

Designation	Manufacturer	No. of pages
Hoist- Trolley- and Slewing motors	Siemens	56
Hoist motorbrake	Siemens	20
Hoist- and Trolley gears	Nordgear	48
Slewing gears	Röchling	5
Trolley motor brake	Intorq	52
Limit switches	Stromag	31

SIEMENS



SIMOTICS GP, SD, DP

Low-voltage motors

1LA, 1LE, 1LF, 1LG, 1LP, 1FP, 1PC, 1PF, 1PK, 1PP, 1PQ

Compact operating instructions

Edition

01/2016

Answers for industry.

SIEMENS

SIMOTICS GP, SD, DP

Low-voltage motors

Standard machines

Compact Operating Instructions

Legal information

Qualified Personnel

The product/system described in this documentation may be operated only by **personnel qualified** for the specific task in accordance with the relevant documentation, in particular its warning notices and safety instructions. Qualified personnel are those who, based on their training and experience, are capable of identifying risks and avoiding potential hazards when working with these products/systems.

Proper use of Siemens products

Note the following:

 WARNING
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Siemens products may only be used for the applications described in the catalog and in the relevant technical documentation. If products and components from other manufacturers are used, these must be recommended or approved by Siemens. Proper transport, storage, installation, assembly, commissioning, operation and maintenance are required to ensure that the products operate safely and without any problems. The permissible ambient conditions must be complied with. The information in the relevant documentation must be observed.
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Warning notice system

This manual contains notices you have to observe in order to ensure your personal safety, as well as to prevent damage to property. The notices referring to your personal safety are highlighted in the manual by a safety alert symbol, notices referring only to property damage have no safety alert symbol. These notices shown below are graded according to the degree of danger.

 DANGER

indicates that death or severe personal injury will result if proper precautions are not taken.
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 WARNING
--

indicates that death or severe personal injury may result if proper precautions are not taken.

 CAUTION
--

indicates that minor personal injury can result if proper precautions are not taken.
--

NOTICE

indicates that property damage can result if proper precautions are not taken.
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If more than one degree of danger is present, the warning notice representing the highest degree of danger will be used. A notice warning of injury to persons with a safety alert symbol may also include a warning relating to property damage.

1 Introduction

1.1 Machine types

These instructions are applicable for the following machine types

1LA, 1LE, 1LF, 1LG, 1LP, 1FP, 1PC, 1PF, 1PK, 1PP, 1PQ

1.2 Information for the reader



Note for 1LE1, 1FP1, 1MB1, 1PC1, 1PC3 machines



Note for 1LE1, 1PC1 and 1PC3 machines, frame sizes 80 and 90 with central terminal box locking

2 Safety notes

2.1 Information for those responsible for the plant or system

This electric machine has been designed and built in accordance with the specifications contained in Directive 2006/95/EC up to April 19, 2016 - and from April 20, 2016 according to Directive 2014/35/EU ("Low-Voltage Directive") and is intended for use in industrial plants. Please observe the country-specific regulations when using the electric machine outside the European Community. Follow the local and industry-specific safety and setup regulations.

The persons responsible for the plant must ensure the following:

- Planning and configuration work and all work carried out on and with the machine is only to be done by qualified personnel.
- The operating instructions must always be available for all work.
- The technical data as well as the specifications relating to the permissible installation, connection, ambient and operating conditions are taken into account at all times.
- The specific setup and safety regulations as well as regulations on the use of personal protective equipment are observed.

Note

Use the services and support provided by the appropriate Service Center (Page 107) for planning, installation, commissioning, and servicing work.

You will find safety instructions in the individual sections of this document. Follow the safety instructions for your own safety, to protect other people and to avoid damage to property.

Observe the following safety instructions for all activities on and with the machine.

2.2 The five safety rules

For your own personal safety and to prevent material damage when carrying out any work, always observe the safety-relevant instructions and the following five safety rules according to EN 50110-1 "Working in a voltage-free state". Apply the five safety rules in the sequence stated before starting work.

Five safety rules

1. Disconnect the system.
Also disconnect the auxiliary circuits, for example, anti-condensation heating.
2. Secure against reconnection.
3. Verify absence of operating voltage.
4. Ground and short-circuit.
5. Provide protection against adjacent live parts.

To energize the system, apply the measures in reverse order.

2.3 Qualified personnel

All work at the machine must be carried out by qualified personnel only. For the purpose of this documentation, qualified personnel is taken to mean people who fulfill the following requirements:

- Through appropriate training and experience, they are able to recognize and avoid risks and potential dangers in their particular field of activity.
- They have been instructed to carry out work on the machine by the appropriate person responsible.

2.4 Safe handling

Workplace safety depends on the attentiveness, care, and common sense of the personnel who install, operate, and maintain the machine. In addition to the safety measures cited, as a matter of principle, the use of caution is necessary when you are near the machine. Always pay attention to your safety.

Also observe the following to prevent accidents:

- General safety regulations applicable in the country where the machine is deployed.
- Manufacturer-specific and application-specific regulations
- Special agreements made with the operator
- Separate safety instructions supplied with the machine
- Safety symbols and instructions on the machine and its packaging

**! WARNING****Live parts**

Electric machines contain live parts.

Fatal or severe injuries and substantial material damage can occur if the covers are removed or if the machine is not handled, operated, or maintained properly.

- Always observe the "five safety rules" (Page 57) when carrying out any work on the machine.
- Only remove the covers using the methods described by these operating instructions.
- Operate the machine properly.
- Regularly and correctly maintain the machine.

**! WARNING****Rotating parts**

Electric machines contain dangerous rotating parts.

Fatal or severe injuries and substantial material damage can occur if the covers are removed or if the machine is not handled, operated, or maintained properly.

- Only remove the covers using the methods described by these operating instructions.
- Operate the machine properly.
- Perform regular maintenance on the machine.
- Secure free-standing shaft ends.

**! WARNING****Hot surfaces**

Electric machines have hot surfaces. Do not touch these surfaces. They could cause burns.

- Allow the machine to cool before starting work on the machine.
- Only remove the covers using the methods described by these operating instructions.
- Operate the machine properly.



 **CAUTION**

Hazardous substances

Chemical substances required for the setup, operation and maintenance of machines can present a health risk.

Poisoning, skin damage, cauterization of the respiratory tract, and other health damage may result.

- Read the information in these operating instructions and the product information supplied by the manufacturer.
- Observe the relevant safety regulations and wear the personal protective equipment specified.



CAUTION

Flammable substances

Chemical substances required for the setup, operation and maintenance of machines may be flammable.

Burns and other damage to health and material may result.

- Read the information in these operating instructions and the product information supplied by the manufacturer.
- Observe the relevant safety regulations and wear the personal protective equipment specified.



WARNING

Interference to electronic devices caused by electrical power equipment

Electrical power equipment generate electric fields during operation. Potentially lethal malfunctions can occur in medical implants, e.g. pacemakers, in the vicinity of electrical power equipment. Data may be lost on magnetic or electronic data carriers.

- It is forbidden for people with pacemakers to enter the vicinity of the machine.
- Protect the personnel working in the plant by taking appropriate measures, such as erecting identifying markings, safety barriers and warning signs and giving safety talks.
- Observe the nationally applicable health and safety regulations.
- Do not carry any magnetic or electronic data media.

2.5 Interference voltages when operating the converter

WARNING

Interference voltages when operating the converter

When a converter is in operation, the emitted interference varies in strength depending on the converter (manufacturer, type, interference suppression measures undertaken). On machines with integrated sensors (e.g. PTC thermistors), interference voltages caused by the converter may occur on the sensor lead. This can cause faults which can result in eventual or immediate death, serious injury or material damage.

Observe the EMC instructions of the converter manufacturer in order to avoid exceeding the limit values according to IEC/EN 61000-6-3 for drive systems comprising machine and converter. You must put appropriate EMC measures in place.

3 Description

Additional languages in the Internet

You can find the operating instructions in other languages on the Internet page: <http://support.industry.siemens.com> (Page 107)

If you require additional language versions, please contact the Siemens Service Center (Page 107).

Intended use of the machines

These machines are intended for industrial installations. They comply with the harmonized standards of the series EN / IEC 60034 (VDE 0530). It is prohibited that these motors are used in hazardous zones if the marking on the rating plate does not explicitly permit line or converter operation. If other/more wide-ranging demands (e.g. protection so that they cannot be touched by children) are made in special cases – i.e. use in non-industrial installations – these conditions must have been complied with in the plant or system itself when the motors are installed.

Note

Machine directive

Low-voltage motors are components designed for installation in machines in accordance with the current Machinery Directive. Commissioning is prohibited until it has been absolutely identified that the end product is in conformance with this Directive. Observe machinery directive EN 60204-1!

3.1 Operating UL-certified machines with a converter

Note

Operating a machine with a converter

Implement all machines of the overall machine-converter system according to UL-File E227215 assuming that the machines are only to be operated with a converter and are supplied with UL certificate.

The company operating the equipment is responsible for implementing this in the actual application.

3.2 CE marking

Note

Use of machines without CE identification

Machines without **CE** marking are intended for operation outside the European Economic Area (EEA). Do not use any machines without CE mark within of the EEA!

3.3 IE2 marking



Note

IE2 marking

Since January 1, 2015, according to REGULATION (EC) No. 640/2009, low-voltage motors with power ratings above 7.5 kW up to 375 kW – and with efficiency IE2 – have this label.

This is mandatory within the European Economic Area (EEA). Customers are solely responsible in ensuring the correct use.

When connecting the machine to a converter, carefully observe the rules and notes in Chapter "Connecting a converter."

3.4 Regulations

The regulations and standards used as basis to design and test this machine are stamped on the rating plate. The machine design basically complies with the following standards:

Table 3-1 Applicable general regulations

Feature	Standard
Dimensioning and operating behavior	EN / IEC 60034-1
Procedure for determining the losses and the efficiency of rotating electrical machines and inspections	EN / IEC 60034-2-1 EN / IEC 60034-2-2 EN / IEC 60034-2-3
Degree of protection	EN / IEC 60034-5
Cooling	EN / IEC 60034-6
Type of construction	EN / IEC 60034-7
Terminal designations and direction of rotation	EN / IEC 60034-8
Noise emission	EN / IEC 60034-9
Starting characteristics of rotating electrical machines	EN / IEC 60034-12
Vibration severity grades	EN / IEC 60034-14
Efficiency classification of three-phase squirrel-cage induction motors	EN / IEC 60034-30
IEC standard voltages	IEC 60038

3.5 Forced ventilation (optional)

Forced ventilation (optional): Type of cooling IC 416 in accordance with EN / IEC 60034-6

Cooling that does not depend on the speed is achieved by means of a separately driven fan wheel (forced ventilation). Forced ventilation does not depend on the operating state of the machine.

The fan wheel for the external flow of cooling air is powered by an independent module and is enclosed by the fan cover.

3.6 Degree of protection

The machine has a type of protection as stamped on the rating plate, and can be installed in dusty or humid environments.

3.7 Environmental conditions

Limit values for the standard version

Relative humidity for ambient temperature T_{amb} 40 °C	Max. 55 %
Ambient temperature	-20 °C to +40 °C
Installation altitude	≤ 1000 m
Air with normal oxygen content, usually	21 % (V/V)

If the environmental conditions are different from the details listed here, then the values on the rating plate will apply.

The machine is suitable for tropical climates.

4 Preparing for use

Good planning and preparation of machine applications are essential in terms of keeping installation simple and avoiding errors, ensuring safe operation, and allowing access to the machine for servicing and corrective maintenance.

This chapter outlines what you need to consider when configuring your plant in relation to this machine and the preparations you need to make before the machine is delivered.

4.1 Safety-related aspects to consider when configuring the plant

A number of residual risks are associated with the machine. These are described in the chapter titled "Safety information" (Page 57) and in related sections.

Take appropriate safety precautions (covers, barriers, markings, etc.) to ensure the machine is operated safely within your plant.

4.2 Observing the operating mode

Observe the machine's operating mode. Use a suitable control system to prevent overspeeds, thus protecting the machine from damage.

4.3 Delivery

Checking the delivery for completeness

The drive systems are put together on an individual basis. When you take receipt of the delivery, please check immediately whether the items delivered are in accordance with the accompanying documents. Siemens will not accept any claims relating to items missing from the delivery and which are submitted at a later date.

- Report any apparent transport damage to the delivery agent immediately.
- Report any apparent defects/missing components to the appropriate SIEMENS office immediately.

Archive the safety and commissioning notes provided in the scope of delivery as well as the optionally available operating instructions so that these documents are always easily accessible.

The rating plate optionally enclosed as a loose item with the delivery is provided to enable the motor data to be attached on or near the machine or installation.

4.4 Transport and storage

When carrying out any work on the machine, observe the general safety instructions (Page 57) and the specifications contained in EN 50110-1 regarding safe operation of electrical equipment.

WARNING

Risk of dropping and swinging when transported suspended

If you transport the motor suspended from cables or ropes, the cables or ropes can break, e.g. as a result of damage. Further, if not adequately attached, the motor can swing. This can result in death, serious injury, or material damage.

- Use additional, suitable lifting equipment for transport and during installation.
- Two cables alone must be able to carry the complete load.
- Prevent the lifting equipment from sliding by appropriately securing it.

 **WARNING**

Toppling over or slipping of the motor

The motor can slide or topple over if it is not correctly lifted or transported. This can result in death, serious injury, or material damage.

- Use all the lifting eyes on the machine.
- When using the lifting eyes on the machine, do not attach any additional loads or weight. The lifting eyes are only designed for the weight of the machine itself.
- Any eyes that are screwed in must be tightly fastened.
- Eyebolts must be screwed in right up to their supporting surface.
- Comply with the permissible eyebolt loads.
- When necessary, use suitably dimensioned transport equipment, for example hoisting straps (EN1492-1) and load restraints (EN12195-2).

Note

When lifting the machines for transport, only lift them in a position that corresponds to their basic construction type.

The type of construction of the machine is stated on the rating plate.

4.4.1 Storage

Storing outdoors

NOTICE

Damage to the motor

Damage can occur if incorrectly stored.

Take all precautions to protect the motor under extreme climatic conditions, e.g. salt-laden and/or dusty, moist/humid atmospheres.

Choose a dry storage location which is safe from flooding and free from vibration. Repair any damage to the packaging before putting the equipment into storage if this is necessary to ensure proper storage conditions. In order to ensure protection against ground moisture, locate machines, equipment and crates on pallets, wooden beams or foundations. Prevent equipment from sinking into the ground. Do not impede air circulation under the stored items.

Covers or tarpaulins used to protect the equipment against the weather must not come into contact with the surfaces of the equipment. Use wooden spacer elements to ensure that air can circulate freely around the equipment.

Storing indoors

The storage rooms must provide protection against extreme weather conditions. They must be dry, free from dust, frost and vibration and well ventilated.

Bare metal surfaces

For transport, the bare surfaces (shaft ends, flange surfaces, centering edges) should be coated with an anti-corrosion agent which will last for a limited amount of time (<6 months). Apply suitable anti-corrosion measures for longer storage times.

Condensation drain hole

Open any condensation drain holes to drain the condensation depending on the environmental conditions, every six months at the latest.

Storage temperature

Permissible temperature range: -20 °C to +50 °C

The relative humidity of the air should be less than 60 %.

For machines that have a special design regarding the coolant temperature in the operating state or the installation altitude, other conditions could apply regarding the storage temperature. In this case, refer to the machine rating plate for data on the coolant temperature and installation altitude.

Storage time

Turn the shafts 1x every year to avoid bearing brinelling. Prolonged storage periods reduce the useful life of the bearing grease (aging).

Open bearings

- For open bearings, e.g. 1Z, check the status of the grease when stored for longer than 12 months.
- Replace the grease if it is identified that the grease has lost its lubricating properties or is polluted. The consistency of the grease will change if condensation is allowed to enter.

Closed bearings

- For sealed bearings, replace the DE and NDE bearings after a storage time of 48 months.

NOTICE

Storage

The motor can be damaged if you use it or store it unprotected outdoors.

- Protect the motor against intensive solar radiation, rain, snow, ice and dust. Use a superstructure or additional cover, for example.
- If required, contact the Siemens Service Center, or technically coordinate outdoors use.

4.5 Electromagnetic compatibility

Note

If the torque levels are very unequal (e.g. when a reciprocating compressor is being driven), a non-sinusoidal machine current will be induced whose harmonics can have an impermissible effect on the supply system and cause impermissible interference emissions as a result.

Note

Converter

- If operated with a frequency converter, the emitted interference varies in strength, depending on the design of the converter (type, interference suppression measures, manufacturer).
 - Avoid that the specified limit values stipulated for the drive system (consisting of the motor and converter) are exceeded.
 - You must observe the EMC information from the manufacturer of the converter.
 - The most effective method of shielding is to conductively connect a shielded machine supply cable to the metal terminal box of the machine (with a metal screw connection) over a large surface area.
 - On machines with integrated sensors (e.g. PTC thermistors), disturbance voltages caused by the converter may occur on the sensor cable.
-

4.6 Converter operation

4.6.1 Parameterizing the converter

- If the design of the motor requires connection to a particular converter type, the rating plate will contain corresponding additional information.
- Correctly parameterize the converter. Parameterizing data can be taken from the machine rating plate (not the supplementary rating plate with the operating data when connected to a converter).
You can find parameter data here:
 - In the operating instructions for the converter.
 - In the SIZER engineering tool
 - In the SINAMICS Configuration Manuals.
 - For explosion-protected machines, also in the declaration of compliance with the order 2.1.
- Do not exceed the specified maximum speed limit n_{\max} . You can either find this on the rating plate n_{\max} , under the supplementary plate for converter operation as the highest speed, or in Catalog D81.1.
- Check that it is guaranteed that the machine is cooled for commissioning.

4.6.2 Reducing bearing currents during operation with converter (low voltage)

Taking the following actions will reduce the bearing currents:

- Ensure that the contacts are established over a large area. Solid copper cables are not suitable for high frequency grounding because of the skin effect.

Equipotential bonding conductors:

Use equipotential bonding conductors:

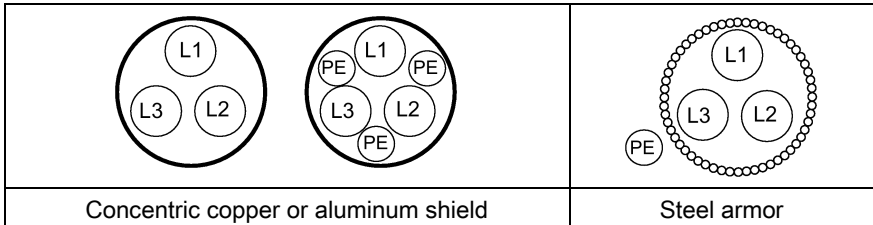
- Between motor and driven machine
- Between motor and converter
- Between the terminal box and the RF grounding point at the motor enclosure.

Selecting and connecting the cable:

As far as possible, use symmetrically arranged, shielded connection cables. The cable shielding, made up of as many strands as possible, must have good electrical conductivity. Braided shields made of copper or aluminum are very suitable.

- The shield is connected at both ends, at the motor and converter.

- To ensure good discharging of high-frequency currents, provide contacting over a large surface area:
 - as contact established through 360° at the converter
 - at the motor, for instance with EMC glands at the cable entries
- If the cable shield is connected as described, then it ensures the specified equipotential bonding between the motor enclosure and converter. A separate RF equipotential bonding conductor is then not necessary.



- If the cable shield is not connected due to special secondary conditions, or not adequately connected, then the specified equipotential bonding is not provided. In this particular case, use a separate RF equipotential bonding conductor:
 - Between the motor enclosure and protective ground rail of the converter.
 - Between motor enclosure and driven machine
 - Use braided flat copper straps or high-frequency cables with finely-stranded conductors for the separate RF equipotential bonding cable. Solid copper cables are not suitable for high frequency grounding because of the skin effect.
 - Ensure that the contacts are established over a large area.

Overall system design

To specifically reduce and prevent damage caused by bearing currents, you must consider the system as a whole, which comprises the motor, converter, and driven machine. The following precautions help to reduce bearing currents:

- In the overall system, set up a properly meshed grounding system with low impedance.
- Use the common-mode filter (damping cores) at the converter output. The Siemens sales representative is responsible for selection and dimensioning.
- Limit the rise in voltage by using output filters. This dampens the harmonic content in the output voltage.

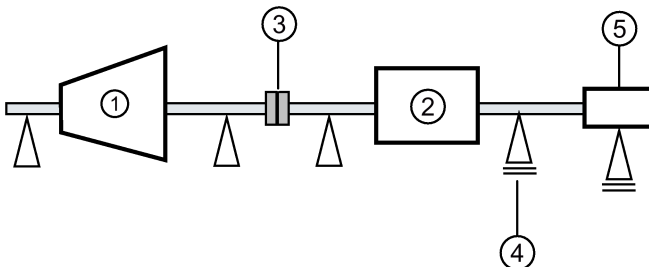
Note**Converter documentation**

The operating instructions for the converter are not part of this documentation. Refer also to the configuration information for the converter.

4.6.3 Insulated bearings when operated with a converter

If the machine is operated from a low-voltage converter, insulated bearings are fitted at the NDE and an insulated encoder with insulated bearings (option).

Comply with the plates on the machine relating to bearing insulation and possible bridges.



- | | |
|-------------------|--------------------------------|
| ① Driving machine | ④ Insulated bearings |
| ② Motor | ⑤ Insulated tachometer fitting |
| ③ Coupling | |

Figure 4-1 Schematic representation of a single drive

NOTICE**Bearing damage**

The bearing insulation must not be bridged. Damage may be caused to the bearings if there is a flow of current.

- Also for subsequent installation work, such as the installation of an automatic lubrication system or a non-insulated vibration sensor, make sure that the bearing insulation cannot be bridged.
- Contact the Service Center, if necessary.

Tandem operation

If you connect two motors in series in "tandem operation", install an insulated coupling between the motors.

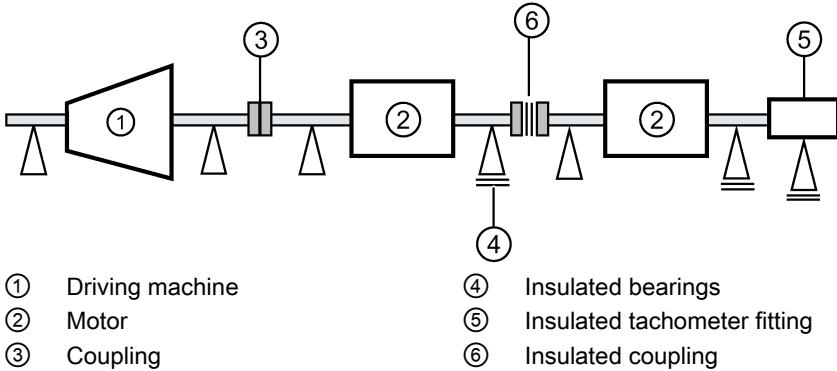


Figure 4-2 Schematic representation of a tandem drive

NOTICE
Bearing damage If the coupling between the motors of the tandem drive is not insulated, bearing currents can cause damage to the drive-end bearings of both motors. Use an insulated coupling to link the motors.

4.6.4 Operation with insulated coupling (EX)

If you connect two motors in series in "tandem operation", fit a coupling between the motors; this coupling should satisfy the ATEX Directive or the regulations that apply in the country where the equipment is installed.

5 Installation

When carrying out any work on the machine, observe the general safety instructions (Page 57) and the specifications contained in EN 50110-1 regarding safe operation of electrical equipment.

Note**Loss of conformity with European directives**

In the delivery state, the machine corresponds to the requirements of the European directives. Unauthorized changes or modifications to the machine lead to the loss of conformity with European directives and the loss of warranty.

5.1 Preparing for installation

5.1.1 Requirements for installation

The following requirements must be satisfied prior to starting installation work:

- Staff have access to the operating and installation instructions.
 - The machine is unpacked and ready for mounting at the installation location.
-

Note**Measure the insulation resistance of the winding before starting installation work**

Wherever possible, measure the insulation resistance of the winding before starting installation work. If the insulation resistance lies below the specified value, take appropriate remedial measures. These remedial measures may necessitate the machine being removed again and transported.

Note

Note also the technical data on the rating plates on the motor enclosure.

NOTICE**Damage to the motor**

To avoid material damage, before commissioning, check whether the correct direction of rotation of the machine has been set on the customer side, e.g. by decoupling from the driven load.

5.1.2 Insulation resistance

5.1.2.1 Insulation resistance and polarization index

Measuring the insulation resistance and polarization index (PI) provides information on the condition of the machine. It is therefore important to check the insulation resistance and the polarization index at the following times:

- Before starting up a machine for the first time

- After an extended period in storage or downtime
- Within the scope of maintenance work

The following information is provided regarding the state of the winding insulation:

- Is the winding head insulation conductively contaminated?
- Has the winding insulation absorbed moisture?

As such, you can determine whether the machine needs commissioning or any necessary measures such as cleaning and/or drying the winding:

- Can the machine be put into operation?
- Must the windings be cleaned or dried?

Detailed information on testing and the limit values can be found here:

"Testing the insulation resistance and polarization index" (Page 74)

5.1.2.2 Testing the insulation resistance and polarization index



WARNING

Hazardous voltage at the terminals

During and immediately after measuring the insulation resistance or the polarization index (PI) of the stator winding, hazardous voltages may be present at some of the terminals. Contact with these can result in death, serious injury or material damage.

- If any power cables are connected, check to make sure line supply voltage cannot be delivered.
- Discharge the winding after measurement until the risk is eliminated, e.g. using the following measures:
 - Connect the terminals with the ground potential until the recharge voltage drops to a non-hazardous level
 - Attach the connection cable.

Measure the insulation resistance

1. Before you begin measuring the insulation resistance, please read the operating manual for the insulation resistance meter you are going to use.
2. Make sure that no power cables are connected.
3. Measure the winding temperature and the insulation resistance of the winding in relation to the machine enclosure. The winding temperature should not exceed 40° C during the measurement. Convert the measured insulation resistances in

accordance with the formula to the reference temperature of 40° C. This thereby ensures that the minimum values specified can be compared.

4. Read out the insulation resistance one minute after applying the measuring voltage.

Limit values for the stator winding insulation resistance

The following table specifies the measuring voltage and limit values for the insulation resistance. These values correspond to IEEE 43-2000 recommendations.

Table 5-1 Stator winding insulation resistance at 40° C

$V_N [V]$	$V_{Meas} [V]$	$R_c [M\Omega]$
$U \leq 1000$	500	≥ 5
$1000 \leq U \leq 2500$	500 (max. 1000)	100
$2500 < U \leq 5000$	1000 (max. 2500)	
$5000 < U \leq 12000$	2500 (max. 5000)	
$U > 12000$	5000 (max. 10000)	

U_{rated} = rated voltage, see the rating plate

U_{meas} = DC measuring voltage

R_c = minimum insulation resistance at reference temperature of 40° C

Conversion to the reference temperature

When measuring with winding temperatures other than 40° C, convert the measuring value to the reference temperature of 40° C according to the following equations from IEEE 43-2000.

(1) $R_c = K_T \cdot R_T$	R_c	Insulation resistance converted to 40° C reference temperature
	K_T	Temperature coefficient according to equation (2)
	R_T	Measured insulation resistance for measuring/winding temperature T in °C
(2) $K_T = (0.5)^{(40-T)/10}$	40	Reference temperature in °C
	10	Halving/doubling of the insulation resistance with 10 K
	T	Measuring/winding temperature in °C

In this case, doubling or halving the insulation resistance at a temperature change of 10 K is used as the basis.

- The insulation resistance halves every time the temperature rises by 10 K.

- The resistance doubles every time the temperature falls by 10 K.

For a winding temperature of approx. 25° C, the minimum insulation resistances are 20 MΩ (U ≤ 1000 V) or 300 MΩ (U > 1000 V). The values apply for the complete winding to ground. Twice the minimum values apply to the measurement of individual assemblies.

- Dry, new windings have an insulation resistance of between 100 and 2000 MΩ, or possibly even higher values. An insulation resistance value close to the minimum value could be due to moisture and/or dirt accumulation. The size of the winding, the rated voltage and other characteristics affect the insulation resistance and may need to be taken into account when determining measures.
- Over its operating lifetime, the motor winding insulation resistance can drop due to ambient and operational influences. Calculate the critical insulation resistance value depending on the rated voltage by multiplying the rated voltage (kV) by the specific critical resistance value. Convert the value for the current winding temperature at the time of measurement, see above table.

Measuring the polarization index

1. To determine the polarization index, measure the insulation resistances after one minute and ten minutes.
2. Express the measured values as a ratio:

$$PI = R_{\text{insul } 10 \text{ min}} / R_{\text{insul } 1 \text{ min}}$$

Many measuring devices display these values automatically following the measurement.

For insulation resistances > 5000 MΩ, the measurement of the PI is no longer meaningful and consequently not included in the assessment.

$R_{(10 \text{ min})} / R_{(1 \text{ min})}$	Assessment
≥ 2	Insulation in good condition
< 2	Dependent on the complete diagnosis of the insulation

NOTICE

Damage to insulation

If the critical insulation resistance is reached or undershot, this can damage the insulation and cause voltage flashovers.

- Contact the Service Center (Page 107).
- If the measured value is close to the critical value, you must subsequently check the insulation resistance at shorter intervals.

Limit values of the anti-condensation heating insulation resistance

The insulation resistance of the anti-condensation heating with respect to the machine housing should not be lower than 1 M Ω when measured at 500 V DC.

5.2 Installation

5.2.1 Cooling

WARNING

Overheating and failure of the motor

Death, severe injury or material damage can occur if you do not carefully observe the following points.

- Do not obstruct ventilation.
- Prevent the air expelled by neighboring equipment from being immediately sucked in again.
- For machines with a vertical type construction with air entry from above, prevent the ingress of foreign bodies and water in the air entry openings (standard IEC / EN 60079-0).
- If the shaft extension is facing upwards, liquid must be prevented from entering by moving along the shaft.

WARNING

Damage caused by small parts falling in

Material damage and injury can occur if the fan is destroyed and therefore the motor overheats.

- For types of construction with the shaft extension facing downwards, prevent small parts from falling into the fan cover by providing suitable covers (standard IEC / EN 60079-0).
- Prevent the cooling airflow from being reduced as a result of covers that might be in place.

Table 5-2 Minimum dimension "X" for the distance between neighboring modules and the air intake of the machine

Frame size	X [mm]
63 ... 71	15
80 ... 100	20
112	25
132	30
160	40
180 ... 200	90
225 ... 250	100
280 ... 315	110

5.2.2 Balancing

The rotor is dynamically balanced. The balancing quality corresponds to vibration severity grade "A" for the complete machine as standard. The optional vibration severity grade "B" is indicated on the rating plate.

The declaration regarding the type of featherkey for balancing is generally marked on the rating plate and optionally on the face of the shaft end.

Designation:

- As a standard measure, balancing is carried out dynamically with a half featherkey (code "H") in accordance with ISO 8821.
- "F" means balancing with a whole featherkey (optional version).
- "N" means balancing without a featherkey (optional version).

 **CAUTION**
Incorrect installation or removal

To avoid injury and material damage, carefully observe general touch protection measures for output transmission elements:

- The general touch protection measures for drive output elements must be observed.
- Drive output elements may only be pushed on or pulled off with the correct equipment.
- The feather keys are only locked against falling out during shipping. If you commission a machine without a drive output element, the feather keys must be secured to prevent them from being thrown out.

Align the offset at the coupling between electrical machines and the driven machines so that the maximum permissible vibration values according to ISO 10816 are not exceeded.

5.3 Alignment and mounting

Observe the following when aligning and mounting:

- Ensure a flat and uniform contact surface for foot and flange mounting.
- Precisely align the machine when couplings are used.
- Ensure that the mounting surfaces are clean and free of any dirt.
- Remove any anti-corrosion protection using white spirit.
- Avoid installation-related resonances with the rotating frequency and twice the line frequency.
- Note any unusual noise when the rotor is manually turned.
- Check the direction of rotation with the motor uncoupled.
- Avoid rigid couplings.
- Repair any damage to the paint, this must be done immediately and correctly.

Frame size	Flatness [mm]
≤ 132	0.10
160	0.15
≥ 180	0.20

6 Electrical connection

When carrying out any work on the machine, observe the general safety instructions (Page 57) and the specifications contained in EN 50110-1 regarding safe operation of electrical equipment.



 **DANGER**

Hazardous voltages

Death, injury or material damage can occur. Note the following safety information before connecting-up the machine:

- Only qualified and trained personnel should carry out work on the machine while it is stationary.
- Disconnect the machine from the power supply and take measures to prevent it being reconnected. This also applies to auxiliary circuits.
- Check that the machine really is in a no-voltage condition.
- Establish a safe protective conductor connection before starting any work.
- If the incoming power supply system displays any deviations from the rated values in terms of voltage, frequency, curve form or symmetry, such deviations will increase the temperature and influence electromagnetic compatibility.
- Operating the machine on a line supply system with a non-grounded neutral point is only permitted over short time intervals that occur rarely, e.g. the time leading to a fault being eliminated (ground fault of a cable, EN 60034-1).

6.1 Terminal box



 **DANGER**

Hazardous voltage

Electric motors have high voltages. When incorrectly handled, this can result in death or severe injury.

Switch off the machine so that it is in a no-voltage condition before you open the terminal box.

NOTICE**Damage to the terminal box**

If you incorrectly carry out work on or in the terminal box, this can result in material damage. You must observe the following to avoid damaging the terminal box:

- Ensure that the components inside the terminal box are not damaged.
- It must be ensured that there are no foreign bodies, dirt or moisture in the terminal box.
- Close the terminal box using the original seal so that it is dust tight and water tight.
- Use O-rings or suitable flat gaskets to seal entries in the terminal box (DIN 42925) and other open entries.
- Please observe the tightening torques for cable glands and other screws.
- When performing a test run, secure the feather keys without output elements.

**! WARNING****Hazardous voltage**

Loosening the safety torx screw can result in death, serious injury or material damage.

Do not loosen the safety torx screw with respect to the center terminal, as this ensures a conductive connection between the grounding conductor and frame!

NOTICE**Serious damage to the machine**

Failure to observe these measures will destroy the motor.

- Only rotate the terminal box if the connection cables have still not been laid.
- If you release the safety torx screw at both sides of the outer connecting terminals, this can destroy the machine.
- Remove the three large snap hooks on the terminal board before rotating the the terminal box. Keep the snap hooks pressed while rotating the terminal box and use a screwdriver to re-engage when finished.

6.1.1 Optional terminal board (star or delta circuit)



NOTICE

Arcing at the optional terminal board can destroy the machine

In order to avoid destroying the machine:

- To change the operating mode, always press the jumper fully into the base of the slot and use the red locking lever to ensure that it is engaged.

6.1.2 Protruding connection cables



WARNING

Risk of short-circuit and voltage hazard

A short circuit can occur if connecting cables are clamped and crushed between parts of the enclosure and the cover plate.

This can result in death, severe injury and material damage.

- During disassembly and particularly when installing the cover plate, make sure that the connecting cables are not clamped between enclosure parts and the cover plate.

CAUTION

Damage to connecting cables that are freely led out

You must observe the following note to avoid damaging connecting cables that are freely led out:

- It must be ensured that there are no foreign bodies, dirt, or moisture in the terminal base of the machine enclosure.
- Use O-rings or suitable flat gaskets to seal entries in cover plates (DIN 42925) and other open entries.
- Seal the terminal base of the machine enclosure using the original seal of the cover plate to prevent dust and water from entering.
- Please observe the tightening torques for cable glands and other screws.

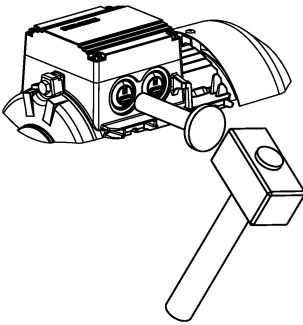
6.1.3 Knockout openings

NOTICE

Damage to the terminal box

To avoid damaging the terminal box:

- Knockout openings in the terminal box must be knocked out using appropriate methods.
- Do not damage the terminal box, the terminal board, the cable connections etc. inside the terminal box.



6.1.4 Installation and routing



NOTICE

Damage to terminal board


The terminal board can be damaged for incorrect installation and routing. You must apply the following measures to avoid damaging the terminal board:

- Remove the screw-type connections (EN 50262) only when the terminal box is closed.
- Tighten the screw-type connections to rated torque value only when the terminal box is closed.
- Tighten the screw-type connections only finger tight when the terminal box is open.
- Make sure that the three large snap hooks are engaged when tightening the screw connections.

6.2 Tightening torques

6.2.1 Electrical connections - Terminal board connections

Table 6-1 Tightening torques for electrical connections on the terminal board

	Thread Ø		M 3,5	M 4	M 5	M 6	M 8	M 10	M 12	M 16
	Nm	min	0,8	0,8	1,8	2,7	5,5	9	14	27
		Ma x.	1,2	1,2	2,5	4	8	13	20	40

6.2.2 Cable glands

Note

Avoid damaging the cable jacket.

Adapt the tightening torques to the cable jacket materials.

You should refer to the table in order to find the correct tightening torque for any metal and plastic cable glands that are to be mounted directly on the machine, as well as for any other screw-type connections (such as adapters).

Table 6-2 Tightening torques for cable glands

	Metal ± 10% [Nm]	Plastic ± 10% [Nm]	Clamping range [mm]		O ring Cord dia. [mm]
			Standard -30 °C ... 100 °C	Ex -30 °C ... 90 °C	
			Ex -30 °C ... 90 °C	Ex -60 °C ... 90 °C	
M 12 x 1.5	8	1.5	3.0 ... 7.0	-	2
M 16 x 1.5	10	2	4.5 ... 10.0	6.0 ... 10.0	
M 20 x 1.5	12	4	7.0 ... 13.0	6.0 ... 12.0	
M 25 x 1.5			9.0 ... 17.0	10.0 ... 16.0	
M 32 x 1.5	18	6	11.0 ... 21.0	13.0 ... 20.0	
M 40 x 1.5			19.0 ... 28.0	20.0 ... 26.0	
M 50 x 1.5	20		26.0 ... 35.0	25.0 ... 31.0	
M 63 x 1.5			34.0 ... 45.0	-	

6.2.3 Terminal boxes, end shields, grounding conductors, sheet metal fan covers

If no other tightening torques are specified, then the values in the following table apply.

Table 6-3 Tightening torques for screws on the terminal box, end shields, screw-type grounding conductor connections



	Thread Ø		M 3.5	M 4	M 5	M 6	M 8	M 10	M 12	M 16	M 20
	N m	min	0.8	2	3.5	6	16	28	46	110	225
		max	1.2	3	5	9	24	42	70	165	340



Table 6-4 Tightening torques for self-tapping screws on the terminal box, end shields, screw-type grounding conductor connections, sheet metal fan covers

	Thread Ø		M 4	M 5	M 6
	Nm	min	4	7,5	12,5
		max	5	9,5	15,5

6.3 General information on connecting the grounding conductor

The machine's grounding conductor cross-section must comply with EN / IEC 60034-1.

Please also observe installation regulations such as those specified in EN / IEC 60204-1.

6.4 Conductor connection



WARNING

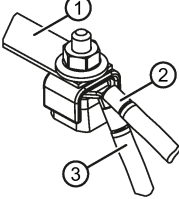
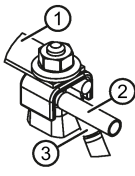
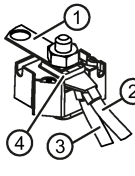
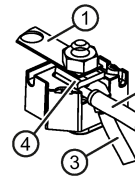
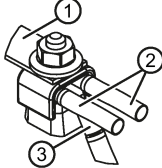
Short-circuit hazard

Connection and installation errors at connecting cables and cover washers can result in a short-circuit. Death or serious physical injury can result.

Note the following precautionary measures:

- Do not lay connection cables over the central dome of the terminal board.
- Observe the opening direction and the mounting position of the cover washers on the terminal board.

6.4.1 Type of conductor connection

Terminal board				Conductor cross-section [mm ²]
<p>Connection with cable lug DIN 46 234 Bend down the cable lug for the connection.</p>				<p>... 25</p>
<p>Connection of an individual conductor with terminal clamp</p>				<p>... 10</p>
<p>Connection of two conductors of approximately the same thickness with terminal clamp</p>				<p>... 25</p>

- ① Link rail
- ② Power supply cable
- ③ Motor connecting cable
- ④ Cover washer

6.5 Connecting converters



NOTICE

Excessively high supply voltage

Material damage can occur if the supply voltage is too high for the insulation system.

The machines can be operated with line voltages ≤ 500 V with SINAMICS G converters and SINAMICS S converters (uncontrolled and controlled infeed) when maintaining the permissible peak voltages.

The maximum permissible voltage rate of rise (gradient) is $9 \text{ kV}/\mu\text{s}$.

$\dot{U}_{\text{conductor-conductor}} \leq 1500 \text{ V}$; $\dot{U}_{\text{conductor-ground}} \leq 1100 \text{ V}$

For VSD machines, the following data apply:

$\dot{U}_{\text{conductor-conductor}} \leq 1600 \text{ V}$, $\dot{U}_{\text{conductor-ground}} \leq 1400 \text{ V}$, voltage rise times of $t_s > 0.1 \mu\text{s}$.

See the list of additional operating instructions.

6.6 Final checks

Before closing the terminal box/terminal base of the machine enclosure, check the following:

- Establish the electrical connections in the terminal box in accordance with the details in the sections above and tighten with the correct torque.
- Maintain air clearances between non-insulated parts:
 $\geq 5.5 \text{ mm}$ up to 690 V , $\geq 8 \text{ mm}$ up to 1000 V .
- Avoid protruding wire ends!
- In order not to damage the cable insulation, freely arrange the connecting cables.
- Connect the machine corresponding to the specified direction of rotation.
- Keep the inside of the terminal box clean and free from trimmed-off ends of wire.
- Ensure that all seals and sealing surfaces are undamaged and clean.
- Correctly and professionally close unused openings in the terminal boxes.

7 Commissioning

When carrying out any work on the machine, observe the general safety instructions (Page 57) and the specifications contained in EN 50110-1 regarding safe operation of electrical equipment.

7.1 Setpoint values for monitoring the bearing temperature

Prior to commissioning

If the machine is equipped with bearing thermometers, set the temperature value for disconnection on the monitoring equipment before the first machine run.

Table 7-1 Set values for monitoring the bearing temperatures before commissioning

Set value	Temperature
Alarm	115 °C
Shutting down	120 °C

Normal operation

Measure the normal operating temperature of the bearings T_{op} at the installation location in °C. Set the values for shutdown and warning corresponding to the operating temperature T_{op} .

Table 7-2 Set values for monitoring the bearing temperatures

Set value	Temperature
Alarm	$T_{operation} + 5 \text{ K} \leq 115 \text{ °C}$
Shutting down	$T_{operation} + 10 \text{ K} \leq 120 \text{ °C}$

7.2 Measures before start-up

NOTICE

Damage to the machine

In order to avoid material damage, check the following points before commissioning the motor:

- Using appropriate measures, check whether the correct direction of rotation of the motor has been set by the customer, e.g. by decoupling from the driven load.
- Ensure that temperature-sensitive parts (cables, etc.) are not in contact with the machine enclosure.
- Ensure that the condensation drain holes are always located at the lowest part of the motor.

NOTICE

Damage caused by insufficient cooling

Effective cooling is no longer possible if air guidance of the machine is not provided as intended. This can damage the machine.

- Before commissioning, attach the covers to guarantee the intended air guidance.

Measures

Once the system has been correctly installed, you should check the following prior to commissioning:

- Ensure that the machine has been correctly installed and aligned.
- Connect the machine corresponding to the specified direction of rotation.
- Ensure that the operating conditions match the data specified on the rating plate.
- Lubricate the bearings, depending on the version. Ensure that machines with roller bearings, which have been stored for longer than 24 months, are relubricated.
Also observe the notes in Chapter Preparation for use.
- Ensure that any optional supplementary machine monitoring equipment has been connected correctly and is functioning as it should.
- For versions with bearing thermometers, check the bearing temperatures when the machine starts to run for the first time. Set the values for alarm and shutdown at the monitoring device. Also observe the notes in Chapter Setting values for monitoring the bearing temperature.

- Corresponding to the control and speed monitoring functions implemented, ensure that the machine cannot exceed the permissible speeds specified on the rating plate.
- Ensure the correct setting conditions of the drive output elements depending on the type (e.g. alignment and balancing of couplings, belt forces in the case of a belt drive, tooth forces and tooth flank backlash/play in the case of gear wheel output, radial and axial clearance in the case of coupled shafts).
- Comply with the minimum insulation resistances and minimum air clearances.
- Ensure correct grounding and potential bonding connection of the protective conductor.
- Tighten all mounting bolts, connection elements and electrical connections to the specified torques.
- Remove any lifting eyes that were screwed after installation – or secure them to prevent them becoming loose.
- Rotate the rotor to ensure that it does not touch the stator.
- Implement all touch protection measures for both moving and live parts.
- Ensure that free shaft extensions cannot be touched, e.g. by attaching covers.
- Secure any featherkeys so that they cannot be flung out.
- Ensure that the optional external fan is ready for operation and connected so that it rotates in the specified direction.
- Ensure that the cooling airflow is not obstructed or diminished in any way.
- If an optional brake is being used, ensure that it is functioning perfectly.
- Comply with the specified mechanical limit speed n_{max} , and ensure that it is not exceeded.

If the design of the machine requires the converter to be assigned in a particular way, the relevant information will be provided on the rating plate or an additional label.

Note

It may be necessary to perform additional checks and tests in accordance with the specific situation on site.

See also

Observing the operating mode (Page 64)

8 Operation

When carrying out any work on the machine, observe the general safety instructions (Page 57) and the specifications contained in EN 50110-1 regarding safe operation of electrical equipment.

Switching on the machine



 **DANGER**

Hazardous voltages

Electrical machines are at hazardous voltage levels. Contact with these can result in death, serious injury or material damage.

Operating the machine on a line supply system with a non-grounded neutral point is only permitted for short periods of time that occur rarely, e.g. the time leading to a fault being eliminated. Cable ground fault EN / IEC 60034-1.

NOTICE

Damage to the machine or premature bearing failure

The bearings can be damaged if the following is not observed.

- It is absolutely crucial that you maintain the permissible vibration values to avoid damage to the machine or its destruction.
- In operation, observe the vibration values in accordance with ISO 10816.
- Under all circumstances maintain the minimum radial load of cylindrical roller bearings of 50% corresponding to what is specified in the catalog.
- Take the appropriate measures to reduce bearing currents. Observe the Chapter Converter operation.

 **WARNING****Faults in operation**

Changes with respect to normal operation indicate that there is an impaired function. This can cause faults which can result in eventual or immediate death, severe injury or material damage.

For instance, observe the following signs that could indicate a malfunction:

- Higher power drawn than usual
- Higher temperatures than usual
- Unusual noises
- Unusual smells
- Response of monitoring equipment

Immediately contact the maintenance personnel if you identify any irregularities. If you are in doubt, immediately switch off the machine, being sure to observe the system-specific safety conditions.

NOTICE**Risk of corrosion due to condensation**

If the machine and/or ambient temperatures fluctuate, this can result in condensation inside the machine.

- If available, remove the drain plugs or screws to drain the water depending on the ambient and operating conditions.
- If available, re-attach the drain plugs or screws.

If the motor is equipped with drain plugs, then the water can drain away by itself.

Switching on the machine with anti-condensation heating (optional) **CAUTION****Machine overheating**

Minor injury or material damage can occur if you do not observe the following:

- If available, switch off the anti-condensation heating each time before switching on.

 **CAUTION**

Risk of injury when touching the fan

There is a risk of injury at machines equipped with a fan cover (e.g. fan cover used in the textile industry), as the fan is not completely touch protected.

- Do not touch the rotating fan.
- Do not put your fingers into the larger air discharge openings.
- Manual intervention must be prevented on the customer's side by using suitable measures, e.g. appropriate housings or a protective grating.

8.1 Stoppages

Longer non-operational periods

Note

- For longer non-operational periods (> 1 month), either operate the machine or at least turn the rotor regularly, approximately once per month.
- Please refer to the section "Switching on" before switching on to recommission the motor.
- Remove any machine rotor locking devices before you turn the rotor.

NOTICE

Restricted motor function

If not used for longer periods of time, material damage or complete motor failure can occur.

If the motor is out of service for a period of more than 12 months, then environmental effects can damage the motor.

- Apply suitable corrosion protection, preservation, packing and drying measures.

Switching on the anti-condensation heater

Switch on any anti-condensation heating while the machine is not being operated.

Taking the machine out of service

Details regarding the necessary measures, Chapter Preparing for use (Page 64).

Lubricating before recommissioning

NOTICE

Dry running bearings

Bearings can be damaged if they do not have sufficient grease.

- Re-grease the bearings if they have been out of service for more than one year. The shaft must rotate so that the grease can be distributed in the bearings. Observe the data on the lubricant plate.

Chapter Bearings (Page 99).

9 Maintenance

When carrying out any work on the machine, observe the general safety instructions (Page 57) and the specifications contained in EN 50110-1 regarding safe operation of electrical equipment.

9.1 Safety instructions for inspection and maintenance

WARNING

Rotating and live parts

Electric machines contain live and rotating parts. Fatal or serious injuries and substantial material damage can occur if maintenance work is performed on the machine when it is not stopped or not de-energized.

- Perform maintenance work on the machine only when it is stopped. The only operation permissible while the machine is rotating is regreasing the roller bearings.
- When performing maintenance work, comply with the five safety rules.

WARNING

Machine damage

If the machine is not maintained it can suffer damage. This can cause faults which can result in eventual or immediate death, serious injury or material damage.

Perform regular maintenance on the machine.

 **CAUTION**

Dust disturbances when working with compressed air

When cleaning with compressed air, dust, metal chips, or cleaning agents can be whirled up. Injuries can result.

When cleaning using compressed air, make sure you use suitable extraction equipment and wear protective equipment (safety goggles, protective suit, etc.).

NOTICE

Damage to insulation

If metal swarf enters the winding head when cleaning with compressed air, this can damage the insulation. Clearance and creepage distances can be undershot. This may cause damage to the machine extending to total failure.

When cleaning with compressed air, ensure there is adequate extraction.

NOTICE

Machine damage caused by foreign bodies

Foreign bodies such as dirt, tools or loose components, such as screws etc., can be left by accident inside the machine after maintenance is performed. These can cause short circuits, reduce the performance of the cooling system or increase noise in operation. They can also damage the machine.

- When carrying out maintenance work, make sure that no foreign bodies are left in or on the machine.
- Securely attach all loose parts again once you have completed the maintenance procedures.
- Carefully remove any dirt.

Note

Operating conditions and characteristics can vary widely. For this reason, only general intervals for inspection and maintenance measures can be specified here.

9.2 Inspection

Notes

Note

Pay particular attention to the relubrication intervals for rolling bearings that deviate from the inspection intervals.

Note

When servicing a three-phase machine, it is generally not necessary to dismantle it. The machine only has to be dismantled if the bearings are to be replaced.

9.3 Maintenance

9.3.1 Re-greasing

For machines with regreasing system, relubrication intervals, grease quantity and grease grade are provided on the lubricant plate. Additional data can be taken from the main machine rating plate.

Grade of grease for standard motors (IP55) UNIREX N3 - ESSO.

Note

It is not permissible to mix different types of grease.

Prolonged storage periods reduce the useful lifetime of the bearing grease. Check the condition of the grease if the equipment has been in storage for more than 12 months. If the grease is found to have lost oil content or to be contaminated, the machine must be immediately relubricated before commissioning. For information on permanently-greased bearings, please refer to the section titled Bearings (Page 99).

Procedure

To relubricate the roller bearings, proceed as follows:

1. Clean the grease nipples at the drive end and non-drive end.
2. Press-in the specified grease and amount of grease according to the data stamped on the lubrication plate.
 - Please observe the information on the rating and lubricant plates.
 - Regreasing should be carried out when the motor is running (max. 3600 rpm).

The bearing temperature can rise significantly at first, and then drops to the normal value again when the excess grease is displaced out of the bearing.

9.3.2 Cleaning

Cleaning the grease ducts and spent grease chambers

The spent grease collects outside each bearing in the spent grease chamber of the outer bearing cap. When replacing bearings, remove the spent grease.

Note

Dismantle the bearing cartridges to replace the grease in the lubrication duct.

Cleaning the cooling air ducts

Regularly clean the cooling air ducts through which the ambient air flows.

The frequency of the cleaning intervals depends on the local degree of fouling.

NOTICE
Damage to the machine
Material damage can occur if you direct compressed air in the direction of the shaft outlet or machine openings.
<ul style="list-style-type: none">• Avoid pointing compressed air directly onto shaft sealing rings or labyrinth seals of the machine.

In the case of machines with fan covers for the textile industry, regularly remove fluff balls, fabric remnants, and similar types of contamination (particularly at the air passage opening between the fan cover and cooling fins of the machine enclosure) to ensure that the cooling air can flow without obstruction.

9.3.3 Drain condensate

If there are condensation drain holes present, open these at regular intervals, depending on climatic conditions.



WARNING

Hazardous voltage

The winding can be damaged if objects are introduced into the condensation holes (optional). This can lead to death, serious injury or material damage.

Note the following to maintain the degree of protection:

- Switch off the machine so that it is in a no-voltage condition before you open the condensation drain holes.
- Close the condensation drain holes, e.g. using T-plugs, before commissioning the machine.

NOTICE

Reduction of the degree of protection

If condensation drain holes are not closed, then this can result in material damage to the motor.

In order to maintain the degree of protection, after the condensation has been drained, you must close all of the drain holes.

9.4 Repair

When carrying out any work on the machine, observe the general safety instructions (Page 57) and the specifications contained in EN 50110-1 regarding safe operation of electrical equipment.

9.4.1 Bearings

Refer to the rating plate or the catalog for the designations of the bearings being used.

Bearing lifetime

Prolonged storage periods reduce the useful lifetime of the bearing grease. For permanently lubricated bearings, this reduces the bearing service life.

We recommend that the bearings or grease are replaced after a storage time of 12 months; if the time exceeds 4 years, replace the bearings or the grease.

Replacing bearings

Recommended interval after which bearings are to be replaced under normal operating conditions:

Table 9-1 Bearing replacement intervals

Ambient temperature	Principle of operation	Bearing replacement intervals
40 °C	Horizontal coupling operation	40 000 h
40 °C	With axial and radial forces	20 000 h

- Do not reuse bearings that have been removed.
- Remove the dirty spent grease from the bearing shield.
- Replace the existing grease with new grease.
- Replace the shaft seals when the bearings are replaced.
- Slightly grease the contact surfaces of the sealing lips.

Note

Special operating conditions

The operating hours are reduced, e.g.

- When machines are vertically mounted.
 - High vibration and surge loads
 - Frequent reversing operation
 - Higher ambient temperatures.
 - High speeds etc.
-

9.4.2 Disassembly

Note

Before commencing removal, you should mark how each of the fastening elements has been assigned, as well as how internal connections are arranged. This simplifies subsequent reassembly.

Fan

NOTICE

Destruction of the fan

Material damage can occur by forcefully removing the fan from the shaft.

Take care not to damage the snapping mechanisms on fans that are equipped with these.

Plastic fan

- Correctly expose the breakout openings provided in the fan plate
- Heat up the fans to a temperature of approximately 50 °C around the area of the hub.
- Use a suitable tool to pull off the fan (puller).
- Locate the arms of the pulling tool in the the breakout openings and slightly tension the pressure screw of the tool.
- Simultaneously release the two snap-in lugs of the fan from the shaft groove
Keep the snap-in lugs in this position.
- Uniformly withdraw the fan from the shaft by turning the pressure screw of the pulling tool.
- Do not apply any hammer blows to avoid damaging the rotor shaft, the fan and the bearings.
- Order the appropriate new parts if damaged.

Metal fan

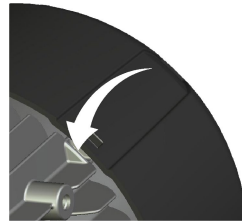
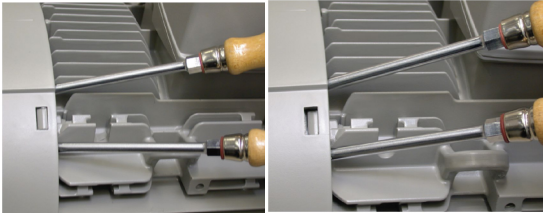
- Remove the locking ring.
- Use a suitable tool to pull off the fan (puller).
- Locate the arms of the pulling tool in the openings in the fan in the vicinity of the hub.
- Alternatively, the pulling tool can be placed at the outer edge of the fan plate.
- Uniformly withdraw the fan from the shaft by turning the pressure screw of the pulling tool.
- Do not apply any hammer blows to avoid damaging the rotor shaft, the fan and the bearings.
- Order the appropriate new parts if damaged.

Plastic fan cover



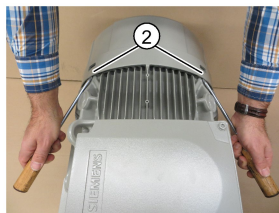
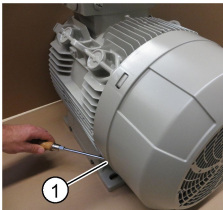
Frame size FS80 ... FS160

1. Carefully release the snap openings of the cover one after the other from the lugs.
2. Do not insert the lever directly under the lug, as otherwise it could break.
3. Take care to not damage the catch mechanism. Order the appropriate new parts if damaged.



Frame size FS180 ... FS200

1. Carefully release the first snap opening of the cover.
2. For machines with type construction B3, select the snap opening in the area of the machine mounting feet.
3. Insert the lever at the edge of the cover close to the lug.
4. Carefully release two other snap openings together and then withdraw the cover.
5. Take care to not damage the catch mechanism. Order the appropriate new parts if damaged.



Protective cover



Canopies with spacer bolts or with bolted holding brackets

NOTICE

Destruction of the mounting elements

Forcibly removing or separating can destroy the distance bolts, the connecting elements of the mounting bracket or the fan cover.

1. Release the fixing screw on the outer surface of the canopy.
2. Under no circumstances remove the spacer bolts or the mounting bracket – or forcibly separate them from one another or the cover.

Canopies with welded support brackets

1. Release the fixing screws at the contact location (canopy foot - riveting nut) at the outer surface of the cover mesh.

9.4.3 Installation

If possible, assemble the machine on an alignment plate. This ensures that the mounting feet surfaces are all on the same plane.

Avoid damaging the windings protruding out of the stator enclosure when fitting the end shield.

Sealing measures

1. Apply Fluid-D to the centering edge.
2. Check the terminal box seals, and if required, replace these.
3. Repair any damage to the paint, also to screws/bolts.
4. Take the necessary measures to ensure compliance with the applicable degree of protection.
5. Do not forget the foam rubber cover in the cable entry. Completely seal the holes, and ensure that cables do not come into contact with sharp edges.

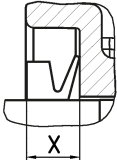
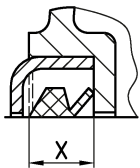
9.4.3.1 Fitting bearings

Sealing the bearings

Note the following details:

- Shaft sealing rings are used to seal machines at the rotor shaft.
 - For V rings, comply with the assembly dimension.
- Use the specified bearings.
- Ensure that the bearing sealing disks are in the correct position.
- Insert the elements for bearing preloading at the correct end.
- Fixed bearings can have a locking ring or bearing cover.
- Seal the bearing cap screws with the appropriate gaskets or with grease.
- Do not interchange the position of the bearing covers (DE and NDE or inner and outer).

Mounting dimension "x" of V rings

Motor types	Frame size	X [mm]	
All	71	4.5 ±0.6	Standard design 
	80 ... 112	6 ±0.8	
	132 ... 160	7 ±1	
1LA 1MA6	180 ... 200		
1FP1	180 ... 200	11 ±1	
1LG 1MA622 1LE 1MB1	180 ... 225	11 ±1	
1LG 1MA6 1LE 1MB1	250 ... 315	13.5 ±1.2	Special design 

9.4.3.2 Mounting fans

- Take care not to damage the snapping mechanisms on fans that are equipped with these.
- To ensure this, the fans should be heated to a temperature of approximately 50 °C around the area of the hub.
- If any damage is caused, request new parts.

9.4.3.3 Mounting the fan cover



CAUTION

Incorrectly mounting covers with snap mechanism

Avoid injury caused by touching the rotating fan or material damage caused by partial or complete release of the cover while the machine is operational.

- Carefully ensure that all four snap openings of the cover completely engage in the associated snap-in lugs.

Plastic fan hub FS 80 ... 200

- Align the cover with the line marked on the edge of the cover with the middle enclosure rib as extension to the terminal box base.
- Center the cover by axially moving on the snap-in lugs of the enclosure or the bearing shield cams.
- First engage two snap openings positioned next to one other, then carefully press the cover into position with the two openings situated opposite these using the snap-in lugs, and snap it into place.
- Attach the cover using all four of its snap-in lugs by applying axial pressure to the reinforced edge of the cover in the area of the cover mesh.
- If required, use a rubber hammer and apply it once or several times to the edge of the cover in the axial direction. When doing this, take care not to damage or destroyed the mesh of the cover.
- When fitting the cover, do not overextend it (you could break it).

9.4.3.4 Reassembly: Miscellaneous information

- Position all rating and supplementary plates as in the original state.
- Where relevant, fix electric cables.
- Check the tightening torques of all screws, as well as those of screws that have not been released.

10 Spare parts

10.1 Parts order

In addition to the exact part designation, please specify the machine type and the serial number in all orders for spare parts and repair parts. The part designation must be identical to the designation stated in the list of parts and specified together with the appropriate part number.

When spare and repair parts are ordered, the following details must be provided:

- Designation and part number
- Order number and serial number of the machine

Spare parts information and database

Using the Siemens order number and the associated serial number, you can download spare parts information from a database for almost all current motors → Spares On Web (https://b2b-extern.automation.siemens.com/spares_on_web)

A Service & support

A.1 Siemens Industry Online Support

Technical queries or additional information



If you have any technical queries or you require additional information, please contact Technical Support (<https://support.industry.siemens.com/cs/ww/en/sc/2090>).

Please have the following data ready:

- Type
- Serial number

You can find this data on the rating plate.

On-site service and spare parts

If you wish to request on-site service or order spare parts, please contact your local Siemens sales office. This office will contact the responsible service center on your behalf.

You can obtain optimum support everywhere using the SIOS App. The SIOS App is available for Apple iOS, Android and Windows phone.



A.2 Further documents

These operating instructions can also be obtained at the following Internet site:

<http://support.industry.siemens.com> (Page 107)

General Documentation

1.517.30777.30.000	1XP8001 encoder
5 610 00000 02 000	Operating_Instructions_Simotics GP, SD, DP, XP
5 610 00000 02 001	Operating_Instructions_Compact_Simotics GP, SD, DP
5 610 00000 02 002	Operating_Instructions_Compact_Simotics XP
5 610 00002 09 000	Incremental encoder 1XP8012-1x
5 610 00002 09 001	Incremental encoder 1XP8012-2x
5 610 70000 02 015	External fan
5 610 70000 10 020	Spring-loaded brake

Observe all of the other documents available for this machine.

Trademarks

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Disclaimer of Liability

We have reviewed the contents of this publication to ensure consistency with the hardware and software described. Since variance cannot be precluded entirely, we cannot guarantee full consistency. However, the information in this publication is reviewed regularly and any necessary corrections are included in subsequent editions.

Siemens AG
Division Process Industries and Drives
Postfach 48 48
90026 NÜRNBERG

Standard machines
56100000002001, 01/2016

- (DE) Federkraftbremse
- (EN) Spring-operated brake
- (FR) Frein monodisque à ressorts de serrage
- (ES) Freno de disco de resorte
- (IT) Freni a molla
- (SV) Fjäderbroms
- (CS) Pružinová brzda
- (RU) Тормоз с пружинным замыканием

Betriebsanleitung
 Operating instructions
 Instructions de service
 Instrucciones para el manejo
 Manuale d'uso
 Bruksanvisning
 Návod
 Инструкция использования

2LM8 005-1NA10 ... 2LM8 400-0NA10



(DE)

DEUTSCH

⚠️ WARNUNG	
	<p>Alle Arbeiten zum Transport, Anschluß zur Inbetriebnahme und regelmäßige Instandhaltung sind von qualifiziertem, verantwortlichem Fachpersonal auszuführen (VDE 0105, IEC 364 beachten). Unsachgemäßes Verhalten kann schwere Personen- und Sachschäden verursachen.</p> <p>Die jeweils geltenden nationalen, örtlichen und anlagespezifischen Bestimmungen und Erfordernisse sind zu berücksichtigen.</p>

⚠️ ALLGEMEINE HINWEISE	
<p>Ergänzend zu dieser Anleitung immer die Sicherheits- und Inbetriebnahmehinweise bzw. Betriebsanleitung der zugehörigen Motoren mitbeachten.</p>	

1 Beschreibung

1.1 Anwendungsbereich

Bestimmungsgemäße Verwendung: Die federbetätigten, gleichstromerregten Scheibenbremsen werden für Drehstrom-Asynchronmotoren der Baugrößen 63 bis 225L verwendet.

Die Bremse (Federkraftbremse) darf nicht in explosionsgefährdeter oder aggressiver Atmosphäre betrieben werden. Bei hoher Luftfeuchtigkeit und tiefen Temperaturen müssen geeignete Maßnahmen gegen das Festfrieren von Ankerscheibe und Rotor getroffen werden (z. B. Heizung).

Um eine sichere Funktion der Federkraftbremse zu gewährleisten müssen beim Einsatz in staubiger Umgebung, bei möglichem Eindringen von Schmutzwasser oder wenn die Verteilung des Abriebstaubes verhindert werden soll geeignete Maßnahmen, z. B. durch Abdeckring, Wellendichtring oder Verschlussdeckel, getroffen werden.

Umgebungstemperatur: -20° C bis 40° C

1.2 Aufbau und Arbeitsweise (s. Fig. 3)

Es handelt sich um Einscheibenbremsen mit zwei Reibflächen. Durch mehrere Druckfedern wird im stromlosen Zustand das Bremsmoment durch Reibschluß erzeugt. Das Lösen der Bremse erfolgt elektromagnetisch.

Beim Bremsvorgang wird der auf der Nabe (3.00) axial verschiebbare Rotor (2.00) durch die Druckfedern (1.04) über die

Ankerscheibe (1.02) an die Gegenreibfläche (8.22) gedrückt. Im gebremsten Zustand ist zwischen Ankerscheibe (1.02) und Magnetteil (1.01) der Luftspalt s_{LU} vorhanden.

Zum Lüften der Bremse wird die Spule des Magnetteils (1.01) mit Gleichspannung erregt. Die entstehende Magnetkraft zieht die Ankerscheibe (1.02) gegen die Federkraft an das Magnetteil.

Der Rotor ist damit von der Federkraft entlastet und kann sich frei drehen.

Die Ausführung mit **mechanischer Handlüftung** ermöglicht das Lüften der Bremse bei Motorstillstand durch Ziehen des Lüfthebels (6.00).

1.3 Approbation:



2 Betrieb

⚠️ WARNUNG	
	<p>Alle Arbeiten nur im elektrisch spannungslosen Zustand der Anlage durchführen!</p>

2.1 Elektrischer Anschluß

Anschluß des Bremsmotors nach dem Schaltbild im Motorenanschlußkasten durchführen. Bremsenanschluß (Standardausführung) siehe Fig. 1.

Die Motoren haben die üblichen Leistungsschilder und erhalten zusätzlich auf der gegenüberliegenden Seite des Motors oder auf die Haube ein zweites Leistungsschild mit den Bremsendaten.

Die Wechselfrequenz für die Erregerwicklung der Bremse wird an den beiden freien Klemmen des Gleichrichterblockes (-) angeschlossen (s. Fig. 1).

Schnelles Einfallen der Bremse

Wird die Bremse vom Netz getrennt, erfolgt die Bremsung. Die Einfallzeit der Bremsscheibe wird durch die Induktivität der Magnetspule verzögert (**wechselstromseitiges** Abschalten). Hierbei tritt eine starke Einfallverzögerung auf. Diese Schaltungsart ist nicht für Hubantriebe geeignet.

Für kurze Einfallzeiten muß **gleichstromseitig** abschaltet werden. Zum Schutz der Spule und Kontakte sollte bei gleichstromseitigem Abschalten parallel ein Funkenlöschglied (s. Fig.1) geschaltet werden (VDE 0580§26).

Lüften der Bremse bei abgeschaltetem Motor

Durch getrennte Erregung des Magneten läßt sich die Bremse im Stillstand des Motors lüften. Hierzu muß an die Klemmen des Gleichrichterblockes die entsprechende Wechselspannung (s. Bremsenleistungsschild) angeschlossen werden. Die Bremse bleibt gelüftet, solange die Spannung anliegt.

Die Gleichrichter sind durch Varistoren im Eingang und Ausgang gegen Überspannung geschützt.

Spannung und Frequenz

Gleichrichter		
Anschluß	230V ± 10% 50/60 Hz	400V ± 10% 50/60 Hz
Magnetspulen	205 V DC	180 V DC

Bei 60 Hz darf die Spannung für die Bremse nicht erhöht werden!

24 V DC - Bremse - Anschluß im Anschlußkasten.

2.2 Betriebswerte (siehe Fig. 4)

2.3 Änderung des Bremsmomentes (siehe Fig. 2)

Die Bremse wird mit eingestelltem Bremsmoment geliefert. Eine Reduzierung durch Herausrauben des Einstellringes mittels Hakenschlüssel (DIN 1810 Form A) ist bis max. auf das Maß "o₁" möglich. Pro Rastung des Einstellringes ändert sich das Bremsmoment nach Fig.2. Hierdurch kann das Bremsmoment auf "M_{br min.}" reduziert werden. Eine Bremsmomentverringerung über den Einstellring verlängert die Einfallzeit und verkürzt die Lüftzeit.

2.4 Maximal zulässige Drehzahlen

Die Bremse ist für den Einsatz als Haltebremse mit **Not-Stop-Funktion** dimensioniert

Der Einsatz als Betriebsbremse ist bei geringer Reibarbeit möglich (Lebensdauer, siehe Instandhaltung).

Die max. Drehzahlen sind Fig. 4 zu entnehmen.

Bei **Not-Stop-Funktion** ist mit erhöhten Temperaturen (bis 130° C) und größerem Verschleiß zu rechnen.

3 Instandhaltung

Für normale Einsatzfälle als Haltebremse ist die Bremse wartungsfrei.

Lediglich bei Einsatzfällen als Betriebsbremse, in denen Reibarbeit zu verrichten ist, muß der Luftspalt "s_{Lü}" in bestimmten Zeitabschnitten kontrolliert und spätestens beim Erreichen des max. Luftspalt "s_{Lü max.}" wieder auf den Nennluftspalt "s_{Lü Nenn}" nachgestellt werden (s. Fig. 2).

Nachstellung des Luftspaltes wie folgt vornehmen:

Lüfterhaube (8.85) entfernen.

Befestigungsschrauben (8.01) etwas lösen, Nachstellhülsen (1.07) mittels Maulschlüssel in das Magneteil (1.01) hineinschrauben und Befestigungsschrauben wieder anziehen.

Anschließend nochmals Kontrolle des Luftspaltes.

Wenn Handlüfthebel vorhanden, dann Maß „s“ gemäß Fig. 2a nachstellen.

HINWEIS

Reibflächen nicht mit Öl oder Fett in Berührung bringen!

Auswechseln des Reibbelages

Bei verbrauchtem Reibbelag ist der Rotor (2.00) auszutauschen. Minimale Rotorstärke s. Fig. 2.

Demontage / Montage (s. Fig.3)

Wenn mechanische Handlüftung vorhanden ist, Handlüfthebel vor dem Abnehmen der Haube heraus-schrauben.

Lüfterhaube (8.85) abnehmen.

Lüftersicherungsring entfernen und Lüfter abziehen (entfällt bei fremdbelüfteten Motoren).

Bei Kombinationen mit Impulsgeber: Drehmomentenstütze (8.31) lösen und Geberwelle mit Maulschlüssel SW 10 (bei 1LG4/6-Motoren SW 13) aus Motorwelle heraus-schrauben.

Befestigungsschrauben (8.01) heraus-schrauben.

Magneteil komplett (1.00) abnehmen. Ggf. hierzu Bremsenanschlußleitung am Gleichrichter lösen.

Rotor mit Reibbelag (2.00) wechseln.

Montage in umgekehrter Reihenfolge. Luftspalt auf Nennmaß einstellen.

Wenn Handlüfthebel vorhanden, dann Maß „s“ gemäß Fig. 2a nachstellen.




Bei Motoren mit Impulsgeber: Geberwelle mit **7 bis 9 Nm** in Motorwelle einschrauben.

Zulässige Rundlauf-toleranz siehe Betriebsanleitung Geber.



HINWEIS

Nach der Instandsetzung muß und vor Inbetriebnahme sollte die Gleichmäßigkeit des Nennluftspaltes im stromlosen Zustand mittels Fühlerlehre zwischen Ankerscheibe und Magneteil an 3 Stellen des Umfanges kontrolliert werden. **Bei Wiederinbetriebnahme des Motors ist die einwandfreie Funktion der Bremse zu prüfen!**

 WARNING	
	All work involved in the transport, connection, commissioning and regular maintenance must be carried out by qualified, responsible specialists (note VDE 0105; IEC 364). Improper behaviour may result in serious injury and damage to property . The applicable national, local and works regulations and requirements must be complied with.
 GENERAL NOTE	
In addition to these instructions, compliance with the safety and commissioning information or operating instructions for the associated motors is always necessary.	

1 Description

1.1 Application

Intended use: The spring-operated, DC-energized disk brakes are used for three-phase induction motors of sizes 63 to 225L. The brake (spring-loaded brake) must not be operated in areas where there is risk of explosion or under corrosive atmospheric conditions. With high humidity and low temperatures, suitable measures (such as a heater) must be implemented to prevent the armature plate and rotor from freezing up.

To ensure reliable operation of the spring-loaded brake, suitable measures, such as the use of a cover ring, shaft seal or cap, must be implemented when the brake is operated in a dusty environment, if there is a possible ingress of dirty water or if the distribution of the abrasion dust is to be prevented.

Ambient temperature: -20° C to 40° C

1.2 Design and mode of operation (see Fig. 3)

The brake is a single disk brake with two friction surfaces. In the de-energized state, more preloading springs generate the braking torque due to frictional locking. The brake is then activated electromagnetically.

During the braking process, the axially movable rotor (2.00) on the hub (3.00) is pressed by the preloading springs (1.04) via the armature disk (1.02) onto the opposing friction surface (8.22).

In the braked state, the air-gap s_{Lu} exists between the armature disk (1.02) and the magnetic section (1.01).

The brake is released by exciting the coil of the magnetic section (1.01) with a DC voltage. The generated magnetic force pulls the armature disk (1.02) against the spring force onto the magnetic section.



The rotor is therefore relieved of the force of the spring and is able to rotate freely.

The design that includes **mechanical manual** releasing enables the brake to be released at motor standstill by pulling the release lever (6.00).

1.3 Approved use:



2 Operation

 WARNING	
	All work must be carried out on the equipment in the de-energized state!

2.1 Electrical wiring

Wire up the brake motor in accordance with the circuit diagram in the motor terminal box. For the brake connections (standard design), s. Fig. 1.

The motors are fitted with the rating plates standard and in

addition, on the opposite side of the motor, there is a second rating plate with the brake data.

The AC voltage for the excitation winding of the brake must be connected to the two spare terminals (~) of the rectifier block (see Fig. 1).

High-speed brake application

When the brake is disconnected from the supply voltage, braking takes place.

The application time of the brake disk is delayed due to the induction of the magnetic coil (AC-side switch-off). In this case, there is a long delay in brake application.

This type of switching is not suitable for lifting drives.



Shorter application times are obtained if the DC side is switched off. The coil and contacts should be protected in the case of DC-side switch-off by connecting a spark trap (VDE 0580, Paragraph 26, see Fig. 1).

Releasing the brake with the motor switched off

Due to separate excitation of the magnet, it is possible to release the brake at motor standstill. For this purpose, the appropriate AC voltage must be applied to the terminals of the rectifier block (see brake rating plate). The brake remains released as long as voltage is applied.

The rectifiers are protected against overvoltage by varistors connected to the input and output.

Voltage and frequency

rectifier		
connection	230V ± 10% 50/60 Hz	400V ± 10% 50/60 Hz
magnetic coils	205 V DC	180 V DC

At 60 Hz, the voltage for the brake must not be increased!
24 V DC - Brake - Connection in terminal box

2.2 Operating values (see Fig. 4)

2.3 Changing the braking torque (see Fig. 2)

The brakes are supplied with the braking torque as set by the manufacturer.

It is possible to reduce this by unscrewing the adjustment ring with a hook spanner to a maximum of "o₁". At each notch of the adjustment ring, the braking torque changes in accordance with Figure 2. In this manner, the braking torque can be reduced to "M_{Br min.}".

Reducing the braking torque by means of the setting ring lengthens the brake delay time and the release time.

2.4 Maximum permissible RPM

The brake is dimensionally designed for use as a holding brake with a **not-stop feature**.

The use as a service brake is possible in case of low frictional work (service life: see Maintenance).

The maximum rotational speeds are given in Fig. 4.

With use of the **not-stop feature** increased temperatures (up to 130° C) and greater wear must be expected.

3 Maintenance

When normally used as a holding brake the brake requires no maintenance.

Only when used as service brake, involving frictional work, does the air gap „s_{air}“ have to be monitored at certain intervals and at the latest when the maximum air gap „s_{air max.}“ is reached reset to the nominal air gap „s_{air nom.}“ (see Fig. 2).

The air gap is adjusted as follows:

Remove fan cover (8.85).

Loosen fixing screws (8.01), screw adjustment bushes (1.07) into the magnetic section (1.01) using a fixed spanner and tighten the fixing screws again. Then check the air-gap again. If there is a manual release lever, then readjust „s“ in accordance with Fig. 2a.

**NOTE**

Frictional surfaces must not come into contact with oil or grease!

Replacing the friction coating

When the friction coating has been consumed, the rotor (2.00) must be replaced. See Figure 2 for the minimum rotor thickness.

Disassembly / assembly (see Fig. 3)

If there is a manual mechanical release device, unscrew the manual release lever before removing the cowl.

Remove fan cover (8.85).

Remove fan securing ring and lift the fan off (not necessary for motors with external fans).

In combinations with pulse transmitters: Remove torque arm (8.31) and screw the pulse transmitter shaft out of the motor shaft using an SW 10 (1LG4/6 SW 13) fixed spanner.

Remove fixing screws (8.01).

Remove the magnetic section complete (1.00). If necessary remove the brake connection leads at the rectifier.

Replace rotor with friction coating (2.00).

Install in the reverse sequence. Adjust air gap to rated size.

If there is a manual release lever, then readjust "s" in accordance with Fig. 2a.

In the case of motors with a pulse encoder, screw in encoder shaft with 7 to 9Nm.

For permissible radial eccentricity tolerance, see operating instructions for encoder.

**NOTE**

Before commissioning, it must be checked in the de-energized state that the air-gap is uniform and equal to the nominal size using a feeler gauge between the armature disk and magnetic section at 3 points on the circumference.

When the motor is recommissioned, the brake must be checked for correct operation!

**ATTENTION**

Tous les travaux de manutention, raccordement, mise en service et entretien régulier sont à exécuter par des **personnes qualifiées responsables** (respecter VDE 0105; CEI 364). Un comportement inapproprié peut occasionner des **blessures graves** et des **dommages matériels** importants. Il convient de respecter les **normes et dispositions nationales, locales et spécifiques de l'établissement**.

**REMARQUE GÉNÉRALE**

Pour les moteurs équipés des freins mentionnés ci-dessus, observer les présentes instructions en complément aux règles de sécurité et aux instructions de service relatives au moteur.

1 Description**1.1 Domaine d'utilisation**

Utilisation conforme : Les freins à disque actionnés par ressort, à courant continu sont utilisés pour les moteurs asynchrones à courant triphasé de la taille de 63 à 225L.

Le frein (frein à élasticité) ne doit pas être mis en service dans des atmosphères soumises aux explosions ou dans des atmosphères agressives. En cas d'humidité relative élevée et de basses températures, il faut prendre les mesures adaptées contre le gel du disque et du rotor (par ex. chauffage).

Afin d'assurer un fonctionnement sûr du frein à élasticité, il faut prendre, dans le cas d'une utilisation dans un environnement poussiéreux, en cas d'éventuelle pénétration d'eau sale ou d'empêchement de la répartition de la poussière de friction, des mesures adaptées par ex. bague de recouvrement, bague à lèvres en caoutchouc ou couvercle de fermeture.

Température ambiante : -20° C à 40° C

1.2 Constitution et fonctionnement (voir Fig. 3)

Il s'agit de freins monodisque à deux faces de friction.

Le couple de freinage est engendré à l'état hors tension par l'action des ressorts sur le disque de freinage. Le desserrage du frein est électromagnétique.

Au freinage, les ressorts (1.04) agissent sur le disque d'armature (1.02) qui repousse le disque de freinage (2.00) le long du moyeu (3.00) pour l'appliquer contre la surface de friction (8.22).

Lorsque le frein est serré, le disque d'armature (1.02) est séparé de la culasse électromagnétique par l'entrefer s_{LU} .

Le frein est desserré par application d'une tension continue à la bobine de la culasse (1.01). L'effort électromagnétique produit attire le disque d'armature (1.02) contre la culasse en sens opposé à la pression des ressorts.

Le rotor du moteur est ainsi libéré de la pression des ressorts et peut tourner librement.

La version à desserrage manuel permet d'ouvrir le frein à l'arrêt par traction sur le levier de desserrage (6.00).

1.3 Approbation :**2 Mise en oeuvre****ATTENTION**

Intervention sur la machine uniquement à l'état hors tension.

2.1 Raccordement électrique

Intervention sur la machine uniquement à l'état hors tension. Procéder au raccordement du moteur conformément au schéma

collé dans la boîte à bornes. Raccordement du frein (version standard), voir Fig. 1.

Les moteurs présentent la plaque signalétique habituelle. Une plaque signalétique supplémentaire comportant les données de freinage est apposée du côté opposé. La tension alternative d'alimentation du moteur est amenée sur les bornes libres du bloc redresseur (~) (voir Fig. 1).

Serrage rapide du frein

Le serrage du frein est commandé par la coupure de la tension. Le retard au serrage est déterminé par l'inductance de la bobine. La coupure de la tension côté alternatif entraîne un retard important.



Ce type de coupure n'est pas adapté aux systèmes de levage. Un serrage rapide peut être obtenu par commande côté continu. Dans ce cas, la bobine et les contacts doivent être protégés par un dispositif d'antiparasitage (VDE 0580 § 26 ; voir Fig. 1).

Desserrage du frein sur moteur hors tension

Le desserrage du frein lorsque le moteur est à l'arrêt est réalisé par application de la tension alternative d'alimentation du frein (voir plaque signalétique de freinage) aux bornes du redresseur. Le frein reste desserré aussi longtemps que la tension est appliquée.

Les redresseurs sont protégés en entrée et en sortie par des varistances.

Tension et fréquence

redresseurs		
raccordement	230V ± 10% 50/60 Hz	400V ± 10% 50/60 Hz
bobine	205 V DC	180 V DC

A 60 Hz, la tension d'alimentation du frein ne doit pas dépasser la valeur prescrite.

24 V DC - Frein - raccordement dans boîte à bornes

2.2 Caractéristiques de service (voir Fig. 4)

2.3 Modification du couple de freinage (voir Fig. 2)

Le couple de freinage est réglé en usine.

Il peut être réduit en desserrant l'anneau de réglage avec une clé à ergots jusqu'à la cote maximale «O». Chaque cran de l'anneau de réglage correspond à une modification du couple de freinage selon le tableau de la Fig. 2. Le couple de freinage minimal est «M_{Br min.}».

Une réduction du couple de freinage à l'aide de l'anneau de réglage rallonge le temps d'activation du frein et réduit le temps de desserrage du frein.

2.4 Vitesses maximales admissibles

Le frein est dimensionné pour un service comme frein d'arrêt avec **fonction d'arrêt d'urgence**.

L'utilisation comme frein de service est possible en cas de friction minimale (durée de service, voir remise en état).

Les vitesses de rotation max. sont indiquées à l'**illustration 4**. Pour la **fonction d'arrêt d'urgence**, il faut s'attendre à des températures plus élevées (jusqu'à 130° C) et à une grande usure.

3 Entretien

Pour les cas d'utilisation normaux comme frein d'arrêt, le frein ne demande pas de maintenance.

Seuls dans les cas d'utilisation comme frein de service où un travail de friction doit être fourni, la fente d'aération «s_{Lü}» doit être contrôlée à certains intervalles de temps et de nouveau réglée sur la fente d'aération nominale «s_{Lü Nenn}» au plus tard quand on atteint la fente d'aération maximale de «s_{Lü max.}» (voir ill. 2).

Ajustage de l'entrefer

Déposer le capot (8.85) du ventilateur. Desserrer légèrement les vis de fixation (8.01), resserrer les douilles d'ajustage (1.07) en direction de la culasse (1.01) à l'aide d'une clé plate. Resserrer les vis de fixation. Contrôler l'entrefer.

Si une manette de desserrage du frein est présente, la cote „s“ doit être ajustée selon la fig. 2a.

NOTE

Eviter tout contact des surfaces de freinage avec de la graisse ou de l'huile.

Remplacement des garnitures

Lorsque les garnitures sont usées, le disque de freinage (2.00) doit être remplacé. Epaisseur totale minimale du disque de freinage, voir Fig. 2.

Démontage/remontage (voir Fig. 3)

Si un mécanisme de desserrage manuel est prévu, la manette de desserrage du frein doit être dévissées avant le retrait du capot.

Déposer le capot (8.85) du ventilateur.

Enlever la bague d'arrêt du ventilateur et déposer le ventilateur (ne concerne pas les moteurs à refroidissement séparé).

Sur les moteurs avec générateur d'impulsion : dévisser l'étrier d'immobilisation en rotation (8.31) et dévisser l'arbre du générateur de l'arbre du moteur à l'aide d'une clé plate de 10 (1LG4/6 plate de 13).

Dévisser les vis de fixation (8.01).

Déposer la culasse magnétique (1.00) complète. Au besoin déconnecter auparavant le câble de liaison au redresseur.

Remplacer le disque de freinage (2.00).

Le montage s'effectue dans le sens inverse. L'interstice doit être réglé sur la cote assignée.

Si une manette de desserrage du frein est présente, la cote «s» doit être ajustée selon la fig. 2a.

Dans le cas des moteurs avec générateur d'impulsions : l'axe de l'encodeur doit être vissé avec un couple de serrage de 7 à 9 Nm. Pour la tolérance de régularité de rotation, voir les instructions de service de l'encodeur.

NOTE

On doit après la remise en état et il serait bon avant la mise en service de contrôler la régularité de la fente d'aération nominale quand le courant est coupé, à l'aide d'une jauge d'épaisseur, entre le disque et la pièce magnétique, à 3 endroits de l'étendue.

A la remise en service du moteur, vérifier le bon fonctionnement du frein!

 ADVERTENCIA	
	Todos los trabajos de transporte, conexión, puesta en marcha y mantenimiento periódico han de ser realizados por personal especializado y cualificado responsable (observar VDE 0105; IEC 364). Un comportamiento inadecuado puede producir graves lesiones y daños materiales . Es necesario respetar las normas y disposiciones vigentes nacionales, locales y específicas de la instalación .
 INDICACIONES GENERALES	
	Observar siempre, junto con estas instrucciones, las instrucciones de seguridad y de puesta en marcha o de servicio de los motores correspondientes.

1 Descripción

1.1 Campo de aplicación

Uso reglamentario: Los frenos de disco activados por resorte, excitados con corriente continua se usan para motores asincrónicos trifásicos de los tamaños de construcción del 63 al 225L.

No está permitido que el freno (freno de fuerza elástica) trabaje en ambientes expuestos a explosiones ni agresivos. Con una alta humedad del aire y bajas temperaturas, tienen que tomarse las medidas apropiadas contra el agarrotamiento por heladas del disco del rotor y del rotor mismo (p, ej., calefacción).

Para garantizar que el freno de fuerza elástica funcione con seguridad, al utilizarlo en un entorno polvoriento, al ser posible que penetre agua sucia o si se quiere evitar que se reparta el polvo producido por la abrasión, se deben tomar medidas apropiadas, p. ej., mediante anillo cobertor, retén de árbol o tapa.

Temperatura ambiente: de -20° C a 40° C cerrado

1.2 Construcción y funcionamiento (v. fig. 3)

Son frenos con un solo disco y dos superficies de fricción. Más resortes de compresión generan el par (torque) de frenado por fricción. El freno se abre con un electroimán.

Durante el frenado el rotor, desplazable axialmente (2.00) y situado sobre el cubo (3.00), es presionado contra la superficie de fricción (8.22) por medio del disco del inducido (1.02).

Cuando está abrir el freno hay un entrehierro $S_{LÜ}$ entre el disco del inducido (1.02) y el electroimán (1.01).

Para abrir el freno se aplica tensión a la bobina de c.c. del electroimán (1.01). Se genera un campo magnético el cual vence la presión del resorte y atrae el disco del inducido (1.02) al electroimán.



Con ello el rotor se libera de la presión del resorte y puede moverse libremente.

Tirando de la palanca (6.00) en la ejecución con **apertura manual mecánica** es posible soltar el freno cuando está parado el motor.

1.3 Aprobación:



2 Servicio

 ADVERTENCIA	
	¡Efectuar cualquier trabajo sólo cuando la instalación esté sin tensión!

2.1 Conexión eléctrica

Conectar el motor del freno siguiendo el esquema en la caja de bornes del motor. Para la conexión de los frenos (ejecución estándar), v. la fig. 1.

Los motores disponen de las placas de características usuales y adicionalmente, en el lado contrario del motor, de una segunda placa de características con los datos de los frenos.

La tensión alterna para los devanados de excitación del freno se conecta a los dos bornes libres del bloque rectificador (-) (v. fig. 1).

Aplicación rápida del freno

El freno actúa tan pronto como se corte la alimentación.

El tiempo de cierre del disco de freno se retarda debido a la inductancia de la bobina del electroimán (desconexión por el **lado de corriente alterna**). El retardo resultante es apreciable. Este tipo de circuito no es apropiado para mecanismos de elevación.



Si se requieren tiempos de cierre cortos, deberá desconectarse por el **lado de corriente continua**. En este caso se recomienda conectar en paralelo un dispositivo supresor (v. fig. 1) con objeto de proteger a la bobina y a los contactos durante la desconexión (VDE 0580§26).

Abrir el freno cuando está desconectado el motor

Como el electroimán es excitado por separado, es posible abrir el freno cuando está parado el motor. A este efecto se corresponde tensión alterna (v. la placa de características del freno). El freno se mantiene abierto mientras esté aplicada la tensión.

Varistores a la entrada y salida protegen a los rectificadores contra sobretensiones.

Tensión y frecuencia

rectificador		
concebido	230V ± 10% 50/60 Hz	400V ± 10% 50/60 Hz
bobinas	205 V DC	180 V DC

¡En redes de 60 Hz, es inadmisibles aumentar la tensión del freno!

24 V DC - el freno - concebido en caja de bornes

2.2 Valores de servicio (v. fig. 4)

2.3 Modificación del par de frenado (v. fig. 2)

El freno se suministra con el par (torque) de frenado ajustado. Es posible reducirlo desatornillando el tornillo de ajuste mediante una llave de gancho hasta «0,» como máx. En la fig. 2 se indican las variaciones del par (torque) de frenado por cada muesca del anillo de ajuste. Con ello es posible reducir el par (torque) de frenado a « $M_{Br\ min.}$ ».

El anillo de ajuste permite reducir el par de frenado, con lo que se prolonga el tiempo de cierre del freno y se acorta el tiempo de apertura del freno.

2.4 Velocidad de giro máxima

El freno está dimensionado para trabajar con **función de parada de emergencia**.

Su uso como freno de servicio es posible si es bajo el trabajo de fricción (duración, véase Mantenimiento).

Las velocidades máxima admisibles pueden verse en la **Fig. 4**. En la **función de stop de emergencia** se tiene que contar con temperaturas aumentadas (hasta de 130° C) y un mayor desgaste.

3 Mantenimiento

Para los casos de aplicación normales como freno de parada, no necesita mantenimiento.

Sólo y exclusivamente en los casos de aplicación como freno de servicio, en el que tiene que rendirse un trabajo de fricción, en ciertos intervalos se tiene que controlar el entrehierro „ $s_{LÜ}$ ” y, lo más tardar al alcanzar el entrehierro máximo „ $s_{LÜ\ max.}$ ”, se tiene que reajustar al entrehierro nominal „ $s_{LÜ\ Nenn}$ ” (véase la Fig. 2).

Reajustar el entrehierro como sigue:

Retirar la caperuza del ventilador (8.85)

Soltar ligeramente los tornillos de fijación (8.01), atornillar al electroimán (1.01) los casquillos de reajuste (1.07) mediante una llave de boca y volver a apretar los tornillos de fijación.

A continuación volver a controlar el entrehierro.

Si existe palanca de apertura manual de freno, entonces reajustar la dimensión "s" según la figura 2a.



INDICACION

¡Evitar que entren en contacto con aceite o grasa las superficies de fricción!

Recambio de la guarnición de fricción

Deberá sustituirse el rotor (2.00) cuando se haya desgastado la guarnición de fricción. Espesor mínimo del rotor: v. fig. 2.

Desmontaje / montaje (ver fig. 3)

Si existe sistema de apertura mecánica de freno, entonces destornillar la palanca de apertura antes de retirar la cubierta.

Retirar la caperuza del ventilador (8.85)

Quitar el clip de seguridad del ventilador y retirar el ventilador (no procede en el caso de motores con ventilación independiente).

En motores con emisor de impulsos acoplado: soltar el brazo de reacción (8.31) y desatornillar el eje del emisor del eje del motor con la llave de boca ancho 10 (1LG4/6 boca ancho 13).

Desatornillar los tornillos de fijación (8.01).

Retirar por completo el electroimán (1.00). En caso dado soltar en el rectificador los cables de conexión del freno.

Sustituir el rotor con guarnición de fricción (2.00).

Efectuar el montaje en sentido inverso. Ajustar el entrehierro a la dimensión nominal.

Si existe palanca de apertura manual de freno, entonces reajustar la dimensión "s" según la figura 2a.

En motores con generador de impulsos: enroscar el eje del generador de impulsos en el eje del motor aplicando un par de **7 a 9 Nm**.

Para tolerancia con concentricidad permitida, ver instrucciones del emisor de impulsos.



INDICACION

Después de la reparación se tiene que y antes de la puesta en marcha se debe controlar la homogeneidad del entrehierro nominal en un estado sin corriente y usando un calibre sonda que se introduce entre el disco del rotor y la unidad magnética en 3 lugares de la periferia.

¡Al reponer en marcha se tiene que controlar si el freno funciona perfectamente!



ATTENZIONE



Tutte le operazioni di trasporto, collegamento, messa in servizio e manutenzione devono essere eseguite da **personale addestrato** (cfr. VDE 0105; IEC 364). La non osservanza di tali norme può **provocare gravi lesioni alle persone ed ingenti danni materiali**. Si raccomanda di rispettare i regolamenti nazionali e locali e di attenersi alle istruzioni relative all'impianto.



AVVERTENZE GENERALI

A completamento di queste istruzioni tecniche attenersi sempre alle norme di sicurezza e di messa in servizio, nonché alle istruzioni di impiego dei relativi motori.

1 Descrizione

1.1 Campo di impiego

Impiego conforme alla destinazione: i freni a disco a pressione di molle alimentati a corrente continua vengono impiegati per i motori trifase asincroni delle serie da 63 a 225L.

Il freno (freni a pressione di molle) non deve essere utilizzato in atmosfera aggressiva o esplosiva. In presenza di elevata umidità dell'aria o di basse temperature si dovrà provvedere con misure opportune in modo che il disco dell'ancora e il rotore non gelino (p. es. riscaldamento).

Per assicurare il funzionamento ineccepibile del freno a pressione di molle in ambienti polverosi, con pericolo di infiltrazione di acqua sporca o quando si deve evitare l'emissione della polvere di frizione, occorre prendere misure adeguate, p. es. con anello di protezione, anello di tenuta per alberi o coperchio.

Temperatura ambiente: -20° C ... 40° C

1.2 Costruzione e funzionamento (vedere Figura 3)

Si tratta di freni monodisco con due superfici di attrito.

Utilizzando più molle di pressione viene prodotto il momento frenante tramite attrito in assenza di corrente. L'apertura del freno viene effettuata con elettromagneti.

Durante la frenatura il rotore (2.00), che scorre assialmente sul mozzo (3.00), viene premuto sulla superficie di contrasto (8.22) mediante le molle di pressione (1.04) agenti sul disco dell'indotto (1.02).

Nello stato di frenatura, fra il disco dell'indotto (1.02) e il magnete (1.01) è presente un traferro d'aria s_{Lu} .

Per allentare il freno la bobina del magnete (1.01) viene eccitata con corrente continua. La forza magnetica che si produce attira il disco dell'indotto (1.02) vincendo le forze delle molle applicate sul magnete.

Il rotore pertanto non subisce più la forza elastica delle molle e ruota liberamente.

L'esecuzione con disinnesto meccanico manuale consente **l'allentamento del freno a motore fermo, che viene effettuato tirando la leva di disinnesto (6.00).**

1.3 Autorizzazione:



2 Utilizzazione



ATTENZIONE



Tutti i lavori sull'impianto devono essere effettuati in assenza di tensione !

2.1 Collegamento elettrico

Eseguire il collegamento del motore con freno secondo lo schema indicato sulla scatola dei morsetti del motore. Per il collegamento del freno (esecuzione standard), vedere Figura 1.

Questo tipo di circuito non è idoneo per meccanismi di sollevamento.

Per tempi di innesto brevi occorre disinserire l'alimentazione del lato della corrente continua. Per la protezione della bobina e dei contatti, con la disinserzione del lato di corrente continua è opportuno collegare in parallelo un elemento antiscontilla (vedere Figura 1) (VDE 0580§2G).

Sblocco del freno con motore non alimentato

Disinserendo l'eccitazione del magnete è possibile sbloccare il freno a motore fermo. Sui morsetti del gruppo del raddrizzatore deve essere pertanto collegata l'opportuna tensione alternata (vedere targhetta dati del freno). Il freno rimane allentato fino a quando è applicata la tensione.

I raddrizzatori sono protetti all'ingresso e all'uscita dalle sovratensioni mediante varistori

Tensione e frequenza

raddrizzatori		
collegamento	230V ± 10% 50/60 Hz	400V ± 10% 50/60 Hz
bobine	205 V DC	180 V DC

Con frequenza pari a 60 Hz la tensione elettrica del freno non deve superare i limiti massimi ammessi!

24 V DC - il freno - collegamento scatola morsetti

2.2 Parametri di utilizzo (vedere Figura 4)

2.3 Modifica della coppia frenante (vedere Figura 2)

Il freno viene fornito con la coppia frenante già regolata.

E' possibile ridurre la coppia allentando verso l'esterno l'anello di regolazione con la chiave a denti fino al valore massimo corrispondente a "o₁". Con l'impegno dell'anello di regolazione la coppia di frenatura viene modificata come indicato in Figura 2. In tal modo è possibile ridurre la coppia di frenatura a "M_{brmin}". Una diminuzione del momento frenante tramite l'anello di regolazione prolunga il tempo di incidenza e riduce il tempo di ventilazione.

2.4 Numero di giri massimo ammesso

Per l'impiego come freno di stazionamento, il freno è dimensionato con **funzione di arresto di emergenza**

E' possibile impiegare il freno come freno di esercizio solo con sollecitazioni ridotte (Durata, vedi Manutenzione).

Rilevare alla **fig. 4** il numero di giri massimo.

Con la **funzione di arresto di emergenza** a temperature elevate (fino a 130° C) si dovrà calcolare un'usura maggiore.

3 Manutenzione

Per il normale impiego come freno di stazionamento, non è prevista una manutenzione.

Solo se impiegato come freno di esercizio in cui si svolge un lavoro di frizione, si dovrà controllare ad intervalli regolari il traferro "s_{Lü}" e, al più tardi, al raggiungimento del traferro max. "s_{Lü max.}", regolarlo in modo da raggiungere di nuovo il traferro nominale "s_{Lü Nenn}" (v. fig. 2).

La regolazione del traferro si effettua come segue:

Smontare la cuffia del ventilatore (8.85).

Allentare leggermente le viti di fissaggio (8.01), inserire le bussole di regolazione (1.07) nel magnete (1.01) utilizzando la chiave fissa e riserrare le viti di fissaggio.

Successivamente effettuare ancora un controllo del traferro.

Se è presente una leva di ventilazione manuale, regolare la misura „s“ secondo la figura 2a.



AVVERTENZA

Non applicare olio o grasso sulle superfici di contatto!

Sostituzione della pastiglia del freno

Quando la pastiglia è usurata si deve sostituire il rotore (2.00).

Per lo spessore minimo del rotore vedere Figura 2.

Smontaggio/montaggio (vedere la figura 3)

Se è presente una ventilazione meccanica ad azionamento manuale, svitare e rimuovere la leva di ventilazione manuale prima di aprire il coperchio.

Smontare la cuffia del ventilatore (8.85).

Estrarre la rondella di sicurezza del ventilatore ed estrarre il ventilatore (non è previsto per motori a ventilazione esterna). Nelle costruzioni con datore di impulsi: allentare i supporti del misuratore del braccio di reazione (8.31) e svitare l'albero del datore con la chiave fissa Ch 10 (1LG4/6 Ch13) dall'albero del motore.

Svitare le viti di fissaggio (8.01).

Estrarre completamente il magnete (1.00). Eventualmente allentare il cavo di collegamento del freno sul raddrizzatore.

Sostituire il rotore con la relativa pastiglia (2.00).

Il montaggio avviene nella sequenza inversa. Impostare il traferro al valore nominale.

Se è presente una leva di ventilazione manuale, regolare la misura "s" secondo la figura 2a.

Nei motori con trasduttore a impulsi: avvitare l'alberino del trasduttore nell'albero motore per **7...9 Nm**

Eccentricità ammessa: vedere il manuale operativo del trasduttore.



INDICACION

Prima della messa in esercizio e dopo operazioni di manutenzione si deve controllare la regolarità del traferro nominale, senza tensione, tra disco ancora ed elemento magnete su 3 punti della circonferenza, impiegando uno spessimetro.

Quando si rimette in funzione il motore verificare prima il funzionamento ineccepibile del freno!

⚠ VARNING	
	Allt arbete i samband med transport, anslutning, idrifttagning och regelbundet underhåll måste utföras av kvalificerade, ansvariga yrkesmän (VDE 0150; IEC 364). Osakkunnig hantering kan medföra svåra person- och materialskador . Uppmärksamma gällande svenska, lokala och anläggningspecifika bestämmelser och krav .
⚠ ALLMÄNNA ANVISNINGAR	
Iaktta förutom denna anvisning alltid anvisningarna för säkerhet och idrifttagande resp. driftsanvisningen för de tillhörande motorerna.	

1 Beskrivning

1.1 Användningsområde

Föreskriven användning: De fjädermanövrerade, likströmsmagnetiserade skivbromsarna är avsedda för trefasasynkronmotorer storlek 63 till 225L.

Bromsen (fjäderkraftbroms) får inte användas på ställen där det finns risk för explosion eller i aggressiv atmosfär. Om man har hög luftfuktighet och låga temperaturer måste lämpliga åtgärder vidtas som förhindrar att ankarskivan och rotorn fryser fast (t ex med hjälp av ett värmeaggregat).

För att säkerställa fjäderkraftbromsens fullgoda funktion även om fjäderkraftbromsen används i dammig miljö, där det finns risk att smutsvatten kan tränga in eller om man vill förhindra att friktionsdamm sprids måste lämpliga åtgärder vidtas t ex genom att montera en skyddsring, en axeltätningssring eller ett skyddslock.

Omgivningstemperatur: -20° C till 40° C

1.2 Konstruktion och arbetsätt (se fig. 3)

Det är enskivsbromsar med två friktionsytor. Bromsmomentet alstras i strömlöst tillstånd genom att friktionen upphör orsakat av flera tryckfjädrar. Bromsen lossas elektromagnetiskt.

Vid bromsning trycks den på navet (3.00) axialt förskjutbara rotorn (2.00) genom tryckfjädrarna (1.04) över ankarskivan (1.02) mot den andra friktionsytan (8.22).

I bromstillstånd finns mellan ankarskivan (1.02) och magnetdelen (1.01) luftgapet s_{Lu} .

För att lufta bromsens magnetiserar magnetdelens (1.01) spole med likström. Den uppkomna magnetkraften drar ankarskivan (1.02) till magnetdelen mot fjäderkraften. Rotorn är därmed avlastad från fjäderkraften och kan rotera fritt.

Utförandet med **mekanisk handluftning** gör att bromsen kan luftas när motorn står stilla genom att dra i luftningsspaken (6.00).

1.3 Behörighet:



2 Drift

⚠ VARNING	
	Varning Genomför arbeten på anläggningen endast när denna ej står under elektrisk spänning!

2.1 Elektrisk anslutning

Anslut bromsmotorn enligt kopplingsdiagrammet i motorns uttagsslåda. Anslutning av bromsen (standardutförande) se fig. 1.

Motorerna har de vanliga effektskytarna och erhåller på den sida som ligger mittemot motorn en skylt till med bromsdata.

Växelspänningen för bromsens magnetledning ansluts till de båda lediga uttagen i likriktarblocket (~) (se fig. 1).

Snabbt infall hos bromsen

Skiljs bromsen från nätet sker bromsningen. Bromsskivans insfallstid fördröjs av magnetspolens induktivitet (frånkoppling på växelströmssidan). Härvid uppstår en kraftig infallsfördröjning.

Denna kopplingsmetod är inte lämplig för lyftdrifter.

För att uppnå korta infallstider måste likströmssidan kopplas från. För att skydda spole och kontakter skall, när likströmssidan kopplas från, en gnistsläckningskomponent (se fig. 1) kopplas parallellt (VDE 0580§26).

Luftning av bromsen vid avstängd motor

Genom åtskild magnetisering av magneten kan bromsen luftas när motorn står still. Här för måste motsvarande växelspänning (se

bromseffektskylt) anslutas till uttagen i likriktarblocket.

Bromsen förblir luftad så länge spänningen är tillkopplad.

Likriktarna är skyddade mot överspänning av varistorer vid in- och utgång.

Spänning och frekvens

spänningar		
inmonterade	230V ± 10% 50/60 Hz	400V ± 10% 50/60 Hz
Magnetspolarna	205 V DC	180 V DC

Vid 60 Hz får bromsens spänning inte höjas!

24 V DC - broms - inmonterade i uttagsslåda

2.2 Driftsvärden (se fig. 4)

2.3 Ändring av bromsmomentet (se fig. 2)

Bromsen levereras med inställt bromsmoment. En reducering genom att skruva ur inställningsringen med en haknyckel till max måttet " s_1 " är möjligt. För varje spår i inställningsringen ändrar sig bromsmomentet enligt fig. 2. Härigenom kan bromsmomentet reduceras till " $M_{Br, min}$ ".

En bromsmomentreducering via inställningsringen förlänger fränkopplingstiden och förkortar tillkopplingstiden.

2.4 Maximalt tillåtna varvtal

Bromsen är dimensionerad för användning som hållbroms med **Nöd-Stopp-funktion**.

En användning som driftbroms är möjlig om friktionen är liten (livslängd, se Underhåll). Max. varvtal, se fig. 4.

I samband med en **Nöd-Stopp-funktion** måste man räkna med högre temperaturen (upp till 130° C) och ökat slitage.

3 Underhåll

Om bromsen används normalt som hållbroms kräver den inget underhåll.

Om den emellertid används som driftbroms och utsätts för friktion måste luftspalten " s_{Lu} " kontrolleras i regelbundna intervaller. Om en max luftspalt " $s_{Lu, max}$ " uppnås måste luftspalten justeras så att man återigen får en nominell luftspalt " $s_{Lu, Nom}$ " (se fig. 2).

Efterinställning av luftgapet sker enligt följande:

Ta bort flätkåpan (8.85).

Lossa befästningsskruvarna (8.01) något, skruva in justerhylsorna (1.07) med en skruvnyckel i magnetdelen (1.01) och dra åter fast fästskruvarna.

I anslutning här till kontrolleras luftgapet än en gång.

När handluftningsspak finns efterjustera måttet " s " enligt Fig. 2a.

⚠ ANVISNING	
Friktionsytorna får inte komma i kontakt med olja eller fett!	

Utbyte av friktionsbeläggningen

Rotorn (2.00) måste bytas ut när friktionsbeläggningen är utsliten. Minsta rotorstyrka se fig. 2.

Isärtagning / ihopsättning (se fig. 3).

När mekanisk handluftning finns, skruva ut handluftningsspaken innan kåpan tas av.

Ta bort flätkåpan (8.85).

Ta bort fläktens säkringsring och dra av fläkten (bortfaller vid motorer med separat fläkt).

I kombination med pulsgivare: lossa vridmomentstödet (8.31) och skruva ur givaraxeln med skruvnyckel NV 10 (1LG4/6 NV 13) ur motoraxeln.

Skruva ur fästskruvarna (8.01)

Ta bort magnetdelen komplett (1.00). Lossa härför eventuell bromsanslutningen på likriktaren.


Byt rotor med friktionsbeläggning (2.00).

Montering i omvänd ordningsföljd. Ställ in luftspalten på nominellt mått.

När handluftningsspak finns efterjustera måttet " s " enligt Fig. 2a.

På motorer med pulsgivare: Skruva in givaraxeln med **7 till 9 Nm** i motoraxeln. Tillåten rotationstolerans se bruksanvisningen för givaren.

⚠ OBSERVERA	
Efter underhållsarbete måste och före idrifttagandet bör man i strömlöst tillstånd kontrollera att den nominella luftspalten är lika stor mellan ankarskivan och magnetdelen. Kontrollen ska ske med hjälp av ett slitmått på tre ställen på periferiytan. När motorn tas i drift igen måste man kontrollera att bromsen fungerar felfritt!	

⚠ POZOR	
	Všechny práce k přepravě, připojení a uvedení do provozu, jakož i pravidelnou údržbu smí provádět pouze kvalifikovaný, zodpovědný odborný personál (dodržovat VDE 0105, IEC 364). Neodborný postup může způsobit těžké škody na zdraví a věcné škody. Dodržovat platná národní, místní a pro zařízení specifická ustanovení a požadavky.

⚠ Všeobecné pokyny	
Kromě tohoto návodu vždy dbejte bezpečnostních pokynů a pokynů na uvedení do provozu event. návodu na uvedení do provozu příslušných motorů.	

1 Popis

1.1 Rozsah použití

Použití v souladu s ustanoveními:

Pružinou ovládané kotoučové brzdy se stejnosměrným buzením se používají pro trojfázové asynchronní motory osových výšek 63 až 225L. Brzda (pružinou ovládaná brzda) nesmí být provozována v prostředích s nebezpečím výbuchu nebo v agresivním prostředí. Při vysoké vlhkosti vzduchu a nízkých teplotách musejí být přijata vhodná opatření proti přimrznutí kotouče kotvy a rotoru (např. vyhřívání).

Aby byla zaručena bezpečná funkce pružinou ovládané brzdy, musí se, při použití v prašném prostředí, při možném vniknutí špinavé vody nebo když se má zabránit roznášení prachu z opotřebením otěrem, přijmout vhodná opatření, např. použití krycího kruhu, hřídelového těsnícího kroužku nebo uzavíracího víka.

Teplota okolí: - 20 °C až 40 °C

1.2 Konstrukce a způsob práce (viz obrázek 3)

Jedná se o jednokotoučové brzdy se dvěma třecími plochami. Několik tlačných pružin vyvíjí v bezproudovém stavu třecím brzdňý moment. Uvolnění brzdy je prováděno elektromagneticky.

Při brždění se rotor (2.00) axiálně posuvný po náboji (3.00) tlačnými pružinami (1.04) přitlačuje přes kotvu (1.02) na protilehlou třecí plochu (8.22).

V zabržděném stavu je mezi kotoučem kotvy (1.02) a magnetem (1.01) vzduchová mezera s_{Lu} .


K odbrždění brzdy se cívka magnetu (1.01) vybudí stejnosměrným napětím. Vznikající magnetická síla přitáhne kotouč kotvy (1.02) proti síle pružin k magnetické části.

Rotor je tak uvolněn od síly pružin a může se volně otáčet. Provedení s mechanickým ručním odbržděním umožňuje odbrždění brzdy v klidovém stavu motoru zatažením za odbrždovací páku (6.00).

1.3 Schválení:



2 Provoz

⚠ POZOR	
	Všechny práce musejí být prováděny v bezproudovém stavu zařízení.

2.1 Elektrické připojení

Provedte připojení brzdového motoru podle schématu zapojení v připojovací svorkovnici motoru (standardní provedení), viz obr. 1.

Motory mají běžné výkonnostní štítky a budou navíc na protilehlé straně motoru nebo na krytu ventilátoru opatřeny druhým výkonnostním štítkem s údaji brzdy.

Střídavé napětí pro budící vinutí brzdy je připojeno na obou volných svorkách bloku usměrňovače (~) (viz obr. 1).

Rychlá reakce brzdy

Dojde-li k oddělení brzdy od sítě, nastane brždění.

Doba reakce brzdy je zpožděna indukčností magnetické cívky (odpojení **na straně střídavého proudu**).

Přítom dochází k výraznému zbrždění reakce brzdy.

Tento druh zapojení není vhodný pro pohony zdvihadel.



Pro krátké časy reakce se musí vypínat na **straně stejnosměrného proudu**. K ochraně cívky a kontaktů je třeba při vypnutí na straně stejnosměrného proudu paralelně připojit zhášecí člen (viz obr. 1) (VDE 0580§26).

Odbrždění brzdy při vypnutí motoru

Díky samostatnému buzení magnetu je možné odbrzdit brzdu v klidovém stavu motoru. K tomu se musí na svorky bloku usměrňovače přivést odpovídající střídavé napětí (viz výkonnostní štítek brzdy). Brzda zůstává odbržděna tak dlouho, dokud je přiváděno napětí.

Usměrňovače jsou chráněny proti předpětí varistory na vstupu a výstupu.

Napětí a kmitočet

Usměrňovač		
Přípoj	230V ± 10% 50/60 Hz	400V ± 10% 50/60 Hz
Cívka elektromagnetu	205 V DC	180 V DC

Při 60 Hz nesmí být napětí brzdy zvýšeno!

24 VDC – brzda – přípoj ve skříní svorkovnice

2.2 Provozní hodnoty (viz obr. 4)

2.3 Změna brzdňého momentu (viz obr. 2)

Brzda se dodává s nastaveným momentem. Je možné jej snížit odšroubením nastavovacího kroužku pomocí hákového klíče až na max. „o₁“. Každé zapnutí nastavovacího kroužku znamená změnu brzdňého momentu dle obrázku 2. Takto se dá zmenšit brzdňý moment na „M_{Br min}“.

Snížení brzdícího momentu pomocí seřizovacího kroužku prodlužuje dobu dopadu a zkracuje dobu větrání.

2.4 Maximální přípustný počet otáček

Brzda je dimenzována pro použití jako brzda se zajištěním polohy s **funkcí nouzového zastavení**.

Použití jako provozní brzdy je možné při velmi nízkém tření (životnost, viz návod k obsluze).

Maximální počty otáček najdete na **obrázku 4**.

U **funkce nouzového zastavení** je třeba počítat se zvýšenými teplotami (do 130 °C) a větším opotřebením

3 Údržba

Pro normální případy použití jako brzda se zajištěním polohy nepotřebuje brzda údržbu.

Pouze v případech použití jako provozní brzdy, při nichž je třeba konat třecí práci, se v určitých časových intervalech musí kontrolovat vzduchová mezera „s_{Lu}“ a nejpozději při dosažení maximální vzduchové mezery „s_{Lu max}“ znovu nastavit na jmenovitou vzduchovou mezera „s_{Lu Nenn}“ (viz obrázek 2).

Dodatečné nastavení vzduchové mezery se provede následovně:

Sejměte kryt ventilátoru (8.85).

Poněkud uvolněte upevňovací šrouby (8.01), pomocí otevřeného klíče zašroubujte do magnetu (1.01) seřizovací pouzdra a upevňovací šrouby znovu dotáhněte.

Následně ještě jednou zkontrolujte vzduchovou mezeru.

Pokud je páka ručního větrání k dispozici, pak nastavit rozměr "s" podle obr. 2a.



Upozornění !

Třecí plochy nesmějí přijít do styku s olejem nebo tukem!

Výměna třecího obložení

Je-li třecí obložení opotřebeno, musí se vyměnit rotor (2.00). Minimální tloušťka rotoru viz obr. 2.

Demontáž/montáž (viz obr. 3)

Pokud je k dispozici mechanické větrání, páku ručního větrání před sejmutím krytu vyšroubovat.

Sejměte kryt ventilátoru (8.85).

Odstraňte pojistný kroužek ventilátoru a stáhněte ventilátor (odpadá u motorů s cizí ventilací).

U kombinací se snímačem impulzů: Uvolněte momentové rameno (8.31) a pomocí otevřeného klíče vyšroubojte hřídel snímače z hřídele motoru.

Vyšroubojte upevňovací šrouby (8.01).

Sejměte celou magnetovou část (1.00). Je-li to nutné, uvolněte případně připojovací vodiče brzdy na usměrňovači.

Vyměňte rotor s třecím obložением (2.00).

Montáž v opačném pořadí. Vzduchovou mezeru nastavit na jmenovitý rozměr.

Pokud je páka ručního větrání k dispozici, pak nastavit rozměr "s" podle obr. 2a.

U motorů se synchronizátorem: hřídel čidla zašroubovat do hřídele motoru se **7 až 9 Nm**.

Přípustná tolerance obvodového házení viz návod k provozu čidla.



Upozornění !

Po opravě se před uvedením do provozu musí ve vypnutém stavu (bez proudu) zkontrolovat rovnoměrnost vzduchové mezery mezi kotoučem kotvy a magnetovou částí na 3 místech pomocí spárové měrky.

Při opětovném uvedení motoru do provozu se musí přezkoušet bezchybná funkce brzdy!



ОСТОРОЖНО!



Все работы, связанные с транспортировкой, подключением для пуска в эксплуатацию, а также регулярное техническое обслуживание должны проводиться только квалифицированными, ответственными специалистами (соблюдать предписания VDE 0150, IEC 364). Ненадлежащее обращение может стать причиной тяжёлых несчастных случаев и материального ущерба. Следует придерживаться действующих национальных, местных и специфических для установок предписаний и требований.



Общие указания

Кроме этого руководства по эксплуатации необходимо всегда соблюдать также инструкции техники безопасности или руководство по эксплуатации соответствующих двигателей.

1 Описание

1.1 Область применения

Применение согласно назначению: Пружинные дисковые тормоза с возбуждением от постоянного тока применяются для асинхронных двигателей переменного тока от ВОВ 63 до ВОВ 225L. Пружинный тормоз не позволено применять во взрывоопасной или агрессивной атмосфере. В случае высокой влажности воздуха и низкой температуры необходимо принять подходящие меры против примерзания диска якоря и ротора (напр. нагревание).

Для гарантирования безопасного функционирования пружинного тормоза необходимо в случае применения в запыленном помещении, при возможности проникновения грязной воды или если нужно помешать распространению возникающей вследствие истирания тонкой пыли, принять подходящие меры, напр. установка защитного кольца, уплотнительного кольца у вала или запорной крышки. Температура окружающей среды: от -20° C до 40° C

1.2 Сборка и способ работы (см. рис. 3)

Описываемые тормоза имеют один диск и две фрикционные накладки. Одна или несколько пружин сжатия генерируют в бестоковом состоянии трением тормозной момент. Тормоз активируется при помощи электромагнита.

Во время процесса торможения пружины (1.04) толкают аксиально перемещаемый ротор (2.00) по заряду (3.00) через якорь (1.02) в направлении противоположной фрикционной накладки (8.22). В заторможенном состоянии находится между шкивом якоря (1.02) и магнитом (1.01) воздушный зазор s_{LB} .

Тормоз отпускается возбуждением катушки электромагнита (1.01) постоянным напряжением. Возникающая магнитная сила притягивает шкив якоря (1.02) против силы пружины к магниту. Благодаря этому ротор освобожден от силы пружины и может свободно вращаться.

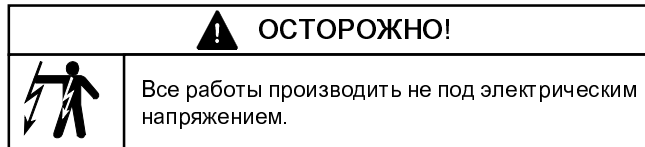
Исполнение с **механическим ручным растормаживанием** делает возможным отпуск тормоза в состоянии покоя двигателя, если потянуть рычаг растормаживания (6.00).

1.3 Аprobация:



или на покрытие

2 Эксплуатация



2.1 Электрическое присоединение

Тормозный двигатель присоединить согласно электрической схеме двигателя в клеммной коробке. Присоединение тормоза (стандартное исполнение) смотри рисунок 1.

На двигателях имеются стандартные щитки с номинальными данными, и вдобавок есть на противоположной стороне двигателя или на колпаке вентилятора еще один щиток с данными тормоза

К двум свободным клеммам выпрямителя (~) присоединить переменное напряжение для обмотки возбуждения тормоза (см. рис. 1).

Быстрое торможение

Если тормоз отключен от питающего напряжения, происходит торможение.

Длительность применения тормозного шкива замедляется индуктивностью катушки электромагнита (выключение на стороне **переменного тока**). При этом происходит сильное замедление применения тормоза.



Этот вид переключения не предназначен для привода подъема. Чтобы достичь более коротких длительностей применения, необходимо выключать на стороне постоянного тока. Рекомендуется защищать катушку и контакты во время выключения стороны постоянного тока с помощью параллельного включения искрогасительного устройства (VDE 0580§26, см. рис. 1).

Отпуск тормоза при выключенном двигателе

Благодаря отдельному возбуждению магнита можно отпустить тормоз в состоянии покоя двигателя. Для этого необходимо присоединить к клеммам выпрямителя подходящее переменное напряжение (см. щиток с номинальными данными тормоза). Тормоз остается отпущенным до тех пор, пока присоединено напряжение.

Выпрямители защищены от перенапряжения варисторами, подключенными к вводу и выводу.

Напряжение и частота

Выпрямитель		
Подключение	230V ± 10% 50/60 Hz	400V ± 10% 50/60 Hz
Магнитные катушки	205 V DC	180 V DC

При 60 Hz не позволено повышать напряжение для тормоза!
24 V DC – тормоз – подключение в распределительном шкафу

2.2 Эксплуатационные данные (см. рис. 4)

2.3 Изменение тормозного момента (см. рис. 2)

Тормоз поставляется с установленным моментом. Вывинтив регулировочный кружок при помощи крюкового ключа, его можно понизить максимально до „o₁“. Каждое заскакивание регулировочного кружка значит изменение тормозного момента (см. рис. 2). Этим образом можно понизить тормозной момент до „M_{Br min.}“.

Уменьшение момента торможения через кольцо настройки увеличивает время от момента отключения питания электромагнита тормоза до момента наложения тормоза и сокращает время отпущения тормоза.

2.4 Максимально допустимая скорость вращения

Размеры тормоза определены для применения в роде стопорного тормоза с функцией аварийной остановки.

Применение в роде рабочего тормоза возможно при маленьком трении (срок службы см. технический уход).

Максимальная скорость вращения см. рисунок 4.

В случае режима работы «аварийная остановка» надо рассчитывать на повышенную температуру (до 130° C) и более высокую степень истирания.

3 Технический уход

В случае нормального применения в родестопорного тормоза не нужен никакой технический уход за тормозом.

Лишь в случаях применения в качестве рабочего тормоза, когда возникает трение, необходимо с определенными интервалами проверять воздушный зазор „S_{LB}“ и наипоздее при достижении макс. воздушного зазора „S_{LB max.}“ нужно опять отрегулировать его на номинальный воздушный зазор „S_{LB Nenn}“ (см. рисунок 2).

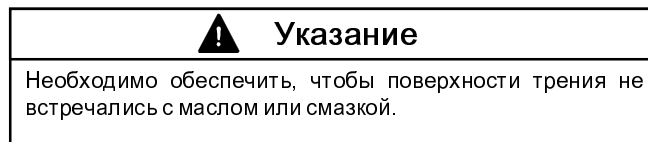
Воздушный зазор устанавливается следующим образом:

Снять покрытие вентилятора (8.85).

Чуть-чуть отпустить крепежные винты (8.01), при помощи ключа вывинтить в магнит (1.01) регулировочную втулку (1.07) и винты опять подтянуть.

После этого вновь проверить воздушный зазор.

Если имеется рычаг для ручного отпущения тормоза, то следует отъюстировать размер „s“ согласно рис. 2a.



Замена фрикционной накладки

Если фрикционная накладка изношенная, ротор (2.00) необходимо заменить. Мин. толщина ротора см. рис. 2.

Разборка/Сборка (см. рис. 3)

Если имеется рычаг для механического ручного отпущения тормоза, то перед снятием колпака следует вывинчивать рычаг. Снять покрытие вентилятора (8.85).

Устранить кружок для фиксирования вентилятора и снять вентилятор (этого не нужно при двигателях с внешними вентиляторами).

В сочетании с импульсным передатчиком: Отпустить плечо момента (8.31) и при помощи ключа SW 10 вывинтить вал импульсного передатчика из вала электродвигателя.

Отпустить крепежные винты (8.01).

Отпустить целую магнитную часть (1.00). В случае надобности ослабить кабельное присоединение тормоза на выпрямителе.

Заменить ротор с фрикционной накладкой (2.00).

Монтаж в обратном порядке. Настроить номинальный размер воздушного зазора.

Если имеется рычаг для ручного отпущения тормоза, то следует отъюстировать размер „s“ согласно рис. 2a.

Для двигателей с импульсным датчиком: Ввинтить вал датчика в вал двигателя с моментом вращения 7 – 9 Нм.

Допустимое радиальное биение датчика указано в Инструкции по эксплуатации датчика

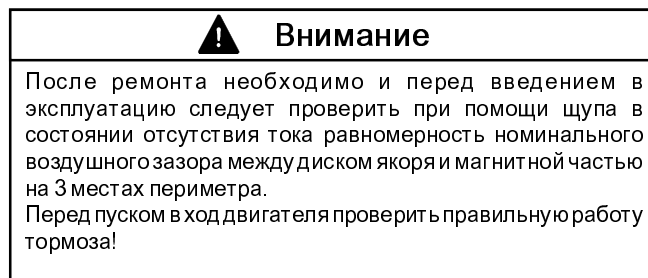
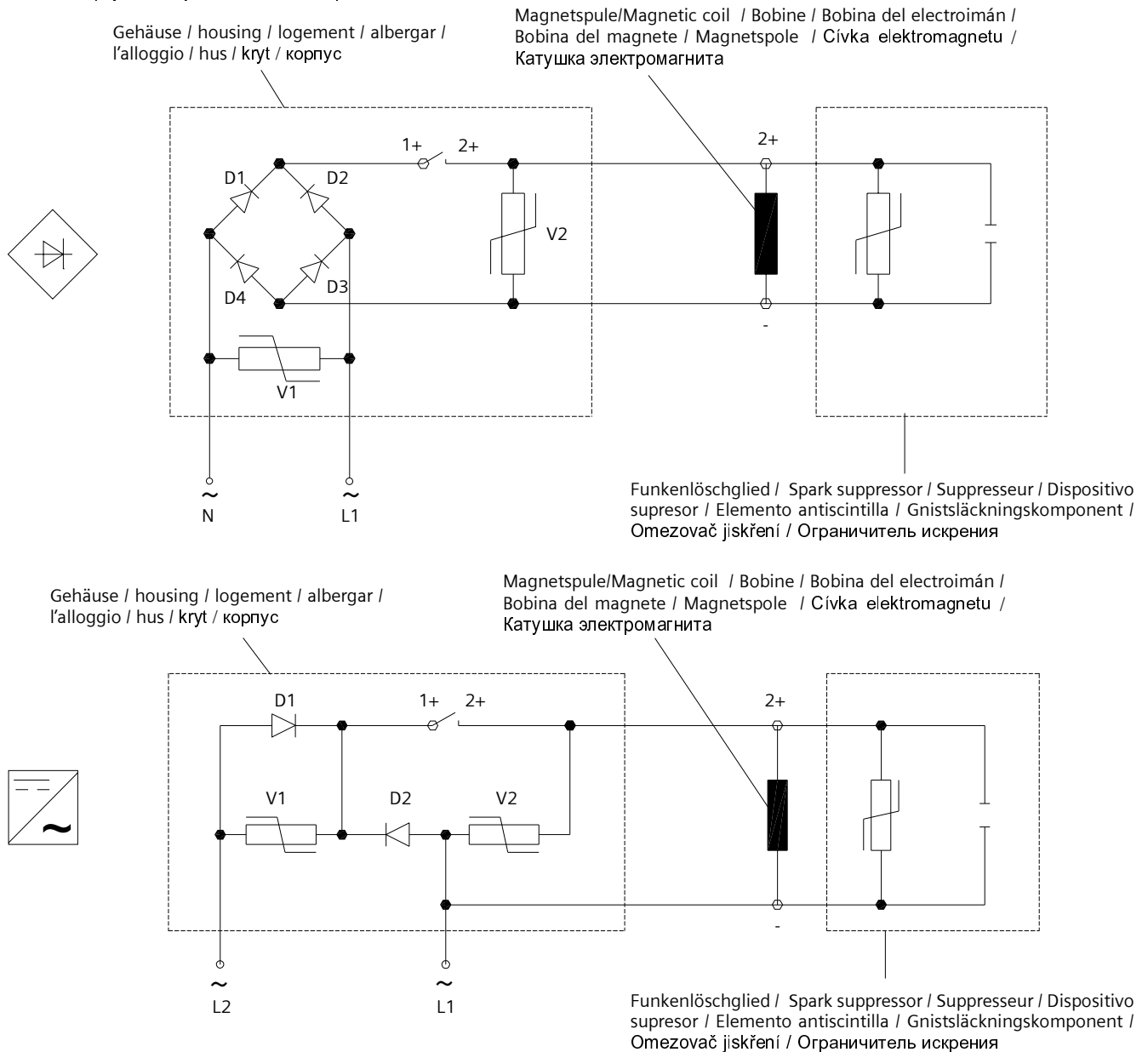


Fig. 1 Schaltung der Bremse / Brake circuit / Commande du frein / Circuito del freno / Collegamento del freno / Koppling av bromsen / Zapojení brzd / Соединение тормоза



Für kurze Einfallzeiten nach Fig. 4 muß gleichstromseitig abgeschaltet werden. Hierzu wird die am Gleichrichter zwischen den Kontakten 1+ und 2+ angebrachte Drahtbrücke entfernt und durch die Kontakte eines externen Schalters ersetzt (vgl. Schaltbilder). Zum Schutz der Spule und Kontakte sollte bei gleichstromseitigem Abschalten parallel ein Funkenlöschglied geschaltet werden.

The direct-current side must be switched off to achieve short application times in conformity with fig. 4. For this purpose the wire jumper between contacts 1+ and 2+ on the rectifier must be removed and replaced with an external switch (see circuit diagrams). To protect the coil and contacts, a spark-quenching device should be switched in parallel with direct-current side switch-off.

Pour les temps de réaction courts selon l'illustration 4, déconnecter du côté du courant continu. Enlever à cet effet les fils de liaison placés au redresseur de courant entre les contacts 1+ et 2+ et remplacer par les contacts d'un commutateur externe (compare schémas des connexions). Pour protéger la bobine et les contacts, il est bon de mettre en circuit parallèlement un souffleur d'étincelles pour la déconnexion du côté du courant continu.

Para tiempos cortos de cierre según la Fig. 4, se tiene que desconectar por el lado de CC. Para este fin se quita el puente de alambre instalado en el rectificador entre los contactos 1+ y 2+ y se sustituyen por contactos de un interruptor externo (compárese con los esquemas de conexiones). Para proteger la bobina y los contactos, en la desconexión por el lado de CC se tiene que conectar paralelamente un elemento apagachispas (supresor).

Per brevi tempi di reazione come da fig. 4, si deve spegnere sul lato della corrente uniforme. Allo scopo, i jumper applicati sul raddrizzatore devono essere tolti e sostituiti con i contatti di un interruttore esterno (cfr. schema di circuito). Per proteggere la bobina ed i contatti, spegnendo sul lato della corrente uniforme, si dovrebbe inserire parallelamente un elemento di soppressione delle scintille.

För korta reaktionstider enligt fig 4 måste frånkoppling ske på likströmssidan. För att iordningställa denna frånkoppling tar man bort den på likriktaren mellan kontaktarna 1+ och 2+ installerade trådbryggen och byter ut den mot kontaktarna på en extern brytare (jmf kopplingsbilderna). För att skydda spolen och kontaktarna bör man parallellt med frånkopplingen på likströmssidan tillkoppla en gnistsläckningsdetalj.

Pro krátké časy zareagování podle obr. 4 se musí vypínat na straně stejnosměrného proudu. K tomu se odstraní drátový můstek umístěný na usměrňovači mezi kontakty 1+ a 2+ a nahradí se kontakty externího spínače (porovnej schéma zapojení). K ochranně cívky a kontaktů se při vypnutí na straně stejnosměrného proudu musí paralelně připojit zhasíací člen.

Чтобы сократить время включения тормоза согласно рис. 4, необходимо отключить постоянный ток. Для этого нужно устранить проволочный мостик прикрепленный на выпрямителе между контактами 1+ и 2+ и заменить его контактами внешнего выключателя (см. электрические схемы).

Для охраны катушки и контактов рекомендуется при отключении постоянного тока параллельно включить дугоасительное устройство.

Bremstyp Brake type Type Tipo de freno Bromstyp Typ brzdy Тип тормоза	Reduzierung pro Rasterung Reduction per notch Réduction par cran Reducción por muesca Riduzione per tacca Reducering per raster Редукция на 1 вруб Редукция на 1 защелку	Maß max Dimension Max. Cote max. Dimensiones máx. Dimensione max. Max. Rozměr Макс. Размер	min Bremsmoment Min. braking torque Couple de freinage min. Par (torque) de frenado min. Coppia min. frenatura min min broms-moment Min. brzdny moment Мин. тормозной момент	Nennluftspalt Nominal air-gap Entrefer nominal Entrehierro nominal Traferro nominale nominell luftgap J m e n o v i t á vzduchová mežera Н о м и н а л ь н ы й воздушный зазор	max. Luftspalt Max. air-gap Entrefer max. Entrehierro máx. Traferro max. max luftgap Max. vzduchová mežera Макс. воздушный зазор	min. Rotorstärke Min. rotor width Epaisseur min. Espesor min. del rotor Spessore min. rotore min rotorstyrka Min. tloušťka rotoru Мин. толщина ротора
		o_1	$M_{Br\ min.}$	$s_{Lü\ Nenn}$	$s_{Lü\ max.}$	$h_{min.}$
2LM8 005	0,17 Nm	7,0 mm	3,7 Nm	0,2 mm	0,4 mm	4,5 mm
2LM8 010	0,35 Nm	8,0 mm	7,0 Nm	0,2 mm	0,45 mm	5,5 mm
2LM8 020	0,76 Nm	7,5 mm	18,2 Nm	0,2 mm	0,55 mm	7,5 mm
2LM8 040	1,29 Nm	12,5 mm	21,3 Nm	0,3 mm	0,65 mm	8,0 mm
2LM8 060	1,66 Nm	11,0 mm	32,8 Nm	0,3 mm	0,75 mm	7,5 mm
2LM8 100	1,55 Nm	13,0 mm	61,1 Nm	0,3 mm	0,75 mm	8,0 mm
2LM8 260	5,6 Nm	17,0 mm	157,5 Nm	0,4 mm	1,2 mm	12,0 mm
2LM8 315	5,6 Nm	17,0 mm	178,4 Nm	0,4 mm	1,0 mm	12,0 mm
2LM8 400	6,15 Nm	21,0 mm	248,7 Nm	0,5 mm	1,5 mm	15,5 mm

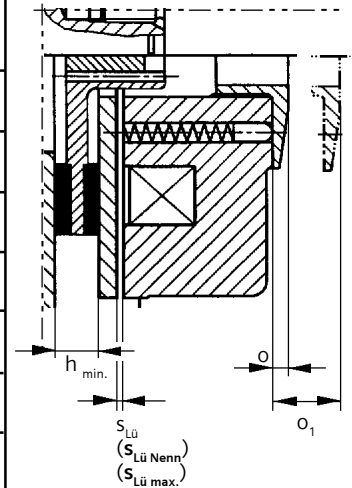
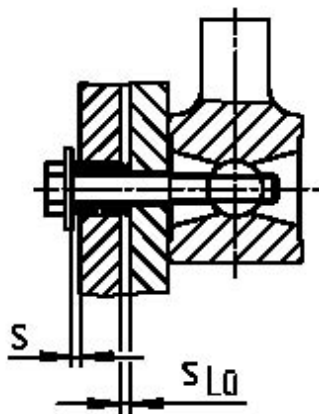


Fig. 2 Änderung des Bremsmomentes / Adjusting the braking torque / Modification du couple de freinage
Modificación del par (torque) de frenado / Variazione della coppia frenante / Ändring av bromsmomentet /
Změna brzdného momentu / Изменение тормозного момента



Größe Size Cote Dimensión Dimensioni Storhet Velikost Размер	$s_{Lü}$ (mm)	$s^{+0,1}$ (mm)	$s + s_{Lü}$ (mm)
06	0,2	1	1,2
08			
10			
12	0,3	1,5	1,8
14			
16			
18	0,4	2	2,4
20			
25	0,5	2,5	3

Fig. 2a

⚠ ACHTUNG / WARNING / AVERTISSEMENT / ATENCIÓN / AVVERTENZA / VIKTIGT / POZOR / ВНИМАНИЕ!

Maß „s“ muß eingehalten werden! - Luftspalt „ $s_{Lü}$ “ überprüfen!
 The dimension „s“ must be adhered to! Check air gap „ $s_{Lü}$ “.
 La cote „s“ doit être respectée - Vérifier l'interstice „ $s_{Lü}$ “.
 ¡La dimensión „s“ debe respetarse imprescindiblemente! ¡Comprobar el entrehierro „ $s_{Lü}$ “!
 La misura „s“ deve essere rispettata! - Verificare il traferro „ $s_{Lü}$ “!
 Måttet „s“ måste respekteras! - Kontrollera luftspalten „ $s_{Lü}$ “!
 Rozměr „s“ musí být dodržen - vzduchovou mezeru „ $s_{Lü}$ “ překontrolovat!
 Следует соблюдать размер „s“! Проверить воздушный зазор „ $s_{Lü}$ “!

DE DEUTSCH

Lieferbare Ersatzteile *):

- 1.00 Magnetteil komplett *)**
- 1.02 Ankerscheibe
- 1.03 Druckstück
- 1.04 Druckfeder
- 1.05 Einstellring
- 1.07 Hülse
- 2.00 Rotor komplett *)**
- 3.00 Nabe
- 6.00 Handlüftung, komplett *)**

- 7.00 Fremdbelüftung**
- 7.12 Lüfter
- 7.41 Haltewinkel
- 7.58 Klemmenkasten

- 8.00 Federkraftbremse
- 8.20 Wellenverlängerung
- 8.22 Gegenreibfläche

- 8.30 Impulsgeber
- 8.31 Drehmomentstütze
- 8.85 Lüfterhaube

Ersatzteile sind über den Vertrieb bei den jeweiligen Produktionsstätten zu bestellen.

- E Bad Neustadt / D
- UD Mohelnice / Cz
- UC Frenstat / Cz

Bestellbeispiel:

Motor 1LA....
 No E0109 / 123456 02 001
2LM8 040-5NL10
1.00 Magnetteil komplett
 205 V 40 Nm
 8.85 Lüfterhaube

HINWEIS: Die Angaben auf dem Zusatzleistungsschild (2LM8 ...) sind bei Ersatzteilbestellung immer mit anzugeben!

EN ENGLISH

Available spare parts *):

- 1.00 Magnetic section (complete) *)**
- 1.02 Armature disk
- 1.03 Clamping member
- 1.04 Preloading spring
- 1.05 Adjustment ring
- 1.07 Bush
- 2.00 Rotor (complete) *)**
- 3.00 Hub
- 6.00 Manual release unit (complete) *)**

- 7.00 External fan**
- 7.12 Fan
- 7.41 Bracket
- 7.58 Terminal box

- 8.00 Spring-operated brake**
- 8.20 Shaft extension
- 8.22 Opposing friction surface

- 8.30 Pulse transmitter
- 8.31 Torque arm
- 8.85 Fan cover

Spare parts can be ordered from the Sales departments of the particular production sites.

- E Bad Neustadt / D
- UD Mohelnice / CZ
- UC Frenstat / CZ

Ordering example:

Motor 1LA....
 No E0109 / 123456 02 001
2LM8 040-5NL10
1.00 Magnetic section (complete)
 205 V 40 Nm
 8.85 Fan cover

NOTE: On ordering spare parts, the information on the additional rating plate (2LM8 ...) must always be specified!

FR FRANÇAIS

Disponible pièces détachées:

- 1.00 culasse magnétique, complète *)**
- 1.02 disque d'armature
- 1.03 pièce de pression
- 1.04 ressort de pression
- 1.05 anneau de réglage
- 1.07 douille d'ajustage
- 2.00 disque de freinage, complet *)**
- 3.00 moyeu
- 6.00 desserrage manuel, complet *)**

- 7.00 motoventilateur**
- 7.12 ventilateur
- 7.41 coude de fixation
- 7.58 boîte à bornes

- 8.00 frein**
- 8.20 prolongement d'arbre
- 8.22 face de friction

- 8.30 générateur d'impulsions
- 8.31 étrier d'immobilisation en rotation
- 8.85 capot de ventilateur

Les pièces de rechange doivent être commandées auprès du service de vente des lieux de production respectifs.

- E Bad Neustadt / D
- UD Mohelnice / Cz
- UC Frenstat / Cz

Exemple de commande :

Moteur 1LA....
 No E0109 / 123456 02 001
2LM8 040-5NL10
1.00 culasse magnétique, complète
 205 V 40 Nm
 8.85 capot de ventilateur

NOTA : à la commande de pièces de rechange, reprendre les indications de la plaque signalétique additionnelle (2LM8 ...).

Normteile sind nach Abmessung, Werkstoff und Oberfläche im freien Handel zu beziehen.

Standard commercially available parts are to be purchased in accordance with the specified dimensions, material and surface finish.

Les **pièces normalisées** peuvent être obtenues dans le commerce d'après leur dimensions, le matériau et l'état de surface.

Disponible repuestos *):

- 1.00 Electroimán completo *)**
- 1.02 Disco del inducido
- 1.03 Pieza de presión
- 1.04 Resorte de presión
- 1.05 Anillo de ajuste
- 1.07 Casquillo
- 2.00 Rotor completo *)**
- 3.00 Cubo
- 6.00 Palanca de apertura manual, completa *)**

- 7.00 Ventilador independiente**
- 7.12 Ventilador
- 7.41 Escuadra de retención
- 7.58 Caja de bornes

- 8.00 Freno de disco de resorte**
- 8.20 Prolongación del eje
- 8.22 Guarnición de fricción

- 8.30 Emisor de impulsos
- 8.31 Brazo de reacción
- 8.85 Caperuza del ventilador

Disponibile pezzi di ricambio *):

- 1.00 Magnete completo *)**
- 1.02 Disco dell'indotto
- 1.03 Elemento di pressione
- 1.04 Molla di pressione
- 1.05 Anello di regolazione
- 1.07 Bussola
- 2.00 Rotore completo *)**
- 3.00 Mozzo
- 6.00 Sblocco manuale completo *)**

- 7.00 Ventilatore esterno**
- 7.12 Ventilatore
- 7.41 Squadra di sostegno
- 7.68 Scatola morsetti

- 8.00 Freno con molle di innesto**
- 8.20 Prolunga albero
- 8.22 Superficie di attrito di contrasto

- 8.30 Datore di impulsi
- 8.31 Braccio di reazione
- 8.85 Cuffia del ventilatore

Rekvireras reservdelar *):

- 1.00 magnetdel komplett *)**
- 1.02 ankarskiva
- 1.03 tryckstycke
- 1.04 tryckfjäder
- 1.05 inställningsring
- 1.07 hylsa
- 2.00 rotor komplett *)**
- 3.00 nav
- 6.00 handluftning, komplett *)**

- 7.00 separat fläkt**
- 7.12 fläkt
- 7.41 Fästvinkel
- 7.68 uttagslåda

- 8.00 fjäderbroms**
- 8.20 axelförlängning
- 8.22 friktionsyta (mittemot)

- 8.30 pulsgivare
- 8.31 vridmomentstöd
- 8.85 fläktkåpa

Los recambios se piden a través de la distribución de las plantas de producción respectivas.

- E Bad Neustadt / D
- UD Mohelnice / Cz
- UC Frenstat / Cz

I pezzi di ricambio vanno ordinati presso i centri di distribuzione dei rispettivi stabilimenti di produzione.

- E Bad Neustadt / D
- UD Mohelnice / Cz
- UC Frenstat / Cz

Reservdelar ska beställas på respektive fabriks distributionsavdelning.

- E Bad Neustadt / D
- UD Mohelnice / Cz
- UC Frenstat / Cz

Ejemplo de pedido:

Motores 1LA....
 No E0109 / 123456 02 001
2LM8 040-5NL10
1.00 Electroimán completo
 205 V 40 Nm
 8.85 Caperuza del ventilador

INDICACION: Hande indicarse siempre los datos de la placa adicional (**2LM8 ...**) al pedir piezas de repuesto

Esempio di ordinazione:

Motori 1LA....
 No E0109 / 123456 02 001
2LM8 040-5NL10
1.00 Magnete completo
 205 V 40 Nm
 8.85 Cuffia del ventilatore

AVVERTENZA: Per l'ordinazione dei pezzi di ricambio indicare sempre i dati riportati sulla targhetta aggiuntiva (**2LM8 ...**)!

Beställningsexempel:

Motorerna 1LA....
 No E0109 / 123456 02 001
2LM8 040-5NL10
 1.00 magnetdel komplett
 205 V 40 Nm
 8.85 fläktkåpa

ANVISNING: Ange alltid uppgiftera på den extra effektskytlen (**2LM8 ...**) vid beställning av reservdelar!

Las **piezas estándar** se comprarán en comercios del ramo según las dimensiones, material y superficie especificados.

Le **parti standard** sono reperibili sul mercato secondo le dimensioni, il materiale e la finitura della superficie.

Normerade detaljer kan erhållas i öppna handelen, och skall specificeras beträffande storlek, material och ytbehandling.

CS

Český

K dodání jsou náhradní díly *):

1.00	Magnetová část komplet *)
1.02	Kotouč kotvy
1.03	Svěrka
1.04	Tlačná pružina
1.05	Nastavovací kroužek
1.07	Pouzdro
2.00	Rotor komplet *)
3.00	Náboj
6.00	Ruční odbrzdění komplet *)
7.00	Cizí ventilátor
7.12	Ventilátor
7.41	Přidržovací úhelník
7.58	Svorkovnicová skříň
8.00	Pružinová brzda
8.20	Prodloužení hřídele
8.22	Protilehlá třecí plocha
8.30	Vysílač impulsů
8.31	Momentové rameno
8.85	Kryt ventilátoru

Náhradní díly je třeba objednat přes odbyt u příslušných výrobních závodů.

E Bad Neustadt / D
UD Mohelnice / CZ
UC Frenštát / CZ

Příklad objednávky:
Motor 1LA...
No E0109 / 123456 02 001
2LM8 040-5NL10
1.00 Magnetová část komplet *)
205 V 40 Nm
8.85 Kryt ventilátoru

Upozornění: Při objednávání náhradních dílů vždy uvádějte údaje z přídatného výkonového štítku (**2LM8 ...**)

Normované díly se nakupují podle rozměru, materiálu a povrchu volně v obchodě.

RU

русский

Поставляемые запчасти *):

1.00	Магнитная часть *)
1.02	Шкив якоря
1.03	Зажим
1.04	Пружина сжатия
1.05	Регулировочный кружок
1.07	Втулка
2.00	Ротор часть *)
3.00	Ступица
6.00	Ручной отпуск тормоза часть *)
7.00	Посторонний вентилятор
7.12	Вентилятор
7.41	Прижим
7.58	Клеммная коробка
8.00	Пружинный тормоз
8.20	Удлинение вала
8.22	Противоположная поверхность трения
8.30	Импульсный передатчик
8.31	Плечо момента
8.85	Покрытие вентилятора

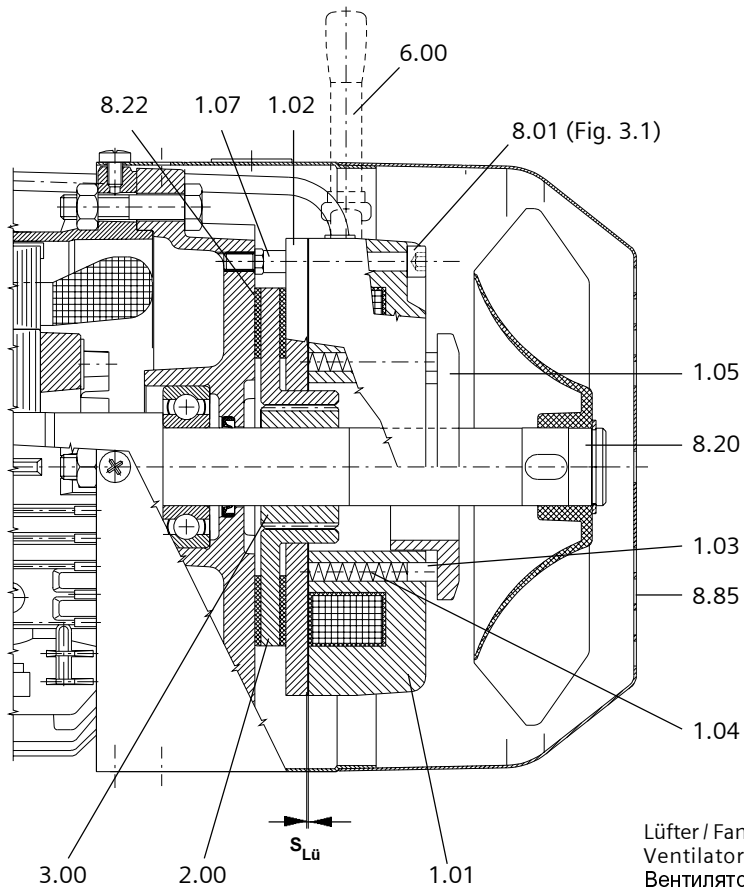
Заказы на запасные части принимают отделения продажи соответствующих производственных заводов.

E Бад Нейштадт / Германия
UD Мохельнице / Чехия
UC Френштат / Чехия

Пример заказа:
Двигатель 1LA...
No E0109 / 123456 02 001
2LM8 040-5NL10
1.00 Магнитная часть *)
205 V 40 Nm
8.85 Покрытие вентилятора

Указание: В случае заказа запчастей всегда указывать данные из дополнительного щитка с номинальными данными (**2LM8 ...**)

Стандартные детали соответственных размеров, материала и поверхности нужно приобрести в свободной торговле.



Lüfter / Fan / Ventilateur / Ventilador / Ventilatore / Fläkt / Ventilátor / Вентилятор

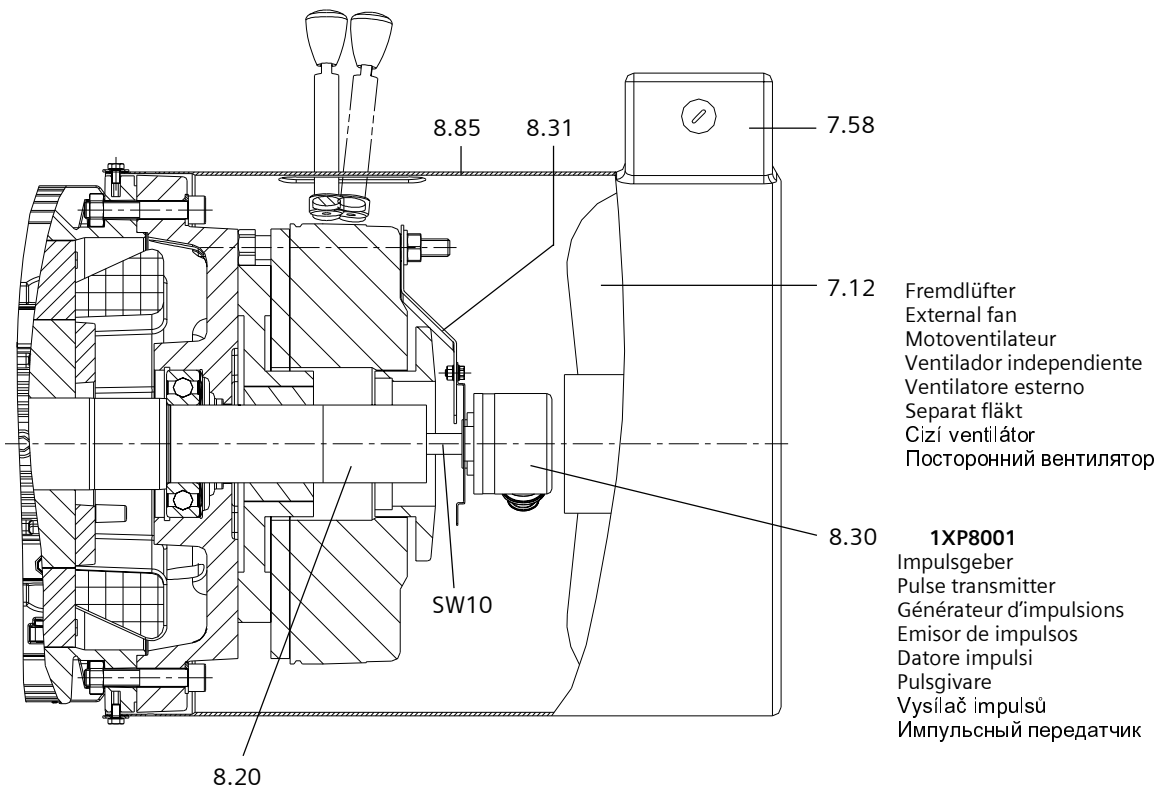


Fig. 3 1LA ...

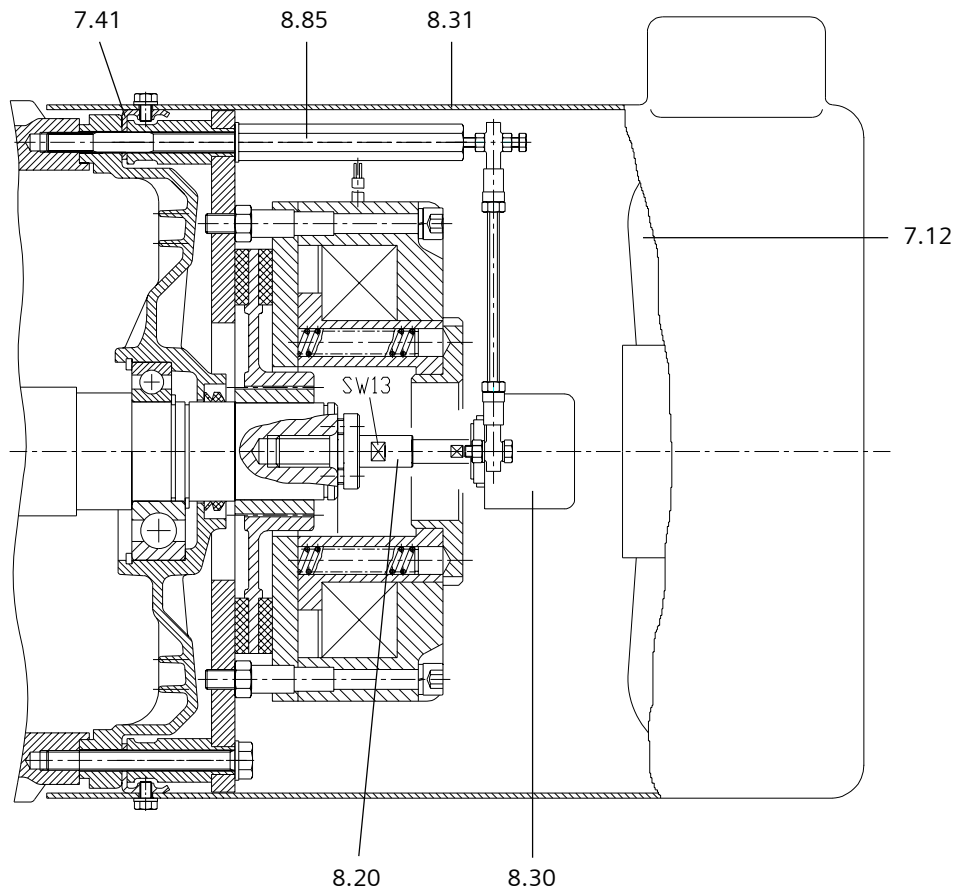


Fig. 3 1LG4/6

Bremsentyp Brake type Type du frein Tipo de freno Tipo di freno Bromstyp Typ brzdý Тип тормоза	DIN EN ISO 4762 (DIN 6912) Schraube (8.01) Bolt (8.01) Vis (8.01) Tornillo (8.01) Vite (8.01) Skruv (8.01) šroub (8.01) винта (8.01)	Anziehdrehmoment Schraube (8.01) Tightening torque bolt (8.01) Couple de serrage vis (8.01) Par de apriete tornillo (8.01) Coppia di serraggio vite (8.01) Ådragningsmoment skruv (8.01) Utahovací moment šroub (8.01) Момент затяжки винта (8.01)
		Nm
2LM8 002-1NA10	3 x M4	2,8
2LM8 005-2NA10	3 x M4	2,8
2LM8 010-3NA10	3 x M5	5,5
2LM8 020-4NA10	3 x M6	9,5
2LM8 040-5NA10	3 x M6	9,5
2LM8 060-6NA10	3 x M8	23
2LM8 100-7NA10	3 x M8	23
2LM8 260-8NA10	6 x M10	46
2LM8 315-0NA10	6 x M10	46
2LM8 400-0NA10	6 x M10	46

Fig. 3.1

Achshöhe Shaft height Hauteur d'axe Altura eje Altezza asse Axelhöjd Osová výška BOB	Bremsentyp Brake type Type du frein Tipo de freno Tipo freno Bromstyp Typ brzdy Тип тормоза	Größe (Fa. Lenze) Size (Lenze) Taille (Sté. Lenze) Tamaño (marca Lenze) Grandezza (Ditta Lenze) Storlek (Fa Lenze) Velikost (firma Lenze) Размер (фирма Lenze)	Bremsmoment bei Brake torque at Couple de freinage sous Par de frenado hasta Momento frenante a Bromsmoment vid Brzdny moment při Тормозной момент при	Reduziertes Bremsmoment bei Drehzahl Reduced brake torque by r.p.m. Réduit couple de freinage à la vitesse Reducido par (torque) de frenado por velocidad Ridotto momento frenante da numero di giri Redusert Bromsmoment varvtal Redukovaný točivý brzdny moment při počtu otáček Пониженный тормозной крутящий момент при частоте вращения	max. zul. Betriebsdrehzahl max. operatin RPM vitesse max. admissible en service velocidad máx. adm. de servicio max. numero di giri di rotazione max tillåtet driftsvarvtal Max. príp. pracovni otáčky Макс. допустимая рабочая частота вращения	
			100 min ⁻¹	1500 min ⁻¹	3000 min ⁻¹	max.
63	2LM8 005-1NA10	06	5 Nm	87%	80%	65%
71	2LM8 005-2NA10	06	5 Nm	87%	80%	
80	2LM8 010-3NA10	08	10 Nm	85%	78%	
90	2LM8 020-4NA10	10	20 Nm	83%	76%	
100	2LM8 040-5NA10	12	40 Nm	81%	74%	
112	2LM8 060-6NA10	14	60 Nm	80%	73%	
132	2LM8 100-7NA10	16	100 Nm	79%	72%	
160	2LM8 260-8NA10	20	260 Nm	75%	68%	1500 min ⁻¹
180	2LM8 315-0NA10	20	315 Nm	75%	68%	
200	2LM8 400-0NA10	25	400 Nm	73%	68%	

Achshöhe Shaft height Hauteur d'axe Altura eje Altezza asse Axelhöjd Osová výška BOB	Bremsentyp Brake type Type du frein Tipo de freno Tipo freno Bromstyp Typ brzdy Тип тормоза	max. zul. Leerlaufdrehzahl mit Not-Stop-Funktion max. no-load RPM incl. emergency stop vitesse à vide max. admissible pour arrêt d'urgence velocidad máx. adm. de giro sin carga, incl. parada de emergencia max. numero di giri a vuoto con arresto di emergenza max tillåtet tomgångsvarvtal med nödstoppfunktion Max. přípustné otáčky v chodu naprázdno s pouzovou stopkou Макс. допустимое число холостых оборотов с аварийным остановом	Leistungsaufnahme bei Power consumption at Puissance absorbée à Consumo a Assorbimento di potenza a Effektförbrukning vid Přikon při Потребляемая мощность при	Einfallzeit der Bremse ¹⁾ Brake applicatio time ¹⁾ Temps de serrage ¹⁾ Tiempo de cierre del freno ¹⁾ Tempo applicazione freno ¹⁾ Bromsens infalltid ¹⁾ Doba brzdění ¹⁾ Длительность торможения ¹⁾	Lüftzeit der Bremse Brake realease time Temps de desserrage Tiempo de apertura del freno Tempo sblocco freno Bromsens luftningstid Doba uvolnění brzdy Длительность отпуска тормоза	Schaltgeräusch Soundpreassure level Emission acoustique Nivel de presión acústica Rumorosi tà Ljudnivá vid koppling Hlučnost Шум	
		Horizontale Einbaulage Horizontal mounting Montage horizontal Montaje horizontal Montaggio orizzontale vägrätt monteringsläge Horizontální montážní poloha Горизонтальная сборочная позиция	Vertikale Einbaulage Vertical mounting Montage vertical Montaje vertical Montaggio verticale lodrätt monteringsläge Vertikální montážní poloha Вертикальная сборочная позиция	20° C			
63	2LM8 005-1NA10	6000 min ⁻¹	6000 min ⁻¹	20 W	25 ms	56 ms	77 dB (A)
71	2LM8 005-2NA10			25 W	26 ms	70 ms	75 dB (A)
80	2LM8 010-3NA10			32 W	37 ms	90 ms	
90	2LM8 020-4NA10			40 W	43 ms	140 ms	80 dB (A)
112	2LM8 060-6NA10			53 W	60 ms	210 ms	77 dB (A)
132	2LM8 100-7NA10			55 W	50 ms	270 ms	
160	2LM8 260-8NA10	3700 min ⁻¹	3200 min ⁻¹	100 W	165 ms	340 ms	79 dB (A)
180	2LM8 315-0NA10			152 ms	410 ms		
200	2LM8 400-0NA10	3000 min ⁻¹	3000 min ⁻¹	110 W	230 ms	390 ms	93 dB (A)

¹⁾ Schaltzeiten für gleichstromseitiges Schalten. Bei wechselstromseitigem Schalten ca. um den Faktor 6 größer!
²⁾ Switching times listed are for DC-side switching; they increase by a factor of 6 for AC-side switching!
³⁾ Les temps de serrage et de desserrage sont donnés pour commande côté continu. Ces temps augmentent d'un facteur 6 en cas de commande côté alternatif.
⁴⁾ Tiempos de maniobra por el lado de c.c. ¡Aumentar aprox. en el factor 6 en caso de maniobra por el lado de c.a!
⁵⁾ I tempi di inserzione sono validi per l'inserzione del lato a corrente continua. Per l'inserzione del lato a corrente alternata i tempi sono maggiori di un multiplo del fattore 6.
⁶⁾ Kopplingsstider på likströmssidan. Vid koppling på växelströmssidan ca 6 gånger större!
⁷⁾ Uvedené spinací časy jsou pro spinání na straně stejnosměrného proudu. U spinání na straně střídavého proudu jsou přibližně 6x delší!!
⁸⁾ Указанные длительности включения предназначены для включения на стороне постоянного тока. В случае включения на стороне переменного тока их необходимо повысить приблизительно на фактор 6!

Fig. 4 Betriebswerte / Operating values / Caractéristiques de service / Valores de servicio / Valori dei parametri / Driftsvärden / Provozní hodnoty / Эксплуатационные данные

Automation & Drives
Standard Drives

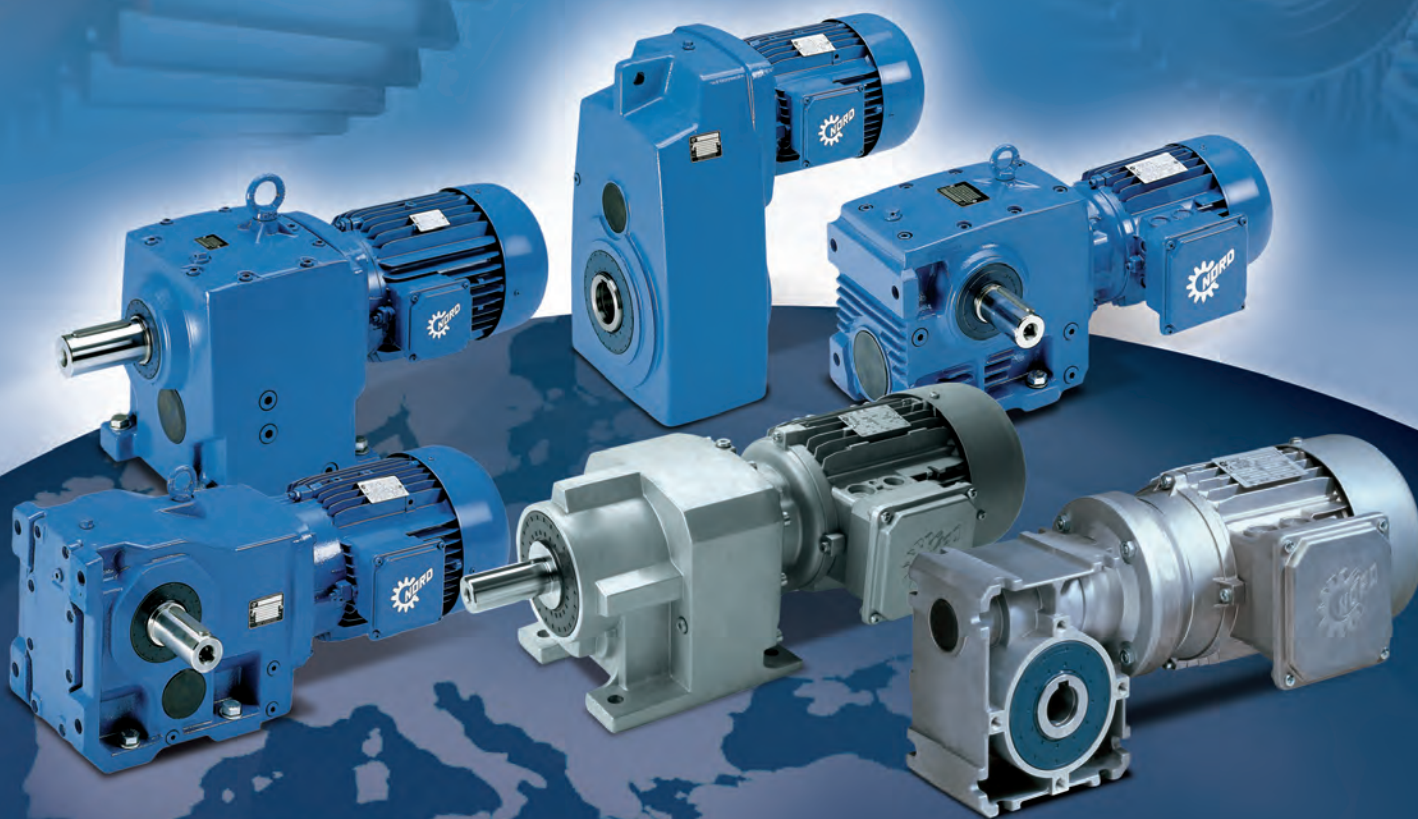
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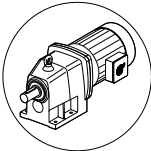






GB

B1000

Operating and Assembly Instructions for
Gear Units and Geared Motors


DRIVESYSTEMS

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1. Notes

1. Notes

1.1 General information

Read the Operating Manual carefully prior to performing any work on or putting the gear unit into operation. Strict compliance with the instructions in this Operating Manual is essential. Getriebebau NORD accepts no liability for damage to persons, materials or assets as a result of the non-observance of this Operating Manual, operating errors or incorrect use. General wearing parts, e.g. radial seals are excluded from the warranty.

If additional components are attached to or installed in the gear unit (e.g. motor, cooling system, pressure sensor etc.) or components (e.g. cooling system) are supplied with the order, the operating instructions for these components must be observed.

If geared motors are used, compliance with the Motor Operating Manual is also necessary.

If you do not understand the contents of this Operating Manual or additional operating instructions, please consult Getriebebau NORD!

1.2 Safety and information symbols

Please always observe the following safety and information symbols!

	Danger!
	Risk of fatalities and injury
	Attention!
	Machine may be damaged
	Note!
	Useful information

1.3 Correct use

These gear units generate a rotational movement and are intended for use in commercial systems. The gear unit must only be used according to the information in the technical documentation from Getriebebau NORD.

	Danger!
	Use in explosion hazard areas is prohibited.

Strict compliance with the technical data on the rating plate is essential.

The documentation must be observed.

Appropriate safety measures must be taken for applications where failure of a gear unit or geared motor may result in injury.

1.4 Safety information

All work including transportation, storage, installation, electrical connection, commissioning, servicing, maintenance and repair must be performed **only by qualified specialist personnel**. It is recommended that repairs to NORD Products are carried out by the NORD Service department.

	Danger!
	<p>Installation and maintenance work must only be performed when gear units are at a standstill and have cooled down. The drive must be isolated and secured to prevent accidental start-up.</p> <p>Tighten the drive elements or secure the parallel key before switching on.</p>

	Danger!
	<p>Only use the eyebolts attached to the gear unit for transport. No additional loads may be attached. Transportation aids and lifting gear must have an adequate load-bearing capacity.</p>

If geared motors have an additional eyebolt attached to the motor, this must also be used. Avoid pulling the eyebolts at an angle. The thread of the eyebolt must be fully screwed in.

Observe all safety information, including that provided in the individual sections of this Operating Manual. All national and other regulations on safety and accident prevention must also be observed.

	Danger!
	<p>Serious physical and property damage may result from inappropriate installation, non-designated use, incorrect operation, non-compliance with safety information, unauthorised removal of housing components or safety covers and structural modifications to the gear unit.</p>



1. Notes

1.5 Other documents

Further information may be obtained from the following documents:

- Gear unit catalogues (G1000, G2000, G1011, G1012, G1034, G1035)
- Operating and maintenance instructions for the electric motor
- if applicable, operating instructions for attached or supplied options

1.6 Disposal

Observe the current local regulations. In particular, lubricants must be collected and disposed of correctly.

Gear unit components:	Material:
Toothed wheels, shafts, rolling bearings, parallel keys, locking rings, ...	Steel
Gear unit housing, housing components, ...	Grey cast iron
Light alloy gear unit housing, light alloy gear unit housing components, ...	Aluminium
Worm gears, bushes, ...	Bronze
Radial seals, sealing caps, rubber components,...	Elastomers with steel
Coupling components	Plastic with steel
Flat seals	Asbestos-free sealing material
Gear oil	Additive mineral oil
Synthetic gear oil (rating plate code: CLP PG)	Polyglycol-based lubricants
Cooling spiral, embedding material of the cooling spiral, screw fittings	Copper, epoxy, yellow brass

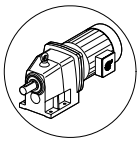
2. Description of Gear Units

2. Description of gear units

2.1 Type designations and gear unit types

	Versions / Options
<p style="text-align: center;"><u>Helical gear units</u></p> <p>SK 11E, SK 21E, SK 31E, SK 41E, SK 51E (single-stage) SK 02, SK 12, SK 22, SK 32, SK 42, SK 52, SK 62N (2-stage) SK 03, SK 13, SK 23, SK 33N, SK 43, SK 53 (3-stage) SK 62, SK 72, SK 82, SK 92, SK 102 (2-stage) SK 63, SK 73, SK 83, SK 93, SK 103 (3-stage)</p>	<p>- Foot mounting with solid shaft A Hollow shaft version V Solid shaft version L Solid shaft both sides Z Drive flange B14 F Output flange B5</p>
<p style="text-align: center;"><u>NORDBLOC helical gear units</u></p> <p>SK 320, SK 172, SK 272, SK 372, SK 472, SK 572, SK 672, SK 772, SK 872, SK 972 (2-stage) SK 273, SK 373, SK 473, SK 573, SK 673, SK 773, SK 873, SK 973 (3-stage) SK 072.1, SK 172.1, SK 272.1, SK 372.1, SK 472.1, SK 572.1, SK 672.1, SK 772.1, SK 872.1, SK 972.1 (2-stage) SK 373.1, SK 473.1, SK 573.1, SK 673.1, SK 773.1, SK 873.1, SK 973.1 (3-stage)</p>	<p>X Foot mounting XZ Base and output flange B14 XF Base and output flange B5 AL Reinforced axial drive bearings 5 Reinforced output shaft (Standard helical gear unit) V Reinforced drive shaft (Standard helical gear unit)</p>
<p style="text-align: center;"><u>Standard helical gear units</u></p> <p>SK 0, SK 01, SK 20, SK 25, SK 30, SK 33 (2-stage) SK 010, SK 200, SK 250, SK 300, SK 330 (3-stage)</p>	<p>D Torque support K Torque console S Shrink disc</p>
<p style="text-align: center;"><u>Parallel shaft gear units</u></p> <p>SK 0182NB, SK 0282NB, SK 1282, SK 2282, SK 3282, SK 4282, SK 5282, SK 6282, SK 7282, SK 8282, SK 9282, SK 10282, SK 11282 (2-stage) SK 1382NB, SK 2382, SK 3382, SK 4382, SK 5382, SK 6382, SK 7382, SK 8382, SK 9382, SK 10382, SK 11382, SK 12382 (3-stage)</p>	<p>VS Reinforced shrink disc EA Hollow shaft with internal spline G Rubber buffer VG Reinforced rubber buffer</p>
<p style="text-align: center;"><u>Bevel gear units</u></p> <p>SK 92072, SK 92172, SK 92372, SK 92672, SK 92772 (2-stage) SK 9012.1, SK 9016.1, SK 9022.1, SK 9032.1, SK 9042.1, SK 9052.1, SK 9062.1, SK 9072.1, SK 9082.1, SK 9086.1, SK 9092.1, SK 9096.1 (3-stage) SK 9013.1, SK 9017.1, SK 9023.1, SK 9033.1, SK 9043.1, SK 9053.1 (4-stage)</p>	<p>R Back stop B Fixing element H Covering cap as contact guard H66 Covering cap IP66 VL Reinforced bearings VL2 Agitator design VL3 Drywell agitator design</p>
<p style="text-align: center;"><u>Contrate worm gear unit</u></p> <p>SK 02040, SK 02050, SK 12063, SK 12080, SK 32100, SK 42125 (2-stage) SK 13050, SK 13063, SK 13080, SK 33100, SK 43125 (3-stage)</p>	<p>IEC Standard motor mounting NEMA Standard motor mounting W With free drive shaft VI Viton radial seals</p>
<p style="text-align: center;"><u>MINIBLOC worm gear units</u></p> <p>SK1 S32, SK1 S40, SK 1S50, SK 1S63, SK 1SU... SK 1SM31, SK 1SM40, SK 1SM50, SK 1SM63 (single-stage) SK 2S32NB, SK 2S40NB, SK 2S50NB, SK 2S63NB, SK 2SU..., SK 2SM40, SK 2SM50, SK 2SM63 (2-stage)</p>	<p>OA Oil expansion vessel OT Oil level tank SO1 Synthetic oil ISO VG 220 CC Casing cover with cooling spiral DR Spring Loaded Breather</p>
<p style="text-align: center;"><u>UNIVERSAL worm gear units</u></p> <p>SK 1SI31, SK 1SI40, SK 1SI50, SK 1SI63, SK 1SI75, SK 1SIS31,...., SK 1SIS75, SK 1SID31,...., SK 1SID63, SK 1SMI31,...., SK 1SMI75, SK 1SMID31,...., SK 1SMID63, SK 1SIS-D31,...., SK 1SIS-D63 (single-stage), SK 2SMID40, SK 2SMID50, SK 2SMID63, SK 2SID40,...., SK 2SID63 (2-stage)</p>	<p>H10 Modular contrate pre-stage /31 Worm pre-stage /40 Worm pre-stage</p>

Double gear units consist of two single gear units. They are to be treated as per the instructions in this Manual, i.e. as two individual gear units. Type designation of double gear units: e.g. SK 73/22 (consisting of single gears SK 73 and SK 22)



2. Description of Gear Units

2.2 Name plate

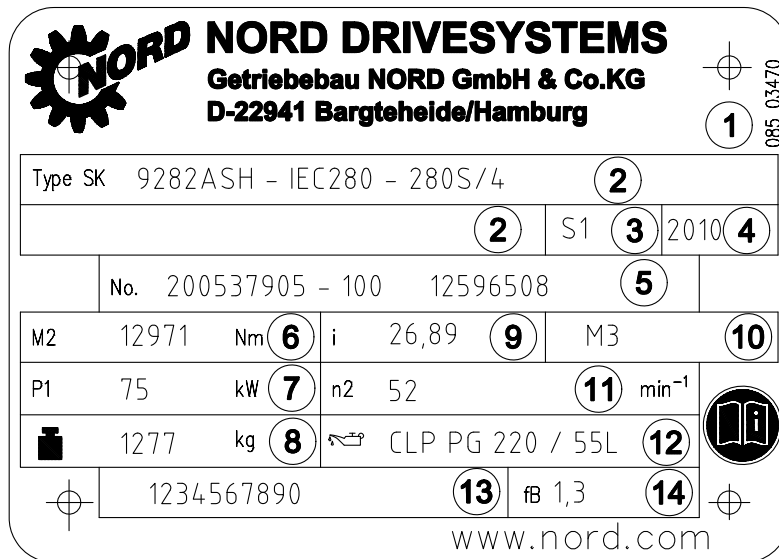


Figure 2-1: Name plate (example)

Explanation of the Name Plate

- 1 Matrix – Barcode
- 2 NORD gear unit type
- 3 Operating mode
- 4 Year of manufacture
- 5 Serial number
- 6 Rated torque of gear unit output shaft
- 7 Drive power
- 8 Weight according to ordered version
- 9 Overall gear unit ratio
- 10 Installation orientation
- 11 Rated speed of gear unit output shaft
- 12 Lubricant type, viscosity and quantity
- 13 Customer's part number
- 14 Operating factor



3. Assembly instructions, storage, preparation, installation


Please observe all of the general safety information in Section 1.4, 1.3 and in the individual sections.

3.1 Storing the gear unit

For short-term storage before commissioning, please observe the following:

- Store in the fitting position (see Section 6.1) and secure gear units against falling
- Lightly grease bare metal housing surfaces and shafts
- Store in dry rooms
- Temperature must not fluctuate beyond the range of -5 °C to $+40\text{ °C}$
- Relative humidity less than 60%
- No direct exposure to sunlight or UV light
- No aggressive, corrosive substances (contaminated air, ozone, gases, solvents, acids, alkalis, salts, radioactivity etc.) in the immediate vicinity
- No vibration or oscillation

3.2 Long-term storage

	Note!
	For storage or standstill periods in excess of 9 months, Getriebebau NORD recommends the long-term storage option. With the long-term storage option and the use of the measures listed below, storage for up to 2 years is possible. As the actual influences on the unit greatly depend on the local conditions, these times should only be regarded as guide values.

Conditions of the gear unit and storage area for long-term storage prior to commissioning:

- Store in the fitting position (see Section 6.1) and secure gear units against falling
- Transportation damage to the external paint must be repaired. Check that a suitable rust inhibitor is applied to the flange bearing surfaces. If necessary apply a suitable rust inhibitor to the surfaces.
- Gear units with the long-term storage option are completely filled with lubricant or have VCI corrosion protection agents added to the gear oil. (See label on gear unit)
- The sealing band in the vent plug must not be removed during storage. The gear unit must remain sealed tight.
- Store in a dry place.
- In tropical regions, the drive unit must be protected against damage by insects
- Temperature must not fluctuate beyond the range of -5 °C to $+40\text{ °C}$
- Relative humidity less than 60%
- No direct exposure to sunlight or UV light
- No aggressive, corrosive substances (contaminated air, ozone, gases, solvents, acids, alkalis, salts, radioactivity etc.) in the immediate vicinity
- No vibration or oscillation

Measures during storage or standstill periods

- If the relative humidity is $<50\%$ the gear unit can be stored for up to 3 years.

Measures before commissioning

- If the storage or standstill period exceeds 2 years or the temperature during short-term storage greatly deviates from the standard range, the lubricant in the gear unit must be replaced before commissioning.
- If the gear unit is completely filled, the oil level must be reduced before commissioning.



3. Assembly instructions, storage, preparation, installation



3.3 Transporting the gear unit

	Danger!
	To prevent injury, the danger area must be generously cordoned off . Standing under the gear unit during transport is extremely dangerous .

	Attention!
	Avoid damage to the gear unit. Impacts to the free ends of the shafts may cause internal damage to the gear unit. Use adequately dimensioned and suitable means of transportation . Lifting tackle must be designed for the weight of the gear unit. The weight of the gear unit can be obtained from the dispatch documents.

3.4 Preparing for installation

The drive unit must be inspected and may only be installed if no transportation damage or leaks are visible. In particular the radial seals and the sealing caps must be inspected for damage.

All bare metal surfaces and shafts of the gear unit are protected against corrosion with oil, grease or corrosion protection agents before shipping.

Thoroughly remove all oil, grease or corrosion protection agents and any dirt from the shafts and flange surfaces before assembly.

In applications where an incorrect rotational direction may result in damage or potential risk, the correct rotational direction of the drive shaft is to be established by test running the drive when uncoupled and guaranteeing such for subsequent operation.

Gears with integrated return stops are marked with arrows on the driven/driving sides. The arrows point in the rotation direction of the gear unit. It must be ensured, when connecting the motor and during motor control, that the gear unit can only operate in the rotation direction, e.g. by means of a rotary field test. (For further details, please refer to Catalogue G1000 and WN 0-000 40)

	Attention!
	With gear units with an integrated back stop, switching the drive motor to the blocked rotation direction, i.e. incorrect rotation direction, can lead to gear damage.

Ensure that no aggressive or corrosive substances are present in the area surrounding the installation site or are subsequently expected during operation, which attack metal, lubricants or elastomers. In case of doubt, please contact Getriebebau NORD and take the recommended action.

Oil expansion tanks (Option OA) must be fitted in accordance with the attached works standard WN 0-530 04. For gear units with an M10x1 vent plug, works standard WN 0-52135 must be observed.

Oil expansion tanks (Option OT) must be fitted in accordance with works standard WN 0-521 30.

If venting of the gear unit is provided, the vent or the pressure vent must be activated before commissioning. To activate, remove the transport securing devices (sealing cord). Position of the vent plug: see Section 6.1.

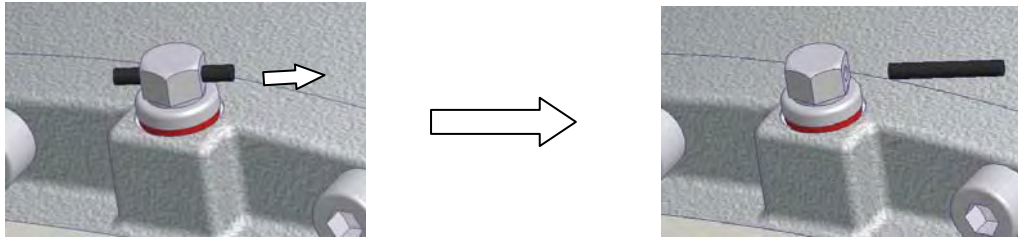


Figure 3-1: Activating the vent plug

Special pressure vents are supplied as loose parts. Before commissioning, the vent plug must be replaced with the pressure vent which is supplied as a loose part. This is achieved by screwing out the vent fitting and replacing it with the pressure vent and seal (refer to Section 6.2 for torque values). Double gear units consist of two single units and are equipped with 2 oil chambers and 2 pressure vents.

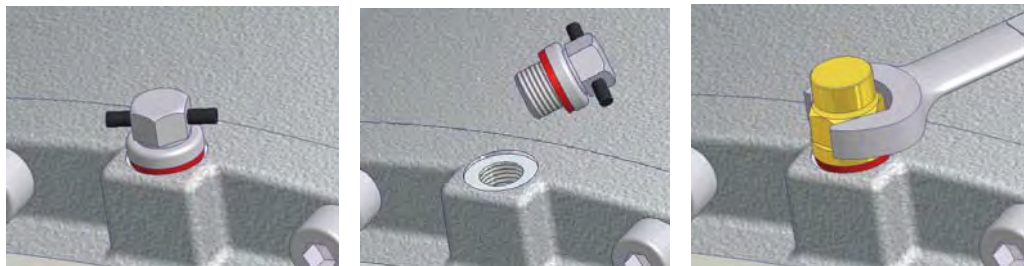


Figure 3-2: Removing vent plug and fitting the pressure vent

3.5 Installing the gear unit

The eyebolts screwed into the gear units must be used during installation. The safety notes in Section 1.4 must be observed.

The base and/or flange to which the gear unit is fitted should be vibration-free, torsionally strong and flat. The smoothness of the mating surface on the base or flange must be according to tolerance class K of DIN ISO 2768-2. All contamination to the bolting surfaces of gear unit and base and/or flange must be thoroughly removed.

The gear unit must be precisely aligned with the drive shaft of the machine in order to prevent additional forces from being imposed on the gear unit due to tension.

Welding of the gear unit is prohibited. The gear unit must not be used as the earth connection for welding work, as this may cause damage to the bearings and gear wheels.



3. Assembly instructions, storage, preparation, installation



The gear unit must be installed in the correct configuration (see Section 6.1) (UNIVERSAL gear unit types SI and SMI are independent of the configuration). Changes to the installation position after delivery require adjustment of the quantity of oil, and often other measures such as e.g. the installation of encapsulated roller bearings. **Damage may result if the stated installation position is not observed.**

All gear unit feet and/or all flange bolts on each side must be used. Bolts must have a minimum quality of 8.8. The bolts must be tightened to the correct torques (refer to Section 6.2 for torque values). Tension-free bolting must be ensured, particularly for gear units with a foot and flange.

	Danger!
	<p>To ensure that the gearbox does not get too warm and to avoid injury to persons, observe the following during installation:</p> <ul style="list-style-type: none">• The surfaces of gear units or geared motors may become hot during or shortly after operation. Attention: danger of burns!! Protection against accidental contact may need to be installed.• With geared motors, the cooling air of the motor fan must be able to flow unobstructed onto the gear unit.

3.6 Fitting hubs on the gear shafts

	Attention!
	Do not subject the gear unit to harmful axial forces when fitting the hubs.

Drive and driven elements, e.g. coupling and chain-wheel hubs must be mounted onto the drive and driven shaft of the gear unit using suitable pullers that will not apply damaging axial forces onto the gear unit. In particular, do not hit the hubs with a hammer.

Use the end thread of the shafts for pulling. Fitting can be aided by coating the hub with lubricant or heating it up to approx. 100°C beforehand.

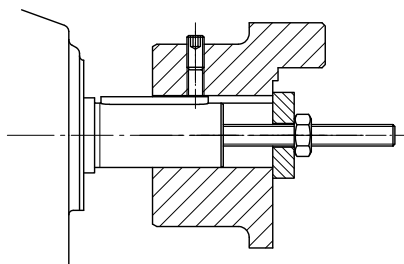



Figure 3-3: Example of a simple pulling device

	Danger!
	Drive and driven elements, such as belt drives, chain drives and couplings must be fitted with contact protection.

Driven elements may only subject the drive units to the maximum radial force F_R and axial force F_A as specified in the catalogue. Observe the correct tension, particularly on belts and chains. Additional loads due to unbalanced hubs are not permitted. The radial force must be applied to the gear unit as closely as possible.

3.7 Fitting push-on gear units

	Attention!
	The bearings, gear wheels, shafts and housing may be damaged by incorrect fitting.

The push-on gear unit must be fitted onto the shaft using a suitable puller, which will not exert damaging axial forces on the gear unit. In particular, do not hit the gear unit with a hammer.

Assembly and subsequent dismantling is aided by applying an anti-corrosive lubricant to the shaft before fitting (e.g. Nord assembly paste Art. No. 8900099).

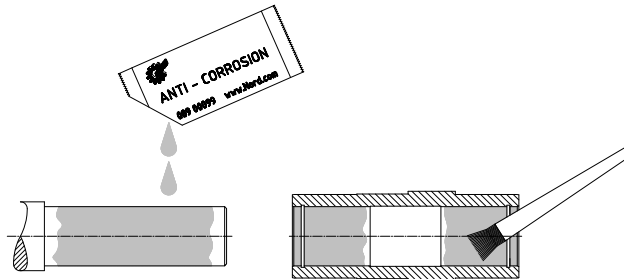



Figure 3-4: Applying lubricant to the shaft and the hub

	Note!
	The gear unit can be fitted to shafts with and without a shoulder using the fastening element (Option B). Tighten the bolt of the fastening element to the correct torque. (See Chapter 6.2 for torque values) For gear units with option H66, the factory-fitted closing cap must be removed before assembly.

For shaft mounted gear units with option H66 and fastening element (Option B) the pressed-in closing cap must be pushed out before fitting the gear unit. The pressed-in closing cap may be destroyed during dismantling. As standard a second closing cap is supplied as a loose spare part. After fitting the gear unit, fit the new / new condition closing cap as described in Section 3.11.

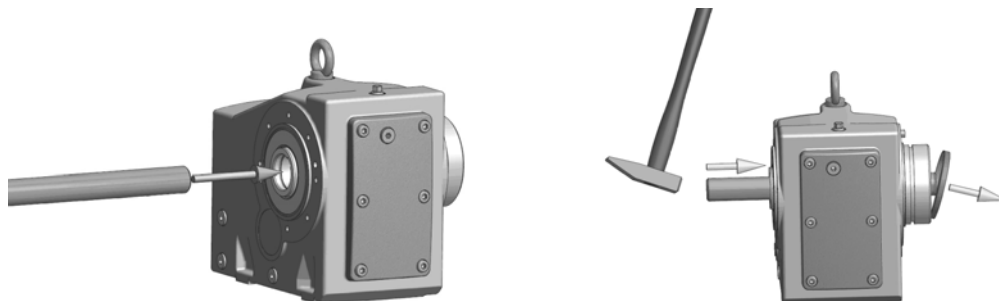


Figure 3-5: Removing the factory-fitted closing cap



3. Assembly instructions, storage, preparation, installation

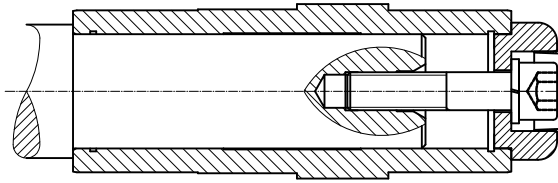


Figure 3-6: Gear unit mounted to shaft with a shoulder using the fastening element

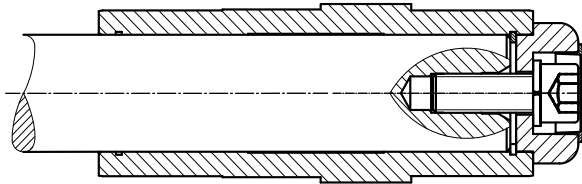


Figure 3-7: Gear unit mounted to shaft without a shoulder using the fastening element

A gear unit can be dismantled from a shaft with shoulder using the following device, for example.

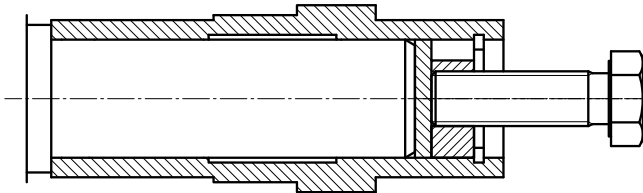


Figure 3-8: Dismantling using dismantling device

When mounting push-on gears with torque supports, the support must not be distorted. Tension-free mounting is aided by the rubber buffer (Option G and/or VG).

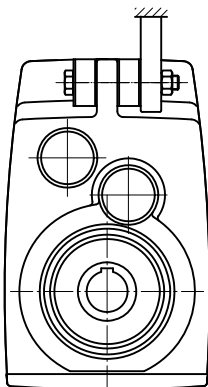


Figure 3-9: Mounting the rubber buffer (Option G and/or VG) on parallel shaft gear units

To fit the rubber buffer, tighten the screw fastening until there is no play between the contact surfaces when there is no load. Then turn the fastening nut (only applies for screw fastenings with adjusting threads) half a turn in order to pre-tension the rubber buffer. Greater pre-tension is not permissible. Secure the screw fastening from coming loose, e.g. with Loctite 242 or a second nut.

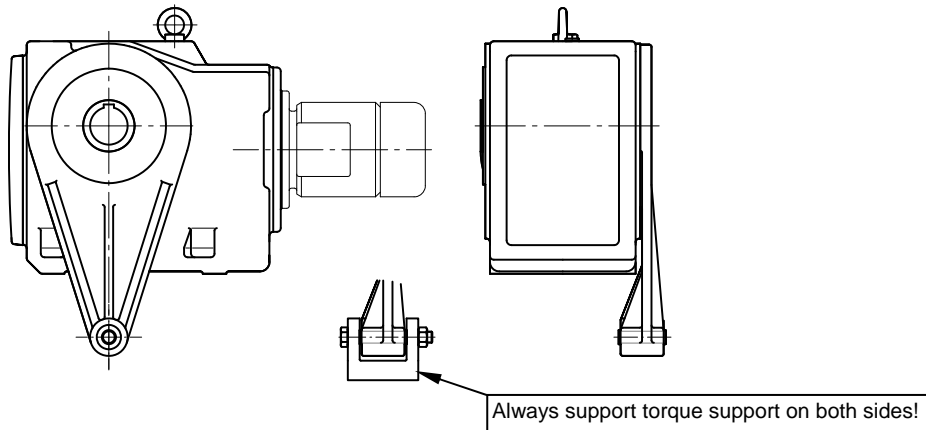


Figure 3-10: Attaching the torque support on bevel gear and worm gear units

Tighten the bolts on the torque support to the correct torque (see Section 6.2 for torque values) and secure to prevent loosening (e.g. Loctite 242, Loxeal 54-03).

3.8 Fitting shrink discs

Shrink disc type, Mat. No. and torque details for tensioning screws

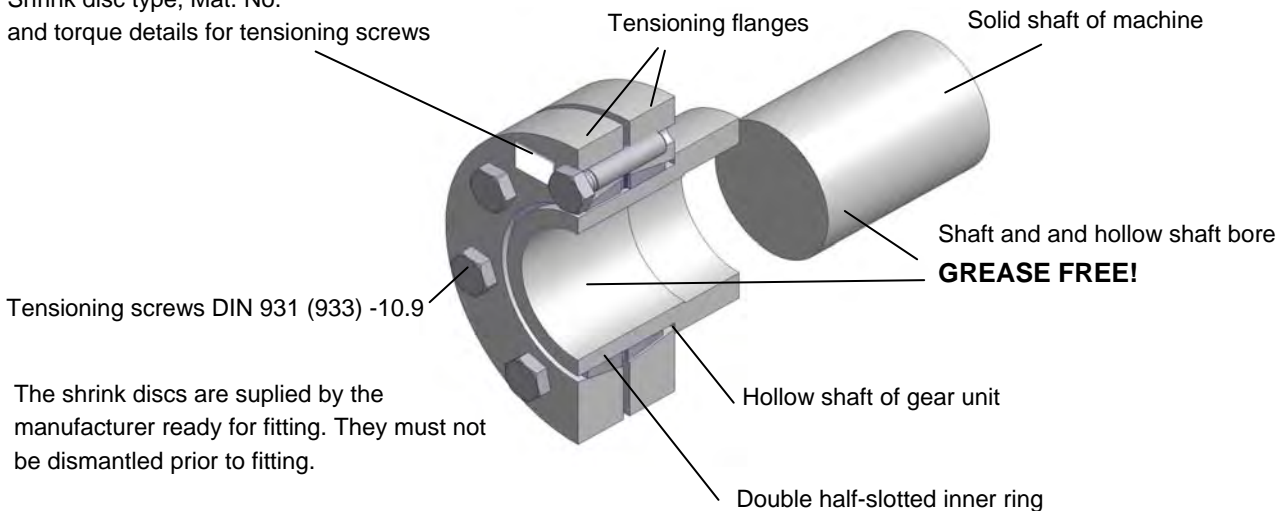


Figure 3-11: Hollow shaft with shrink disc

	Attention!
	Do not tighten bolts if the solid shaft is not inserted!

Assembly sequence:

1. Remove any transport securing devices.
2. Loosen but do not remove tightening bolt and tighten gently by hand until there is no play between the flanges and the inner ring.



3. Assembly instructions, storage, preparation, installation



3. Slide the shrink disc onto the hollow shaft until the outer clamping flange is flush with the hollow shaft. The shrink disc is easier to slide on if the bore of the inner ring is lightly greased.
4. Prior to mounting, grease the solid shaft only in the area which will later come into contact with the bronze bush in the hollow shaft of the gear unit. Do not grease the bronze bush, in order to prevent grease penetrating the area around the shrink connection.
5. The hollow shaft of the gear unit must be completely de-greased and **completely free of grease**.
6. In the area of the shrink connection the solid shaft of the machine must be degreased and **completely free of grease**.
7. Insert the solid shaft of the machine into the hollow shaft so as to completely fill the area around the shrink connection.
8. Position the clamping flange by gently tightening the bolts.
9. Tighten the bolts successively in a clockwise direction by several turns – not crosswise – with approx. ¼ rotation per turn. Tighten the bolts with a torque wrench to the torque indicated on the shrink disc.
10. When the tensioning bolts have been tightened, there must be an even gap between the clamping flanges. If this is not the case, the gear unit must be dismantled and the shrink disc connection checked for correct fit.

	Danger!
	Risk of injury from incorrect mounting and dismantling of the shrink disc.

Dismantling sequence:

1. Loosen the bolts successively in a clockwise direction by several turns with approx. ¼ rotation per turn. Do not remove the bolts from their thread.
2. Loosen the clamping flanges from the cone of the inner ring.
3. Remove the gear unit from the solid shaft of the machine.

3.9 Fitting the covers

	Danger!
	Shrink discs and exposed rotating shaft ends require contact guards in order to prevent injuries. A cover (Option H and Option H66) can be used as a guard. If this does not achieve sufficient protection against contact according to the required protection type, the machinery and plant constructor must ensure this by means of special attached components.

All fixing screws must be used and tightened to the correct torque. (See Section 6.2 for torque values) For covers with option H66, press in the new / new condition closing cap by tapping it lightly with a hammer.



Figure 3-12: Fitting the covers, Option SH, Option H, and Option H66

3.10 Fitting a standard motor

The maximum permitted motor weights indicated in the table below must not be exceeded when attaching the motor to an IEC- / NEMA adapter

Maximum permitted motor weights														
IEC motor size	63	71	80	90	100	112	132	160	180	200	225	250	280	315
NEMA Motor size		56C	143T	145T	182T	184T	210T	250T	280T	324T	326T	365T		
Max. motor weight [kg]	25	30	40	50	60	80	100	200	250	350	500	700	1000	1500

Assembly procedure to attach a standard motor to the IEC adapter (Option IEC)/NEMA adapter

1. Clean motor shaft and flange surfaces of motor and IEC /NEMA adapter and check for damage. Mounting dimensions and tolerances of the motor must conform to DIN EN 50347/NEMA MG1 Part 4.
2. Push the coupling sleeve onto the motor shaft so that the motor parallel key engages into the groove in the sleeve on tightening.
3. Tighten the coupling sleeve on the motor shaft in accordance with the motor manufacturer's instructions until it touches the collar. With motor sizes 90, 160, 180 and 225, any spacer bushes must be positioned between the coupling sleeve and the collar. With standard helical gear units, dimension B between the coupling sleeve and the collar must be observed (see Figure 3-13). Certain **NEMA adapters** require the adjustment of the coupling in accordance with the specifications indicated on the adhesive plate.
4. If the coupling half contains a threaded pin, the coupling can be secured axially on the shaft. The threaded pin must be coated prior to use with a securing lubricant e.g. Loctite 242, Loxeal 54-03 and tightened to the correct torque. (See Chapter 6.2 for torque values)
5. Sealing of the flange surfaces of the motor and the IEC /NEMA adapter is recommended if the motor is installed outdoors or in a humid environment. **The flange surfaces** of motor and adapter must be completely coated with **surface sealant** Loctite 574 or Loxeal 58-14 prior to mounting so that the flange seals after mounting.
6. Mount the motor to the IEC /NEMA adapter, do not forget to fit the gear rim or the sleeve. (See Figure 3-13)
7. Tighten the IEC /NEMA adapter bolts to the correct torque. (See Chapter 6.2 for torque values)



3. Assembly instructions, storage, preparation, installation

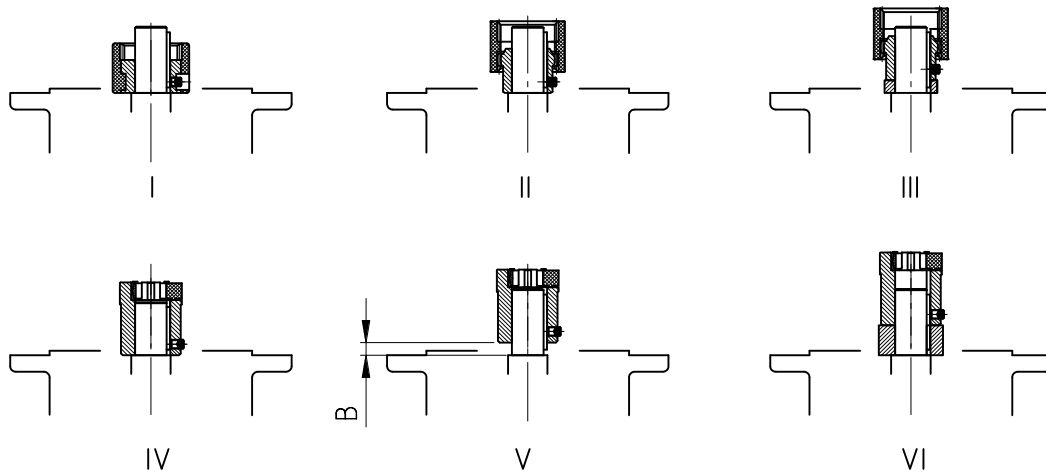


Figure 3-13: Fitting the coupling onto the motor shaft - various types of coupling

- I Gear coupling, one-part
- II Gear coupling, two-part
- III Gear coupling, two-part with spacer bush
- IV Claw coupling, two-part
- V Claw coupling, two-part, observe dimension B:

	Standard helical gear unit: SK0, SK01, SK20, SK25, SK30, SK33 (2-stage) SK010, SK200, SK250, SK300, SK330 (3-stage)	
	IEC size 63	IEC size 71
Dimension B (Fig. 3-13V)	B = 4.5mm	B = 11.5 mm

- VI Claw coupling, two-part with spacer bush

3.11 Retrospective paintwork

	Attention!
	For retrospective painting of the gear unit, the radial seals, rubber elements, pressure venting valves, hoses, type plates, adhesive labels and motor coupling components must not come into contact with paints, lacquers or solvents, as otherwise components may be damaged or made illegible.



3.12 Fitting the cooling coil to the cooling system

Cutting ring screw threads (see Item 1, Figs. 3-14) are located at the casing cover for the connection of a pipe with an external diameter of 10 mm according to DIN 2353. **Remove the drain plug from the screw neck prior to assembly to avoid any contamination of the cooling system.** The screw necks should be connected with the coolant circuit, which must be provided by the operator. The flow direction of the coolant is irrelevant.

Make sure not to twist the screw necks during or after assembly as the cooling coil may be damaged (see Item 3, Fig. 3-14). You must ensure that no external forces act on the cooling coil.

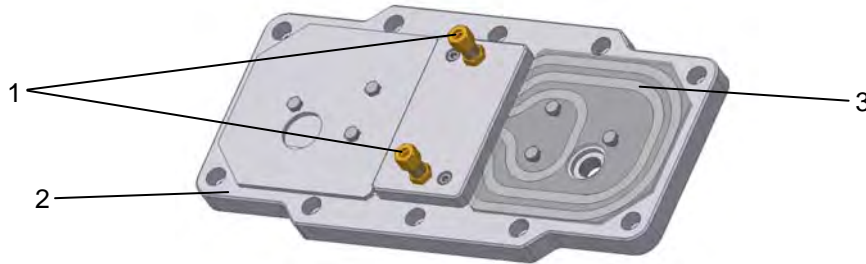



Figure 3-14: Cooling cover

	Danger!
	The pressure released from the cooling circuit before carrying out any work on the gear unit.



4. Commissioning

4. Commissioning

4.1 Checking the oil level

The oil level must be checked prior to commissioning. See Section 5.2.

4.2 Activating the automatic lubricant dispenser

Some gear unit types with standard motor (Option IEC/NEMA) have an automatic lubricant dispenser for the rolling bearings. This dispenser must be activated prior to commissioning. The cartridge case cover has a red information sign for the activation of the lubricant dispenser.

Activating the Automatic Lubricant Dispenser:

1. Loosen and remove cylinder bolts M8x16 (1)
2. Lift off cartridge case cover (2)
3. Insert activation screw (3) into the lubricant dispenser (5) until the lug (4) breaks off at the defined fracture point
4. Refit cartridge case cover (2) and fasten using cylinder bolt (1). (See Chapter 6.2 for torque values)
5. Mark activation date on the adhesive plate (6) indicating month/year

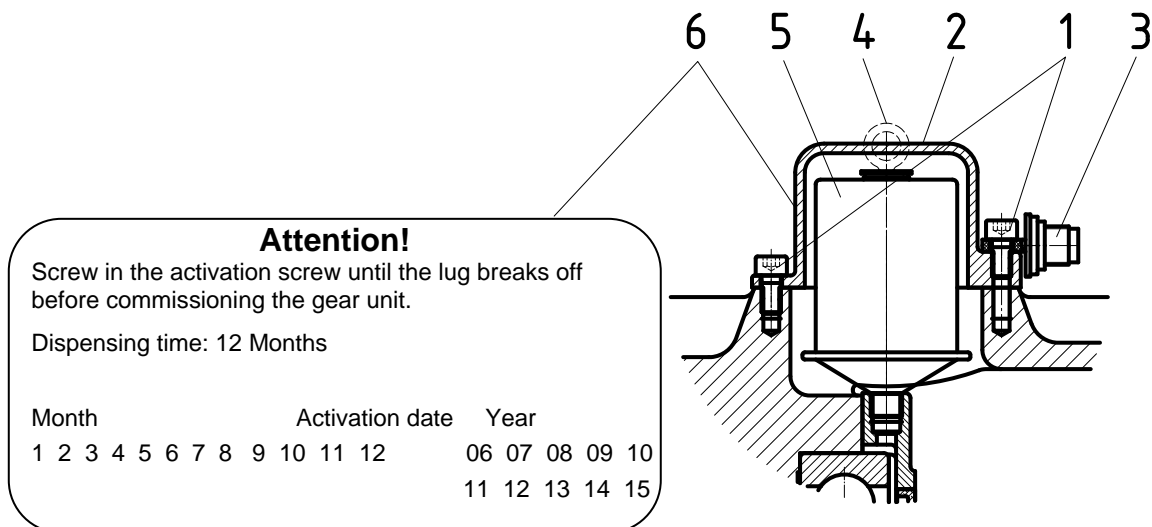



Figure 4-1: Activating the automatic lubricant dispenser with standard motor mounting

4. Commissioning

4.3 Operation with lubricant cooling

Water cooling

	Caution!
	The drive may only be commissioned after the cooling spiral has been connected to the cooling circuit, and the cooling circuit has been put into operation.

The coolant must have a similar thermal capacity as water (specific thermal capacity at 20°C $c=4.18 \text{ kJ/kgK}$). Industrial water without any air bubbles or sediments is recommended as a coolant. The water hardness must be between 1° dH and 15° dH, and the pH value must be between pH 7.4 and pH 9.5. No aggressive liquids should be added to the coolant!

The **coolant pressure** must not exceed **8 bar**. The required **quantity of coolant** is **10 litres/minute**, and the **coolant inlet temperature** should not exceed 40°C; we recommend **10°C**.

We also recommend fitting a pressure reducer at the coolant inlet to avoid any damage due to excessive pressure.


If there is a danger of frost the operator should add a suitable anti-freeze solution to the cooling water.

The **temperature of the cooling water** and the **cooling water flow rate** must be **supervised** and **ensured** by the operator.

Air/Oil cooler

This version and all important data concerning the air/oil cooler can be obtained from Catalogue G1000, or contact the manufacturer of the cooling unit.

4.4 Running-in time for the worm gear unit

	Note!
	In order to achieve maximum efficiency of the worm gear unit, the gear unit must be subjected to a running-in period of approx. 25 h – 48 h under maximum load. There may be a reduction in efficiency before the running-in period is complete.

4.5 Checklist

Checklist		
Object of the check	Checked on:	Information – see Section
Is the vent plug activated or the pressure vent screwed in?		Sec. 3.4
Does the required configuration conform with the actual installation?		Sec. 6.1
Are the external gear shaft forces within permitted limits (chain tension)?		Sec. 3.6
Is the torque support correctly fitted?		Sec. 3.7
Are contact guards fitted to rotating components?		Sec. 3.9
Is the automatic lubricant dispenser activated?		Sec. 4.2
Is the cooling cover connected to the cooling circuit?		Sec. 3.12/4.3



5. Service and Maintenance

5. Service and maintenance

5.1 Service and maintenance intervals

Service and Maintenance Intervals	Service and Maintenance Work	Information – see Section
At least every six months	<ul style="list-style-type: none">- Visual inspection- Check for running noises- Check oil level- Re-grease (applicable only to free drive shaft / Option W and on agitator bearings / Option VL2 / VL3)- Replace automatic lubricator (for operating times < 8 h/day: a replacement interval for the lubricant dispenser of 1 year is permissible) (only with IEC/NEMA standard motors)	5.2 5.2 5.2 5.2 5.2
For operating temperatures up to 80°C Every 10000 operating hours at least every 2 years (The interval is double this if the unit is filled with synthetic products) For higher temperatures or extreme operating conditions (high humidity, aggressive environments and large temperature fluctuations) the oil change intervals must be halved.	<ul style="list-style-type: none">- Change the oil- Clean or replace the vent plug.	5.2 5.2
At least every 10 years	<ul style="list-style-type: none">- General overhaul	5.2

5.2 Service and maintenance work

Servicing and maintenance work must only be performed by qualified specialist personnel.

Installation and maintenance work must only be performed when gear units are at a standstill. The drive must be isolated and secured to prevent accidental start-up.

Visual inspection

The gear unit must be checked for leaks. In addition, the gear unit must be inspected for external damage and cracks in the hoses, hose connections and rubber buffers. Have the gear unit repaired in case of leaks, e.g. dripping gear oil or cooling water, damage or cracks. Please contact the NORD service department.

Note:

SI, SMI and IEC/Nema adapter type universal worm gear drives for NORDBLOC.1 up to size 673.1 and SEP/SEK servo motor adapters are sealed on the drive side by means of a shaft sealing ring which is located directly in the oil space. **This ensures that the shaft sealing ring is especially well supplied with lubricating oil, and has low friction and a long service life.**

The drive shaft bearing has two cover discs, which form a non-contact seal (See Fig. 5-1). These form a long sealing gap between the shoulder of the inner ring. Because of this, the bearing is almost frictionless, friction losses are minimal and there is no temperature increase in the drive shaft bearing.

5. Service and Maintenance

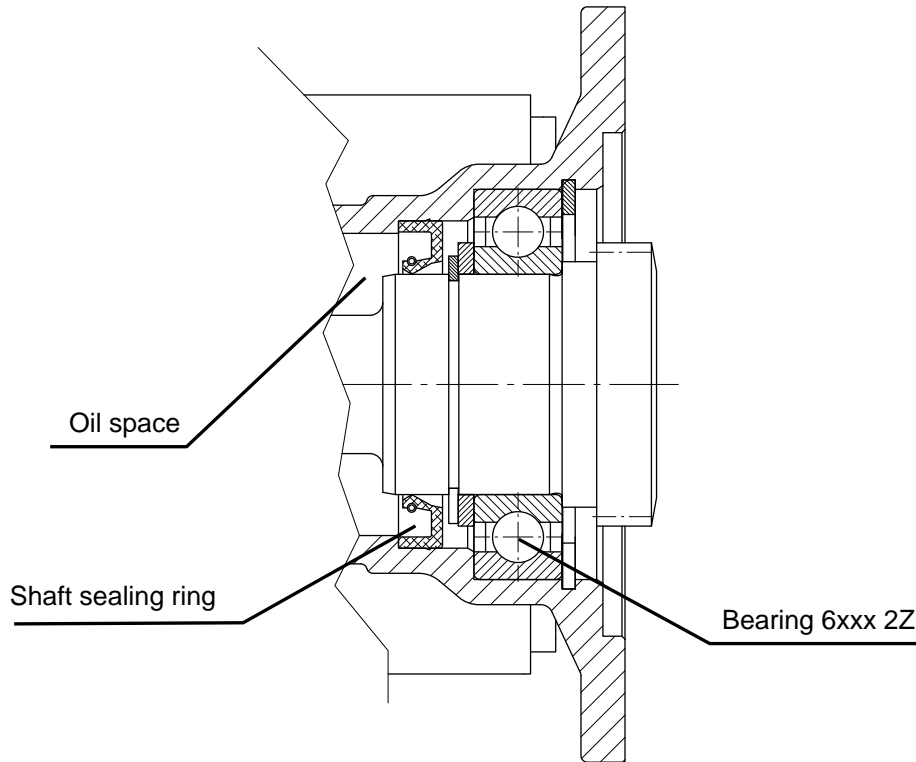


Fig. 5-1: Drive shaft bearing and seal on the coupling side of universal worm gear units

Due to the internal construction of the bearing, there may initially be a very slight apparent leakage on the drive shaft, which is caused by transport or storage. I.e. there may be a slight escape of oil from the bearing grease before commissioning and in the initial phase of operation.

We hereby explicitly point out that any slight escape of oil does not constitute technical faults and does not impair the reliability of the gear unit and the bearing.

Check for running noises

If the gear unit produces unusual running noises and/or vibrations, this could indicate damage to the gear unit. In this case the gear should be shut down and a general overhaul carried out.

Check the oil level

Section 6.1 describes the versions and the corresponding oil level screws. With double gear units, the oil level must be checked on both units. The pressure vent must be at the position marked in Section 6.1.

The oil level does not need to be checked on gear units without oil level screw (see Section 6.1).

Gear unit types that are not supplied full of oil must be filled before the oil level is checked. (see "Changing the oil")

Checking the oil level:

1. The oil level may only be checked when the gear unit is **at a standstill and has cooled down**. The gear unit must be secured to prevent accidental switch-on.
2. The oil level screw corresponding to the version must be screwed out. (See Section 6.1)



5. Service and Maintenance



Note!

At the first oil level check a small amount of oil may escape, as the oil level may be below the lower edge of the oil level hole.

3. Gear units with oil level screw: The maximum oil level is the lower edge of the oil level hole. The minimum oil level is 4 mm below the oil level hole. If the oil level is too low, this must be corrected using the correct type of oil. An oil level glass is available instead of the oil level screw
4. Gear units with an oil level vessel: The oil level must be checked **in the oil level vessel** with the aid of the dipstick plug (thread G1 1/4). The oil level must be between the upper and lower mark when the dipstick is completely screwed in (see Fig. 5-2). The oil level must be corrected with the correct type of oil if necessary. These gearboxes may only be operated in the configuration stated in Section 6.1.
5. The oil level screw or the cap screw with dipstick and all other loosened screws must be correctly re-tightened.

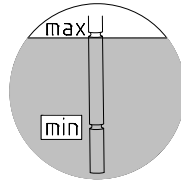


Figure 5-2: Check the oil level with a dipstick

Regreasing

Some gear unit designs (free drive shaft, Option W, agitator designs VL2 and VL3) are equipped with a regreasing device.

For agitator versions VL2 and VL3, the vent screw located opposite to the grease nipple must be unscrewed before regreasing. Grease should be injected until a quantity of 20-25g escapes from the vent hole. After this, the vent plug must be reinserted and tightened.

For Option W and some IEC adapters, the outer roller bearing must be regreased with approx. 20-25g of grease via the grease nipple provided

Recommended grease: Petamo GHY 133N (see Section 6.4: Klüber Lubrication).

Replacing the automatic lubricant dispenser

Screw-off the cartridge case cover (2), (see Fig. 4-1). The lubrication dispenser (5) is screwed out and replaced with a new component (Part No. 283 0100). Then activate (see Chapter 4.2)!

Changing the oil

The figures in Section 6.1 show the oil drain screw, the oil level screw and the pressure vent screw for various designs.

Sequence:

1. Place the drip tray below the oil drain screw or the oil drain cock
2. Completely remove oil level screw, screwed sealing plug with dipstick if an oil level tank is being used and oil drain screw.




Danger!

Warning: Hot oil!

5. Service and Maintenance

3. Drain all the oil from the gear unit.
4. If the screw lock coating of the oil drain screw or oil level screw is damaged in the thread, a new oil level screw must be used or the thread cleaned and coated with securing lubricant, e.g. Loctite 242, Loxeal 54-03 prior to inserting. Always use a new sealing ring.
5. Support the seal ring, insert the oil drain screw into the hole and tighten to the correct torque! (See Section 6.2 for torque values)
6. Using a suitable filling device, refill with oil of the same type through the oil level hole until oil emerges from the oil level hole. (The oil can also be filled through the pressure vent screw or a sealing plug located higher than the oil level). If an oil level vessel is used, fill the oil through the upper inlet (thread G1¼) until the oil level is set as described in Section 5.2.
7. Wait at least 15 minutes, or at least 30 minutes if an oil level tank is used, and then check the oil level. Proceed as described in Section 5.2.

Note!	
	<p>The oil does not need to be changed on gear units without oil level screw (see Section 6.1). These gear units are lubricated for life.</p> <p>Standard helical gear units have no oil level screw. Here, the oil is topped up through the pressure vent bolt using the quantities listed in the table in Section 6.5.</p>

Cleaning or replacing the vent plug

In case of severe dirt, unscrew the vent plug and clean it thoroughly. If necessary screw in a new vent plug with a new sealing ring.

General overhaul

The gear units must be completely dismantled The following work must be carried out:

- Clean all gear unit components
- Examine all gear unit components for damage
- All damaged components must be replaced
- All roller bearings must be replaced
- Replace back stops if fitted
- Replace all seals, radial seals and Nilos rings
- Replace plastic and elastomer components of the motor coupling

The general overhaul must be carried out by qualified personnel in a specialist workshop with appropriate equipment in observance of national regulations and laws. We recommend that the general overhaul is carried out by the NORD service department.







6. Appendix

6. Appendix

6.1 Versions and maintenance

Explanation of symbols for the following version illustrations:

-  Vent
-  Oil level
-  Oil drain

Note!	
	SK 320, SK 172, SK 272, SK 372K, SK 273 and SK373 as well as SK 01282 NB, SK 0282 NB, SK 1382 NB and UNIVERSAL / Minibloc gear units are lubricated for life. These gear units do not have an oil filler screw.

UNIVERSAL / MiniBloc worm gear units

NORD UNIVERSAL / MiniBloc worm gear units are suitable for all installation positions. They have an oil filler which is independent of the the version.

As an option, types SI and SMI can be equipped with a vent screw. Gear units with vents must be installed in the stated position (see section 6.5)

Types SI, SMI, S, SM and SU as 2-stage gear unit types and types SI, SMI as worm gear units for direct motor mounting have an oil filler which depends on the version and must be installed in the stated position.

6. Appendix

Parallel shaft gear units with oil level vessel

The following applies for SK 9282, SK 9382, SK 10282, SK 10382, SK 11282, SK 11382 parallel gear units and SK 12382 in the M4 configuration with oil level vessels:

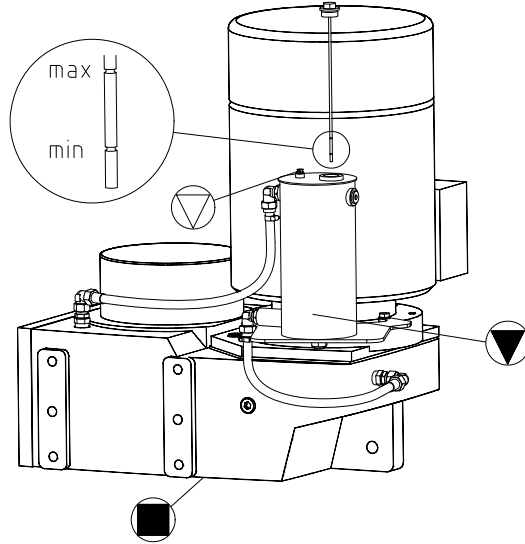
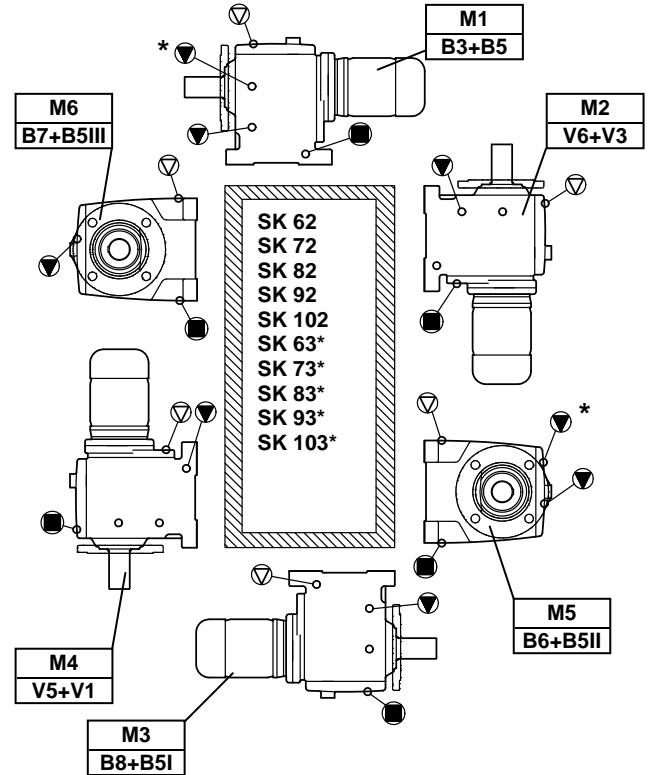
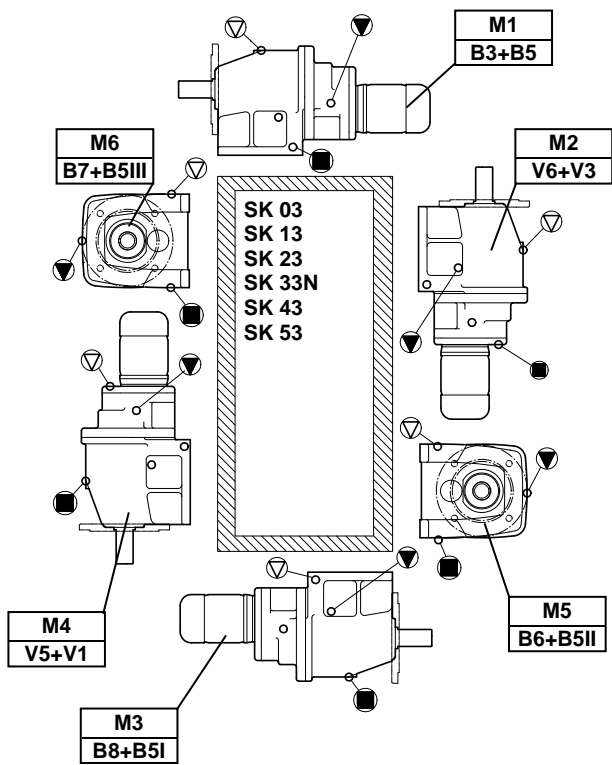
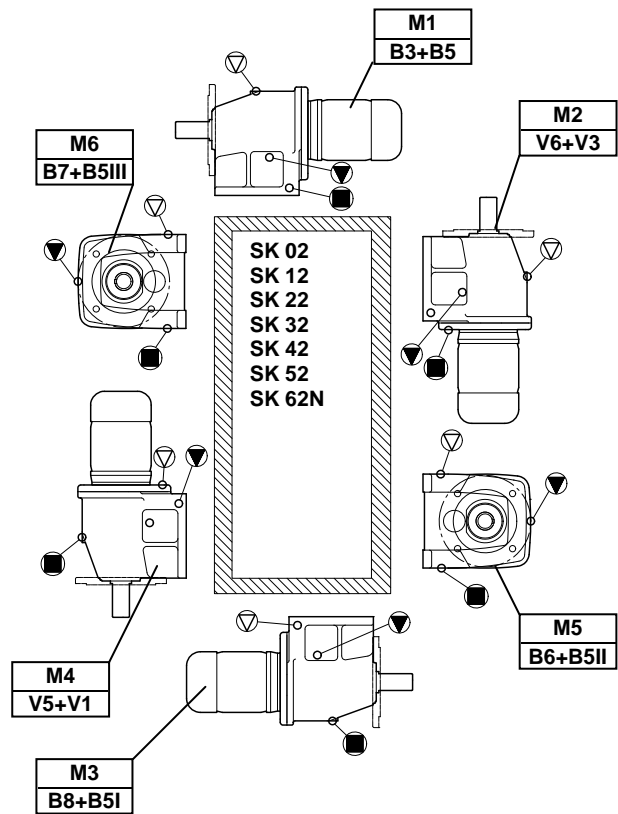
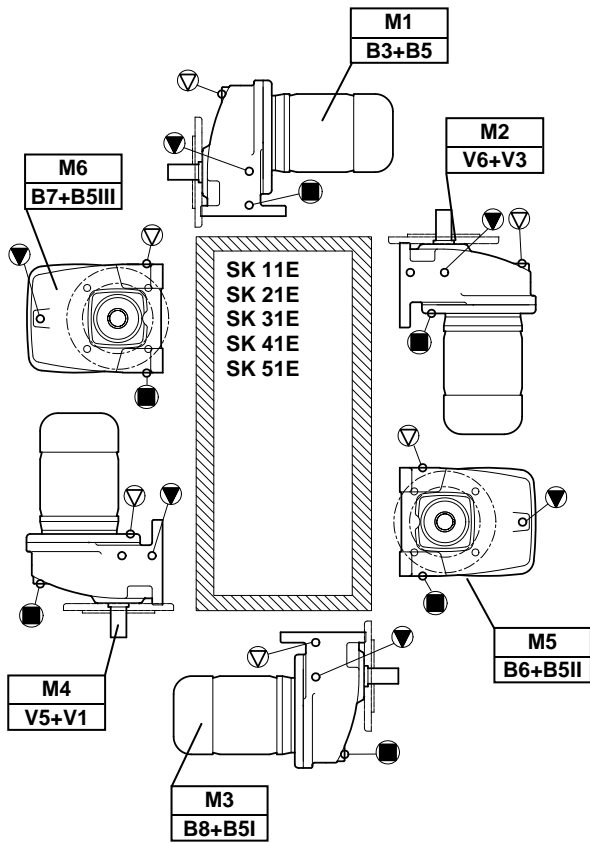
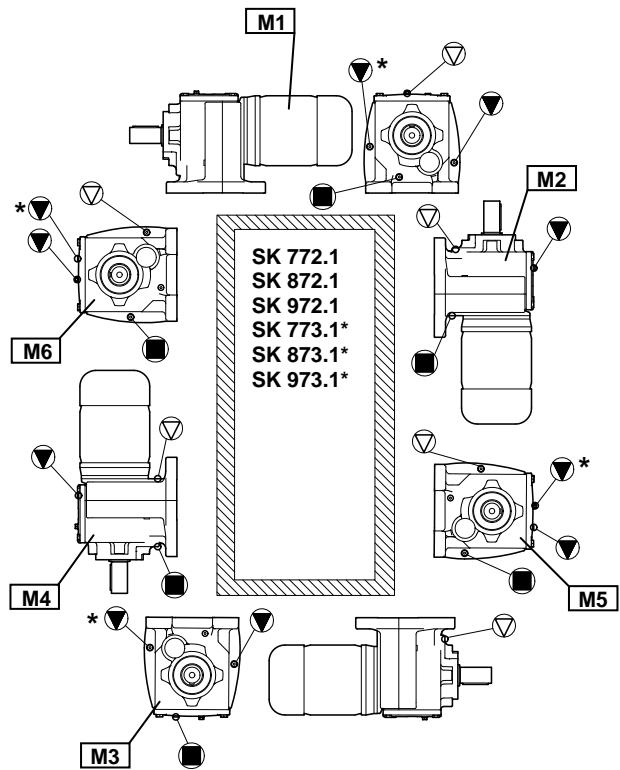
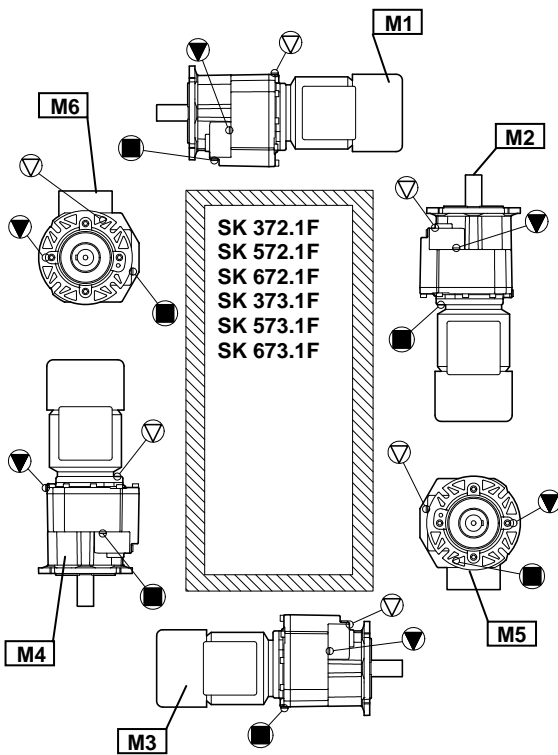
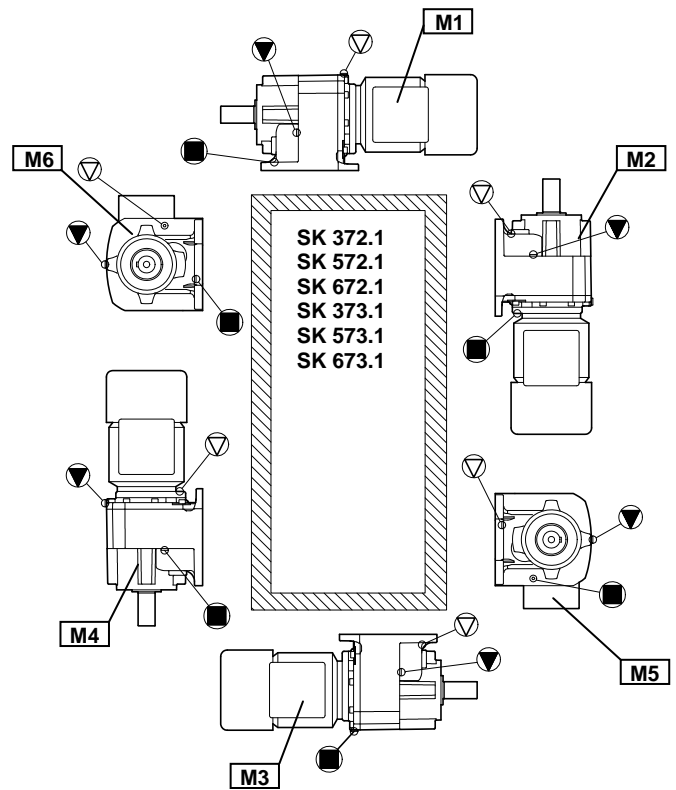
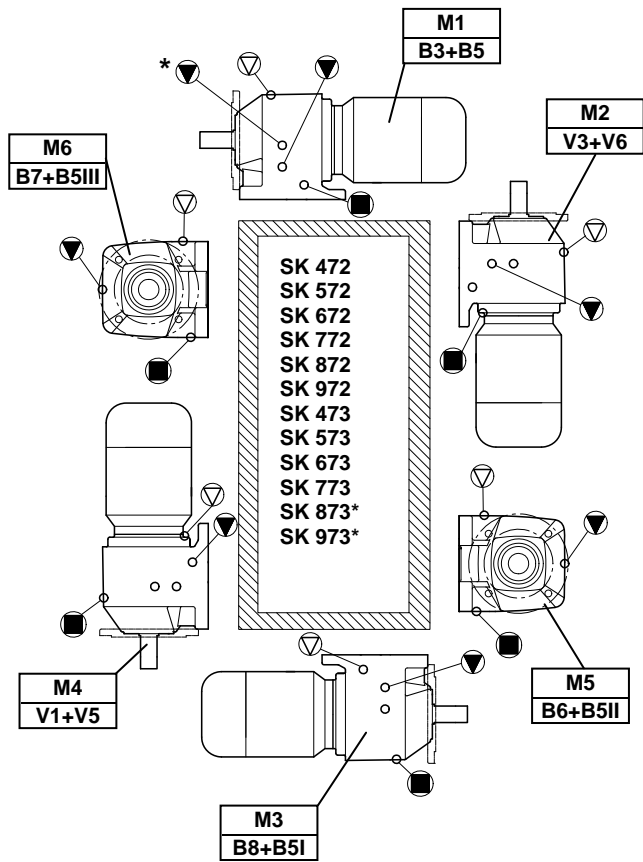
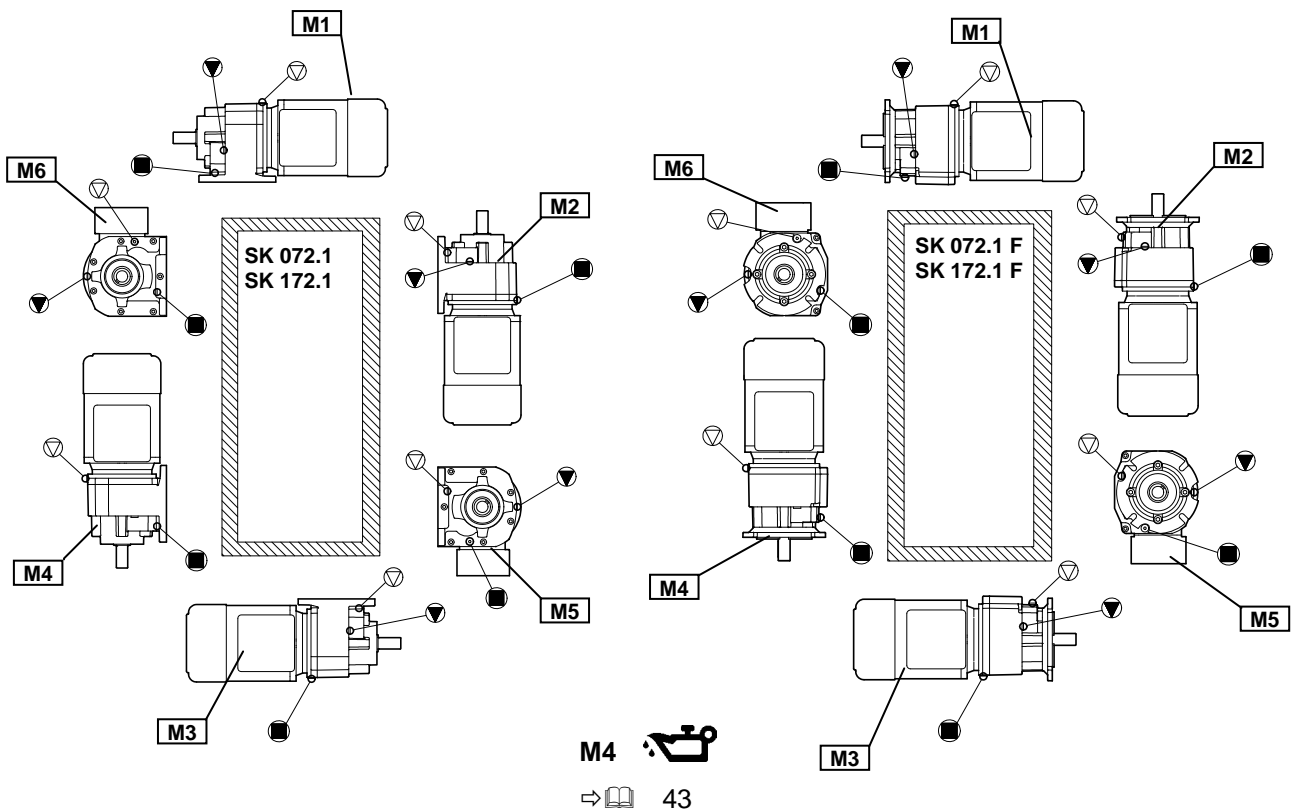
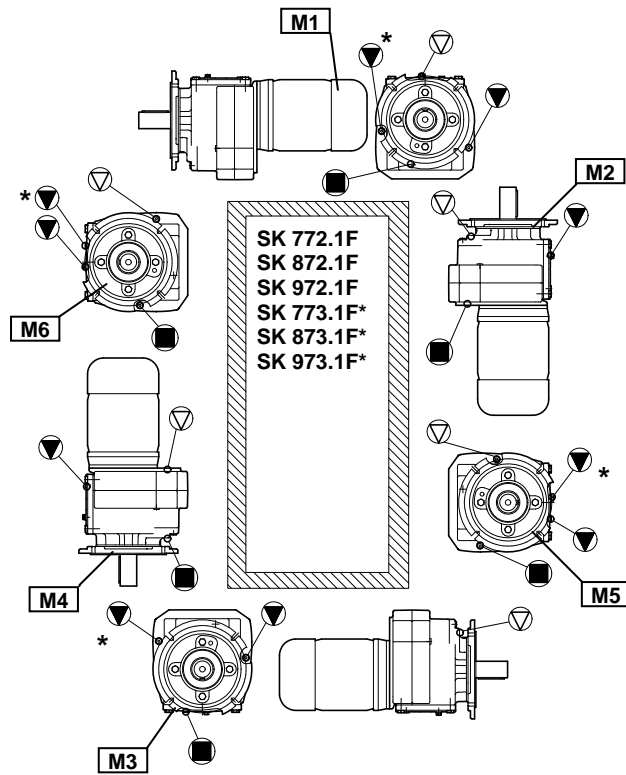
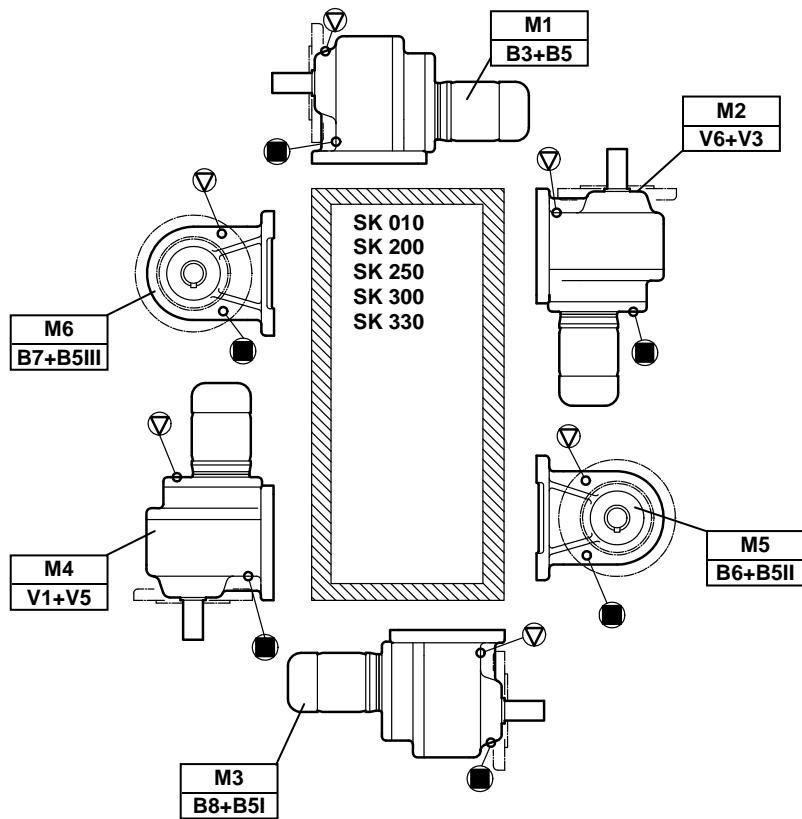
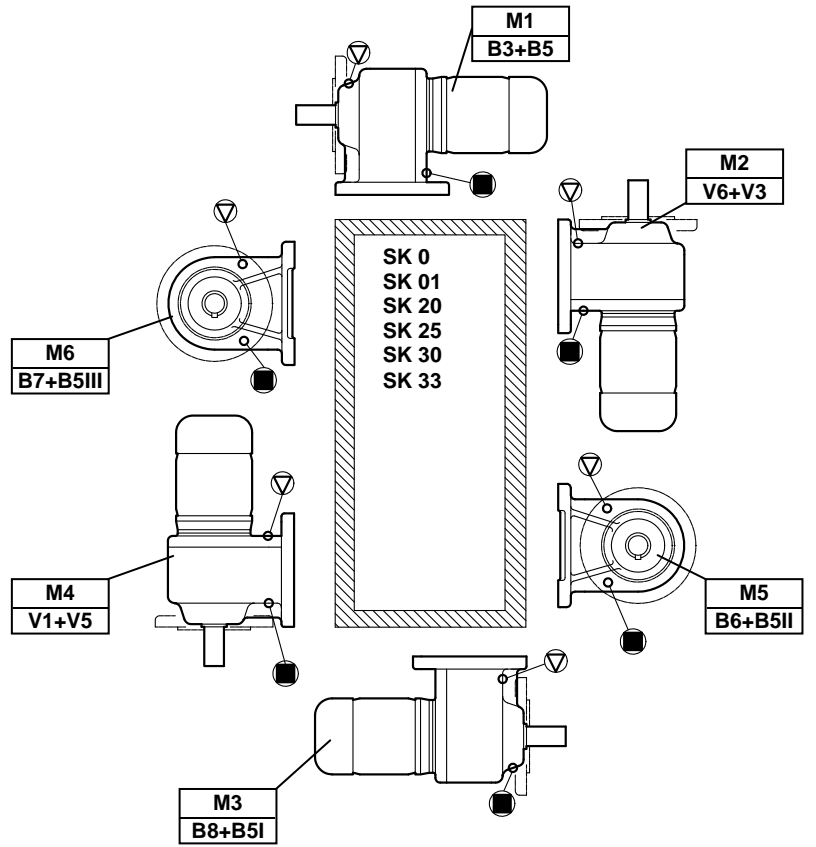


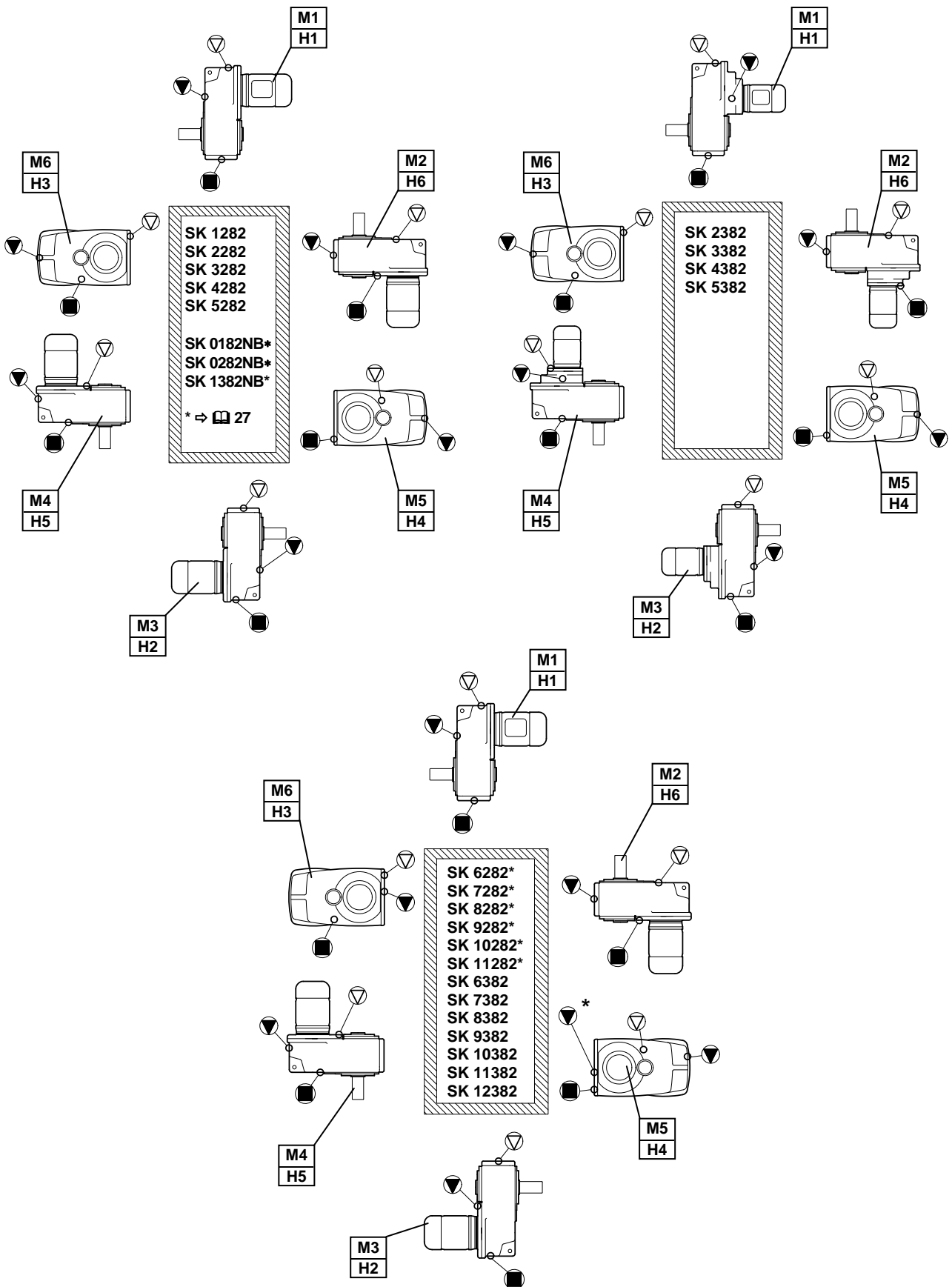
Figure 6-1: Oil level check with oil level tank

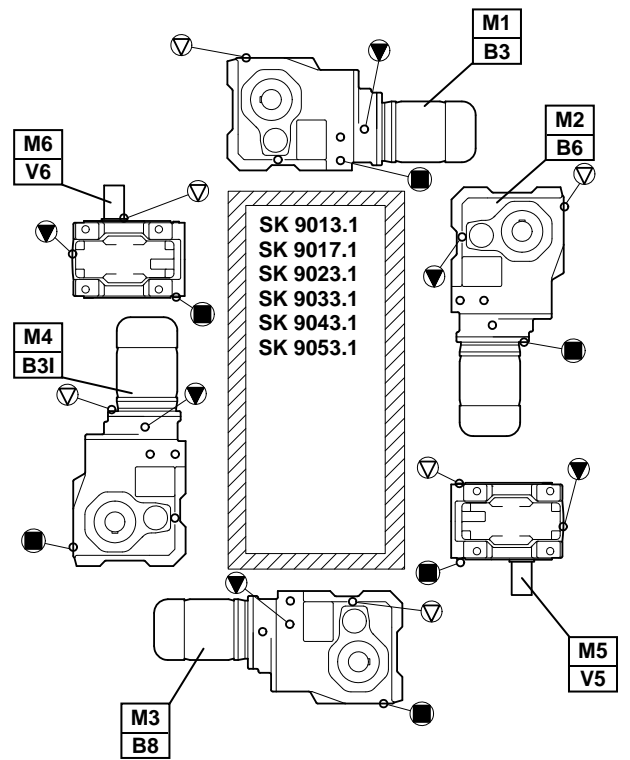
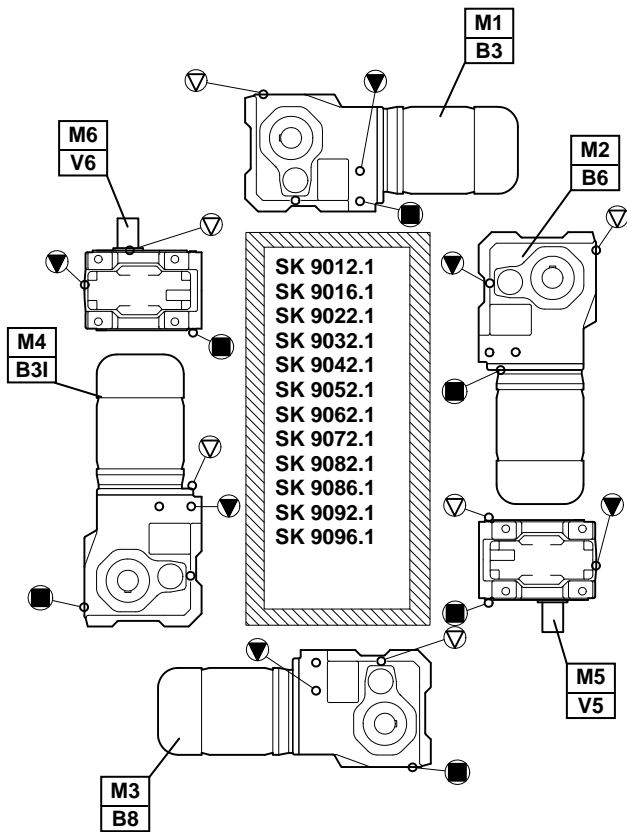
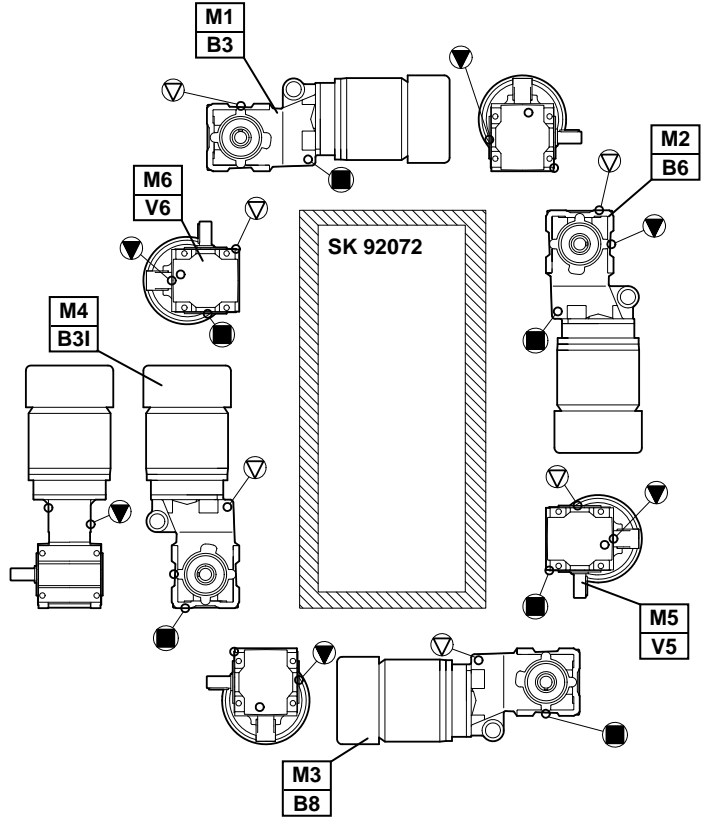
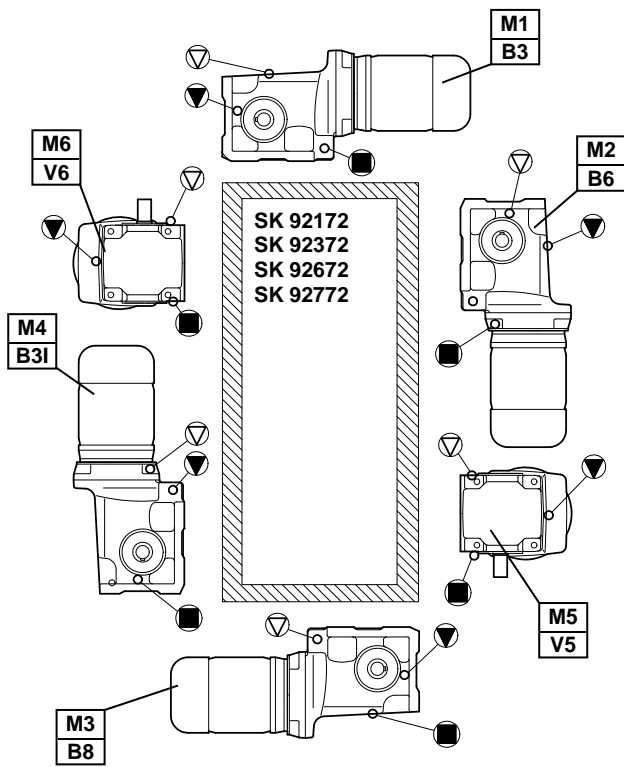


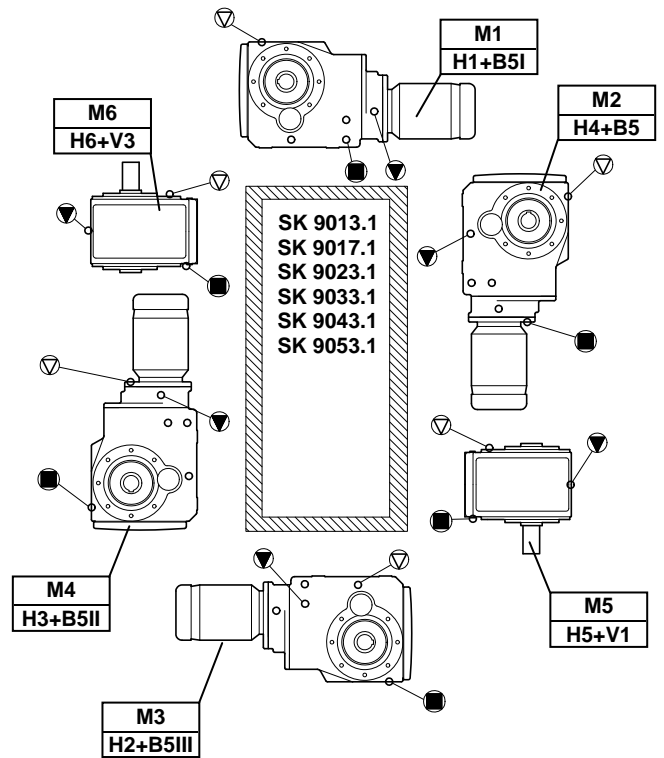
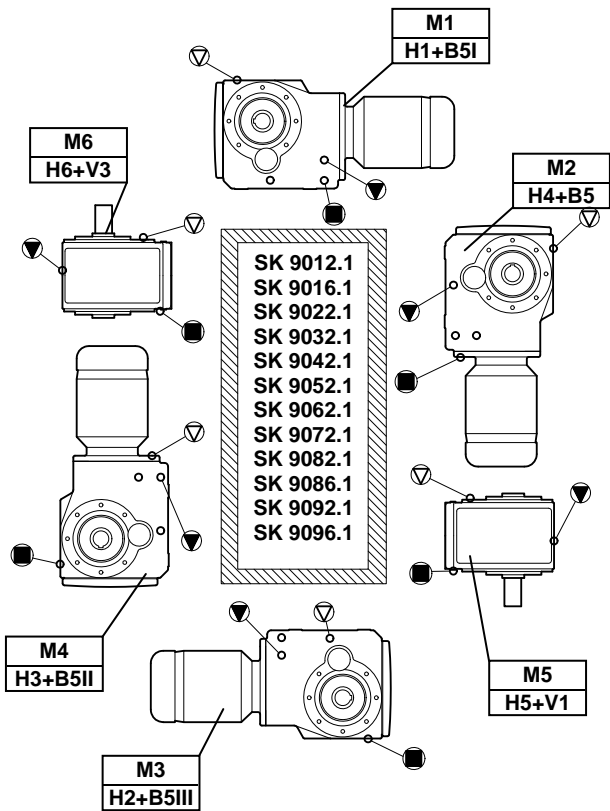
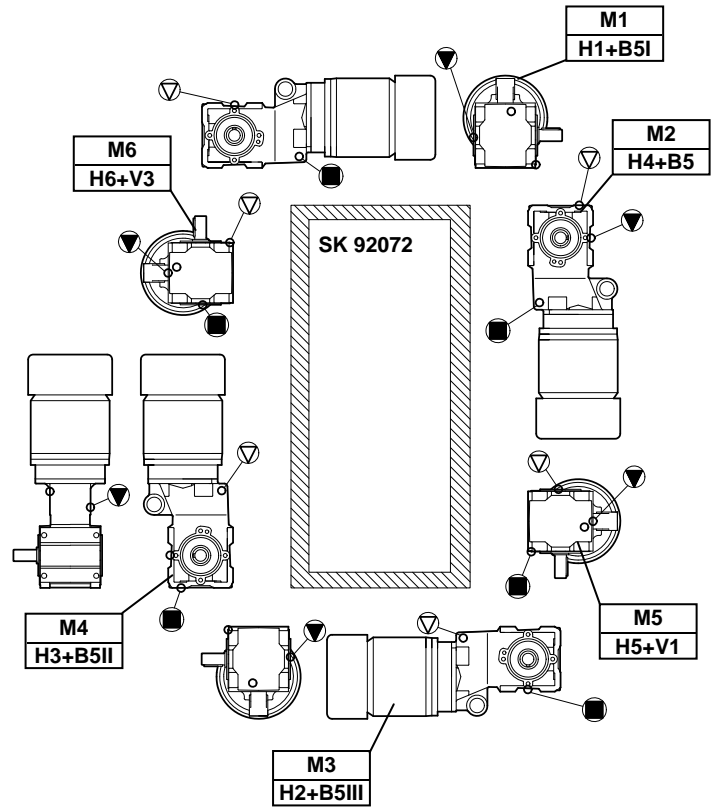
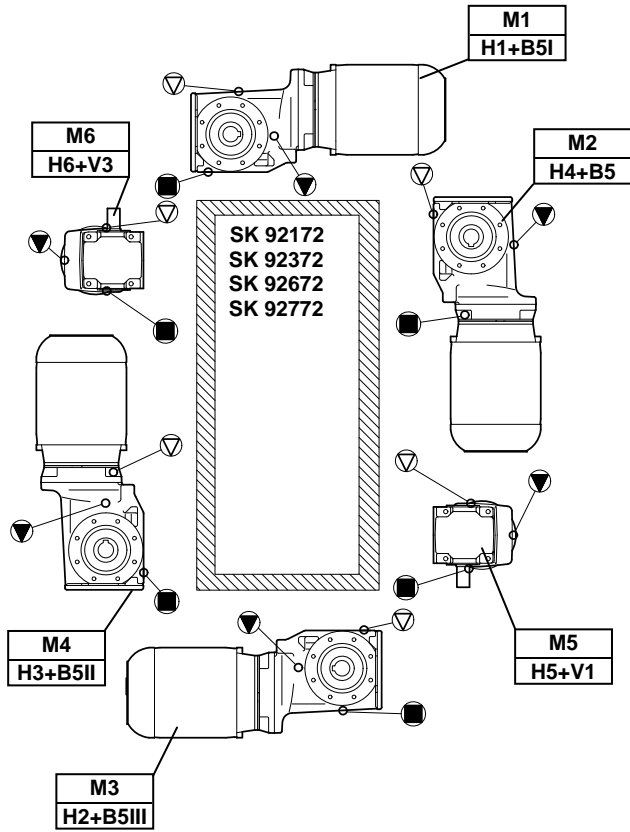


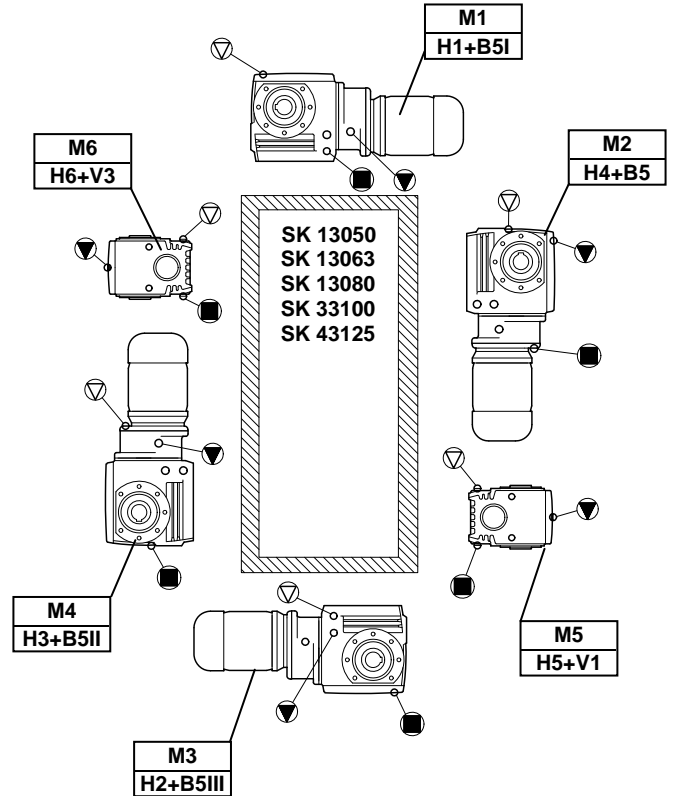
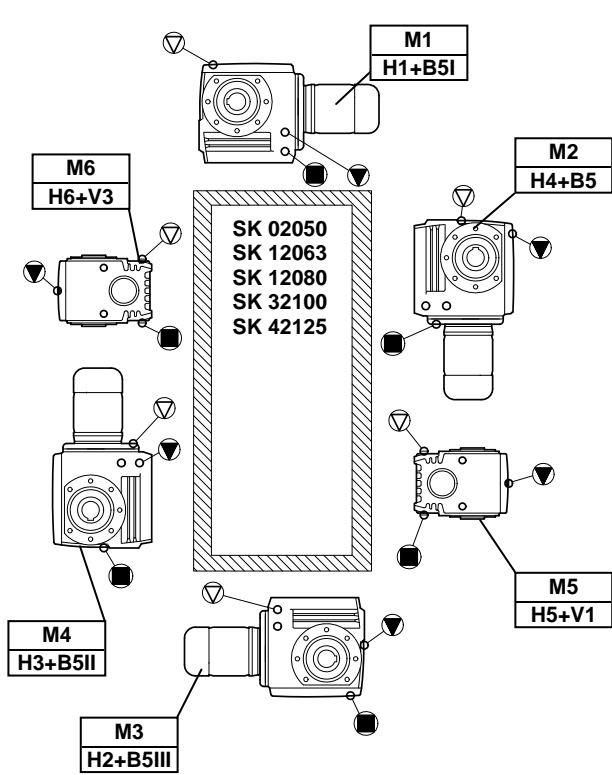
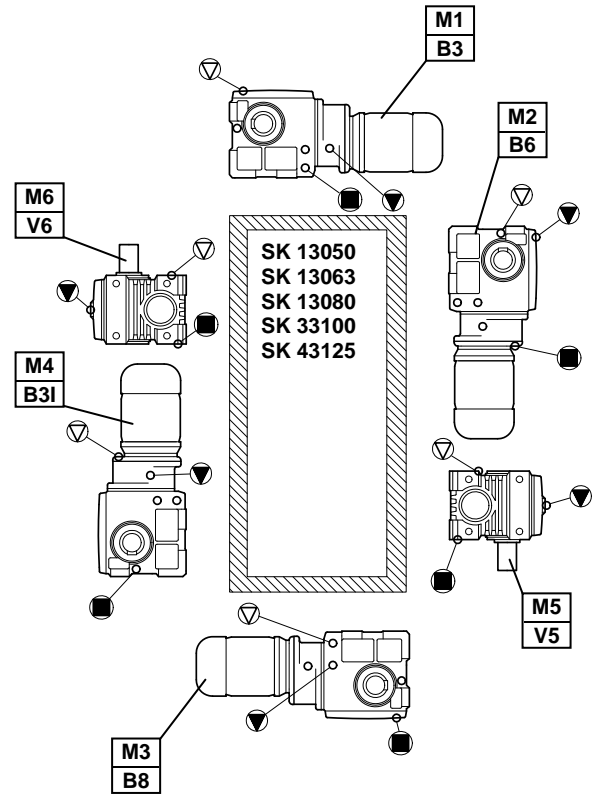
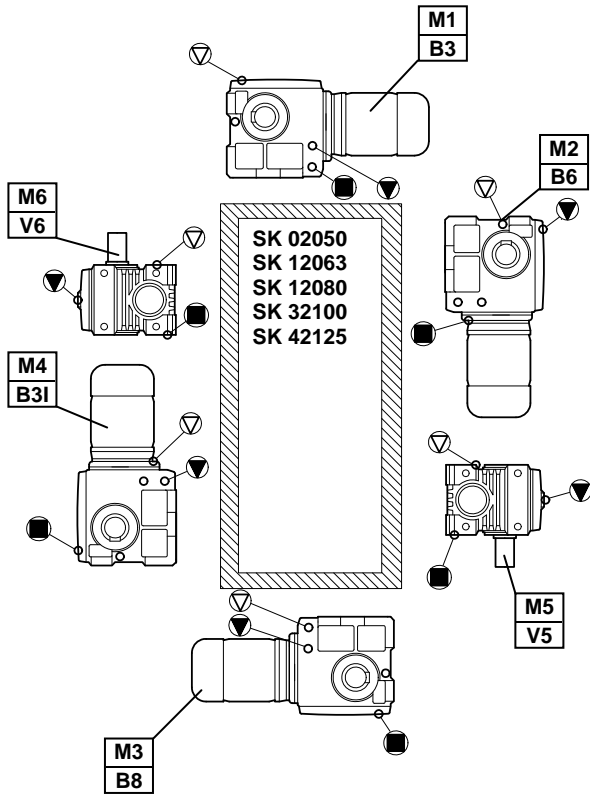


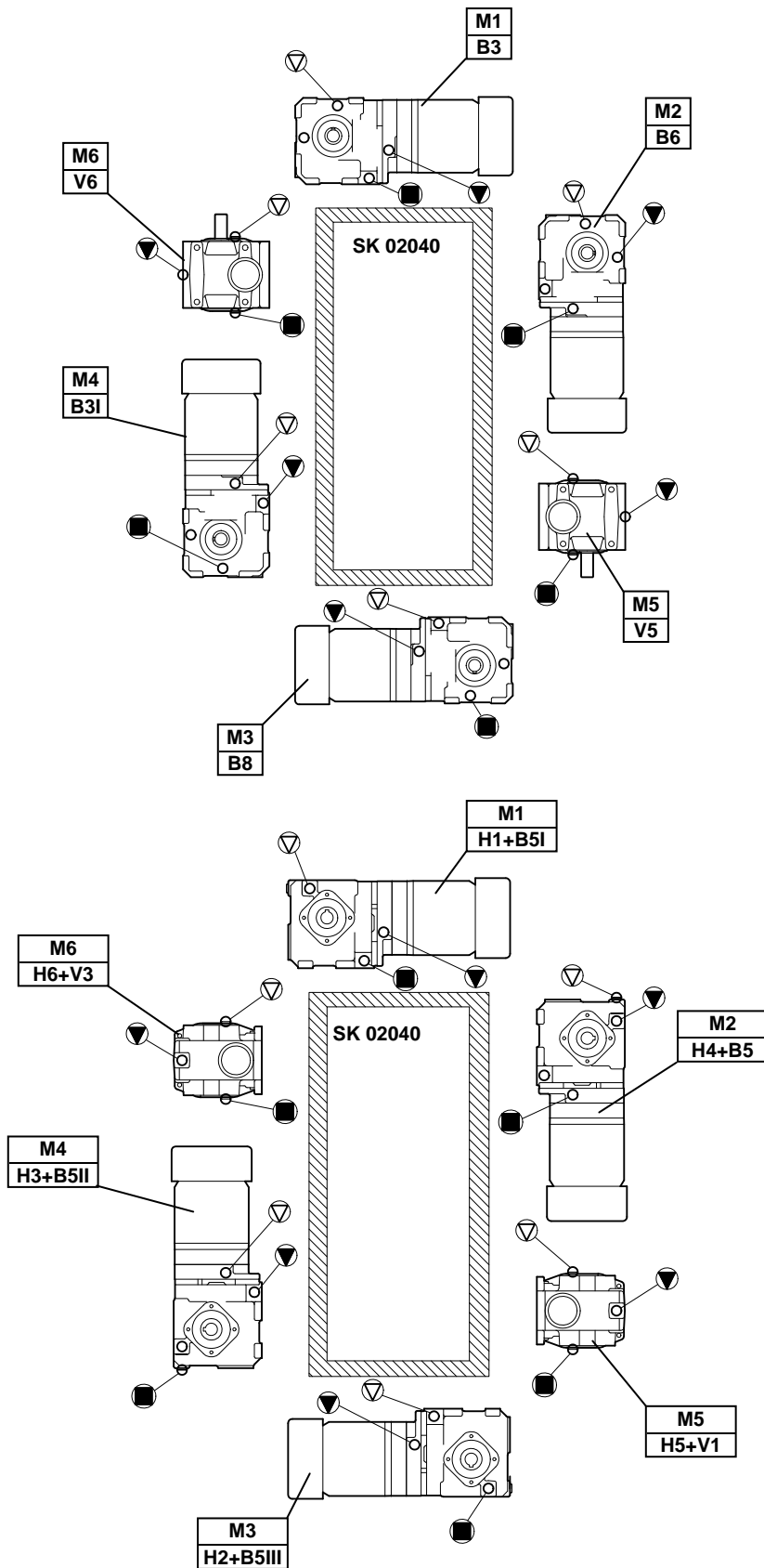




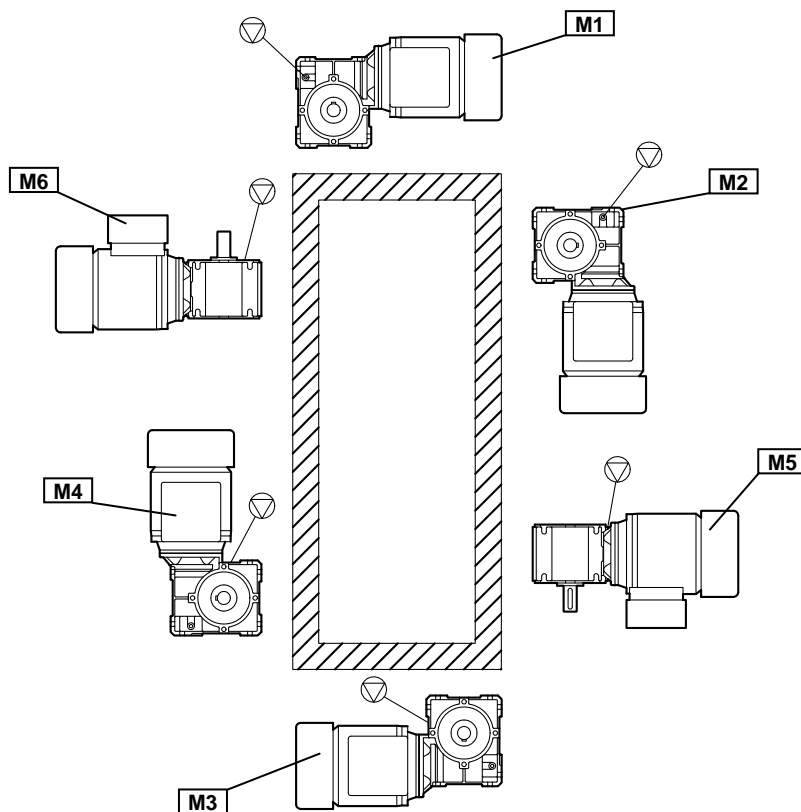








SK 1S32 – SK 1S63
 SK 1SU32 – SK 1SU63
 SK 1SM31 – SK 1SM63
 SK 1SI31 – SK 1SI75
 SK 1SIS31 – SK 1SIS75
 SK 1SMI31 – SK 1SMI75
 SK 1SID31 – SK 1SID75
 SK 1SIS-D31 – SK 1SIS-D63
 SK 1SMID31 – SK 1SMID75
 SK 2S32NB – SK 2S63NB
 SK 2SU32NB- SK 2SU63NB
 SK 2SM40 – SK 2SM63
 SK 2SIS-D40 – SK 2SIS-D63
 SK 2SID40 – SK 2SID63
 SK 2SMID40 – SK 2SMID63



⇒ 26



6. Appendix

6.2 Torque values

Bolt Torques [Nm]						
Size	Screw connections in the strength classes			Sealing screws	Threaded pin on coupling	Screw connections on protective covers
	8.8	10.9	12.9			
M4	3.2	5	6	-	-	
M5	6.4	9	11	-	2	
M6	11	16	19	-	-	6.4
M8	27	39	46	11	10	11
M10	53	78	91	11	17	27
M12	92	135	155	27	40	53
M16	230	335	390	-	-	92
M20	460	660	770	-	-	230
M24	790	1150	1300	80	-	460
M30	1600	2250	2650	170	-	
M36	2780	3910	4710	-	-	
M42	4470	6290	7540	-	-	
G1¼	-	-	-	20	-	

6.3 Troubleshooting

Gear unit malfunctions		
Fault	Possible cause	Remedy
Unusual running noises, vibrations	Oil too low or bearing damage or toothed wheel damage	Consult NORD Service
Oil escaping from gear unit or motor	Defective seal	Consult NORD Service
Oil escaping from pressure vent	Incorrect oil level or incorrect, contaminated oil or unfavourable operating conditions	Oil change Use oil expansion tank (Option OA)
Gear unit becomes too hot	Unfavourable installation conditions or gear unit damage	Consult NORD Service
Shock when switched on, vibrations	Defective motor coupling or loose gear unit mounting or defective rubber element	Replace elastomer gear rim, tighten motor and gear unit fastening bolts, replace rubber element
Drive shaft does not rotate although motor is running	Fracture in gear unit or defective motor coupling or shrink disc slippage	Consult NORD Service

	Attention!
	Warning: shut down the gear unit immediately should any of the above faults occur!







6. Appendix

6.4 Lubricants

With the exception of type SK 11282, SK 11382, SK 12382 and SK 9096.1 gear units, all gear units are filled with lubricant ready for operation in the required installation position when delivered. This initial filling corresponds to a lubricant from the column for the ambient temperatures (normal version) in the lubricant table.

Roller bearing greases

This table shows comparable roller bearing greases from various manufacturers. The manufacturer can be changed for a given grease type. Getriebebau NORD must be contacted in case of change of grease type or ambient temperature range, as otherwise no warranty for the functionality of our gear units can be accepted.







Lubricant type	Ambient temperature						
Mineral oil-based grease	-30 ... 60°C	Energrease LS 2 Energrease LS-EP 2	Longtime PD 2	RENOLIT GP 2 RENOLIT LZR 2 H	-	Mobilux EP 2	Gadus S2 V100 2
	-50 ... 40°C	-	Optitemp LG 2	RENOLIT JP 1619	-	-	-
Synthetic grease	-25 ... 80°C	Energrease SY 2202	Tribol 4747	RENOLIT HLT 2 RENOLIT LST 2	PETAMO GHY 133 N Klüberplex BEM 41-132	Mobiltemp SHC 32	Cassida EPS2
Biodegradable grease	-25 ... 40°C	Biogrease EP 2	-	PLANTOGEL 2 S	Klüberbio M 72-82	Mobil SHC Grease 102 EAL	Naturelle Grease EP2
Foodstuff-compatible grease	-25 ... 40°C	-	Obeen UF 2	RENOLIT G 7 FG 1	Klübersynth UH1 14-151	Mobilgrease FM 222	Cassida RLS2




6. Appendix

Lubricant table

This table shows comparable lubricants from various manufacturers. The manufacturer can be changed within a particular viscosity or lubricant type. Getriebbau NORD must be contacted in case of change of viscosity or lubricant type, as otherwise no warranty for the functionality of our gearboxes can be accepted.

Lubricant type	Details on type plate	DIN (ISO) / Ambient temperature						
Mineral oil	CLP 680	ISO VG 680 0...40°C	Energol GR-XP 680	Alpha EP 680 Alpha SP 680 Optigear BM 680 Tribol 1100/680	RENOLIN CLP 680 RENOLIN CLP 680 Plus	Klüberoil GEM 1-680 N	Mobilgear 600 XP 680	Omala S2 G 680
	CLP 220	ISO VG 220 -10...40°C	Energol GR-XP 220	Alpha EP 220 Alpha SP 220 Optigear BM 220 Tribol 1100/220	RENOLIN CLP 220 RENOLIN CLP 220 Plus	Klüberoil GEM 1-220 N	Mobilgear 600 XP 220	Omala S2 G 220
	CLP 100	ISO VG 100 -15...25°C	Energol GR-XP 100	Alpha EP 100 Alpha SP 100 Optigear BM 100 Tribol 1100/100	RENOLIN CLP 100 RENOLIN CLP 100 Plus	Klüberoil GEM 1-100 N	Mobilgear 600 XP 100	Omala S2 G 100
Synthetic oil (Polyglycol)	CLP PG 680	ISO VG 680 -20...40°C	-	Alphasyn GS 680 Tribol 800/680	RENOLIN PG 680	Klübersynth GH 6-680	Mobil Glygoyle 680	Omala S4 WE 680
	CLP PG 220	ISO VG 220 -25...80°C	Energol SG-XP 220	Alphasyn GS 220 Alphasyn PG 220 Tribol 800/220	RENOLIN PG 220	Klübersynth GH 6-220	Mobil Glygoyle 220	Omala S4 WE 220
Synthetic oil (hydrocarbon)	CLP HC 460	ISO VG 460 -30...80°C	-	Alphasyn EP 460 Tribol 1510/460 Optigear Synthetic X 460	RENOLIN Unisyn CLP 460	Klübersynth GEM 4-460 N	Mobil SHC 634	Omala S4 GX 460
	CLP HC 220	ISO VG 220 -40...80°C	-	Alphasyn EP 220 Tribol 1510/220 Optigear Synthetic X 220	RENOLIN Unisyn CLP 220	Klübersynth GEM 4-220 N	Mobil SHC 630	Omala S4 GX 220
Bio-degradable oil	CLP E 680	ISO VG 680 -5...40°C	-	-	PLANTOGEAR 680 S	-	-	-
	CLP E 220	ISO VG 220 -5...40°C	-	Tribol BioTop 1418/220	PLANTOGEAR 220 S	Klübersynth GEM 2-220	-	Naturelle Gear Fluid EP 220
Food grade oil	CLP PG H1 680	ISO VG 680 -5...40°C	-	Tribol FoodProof 1800/680	-	Klübersynth UH1 6-680	Mobil Glygoyle 680	Cassida Fluid WG 680
	CLP PG H1 220	ISO VG 220 -25...40°C	-	Tribol FoodProof 1800/220	-	Klübersynth UH1 6-220	Mobil Glygoyle 220	Cassida Fluid WG 220
	CLP HC H1 680	ISO VG 680 -5...40°C	-	Optileb GT 680	GERALYN SF 680	Klüberoil 4 UH1-680 N	-	Cassida Fluid GL 680
	CLP HC H1 220	ISO VG 220 -25...40°C	-	Optileb GT 220	GERALYN SF 220	Klüberoil 4 UH1-220 N	Mobil SHC Cibus 220	Cassida Fluid GL 220
Gear unit liquid grease		-25 ... 60°C	Energol LS-EP 00	Longtime PD 00 Tribol 3020/1000-00	RENOLIT DURAPLEX EP 00	MICROLUBE GB 00	Mobil Chassis Grease LBZ	Alvania EP(LF)2
					RENOLIT LST 00			


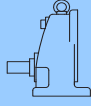
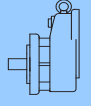
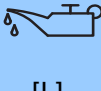
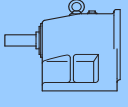
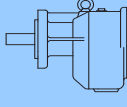
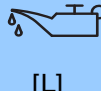
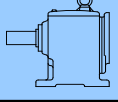
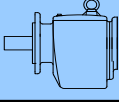

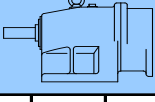
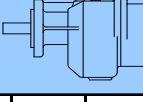
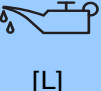
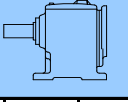
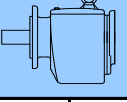
6.5 Lubricant quantities

	Note!
	After changing the lubricant, and in particular after the initial filling, the oil level may change during the first few hours of operation, as the oil galleries and hollow spaces only fill gradually during operation. The oil level is still within the permissible tolerance.
	If at the express request of the customer, an oil inspection glass is installed at an additional charge, we recommend that the customer corrects the oil level after an operating period of approx. 2 hours, so that when the gear unit is at a standstill and has cooled down, the oil level is visible in the inspection glass. Only then, is it possible to check the oil level by means of the inspection glass.

The filling quantities stated in the following tables are for guidance only. The precise quantities vary depending on the exact gear ratio. When filling, always observe the oil level screw hole as an indicator of the precise quantity of oil.

* Type SK11282, SK11382, SK12382 and SK 9096.1 gear units are normally supplied without oil.



 [L]												
⇒ 6.1	M1	M2	M3	M4	M5	M6	M1	M2	M3	M4	M5	M6
⇒ 6.1	B3	V6	B8	V5	B6	B7	B5	V3	B5I	V1	B5II	B5III
SK11E	0,25	0,50	0,55	0,40	0,35	0,35	0,30	0,35	0,50	0,30	0,40	0,40
SK21E	0,60	1,20	1,20	1,00	1,00	1,00	0,50	1,40	1,10	0,70	0,90	0,90
SK31E	1,10	2,70	2,20	2,30	1,70	1,70	0,80	1,30	1,65	1,10	2,00	2,00
SK41E	1,70	2,60	3,30	2,50	2,60	2,60	1,00	2,60	2,80	1,60	3,30	3,30
SK51E	2,20	4,40	4,70	4,00	3,40	3,40	1,80	3,50	4,10	3,00	3,80	3,80
 [L]												
SK02	0,15	0,60	0,70	0,60	0,40	0,40	0,25	0,60	0,60	0,60	0,50	0,50
SK12	0,25	0,75	0,85	0,75	0,50	0,50	0,35	0,85	0,90	0,90	0,60	0,60
SK22	0,50	1,80	1,80	1,80	1,35	1,35	0,70	2,00	2,00	1,80	1,55	1,55
SK32	0,90	2,50	2,50	2,90	2,00	2,00	1,30	2,90	3,30	3,10	2,40	2,40
SK42	1,30	4,50	4,50	4,30	3,20	3,20	1,80	4,40	4,50	4,00	3,70	3,70
SK52	2,50	7,00	6,80	6,80	5,10	5,10	3,00	6,80	6,20	7,40	5,60	5,60
 [L]												
SK62	6,50	15,00	13,00	16,00	15,00	15,00	7,00	15,00	14,00	18,50	16,00	16,00
SK72	10,00	23,00	18,00	26,00	23,00	23,00	10,00	23,00	18,50	28,00	23,00	23,00
SK82	14,00	35,00	27,00	44,00	32,00	32,00	15,00	37,00	29,00	45,00	34,50	34,50
SK92	25,00	73,00	47,00	76,00	52,00	52,00	26,00	73,00	47,00	78,00	52,00	52,00
SK102	36,00	79,00	66,00	102,00	71,00	71,00	40,00	81,00	66,00	104,00	72,00	72,00
 [L]												
SK03	0,30	1,00	0,80	0,90	0,60	0,60	0,50	0,80	0,90	1,10	0,80	0,80
SK13	0,60	1,25	1,10	1,20	0,70	0,70	0,85	1,20	1,20	1,20	0,95	0,95
SK23	1,30	2,40	2,30	2,35	1,60	1,60	1,50	2,60	2,50	2,80	2,80	2,80
SK33N	1,60	2,90	3,20	3,70	2,30	2,30	2,50	3,40	3,50	4,40	2,60	2,60
SK43	3,00	5,60	5,20	6,60	3,60	3,60	3,50	5,70	5,00	6,10	4,10	4,10
SK53	4,50	8,70	7,70	8,70	6,00	6,00	5,20	8,40	7,00	8,90	6,70	6,70
 [L]												
SK63	13,00	14,50	14,50	16,00	13,00	13,00	13,50	14,00	15,50	18,00	14,00	14,00
SK73	20,50	20,00	22,50	27,00	20,00	20,00	22,00	22,50	23,00	27,50	20,00	20,00
SK83	30,00	31,00	34,00	37,00	33,00	33,00	31,00	34,00	35,00	40,00	34,00	34,00
SK93	53,00	70,00	59,00	72,00	49,00	49,00	53,00	70,00	59,00	74,00	49,00	49,00
SK103	74,00	71,00	74,00	97,00	67,00	67,00	69,00	78,00	78,00	99,00	67,00	67,00

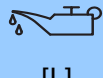
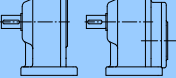
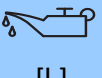
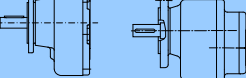
[L]							[L]						
	⇒ 6.1	M1	M2	M3	M4	M5		M6	⇒ 6.1	M1	M2	M3	M4
SK072.1	0,16	0,32	0,21	0,23	0,18	0,20	SK072.1 F	0,16	0,32	0,21	0,23	0,18	0,20
SK172.1	0,27	0,59	0,42	0,45	0,32	0,39	SK172.1 F	0,27	0,59	0,42	0,45	0,32	0,39
SK372.1	0,45	1,05	0,75	1,00	0,60	0,65	SK372.1 F	0,45	1,05	0,75	1,00	0,60	0,65
SK572.1	0,75	1,90	1,50	2,00	1,10	1,15	SK572.1 F	0,75	1,90	1,50	2,00	1,10	1,15
SK672.1	1,10	2,60	2,15	2,70	1,55	1,65	SK672.1 F	1,10	2,60	2,15	2,70	1,55	1,65
SK772.1	1,15	3,65	2,25	3,15	1,35	2,15	SK772.1 F	1,15	3,65	2,25	3,15	1,35	2,15
SK872.1	3,20	8,00	5,30	7,00	2,80	4,60	SK872.1 F	2,60	8,00	5,30	7,00	2,80	4,60
SK972.1	4,50	12,90	8,10	12,70	4,60	7,80	SK972.1 F	4,50	12,90	8,10	12,70	4,60	7,80


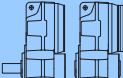

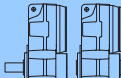
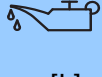
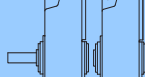
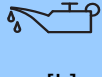


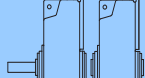
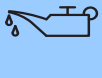
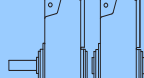
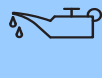
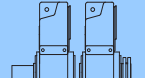
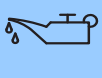
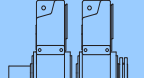
[L]							[L]						
	⇒ 6.1	M1	M2	M3	M4	M5		M6	⇒ 6.1	M1	M2	M3	M4
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SK573.1	0,75	1,90	1,50	2,00	1,10	1,15	SK573.1 F	0,75	1,90	1,50	2,00	1,10	1,15
SK673.1	1,10	2,60	2,15	2,70	1,55	1,65	SK673.1 F	1,10	2,60	2,15	2,70	1,55	1,65
SK773.1	1,95	3,50	3,20	2,90	2,25	2,95	SK773.1 F	1,95	3,50	3,20	2,90	2,25	2,95
SK873.1	4,05	7,60	6,85	6,55	5,00	6,55	SK873.1 F	4,05	7,60	6,85	6,55	5,00	6,55
SK973.1	7,40	12,20	11,10	11,60	8,00	10,90	SK973.1 F	7,40	12,20	11,10	11,60	8,00	10,90

[L]												
	⇒ 6.1	M1	M2	M3	M4	M5	M6	M1	M2	M3	M4	M5
⇒ 6.1	B3	V6	B8	V5	B6	B7	B5	V3	B5I	V1	B5II	B5III
SK172	0,35	0,50	0,50	0,50	0,50	0,50	0,35	0,50	0,50	0,50	0,50	0,50
SK272	0,60	1,00	1,00	1,00	1,00	1,00	0,60	1,00	1,00	1,00	1,00	1,00
SK372	0,60	1,00	1,00	1,00	1,00	1,00	0,60	1,00	1,00	1,00	1,00	1,00
SK472	1,00	1,90	1,90	2,00	1,80	1,80	1,00	1,90	1,90	1,90	1,90	1,50
SK572	1,00	1,90	1,90	2,00	1,80	1,80	1,00	1,90	1,90	1,90	1,90	1,50
SK672	1,40	3,40	3,10	3,15	1,45	3,15	1,15	3,40	2,70	2,80	1,25	2,70
SK772	2,00	3,30	3,50	4,20	2,70	3,30	1,60	3,30	3,50	3,30	3,10	3,10
SK872	3,70	9,60	9,10	7,30	4,70	8,00	3,50	9,00	7,90	7,70	3,90	7,20
SK972	6,50	16,00	15,70	14,70	8,50	14,00	6,50	15,00	13,00	13,50	6,50	12,00


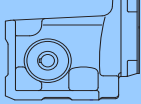
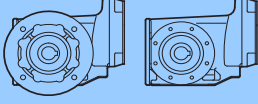

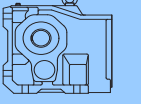
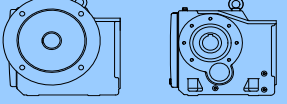

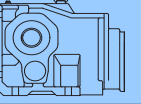
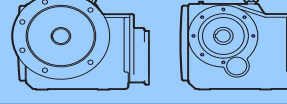
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	M1	M2	M3	M4	M5	M6	M1	M2	M3	M4	M5	M6
SK273	0,62	1,10	1,10	1,10	1,10	1,10	0,62	1,10	1,10	1,10	1,10	1,10
SK373	0,55	1,10	1,10	1,10	1,10	1,10	0,55	1,10	1,10	1,10	1,10	1,10
SK473	1,30	2,50	2,10	2,40	2,10	2,10	1,25	2,40	2,10	2,50	2,10	2,10
SK573	1,30	2,50	2,10	2,40	2,10	2,10	1,25	2,40	2,10	2,50	2,10	2,10
SK673	1,80	3,80	3,20	3,40	2,90	3,00	1,70	3,80	3,00	3,20	3,00	3,00
SK773	2,50	4,50	3,70	4,60	3,30	3,30	2,30	5,00	3,60	4,50	3,90	3,90
SK873	6,20	8,40	7,50	9,10	7,50	7,50	5,00	8,80	7,60	8,00	8,00	8,00
SK973	11,00	15,80	13,00	16,00	13,30	13,00	10,30	16,50	13,00	16,00	14,00	14,00




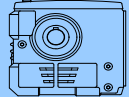
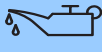
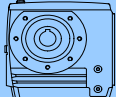

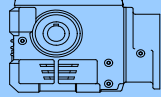

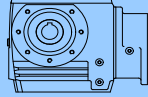

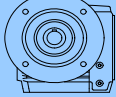

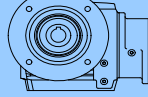
 [L]							 [L]						
⇒ 6.1	M1	M2	M3	M4	M5	M6	⇒ 6.1	M1	M2	M3	M4	M5	M6
SK0	0,13	0,22	0,13	0,22	0,13	0,13	SK0 F	0,13	0,22	0,13	0,22	0,13	0,13
SK01	0,22	0,38	0,22	0,38	0,22	0,22	SK01 F	0,22	0,38	0,22	0,38	0,22	0,22
SK20	0,55	1,00	0,55	1,00	0,55	0,55	SK20 F	0,35	0,60	0,35	0,60	0,35	0,35
SK25	0,50	0,90	0,50	0,90	0,50	0,50	SK25 F	0,50	0,90	0,50	0,90	0,50	0,50
SK30	0,80	1,40	0,70	1,40	0,70	0,70	SK30 F	0,80	1,40	0,70	1,10	0,70	0,70
SK33	0,80	1,60	1,00	1,60	0,80	1,00	SK33 F	1,00	1,60	1,00	1,60	0,80	1,00
SK000	0,24	0,41	0,24	0,41	0,24	0,24	SK000 F	0,24	0,41	0,24	0,41	0,24	0,24
SK010	0,38	0,60	0,38	0,60	0,38	0,38	SK010 F	0,38	0,60	0,38	0,60	0,38	0,38
SK200	0,80	1,30	0,80	1,30	0,80	0,80	SK200 F	0,60	1,04	0,60	1,04	0,60	0,60
SK250	1,20	1,50	1,40	1,50	1,40	1,40	SK250 F	1,40	1,50	1,40	1,50	1,40	1,40
SK300	1,40	1,50	1,40	1,50	1,40	1,40	SK300 F	1,40	1,50	1,40	1,50	1,40	1,40
SK330	1,50	1,58	1,50	1,58	1,50	1,50	SK330 F	2,00	1,58	1,50	2,80	1,50	1,50

 [L]							 [L]						
⇒ 6.1	M1	M2	M3	M4	M5	M6	⇒ 6.1	M1	M2	M3	M4	M5	M6
⇒ 6.1	H1	H6	H2	H5	H4	H3	⇒ 6.1	H1	H6	H2	H5	H4	H3
SK0182NB A	0,40	0,55	0,60	0,55	0,35	0,35							
SK0282NB A	0,70	1,00	0,80	1,10	0,90	0,90							
							SK1382NB A	1,30	2,30	1,40	2,10	2,00	1,90
 [L]							 [L]						
SK1282 A	0,90	1,30	0,90	1,20	0,95	0,95							
SK2282 A	1,65	2,40	1,90	2,00	1,80	1,80	SK2382 A	1,70	2,60	1,90	3,10	1,50	1,50
SK3282 A	3,15	4,10	3,25	4,10	3,15	3,15	SK3382 A	4,10	4,90	3,30	5,60	3,30	3,30
SK4282 A	4,70	6,10	4,75	5,40	4,70	4,70	SK4382 A	5,90	6,80	4,90	8,30	4,90	4,90
SK5282 A	7,50	8,80	7,50	8,80	7,20	7,20	SK5382 A	12,50	12,00	6,70	14,00	8,30	8,30
 [L]							 [L]						
SK6282 A	17,00	14,00	12,00	17,50	10,00	14,00	SK6382 A	16,50	13,00	9,60	18,00	14,00	12,50
SK7282 A	25,00	21,00	20,00	27,00	16,00	21,00	SK7382 A	22,00	20,00	16,00	25,00	23,00	19,00
SK8282 A	37,00	33,00	30,00	41,00	31,00	31,00	SK8382 A	34,00	32,00	25,00	38,00	35,00	30,00
SK9282 A	74,00	70,00	55,00	72,00	60,00	59,00	SK9382 A	73,00	70,00	45,00	74,00	65,00	60,00
 [L]							 [L]						
SK10282 A	90	90	40	90	60	82	SK10382 A	85	100	73	100	80	80
SK11282 A	165	160	145	195	100	140	SK11382 A	160	155	140	210	155	135
							SK12382 A	160	155	140	210	155	135

* ⇒ 41

 [L]												
	⇒ 6.1	M1	M2	M3	M4	M5	M6	M1	M2	M3	M4	M5
⇒ 6.1	B3	B6	B8	B3I	V5	V6	B5I	B5	B5III	B5II	V1	V3
							H1	H4	H2	H3	H5	H6
SK92072	0,40	0,60	0,50	0,50	0,40	0,40	0,40	0,60	0,50	0,50	0,40	0,40
SK92172	0,55	0,90	0,95	1,10	0,75	0,62	0,50	0,92	0,87	1,05	0,75	0,65
SK92372	0,90	1,30	1,45	1,60	1,20	1,20	1,15	1,50	1,20	1,70	1,15	1,15
SK92672	1,80	3,50	3,20	3,40	2,60	2,60	1,55	2,80	2,50	3,30	2,40	2,40
SK92772	2,30	4,50	4,60	5,30	4,10	4,10	2,75	4,40	4,50	5,50	3,50	3,50
 [L]												
SK9012.1	0,70	1,60	1,90	2,40	1,20	1,70	0,70	1,90	1,90	2,10	1,20	1,70
SK9016.1	0,70	1,60	1,90	2,40	1,20	1,70	0,70	1,90	1,90	2,10	1,20	1,70
SK9022.1	1,30	2,60	3,50	4,20	2,00	2,80	1,30	2,60	3,50	4,20	2,00	2,80
SK9032.1	1,70	4,80	6,40	6,70	4,10	5,10	1,90	5,20	6,40	7,30	3,30	5,10
SK9042.1	4,40	8,70	10,00	9,80	6,80	7,50	3,60	9,70	11,40	11,50	6,50	8,20
SK9052.1	6,50	16,00	19,00	21,50	11,00	15,50	7,50	16,50	20,00	22,50	11,50	18,00
SK9062.1	10,00	27,50	32,00	36,00	18,00	24,00	12,00	27,50	33,00	38,50	19,00	26,00
SK9072.1	10,00	27,50	32,00	36,00	18,00	24,00	12,00	27,50	33,00	38,50	19,00	26,00
SK9082.1	17,00	51,50	62,50	71,50	33,00	46,50	21,00	54,00	66,00	80,00	38,00	52,00
SK9086.1	29,00	73,00	85,00	102,00	48,00	62,00	36,00	78,00	91,00	107,00	53,00	76,00
SK9092.1	41,00	157,00	170,00	172,00	80,00	90,00	40,00	130,00	154,00	175,00	82,00	91,00
SK9096.1	70,00	187,00	194,00	254,00	109,00	152,00	80,00	187,00	193,00	257,00	113,00	156,00
 [L]												
SK9013.1	1,20	2,00	2,20	3,00	1,40	1,90	1,20	2,30	2,20	3,00	1,40	1,90
SK9017.1	1,20	2,00	2,20	3,00	1,40	1,90	1,20	2,30	2,20	3,00	1,40	1,90
SK9023.1	2,40	3,00	3,80	5,30	2,20	3,10	2,40	3,00	3,80	5,30	2,20	3,10
SK9033.1	3,30	6,60	7,00	7,80	4,30	5,10	3,80	5,70	6,90	8,50	3,60	5,60
SK9043.1	4,60	10,20	10,70	12,80	5,20	6,70	5,70	10,20	14,70	14,70	6,60	9,60
SK9053.1	10,00	17,00	20,00	24,20	11,50	16,50	12,50	18,00	21,50	26,50	13,00	17,00



 [L]							 [L]						
⇒ 6.1	M1	M2	M3	M4	M5	M6		M1	M2	M3	M4	M5	M6
⇒ 6.1	B3	B6	B8	B3I	V5	V6		B5I	B5	B5III	B5II	V1	V3
⇒ 6.1								H1	H4	H2	H3	H5	H6
SK02040	0,45	0,60	0,60	0,60	0,50	0,50	SK02040 A	0,40	0,80	0,65	0,60	0,50	0,50
SK02050	0,40	1,20	0,70	1,15	0,70	0,70	SK02050 A	0,45	1,10	0,90	1,10	0,80	0,80
SK12063	0,60	1,70	1,20	1,55	1,00	1,00	SK12063 A	0,50	1,45	1,20	1,40	1,10	1,10
SK12080	0,80	2,60	1,70	2,70	1,70	1,70	SK12080 A	0,90	3,10	3,00	3,00	2,20	2,20
SK32100	1,60	5,50	3,40	5,40	3,20	3,20	SK32100 A	1,50	5,20	3,80	5,30	3,80	3,80
SK42125	2,80	11,00	6,20	10,30	5,80	5,80	SK42125 A	3,20	12,90	6,10	10,50	6,30	6,30
 [L]							 [L]						
SK13050	0,95	1,55	1,10	1,45	0,95	0,95	SK13050 A	0,85	1,75	1,25	1,35	1,15	1,15
SK13063	0,85	2,30	1,60	2,00	1,25	1,25	SK13063 A	0,90	2,10	1,55	2,10	1,45	1,45
SK13080	1,70	3,20	2,10	3,40	1,95	1,95	SK13080 A	1,70	3,45	3,60	3,60	2,55	2,55
SK33100	2,10	7,60	4,00	6,80	3,70	3,70	SK33100 A	2,10	6,10	4,80	6,60	4,20	4,20
SK43125	7,80	14,00	7,20	13,50	6,70	6,70	SK43125 A	4,80	13,50	7,40	14,50	8,00	8,00
 [L]							 [L]						
SK02040 F	0,50	0,80	0,75	0,60	0,50	0,50							
SK02050 F	0,45	1,40	0,90	1,25	1,00	1,00	SK13050 F	0,90	1,80	1,15	1,75	1,25	1,25
SK12063 F	0,50	1,60	1,40	1,80	1,50	1,50	SK13063 F	0,95	2,10	1,65	2,15	1,75	1,75
SK12080 F	0,95	3,20	3,10	3,70	2,50	2,50	SK13080 F	1,40	4,20	3,35	3,80	2,75	2,75
SK32100 F	1,50	7,10	4,90	7,10	4,40	4,40	SK33100 F	2,30	7,60	5,50	7,80	4,85	4,85
SK42125 F	3,30	11,20	6,10	10,40	6,80	6,80	SK43125 F	4,30	14,50	7,10	12,10	7,70	7,70



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INSTALLATION INSTRUCTION

Instructions for design and assembly

Put in slewing gear without force into the recess of the crane.

Tooth flank clearance between pinion and wheel rim of the bearing slewing ring adjusted i.e. acc. to the indications of the crane manufacturer (for ex. clearance = $0,03 - 0,04 \times \text{module}$) In order to reach that, it is necessary to put the dial gauge on the tooth of the pinion. By manual turning at the input, the pinion can be moved in both directions up to contact with the teeth. Now, the tooth flank clearance can be exactly measured on the dial gauge.

With eccentricity of the gear-housing the flank clearance can be changed by means of turning one or more screw holes of the whole slewing gear.

Fastening of the gear means of pre-tensioning of the screw up to the recommended torque. We recommend add. to use Loctite Type 242 for screw security. The tensile shear, i.e. the shear tension can be augmented by means of e.g. Loctite Type 640 on the surface of the flange.

Screw plug removed on the surface (for transport only) and added air vents screwed in.

If necessary fill in gear oil (type see maintenance instructions). Approx. oil quantity is marked on the name plate.

Before assembly of the motor, the shaft and the tooth profile is to protect with appropriate grease against corrosion. We recommend Optimoly Paste White T.

Function of slewing gear is to check up when motor is running, esp. function and control of input motor.

Furthermore we point out to the technical data in our installation drawing.

MAINTENANCE INSTRUCTION

Lubrication

Oil filling ex factory : AVIA gear oil Hypoid 90 EP
Choice according to DIN : DIN 51502 resp. API GL5
Description according to DIN : Oil, DIN 51517-CLP 220

Oil quantity is marked on the name plate. If the gear is delivered without oil, we point out to that with a sticker.

The roller bearing of the gear output is filled with grease.

Grease filling ex factory : AVIA AVIALITH 2 EP
Choice according to DIN : DIN 51502
Description according to DIN : Grease, DIN 51825-KP2K

This is life-time lubrication and it is not necessary to renewal or to refill it.

Further oil and grease types see recommendations for lubricants.

Recommendation for maintenance intervals

Oil control : Weekly.

Control oil level only with non-running gear.

First oil change after 200. then after each 1000 operation hours, but at least once a year.
The intervals refer to the service temperatures indicated in the installation drawing.

Oil change only with service temperature condition, therefore remove the ventilating filters.

We recommend to clean with a pre-heated part of new oil when ambient temperature is low, so that abrasion and contaminations can flow away.

RECCOMENDATION FOR LUBRICANTS

Choice list

	CHOOSEN ACCORDING TO API GL 5	CHOOSEN ACCORDING TO DIN 51502	CHOOSEN ACCORDING TO DIN 51502
	OIL, SAE 90	OIL, DIN 51517 – CLP 220	GREASE, DIN 51825 – KP2K
ARAL	ARAL GEAR OIL HYP 90	BG 220	ARAL GREASE HLP 2
AVIA	AVIA GEAR OIL HYPOID 90 EP	RSX 220	AVIA AVIALITH 2 EP
BP	BP HYPOGEAR EP 90	GR-XP 220	BP ENERGR. LS EP 2
CASTROL	CASTROL EPX 90	ALPHA SP 220	CASTROL SPHEEROL EPL 2 GREASE
ELF	TRANSELF TYP B SAE 90	REDUCTELF SP 220	ELF EPEXA 2
ESSO	ESSO GEAR OIL GX-D90	SPARTAN EP 220	ESSO BEACON 2 EP
FUCHS	FUCHS GEAR OIL RENOGEAR HYPOID 90	COMPOUND 106 VG 220	FUCHS RENOLIT FEP 2
GULF	GULF MULTI-PURPOSE GEAR LUBRICANT SAE 90	EP LUBRICANT HD 220	GULF CROWN GREASE NO.2
MOBIL	MOBILUBE HD-A 90	MOBILGEAR 630	MOBILUX 2 EP
SHELL	SHELL SPIRAX MB 90	OMALA 220	SHELL ALVANIA EP 2
TEXACO	GEARTEX EP-B 85W-90	MEROPA 220	MULTIFAK EP 2

Oil change and greasing intervals see maintenance instruction.

GEARBOX INSPECTION

Gear oil analyses - preventive maintenance

Surveying mechanisms for machines and gearboxes get more and more important, because the requirements and service conditions are often differing from the ones that are foreseen from the designers.

Systematic oil tests during regular intervals give a trendy reliable diagnostic regarding the wear development and beginning damage. The point at issue will be which oil, permitted according the lubrication recommendation, has really been used.

Why oil analyses ?

Advanced diagnosis of damages:

Wear-particles "float" in the oil. These can be stated by oil analysis and give notes as to the wear of the construction part from which they have been abraded.

Maintenance depending on status:

A damage that was stated early enough through an oil analysis obviously means less repair and still-stand charges.

Damage analysis to small expenses:

An estimated reason for the damage can be given by such an oil inspection to small expenses. Spurs of dirt by dust and water, mixture with other oils, parts of worn metals as well as changements of the oil level give a detailed early recognition of damages.

Simple surveillance:

In order to get a detailed information on the status of the gearbox, regular oil analyses prevent partial or complete disassemblies.

Influencing interference factors of the lubrication oil:

Worn metals, dirt, changements of oil level and additives may influence very negatively the effectiveness of the used lubricating oil. Oil analyses, effected by an authorised laboratory, give information regarding worn metals, dirt etc.

The analysis is commented according to the disposed dates and information.

The more exact the indications regarding the used oil, service time and operation conditions are, the more detailed and effective can be instructed preventive measurements.

There are no reliable comparing and limit values as to wear metal and contaminations. An important factor is always the oil quantity from which the oil sample was taken.

A reliable possibility to diagnose is not possible than by a competent laboratory. Extremely high values resulting in the evaluation must not absolutely show a beginning damage.

Based on their experience all values noted are considered in the correct coordination by the laboratory analysing the oil. Oil analyses made in regular intervals show a sure value as to wear resp. as to a beginning damage of a certain construction unit.

Each gear shows its own wear according to the corresponding conditions of operation.

Magnetizing particles larger than 5 µm noted in the analysis, are probably showing a beginning pitting of a construction part.

Particles of a size of 40 µm in clear oil are visible with the eye. If so there is certainly already a progressed damage of the gear.

Taking of an oil sample

A certain evidencing diagnostics of an oil sample depends decisively of the kind of taking the sample.

The taking of the sample has to be made always in the same manner. In principle the oil should be at least hand warm when taking it. If possible the oil to be analysed has to be taken in about the middle of the oil level.

At winch gear where it is not possible to have access to the oil level, the oil to be analysed has to be taken off the oil drain line. About 1-2 l oil have to be drained into a container and an oil sample has to be taken from the draining oil.

The access to a good oil level at the slewing gears is also difficult. Here too we recommend to have a part of oil drained by removing the accessible oil draining screw and to take an oil sample off the draining oil.



INTORQ

setting the standard

INTORQ BFK470

Spring-applied brake with electromagnetic release

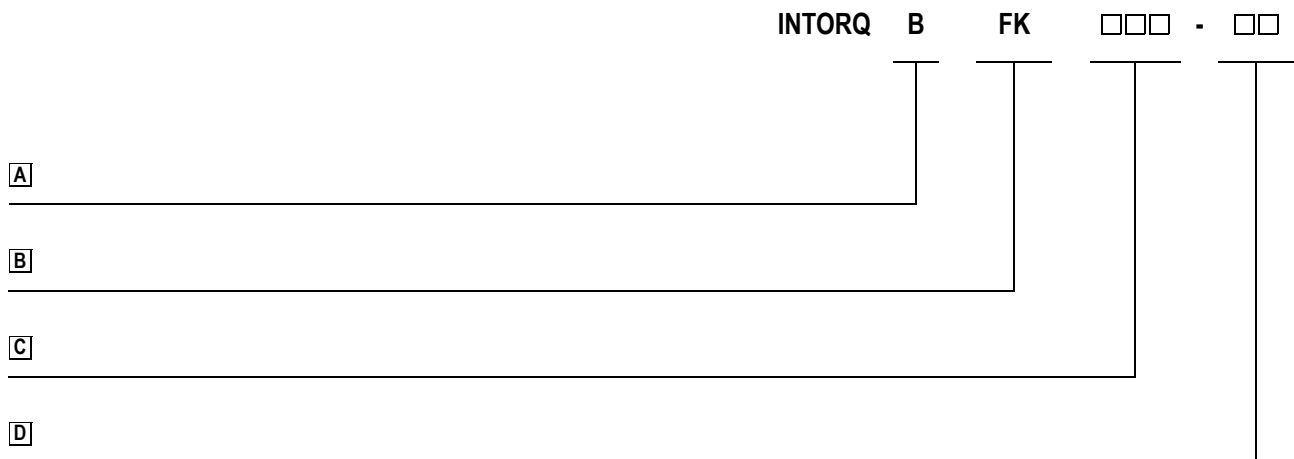
Translation of the Original Operating Instructions

www.intorq.com

This documentation applies to the:



Product key



Legend for the product key

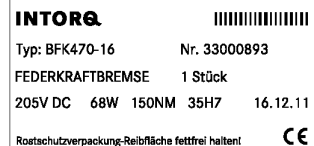
INTORQ BFK470

A	Product group	Brake
B	Product type	Spring-applied brake
C	Type	470
D	Size	06, 08, 10, 12, 14, 16, 18

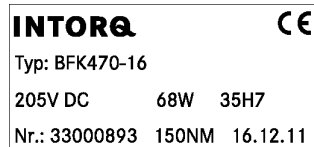
Not coded: Supply voltage, hub bore hole, options

Identification

Packaging label	Example
Manufacturer	Bar code
Type (see product key)	Type No.
Designation	Qty. per box
Rated voltage	Rated power
Rated torque	Hub diameter
Note	Packaging date
	CE mark



Name plate	Example
Manufacturer	CE mark
Type (see product key)	
Designation	
Rated voltage	Rated power
Type No.	Hub diameter
Rated torque	Date of manufacture



Document history

Material number	Version			Description
33001439	1.0	01/2012	TD09	First edition
33001439	1.1	03/2012	TD09	Supplemented the technical data
33001439	1.2	10/2012	TD09	Added to the "Brake assembly" chapter Updated the "Abbreviations used" table Supplemented the characteristics, rated data and operating times
33001439	2.0	05/2013	TD09	Degree of protection changed Added note about the end shield characteristics Shaft characteristic defined, "Mechanical installation" chapter "Checking the brake" chapter (maintenance and repair) supplemented
33001439	3.0	05/2013	TD 09	Text with regard to the disengagement time updated
33001439	3.1	03/2014	SC	Restructured FM; note concerning brake seal 23
33001439	4.0	01/2015	SC	Harmonized connection diagrams
33001439	5.0	08/2016	SC	Additional sizes: 06, 08, 10, 12

Refer to www.intorq.de for the latest version of these operating instructions.

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1 Preface and general information

1.1 About these Operating Instructions




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

1.2 Terminology used

Term	In the following text used for
Spring-applied brake	Spring-applied brake with electromagnetic release
Drive system	Drive systems with spring-applied brakes and other drive components

1.3 Conventions 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	<input type="checkbox"/>	Wildcard for options, selections For example: BFK458- <input type="checkbox"/> <input type="checkbox"/> = BFK458-10
	Note		Important notice about ensuring smooth operations or other key information.

1.4 Abbreviations used

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




Letter symbol	Unit	Designation
t_{11}	ms	Delay during engagement (time from switching off the supply voltage to the beginning of the torque rise)
t_{12}	ms	Rise time of the braking torque, time from the start of torque rise until reaching the braking torque
t_{ue}	s	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

1.5 Safety instructions and notices








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

Safety instructions

Structure of safety instructions:

	 SIGNAL WORD
	Icon Indicates the type of danger
	Signal word 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

	<p> DANGER</p> <p>DANGER indicates a hazardous situation which, if not avoided, <i>will</i> result in death or serious injury.</p>
	<p> WARNING</p> <p>WARNING indicates a potentially hazardous situation which, if not avoided, <i>could</i> result in death or serious injury.</p>
	<p> CAUTION</p> <p>CAUTION indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.</p>
	<p>NOTICE</p> <p>Notice about a harmful situation with possible consequences: the product itself or surrounding objects could be damaged.</p>

1.6 Scope of delivery

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

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

1.7 Disposal

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

- Recycle 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 commissioned if they are incompletely mounted or connected.
 - ... 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 IP66 protection. Because of the numerous possibilities of using the brake, it is however necessary to check the functionality of all mechanical components under the corresponding operating conditions.

2.2 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

- No explosive or aggressive atmosphere.
- Humidity: no restrictions
- Ambient temperature:
 - Standard design: -20 °C to +50 °C
 - Optional CCV design: -40 °C to +50 °C

3 Technical specifications

3.1 Product description

3.1.1 Structure and function

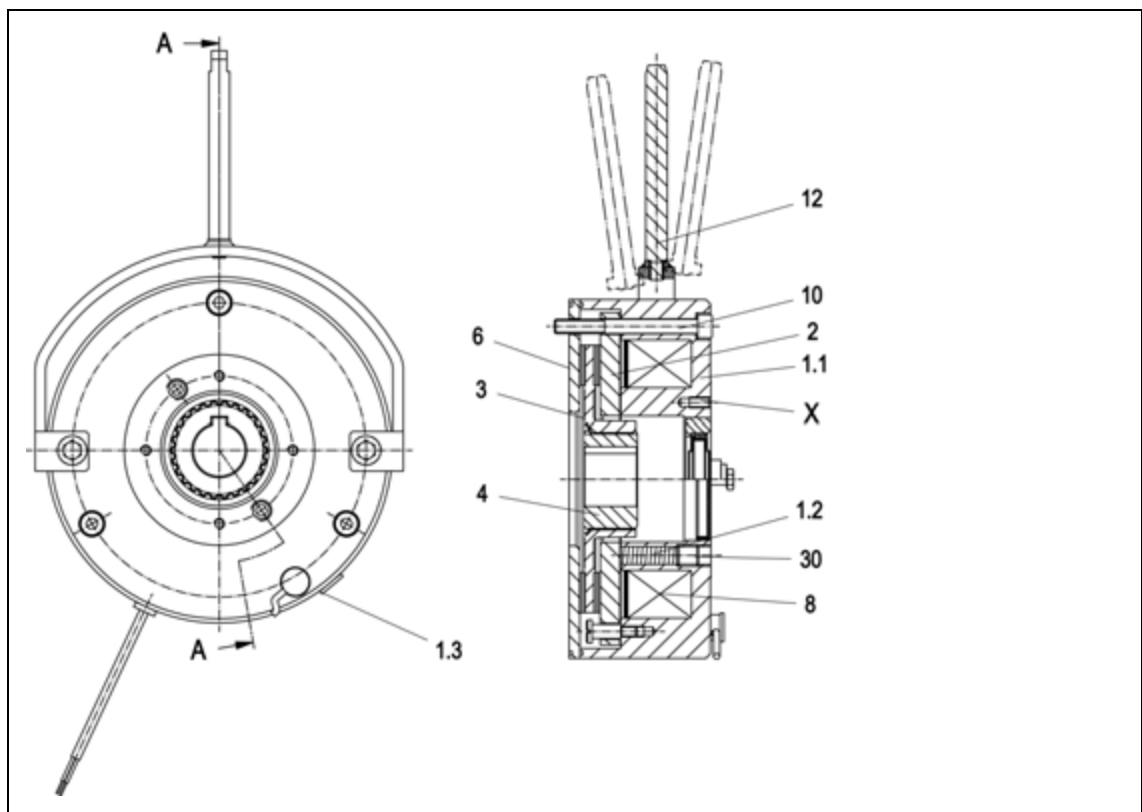


Abb.1 Design of a BFK470 spring-applied brake

1.1 Stator	3 Complete rotor	10 Socket head cap screw, DIN EN ISO 4762
1.2 Pressure springs	4 Hub	12 Complete manual release (optional)
1.3 Plug (check for air gap)	6 Flange (optional)	30 Setting screw for the factory-set adjustment of the spring force (sealed), applies only to sizes 12-18
2 Armature plate	8 Coil	X Bore holes are optional

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

The spring-applied brakes BFK470 are electrically releasable single-disc brakes with two friction surfaces. When de-energized, both of the rotor's friction surfaces are tightened by the force of the compression springs between the armature plate and the flange. The braking torque is applied over the friction radius of the rotor; it is transferred to the shaft via a hub that has axial gear teeth. When the brakes are applied, an air gap "s_L" is present between the stator and the armature plate. To release the brake, the stator's coil is energized with DC voltage. The resulting magnetic flux works against the spring force to draw the armature plate to the stator. This releases the rotor from the spring force and allows it to rotate freely.



NOTICE

Due to the structural design of the stator, the air gap cannot be installed downstream. If the wear limit is reached, the rotor must be replaced.

3.1.2 Brakes

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

3.1.3 Brake release

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

3.1.4 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.
- 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	Max. speed of rotation ¹⁾ n _{max} [rpm]	Temperature class Stator	Operating time [%]	Moment of inertia Rotor [kgcm ²]	Mass of brake			
					without flange [kg]	with flange [kg]	without flange + Manual release [kg]	with flange + Manual release [kg]
BFK470-06	6000	F (155°C)	100	0.15	1.3	1.5	1.4	1.6
BFK470-08	5000	F (155°C)	100	0.61	2.0	2.2	2.1	2.3
BFK470-10	4000	F (155°C)	100	2.0	3.5	3.9	3.7	4.0
BFK470-12	3600	F (155°C)	100	4.5	5.0	5.6	5.3	5.8
BFK470-14	3600	F (155°C)	100	6.3	7.7	8.5	8.1	8.9
BFK470-16	3600	F (155°C)	100	15.0	11.9	13.1	12.5	13.7
BFK470-18	3600	F (155°C)	100	29.0	17.6	19.1	18.6	20.0

Tab. 1: General brake characteristics




¹⁾ Maximum speed of rotation when installed horizontally (for higher speeds, contact the manufacturer)

Type	Air gap			Rotor thickness		New state [mm]
	s _{LN} [mm]	s _{L max}		min.		
		operating brake [mm]	holding brake [mm]	operating brake [mm]	holding brake [mm]	
BFK470-06	0.2 ^{+0.08} / _{-0.05}	0.5	0.3	5.73	5.93	6.0 _{-0.05}
BFK470-08	0.2 ^{+0.08} / _{-0.05}	0.5	0.3	6.73	6.93	7.0 _{-0.05}
BFK470-10	0.2 ^{+0.13} / _{-0.05}	0.5	0.35	8.73	8.88	9.0 _{-0.1}
BFK470-12	0.3 ^{+0.08} / _{-0.10}	0.6	0.45	9.68	9.83	10.0 _{-0.1}
BFK470-14	0.3 ± 0.1	0.75	0.45	9.55	9.85	10.0 _{-0.1}
BFK470-16	0.3 ^{+0.15} / _{-0.05}	0.80	0.50	11.05	11.35	11.5 _{-0.1}
BFK470-18	0.4 ^{+0.20} / _{-0.10}	1.0	0.65	12.50	12.85	13.0 _{-0.1}

Tab. 2: Air gap / rotor thickness

Type	Outer diameter [mm]	Pitch circle		Fixing screws DIN EN ISO 4762		Minimum thread depth		Tightening torque M_a [Nm]
		∅ [mm]	Thread	without flange [mm]	with flange [mm]	without flange [mm]	with flange [mm]	
BFK470-06	89	72	M4	3 x M4x40	3 x M4x45	7.5	9.0	3.0
BFK470-08	106	90	M5	3 x M5x45	3 x M5x50	10.5	10.0	5.9
BFK470-10	130	112	M6	3 x M6x55	3 x M6x60	14.0	13.5	10.1
BFK470-12	148	132	M6	3 x M6x60	3 x M6x65	12.5	12.5	10.1
BFK470-14	168	145	M8	3 x M8x75	3 x M8x80	19.5	18.5	24.6
BFK470-16	200	170	M8	3 x M8x80	3 x M8x85	18.0	17.0	24.6
BFK470-18	226	196	M8	6 x M8x90	6 x M10x100	19.5	23.0	24.6

Tab. 3: Installation data

	 CAUTION
	<ul style="list-style-type: none"> ■ The minimum thread depth of the end shield must be maintained!  Tab. 3. ■ If the required thread depth is not maintained, the fixing screws may run onto the root. This has the effect that the required pre-load force is no longer established – the brake is no longer securely fastened! ■ The material of the end shield must have a tensile strength of $R_m \geq 250 \text{ N/mm}^2$.

3.3 Rated data (dimensioning data) electrical data

Type	Voltage U [V DC]	Rated current I _N [A]	Power P _N [W]	Coil resistance R _N ± 4% [Ω]
BFK470-06	205	0.098	20	2101.0
BFK470-08		0.122	25	1681.0
BFK470-10		0.161	33	1273.0
BFK470-12		0.195	40	1051.0
BFK470-14		0.307	60	667.1
BFK470-16		0.332	68	618.0
BFK470-18		0.415	85	494.4

Tab. 4: Coil data at 20°C

Type	Braking torques at relative speed of rotation Δn				
	Rated torque [Nm] 100 rpm	Braking torque X [%] of the rated torque			Maximum speed horizontal mounting position rpm
		1500 rpm	3000 rpm	maximum	
BFK470-06	2.0 / 2.5 / 3.0 / 3.5 / 4.0 / 4.5 / 5.5 / 6.0 / 6.5 / 7.0 / 7.5	87	80	74	6000
BFK470-08	3.5 / 5 / 6 / 7 / 8 / 10 / 11 / 12 / 14 / 15	85	78	73	5000
BFK470-10	9 / 11 / 14 / 16 / 18 / 21 / 23 / 25 / 28 / 30 / 33 / 36	83	76		4000
BFK470-12	12 / 14 / 15 / 16 / 18 / 23 / 27 / 32 / 36 / 40 / 45 / 46 / 48 / 50 / 55	81	74	72	3600
BFK470-14	40 / 50 / 60 / 65 / 70 / 75 / 80 / 100 / 110	80	73		
BFK470-16	55 / 80 / 90 / 100 / 105 / 125 / 150	79	72		
BFK470-18	100 / 150 / 165 / 185 / 200 / 235 / 250	77	70		

Tab. 5: Rated torques

Switching times

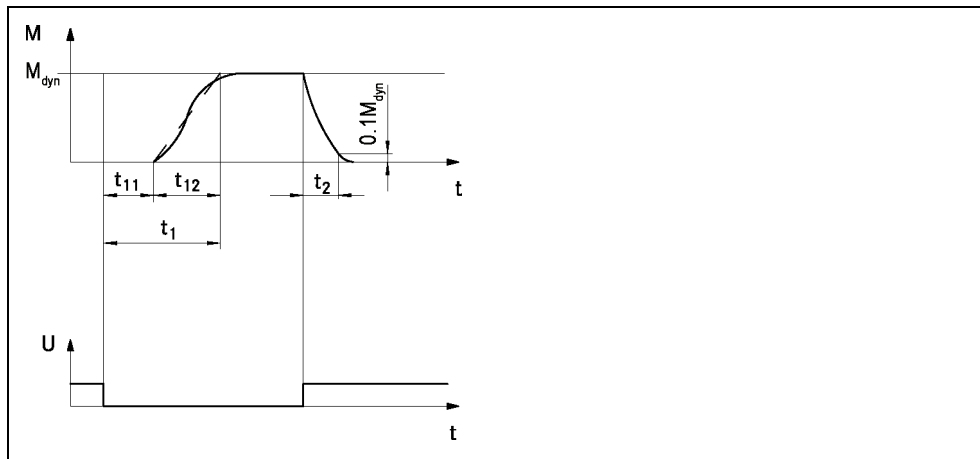


Abb. 2 Operating/switching times of the spring-applied brakes

- t_1 Engagement time
- t_2 Disengagement time (up to $M = 0.1 M_{dyn}$)
- M_{dyn} Rated torque
- t_{11} Reaction delay of engagement
- t_{12} Rise time of the braking torque
- U Voltage



Type	Rated torque M_K [Nm]	Max. perm. switching energy Q_E [J]	Transitional operating frequency S_{hue} [h ⁻¹]	Operating times [ms] ¹⁾ at s_{LN} and $0.7 I_N$			
				DC engagement ²⁾			Disengagement t_2
				t_{11}	t_{12}	t_1	
BFK470-06	4	3000	79	16	25	41	32
BFK470-08	8	7500	50	30	26	56	52
BFK470-10	16	12000	40	40	64	104	107
BFK470-12	32	24000	30	47	34	81	121
BFK470-14	60	30000	28	30	47	76	162
BFK470-16	80	36000	27	46	62	109	255
BFK470-18	150	60000	20	62	92	155	343

Tab. 6: Switching energy - operating frequency - operating times

- 1) Typical values
- 2) Measured with induced voltage limitation of -800 V DC

Engagement time

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

- The engagement times are valid for DC switching with a spark suppressor.
 - Spark suppressors are available for the rated voltages.
 - Connect the spark suppressors in parallel to the contact. If this switching is not admissible for safety reasons (e.g. with hoists and lifts), the spark suppressor can also be connected in parallel to the brake coil.
 - Circuit proposals:  25
- The engagement times are approx. 10 times longer with AC switching.
 - Connection:  25

Disengagement time

The disengagement time is the same for DC and AC switching. The disengagement time can be shortened by special equipment for fast-response excitation or over-excitation.

3.4 Switching energy / operating frequency

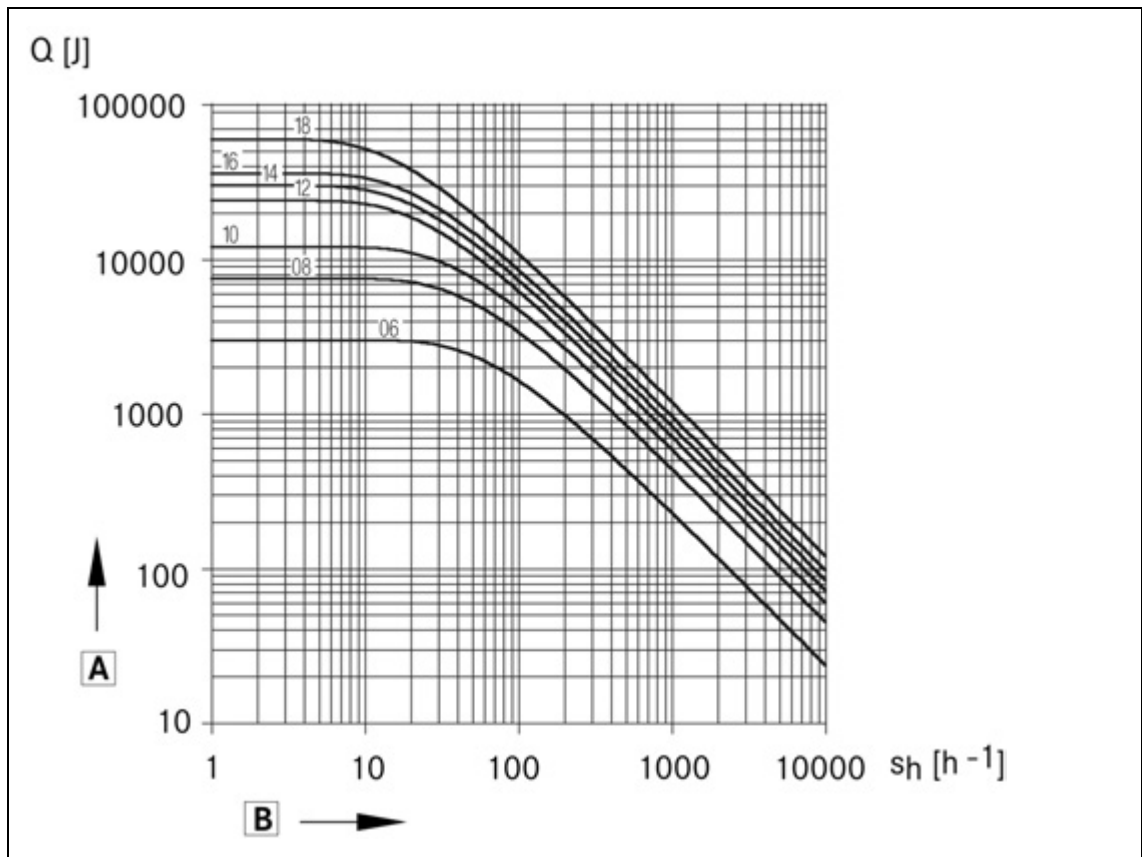



Abb. 3 Switching energy as a function of the operating frequency

 Switching energy

 Operating frequency

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

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

The permissible operating frequency S_{hmax} depends on the amount of heat Q_R (refer to Figure 3). At a pre-set operating frequency S_h , the permissible amount of heat is Q_{smax} .

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

3.5 Emissions

Electromagnetic compatibility



NOTICE

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

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

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

Heat

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

Noise

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

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

Others

The abrasion of the friction parts produces dust.


4 Mechanical installation

4.1 Important notes

4.1.1 Design of end shield and motor shaft



- Comply with the mentioned minimum requirements regarding the end shield and the motor shaft to ensure a correct function of the brake.
- The diameter of the shaft shoulder must not be greater than the tooth root diameter of the hub.
- The form and position tolerances apply only to the materials mentioned. Contact INTORQ if you are using other materials.
- The brake flange must be supported by the end shield across the full surface.

Design of the end shield




Type	Minimum requirements: Use as counter friction surface					
	Material	Evenness	Axial runout	Roughness		Miscellaneous
		[mm]	[mm]	without flange	with flange	
BFK470-06	S235JR; C15; EN-GJL-250	≤ 0.03	0.05	Rz 10	Rz 16	<ul style="list-style-type: none"> ■ Threaded holes with minimum thread depth  15 ■ Free of grease and oil
BFK470-08						
BFK470-10						
BFK470-12						
BFK470-14		≤ 0.05				
BFK470-16		≤ 0.08				
BFK470-18		≤ 0.10	0.08			

Tab. 7: End shield as counter friction surface

4.1.2 Necessary tools

Type	Torque wrench  Measuring range [Nm]	Bit for hexagon socket screws  Wrench width [mm] *
BFK470-06	1 - 12	3
BFK470-08		4
BFK470-10		5
BFK470-12		
BFK470-14	20 - 100	6
BFK470-16		
BFK470-18		

* For attaching flange inner bit with pin guide


Multimeter	Caliper gauge	Feeler gauge
		

4.2 Assembly

4.2.1 Preparation

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

4.2.2 Brake assembly

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

Installation of the hub onto the shaft



NOTICE

The customer is responsible for constructing the shaft-hub connection. Make sure that the bearing length of the key is identical to the length of the hub.



NOTICE

Check the tensile strength of the hub material: When operating with high torque, consult with INTORQ and use a steel hub with a higher tensile strength.

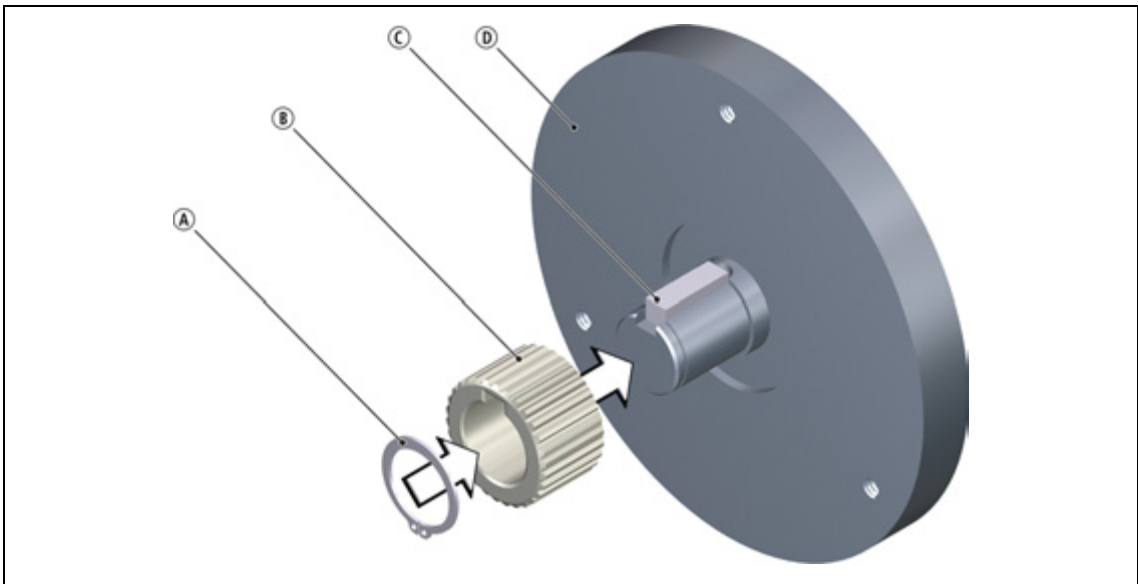



Abb. 4 Installing the hub onto the shaft

- | | | |
|--------------|-------|----------|
| A Circlip | B Hub | C Keyway |
| D End shield | | |

1. Press the hub with a moderate amount of force to the shaft.

Secure the hub against axial displacement (for example, by using a circlip).

	NOTICE
	If you are using the spring-applied brake for reverse operations, glue the hub to the shaft.

Mounting the flange

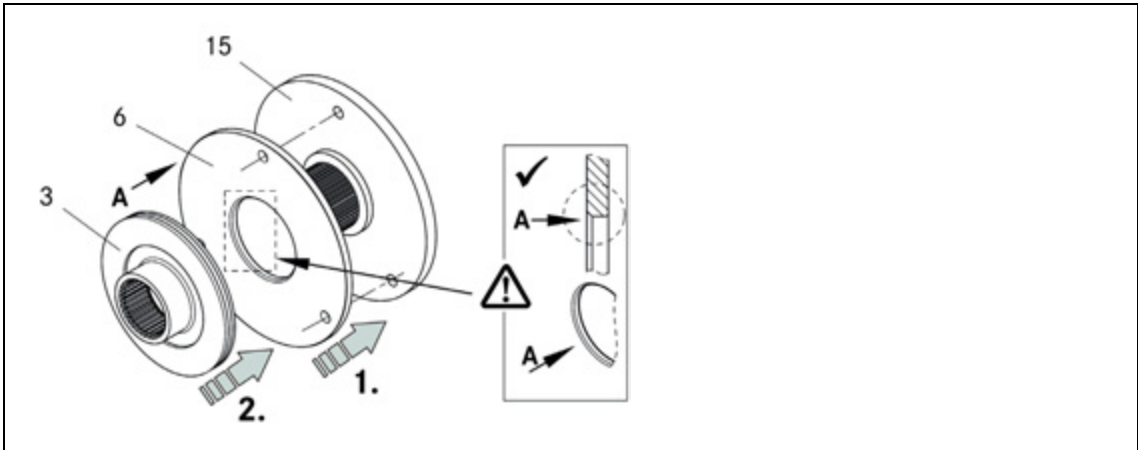


Abb. 5 Flange and rotor mounting

1. If required, slide the optional flange (6) onto the shaft.
 - The chamfer on the flange must point towards the brake!
 - Align the through holes of the flange (6) with the fixing holes in the end shield (15).

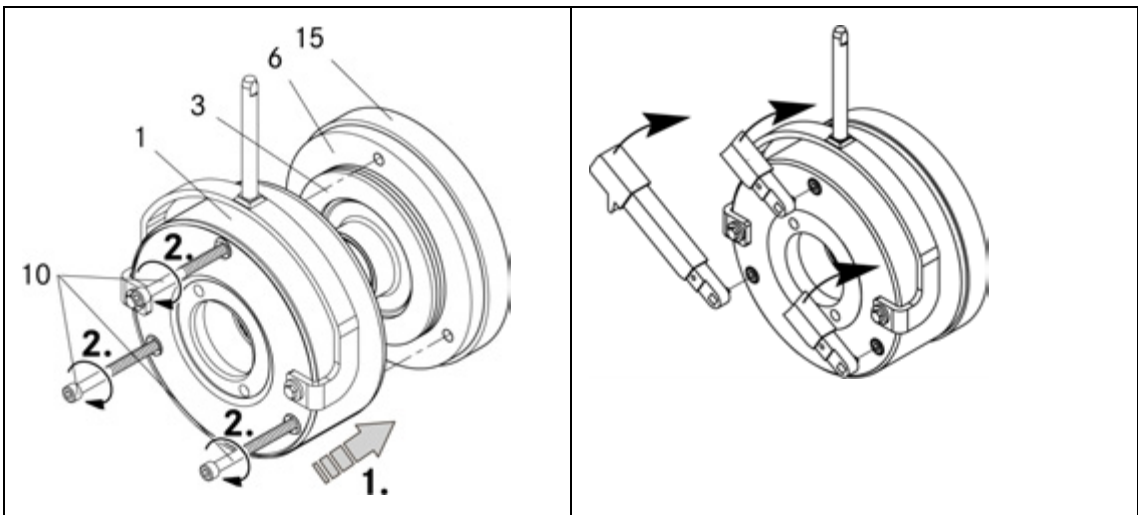



Abb. 6 Mounting the brake

- | | | |
|---------|---------------------------|---------------|
| 1 Brake | 6 Flange | 15 End shield |
| 3 Rotor | 10 Socket head cap screws | |


	NOTICE
	<p>When using a shaft seal, the brake has to be mounted so that it is centred properly! The shaft diameter must be implemented in accordance with ISO tolerance h11, with a radial eccentricity tolerance according to IT8 and an averaged surface roughness of $Rz \leq 3.2 \mu\text{m}$ in the sealing area.</p>



NOTICE

Please note the following for the version "brake with shaft sealing ring":

- Lightly lubricate the lip of the shaft seal with grease.
- No grease should be allowed to contact the friction surfaces.
- When assembling the stator, push the shaft sealing ring carefully over the shaft. The shaft should be located concentrically to the shaft seal.

2. Slide the brake onto the shaft.
 - Align supplied socket head cap screws (10) with fixing holes in the end shield (15).
3. Use a torque key to tighten the socket head cap screws (10) with the required tightening torque,  15.



NOTICE

The customer must seal the brake in this position himself if **no** shaft seal or cover is in use.






NOTICE

If it is necessary to loosen the screws with the seal again, the seals or the complete screw set must be replaced.

5 Electrical installation


5.1 Important notes

	 DANGER
	<p>There is a risk of injury by electrical shock!</p> <ul style="list-style-type: none"> ■ 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
	<ul style="list-style-type: none"> ■ It must be ensured that the supply voltage corresponds to the name plate data.

5.2 Electrical connection

Circuit suggestions

	NOTICE
	<p>The terminal pin sequence shown here does not match the actual order.</p>

AC switching at the motor – extremely delayed engagement

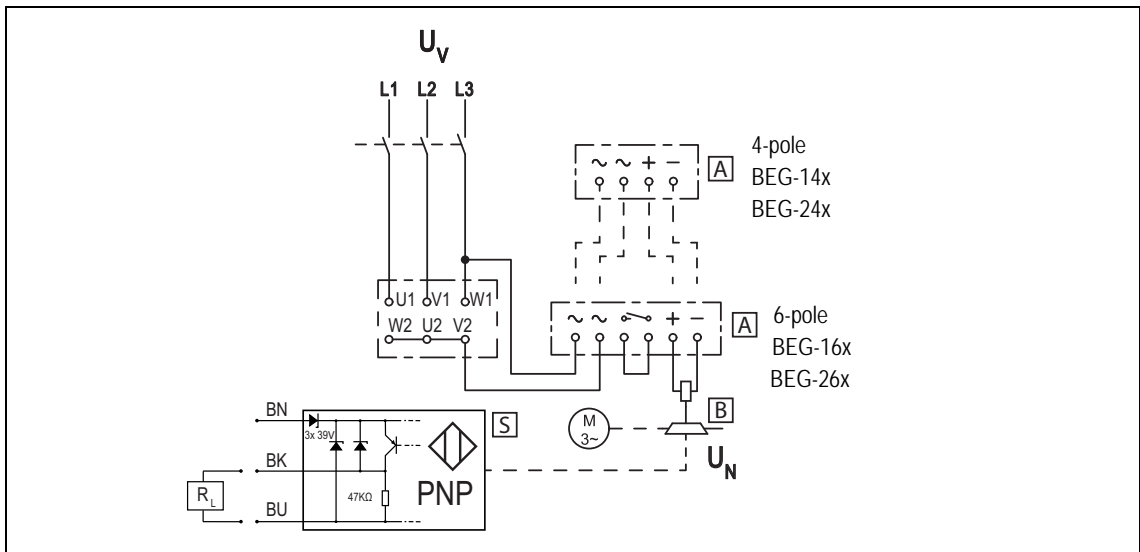


Abb. 7 Supply: Phase-neutral

A Bridge rectifiers

$$\text{BEG-1xx: } U_N [\text{VDC}] = 0.9 \cdot \frac{U_V}{\sqrt{3}} [\text{VAC}]$$

B Brake

A Half-wave rectifiers

$$\text{BEG-2xx: } U_N [\text{VDC}] = 0.45 \cdot \frac{U_V}{\sqrt{3}} [\text{VAC}]$$

S Inductive proximity sensor

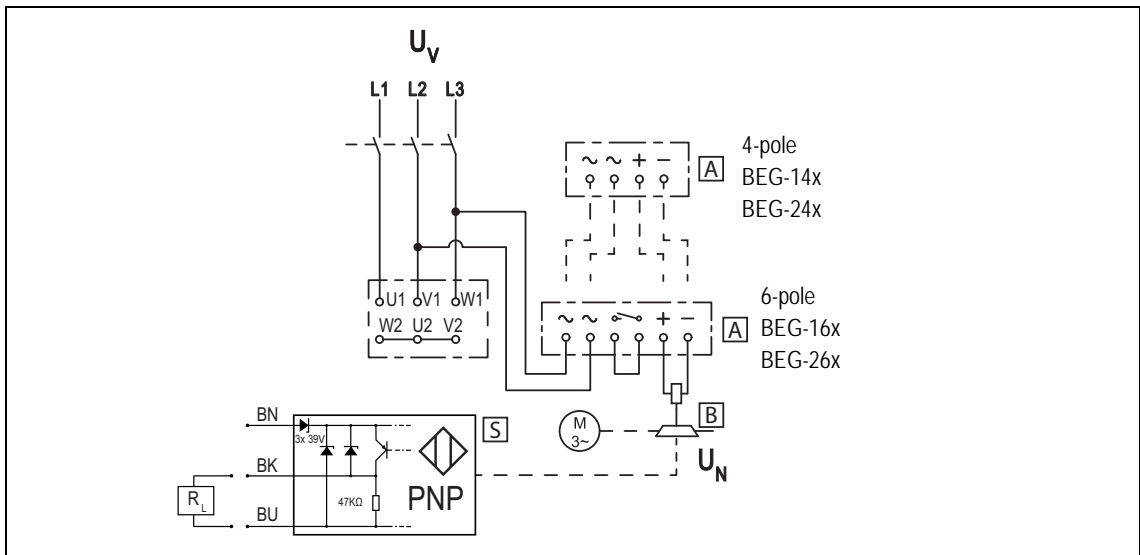


Abb. 8 Supply: Phase-phase

A Bridge rectifier ¹⁾

$$\text{BEG-1xx: } U_N [\text{VDC}] = 0.9 \cdot U_V [\text{VAC}]$$

B Brake

A Half-wave rectifiers

$$\text{BEG-2xx: } U_N [\text{VDC}] = 0.45 \cdot U_V [\text{VAC}]$$

S Inductive proximity sensor

¹⁾ Not recommended for most regional/national high-voltage mains systems

DC switching at the motor – fast engagement

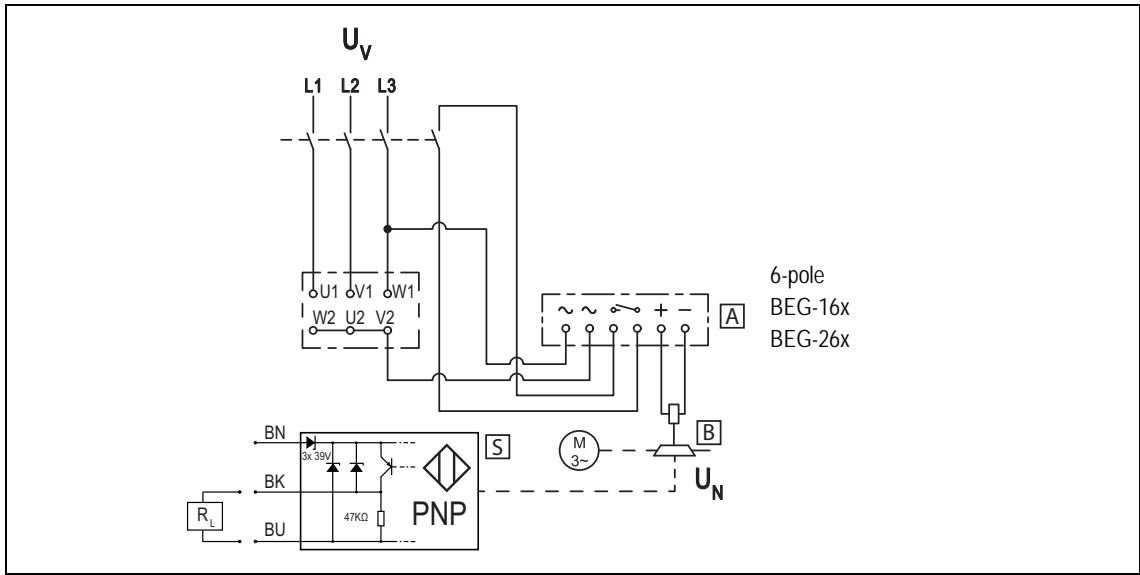


Abb. 9 Supply: Phase-neutral

A Bridge rectifiers

$$\text{BEG-1xx: } U_N [\text{VDC}] = 0.9 \cdot \frac{U_V}{\sqrt{3}} [\text{VAC}]$$

A Half-wave rectifiers

$$\text{BEG-2xx: } U_N [\text{VDC}] = 0.45 \cdot \frac{U_V}{\sqrt{3}} [\text{VAC}]$$

B Brake

S Inductive proximity sensor

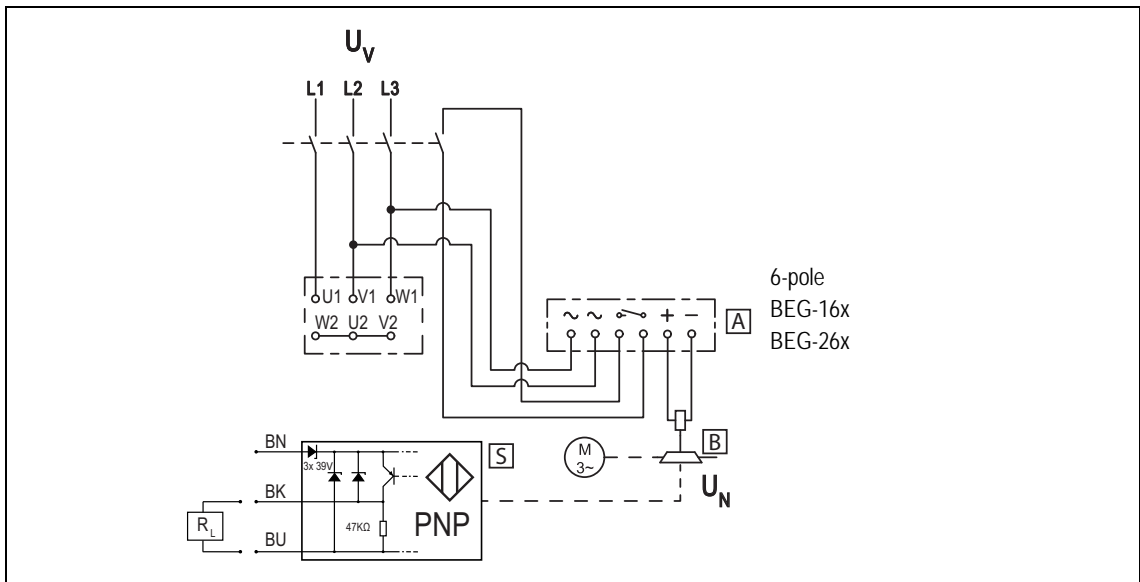


Abb. 10 Supply: Phase-phase

A Bridge rectifier ¹⁾

$$\text{BEG-1xx: } U_N [\text{VDC}] = 0.9 \cdot U_V [\text{VAC}]$$

A Half-wave rectifiers

$$\text{BEG-2xx: } U_N [\text{VDC}] = 0.45 \cdot U_V [\text{VAC}]$$

B Brake

S Inductive proximity sensor

¹⁾ Not recommended for most regional/national high-voltage mains systems

DC switching at mains – fast engagement

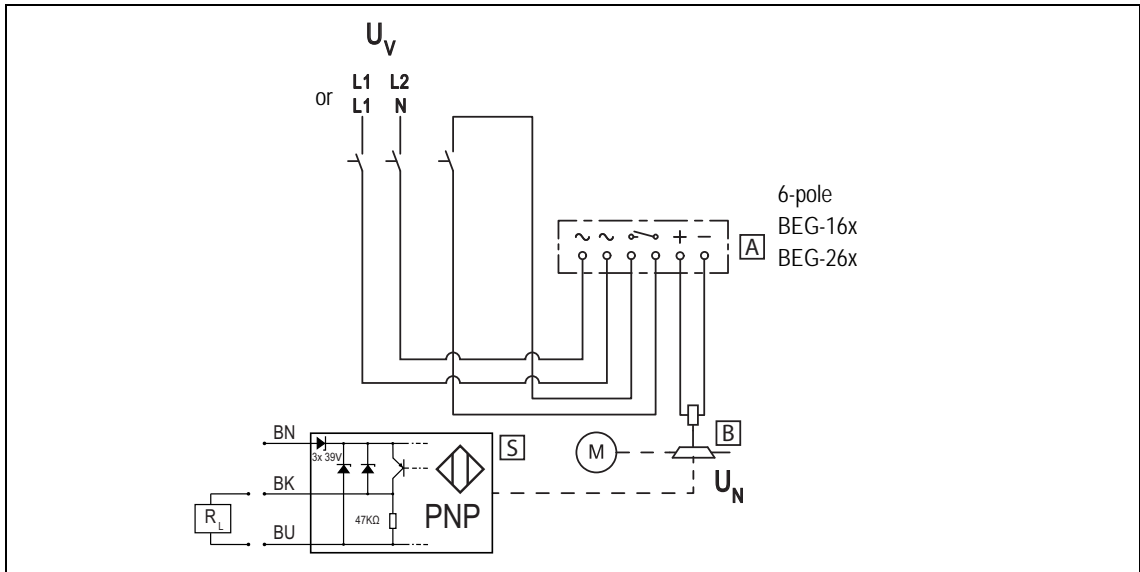


Abb. 13 Supply: Phase-phase or phase-N via 6-pole rectifier

- | | |
|---|--|
| A Bridge rectifier ¹⁾
BEG-16x: $U_N [VDC]=0.9 \cdot U_V [VAC]$ | A Half-wave rectifiers
BEG-26x: $U_N [VDC]=0.45 \cdot U_V [VAC]$ |
| B Brake | S Inductive proximity sensor |

¹⁾ For most regional/national high-voltage mains systems, this only makes sense for supplies on L1 and N.

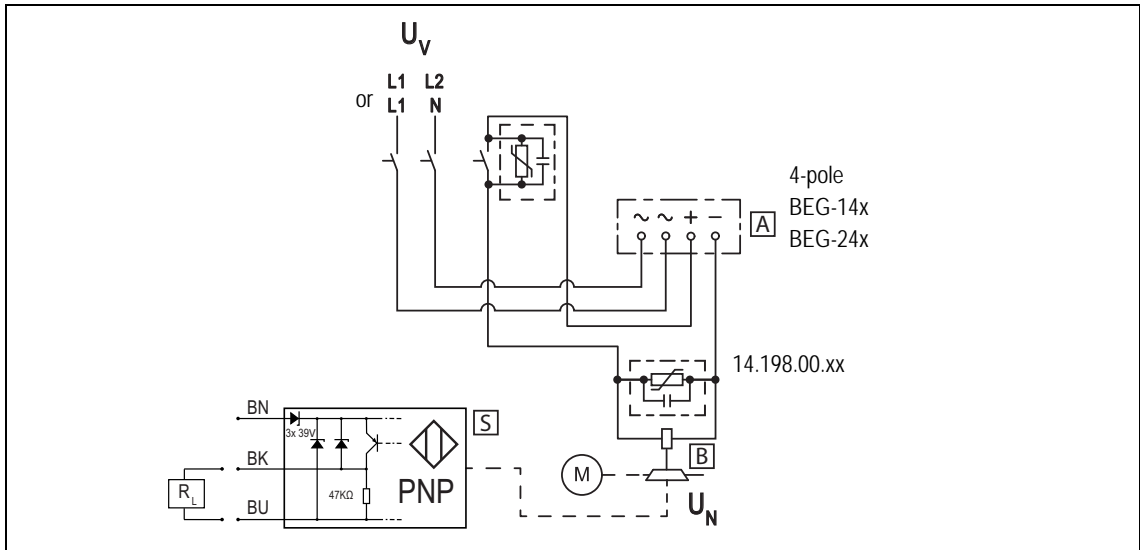


Abb. 14 Supply: Phase-phase or phase-N via 4-pole rectifier

- | | |
|---|--|
| A Bridge rectifier ¹⁾
BEG-14x: $U_N [VDC]=0.9 \cdot U_V [VAC]$ | A Half-wave rectifiers
BEG-24x: $U_N [VDC]=0.45 \cdot U_V [VAC]$ |
| B Brake | S Inductive proximity sensor |

Spark suppressor
14.198.00.xx (required once, select position)

¹⁾ For most regional/national high-voltage mains systems, this only makes sense for supplies on L1 and N.

5.3 Technical data for inductive proximity sensors

5.3.1 Proximity sensor for release check

Design	PNP, N/O contact
Operating voltage	10 to 30 VDC
Permitted residual ripple	20% U_B
No-load current	Max. 10 mA
Output current	Max. 200 mA
Voltage drop at outputs	Max. 2.0 V at 200 mA
Short circuit protection	integrated
Reverse polarity protection	integrated
Induction protection	integrated
Protection class	IP67
Cable configuration and parameters	
Cable (diameter / length / AWG)	Ø 3.3 mm / L = 2 m / AWG 26
Maximum cable length	100 m
Grey	Colour of sheath insulation
Brown (BN)	+ U_B
Black (BK)	Signal (with released armature plate - brake energized)
Blue (BU)	- U_B
Operating conditions	
Ambient temperature range T_A	from -40 °C to +120 °C (no component damage) from -25 °C to +120 °C (information analysis)
Shock and vibration	IEC 60947-5-2 / 7.4
EMC protection	
IEC 60947-5-2 (7.2.3.1)	1 kV
IEC 61000-4-2	Level 2
IEC 61000-4-3	Level 3
IEC 61000-4-4	Level 2

Tab. 8: Technical data for inductive proximity sensors (release check)

5.4 Minimum bend radius for the brake connection line

Brake size	Wire cross-section	Minimum bendradius [mm]
06	AWG 20	28
08		
10		
12		
14		
16	AWG 16	46
18		

Tab. 9: Minimum bend radius for the brake connection line

5.5 Bridge/half-wave rectifier (optional)

BEG-561-□□□-□□□

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

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

Terminals 3 and 4 are located in the DC circuit of the brake. The induction voltage peak for DC switching (see "DC switching - fast engagement" circuit diagram) is limited by an integrated overvoltage protection at terminals 5 and 6.

5.5.1 Assignment: Bridge/half-wave rectifier – brake size

Rectifier type	Supply voltage [V AC]	Over-excitation		Holding current reduction	
		Coil voltage [V DC]	Size	Coil voltage [V DC]	Size
BEG-561-255-030	230	103	06 – 18	205	06 – 12
BEG-561-255-130			–		14 – 18
BEG-561-440-030-1	400	180	06 – 18	–	–

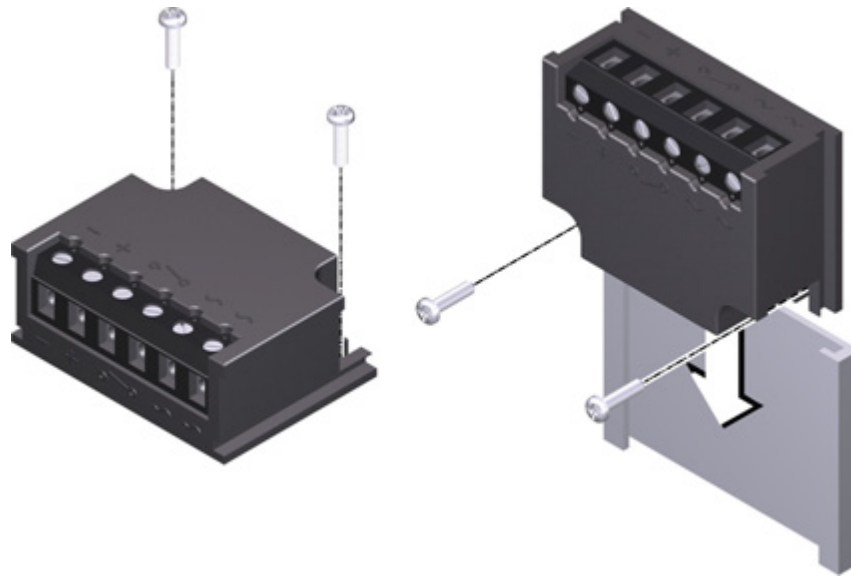


Abb. 15 BEG-561 attachment options

5.5.2 Technical specifications

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

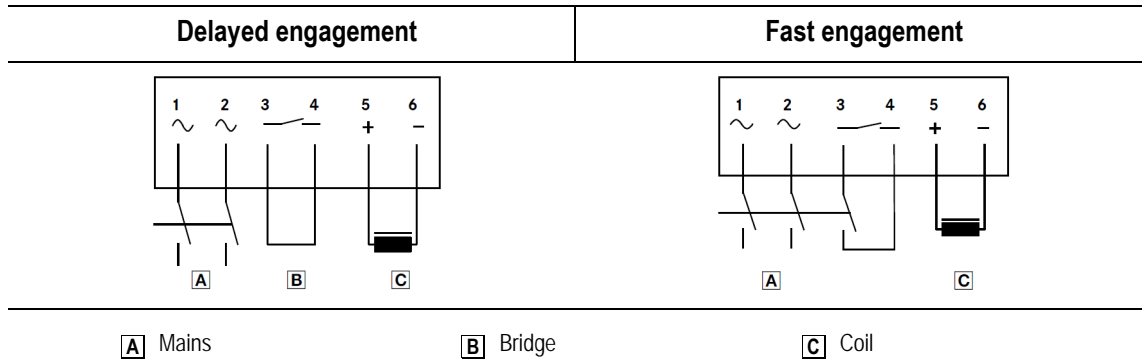
Type	Input voltage U_1 (40 Hz – 60 Hz)			Max. current I_{max}		Over-excitation time t_{ue} ($\pm 20\%$)		
	Min. [V ~]	Rated [V ~]	max. [V ~]	Bridge [A]	half-wave [A]	at U_{1min} [s]	at U_{1Nom} [s]	at U_{1max} [s]
BEG-561-255-030	160	230	255	3.0	1.5	0.430	0.300	0.270
BEG-561-255-130						1,870	1,300	1,170
BEG-561-440-030-1	230	400	440	1.5	0.75	0.500	0.300	0.270

Tab. 10: Data for bridge/half-wave rectifier type BEG-561

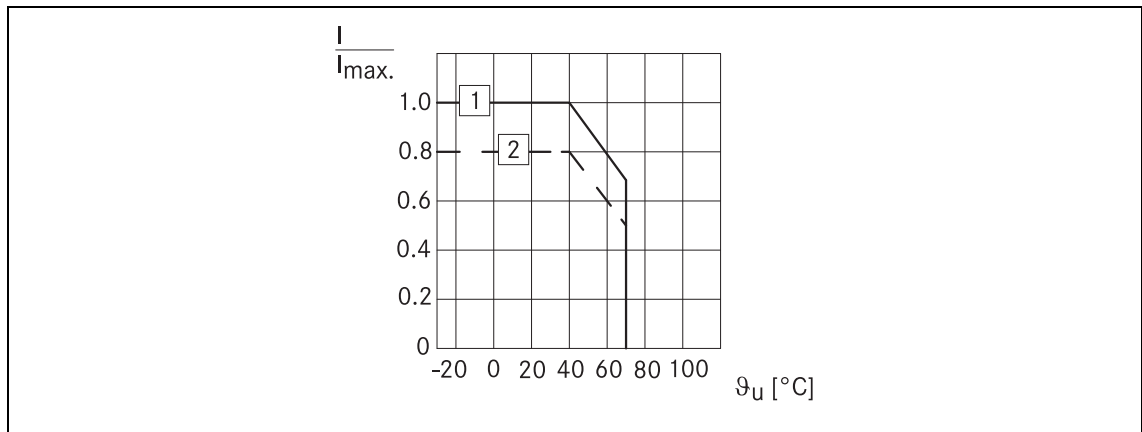
U_1 input voltage (40 – 60 Hz)

5.5.3 Reduced switch-off times

AC switching must also be carried out for DC switching (fast engagement)! Otherwise, there will be no over-excitation when it is switched back on.





5.5.4 Permissible current load at ambient temperature







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

6 Commissioning and operation

6.1 Important notes

	 DANGER
	<p>There is a risk of injury by electrical shock!</p> <ul style="list-style-type: none"> ■ 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.

	 DANGER
	<p>Danger: rotating parts!</p> <p>The brake must be free of residual torque. The drive must not be running when checking the brake.</p>

	 CAUTION
	Danger: hot surfaces. Do not touch!

- The brake is designed for operation under the environmental conditions that apply to IP66 protection. Because of the numerous possibilities of using the brake, it is however necessary to check the functionality of all mechanical components under the corresponding operating conditions.



NOTICE

Functionality for different operating conditions

- 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.





NOTICE


Operation without dynamic loads (functioning as a pure holding brake)

- If the brake is used as a pure holding brake without dynamic load, the friction lining must be reactivated regularly.

6.2 Function checks before commissioning

1. The switching contact for the brake must be open.
2. Remove two bridges from the motor terminals to deenergize the motor.
 - Do **not** disconnect the supply voltage for the brake.



	 DANGER
	<p>There is a risk of electric shock!</p> <p>If the rectifier is connected to the neutral point of the motor, the neutral conductor must also be connected to this point.</p>



3. Apply DC voltage to the brake.
4. Measure the AC voltage at the motor terminals. The measured level must be zero.
5. Close the switching contact for the brake.
 - The brake is released.
6. Measure the DC voltage at the brake.
 - Compare the DC voltage with the voltage indicated on the name plate. A deviation of 10 % is permissible.
 - If the measured value deviates:  45
7. Open the switching contact for the brake.
 - The brake is applied.
8. Switch off DC voltage for the brake.
9. Screw the bridges onto the motor terminals.
10. If necessary, remove the neutral conductor from the neutral point (step 2).

The preparations for commissioning are completed.

If faults occur, refer to the the error search table,  44. If the fault cannot be fixed or eliminated, please contact your customer service.

6.3 Brake with proximity sensor

	 DANGER
	<p>There is a risk of injury by electrical shock!</p> <ul style="list-style-type: none"> ■ 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.

	 WARNING
	<p>Danger: rotating parts!</p> <p>The brake must be free of residual torque. The motor must not run!</p>

1. The switching contact for the brake must be open.
2. Remove two bridges from the motor terminals to deenergize the motor.
 - Do not switch off the voltage supply to the brake.
 - When connecting the rectifier to the neutral point of the motor, the PE conductor must also be connected to this point.
3. Apply DC voltage to the brake.
4. Measure the AC voltage at the motor terminals. The measured level must be zero.
5. Close the switching contact for the brake.
 - The brake is released.
6. Measure the DC voltage at the brake:
 - Compare the DC voltage with the voltage indicated on the name plate. A deviation of $\pm 10\%$ is permissible.
7. Check the air gap "s_L".
 - It must be zero and the rotor must rotate freely.
8. Check the switching status of the proximity sensor (refer to Table 11).
9. Open the switching contact for the brake.
 - The brake is applied.
10. Check the switching status of the proximity sensor (refer to Table 11).
11. Switch off DC voltage for the brake.
12. Screw the bridges onto the motor terminals. Remove additional PE conductor, if necessary.


Contact type	Connection	Brake released	Proximity sensor is closed
N/O contact	black / blue	no	no

Tab. 11: Switching status of the proximity sensor

6.4 Commissioning

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

6.5 During operation

- Checks must be carried out regularly. Pay special attention to:
 - unusual noises or temperatures
 - loose fixing elements
 - the condition of the electrical cables
 - The armature plate must be attracted and the rotor must move without residual torque.
- Measure the DC voltage at the brake.
 - Compare the DC voltage with the voltage indicated on the name plate. A deviation of 10 % is permissible.
- If faults occur, refer to the the error search table,  44. If the fault cannot be fixed or eliminated, please contact your customer service.

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 operating frequency. If several of the causes of friction lining wear occur in an application at the same time, the influencing factors should be added together when the amount of wear is calculated.


Component	Cause	Effect	Influencing factors
Friction lining	Braking during operation	Wear of friction lining	Friction work
	Emergency stops		
	Overlapping wear during start and stop of drive		
	Active braking via the drive motor with support of brake (quick stop)		
	Starting wear in case of motor mounting position with vertical shaft, even when the brake is not applied		Number of start/stop cycles
Armature plate and counter friction face	Rubbing of brake lining	Run-in of armature plate and counter friction face	Friction work
Gear teeth of brake rotor	Relative movements and shocks between brake rotor and brake shaft	Wear of gear teeth (primarily on the rotor side)	Number of start/stop cycles
Brake support	Changing load cycles and shocks in backlash on reversal between armature plate and cylinder pin	Play of armature plate and cylinder pin	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. 12: Causes for wear

7.2 Inspections



7.2.1 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,  38. 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.

7.2.2 Maintenance intervals

Time interval	for operating brakes:	for holding brakes with emergency stop:
	<ul style="list-style-type: none"> ■ according to service life calculation ■ or else every six months ■ after 4000 operating hours at the latest 	<ul style="list-style-type: none"> ■ at least every 2 years ■ after 1 million cycles at the latest ■ plan shorter intervals for frequent emergency stops
Inspections with assembled brake	<ul style="list-style-type: none"> ■ Check release function and control 	 42
Inspections after removing the brake	<ul style="list-style-type: none"> ■ Check rotor ■ Check hub ■ Check armature plate and counter friction face 	 40

7.3 Maintenance



NOTICE

Brakes with defective armature plates, springs or flanges must be completely replaced. Observe the following for inspections and maintenance works:

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

7.3.1 Check the brake

1. Air gap control (only for sizes 12 to 18):
 - Do not energise the brake when checking the air gap.
 - When checking the air gap s_L , the plug (item 1.3 in Figure 1) must be levered out manually. Sharp-edged tools will destroy the plug!
 - Use a feeler gauge to determine the actual air gap. It can then be compared to the max. permissible air gap s_{Lmax} . 14.

At $s_L < s_{Lmax}$, the brake remains operational.



	NOTICE
	After the procedure, the plug (item 1.3) must be pushed in straight so that it is firmly inserted. Make sure that the plug does not become tilted.



If further tests are required, the brake must be disassembled 41 (only for sizes 6-18).

	DANGER
	Switch off the voltage. The brake must have no load torque on it when it is being dismantled.

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

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

	 CAUTION
	Danger: hot surfaces. Do not touch!

1. Dismantling the brake,  41.
2. Check rotor: Rotor thickness
 - Measure the rotor thickness using a caliper gauge.
 - Compare the measured rotor thickness with the minimally permissible rotor thickness,  14.
 - If necessary, exchange the rotor.
 - Check the gear teeth of the rotor.
 - If the gear teeth are damaged, replace the rotor.

7.3.2 Dismantling the brake

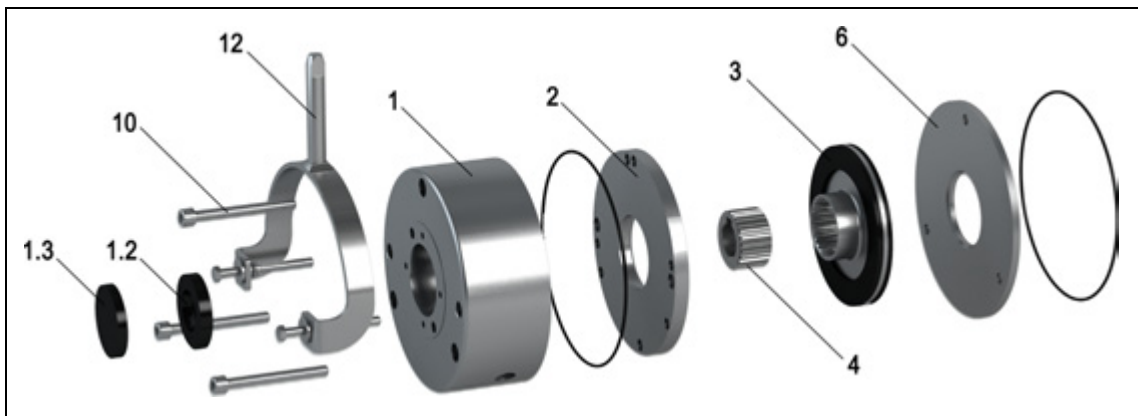







Abb. 16 Dismantling the brake

1 Stator	1.2 Shaft seal	1.3 Plug
2 Armature plate	3 Rotor	4 Hub
6 Flange	10 Socket head cap screws	12 Complete manual release
15 End shield		

1. Disconnect the connection cable.
2. Loosen the socket head cap screws (10) and remove them.
3. Detach stator (1) from the shaft.
4. Detach rotor (3) from the hub.
5. Check hub: Gear teeth
 - Check the gear teeth of the hub.
 - If the gear teeth are damaged, dismount and replace the hub.
6. Check armature plate: Thermal damage
 - In the case of thermal damage (dark blue tarnishing), replace the stator.

7. Check counter friction face:
 - A Flange
 - Maximum run-in depth = 30 % of rated air gap  13.
 - In the case of strong scoring, replace the flange.
 - In the case of thermal damage (dark blue tarnishing), replace the flange.
 - B End shield
 - Maximum run-in depth = 30 % of rated air gap  13.
 - In case of strong scoring, reprocess the end shield  20.
8. Assemble the brake,  22.
9. Connect the supply cable.
10. Recommission the brake,  34.

**NOTICE**

After replacing the rotor, the original braking torque will not be reached until the run-in operation for the friction surfaces has been completed. After replacing the rotor, the run-in armature plates and the flanges have an increased initial rate of wear.

7.3.3 Release / voltage

1. Observe the brake functionality while the drive is operating. The armature plate must be attracted and the rotor must move without residual torque.
2. 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.

7.4 Spare-parts list

Spring-applied brake INTORQ BFK470-06 to 18

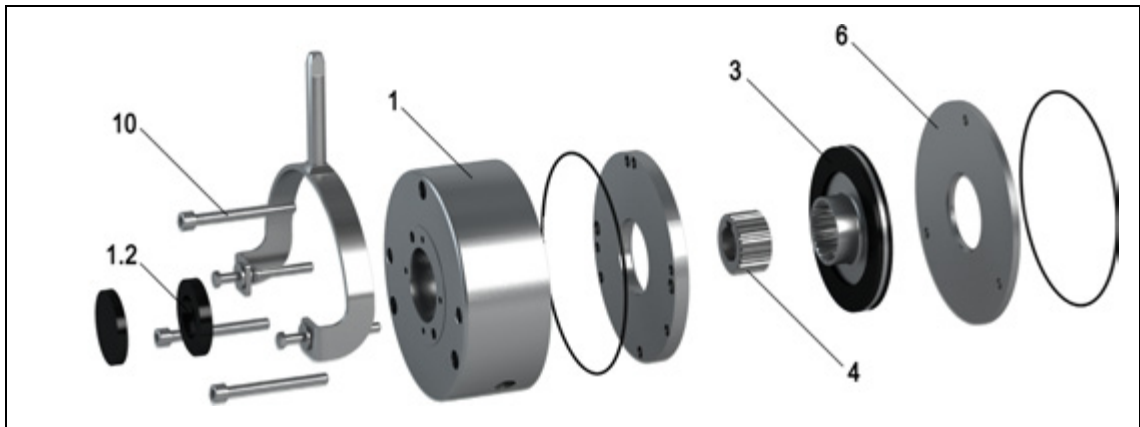


Abb. 17 Spring-applied brake BFK470

_____ material number of the brake (PLEASE INCLUDE: refer to the nameplate)!

Only parts with item numbers are available.

Item	Designation	Variant
1.2	Shaft sealing ring	Shaft diameter
3	Complete rotor	
4	Hub	Bore diameter
6	Complete flange (incl. O-ring)	
10	Fixing screws with sealing rings Socket head cap screw set, DIN EN ISO 4762	for mounting to the motor for flange with through hole

7.5 Electrical accessories




Rectifier

Refer to the Operating Instructions "Electrical switching devices and accessories", on page 15.

8 Troubleshooting and fault elimination

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

Brake malfunctioning

Fault	Cause	Remedy
Brake does not release	Coil interruption	<ul style="list-style-type: none"> ■ Measure coil resistance using a multimeter: <ul style="list-style-type: none"> - If resistance is too high, replace the complete stator.
	Coil has contact to earth or between windings	<ul style="list-style-type: none"> ■ Measure coil resistance with multimeter: <ul style="list-style-type: none"> - Compare measured value with rated resistance. - Values:  16 - If resistance is too low, replace the complete stator. ■ Check coil for short circuit to ground using a multimeter: <ul style="list-style-type: none"> - Replace the complete stator if short circuit to ground is detected. ■ Check brake voltage (refer to "defective rectifier, voltage too low").
	Wiring defective or wrong	<ul style="list-style-type: none"> ■ Check and correct <ul style="list-style-type: none"> - Check cable for continuity using a multimeter: ■ Replace the complete stator if a cable is defective.
	Defective or incorrect rectifier	<ul style="list-style-type: none"> ■ Measure rectifier DC voltage using a multimeter. If DC voltage is zero: <ul style="list-style-type: none"> ■ Check AC rectifier voltage. If AC voltage is zero: <ul style="list-style-type: none"> - Switch on power supply - Check fuse - Check wiring. If AC voltage is okay: <ul style="list-style-type: none"> - Check rectifier, - Replace defective rectifier If DC voltage is too low: <ul style="list-style-type: none"> - Check rectifier, - Diode defective - install an appropriate undamaged rectifier. ■ Check coil for inter-turn fault or short circuit to ground. ■ If the rectifier defect occurs again, replace the entire stator, even if you cannot find any fault between turns or short circuit to ground. The fault may occur later during heating-up.
	Air gap too large	Replace rotor  41
	Rotor thickness too small	Replace rotor  41

Deviations in measured values

Measured value	Cause	Remedy
Voltage too high	Brake voltage does not match the rectifier	Adjust rectifier and brake voltage to each other.
Voltage too low	Brake voltage does not match the rectifier	Adjust rectifier and brake voltage to each other.
	Defective rectifier diode	Replace defective rectifier by a suitable undamaged one.
AC voltage is not mains voltage	Fuse is missing or defective	Install fuse. Exchange fuse.

Notes

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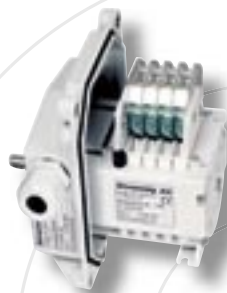
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**Getriebe-Nocken-
Endschalter**

Geared Cam
Limit switches

Serie 51 / 51 DZ

51



- Planetengetriebe: Kunststoff
- Präzise
- Sehr einfach einstellbar
- Gehäuse: Kunststoff oder Aluminiumguss

- Planetary gears: plastics
- Precise
- Very simple adjustment
- Housing: Plastics or aluminium cast

Wir geben Ihrem Antrieb Sicherheit

Katalog - Nr. D 142

Alle Angaben über Getriebe - Nocken - Endschalter der Reihe 51 und Getriebe - Nocken - Endschalter mit Differenzzahn - Getriebe der Reihe 51 DZ in Druckschriften älteren Datums sind mit dem Erscheinen dieser Druckschrift nur noch bedingt gültig.

Maß - und Konstruktionsänderungen behalten wir uns vor.

Stromag - Produkte entsprechen dem Qualitätsstandard nach EN ISO 9001.

Catalogue No. D 142

This catalogue for geared cam limit switches series 51 and geared cam limit switches with differential tooth gear series 51 DZ cancels and replaces all former editions.

We reserve the right to modify the dimensions and constructions.

Stromag products comply with the Quality Standard to EN ISO 9001.

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1 Standardschalter

1.1 Allgemeines

Getriebe - Nocken - Endschalter der Reihe 51 sind universell einsetzbare, mechanische Schaltgeräte, mit denen eine Vielzahl von Umdrehungen einer Welle auf dem Drehwinkel der eingebauten Nockenscheiben abgebildet wird. Von diesen Nockenscheiben werden die mechanischen Schaltkontakte betätigt.

Getriebe - Nocken - Endschalter werden überall dort eingesetzt, wo Winkel oder Strecken nicht direkt durch Schaltgeräte begrenzt werden können, sondern diese Begrenzung nur indirekt über die Messungen des Drehwinkels einer Welle möglich ist. Das klassische Beispiel für eine solche Anwendung ist die Begrenzung des Hakenweges eines Kranhubwerkes.

Besonders dort, wo im Zusammenhang mit einer möglichen Personengefährdung **zwangstrennende Schaltkontakte nach EN 60947 T5 - 1, IEC 947 - 5 - 1 vorgeschrieben sind**, gibt es keine wirtschaftliche Alternative zu Getriebe - Nocken - Endschaltern.

Abnahmen bzw. Zulassungen

Abnahmen bzw. Zulassungen für Standardausführungen:
Germanischer Lloyd Nr. 11300 - 98 HH (ohne DZ)
CSA Nr. 201 644 (ohne Zusatzanbauten)

Die besonderen Vorteile der Getriebe - Nocken - Endschalter der Reihe 51 sind:

- **Patentierte Planeten - Getriebe**
Formschlüssiges, reibungsarm laufendes Planetengetriebe mit selbsthemmender, selbstarretierender Schneckenverstellung der Nockenscheiben.
- **Im Gehäuse feststehende Nockenverstellung**
Die Verstell Schnecken der Nockenscheiben sind so angeordnet, daß sie aus der gleichen Richtung zu erreichen sind, wie die Anschlüsse der Kontakte. Damit ist optimale Erreichbarkeit auch unter beengten Einbauverhältnissen gewährleistet. Die Verstellung ist auch während des Betriebes möglich. Die Einfachheit und Genauigkeit der Nockenverstellung ist unübertroffen.
- **Modularer Aufbau**
Durch konsequente Verwendung von gleichen Teilen sowohl im Getriebe als auch beim Gehäuse wird eine wirtschaftliche und flexible Herstellung und Montage garantiert.
- **Patentierte Blockverstellung**
Das Verstellen aller Schaltkontakte gemeinsam ist durch eine einzige Verstell Schnecke (schwarz) möglich, ohne daß die Schaltpunkte der einzelnen Schaltkontakte zueinander verändert werden.
- **Große Nockenscheiben - Durchmesser**
Das bedeutet eine gute Einstellbarkeit und eine hohe Schaltpunktwiederholgenauigkeit.

1 Standard switches

1.1 General

51 series geared cam limit switches are universal mechanical switching devices that have been designed for use in conjunction with cam discs based on a specific angle of rotation for indication of a large number of shaft revolutions. These cam discs serve to operate mechanical contacts.

Geared cam limit switches are used wherever angles or routes cannot be directly limited by closing devices but only indirectly via measurements of the angle of rotation.

A classic example of such an application is limitation of the hook travel of crane hoisting gear.

Especially where there is a danger to persons and the **use of positive opening switching contacts is required according to EN 60947, part 5 - 1, IEC 947 - 5 - 1**, the use of geared cam limit switches is the most efficient alternative.

Survey and approval

Survey and approval for standard executions:
Germanischer Lloyd No. 11300 - 98 HH (without DZ)
CSA No. 201 644 (without supplementary fittings)

The particular advantages of 51 series geared cam limit switches are as follows:

- **Patented planetary gearing**
Low friction planetary gearing with irreversible, self-locking worm adjustment of the cam discs.
- **Fixed cam adjustment in housing**
The adjusting worms of the cam discs are arranged so that they can be accessed from the same direction as the contact connections for optimal accessibility in confined conditions. Adjustment is possible during operation. The simplicity and accuracy of the cam adjustment is unexcelled.
- **Modular design**
The consistent use of the same components for the gearing and housing guarantees economical and flexible manufacture and assembly.
- **Patented block adjustment**
The adjustment of all switching contacts jointly is made possible by a single adjusting worm (black) without the switching points of the individual switching contacts being altered with respect to each other.
- **Large cam disc diameter**
This means good adjustability and high switching point repeat accuracy.

1.2 Aufbau des Getriebe - Endschalers

Der Getriebe - Endschalter 51 besteht aus einem Getriebe - und Schalterteil, die in einem Gehäuse untergebracht sind. Das Drehmoment wird formschlüssig von der durchgehenden Antriebswelle auf die Nockenscheiben übertragen. Die Getriebeteile sind aus hochwertigem Kunststoff gefertigt und laufen wartungsfrei.

Getriebe - Endschalter der Reihe 51 werden standardmäßig in der Schutzart IP00/IP20 als Einbauschalter geliefert. Gegen Mehrpreis kann der Schalter in einem Aluminium - Gehäuse der Schutzart IP65 oder in einem GF - verstärkten Polycarbonat Gehäuse in der Schutzart IP66 geliefert werden.

Die Gebrauchslage ist beliebig.

Die Dauer - Betriebstemperatur beträgt -40°C bis $+80^{\circ}\text{C}$.

Die Schaltkontakte können mit Schraub - oder Flachsteckanschluß 6,3 mm ausgeführt sein.

1.3 Aufbau des Differenz Zahn - Getriebes

Getriebeaufbau

Das Differenz Zahn - Getriebe der Reihe 51 basiert auf der normalen Planetenstufe der Reihe 51, bei der die Nockenscheiben zur Betätigung der Schaltkontakte auf die Planetenträger aufgesteckt sind.

Die Nockenscheibe des Differenz Zahn - Getriebes hat dazu im Unterschied eine eigene Innenverzahnung mit gleichem Teilkreisdurchmesser wie das Hohlrad. Allerdings ist die Zahnzahl der Nockenscheibe um 3 Zähne größer. Die Planetenräder greifen gleichzeitig in beide Verzahnungen ein.

Dadurch verdreht sich bei jedem Umlauf der Planetenräder die Nockenscheibe um den Unterschied der Zahnzahlen von Hohlrad und Nockenscheibe.

Das ergibt eine Untersetzung pro Getriebestufe von 69,98.

Der Vorteil dieser Getriebeausführungen ist, daß die Abmessungen der Differenz Zahn - Getriebe gleich sind mit den Abmessungen der bisherigen Planetenstufen. Sie passen aus diesem Grund in die gleichen Gehäusegrößen. Auch die Kombination mit den Voruntersetzungen und mit normalen Planetenstufen sind dadurch gewährleistet. Die unterschiedlichen Schaltstufen sind sogar gemischt verwendbar, so daß zwei nebeneinander liegende Nockenscheiben eine um den Faktor 16 unterschiedliche nutzbare Umdrehung haben können. Bei Parallelschaltung der nebeneinander liegenden Schaltkontakte würde der Stromkreis erst unterbrochen, wenn beide Kontakte geschaltet sind. Die Schaltgenauigkeit wird damit um den Faktor 16 verbessert, bei sehr geringem Mehraufwand.

Die technischen Daten der Getriebe entnehmen Sie bitte der Tabelle 2. Die kleinste mögliche Getriebe - Untersetzung ist 69,98. Bei Getriebeuntersetzungen kleiner als diese Untersetzung sind die normalen Planeten - Getriebe der Reihe 51 zu verwenden, s. Tabelle 1.

Die Abmessungen der Getriebegröße 1 der DZ - Getriebe entsprechen der Getriebegröße 1 der Planeten - Getriebe. Damit gelten alle Maßzeichnungen dieses Kataloges für beide Ausführungen.

1.2 Construction of the geared limit switch

The geared limit switch 51 consists of a gearbox and switch combination which are located within a housing. The torque is positively transferred from the input shaft to the cam discs. The gearbox components are made of high - quality synthetic material and are maintenance - free.

The standard geared limit switches of series 51 are supplied as skeleton switches with protection IP00/IP20. Limit switches in an aluminium housing of protection IP65 or GF - reinforced polycarbonate of protection IP66 can be supplied at extra price.

Mounting as required.

The continuous service temperature is -40°C to $+80^{\circ}\text{C}$. The switching contacts can optionally be executed with screw terminal connection or flat plug connection 6.3 mm.

1.3 Construction of the differential tooth gear

Gear construction

The differential tooth gear of series 51 is based on the normal planetary step of series 51, whereas the cam discs for actuation of the switching contacts are fitted to the planetary carrier.

Difference: the cam disc of the differential tooth gear is provided with an own internal toothing having the same pitch circle diameter as the internal geared wheel. However, the cam disc has 3 teeth more. The planetary wheels catch simultaneously into both toothings.

With every rotation of the planetary wheels the cam disc turns by the difference of the gear number of the geared wheel and the cam disc.

Hence it follows a gear reduction of 69.98 per gear step.

This gear execution offers the advantage that the dimensions of the differential tooth gear are identical with the dimensions of the former planetary steps. Therefore they suit into the same housing sizes. The possibility of combination with pre - reductions and with normal planetary steps as well is assured. It is even possible to mix the different switching steps so that two adjacent cam discs may have a useful travel differing by factor 16. With parallel operation of the adjacent switching contacts the current circuit would only be interrupted when both contacts are actuated. Thereby the switching accuracy is improved by factor 16, whereas the additional expenditure is very low.

The technical data of the gear are stated in table 2. The smallest possible gear reduction is 69.98. For smaller gear reductions use the normal planetary gears of series 51, see table 1.

The dimensions of gear size 1 of the differential tooth gear correspond to gear size 1 of the planetary gear. So all dimensional drawings of this catalogue apply to both executions.

Die Antriebswelle kann wie bei den normalen Planetenstufen nach hinten verlängert werden, so daß hinter dem Getriebe-schalter Inkrementalgeber, Impulsgeber oder Multiturn - Absolutwertgeber angebaut werden können, s. Seiten 20 und 23.

Beschränkungen

Nicht mehr möglich bei dieser Getriebe - Ausführung ist die konkurrenzlos einfache Blockverstellung der normalen Reihe 51. Kunden die diese Eigenschaft benötigen, verwenden weiterhin die normale Reihe 51. Außerdem ist bei dieser Ausführung der Einbau einer Potikupplung nicht mehr möglich. Solen Potentiometer oder Singleturn - Absolutwertgeber angebaut werden, sind weiterhin die normalen Schaltstufen der Reihe 51 zu verwenden.

Vorteile der DZ - Getriebe

Bei gleicher Getriebe - Untersetzung reduziert sich die Baulänge der Getriebe-schalter um ca. 19 mm.

1.4 Schaltungspunkteinstellung

Die Schaltungspunkteinstellung jedes einzelnen Kontaktes erfolgt durch einen selbsthemmenden Schneckenantrieb (2) stufenlos auf die Nockenscheibe (1). Der Schaltungspunkt-Abstand kann innerhalb des nutzbaren Umdrehungsbereiches stufenlos eingestellt werden. Eine Umdrehung an der Verstell-schnecke entspricht einer Drehung der Nockenscheibe von 2,464° (Reihe 51) und 3,168° (Reihe 51 DZ). Die Verstellung kann in beiden Drehrichtungen erfolgen.

Die Schaltungspunkte können unabhängig voneinander eingestellt werden. Ein Feststellen irgendwelcher Teile ist nach der Einstellung nicht erforderlich.

As for the normal planetary steps, the input shaft can be extended to the rear side so that incremental encoders, pulse generators or multiturn absolute value encoders can be mounted behind the gear switch, see pages 20 and 23

Restrictions

The simple block adjustment (which is without any competition) of the normal series 51, however, cannot be used for this gear execution. Customers requiring this characteristic still use the normal series 51. It is not possible, too, to mount a potentiometer coupling. If intended to fit potentiometers or singleturn absolute value encoders, the normal switching steps of series 51 have still to be used.

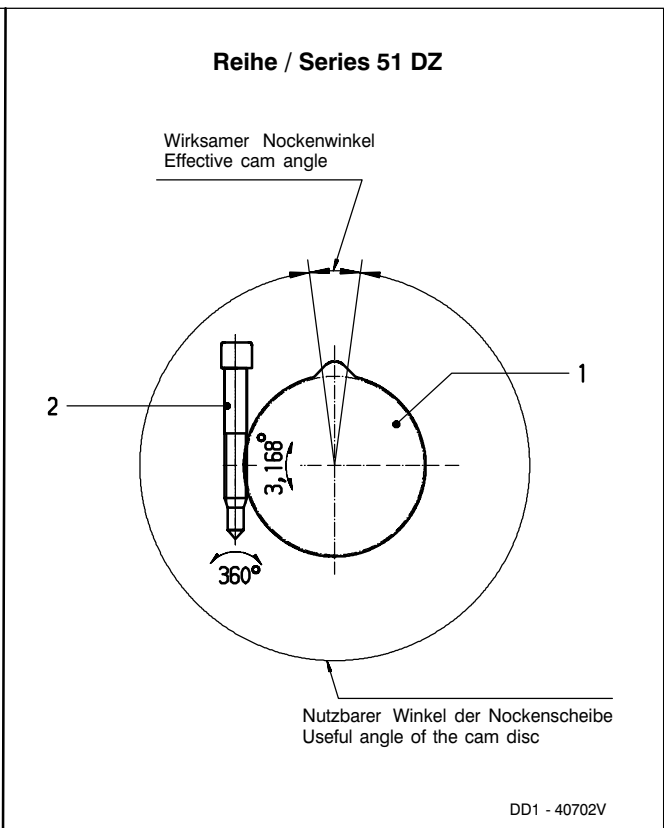
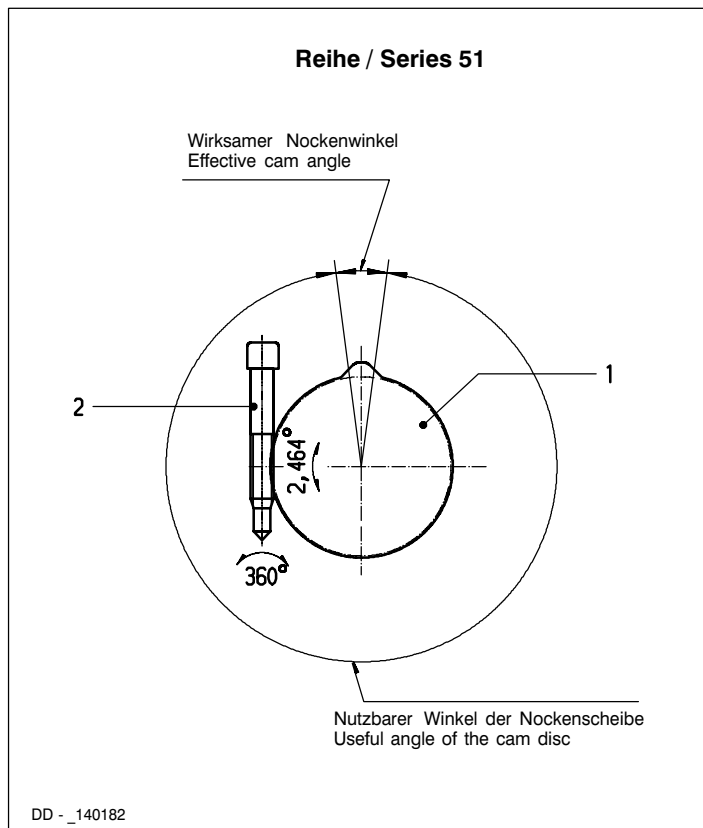
Advantages of the differential tooth gears

With the same gear reduction, the assembly length of the geared switch reduces by approx. 19 mm.

1.4 Switching point adjustment

The switching point adjustment of each contact is infinitely made on the cam disc (1) by means of a self-locking worm gear (2). The switching point distance is infinitely adjustable within the range of usable revolutions. One revolution of the controllable worm corresponds to a revolution of 2.464° (Series 51) and 3.168° (Series 51 DZ) of the cam disc. The adjustment can be made in both directions.

The switching points are independently adjustable. Locking of any parts after adjustment is not necessary.



1.5 Blockverstellung

Durch die Bauweise des Getriebes mit Planetenstufen ergibt sich ab der nutzbaren Umdrehung 17,5 (Getriebe - Größe 2) die Möglichkeit einer Blockverstellung. Diese ist standardmäßig eingebaut.

Dabei ist die letzte Getriebestufe ebenfalls mit einer Verstell-schnecke, in schwarzer Farbe, ausgerüstet.

Die Blockverstellung ermöglicht, zusätzlich zur Einzeleinstellung, eine gemeinsame Verstellung aller Nockenscheiben.

Die Schaltposition der Einzelkontakte zueinander bleiben dabei unverändert.

Achtung!

Um bei der Reihe 51 DZ gleiche Systemmaße beizubehalten, ist auch die Blockverstellungsstufe eingebaut.

Die eingebaute Verstell-schnecke wirkt aber nicht als Blockverstellung.

1.5 Block adjustment

As a standard the planetary gear construction allows a block adjustment in addition to the individual contact adjustment from the usable revolution 17.5 (gear size 2).

The final gear stage is also provided with an adjusting worm, coloured black.

All cam discs can be commonly adjusted by means of this adjusting worm.

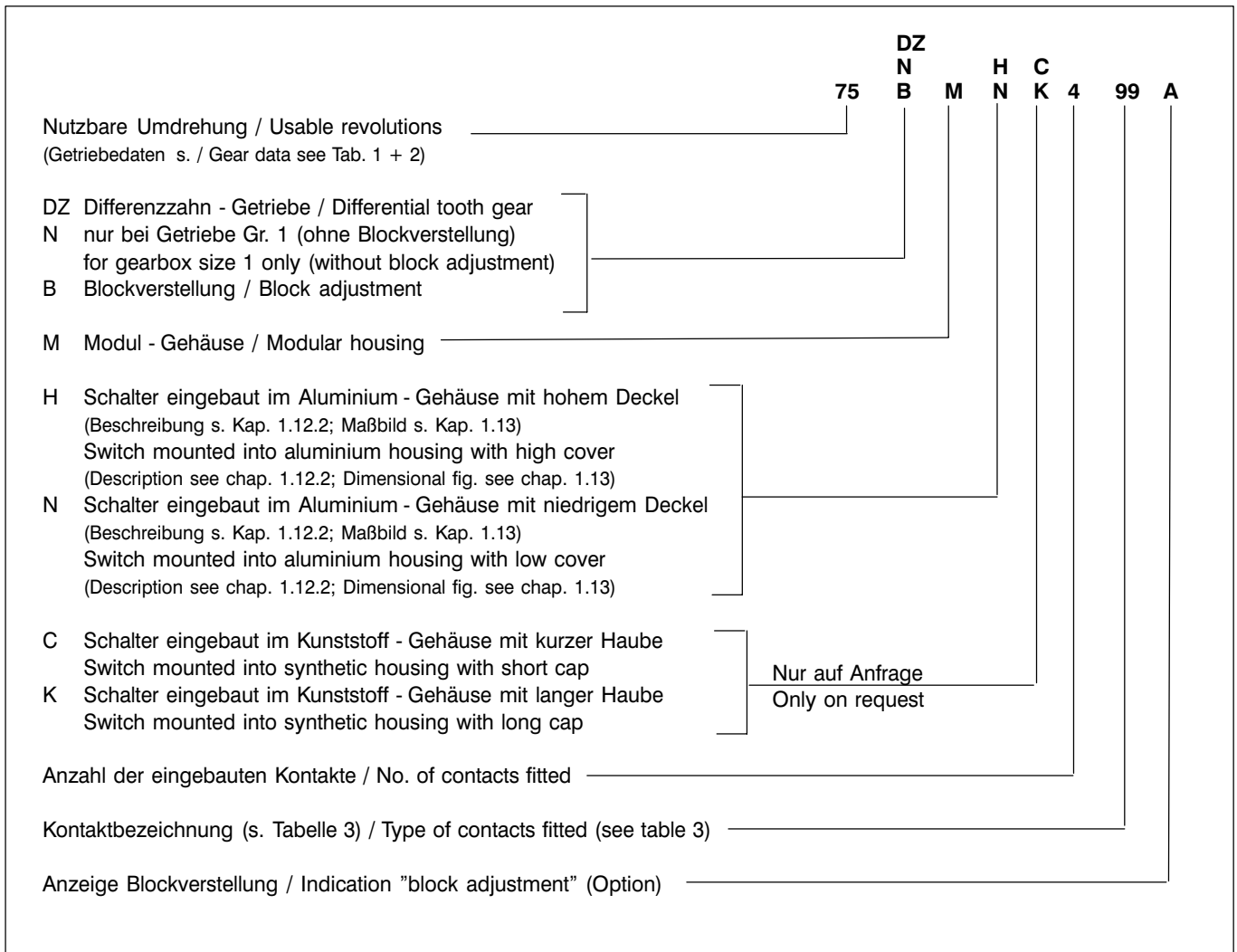
The relative adjustments of the individual contacts to each other are not modified.

Caution!

To maintain identical system dimensions with series 51 DZ, the block adjustment step is mounted.

The built - in adjusting worm, however, does not act as block adjustment.

1.6 Typenschlüssel / Key to types



1.6.1 Bestellbeispiel

Notwendige Bestellangaben für Standard - Getriebeschalter:

1.6.1 Ordering example

Ordering data required for standard geared switches:

Reihe / Series	51	
Typ / Type	75 BMH - 499 A	s. Kapitel / see Chapter 1.6
Bauform / Construction	B3	s. Kapitel / see Chapter 1.12 - 1.17
Schutzart / Protection	IP65	s. Kapitel / see Chapter 1.12 - 1.17

Ergänzende Angaben bei Sonderausführungen bzw. bei Optionen:

- Nockenscheiben:
Angabe des wirksamen Nockenwinkels falls abweichend von der 15° Standardnockenscheibe, s. auch Kap. 1.9.
- PTC - Heizung:
Angabe der Anschlußspannung, s. auch Kap. 2.4.
- Geberanbau:
Bei einer Anfrage bzw. Bestellung sind unbedingt verbindliche Maß - bzw. Datenblätter des einzubauenden Gebers erforderlich, s. auch Kap. 2.1.

Additional data for special types and options:

- Cam discs:
Data on effective cam angle if deviating from the 15° standard cam disc, see also Chapter 1.9.
- PTC heater:
Data on supply voltage, see also Chapter 2.4.
- Sensor:
For enquiries or orders, binding dimension and data sheets on the sensor to be fitted are required, see also Chapter 2.1.

1.7 Tabelle / Table 1

Getriebedaten / Gear data Reihe 51

Getriebe- größe Gear size	Nenn - Um- drehungen für Nocken- scheibe 15° Nominal revolutions for cam disc 15°	Nutzbare Umdrehungen theo. bei Nok- kenscheiben 15° Usable revs. theor. at cam discs 15°	Ge - triebe i Gear - ratio i	Vorsatz- stufe Input/ output stage	Anzahl i _{ges.} Planeten - stufen No. of planetary stages i	1 Umdr. der Antriebswelle = Grad an der Nocken- scheibe 1 rev. of the drive shaft - corresp. to an ang. motion of cam disc = °	Rückschalt - Umdr. an der Antriebswelle für Schnapp- schalter Reset rev. at driving shaft for snap ac- tion	max. Antriebs- drehzahl max. drive speed min ⁻¹	min. Antriebs- drehzahl (nur bei Wechsler) min. drive shaft (only for change - over contact) min ⁻¹
1	4,1	4,16	4,285	-	1x4,285	84	0,01 - 0,02	1000	0,67
	6,5	6,88	7,083	1,653	1x4,285	50,8	0,01 - 0,02	1200	1,1
	11	11,23	11,56	2,698	1x4,285	31,14	0,02 - 0,04	1500	1,8
2	17,5	17,84	18,361	-	2x4,285	19,6	0,03 - 0,06	1800	2,9
	29,0	29,5	30,35	1,653	2x4,285	11,86	0,05 - 0,1	1800	4,7
	48	48,13	49,538	2,698	2x4,285	7,27	0,08 - 0,16	1800	7,7
3	75	76,45	78,678	-	3x4,285	4,57	0,13 - 0,3	1800	12,2
	125	126,39	130,054	1,653	3x4,285	2,77	0,21 - 0,42	1800	20,2
	205	206,26	212,272	2,698	3x4,285	1,69	0,35 - 0,68	1800	33
4	323	327,6	337,135	-	4x4,285	1,06	0,6 - 1,17	1800	52
	540	541,5	557,284	1,653	4x4,285	0,65	0,92 - 1,8	1800	87
	880	883,8	909,59	2,698	4x4,285	0,4	1,5 - 2,9	1800	141
5	1384	1403,7	1444,62	-	5x4,285	0,25	2,4 - 4,7	1800	224
	2288	2320,2	2387,96	1,653	5x4,285	0,15	3,9 - 7,7	1800	371
	3735	3787,1	3897,58	2,698	5x4,285	0,09	6,5 - 12,7	1800	606
6	5900	6014,77	6190,204	-	6x4,285	0,06	10,3 - 20,1	1800	1)
	9800	9942,42	10232,407	1,653	6x4,285	0,04	17,0 - 33,3	1800	1)
	16000	16227,86	16701,17	2,698	6x4,285	0,02	27,8 - 54,2	1800	1)

1) Nur als Öffner - Kontakt zu verwenden / Only use as normally closed contact

Tabelle / Table 2

Getriebedaten / Gear data 51 DZ

Getriebe- größe	Nenn - Um- drehungen für Nocken- scheibe 15°	Nutzbare Umdrehungen theo. bei Nok- kenscheiben 15°	Ge - triebe i	Vorsatz- stufe	Anzahl i _{ges.} Planeten - stufen	1 Umdr. der Antriebswelle = Grad an der Nocken- scheibe	Rückschalt - Umdr. an der Antriebswelle für Schnapp- schalter	max. Antriebs- drehzahl	min. Antriebs- drehzahl (nur bei Wechsler)
Gear size	Nominal revolutions for cam disc 15°	Usable revs. theor. at cam discs 15°	Gear - ratio i	Input/ output stage	No. of planetary stages i	1 rev. of the drive shaft - corresp. to an ang. motion of cam disc = °	Reset rev. at driving shaft for snap ac- tion	max. drive speed min ⁻¹	min. drive shaft (only for change - over contact) min ⁻¹
1	67	67,23	69,98	-	1x 69,98	5,14	0,11 - 0,22	1800	10,9
	110	111,1	115,68	1,653	1x 69,98	3,11	0,19 - 0,4	1800	18,0
	180	181,4	188,8	2,698	1x 69,98	1,90	0,31 - 0,6	1800	29,4
2	280	288,1	299,86	-	1x 4,285 1x69,98	1,20	0,5 - 1,0	1800	46,7
	470	476,25	495,67	1,653	1x 4,285 1x69,98	0,73	0,84 - 1,7	1800	77,1
	770	777,3	809,02	2,698	1x 4,285 1x69,98	0,44	1,35 - 2,6	1800	125,0
3	1200	1234,5	1284,9	-	2x 4,285 1x69,98	0,28	2,1 - 4,1	1800	199,0
	2000	2040,7	2123,97	1,653	2x 4,285 1x69,98	0,17	3,5 - 10,3	1800	330,0
	3300	3330,9	3466,66	2,698	2x 4,285 1x69,98	0,1	5,5 - 11,3	1800	539,0
4	5200	5290,2	5505,87	-	3x 4,285 1x69,98	0,06	9,1 - 17,8	1800	856,0
	8700	8744,7	9101,2	1,653	3x 4,285 1x69,98	0,04	15,1 - 29,5	1800	1415,0
	14200	14272,9	14854,8	2,698	3x 4,285 1x69,98	0,02	24,7 - 48,2	1800	1)

1 Umdrehung der Verstell Schnecke entspricht 3,168° an der Nockenscheibe
Revolution of the adjusting worm corresponds to 3.168° at the cam disc

1) Nur als Öffner - Kontakt zu verwenden / Only use as normally closed contact

Achtung!

**Bedingt durch die langsame Betätigungs-
geschwindigkeit der Schaltkontakte aufgrund der hohen
Getriebeuntersetzungen wird das Umschaltverhalten der
Kontakte negativ beeinflusst.**

**Bei Getriebegröße 6 sollten deshalb nur noch die Öffner-
kontakte der Schalter genutzt werden.**

**Vor Verwendung analoger Rückmeldesysteme (z.B. Poti)
ist Rücksprache mit den technischen Abteilungen nötig.**

Caution!

**Due to the slow actuation speed of the
switching contacts caused by the high gear reductions,
the change - over behaviour of the contacts is affected
negatively.**

**From gear size 6 it is therefore recommended to use only
the normally - closed contacts of the switches.**

**Before using analog feedback systems (e.g. potentiometer)
please consult our technical department.**

1.8 Kontakte

Die Kontakte können, je nach Art, über Schraubanschlüsse für Leiterquerschnitte 2x0,75 mm²/AWG 18 bis 2x1,5 mm²/AWG 16 oder über Flachstecker 6,3x0,8 mm angeschlossen werden.

Bei Kontakten mit Flachsteckanschluß sind bei Spannungen > 25V AC bzw. 60V DC isolierte Flachsteckhülsen zu verwenden.

1.8 Contacts

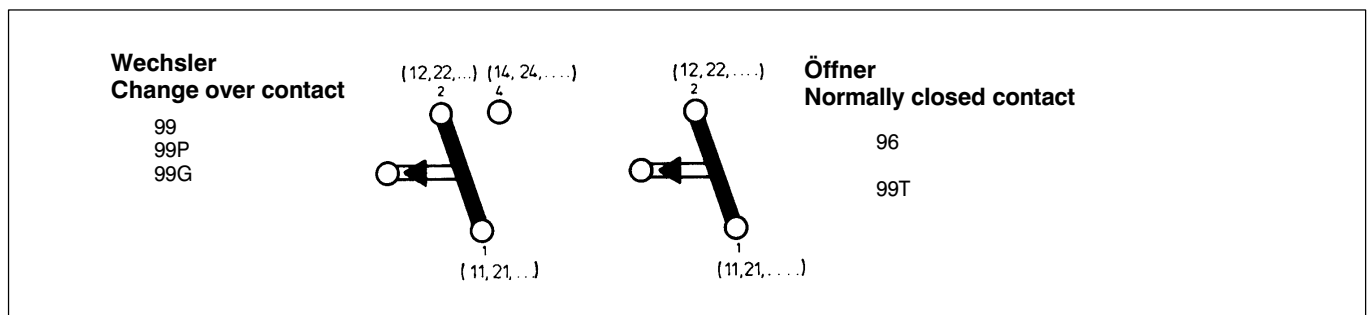
The contacts can either be connected through screw terminals for a cable cross sections of 2x0.75 mm²/AWG 18 to 2x1.5 mm²/AWG 16 or through flat plugs 6.3x0.8 mm.

For contacts with flat - plug connection, insulated flat - plug receptacles must be used at voltages above 25V AC and 60V DC.

Tabelle / Table 3

Kontaktbezeichnung Contact designation	Kontaktart Contact type	Kontaktwerkstoff Contact material	Schalt-system Switch actuation	Kontaktanschlußart Type of contact connection	Zwangstrennung nach Positive opening to EN60947T5 - 1 IEC947 - 5 - 1	Elektrische Daten Electrical data nach/to EN 60947 - 5 - 1				mechanische Lebensdauer in Mio. Schaltungen Mech. life in mio. switching operations		
						AC - 15 I[A] U[V]		DC - 13 I[A] U[V]				
99 ¹⁾	Wechsler Change - over cont.	Silber Silver	Schnapp - schaltung Snap action	Schraubanschluß Screw terminal	ja/yes	1.5	230			10		
99P ¹⁾	Wechsler Change - over cont.	Silber/ Silver	Schnapp - schaltung Snap action	Flachstecker 6,3 Flat plug 6,3							0,5	60
99G ^{1) 3)}	Wechsler Change - over cont.	Gold	Schnapp - schaltung Snap action	Schraubanschluß Screw terminal								
Nicht für Neukonstruktion Not for new construction	92 ²⁾	Wechsler Change - over cont.	Silber/ Silver	Schnapp - schaltung Snap action								
	97 ²⁾³⁾	Wechsler Change - over cont.	Gold	Schnapp - schaltung Snap action							-	-
	96 ²⁾	Öffner Normally closed contact	Silber/ Silver	Tast - schaltung push action								
99T ⁴⁾				Schraubanschluß Screw terminal			0,5	60				

- 1) Therm. Dauerstrom I_{th} = 10A; Bemessungsisolationsspannung U_i = 250V bei Verschmutzungsgrad 3
Thermal permanent current I_{th} = 10A; Reference insulation voltage U_i = 250V at pollution degree 3
- 2) Therm. Dauerstrom I_{th} = 6A; Bemessungsisolationsspannung U_i = 250V bei Verschmutzungsgrad 3
Thermal permanent current I_{th} = 6A; Reference insulation voltage U_i = 250V at pollution degree 3
- 3) Kontakte 99G und 97 für SPS - Anwendungen (Goldkontakte) / Contacts 99G and 97 for PLC applications (gold contacts)
- 4) Bei Schraubenanschluss zulässiger Leiterquerschnitt: 0,5 - 1,5 mm²/For screw terminal admissible cable cross section AWG 22 - 16



Typentabelle / Table of types

nutzbarer Umdrehungsbereich Usable revolution Reihe / Series 51 + 51 DZ	mit Wechsler - Kontakt with change - over contact 99 Reihe/Series 51	mit Öffner - Kontakt with normally closed contact 96 Reihe/Series 51 + 51 DZ	Größe Size
4,1 67 6,5 110 11,0 180	1) ...NM/DZM 299 ...NM/DZM 499 ...NM/DZM 699 ...NM/DZM 899	1) ...NM/DZM 296 ...NM/DZM 496 ...NM/DZM 696 ...NM/DZM 896	1 A 1 B 1 C 1 D **
17,5 280 29,0 470 48,0 770	...BM/DZM 299 ...BM/DZM 499 ...BM/DZM 699 ...BM/DZM 899	...BM/DZM 296 ...BM/DZM 496 ...BM/DZM 696 ...BM/DZM 896	2 A 2 B 2 C 2 D **
75,0 1200 125,0 2000 205,0 3300	...BM/DZM 299 ...BM/DZM 499 ...BM/DZM 699 ...BM/DZM 899	...BM/DZM 296 ...BM/DZM 496 ...BM/DZM 696 ...BM/DZM 896	3 A 3 B 3 C 3 D **
323,0 5200 540,0 8700 880,0 14200	...BM/DZM 299 ...BM/DZM 499 ...BM/DZM 699 ...BM/DZM 899	...BM/DZM 296 ...BM/DZM 496 ...BM/DZM 696 ...BM/DZM 896	4 A 4 B 4 C 4 D **
1384,0 2288,0 3735,0	...BM 299 ...BM 499 ...BM 699 ...BM 899	...BM 296 ...BM 496 ...BM 696 ...BM 896	5 A 5 B 5 C 5 D **
5900,0 9800,0 16000,0 *	...BM 299 ...BM 499 ...BM 699 ...BM 899	...BM 296 ...BM 496 ...BM 696 ...BM 896	6 A 6 B 6 C 6 D **

1) Den gewünschten nutzbaren Umdrehungsbereich einsetzen / Insert the required usable revolution range
 * Größere nutzbare Umdrehungen auf Anfrage / Higher usable revolutions on request
 ** Mehr als 8 Kontakte auf Anfrage möglich / More than 8 contacts on request
 Im Aluminium - Gehäuse ist die Kontaktanzahl durch die Kombination von Getriebegröße und Schaltkontaktanzahl begrenzt
 In an aluminium housing, the number of contacts is limited by the combination of gear size and number of switching contacts

1.9 Nockenscheiben

Serienmäßig sind die Nockenscheiben mit 15° -Auflaufnocken ausgerüstet. Auf Wunsch können ohne Mehrpreis auch Nockenscheiben mit 40° eingebaut werden. Gegen Mehrpreis können beliebige Sondernockenwinkel hergestellt werden.

Werden bei Bestellung keine Nockenwinkel angegeben, werden Nockenscheiben mit 15° Nockenwinkel eingebaut.

Für Sondernockenscheiben mit einem festen Programm bitte ein Diagramm ähnlich der unten stehenden Beispielzeichnung angeben.

1.9 Cam discs

The cam discs are provided with 15° contact cams as standard. Cam discs with 40° can be provided at no extra charge on request. At extra charge various special cam angles can be made.

When not stating the cam angle on order placement, cam discs with a cam angle of 15° will be fitted.

For special cam discs with a firm program please provide a diagram similar to the below shown example drawing.

Die Nockenscheiben werden nach dem wirksamen Nockenwinkel benannt. Bei Nockenscheiben der Reihe 51 entspricht dieser dem Schaltpunktwinkel auf dem Schaltpunktradius der Nockenscheibe. Der Fertigungswinkel ergibt sich aus der Konstruktion der Nockenscheibe.

The cam discs are designated according to their effective cam angle. With 51 series cam discs, this corresponds to the switching point angle on the switching point radius of the cam disc. The production angle results from the design of the cam disc.

Beispielzeichnung Example drawing

Kontakt / Contact	Nockenwinkel / Cam angle °
	0 15 60 270 315 360
1	0 to 15° shaded
2	0 to 60° shaded
3	270 to 315° shaded
4	315 to 360° shaded

Die nutzbaren Umdrehungen, die eine Nockenscheibe an der Antriebswelle eines Getriebeschalters ermöglicht, ergibt sich folgendermaßen:
 The usable number of revolutions of the drive shaft of a geared switch enabled by a cam disc can be calculated as follows:

$$\frac{(360^\circ - \alpha \text{ (wirksamer Nockenwinkel/effective cam angle)}) \times i \text{ (Getriebeuntersetzung des Schalters/gear reduction of switch)}}{360^\circ}$$

DD1_40294V DD - _140184

1.10 Antrieb

Der Antrieb kann radial, z.B. über einen Kettentrieb, oder axial, z.B. über eine elastische Kupplung, erfolgen. Bei Ketten-, Zahnrad- oder Zahnriementrieb ist die maximal zulässige radiale Belastung der Antriebswelle zu beachten (s. Diagramm). Bei einigen Schutzartgehäusen ist zusätzlich zum Gleitlager ein Rillenkugellager eingebaut. Bei Verwendung dieser Gehäuse kann der zulässige Kurvenwert verdoppelt werden. Der ideale Antrieb erfolgt über eine drehsteife elastische Kupplung mit geringen axialen und radialen Rückstellkräften. Hierbei werden Fluchtfehler und Achsversatz ausgeglichen.

1.10 Drive

The drive can be transmitted radially, e.g. by a chain, or axially, e.g. by a flexible coupling. With chain, toothed wheel or synchronous belt drive, pay attention to the max. admissible radial load (f max) of the input shaft (see diagram). To some housings a grooved ball bearing is fitted in addition to the plain bearing. When using these housings, the admissible graphical values can be doubled. The ideal drive is transmitted by a torsionally stiff, flexible coupling with low axial and radial restoring forces. Thereby misalignment and axial displacement are balanced.

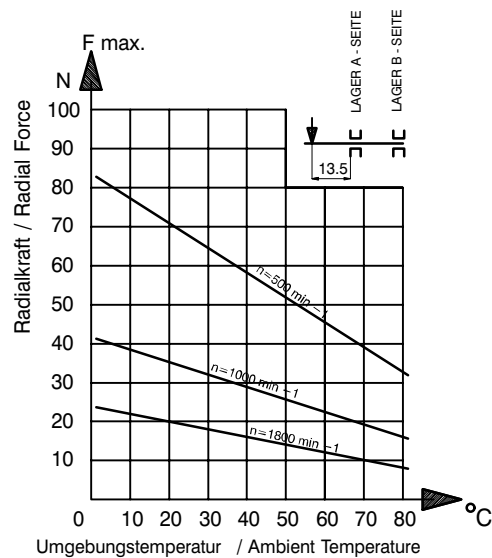
Achtung!

Bei Montage von Antriebselementen wie z.B. Kettenräder keine unzulässigen axialen Kräfte ausüben. Axiale oder radiale Schläge auf die Welle vermeiden.

Caution!

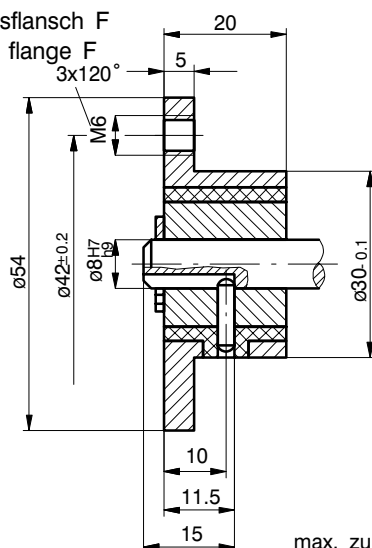
When mounting driving elements, such as chain wheels, do not exercise inadmissible axial forces. Avoid axial or radial shocks onto the shaft.

Beispiel / Example:
Bei / with $n_1 = 1800 \text{ min}^{-1}$ / rpm
und / and
40°C Umgebungstemperatur
ambient temperature $F_{\text{max}} = 16 \text{ N}$
und / and
80°C Umgebungstemperatur
ambient temperature $F_{\text{max}} = 9 \text{ N}$



DD - _140161

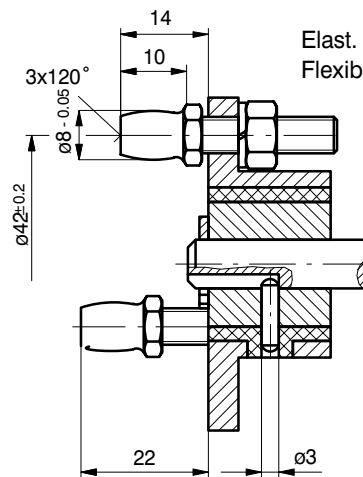
Elast. Antriebsflansch F
Flexible drive flange F



max. zulässige Betriebsdrehzahl:
max. adm. service speed:
Verdrehwinkel bei/twisting angle at 5Nm:

$n = 1000 \text{ min}^{-1}$
 $5 \pm 0,5^\circ$

Elast. Antriebsflansch F+M
Flexible drive flange F+M



DD1_40170V

1.11 Elastischer Antriebsflansch F bzw. F+M

Alle Ausführungen der Getriebe - Endschalter Reihe 51 können zusätzlich mit elastischen Antriebsflansch F bzw. F+M geliefert werden.

Bei Gehäuseform C/K ist die Verwendung von F+M - Flansch nur auf Anfrage möglich.

1.11 Flexible driving flange F or F+M

All executions of the geared limit switch series 51 can also be supplied with flexible driving flange F or F+M.

With housing form C/K, the utilisation of a flange F+M is possible only on request.

1.12 Gehäuseausführungen

1.12.1 Einbaugehäuse Schutzart: IP20/IP00

Diese Gehäuseausführung wird eingesetzt, wenn kundenseitig bereits ein Gehäuse zur Verfügung steht, in das der Getriebebeschalter eingebaut werden kann. Er wird auch in den nachfolgend beschriebenen Schutzgehäusen aus Aluminium (Schutzart IP65) und Polycarbonat (Schutzart IP66) verwendet.

Der Schalter ist modular aufgebaut. Die Baulänge hängt ab von der Getriebeuntersetzung und der Anzahl der eingebauten Kontakte. Die Detailmaße entnehmen Sie bitte dem nachfolgenden Maßbild.

Zur Befestigung stehen Füße und Gewindebohrungen an der Stirnseite zur Verfügung.

Kontakte mit Schraubanschluß standardmäßig mit Berührungsschutz, Schutzart IP20.

Kontakte mit Flachsteckanschluß Schutzart IP00. Bei Spannungen > 25V AC oder 60V DC sind zum Erreichen einer Handrücksensicherheit isolierte Flachstecker zu verwenden. Auch bei Öffnerfunktion muß der Schließeranschluß mit einem isolierten Stecker versehen sein.

1.12.2 Aluminium - Schutzgehäuse Schutzart IP65

- Für raue Umgebungsbedingungen
- Zum äußeren Anbau schwerer und großer Geber
- Öffnung des Gehäuses nach oben

Dieses robuste Schutzgehäuse wird überall dort eingesetzt, wo bei hohen mechanischen Beanspruchungen auch hohe Korrosionsfestigkeit benötigt wird. Standardmäßig wird das Gehäuse geliefert mit Zentrierungen an der B-Seite für Geber mit Einpaßdurchmessern von 36 mm und 50 mm. Über Zwischenflansche können auch größere Geber oder Tachogeneratoren angebaut werden. Das Gehäuse kann mit 2 Haubenhöhen geliefert werden:

Typ B (N) MH oder DZMH

In dieser Gehäusegröße sind alle Einbauteile, z.B. Motorverstellung einzubauen.

Typ B (N) MN oder DZMN

Bei dieser Gehäusegröße wurde auf eine Bauhöhe früherer Gehäuseausführungen (Ersatzbedarf) Wert gelegt.

1.12.3 Kunststoff - Gehäuse Schutzart IP66

Das Kunststoffgehäuse aus glasfaserverstärktem Polycarbonat ist das preisgünstigste Gehäuse für allgemeine Anwendungen. Es zeichnet sich durch hohe Formstabilität über einen großen Temperaturbereich (-40° bis +80°C) und eine hohe Schutzart aus.

Das Kunststoffgehäuse ist modular aufgebaut. Es wird über Zwischenstücke den Erfordernissen angepaßt.

Das Gehäuse wird in drei Bauformen geliefert:

Bauform B14

Grundausführung, Anbau über 3 Gewindebuchsen M6 im Gehäusevorderteil.

Bauform B3

An das Gehäusevorderteil wird zusätzlich ein Aluminium-winkelfuß angeschraubt.

Bauform B5

An das Gehäusevorderteil wird zusätzlich ein Aluminium-flansch angeschraubt.

1.12 Housing variants

1.12.1 Component housing protection IP20/IP00

This housing variant is used where a housing is already available in which the geared switch can be integrated. It is also used in the following described protective housings of aluminium (protection IP65) and polycarbonate (protection IP66).

The switch is in a modular design. The overall length depends on the gear reduction and number of installed contacts. The detail dimensions are shown in the following dimension diagram.

Provided for fixing purposes are feet and tapped holes on the front face.

Contacts with screw-connection are provided with a cover as standard, protection IP20.

Contacts with push-on connections, protection IP00. At voltages above 25V AC or 60V DC, insulated tab connectors must be used for safety from touch by the back of the hand. With function "normally closed" as well the normally open contact has to be provided with an insulated plug.

1.12.2 Aluminium protective housing protection IP65

- For use in harsh environments
- For external fitting of large and heavy encoders
- Housing opens upwards

This tough protective housing is suitable for use wherever high corrosion resistance is required under high mechanical loads. The housing is supplied with centering lugs on the B-Side for encoders with fitting diameters of 36 mm and 50 mm as standard. Also larger encoders or tachogenerators can be fitted via intermediate flanges.

The housing is available with two cover heights:

Type B (N) MH or DZMH

This housing size is designed to accept all built-in components, e.g. motor adjustment.

Type B (N) MN or DZMN

This housing size corresponds to the height of earlier housing variants (replacement requirement)

1.12.3 Plastic housing protection IP66

This plastic housing of glass fibre reinforced polycarbonate is a reasonably priced housing for general applications. It is characterised by high dimensional stability, suitability for use over a wide temperature range (-40° to +80°C) and a high protection.

This plastic housing is in a modular design and can be adapted via intermediate pieces to suit individual requirements. This housing is available in three types:

Type B14

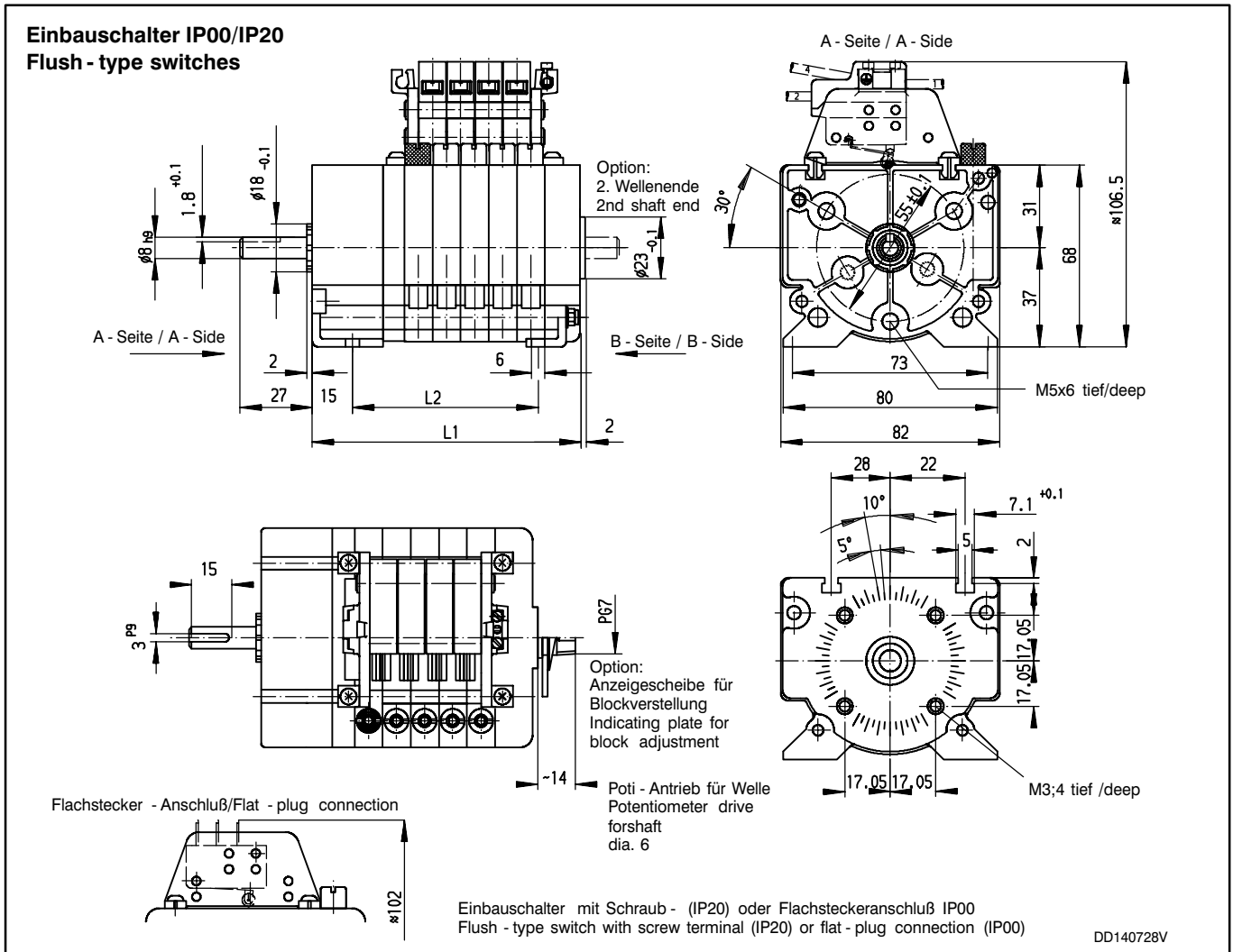
Basic type, fitting via 3 M6 threaded bushes at the front of the housing.

Type B3

An aluminium angle foot is additionally screwed to the front of the housing.

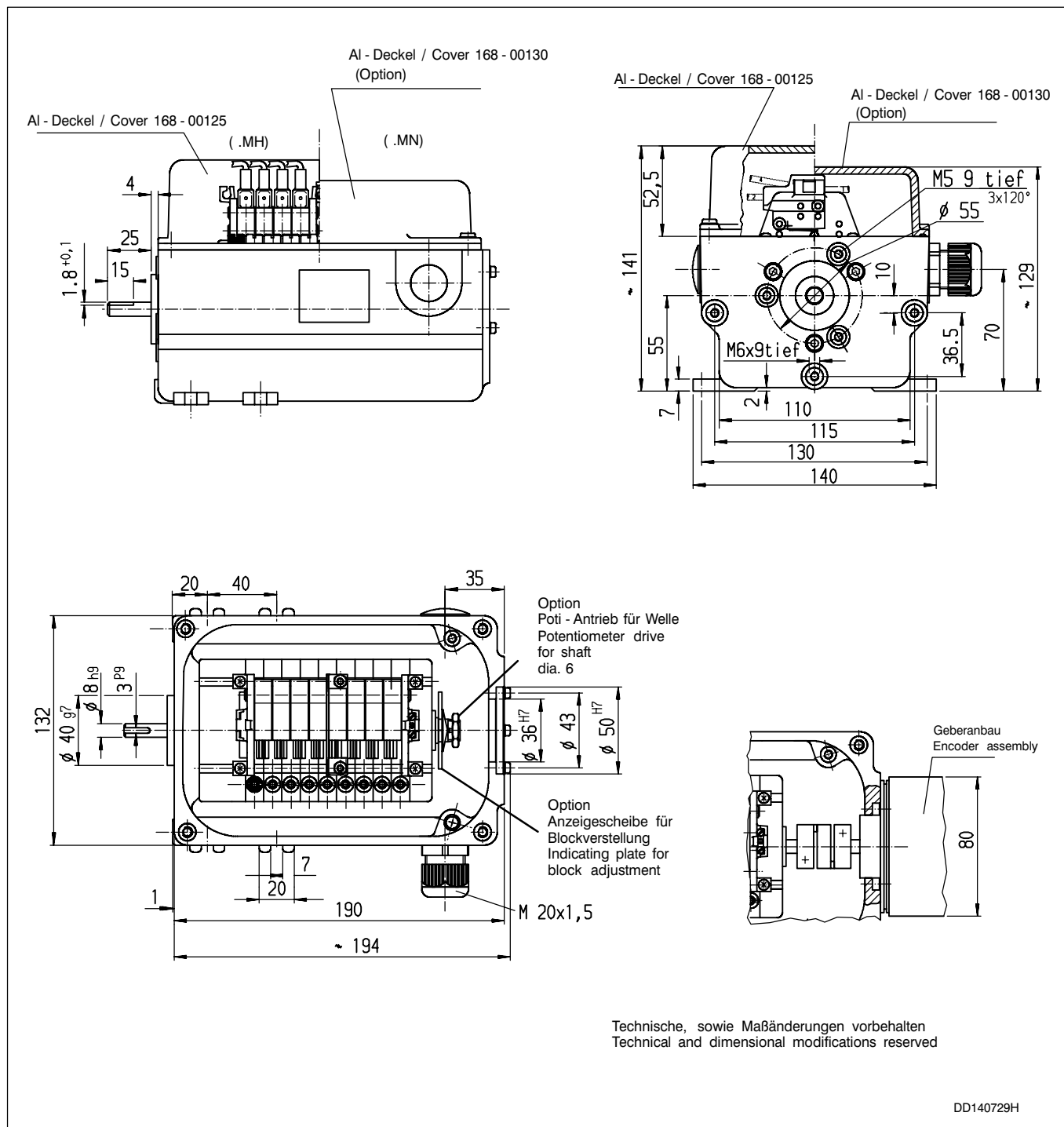
Type B5

An aluminium flange is additionally screwed to the front of the housing.



Nutzb. Umdrehung/Usable rev.		Anzahl Kontakte/No. of contacts		Größe/Size	Maß/Dim. L1	Maß/Dim. L2
51 4,1 NM 6,5 NM 11 NM	51 DZ 67 DZM 110 DZM 180 DZM	2		1A	62,5	32,5
		4		1B	83,5	53,5
		6		1C	104,5	74,5
		8		1D	125,5	95,5
17,5 BM 29 BM 48 BM	280 DZM 470 DZM 770 DZM	2		2A	73,0	43,0
		4		2B	94,0	64,0
		6		2C	115,0	85,0
		8		2D	136,0	106,0
75 BM 125 BM 205 BM	1200 DZM 2000 DZM 3300 DZM	2		3A	81,5	51,5
		4		3B	102,5	72,5
		6		3C	123,5	93,5
		8		3D	144,5	114,5
323 BM 540 BM 880 BM	5200 DZM 8700 DZM 14200 DZM	2		4A	90,0	60,0
		4		4B	111,0	81,0
		6		4C	132,0	102,0
		8		4D	153,0	123,0
1384 BM 2288 BM 3735 BM		2		5A	98,5	68,5
		4		5B	119,5	89,5
		6		5C	140,5	110,5
		8		5D	161,5	131,5
5900 BM 9800 BM 16000 BM		2		6A	107	77
		4		6B	128	98
		6		6C	149	119
		8		6D	170	140

Bauform / Construction B3



**1.13 Schalter im Aluminium - Gehäuse IP65
 (Bauform B3, B3/5)**

Merkmale:

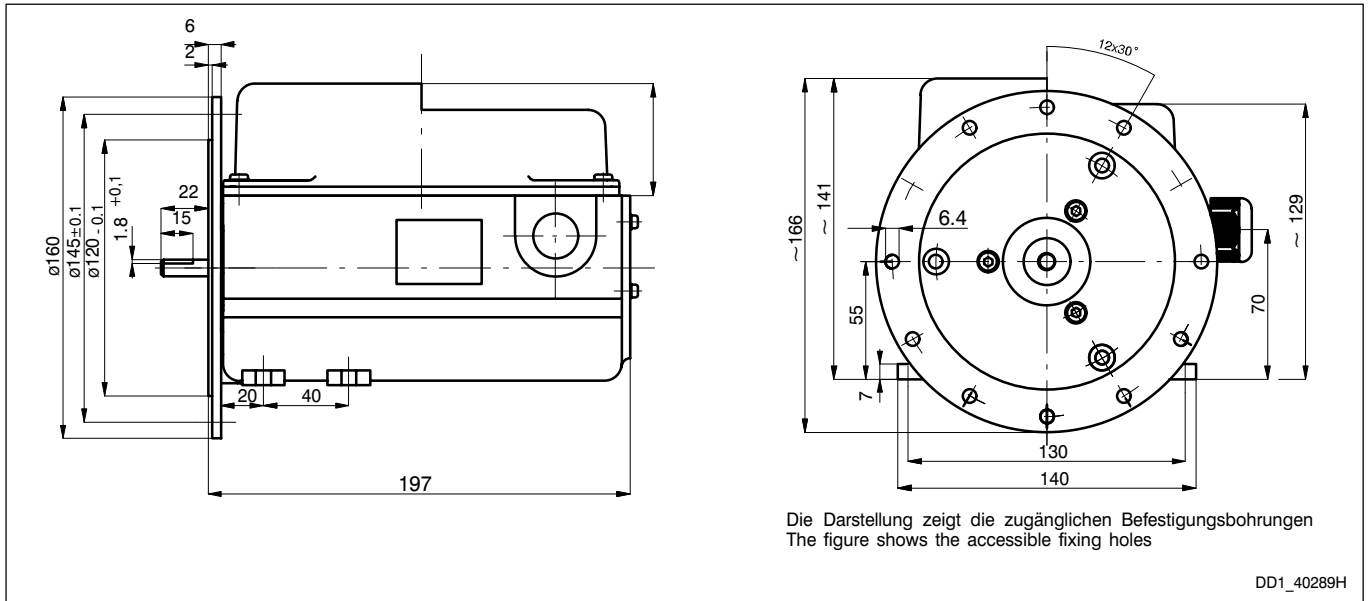
Getriebschalter eingebaut im Aluminium - Gehäuse für den Einsatz in rauher Umgebung.

**1.13 Switches in aluminium housing IP65
 (Type B3, B3/5)**

Features:

Geared switch installed in aluminium housing for use in harsh environments.

Bauform / Construction B3/B5



Mögliche Baugrößen in Al - Gehäuse IP65 / Possible sizes in aluminium housing IP65

						Zusatz / Accessory: Anzeigscheibe für Blockverstellung (nicht möglich bei Reihe 51 DZ) Indicating plate for block adj. (not possible for series 51 DZ)		
nutzbare Umdrehung / usable rev.		2 Kont. 2 Cont.	4 Kont. 4 Cont.	6 Kont. 6 Cont.	8 Kont. 8 Cont.	2 Kont. 2 Cont.	4 Kont. 4 Cont.	6 Kont. 6 Cont.
51	51 DZ							
4,1 NMN/NMH 6,5 NMN/NMH 11 NMN/NMH	67 DZMN/DZMH 110 DZMN/DZMH 180 DZMN/DZMH	1A	1B	1C	1D			
17,5 BMN/BMH 29 BMN/BMH 48 BMN/BMH	280 DZMN/DZMH 470 DZMN/DZMH 770 DZMN/DZMH	2A	2B	2C	2D	2A	2B	2C
75 BMN/BMH 125 BMN/BMH 205 BMN/BMH	1200 DZMN/DZMH 2000 DZMN/DZMH 3300 DZMN/DZMH	3A	3B	3C	3D	3A	3B	3C
323 BMN/BMH 540 BMN/BMH 880 BMN/BMH	5200 DZMN/DZMH 8700 DZMN/DZMH 14200 DZMN/DZMH	4A	4B	4C		4A	4B	4C
1384 BMN/BMH 2288 BMN/BMH 3735 BMN/BMH		5A	5B	5C		5A	5B	
5900 BMN/BMH 9800 BMN/BMH 16000 BMN/BMH		6A	6B			6A		

Beispiele für Typbezeichnung bei Endschalter Reihe 51 im Al - Gehäuse IP65

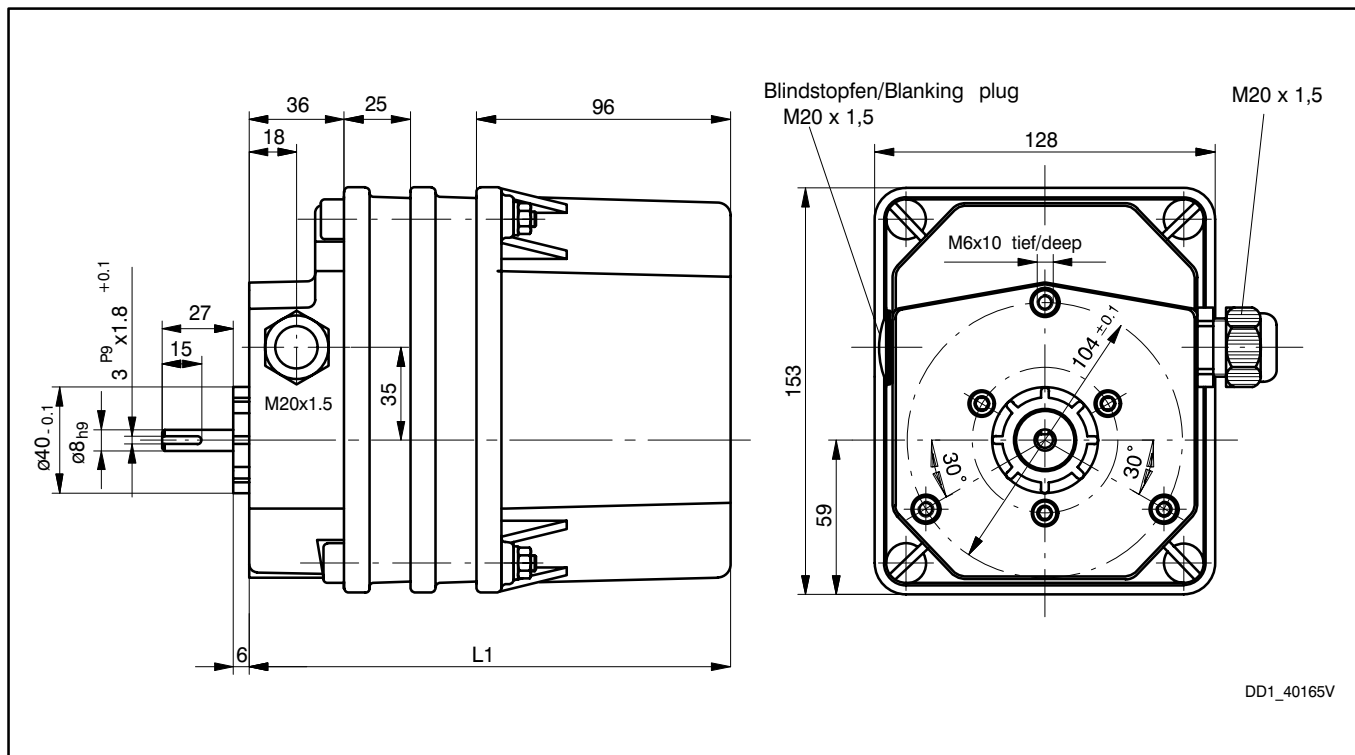
- z. B. 48 BMH...= 48 nutzbare Umdrehungen (48BM_) im 141 mm hohen Al - Gehäuse IP65 (_H_)
- 11 NMN...= 11 nutzbare Umdrehungen ohne Blockverstellung (11NM_) im 129 mm hohen Al - Gehäuse IP65 (_N_)
- (Kein Kontaktanschluß mit Flachstecker möglich)

Examples of type designation for 51 series limit switches in aluminium housing IP 65

- e. g. 48 BMH...= 48 usable revolutions (48BM_) in 141mm high aluminium housing IP65 (_H_)
- 11 NMN...= 11 usable revolutions without block adjustment (11NM_) in 129mm high aluminium housing IP65 (_N_)
- (Contact connection with flat plug not possible)

1.14 Kunststoff - Modul - Gehäuse IP66
Bauform B14

1.14 Plastic module housing IP66
Construction B14



Merkmale:
Gehäuse aus GF -verstärktem Polycarbonat in Schutzart IP66.
Modultechnik ermöglicht bestmögliche Raumausnutzung auch bei Sonderausführungen.
Gesamtlänge durch den Einbau von 25 mm breiten Zwischenstücken nahezu beliebig verlängerbar.

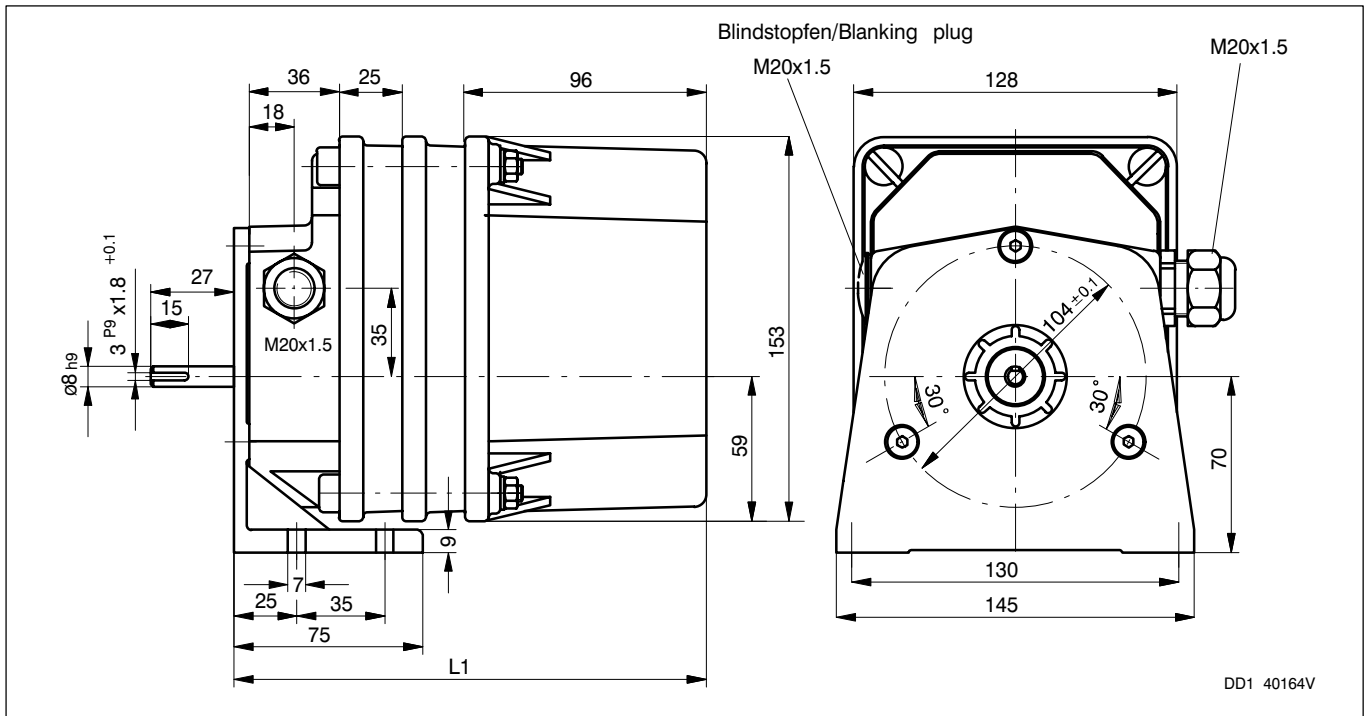
Features:
Housing made of glass fibre reinforced polycarbonate with the degree of protection IP66.
Modular design enables optimal space utilisation also for special types.
Overall length can be extended as required with 25mm wide intermediate pieces.

51	51 DZ	Getriebe- größe Gear size	2 Kontakte/Contacts A		4 Kontakte/Contacts B		6 Kontakte/Contacts C		8 Kontakte/Contacts D	
			L1 / mm	Anz. Zwst.	L1 / mm	Anz. Zwst.	L1 / mm	Anz. Zwst.	L1 / mm	Anz. Zwst.
4,1NM 6,5NM 11NM	67DZM 110DZM 180DZM	1	132	0	132	0	132	0	157	1
17,5BM 29BM 48BM	280DZM 470DZM 770DZM	2	132	0	132	0	157	1	182	2
75BM 125BM 205BM	1200DZM 2000DZM 3300DZM	3	132	0	132	0	157	1	182	2
323BM 540BM 880BM	5200DZM 8700DZM 14200DZM	4	132	0	157	1	182	2	182	2
1384BM 2288BM 3735BM		5	132	0	157	1	182	2	207	3
5900BM 9800BM 16000BM		6	157	1	157	1	182	2	207	3

Mehr als 8 Kontakte auf Anfrage möglich / More than 8 contacts on request
Abmessungen bei mehr als 8 Kontakten und bei Sonderausführungen, z. B. Poti, auf Anfrage
Dimensions with more than 8 contacts and with special executions, e.g. potentiometer, on request
Für jedes weitere Zwischenstück sind zu L1 25 mm zu addieren / For any further intermediate piece add 25 mm to L1

1.15 Kunststoff - Modul - Gehäuse IP66
Bauform B3

1.15 Plastic module housing IP66
Construction B3



Merkmale:

Gehäuse aus GF-verstärktem Polycarbonat in Schutzart IP66.

Modultechnik ermöglicht bestmögliche Raumausnutzung auch bei Sonderausführungen.

Gesamtlänge durch den Einbau von 25 mm breiten Zwischenstücken nahezu beliebig verlängerbar.

Features:

Housing made of glass fibre reinforced polycarbonate with the degree of protection IP66.

Modular design enables optimal space utilisation also for special types.

Overall length can be extended as required with 25mm wide intermediate pieces.

51	51 DZ	Getriebe- größe Gear size	2 Kontakte/Contacts A		4 Kontakte/Contacts B		6 Kontakte/Contacts C		8 Kontakte/Contacts D	
			L1 / mm	Anz. Zwst.	L1 / mm	Anz. Zwst.	L1 / mm	Anz. Zwst.	L1 / mm	Anz. Zwst.
4,1NM 6,5NM 11NM	67DZM 110DZM 180DZM	1	138	0	138	0	138	0	163	1
17,5BM 29BM 48BM	280DZM 470DZM 770DZM	2	138	0	138	0	163	1	188	2
75BM 125BM 205BM	1200DZM 2000DZM 3300DZM	3	138	0	138	0	163	1	188	2
323BM 540BM 880BM	5200DZM 8700DZM 14200DZM	4	138	0	163	1	188	2	188	2
1384BM 2288BM 3735BM		5	138	0	163	1	188	2	213	3
5900BM 9800BM 16000BM		6	163	1	163	1	188	2	213	3

Mehr als 8 Kontakte auf Anfrage möglich / More than 8 contacts on request

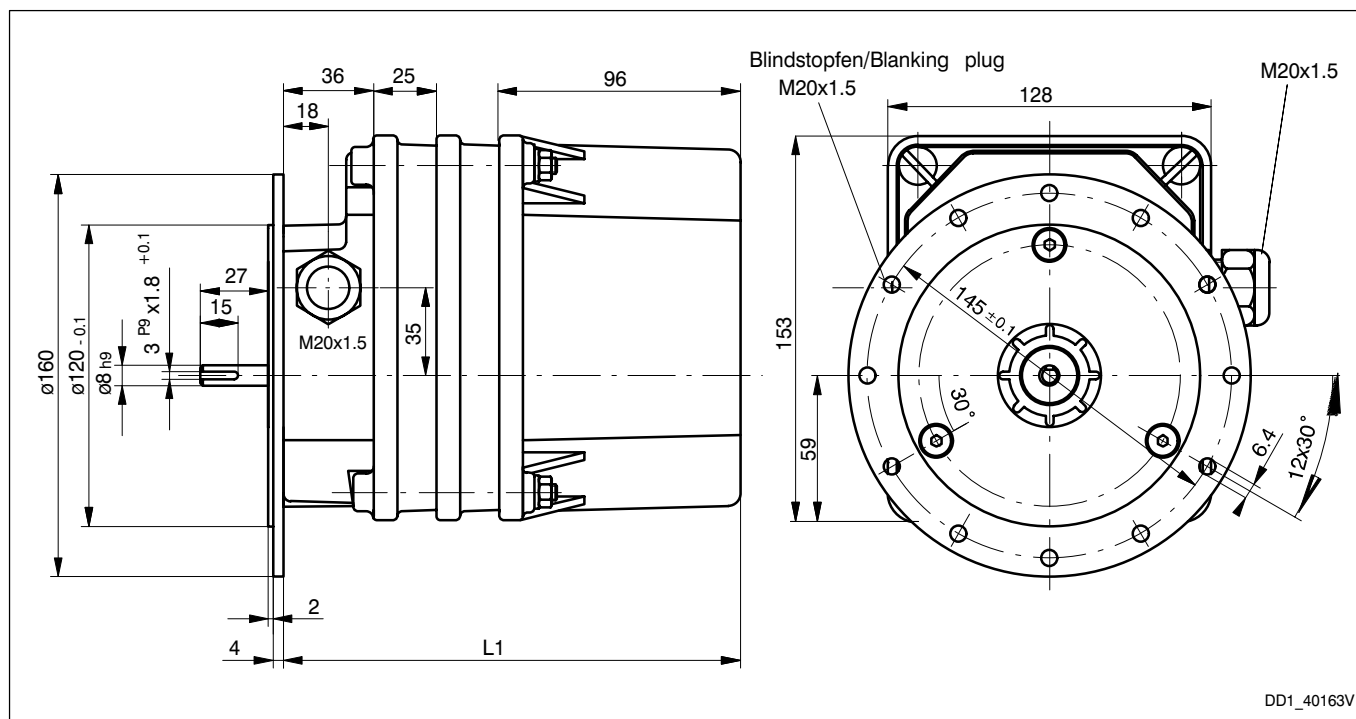
Abmessungen bei mehr als 8 Kontakten und bei Sonderausführungen, z. B. Poti, auf Anfrage

Dimensions with more than 8 contacts and with special executions, e.g. potentiometer, on request

Für jedes weitere Zwischenstück sind zu L1 25 mm zu addieren / For any further intermediate piece add 25 mm to L1

1.16 Modul - Gehäuse IP66
Bauform B5

1.16 Module housing IP66
Construction B5



Merkmale:

Gehäuse aus GF -verstärktem Polycarbonat in Schutzart IP66.

Modultechnik ermöglicht bestmögliche Raumausnutzung auch bei Sonderausführungen.

Gesamtlänge durch den Einbau von 25 mm breiten Zwischenstücken nahezu beliebig verlängerbar.

Features:

Housing made of glass fibre reinforced polycarbonate with the degree of protection IP66.

Modular design enables optimal space utilisation also for special types.

Overall length can be extended as required with 25mm wide intermediate pieces.

51	51 DZ	Getriebe- größe Gear size	2 Kontakte/Contacts A		4 Kontakte/Contacts B		6 Kontakte/Contacts C		8 Kontakte/Contacts D	
			L1 / mm	Anz. Zwst.	L1 / mm	Anz. Zwst.	L1 / mm	Anz. Zwst.	L1 / mm	Anz. Zwst.
4,1NM 6,5NM 11NM	67DZM 110DZM 180DZM	1	132	0	132	0	132	0	157	1
17,5BM 29BM 48BM	280DZM 470DZM 770DZM	2	132	0	132	0	157	1	182	2
75BM 125BM 205BM	1200DZM 2000DZM 3300DZM	3	132	0	132	0	157	1	182	2
323BM 540BM 880BM	5200DZM 8700DZM 14200DZM	4	132	0	157	1	182	2	182	2
1384BM 2288BM 3735BM		5	132	0	157	1	182	2	207	3
5900BM 9800BM 16000BM		6	157	1	157	1	182	2	207	3

Mehr als 8 Kontakte auf Anfrage möglich / More than 8 contacts on request

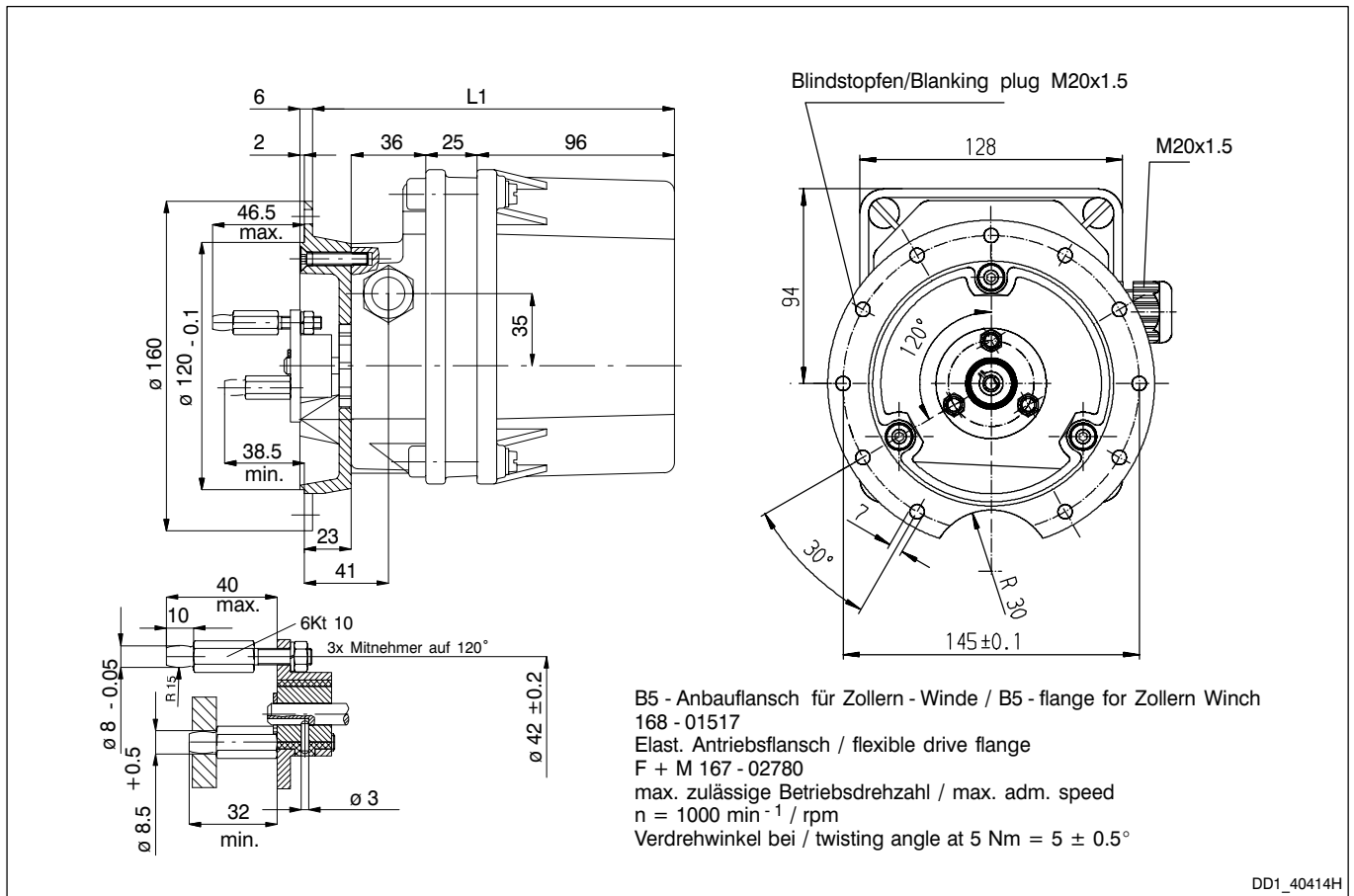
Abmessungen bei mehr als 8 Kontakten und bei Sonderausführungen, z. B. Poti, auf Anfrage

Dimensions with more than 8 contacts and with special executions, e.g. potentiometer, on request

Für jedes weitere Zwischenstück sind zu L1 25 mm zu addieren / For any further intermediate piece add 25 mm to L1

1.17 Modul - Gehäuse IP66
Bauform B5 "Zollern - Winde"

1.17 Module housing IP66
Construction B5 "Zollern winch"



Merkmale:
Gehäuse aus GF-verstärktem Polycarbonat in Schutzart IP66.
Modultechnik ermöglicht bestmögliche Raumausnutzung auch bei Sonderausführungen.
Gesamtlänge durch den Einbau von 25 mm breiten Zwischenstücken nahezu beliebig verlängerbar.

Features:
Housing made of glass fibre reinforced polycarbonate with the degree of protection IP66.
Modular design enables optimal space utilisation also for special types.
Overall length can be extended as required with 25mm wide intermediate pieces.

51	51DZ	Getriebe- größe Gear size	2 Kontakte/Contacts A		4 Kontakte/Contacts B		6 Kontakte/Contacts C		8 Kontakte/Contacts D	
			L1 / mm	Anz. Zwst.	L1 / mm	Anz. Zwst.	L1 / mm	Anz. Zwst.	L1 / mm	Anz. Zwst.
4,1NM 6,5NM 11NM	67DZM 110DZM 180DZM	1	151	0	151	0	151	0	176	1
17,5BM 29BM 48BM	280DZM 470DZM 770DZM	2	151	0	151	0	176	1	201	2
75BM 125BM 205BM	1200DZM 2000DZM 3300DZM	3	151	0	151	0	176	1	201	2
323BM 540BM 880BM	5200DZM 8700DZM 14200DZM	4	151	0	176	1	201	2	201	2
1384BM 2288BM 3735BM		5	151	0	176	1	201	2	226	3
5900BM 9800BM 16000BM		6	151	1	176	1	201	2	226	3

2 Sonderausführungen

2.1 Durchgeführte Antriebswelle

Bedingt durch die Konstruktion der Getriebe - Nocken - Endschalter der Reihen 51 und 51 DZ wird die Antriebswelle durch den Schalter geführt. Sie schließt normalerweise mit dem Modulhinterteil ab.

Gegen Mehrpreis wird auf Wunsch die Antriebswelle verlängert (Sonderwelle).

Synchron zur Antriebswelle können damit Inkremental- und Absolut - Encoder zur digitalen Stellungsrückmeldung angetrieben werden. Auch Tachogeneratoren werden direkt von der Antriebswelle angetrieben.

Je nach Gewicht des anzubauenden Gebers sind unterschiedliche Anbaukonstruktionen möglich.

Hohlwellengeber werden direkt auf die Welle aufgesteckt und das Gehäuse über eine Drehmomentstütze gehalten.

Geber mit Zapfenwelle bis zu einem Gewicht von ca. 250 g und bei Einsatzfällen ohne Vibrationen und Schläge werden über ein leichtes Halblech angebaut.

Geber mit Zapfenwelle ab einem Gewicht von ca. 250 g oder für den Einsatz unter erschwerten Bedingungen werden über einen Adapterflansch mit einer zusätzlichen Verstärkung angebaut.

Für die konstruktive Überprüfung der Einbausituation benötigen wir **verbindliche Maß - und Gewichtsangaben** der Anbauteile.

Zusätzlich eingebaute Teile vergrößern unter Umständen die Baulänge der Getriebe - Schalter.

2 Special executions

2.1 Inserted drive shaft

On account of the design of 51 and 51 DZ series geared cam limit switches, the drive shaft is inserted through the switch and normally terminates flush with the rear part of the module.

The drive shaft can be extended at an additional charge (special shaft) on request.

As a result, incremental and absolute encoders can be driven synchronous with the drive shaft for digital position feedback. Also tachogenerators can be directly driven by the drive shaft.

In relation to the weight of the encoder to be fitted, various mounting executions are possible.

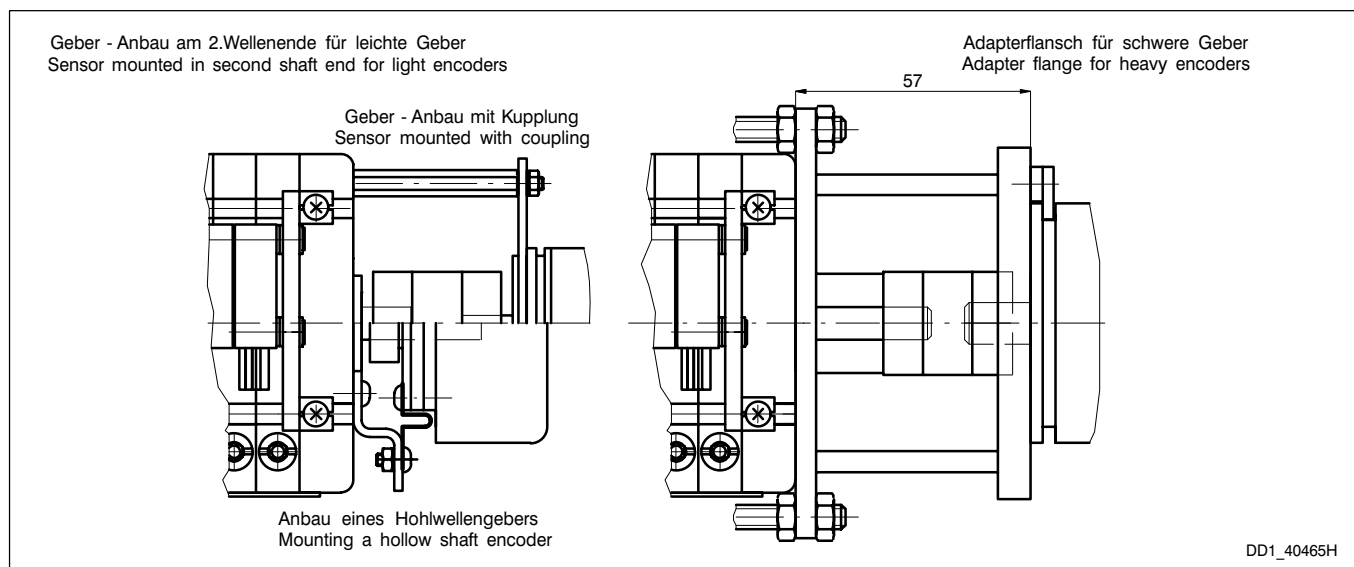
Hollow shaft encoders are directly slipped on the shaft and the housing is held by a torque support.

Encoders with power take - off shaft up to a weight of approx. 250 g and for vibration - free and shock - free applications are mounted through a light holding sheet.

Encoders with power take - off shaft having a weight of more than approx. 250 g or being intended for application under heavy conditions, are mounted via an adapter flange with additional reinforcement

For constructional examination of the mounting situation, we require **binding data on the dimensions and weights** of the mounting components.

Additional mounted parts may increase the overall length of the gearing.



2.2 Potentiometerantrieb (nur bei Reihe 51 möglich)

Für den Antrieb von Drehwiderständen zur analogen Stellungsrückmeldung stehen 2 Ausführungen zur Verfügung. Sie sind konstruktiv gleich ausgeführt und für die Aufnahme von Potentiometerwellen mit einem Durchmesser von 6 mm sowie für ein max. Drehmoment von 10 Ncm vorgesehen.

a) Potikupplung "N"

Die Kupplung dreht synchron mit den Nockenscheiben. Der nutzbare Drehwinkel für die Potentiometer ist max. 345°.

2.2 Potentiometer drive (only possible for series 51)

Available are two types for driving potentiometers for analogue position feedback. They are identical in design and are able to accept two potentiometer shafts with a diameter of 6 mm and a max. torque of 10 Ncm.

a) Potentiometer coupling "N"

This coupling turns synchronous with the cam disc. The usable angle of rotation for the potentiometer is maximum 345°.

Beim Einsatz einer zusätzlichen Nockenscheibengruppe (verlängert den Schalter um 10,5 mm) kann die Einstellung des Potentiometers mit der letzten Verstellschnecke ohne das Lösen von Schrauben und Muttern erfolgen. Die Poti - Einstellung mit zusätzlicher Nockenscheibengruppe kann nur in Ausführung "N" erfolgen.

When fitting an additional cam disc assy (extends the switch by 10.5 mm), the potentiometer can be adjusted by the last adjusting worm without having to lose the screws and nuts. The potentiometer adjustment with additional cam disc assy is possible with execution "N" only.

b) Potikupplung "S"

Die Kupplung dreht synchron mit der Eingangsdrehzahl der Nockenscheibengruppe. Der nutzbare Drehwinkel für die Potentiometer ist max. 1470° (345°x4,285). Für diese Drehwinkel werden üblicherweise Mehrfach - Wendel - Potentiometer eingesetzt.

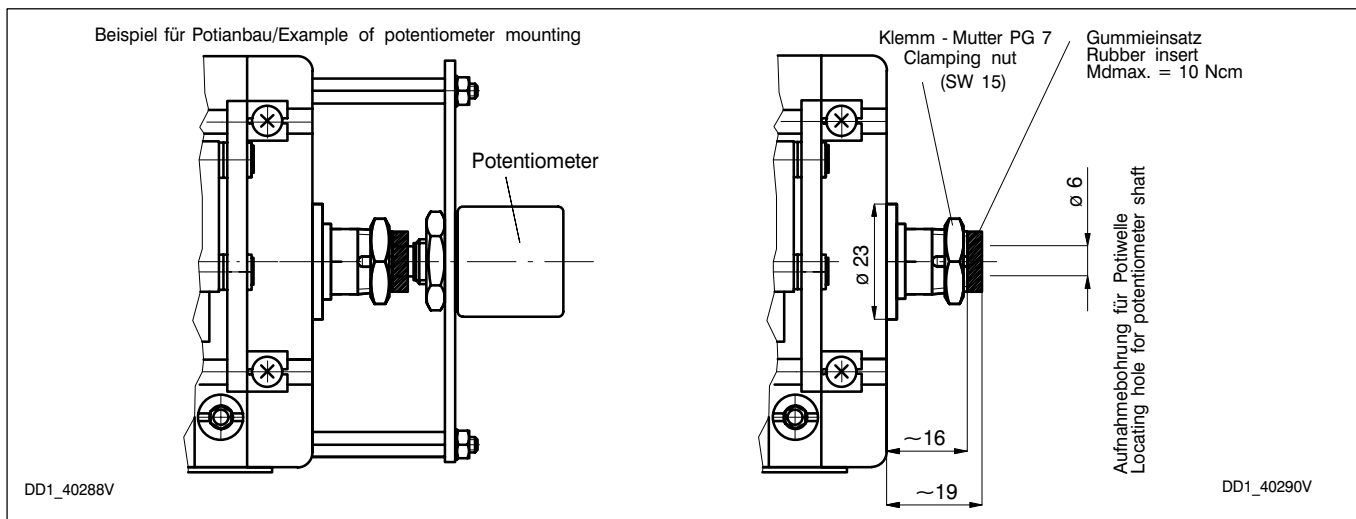
b) Potentiometer coupling "S"

This coupling turns synchronous with the input speed of the cam disc group. The usable angle of rotation for the potentiometer is maximum 1470° (345°x4.285). For this angle of rotation, multi - turn potentiometers are normally used.

Zusätzlich eingebaute Potentiometer vergrößern unter Umständen die Baulänge der Getriebe - Schalter. Für die Angabe der genauen Baulänge bitten wir um Rückfrage, evtl. unter Angabe der Potentiometermaße.

Additionally installed potentiometers may increase the overall length of the geared switch.

For the exact overall length please consult us stating the potentiometer dimensions.

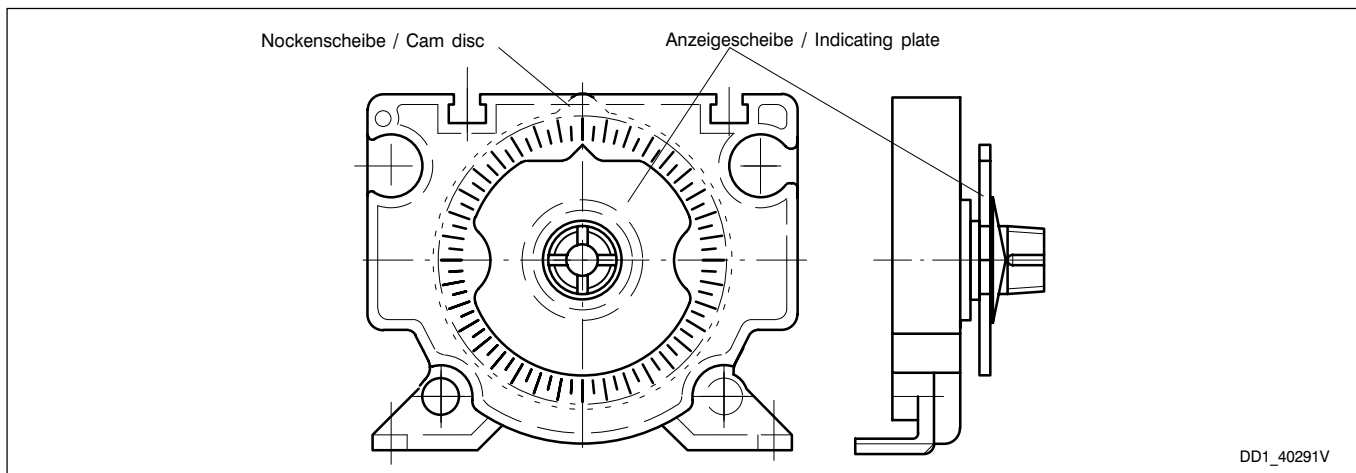


2.3 Anzeigescheibe (nur bei Reihe 51 möglich)

Die Anzeigescheibe zur Blockverstellung (auf Wunsch gegen Mehrpreis lieferbar) dient dazu, die Verstellung der Schalter mittels Blockverstellung zu erleichtern. Die durch Reibschluß gehaltene Anzeigescheibe wird auf eine Referenzmarke eingestellt und erleichtert dadurch den späteren Abgleich auf diese Referenzmarke mittels der Blockverstellschnecke wesentlich. Unter Umständen wird durch die Anzeigescheibe ein zusätzliches Gehäuse - Zwischenstück nötig.

2.3 Indicating plate (only possible for series 51)

The indicating plate for block adjustment (available at an additional charge on request) serves to facilitate adjustment of the switch by means of block adjustment. The friction locked indicating plate is set at a reference mark which thus considerably facilitates subsequent adjustment to this reference mark by means of the block adjusting worm. The use of the indicating plate may make an additional housing intermediate piece necessary.



2.4 Stillstandsheizung

Der Innenraum der Getriebebeschalter ist ein elektrischer Betriebsraum genau wie ein Schaltschrank. Es sollten bei extrem niedrigen Außentemperaturen oder bei extrem wechselnden Temperaturen bei einer feuchten Umgebungsatmosphäre Vorkehrungen gegen Kondenswasser im Schalter getroffen werden.

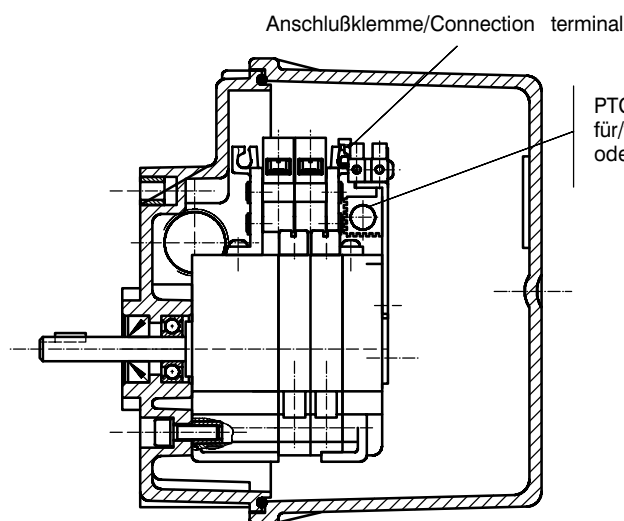
Die speziell für die Getriebe - Endschalter entwickelten geregelten Stillstandsheizungen verhindern wirkungsvoll Kondenswasser und zu niedrige Temperaturen im Schalter. Es gibt sie in 2 Ausführungen, die sich nur in der zulässigen Anschlußspannung unterscheiden. Der Einbau der Stillstandsheizung verlängert nicht die Einbaulänge der Schalter. Sie sind in jede Schalterausführung einbaubar. Sie können auch nachgerüstet werden.

2.4 Anti - condensation heater

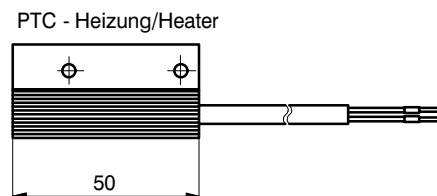
The interior space of the geared switch is an electrical operating area just like a switchgear cabinet. Precautions should be taken to prevent condensation from forming inside the switch at extremely low outside temperatures or extreme changes of temperature in a damp atmosphere.

These controlled, anti - condensation heaters, which have been specially developed for use with our geared limit switches, effectively prevent condensation and excessively low temperatures in the switches. They are available in two versions and differ only by the permissible supply voltage. The anti - condensation heater, which can be installed in any switch version, will not increase the overall length of the switches and can also be retrofitted.

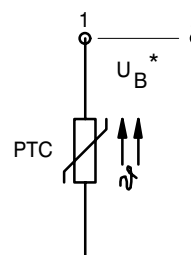
Beispiel für den Einbau einer PTC - Heizung in ein IP66 Gehäuse
Example of installation of a PTC heater in an IP66 housing



PTC - Heizungsgruppe/PTC heater assembly
für/for 12 - 36V AC/DC, P ca./approx. 2.5 Watt
oder/or 110 - 250V AC/DC, P ca./approx. 4 Watt



Ersatzschaltbild
Equivalent wiring diagram



Ausführung/Execution: U_B 12 - 36V AC/DC
Heizleistung/Heating cap.: ca. 2.5 Watt
(im ausgeregelten Zustand/in levelled condition)

Kaltwiderstand PTC (bei 25°C)
Cold resistance PTC: R_{25} 20 \pm 35%
PTC - Bezugstemperatur:
PTC ref. temperature: 50°C

Schutzklasse
Protection (VDE 0100, 0160): II

Anschlußleitung:
Connection cable: 2x0.25mm², Silikonkabel
Heizkörper/Radiator:
Aluminium eloxiert/eloxed
Gewicht / Weight: ca. 40 g

110 - 250V AC/DC
ca. 4 Watt

R_{25} 1500 \pm 35%
50°C

II

2x0.25mm², Silikonkabel
2x0.25mm², Silicone cable
Aluminium eloxiert/eloxed
ca 40 g

*Anschlußspannung je nach verwendeter Variante 12 - 36V AC/DC bzw. 110 - 250V AC/DC
Connection voltage in relation to the variant used 12 - 36V AC/DC or 110 - 250V AC/DC

DD1_ 40298V

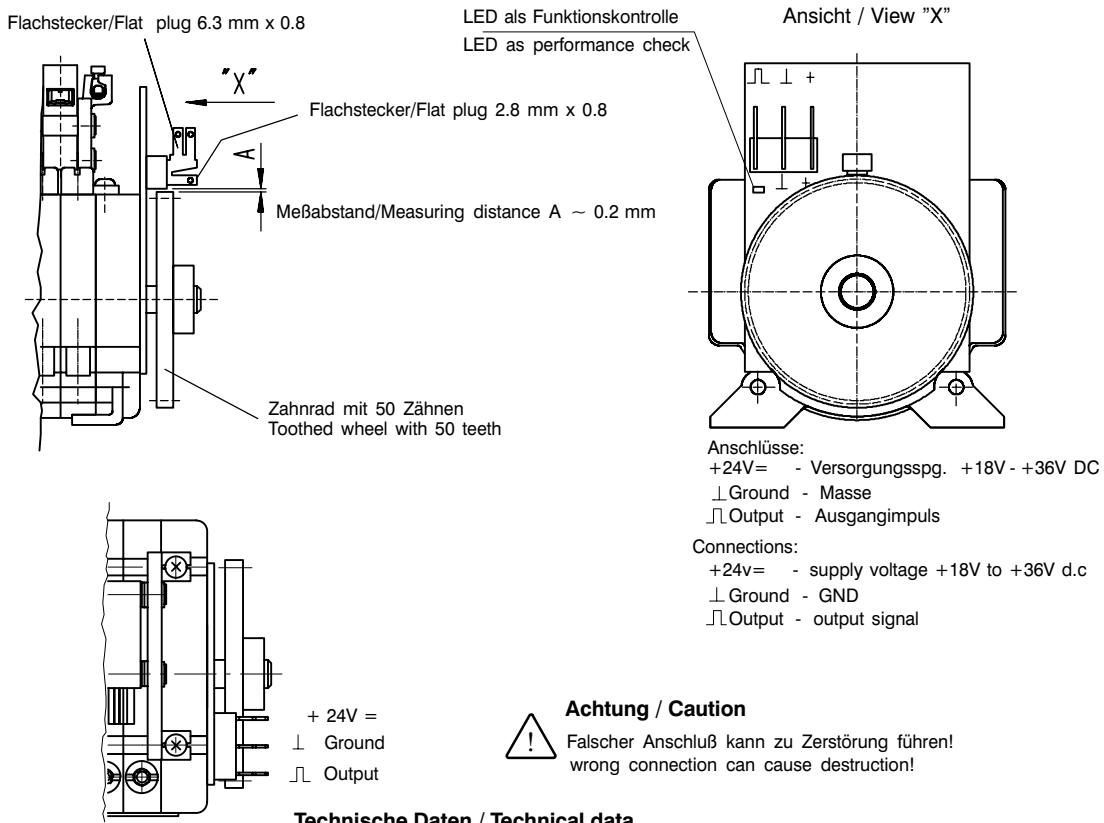
2.5 Impulsgeber I 49

Speziell für den Einsatz in Mobilkränen wurde ein Impulsgeber mit besonderen technischen Eigenschaften entwickelt. Es wird magnetisch ein Zahnrad mit 50 Zähnen abgetastet (50 Impulse/Umdrehung). Die Elektronik ist für den Betrieb in einem Fahrzeug - Bordnetz vorgesehen und ist besonders geschützt gegen die in diesen Netzen auftretenden Überspannungen. Der Versorgungsspannungs - Anschluß ist verpolungssicher. Der einkanalige Impulsgeberausgang kann induktive Lasten bis zu einem Strom von ca. mittl. 110 mA treiben und er ist kurzschlußfest. Um eine zu starke Erwärmung der anzuschließenden Hubmagnetspulen bei einem Dauersignal zu verhindern, schaltet der Ausgangsverstärker jeden Impuls nach ca. 20 ms aus (Monoflop - Funktion). Mit diesem Impulsgeber wird eine Drehung des Endschalters angezeigt und es kann die Geschwindigkeit erkannt werden. Eine Erkennung der Rechts - und Linksdrehrichtung ist nicht möglich.

2.5 Pulse transmitter I 49

This pulse transmitter has been specially developed for use in mobile cranes and has special technical features. A toothed wheel with 50 teeth is magnetically scanned (50 pulse/revolution). The electronic circuitry is designed for operation in a motor vehicle supply system and is specially protected against the overvoltages occurring on these systems. The supply voltage connection is protected against polarity reversal. The single channel pulse transmitter output can drive inductive loads up to a current of on average approx. 110 mA and is short - circuit proof. To prevent excessive heating of the solenoid coils to be connected, with a continuous signal, the output amplifier disconnects each pulse after about 20 ms (monoflop function). With this pulse transmitter, rotation of the limit switch is indicated and the speed can be identified. It is not possible to distinguish between clockwise and counter - clockwise rotation.

Impulsgeber mit 50 Impulsen/Umdrehung für Endschalter der Reihe 51 zur Montage an der B - Seite des Schalters
Pulse generator with 50 pulses/rev. fitted to the B - side of the limit switch



Anschlüsse:
+ 24V = - Versorgungsspg. +18V - +36V DC
⊥ Ground - Masse
⌋ Output - Ausgangsimpuls

Connections:
+ 24v = - supply voltage +18V to +36V d.c
⊥ Ground - GND
⌋ Output - output signal

Technische Daten / Technical data

Betriebsspannung/Service voltage	24V DC (18 - 36V DC)
Stromaufnahme/Power consumption	ca./approx. 180 mA
Ausgang/Output	mittl./on average 110 mA
Impulsdauer/Pulse duration	ca./approx. 20 ms (Monoflop-funktion/monoflop function)
Temperaturbereich/T emperature range	- 40°C bis/to +85°C

- Kurzschlußfester Ausgang / Output short circuit proof
- Versorgungsspannung verpolungssicher / Supply voltage protected against exchange of poles
- Funktionskontrolle mittel gelber Leuchte / Performance check by yellow LED
- 50 Impulse/Umdrehung; Pulses/rev.
- keine Abgleich - und Einstellarbeiten / no aligning and adjusting works
- Anschluß über Flachstecker / Connection through flat plug 6.3 mm x 0.8

DD1 40565H

2.6 Motorische Blockverstellung (nur bei Reihe 51)

Durch die Möglichkeit, alle Kontakte mit einer einzigen Verstellschnecke zu verstellen, bietet sich die Möglichkeit, diese Verstellung mittels eines kleinen Getriebe - Motors zu automatisieren. Einer der eingebauten Schaltkontakte wird dabei zur Abschaltung des Verstellmotors verwendet. Damit lassen sich nach einer Verstellung des Antriebssystems und einer anschließenden Referenzfahrt alle Kontakte wieder in eine vorbestimmte Position zu diesem Motorabschaltkontakt bringen. Eingesetzt werden kann dieses System z. B. nach einem Seilwechsel bei Kranen und Schrapfern. Nach dem Seilwechsel wird das Lastaufnahmemittel per Hand in eine vorgegebene Position gefahren. Durch Knopfdruck wird der Verstellvorgang gestartet. Sobald die Nockenscheibe den Motorabschaltkontakt (Selbsthaltung der Verstellung) betätigt, wird der Verstellvorgang gestoppt. Alle Abschaltpunkte der Maschine stehen jetzt wieder in dem vorherigen Verhältnis zum Referenzpunkt. Auch mit der Potikupplung "N" angebaute Potentiometer werden mitverstellt, siehe dazu Einbaubild und Schaltungsvorschlag.

Dieses System kann auch in verstellbaren Punktzügen von bühnentechnischen Einrichtungen eingesetzt werden. Dabei ist zu beachten, daß durch die Verstellung der Nockenscheiben die Antriebswelle, und damit evtl. dort angebaute Encoder, nicht mit verstellt werden.

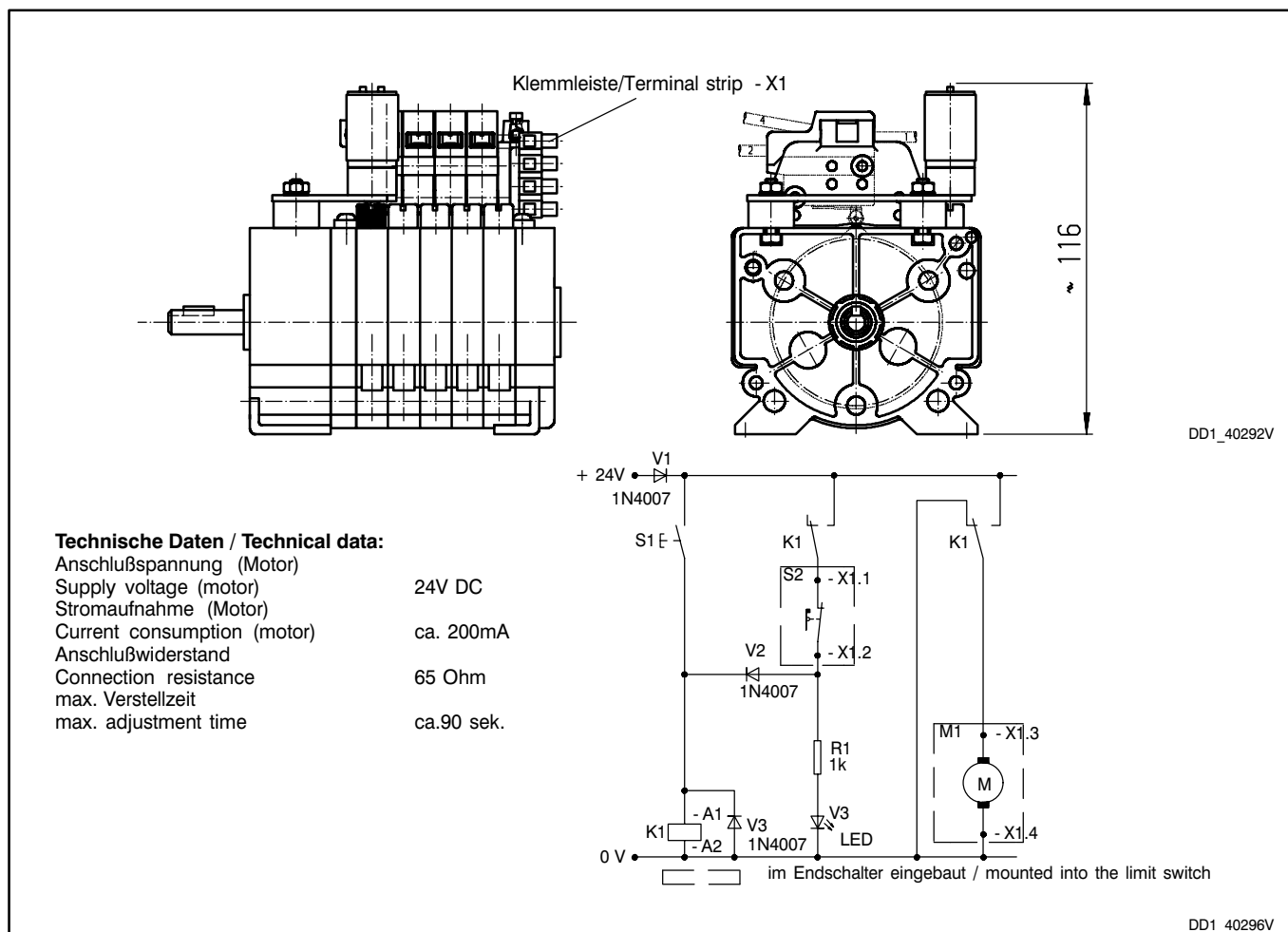
Dieser ist gesondert nachzuzustieren.

2.6 Motor - driven block adjustment (only for series 51)

The possibility to adjust all contacts with a single adjusting worm offers the option of automating this adjustment by means of a small geared motor. One of the switching contacts provided is used for disconnection of the adjusting motor. After adjustment of the drive system and subsequent reference operation, all contacts can be reset to a predetermined position with respect to this motor disconnecting contact. This system can be used, e.g. after a rope change for cranes and scrapers. After the rope change, the lifting appliance is moved into a predetermined position manually. Adjustment can be initiated by pressing a button. Adjustment is stopped as soon as the cam disc actuates the cam disc of the motor disconnecting contact (self - holding of adjustment). All disconnecting points of the machine are now placed in their previous relation to the reference point. Potentiometers with the potentiometer coupling "N" are also adjusted, see installation diagram and circuit suggestion.

This system is also suitable for use in adjustable stage machinery, whereby it is important to ensure that the drive shaft and in turn a possibly installed encoder is not affected through adjustment of the cam discs.

The encoder has to be re - adjusted separately.



3 Getriebe - Nocken - Endschalter Reihe 51
Ausführung für erhöhte Anforderungen nach BGV C1
(VBG 70) (Bühnentechnik)

3.1 Allgemeines

Die gesamte moderne Bühnentechnik, mit den für diesen Bereich speziell entwickelten Hebezeugen, ist ein typischer Einsatzfall für Getriebe - Nocken - Endschalter. Bei normalen Hebezeugen ist der Aufenthalt unter schwebenden Lasten verboten. Auf den Theaterbühnen müssen sich Schauspieler und weiteres Theaterpersonal immer unter den schwebenden Lasten der Obermaschinen aufhalten. Das ist der Grund für die Unfall - Verhütungsvorschrift BGV C1. Sie legt für verschiedene Komponenten der Hebezeuge zwingend einen Mindeststandard fest und schreibt vor, daß die Anlagen sicherheitstechnisch abgenommen werden müssen. Für diese Abnahmen sind die Technischen Überwachungs - Vereine (TÜV) der einzelnen Bundesländer zuständig. Zur Vereinfachung der Anlagenprüfungen können sicherheitstechnisch relevante Komponenten separaten Typenprüfungen unterzogen werden.

Dieser **Baumuster - Teilprüfung** wurde auch unser **Getriebe - Nocken - Endschalter Reihe 51 / 51 DZ** von dem zuständigen RWTÜV in Essen unterzogen. Die Prüfzertifikate werden jeder Lieferung beigelegt, sie können aber auch separat als PDF - Datei angefordert werden.

Reihe 51: TÜ - 04 - 94 - 250

Reihe 51 DZ: TÜ - 04 - 99 - 348

Die Katalogausführung der Getriebe - Nocken - Endschalter hat sich auch für diese sicherheitstechnisch sehr anspruchsvolle Anwendung bewährt, es müssen lediglich die ohne Mehrpreis lieferbaren Nockenscheiben mit einem Nockenwinkel von 40° eingesetzt werden. Dadurch ändern sich die nutzbaren Umdrehungen der Getriebe - Nocken - Endschalter; s. Tabelle 4.

Alle im Kapitel 2 beschriebenen Ausführungen sind auch in der Theatertechnik einsetzbar. Es sollte aber immer das für diesen Einsatzfall benötigte Sicherheitsniveau beachtet werden. Im Zweifelsfall fragen Sie zurück oder lassen Sie die neuen Kombinationen einer Baumuster - Teilprüfung unterziehen. Mehrfach eingesetzt wird die Kombination mit einem Absolut - Encoder, der je nach Anwendungsfall mit im Gehäuse oder an der B - Seite außen am Gehäuse angebaut ist.

Da ein zusätzliches Schild für die Baumuster - Teilprüfung am Schalter angebracht und auch zusätzliche Prüfzertifikate ausgestellt werden müssen, benötigen wir unbedingt in Ihrer Bestellung den Vermerk "mit Baumuster - Teilprüfung nach BGV C1".

3 Geared Cam Limit Switches Series 51
Variant for increased requirements according to BGV C1
(VBG 70) (stage technology)

3.1 General

All modern stage technology using hoisting specially developed for this particular use is a typical application of geared cam limit switches. With standard hoisting gear, standing under suspended loads is forbidden. On theatre stages, actors and other personnel must always stand under the suspended loads of machinery in the flies. This is the reason for the accident prevention regulation BGV C1, which specifies for various components of hoisting gear a binding minimum standard, and requires that these installations are tested for safety. Responsible for these tests is the Technical Inspectorate (TÜV) of the individual federal states. For simplification of these tests, safety - relevant components can be tested in separate type tests.

Our **51 / 51 DZ series geared cam limit switches** have been **type tested** by the responsible RWTÜV in Essen. The test certificates are attached to each consignment; they can also be inquired as PDF - file.

Series 51: TÜ - 04 - 94 - 250

Series 51 DZ: TÜ - 04 - 99 - 348

The catalogue version of the geared cam limit switch is also suitable for this application requiring a high degree of safety; only the cam limit switches available at no additional charge with a cam angle of 40° must be used. This changes the useful revolutions of the geared cam limit switch; see table 4.

All variants described in chapter 2 are also suitable for use in stage technology; the level of safety required for this particular application should always be taken into account. If in doubt, we will be pleased to be of assistance or you can have your new combinations type tested. Widely used is the combination with absolute encoder available in a housing or for fitting on the B - Side outside on the housing, depending on the particular application.

Since an additional shield for the type test is provided at the switch and also additional test certificates have to be issued, the indication "with type test according to BGV C1" must be stated in your order.

3.2 Getriebedaten / Gear data

Tabelle / Table 4 (Reihe/Series 51)

Getriebe größe Gear size	Nenn - Umdrehung 15° - Nock- enscheibe Nominal revolution 15° cam disc	Nutzbare Umdrehungen 40° Nockenscheibe Usable revs. 40° Cam disc	Getriebe i Gear ratio i	Nachlaufumdreh. der Antriebswelle nach jeder Seite Overrun revs. of drive shaft in each direction	Umdrehung der Antriebswelle vom Schaltpunkt bis zur wirk- samen Zwangstrennung Rev. of the drive shaft from switching point up to effec- tive forced separation		Umdrehung der Antriebswelle für wirks. Zwangstrennung im Nachlauf Rev. of the drive shaft from switching point ef- fective forced separa- tion with overrun
					rechtsdreh. clockwise	linksdreh. counter clockwise	
1	4,1	3,8	4,285	0,4	0,038	0,044	0,37
	6,5	6,2	7,083	0,7	0,063	0,073	0,61
	11	10,0	11,56	1,2	0,103	0,118	1,0
2	17,5	16,0	18,361	1,0	0,163	0,188	1,6
	29,0	27,0	30,35	3,2	0,27	0,312	2,6
	48	44,0	49,538	5,3	0,44	0,508	4,2
3	75	70,0	78,678	8,4	0,7	0,808	6,8
	125	115,0	130,054	13,9	1,153	1,335	11,2
	205	185,0	212,272	22,7	1,883	2,18	18,3
4	323	300,0	337,135	36,0	2,99	3,462	29,0
	540	495,0	557,284	59,7	4,94	5,723	48,0
	880	800,0	909,59	97,5	8,07	9,34	78,3
5	1384	1280,0	1444,62	155,0	12,81	14,84	124,4
	2288	2100,0	2387,96	256,0	21,18	24,52	205,6
	3735	3400,0	3897,58	417,0	34,57	40,03	335,6
6	5900	5500,0	6190,204	663,7	55,07	63,57	520,1
	9800	9000,0	10232,407	1097,0	91,04	105,08	856,6
	16000	14500,0	16701,17	1790,7	148,59	171,51	1403,1

Tabelle / Table 4 a (Reihe/Series 51 DZ)

Getriebe größe Gear size	Nenn - Umdrehung 15° - Nock- enscheibe Nominal revolution 15° cam disc	Nutzbare Umdrehungen 40° Nockenscheibe Usable revs. 40° Cam disc	Getriebe i Gear ratio i	Nachlaufumdreh. der Antriebswelle nach jeder Seite Overrun revs. of drive shaft in each direction	Umdrehung der Antriebswelle vom Schaltpunkt bis zur wirk- samen Zwangstrennung Rev. of the drive shaft from switching point up to effec- tive forced separation		Umdrehung der Antriebswelle für wirks. Zwangstrennung im Nachlauf Rev. of the drive shaft from switching point ef- fective forced separa- tion with overrun
					rechtsdreh. clockwise	linksdreh. counter clockwise	
1	67	62	69,98	7,6	0,62	0,718	6,04
	110	100	115,68	12,6	1,025	1,187	9,98
	180	165	188,80	20,7	1,673	1,937	16,29
2	280	265	299,86	32,8	2,656	3,076	25,88
	470	405	495,67	54,3	4,390	5,085	42,77
	770	715	809,02	88,7	7,168	8,3	69,82
3	1200	1140	1284,90	140	11,384	13,183	110,9
	2000	1880	2123,97	323	18,82	21,79	184,1
	3300	3000	3466,66	380	30,71	35,57	299,2
4	5200	4850	5505,87	604	48,78	56,49	475,2
	8700	8000	9101,20	998	80,64	93,38	785,4
	14200	13200	14854,80	1029	131,61	152,41	1282,0

3.3 Elektromagnet - Federdruck - Zahnkupplung EZX 0.1

Speziell für die Anforderungen von Punktzugwinden in der Bühnentechnik wurde die formschlüssige Elektromagnet - Federdruck - Zahnkupplung EZX 0.1 entwickelt. Sie kann mit allen Baureihen der Stromag Steuerstrom - Getriebe - Endschalter kombiniert werden und erfüllt in der Kombination alle aus dieser Spezialanwendung bekannten Forderungen in idealer Weise.

Merkmale (siehe Zeichnung unten)

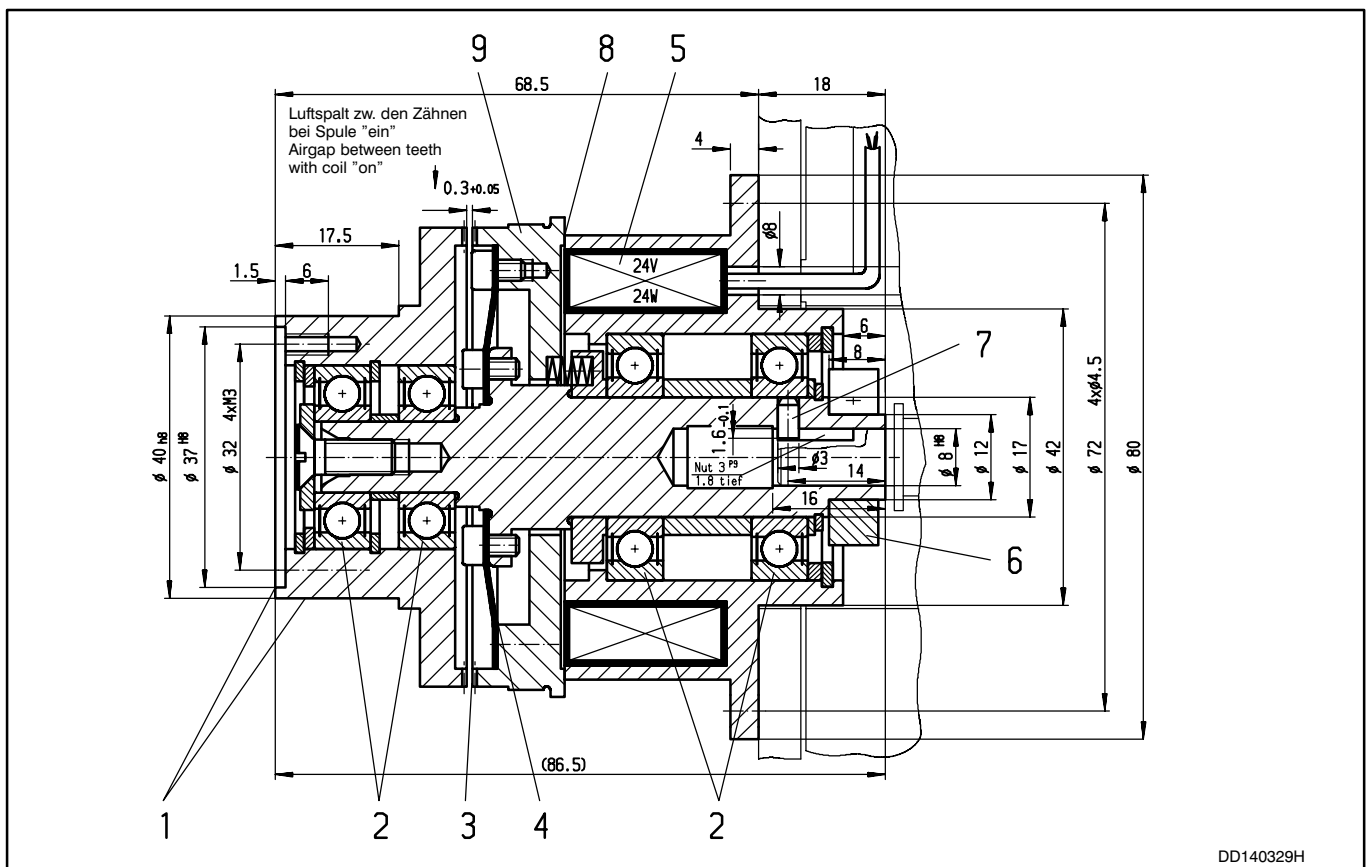
- 1 Innen - und Außenzentrierung der Eintriebsnabe für direktes Anflanschen von Controlflex - Kupplungen oder Ketten - bzw. Zahnriemenrädern.
- 2 Große Lagerabstände für die Aufnahme großer Radialkräfte.
- 3 Formschlüssige Planverzahnung durch Federdruck geschlossen, elektromagnetisch geöffnet.
- 4 Spielfreie Drehmomentübertragung durch Doppelmembran.
- 5 Groß dimensionierte Spule für sicheres Schalten über großen Luftspalt.
- 6 Klemmring für spielfreie Drehmomentübertragung auf den Getriebeschalter
- 7 Zusätzliche formschlüssige Wellenverbindung zwischen Kupplung und Getriebeschalter.
- 8 Im geöffneten Zustand wirkt die Kupplung als Bremse für den Getriebeschalter. Eine ungewollte Verstellung ist verhindert.
- 9 Zusätzliche Zentrierung für das Aufbringen eines Schalt - ringes zur Schaltzustandsüberwachung der Kupplung mittels berührungsfreien Schalters (auch in geprüfter Sicherheit).

3.3 EZX 0.1 Electromagnetic spring - applied toothed clutch

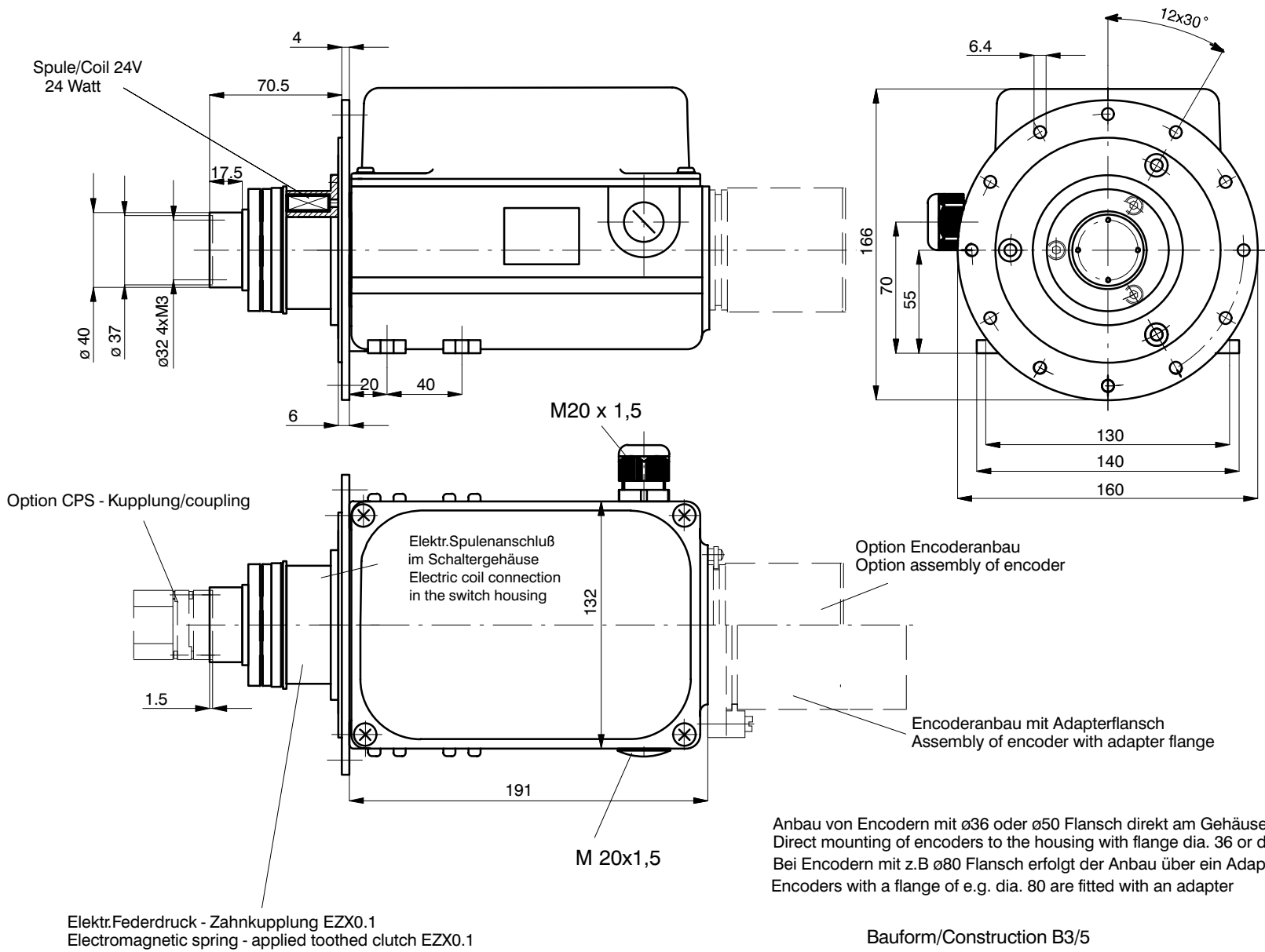
The EZX 0.1 positive - locking electromagnetic spring - applied toothed clutch has been developed specially for use with stage hoisting gear, and can be combined with all Stromag control current geared limit switch series to fully meet all requirements of this special application.

Features (see drawing below)

- 1 Internal and external centering of the input hub for direct flange - mounting of Controlflex couplings or chains and toothed belt pulleys.
- 2 Large bearing distances for taking up high radial forces
- 3 Form - locking rack teeth closed by spring pressure and opened electromagnetically.
- 4 Backlash - free torque transmission via double diaphragm.
- 5 Large dimensioned coil for reliable switching via large air gap.
- 6 Clamping ring for backlash - free torque transmission to geared switch.
- 7 Additional form - locking shaft connection between clutch and geared switch.
- 8 In an open condition, the clutch acts as a brake for the geared switch; accidental adjustment is prevented.
- 9 Additional centering for the provision of a contact ring for monitoring the switched condition of the clutch by means of a contactless switch (also safety approved).

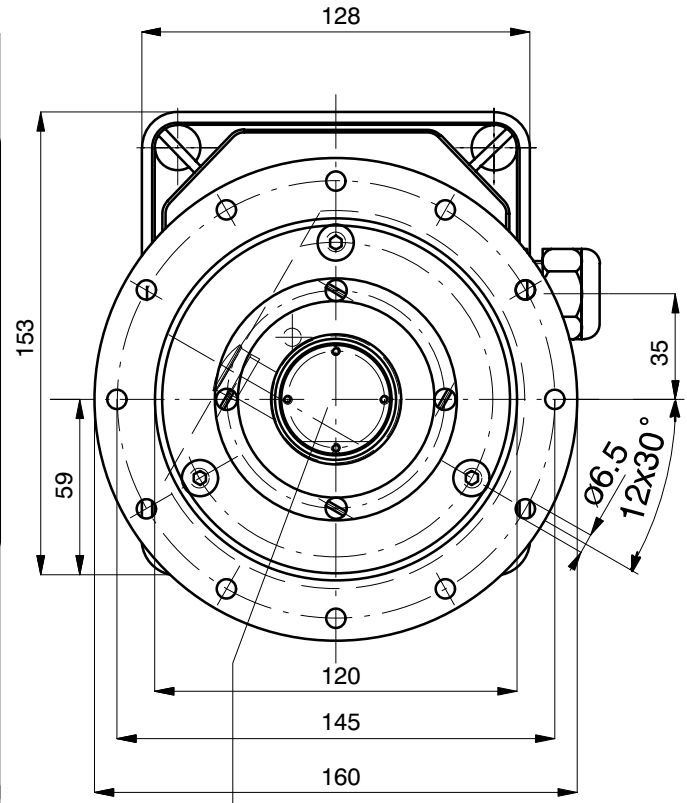
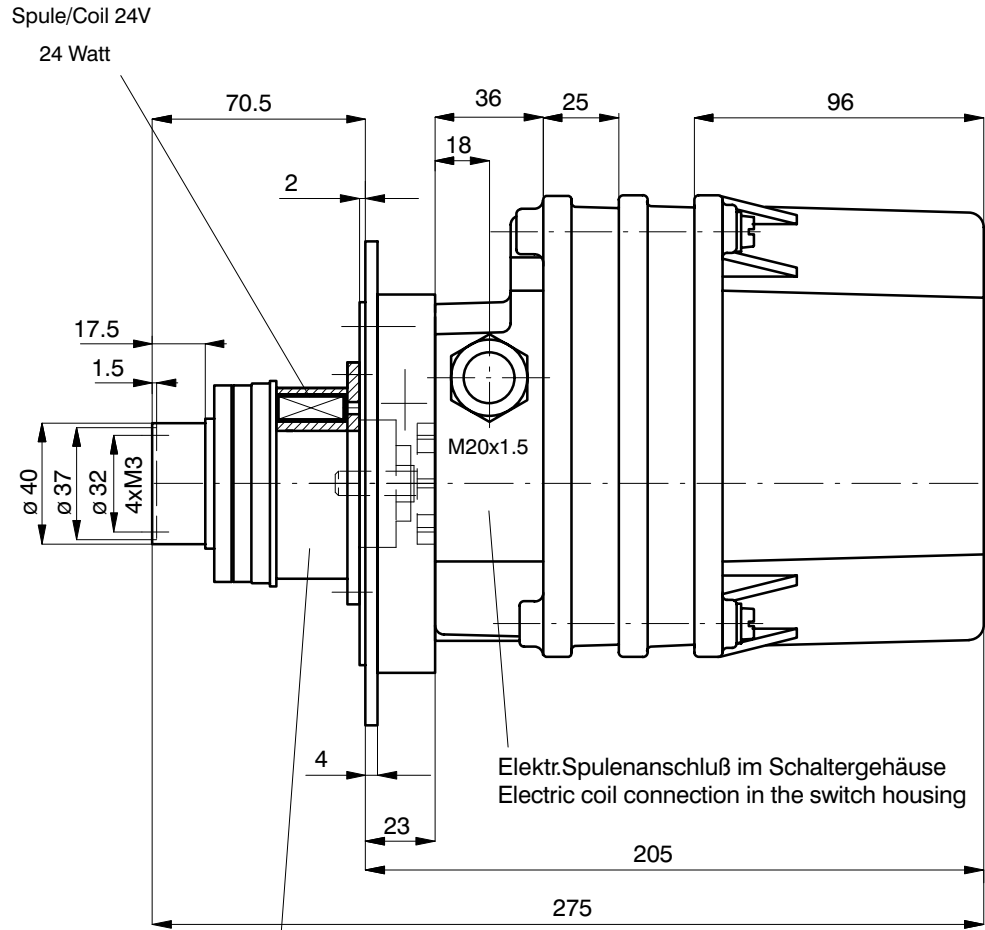


Getr. - Schalter 51 mit El. - Zahnkupplung und Encoder für die Bühnentechnik
Geared switch 51 with el. toothed clutch and encoder for stage technology



DD1_40293H

**Getr. - Schalter 51 mit El. - Zahnkupplung für die Bühnentechnik
Geared switch 51 with el. toothed clutch for stage technology**



Option CPS - Kupplung/Coupling

Bauform / Construction B5

Elektr.Federdruck - Zahnkupplung EZX0.1
Electromagnetic spring - applied toothed clutch EZX0.1

DD1_40347H

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