Bauer Gear Motor GmbH
Eberhard-Bauer-Strasse 36-60
73734 Esslingen am Neckar

Operating Instruction
BA 168 GB - Edition 06/11

These documents must be kept with the unit
Further documentation can be found under www.bauergears.com

EC-Declaration of Conformity

acc. to Low Voltage Directive 2006/95/EC
for geared motors for all types of current and gearbox designs

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Bauer Gear Motor GmbH
Eberhard-Bauer-Str. 36-60, D-73734 Esslingen

declares in sole responsibility the conformity of the following products:

Electric Motors of the ranges
D..04, D..05, D..06, D..07; D..08, D..09, D..11, D..13, D..16, D..18, D..20, D..22, D..25, D..28
E..04, E..05, E..06, E..07, E..08, E..09
S..06, S..08, S..09, S..11, S..13

where applicable in connection with:

Gearboxes of the ranges:
Helical Gearboxes BG.., Parallel Shaft Gearboxes BF.., Bevel Gearboxes BK.., Worm Gearboxes BS.., Monorail Gearboxes BM..

with the requirements of the European Directive(s) in their latest amended versions
Low Voltage Directive - 2006/95/EG
concerning electrical equipment for use within certain voltage limits

verified through the compliance with the following harmonised standards:

Rotating Electrical Machines:

EN 60034-1:2004	Part 1: Rating and Performance
EN 60034-5:2001	Part 5: Degrees of Protection (IP-Code)
EN 60034-6:1993	Part 6: Methods of Cooling (IC-Code)
EN 60034-8:2002	Part 8: Terminal Markings and Direction of Rotation
EN 60034-9:2005	Part 9: Noise Limits
EN 60 529:1991	Degrees of Protection provided by Enclosures (IP-Code)

Notes:
The safety instructions in the documentation attached to the product (e.g. operating instructions) must be followed.

Esslingen, date of the initial edition 01.07.1999

Bauer Gear Motor GmbH

i.V. Hanel
(Leiter IM)

i.V. Dipl.-Ing. Eiffler
(Leiter EE)

This declaration does not constitute a guarantee of features or performance with regard to product liability. The technical documentation is produced and administered by Bauer Gear Motor GmbH

Safety information for the operation of geared motors

(in accordance with the Low Voltage Directive 2006/95/EC)

General

This safety information applies in addition to the relevant product-specific operating instructions and for safety reasons must be taken into particular consideration in every case.

This safety information is intended to protect persons and objects from injury and hazards which can arise from improper use, incorrect operation, inadequate maintenance or other incorrect handling of electric drive units in industrial installations. Low-voltage machines have rotating parts and may have parts that are live, even when the machine is at rest, and surfaces that may become hot in operation. Warning signs and information signs on the machine are to be observed without exception. Details may be found in our detailed operating instructions. They are provided with the machine when it is supplied and can be requested separately as required by stating the motor model.

1 Personnel

All necessary work on electric drive units, in particular also planning work, transport, assembly, installation, commissioning, maintenance, repair, may only be performed by adequately qualified personnel (e.g. electrical engineers as specified in draft EN 50 110-1/DIN VDE 0105), who have the operating instructions provided and other product documentation available during any corresponding work and who are obliged to abide by the instructions contained therein. This work is to be monitored by a specialist supervisor. Qualified personnel are persons who are authorised due to training, experience and instruction as well as their knowledge of relevant standards, rules, accident prevention regulations and operating conditions by the person responsible for the safety of the installation to perform the activities required in each case and who are able to recognise and avoid possible hazard.

Knowledge of first-aid measures and of the available lifesaving equipment is also required.

Non-qualified personnel shall be forbidden to work on the geared motors.

2 Intended use taking into account the relevant technical regulations

These machines are intended for commercial installations, unless otherwise expressly agreed. They comply with the standards of the series EN 60034/DIN VDE 0530. Use in a potentially explosive atmosphere is forbidden, if not expressly intended for this purpose (refer to additional information). If in a special case --use in non-commercial installations-- Increased safety precautions are required (e.g. protection against access by children's fingers), these conditions are to be ensured when setting up the installation. The machines are designed for ambient temperatures between -20°C to +40°C as well as for installation heights up to 1000 m above sea level. Any deviations found on the rating plate must be taken into consideration.

The conditions at the place of work must correspond to all rating plate data.

Low-voltage machines are components for installation in machines in the sense of the Machinery Directive 2006/42/EC.

It is forbidden to use the machine until conformity of the final product with this directive is established (consult EN 60204-01).

3 Transportation, storage

When the electric drive units are being transported, the eye bolts -- where provided in the design-- must be firmly tightened down their bearing surface. They may be used only for transporting the drive unit and not for lifting both the drive unit and the driven machine. Damage sustained after delivery must be reported to the haulage company immediately. Commissioning may have to be suspended.

If drive units are to be stored, ensure a dry, dust free and low vibration (veff < 0,2 mm/s) environment (damage sustained during storage). The life of the lubricants and seals is reduced with longer storage times.

There is a risk of fracture at very low temperatures (under approximately - 20° C). If the transport eye bolts are replaced, drop forged eye bolts as specified in DIN 580 are to be used.

4 Mounting arrangement, assembly

The drive unit is to be fastened by its flange or foot if an IM.. mounting arrangement is intended. Gear units with hollow shafts are to be attached on the driven shaft using the means provided.

Caution! Depending on the reduction ratio, geared motors develop substantially higher torques and forces than high-speed motors of similar power.

Mounts, substructure and torque restraint are to be rated for the high forces to be anticipated during operation and secured sufficiently against loosening. The output shaft(s) and any second motor shaft extension present as well as the transmission elements mounted on it (couplings, chain wheels etc.) are to be covered so that they cannot be touched.

5 Connection

All work shall only be carried out by qualified technical personnel on a stationary machine which has been protected against re-starting. This applies also to auxiliary circuits (e.g. stationary heating). Remove any transportation blocks before start-up.

Check to ensure safe isolation from the supply!
The terminal box may only be opened once it has been ensured that the power is switched off. The information on voltage and frequency on the rating plate must correspond with the mains voltage under observance of the terminal circuit. Exceeding the tolerances as in EN 60034 / DIN VDE 0530, i.e. voltages ± 5%, frequency ± 2 %, cam form, symmetry, increases heating and reduces service life.
Accompanying connection diagrams, particularly for special equipment (e.g. pole-changing, thermistor protection etc.), are to be observed. Type and cross-section of the main conductors as well the protective conductors and any potential equalization which may become necessary must correspond to the general and local installation regulations. With switching duty, the starting current is to be taken into account.
The drive unit is to be protected against overloading and in dangerous situations against automatic restarting due to inadvertent starting.
The terminal box is to be locked again to protect against contact with live components.

6 Commissioning
Before commissioning, protective films are to be removed, the mechanical connection to the driven machine disconnected as far as possible and the direction of rotation examined in the no-load state. Feather keys are to be removed or secured in such a way that they cannot be ejected as this is done. Ensure that the current draw in the loaded condition does not exceed the rated current indicated on the rating plate for any length of time. Observe the drive unit after first commissioning for at least one hour for any unusual heat or noise.

7 Operation
With certain layouts (e.g. unventilated machines), relatively high temperatures can occur on the motor frame, which are however within the limits specified in the standard. If these drive units are located in a place where they are subject to intensive contact, measures must be taken by the installer or operator to provide protective shielding.

8 Spring-loaded brakes
Spring-loaded brakes are safety brakes which continue to work in the event of power failure or usual wear. If a manual release bracket is provided, it is to be removed when operating. Since other components could also fail, suitable safety precautions are to be taken to avoid any injury to persons or damage to objects cause by un-braked operation.

9 Maintenance
In order to prevent breakdowns, danger and damage, the drive units must be examined at regular intervals depending on the operating conditions. The lubrication intervals for bearings and gear units specified in the respective operating instructions are to be observed. Worn or damaged parts are to be replaced using original spare parts or standard parts. In the event of heavy dust accumulation, clean airways regularly. For all inspection and maintenance work, observe Section 5 and the information provided in the detailed operating instructions.

10 Operating instructions
For reasons of clarity, the operating instructions and safety information do not contain all information relating to all geared motors types and cannot take into account every conceivable case of installation, operation or maintenance. The information is essentially limited to that which is required for qualified personnel in normal working situations. Any unclear points can be clarified by contacting Bauer.

11 Faults
Changes in relation to normal operation, such as higher temperatures, vibrations, noises etc. tend to indicate that the function is impaired. To avoid faults which could lead directly or indirectly to injury to persons or damage to property, the maintenance staff responsible must be informed. If in any doubt, the geared motors are to be switched off immediately.

12 Electromagnetic compatibility
The operation of the low-voltage machine in its intended application must meet the protection requirements of the EMC (electromagnetic compatibility) Directive 2004/108/EC.
Correct installation (e.g. screened cables) is the responsibility of the system's installers. Precise information can be taken from the operation instructions. For systems with frequency inverters and rectifiers, the manufacturer's electromagnetic compatibility information is also to be taken into consideration. The electromagnetic compatibility directive in accordance with EN 61000-6-2 and EN 61000-6-4 is complied with given proper use and installation of BAUER geared motors. This is also true in combination with frequency inverters and rectifiers. The additional information provided in the operation instructions is to be taken into consideration when using the motors in the residential, commercial and trade sectors, as well as in small businesses in accordance with EN 61000-6-1 and EN 61000-6-3.

13 Warranty and liability
The warranty obligations of Bauer arise out of the relevant supply contract, which is neither expanded nor restricted by this safety information or other instructions.

This safety information is to be kept in a safe place.

Geared motors with three phase cage rotors

1 Geared motors in degree of protection IP65

(Motor models D/E06... to D.28...) complying with EN 60529 and IEC 34-5/529 are totally enclosed and dust-tight as well as hose proof.

For outdoor installation, the geared motor must be coated with several layers of durable paint to protect against corrosion. The condition of the paint must be checked and repaired at regular intervals, depending on ambient influences. The paint finish must be compatible with the other components. Paints with a synthetic resin base have proved well suited to this purpose.

2 Geared motors in degree of protection IP54

(Motor models D/E04... and D/E05...) complying with EN 60034, part 5 and IEC 34-5 are protected against dust and occasional splashing water. Installation outdoors or in wet areas is not permissible without special protective measures.

3 Mounting arrangement

It is recommended that drinking water, food, textiles etc. beneath the geared motor be covered.

The drive unit should be installed as free from vibration as possible.

Special instructions are to be observed in installation locations with abnormal operating conditions (e.g. prolonged exposure to dripping water, high ambient temperatures above 40°C, explosion hazards). The fresh air intake must not be restricted by unsuitable installation or by fouling.

Flexible couplings with zero play, if possible, are recommended for direct power transmission from the gear unit to the driven machine and commercially available slip clutches are recommended if there is a risk of blocking.

Care must be taken when fitting transmission elements onto the output shaft of the gear unit, which is finished to ISO k 6 or m 6, and the tapped end hole intended for this purpose according to DIN 332 should be used if possible. Warming the machine part to be fitted onto the shaft to approximately 100 °C has proved to be advantageous. The bore must be dimensioned in accordance with following table and must thus exhibit the following tolerances:

Nominal size of bore (in mm)	k 6 or m 6 output shaft Bore H7 with tolerances (in 1/1000 mm)
over 6 to 10	0 to + 15
over 10 to 18	0 to + 18
over 18 to 30	0 to + 21
over 30 to 50	0 to + 25
over 50 to 80	0 to + 30
over 80 to 120	0 to + 40

Where the gear units have a hollow shaft and keyway for high profile feather keys as specified in DIN 6885, Part 1 and hollow shaft for shrink-disc connection, the shafts intended to form the counterpart must be dimensioned to ISO h 6. They must, therefore, exhibit the following tolerances:

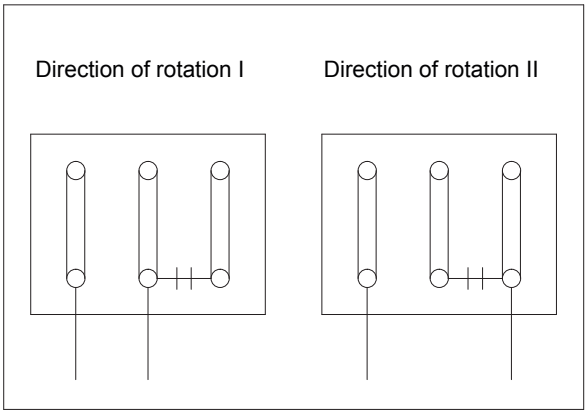
Shaft diameter (in mm)	Nominal allowance (in [1]/1000] mm)
over 18 to 30	0 to - 13
over 30 to 50	0 to - 16
over 50 to 80	0 to - 19
over 80 to 120	0 to - 22
over 120 to 140	0 to - 25

In all cases, particular care shall be taken to ensure that any burring, swarf etc. is carefully removed before assembly. The keyways should be lightly greased to prevent seizing. Hollow shafts to be fitted with shrink-disc connections must not be greased. The following installation instructions are to be noted here.

The eye bolt is to be retightened firmly if it has worked loose during transportation.

4 Electrical connection

When connecting the motor, take note of the rating plate information and the connection diagram as well as the relevant safety regulations and rules for the prevention of accidents.
Unless a special design is concerned, the rating data refer to ± 5% voltage tolerance, -20 to 40°C ambient temperature and altitudes up to 1000 m above sea level.
Small motors can be connected directly (the regulations of the local electricity supply companies are to observed). The permissible switching frequency depends on the design of the motors, the load torque and the mass moment of inertia.
The direction of rotation of single phase motors may generally only be changed after the motor has stopped and in accordance with the following diagram:



Unless otherwise stated, the three phase motor is connected for the higher of the two rated voltages specified. The motor may have to be connected from star to delta at the terminal board, if necessary, to ensure that it complies with the mains voltage.

Specially designed motors (e.g. for two rated voltages in the ratio 1:2 or with pole-changing windings) are to be connected in accordance with the relevant circuit diagram.

Two mains leads must be swapped in the event of incorrect direction of rotation. When closing the terminal box, particular attention must be given to obtaining a perfect seal. With motors in sizes D/E 04 to D/E 09 with moulded terminal boxes, two connection openings each on side A and C are possible.

The cable entry openings required depending on the installation position should carefully pierced with a suitable tool. Take care not to damage the terminal board.

Two lock nuts and seals are provided in the terminal box for the cable glands (metric). Plugs must be screwed into unused cable entry holes.
The maximum spanner opening for the cable glands of the D04 is 24 mm and of the D05 to D09 is 29 mm.
To guarantee electromagnetic compatibility (EMC) as defined in EMC Directive 2004/108/EC, all signal lines must use shielded cables. The cable sheath is to be earthed at both ends. The frequency inverter operating instructions will indicate whether a shielded cable is necessary for the motor supply line. A shielded motor cable is not required when connecting to the low-voltage network or to a frequency inverter with an output filter. Signal cables and power cables should not be laid parallel over long distances.

5 Overload protection

A motor protection switch must be used to protect the winding against overloading and against the consequences of operating on only 2 mains leads (e.g. when only one fuse blows or in the event of a wire breakage)

Example	Motor winding for 230/400 V;	
	Rated currents	5.7/3.3 A
	Setting of the motor protection switch at	
	Connection for 230 V (delta):	5.7 A
	Connection for 400 V (star):	3.3 A

The overcurrent relay of the motor protection switch is to be set to the correct rated current intensity for the rated voltage concerned (see rating plate).

Take note of the relevant circuit diagram for motors with thermally activated winding protection (e.g. thermostats or thermistors).

Automatic restarting after the winding has cooled must be avoided in most applications.
The output of the motors is normally adequately rated, particularly in connection with four and multistage gear units. The rated current does not represent a measure of gear unit utilization in these cases and cannot be used as overload protection for the gear unit. In some cases, the way in which the driven machine is loaded can exclude any overloading as a matter of course. In other cases it is prudent to protect the gear unit by mechanical means (e.g. slip clutch, sliding hub etc.). The maximum permissible limit torque M_2 in continuous running duty specified on the rating plate is decisive here.

6 Lubricant changes

The gear units are supplied with lubricant ready for operation.

In normal operating conditions and with a lubricant temperature of approximately 80° C, the oil should be replaced after approximately 15000 operating hours when using CLP 220, or after 25000 operating hours when using PGLP 220/PGLP 460. The lubrication interval must be reduced at higher temperatures (halve it for each 10 K increase in the lubricant temperature).

The lubricant must be changed after 2 or 3 years at the latest whatever the operating hours.

The medium and larger gear units have filling plugs and drain plugs. In the standard designs, these make it possible to change the lubricant without disassembly.
With smaller gear units, the interior is accessed by unscrewing the connecting bolts. Alignment pins and centrings secure the precise assembly.

Worm-gear units are sliding gear units whose tooth flanks, contrary to rolled gear units, only become smooth once run in. They should therefore initially be run in under partial loading (about $^2/_3$ of the rated load) until the full load capacity of the flanks and the optimal efficiency is achieved. After approximately 200 operating hours, the lubricant should be changed and the gear unit enclosure thoroughly flushed, so that the minimal, but inevitable amount of material removed by smoothing abrasion is cleared.

It is also necessary to flush the gear unit enclosure if the lubricant grade or lubricant type is changed.
If the motor is only used briefly it is sufficient to drain off the original oil and use the original lubricant type to refill the maximum possible amount for the gear unit as defined in the lubricant volume table. Then operate the drive unit briefly under no load, drain this oil off again and refill with the new lubricant as defined on the rating plate. In special cases, refill up to the oil level mark.

If necessary, drain off the original lubricant and flush out the gear unit with petroleum until all traces have been washed out. Then perform the procedure described above for short-term operation twice before filling with the specified volume of new lubricant in accordance with the rating plate, in special cases up to the oil level mark.

It is advisable to inspect and if necessary replace the wear parts (bearings and seals) when changing the lubricant.

7 Lubricant grade

Oils CLP 220, PGLP 220 and PGLP 460 complying with DIN 51502 and DIN 51517 are suitable for lubricating the gear unit, or in special cases use soft flow grease GLP 00f with good EP properties.

The lubricant must permit low-friction, virtually wear-free continuous operation. The damage load level on the FZG test as specified in DIN 51354 shall be in excess of load level 12, and the specific wear below 0.27 mg/kWh. The lubricant should not foam, should protect against corrosion and should not attack the interior paint, the rolling contact bearings, gearwheels and seals.

Lubricants of different types may not be mixed, as otherwise the lubrication characteristics may be impaired. A long service life is only ensured by the use of a lubricant listed below or which is demonstrably equivalent. The original lubricant can also be supplied in small amounts (5 and 10 kg) from the factory.

Should geared motors need to be stored for a longer period of time before installation, please observe the chapter „Information on the storage of geared motors with cage rotors“

Wear-protecting EP gear lubricant oils as listed in the lubricant table below have proved particularly suitable.

Lubricant manufacturer	Lubricant type				
	Mineral oil	Synthetic oil			USDA H1 oil
	ISO VG 220	ISO VG 68	ISO VG 220	ISO VG 460	ISO VG 220
	Standard oil for gear units of type series **BF06-BF90 BG04-BG100 BK60-BK90**	Low temperature oil for gear units of type series **BF06-BF90 BG04-BG100 BK60-BK90** **BS02-BS40**	Standard oil for gear units of type series **BS02-BS10 BK06-BK10** High temperature oil for gear units of type series **BS02-BS10 BK06-BK10 BF06-BF90 BG04-BG100 BK60-BK90**	Standard oil for gear units of type series **BS20-BS40 BK20-BK50** High temperature oil for gear units of type series	Foodstuffs industryoil of type series **BF06-BF90 BG04-BG100 BK06-BK90** **BS02-BS40**
AGIP	BLASIA 220				
ARAL	DEGOL BMB220 DEGOL BG220		DEGOL GS220	DEGOL GS460	
BECHEM RHUS	STAROIL SMO220				
BP	ENERGOL GR-XP220		ENERSYN SG-XP 220	ENERSYN SG-XP 460	
CASTROL	ALPHA SP 220 ALPHA BMB 220 OPTIGEAR BM 220 TRIBOL 1100/220		ALPHASYN PG 220 TRIBOL 800/220 ALPHASYN GS 220	ALPHASYN PG 460 TRIBOL 800/460 ALPHASYN 460	CASTROL OPTILEB GT 220 CASTOL TRIBOL FOODFROOF 1800/220
ESSO	see MOBIL				
FUCHS	RENOLIN CLP 220 RENOLIN CLPF 220 SUPER	RENOLIN PG 68	RENOLIN PG 220	RENOLIN PG 460	
KLÜBER	KLÜBEROIL GEM 1-220 N	KLÜBERSYNTH GH6-80	KLÜBERSYNTH GH6-220	KLÜBERSYNTH GH6-460	KLÜBEROIL 4UH1-220N KLÜBERSYNTH UH1 6-220
MOBIL	MOBILGEAR 600 XP 220 MOBILUBE HD PLUS 80W-90		GLYGOYLE 220 GLYGOYLE 30	GLYGOYLE 460	
OEST	Gearol C-LP 220				
OPTIMOL	OPTIGEAR 220		OPTIFLEX A 220	OPTIFLEX A 460	OPTILEB GT 220
SHELL	OMALA S2 G220 FALCON CLP 220		OMALA S4 WE 220	OMALA S4 WE 460	CASSIDA FLUID GL 220
TEXACO	GEARTEX EP-A SAE 85W-90				
TOTAL	CARTER EP 220				NEVASTANE SL220
WINTERSHALL	SRS ERSOLAN 220				

Attention:
Synthetic gear oils with a polyglycol base (e.g. PGLP etc) must be kept separate from mineral oils and disposed of as special waste.

As long as the ambient temperature does not fall below -10° C, ISO viscosity grade VG 220 (SAE 90) is recommended in accordance with the international definition of viscosity grades at 40° C in accordance with ISO 3448 and DIN 51519, and AGMA 5 EP in North America.

For lower ambient temperatures, oils of a lower nominal viscosity, with correspondingly better starting characteristics should be used, such as PGLP with a nominal viscosity of VG 68 (SAE 80) or AGMA 2 EP. These grades may also be required at temperatures around the freezing point if the drive unit's breakaway torque has been reduced with a view to achieving soft starting or if the motor has a relatively low power output.

9 Lubricant volume

The recommended lubricant quantity for the particular style is indicated on the rating plate of the motor (symbol). When filling, make certain that the upper gear unit components, depending upon the installation position, are also well lubricated. The oil level mark should be taken into consideration in special cases. Information about the lubricant volume required for other styles construction can be obtained from the works.

10 Disposal

The metallic parts of the gear unit and the geared motor can be disposed of as scrap, segregated into steel, iron, aluminium and copper.
The lubricants used are to be disposed of as waste oil, and the synthetic oils are to disposed of as special waste.
Information on this can be found on the lubrication chart or the rating plate.

11 Bearing lubrication for large geared motors

The lubrication periods for rolling contact bearings on the input shaft vary depending on type of storage, temperature, speed, loading etc.

On the larger gear units, therefore, input parts SN 70 to SN 90 and KB 70 to KB 90 are provided with a lubrication device for the input shaft. Each bearing has its own lubrication point (lubricating nipple).
The maximum permissible speed is 1800 rpm. The required lubrication period is 2000 operating hours or 6 months whichever is soonest.
With lubrication intervals up to half a year, the grease filling in the bearing can be supplemented at intervals of 1000 operating hours by periodically adding fresh grease. The complete grease filling must, however, be replaced after three grease top-ups at the latest.
The grease top-up is approximately 30 g, however three times this quantity will be required (approximately 90g) when replacing the grease. When this is done, the surplus used grease should also be removed from the grease outlet chamber.
KLÜBER PETAMO GHY 133 N shall be used as the lubricant.

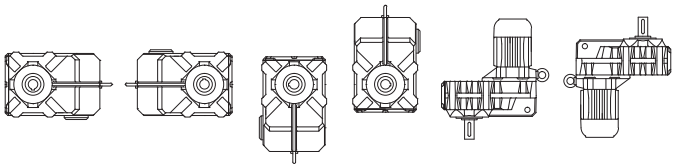
12 Bearing lubrication for small geared motors (motor size less than or equal to IEC 200)

With smaller and middle sized gear units, the input components/motor components are designed with enclosed ball bearings.

An input speed of 1500 rpm results in a lubrication interval of 10000 operating hours. The maximum permissible speed is 3600 rpm. The lubrication interval is halved in this case. The lubricant change is to be carried out here when the bearings are replaced in the context of maintenance/monitoring of the rotary shaft seals. Cleaning and lubrication of the bearings is not recommended due to the risk of contamination.

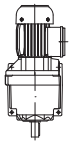
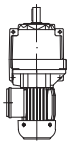
Lubrication quantity series BF

Lubrication quantity in l



Gear type	H1	H2	H3	H4	V1	V2
BF06	0.25	0.25	0.25	0.37	0.35	0.3
BF10	0.85	0.85	0.85	1.1	1.45	1.5
BF20	1.3	1.3	1.3	1.7	2.2	2.25
BF30	1.7	1.7	1.7	2.2	3.2	3.0
BF40	2.7	2.7	2.7	3.5	4.9	4.8
BF50	3.8	3.8	3.8	5.0	6.7	6.7
BF60	6.7	6.7	6.7	9.0	12.3	12.0
BF70	12.2	12.2	12.2	16.0	24.2	21.8
BF80	17.0	17.0	17.0	21.0	32.2	27.5
BF90	32.0	32.0	32.0	41.0	62.0	53.0

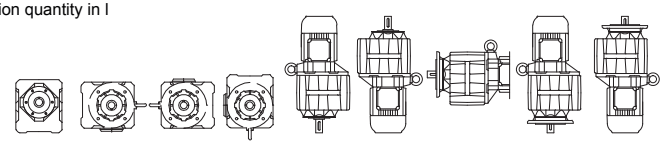
Lubrication quantity for BG20-01R

Gear type	Lubrication quantity in l					
						
	H4	H1	H2	H3	V5	V6
BG20-01R	0.8	1.0	0.8	1.4	1.65	1.0

Lubrication quantity series BG

Lubrication quantity in l

Gearbox type



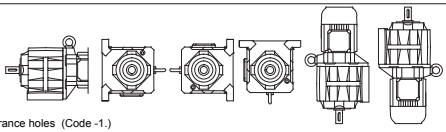
BG04-BG100 (gear-housing with flange or foot)

Flange (Code-2./Code-3./Code-4./Code-7.)
Foot with threads (Code-6.)

Foot with clearance holes (Code-9.)
[Completely machined (Code -8.)]

BG04-BG100

(Gearbox housing)



cast-on-foot with clearance holes (Code -1.)

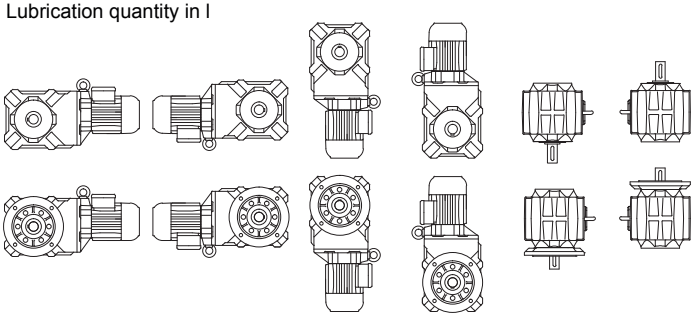
		H4	H1	H2	H3	H5	H6	B5	V1	V3
		B3	B6	B7	B8	V5	V6			
BG04	✳	-	0.03	0.03	0.03	-	-	0.03	0.05	0.05
	✳✳	0.05	0.05	0.05	0.05	0.1	0.05	-	-	-
BG05	✳	-	0.05	0.05	0.05	-	-	0.05	0.08	0.08
	✳✳	0.08	0.08	0.08	0.08	0.16	0.08	-	-	-
BG06	✳	-	0.08	0.08	0.08	-	-	0.08	0.15	0.15
	✳✳	0.12	0.12	0.12	0.12	0.24	0.15	-	-	-
BG10	✳	0.65	0.65	0.65	0.85	1.05	0.85	0.65	1.05	0.85
	✳✳	0.45	0.45	0.45	0.6	0.75	0.6	-	-	-
BG20	✳	0.8	0.8	0.8	1.1	1.4	1.1	0.8	1.4	1.1
	✳✳	0.6	0.6	0.6	1.0	1.15	0.9	-	-	-
BG30	✳	1.0	1.0	1.0	1.7	2.2	1.6	1.0	2.2	1.6
	✳✳	1.0	1.0	1.0	1.7	2.3	1.7	-	-	-
BG40	✳	1.7	1.7	1.7	2.5	3.5	2.1	1.7	3.5	2.1
	✳✳	1.7	1.7	1.7	2.5	3.5	2.1	-	-	-
BG50	✳	3.0	3.0	3.0	4.5	5.5	3.3	3.0	5.5	3.3
	✳✳	3.0	3.0	3.0	4.5	5.5	3.3	-	-	-
BG60	✳	5.5	5.5	5.5	7.0	10.9	6.4	5.5	10.9	6.4
	✳✳	5.5	5.5	5.5	7.0	10.9	6.4	-	-	-
BG70		6.5	6.5	6.5	8.0	13.5	9.0	6.5	13.5	9.0
BG80		11.0	11.0	11.0	11.0	22.5	15.0	11.0	22.5	15.0
BG90		19.0	19.0	19.0	19.0	40.0	26.0	19.0	40.0	26.0
BG100		35.0	35.0	55.0	50.0	66.0	50.0	35.0	66.0	50.0

✳ Attachment housing

✳✳ Gearbox housing

Lubrication quantity series BK

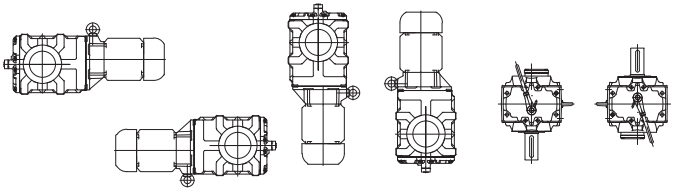
Lubrication quantity in l



Gear box type	H1	H2	H3	H4	V1	V2
BK06	0.15	0.23	0.29	0.31	0.18	0.23
BK10	0.83	0.83	0.92	1.75	0.92	0.92
BK20	1.5	1.5	1.6	2.9	1.65	1.65
BK30	2.2	2.2	2.3	4.4	2.4	2.4
BK40	3.5	3.5	3.5	6.7	3.7	3.7
BK50	5.8	5.8	5.8	11.5	6.0	6.0
BK60	6.0	8.7	6.9	12.0	8.6	8.6
BK70	10.2	15.0	11.5	20.5	13.5	14.5
BK80	18.0	25.5	19.0	37.0	23.5	25.5
BK90	33.0	48.0	36.0	69.0	45.0	48.0

Lubrication quantity series BM

Lubrication quantity in l

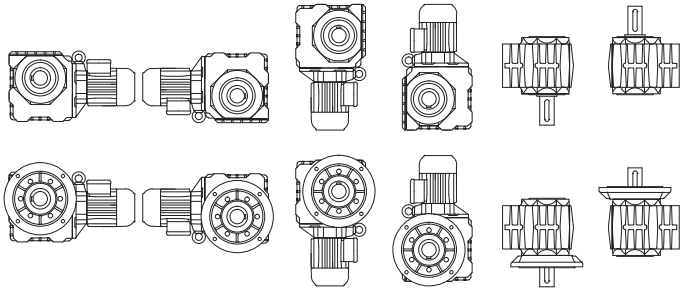


Gearbox type	H1	H2	H3	H4	V1	V2
BM09	0.5				0.45	0.7
BM10	0.65				0.8	1.3
BM20	0.7				1.0	1.4
BM30	1.2 1.8*				2.4	2.4
BM30/S1	1.2 1.8*	on request			2.4	2.4
BM30/S2	1.3 1.9*				2.7	2.4
BM40	2.5 3.2*				3.0	3.5
BM40/S1	2.5 3.2*				3.0	3.5
BM40/S2	2.6 3.3*				3.3	3.5

*: Lubrication quantity für BM30Z/BM40Z
Caution: if * is shown the lubrication quantity of the pre-stage is filled into the main gear.

Lubrication quantity series BS

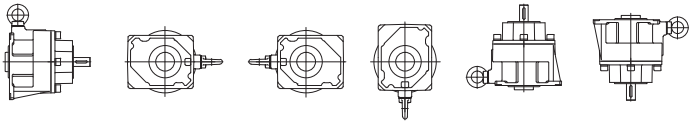
Lubrication quantity in l



Gear type	H1	H2	H3	H4	V1	V2
BS02	0.06	0.06	0.06	0.06	0.06	0.06
BS03	0.17	0.17	0.17	0.17	0.17	0.17
BS04	0.11	0.17	0.11	0.2	0.11	0.11
BS06	0.24	0.36	0.24	0.45	0.24	0.24
BS10	0.9	1.3	0.9	1.6	0.9	0.9
BS20	1.5	2.1	1.5	2.7	1.5	1.5
BS30	2.2	3.0	2.2	3.8	2.2	2.2
BS40	3.5	4.7	3.5	6.0	3.5	3.5

Lubrication quantity for gear design with free running input shaft

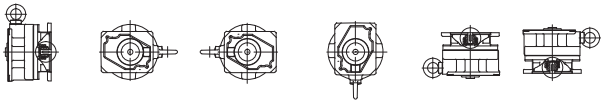
Lubrication quantity in kg



BG / BF	B3 H4 B5	B6 H1	B7 H2	B8 H3	V5 V1	V6 V3 V2
BK / BS	H1	V1	V2	H2	H4	H3
Gear type						
BK06-SN / BS06-SN						
BG10-BG10Z-SN BF10-BF10Z-SN BK10-BK10Z-SN BS10-BS10Z-SN						
BG20-BG20Z-SN BF20-BF20Z-SN BK20-BK20Z-SN BS20-BS20Z-SN						
BG30-BG30Z-SN BF30-BF30Z-SN BK30-BK30Z-SN BS30-BS30Z-SN			2-Z-bearing grease lubricated, sealed for life non regreasable			
BG40-BG40Z-SN BF40-BF40Z-SN BK40-BK40Z-SN BS40-BS40Z-SN						
BG50-BG50Z-SN BF50-BF50Z-SN BK50-BK50Z-SN						
BG60-BG60Z-SN BF60-BF60Z-SN BK60-BK60Z-SN						
BG70Z-SN BF70Z-SN BK70Z-SN BG80Z-SN BF80Z-SN BK80Z-SN BG100Z-SN BF90Z-SN						
BG70-SN BK70-SN BF70-SN BG80-SN BF80-SN BK80-SN BG90-BG90Z-SN BK90-BK90Z-SN BF90-SN BG100-SN	grease lubrication for subsequent lubrication regreasable: (PETAMO GHY133N)					

Lubrication quantity for coupling lantern

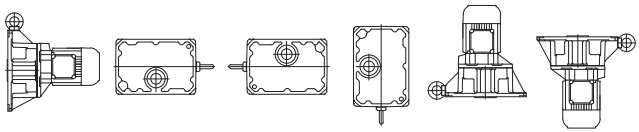
Lubrication guantity in kg



BG / BF	B3 H4 B5	B6 H1	B7 H2	B8 H3	V5 V1	V6 V3 V2
BK / BS	H1	V1	V2	H2	H4	H3
Gear type						
BK06-K / BS06-K BG10-BG10Z-K BG20-BG20Z-K BF10-BF10Z-K BF20-BF20Z-K BK10-BK10Z-K BK20-BK20Z-K BS10-BS10Z-K BS20-BS20Z-K BG30-BG30Z-K BG40-BG40Z-K BF30-BF30Z-K BF40-BF40Z-K BK30-BK30Z-K BK40-BK40Z-K BS30-BS30Z-K BS40-BS40Z-K BG50-BG50Z-K BG60-BG60Z-K BF50-BF50Z-K BF60-BF60Z-K BK50-BK50Z-K BK60-BK60Z-K BG70-K BG80-K BF70-K BF80-K BK70-K BK80-K BG90-BG90Z-K BG100-K BF90-K BK90-BK90Z-K BG70Z-K BF70Z-K BK70Z-K BG80Z-K BF80Z-K BK80Z-K BG100Z-K BF90Z-K up to IEC200 or up to Nema284/286TC	2-Z-bearing grease lubricated, sealed for life non regreasable					
BG70-K BK70-K BF70-K BG80-K BK80-K BF80-K BG90-BG90Z-K BK90-BK90Z-K BF90-K BG100-K only from IEC225 up only from Nema324/326TC up	grease lubrication for subsequent lubrication regreasable: (PETAMO GHY133N)					

Lubrication quantity for pre-stage

Lubrication quantity in l



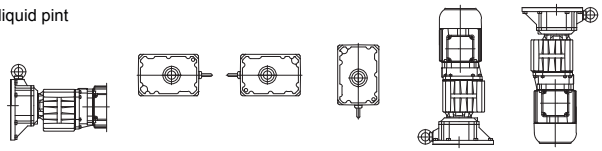
BG / BF	B3 H4 B5	B6 H1	B7 H2	B8 H3	V5/H5 V1	V6/H6 V3 V2
BK / BS	H1	V1	V2	H2	H4	H3
Gear type						
BG10Z BF10Z BK10Z BS10Z	0.10	0.05	0.12	0.07	0.16	0.07
BG20Z BF20Z BK20Z BS20Z	0.15	0.07	0.19	0.17	0.27	0.10
BG30Z BF30Z BK30Z BS30Z BM30Z	0.2*	0.10	0.35	0.22	0.35	0.19
BG40Z BF40Z BK40Z BS40Z BM40Z	0.32*	0.17	0.50	0.37	0.6	0.32
BG50Z BF50Z BK50Z	0.5	0.3	0.92	0.7	1.15	0.5
BG60Z BF60Z BK60Z	0.9	0.5	1.55	1.1	2.0	0.7
BG70Z BF70Z BK70Z BF80Z	1.2	0.6	1.8	1.6	2.4	1.4
BG80Z BF90Z BK80Z BG100Z	3.1	1.3	4.0	2.6	5.2	2.0
BG90Z BK90Z	4.2	1.5	5.4	3.5	7.7	3.0

Lubrication quantity for intermediate gear

Definition of the terminal box position

Terminal box position for intermediate gear
is similar to the main gearbox that means
Main gearbox BG,BF terminal box pos. I
-> intermediate gearbox terminal box pos. I
Main gearbox BK,BS terminal box pos. II
-> intermediate gearbox terminal box pos. II

Lubrication quantity in liquid pint



Mounting position of main gearbox								
	BG / BF	B3 H4 B5	B6 H1	B7 H2	B8 H3	V5/H5 V1	V6/H6 V3 V2	
	BK / BS	H1	V1	V2	H2	H4	H3	
Standard position of KLK mounting position H1,H2,H3, B5,V1,V3 for mounting with screwed resp. casted flange		B5	H1	H2	H3	V1	V3	
Type designation of double gearbox combination								
BG06G04 BS06G04 BK06G04		0.03	0.03	0.03	0.03	0.05	0.05	
BG10G06 BF10G06 BK10G06 BS10G06		0.08	0.08	0.08	0.08	0.15	0.15	
BG20G06 BF20G06 BK20G06 BS20G06		0.08	0.08	0.08	0.08	0.15	0.15	
BG30G06 BF30G06 BK30G06 BS30G06		0.08	0.08	0.08	0.08	0.15	0.15	
BG40G10 BF40G10 BK40G10 BS40G10		0.65	0.65	0.65	0.85	1.05	0.85	
BG50G10 BF50G10 BK50G10		0.65	0.65	0.65	0.85	1.05	0.85	
BG60G20 BF60G20 BK60G20		0.8	0.8	0.8	1.1	1.4	1.1	
BG70G20 BF70G20 BK70G20		0.8	0.8	0.8	1.1	1.4	1.1	
BG80G40 BF80G40 BK80G40		1.7	1.7	1.7	2.5	3.3	2.1	
BG90G50 BF90G50 BK90G50 BG100G50		3.0	3.0	3.0	4.5	5.5	3.3	

Spring-loaded brakes with direct current solenoid release
Models E003B and E004B

1 Safety information

Connection, adjusting and maintenance work may only be carried out taking into account the safety information given on pages 3/4.

2 General information

In addition to holding loads in the idle state, the spring-loaded brake slows rotating and linear moving masses, thus reducing unwanted overtravel distances and times.
The brake is released electromagnetically. Under zero-load conditions, braking force is applied by spring pressure. Because braking is still effective even if an accidental power failure occurs, it can be considered a safety brake within the context of accident prevention regulations.
During the braking process, the kinetic energy of the mass moments of inertia is converted into heat via the brake disc. The brake disc, which consists of high-quality, asbestos-free material, is highly resistant to wear and heat. A certain amount of wear is unavoidable, however. For this reason, the limit values specified in paragraph 8 regarding the working capacity and the minimum lining thickness are to be strictly observed.

3 Operating principle

The operating principle is described in Figure 1.

3.1 Brakes

The brake disc (1) is pressed axially through the retaining plate (2) against the friction plate (4) by springs (3). Radial movement of the retaining plate is prevented by the fillister screws (5). The braking torque is transferred to the rotor via gear teeth connecting the brake disc and the carrier (6) fixed to the shaft. The braking torque and the number of springs can be changed in stages (see paragraph 6).

3.2 Brake release

Supplying the coil (7) with the correct DC voltage causes the retaining disc to be attracted by the magnetic field generated in the magnet housing (8) against the spring force. This relieves the brake disc and as a result allows the rotor to move freely.
The increased air gap s_L caused by the wear to the brake discs can be overcome thanks to the generous dimensioning of the electromagnets. No adjustment facility is hence provided.
All brakes can be optionally fitted with either a latching or non-latching manual release, which may be used to release the brake manually e.g. in the event of a power failure.

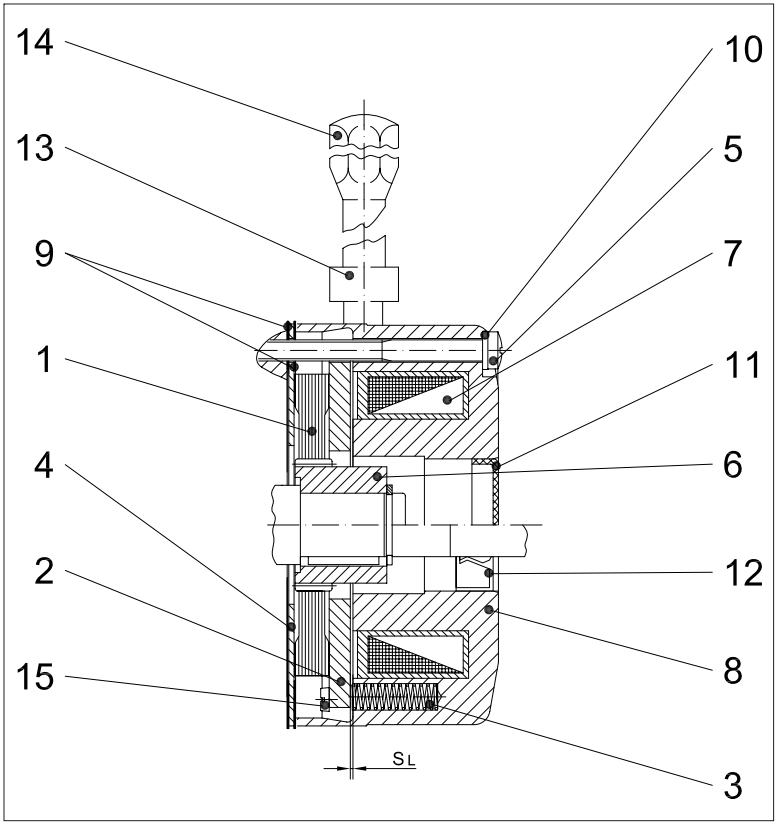


Figure 1: Spring-loaded brake from the series E003B and E004B

4 Electrical connection

4.1 General information

There are 2 different options for the voltage supply of the DC solenoid:
1. Externally from an existing DC control power supply, or from a rectifier in the control cabinet.
2. From a rectifier built into the motor terminal box or brake terminal box.
In this instance, the rectifier can be supplied either directly from the motor terminal board or from the mains.
In the following instances, the rectifier must not however be connected to the motor terminal board:

- Pole-changing motors and wide range motors
- Operation with frequency converter
- Other designs in which the motor voltage is not constant, e.g. operation on smooth-start equipment, starting transformers, ...

4.1.1 Brake release

If the solenoid is energised using nominal voltage, the coil current and the magnetic field build up follow an exponential function. Only when the power has achieved a specific value (I_{Rel}) is the spring force overcome and the brake begins to release.

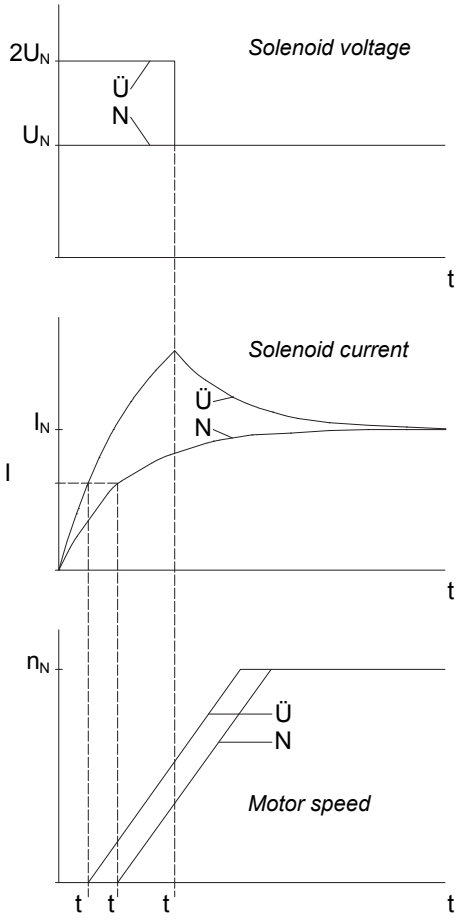


Figure 2: Solenoid voltage, solenoid current and motor speed development at normal excitation (N) and overexcitation (Ü).
$t_Ü$: overexcitation period; t_{AN}, $t_{AÜ}$: response times at normal excitation and overexcitation

Two different cases can occur during response time t_A, assuming the power is supplied to the motor and the brake at the same time:

- Motor is blocked - condition: MA < ML + MBr
  The motor takes the inrush current and is thereby subjected to additional thermal loading.
  This scenario is shown in Figure 2.
- Motor tears away from brake - condition: MA > ML + MBr
  At the start, the brake is subject to thermal loading and wears more rapidly.

M_A: starting torque of the motor, M_L: load torque, M_{Br}: braking torque

In both scenarios, the motor and brake are therefore subjected to additional loading. The response time becomes noticeably longer as the size of the brakes increases. A reduction in response time is therefore especially recommended for medium and large-sized brakes as well as with a high frequency of braking operations. A relatively simple electrical solution is possible using the principle of ‚overexcitation'. In this instance, the solenoid is briefly supplied with twice the nominal voltage when switched on.
The response time is decreased to approximately half by comparison with 'normal excitation' as a result of the associated steeper rise of the current. This overexcitation function is integrated in the MSG special rectifier (see section brake connection).
As the air gap gets larger, the release current and therefore the response time increase. As soon as the release current exceeds the nominal coil current, the brake no longer releases during normal excitation and the brake disc wear limit is reached.

4.1.2 Braking

The braking torque is not effective immediately after the power supply to the solenoid is switched off. Firstly, the magnetic energy has to reduce until the spring force can overcome the magnetic force. This occurs at holding amperage I_{Hold} which is far smaller than the release current. Dependent on the circuit design, different response times result.

4.1.2.1 Switching off the AC supply of the standard rectifier SG

a) Rectifier supply from the motor terminal board (Figure 3, graph 1)
   Response time t_{A1}: very long
   Cause: after the motor voltage is switched off, the remanence of the motor induces a slowly decaying voltage which continues to supply the rectifier and thus the brake. The magnetic energy of the brake solenoid declines relatively slowly through the freewheeling circuit of the rectifier.

b) Separate rectifier supply (Figure 3, graph 2)
Response time t_{A2}: long
Cause: after the rectifier voltage is switched off, the magnetic energy of the brake solenoid declines relatively slowly through the freewheeling circuit of the rectifier.

No significant shut-off voltages arise on the solenoid during an AC interruption.

4.1.2.2 Interruption in the DC switching circuit of the solenoid (Figure 3, graph 3)

a) By mechanical switch
- for separate supply from a DC control network or
- at the DC switching contacts (A2, A3) of the standard rectifier
Response time t_{A3}: very short
Cause: The magnetic energy of the brake solenoid is rapidly reduced by the arc developing at the switch.

b) Electronically
By use of a special rectifier, type ESG or MSG
Response time t_{A3}: short
Cause: the magnetic energy of the brake solenoid is reduced rapidly by a varistor integrated in the rectifier.

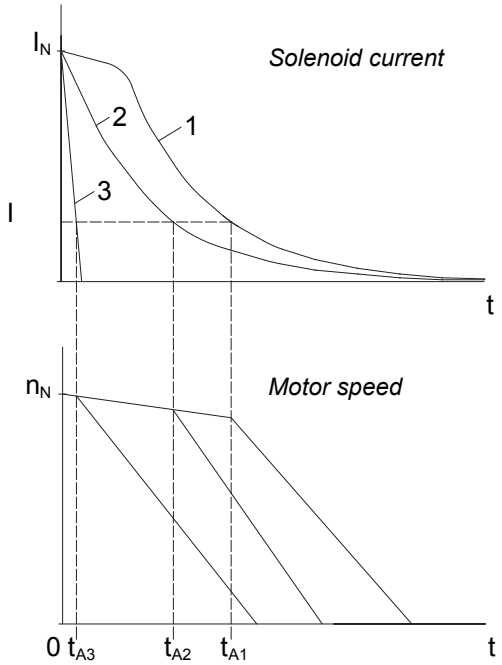


Figure 3: Development of the solenoid current and the motor speed after AC (1, 2) and DC (3) disconnection

With a DC interruption, voltage spikes u_q are induced through the solenoid the height of which depends on the following relationship between the self-inductance L of the coil and the cut-off speed di/dt:

$$u_q = L \cdot \frac{di}{dt}$$

As a consequence of the winding design, inductivity L increases as the solenoid rated voltage increases. With higher solenoid voltages, the cut-off voltage spikes may therefore be dangerously high. All brakes for voltages in excess of 24 V are therefore connected with a varistor.
The varistor serves only to protect the solenoid and not as protection for the surrounding electronic components and devices against electromagnetic compatibility interference.
On request, brakes for voltages of less than or equal to 24 V can also be produced with varistors.

If the direct current interruption is produced by a mechanical switch, high levels of burn down are caused by the arc produced on the switch contacts. Only special DC direct current contactors or adapted AC alternating current contactors can be used with contacts of usage category AC3 as defined in EN 60947-4-1.

5 Fitting

Generally, the spring-loaded brakes are mounted ready for operation on the motor. Proceed as follows for retrofitting (see Figure 1):

5.1 Fit carrier (6) to the shaft, pay attention to the total supporting length of the keys and fix axially with a retaining ring.

5.2 Push friction plate (4) with both seals (9) and brake disc (1) onto the carrier manually. Ensure that the gearing moves easily.
Do not damage !
Observe the correct installation position of the friction plate (4):Side with engraved marking "Reibseite" (friction side) facing toward brake disc (1).

5.3 Secure the brake (4) using the fillister screws (5) and the USIT rings (10) over the friction plate and both seals (9) on the end shield of the motor. Observe starting torque, $M_A = 2.5$ Nm.

5.4 For motor types without a second shaft end, fit a closure cap (11) and for motor types with a second shaft end, fit a shaft sealing ring (12).

The brake is ready for operation once the electrical connection has been made.

6 Setting the braking torque

Different braking torques can be obtained with a different spring configuration in the magnet housing (see paragraph 8).
Request the relevant set of springs from the factory, specifying the brake type and the required braking torque setting.

Procedure for changing the spring configuration (see Figure 1):

6.1 Remove brake from the motor end shield.

6.2 Remove fastening screws (5).

6.3 Unscrew the shoulder screws (15) from the magnet housing (8) and remove the retaining plate (2).

Attention:
The springs (3) press against the retaining plate. To remove the shoulder screws, the retaining plate must be pressed against the magnet housing to avoid releasing the springs too quickly. Observe the installation position of the retaining plate and make sure that no springs fall out.

6.4 Insert springs (3) according to desired braking torque (see paragraph 8).

Attention:
The springs should be arranged **symmetrically**.

6.5 Place the retaining plate (2) on the magnet housing (8) or springs (3) (observe installation position, if necessary use fastening screws (5) as centring assistance), press the retaining plate down against the spring force and screw in the shoulder screws (15) to the stop.

6.6 Secure the brake using the fastening screws (5) and USIT rings (10) above the friction plate (4) and both seals (9) on the end shield of the motor. Observe starting torque, $M_A = 2.5$ Nm.

7 Maintenance

The E003B and E004B brakes are to a large extent maintenance-free, since a very long service life is obtained by the durable and wear resistant brake discs. However, if the brake disc becomes worn due to high total friction and the function of the brake is therefore no longer guaranteed, replacing the brake disc will restore the brake to its original condition.
The state of wear of the brake disc should be checked regularly by measuring the brake disc thickness. This must not fall below the limit value indicated in paragraph 8.
Procedure for checking the state of wear and for replacing the brake disc (see Figure 1)

7.1 Remove brake from the motor end shield.
7.2 Remove fastening screws (5).
7.3 Clean brake. Remove abrasion material using compressed air.
7.4 Remove brake disc (1) from the carrier (6).
7.5 Measure the thickness of the brake disc. At the latest, the brake disc is to be replaced when it reaches the minimum thickness indicated in paragraph 8
7.6 Check retaining plate (2) for wear and parallelism (there should be no significant grooving). Replace retaining plate if necessary (proceed as described in paragraph 6.3 and 6.5).
7.7 Push brake disc (1) onto carrier (6) and check for radial play. If there is increased play in the gear teeth between the carrier and brake disc, the carrier must be removed from the shaft and replaced.
7.8 Secure the brake using the fastening screws (5) and USIT rings (10) over the friction plate (4) and both seals (9) on the end shield of the motor. Observe starting torque M_A = 2.5 Nm.

8 Technical data

Type	**M_N** [Nm]	**NS**	**W_{max}** [*10 ^{3}J]	**W_{th}** [*10 ^{3}J]	**W_L** [*10 ^{6}J]	**t_A** [ms]	**t_{AC}** [ms]	**t_{DC}** [ms]	**d_{min}** [mm]	**P_{el}** [W]
E003B9	3	4	1,5	36	55	35	150	15	5,85	20
E003B7	2,2	3	1,8	36	90	28	210	20	5,75	20
E003B4	1,5	2	2,1	36	140	21	275	30	5,6	20
E004B9	5	4x red	2,5	60	50	37	125	15	5,87	30
E004B8	4	4x grey	3	60	100	30	160	18	5,75	30
E004B6	2,8	4x yellow	3,6	60	180	23	230	26	5,55	30
E004B4	2	2x grey	4,1	60	235	18	290	37	5,4	30
E004B2	1,4	2x yellow	4,8	60	310	15	340	47	5,2	30

Explanation of abbreviations

M_N Nominal braking torque.
This value is only reached when the brake disc has been run in for a certain period and may then deviate by approximately -10 / +30% depending on the operating temperature and the state of wear of the frictional partner.

NS Number of springs
Because different springs can be used for the E004B, the colour of the relevant springs must also be specified here.

W_{max} Maximum permissible switching energy for a single braking operation.The switching energy W_{Br} of a braking operation is calculated as follows:

$$W_{Br} = \frac{J \cdot n^2}{182,5}$$

J - mass moment of inertia [kgm ^{2}] of the overall system related to the motor shaft
n - motor speed [rpm] which is to be braked

W_{th} Maximum permissible switching energy per hour

W_L Maximum permissible switching until replacement of the brake disc

t_A Response time when releasing with normal excitation.
Overexcitation by the MSG special rectifier results in response times that are approximately half as long.

t_{AC} Response time when braking with alternating current isolation, i.e. by interruption of the power supply of a separately fed standard rectifier

t_{DC} Response time when braking with direct current interruption by mechanical circuit breaker.
Electronic direct-current interruption by a special rectifier (type ESG or MSG) results in response times that are approximately twice as long.

Dependent on the operating temperature and the state of wear of the brake disc, the actual response times (t_A, t_{AC}, t_{DC}) can deviate from the guide values indicated here.

d_{min} Minimum permissible thickness of the brake disc

P_{el} Electrical power consumption of the solenoid at 20° C

Spring-loaded brakes with DC solenoid release
Models E../Z..008B, Z..015B, E../Z..075B, Z..100B

1 Safety information

Connection, adjusting and maintenance work may only be carried out taking into account the safety information on pages 3/4.

2 General information

In addition to holding loads in the idle state, the spring-loaded brake slows rotating and linear moving masses, thus reducing unwanted overtravel distances and times.
The brake is released electromagnetically. In the de-energized state, braking force is applied by spring pressure. Because the retardation effect is still effective even if an unforeseen power failure occurs, it can be considered to be a safety brake within the context of accident prevention regulations.
During the braking process, the kinetic energy of the mass moments of inertia is transformed into heat via the brake discs. The brake discs consist of high-quality, asbestos-free material and are particularly resistant to abrasion and heat. A certain amount of wear is, however, unavoidable. For this reason, the limit values specified in paragraph 9 regarding the working capacity and the minimum lining thickness are to be strictly observed.

3 Operating principle

The operating principle is explained using the twin-disc spring-loaded brake shown in Figure 1 (series Z).

3.1 Braking

The brake discs (1) are pressed through pressure plate (2) by springs (3) axially against intermediate plate (4) and centring flange (5). A radial movement of the pressure plate and the intermediate plate is prevented by parallel pins (6). The braking torque is transferred to the rotor via gear teeth connecting the brake discs and the carrier (7) fixed to the shaft. The braking torque can be modified in stages by increasing or decreasing the number of springs (see paragraph 7).

3.2 Brake release

Supplying the coil (8) with the correct DC voltage causes the pressure plate to be attracted by the magnetic field generated in the magnet housing (9) against the spring force. The rotor can thus move freely as a result of the force being relieved from the brake discs.
The increased air gap s_L caused by the wear to the brake discs can be overcome thanks to the generous dimensioning of the electromagnets. No adjustment facility is hence provided.
E series single-disc spring-loaded brakes are similar to the double-disc brake described here in their design and function. The absence of the intermediate plate and one brake disc constitute the difference.

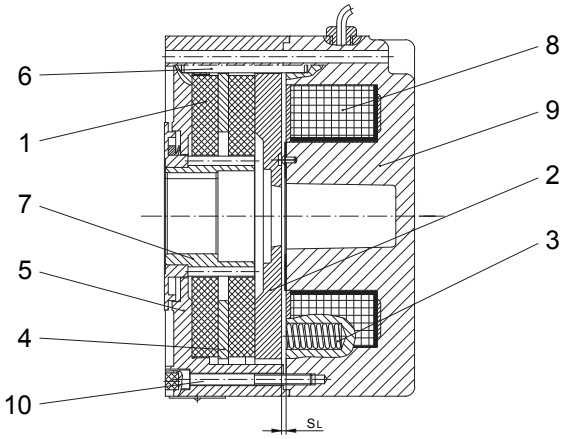


Figure 1: Z.. series double-disc spring-loaded brakes

3.3 Further design options

Starting from the variant shown in Figure 1, all brakes can be additionally equipped with the following options:

- Terminal box
  Contains either a rectifier or a terminal, according to whether the power is supplied from an AC source or directly from a DC source.
- Manual release, latching/non-latching
  Allows the brake to be released mechanically, e.g. in the event of a power failure (see section manual release spring loaded brake with direct current solenoid models E../Z..008B, Z..015B, E../Z..075B,Z100B).

4 Electrical connection

4.1 General information

There are 2 different options for the voltage supply of the DC solenoid:
1. Externally from an existing DC control power supply, or from a rectifier in the control cabinet.
2. From a rectifier built into the motor terminal box or brake terminal box.
In this instance, the rectifier can be supplied either directly from the motor terminal board or from the mains.
In the following instances, the rectifier must not however be connected to the motor terminal board:

- Pole-changing motors and wide range motors
- Operation with frequency converter
- Other designs in which the motor voltage is not constant, e.g. operation on smooth-start equipment, starting transformers, ...

4.1.1 Brake release

If the solenoid is energised using nominal voltage, the coil current and the magnetic field build up follow an exponential function. Only when the power has achieved a specific value (I_{Rel}) is the spring force overcome and the brake begins to release.

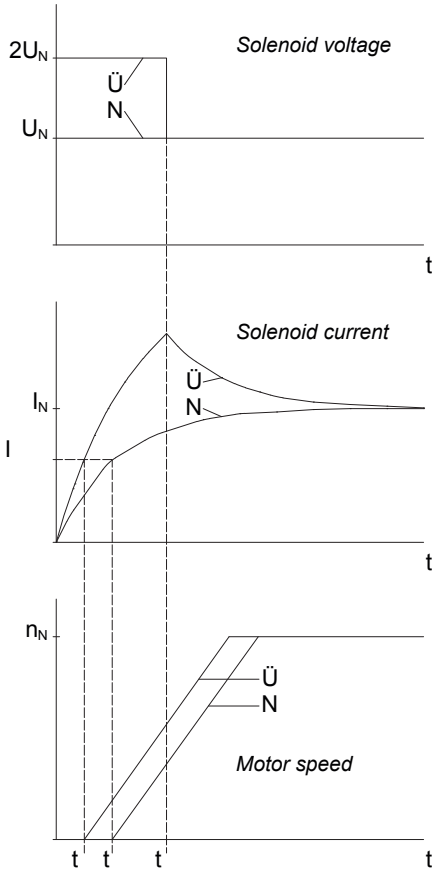


Figure 2: Solenoid voltage, solenoid current and motor speed development at normal excitation (N) and overexcitation (Ü).
$t_Ü$: overexcitation period; t_{AN}, $t_{AÜ}$: response times at normal excitation and overexcitation

Two different cases can occur during response time t_A, assuming the power is supplied to the motor and the brake at the same time:

- Motor is blocked - condition: $M_A < M_L + M_{Br}$
  The motor takes the inrush current and is thereby subjected to additional thermal loading.
  This scenario is shown in Figure 2.
- Motor tears away from brake - condition: $M_A > M_L + M_{Br}$
  At the start, the brake is subject to thermal loading and wears more rapidly.

M_A: starting torque of the motor, M_L: load torque, M_{Br}: braking torque

In both scenarios, the motor and brake are therefore subjected to additional loading. The response time becomes noticeably longer as the size of the brakes increases. A reduction in response time is therefore especially recommended for medium and large-sized brakes as well as with a high frequency of braking operations. A relatively simple electrical solution is possible using the principle of ‚overexcitation'. In this instance, the solenoid is briefly supplied with twice the nominal voltage when switched on.
The response time is decreased to approximately half by comparison with 'normal excitation' as a result of the associated steeper rise of the current. This overexcitation function is integrated in the MSG special rectifier (see brake connection).
As the air gap gets larger, the release current and therefore the response time increase. As soon as the release current exceeds the nominal coil current, the brake no longer releases during normal excitation and the brake disc wear limit is reached.

4.1.2 Braking

The braking torque is not effective immediately after the power supply to the solenoid is switched off. Firstly, the magnetic energy has to reduce until the spring force can overcome the magnetic force. This occurs at holding amperage I_{Hold} which is far smaller than the release current. Dependent on the circuit design, different response times result.

4.1.2.1 Switching off the AC supply of the standard rectifier SG

a) Rectifier supply from the motor terminal board (Figure 3, graph 1)Response time t_{A1}: very long
   Cause: after the motor voltage is switched off, the remanence of the motor induces a slowly decaying voltage which continues to supply the rectifier and thus the brake. The magnetic energy of the brake solenoid declines relatively slowly through the freewheeling circuit of the rectifier.

b) Separate rectifier supply (Figure 3, graph 2)
Response time t_{A2}: long
Cause: after the rectifier voltage is switched off, the magnetic energy of the brake solenoid declines relatively slowly through the freewheeling circuit of the rectifier.

No significant shut-off voltages arise on the solenoid during an AC interruption.

4.1.2.2 Interruption in the DC switching circuit of the solenoid (Figure 3, graph 3)

a) By mechanical switch
- for separate supply from a DC control network or
- at the DC switching contacts (A2, A3) of the standard rectifier
Response time t_{A3}: very short
Cause: The magnetic energy of the brake solenoid is rapidly reduced by the arc developing at the switch.

b) Electronically
By use of a special rectifier, type ESG or MSG
Response time t_{A3}: short
Cause: the magnetic energy of the brake solenoid is reduced rapidly by a varistor integrated in the rectifier.

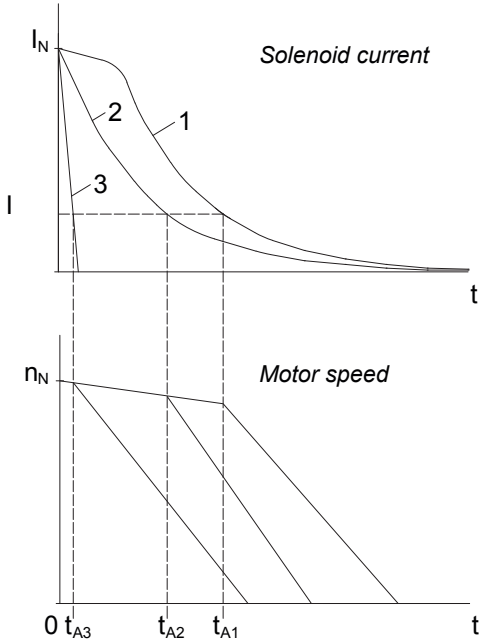


Figure 3: Development of the solenoid current and the motor speed after AC (1, 2) and DC (3) disconnection

With a DC interruption, voltage spikes u_q are induced through the solenoid the height of which depends on the following relationship between the self-inductance L of the coil and the cut-off speed di/dt:

$$u_q = L \cdot \frac{di}{dt}$$

As a consequence of the winding design, inductivity L increases as the solenoid rated voltage increases. With higher solenoid voltages, the cut-off voltage spikes may therefore be dangerously high. All brakes for voltages in excess of 24V are therefore connected with a varistor.
The varistor serves only to protect the solenoid and not as protection for the surrounding electronic components and devices against electromagnetic compatibility interference.
On request, brakes for voltages of less than or equal to 24 V can also be produced with varistors.

If the direct current interruption is produced by a mechanical switch, high levels of burn down are caused by the arc produced on the switch contacts. Only special DC direct current contactors or adapted AC alternating current contactors can be used with contacts of usage category AC3 as defined in EN 60947-4-1.

5 Fitting

Generally, the spring-loaded brakes are installed ready for operation on the motor.
If they are to be retrofitted, first heat the carrier (7 in Figure 1) to approximately 80° C and push it onto the extended shaft extension of the rotor.
The brake can now be pushed on and fastened by tapping softly onto the centring carrier on the fan cowl or onto the end shield of the motor. The fastening screws are to be secured against loosening by suitable washers.
The brake is ready for operation once the electrical connection has been made.

6 Air gap

The wear arising in the course of operation on the brake discs only results the air gap increasing and not in any substantial reduction of the braking torque.
When the air gap increases, slightly higher response times are to be expected on brake release.
To ensure the continued perfect function of the brake, the maximum values given in paragraph 9 for the air gap and the minimum values for the brake disc thickness must be maintained. At the latest, the brake discs must be replaced when these limit values are reached (see paragraph 8.2).

6.1 Monitoring wear

The state of wear is to be checked regularly.
There are two different options for doing this:

6.1.1 Measuring the air gap

- Disassemble the brake from the motor
- Remove the labyrinth seals from centring flange (5 in Figure 1).
- Place the brake with the magnet housing (9 in Figure 1) facing down on a smooth surface.

When the brake is released, the pressure plate (2 in Figure 1) moves down by the value of the current air gap (s_L). The air gap can thus be determined as the difference between

- the distance of the pressure plate from the surface of the centring flange in the released state (switched on electrically) and
- the distance of the pressure plate from the surface of the centring flange in the braked state (switched off electrically)

Measurement is to be carried out using a depth gauge.

With model E../Z..075 and Z..100 brakes with manual release, the air gap can also be determined without disassembling the brake by the difference between

- the distance of the manual release ring from the magnet housing in the released state (switched on electrically) and
- the distance of the manual release ring from the magnet housing in the braked state (switched off electrically)

(see Figure 12). In order to avoid incorrect measurements, the final coating in the area of the measuring point should be removed.

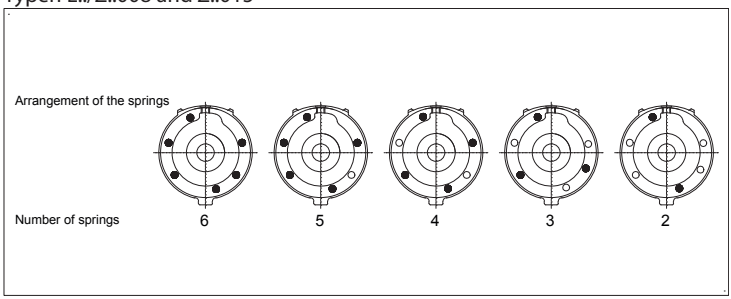
6.1.2 Measuring the brake disc thickness

The brake must be disassembled as described in paragraph 8.1 to allow this.

7 Setting the braking torque

The braking torque can be changed in steps by the number of springs. The springs, as seen in picture 14, must be arranged symmetrically. To reduce the noise level when opening the brake, the springs can be arranged asymmetrically. In this case an increased wear is expected which leads to a reduction in the lifetime of the brake.
The spring configuration permitted dependent on brake type is listed along with the appropriate braking torque in paragraph 9.

Typen E../Z..008 and Z..015



Typen E../Z..075 and Z..100

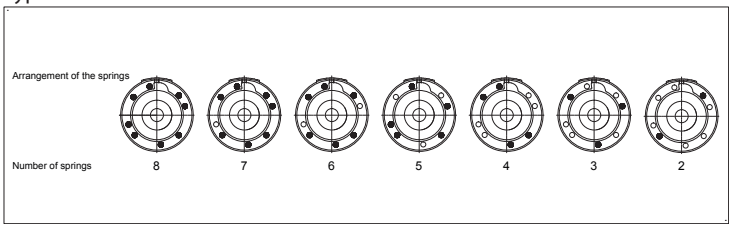


Figure 14: Arrangement of springs in partial assembly

8 Maintenance

8.1 Measuring the brake disc thickness

As indicated in paragraph 6.1, in addition to the option of monitoring wear via the air gap, there is also the option to check the state of wear by measuring the brake disc thickness. To do this, the brake must be dismantled (see also Figure 1):

a) Disconnect motor and brake from the mains. Disconnect supply line on brake.
b) Unscrew fastening screws between brake and motor. Remove brake from fitting by tapping lightly with the hand.
c) The carrier (7) remains on the motor shaft.
d) Unscrew screws (10). Disassemble brake.
e) Clean brake. Remove abrasion material.
f) Measure the thickness of the brake disc(s) (1). At the latest, the brake discs must be replaced (see paragraph 9) when they reach the minimum thickness indicated in paragraph 8.2 .

8.2 Replacing the brake discs

See also Figure 1.

a) as for a) – e) in accordance with paragraph 8.1.
b) Check remaining frictional partners – pressure plate (2), centring flange (5) and on double-disc brakes from the Z series, the intermediate plate (4) for parallelism and wear (slight groove formation may be present), replace, together with the brake discs (1), if necessary.
c) Reassemble brake correspondingly.

With new brake discs and frictional partners, the original braking torque is only achieved after a certain run-in period.

Attention:
With model E../Z..075 and Z..100 brakes with manual release, the manual release ring should not be adjusted during maintenance (see Figure 12).
If this becomes necessary because of cleaning or the replacement of the pressure plate, the axial latch must first be released at the fillister screw. Then the manual release ring can be screwed out anticlockwise. When refitting, the manual release ring is to be turned clockwise until it grips firmly. The manual release ring must then be turned back by at least 2 and no more than 3 turns from the stop and latched using the fillister screw in the bore in the magnet housing.
The manual release ring is not to be used to adjust the air gap.

9 Single-disc brake technical data

Type	M_N [Nm]	NS	W_{max} [*10³J]	W_{th} [*10³J]	W_L [*10⁶J]	t_A [ms]	t_{AC} [ms]	t_{DC} [ms]	s_{Lmax} [mm]	d_{min} [mm]	P_{el} [W]
E..008B9	10	6x blue	50	250	60	90	60	10	1,0	9,5	30
E..008B8	8	5x blue	50	250	100	90	60	10	1,3	9,2	30
E..008B6	6,5	4x blue	50	250	140	85	65	10	1,6	8,9	30
E..008B5	5	3x blue	50	250	180	75	100	15	1,9	8,6	30
E..008B4	3,5	2x blue	50	250	220	60	150	25	2,2	8,3	30
E..008B2	2,5	4x red	50	250	250	45	190	30	2,4	8,1	30
E..075B9	70	8	100	600	600	200	150	20	1,8	12,9	110
E..075B8	63	7	100	600	950	200	150	20	2,5	12,2	110
E..075B7	50	6	100	600	1200	180	150	20	3,0	11,7	110
E..075B6	42	5	100	600	1500	160	150	20	3,5	11,2	110
E..075B5	33	4	100	600	1500	140	240	20	3,5	11,2	110
E..075B4	25	3	100	600	1500	120	350	20	3,5	11,2	110
E..075B2	19	2	100	600	1500	90	450	25	3,5	11,2	110

Double-disc brake technical data

Type	MN	ZF	W_{max}	W_{th}	W_L	t_A	t_{AC}	t_{DC}	s_{Lmax}	d_{min}	P_{el}
	[Nm]		[*10^{3}J]	[*10^{3}J]	[*10^{6}J]	[ms]	[ms]	[ms]	[mm]	[mm]	[W]
Z..008B9	20	6x blue	50	250	60	90	60	10	1,0	9,8	30
Z..008B8	16	5x blue	50	250	100	90	60	10	1,3	9,6	30
Z..008B6	13	4x blue	50	250	140	85	65	10	1,6	9,5	30
Z..008B5	10	3x blue	50	250	180	75	100	15	1,9	9,3	30
Z..008B4	7	2x blue	50	250	220	60	150	25	2,2	9,2	30
Z..015B9	40	6	50	350	470	90	80	10	1,8	9,4	45
Z..015B8	34	5	50	350	580	90	80	10	2,1	9,2	45
Z..015B6	27	4	50	350	690	90	100	15	2,4	9,1	45
Z..015B5	22	3	50	350	800	85	120	15	2,7	8,9	45
Z..015B4	16	2	50	350	880	70	140	15	2,9	8,8	45
Z..075B9	140	8	100	600	600	200	150	20	1,8	13,5	110
Z..075B8	125	7	100	600	950	200	150	20	2,5	13,2	110
Z..075B7	105	6	100	600	1200	180	150	20	3,0	12,9	110
Z..075B6	85	5	100	600	1500	160	150	20	3,5	12,7	110
Z..075B5	65	4	100	600	1500	140	240	20	3,5	12,7	110
Z..075B4	50	3	100	600	1500	120	350	20	3,5	12,7	110
Z..075B2	38	2	100	600	1500	90	450	25	3,5	12,7	110
Z..100B9	200	8	150	700	1500	290	800	50	3,4	14,7	120
Z..100B8	185	7	150	700	1600	280	800	50	3,5	14,6	120
Z..100B7	150	6	150	700	1600	250	800	50	3,5	14,6	120
Z..100B6	125	5	150	700	1600	230	800	50	3,5	14,6	120
Z..100B5	100	4	150	700	1600	200	900	50	3,5	14,6	120
Z..100B4	80	3	150	700	1600	170	1200	60	3,5	14,6	120
Z..100B2	60	2	150	700	1600	140	1400	80	3,5	14,6	120

Explanation of abbreviations

M_N Nominal braking torque.
This value is only reached when the brake disc has been run in for a certain period and may then deviate by approximately -10 / +30% depending on the operating temperature and the state of wear of the frictional partner.

NS Number of springs.
Since different springs can be used with the models E../Z..008, the colour of the relevant spring is also to be indicated here.
If an excessive or overly low braking torque was obtained during the braking torque inspection carried out at the works with the spring assembly, the actual number of springs can deviate in individual cases from the values indicated here.

W_{max} Maximum permissible switching energy for a single braking operation.
The switching energy W_{Br} of a braking operation is calculated as follows:

$$W_{Br} = \frac{J \cdot n^2}{182{,}5}$$

J - mass moment of inertia [kgm^2] of the overall system related to the motor shaft
n – motor speed [rpm] which is braked

W_{th} Maximum permissible switching energy per hour

W_L Maximum permissible switching until replacement of the brake discs

t_A Response time when releasing with normal excitation.
Overexcitation by the MSG special rectifier results in response times that are approximately half as long.

t_{AC} Response time when braking with alternating current switch-off, i.e. by interrupting the power supply of a separately fed standard rectifier

t_{DC} Response time when braking with direct current interruption by mechanical circuit breaker.
Electronic direct-current interruption by a special rectifier (type ESG or MSG) results in response times that are approximately twice as long.

Dependent on the operating temperature and the state of wear of the brake discs, the actual response times (t_A, t_{AC}, t_{DC}) can deviate from the guide values indicated here.

s_{Lmax} Maximum permissible air gap

d_{min} Minimum permissible thickness of the brake discs.
With Z series double-disc brakes, this value applies for each of the two brake discs.

P_{el} Electrical power consumption of the solenoid at 20° C

Brake connection: special rectifier ESG 1.460A

1 Via special rectifier ESG 1.460A

Rectifier technical data

Operating principle	Half-wave rectifier with electronic direct current interruption
Supply voltage U_1	220 - 460 V AC ±5% , 50/60 Hz
Output voltage	0.45 * U_1 V DC
Maximum output current	1 A DC
Ambient temperature	-20°C to 40°C
Possible conductor cross-sections	maximum 1.5 mm^2

The blue conductor routed out of the casing must be connected to PE to activate the integrated high-speed switch-off function.
As this conductor is coupled to the supply voltage with high impedance, leakage currents of up to a maximum of 2 mA may flow, depending on the voltage level.

When operating on unearthed networks, the blue conductor is to be connected with the right alternating current voltage contact (N) of the ESG. If the rectifier is supplied from the motor terminal board in this case, an increase in the response time on shut-down is to be anticipated.

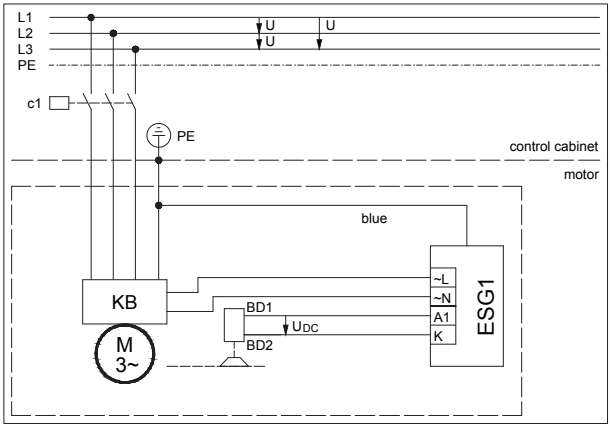
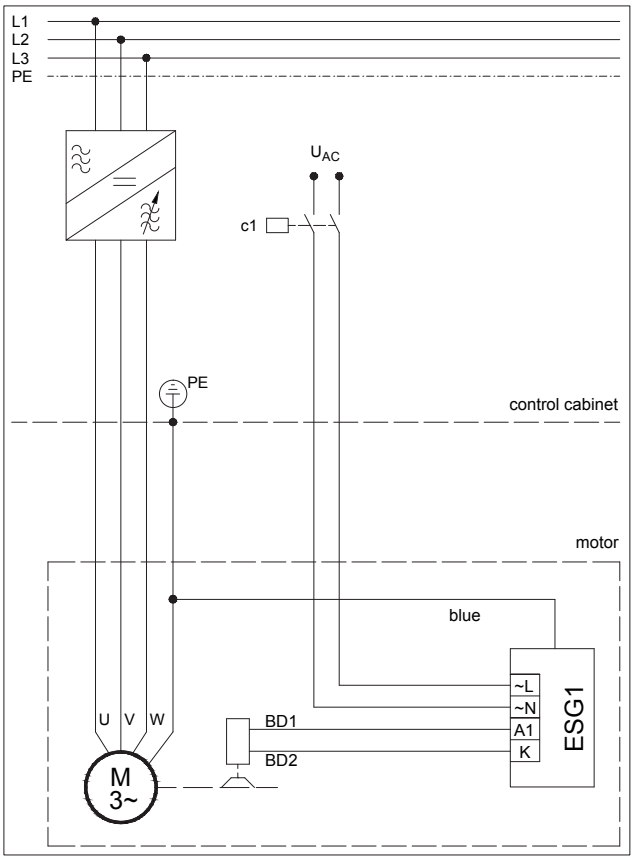


Figure 8: Rectifier voltage supply from the motor terminal board Voltage connection for the rectifier from the motor terminal block or cage clamp (see Rectifier Connection on Motor Terminal Block or Cage Clamp)



Picture 8a: Separate voltage supply of the rectifier, e.g. for usage on frequency inverter

Brake connection: DC voltage supply

If the brake is supplied directly from a DC control power supply.

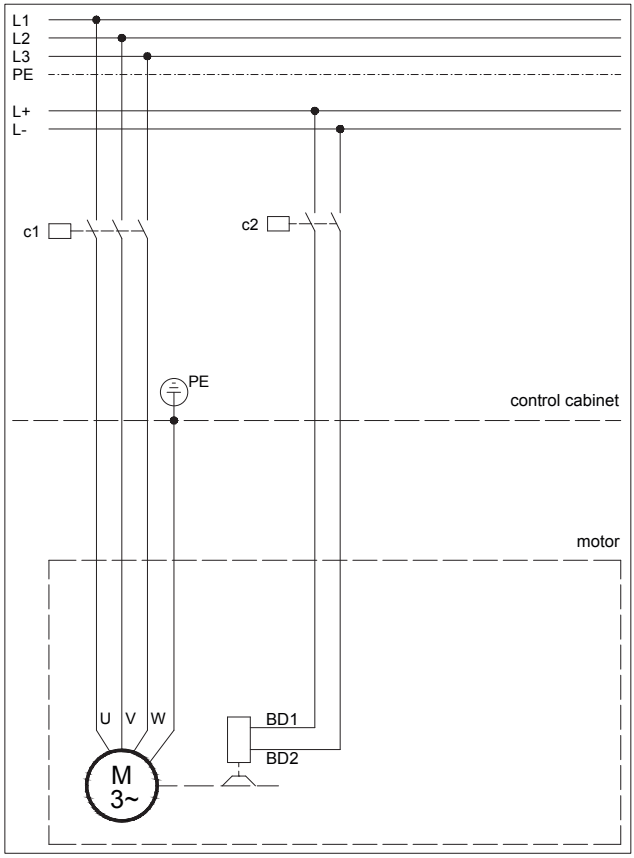


Figure 4: Direct DC power supply from a control network

Brake connection: special rectifier MSG...I

Rectifier technical data MSG 1.5.480I

Operating principle	Half-wave rectifier with time-limited overexci tation and electronic direct current interruption Quick switch-off due to absence of motor current in a phase.
Operating voltage U_1	220 - 480 V AC +6/-10%, 50/60 Hz
Output voltage	0.9 * U_1 V DC during overexcitation 0.45 * U_1 V DC after overexcitation
Overexcitation period	0.3 s
Maximum output current	1,5 A DC
Ambient temperature	-20°C to 40°C
Possible conductor cross-sections	maximum 1.5 mm^2

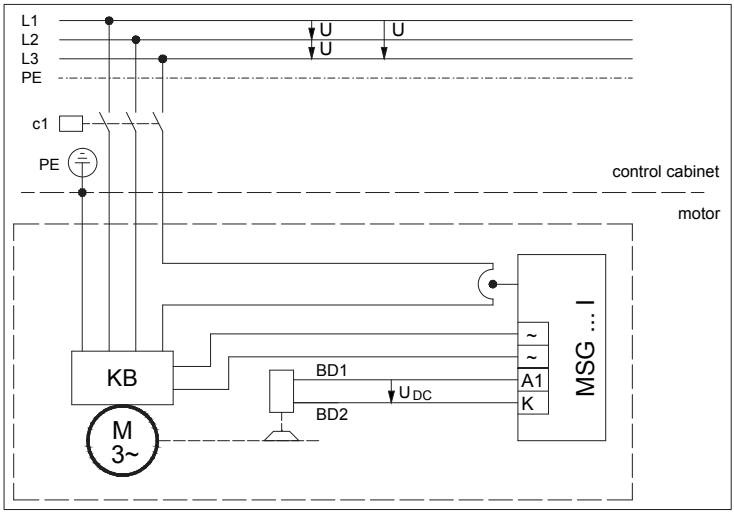
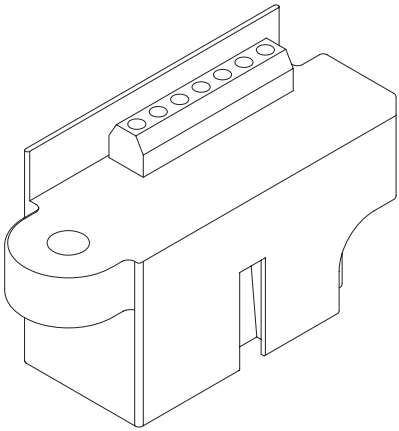


Figure 10: Voltage connection for the rectifier from the motor terminal block or cage clamp (see Rectifier Connection on Motor Terminal Block or Cage Clamp)

To enable the current monitoring, one of the leads of the supply cable must be passed through the current sensor on the side of the rectifier. As the current sensing has a lower threshold, the lead must be passed through the sensor twice if the motor no-load current is lower than 0,4A. In this case a sticker with the number "2" is on the rectifier underneath the sensor itself. The maximum constant current of the sensor is 64A.

Caution:
It is imperative for the correct functioning of the rectifier that a motor lead is passed through the sensor. If not, the rectifier will not switch on and in the worst case can be permenantly damaged.



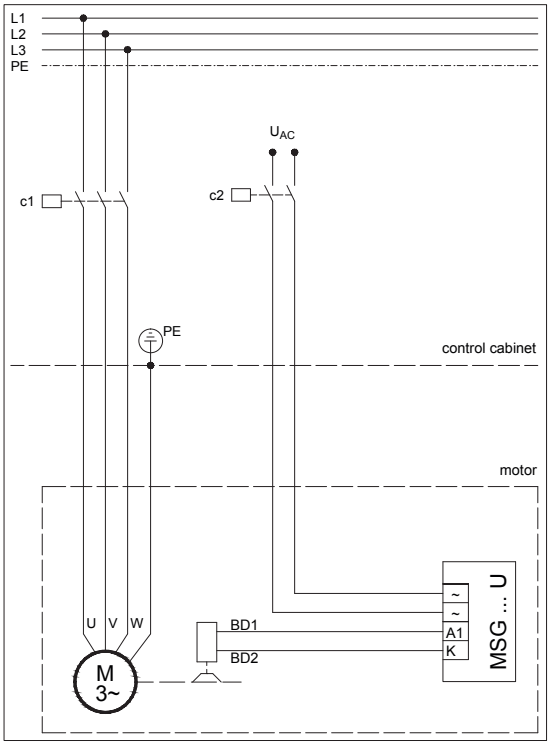
The diameter of the sensor bore for passing the leads through is 7mm. The diameter of the leads of the motor connection cable must therefore not exceed the following values:

max. lead diameter:	6,7 mm for 1 passthrough
	3,2 mm for 2 passthroughs

Brake connection: special rectifier MSG...U

Rectifier technical data MSG 1.5.500U

Operating principle	Half-wave rectifier with time-limited overexci tation and electronic direct current interruption Quick shut-down due to absence of input voltage.
Operating voltage U_1	220 - 500 V AC +/-10%, 50/60 Hz
Output voltage	0.9 * U_1 V DC during overexcitation 0.45 * U_1 V DC after overexcitation
Overexcitation period	0.3 s
Maximum output current	1,5 A DC
Ambient temperature	-20°C to 40°C
Possible conductor cross-sections	maximum 1.5 mm^2



Picture 9: Separate voltage supply of the rectifier

Brake connection: standard rectifier SG 3.575A

Rectifier technical data

Operating principle	Half-wave rectifier
Supply voltage U_1	maximum 575 V AC +5%, 50/60 Hz
Output voltage	0.45 * U_1 V DC
Maximum output current	2 A DC when fitted in motor terminal box or brake terminal box 2.5 A DC when fitted in switch cabinet
Ambient temperature	-40°C to 40°C
Possible conductor cross-sections	max. 1.5 mm²

1 Rectifier voltage supply from the motor terminal board Voltage connection for the rectifier from the motor terminal block or cage clamp (see Rectifier Connection on Motor Terminal Block or Cage Clamp)

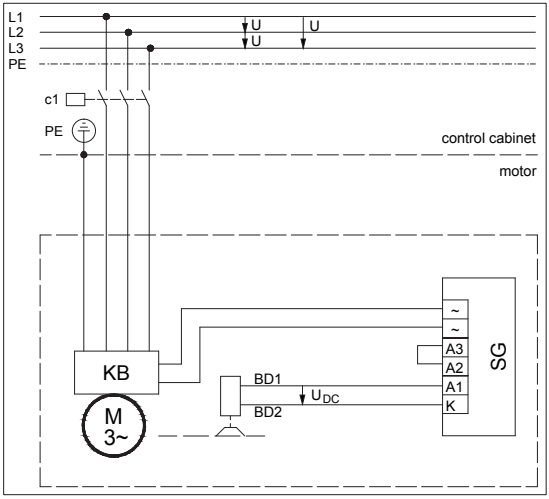


Figure 5: AC disconnection → Terminal A2 and A3 bridged

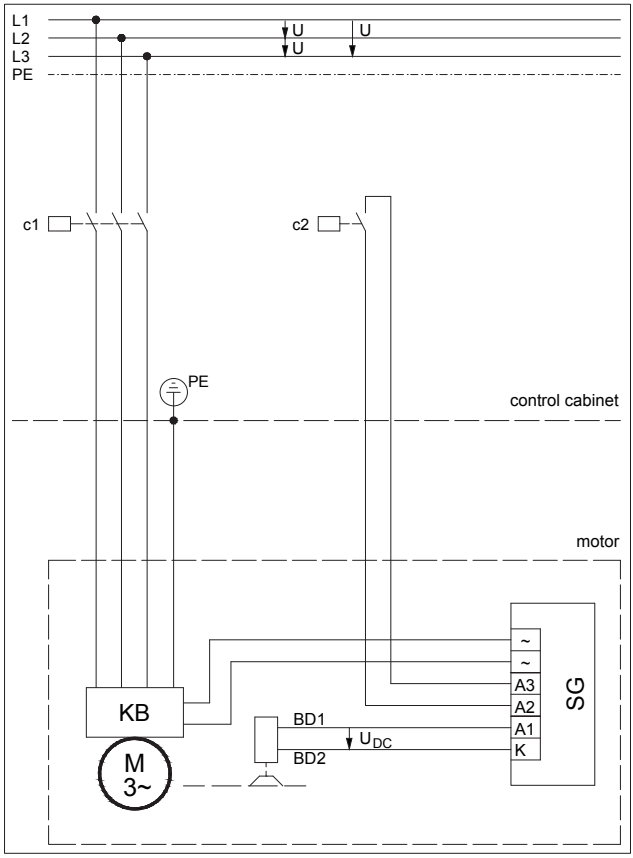


Figure 6: DC disconnection at terminals A2 and A3 e.g. via direction of rotation contactor via relay

2 Rectifier voltage supply via separate contactor

As described in paragraph 4.1, the rectifier may not be connected at the motor terminal board on all models with variable motor voltage or on pole changing motors. Instead, the input voltage of the rectifier must be connected through a separate contactor. The implementation principle when operating on the frequency inverter is shown in Figure 7 and 7a by way of example.

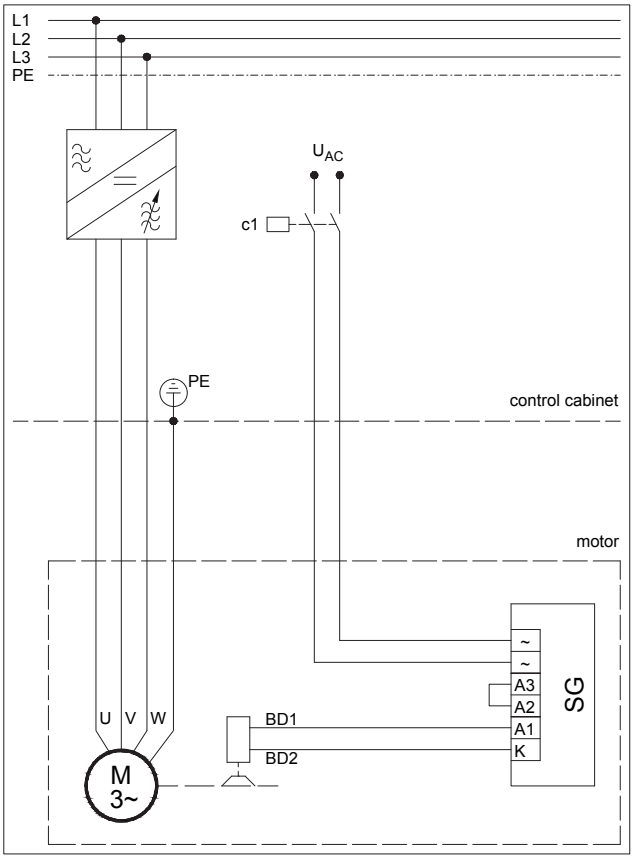
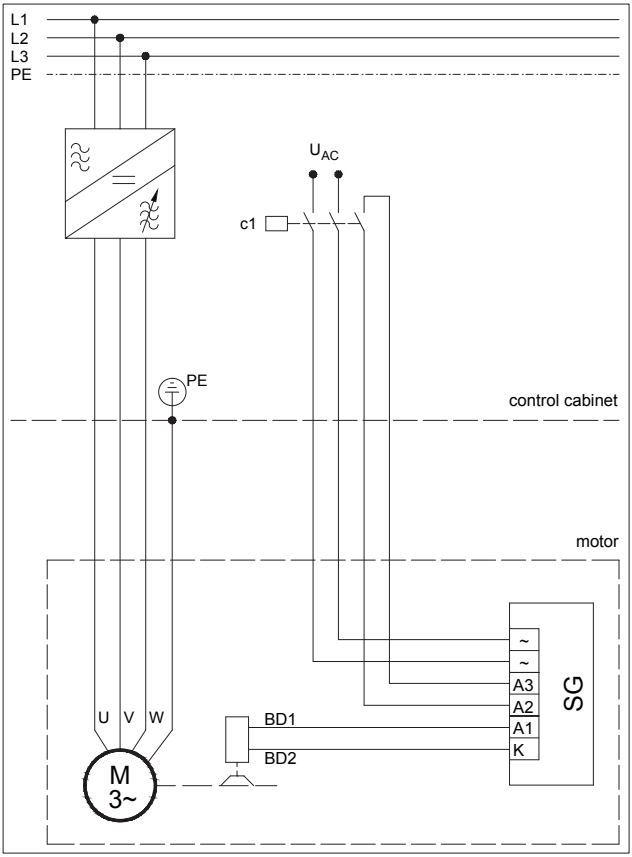
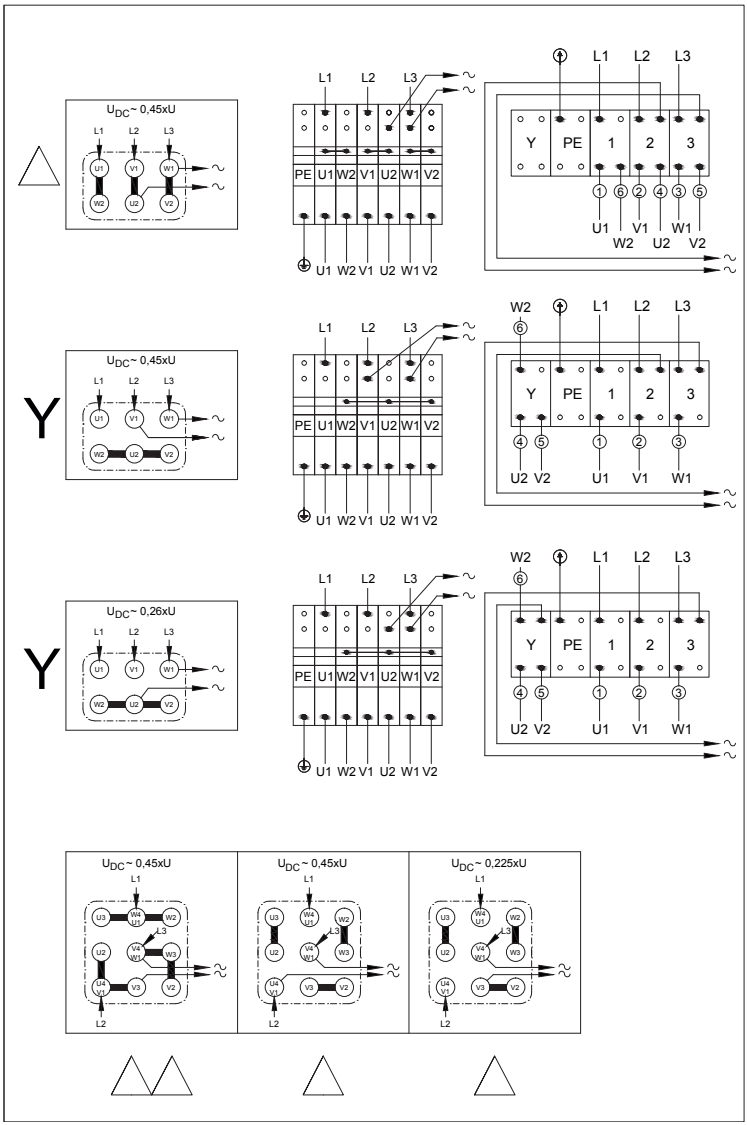


Figure 7: Separate voltage supply of the rectifier.
Alternating current switch-off → Terminals A2 and A3 bridged



Picture 7a: Separate voltage supply of the rectifier. DC side switching on the terminals A2 and A3 via relay.

Rectifier on motor terminal block or cage clamp



1 Assembly

The manual release can only be assembled with the rake removed.
Procedure (see Figures 1 and 12 in section spring loaded E003B and E004B):

1.1 Remove brake from the motor end shield.
1.2 Remove stopper plugs from the manual-release holes in the magnet housing (8).
1.3 Push compression springs (16) onto the manual-release bolts (17).
1.4 Push manual-release bolts (17) with compression springs (16) into the manual-release holes on the magnet housing (8) from the inside (in the direction of the coil (7)).
1.5 Push the O-rings (18) onto manual-release bolts (17) and push into the countersinks on the magnet housing (8).
1.6 Push spacer plates (19) onto the manual-release bolts (17).
1.7 Locate manual release bracket (13), push on washer (20) and screw on self-locking nut (21) loosely.
1.8 Tighten both lock nuts (21) until the retaining plate (2) is flush with the magnet housing (8).
1.9 With non-lockable manual release:
Unscrew both lock nuts (21) by 1.5 turns, thereby creating the air gap between the retaining plate (2) and magnet housing (8) and the test dimension X = 0.9 mm.
With latching manual release:
Unscrew both lock nuts (21) by 3 turns, thereby creating the test dimension X = 2 mm.
1.10 After fitting the fan cowl, screw the manual-release rod (14) into manual-release bracket (13) and tighten.

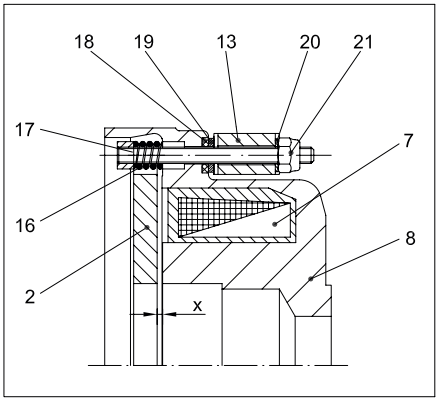


Fig 12: Assembly of the manual release

2 Function

The manual release bracket (13) is pressed by the compression springs (16) into the neutral position. The brake can be released by axial manipulation.
For the model with a latching manual release, the manual release bracket is fixed by screwing the manual release rod (14) into the appropriate bore in the brake housing with the brake released.
To release the latch, turn the manual release rod back again.

Manual release
Spring loaded brake with DC solenoid model E../Z..008B, Z..015B, E../Z..075B, Z..100B

On brakes with manual release, exceeding the wear limit results in a clear reduction in braking torque. For this reason, particular attention should be paid to regular and careful monitoring of wear (instruction brake paragraph 6.1) with this model.

1 Models E../Z..008 and Z..015

The manual release lever is pressed by a spring into the neutral position. The brake can be released by axial movement. For models with a latching manual release, the manual release bracket is secured by bracing the lever screw to an opposing surface on the brake housing while the lever screw is tightened when the brake is released.
Unscrew the lever screw to release the latch.

2 Models E../Z..075 and Z..100

2.1 Latching manual release

As shown in Figure 12, first unscrew the axial latch using the fillister screw, then place a screwdriver into a suitable bore on the perimeter of the manual release ring and turn it clockwise until a perceptible stop. The number of turns of the manual release ring must be counted.

To release the manual release, turn the manual release ring back from the stop through the same angle, but by a minimum of 2 turns (maximum 3 turns), and latch using the fillister screw. The filllister-head screw must enter axially into the bore of the magnet housing here.

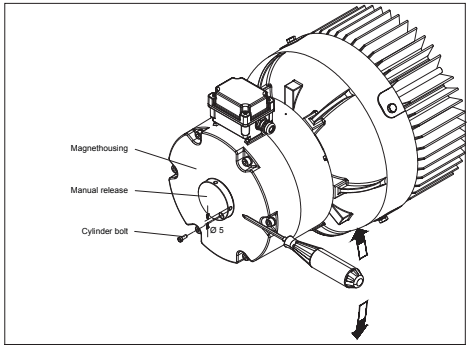


Figure 12: Brakes - models E../Z..075 and Z..100 - with latching manual release
Only the original fillister screw may be used since the brake's function could otherwise be impaired (observe screw length).
The manual release ring cannot be used to readjust the air gap.

2.2 Non-latching manual release

The pins of the U-shaped manual release bracket are to be latched into two diametrically positioned bores on the manual release ring (see Figure 13). To release, the bracket should be moved axially for a short distance without excessive application of force.

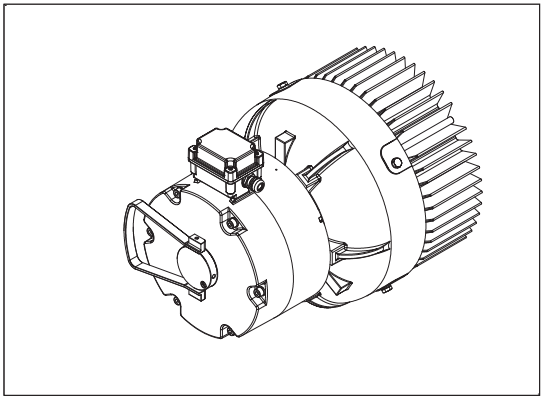


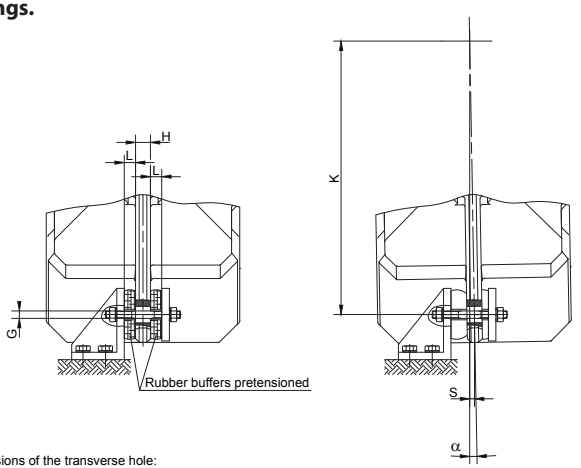
Figure 13: Brakes - models E../Z..075 and Z..100 - with non-latching manual release

The manual release bracket must be removed after use for normal operation in order to prevent obstruction of the release movement and unauthorized activation.

1. Installation of the rubber buffer.
The rubber buffers provided are to be fixed in accordance with the drawings N-BF-DST,
N-BK-DST or N-BS-DST and tightened to the pretension required.

2. As part of the specified maintenance intervals, the correct tensioning and conditions of the rubber buffers is to be checked and the same changed should faults be apparent. For dynamic applications, this proceedure must be performed independent from the standard intervals, every 3.000 hours machine usage.

Note:
Play in the rubber buffers can result in damage to the gearwheels and bearings.



Dimensions of the transverse hole:
see dimension sheet of the respective shaft mounted gearbox

T_2 = assigned gear torque
F = pressing force on the rubber buffers

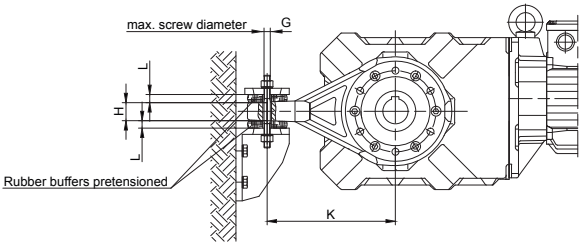
Gear	Pos. (see T 223)	T_2 (Nm)	K (mm)	F (N)	Pre-tensioning per rubber buffer (mm)	G	H (mm)	L (mm)	max.α (mm) (Not for rubber buffer)	max. way s (mm)
BF06	Pos.0	95	104	913	2.0	M8	10	10	2.5°	5
BF10	Pos.1	200	155	1290	2.2	M10	16	13.5	2.5°	7
BF20	Pos.1	350	190	1842	3.0	M10	18	13	2.5°	8
BF30	Pos.2	500	210	2381	2.5	M10	18	17	2.5°	9
BF40	Pos.2	780	242	3223	4.0	M10	20	16.5	2.5°	11
BF50	Pos.3	1200	270	4444	4.0	M18	24	21.5	2.5°	12
BF60	Pos.3	2150	340	6324	4.5	M18	28	21	2.5°	15
BF70	Pos.4	5200	377	13793	4.5	M20	30	25.5	2.5°	16
BF80	Pos.5	9500	445	21348	5.5	M20	40	30	2.5°	19
BF90	Pos.5	16800	555	30270	7.0	M20	50	29.5	2.5°	24

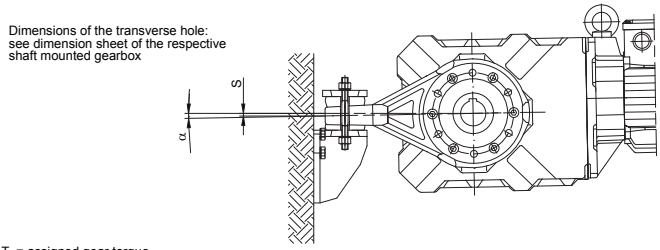
Gear units designed with torque arms and rubber buffers for series BK

1. Installation of the rubber buffer.
The rubber buffers provided are to be fixed in accordance with the drawings N-BF-DST,
N-BK-DST or N-BS-DST and tightened to the pretension required.

2. As part of the specified maintenance intervals, the correct tensioning and conditions of the rubber buffers is to be checked and the same changed should faults be apparent. For dynamic applications, this proceedure must be performed independent from the standard intervals, every 3.000 hours machine usage.

Note:
Play in the rubber buffers can result in damage to the gearwheels and bearings.





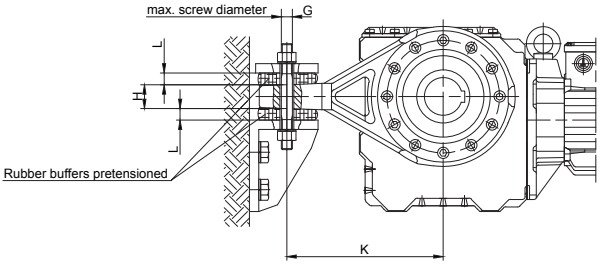
T_2 = assigned gear torque
F = pressing force on the rubber buffers

Gear	Pos. (see T 223)	T_2 (Nm)	K (mm)	F (N)	Pre-tensioning per rubber buffer (mm)	G	H (mm)	L (mm)	max. α (mm) (Not for rubber buffer)	max. way s (mm)
BK06	Pos.0	80	144	555	1.5	M8	10	10.5	2.5°	6
BK10	Pos.1	170	160	1063	1.5	M10	19	13.5	2.5°	7
BK20	Pos.1	280	180	1556	2.0	M10	19	13	2.5°	8
BK30	Pos.2	400	205	1951	3.0	M10	30	17	2.5°	9
BK40	Pos.2	680	250	2720	3.0	M10	30	17	2.5°	11
BK50	Pos.3	950	250	3800	3.5	M18	36	21.5	2.5°	11
BK60	Pos.3	2150	340	6324	4.0	M18	38	21	2.5°	15
BK70	Pos.4	5200	370	14054	4.5	M20	40	25.5	2.5°	16
BK80	Pos.5	10500	470	22340	5.0	M20	45	30	2.5°	21
BK90	Pos.5	16800	570	29474	5.5	M20	45	29.5	2.5°	25

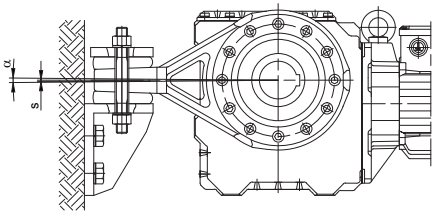
1. Installation of the rubber buffer.
The rubber buffers provided are to be fixed in accordance with the drawings N-BF-DST,
N-BK-DST or N-BS-DST and tightened to the pretension required.

2. As part of the specified maintenance intervals, the correct tensioning and conditions of the rubber buffers is to be checked and the same changed should faults be apparent. For dynamic applications, this proceedure must be performed independent from the standard intervals, every 3.000 hours machine usage.

Note:
Play in the rubber buffers can result in damage to the gearwheels and bearings.



Dimensions of the transverse hole:
see dimension sheet of the respective shaft mounted gearbox



T_2 = assigned gear torque
F = pressing force on the rubber buffers

Gear	Pos. (see T 223)	T_2 (Nm)	K (mm)	F (N)	Pre-tensioning per rubber buffer (mm)	G	H (mm)	L (mm)	max. α (mm) (Not for rubber buffer)	max. way s (mm) (Not for rubber buffer)
BS03	Pos.0	55	118	466	1.5	M8	10	10.5	2.5°	5
BS04	Pos.0	45	121	372	1.5	M8	10	10.5	2.5°	5
BS06	Pos.0	110	144	764	2.0	M10	10	10	2.5°	6
BS10	Pos.1	180	160	1125	2.0	M10	19	13	2.5°	7
BS20	Pos.2	290	205	1415	2.5	M10	30	17.5	2.5°	9
BS30	Pos.2	542	250	2096	3.0	M10	30	17	2.5°	11
BS40	Pos.3	980	340	2882	3.0	M18	38	22	2.5°	15

Geared motors with built-on backstop

The backstop - non-contact type F - locks the geared motor in a certain direction of rotation (indication of direction with view of the mounted side of the gear unit).

1 Mounting

The backstop is assembled on the fan cowl of self-ventilated motors and on the end shield of unventilated motors.
The inner ring with mounted on clamping part insert is located on the extended rotor shaft. This clamping part insert consists of caging in which the individually spring-loaded clamping parts are guided. The clamping parts lay flush on the outer ring. The end guard protects against contact and the penetration of foreign objects.

2 Operation

When the geared motor is started, the clamping parts disengage and do not make contact until the speed of the motor drops below approximately 700 rpm after disconnection or a power failure. The clamping parts then slowly rise and lock a reversing movement at the moment of rest.
The power transmission in locked state goes from the rotor shaft via the inner ring to the clamping parts and from there via the outer ring to the fan cowl/ end shield and the housing of the geared motor.

3 Supply connection

The standard three phase current motors are normally connected for anti-clockwise rotation when looking at the front of the fan shaft end and with the phase sequence L1 - L2 - L3. The actual phase sequence of the mains is to be selected in such a way that the motor starts in the freewheeling direction. For the first test start, it is advisable to connect particularly larger motors in star connection to protect the backstop as far as possible.
If a brief test connection finds that the motor is not connected in direction of rotation, but in the blocked direction, two mains leads are to be exchanged as with any normal change of direction of rotation. After a wrong connection, check fuses and motor protection switches and check for correct terminal board connection as indicated on the rating plate.

Safety information:
Mounting, connection, adjusting and maintenance work may only be carried out taking into account the safety information given on the accompanying information sheet No. 122 and of the operating instructions for the backstop.

4 Installation and maintenance instructions

Assembly of the freewheeling mechanisms may only be carried out by trained specialist personnel taking into account the installation information.
This information is to be noted fully in order to avoid a failure of the freewheeling mechanism or a malfunction on the machine.
Nonobservance of the information we provide will result in all liability claims against STIEBER becoming null and void.

Description:
The backstops F720-D and F721-D consist of an inner ring, an outer ring with flange, caging which carries the individual, spring-loaded centrifugal force disengaging clamping parts and an end guard.

The freewheeling mechanisms must be used in such a way that the inner ring executes the no-load movement.
The minimum no-load speed should not be undershot to ensure that the clamping parts are able to work surely in the non-contact speed range and that benefit can be derived from the centrifugal force disengagement. Operating below the minimum speed means that the service life of the freewheeling mechanism cannot be achieved, as for operation above the disengagement speed. When operating above the minimum speed, wear only occurs when starting and stopping the driving motor. Frequent starting and stopping reduce the service life. For speeds, see the technical data table below.

Before assembly:
It must be ensured that the radial eccentricity between the inside diameter of the outer ring and the inner ring in the integrated state cannot exceed the values given in the table at the end of the instructions. See the table for the associated centring diameters on the flange of the outer ring.

Before installing the backstop, the no-load direction of rotation is to be checked. A change in direction of rotation can be obtained by turning around the freewheeling cage.

After electrical connection, check whether the desired direction of rotation corresponds with the freewheeling direction. The following cases could occur here:

1. The desired direction of rotation is reached; the freewheeling mechanism does not block: the assembly of the freewheeling mechanism and the electrical connection are correct.
2. The motor starts unimpeded in the wrong direction of rotation: in this case both the freewheeling cage must be turned around and the direction of rotation reversed electrically.
3. The motor does not start. The shaft only vibrates. Since no direction of rotation is recognisable in this case, both the electrical connection and the freewheeling mechanism could be incorrect.
   If this sort of shaking or vibrating is observed, the motor must be switched off IMMEDIATELY, as both the freewheeling mechanism and the motor could be damaged or destroyed.Reversing the motor now results either in the desired result as described in point 1
   or in the measures described in point 2 in the event of the incorrect direction of rotation

Assembly:
When assembling, always make certain that no dirt can enter into the freewheeling mechanism.

- Unscrew the end guard.
- Check that the springs located on the sides of the cage are correctly positioned. If necessary, correct this using a small screwdriver.
- Fit the freewheeling mechanism onto the shaft. Observe the key and apply force only over the inner ring.
- Secure the inner ring against axial shifting, e.g. by means of retainer ring.
- Screw the outer ring onto the housing.
- Apply liquid sealant to the end guards and bolt on.

With shaft ends which are longer than the freewheeling mechanism, replace the sealing cap in the end guard with an appropriate radial shaft seal.

Maintenance/modification of the inverse direction and lubrication.
When carrying out maintenance work or a subsequent change of the direction of rotation it may become necessary to remove the caging:

Removal of the caging:
- Unscrew the end guards.
- Remove the retainer ring in front of the freewheel caging.
- In the extractor threads of the caging, screw suitable M3 screws into the caging discs to the same depth as the thickness of the discs.
- Use the screws to pull the cage by hand out of the inner and outer ring while simultaneously turning in the no-load direction.

Installing the caging:
- The surfaces of all parts inside the backstop are to be thinly coated before assembly with grease as listed in the table. The inside diameter of the outer ring must be noted particularly when doing this.
- Brace the freewheeling mechanism on the perimeter using an O-ring or a cable tie. Using a screwdriver, turn the clamping parts in such a way that they are in the disengagement position.
- Ensure that the springs seat perfectly, adjust if necessary.
- While observing the no-load direction of rotation, push the caging onto the inner ring. If the clamping parts are located approximately half way in the outer ring, the o-ring must be removed. Push the cage completely into the outer ring while turning it in the direction of travel. The front carrier screw of the caging must engage in the opening between the ends of the retainer ring.
- Assemble the retainer ring that was previously removed so that its ends cover the front carrier screws of the caging.
- Apply liquid sealant to the end guards and bolt in place.

After installation:
After installation, check whether the freewheeling mechanism can turn empty in the correct direction without excessive use of force. The trailing torque which develops in the freewheeling mechanism is approximately 1/1000 of its torque capacity.

Disassembly:
When assembling, always make certain that no dirt can enter into the freewheeling mechanism.

- Unscrew the screws on the end guard and remove the end guard.
- Unscrew the fastening screws of the outer ring and loosen the outer ring.
- Remove the retainer ring of the inner ring.
- Withdraw the complete freewheeling mechanism from the shaft. Only apply pressure above the inner ring.

or

- Unscrew the end guard screws and remove the end guard.
- Remove the retainer ring (rotor shaft).
- Dismantle the inner ring with caging from the rotor shaft.
- Dismantle outer ring with built-in retainer ring and radial shaft seal.

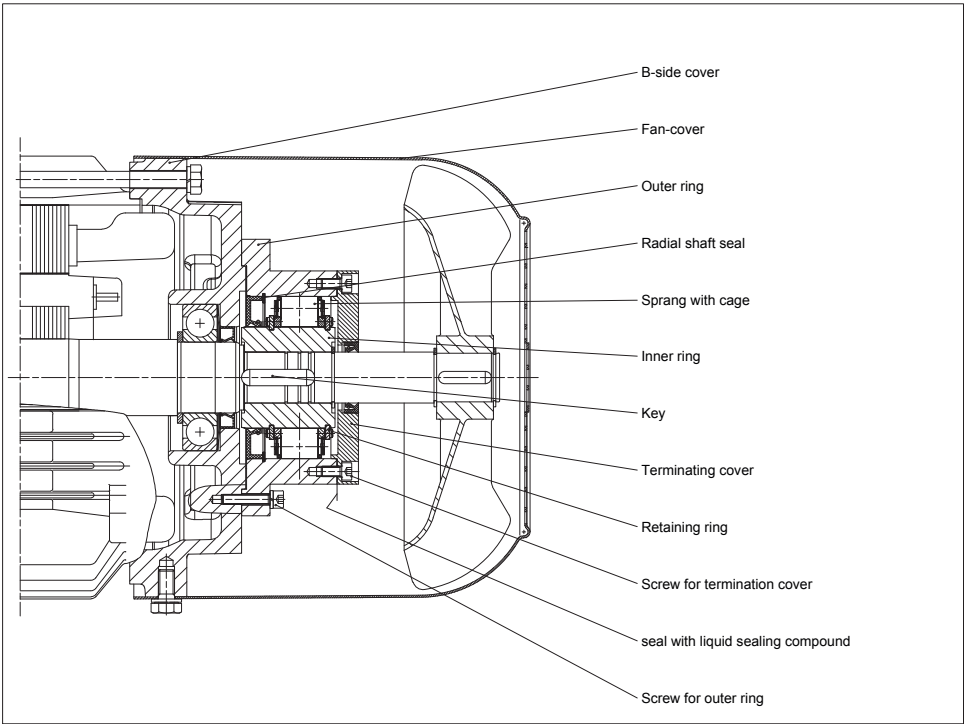
Lubrication and maintenance:
Store in a dry place for a maximum of 1 year. Re-preservation must be carried out after this time.
For grease lubrication, greases with a grade II or softer consistency, or from the accompanying lubricant chart, are particularly recommended.
Important: It is sufficient for the contact surface of the caging to be covered with a grease film on the outer ring and inner ring. Overgreasing, which limits the mobility of the clamping parts, is to be avoided.
The backstops must be protected in the long term from corrosion.

Technical data table:

Type	Max. Torque [Nm]	No-load speed [rpm] min.	No-load speed [rpm] max.	Max. radial eccentricity [mm]	Centring Ø H7 [mm]	Outer ring InnerØ H7 [mm]	Caging extractor thread	Grease volume [g] (max.)
F720D	300	740	10500	0,3	80	80	M3	15
F721D	700	665	6600	0,3	160	95	M3	30

Lubrication:

Manufacturer	**Grease**
ARAL	ARALUB HL2
BP	ENERGREASE LS2
DEA	GLISSANDO 20
ESSO	BEACON 2
FUCHS	RENOLIT LZR2
KLÜBER	POLYLUB WH2
MOBIL	MOBILUX2
SHELL	ALVANIA G2
TOTAL	MULTIS 2



Assembly of standard motor with C-Adapter (IEC and NEMA)

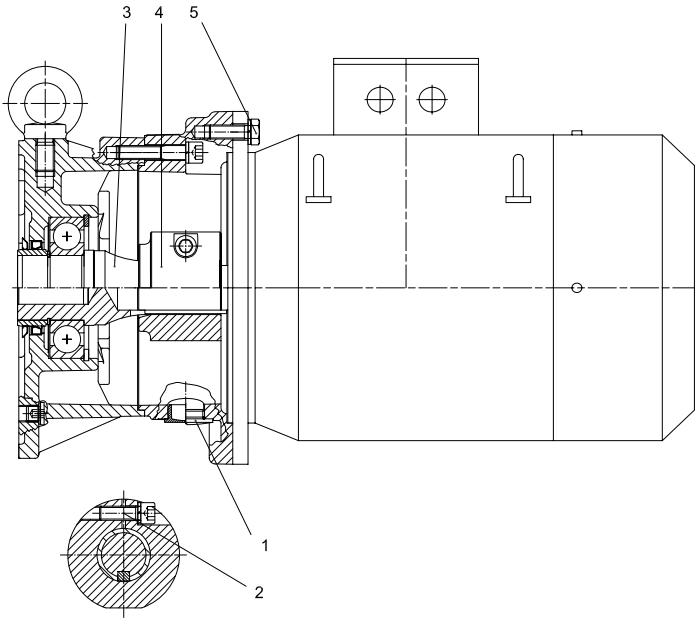
1 Safety Information

Connection and maintenance work may only be carried out taking into account the safety information on pages 3/4.

2 Motor Attachment

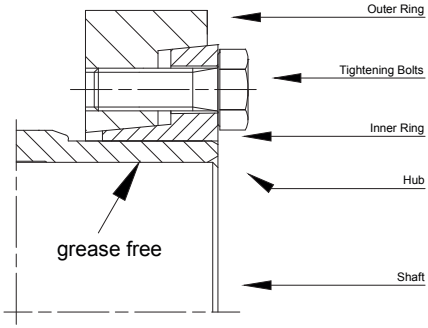
The assembly of standard motors in the size range IEC 56 to IEC 280 and NEMA 56C to NEMA 405TC using the C-Adapter is to be performed according to the following plan:

I. Remove assembly plug 1
II. Arrange the clamping ring so that the clamping screw 2 is under the assembly hole. Loosen the clamping screw 2 so much that the clamping ring 4 does not tighten on the intermediate shaft 3 anymore.
III. Arrange the motor ans rotor shaft to the gear side mounting face
IV. To make assembly easier, bring the motor and gearbox together in the vertical position (motor pointing upwards)
V. Insert motor shaft into the intermediate shaft without forcing
VI. Tighten clamping screw 2
VII. Tighten motor fitting screws 5
VIII. Insert assembly plug 1



Assembly and disassembly of the shrink-disc

The shrink-disc is supplied ready to be installed and should therefore not be dismantled. The shrink-disc may not be clamped without fitting the shaft.
The shaft must be fitted or the hub pushed onto the shaft in the area of the shrink-disc seat.
The tightening bolts must then be tightened evenly around the circumference until the front side face of the outer ring and inner rings is flush. The state of clamping can thus be monitored visually.
To disassemble, loosen all screws evenly in sequence. If the outer ring does not automatically separate from the inner ring, a number of tightening bolts may be removed and screwed into the neighbouring forcing-off threads.
Any rust on the shaft in front of the hub must be removed before the shaft is removed or the hub is taken from the shaft.
Removed shrink-discs only need to be dismantled, cleaned, and regreased before refitting if they are very dirty. In this event, a solid lubricant with a coefficient of friction of $\mu = 0.04$ or better is to be used.



Information on the storage of geared motors with cage rotors

If geared motors are to be stored for an extended time before start-up, increased protection against damage by corrosion or humidity can be achieved by observing the following information. Since the actual loading depends very strongly on local conditions, the time data can be regarded only as a guide value. It should also be noted that this data does not include any extension of the warranty term. If disassembly is necessary before start-up according to this information, it is recommended that the nearest BAUER franchised workshop or representatives be called in. The instructions contained in the after-sales manual are to be observed in all cases.

1 Geared motor condition and storage space

The plugs supplied by the works in all entry holes on the terminal box are to be checked for damage caused during transportation and for correct positioning and replaced if necessary.

Any vent valves which are present are to be removed and replaced with a suitable cover screw.

Any damage caused during transit to the exterior paint layer or to the rust protection of the bright metal shafts, including hollow shafts, must be repaired.

The storage space should be dry, well-ventilated and vibration-free. If the temperature in the space exceeds the normal range of approximately -20° C to +40°C for an extended period of time or varies strongly frequently, it could even become necessary to employ the measures before start-up specified in section 3 after shorter storage times.

2 Measures during the storage period

Space permitting, it is recommended that the drive units be turned 180° after approximately one year and annually thereafter so that the lubricant in the gear unit covers the bearings and gearwheels which have previously been positioned on top. Also, the output shaft should be turned manually in order to churn the rolling-contact bearing grease and distribute it evenly.

Turning the drive unit does not have to be carried out if the gear unit enclosure is completely filled with lubricant as the result of a special agreement. In this case, the lubricant level before start-up is to be reduced to the desired value as defined in the operating instructions and the lubrication information plate.

3 Measures before start-up

3.1 Motor component

- Insulation measurement
  Measure the insulation resistance of the winding with commercially available measuring apparatus
  (e.g. with a magneto) between all winding parts and between the winding and the enclosure.

- Measured value above 50 megohm: no drying necessary, new condition
  Measured value under 5 megohm: drying advised
  Measured value approximately 1 megohm: lowest permissible threshold
- Drying the winding by standstill stator heating without disassembly
  Connection to stepless or tapped variable alternating current voltage up to approximately 20% maximum of the rated voltage. Heating current max. 65% of the rated current according to the rating plate.Observe heating up for first 2 to 5 hours; reduce heating voltage if necessary.
  Heating duration approximately 12 to 24 hours until insulation resistance rises to desired value.
- Dry the winding in the oven after disassembly
  Dismantle the motor in the appropriate manner
  Dry the stator winding in a well ventilated drying oven at between 80° C and 100° C for approximately 12 to 24 hours until the insulation resistance rises to the desired value.
- Lubricating the rotor position
  If the storage period exceeds approximately 2 to 3 years, or the temperatures were very unfavourable throughout a shorter storage period as described in "Geared motors with three phase cage rotors" paragraph 3, the lubricant in the rotor positions must be checked and refilled if necessary. For checking, a partial assembly on the fan side is sufficient, where the rolling contact bearing becomes visible after removal of the fan cowl, fan and bearing flange (end shield).

3.2 Gear unit component

- Lubricant
  If the storage period exceeds approximately 2 to 3 years, or the temperatures were very unfavourable throughout a shorter storage period as described in "Geared motors with three phase cage rotors" paragraph 3, the lubricant in the gear unit must be changed. For detailed instructions and lubricant recommendations please see chapter lubrication quantity.
- Shaft seals
  When changing the lubricant, the function of the shaft seals between the motor and gear unit as well as on the output shaft must also be checked. If a change in shape, colour, hardness or sealing effect is determined, the shaft seals must be replaced appropriately under observance of the after-sales manual.
- Gaskets
  If lubricant is draining out at the connecting points on the gear unit enclosure, the sealing compound must be replaced as described in the after-sales manual.
- Vent valve
  If a vent valve was replaced with a cover screw when storing, this must be refitted in the correct place.

Notes

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