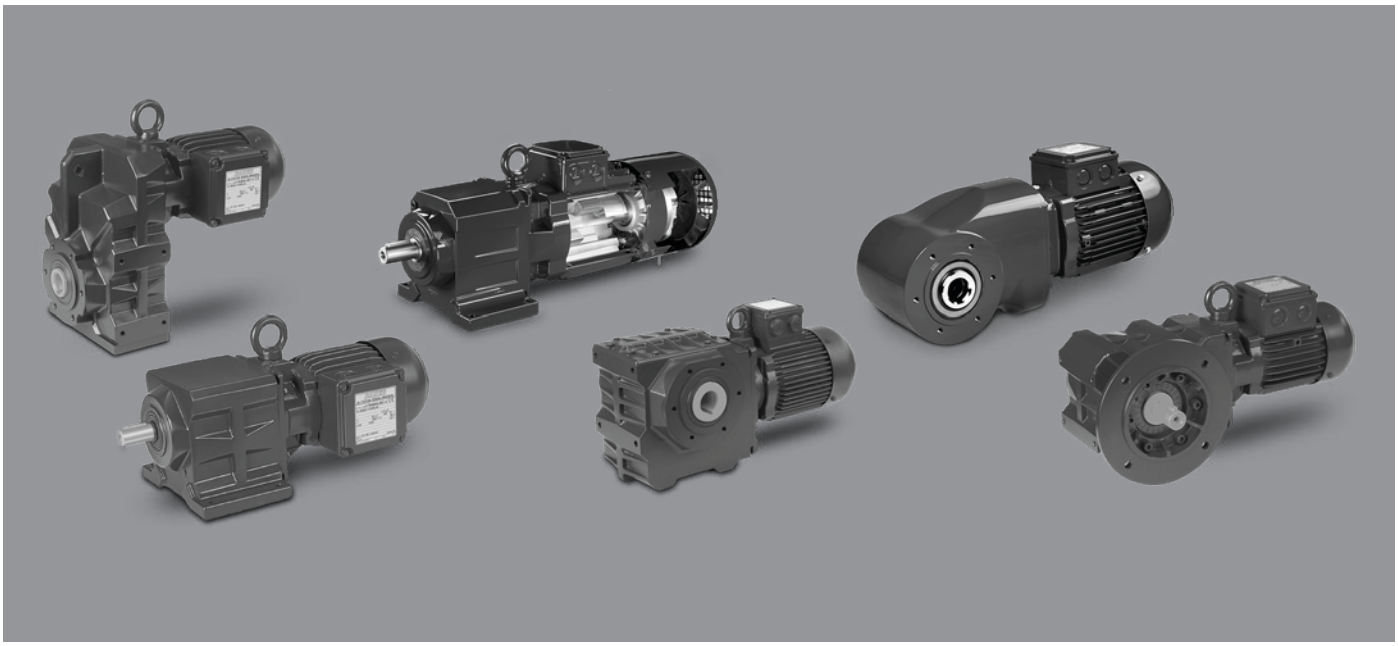
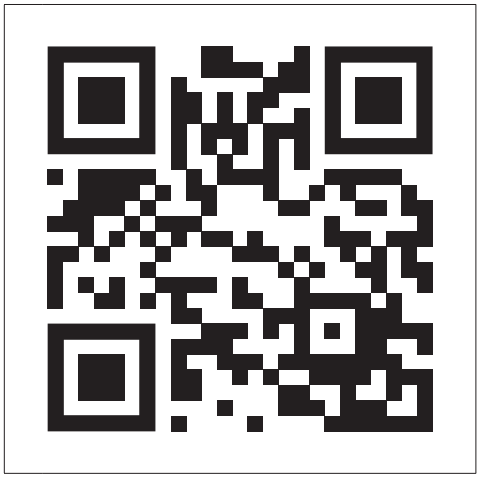
Gears Series BG.. / BF.. / BK.. / BS.. / BM..
Motor Series D.. / E.. / S..

English



Digital documentation

Scan the QR code to view and download more languages.



BG Сканирайте QR кода, за да видите и да изтеглите още езици.

CN 扫描二维码以查看和下载更多语言。

CZ Pro zobrazení a stažení dalších jazyků naskenujte QR kód.

DE Scannen Sie den QR-Code, um weitere Sprachen anzusehen und herunterzuladen.

DK Scan QR-koden for at se og downloade flere sprog.

EE Muude keelte nägemiseks ja alla laadimiseks skannige QR-kood.

EN Scan the QR code to view and download more languages.

ES Escanee el código QR para ver y descargar más idiomas.

FI Skannaa QR-koodi nähdäksesi muut kielet ja ladataksesi sisältöä.

FR Scanner le code QR pour afficher et télécharger d'autres langues.

GR Σαρώστε τον γραμμωτό κώδικα QR, για να δείτε και να κατεβάσετε περισσότερες γλώσσες.

HR Skenirajte QR kod za pregled i preuzimanje drugih jezika.

HU További nyelvek megtekintéséhez és letöltéséhez olvassa be a QR-kódot.

IT Scansiona il codice QR per visualizzare e scaricare altre lingue.

LT Nuskaitykite QR kodą, jei norite peržiūrėti ir atsisiųsti daugiau kalbų

LV Noskenējiet QR kodu, lai skatītu un lejupielādētu citas valodas.

NL Scan de QR-code om meer talen te bekijken en te downloaden.

NO Skann QR-koden for å se og laste ned flere språk.

PL Zeskanować kod QR, aby zobaczyć i pobrać inne języki.

PT Ler o código QR para ver e descarregar mais idiomas.

RO Scanați codul QR, pentru a vizualiza și descărca și alte limbi.

RU Отсканируйте QR-код, чтобы просмотреть и загрузить другие языки.

SE Skanna QR-koden för att se och ladda ned fler språk.

SI Naskenujte QR kód, aby ste si mohli pozrieť a stiahnuť dokumentáciu v ďalších jazykoch.

SK Skenirajte QR kodo, da si ogledate in prenesete dodatne jezike.

TR Daha fazla dil görüntülemek ve indirmek için QR kodunu tarayın.

Table of contents

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1 About this documentation

These Assembly and Operating Instructions (hereinafter referred to as "documentation") are an integral part of the product. It is intended for persons carrying out work associated with the product and contains important information on safety and safe handling of the device. All safety instructions and work steps specified must be followed in order to work safely with the device.

- ▶ Read this document carefully before starting any work.
- ▶ Keep these Assembly and Operating Instructions in the immediate vicinity of the device, accessible to personnel at all times, and in legible condition

For purposes of better presentation, the figures in this document are not to scale and may differ from the actual version.

- ▶ Should anything be unclear, please contact Bauer Gear Motor.

You can download the complete operating instructions in digital form with larger font here:

You can find further documentation at www.bauergears.com.

1.1 Product name

Product designations mentioned in this document are trademarks of Bauer Gear Motor, some with a registered trademark ® .

1.2 Validity

This document applies to the following series:

- Gear series BG.. / BF.. / BK.. / BS..
- Motor series D.. / E.. / S..

1.3 Applicable documents

The following documents form part of these Assembly and Operating Instructions:

- Connection diagram (supplied with device)
- Manufacturer documentation of supplier components

1.4 Symbols and means of representation

1.4.1 Warnings

Warnings are used in this document to warn of situations that could cause damage to property and personal injury.

- ▶ Read and observe warning notices.
- ▶ Follow all steps marked with the warning symbol and warning word.

Warning symbol	Warning word	Meaning
	**HAZARD**	Danger to persons. Non-compliance will result in death or serious injury.
	**WARNING**	Danger to persons. Non-compliance may result in death or serious injury.
	**CAUTION**	Danger to persons. Non-compliance may lead to minor injuries.
–	**CAUTION**	Information on how to avoid property damage, or to understand or optimize work processes.

1.4.2 Symbols and means of representation

Symbol	Meaning
	means “additional information”
▶	Symbol for an action: You must do something here. ▶ If there are several steps, follow the order given.

1.5 Abbreviations

Abbreviation	Definition	Description
AC	Alternating current	AC current
BCD	-	Output code for absolute encoder with SSI interface
BG	-	Helical gear
BF	-	Shaft-mounted gear
BK	-	Bevel
BM	-	Monorail gear
BS	-	Worm gear
CRC	-	Output format for absolute encoder with SSI interface
DC	Direct current	DC current
DP	Decentralised Periphery	PROFIBUS interface variant
ESG	Electronic fast-acting rectifier	Fast-acting rectifier
EMC	Electromagnetic compatibility	-
HL	Manual release	-
HTL	-	Output signal for incremental encoder
OK	Okay	-
IP	Ingress protection	Protection rating, indicates protection for active parts against contact, ingress of foreign bodies and water
MSG	Fast-acting rectifier with overex-citation	Fast-acting rectifier
NN	Normal-null ("standard elevation zero”)	-
PMSM	Permanent magnet synchronous motor	-
PNO	Encoder profile	for absolute encoder with Profibus interface
RL	Backstop, blocking direction left	-
RR	Backstop, blocking direction right	-
SSI	Synchronous Serial Interface	SSI Synchronous Serial Interface
SSV	Shrink disc connection	-
TR	Programmable parameter	Speed output
TTL	Programmable parameter	Output signal for incremental encoder
V/R	Counting direction	For absolute encoder with SSI interface
UB	Non-ventilated	-
USIT	Gaskets	USIT rings
UVV	Accident prevention regulations	-
VD	Sealing cover	-
VK	Sealing cap	-
ZV	Shaft with square end	Second motor shaft end
ZW	Shaft with key	Second motor shaft end

1.6 Copyright

2 Safety

The safety instructions serve to prevent personal injury and material damage. They relate only to the drive unit concerned in this document.

▶ When using special options/components: Also refer to additional product-specific documents provided.

The product is part of a drive system and may only be put into operation if it has been properly determined that the machine or system can be operated safely.

▶ Operate the product only in accordance with the information in this document and with the information on the name plate.
▶ Only operate the entire unit in the mounting position specified on the name plate.

Non-observance of Assembly and Operating Instructions!
Failure to follow the Assembly and Operating Instructions can result in serious injury or death.

▶ Read this document carefully before using the product.
▶ The operator must ensure that all persons entrusted to work on the product have read and understood this document and that they follow the safety instructions given.
▶ Keep this document near the product in a place accessible to the operator.

2.1 Intended use

The products are gearboxes, three-phase motors, and geared motors – a unit made up of a mechanical gearbox and integrated three-phase motor. The products are intended exclusively for use in industrial and commercial machines and systems.

2.2 Improper use

The following is considered improper or incorrect use:

- Changes to product
- Use in potentially explosive areas

2.3 Personnel qualification

Knowledge of this documentation is a prerequisite for all persons.

▶ Only qualified personnel are permitted to perform any work with or on the product.

Person group	Required qualifications
Electrician	• Specific and general education and training as an electrician • At least 2 years of relevant professional experience • Knowledge of how drive units work and how to handle them • Experience using common work tools • Routine use of smartphones (e.g. videos), PC/tablet
Mechanic	• Specific and general training as a mechanic • At least 2 years of relevant professional experience • Knowledge of how drive units work and how to handle them • Experience using common work tools • Routine use of smartphones (e.g. videos), PC/tablet.

Qualified personnel must be familiar with and observe the IEC 60364/IEC 60664 standards as well as national occupational safety and accident prevention regulations and environmental regulations.

Bauer Gear Motor GmbH offers disassembly and assembly training at regular intervals both at its headquarters and on site. Training content and dates can be found at www.bauergears.com/sales-and-service/gear-motor-academy/ under "Gear Motor Academy". Register for training courses online at www.bauergears.com/sales-and-service/global-service/ under "Gear Motor Academy Registration". Coordinate individual training sessions with head office.

2.4 Residual risks

Hazardous voltage
Serious or fatal injuries may result.
- ▷ Before working on electrical components of the product, ensure that there is no voltage.
- ▷ Take appropriate measures to prevent unintentional or accidental restart, such as removing fuses, assigning personnel to monitor, placing warning signs, etc.

Electric shock due to regenerative operation with permanent magnet synchronous motors (PMSM)
Serious to fatal injuries due to regenerative operation can result. When the drive is driven by the output shaft, the motor induces a voltage that is present at the motor terminals.
- ▷ Prevent the output shaft from turning, e.g. by blocking it mechanically.

Risk of injury from magnetic fields
Serious or fatal injuries may result.
- ▷ Persons with pacemakers and implants are prohibited from standing near the product and handling the product.

Risk of injury during automatic restart
Serious or fatal injuries may result from persons being drawn-in and caught.
- ▷ Before starting maintenance and repair work, make sure that the machine/system cannot be switched on again.
- ▷ During commissioning, ensure that no unauthorised persons are in the hazard zone.
- ▷ Place warning signs.
- ▷ Keep a safe distance from moving parts.

Risk of injury due to improper assembly or disassembly
Serious to fatal injuries and property damage can result.
- ▷ Ensure that only authorised personnel are present on site.
- ▷ Only perform assembly and installation work when the machine/system is standing idle.
- ▷ Only perform work on the product when it is at a standstill and safeguarded from being inadvertently switched on, and the connection voltage is safely disconnected.
- ▷ Secure heavy components and attachments from falling.
- ▷ Ensure there is sufficient safety clearance, e.g. by using barriers as necessary.

Risk of injury due to rotating parts
Serious or fatal injuries may result from persons being drawn-in and caught.
- ▷ Before starting maintenance and repair work, make sure that the machine/system cannot be switched on again.
- ▷ Do not work on couplings, brakes, or backstops unless they are safeguarded against a unit automatically starting up, a trolley/shuttle rolling, or a load dropping or even falling, etc.

Parts may break loose and cause injury
Parts may break loose and cause minor to moderate injury.
- ▷ Wear safety glasses during assembly and disassembly.

Risk of injury from hot surfaces
Serious injury from skin burns
- ▷ Allow hot product surfaces to cool before touching them.
- ▷ Suitable protective gloves must be worn when working on hot product components.

Risk of burns from frozen surfaces
Serious injury from cold burns on skin
- ▷ Allow cold product surfaces to warm before touching them.
- ▷ Suitable protective gloves must be worn when working on frozen product components.

Hearing hazard due to high noise emissions
- ▷ Wear hearing protection.

Risk of injury when disconnecting transmission elements
Serious or fatal injuries may result.
- ▷ Only loosen and disconnect transmission elements such as couplings, chain and belt drives, etc. if no force or torque is acting on the output shaft.
- ▷ With shaft-mounted gears, only remove the torque arms if no force or torque is being applied.
- ▷ Only remove the shaft-mounted gear if no force or torque is being applied.

Injury and malfunction due to non-approved spare parts
Serious to fatal injuries and material damage from drive failure, crashes, blockages, unexpected system downtimes, etc. due to the use of non-approved spare parts
- ▷ Use only approved spare parts.

Risk of injury from falling products
Improper transport of the product can result in serious injury or death.
- ▷ Only use suitable lifting and transport equipment.
- ▷ Make sure that lifting or transport equipment is approved for the specified weight.

Risk of injury from suspended loads
Serious or fatal injuries may result.
- ▷ Do not walk under suspended loads.

Risk of injury due to unsecured loads
Serious or fatal injuries may result.
The product can also be equipped with a manual release. Manually releasing the de-energized motor can cause loads to move freely.
- ▷ Before operating the manual release: Secure loads.
- ▷ After manual release (with lockable manual release): First release the locking mechanism, then release the load.

Paint damage due to transport, storage, and installation
Improper transport, storage, and installation can damage corrosion-resistant paint coatings and lead to corrosion.
- ▷ Make sure that paint coatings are protected properly during transport, storage and installation.
- ▷ Have damage to paint coating repaired professionally.
- ▷ Before applying the paint or coating material, all surfaces must be inspected and processed in accordance with ISO 8504-2.
- ▷ With IM2 corrosion protection, the instructions in the technical data sheet of the coating material must be observed, especially when reworking, please contact Bauer Gear Motor GmbH.

Motor damage from exceeding permissible limit values
Heat, centrifugal force, and demagnetisation in the permanent magnets can lead to overloading, gear damage, and damage to the system/machine.
- ▷ Use the values for torque limit, limiting currents, and limit speed on the rating plate.

Corrosion at attachment element pressure points
Pressure marks from attachment elements can damage corrosion-resistant paint coatings and lead to corrosion.
- ▷ After loosening attachment elements: Check pressure marks for paint damage.
- ▷ Have damage to paint coating repaired professionally.

2.5 Pictograms on product

Symbol	Meaning
	The geared motor is suitable for use in potentially explosive atmospheres.
	This is not a lifting point.
	Hot surface, can cause burns.
	Operate permanent magnet synchronous motor only via inverter.
	Rotation direction of the geared motor

2.6 Personal protective equipment

All specialist personnel must wear the necessary work/protective clothing.

- Wear hearing protection for high noise emissions.
- Wear suitable protective gloves if coming into contact with hot or frozen components.
- Wear safety shoes.
- Wear safety glasses when installing electrical equipment.

2.7 Safety devices

Do not disable local monitoring and protection devices when working on the product.

2.8 Environmental protection and disposal

- Dispose of gearboxes, motors, and geared motors in accordance with applicable local regulations.
- Collect old lubricant (waste oil, grease) and dispose of properly.

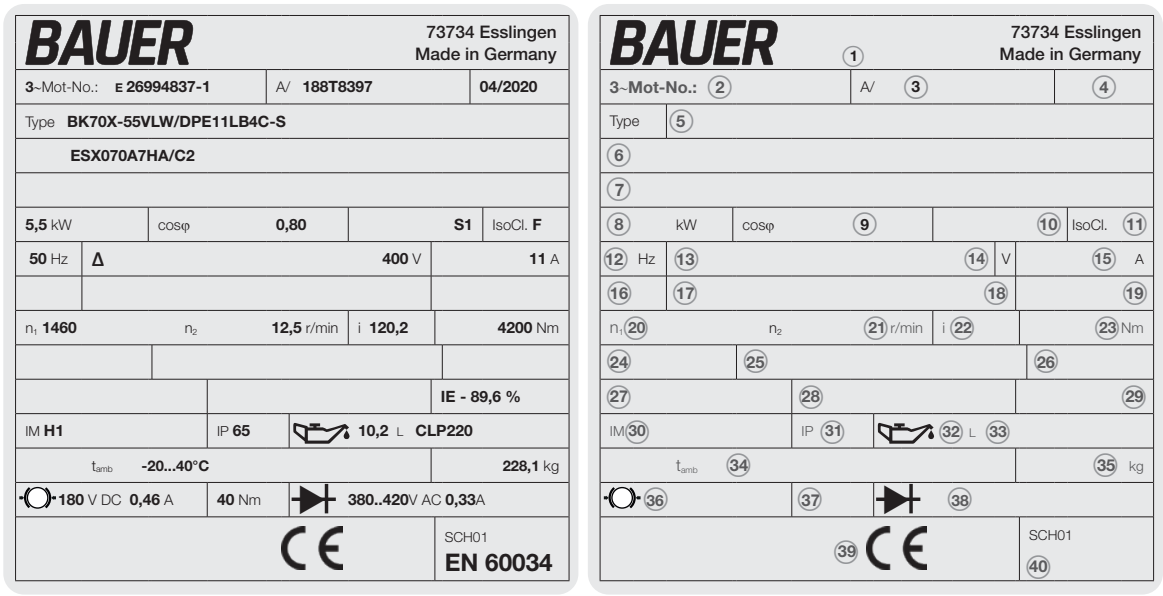
3 Product description

3.1 Product identification: geared motor

Geared motors are used to drive slow-running machines, devices, and systems. Products are identified using the type codes described below.

3.1.1 Rating plate/type plate

All essential data and information is stated on the rating plate in accordance with EN 60034.



Example illustration of the rating plates

1 Manufacturer
2 Motor number
3 Article number
4 Production date (week/year)
5 Type designation
6 Space for supplementary type designation
7 Space for customer-specific information
8 Rated power
9 Power factor
10 Operating mode
11 Heat class
12 Rated frequency
13 Motor connection (e.g. Y)
14 Rated voltage
15 Rated current
16 Space for additional rated frequency
17 Space for additional motor connection
18 Space for additional rated voltage
19 Space for additional rated current
20 Rated motor speed
21 Input speed of gearbox
22 Gear reduction ratio
23 Rated torque at output shaft
24 Space for additional rated motor speed
25 Space for additional input speed of gearbox
26 Space for additional rated torque at output shaft
27 free field
28 free field
29 Energy efficiency
30 Installation position
31 Protection rating
32 Lubricant quantity
33 Lubricant class
34 Permissible ambient temperature range
35 Drive weight
36 With brake installed: Brake DC voltage and current
37 With brake installed: Braking torque on motor shaft
38 With brake installed: Brake AC connection voltage and current
39 Approvals
40 Standards complied with

3.1.2 Type code/type designation

BK 50 Z - 1 1 U W A / D.. 09L A 4 - TF - S / ES 010 A 9 HN / C2

① ② ③ ④

1 Gear type, size, and design
2 Motor type, size, and integrated designs
3 Motor attachments
4 Additional options

A complete breakdown can be found in all of our catalogues in chapter 3, see www.bauergears.com.

3.2 Gear types and designations

BK	20	Z	X	-	6	4	U	A
①	②	③	④	⑤	⑥	⑦	⑧	⑨

1 Gearbox type*
2 Gearbox size
3 Pre-stage
4 Reinforced bearing
5 Placeholder
6 Code number for gearbox version
7 Code number for output shaft version
8 Position of gearbox version (optional)
9 Additional version (optional)

*)
BG Helical gear
BF Shaft-mounted gear
BK Bevel gear
BS Worm gear
BM Monorail

3.3 Motor types and designations

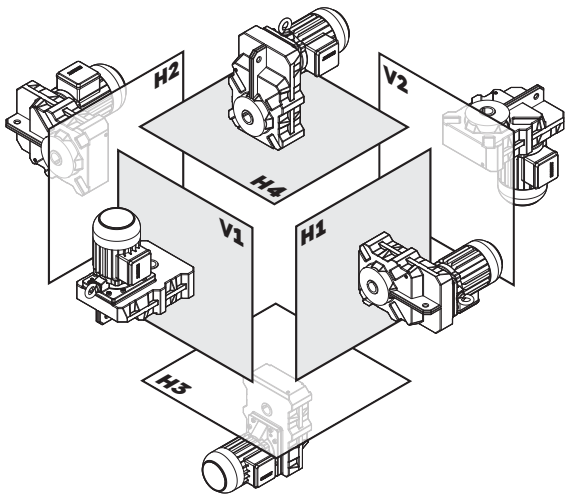
D	NF	R	P	E	09	L	A	4	C	1	-TF
①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩	⑪	⑫

1 Motor type*
2 Installation type (not required for geared motor)
3 Motor design
4 Efficiency class
5 Country-specific version of efficiency class
6 Motor size
7 Core length
8 Design status
9 Number of poles
10 Rotor material
11 Rotor material grade
12 Additional versions

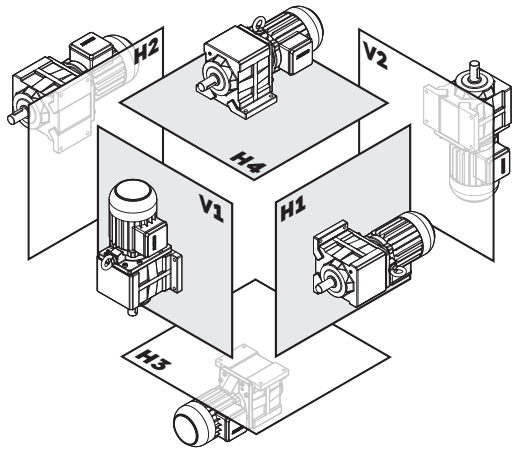
*)
D Three-phase motor
E(C) Single-phase motor
S PMSM (permanent magnet synchronous motor)

3.3.1 Installation positions

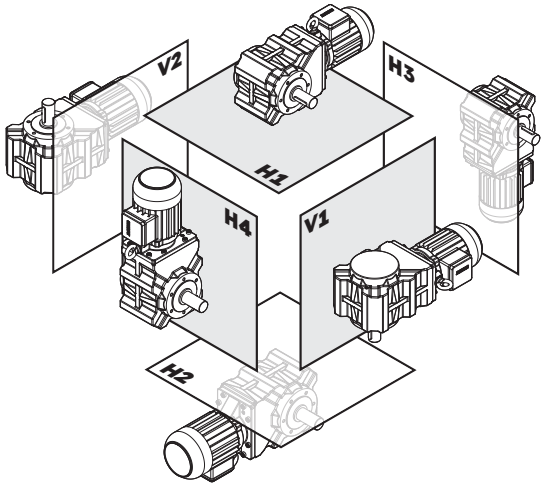
BF gearbox



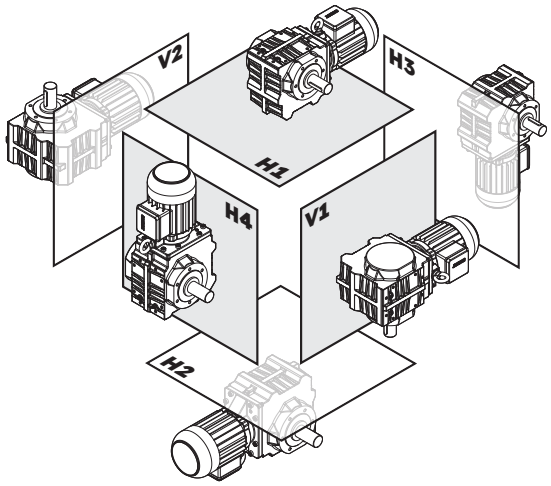
BG gearbox



BK gearbox



BS gearbox



BM gearbox

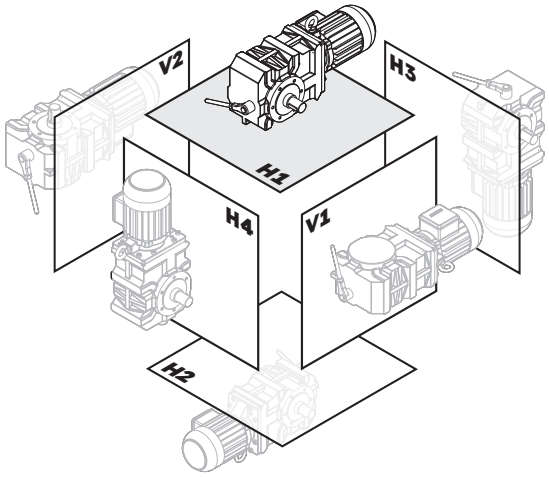


Fig. 1: mounting positions

Inclined installation positions - Explanation of the abbreviations on the type plate

Information on rating plate (example)	Explanation
H4/V1 30° Example for BG	[Installation position 1] / [Installation position 2] [Deviation value] • Installation position 1: Output installation position • Installation position 2: Installation position in which the gearbox is rotated • Deviation value: Twist angle in degrees [°]
	The actuators are used stationary in installation position H4, but rotated by 30° in direction V1.

Tab. 1: Inclined installation positions

Multiple installation positions - Explanation of the abbreviations on the type plate

Information on rating plate (example)	Explanation
H1-V2 Example for BG	[Installation position 1] - [Installation position 2]
	The drives may be used stationary in all installation positions H1 to V2.
H1,H2,V2 Example for BG	[Installation position 1] , [Installation position 2] , [Installation position 3]
	The drives may be used stationary in exactly the specified installation positions H1, H2 and V2.

Tab. 2: Multiple installation positions

Swivelling installation positions - Explanation of the abbreviations on the type plate

Information on rating plate (example)	Explanation
V2/H4/V1 Example for BG	[Installation position] / [End position] / [Intermediate position] • Installation position: Output installation position • End position: Position of the gearbox after swivelling over the intermediate position • Intermediate position: Position that the gearbox assumes when swivelling
	The actuators are used stationary in installation position V2 and can be swivelled to end position H4 via intermediate position V1.

Tab. 3: Swivelling installation positions

ATTENTION
Material damage due to incorrect service intervals
The lubricant quantity for swivel mounting positions is adapted for use in different positions. Operation with an adapted (= increased) lubricant quantity without gearbox ventilation leads to higher internal gearbox pressure and reduces the service life of the shaft seals.
▷ Only operate the product in the installation position, intermediate position and end position specified on the type plate.
▷ Adjust the division of the service intervals.

3.4 Functional description

3.4.1 Three-phase motor

Induction motor
Bauer geared motors and Bauer motors for three-phase connection are supplied with specially designed asynchronous technology.
This design enables maximum operational reliability with high torque and low inrush current.

Permanent magnet synchronous motor
PMSM motor rotors are equipped with embedded permanent magnets.

3.4.2 Brakes

Spring-loaded brakes
In addition to holding loads at rest (holding brakes), the spring-loaded brake is used to decelerate masses rotating and moving linearly (service brakes) in order to shorten undesired over-travel distances and times.
The brake releases electromagnetically.
When de-energized, braking force is generated by spring pressure.
Since this system also applies braking in the event of an unintentional power failure, it can be regarded as a safety brake in the sense of accident prevention regulations.
During braking, the kinetic energy of the moments of inertia is converted into heat via the brake disc. The asbestos-free brake disc is resistant to wear and heat.

Service brakes
During normal operation, the brakes perform friction work, i.e., they perform a slowdown function. Service brakes are required to brake rotating or translational masses in a defined manner, e.g. for positioning tasks, holding loads, etc. In so doing, they convert kinetic energy into heat. For physical reasons, some wear is unavoidable to maintain braking torque and performance.
Example service brakes are spring-loaded brakes of type E003B and E004B (each with DC release solenoid).

Holding brakes
Spring-loaded brakes ES010A ... ES250A, ZS300A and ZS500A are holding brakes that do not perform friction work during normal operation, rather they secure an approached position. In an emergency, they perform a slowdown function.
Spring-loaded brakes ESX010A ... ESX250A, ZSX300A and ZSX500A are service brakes that perform friction work during normal operation, i.e., they perform a slowdown function.

Brake attachment
- ES and ESX: Brakes are attached under the fan cover
- EH and EHX: Brakes are attached on the fan cover

Example service brakes are spring-loaded brakes of type ES(X)010A ... ES(X)300A, ZS(X)300 and ZS(X)500A (each with DC release solenoid)

3.4.3 Gearbox ventilation

The gearboxes are dimensioned in such a way that no gearbox ventilation is required in many installation positions.
Install a pressure relief valve as necessary.

3.4.4 Encoder system

Incremental rotary encoders
Incremental rotary encoders (impulse generators/encoders) determine the position of motor shafts. Rotational movement is processed by the incremental rotary encoder and output as an electrical signal. An impulse disc with a certain number of periods per revolution detects step angles.

Absolute rotary encoders
Absolute rotary encoders detect both angular and rotational movements and convert these into electrical signals.

3.4.5 Backstop (RR, RL)

Specify blocking direction right (RR) or left (RL) when ordering.
The reference is a view of the gearbox mounting side. If the mounting side is not clearly defined, gearbox side V (front) is taken as a basis.

3.4.6 Second motor shaft end (ZW, ZV)

With this shaft end, half of the rated power can be transferred with a central drive. Permissible radial load on request. Covers are not included with delivery.

3.4.7 Rain cover above fan cover (D)

For outdoor installation with significant or long-lasting exposure to water, we recommended using a rain cover over the fan cover if the motor points upwards.

3.4.8 Oil expansion tank

The oil expansion tank is used in critical drive configurations to maintain the build-up of pressure in the gearbox resulting from the volumetric expansion of the oil within the permissible range during operation.

3.4.9 Motor heating

To dry motor windings after long storage periods, the motor can be heated actively, e.g. standstill heating via heater bands, see also chapter 6.8.10, p. 39.
Heating is also provided in order to ensure that the motors/geared motors start up reliably after being idle for a long period of time in very cold locations.

4 Included with delivery

The geared motor is delivered as a ready-to-use unit (filled with lubricant).
Accessories ordered separately, e.g. shrink disc connections or rubber buffers for torque arm, are attached to the product or otherwise enclosed with delivery.
The gearboxes are delivered from the factory with the type and quantity of lubricant specified on the rating plate.

5 Transport and storage

5.1 Goods Receiving

Incomplete or damaged products complicate or hinder operation.
Do not install or put damaged products into operation.

- ▶ Immediately check delivery for completeness upon receipt.
- ▶ Verify that the technical design of the product corresponds to the order.
- ▶ Check rating plate.
- ▶ Inspect products for packaging and shipping damage.
- ▶ Report any damage to the transport company immediately.

The product is delivered assembled.
Any additional equipment is supplied separately and packaged as an "accessory pack".

5.2 Transportation

With our products, only eye bolts pursuant to DIN 580 are permitted for use as lifting points for lifting equipment. The eye bolts are only designed for the weight force of the gearbox/motor/geared motor. Additional loads are not permitted.
Only one lifting point is provided per product.

- ▶ When lifting and transporting heavy loads, follow internal factory specifications for handling loads.
- ▶ Only use suitable lifting and transport equipment.
- ▶ See the rating plate for the product weight.
- ▶ Make sure that the lifting or transport equipment is approved for the specified weight.
- ▶ Only use the provided lifting points for lifting and transporting.
- ▶ For geared motors with pre-stages (Z) or intermediate gears (G), use only the eye bolt closest to the main gearbox.
- ▶ Make sure that the eye bolts are completely tightened.
  - The eye bolt(s) should lie flat on the housing surface.

5.3 Storage

5.3.1 Short-term storage

If the product is not installed immediately as intended, it can be stored for up to 9 months without taking any special measures.
Improper storage can damage the product.

Note the following for storage:

- ▶ If possible, store in the intended installation position. If necessary, replace already installed vent screws with screw plugs.
- ▶ Store product in a dry place.
- ▶ Avoid temperature fluctuations outside the normal range of -20 to +40 °C.
- ▶ Do not subject product to shocks or vibrations.
- ▶ Have transport damage to paint or corrosion protection repaired professionally.

5.3.2 Long-term storage

☑ Storage space requirements
☑ Storage space is dry, dust-free, ventilated, and free of vibrations (permissible vibrations v_{eff} <0.2 mm/s).
☑ Storage temperature range: -20°C to +40°C with minor fluctuations.
☑ Air in the room should be free from aggressive, corrosive, or radioactive elements.
☑ Do not expose product to direct sunlight or any other source of UV radiation.

Preparation for storage

CAUTION
Damage to property
Do not allow paint to be damaged. Mechanical damage (scratches, slivers), chemical corrosion from acids or alkali, or thermal damage from flying sparks, welding beads, and heat will cause the external protection to deteriorate and fail.
▷ Check the exterior paint and touch up any existing damage.

▶ Check anti-corrosion protection on bare metal parts (shafts, hollow shafts, flanges, etc.). Touch up as necessary.
▶ Replace vent valve with an appropriate screw plug.

During storage
Do not stack products on top of each other.
▶ Store the product on a hollow base.
▶ Cover product when stored.
▶ Products that require the oil to be refilled during normal operation must be turned 180° at 6-month intervals to ensure all bearings and gears on the reverse side are covered with lubricant.
  • On special request, the product can be prepared for long-term storage and completely filled with lubricant. In this case, there is no need to turn the product during storage.
▶ To prevent the sealing ring/sealing lips from sticking or hardening, we recommend turning the product every six months.

6 Installation

6.1 Requirements for installation site

The product may only be operated in the installation position and ambient temperature specified on the rating plate.
When installing/attaching in a different arrangement, adjust the lubricant fill level. For lubricant quantity, see chapter 11.4.3, p. 53.
▶ If the installation position specified on the rating plate and the lubricant quantity is subsequently changed: Install pressure relief valve. In these cases, contact our service team.

6.1.1 Substructure

☑ The substructure is torsion-resistant and vibration-damping.
☑ Mounting surfaces for gearbox feet or gearbox flanges are flat.
▶ If the installation position specified on the rating plate and the lubricant quantity is subsequently changed: Install pressure relief valve. In these cases, contact our service team.

6.1.2 Cooling air supply

☑ Cooling air supply to the motor is unobstructed (at least 10 cm away from the air inlet in the fan cover).

6.1.3 Installation outdoors or in damp rooms

Geared motors starting from motor size 63 (D06...) are suitable as standard for protection rating IP65 and for use outdoors or in damp rooms. For corrosion reasons, use increased corrosion protection (CORO1 ... CORO5-M and Im2).
Direct sunlight, e.g. when installed outdoors, is not permitted.

- ▶ Use suitable covers that do not accumulate heat.
- ▶ Have any damage to paint coating caused during transport, installation, and assembly repaired professionally before commissioning.
- ▶ For vertical installation (motor up), select the option "Rain cover" above the fan cover.
- ▶ Check the product at regular intervals with regard to fastening and tightness of cabling.
- ▶ Remove any deposits of dust and dirt.

6.1.4 Installation of roller table drives

In addition to the general specifications in chapter 6, p. 21 , note the following when installing roller table drives:

- ▶ Shield the product against long-term or significant water exposure.
- ▶ Protect the product from strong radiant heat by means of suitable shielding.

6.2 Mechanical installation

6.2.1 Required tools and aids

The following tools and aids are required for mechanical installation:

- Disassembly/assembly aids
- Transport devices
- Lifting equipment
- Hand tools such as wrenches, screwdrivers, etc.
- Torque wrench for checking tightening torques
- Mounting tools for shaft-mounted gearboxes as well as couplings, chain/gearwheels etc.
- Cleaner for degreasing shafts for shrink disc connections
- Anti-skid/anti-corrosion agent for mounting hollow shafts with keyway
- Screw locking agent, e.g. Loctite®
- Measuring equipment, e.g. caliper gauge for measuring rubber buffer pre-stress
- Use fixing screws of strength class 8.8 at least.

6.2.2 Consumables

CAUTION
Material damage due to lack of lubricant or over-lubrication
Material damage or machine/system downtime can result.

- ▷ Only operate the product in the installation position specified on the rating plate.
- ▷ When installing/attaching in a different arrangement, adjust the lubricant fill level. See rating plate for the lubricant quantity.

The product is delivered ready for operation with lubricant.
The lubricant type and quantity favourable for the intended mounting position are specified on the rating plate, see chapter 3.1.1, p. 14.
For information on lubricant schedules and approved lubricant types, see chapter 11.1, p. 46 and chapter 11.4.2, p. 52.

- ▶ If the installation position specified on the rating plate and the lubricant quantity is subsequently changed: Install pressure relief valve. In these cases, contact our service team.

6.2.3 Inspections and preparatory work before installation

Work can only be carried out if the following requirements are met:
- ☑ Product is not damaged or leaking.
- ☑ The information on the product rating plate matches the requirements with regard to power, speed, voltage, frequency, installation position, and ambient temperature in particular.
- ☑ Any potential dirt and anti-corrosion agents on flange surfaces, fittings, and output shafts have been removed.

In abrasive, aggressive, or corrosive ambient conditions, only use the product if it is appropriately dimensioned and designed.
If in doubt, consult Bauer Gear Motor.

- ▶ Check the direction of rotation when not coupled. (For information on electrical connection, see chapter 6.8, p. 35 if hazards and/or material damage are expected if the output shaft rotates in the wrong direction).
- ▶ For products with backstop, check that the working direction (see arrow) corresponds to the required direction of rotation.
- ▶ When connecting, make sure that the output shaft rotates in the correct direction. In case of doubt, perform a rotary field test.

6.3 Installation of hollow shaft, gearbox with hollow shaft with keyway or spline

This also applies to AsepticDrives or CleanDrives.
- ▶ Use the following tightening torques:

Screws/nuts with thread	Tightening torque [Nm]
M6	11
M8	25
M10	48
M12	86
M16	210
M20	410
M24	710
M30	1450

Tab. 4: Tightening torques, hollow shaft installation

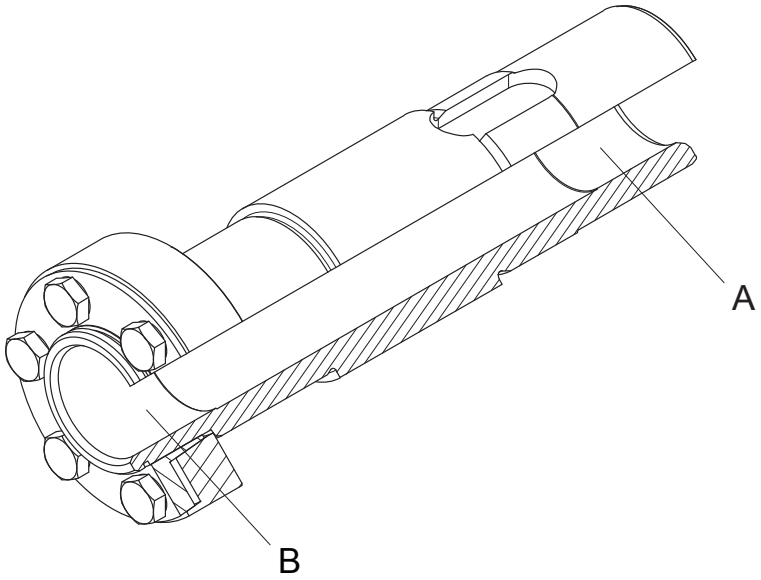
CAUTION
Damage to bearings, shaft, and gearbox housing
- ▷ Do not hit transmission elements such as pinions, hubs, couplings, etc. with a hammer.
- ▷ Pull on transmission elements with a suitable device.

- ▶ Use an assembly aid to pull the gearbox onto the machine solid shaft with key or spline and secure it axially, see 6.2.1, p. 22.
- ▶ To facilitate assembly: Apply suitable anti-corrosion protection to shaft and bore.

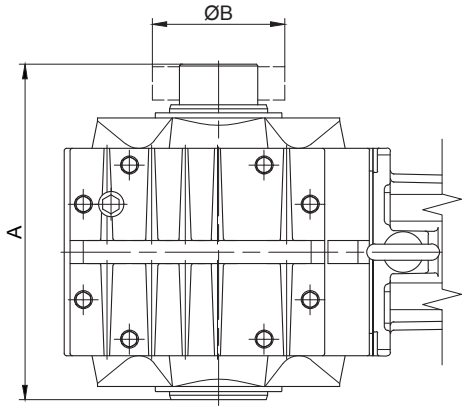
6.4 Assembly of shaft-mounted gear with hollow shaft with shrink disc connection

CAUTION
Damage to hollow shaft
Risk of material damage due to improper handling
▷ Tighten screws on shrink disc connection only with the solid shaft installed.

1. Clean solid shaft and hollow shaft bore over the entire length. In particular, assembly personnel must clean areas A and B of oil, grease, and any contaminant that reduce the friction coefficient.
2. Before tightening (tensioning the shrink disc), ensure that the contact surface between the outer surface of the hollow shaft and shrink disc (area B) is free of oil, grease, and any contaminant that reduce the friction coefficient. Remove residue.



3. Slide shrink disc onto the hollow shaft so that the outer clamping flange is flush with the shoulder of the hollow shaft phase. If the shrink disc connection cannot be pushed on, slightly loosen the tensioning screws.



4. The solid shaft must be at least long enough to cover the entire area under the shrink disc connection. Slide the gearbox onto the solid shaft of the machine.
5. Tighten the tensioning screws with several clockwise turns using a torque wrench. Make sure that the gap between the flanges is uniform all around. Required tightening torque: see SSV manual.

6.5 Installation of torque arm

WARNING

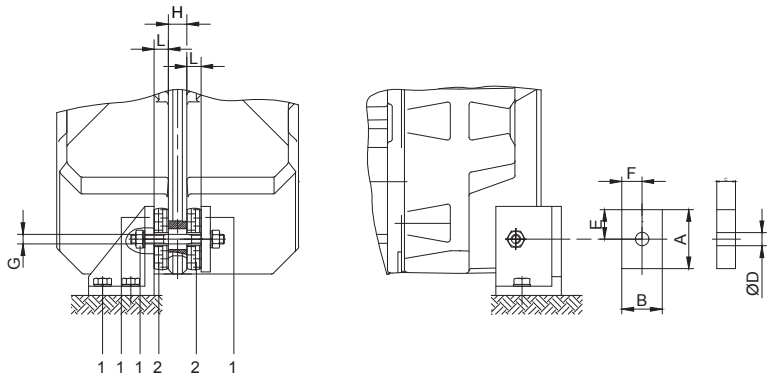
Improper installation of torque arm

Observe specified pre-stresses (see tables). The dimension "L", see following graphics and tables, determines both the pre-stress force of the torque arm and the tightening torque of the fixing screw "G". Play leads to knocking and gearbox overload.

- ▷ Use screws and nuts with a strength of 8.8 or higher.
- ▷ Make sure that the position of fixing screw "G" is parallel to the bore.

6.5.1 Rubber buffer for torque arm with shaft-mounted gearboxes

For gear code BF..-0./ (shaft-mounted version): Rubber buffers are included with delivery. Attachments are not included with delivery.



1 Not included with delivery
2 Rubber buffer pre-stressed
G Maximum bolt diameter

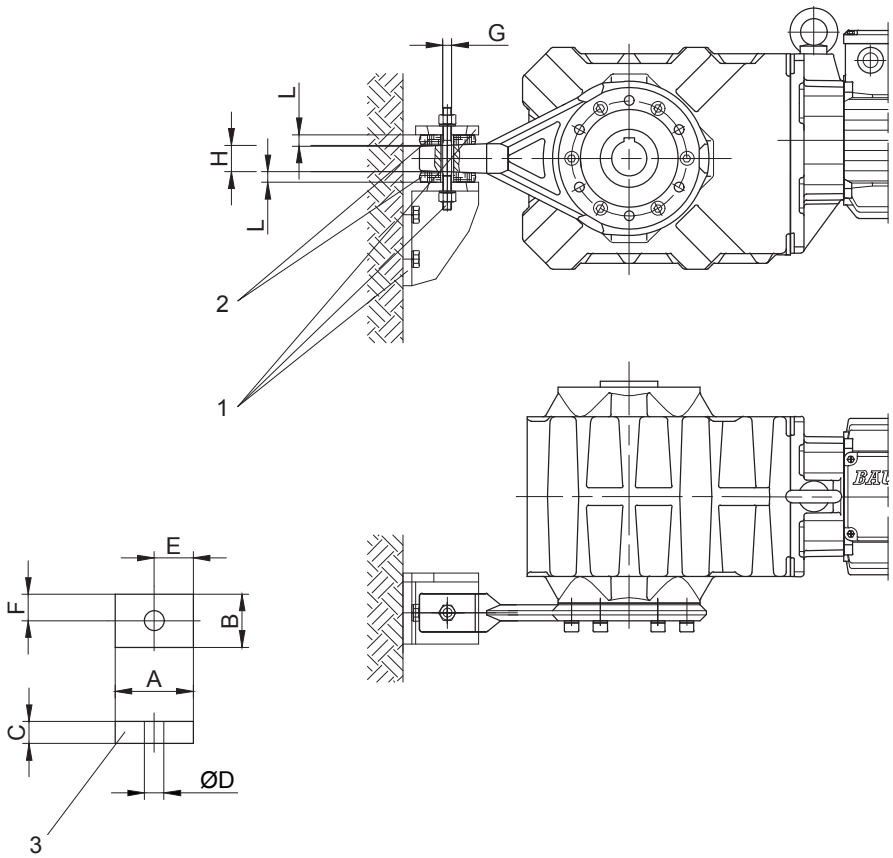
Material:	Natural rubber
Hardness:	50 +/-5 Shore A
Transverse hole dimensions:	See dimension drawing for respective gearbox

Gearbox	Pos.	A	B	C	D	E	F	G	H	L
BF06	0	30	30	12	12	15	15	M10	10	10
BF10	1	48	32	15	14	24	16	M10	16	13.5
BF20	1	48	32	15	14	24	16	M10	18	13
BF30	2	63	43	20	14	31.5	21.5	M10	18	17
BF40	2	63	43	20	14	31.5	21.5	M10	20	16.5
BF50	3	88	60	25	22	44	30	M18	24	21.5
BF60	3	88	60	25	22	44	30	M18	28	21
BF70	4	123	88	30	26	61.5	44	M20	30	25.5
BF80	5	133	103	35	26	66.5	51.5	M20	40	30
BF90	5	133	103	35	26	66.5	51.5	M20	50	29.5
Dimensions [mm]										

Tab. 5: Rubber buffer, shaft-mounted gearbox, dimensions

6.5.2 Rubber buffer for torque arm with bevel gearboxes

With supplied torque arm for gearbox code BK..-0: Rubber buffers are included with delivery. Attachments are not included with delivery.



1 Not included with delivery
2 Rubber buffer pre-stressed
3 Rubber buffer
G Maximum bolt diameter

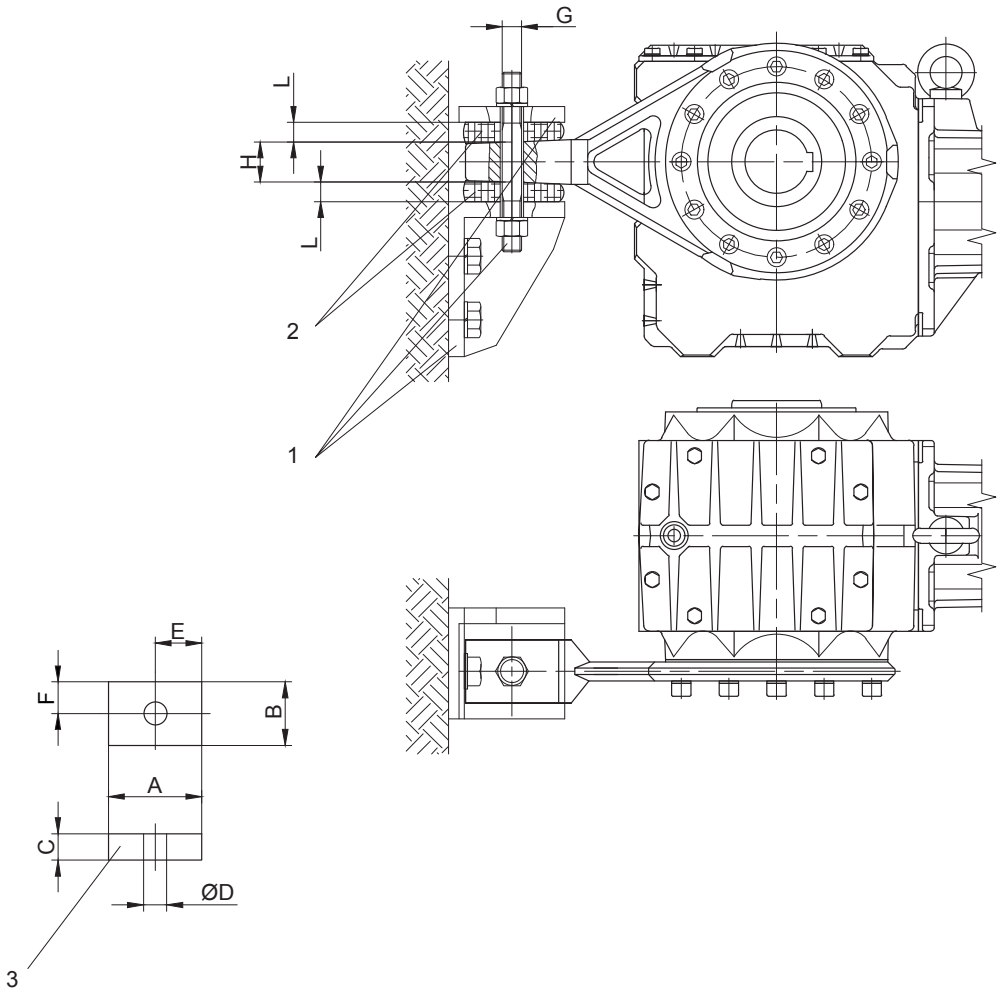
Material:	Natural rubber
Hardness:	50 +/-5 Shore A
Transverse hole dimensions:	See dimension drawing for respective gearbox

Gearbox	Pos.	A	B	C	D	E	F	G	H	L
BK06	0	30	30	12	12	15	15	M10	10	10
BK08	1	48	32	15	14	24	16	M10	19	13.5
BK10	1	48	32	15	14	24	16	M10	19	13.5
BK17	1	48	32	15	14	24	16	M10	19	13
BK20	1	48	32	15	14	24	16	M10	19	13
BK30	2	63	43	20	14	31.5	21.5	M10	30	17
BK40	2	63	43	20	14	31.5	21.5	M10	30	17
BK50	3	88	60	25	22	44	30	M18	36	21.5
BK60	3	88	60	25	22	44	30	M18	38	21
BK70	4	123	88	30	26	61.5	44	M20	40	25.5
BK80	5	133	103	35	26	66.5	51.5	M20	45	30
BK90	5	133	103	35	26	66.5	51.5	M20	45	29.5
Dimensions [mm]										

Tab. 6: Rubber buffer, bevel gearbox, dimensions

6.5.3 Rubber buffer for torque arm with worm gearboxes

With supplied torque arm for gearbox code BS..-0: Rubber buffers are included with delivery. Attachments are not included with delivery.



1 Not included with delivery
2 Rubber buffer pre-stressed
3 Rubber buffer – only for BS03-BS40
G Maximum bolt diameter

Material:	Natural rubber
Hardness:	50 +/-5 Shore A
Transverse hole dimensions:	See dimension drawing for respective gearbox

Gearbox	Pos.	A	B	C	D	E	F	G	H	L
BS02	-	-	-	-	-	-	-	M8	6	-
BS03	0	30	30	12	12	15	15	M8	10	10.5
BS04	0	30	30	12	12	15	15	M8	10	10.5
BS06	0	30	30	12	12	15	15	M10	10	10
BS10	1	48	32	15	14	24	16	M10	19	13
BS20	2	63	43	20	14	31.5	21.5	M10	30	17.5
BS30	2	63	43	20	14	31.5	21.5	M10	30	17
BS40	3	88	60	25	22	44	30	M18	38	22
Dimensions [mm]										

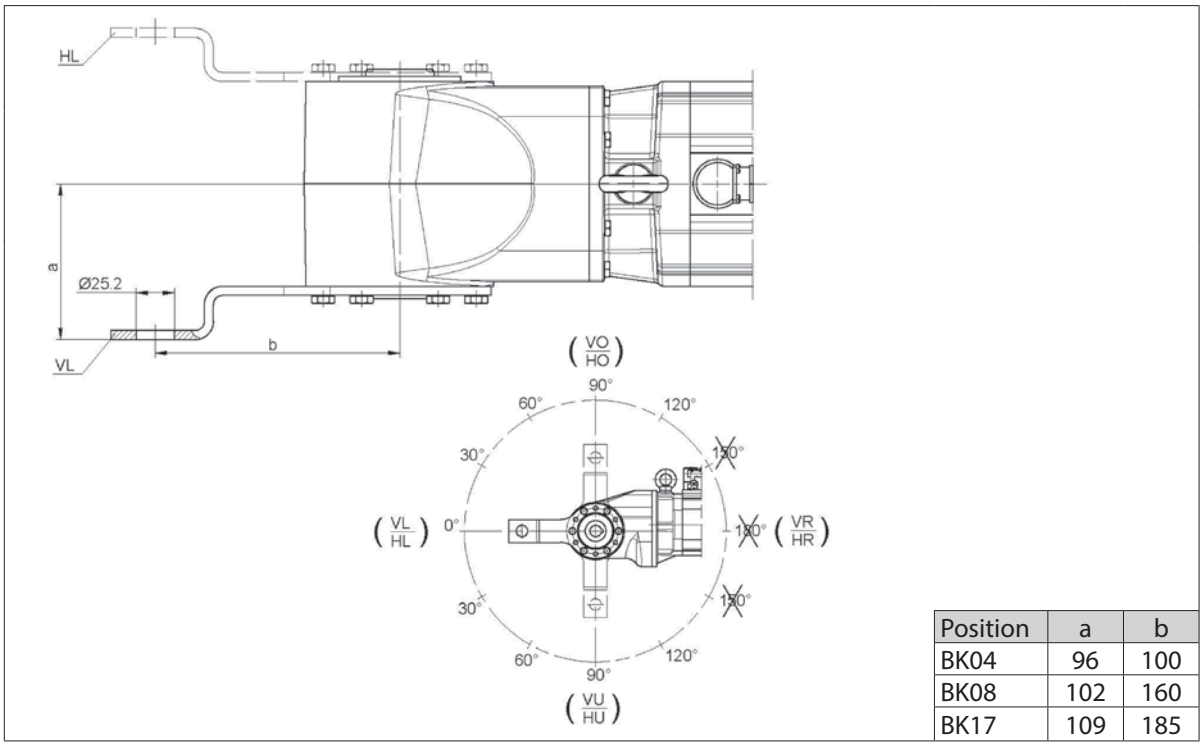
Tab. 7: Rubber buffer, worm gearbox, dimensions

6.5.4 Torque arm for gearboxes BK04, BK08, and BK17

For gearbox code BKH..-0: The torque arm is delivered as a set, consisting of a mounting kit and the torque arm as an accessory with the drive.
The torque arm is not suitable for switching operation.

- ▶ For switching operation, please contact Bauer Gear Motor GmbH.

- ▶ Attach mounting kit according to illustration below.



Position	a	b
BK04	96	100
BK08	102	160
BK17	109	185

Fig. 2: Torque arm design and position

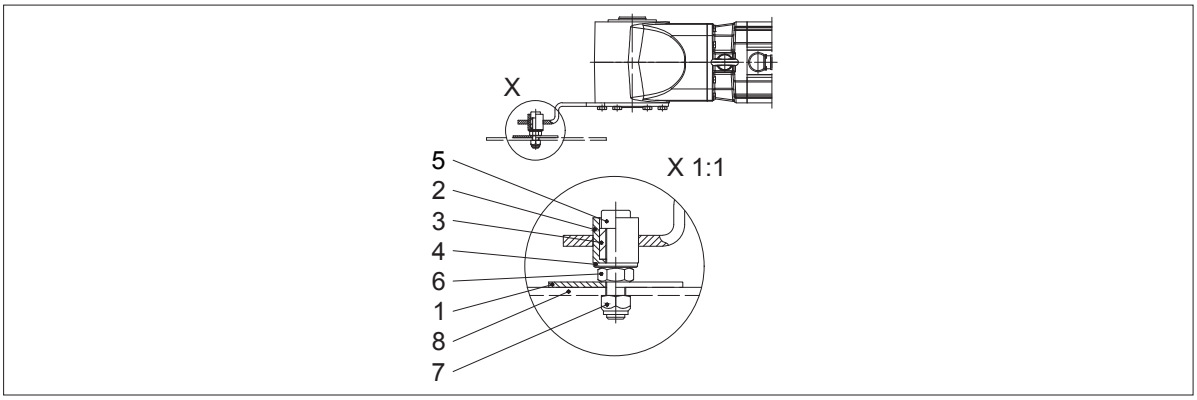


Fig. 3: Mounting kit

Item	Description	Specification
1	Disc	-
2	Bushing	-
3	Sleeve	-
4	Disc	DIN 125-B 13 VA
5	Cylinder screw	DIN EN ISO 4762-M10x50
6	Hex nut	DIN EN ISO 4032-M10
7	Hex nut	DIN 982-M10
8	Customer-side machine housing	-

Tab. 8: Mounting kit

To install the torque arm to the gearbox housing, the mounting kit includes 6 stainless steel screws.

▶ Use the following tightening torques:

Size	Tightening torque [Nm]
M6	8
M8	22
M10	43

Tab. 9: Tightening torques for torque arm installation

6.6 Installation of protective cover

HAZARD
Dangerous rotating parts
Serious or fatal injuries may result.
▷ If no protection is provided on site, install a protective cover for the SSV in accordance with accident prevention regulations (UVV) (available as an option).

6.6.1 Protective cover for shrink disc connection

The following covers are provided as contact protection. They do not protect against water or dirt. Special versions for protection rating IP65 are available on request.

Optionally available
Following versions:

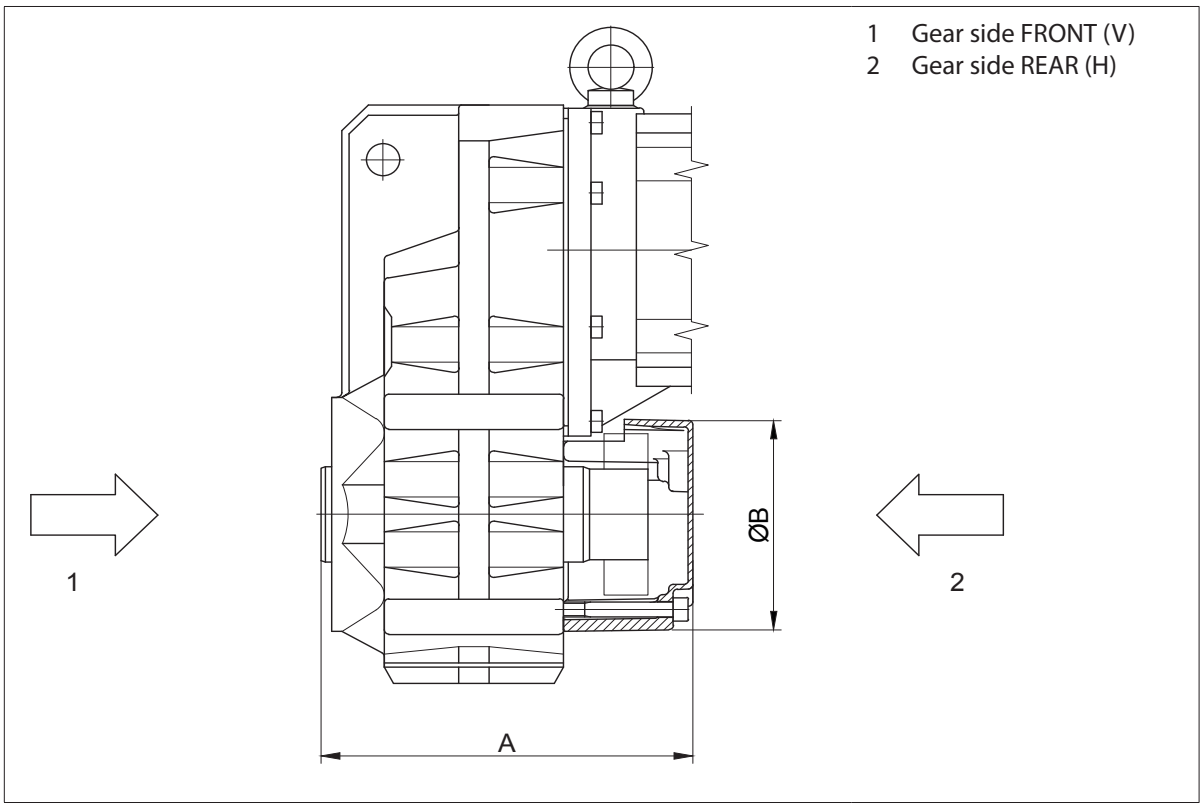


Fig. 4: SSV cover for shaft-mounted gearbox BF10 ... BF90

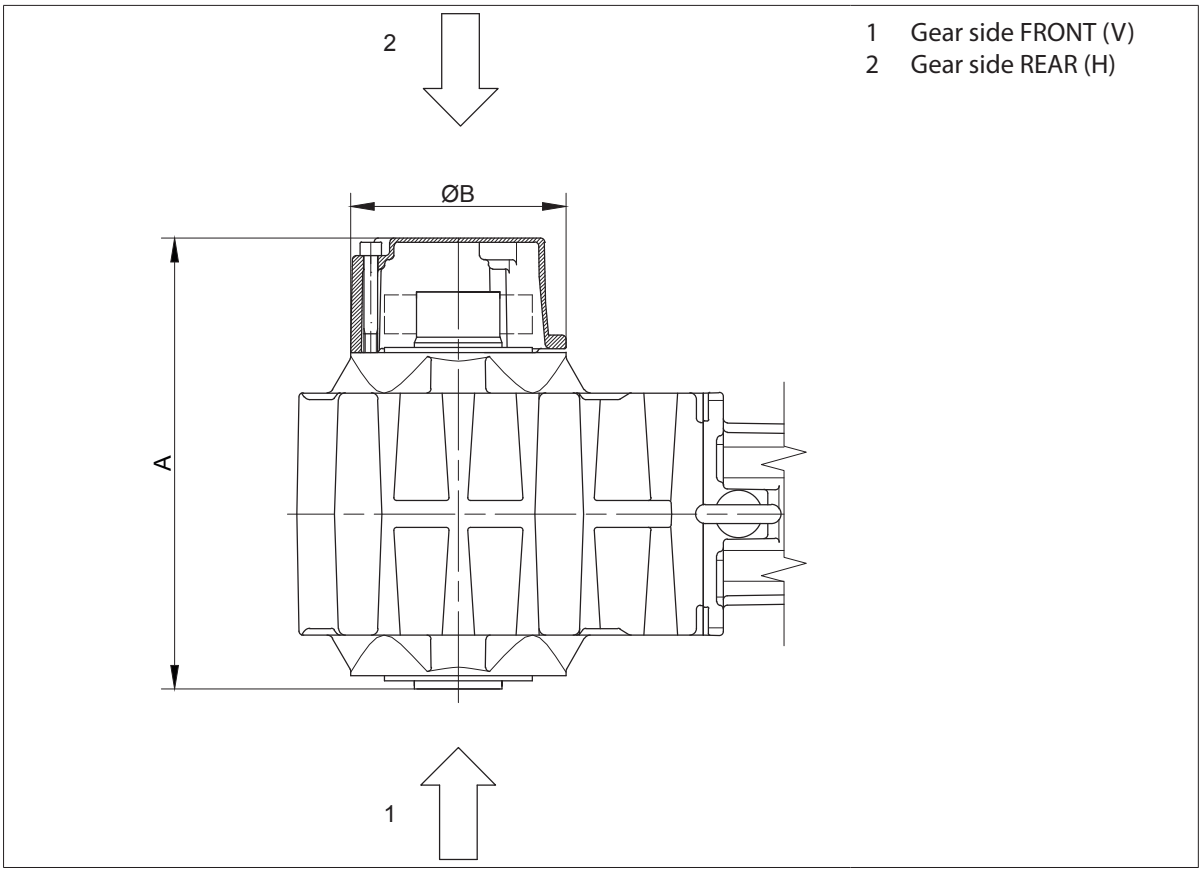


Fig. 5: SSV cover for bevel gearbox BK10 ... BK90

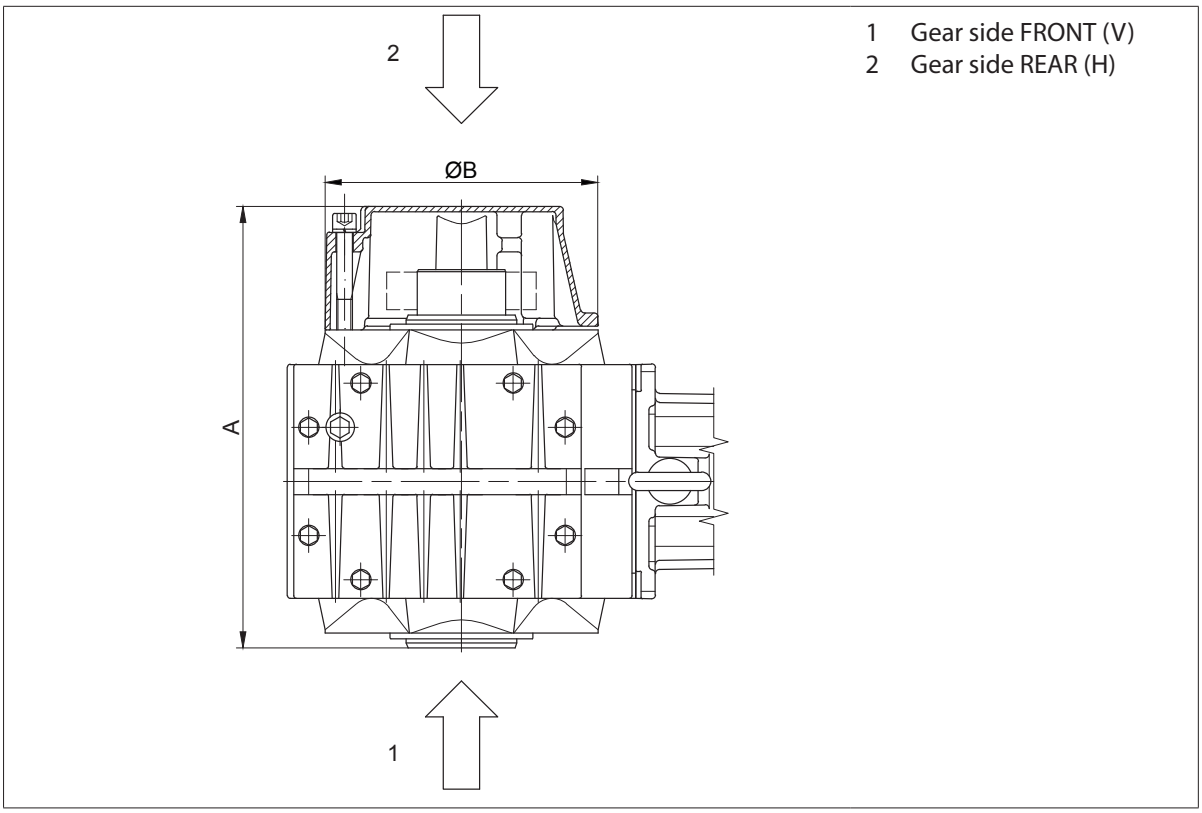


Fig. 6: SSV cover for worm gearbox BS10 ... BS40

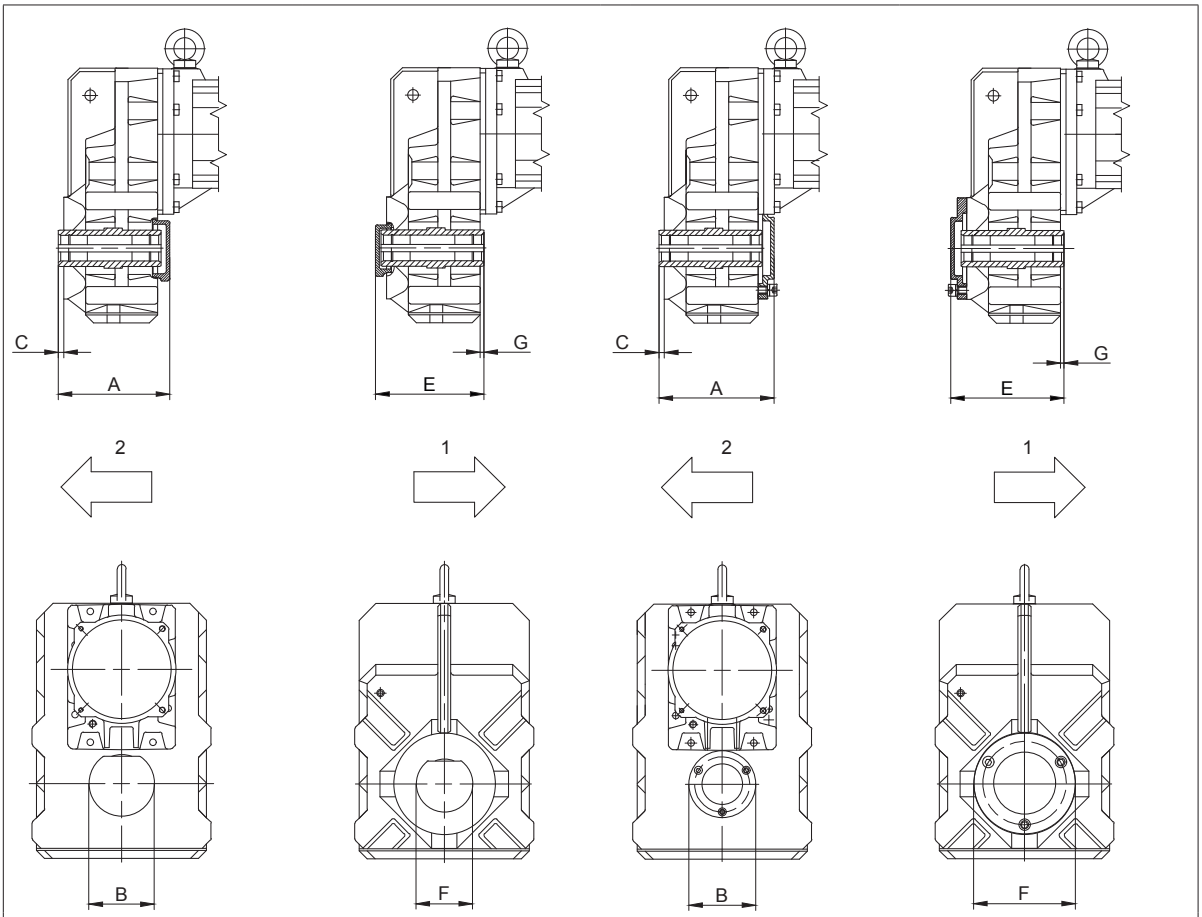
▶ Install covers as contact guard for drives with shrink disc connection.

6.6.2 Protective covers for hollow shafts with keyway or splines

Drives with hollow shafts can be protected against contact and the ingress of occasional splashed water or dirt by installing sealing caps (VK) or sealing covers (VD).

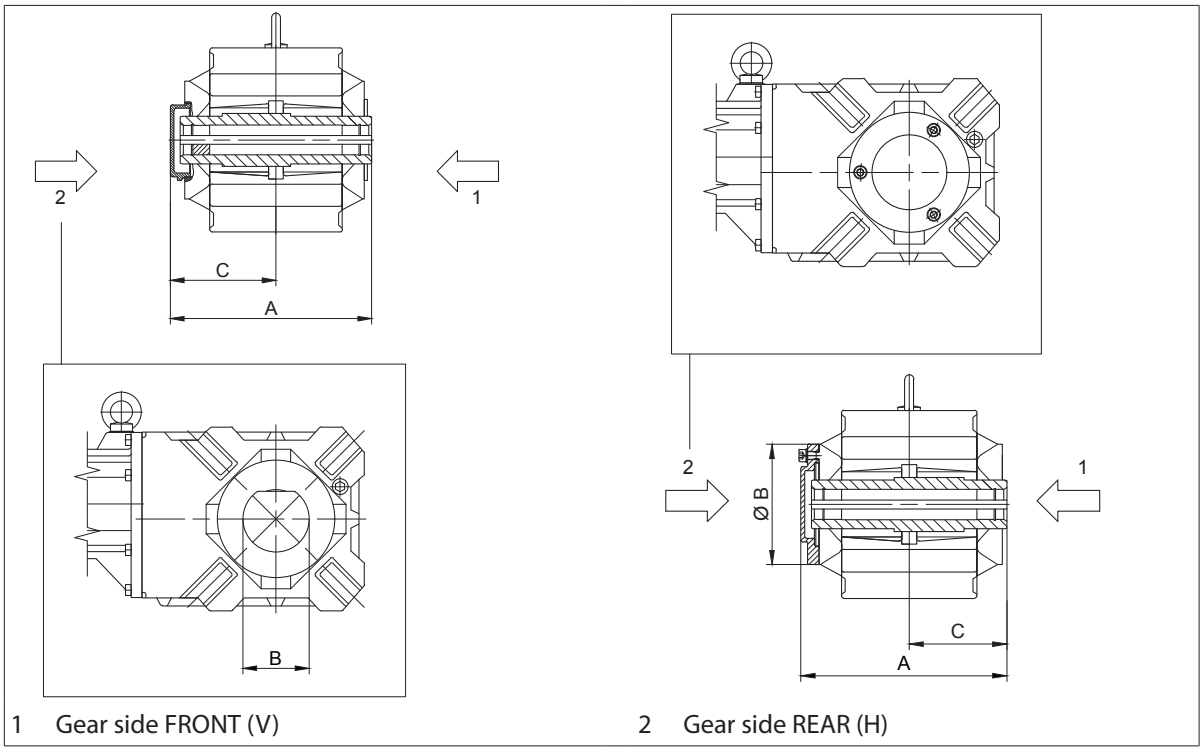
▶ Before mounting the sealing cover, degrease sealing surfaces and seal with a suitable liquid seal.

Optionally available
Following versions:



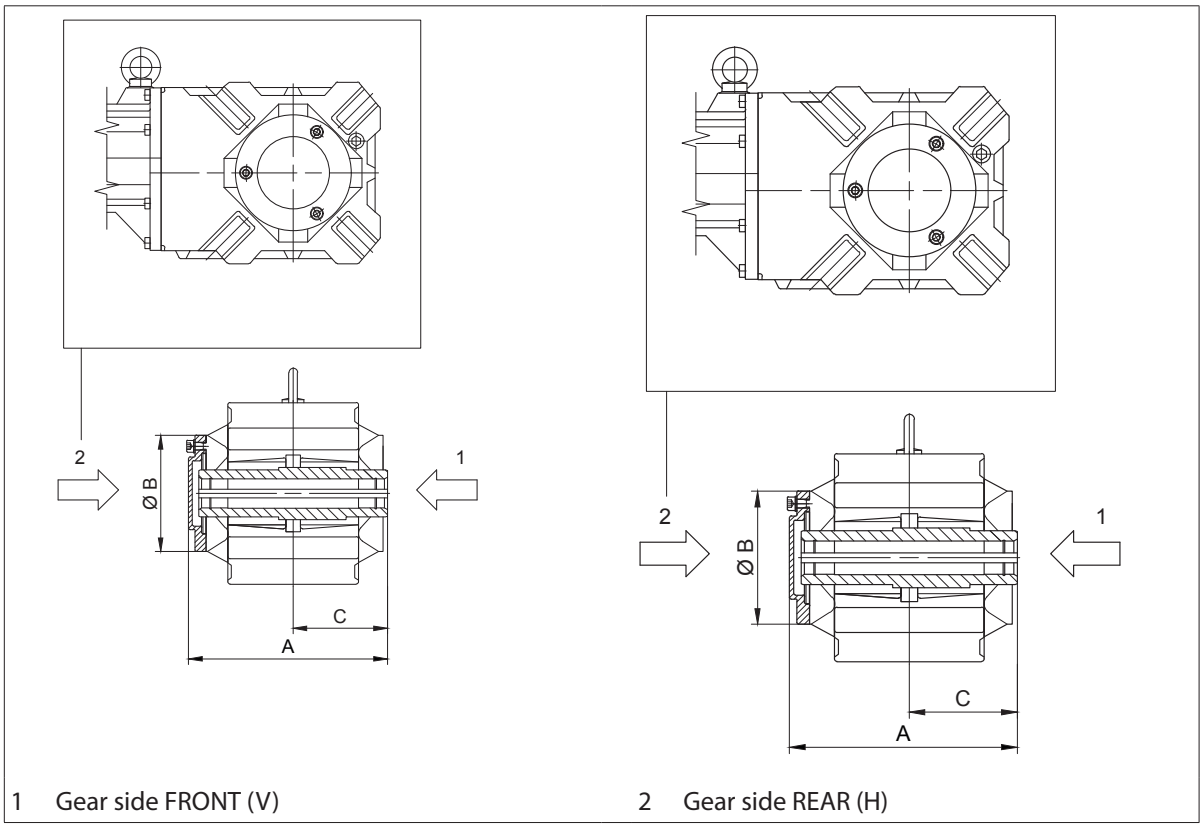
1 Gear side FRONT (V) 2 Gear side REAR (H)

Fig. 7: SSV cover for shaft-mounted gearbox BF10 ... BF90
– sealing caps (left) and sealing covers (right)



1 Gear side FRONT (V) 2 Gear side REAR (H)

Fig. 8: SSV cover for bevel gearbox BK10 ... BK90
– sealing caps (left), sealing cover (right)



1 Gear side FRONT (V) 2 Gear side REAR (H)

Fig. 9: SSV cover for worm gearbox BS10 ... BS40
– sealing caps (left), sealing cover (right)

6.7 Installation of oil expansion tank

The oil expansion tank and the components required for installation are supplied as a three-piece accessory set delivered with the drive.

☑ Drive correctly positioned for installation according to rating plate
▶ Install oil expansion tank on gearbox in system on site.

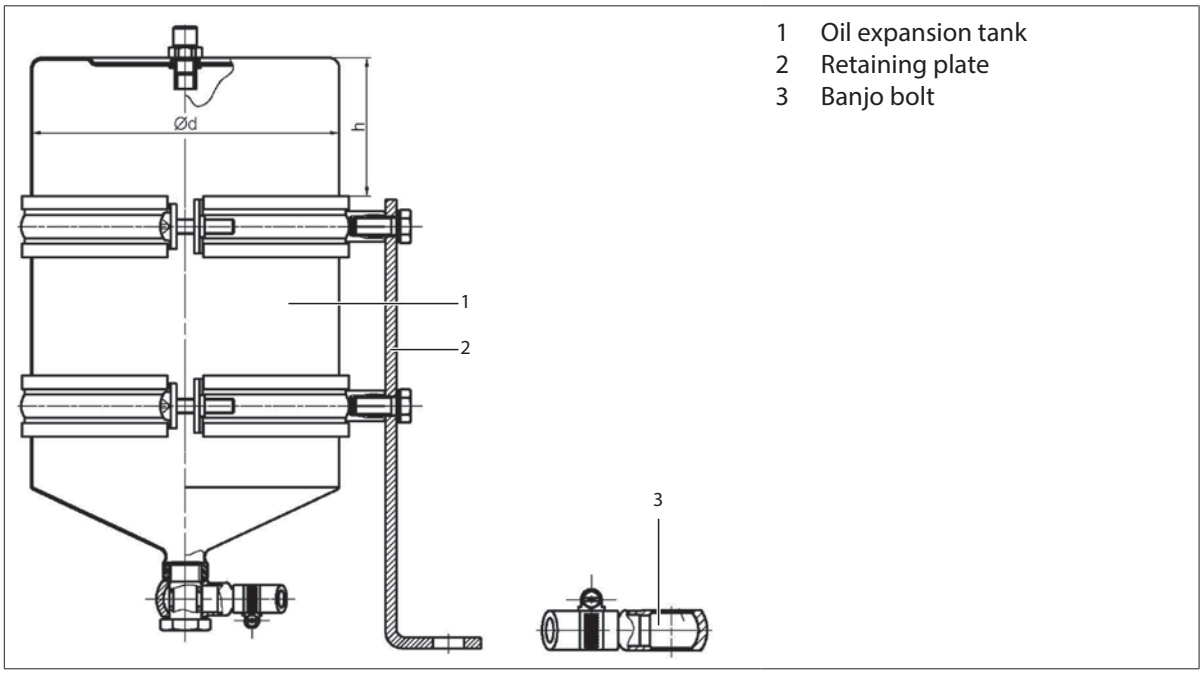


Fig. 10: Accessory set, Part 1: Oil expansion tank unit with retaining plate

Tank diameter d [mm]	Height positioning h [mm]
ca. 100	5
ca. 112	77

Tab. 10: Oil expansion tank height adjustment

6.7.1 Attach oil expansion tank to gearbox housing

The gearbox is delivered with pre-installed threaded bolt, spring washer, and hex nut.

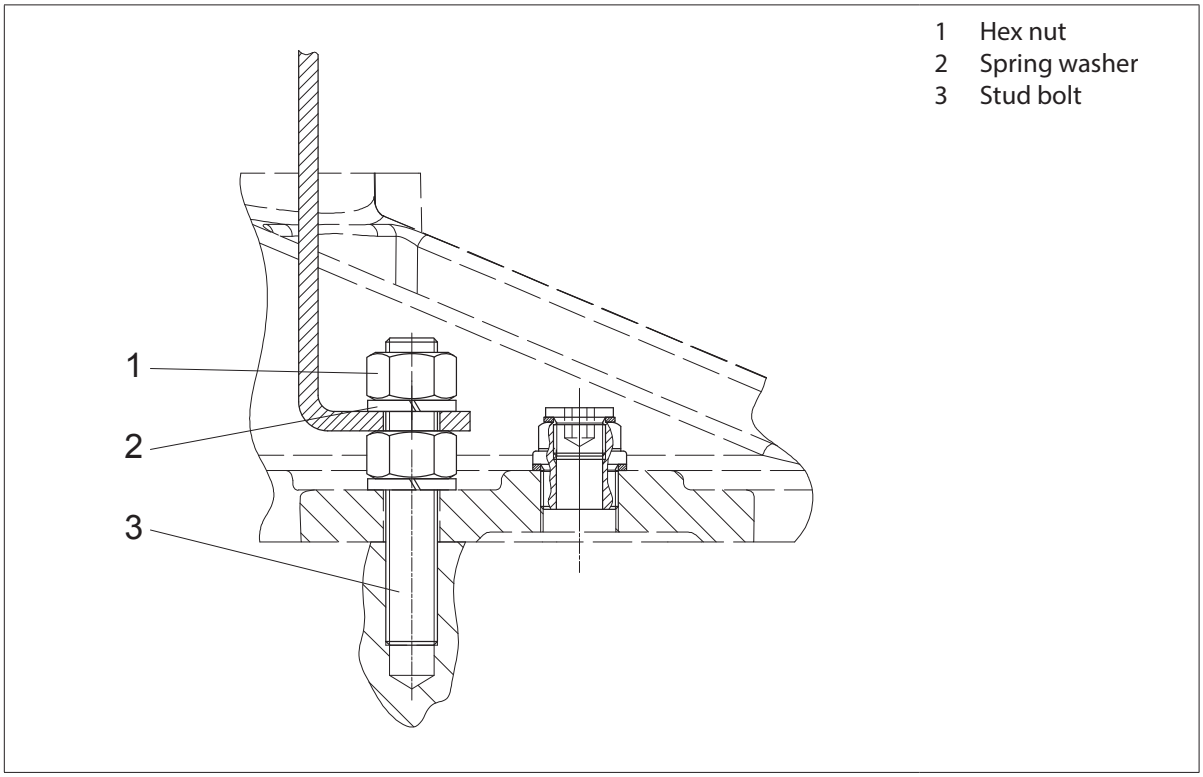


Fig. 11: Accessory set, Part 2: Mounting set with nut and spring washer

- ▶ Place oil expansion tank (1, Fig. 10, p. 33) with mounted retaining plate (2, Fig. 10, p. 33) on threaded bolt (3) and fasten with spring washers (2) and hex nut (1).
  - Tightening torques for hex nut on threaded bolt:
    M12: 86 Nm
    M16: 210 Nm

6.7.2 Avoiding noise

- ▶ To avoid noise, make sure that the tank unit does not come into contact with the motor housing when mounted.

Aligning the connection hose

- ▶ If it is necessary to align the connection hose, turn the entire tank in the pipe clamps as follows:

1. Sufficiently loosen the pipe clamps by opening the tensioning screws; see information label on tank (Fig. 12).
2. Align the tank. When doing so, note the correct height position h of the tank, see Fig. 10, p. 33 and Tab. 10, p. 33.
3. Re-tighten tensioning screws of pipe clamps with 5 + 2 Nm.

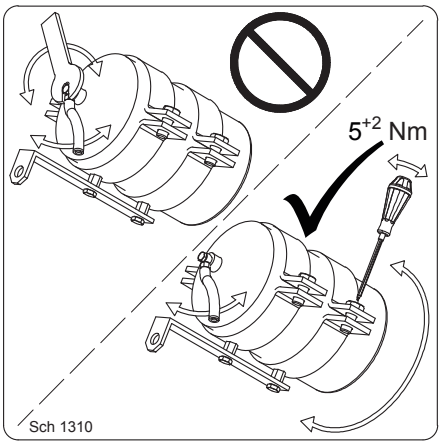
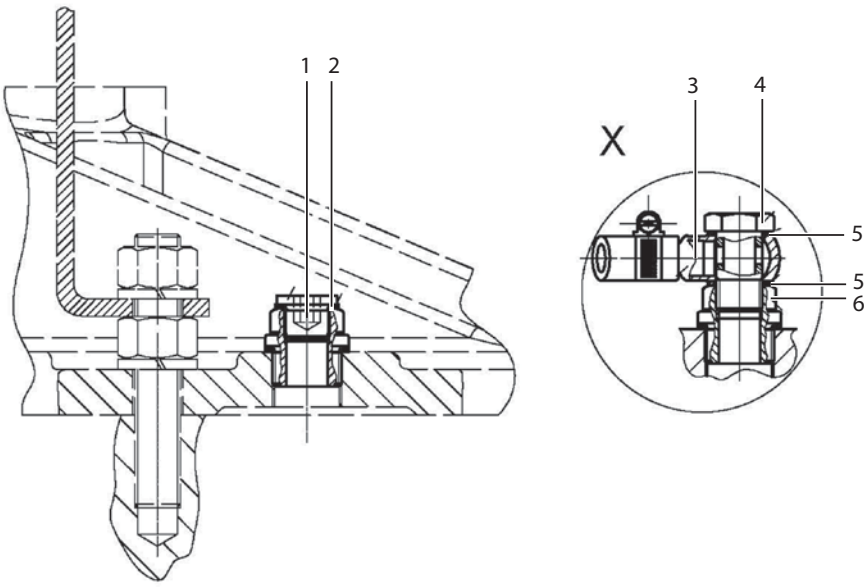


Fig. 12: SCH-1310

6.7.3 Attach connection hose to gearbox housing



1 Screw plug (M16x1.5)
2 Gasket
3 Banjo bolt
4 Banjo screw
5 Gasket
6 Reducer

Fig. 13: Accessory set, Part 3: Hollow screw and two gaskets

To ensure that the expansion tank functions correctly, connect the free end of the connection hose to the gearbox using the banjo bolt as follows:

1. Remove the screw plug (1) marked with a red dot and the gasket (2) underneath it. Both are no longer required for operation.
2. Into the open threaded hole of the reducer (6), screw the banjo bolt (3) of the connection hose according to Fig. 13, detail X with new gaskets (5) and new hollow screw (4), taking into account the arrangement of the components.
   - Tightening torque for banjo screw: 27 Nm

6.8 Electrical installation

Before performing any work, read and follow the safety instructions described in chapter 2, p. 10.
All work with the product must be performed by qualified and trained specialist personnel.
Also follow:
- Plant-specific and local regulations and requirements
- Safety barriers and warning and safety signs specified on site.

▶ If product was stored for a long period of time (>9 months / long-term storage): Prepare the product before installation in accordance with the specifications in chapter 5.3.2, p. 21 .

The connection diagrams for the respective motor are attached in the terminal box cover of the product.

6.8.1 Required tools and aids

- Chisel or similar
- Hammer
- Screwdriver

6.8.2 Prerequisites

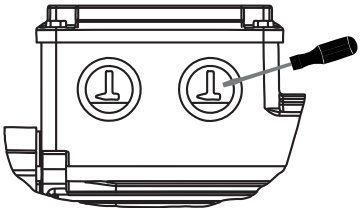
- ▶ Only install the product if the mains voltage and frequency match the motor data or, with inverter duty, the output voltage of the inverter matches the connection voltage of the motor, see chapter 3.1.1, p. 14 and drive rating plate.
- ▶ The electrical connection of the motor must be made according to the connection diagram enclosed in the terminal box.
- ▶ If the connection diagram is missing: Do not connect the motor. An approved connection diagram can be requested from Bauer Gear Motor GmbH.

6.8.3 Open cable entry of cast-on terminal box (D..04.. to D..11..)

WARNING
Parts may break loose and cause injury
▷ Wear safety glasses.

1. Screw on terminal box cover.
2. Place chisel or similar at a slight angle on the cable entry to be opened and hammer it in lightly.

CAUTION
Material damage due to incorrect use of tool
Risk of damage to terminal box
▷ Do not punch tool through.

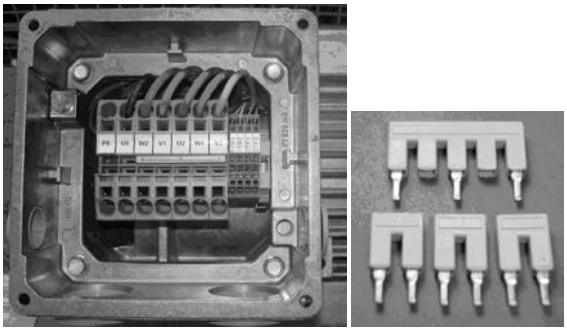


3. Unscrew terminal box cover and remove broken-out parts.
4. Fasten cable gland with enclosed lock nut. When doing so, use the installation torques specified by the cable gland manufacturer.
5. Tighten the terminal box cover with a tightening torque of 1-1.5 Nm to ensure terminal box cover sealing.

6.8.4 Electrical connection on terminal block

Make the electrical connection according to the connection diagram. A terminal block with cage spring clamps (CAGE CLAMP®) is installed as standard.

Terminal block with CAGE CLAMP® technology



- 6 terminals for winding
- 1 terminal for PE
- 4 auxiliary terminals in different sizes and colours (e.g. thermistors for warnings and shutdown)
- Star connection W2-U2-V2 fitted
- The lower terminal row is for the mains connection.

6. Open clamp with a suitable screwdriver: Insert screwdriver until the stop.
   ▫ Leave screwdriver in place to hold the CAGE CLAMP®.
7. Insert cable: Insert the approx. 10 mm long insulated single-wire, fine-wire, or crimped connection wire. For fine-wire connection wires, ensure that no splices protrude out.

Single-wire

Fine-wire

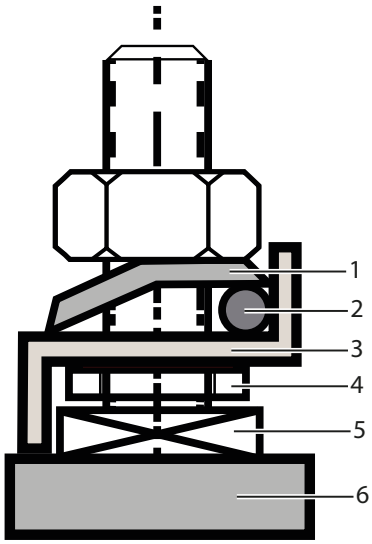
Crimped

8. Pull out screwdriver.
   - Cable is clamped automatically.
9. Once the connection is complete, screw on the terminal box cover. Make sure that no cable strands are crushed. Ensure that the seal is seated correctly.
10. After completing work: Have any damage to paint coating repaired professionally to ensure corrosion protection.

6.8.5 Electrical connection on terminal board

Optionally available
Motor with terminal board with screw bolts installed in terminal box

▶ Make connection according to following sketch. Use the tightening torques in accordance with Tab. 11, p. 37.



1 Connecting washer in accordance with DIN 46288 as loosening protection and pressure piece
2 Mains cable
3 Z anti-rotation bracket (bottom) and mains cable retainer bracket (top)
4 Winding end with ring lug
5 Square on brass stud to prevent turning
6 Plastic base of terminal board

▶ Use the following tightening torques:

Nut	Tightening torque [Nm]
M4	1.6
M5	2.0
M6	3.0
M8	6.0

Tab. 11: Tightening torques for electrical connection on terminal board

6.8.6 Electrical connection with plug-in connection on terminal box, CleanConnect® plug, or cable version (CleanDrive)

Optionally available

Product with following connection variants:

Connection variant	Description	Connection diagram	Remarks
Plug-in connection on terminal box	Plug installed on terminal box for electrical connection	Included with delivery	-
CleanConnect® plug	AsepticDrives equipped with CleanConnect® stainless steel circular connector, protection rating IP67/IP69K	Included with delivery	pH2 to pH12 cleaners are permitted for cleaning when using the supplied or recommended power cables.
Cable version (CleanDrive)	Can also be equipped with cable version with stainless steel screw connection, protection rating IP67	Included with delivery	pH2 to pH12 cleaners are permitted for cleaning.

Tab. 12: Electrical connection variants – properties and information

If the connector is supplied, read supplied documentation.

6.8.7 Protective earthing

- ▶ Establish standard earthing via protective conductors in respective motor terminal box. When connecting the earthing cable, make sure that the connection conducts well.

Optionally available
For corresponding requirements: Drive with easily accessible earthing screw mounted on outside of motor housing to optimise earthing.

6.8.8 Contact protection

If voltage is present, e.g. in testing and commissioning phases with open terminal box:
- ▶ Make sure that no one is standing in the hazard area.
- ▶ Attach contact guards, warning signs, barriers, or similar in accordance with safety specifications.

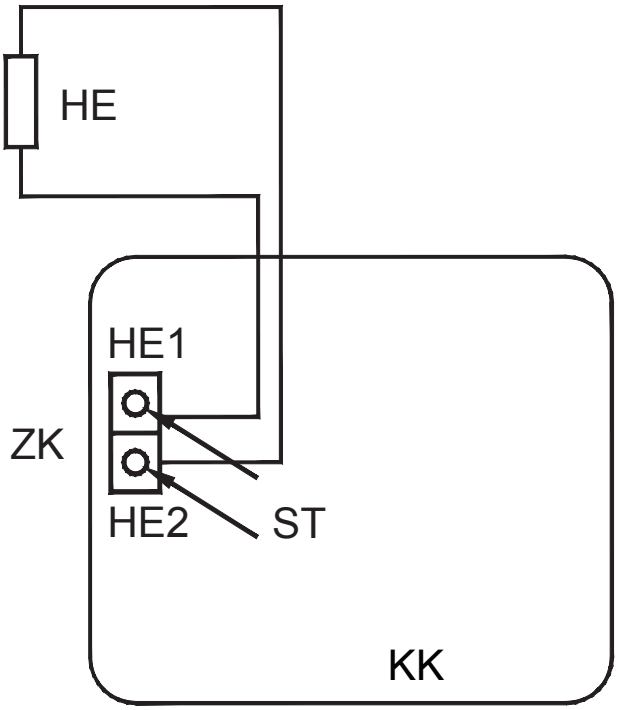
6.8.9 Electrical connection for motor protection devices

HAZARD
Automatic restart
After the winding has cooled, the system may restart on its own, which could lead to severe to fatal injuries.
- ▷ Prevent restarting via switching.

- ▶ Use motor protection switches to protect the winding against overload and against the consequences of operating on only two mains supply lines, e.g. in the event of phase failure.
- ▶ Set the motor protection switch to the rated current at the respective rated voltage of the motor, see rating plate.

6.8.10 Stator standstill heating

CAUTION
Incorrect connection voltage for auxiliary heating via heater bands
Motor damage and material damage due to drive failure can result.
- ▷ Note the connection voltage, see rating plate.
- ▷ Only switch on the heater bands when at a standstill.
- ▷ Apply the heating voltage (AC voltage) according to the wiring diagram of the parking heater.



KK	Motor terminal box
ZK	Auxiliary terminal
HE	Heating
ST	Connection for heater _____ V _____ W

The auxiliary terminal arrangement drawn does not have to correspond to the spatial arrangement.

Fig. 14: Connection diagram for stator standstill heating via heater bands

6.8.11 Electrical connection for brakes

▶ When making electrical connection for brakes: Follow factory regulations or rules from professional associations for connecting brakes, e.g. phase failure protection or other safety circuits.

There are 2 options for supplying power to the DC solenoid:
- Externally from an existing DC control network or through a rectifier in the control cabinet.
- Through a rectifier mounted in the motor or brake terminal box. In this case, the rectifier can be supplied either directly from the motor terminal board or from the mains.

Do **not** connect the rectifier to the motor terminal board in the following cases:
- Pole-changing motors and wide-voltage motors
- Frequency inverter duty
- Other versions where motor voltage is not constant, e.g. operation on soft starters, starting transformers, etc.

▶ Make the electrical connection for the brake according to the connection diagram (included with motor with every delivery).

6.8.12 Electrical connection for external fan

CAUTION
Incorrect connection of external fan
Material damage and financial losses caused by a system malfunction due to motor failure may occur because the external fan cannot cool during downtimes or does not supply enough cooling air at low frequencies (inverter duty).
▷ Make electrical connection for external fan separately (not on motor terminal board) for intermittent, periodic, or frequency inverter duty.

▶ Make the electrical connection for the external fan in accordance with the connection diagram (included with motor with every delivery).
- For possible connection voltages, see table in chapter 16.5.1, p. 57.

6.8.13 Encoder electrical connection

▶ Establish the electrical connection for the encoders in accordance with the manufacturer's operating manual supplied with the product.

6.8.14 Connection for motors with plug

▶ Information on connecting motors with plugs: Read motor data sheet.

When connecting, follow manufacturer's documentation for plug.

7 Commissioning

CAUTION
Hearing hazard due to high noise emissions
▷ Wear hearing protection.

- ▶ Observe the values on the rating plate.
- ▶ Follow instructions in chapters 2, p. 10, 6.2, p. 22 and 6.8, p. 35 .
- ▶ Observe motor speeds, e.g. with inverter duty, for frequency inverter possibly being used.

For existing options, e.g. encoders, follow the operating manual supplied by the manufacturer.

7.1 Checks before commissioning

- ▶ Before commissioning the product, check the following:
  - Integrity
  - No leaks
  - Fasten the drive and transmission elements with the necessary screws and torques
  - Transmission elements such as chains or belts are tensioned according to specification.
  - Possible torque arms are placed correctly and rubber buffers are pre-stressed.
  - Safety devices and covers are correctly mounted on both the drive and the system/machine.
  - All electrical cables are correctly laid and connected.
  - Cable glands are tightened and sealed as necessary.
  - Motor protection switches are set to the rated current and, if necessary, other motor protection devices are activated.
  - Cooling air supply to the motor is unobstructed.
  - Any existing brake is set to the projected braking torque.
  - Existing brake is working in accordance with requirements and does not lock in place, particularly during lifting operations, and existing manual release lever has been removed.
  - The direction of rotation is correct. U, V, W on L1, L2, L3 give a clockwise rotation of the motor when looking at the motor shaft, i.e. on two-stage and four-stage gears, the output shaft also rotates to the right, while on one-stage, three-stage, and five-stage gears, the output shaft rotates to the left.
    For gearboxes with right-angle output (BK... and BS... gearbox), the defined direction of rotation is related to gear side "V".

7.2 Initial commissioning

☑ Installation position according to rating plate.
- ▶ For motors with backstop: The permissible motor rotation direction is marked with an arrow on the fan cover. Start the motor in the permissible direction of rotation. Do not start motors with backstop in the blocking direction as this may damage the backstop.

Worm gearboxes (BS...) are so-called sliding gears whose tooth flanks must be smoothed during a run-in phase in order to achieve optimum efficiency. Depending on the load, this is achieved within 50 ... 100 operating hours.
With non-ventilated motors, this can cause them to get a little hotter during the run-in phase, which is harmless.

Small amounts of lubricant will occasionally leak out of the output shaft seals during commissioning and within the first hours of operation. This is not a defect, it is a so-called apparent leak. These can be caused by grease "bleeding" between the dust lip and sealing lip of the shaft seal as well as by an incomplete run-in process between sealing lip and shaft.
▷ Wipe off any leaking lubricant with a lint-free cloth.
▷ Check the sealing point again after a few operating hours.

7.3 Commissioning after long-term storage

7.3.1 Gearbox measures

Detailed information and instructions on lubricant recommendations can be found in chapter 11.4.2, p. 52. For lubricant quantities, see rating plate or customer service manual.

- ▶ Before commissioning, reduce the lubricant level of the gearbox back to the value specified on the rating plate or in these Operating Instructions.
- ▶ If the vent screws have been replaced with screw plugs: Re-insert vent screws.
- ▶ If the storage period exceeds two years, for shorter storage periods, or if the ambient temperature often exceeds the normal values of -20 °C to +40 °C: Change lubricant.
- ▶ Check shaft seals for damage, inspect shape, colour, hardness, and replace if changed.

7.3.2 Motor measures

HAZARD
Electric shock
Serious injury or death can result.
▷ Check the insulation resistance between all winding points and between the winding and housing. Check insulation resistance with commercially available measuring devices.

- Measured value 50 MΩ = optimal, corresponds to new
- Measured value 5 MΩ = drying advisable
- Measured value 1 MΩ = drying required

Option 1: Dry motor via stator heater
▶ Warm up the engine with the standstill heater (optionally available).
For stator standstill heating to dry motor part without disassembly, see additional information in chapter 6.8.10, p. 39.

Option 2: Heat motor via motor winding
1. Dismantle the motor (see chapter 13, p. 54).
2. Connect adjustable AC voltage to dry the motor part.
   - Voltage: max. 20% of rated voltage according to rating plate
   - Heating current: max. 65% of rated current according to rating plate
3. Monitor heating during the first 2-5 hours. If the current is too high, reduce the heating voltage.
4. Stop drying as soon as the insulation value has risen again to values >10 MΩ.
   - Experience has shown that heating lasts 12-24 hours.
5. If the storage period exceeds two years, or, for shorter storage periods, the environmental temperature exceeds the normal values of -20 °C to +40 °C : Check the motor bearings lubricant and replace as necessary.
6. Install the motor (see chapter 6, p. 21).

8 Normal operation

Normal operation depends on the overall situation after installing the drive in the overall system or machine.

Read and follow documentation for overall system or machine.

9 Malfunctions and troubleshooting

9.1 Motor malfunctions

Malfunction	Possible cause	Remedy
Motor not starting	No voltage connected to motor	▶ Correct connections, eliminate interruptions as necessary.
	Fuse switched off/burnt	▶ Switch on or replace fuse.
	Brake not releasing.	▶ Configure drive and connections correctly.
	Motor protection has tripped.	▶ Check motor protection configuration. ▶ Remove blockages.
	No release for inverter duty	▶ Follow operating instructions of the frequency inverter.
Motor not starting or "racking" up.	Motor runs against closed brake.	▶ Adjust brake drive and connections correctly.
	• Voltage drop too large • Cable cross section too small in general or for existing large cable length	▶ Insert cable with correct cross section.
	Motor intended for delta connection, but connected in star	▶ Correct switching.
	If configured for Y-D start-up, starting torque in Y-switching too low (incorrect configuration)	▶ Eliminate tension or other additional mechanical loads in the system. ▶ Check projection, use stronger motor as necessary. ▶ Design different start-up solution.
Motor not reaching its rated speed or speed drops sharply	Motor is overloaded.	▶ Eliminate overload. ▶ Measure load. ▶ Check configuration and initiate further measures as necessary.
	Voltage drop too large, cable cross section too small in general or for existing large cable length	▶ Insert cable with correct cross section.
Fuses fail immediately after switching on	• Connected incorrectly • Short-circuit in supply line	▶ Correct the connection.
	Motor has short-circuited or shorted to ground.	▶ Speak with Bauer Gear Motor in advance, this may fall under warranty. ▶ Have the motor repaired or replaced by a specialist company.
Motor protection trips immediately after switching on	• Connected incorrectly • Short-circuit in supply line	▶ Correct the connection.
	Motor has short-circuited or shorted to ground.	▶ Speak with Bauer Gear Motor in advance, this may fall under warranty. ▶ Have the motor repaired or replaced by a specialist company.

Malfunction	Possible cause	Remedy
Motor becomes too hot. ▶ If necessary, consult with Bauer Gear Motor GmbH • How hot does the motor get? • After what runtime? • Measured where?	Drive is overloaded.	▶ Take a power measurement. ▶ If necessary, select different drive and reconfigure.
	Connection voltage at motor terminals too high or too low (if not otherwise confirmed, ± 5% as standard)	▶ Voltage drop too large. Check connection cable cross section, correct if necessary ▶ If necessary, adjust motor to available mains voltage.
	Cooling insufficient	▶ Ensure unimpeded air supply, retrofit external fans if necessary.
	Motor configured for wrong operating mode (S1 ... S10)	▶ Operate the system according to the operating mode. ▶ If necessary, select different drive and reconfigure.
	Ambient temperature higher than considered during configuration	▶ Consult with Bauer Gear Motor and find a solution together.
	Motor runs on 2 phases only.	▶ Check fuses, connection lines. ▶ Rectify malfunction. ▶ Measure motor winding. ▶ If necessary, repair at specialist workshop.

Tab. 13: Motor malfunctions

9.2 Gearbox malfunctions

Malfunction	Possible cause	Remedy
Gearbox making unusual grinding noises	• Drive installed unfavourably in system (tensioned) • Potentially (also) bearing damage	▶ Correct alignment and mounting of the drive. ▶ If bearings are damaged, repair at specialist workshop.
Gearbox making unusual knocking noises	Damage in gearing	▶ Repair at a specialist workshop.
Oil leaking at output shaft or at housing separation points	• Sealing ring defective/worn • Surface seals defective	▶ Repair at a specialist workshop.
Minimal lubricant leakage at output shaft, usually during commissioning	Apparent leakage	No damage present. ▶ Wipe off excess lubricant and monitor area. If no further leakage occurs, seal point OK
Oil leak at vent valve	• Incorrect installation position • Too much lubricant in gearbox	▶ Correct lubricant quantity according to installation position. See rating plate for the correct lubricant quantities.

Tab. 14: Gearbox malfunctions

9.3 Brake malfunctions

Malfunction	Possible cause	Remedy
Brake does not release	No voltage present.	▶ Check and correct control. ▶ If possible due to connection used, place missing connection between rectifier and terminal board. ▶ Rectifier defective, replace.
	Incorrect voltage applied.	▶ Correct voltage.
	Air gap too large	Brake pads worn. ▶ Have repaired by trained personnel or specialist workshop
	Brake coil defective	▶ Replace brake. ▶ Have repaired by trained personnel or a specialist workshop.
Drive does not brake as planned	Incorrect braking torque	▶ Have the braking torque corrected by trained personnel or a specialist workshop.
	Brake lining worn	▶ Insert new linings and friction discs, have repaired by trained personnel or specialist workshop.
	Air gap too large	▶ Adjust air gap or replace friction discs. ▶ Have repaired by trained personnel or a specialist workshop.
Brake engages too slowly	Incorrect control selected	▶ Install DC-side switch-off. or ▶ Use electronic or overexcitation fast-acting rectifiers.
Brake wear is high (especially with higher switching frequency)	When the motor is switched on, it moves off against the closed brake until it is released, see chapter 6.8, p. 35.	▶ Use overexcitation fast-acting rectifiers.
Brake rattling	Usually occurs due to alternating torques on inverter duty.	▶ Configure inverter correctly.

Tab. 15: Brake malfunctions

10 Repair

Any work on the products must be performed by qualified specialist personnel.
▶ Follow the troubleshooting instructions in chapter 9, p. 43 .

Repairs must be made in compliance with chapters 2, p. 10, 6.2, p. 22, 6.8, p. 35, 7, p. 41, 8, p. 42, and 15, p. 55 by authorised personnel trained on the product.
▶ Use only original spare parts.
Bauer Gear Motor GmbH assumes no liability or guarantee in the event of non-compliance.

CAUTION
Damage to property
Possible damage to drives and environment/system
▷ Avoid damage to paint coating.
▷ For drives with corrosion class C4, C5, IM2, and aseptic: Have repaired only by Bauer contract partners or at the main plant.

11 Maintenance

Insufficient maintenance and defective products can result in personal injury and property damage.
▶ Perform specified inspections and maintenance work at the recommended intervals.
▶ Bauer Gear Motor GmbH accepts no liability or warranty in the event of non-compliance.

ATTENTION
Material damage
Damage to drives and surroundings/system possible
▷ For all maintenance work, observe the installation position according to the type plate (see chapter 3.1.1, p. 14).
▷ Do not change the installation position.

11.1 Maintenance schedule

Assembly	Component	Maintenance interval	Activities
Motor part and attachments	Entire motor	Every 10,000 hours or earlier, e.g. based on operational experience and specifications for: • Ambient temperatures >40 °C • Difficult operating conditions such as switching and reversing duty • For shock and vibration loads	See chapter 11.2, p. 48
	Brake	Holding brake: Inspect every 2 years Service brake: Every six months or according to specifications from system manufacturer or system operator	See chapter 11.3, p. 49
	Encoder	every motor maintenance	See separate operating manual from manufacturer
	Backstop	every motor maintenance	See separate operating manual from manufacturer

Assembly	Component	Maintenance interval	Activities
Brakes	E003B and E004B	Holding brake: Every 2 years Service brake: Every 3,000 operating hours, every six months at the latest, or according to specifications from system manufacturer or operator	See chapter 11.3.1, p. 49
	Single-disc brakes: ES010A … ES250A, EH027A ... EH400A	Holding brake: Every 2 years Service brake: Every 3,000 operating hours Note: • Brakes type "E..." are installed under the fan cover. • Brakes type "EH..." are installed on the fan cover.	See chapter 11.3.2, p. 50
	Single-disc brakes: ESX010A … ESX250A, EHX027A ... EHX400A	Service brake: Every 3,000 operating hours, every 6 months at the latest, or according to specifications from system manufacturer and/or operator Note: • Brakes type "ESX" are installed under the fan cover • Brakes type "EHX..." are installed on the fan cover.	See chapter 11.3.3, p. 51
	Double-disc brakes: ZS300A ... ZS500A	Holding brake: Every 2 years Note: Brakes of type "Z..." are installed under the fan cover.	See chapter 11.3.4, p. 51
	Double-disc brakes: ZSX300A ... ZSX500A	Service brake: Every 3,000 operating hours, every 6 months at the latest, or according to specifications from system manufacturer and/or operator Note: Brakes type "ZSX..." are installed under the fan cowl	See chapter 11.3.5, p. 52

Assembly	Component	Maintenance interval	Activities
Gearbox	Entire gearbox	After 3,000 operating hours, every 6 months at the latest	See chapter 11.4.1, p. 52
	Only for worm gearboxes	Occasionally, depending on load and operating mode, normally only after running for some time	▶ Replace worm gear.
	Lubricants	After 15,000*) operating hours for mineral gear oil (CLP 220) Every 25,000 operating hours for synthetic gear oil (PGLP220/ PGLP460), after 2 ... 3 years at the latest (does not apply to lifetime lubricated gears).	See chapter 11.4.2, p. 52 For approved lubricant types and quantities depending on installation position, see rating plate or chapter 11.4.3, p. 53.
*) Gearboxes without oil filler and oil drain plugs do not require a lubricant change. They are lifetime lubricated under normal operating conditions.			

Tab. 16: Maintenance schedule

11.2 Motor inspection and maintenance

The motors must be inspected at regular intervals by a qualified specialist.
For geared motors, motor inspection and maintenance is usually performed at the same time as the gearbox.

- ▶ Pay special attention to the following:
  - Possible damage
  - Noticeable noises and vibrations
  - Correct and proper electrical connection
  - Unobstructed cooling air supply
  - No impermissible dirt or dust deposits present

- ▶ Check roller bearings and replace as necessary.
  - We do not recommended cleaning and relubricating the bearings due to the risk of contamination.
- ▶ Check sealing ring running surfaces. For non-permissible run-in grooves, replace the sleeves or, in the case of motors D..04LA.. - D..07LA.., replace the rotors.
- ▶ Replace shaft sealing ring. Grease the sealing lips before inserting and, if present, fill 50% of the grease chamber between the dust and sealing lips (see Tab. 17, p. 53).
  - Make sure that the new sealing ring does not return to the "old" track.
- ▶ Also remove dirt and dust deposits near the cooling air supply.
- ▶ Touch up paint/corrosion protection, replace as necessary.

11.3 Inspection and maintenance of brakes

HAZARD
Hazard due to non-functional brake
Brakes are components important for safety.
- ▷ Any work must be performed by qualified and personnel trained on the product.
- ▷ Do not expose any friction surfaces and brake discs to oil or grease. Even small quantities reduce the braking torque significantly.

The nearest Bauer service partner can be found at www.bauergears.com.

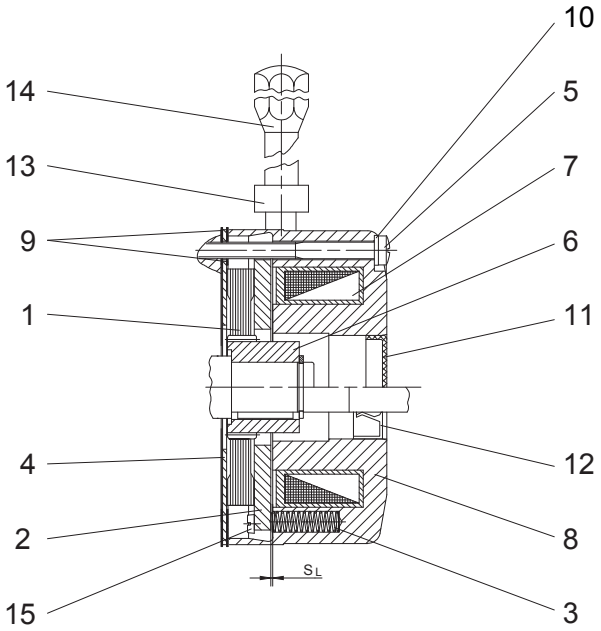
11.3.1 Maintenance of brake types E003B and E004B

The brakes are low-maintenance.

1. Regularly check the wear of the brake disc by measuring the brake disc thickness.
   - ▫ Has the specified limit value d_{min}, see Tab. 25, p. 59, been reached or even fallen short of?
   - ▫ Install a new brake disc as described.

Install new brake disc

1. Remove fan cover and fan blade (does not apply to non-ventilated motors).
2. Unscrew the fixing screws (5).
3. Pull off solenoid housing (8).
4. Remove dirt and debris.
5. Pull brake disc (1) off carrier.
6. Measure thickness of brake disc and replace as necessary.
7. Check armature disc (2) and friction plate (4), replace if there are large grooves.
8. Slide the brake disc (1) onto the carrier and check the radial play. If the play is large, replace the carrier.
9. Replace both seals (9) on the friction plate (4).
10. Slide the brake over the friction plate onto the motor end shield and fasten it with the fixing screw (5) and the USIT rings (10) that are also to be replaced. Tightening torque of fixing screws M_A = 2.5 Nm
11. Reinstall disassembled parts in reverse order.



1 Brake disc
2 Armature disc
3 Compression spring
4 Friction plate
5 Fixing screw
6 Carrier
7 Brake coil
8 Solenoid housing
9 Seals
10 USIT ring
11 Shaft sealing ring
12 Snap ring
13 Manual release bracket (optional)
14 Manual release lever (optional)
15 Retaining bolt

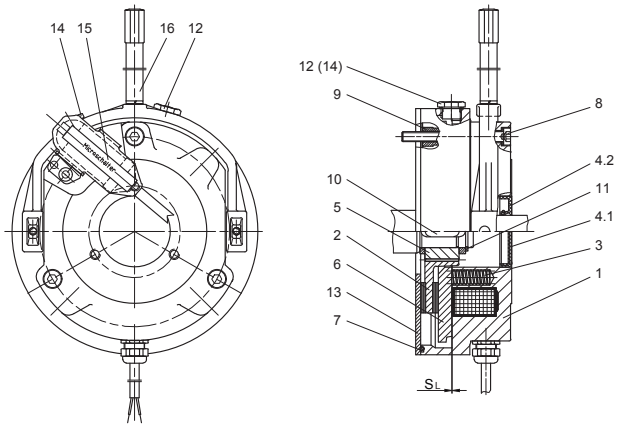
11.3.2 Maintenance of single-disc holding brakes ES010A ... ES250A, EH027A ... EH400A

Holding brakes are only used to secure a position that has been approached. In the event of an emergency, a slowdown function can be used. This slowdown function causes abrasion, which makes it necessary to check the air gap and perform additional maintenance work as necessary.

The air gap in these single-disc brakes cannot be adjusted due to the design of the solenoid housing.

Check air gap

1. If present, remove the fan cover.
2. Screw out screw plug (12) and check air gap with a feeler gauge.
3. After checking, secure the screw plug (12) again with locking varnish.
   - If the measured air gap corresponds to the nominal air gap, see Tab. 34, p. 64. No further work is necessary.
   - If there is wear: Further maintenance work is necessary, see chapter 11.3.3, p. 51.
4. Install removed parts in reverse order.



1 Solenoid housing
2 Brake disc
3 Compression spring
4.1 Sealing cap with closed brake
4.2 Shaft sealing ring with continuous shaft
5 Carrier
6 Armature disc
7 O-ring
8 Fixing screw with copper washer
9 Banjo screw
10 Key
11 Snap ring
12 Screw plug for checking air gap
13 Friction plate - only in motors with aluminium B-side end shield
14 Screw plug for checking microswitch setting
15 Microswitch (optional)
16 Manual release (optional)[1]

11.3.3 Maintenance of single-disc service brakes ESX010A … ESX250A, EHX027A … EHX400A

For pos. numbers, see chapter 11.3.2, p. 50

Check air gap

1. Remove the fan cover (for brakes under the fan cover).
2. Screw out screw plug (13) and check air gap with a feeler gauge.
   - In Tab. 36, p. 65, S_{Lmax} specifies the maximum permissible air gap.
3. After checking, secure the screw plug with locking varnish.

Brake maintenance

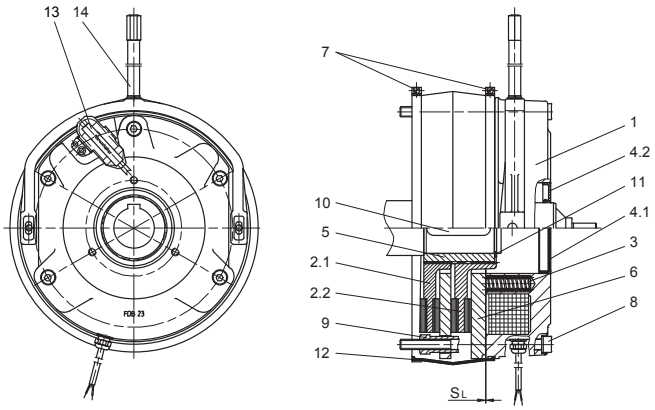
If the brake-related value is reached or exceeded, maintain the brake as follows:

1. Remove the fan blade (under the fan cover).
2. Unscrew fixing screws with copper ring (8) and pull the brake off the motor end shield.
3. Clean the brake and remove any debris.
4. Check armature disc (6) and friction plate (14) (only present on D..08 and D..09 motors) and replace if there are large grooves.
5. Pull brake disc (2) off carrier (5).
6. Slide on new brake disc (2). If there is increased play between the carrier and brake disc, pull off the carrier and replace it.
7. Replace O-ring (7) and copper washers under fixing screws (8).
8. Slide on the brake, tighten the screws (8), evenly offset with the corresponding torque, see 16.6.2, p. 63.
9. Install the fan blade and fan cover under the fan cover in reverse order.

11.3.4 Maintenance of double-disc holding brakes ZS300A ... ZS500A

Check air gap

1. Remove the fan cover.
2. Loosen fixing screws (8).
3. Remove dust cover (12).
4. Check air gap with feeler gauge, see figure below.
   - If the measured air gap corresponds to the nominal air gap, see Tab. 35, p. 64. No further work is necessary.
   - If there is wear, further maintenance work is required, see chapter 11.3.5, p. 52.
5. Install removed parts in reverse order.



1 Solenoid housing
2 Brake disc 2.1 and 2.2
3 Compression spring
4.1 Sealing cap with closed brake
4.2 Shaft sealing ring with continuous shaft
5 Carrier
6 Armature disc
7 Clamp
8 Fixing screw with copper washer
9 Banjo screw
10 Key
11 Snap ring
12 Dust protection ring
13 Microswitch (optional)
14 Manual release (optional)

11.3.5 Maintenance of double-disc service brakes ZSX300A ... ZSX500A

For pos. numbers, see chapter 11.3.4, p. 51

Check air gap

1. Remove the fan cover and fan blade.
2. Loosen fixing screws (14), take off plate (15), and remove cover (13).
3. Check air gap with feeler gauge, see figure in chapter 11.3.4, p. 51.
   - If the measured air gap corresponds to the nominal air gap, see the following table. No further work is necessary, reinstall disassembled parts in reverse order.
   - If the air gap is outside the tolerance limit, adjust the brake as follows.

Adjusting the brake

1. Loosen fixing screws (8) by turning counterclockwise 1/2 a turn.
2. Screw banjo screws (9) into solenoid housing (1) by turning them counterclockwise.
3. Screw in fixing screws (8) evenly in a clockwise direction, offset by 120°, until the nominal air gap is reached.
4. Unscrew banjo screws (9) clockwise until they are firmly against the counter-friction surface.
5. Tighten fixing screws with the specified torque, see Tab. 37, p. 65.
6. Check air gap again and adjust if necessary as described.
7. Install the disassembled parts in reverse order.

Once the minimum lining thickness has been reached, further adjustment of the air gap is no longer possible. Brake discs 2.1 and 2.2 and usually all other mechanical parts involved must be replaced.

- ▶ The drive can no longer be used as intended. Decommission the drive.
- ▶ Contact your nearest Bauer service partner, see www.bauergears.com.

11.4 Inspection and maintenance of gearboxes

Check the following components during inspection and maintenance:

- Shaft sealing rings (wear parts)
- Roller bearings (wear parts to a lesser extent)

11.4.1 Gearing

If there is unusual running noise caused by bearing damage and/or leaks, have gearing repaired by trained personnel.

- ▶ Check for bearing damage if noise is heard while running.
- ▶ Visually inspect the seals on the output and housing for leaks.
- ▶ Check that rubber buffers for any existing torque arms are installed properly and pre-stressed, see chapter 6.2, p. 22.
- ▶ Replace rubber buffers if cracked, damaged, or severely compressed.
- ▶ Check paint/corrosion protection and touch up as necessary.

11.4.2 Lubricants

HAZARD
Environmental damage

- ▷ Synthetic gear oils based on polyglycol (e.g. PGLP...) must be disposed of separately from mineral oils as hazardous waste.

We also recommend replacing the roller bearings in order to ensure longterm operating reliability.

- ▶ Allow the lubricant to completely drain into a suitable container and dispose of it properly.
- ▶ Fill with new lubricant of the same type; see rating plate for quantity.
- ▶ Replace the shaft sealing ring for gears with pre-stage or for tandem gearboxes. Fill 50% of the chamber between the dust lip and sealing lip with grease (Shell Gadus S2 V100 3 or similar). Make sure that the new sealing ring does not return to the "old" track.

11.4.3 Approved lubricant types for three-phase geared motors

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 gearboxes of series	Low-temperature oil for gearboxes of series		Standard oil for gearboxes of series	Standard oil for gearboxes of series	Food industry oil for gearboxes of series
	BF06-BF90 BG04-BG100 BK60-BK90	BF06-BF90 BG04-BG100	BK06-BK90 BM09-BM40 BS02-BS40	BS02-BS10 BK06-BK10 BM09-BM10 High-temperature oil for gearboxes of series BS02-BS10 BK06-BK10 BF06-BF90 BG04-BG100 BK60-BK90 BM09-BM10	BS20-BS40 BK17-BK50 BM20-BM40 High-temperature oil for gearboxes of series BS20-BS40 BK17-BK50 BM20-BM40	BF06-BF90 BG04-BG100 BK06-BK90 BM09-BM40 BS02-BS40
AGIP	BLASIA 220 [13 02 08]	—	—	BLASIA S 220 [13 02 06]	BLASIA S 460 [13 02 06]	—
BECHEM RHUS	STAROIL G 220 [13 02 08]	—	BERUSYNTH EP 68 [13 02 06]	BERUSYNTH EP 220 [13 02 06]	BERUSYNTH EP 460 [13 02 06]	BERUSYNTH EP 220 H1 [13 02 06]
CASTROL	ALPHA EP 220 [13 02 08] ALPHA SP 220 [13 02 08] OPTIGEAR EP 220 [13 02 08] OPTIGEAR 1100/220 [13 02 08]	Alphasyn T68 [13 02 06]	—	ALPHASYN PG 220 [13 02 06] OPTIGEAR 800/220 [13 02 06] OPTIGEAR 1300/220 [13 02 06] ALPHASYN GS 220 [13 02 06]	ALPHASYN PG 460 [13 02 06] OPTIGEAR 800/460 [13 02 06] OPTIGEAR 1300/460 [13 02 06] ALPHASYN GS 460 [13 02 06]	OPTILEB GT 220 (CLP-HC) [13 02 06] OPTILEB GT 1800/220 (CLP-PG) [13 02 08]
CHEVRON	Meropa 220 [13 02 08] GEARTEX EP-A SAE 85W-90 [13 02 06]	—	Meropa Synlube WS 68 [13 02 06]	Meropa Synlube WS 220 [13 02 06]	Meropa Synlube WS 460 [13 02 06]	Chevron Lubricating Oils FM 220 (USA) [13 02 06]
FUCHS	RENOLIN CLP 220 [13 02 08] RENOLIN CLPF 220 SUPER [13 02 08] RENOLIN CLP 220 PLUS [13 02 08]	RENOLIN UNISYN CLP 68 [13 02 06]	RENOLIN PG 68 [13 02 06]	RENOLIN PG 220 [13 02 06]	RENOLIN PG 460 [13 02 06]	CASSIDA FLUID GL 220 [13 02 06]
KLÜBER	KLÜBEROIL GEM 1-220 N [13 02 08]	—	KLÜBERSYNTH GH 6-80 [13 02 06]	KLÜBERSYNTH GH 6-220 [13 02 06]	KLÜBERSYNTH GH 6-460 [13 02 06]	KLÜBEROIL 4UH1-220 N [13 02 06] KLÜBERSYNTH UH1 6-220 [13 02 06]
MOBIL	MOBILGEAR 600 XP 220 [13 02 08]	MOBIL SHC 626 [13 02 06]	—	MOBIL SHC Gear 220 [13 02 06] MOBIL SHC 630 [13 02 06]	MOBIL SHC Gear 460 [13 02 06] MOBIL SHC 634 [13 02 06]	MOBIL SHC CIBUS 220 [13 02 06]
OEST	Gearol 220 [13 02 06]	—	—	—	—	—
SHELL	OMALA S2 GX220 [13 02 08]	—	—	OMALA S4 WE 220 [13 02 06]	OMALA S4 WE 460 [13 02 06]	—
TOTAL	CARTER EP 220 [13 02 08] CARTER XEP 220 [13 02 06]	—	—	CARTER SY 220 [13 02 06]	CARTER SY 460 [13 02 06]	NEVASTANE SL 220 [13 02 06] NEVASTANE EP 220 [13 02 06] NEVASTANE SY 220 [13 02 06]
WINTERSHALL	SRS ERSOLAN 220 [13 02 08]	—	—	—	—	—
—	Bearing grease					
—	SHELL S2 V100 3 – or similar –	KLÜBER PETAMO GHY 133 – or similar –		Standard: SHELL S2 V100 3 High temperature: KLÜBER PETAMO GHY 133 – or similar –		MOBIL Polyrex 222 – or similar –

Tab. 17: Approved lubricant types ([....] code from European Waste Catalogue (Decision 2001/118/EC))

11.5 Cleaning and maintenance

CAUTION
Material damage due to improper cleaning of paint coating
Corrosion protection is impaired. The drive or its surroundings may be damaged.
▷ Only use non-abrasive cleaning tools.

CAUTION
Material damage due to penetration of liquid into device.
▷ Water exposure only permitted in accordance with protection rating IP (rating plate).
▷ Avoid direct impacts to shaft seal (>IP65).

1. Perform cleaning work.
2. At the end of the cleaning cycle, remove any cleaner residue from the drive shaft sealing rings.

12 Decommissioning

Follow the instructions and notes for installation and commissioning in chapters 6.2, p. 22, 6.8, p. 35, 7, p. 41, and 8, p. 42, and proceed in reverse order.

13 Disassembly

Follow the instructions and notes for installation and commissioning in chapters 6.2, p. 22, 6.8, p. 35, 7, p. 41, and 8, p. 42, and proceed in reverse order.

14 Disposal

14.1 Packaging

Improper disposal of packaging materials can cause environmental damage.
The products are packaged in accordance with the necessary or prescribed requirements for the respective mode of transport.
▶ Dispose of non-reusable packaging materials in accordance with local waste or disposal regulations.

14.2 Lubricants

▶ Dispose of synthetic gear oils based on polyglycol (e. g. PGLP, etc.) separately from mineral oils as hazardous waste.

14.3 Gearbox

▶ Dispose of gear and its components, e.g. as scrap steel:
- Housing and housing parts
- Gearwheels
- Shafts
- Roller bearing
- Worm gears (copper alloy)

14.4 Motor

▶ Dispose of motor and its components separately according to material:
- Iron
- Aluminium
- Copper
- Plastic
- Electronic components

15 Spare parts and accessories

Our worldwide service team is always ready to provide advice and support for supplying spare parts. You can find the nearest service partner online at www.bauergears.com/sales-and-service/global-service/ under "Sales Locator".

Necessary spare parts can be requested and ordered from Bauer Gear Motor GmbH or one of our service partners.
Our website www.bauergears.com/sales-and-service/global-service/ allows you to select the necessary spare parts yourself using the "Spare Part Selector".

16 Technical data

16.1 General data and conditions of use

See the rating plate/type plate for the most important technical data on operating the gears, motors, and geared motors.
These technical data and other contractually agreed data and properties form the basis and limit of the intended use.
Unless explicitly stated or agreed, the products can be operated without restriction and without taking special measures under the following environmental conditions:

Parameter	Value
Ambient temperature range	-20°C - +40°C
Installation altitude	1000 m above sea level

Tab. 18: Permissible ambient conditions

The power and torque data given on the rating plate is fully available at the output shaft.

Gearbox efficiencies are taken into account here.
Specific technical data can be requested from Bauer Gear Motor by specifying the serial and/or article number.

16.2 Substructure and system-related vibrations

Gearbox series	Gearbox size	Max. permissible error (mm)
BG	<06	0.2
	10 … 30	0.4
	40 … 60	0.5
	70 … 80	0.7
	90 …100	0.8
BF	10 … 30	0.2
	40 … 50	0.4
	60 … 70	0.5
	80 … 90	0.7
BK	06 … 30	0.2
	40 … 50	0.4
	60 … 80	0.5
	90	0.7
BS	<06	0.2
	10 … 30	0.4
	40	0.5

Tab. 19: Foot design: permissible flatness error

Gearbox series	Bolt circle Ø (mm), A-flange	Bolt circle Ø (mm), C-flange	Max. permissible error (mm)
BG, BF, BK, BS	<165	<165	0.2
	>165 … 265	>165 … 265	0.4
	>265 … 350	>265	0.5
	>350 … 500	-	0.7
	>500	-	0.8

Tab. 20: Flange design: permissible flatness error)

16.3 Gearbox

16.3.1 General

Numerous influencing factors are decisive for the overall load on a gearbox.
The most important include:

- Average torque (rated torque) in Nm
- Daily operating time in hours (h)
- Strength of torque peaks (load classification)
- Frequency of torque peaks (switching operation)

These influences can be described in a simplified and practical manner by operating factors.
A distinction is made between operating factor 1 for load classification and operating time and operating factor 2 for load classification and switching frequency.

16.3.2 Torque ranges

Bauer gearboxes and geared motors are provided in different gear sizes:

Type of gearbox	Series	Number of sizes	Torque range
Helical gear	BG	13	20 Nm to 16,800 Nm
Shaft-mounted gear	BF	10	90 Nm to 16,800 Nm
Bevel	BK	10	80 Nm to 16,800 Nm
Worm gear	BS	8	25 Nm to 1,000 Nm

Tab. 21: Torque ranges for Bauer gearboxes and geared motors

16.4 Motors

16.4.1 General

The power specified on the rating plate is fully available at the output shaft.
This applies to continuous operation (S1-100%) – unless otherwise specified – at a maximum ambient temperature of 40°C and up to an installation altitude of 1000 m above sea level.
If ambient conditions deviate, the values must be reduced.
The reduction factors can be requested from Bauer, specifying the exact ambient conditions.
Unless otherwise specified, a tolerance of +/- 5% applies to the rated voltage accordingly.
IEC 60034-1

16.4.2 Permanent magnet synchronous motors (PMSMs)

Parameter	Value
Parameter for optimal frequency inverter duty	See rating plate
Limit torques	See rating plate
Limit currents	See rating plate
Limit speed	See rating plate

Tab. 22: PMSM parameters

16.5 Motor attachments and accessories

16.5.1 External fan

For special applications, motors and brake motors starting at size D08 can be supplied with a mounted external fan.
A connection with multivolt design – operating capacitor for single-phase operation is installed as standard.

Operating mode	Frame size	Fan diameter [mm]	Voltage range [V]		Max. permissible current [A]		Max. power consumption [W]	
			50 Hz	60 Hz	50 Hz	60 Hz	50 Hz	60 Hz
1 ~ ⊥ (Δ)	63	118	230-277	230-277	0.18	0.21	46	54
	71	132	230-277	230-277	0.18	0.21	48	56
	80	150	230-277	230-277	0.19	0.22	48	59
	90	169	220-277	220-277	0.29	0.23	59	61
	100	187	220-277	220-277	0.29	0.28	62	73
	112	210	220-277	220-277	0.27	0.36	64	88
	132	250	230-277	230-277	0.52	0.61	125	163
	160-200	300	230-277	230-277	1.05	1.52	246	390
3 ~ Y	63	118	346-525	380-575	0.09	0.08	28	29
	71	132	346-525	380-575	0.09	0.07	29	28
	80	150	346-525	380-575	0.09	0.07	33	36
	90	169	346-525	380-575	0.22	0.18	78	71
	100	187	346-525	380-575	0.21	0.18	80	80
	112	210	346-525	380-575	0.2	0.17	87	93
	132	250	346-525	380-575	0.37	0.32	160	180
	160-200	300	346-525	380-575	0.74	0.62	314	391
3 ~ Δ	63	118	200-303	220-332	0.15	0.14	28	29
	71	132	200-303	220-332	0.15	0.13	29	28
	80	150	200-303	220-332	0.16	0.13	33	36
	90	169	200-303	220-332	0.39	0.32	78	71
	100	187	200-303	220-332	0.37	0.3	80	80
	112	210	200-303	220-332	0.35	0.29	87	93
	132	250	200-303	220-332	0.64	0.55	160	180
	160-200	300	200-303	220-332	1.28	1.08	314	391

Tab. 23: Technical data, external fans

16.5.2 Brakes

The spring-loaded brakes with DC release solenoid of series E003B, E004B, ES(X)010A ... ES(X)300A, ZS(X)500A, EH(X)027A ... EH(X)400A **are not approved for use in potentially explosive atmospheres**.

Abbreviations

Abbreviation	Description
M_{Br}	Rated braking torque Braking torque tolerance: -10/+30% 1), 2) Braking torque tolerance: -20/+30% when run in. Up to -30% is possible when new. 3)
ZF	Number of springs Since different springs can be used with the E004B, the colour of the corresponding springs is also specified here.
W_{max}	Maximum permissible friction work per braking event 1) Maximum permissible friction work for emergency stop 2)
W_{th}	Maximum permissible friction work per hour
W_L	Maximum permissible friction work before brake disc replacement The stated values of W_L are guidelines which may vary considerably from one application case to another. Regular inspection of the brake disc thickness is recommended. 1), 2) Maximum permissible friction work until maintenance, i.e. brake disc replacement or air gap adjustment. The air gap can only be adjusted with type ZXS... brakes. The stated values of W_L are guidelines which may vary considerably from one application case to another. Regular inspection of the air gap is recommended. 3)
t_A	Response time for release with normal excitation. If the special overexcitation fast-acting rectifier overexcites, response times are approx. half as long.
t_{AC}	Response time during braking with AC-side switch-off, i.e. by interrupting the voltage supply of a separately supplied standard rectifier. When the rectifier is supplied with voltage from the motor terminals, significantly higher response times can be expected due to the remanence of the motor – depending on motor size and winding design.
t_{DC}	Response time during braking with interruption on DC side via mechanical switches. In the case of an electronic DC-side interruption by a special electronic or overexcitation fast-acting rectifier, response times are approx. 2-3 times longer. For the braking torque versions marked with *, which are only permitted with overexcitation fast-acting rectifiers, the values for t_A and t_{DC} apply for operation with overexcitation fast-acting rectifiers, i.e. t_A for overexcitation and t_{DC} for electronic direct current interruption. 2), 3) Depending on the operating temperature, the state of brake disc wear, and manufacturing tolerances, the actual response times may deviate from the benchmark values specified here.
d_{min}	Minimum permissible brake disc thickness
P_{el}	Electrical power consumption of solenoid coil at 20°C. Depending on the voltage version of the coil, the actual power may differ from the benchmark given here.
1) Only for spring-loaded brakes with DC release solenoid of type E003B and E004B 2) Only for holding brakes with emergency stop feature of type ES.../ZS... 3) Only for service brakes of type ES(X).../ZS(X)...	

Tab. 24: Abbreviations for brake technical data

Spring-loaded brakes with DC release solenoid of type E003B and E004B

Type	M_{Br} [Nm]	ZF	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

Tab. 25: Technical data for spring-loaded brakes with DC release solenoid of type E003B and E004B

Spring-loaded brakes with DC release solenoid of type ES(X)010A ... ES(X)300A, ZS(X)300, and ZS(X)500A
Holding brakes with emergency stop feature of type ES.../ZS... Friction work, response times, performance

Type	M_{Br} [Nm]	W_{max} [*10^{3}J]	W_{th} [*10^{3}J]	W_L [*10^{6}J]	t_A [ms]	t_{AC} [ms]	t_{DC} [ms]	P_{el} [W]
ES/EH010AX	15*	3	-	-	110	-	30	35
ES/EH010A9	10	3	-	-	60	100	15	
ES/EH010A8	8	3	-	-	55	150	20	
ES/EH010A5	5	3	-	-	45	220	20	
ES/EH010A4	4	3	-	-	30	250	20	
ES/EH010A2	2.5	3	-	-	25	350	25	
ES027AX	32*	2.5	-	-	80	-	30	50
ES/EH027A9	27	2.5	-	-	120	100	15	
ES/EH027A7	20	2.5	-	-	100	130	20	
ES/EH027A6	16	2.5	-	-	80	170	25	
ES/EH040A9	40	3.5	-	-	100	100	20	65
ES/EH040A8	34	3.5	-	-	80	200	25	
ES/EH040A7	27	3.5	-	-	70	250	30	
ES/EH070AX	90*	3.5	-	-	120	-	40	85
ES/EH070A9	70	3.5	-	-	120	150	18	
ES/EH070A8	63	3.5	-	-	120	200	20	
ES/EH070A7	50	3.5	-	-	90	220	25	
ES/EH125A9	125	4.5	-	-	170	220	25	105
ES/EH125A8	105	4.5	-	-	150	320	28	
ES/EH125A7	85	4.5	-	-	135	350	30	
ES/EH125A6	70	4.5	-	-	120	440	35	
ES125A5	57	4.5	-	-	100	600	40	
ES125A3	42	4.5	-	-	90	700	45	
ES/EH200A9	200	8	-	-	400	150	22	105
ES/EH200A8	150	8	-	-	280	250	35	
ES/EH200A7	140	8	-	-	200	320	35	
ES250A9	250	9	-	-	300	500	45	135
ES250A8	200	9	-	-	200	960	60	
ES250A6	150	9	-	-	160	1100	60	
ES250A5	125	9	-	-	150	1500	90	
ES250A4	105	9	-	-	130	1800	110	
ZS300A9	300	8	-	-	280	220	35	75
ZS300A8	250	8	-	-	210	380	45	
EH400A9	400	10	-	-	300	600	60	180
EH400A7	300	10	-	-	200	850	75	
EH400A5	200	10	-	-	150	1400	85	
ZS500A9	500	9	-	-	320	320	50	100
ZS500A8	400	9	-	-	260	600	60	
* Requires overexcitation and is therefore only permissible with overexcitation fast-acting rectifiers								

Tab. 26: Technical data for spring-loaded holding brakes with emergency stop feature of type ES.../ZS...

Service brakes of type ES(X).../ZS(X)... Friction work, response times, friction work performance, response times, performance

Type	M_{Br} [Nm]	W_{max} [10^3J]	W_{th} [10^3J]	W_L [10^6J]		t_A [ms]	t_{AC} [ms]	t_{DC} [ms]	P_{el} [W]
				without HL	with HL				
ESX/EHX010AX	15*	3	250	120	120	110	-	30	35
ESX/EHX010A9	10	3	250	120	120	60	100	15	
ESX/EHX010A8	8	3	250	150	150	55	150	20	
ESX/EHX010A5	5	3	250	240	240	45	220	20	
ESX/EHX010A4	4	3	250	300	240	30	250	20	
ESX/EHX010A2	2.5	3	250	390	240	25	350	25	
ESX027AX	27*	10	350	150	150	80	-	30	50
ESX/EHX027A9	22	10	350	150	150	120	100	15	
ESX/EHX027A7	16	10	350	300	300	100	130	20	
ESX/EHX027A6	13	10	350	350	350	80	170	25	
ESX/EHX040A9	32	20	450	420	420	100	100	20	65
ESX/EHX040A8	27	20	450	560	490	80	200	25	
ESX/EHX040A7	22	20	450	700	490	70	250	30	
ESX/EHX070AX	72*	28	550	700	700	120	-	40	85
ESX/EHX070A9	58	28	550	500	500	120	150	18	
ESX/EHX070A8	50	28	550	800	700	120	200	20	
ESX/EHX070A7	40	28	550	1200	700	90	220	25	
ESX/EHX125AX	100*	40	700	1900	1900	100	-	70	105
ESX/EHX125A9	85	40	700	1700	1700	150	320	28	
ESX/EHX125A8	70	40	700	1900	1700	135	350	30	
ESX/EHX125A7	58	40	700	2700	1700	120	440	35	
ESX125A5	45	40	700	3300	1700	100	600	40	
ESX125A3	34	40	700	3300	1700	90	700	45	
ESX/EHX200AX	160*	60	850	2000	2000	105	-	70	105
ESX/EHX200A9	120	60	850	1700	1700	280	250	35	
ESX/EHX200A8	110	60	850	2600	2600	200	320	35	
ESX250A9	200	84	1000	2800	2800	300	500	45	135
ESX250A8	160	84	1000	6800	5700	200	960	60	
ESX250A6	120	84	1000	8500	5700	160	1100	60	
ESX250A5	100	84	1000	11000	5700	150	1500	90	
ESX250A4	85	84	1000	11000	5700	130	1800	110	
ZSX300A9	250	60	850	1300	1300	280	220	35	75
ZSX300A8	200	60	850	2000	2000	210	380	45	
EHX400A9	320	120	1100	3000	3000	300	600	60	180
EHX400A7	240	120	1100	4800	4800	200	850	75	
EHX400A5	160	120	1100	6000	4800	150	1400	85	
ZSX500A9	400	84	1000	2800	2800	320	320	50	100
ZSX500A8	320	84	1000	4000	4000	260	600	60	
* Requires overexcitation and is therefore only permissible with overexcitation fast-acting rectifiers									

Tab. 27: Technical data for spring-loaded service brakes of type ES(X).../ZS(X)...

No information on W_{th} and W_L, since holding brakes perform no or only insignificant friction work in normal operation.

16.5.3 Encoder system

Bauer standard encoders have a robust protective cover to prevent mechanical damage starting at motor size D05 (0.18 kW).

Parameter	Value
Robust bearings	
Protection rating	IP66
EMC tested	
Protected against polarity reversal	
Supply voltage	8-30 VDC
A-, B-, and N-track and inverted signals or output signals can be selected	
HTL output signals (TTL on request)	
1024 impulses per revolution	

Tab. 28: Special features – standard impulse encoders

Parameter	Value
Protection rating	IP66
Steps per revolution	8192 (13 bit)
Number of revolutions	4096 (12 bit)
Electronics version	SSI (Synchronous Serial Interface)
Output code type	Gray code
Supply voltage	II-27 V DC
Power loss (without load)	≤3 watts
Data output	RS-422 (2-wire)

Tab. 29: Special features – standard absolute encoders

Incremental rotary encoders

Parameter	Value
Supply voltage	8-30 V DC for HTL
	5 V DC for TTL push-pull
Output signal	HTL A-, B-, N-track, optional TTL
Pulses per revolution	1024
	optional 1...65536
Degree of protection	IP65, IP67 optional
Temperature range	-40 °C to +100 °C

Tab. 30: Technical data for incremental rotary encoders

Output voltage	RS 422 (TTL compatible)	RS 422 (TTL compatible)	Push-pull	Push-pull (7272)
Supply voltage	5 ... 30°VDC	5°V ±5°%	8 ... 30°VDC	5 ... 30°VDC
Current consumption (without load) with inversion	Max. 70 mA	Max. 70 mA	Max. 70 mA	Max. 70 mA
Permissible load/channel Pulse frequency	Max.±20 mA Max. 300 kHz	Max.±20 mA Max. 300°kHz	Max. ±20 mA °Max. 160°kHz	Max. ±20 mA °Max. 160°kHz
Signal level high	Min. 2.5 V	Min. 2.5 V	Min. UB - 3 V	Min. UB - 3 V
Signal level low	Max. 0.5°V	Max. 0.5°V	Max. 1°V	Max. 1 V

Tab. 31: Electrical parameters, incremental rotary encoders

For more data and information, see manufacturer's data sheet.

Absolute rotary encoders

Parameter	with PROFIBUS-DP interface	with SSI interface
Supply voltage	11 … 27 V DC	
Current consumption without load	<350 mA	
Total resolution [1]	≤33 bit	≤25 bit
Number of steps/revolutions, standard/extended [1], [2]	≤8,192/≤32,768	≤8,192
Number of revolutions, standard/extended [1]	≤4,096/≤256,000	
Profibus-DP V0 [3]	IEC 61158, IEC 61784	-
PNO Encoder Profile • Parameter [1], [3]	Class 1 and 2 counting direction switchover, scaling function etc.	-
Output code [1]	Binary, Gray, capped Gray	Binary, Gray, BCD
Output format [1], [4]	-	Standard, fir tree, SSI+CRC, 26-bit repeat, variable number of data bits
Addressing [3]	3...99, adjustable via rotary switch	-
Baud rate [3]	9.6 kbit/s ...12 Mbps	-
TR-specific functions [1], [3]	Gearbox, speed output	-
Data width for actual position on bus [3]	≤25 bit	-
Clock input [4]	-	Optocoupler
Data output [4]	-	RS-422, 2-wire
Clock frequency [4]	-	80 kHz – 1 MHz
Monotime t_M [4]	-	16 µs ≤tM ≤25 µs, 20 µs typical
Negative values [1], [4]	-	Sign + value, 2's complement
SSI or parallel special bits [1], [4]	-	Limit switch, overspeed, direction indication, motion indication, error message, parity
V/R [1], [4]	-	Counting direction
Preset [1], [4]	-	Electronic adjustment
Logical state [4]	-	"0" < +2 V DC, "1" = supply voltage
Max. permissible speed	≤ 12,000 rpm	
Shaft load	Net weight	
Bearing life • RPM • Operating temperature	≥3.9 * 10^{10} rotations at ≤ 6,000 rpm ≤60 °C	
Shaft diameter [mm]	10 H7	
Permissible angular acceleration	≤10^4 rad/s^2	
Moment of inertia	Typically 2.5 * 10^{-6} kg m^2	
Starting torque at 20°C	Typically 2 Ncm	
Mass	0.3 kg...0.5 kg	
Optional [4] • Incremental signals, RS422 level	-	K1+, K1-, K2+, K2- with 1024 or 2048 impulses

[1] Programmable parameter
[2] Differentiation only for PROFIBUS-DP interface
[3] Only for PROFIBUS-DP interface
[4] Only for SSI interface

Tab. 32: Technical data for incremental rotary encoders

For more data and information, see manufacturer's data sheet.

16.5.4 Backstop (RR, RL)

With frequency inverter duty, note that correct operation of the backstop is only guaranteed at rotor speeds above 740/min.

16.6 Brake maintenance

The following abbreviations are used in the following:

Abbreviation	Description
M_{Br}	Rated braking torque
	Braking torque tolerance: -10/+30%
M_A	Tightening torque of fixing screws
d_{min}	Minimum permissible brake disc thickness
s_{LN} [2), 3), 4)]	Nominal air gap when new: Tolerance: +0.15 mm except for EH400 and ZS800: Tolerance: +0.20 mm
s_{Lmax} [2), 3), 4)]	Maximum permissible air gap
Manual release [2), 3), 4)]	Manual release
[1)] Only for spring-loaded brakes of series E003B or E004B [2)] Only for single-disc holding brakes ES010A ... ES250A, EH027A ... EH400A [3)] Only for single-disc service brakes ESX010A ... ESX250A, EHX027A ... EHX400A [4)] Only for double-disc service brakes ZSX300A ... ZSX500A	

Tab. 33: Abbreviations for brake maintenance

16.6.1 Spring-loaded brake of series E003B or E004B

Typ	M_{Br} [Nm]	d_{min} [mm]	M_A [mm]
E003B9	3	5.85	2.5
E003B7	2.2	5.75	2.5
E003B4	1.5	5.6	2.5
E004B9	5	5.87	2.5
E004B8	4	5.75	2.5
E004B6	2.8	5.55	2.5
E004B4	2	5.4	2.5
E004B2	1.4	5.2	2.5

16.6.2 Technical data for maintenance of spring-loaded brakes of series E003B or E004B

16.6.3 Single-disc holding brakes ES010A … ES250A, EH027A ... EH400A

Type	M_{Br} [Nm]	s_{LN} [mm]	s_{Lmax} [mm]		M_A [mm]
			without HL	with HL	
ES/EH010AX	15*[1)]	0.2	0.6	0.6	6
ES/EH010A9	10	0.2	0.6	0.6	
ES/EH010A8	8	0.2	0.7	0.7	
ES/EH010A5	5	0.2	1.0	1.0	
ES/EH010A4	4	0.2	1.2	1.0	
ES/EH010A2	2.5	0.2	1.5	1.0	
ES027AX	32*[1)]	0.3	0.6	0.6	10
ES/EH027A9	27	0.3	0.6	0.6	
ES/EH027A7	20	0.3	0.9	0.9	
ES/EH027A6	16	0.3	1.0	1.0	
ES/EH040A9	40	0.3	0.9	0.9	10
ES/EH040A8	34	0.3	1.1	1.0	
ES/EH040A7	27	0.3	1.3	1.0	
ES/EH070AX	90*	0.3	1.0	1.0	25
ES/EH070A9	70	0.3	0.8	0.8	
ES/EH070A8	63	0.3	1.1	1.0	
ES/EH070A7	50	0.3	1.5	1.0	
ES/EH125A9	125	0.4	0.7	0.7	25
ES/EH125A8	105	0.4	1.2	1.2	
ES/EH125A7	85	0.4	1.3	1.2	
ES/EH125A6	70	0.4	1.7	1.2	
ES125A5	57	0.4	2.0	1.2	
ES125A3	42	0.4	2.0	1.2	
ES/EH200A9	200[1)]	0.4	0.6	0.6	25
ES/EH200A8	150	0.4	0.9	0.9	
ES/EH200A7	140	0.4	1.2	1.2	
ES250A9	250	0.5	1.0	1.0	50
ES250A8	200	0.5	1.7	1.5	
ES250A6	150	0.5	2.0	1.5	
ES250A5	125	0.5	2.4	1.5	
ES250A4	105	0.5	2.4	1.5	
EH400A9	400	0.5	1.2	1.2	50
EH400A7	300	0.5	1.5	1.5	
EH400A5	200	0.5	1.7	1.5	
* Requires overexcitation and is therefore only permissible with overexcitation fast-acting rectifier					
[1)] Brake with special spring bore. Cannot be converted to a different braking torque.					

Tab. 34: Technical data for maintenance of single-disc holding brakes ES010A ... ES250A, EH027A ... EH400A

16.6.4 Double-disc holding brakes ZS300A ... ZS500A

Type	M_{Br} [Nm]	s_{LN} [mm]	s_{Lmax} [mm]		M_A [mm]
			without HL	with HL	
ZS300A9	300	0.5	0.9	0.9	25
ZS300A8	250	0.5	1.1	1.1	
ZS500A9	500	0.5	1.0	1.0	50
ZS500A8	400	0.5	1.2	1.2	

Tab. 35: Technical data for maintenance of double-disc holding brakes ZS300A ... ZS500A

16.6.5 Single-disc service brakes ESX010A … ESX250A, EHX027A … EHX400A

Type	M_{Br} [Nm]	s_{LN} [mm]	s_{Lmax} [mm]		M_A [mm]	d_{min} [mm]	
			without HL	with HL		without HL	with HL
ESX/EHX010AX	15*[1)]	0.2	0.6	0.6	6	8.1	8.1
ESX/EHX010A9	10	0.2	0.6	0.6		8.1	8.1
ESX/EHX010A8	8	0.2	0.7	0.7		8	8
ESX/EHX010A5	5	0.2	1.0	1.0		7.7	7.7
ESX/EHX010A4	4	0.2	1.2	1.0		7.5	7.7
ESX/EHX010A2	2.5	0.2	1.5	1.0		7.2	7.7
ESX027AX	27*[1)]	0.3	0.6	0.6	10	10	10
ESX/EHX027A9	22	0.3	0.6	0.6		10	10
ESX/EHX027A7	16	0.3	0.9	0.9		9.7	9.7
ESX/EHX027A6	13	0.3	1.0	1.0		9.6	9.6
ESX/EHX040A9	32	0.3	0.9	0.9	10	11.9	11.9
ESX/EHX040A8	27	0.3	1.1	1.0		11.7	11.8
ESX/EHX040A7	22	0.3	1.3	1.0		11.5	11.8
ESX/EHX070AX	72*	0.3	1.0	1.0	25	13.8	13.8
ESX/EHX070A9	58	0.3	0.8	0.8		14	14
ESX/EHX070A8	50	0.3	1.1	1.0		13.7	13.8
ESX/EHX070A7	40	0.3	1.5	1.0		13.3	13.8
ESX/EHX125AX	100*	0.4	1.3	1.3	25	15.1	15.1
ESX/EHX125A9	85	0.4	1.2	1.2		15.7	15.7
ESX/EHX125A8	70	0.4	1.3	1.2		15.2	15.2
ESX/EHX125A7	58	0.4	1.7	1.2		15.1	15.2
ESX125A5	45	0.4	2.0	1.2		14.4	15.2
ESX125A3	34	0.4	2.0	1.2		14.4	15.2
ESX/EHX200AX	160*[1)]	0.4	1.0	1.0	25	17.4	17.4
ESX/EHX200A9	120	0.4	0.9	0.9		17.8	17.8
ESX/EHX200A8	110	0.4	1.2	1.2		17.5	17.5
ESX250A9	200	0.5	1.0	1.0	50	19.5	19.5
ESX250A8	160	0.5	1.7	1.5		18.8	19
ESX250A6	120	0.5	2.0	1.5		18.5	19
ESX250A5	100	0.5	2.4	1.5		18.1	19
ESX250A4	85	0.5	2.4	1.5		18.1	19
EHX400A9	320	0.5	1.2	1.2	50	19.3	19.3
EHX400A7	240	0.5	1.5	1.5		19.0	19.0
EHX400A5	160	0.5	1.7	1.5		18.8	19

* nur mit MSG-Gleichrichter zulässig. da Übererregung erforderlich

[1)] Bremse mit Sonder-Federbohrung. Umbau auf ein anderes Bremsmoment ist nicht möglich.

Tab. 36: Technical data for maintenance of single-disc service brakes ESX010A ... ESX250A, EHX027A ... EHX400A

16.6.6 Double-disc working brakes ZSX300A ... ZSX500A

Type	M_{Br} [Nm]	s_{LN} [mm]	s_{Lmax} [mm]		M_A [mm]	d_{min} [mm]	
			without HL	with HL		without HL	with HL
ZSX300A9	250	0.5	0.9	0.9	25	17.8	17.8
ZSX300A8	200	0.5	1.1	1.1		17.7	17.7
ZSX500A9	400	0.5	1.0	1.0	50	19.75	19.75
ZSX500A8	320	0.5	1.2	1.2		19.65	19.65

Tab. 37: Technical data for maintenance of double-disc service brakes ZSX300A ... ZSX500A

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