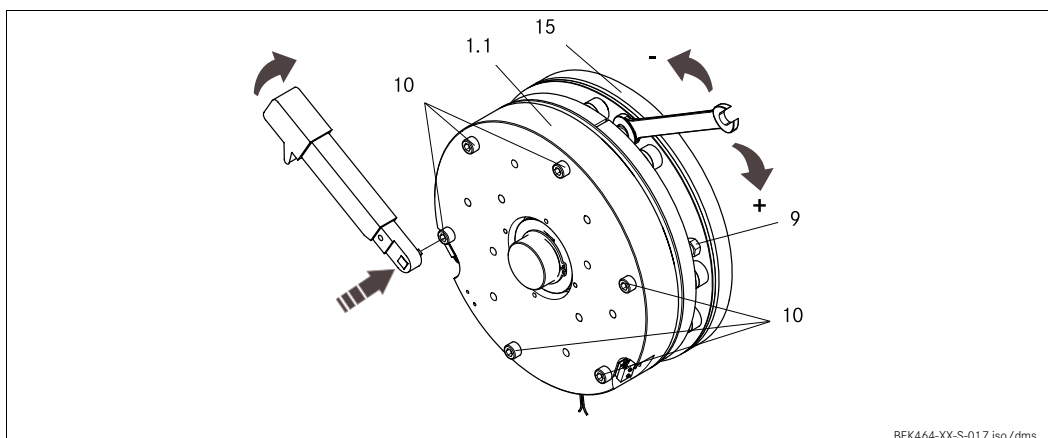


Fig. 10 Air gap adjustment



4 Mechanical installation

1. Unbolt screws (10).



Note!


Correctly adjust the air gap using every 2nd screw (10) / sleeve bolt (9)! Turn the remaining three sleeve bolts just far enough into the stator to make sure that they do not touch the flange or the end shield. Repeat this process with the other three screws (10).

2. Slightly turn the sleeve bolts (9) using a spanner.
 - If the air gap is too large, screw them into the stator (1.1).
 - If the air gap is too small, screw them out of the stator (1.1).
 - $\frac{1}{6}$ turn changes the width of the air gap by approx. 0.15mm.
3. Tighten the screws (10), (for torques, see table  15).
4. Check the air gap "s_{Lü}" near the screws (10) using a feeler gauge, ("s_{Lü}rated" see table  15).
5. If the difference between the measured air gap and "s_{Lü}rated" is too large, repeat the readjustment.



Stop!

Only for brakes with manual release

- Also check dimension "s" and readjust, if necessary  29



Danger!

Brake may fail

If the manual release is not adjusted correctly the brake may fail.

Possible consequences:

- Severe injuries or material damage.

Protective measure:

- Observe dimension "s".

4 Mechanical installation

4.4.5 Assembly of the cover seal



Stop!

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

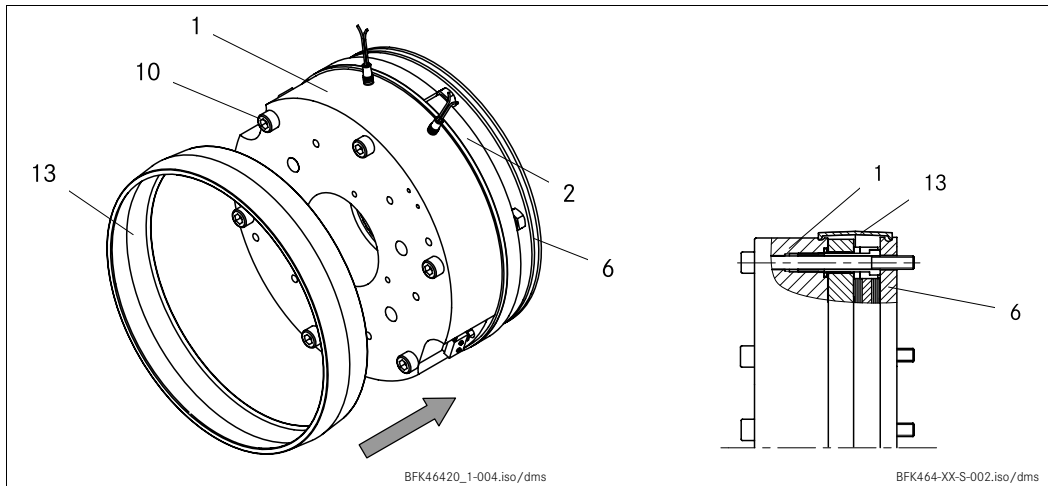


Fig. 11 Assembly of the cover seal

1	Complete stator	6	Flange	13	Cover seal
2	Armature plate	10	Cheese head screw		

1. Pull the cable through the seal (13).
2. Push the seal (13) over the complete stator (1).
3. Press the lips of the cover seal (13) into the groove of complete stator (1) and flange (6)/end shield.



Stop!

Cover seal with condensation drain hole:
Attach cover seal such that condensate can run off through hole.

4 Mechanical installation

4.4.6 Assembly of the manual release (optional)



Note!

The manual release is installed when the spring-applied brake has been mounted onto the end shield (see chapters 4.3.1 ... 4.3.4). The air gap of the brake is adjusted to the rated air gap.

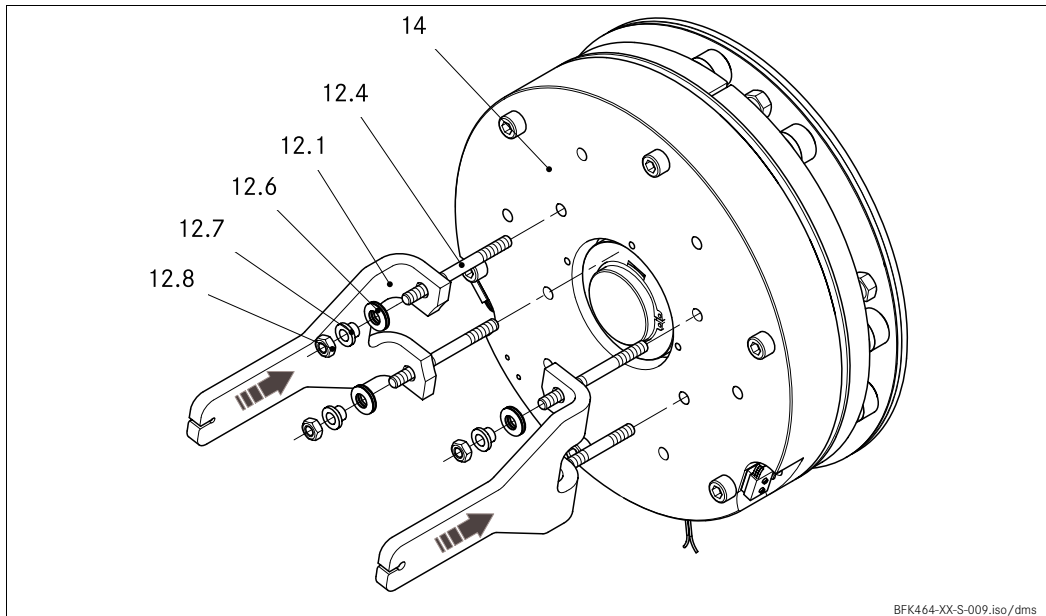
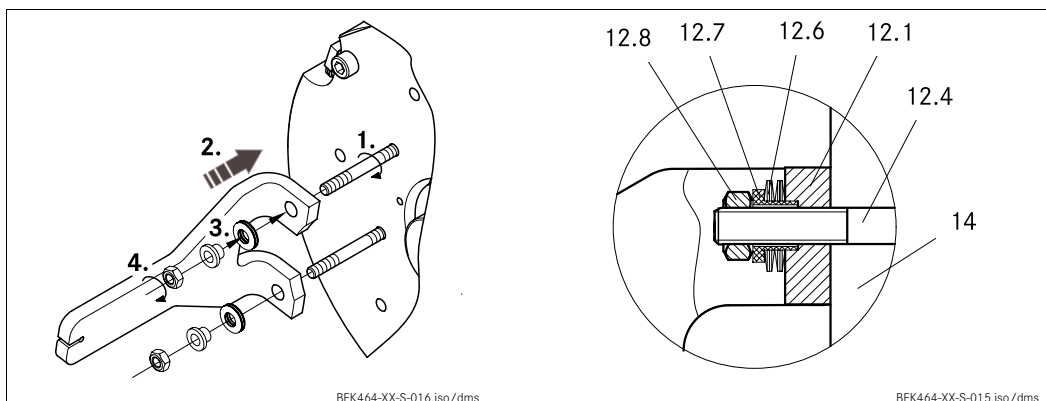


Fig. 12 Assembly of the manual release

12.1	Lever	12.6	Disc springs	12.8	Nuts
12.4	Stud bolts	12.7	Bushes	14	Brake



1. Insert four stud bolts (12.4) into the bore holes of the transport safety bolts which have been removed and screw down tight using a screw driver.
2. Locate the levers (12.1) onto the brake (14).
3. Place four disc springs (12.6) each opposed to each other onto the four bushes (12.7) and insert the bushes into the bore holes of the levers (12.1).
4. Screw self-locking nuts (12.8) onto the stud bolts and tighten until dimension "s" has been adjusted.

4 Mechanical installation



Stop!

Before adjusting dimensions "s", check air gap "s_{Lü}" and, if necessary, adjust to "s_{Lü}rated" (☞ 15) (☞ 23). During air gap adjustment, the brake is **not** energised.

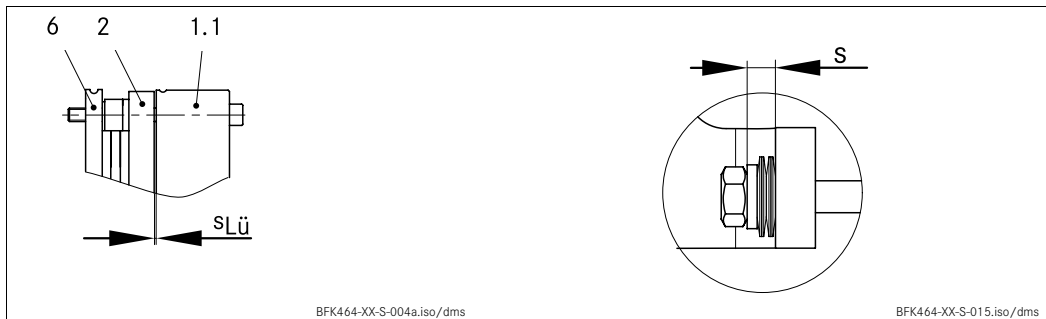


Fig. 13 Dimension "s_{Lü}" and "s"

1.1 Stator

2 Armature plate

6 Flange

Type	s _{Lü} rated ^{+0.05} [mm]	s ^{+0.1} [mm]
BFK464-18S		
BFK464-19S		
BFK464-20S	0.4	5.3
BFK464-20S.1		
BFK464-25S		
BFK464-28S	0.5	6.5



Danger!

Brake may fail

If the manual release is not adjusted correctly the brake may fail.

Possible consequences:

- Severe injuries or material damage.

Protective measure:

- Observe dimension "s".

5 Electrical installation

5.1 Electrical connection

5.1.1 Important notes



Danger!

- Perform electrical connection only when no voltage is applied.
- If an "emergency stop" is carried out without the protective circuit provided, the control device may be destroyed. Observe the correct polarity of the protective circuit!



Stop!

- For checking the individual braking circuits, it must be possible to switch off the power supply separately for each braking circuit. For a new overexcitation during switch-on, switches K1/K3 must be opened, too.
- The suppressor circuit included in INTORQ switchgear BEG-561-255-130 (terminals 3 and 4) may not be used in lift or hoist applications. In this case, the suppressor circuit must be connected in parallel to the brake coil (see Fig. 14).



Danger!

- Electrical connection must only be carried out by skilled personnel!
- Connections must only be made when the equipment is de-energised! Danger through unintended starts or electric shocks.



Stop!

- It must be ensured that the supply voltage corresponds to the nameplate data.
- Voltages must be adapted to the local environment!

5 Electrical installation

5.1.2 Circuit proposals

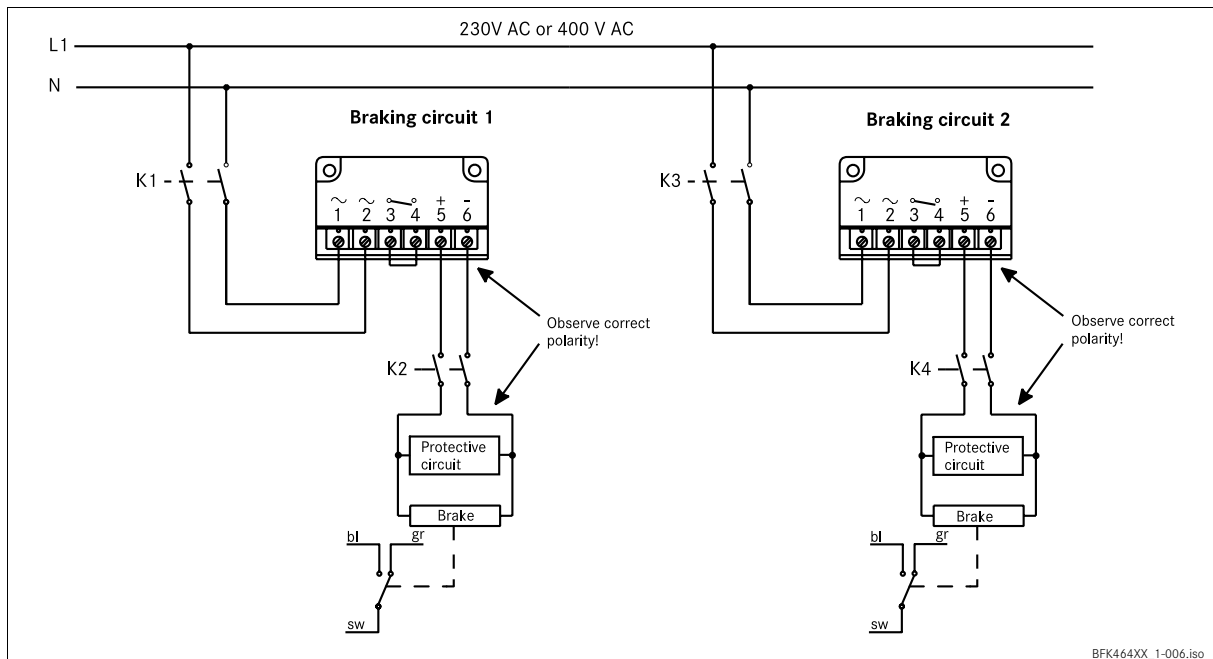


Fig. 14 INTORQ BFK464 connection diagram

Switch-on

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

Switch-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

5.2 Bridge/half-wave rectifiers (option)

BEG-561-□□□-□□□

Bridge/half-wave rectifiers are used for the supply of electromagnetic spring-applied DC brakes which have been released for operation with such rectifiers. Any other use is only permitted with the explicit written approval of INTORQ.

After a defined overexcitation time, the bridge/half-wave rectifiers change from bridge rectification to half-wave rectification. Depending on the dimensioning of the load, the switching performance can thus be improved or the power can be derated.

5 Electrical installation

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

Rectifier type	AC voltage [V AC]	Coil voltage release/holding [V DC]	Assigned brake
BEG-561-255-030	230 ±10%	205 / 103	BFK464-18S
BEG-561-255-030			BFK464-19S
BEG-561-255-030			BFK464-20S
BEG-561-255-030			BFK464-20S.1
BEG-561-255-130			BFK464-25S
BEG-561-255-130			BFK464-28S
BEG-561-440-030-1	400 ±10%	360 / 180	BFK464-18S
BEG-561-440-030-1			BFK464-19S
BEG-561-440-030-1			BFK464-20S
BEG-561-440-030-1			BFK464-20S.1
BEG-561-440-130			BFK464-25S
BEG-561-440-130			BFK464-28S

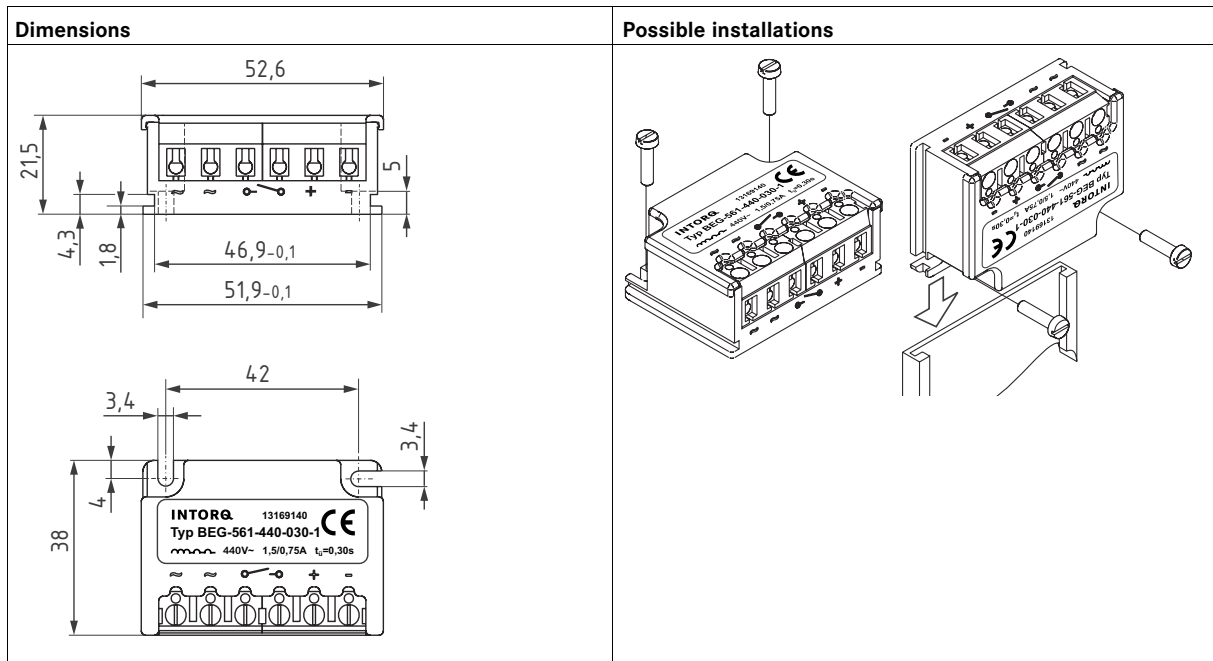


Fig. 15 Dimensions and possible installations of bridge/half-wave rectifier

5.2.2 Technical data

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

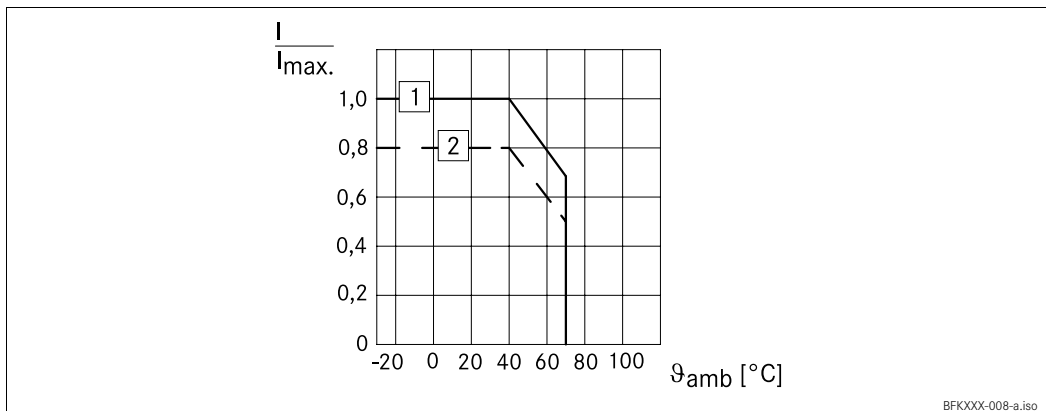
5 Electrical installation

Type	Input voltage U_1 (40 Hz ... 60 Hz)			Max. current I_{max} .		Overexcitation time t_o ($\pm 20\%$)		
	min. [V ~]	rated [V ~]	max. [V ~]	bridge [A]	half-wave [A]	with $U_{1\ min}$ [s]	with $U_{1\ rated}$ [s]	with $U_{1\ max}$ [s]
BEG-561-255-030	160	230	255	3.0	1.5	0.430	0.300	0.270
BEG-561-255-130						1.870	1.300	1.170
BEG-561-440-030-1	230	400	440	1.5	0.75	0.500	0.300	0.270

Tab. 4 Data for bridge/half-wave rectifier type BEG-56 1

Input voltage U_1 (40 ... 60 Hz)

5.2.3 Permissible current load - ambient temperature



- 1 For screw assembly with metal surface (good heat dissipation)
- 2 For other assembly (e.g. glue)

5.3 Electrical connection



Danger!

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



Tip!

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.

The brakes are designed such that the specified rated torques (Tab. 3) will usually be safely reached after a short run-in process.

Due to the varying properties of the organic friction linings and changing environmental conditions, the specified rated torques (Tab. 3) may, however, differ. The deviations must be considered appropriately during dimensioning.

In particular in the case of humidity and changing temperatures, the breakaway torque may be higher after long downtimes.

6 Commissioning and operation

6.2 Function checks before commissioning

6.2.1 Operational check

Brake with microswitch



Danger!

The brake must be free of residual torque. The motor must not rotate.



Danger!


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 deenergise the motor.
 - Do not switch off the DC brake supply.



Stop!

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. It must be zero.
5. Close the switching contact for the brake.
 - The brake is released.
6. Measure the DC voltage at the brake:
 - The DC voltage measured after the overexcitation time (see bridge/half-wave rectifier,  32) must correspond to the holding voltage (see Tab. 4). A $\pm 10\%$ deviation is permissible.
7. Check air gap "sLü".
 - It must be zero and the rotor must rotate freely.
8. Check the switch position of the microswitch (see Tab. 5).
9. Open the switching contact for the brake.
 - The brake is applied.
10. Check the switch position of the microswitch (see Tab. 5).
11. Switch off DC voltage for the brake.
12. Bolt bridges to the motor terminals.
13. If necessary, remove additional PEN conductor (step 2).

6 Commissioning and operation

Contact type	Connection	Brake released	Microswitch closed
NC contact	black / grey	yes	no
		no	yes
NO contact	black / blue	yes	yes
		no	no

Tab. 5 Switching status of microswitch

6.2.2 Checking the manual release function



Note!

- The manual release is designed for operation using a Bowden cable.
- The braking circuits can only be released electrically.



Danger!

The drive system must be load-free. The motor must not rotate.

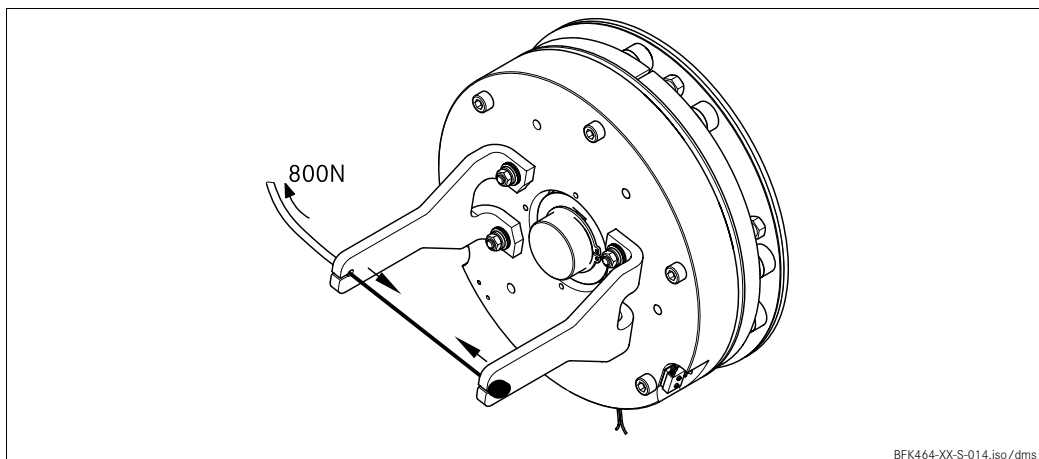


Fig. 16 Turning direction of the lever

1. Motor and brake deenergised.
2. Suspend bowden cable (not included in the delivery package) and pull with approx. 800 N.
 - The rotor must rotate freely. A small residual torque is permissible.
3. Release the lever.
 - Torque must be available!

The preparations for commissioning are completed.

6 Commissioning and operation

6.3 Commissioning

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


6.4 During operation

**Danger!**

The running rotor must not be touched.

**Danger!**

Live connections must not be touched.

- Check the brake regularly during operation. Take special care of:
 - unusual noises or temperatures
 - loose fixing elements
 - the condition of the electrical cables.
- The armature plate must be attracted and the rotor must move without residual torque.
- Measure the DC voltage at the brake.
 - The DC voltage measured after the overexcitation time (see bridge/half-wave rectifier,  32) must correspond to the holding voltage (see Tab. 4). A $\pm 10\%$ deviation is permissible.
- In the event of failures, refer to the troubleshooting table in chapter 8. If the fault cannot be eliminated, please contact the aftersales service.

7 Maintenance/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 the mechanical brake components are subject to function-related wear. For safe and trouble-free operation, the brake must be checked and readjusted at regular intervals, and, if necessary, be replaced.

The following table describes different causes of wear and their effects on the components of the spring-applied brake. For calculating the service life of rotor and brake and determining the maintenance intervals to be observed, the relevant factors of influence must be quantified. The most important factors are the friction work, initial speed of braking and the operating frequency. If several of the causes of wear indicated for the friction lining occur in an application at the same time, the influencing factors must be added for calculating the wear. The INTORQ Select dimensioning program can be used to calculate the maintenance intervals.

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		
Armature plate and flange	Rubbing of brake lining	Armature plate and flange are run in	Friction work
Splining of brake rotor	Relative movements and shocks between brake rotor and brake shaft	Wear of splining (primarily on the rotor side)	Number of start/stop cycles
Armature plate support	Load alternation and jerks in the backlash between armature plate, sleeve bolts and guide bolt	Breaking of armature plate, sleeve bolts and guide bolt	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

7 Maintenance/repair

7.2 Inspections

To ensure safe and trouble-free operation, spring-applied brakes must be checked and maintained at regular intervals. Servicing can be made easier if good accessibility of the brakes is provided in the plant. This must be considered when installing the drives in the plant.

Primarily, the necessary maintenance intervals for industrial brakes result from the load during operation. When calculating the maintenance interval, all causes for wear must be taken into account (see chapter 7.1). For brakes with low loads such as holding brakes with emergency stop, we recommend a regular inspection at a fixed time interval. To reduce the cost, the inspection can be carried out along with other regular maintenance work in the plant if necessary.



Stop!

Stable properties of the organic friction lining are only achieved in the case of continuous use. The readiness for operation of the brake has to be ensured with a braking energy that is equivalent to one emergency stop per week. Unplanned emergency stops occurring at a sufficient frequency have the same effect.

If the brakes are not maintained, failures, production losses or damage to the system may occur. Therefore, a maintenance concept adapted to the particular operating conditions and brake loads must be defined for every application. For the INTORQ spring-applied brakes, the maintenance intervals and maintenance operations listed in the below table must be provided. The maintenance operations must be carried out as described in the detailed descriptions.

Type BFK464□□-S/S .1	Time interval	
	for service brakes:	for holding brakes with emergency stop:
	<ul style="list-style-type: none"> ■ according to service life calculation ■ otherwise every six months ■ after 4000 operating hours at the latest 	<ul style="list-style-type: none"> ■ at least every two years ■ after 1 million cycles at the latest
	Maintenance	
Inspections with assembled brake:	Inspections after removing the brake:	
<ul style="list-style-type: none"> ■ Check release function and control (☞ 42) ■ Measure air gap (adjust, if necessary, ☞ 26) ■ Measure rotor thickness (replace rotor, if necessary, ☞ 43) ■ Thermal damage of armature plate or flange (dark-blue tarnishing) 	<ul style="list-style-type: none"> ■ Check clearance of the rotor gearing (replace worn-out rotors, ☞ 43) ■ Play of torque plate at sleeve bolts and armature plate ■ Check springs for damage ■ Check armature plate and flange/end shield <ul style="list-style-type: none"> - Evenness < 0.1 mm - Max. run-in depth = rated air gap of brake size 	

7 Maintenance/repair

7.3 Maintenance



Note!

Brakes with defective armature plates, cheese head screws, springs or flanges must be replaced completely.

Please observe the following for inspections and maintenance operations:

- Remove impurities through oil and grease using brake cleaning agents, if necessary, replace brake after finding out the cause of the contamination. Dirt deposits in the air gap between stator and armature plate impair the function of the brake and must be removed.
- After replacing the rotor, the original braking torque will not be reached until the run-in operation of the friction surfaces has been completed. After replacing the rotor, run-in armature plates and flanges have an increased initial rate of wear.

7.3.1 Checking the rotor thickness



Danger!

The motor must not run during the check.

1. Stop motor and control system!
2. Remove the motor cover and seal ring, if mounted.
3. Measure the rotor thickness using a caliper gauge.
4. Compare the measured rotor thickness with the minimally permissible rotor thickness (15).
5. If necessary, replace the complete rotor. See 43 for description.

7.3.2 Check air gap



Danger!

The motor must not run during the check.

1. Stop motor and control system!
2. Check the air gap " $s_{Lü}$ " near the fixing screws between armature plate and stator using a feeler gauge (15).
3. Compare the measured air gap with the maximum permissible air gap " $s_{Lümax}$." (15).
4. If necessary, adjust the air gap to " $s_{Lürated}$ " (26).

7 Maintenance/repair

7.3.3 Release / voltage



1. Start motor and control system!

**Danger!**

The running rotor must not be touched.

**Danger!**

Live connections must not be touched.

2. Observe air gap "s_{Lü}" during operation of the drive. The air gap must be zero.
3. Measure the DC voltage at the brake.
 - The DC voltage measured after the overexcitation time (see bridge/half-wave rectifier,  32) must correspond to the holding voltage ( 34). A ±10 % deviation is permissible.

7 Maintenance/repair

7.4 Maintenance operations

7.4.1 Rotor replacement



Danger!

Disconnect voltage. The brake must be free of residual torque.

1. Switch off voltage!
2. Disconnect the supply cable.
3. Loosen the screws evenly and remove them completely.
4. Remove the complete stator from the end shield. Observe the supply cable.
5. Pull the complete rotor off the hub.
6. Check hub teeth.
7. Replace the hub as well if worn.
8. Check the friction surface at the end shield. In case of strong scoring at the flange, replace the flange. If scoring occurs at the end shield, re-finish end shield.
9. Measure rotor thickness (new rotor) and sleeve bolt head with a caliper gauge.
10. Calculate the gap between the stator and the armature plate as follows:

$$\text{Gap} = \text{rotor thickness} + s_{\text{Lürated}} - \text{head height}$$

("s_{Lürated}" see table in chapter 3.2)

11. Unscrew the sleeve bolts evenly until the calculated gap between stator and armature plate is reached.
12. Install and adjust new rotor and stator (see chapter 4.4.2).
13. Reconnect the supply cable.

7 Maintenance/repair

7.5 Spare-parts list

Only parts with item numbers are available.

The item numbers are only valid for the standard design.

- Bore diameter in mm
- Standard keyway to DIN 6885/1 P9

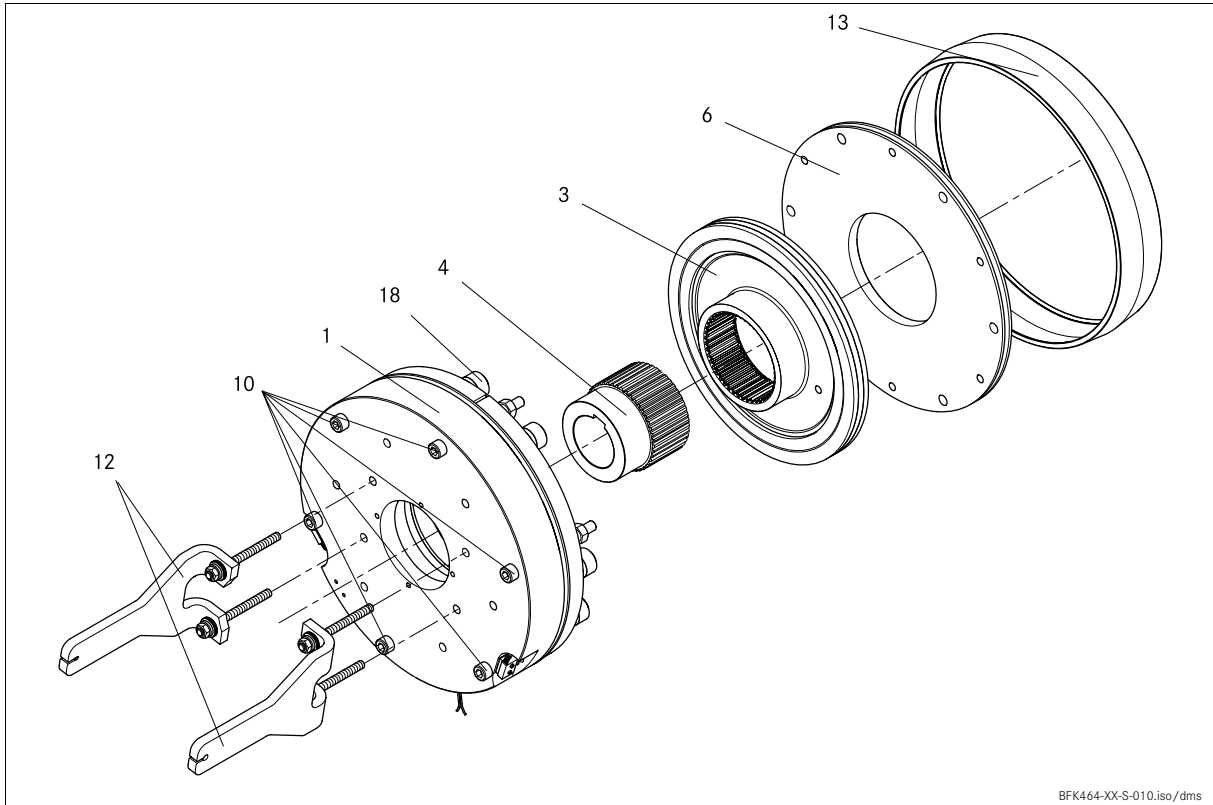


Fig. 17 Spring-applied brake BFK464-□□ S / S.1

Item	Designation	Variant
1	Complete stator	Voltage
3	Complete rotor Complete rotor, noise-reduced	
4	Hub	Bore diameter
6	Flange	
10	Set of fastening screws Cheese head screw DIN912	for mounting to the motor for flange with through hole
12	Complete manual release	
13	Cover seal	
18	Noise reducer	

7 Maintenance/repair

7.6 Spare parts order

INTORQ BFK464-□□S /S.1, complete stator

- Size** 18 19 20 25 28
Design S S.1
Voltage 205 V / 103 V
 360 V / 180 V
Brake torque _____ Nm
 Standard (600 mm)
Cable length _____ mm (from 100 mm - 1000 mm in 100 mm steps,
from 1000 mm - 2500 mm in 250 mm steps)
Manual release mounted
Armature plate Standard
Microswitch Monitoring of the switching function
Switching noises Low-noise

Accessories

- Rotor** Aluminium
 Low-noise version (rotor with sleeve)
Hub _____ mm (for bore diameter, see dimensions)
Flange
Fixing screw set For mounting to the motor
 For mounting to the flange with through holes
 Cover seal
Sealing Shaft seal (shaft diameter on request)
 Cap
Noise reduction Noise-reducer set




Electrical accessories

Rectifier type: For selection, see chapter 5.2.1

- Rectifier** BEG-561-255-030
 BEG-561-255-130
 BEG-561-440-030-1
 BEG-561-440-130


8 Troubleshooting and fault elimination

If any malfunctions should occur during operation of the drive system, please check the possible causes using the following table. If the fault cannot be eliminated by one of the listed measures, please contact the aftersales service.

Fault	Cause	Remedy
Brake does not release	Coil is interrupted	<ul style="list-style-type: none"> ■ Measure coil resistance using multimeter: <ul style="list-style-type: none"> - If resistance is too high, replace the complete stator.
	Coil has interturn fault or short circuit to ground	<ul style="list-style-type: none"> ■ Measure coil resistance using multimeter: <ul style="list-style-type: none"> - Compare measured resistance to rated resistance. For values, see  15. If the resistance is too low, replace the complete stator. ■ Check coil for short circuit to ground using a multimeter: <ul style="list-style-type: none"> - Replace the complete stator if short circuit to ground is detected. ■ Check brake voltage (see "defective rectifier, voltage too low").
	Wiring incorrect or defective	<ul style="list-style-type: none"> ■ Check and correct wiring. ■ Check cable continuity using a multimeter: <ul style="list-style-type: none"> - Replace defective cable.
	Rectifier defective or wrong	<ul style="list-style-type: none"> ■ Measure the DC voltage at the rectifier using a multimeter. If DC voltage is zero: <ul style="list-style-type: none"> ■ Measure AC voltage at the rectifier. If AC voltage is zero: <ul style="list-style-type: none"> - Apply voltage - Check fuse - Check wiring If AC voltage is ok: <ul style="list-style-type: none"> - Check rectifier - Replace defective rectifier ■ Check coil for fault between turns and short circuit to ground. ■ If the rectifier defect occurs again, replace the complete stator, even if no fault between turns or short circuit to ground can be detected. The fault may only occur when warm.
	Incorrect wiring of microswitch	Check the wiring of the microswitch and correct it.
	Incorrect setting of microswitch	Replace the complete stator and advise the manufacturer of incorrect microswitch setting.
	Air gap too large	Adjust air gap ( 26) Measure rotor thickness and compare with minimum rotor thickness ( 3.2). If necessary, replace rotor.
Rotor cannot rotate freely	Wrong setting of manual release	Check dimension "s+s _{Lü} " with energised brake. The dimension must be identical at both sides. Correct if necessary.
	Air gap "s _{Lü} " too small	Check air gap "s _{Lü} " and readjust it, if necessary (chapter 4.4.4).

8 Troubleshooting and fault elimination



Fault	Cause	Remedy
Rotor not thick enough	Rotor has not been replaced in time	Replace rotor (📖 43)
Voltage is not zero during functional test (chapter 6.2)	Incorrect wiring of microswitch	Check and correct the microswitch wiring.
	Defective microswitch or incorrect setting	Replace the entire stator and send the defective stator to the manufacturer.
Voltage too high	Brake voltage does not match the rectifier	Adapt rectifier and brake voltage to each other.
Voltage too low	Brake voltage does not match the rectifier	Adapt rectifier and brake voltage to each other.
AC voltage is not mains voltage	Fuse missing or defective	Select a connection with proper fusing.
	Incorrect wiring of microswitch	Check the microswitch wiring and correct it.
	Defective microswitch or incorrect setting	Replace the entire stator and send the defective stator to the manufacturer.

 **INTORQ GmbH & Co KG**

Wülmser Weg 5
D-31855 Aerzen
Germany

 +49 (0) 51 54 95 39-01
 +49 (0) 51 54 95 39-10
 info@intorq.com
 www.intorq.de

Service

 00 80 00 24 4 68 77 (24 h helpline)
 +49 (0) 51 54 82 13 96

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www.intorq.de