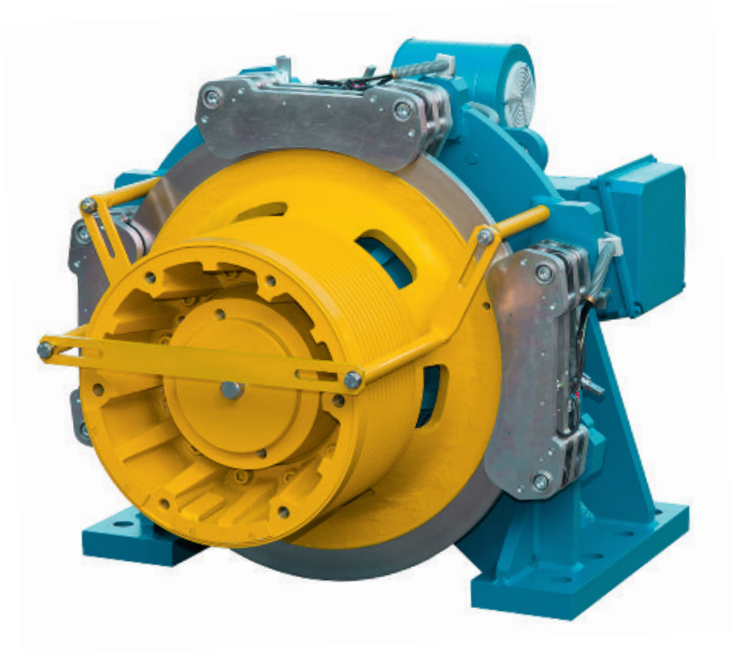
Gearless Lift Machine
WSG-25
Operating Instructions

Gearless Lift Machines

beamer 2

WSG-25.1
WSG-25.2



Translation of the Original Operating Instructions

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Gearless Lift Machine
WSG-25
Operating Instructions

These operating instructions are applicable to lift machines:

WSG - 25.1 - ....
WSG - 25.2 - ....

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WSG-25
Operating Instructions

Contents

1. General information

1.1. About this operating manual

The purpose of this operating manual is to ensure that any work on WSG-25 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-25 lift machines must have read and understood this operating manual.

1.2. Intended use

WSG-25 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-25 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-25 lift machine
- Improper installation, commissioning, operation or maintenance
- Operation of the WSG-25 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-25
- 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-25 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-25 lift machines are intended for use in an enclosed, lockable operating area to which only qualified personnel and personnel authorised by the customer have access.

Qualified personnel

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

2.2. Format of the safety instructions

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

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

Danger symbols

	Risk of electric shock		Property damage
	General danger		Information

Signal words

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

2.3. Safety precautions

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

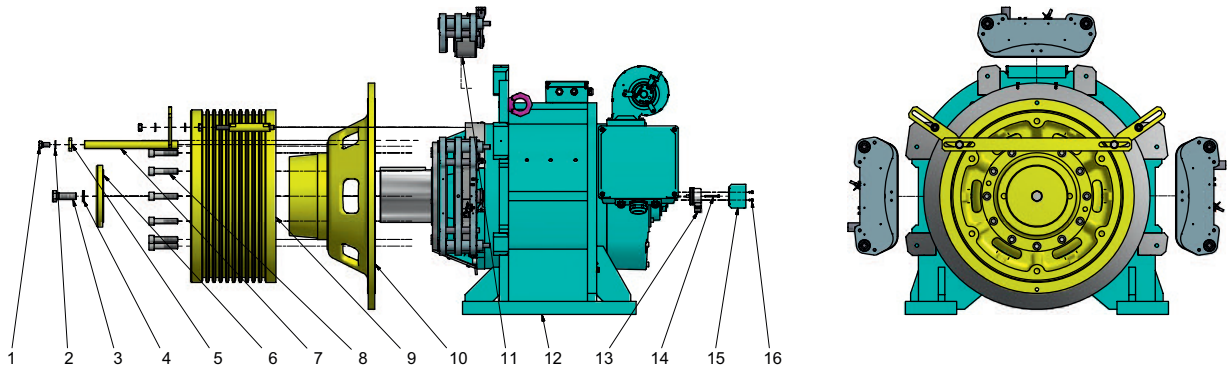
3. Product overview

3.1. Product description

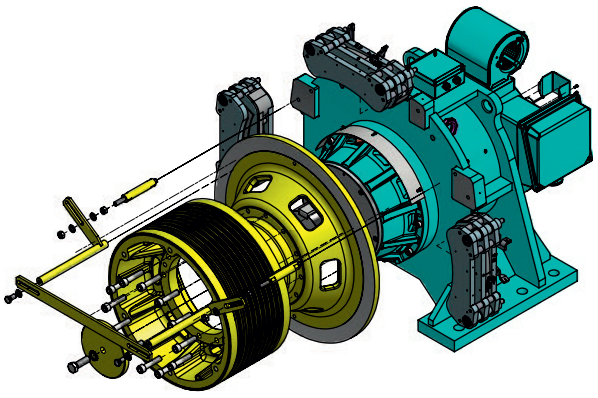
The compact gearless WSG-25 synchronous lift machines are designed for traction sheave lifts. They are distinguished by their high efficiency, extremely low noise and excellent operating characteristics. The machines can be supplied for several rated speeds.

The machine comprises a frame, the synchronous motor, the traction sheave, and the typetested safety brake, which can be used to prevent uncontrolled upward movement of the car.

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



Item	Part	
1	Bolts (2x)	DIN 933 - M 16 x 30
2	Washer	DIN 125-A17
3	Bolt	DIN 933 - M 24 x 75
4	Lock washer	NL 24-DIN 25201
5	Rope slip-off guard	
6	Pressure disc	
7	Rope slip-off guard (2x)	
8	Bolts (12x)	DIN 912-M20x90-12.9
9	Traction sheave	
10	Brake hub	
11	Brake	BFK 466-61
12	Frame	
13	Measuring system	
14	Screw	DIN 912 - M 5 x 50
15	Protective cover	
16	Screws (4x)	DIN 912 - M 5 x 10



3.2. 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.
- Do not expose the motor to any shocks or impact.
- Check that the eyebolts are tightly fitted before using them.

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

Storage

- Store the motors only in closed, dry, dust-free, well-ventilated and vibration-free rooms (storage temperature: -20°C to 60°C). Do not store lift machines in the open air. Bright parts are not sufficiently preserved to withstand extended periods of exposure.
- Avoid excessive storage periods (recommendation: max. one year).
- After prolonged storage (>3 months), rotate the motor in both directions at a low speed (< 20 min^{-1}) to allow the grease to distribute evenly in the bearings.
- Measure the insulation resistance before initial operation of the machine. If the value has dropped below 1kΩ per volt of rated voltage, the winding needs to be dried (insulation meter voltage: 1,000 V DC).

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.

3.3. Disposal

- The lift machines consist of different materials. A waste separation of those different material components has to be done.
- The disposal must be professional and environmentally friendly according to law.

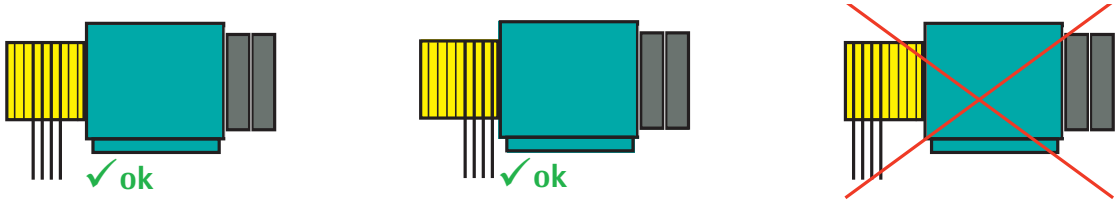
4. Installation

4.1. Setting up

Danger

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

- The machines can be used in lift systems with or without a machine room
- The permissible uneveness of the mounting surface is 0.3 mm. The mounting surface must be sufficiently distortion-resistant and stable to accommodate the forces occurring in the system.
- The rope force can be applied to the lift machine in any direction
- The machine must be mounted on vibration dampers for vibration damping
- No welding work may be performed on the lift machine, nor is it permissible to use the machine as a mass point for welding work. This might cause irreparable damage to the bearings and magnets.
- If there are more grooves on the traction sheave than the number of ropes used, position the ropes either in the centre of the traction sheave or towards the motor end.



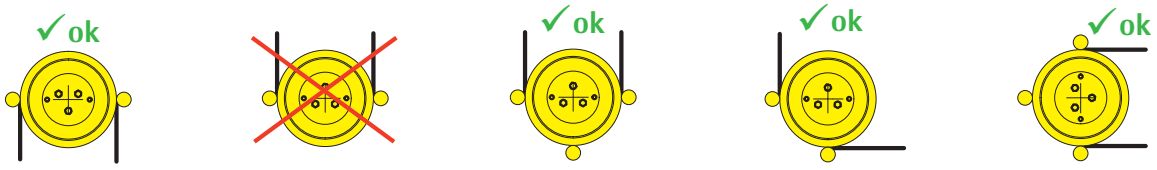
- The measuring system is only accessible from the rear side. Therefore, leave enough space between the wall and the rear side of the machine or ensure that the machine can be moved away from the wall.

Warning

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

Securing the machine

- Fasten the machine using 8 **M 36** bolts - **strength class 8.8; tightening torque: 2,360 Nm** .
- After completing the adjusting work or after a breakdown, tighten all the fastening bolts of the machine, using the specified torque .
- Lift machines are generally equipped with rope slip-off guards. After putting the ropes in place, adjust them so that the distance between the rope and the rope slip-off guard does not exceed 1.5 mm.
- If the lift machine is not installed at the head of the machine room as is usually the case, it may be necessary to modify the fitting of the rope slip-off guard to fulfill the requirements of EN 81-20 . Optional rope slip-off guards are available for this purpose.



Ambient conditions

- The following ambient conditions must be ensured on site

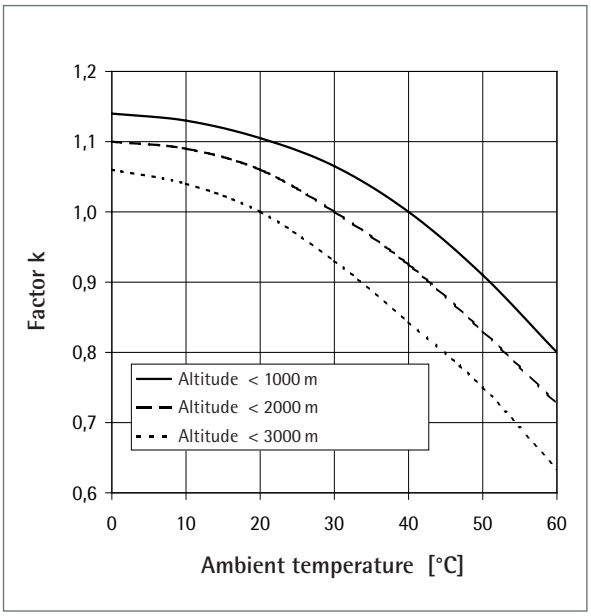
  Altitud: max. 1,000 m a.s.l.

  Ambient temperature: -5°C ... 40 °C

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

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

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



4.2. Electrical connection

4.2.1. 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

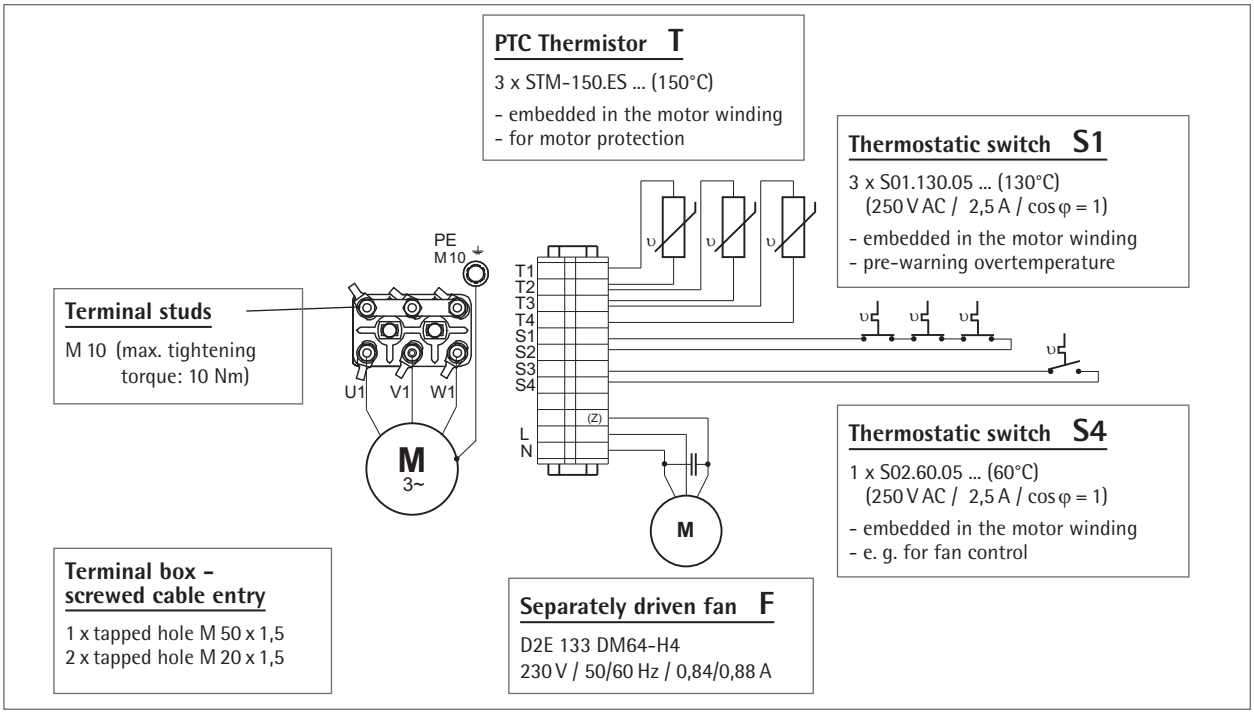
The insulation system of the motors is designed such that they can be connected to a inverter with a maximum DC link voltage $U_{link\ max}$ up to max. 700 V DC.

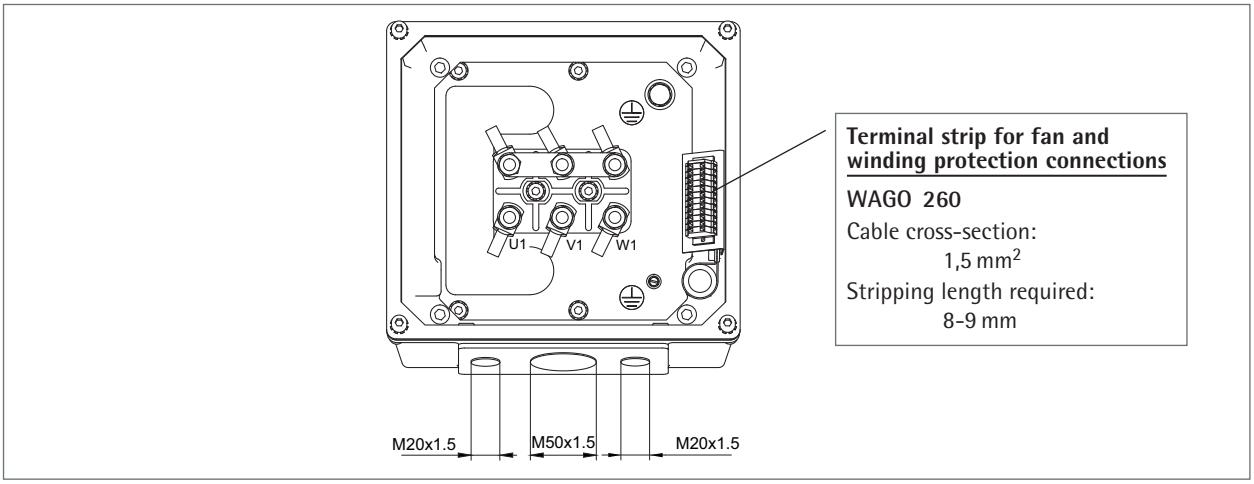
$U_{link\ max}$ is the maximum value of the DC link voltage which is only transient and approximately equivalent to the inception voltage of the braking chopper or of the energy recovery unit.

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

4.2.2. Motor connection / Winding protection / Separately driven fan

- The electrical connection of the motor, the separetely driven fan and the winding sensors to the mains is made in the motor terminal box.
- 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 inverter; they must not be interchanged.
- We recommend using a inverter with a switching frequency of 8 kHz.
- The thermocouples installed in the winding such as PTC thermistor detectors and thermostatic switches must be evaluated in the control system or frequency inverter to protect the motor from overtemperature.
- The separately driven fan must be properly connected and operated. If required, it can be switched in dependence of the temperature by means of thermal switch S4 (relay must be used).





Cable cross-section required:

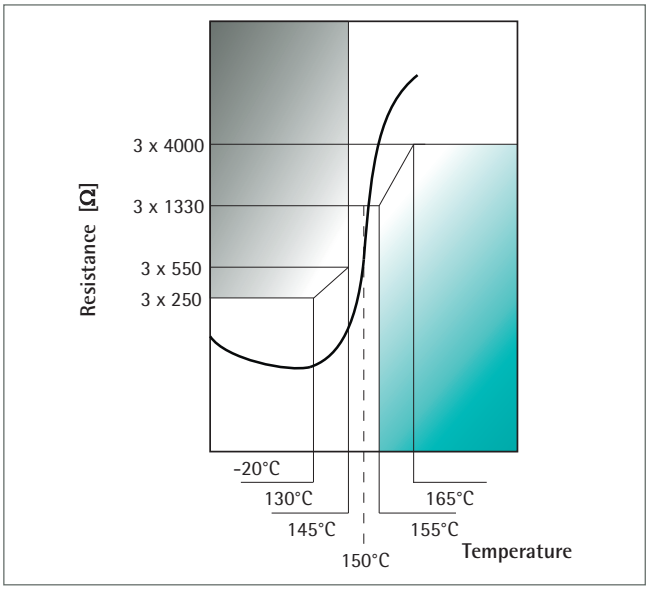
The table on the right gives the **standard values** for the current-carrying capacity of PVC cables at a maximum ambient temperature of 40°C.

Cable cross-section required	Permissible max. current (r.m.s. value)
6,0 mm^2	38 A
10,0 mm^2	53 A
16,0 mm^2	71 A
25,0 mm^2	94 A
35,0 mm^2	117 A
50,0 mm^2	146 A

PTC thermistors

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

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



Short-circuiting the motor terminals

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

4.2.3. 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.

STOP Caution

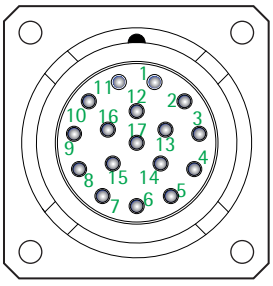
The measuring system of WSG lift machines with a synchronous motor (WSG) is matched to the associated inverter. Do not change the adjustment, as this may make it impossible to use the motor. On the measuring system housing there is a label showing the "offset angle" and the inverter type.

The offset angle depends on the inverter used.

Measuring system ECN 413

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

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

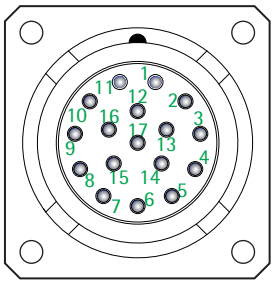


Pin contacts of flanged connector socket (exterior)

Measuring system ECN 487

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

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



Pin contacts of flanged connector socket (exterior)

4.2.4. Brake

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

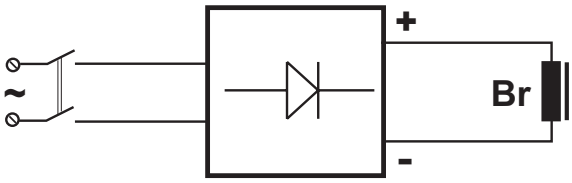
Note on the use of DC/AC side switching:

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

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

AC side switching

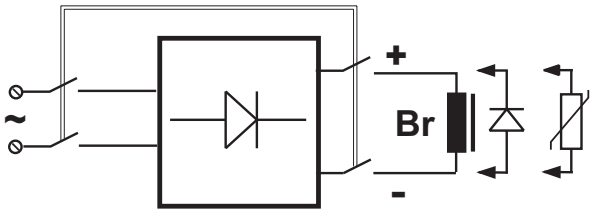
- Low-noise switching of the brake
- No protective measures required for switching contact
- Slow application of the brake.



Attention: schematic diagram!

DC side switching

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



Attention: schematic diagram!

Monitoring the brakes

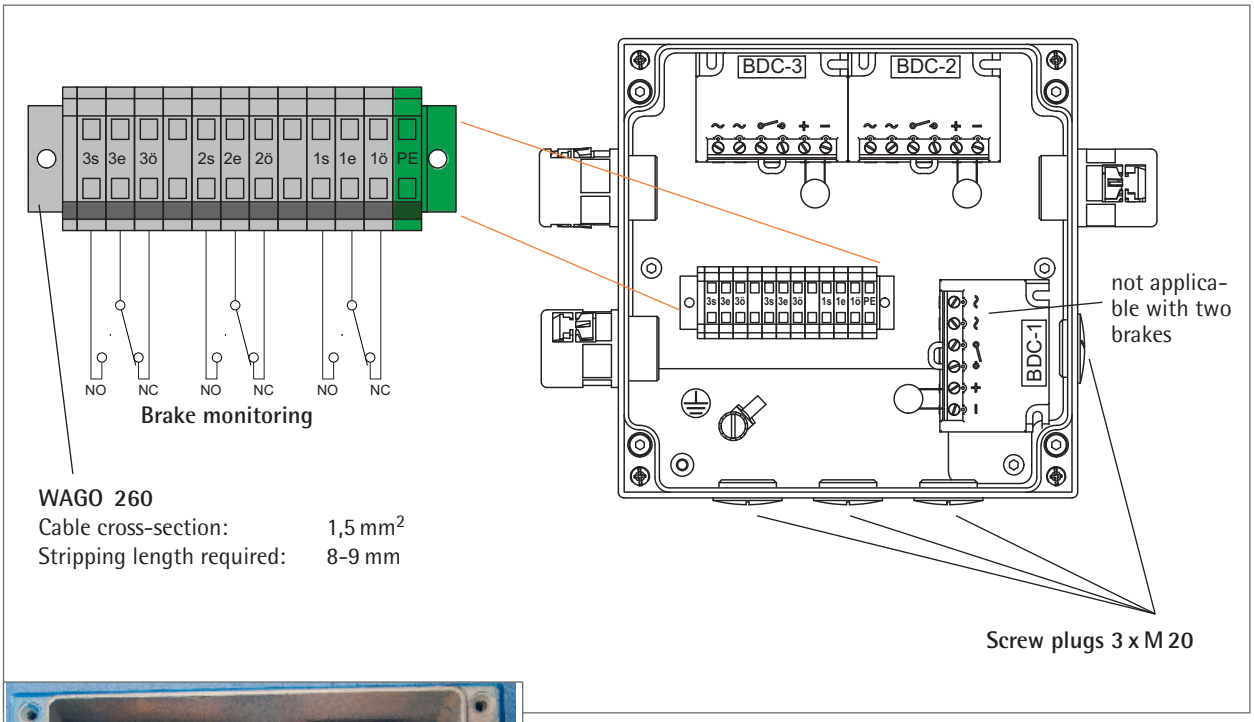
- The switching states of the brakes are monitored by means of dust-proof microswitches.
- Please assure that the contact-current is at least 10 mA to keep the contacts clean.

Warning

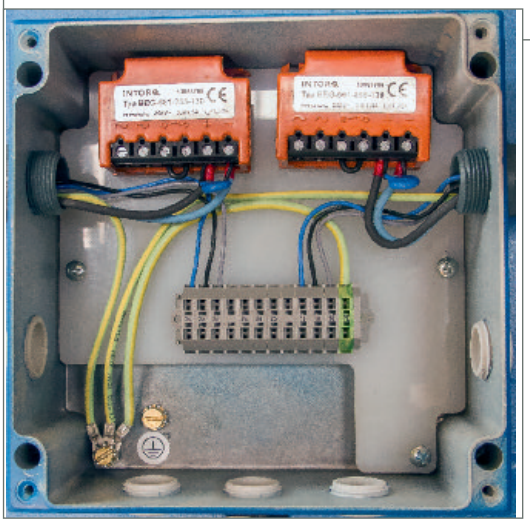
The microswitches must be evaluated separately for each partial brake to ensure compliance with the requirements of the type examination.

Connection of the brakes

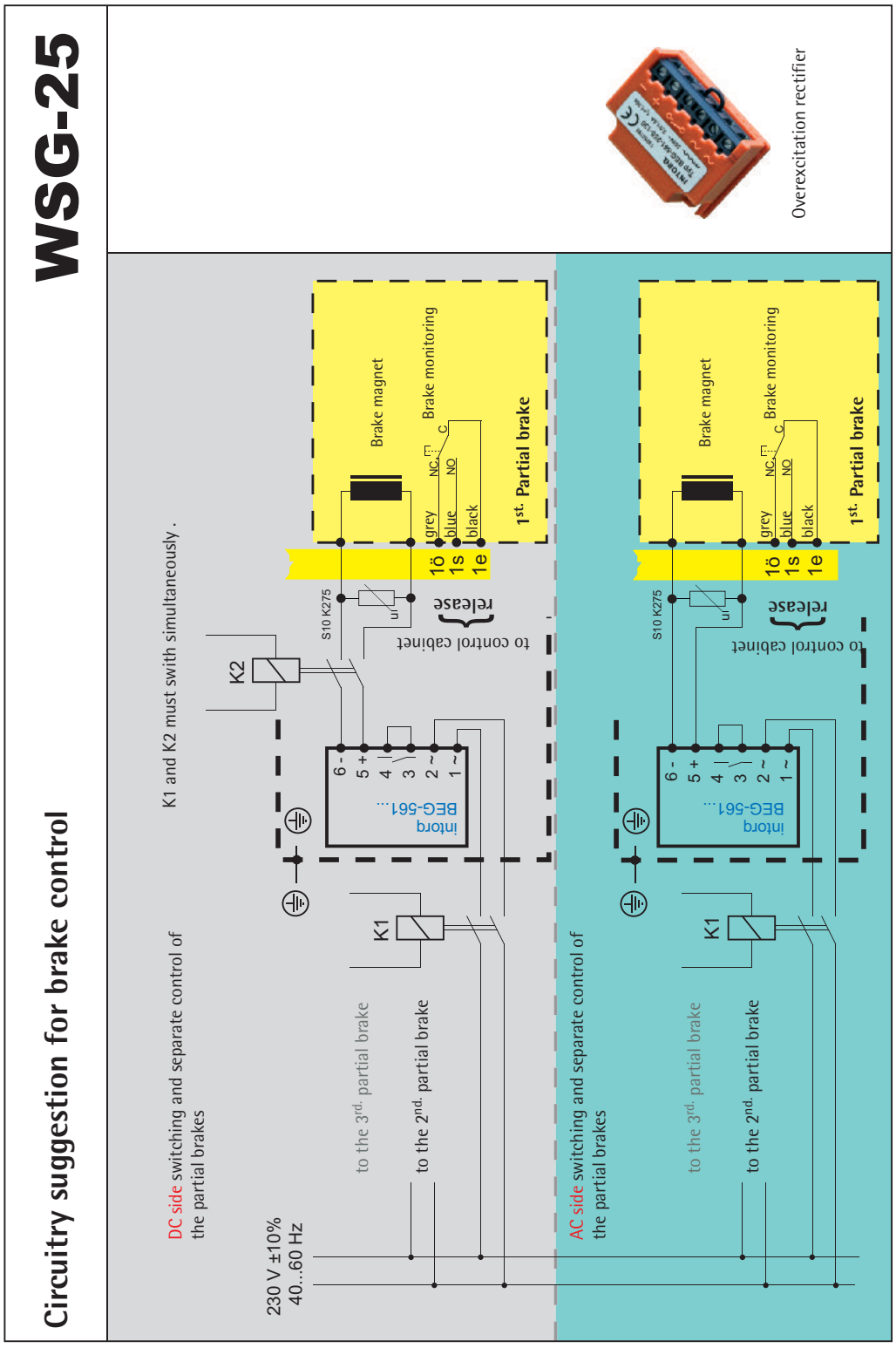
The brake coils, the brake control units and the monitoring contacts are connected to the mains in the brake terminal box.



WAGO 260
Cable cross-section: 1,5 mm²
Stripping length required: 8-9 mm



Circuitry suggestion for brake control WSG-25



5. Commissioning

The following points should be checked or completed:

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

An initial function test of the motor and the brake, together with the inverter, 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.

6. Operation and maintenance

6.1. General

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

Bolt/screw tightening torques

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

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

6.2. Maintenance intervals

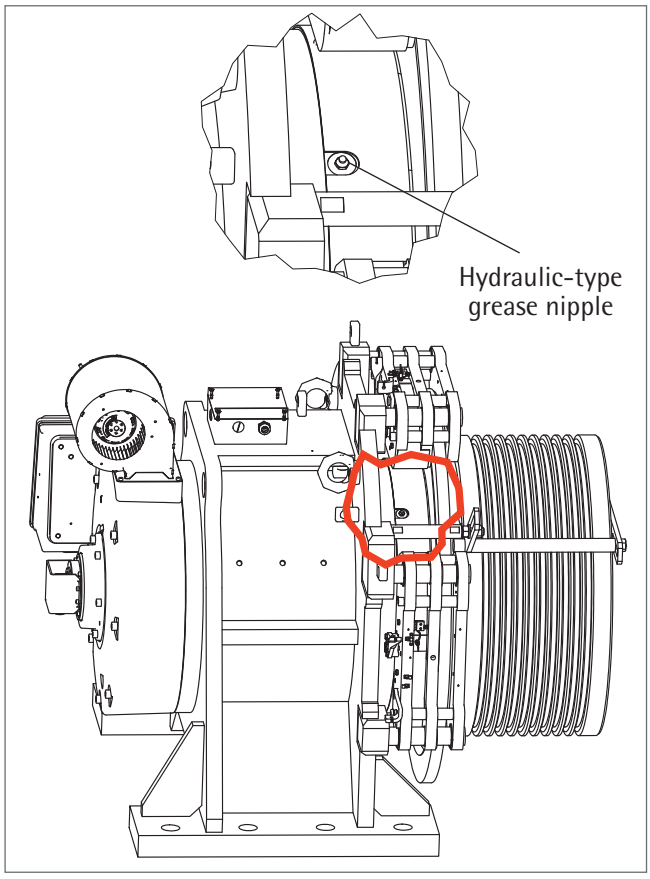
Check the brake air gap	every six months	see the brake operating instructions
Check the proper functioning of the brakes and the brake monitoring switches	every six months	see the brake operating instructions
Check the bearing noise	every six months	
Regrease the bearings	see section 6.3.	
Check the 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 6.1.
Check the electrical cables	every six months	see section 4.2.
Check the rope slip-off guard	every six months	
Check the guards and safety devices for their condition and safe functioning	every six months	
Clean the external machine surfaces; clean the fan filter mats	as required	see section 6.4.

6.3. Regreasing the bearings

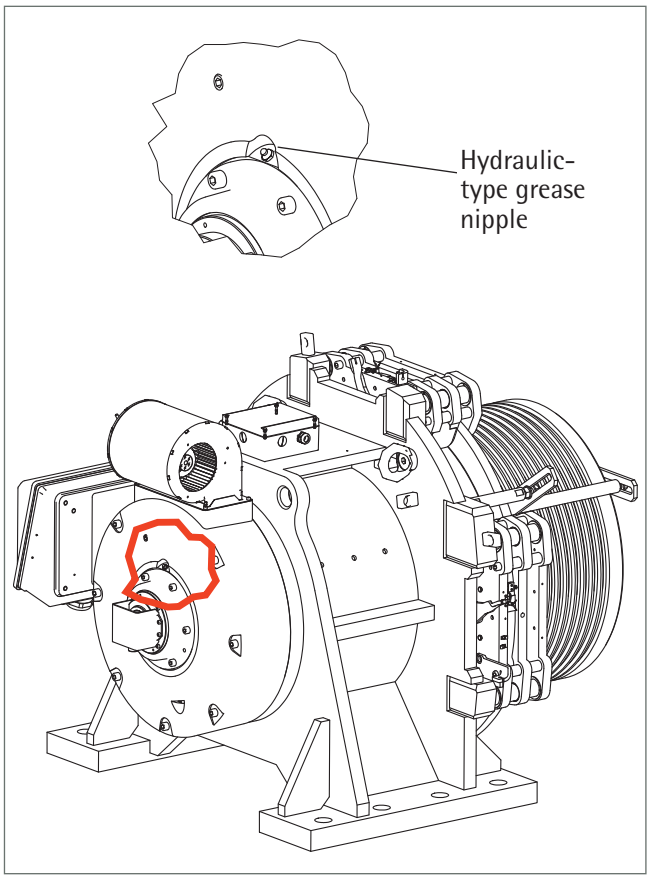
Relubricate the main bearing after about 7,000 hours of operation or every 3 years, using a KP 2 N-30 to DIN 51 502 grease such as Wälalit LZ 2 or Klüberlub BE 41-542 (approx. 185 g on DE and approx. 40 g on NDE).

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

The relubricating points are provided on the D- and N- end shields of the machine. The DE grease nipple is located behind the traction sheave.



DE grease nipple



NDE grease nipple

6.4. Filter mats

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

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

6.5. Replacing the traction sheave

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

Disassembly

- Disconnect the system and prevent 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 12 fastening bolts M 20 x 90-12.9.
- Insert the M 20 x 90 jack bolts (accessories) into the two threaded forcing holes and force off the traction sheave.

Assembly

- Clean the traction sheave and the motor shaft.
- For better assembly heat up traction sheave – **caution: very hot – do not touch!**
- Slide the traction onto the rotor flange as far as possible.
- Insert the fastening bolts and tighten diagonally opposite bolts. Use "omnifit 100" or a similar adhesive to secure the bolts. Tighten them along the bolt hole circle (M_A = 660 Nm) with a torque spanner.
- Replace the ropes and reinstall the rope slip-off guard.

6.6. Emergency evacuation

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

Manually operated evacuation in case of emergency

- For this purpose, the individual brakes are equipped with a manual release lever (16). The lever and the associated counterplate have holes and slots to which Bowden cables can be attached. By using a special lever system, the brakes can be released remotely by hand. This device is shown in the figure "Remote brake control by Bowden cable". It is available as an option together with Bowden cables (length 3 m).
- Is the brake opened manually, the cabin moves in the direction of the higher weight. In case of balance, the cabin has to be weighted down with suitable additional mass.
- The motor winding has to be short-circuited via the motor contactors. With the short circuit the motor creates a brake torque, which is dependent on the motor speed. This prevents an uncontrolled acceleration of the elevator.
- It is possible that the brake torque which is created by the motor short circuit is not enough to limit the speed of the elevator. Therefore the cabin speed has to be observed carefully during the evacuation and if needed, the evacuation has to be stopped.
- When the cabin has reached the next floor, the manually opened brake is closed again. The rescue of the trapped persons in the cabin can begin.

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

Electrically operated evacuation in case of emergency

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

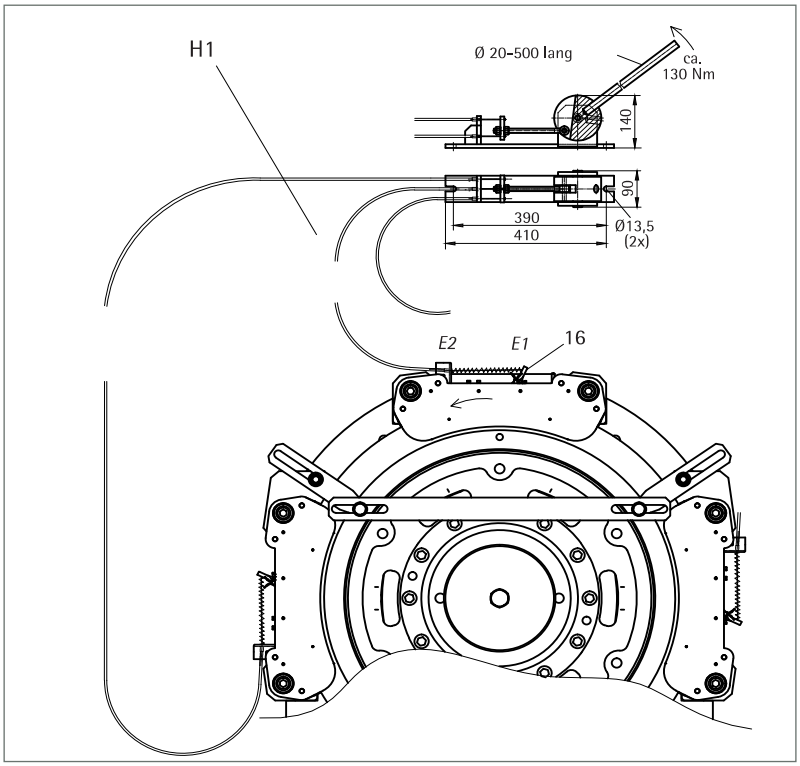
Return motion device

- For cases such as lift failure or the car being caught by the safety device, a mechanical return motion device can be used to move the lift manually. The use of the return motion device is shown in the drawing.

Bolt the bearing block to a cross-beam at the recommended spacing. The cross-beam is firmly connected to the lift machine. When fitting the device, a switching command "electrical supply disconnected" must be activated.

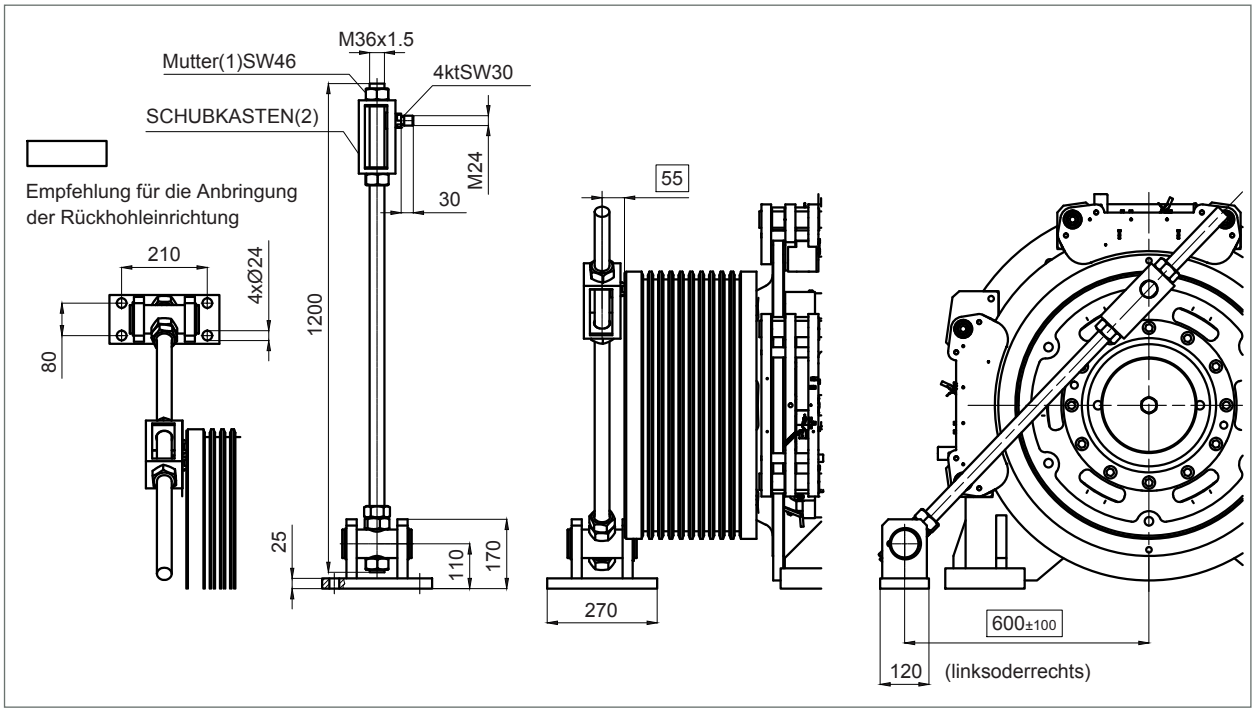
- Then screw the threaded bolt tightly into an appropriately positioned threaded hole in the traction sheave. While releasing the brakes, either electrically or manually, the slide block can be displaced by turning the corresponding nuts. This turns the traction sheave.
- The bolt can then be moved to a new hole in the traction sheave, if required.

Warning The lift must be braked when changing the bolt.



Remote control by Bowden cable

Return motion device



6.7. Testing the brake system to EN 81

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

Overload

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

Failure of a brake

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

Separate operation of the individual brakes

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

Monitoring the brakes

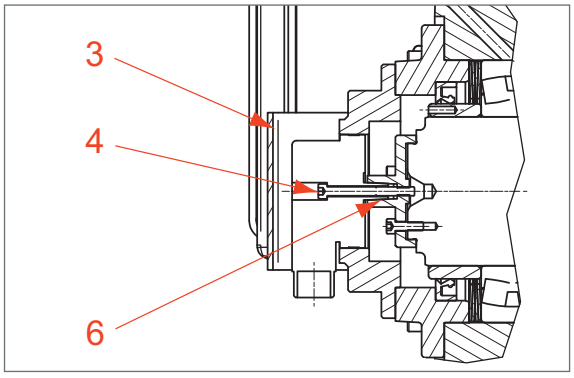
- Check the brake monitoring switches individually. No car travel must be permitted if a microswitch signal is missing or a wrong signal operates.

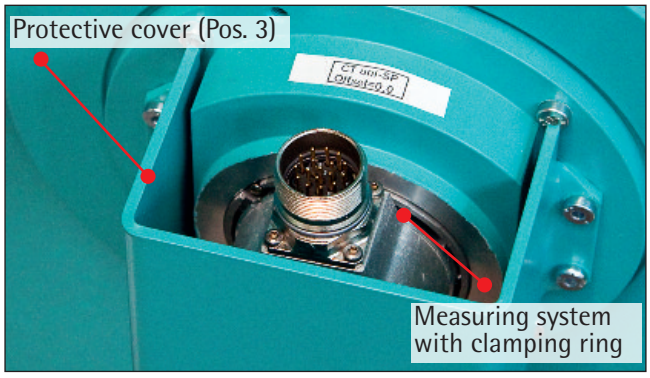
6.8. Replacing the measuring system

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

See the mounting instructions for the Heidenhain encoder.

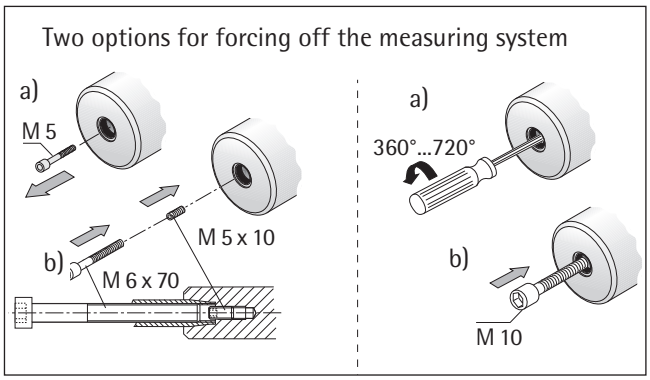
Disassemble the measuring system only if this is necessary because of a defect. Remember to readjust the offset value after reassembly (see the inverter operating instructions).





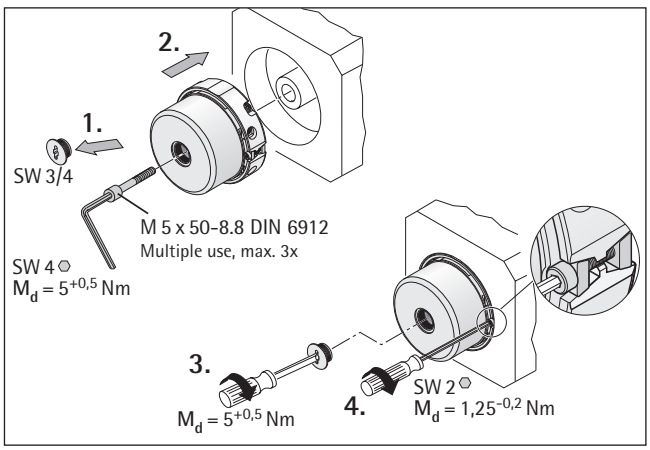
Disassembly

- Remove the protective cover (3).
- Remove the locking screw (4).
- Loosen the clamping ring on the measuring system (2mm Allen screw, see figure "Assembly").
- Push off the measuring system.



Assembly

- Check the true running on the stud (6) (permissible runout max. 0.02 mm).
- Clean the stud and the measuring system shaft end; do not grease them.



- Fit the protective cover (3).

Subject to changes without notice !

6.9. Trouble shooting

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

7. Type code

Example:	W	S	G-	25	.	2	-	0		0		23	/	65A	-	DF
	W	**S**	**G-**	**25**	**.**	**Z3**	**-**	**X1**		**X2**		**X3 X4**	**/**	**X5 X6 X7**	**-**	**X8 X9**

Customer specific identifier

S = Synchronous motor

G = gearless
U = gearless; UL-CSA approved

Frame size

Z3: Overall length:
2 overall lengths are available;
identified by: 1, 2

X1: Customer specific identifier

X2: Motor voltage:
0: suitable for inverter supply using a link voltage of 500 .... 620 V DC

X3 X4: Rated speed:
e.g. 11: 118 min^{-1} (with D_T = 650 mm v = 2.0 m/s; suspension 2:1)
21: 216 min^{-1} (with D_T = 530 mm v = 3.0 m/s; suspension 2:1)
23: 235 min^{-1} (with D_T = 650 mm v = 4.0 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)
ZE: 3 clasp brakes; measuring system ECN 413-2048 incr. - SSI-interface
ZF: 3 clasp brakes; measuring system ECN 413-2048 incr. - ENDAT-interface
ZG: 3 clasp brakes; measuring system ERN 487-2048 incr.
2E: 2 clasp brakes; measuring system ECN 413-2048 incr. - SSI-interface
2F: 2 clasp brakes; measuring system ECN 413-2048 incr. - ENDAT-interface

8. Technical data

Duty type:	S1
Traction sheave:	dia. 530 mm or dia. 650 mm
Traction sheave hardness:	mind. 220 HB 30
DE bearing:	self-aligning roller bearing
NDE bearing:	self-aligning roller bearing
perm. shaft load:	up to 200.000 N
Drive motor:	synchronous motor
Number of pole pairs:	11
Thermal class:	155 (F)
Degree of protection:	IP 23 M / IP 12S
Winding protection:	triple PTC 150°C triple therm. switch (NC contact)130°C therm. switch (NO contact) 60°C

Site conditions

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

Separately driven fan

Type:	D2E 146 AZ03
Operating voltage:	230 V AC / 50 Hz
Power consumption:	1,44 A
Capacitor:	7 µF / 400 V

Dual-circuit fail-safe brake

Brake type:	BFK 466-61
Brake torque:	2/3 x 2400 Nm
Air gap s_B:	$0{,}4^{\pm 0{,}1}$ mm (new air gap)
Max. air gap $s_{B\,max}$:	0,7 mm
Holding voltage:	103 V DC
Holding current:	2/3 x 1,4 A
Overexcitation voltage:	205 V DC
Overexcitation current:	2/3 x 2,7 A

Brake control units

Typ:	BEG-561-255-130 from intorq GmbH (accessories)
Betriebsspannung:	U_N = 230 V AC (± 10 %), 40...60 Hz
Abmessungen:	52 x 22 x 38 (w x h x l)

Brake monitoring contacts

Contact rating:	12 - 30 V DC / 0,01 - 0,1 A
Minimum switching power:	12 V, 10 mA DC-12

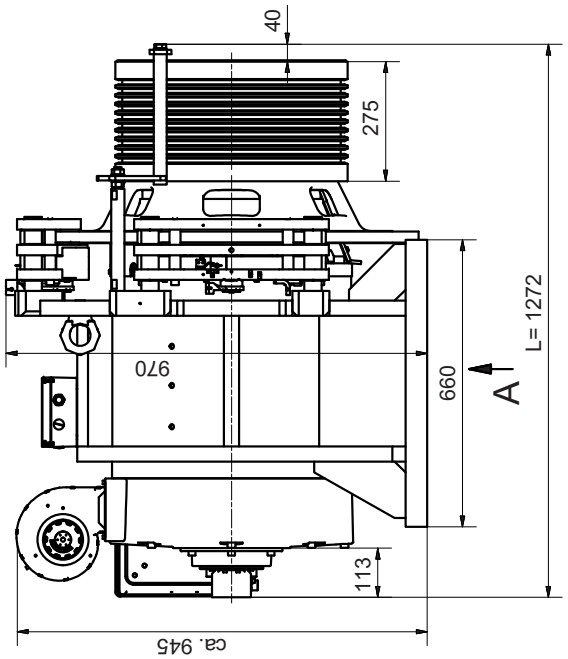
*) Reference values. Achievable nominal load depends on specific lift system data.

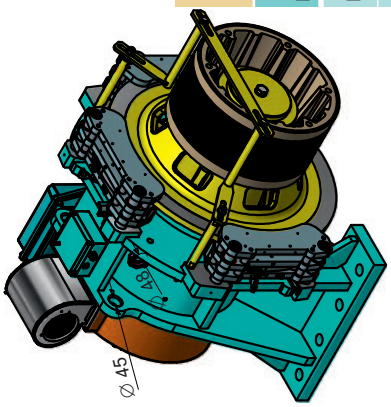
The table is applicable to an overall shaft efficiency of approx. 73..85 % (counterweight: 50 %). It lists a standard selection of machines. The lift and project data will be adapted to actual site conditions and may deviate from the above values.

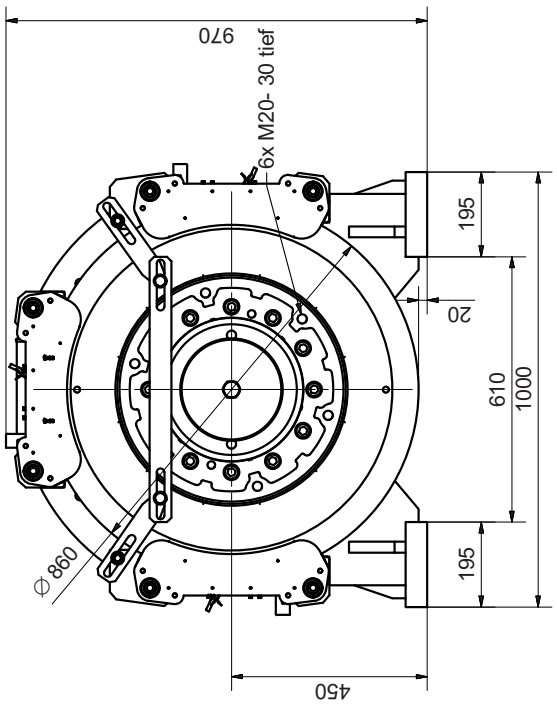
Motor / *motor*		synchron / *synchronous* 22-polig / *22-poles*											
		WSG-25.1						WSG-25.2					
Drehmoment / *torque* S1	M_N [Nm]	1750						2200					
Maximalmoment / *max. torque*	M_{max} [Nm]	4850						6100					
Bremsmoment / *braking torque*	M_B [Nm]	2 x 2400 / 3 x 2400						2 x 2400 / 3 x 2400					
Treibscheibe / *sheave*	Ø D_T [mm]	530			650			530			650		
für Nennlasten / *for loads* *)	Q [kg]	bis / *up to* 3200			bis / *up to* 2500			bis / *up to* 4000			bis / *up to* 3200		
Aufhängung / *suspension*		Tabelle gilt für / *table applies for* 2:1											
Motorströme gelten für 500...620 V Zwischenkreisspannung *Motor currents applicable to 500...620 V d.c. link voltage*	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]
	1,0	72	13,2	36,5	59	10,8	36,5	72	16,6	45	59	13,6	45
	2,0	144	26,4	66	118	21,6	56	144	33,2	81	118	27,2	66
	3,0	216	39,6	103	176	32,3	80	216	49,8	120	176	40,5	91
	4,0	288	52,8	120	235	43,1	103	288	66,4	145	235	54,1	120
	5,0				294	53,9	120				294	67,7	145

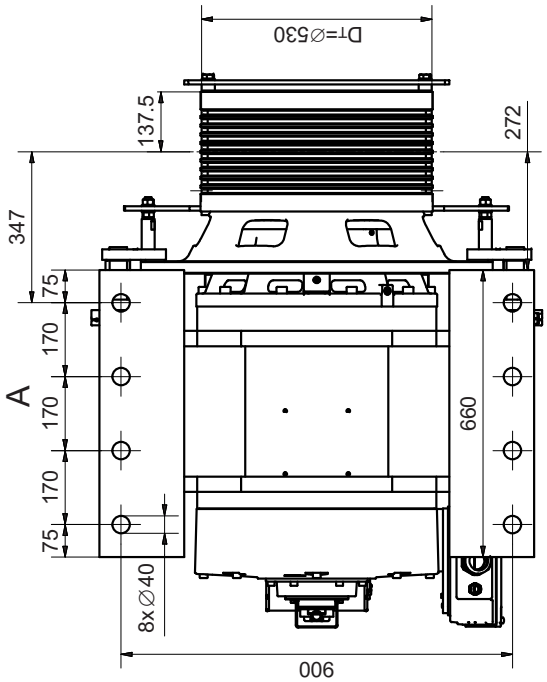
9. Dimension drawing WSG-25.1/2 with traction sheave dia. 530 mm

Treibscheibe / *traction sheave* Ø D_T = 530 mm	Motor / *motor* WSG-	Masse / *weight* m_G [kg]	Trägheitsmoment *inertia* J_G [kgm²]	zul. Achskraft / *perm. shaft load* F_S [kN]
200	25.1	1786	24,7	
	25.2	1846	25,3	

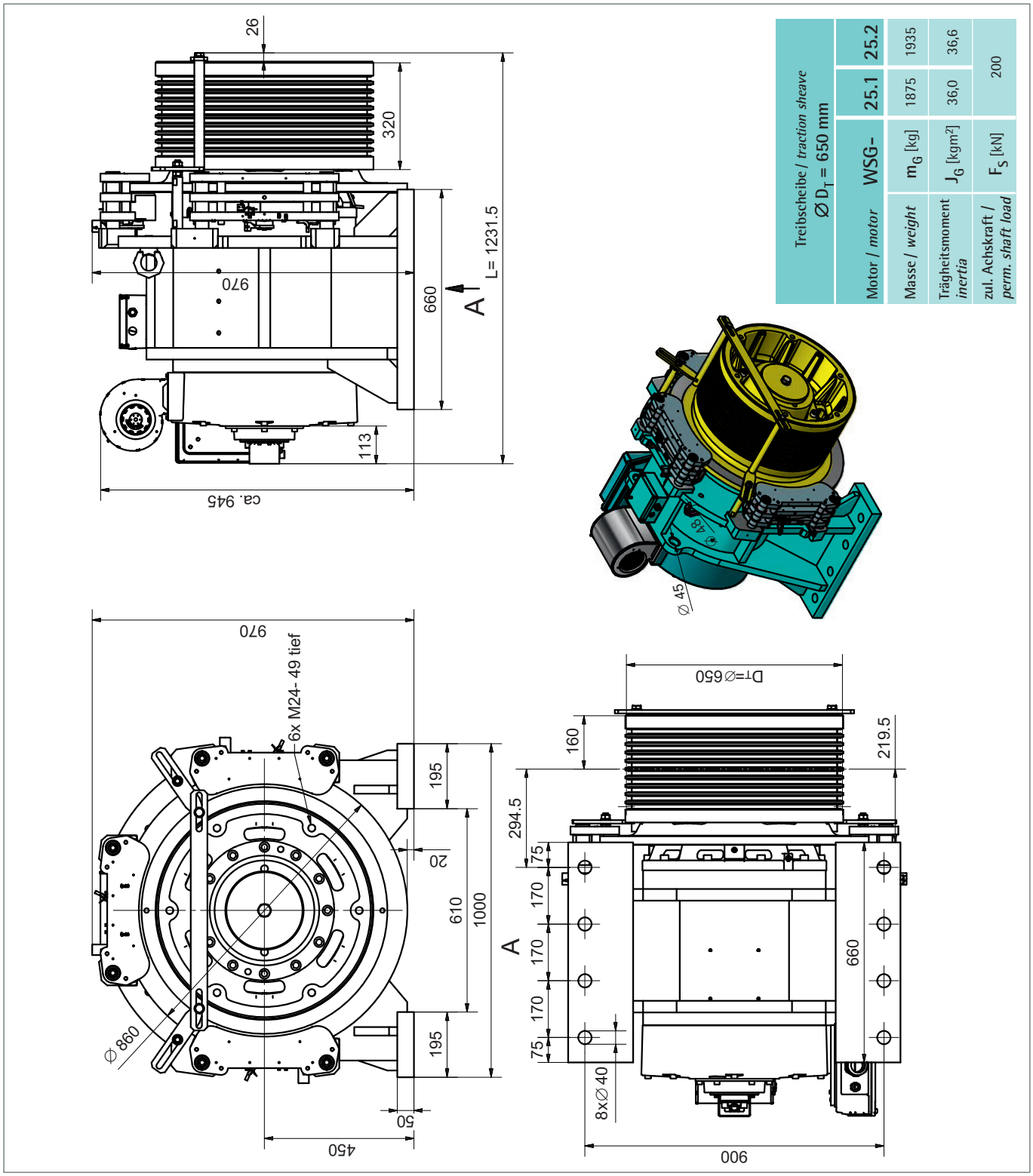






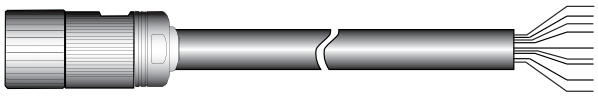
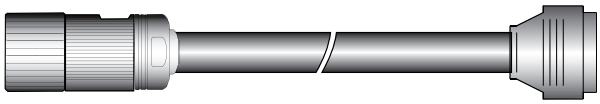
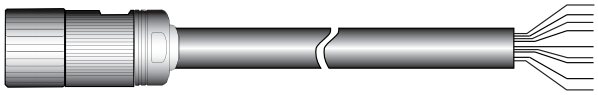
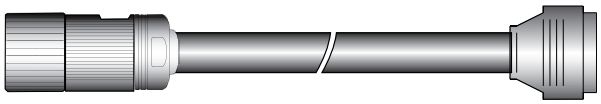
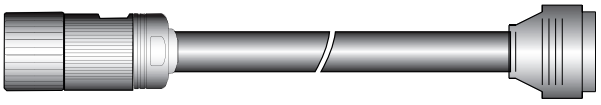
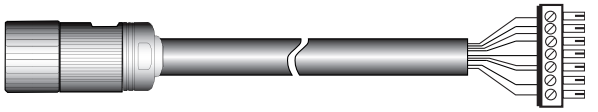
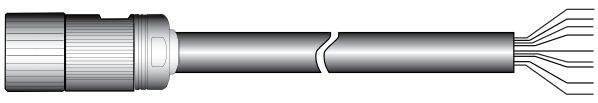
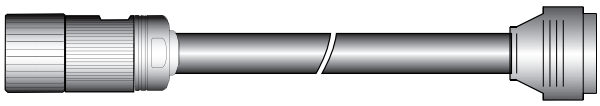


10. Dimension drawing WSG-25.1/2 with traction sheave dia. 650 mm



11. Accessories

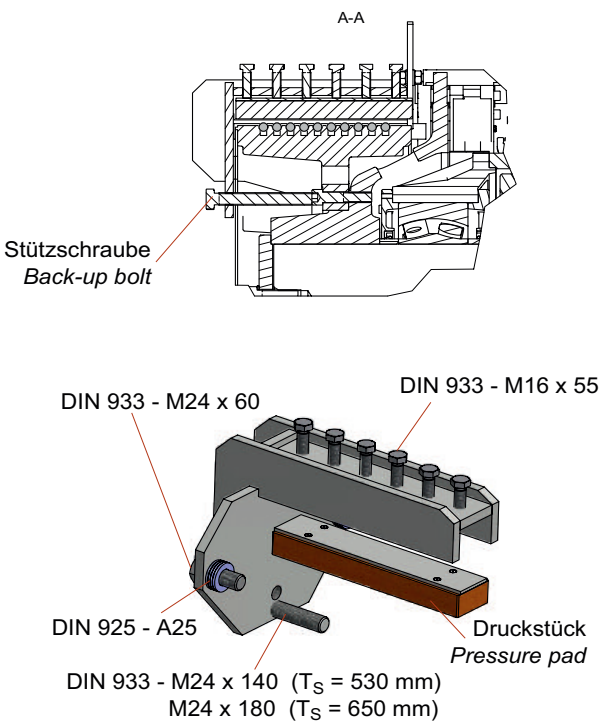
11.1. Connecting cable for measuring systems

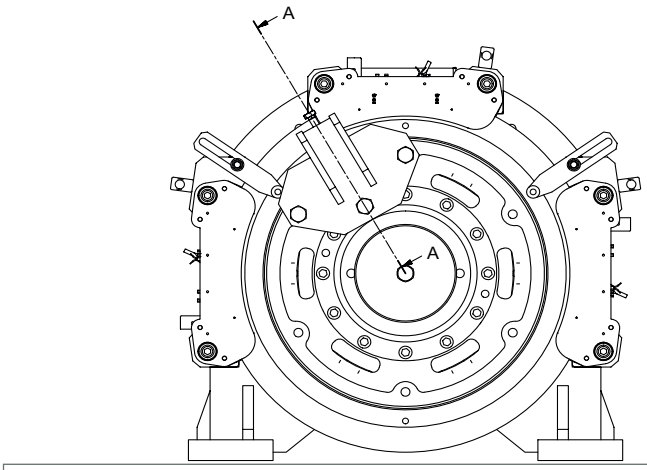
	Inverter type	recom. encoder system	recommended measurement system cable
	E-Pack Arkel ARCODE	ECN 413 (EnDat / SSI)	503 325 021 xx
	D-Pack Arkel ADrive CT unidrive SP	ECN 413 (EnDat / SSI)	502 452 021 xx
	emotron/ Dietz DSV 5445	ECN 413 (EnDat / SSI)	501 112 022 xx
	Fuji Frenic	ECN 413 (EnDat)	502 679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

xx... cable length [m]

Subject to changes without notice !

11.2. Rope clamp

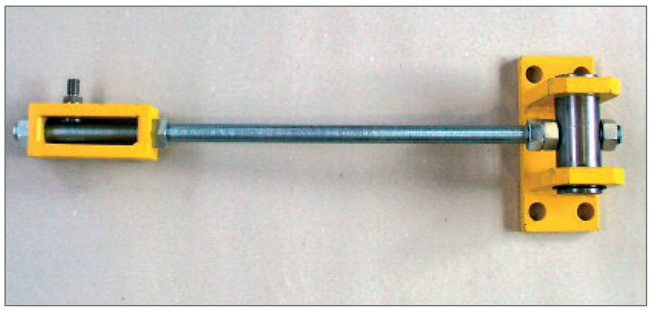




A rope clamp is used, for example, to pull the car from the safety devices if the ropes are slipping.

Fasten the clamp to the traction sheave by inserting two M 24 bolts in the appropriate threaded holes in the traction sheave. Note that different devices are used for the different traction sheave diameters. (The rope slip-off guards must be removed when using the rope clamp.)

11.3. Return motion device



The return motion device is used to move the lift manually in the case of an emergency, for example if the car is caught by the safety device. See section 6.6. "Emergency evacuation" for details.

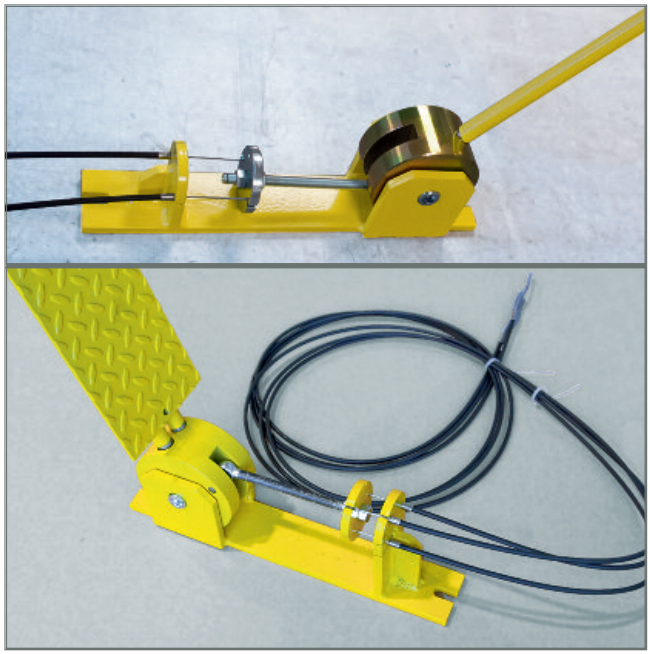
11.4. Cable set for motor and brake

11.5. Remote brake control by Bowden cable

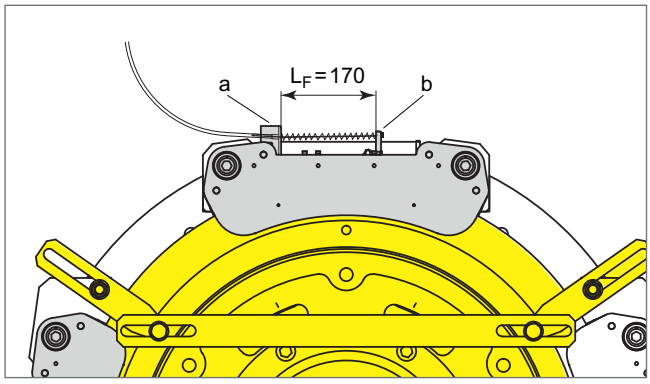
The Bowden cable remote control is used to release the brakes mechanically in the case of an emergency. See section 6.6 "Emergency evacuation" for details.

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

*Remote brake control by Bowden cable, **manually operated***



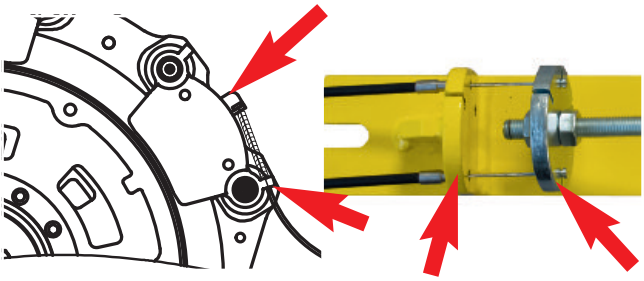
*Remote brake control by Bowden cable, **foot-operated***



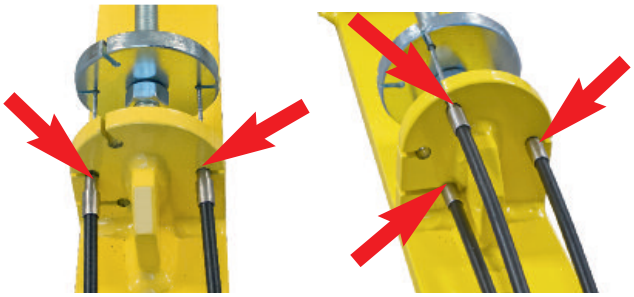
Installation:

Install the manual brake releasing device while the brake is disconnected from the power supply.

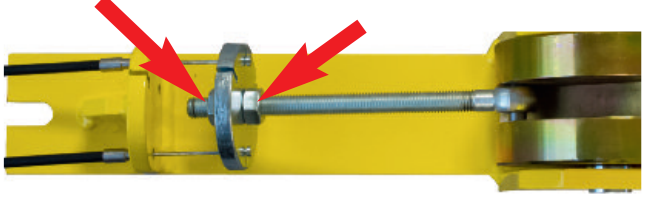
- Lock the car and the counterweight. Ensure that the required safety measures are observed for the lift system.
- Install the lever block.
- Insert the Bowden cable into the brake lever (a and b) and the lever block . Adjusting of the Bowden cable on the lever block. Set L_F = **170 mm** on the lever block with the assistance of threaded rod. (Do not actuate the lever block !)



- **Caution:** Mount Bowden cable symmetrically. (see pictures below). Differences between 2 or 3 brakes must be considered.



- Adjusting of the Bowden cable on the lever block. Set L_F on the lever block with the assistance of threaded rod. (Do not actuate the lever block - the brakes must not be released!)



- Perform a functional test (at least three times).
- **Caution**: The Bowden cable has to be installed in wide arcs only (bending radius > 0.5 m, if possible). **Put no loops !**

12. Spare parts

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

WITTUR Electric Drives GmbH

EU-Konformitätserklärung
EU Declaration of Conformity

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

Der Hersteller
The manufacturer

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

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

Produktbezeichnung:
Product designation:

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

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

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

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

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

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

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

Markus Weber
Geschäftsführer
Managing Director

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

EC_06_2016

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-25.1, xSG-25.2
Inspection order:	Review of the traction sheave shaft calculation
Specification:	DIN 743 Shafts and axles; calculation of load capacity
Scope:	– Review of the calculations to ensure compliance with the specification – Review of the calculation results – Review of the calculation documents to ensure compliance with the data in the drawings
Inspector:	Dipl.-Ing. Thoralf Mührel Technical Expert

Datum: 12.01.2012

Unsere Zeichen:
IS-FT1-DRE/Dmü

Dokument:
20120112_xSG-25.X_en.docx

Das Dokument besteht aus
2 Seiten.

Industrie Service

1. Calculation documents

The following technical documents were to be reviewed:

- Calculation documents 25FE1.DOC pages 1 to 5 dated 12/01/2012.
- Drawing no. 512 410 (Revision Äm 201/11, 18/08/2011).

2. Technical data

The data which are of relevance to the calculation are specified as follows in the calculation document 25FE1.DOC :

– max. shaft load:	200.0 kN
– max. magnetic pull:	1.9 kN
– traction sheave+hub weight:	417.0 kg
– rotor weight:	121.0 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 drawings nos. 512 410 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 Mühre l

TÜV SÜD Industrie Service GmbH
Fördertechnik

ZERTIFIKAT ◆ CERTIFICATE ◆ 認証証書 ◆ СЕРТИФИКАТ ◆ CERTIFICADO ◆ CERTIFICAT

Industrie Service

EU TYPE-EXAMINATION CERTIFICATE

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

Certificate No.:	EU-BD 908
Certification Body of the Notified Body:	TÜV SÜD Industrie Service GmbH Westendstr. 199 80686 Munich - Germany Identification No. 0036
Certificate Holder:	INTORQ GmbH & Co. KG Wülmser Weg 5 31855 Aerzen - Germany
Manufacturer of the Test Sample: (Manufacturer of Serial Production – see Enclosure)	INTORQ GmbH & Co. KG Wülmser Weg 5 31855 Aerzen - Germany
Product:	Braking device acting on the traction sheave, as part of the protection device against overspeed for the car moving in upwards direction and braking element against unintended car movement
Type:	BFK466-61
Directive:	2014/33/EU
Reference Standards:	EN 81-20:2014 EN 81-50:2014 EN 81-1:1998+A3:2009
Test Report:	EU-BD 908 of 2016-03-18
Outcome:	The safety component conforms to the essential health and safety requirements of the mentioned Directive as long as the requirements of the annex of this certificate are kept.
Date of Issue:	2016-03-18
Date of Validity:	from 2016-04-20

TÜV SÜD Industrie Service GmbH 00 36 Notified Body

Werner Rau
Certification Body "lifts and cranes"

TÜV®

Annex to the EC Type-Examination Certificate
No. EU-BD 908 of 2016-03-18

Industrie Service

1 Scope of application

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

1.1.1 Permissible brake force when the braking device acts on the brake disk while the car is moving upward 6011 N

The brake force refers to a single brake on the brake disc diameter effectivley

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

The maximum tripping speed of the overspeed governor and the maximum rated speed of the lift must be calculated on the basis of the brake disc maximum tripping speed (gliding speed) as outlined below taking into account the brake disk diameter effectively, traction sheave diameter and car suspension.

$$v = \frac{D_{TS} \times v_{BS}}{D_{BS} \times i}$$

v	=	Tripping (rated) speed (m/s)
D_{TS}	=	Diameter of the traction sheave from rope's center to rope's center (m)
D_{BS}	=	Diameter of the brake disk effectively (m)
v_{BS}	=	Gliding speed on the brake disk diameter effectively (m/s)
i	=	Ratio of the car suspension

Maximum tripping speed on the brake disk diameter effectively 19.02 m/s

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

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

Nominal brake force* [N]	Maximum response times** [ms] without / with overexcitation		
	t_{10}	t_{50}	t_{90}
6011	57 / 68	119 / 131	181 / 194

Interim values can be interpolated

Explanations:

* **Nominal brake force:** Brake force 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 force, t_{50} optionally calculated $t_{50} = (t_{10} + t_{90})/2$ or value taken from the examination recording

1.2.2 Assigned execution features

Type of powering / deactivation	continuous current / continuous current end
Brake control	single
Nominal air gap	0.35 mm
Damping elements	YES
Overexcitation	at double non-release voltage
Maximum tripping speed on the brake disc diameter effectively	19.02 m/s

2 Conditions

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

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

2.3 The single brakes have to be arranged symmetrically around the circumference of the brake disc. In order to comply with the redundancy required in section 5.6.6.2 of EN 81-20:2014 (D), at least two braking circuits (single brake actuator) must be used.

2.4 Where more than two braking circuits are used, redundancy requirements necessitate that a sufficient braking effect as outlined in section 5.9.2.2.2.1 of EN 81-20:2014 (D) is still maintained if one of the braking circuit fails. It is not assumed that two braking circuits will fail simultaneously.

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

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

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

2.7 The identification drawing no. 5020186 including stamp dated 2016-03-18 shall be included to the EU type-examination for the identification and information of the general construction and operation and distinctness of the approved type.

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

3 Remarks

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

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

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

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

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

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

Enclosure to the EU Type-Examination Certificate
No. EU-BD 908 of 2016-03-18

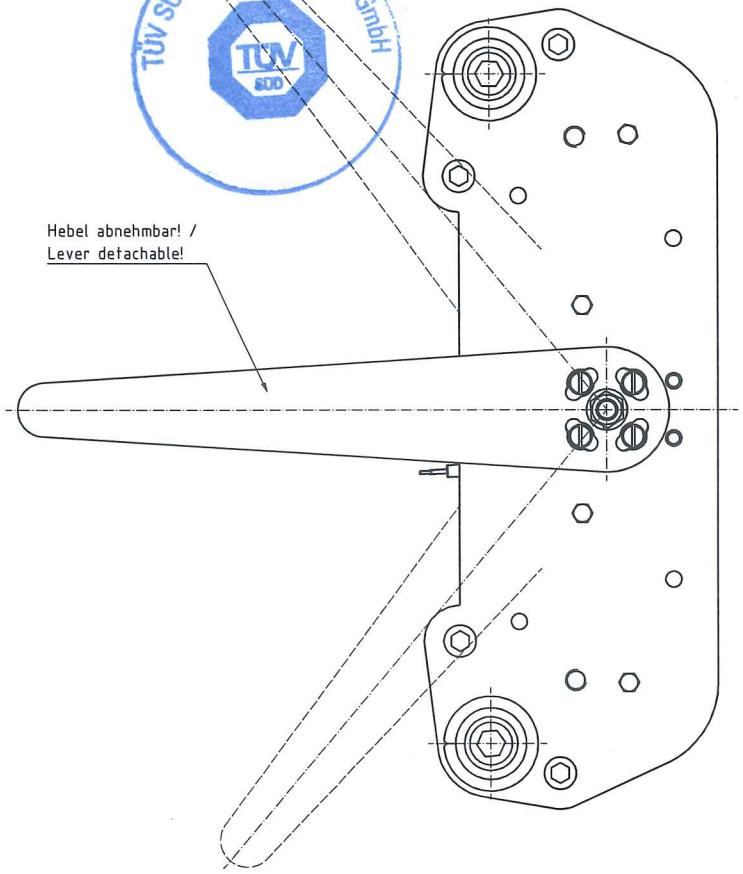
Industrie Service

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

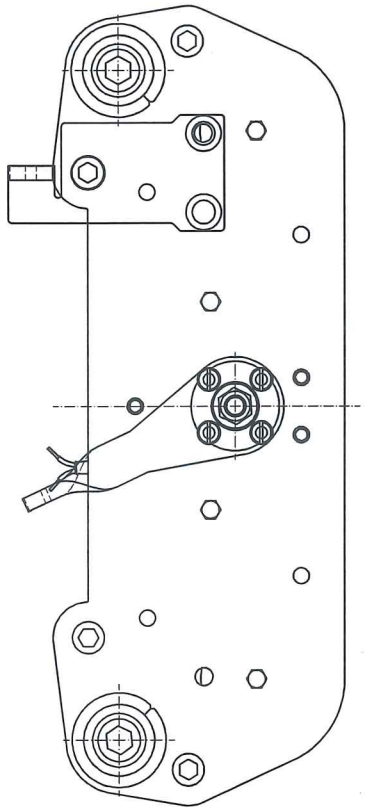
Company	INTORQ GmbH & Co. KG
Address	Wülmser Weg 5 31855 Aerzen – Germany

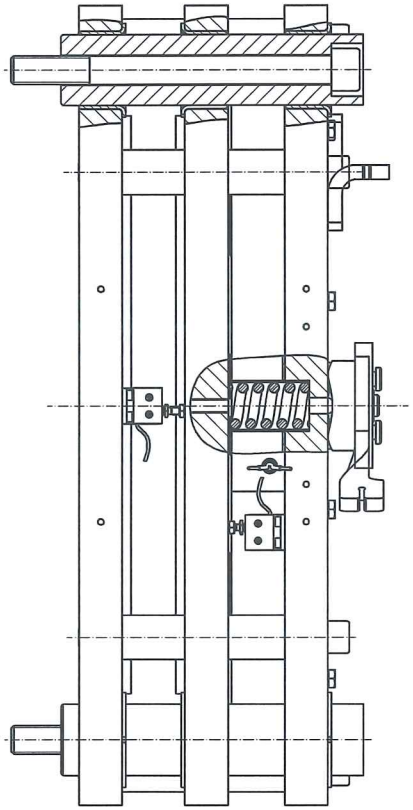
- END OF DOCUMENT -

Ausführung mit Handbetätigung /
Layout with hand lever



Ausführung für manuelle Lüftung mit Bowdenzug /
Layout for manual release by bowden cable





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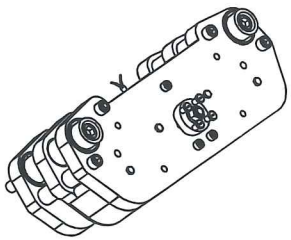
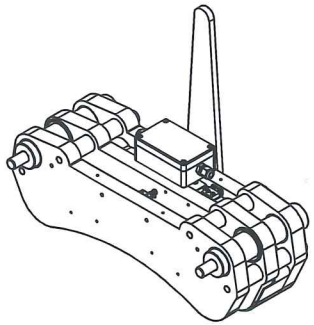




1 8. MRZ. 2016

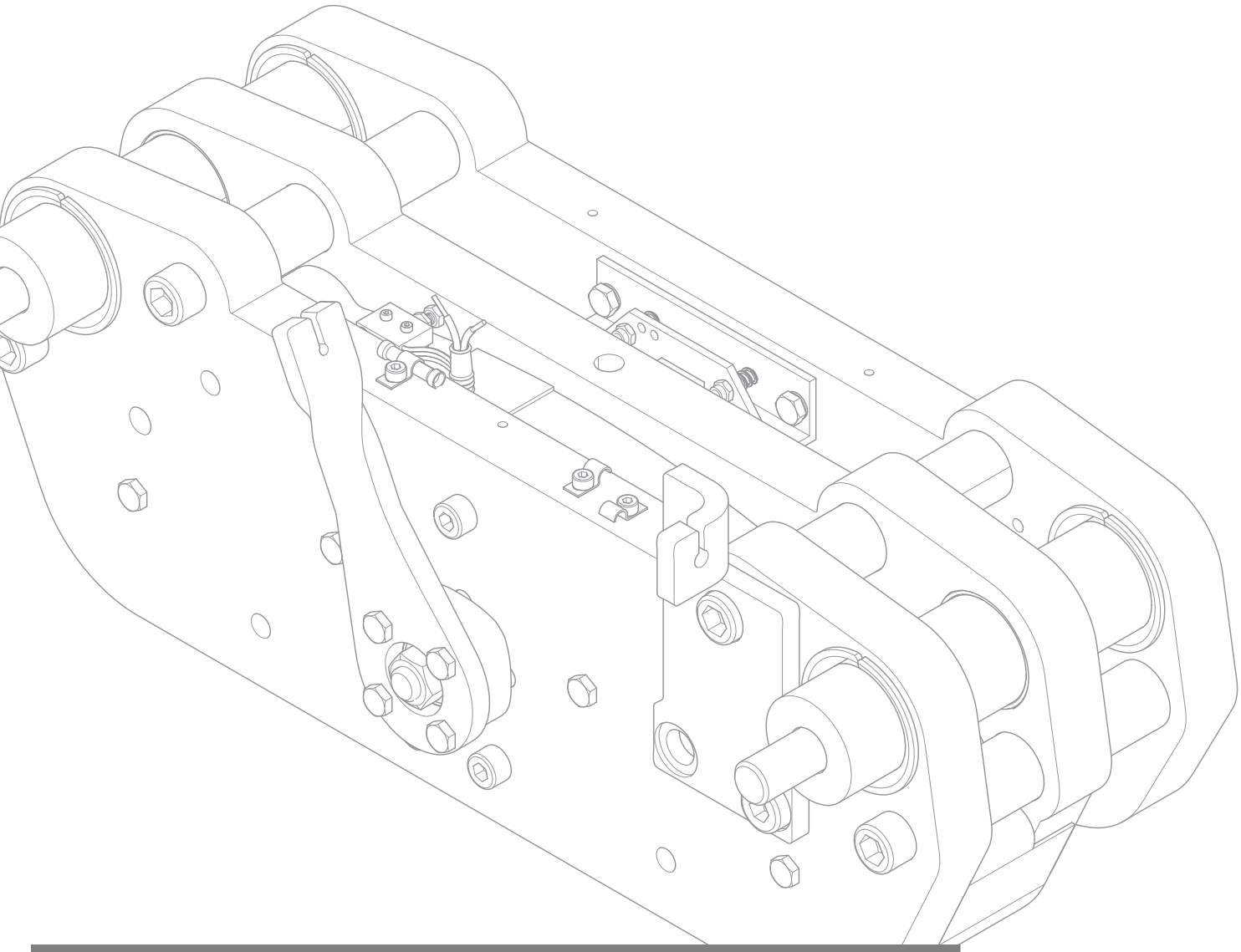
GEPRÜFT / APPROVED
TÜV SÜD Industrie Service GmbH
Prüflaboratorium für Produkte der Fördertechnik
Westendstraße 199
80686 München
Sachverständige(r) / Expert

Type / type BFK466-61

SAP Ident-Nr. / ID.-no.		Projekt-Nr. / project-no.		Allgemeintoleranzen/ general tolerance	Oberflächen/ surface DIN ISO 1302		Maßstab / scale 1:2		Gewicht / weight
Typ / type BFK466		Baugröße / design size 61					Werkstoff / material		Werkstoff-Nr. / material-no.
Version / version AB		Status / status 40 released							
					Datum / date	Name / name	Dokumentbeschreibung / document description		
					Bea / drn	11.02.2016	DITTRICH	Federkraftbremse	
					Gepr / chkd	24.02.2016	QUADFASELW	Spring-op-brake	
					Freig / appr	24.02.2016	QUADFASELW		
2	-	501676	24.02.2016	DIT	CAD INTORQ		Dokument-Nr. / document-no. 5020186		Blatt / sheet 3 von / of 3
Index / index	Anz. / quan.	Ander-Nr. / revision no.	Datum / date	Name / name	Datei / file 5016185_IAM_000.iam		Ersatz für / back-up for BFK46651-001		

INTORQ

setting the standard



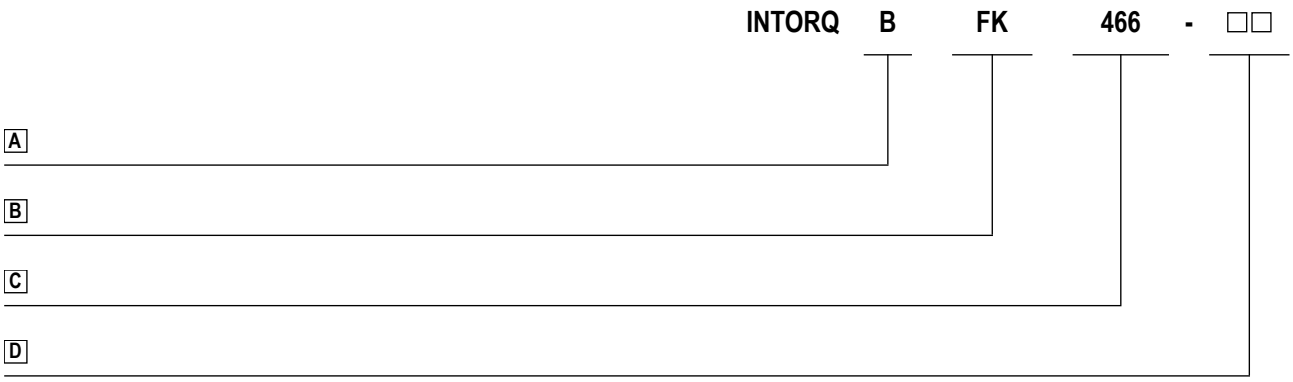
INTORQ BFK466-61

Multi-pole spring-loaded brake

Translation of the Original Operating Instructions

www.intorq.com

Product key



Legend for the product key

INTORQ BFK466

A	Product group	Brakes
B	Product type	Spring-applied brake
C	Type	466
D	Size	61

Not coded: Supply voltage, hub bore hole, options

Identification

Packaging label			**Example**
Manufacturer		Type No.	
Type		Bar code	
Designation		Qty. per box	
Rated/holding voltage	Rated frictional force		
Rated/holding power		Packaging date	
Model identification		CE mark	
Addition			

Nameplate			**Example**
Manufacturer			
Type	Model identification	CE mark	
Rated/holding voltage	Rated/holding power		
Type No.	Rated frictional force	Date of manufacture	

Product traceability sticker		Example
Type	QR code	
Type No.		
Serial number		
Manufacturer		

Document history

Material number	Version			Description
33002314	1.0	04/2016	SC	First edition

Contents

1 Preface and general information

1.1 About these Operating Instructions

- These Operating Instructions will help you to work safely with the multi-pole spring-applied brake. They contain safety instructions that must be followed.
- All persons working on or with the multi-pole spring-applied brake must have these Operating Instructions available and observe the information and notes relevant for their work.
- 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	Multi-pole spring-loaded brake
Drive system	Drive systems with spring-applied brakes and other drive components

1.3 Abbreviations used

Letter symbol	Unit	Designation
F_R	N	Rated frictional force
I	A	Current
I_H	A	Holding current, at 20 °C and holding voltage
I_L	A	Release current, at 20 °C and release voltage
I_N	A	Rated current, at 20 °C and rated voltage
M_A	Nm	Tightening torque of fixing screws
M_{dyn}	Nm	Braking torque at a constant speed of rotation
M_K	Nm	Rated torque of the brake, rated value at a relative speed of rotation of 100 rpm
n_{max}	rpm	Maximum occurring speed of rotation during the slipping time t_3
P_H	W	Coil power during holding, after voltage change-over and 20 °C
P_L	W	Coil power during release, before voltage change-over and 20 °C
P_N	W	Rated coil power, at rated voltage and 20 °C
Q	J	Quantity of heat/energy
Q_E	J	Max. permissible friction energy for one-time switching, thermal parameter of the brake
Q_R	J	Braking energy, friction energy

Letter symbol	Unit	Designation
Q_{Smax}	J	Maximally permissible friction energy for cyclic switching, depending on the switching frequency
R_m	N/mm^2	Tensile strength
R_N	Ohms	Rated coil resistance at 20 °C
R_z	µm	Averaged surface roughness
S_h	1/h	Switching frequency: the number of switching operations evenly spread over the time unit
S_{hue}	1/h	Transition switching frequency, thermal parameter of the brake
S_{hmax}	1/h	Maximum permissible switching frequency, depending on the friction energy per switching operation
s_L	mm	Air gap: the lift of the armature plate while the brake is switched
s_{LN}	mm	Rated air gap
s_{Lmin}	mm	Minimum air gap
s_{Lmax}	mm	Maximum air gap
s_{HL}	mm	Air gap for manual release
t_1	ms	Engagement time, sum of the delay time and braking torque - rise time $t_1 = t_{11} + t_{12}$
t_2	ms	Disengagement time, time from switching the stator until reaching 0.1 M_{dyn}
t_3	ms	Slipping time, operation time of the brake (according to t_{11}) until standstill
t_{11}	ms	Delay during engagement (time from switching off the supply voltage to the beginning of the torque rise)
t_{12}	ms	Rise time of the braking torque, time from the start of torque rise until reaching the braking torque
t_{ue}	s	Overexcitation time
U	V	Voltage
U_H	V DC	Holding voltage, after voltage change-over
U_L	V DC	Release voltage, before voltage change-over
U_N	V DC	Rated coil voltage; in the case of brakes requiring a voltage change-over, U_N equals U_L

1.4 Conventions in use

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

Spelling of numbers	Decimal separator	Point	The decimal point is always used. For example: 1234.56
Symbols	Page reference	🕮	Reference to another page with additional information For example: 🕮 16 = refer to page 16
	Wildcard	□	Wildcard for options, selections For example: BFK466-□□ = BFK466-10
	Note		Important notice about ensuring smooth operations or other key information.

1.5 Notices used

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

Safety instructions

Structure of safety instructions:

	⚠ **SIGNAL WORD**
 	**Icon** Indicates the type of danger **Signal word** 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.

Danger level

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

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

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

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

1.6 Scope of delivery

- The spring-applied brakes are delivered preassembled, the brake disc is not included in the scope of supply.
- After receipt of the delivery, check immediately whether the items delivered match the accompanying papers. INTORQ does not accept any liability for deficiencies claimed subsequently. You should make a complaint concerning:
  - visible transport damage immediately to the forwarder.
  - visible deficiencies / incompleteness immediately to INTORQ GmbH & Co. KG.

1.7 Disposal

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

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

1.8 Drive systems

Labelling

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

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

1.9 Legal regulations

Liability

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

Warranty

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

2 Safety instructions

2.1 General safety instructions

- INTORQ components ...
  - ... must only be used as directed.
  - ... must not be commissioned if they are noticeably damaged.
  - ... must not be technically modified.
  - ... must not be used 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.
- Follow all specifications and information found in the corresponding enclosed documentation.
  - These must be followed to maintain safe, trouble-free operations and to achieve the specified product characteristics.
- Only qualified, skilled personnel are permitted to work on and with INTORQ components.

  According to IEC 60364 or CENELEC HD 384, qualified, skilled personnel are persons ...
  - ... who are familiar with the installation, mounting, commissioning, and operation of the product.
  - ... who have the qualifications necessary for their occupation.
  - ... who know and apply all regulations for the prevention of accidents, directives, and laws relevant on site.
- Risk of burns!
  - Surfaces may be hot during operation! Provide for protection against accidental contact.
- Risk of injury due to a rotating shaft!
  - Wait until the motor is at standstill before you start working on the motor.
- The friction lining and the friction surfaces must never contact oil or grease since even small amounts reduce the braking torque considerably.
- The brake is designed for operation under the environmental conditions that apply to IP54 protection. Because of the numerous possibilities of using the brake, it is still necessary to check the functionality of all mechanical components under the corresponding operating conditions.

2.2 Application as directed

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

Any other use or excessive usage shall be deemed improper!

Possible applications of the INTORQ spring-applied brake

- Humidity: no restrictions
- Ambient temperature:
  -5 °C to +40 °C (standard)
- At high humidity and low temperature:
  - Take measures to protect the armature plate and rotor from freezing.
- Protect the electrical connections against any contact or touching.

3 Technical specifications

3.1 Product description

3.1.1 Structure and function

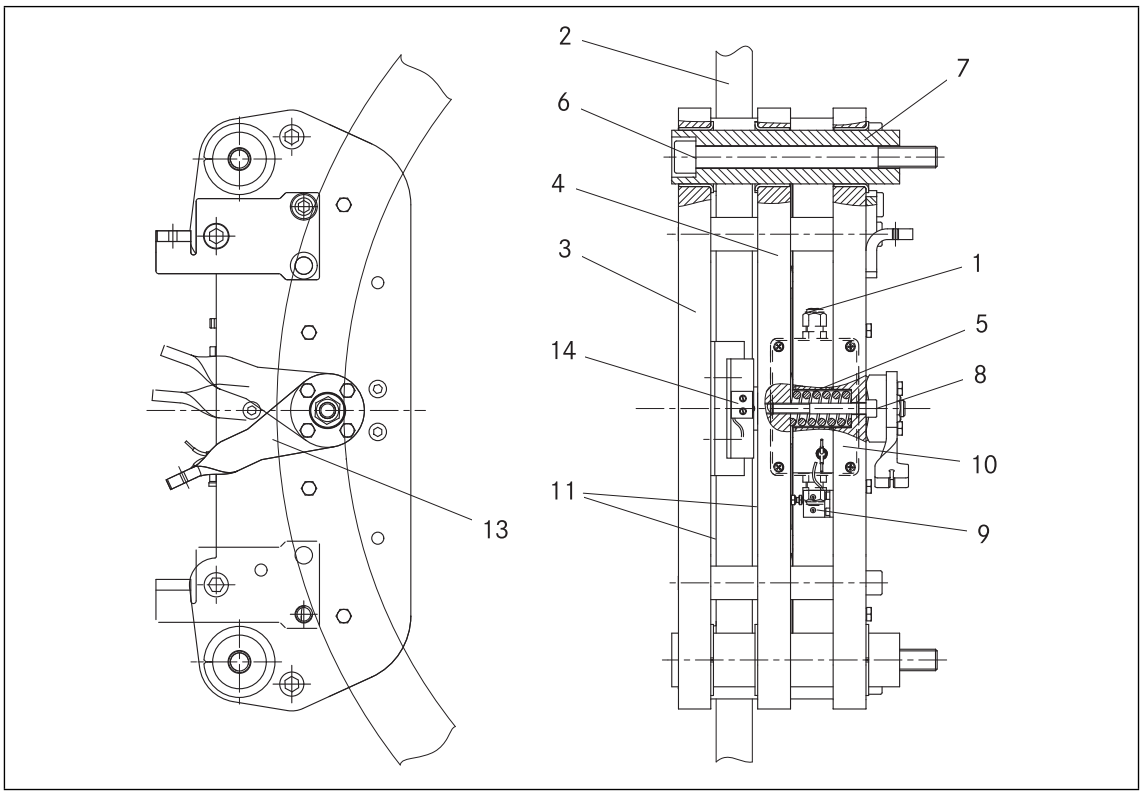


Fig. 1 Construction of an INTORQ BFK466-61 spring-applied brake

1	Stator	6	Cylinder head bolt	11	Friction lining
2	Brake disc	7	Guide sleeve	13	Manual release lever
3	Flange	8	Cylinder head bolt	14	Microswitch (wear monitoring)
4	Armature plate	9	Microswitch (release check)		
5	Pressure spring	10	Terminal box (optional)		

3.1.2 General information

The spring-applied brake is designed as a floating caliper brake for mounting on direct drive motors. The brake disc (2) is not included in the scope of supply. By using two or more spring-applied brakes on one brake disc, the demand for redundancy can be fulfilled for special applications such as lift and stage technology.

The braking torque is generated by the pressure of several compression springs (5) via friction locking between the two friction linings (11) of the friction lining support (12) and the flange (3) and the brake disc (2). The brake is released electromagnetically. For this, an overexcitation voltage is applied to the brake for approx. 1 to 2 seconds. The voltage is then decreased by 50 %. This results in a reduction of the average electrical power of the brake.

The BFK466 spring-applied brake is designed for converting mechanical work and kinetic energy into heat energy. Due to the static braking torque, loads can be held at a standstill.

Emergency braking at higher speeds is possible. Here, the maximum permissible speed of rotation must not be exceeded (refer to 📖 14).

The stator (1) is supplied in heat class F. The temperature limit of the coil is 155 °C.

The spring-applied brake is designed for a maximum switching time (duty cycle) of 80 %.

Certificate

Type	EC-type examination certificate		
	Directive 95/16/EC	UCM	Directive 2014/33/EC
BFK466-61	ABV 908/1	ESV 908/1	EU-BD 908

3.1.3 Brakes

During braking, the friction lining carrier (12) and the affixed friction lining (11) are pushed against the axially fixed brake disc (2). Almost simultaneously, the caliper moves in the opposite direction on the guide sleeves (7), so that the friction lining (11) on the flange (3) is also pushed against the brake disc (2). The braking torque is supported by the mounting flange via the guide sleeves (7). The asbestos-free friction linings ensure high braking torque and low wear.

3.1.4 Brake release

When the brake is being applied, there is an air gap "s_L" between the armature plate (4) and the pole faces of the stator (1). To release the brake, the coils of the stator (1) are supplied with overexcitation voltage from the associated switching device. The resulting magnetic force pulls the armature plate (4) to the pole faces of the stator (1) against the spring pressure. The friction lining (12) is now relieved of the spring force. The caliper can move on the guide sleeves (7) until the brake disc (2) is relieved and can rotate freely. After 1 or 2 seconds, the supply voltage is reduced by half.

3.1.5 Release monitoring

The INTORQ BFK466 spring-applied brake is equipped with a microswitch (changeover contact) which monitors the switching status. When the brake is released, the microswitch (9) toggles. This means that it is possible to prevent the drive from being operated when the brake is closed.

3.1.6 Monitoring wear

The amount of wear of this spring-applied brake is monitored by an additional microswitch (14). The microswitches can be used as NC contacts (series connection) or as NO contacts (parallel connection).

3.1.7 Emergency release option

An optional manual release is available for briefly releasing the brake. This allows the load to be lowered in the event of a power failure.

3.1.8 Project planning notes

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

3.2 Rated data

Type	Friction force F_R [N]	Brake disc radius R_a [mm] min / max	Max. sliding speed $V_{max.}$ [m/s]	Voltage[1] U ±10% [V] DC	Power[2] P_N [W]	Coil resistance R_N±5% [Ω]	Max. Current $I_{max.}$ [A]	Over-excitation time t_{ue}[s]
BFK466-61	6011	300 / 600	19	90/45	522/130.5	15.52	5.8	1...2
				110/55	522/130.5	23.18	4.75	
				205/103	550/137.5	76.41	2.68	

1) Voltage for releasing/holding

2) Coil power at 20 °C during the release/holding

Type	Air gap s_L [mm]	Max. Air gap s_{Lmax} [mm]	Fixing screws	Tightening torque M_A [Nm]	Max. perm. Switching energy Q_E [J]	Transitional switching frequency S_{hue} [h^{-1}]	Weight (without brake disc) m [kg]
BFK466-61	0.4 ±0.1	0.7	2 x M16	195	250000	24	44

3.3 Switching times

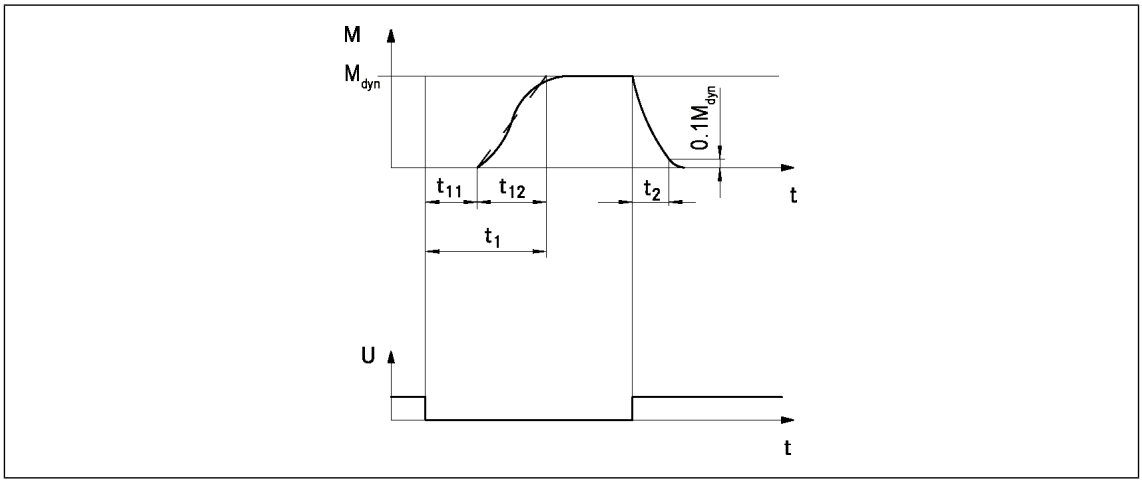


Fig. 2 Operating/switching times of the spring-applied brakes

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

Type	Switching times [ms] for s_{LN} and 70 % current			
	Engage			Disengage
	t_{11}	t_{12}	t_1	t_2
INTORQ BFK466-61	36	94	130	172

Tab. 1: Switching energy - switching frequency - switching times

Disengagement time

The disengagement time is not influenced by DC or AC switching operations. The indicated disengagement time applies to an air gap of 0.4 mm. If the air gap is larger (due to wear), the disengagement time increases.

Engagement time

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

If the drive system is operated with a frequency inverter so that the brake will not be de-energized before the motor is at standstill, AC switching is also possible (not applicable to emergency braking). In this case, the engagement times increase approximately by a factor of 5.

3.4 Switching energy / switching frequency

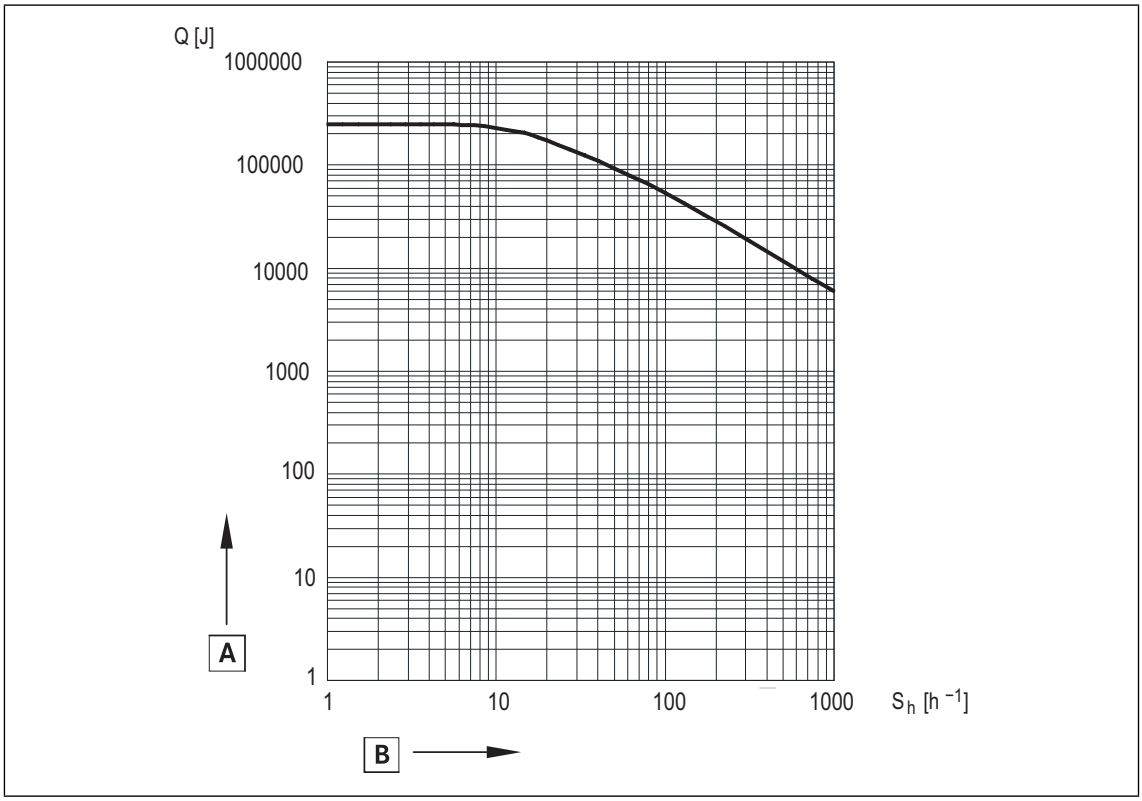


Fig. 3 Switching energy as a function of the switching frequency

A Switching energy

B Switching frequency

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

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

The permissible switching frequency "S_{hzul}" depends on the amount of heat "Q" (refer to Figure 3). At a preset switching frequency "S_h", the permissible amount of switching energy is "Q_{zul}". "S_{hue}" and "Q_E" are specified in 📖 14.

3.5 Emissions

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.

	**DANGER**
	Risk of burns on brake and brake disc!

Noise

The loudness of the switching noise during engaging and disengaging depends on the air gap "s_L" and the brake size.

Others

Abrasion due to braking occurs in the form of dust.

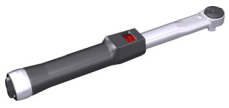
In case of high load, the friction face will become so hot that odours may occur.

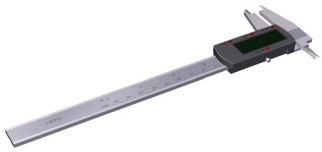
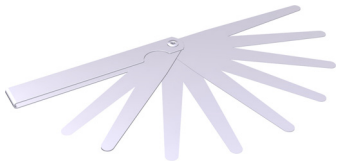
4 Mechanical installation

Important notes

	NOTICE
	Do not lubricate the screws with oil or grease.

4.1 Necessary tools

Type	Torque wrench	Insert for hexagon socket screws	Transport screw	Cross-tip screwdriver
				
	Measurement range [NM]	**Width across flats [mm]**	**Wrench width [mm]**	**Cross-tip size**
BFK466-61	250	14 x 1/2" square	6 x 1/4" square	2

Multi-meter	Calliper gauge	Feeler gauge
		

4.2 Assembly

4.2.1 Preparing the installation

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

4.3 Installation

The brake is delivered preassembled with two transport safety bolts (17).

1. Fit the guide sleeve (19) on the drive and tighten it lightly with the fixing screw (21).
2. Use a through-hole and push the brake onto the guide sleeve until the friction faces are in alignment with the brake disc (20).
3. Turn the brake around the guide sleeve (19) and position the brake radially over the brake disc (20).
4. Push the second guide sleeve (19) into the second through-hole of the brake and tighten it with the fixing screw (21).

	NOTICE
	The sum of the measured gaps may not be larger than "s_{Lmax}"!

5. Tighten the two fixing screws (21) to the specified torque (📖 14).
6. Remove locking screws (17) that secure the device during transport!
7. Switch the current on and off several times, checking the movability of the brake on the guide sleeves.
8. Check the clearance of the brake disc and the air gap "s_L" between the two friction linings (3.2) and the brake disc (20) using a feeler gauge (24).

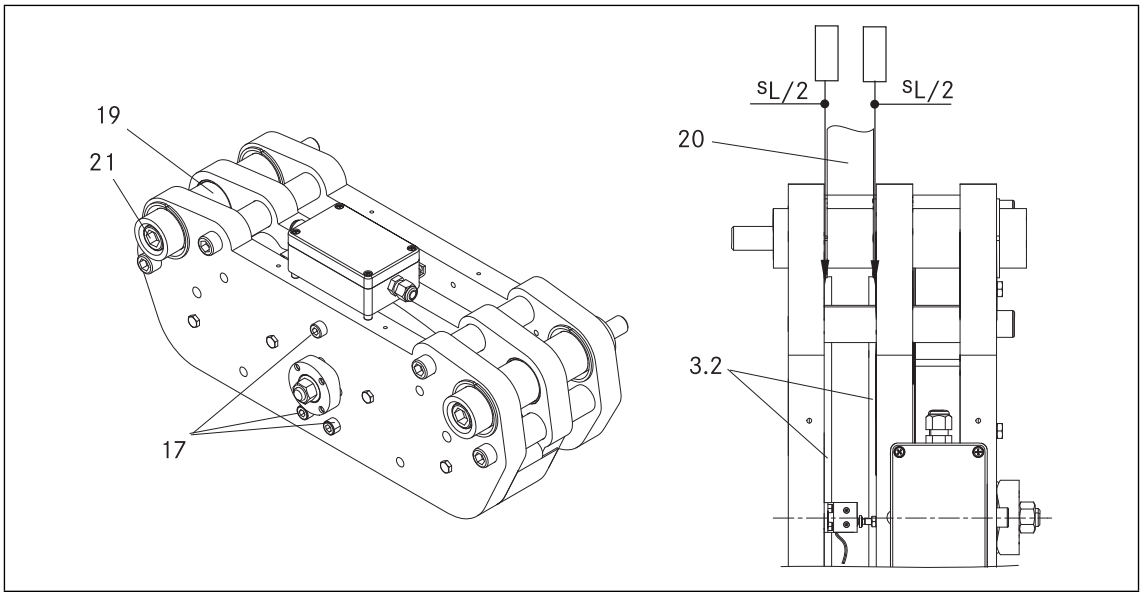


Fig. 4 Procedure for installing the BFK466-61 spring-applied brake

5 Electrical installation

Important notes

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

	NOTICE
	▮ It must be ensured that the supply voltage corresponds to the name plate data. ▮ Voltages must be adjusted to the local environment!

	NOTICE
	▮ If emergency switching off is carried out without the required suppressor circuit, the control unit may be destroyed. ▮ Observe the correct polarity of the suppressor circuit!

5.1 Electrical connection

Ground/earth

Use the PE screw in the terminal box (Figures 6 and 8) to establish the PE (earth) connection.

PE connection via the fixing screws on the motor is not permitted because there is no electrically conductive connection between the brake and the guide sleeves!

Temperature sensor connection (optional)

The spring-applied brake can be delivered with PTC sensors according to DIN 44082 for temperature monitoring (reference temperature 130 °C). The signal is evaluated via a PTC thermistor tripping device provided by the customer.

Connection: AWG 26 blue/blue

5.2 Microswitch

NOTICE
Application range recommended for the microswitch
- DC current: 10 mA to 100 mA at 12 V
- AC current: 10 mA to 5 A at 12 V / max. 250 V

5.2.1 Microswitch as NC contact (series connection)

DANGER

There is a risk of injury by electrical shock!
- If an emergency stop is carried out without the required suppressor circuit, the control unit may be destroyed.
- Observe the correct polarity of the suppressor circuit!

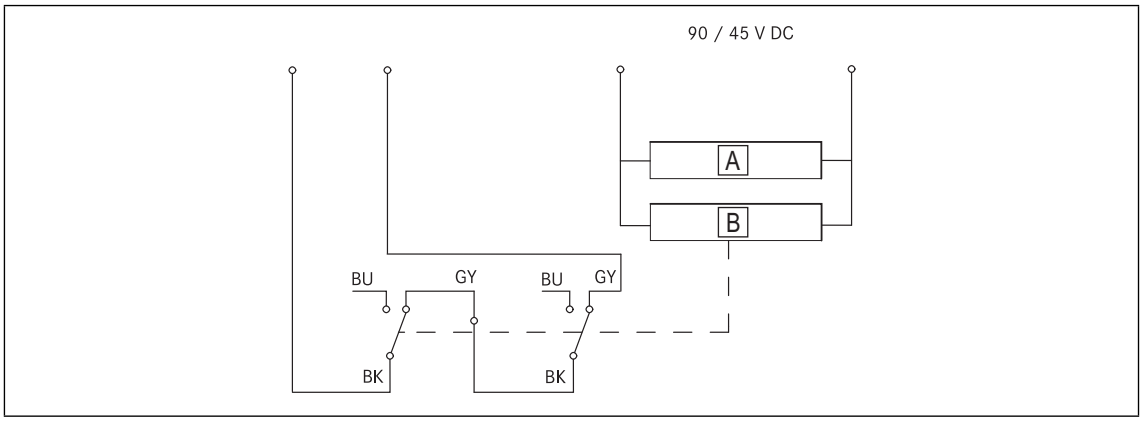


Fig. 5 BFK466 connection diagram (circuit proposal for series connection)

A Suppressor circuit B Brake

Pin assignment for microswitch

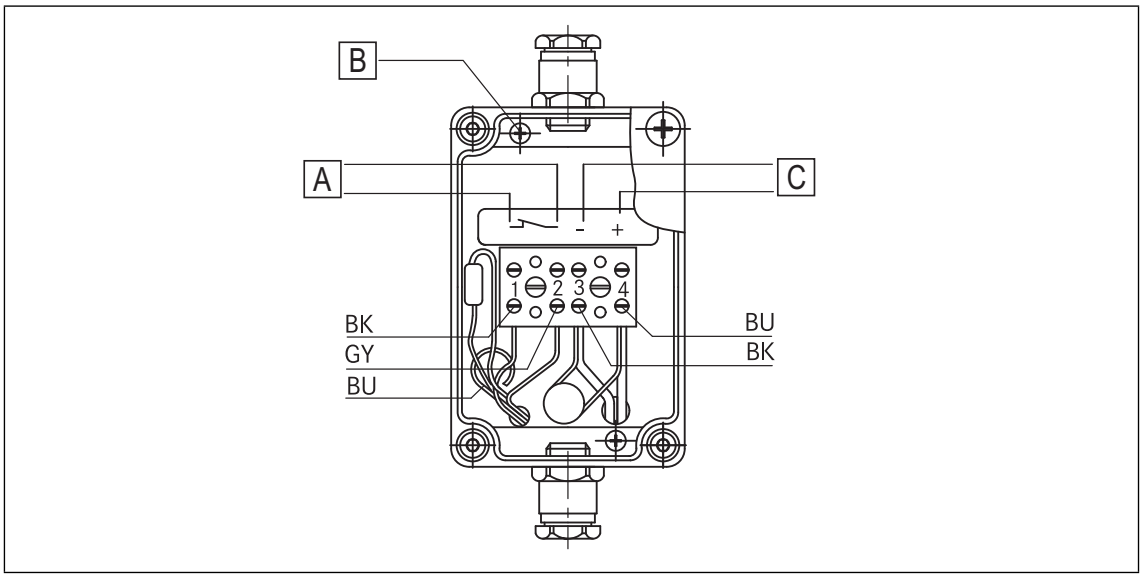


Fig. 6 **BFK466 terminal box (optional: series connection, with built-in varistor)**

A Microswitch	B Ground/earth	C Brake
Microswitch:	Input connection	BK
	N/O contact	BU
	NC contact	GY

When current is fed to the spring-applied brake, the armature plate is released. The microswitch (NC contact) is actuated and gives the signal “Spring-applied brake released".

When the maximum working air gap is exceeded, the release monitoring circuit is opened by the wear monitoring microswitch connected in series. In this case, the signal "Spring-applied brake applied" will not be given when the brake is de-energized.

Brake released	Brake worn-out	Circuit
no	no	closed
yes	no	open
no	yes	open
yes	yes	open

Tab. 2: **Microswitch (NC contact, series connection)**

5.2.2 Microswitch as NO contact (parallel connection)

DANGER

There is a risk of injury by electrical shock!

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

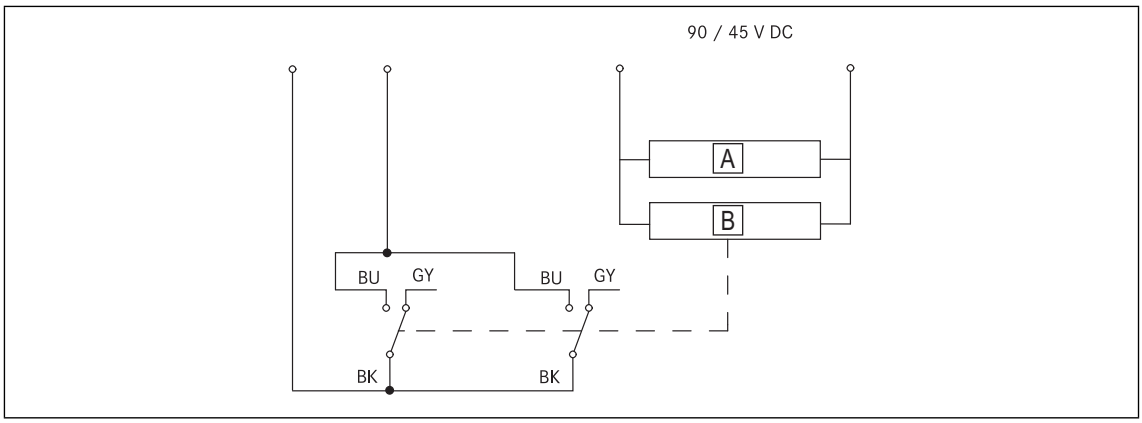


Fig. 7 BFK466 connection diagram (circuit proposal for parallel connection)

A Suppressor circuit B Brake

Pin assignment for microswitch

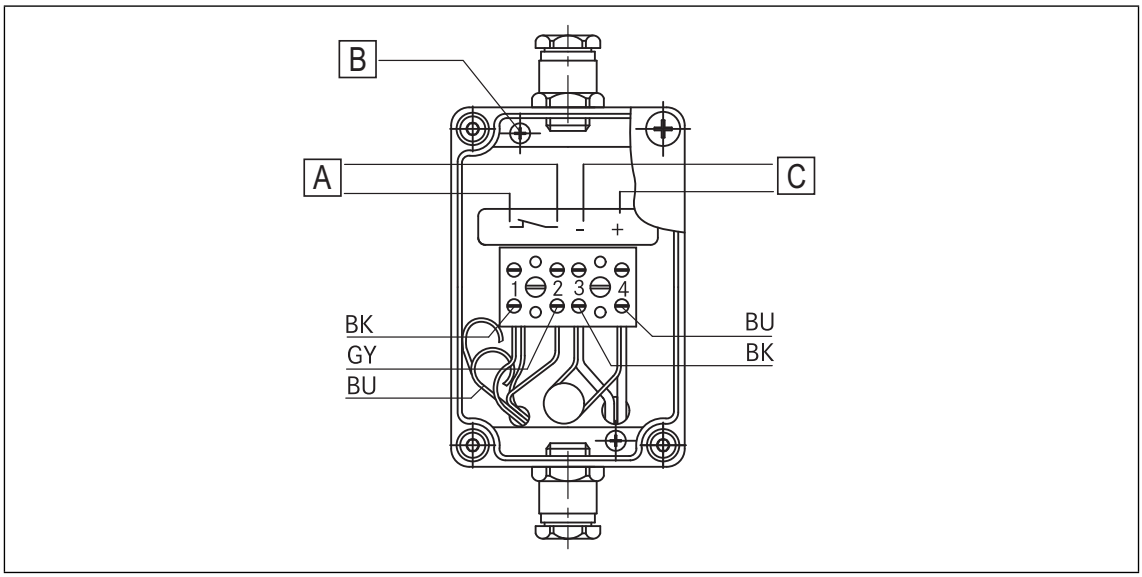


Fig. 8 **BFK466 terminal box (optional: parallel connection, with built-in varistor)**

A Microswitch	B Ground/earth	C Brake
Microswitch:	Input connection	BK
	N/O contact	BU
	NC contact	GY

When current is fed to the spring-applied brake, the armature plate is released. The microswitch (NO contact) is actuated and gives the signal “Spring-applied brake released".

When the maximum working air gap is exceeded, the wear monitoring circuit is closed. In this case, the signal "Spring-applied brake released" will also be given when the brake is de-energized.

Brake released	Brake worn-out	Circuit
no	no	open
yes	no	closed
no	yes	closed
yes	yes	closed

Tab. 3: **Microswitch (NO contact, parallel connection)**

6 Commissioning and operation

Important notes

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

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

6.1 Performing functional tests

6.1.1 Release / voltage control

	DANGER
	Make sure that you remove all loads from the drive. Otherwise, there is a risk of an accident. The motor must **not** run while the spring-applied brake is being checked.

1. Remove two bridges from the motor terminals. Do not switch off the voltage supply to the brake.
2. Measure the AC voltage at the motor terminals. The measured level must be zero!
3. Switch on the power supply for the brake.
4. Measure the AC voltage at the motor terminals. It must be the same as the mains voltage!
5. Check the air gap "s_L" between the brake disc and friction lining. It must be a total of 0.4 (± 0.1) mm. The brake disc must be able to be turned freely!
6. Switch off the power supply.
7. Screw the bridges onto the motor terminals.

6.1.2 Microswitch

These spring-applied brakes are equipped with two microswitches. One microswitch is for release monitoring and one is for wear monitoring (see Figure 1). The microswitches are either connected in series (NC contacts, black and grey wire strands) or in parallel as NO contacts (black and blue wire strands).

NOTICE
Each of the two microswitches should be checked for correct operation when the brake is applied (not actuated). During the check, the other microswitch must not be actuated.

Checking the release control

NOTICE
The brake is deenergized, the transport screws are removed.

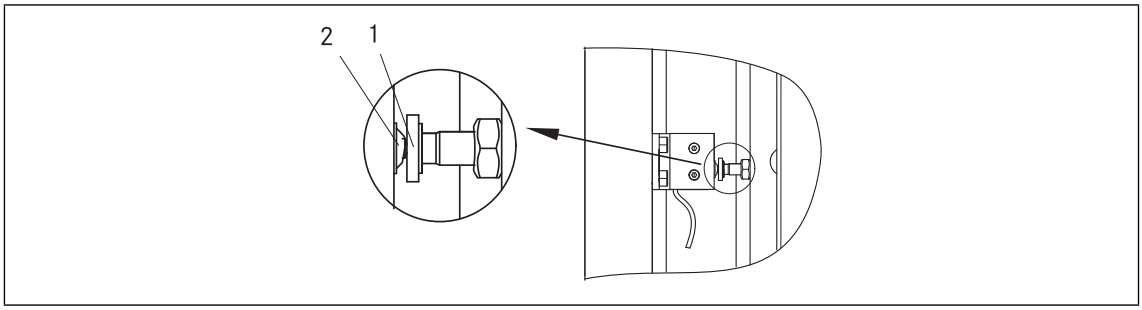


Fig. 9 Release monitoring

1 Hexagon head screw 2 Microswitch tappet

Check the setting of the microswitch for release monitoring using a feeler gauge with thickness "Y_{max} and Y_{min}" between hexagon head cap screw (1) and microswitch tappet (2).

Feeler gauge thickness	NC contact	N/O contact
$Y_{max.} = s_L - 0.10$	Switch open	Switch closed
$Y_{min.} = s_L - 0.25$	Switch closed	Switch open

Checking the wear monitoring

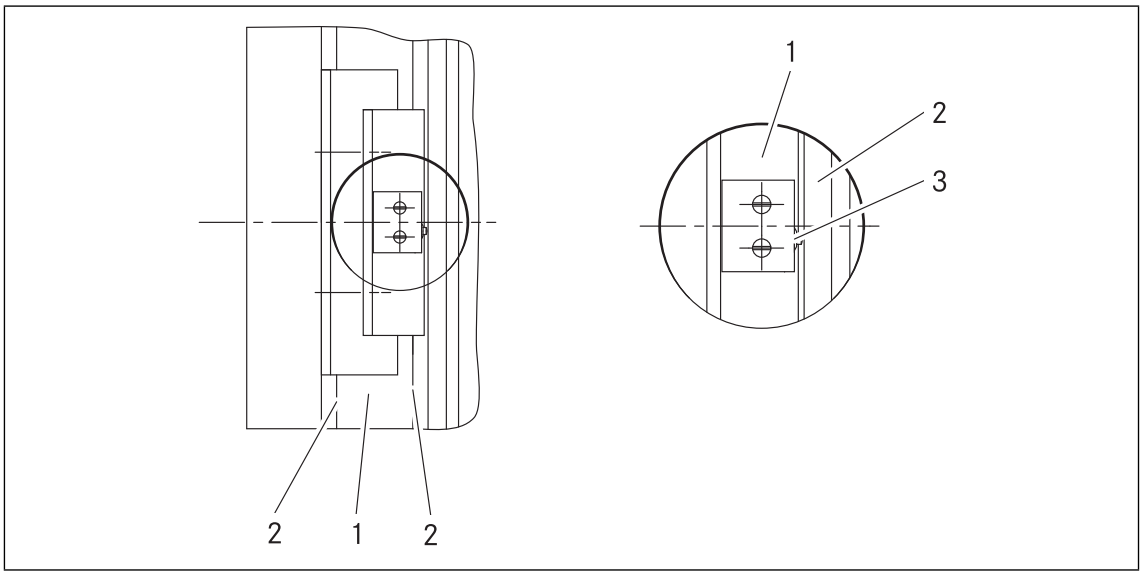


Fig. 10 Wear monitoring

1 Brake disc 2 Friction lining 3 Microswitch tappet

1. Measure the air gap "s_L" between brake disc (1) and friction linings (2) using a feeler gauge (with brake energized, refer to 📖 25).
2. Switch off the voltage supply
3. Calculate the thickness "X" of the feeler gauge: **0.75 - "s_L" = X**
4. Insert a feeler gauge of thickness "X" between microswitch tappet (3) and friction lining carrier (2) (with brake deenergized). The feeler gauge must lie flat. The switch must be actuated.
5. Use a feeler gauge with a thickness lower by 0.05 mm and check if the switch remains in the original switch position. The feeler gauge must lie flat.

6.1.3 Test that the manual release functions

	NOTICE
	This operational test is to be carried out additionally!

	DANGER
	The drive system must be free of loads. The motor must not run!

	NOTICE
	When the maximum permissible working air gap "s_{Lmax}" (📖 14) is exceeded during brake operation, the braking torque is considerably reduced by the manual release. Proper brake function is no longer ensured.

Manual release with lever

The installed manual release is designed to be manually operated in two directions. The lever is detachable.

	NOTICE
	When the maximum permissible working air gap "s_{Lmax}" (📖 14) is exceeded during brake operation, the braking torque is considerably reduced by the manual release. Proper brake function is no longer ensured.

1. Pull the lever with approx. 270 N until the resistance significantly increases.
2. Release the lever.

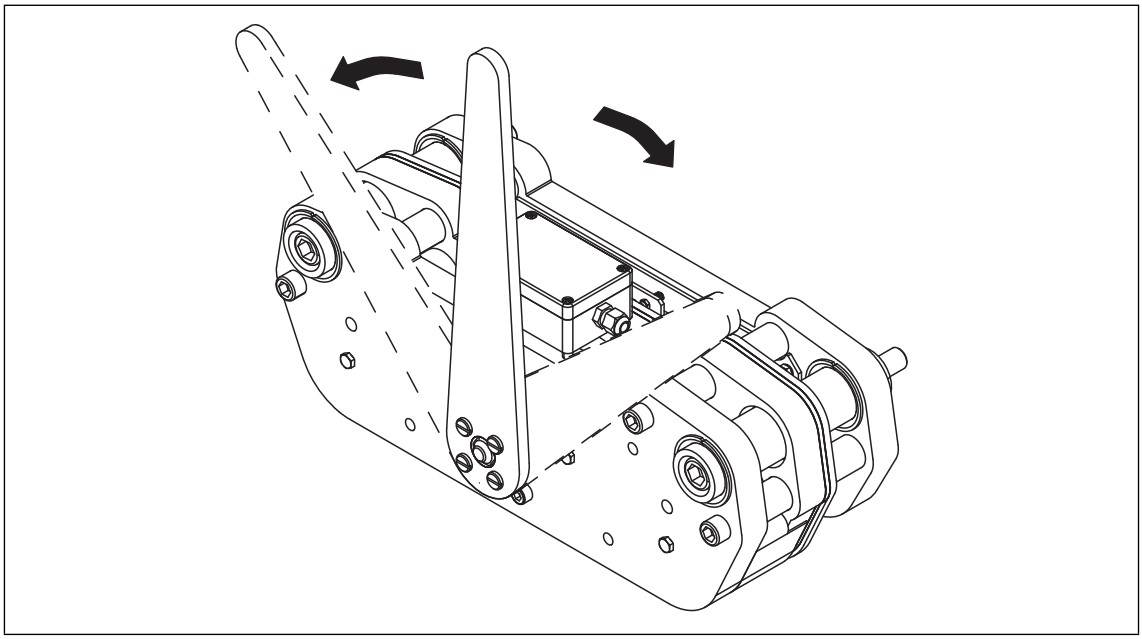


Fig. 11 Checking the manual release

Manual release with Bowden cable

NOTICE
The manual release is designed for activation via a Bowden cable.

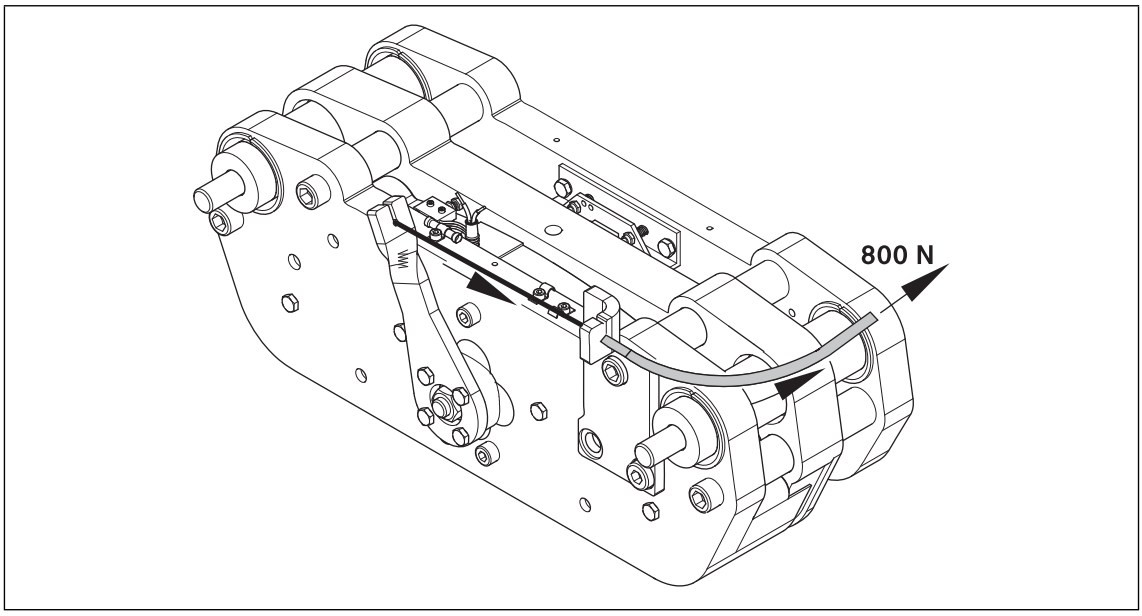


Fig. 12 Manual release with Bowden cable

Motor and brake are de-energized.

3. Suspend Bowden cable (not included in the delivery package) and pull with approx. 800 N.
   - The drive must be able to be turned freely. A low residual torque is permitted.
4. Release the lever.
   - Torque must be available!

The preparations for commissioning are completed.

6.2 Commissioning

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

6.3 During operation

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

- Checks must be carried out regularly. Pay special attention to:
  - unusual noises or temperatures
  - loose fixing/attachment 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.
  - Compare the DC voltage with the voltage indicated on the name plate. A deviation of ±10 % is permissible.

7 Maintenance and repair

7.1 Wear of spring-applied brakes

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

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

Tab. 4: Causes for wear

7.2 Inspections

Important notes

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

Primarily, the required maintenance intervals for industrial brakes result from their load during operation. When calculating the maintenance interval, all causes for wear must be taken into account, 📖 32. For brakes with low loads (such as holding brakes with emergency stop function), we recommend a regular inspection at a fixed time interval. To reduce costs, the inspection can be carried out along with other regular maintenance work in the plant.

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

7.2.1 Maintenance intervals

The spring-applied brake must be checked during the prescribed inspections of the drive system in which it is installed.

- The service life of the brake before replacement does not only depend on the number of emergency brakings.
- The wear of the brake friction linings varies depending on the operating conditions.
- The friction work possible before replacement decreases with every braking when the switching energy increases.

7.2.2 Checking the air gap

⚠	⚠ **DANGER**
	Make sure that you remove all loads from the drive. Otherwise, there is a risk of an accident. The motor must **not** run while the spring-applied brake is being checked.

1. Switch on the current for the brake (see 📖 25).
2. Use a feeler gauge to check the air gap "s_L" between the brake disc and friction lining. It must not exceed the maximum permissible air gap "s_{Lmax}", as specified in the table (📖 14).
3. Switch off the current.
4. Reconnect the motor.

7.2.3 Braking torque / delay check

In case of drives with several brakes, one brake at a time can be released with the socket head cap screws of the transport safety device or the manual release when checking redundancy. These screws must be removed again after checking.

	NOTICE
	The screws of the transport locking device must not be used for releasing the brake during evacuation!

The stopping distances of the drive must be within the permissible tolerance range of the corresponding facility (🕮 , Operating Instructions for the facility).

7.3 Maintenance

The brake does not require any maintenance when it is being used as a holding brake. The brake is replaced in the reverse order of the assembly (🕮 18).

	DANGER
	Make sure that you remove all loads from the drive. Otherwise, there is a risk of an accident. The motor must **not** run while the spring-applied brake is being checked.

1. Screw in the transport screws (17; DIN912 M8x70) (🕮 19).
2. Switch off the power supply and disconnect the connecting cables.
3. Loosen a fixing screw (4) and remove the guide sleeve (2) from the through-hole.
4. Turn the brake around the second guide sleeve (2) away from the brake disc (3).
5. Remove the brake from the guide sleeve (2).

7.4 Ordering spare parts

INTORQ BFK466-61 spring-applied brake

Order quantity	_____ Pieces	
Size	☐ 61	
Voltage	☐ 90 / 45 VDC	☐ 110/55 VDC ☐ 205/103 VDC
Cable length	☐ Standard	
	_____ mm	(from 100-1000 mm in 100 mm steps, from 1000-2500 mm in 250 mm steps)
Terminal box mounted	☐	
PTC sensor	☐	
Manual release mounted	☐	

8 Troubleshooting and fault elimination

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

Fault	Cause	Remedy
Brake does not release The air gap is zero	Coil interruption	▮ Measure coil resistance using a multimeter: - Compare the measured resistance with the nominal resistance (📖 14). - Replace the brake when the resistance is too high.
	Coil has contact to earth or between windings	▮ Measure the coil resistance using a multimeter: - Compare the measured resistance with the nominal resistance. Refer to 📖 14 for the values. If resistance is too low, replace the complete brake. ▮ Check the coil for short to ground using a multimeter: - Replace the brake in case of short circuit to ground. ▮ Check the brake voltage (refer to section on defective rectifier, voltage too low).
	Wiring defective or wrong	▮ Check and correct ▮ cable for continuity using a multimeter - Replace defective cable.
	Rectifier defective or incorrect	▮ Measure rectifier DC voltage using a multimeter. If DC voltage is zero: ▮ Check AC rectifier voltage. If AC voltage is zero: - Switch on power supply - Check fuse - Check wiring. - Check microswitch If AC voltage is okay: - Check rectifier, - Replace defective rectifier Measure the DC voltage: - Overexcitation 90 V (approx. 1 sec.) holding voltage 45 V (tolerance ±10 %) ▮ Check coil for inter-turn fault or short circuit to ground. ▮ If the rectifier defect occurs again, replace the entire stator, even if you cannot find any fault between turns or short circuit to ground. The error may only occur on warming up.
	Air gap too big	Replace the brake (📖 33)

Fault	Cause	Remedy
Brake disc cannot rotate freely	Air gap "s_L" is too small	▮ Check air gap "s_L" and replace brake if necessary. ▮ Check the thickness of the brake disc and replace the brake disc if necessary. ▮ Check the movability of the brake on the guide sleeves and, if necessary, replace the guide sleeves.
Brake cannot be released with manual release	Wrong setting of manual release	Replace the brake and complain about the manual release setting to the manufacturer.
Microswitch furnishes wrong signal despite correct function of the brake	Incorrect micro-switch wiring	Check and correct the wiring of the micro-switch.
	Micro-switch defective or incorrectly set	Replace the brake and send the defective brake to the manufacturer.
Voltage too high	Supply voltage too high	Adjust the coil voltage to the supply voltage.
	Rectifier is defective	Replace the rectifier
	Bridge rectifier used instead of bridge/half-wave rectifier	Replace the bridge rectifier by a bridge/half-wave rectifier.
Voltage too low	Supply voltage too low	Adjust the coil voltage to the supply voltage.
AC voltage is not mains voltage	Fuse is missing or defective	Select a connection with proper fusing.
	Incorrect micro-switch wiring	Check and correct the wiring of the micro-switch.
	Micro-switch defective or incorrectly set	Replace the complete brake and return the defective complete brake to the manufacturer.

Notes

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