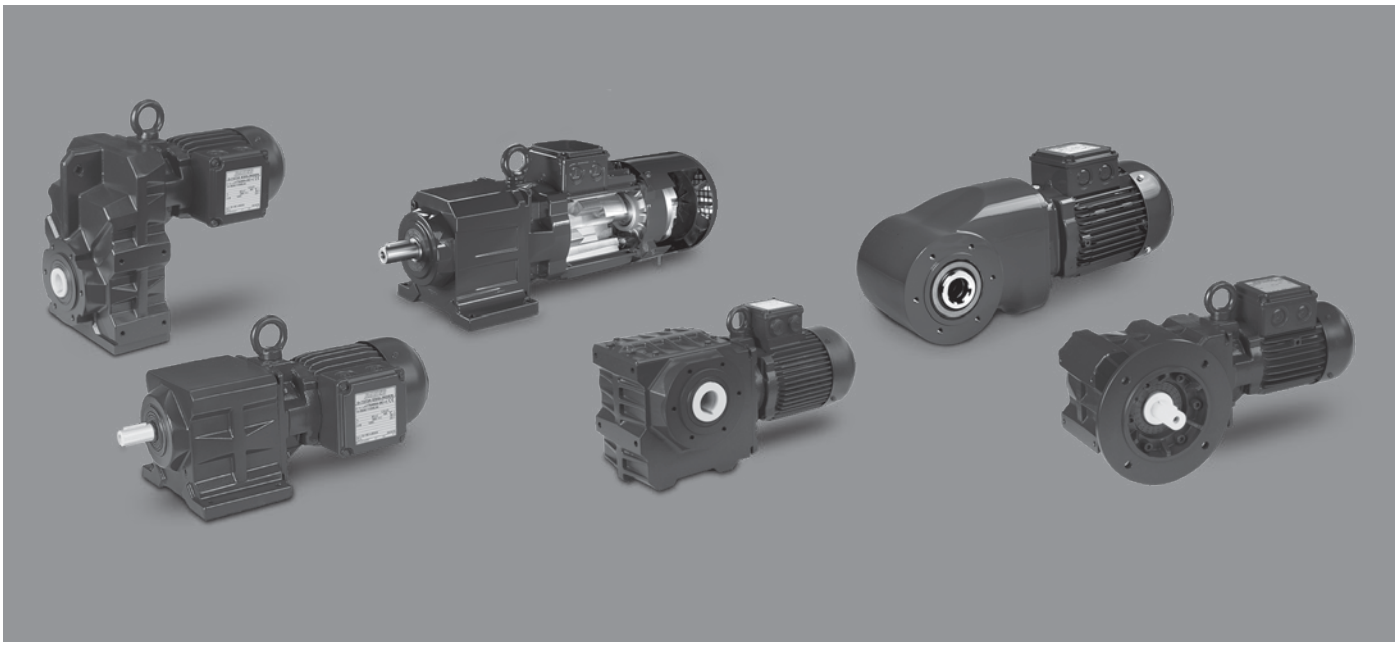
# Motor Series D.. / E.. / S..

**English**



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

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

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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.

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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:

https://rrx.link/mcm12600

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:

- 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.

| Safety Alert Symbol | Signal Word | Meaning |
|---|---|---|
|  | **DANGER** | indicates a hazardous situation which, if not avoided, will result in death or serious injury. |
|  | **WARNING** | indicates a hazardous situation which , if not avoided, could result in death or serious injury. |
|  | **CAUTION** | indicates a hazardous situation which, if not avoided, could result in minor or moderate injury. |
| – | ***NOTICE*** | indicates practices not related to physical injury and which, if not avoided, could result in property damages. |

### 1.4.2 Symbols and means of representation

| Symbol | Meaning |
|---|---|
|  | means “additional information” |
| ▶ | Symbol for an action: You must do something here.<br>▶ 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 |
| 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 | - |
| 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.

**WARNING!**
Failure to observe the documentation
Serious or fatal injuries may result.
▷ Before using the product, carefully read this documentation and all other relevant documents.

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 three-phase motors intended exclusively for use in 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<br>• At least 2 years of relevant professional experience<br>• Knowledge of how drive units work and how to handle them<br>• Experience using common work tools<br>• Routine use of smartphones (e.g. videos), PC/tablet |
| Mechanic | • Specific and general training as a mechanic<br>• At least 2 years of relevant professional experience<br>• Knowledge of how drive units work and how to handle them<br>• Experience using common work tools<br>• 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.

**Magnetic fields**
Serious or fatal injuries may result.
▷ Persons with pacemakers and implants are prohibited from standing near the product and handling the product.

**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.

**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.

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

**Hot surfaces**
Serious injury from skin burns may result.
▷ Allow hot product surfaces to cool before touching them.
▷ Suitable protective gloves must be worn when working on hot product components.

**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.

**High noise emissions**
Hearing damage may result
▷ Wear hearing protection.

**Forces and torques when separating 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.

**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.

**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.

**Suspended loads**
Serious or fatal injuries may result.
▷ Do not walk under suspended loads.

**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.

**Improper transport, storage and installation**
Improper transport, storage, and installation can damage corrosion-resistant paint coatings and lead to corrosion. Mechanical damage (scratches, chipping), chemical degradation by acids or alkalis or thermal damage caused by sparks, welding beads and heat lead to corrosion and failure of the external protection.
▷ Make sure that paint coatings are protected properly during transport, storage and installation.
▷ Have damage to paint coating repaired professionally. Observe permissible paint layer thicknesses.

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

**Attachment element pressure points**
Pressure marks from attachment elements can damage corrosion-resistant paint coatings and lead to corrosion.
▷ Have damage to paint coating repaired professionally.

**Incorrect installation positions and ambient temperatures**
Material damage may occur
▷ Ensure compliance with the specified permissible installation orientations and ambient temperature ranges.

## 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 |
|  | Products and accessories may be subject to country-specific regulations implementing the WEEE directive (Waste Electrical and Electronic Equipment).<br>Disposal of the product and all accessories must therefore be carried out in accordance with the statutory disposal and return regulations in force in your country. |

## 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 motors in accordance with applicable local regulations.
▶ Collect old lubricant (waste oil, grease) and dispose of properly.

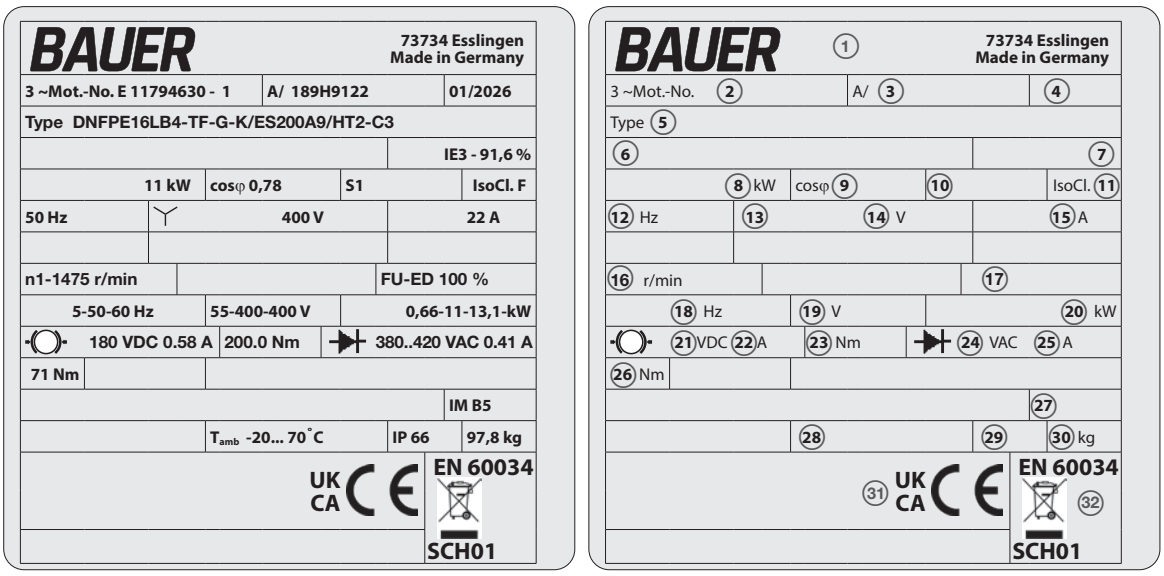
# 3 Product description

## 3.1 Product identification: motor

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 additional information
7 Energy efficiency
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 Rated motor speed
17 Space for inverter duty cycle
18 Space for inverter duty frequency range
19 Space for inverter duty voltage range
20 Space for inverter duty output range
21 With brake installed: DC voltage
22 DC current of brake
23 With brake installed: Braking torque on motor shaft
24 With brake installed: AC connection voltage
25 AC current of brake
26 With brake installed: Braking torque on motor shaft
27 Installation position
28 Permissible ambient temperature range
29 Protection rating
30 Drive weight
31 Approvals
32 Standards complied with

## 3.2 Type code/type designation


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

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

## 3.3 Motor type designation

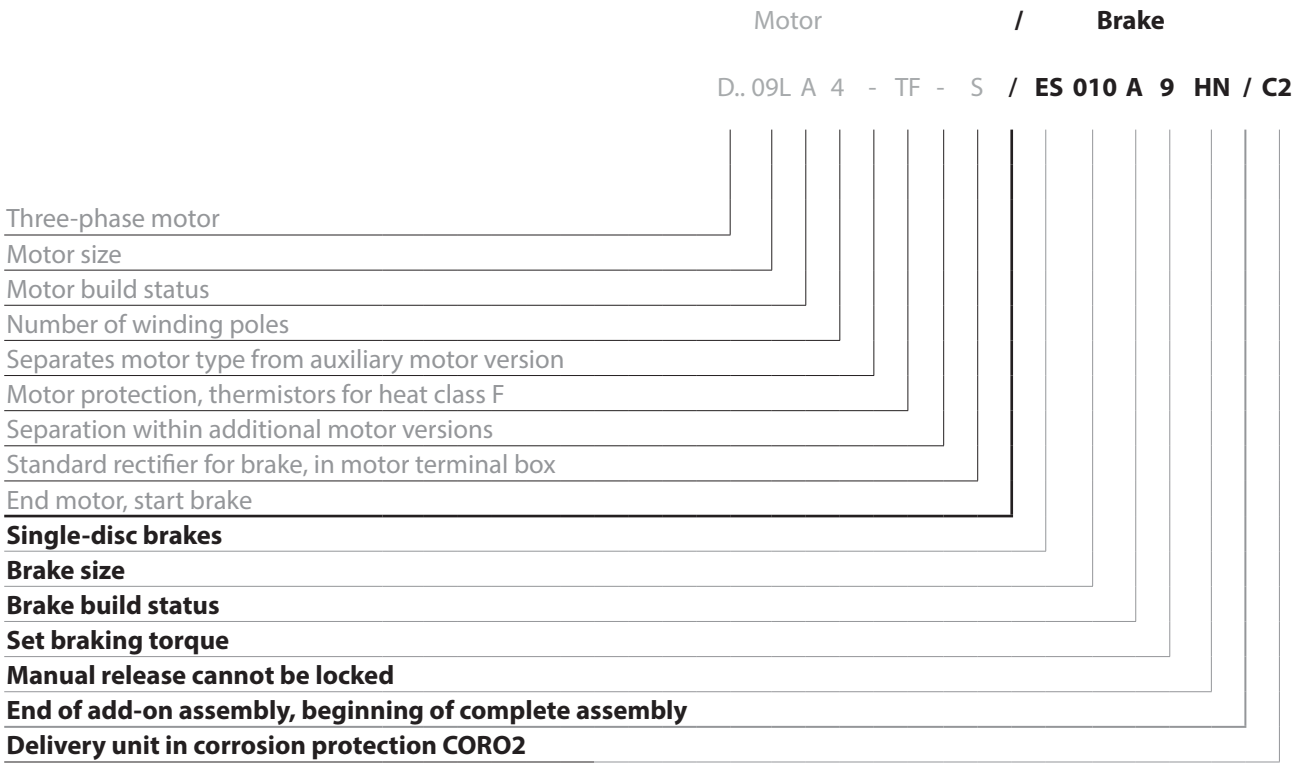
**Motor** / Brake

**D.. 09L A 4 - TF - S** / ES 010 A 9 HN / C2

**Three-phase motor**
**Motor size**
**Motor build status**
**Number of winding poles**
**Separates motor type from auxiliary motor version**
**Motor protection, thermistors for heat class F**
**Separation within additional motor versions**
**Standard rectifier for brake, in motor terminal box**
**End motor, start brake**
Single-disc brakes
Brake size
Brake build status
Set braking torque
Manual release cannot be locked
End of add-on assembly, beginning of complete assembly
Delivery unit in corrosion protection CORO2

| | | | |
|---|---|---|---|
| **Three-phase motor** | D | | = Three-phase motor |
| | E | | = Single-phase motor (masonry circuit) |
| | S | | = PM synchronous motors |
| | | A | = Aseptic motor = germ control drive |
| | • | SE | = Three-phase motor with increased efficiency according to IE1 |
| | • | HE | = Three-phase motor with increased efficiency according to IE2 |
| | • | PE | = Three-phase motor with increased efficiency according to IE3 |
| | • | N | = Motor without gearbox, motor in foot-mount version |
| | • | NF | = Motor without gearbox, motor in flange version |
| | • | R | = Roller conveyor motor |
| | • | XE | = Explosion-protected motor with increased safety |
| | • | XD | = Pressure-resistant |
| | • | W | = Rotating-field magnet |
| | • | L | = Special rotor for traction and rotary motors |
| | • | C | = with main and auxiliary windings (single-phase motors only: EC....) |
| | • | V | = Wide-range voltage |
| | • | U | = Unventilated (i.e. also without fan) |
| Motor protection | TB | | = Thermistors 140° |
| | TF | | = Thermistors 160° |
| | TH | | = Thermistors 180° |
| | TEB | | = Thermistor warning/trip 120°/140° |
| | TBF | | = Thermistor warning/trip 140°/160° |
| | TFH | | = Thermistor warning/trip 160°/180° |
| | TOB | | = Thermostat, opener 140° |
| | TOF | | = Thermostat, opener 160° |
| | TOH | | = Thermostat, opener180° |
| | TSB | | = Thermostat, closer 125° |
| | TSF | | = Thermostat, closer 160° |
| | TSH | | = Thermostat, closer180° |
| | TX | | = other |
| Brake rectifier in the motor terminal box | S | | = Standard rectifier SG |
| | E | | = Special rectifier ESG |
| | M | | = Special rectifier MSG |
| Plug-in connection | ST | | = Harting (andere) |
| Heavy fan | SL | | |
| Protective hood | D | | |
| CleanDrive | CD | | = Aseptic drive with cable |

## 3.4 Type designation of motor attachments




| | | | |
|---|---|---|---|
| Brake | E | | = Single-disc brakes |
| | ES | | = Single-disc holding brake |
| | EH | | = Holding brake, single-disc, heavy-duty version |
| | ZS | | = Double-disc holding brake |
| | ESX | | = Single-disc service brake |
| | EHX | | = Single-disc working brake in heavy-duty version |
| | ZSX | | = Dual-disc service brake |
| | | 010 | = Brake size |
| | | ... A | = Build status |
| | | ... . 9 | = Code number of the set braking torque |
| | | ... . . HN | = Manual release (not lockable) |
| | | ... . . HA | = Manual release (lockable) |
| Backstop | RR | | = Locking direction right |
| | RL | | = Locking direction left |
| Digital and analogue sensors | G | | |
| Second motor shaft end | ZW | | = with key |
| | ZV | | = with square |
| External ventilation | FV | | |
| Overall design | AV | | = USA/Canada version with shaft dimensions in inches |
| | AM | | = USA/Canada version with metric shaft dimensions |
| | UL | | = US version |
| | CS | | = Canadian version |
| | C1 | | = Anti-corrosive protection Coro1 |
| | C2 | | = Anti-corrosive protection Coro2 |
| | C3 | | = Anti-corrosive protection Coro3 |
| | C4 | | = Anti-corrosive protection Coro4 |
| | C5-I | | = Corrosion protection Coro5 (industrial) |
| | C5-M | | = Corrosion protection Coro5 (marine) |
| | IM2 | | = Protection against sea or brackish water |
| | SP | | = Non-catalogue version |

### 3.4.1 Installation positions

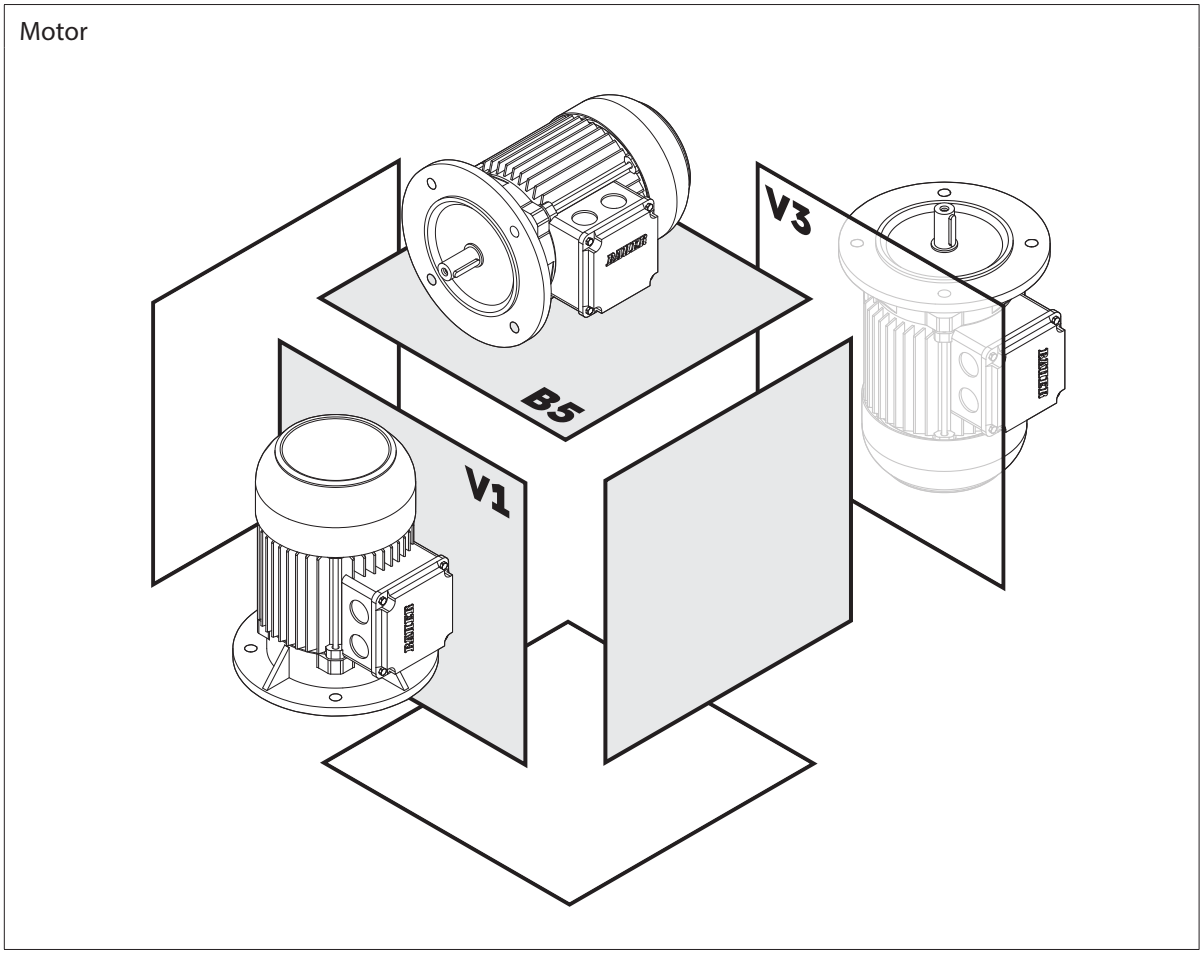



Fig. 1: mounting positions

## 3.5 Functional description

### 3.5.1 Three-phase motor

**Induction motor**
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.

### 3.5.2 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)

### 3.5.3 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.

### 3.5.4 Backstop (RR, RL)

Specify blocking direction right (RR) or left (RL) when ordering.
The reference is a view of the mounting side.

### 3.5.5 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.

### 3.5.6 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.

### 3.5.7 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 6.4.10, p. 29.
Heating is also provided in order to ensure that the motors start up reliably after being idle for a long period of time in very cold locations.

# 4 Included with delivery

The motor is delivered as a ready-to-use unit.

# 5 Transport and storage

## 5.1 Goods Receiving

***NOTICE***
**Incomplete and damaged products**
Obstruction and complication of operational processes
▷ Do not install or commission damaged products.

▶ 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

***NOTICE***
**Improper transport**
Material damage may result. The ring eyelet attached close to the centre of gravity does not guarantee that the product will remain in a horizontal position.
▷ Observe the specifications for proper transport.
▷ Lift the product slowly and ensure that it remains in a horizontal position by attaching the lifting gear (additional loops) appropriately.
▷ Do not install or commission damaged products..

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 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.
▶ Make sure that the eye bolts are completely tightened.
  • The eye bolt(s) should lie flat on the housing surface.

## 5.3 Storage

***NOTICE***
**Improper storage**
Material damage may result.
▷ Observe the specifications for proper storage.
▷ Do not install or commission improperly stored products.

### 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.

▶ 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**

***NOTICE***
**Improper storage**
Improper storage can damage corrosion-resistant paint layers and thus lead to corrosion. 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.
▷ Observe the specifications for proper storage.

▶ Check the exterior paintwork. Repair any damage if necessary. Observe the permissible paint layer thicknesses.
▶ Check the corrosion protection on bare metal parts (shafts, hollow shafts, flanges, etc.). Repair any damage if necessary.

**During the storage time**
Do not stack products on top of each other.
▶ Store the product on a hollow base.
▶ Cover product when stored.
▶ 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

### 6.1.1 Substructure

☑ The substructure is torsion-resistant and vibration-damping.

### 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

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. 20 , 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
- Screw locking agent, e.g. Loctite®
- Use fixing screws of strength class 8.8 at least.

### 6.2.2 Inspections and preparatory work before installation

**CAUTION**
**Sharp edges on open keyways**
Cutting injuries may result
▷ Insert the key into the keyway

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, 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 6.4, p. 22 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.

### 6.2.3 Drive elements

***NOTICE***
**Material damage due to improper installation of drive elements**
This may result in damage to the bearing.
▷ Heat drive elements, such as pinions or couplings, before assembly.

**DANGER**
**Ejection of unsecured keys from the keyway**
This can result in serious or even fatal injuries caused by flying debris.
▷ Drive with the customer's drive element fitted or the key suitably secured operate.

### 6.2.4 Motor with second shaft end

Engines with an optional ZW second motor shaft end are delivered with the key inserted and secured for transportation.

**DANGER**
**Ejection of unsecured keys from the keyway**
This can result in serious or even fatal injuries caused by flying debris.
▷ Operate the drive with the customer's drive element fitted or suitably secured key.

**DANGER**
**Rotating parts.**
Serious to fatal injuries are the result.
▷ If no protection is provided on site, install a protective cover in accordance with accident prevention regulations.

## 6.3 Installation of standard motors

Tightening torques for the clamping bolts of standard motors with IEC frame sizes 56 to 280 and NEMA 56C to 405TC.

▶ Use the following tightening torques:

| IEC motor size | Bolt | Tightening torque [Nm] |
|---|---|---|
| 56 | M6 | 10.1 |
| 63 | M6 | 10.1 |
| 71 | M6 | 10.1 |
| 80 | M8 | 24.6 |
| 90 | M8 | 24.6 |
| 112 | M8 | 24.6 |
| 132 | M12 | 84 |
| 160 | M12 | 84 |
| 180 | M12 | 84 |
| 200 | M16 | 206 |
| 225 | M16 | 206 |
| 250 | M16 | 206 |
| 280 | M16 | 206 |

Tab. 1: Tightening torques for tensioning screws

## 6.4 Electrical installation

Before performing any work, read and follow the safety instructions described in chapter 2, p. 9.
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. 19.

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

### 6.4.1 Required tools and aids

- Chisel or similar
- Hammer
- Screwdriver
- Hexagonal wrench

### 6.4.2 Prerequisites

**WARNING**
**Improperly performed work**
Serious or fatal injuries may result.
▷ Observe and comply with all the requirements described.

Only suitably qualified personnel in accordance with EN 50110-1/-2 (VDE 0105 Part 100) may perform work on this device or system.

- Remove any transport locks before putting the device into service.

**Before starting installation**

▶ Before performing any work, read and follow the safety instructions described in chapter 2, p. 9.
▶ Comply with the general installation regulations.
  - Carry out the electrical installation in accordance with the relevant regulations (e.g. cable cross-sections, fuses, protective conductor connection).
▶ In addition, observe the following regulations, requirements and safety measures:
  - Plant-specific and local regulations and requirements
  - Safety barriers and warning and safety signs specified on site.
▶ Only install the product if the mains voltage and frequency match the voltage and frequency data on the rating plate of the motor, or, in the case of inverter duty, the output voltage of the inverter matches the connection voltage of the motor, see chapter 3.1.1, p. 13 and drive rating plate.

**Preparing for installation**

▶ Observe the assembly instructions specified for the product.
▶ Observe the 5 safety rules in accordance with DIN VDE 0105.
  - Switch off the system.
  - Protect the system from being switched on again.
  - Check that no voltage is present.
  - Cover or fence off nearby live parts.
  - Earth and short out the device.
▶ Use original spare parts for each repair.

**Performing installation**

- ▶ 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.
- ▶ Check the seal of the terminal box for damage after opening. If damaged, replace with original parts (sealing material and adhesive).
- ▶ Only use the original connecting parts supplied.
- ▶ If unexpected start-up of the system can endanger personnel, do not use motor protection devices with automatic restart.
- ▶ Connect motor and control, overload protection and earthing according to local installation regulations.

**Installation after a long storage period**

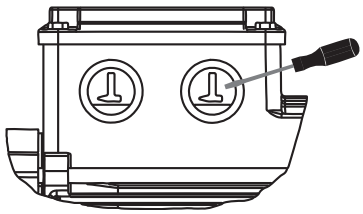
- ▶ If product was stored for a long period of time (>9 months / long-term storage): Prepare the product before installation in accordance with the specifications in chapter 5.3.2, p. 19.

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

**WARNING**
**Loose, unsecured parts**
Eye injury can be the result
▷ Wear safety glasses.

1. For third-party engines, follow the instructions in the engine manufacturer's operating manual.
2. Fit terminal box cover
3. Place chisel or similar at a slight angle on the cable entry to be opened and hammer it in lightly.

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

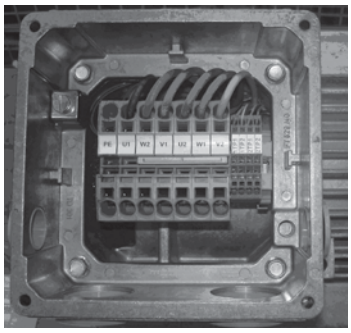


4. Unscrew terminal box cover and remove broken-out parts.
5. Fasten cable gland with enclosed lock nut. When doing so, use the installation torques specified by the cable gland manufacturer.
6. Tighten the terminal box cover with a tightening torque of 1-1.5 Nm to ensure terminal box cover sealing.

### 6.4.4 Electrical connection on terminal block

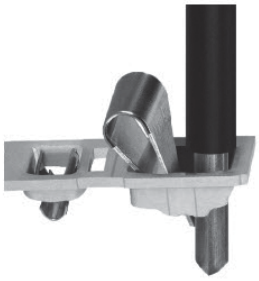
Make the electrical connection according to the connection diagram. A terminal block with cage spring clamps (CAGE CLAMP®) is installed as standard.

**Terminal block with CAGE CLAMP® technology**



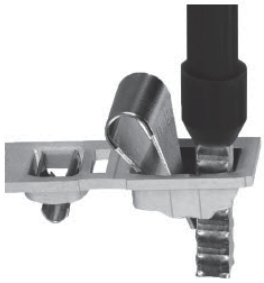
- 6 terminals for winding
- 1 terminal for PE
- 4 auxiliary terminals in different sizes and colours (e.g. thermistors for warnings and shutdown)
- Star connection W2-U2-V2 fitted
- The lower terminal row is for the mains connection.

1. For third-party engines, follow the instructions in the engine manufacturer's operating manual.
2. Open clamp with a suitable screwdriver: Insert screwdriver until the stop.
   - Leave screwdriver in place to hold the CAGE CLAMP®.
3. 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

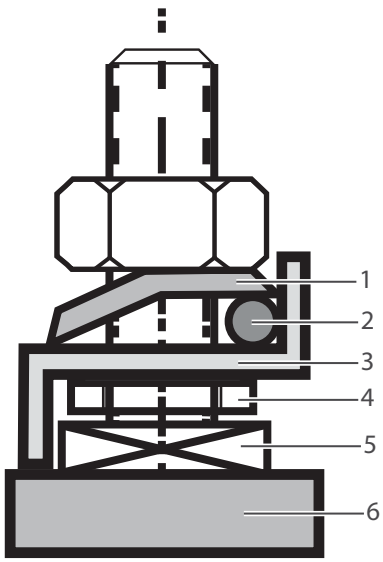


Crimped

4. Pull out screwdriver.
   - Cable is clamped automatically.
5. 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.
6. After completing work: Have any damage to paint coating repaired professionally to ensure corrosion protection.

### 6.4.5 Electrical connection on terminal board

**Optionally available**
Motor with terminal board with screw bolts installed in terminal box
▶ For third-party engines, follow the instructions in the engine manufacturer's operating manual.
▶ Make connection according to following sketch. Use the tightening torques in accordance with Tab. 3, p. 26.




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

Tab. 2: Connection of single-wire conductor; version with stud terminal

▶ Use the following tightening torques:

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

Tab. 3: Tightening torques for electrical connection on terminal board

▶ Do not route connecting lines over electrically live parts.

Additional terminals for temperature monitoring or standstill heating are located in the main connection compartment or in supplementary connection compartments, depending on the version (see supplied wiring diagram).
▶ Keep the supplied wiring diagram (in the connection compartment) with the drive documents in the plant.

**Connect external fan**
▶ For third-party motors, follow the instructions in the motor manufacturer's operating manual.
If an external fan is provided, it must always be switched on together with the motor, and with duty type S3 or S4 it should operate continuously with the motor as much as possible.
▶ Connect external fan (see chapter 16.3.1, p. 43).

**Ensure protection against contact with electrically live parts**

▶ For third-party motors, follow the instructions in the motor manufacturer's operating manual.

1. Close the terminal box again using the seals provided at the factory and in compliance with the IP protection class.
2. Check the seal of the terminal box and replace with original parts if damaged.
3. Ensure that the insertion parts comply with the IP rating of the motor as a minimum.
4. Seal unused insertion holes with approved (e.g. metal) seal plugs with sealing rings at least IP protection class of the motor.
   - If the supplied cable entries have caps, they are only intended to provide protection during transport and are not approved seals. This also applies to outdoor storage of motors. Additional rain protection is necessary in such case.

**Motors with cast-on terminal boxes**

▶ For third-party motors, follow the instructions in the motor manufacturer's operating manual.
▶ Observe operating instructions for cable and line entries.
▶ Ensure that the diameters of the cables and connectors used correspond to the clamping range marked on the entry.

Cable entries and entry seals that do not meet these requirements are not permitted.

**Motors with screwed-on terminal boxes**

▶ For third-party motors, follow the instructions in the motor manufacturer's operating manual.
▶ Observe operating instructions for cable and line entries.
▶ Ensure that the diameters of the cables and connectors used correspond to the clamping range marked on the entry.

Cable entries and entry seals that do not meet these requirements are not permitted.

To change the position of the cable and conductor entries, the compartment can be rotated in four steps of 90°.

1. Screw on the terminal box cover.
2. Loosen and remove four screws in the corners at the bottom of the terminal box.
3. Loosen the terminal box from the motor housing and rotate it.
   - To do this, undo the motor connection if necessary and, after aligning the terminal box, reconnect it according to the information in chapter 6.4.4, p. 25, 6.4.5, p. 26 and chapter 6.4.7, p. 28.
4. Check the seal of the terminal box and replace with original parts if damaged.
5. Screw the terminal box to a motor housing and tighten to the tightening torque specified Tab. 4, p. 27 to ensure that the terminal box is leaktight.

| Thread size | Tightening torque [Nm] |
|---|---|
| M4 | 2.5 |
| M5 | 5.5 |
| M6 | 10.0 |
| M8 | 20.0 |

Tab. 4: Tightening torques for terminal box screw connection

6. Check the seal of the terminal box on the cover and replace with original part if damaged.
7. Ensure that the cover of the terminal box is leak-tight
   - To do this, tighten the terminal box cover with a tightening torque in accordance with Tab. 3, p. 26.

### 6.4.6 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. 5: Electrical connection variants – properties and information

If the connector is supplied, read supplied documentation.

### 6.4.7 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.

### 6.4.8 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.

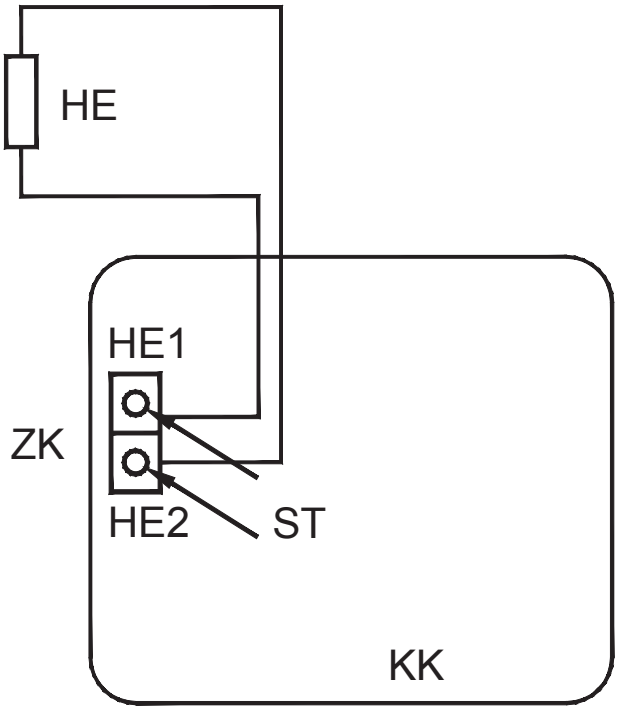
### 6.4.9 Electrical connection for motor protection devices

**WARNING**
**Automatic restart**
After the winding has cooled down, it may restart automatically. This can result in serious or 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.

### 6.4.10 Stator standstill heating

***NOTICE***
**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<br>_____ V<br>_____ W |

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

Fig. 2: Connection diagram for stator standstill heating via heater bands

### 6.4.11 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 terminal block or from the mains.

Do **not** connect the rectifier to the motor terminal board or terminal block 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 - see Tab. 6, p. 30).

| Supply voltage of brake | Rectifier type | Supply voltage of rectifier | Switch-off Brake supply | Connection diagram | Additional connection diagram |
|---|---|---|---|---|---|
| **External DC connection** | - | - | - | A311.1000-25 | - |
| **Rectifier** | **SG3.575B** | Motor terminal board or terminal block | AC-side | A311.1000-26 | Z011.1000-25 |
| | | | DC-side | A311.1000-27 | Z011.1000-25 |
| | | Separate | AC-side | A311.1000-28 | - |
| | | | DC-side | A311.1000-29 | - |
| | **ESG1.460A** | Motor terminal board or terminal block | Automatic | A311.1000-30 | Z011.1000-25 |
| | | Separate | Automatic | A311.1000-31 | - |
| | **MSG1.5.500U** | Separate | Automatic | A311.1000-32 | - |
| | **MSG1.5.480I** | Motor terminal board or terminal block | Automatic | A311.1000-33 | Z011.1000-25 |

Tab. 6: Brake connection options

Clampable conductor cross-section of rectifier: max. 1.5 mm²
For SG rectifiers: max. 1.0 mm² when using ferrules

**Operation using rectifier ESG1.460A**
- To activate the integrated quick shut-off function, connect the blue conductor leading out of the housing to PE. Since this conductor is coupled to the supply voltage with high impedance, leakage currents of up to max. 2 mA can flow, depending on the voltage level.
- If the motor undergoes high-voltage testing, the blue wire of the rectifier must be disconnected from the PE beforehand.
- For operation on ungrounded networks, the blue conductor must be connected to the right AC voltage contact (N) of the electronic fast-acting rectifier. If, in this case, the rectifier is supplied by the motor terminal board, an increase in the response time must be expected when switching off.

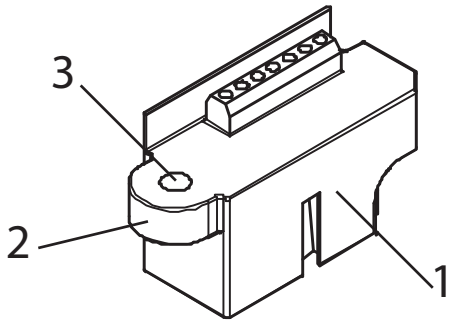
**Operation using rectifier MSG1.5.480I**

***NOTICE***
**Motor supply cable not routed through sensor**
The rectifier does not switch on and can be damaged.
▷ Make sure that a motor supply cable is routed correctly through the current sensor.

The current sensor is used to detect the motor current. For the rectifier to function correctly, a motor supply cable must be routed through the sensor.

**Technical specifications of sensor**
- Maximum continuous current rating: 64 A
- Sensor bore diameter: 7 mm
- Permissible wire diameter:
  - 1x passage: max. 6.7 mm
  - 2x passage: max. 3.2 mm

**Connecting the sensor**
- Pass one wire of the motor connection cable through the hole in the current sensor, which is mounted on the side of the rectifier.
- For engine no-load currents < 0.4 A, the wire must be guided twice through the sensor hole. In this case, the rectifier below the sensor is marked with sticker "2".




1 Rectifier MSG1.5.480I
2 Current sensor
3 Current sensor bore

Fig. 3: MSG1.5.480I rectifier sensor

### 6.4.12 Electrical connection for external fan

***NOTICE***
**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 Tab. 13, p. 43.

### 6.4.13 Encoder electrical connection

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

### 6.4.14 Connection for motors with plug

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

When connecting, follow manufacturer's documentation for plug.

### 6.4.15 Connection of rotating field magnet motors

***NOTICE***
**Property damage due to improper use of tooling**
Risk of damage to the terminal box
▷ If the rotary field magnet is operated on a frequency converter **without** an output filter, the varistors in the motor terminal box must be disconnected.

# 7 Commissioning

**CAUTION**
**High noise emissions**
Hearing damage may occur.
▷ Wear hearing protection.

▶ Observe the values on the rating plate.
▶ Follow instructions in chapters Tab. 2, p. 26, 6.2, p. 20 and 6.4, p. 22.
▶ 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.

## 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.

## 7.3 Commissioning after long-term storage

### 7.3.1 Motor measures

**WARNING**
**Electric shock**
Serious or fatal injuries may 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

If it is necessary to dry the motor:
▶ Have the manufacturer or a specialist workshop for electrical machines carry out any work required.
If the work is not carried out by the manufacturer:
▶ Have the work assessed by a recognised qualified person.

# 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.<br>▶ 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<br>• 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.<br>▶ Check projection, use stronger motor as necessary.<br>▶ Design different start-up solution. |

| Malfunction | Possible cause | Remedy |
|---|---|---|
| Motor not reaching its rated speed or speed drops sharply | Motor is overloaded. | ▶ Eliminate overload.<br>▶ Measure load.<br>▶ 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<br>• 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.<br>▶ Have the motor repaired or replaced by a specialist company. |
| Motor protection trips immediately after switching on | • Connected incorrectly<br>• 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.<br>▶ Have the motor repaired or replaced by a specialist company. |
| Motor becomes too hot.<br>▶ If necessary, consult with Bauer Gear Motor GmbH<br>• How hot does the motor get?<br>• After what runtime?<br>• Measured where? | Drive is overloaded. | ▶ Take a power measurement.<br>▶ 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<br>▶ 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.<br>▶ 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.<br>▶ Rectify malfunction.<br>▶ Measure motor winding.<br>▶ If necessary, repair at specialist workshop. |

Tab. 7: Motor malfunctions

## 9.2 Brake malfunctions

| Malfunction | Possible cause | Remedy |
|---|---|---|
| Brake does not release | No voltage present. | ▶ Check and correct control.<br>▶ If possible due to connection used, place missing connection between rectifier and terminal board.<br>▶ Rectifier defective, replace. |
| | Incorrect voltage applied. | ▶ Correct voltage. |
| | Air gap too large | Brake pads worn.<br>▶ Have repaired by trained personnel or specialist workshop |
| | Brake coil defective | ▶ Replace brake.<br>▶ 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.<br>▶ Have repaired by trained personnel or a specialist workshop. |
| Brake engages too slowly | Incorrect control selected | ▶ Install DC-side switch-off.<br>or<br>▶ 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 6.4, p. 22. | ▶ Use overexcitation fast-acting rectifiers. |
| Brake rattling | Usually occurs due to alternating torques on inverter duty. | ▶ Configure inverter correctly. |

Tab. 8: Brake malfunctions

# 10 Repair

***NOTICE***
**Property damage**
This may result in damage to drives and the surrounding area/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.

Any work on the products must be performed by qualified specialist personnel.
▶ Follow the troubleshooting instructions in chapter 9, p. 33.

Repairs must be made in compliance with chapters 2, p. 9, 6.2, p. 20, 6.4, p. 22, 7, p. 32, 8, p. 33, and, 15, p. 42 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.

***NOTICE***
**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

**WARNING**
**Inadequate maintenance**
Death and serious injuries may result.
▷ Observe maintenance and inspection intervals.

***NOTICE***
**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. 13).
▷ 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<br>or earlier, e.g. based on operational experience and specifications for:<br>• Ambient temperatures >40 °C<br>• Difficult operating conditions such as switching and reversing duty<br>• For shock and vibration loads | See chapter 11.2, p. 37 |
| | Brake | Holding brake:<br>Inspect every 2 years<br><br>Service brake:<br>Every six months or according to specifications from system manufacturer or system operator | See chapter 11.3, p. 38 |
| | 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:<br>Every 2 years<br><br>Service brake:<br>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. 38 |
| | Single-disc brakes:<br>ES010A …<br>ES250A,<br>EH027A ...<br>EH400A | Holding brake:<br>Every 2 years<br><br>Service brake:<br>Every 3,000 operating hours<br><br>Note:<br>• Brakes type "E..." are installed under the fan cover.<br>• Brakes type "EH..." are installed on the fan cover. | See chapter 11.3.2, p. 39 |
| | Single-disc brakes:<br>ESX010A …<br>ESX250A,<br>EHX027A ...<br>EHX400A | Service brake:<br>Every 3,000 operating hours, every 6 months at the latest, or according to specifications from system manufacturer and/or operator<br><br>Note:<br>• Brakes type "ESX" are installed under the fan cover<br>• Brakes type "EHX..." are installed on the fan cover. | See chapter 11.3.3, p. 40 |
| | Double-disc brakes:<br>ZS300A ...<br>ZS500A | Holding brake: Every 2 years<br><br>Note:<br>Brakes of type "Z..." are installed under the fan cover. | See chapter 11.3.4, p. 40 |
| | Double-disc brakes:<br>ZSX300A ...<br>ZSX500A | Service brake:<br>Every 3,000 operating hours, every 6 months at the latest, or according to specifications from system manufacturer and/or operator<br><br>Note:<br>Brakes type "ZSX..." are installed under the fan cowl | See chapter 11.3.5, p. 41 |

Tab. 9: Maintenance schedule

## 11.2 Motor inspection and maintenance

The motors must be inspected at regular intervals by a qualified specialist.

▶ 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. 10, p. 38).
  • 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

▶ Replace shaft sealing ring. Before installation, grease the sealing lips and, if present, fill the grease cavity between the dust lip and the sealing lip to 50% with grease (see Tab. 10, p. 38).
  • Make sure that the new sealing ring does not return to the "old" track.

| Applicability | Bearing grease type or similar |
|---|---|
| Standard | SHELL S2 V100 3 |
| High temperature | KLÜBER PETAMO GHY 133 |
| Food & beverage | MOBIL Polyrex 222 |

Tab. 10: Lubricant chart

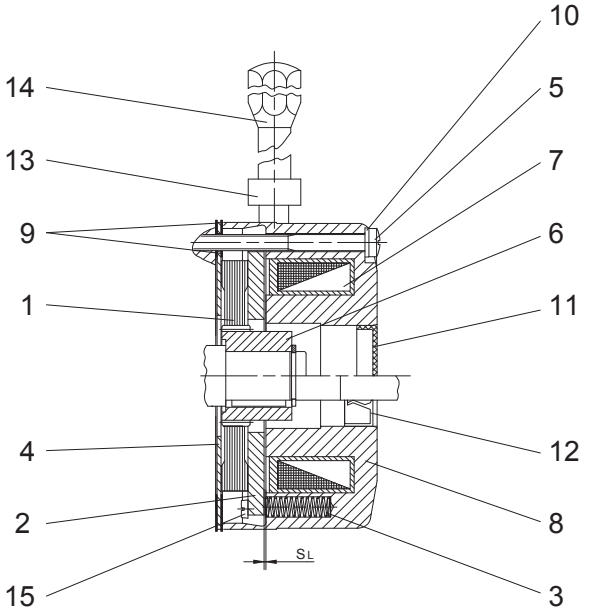
**WARNING**
**Non-functional brake**
Brakes are components important for safety. Death and serious injury may result.
▷ Any work must be performed by qualified and personnel trained on the product.
▷ Do not expose any friction surfaces and brake discs to oil or grease. Even small quantities reduce the 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. 15, p. 45, 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

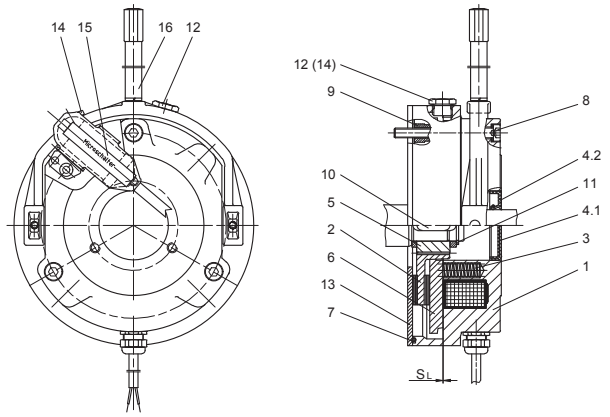
### 11.3.2 Maintenance of single-disc holding brakes ES010A ... ES250A, EH027A ... EH400A

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. 25, p. 50. No further work is necessary.
   - If there is wear: Further maintenance work is necessary, see chapter 11.3.3, p. 40.
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. 39

**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. 27, p. 51, $S_{Lmax}$ specifies the maximum permissible air gap.
3. After checking, secure the screw plug with locking varnish.

**Brake maintenance**

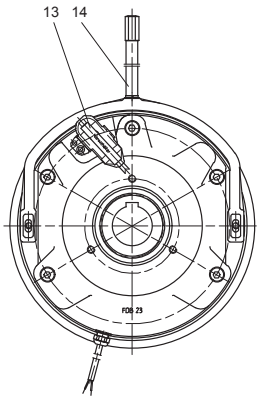
If the brake-related value is reached or exceeded, maintain the brake as follows:

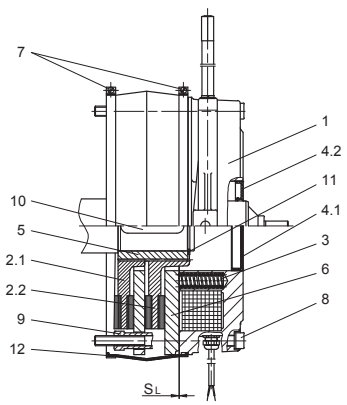
1. Remove the fan blade (under the fan cover).
2. Unscrew fixing screws with copper ring (8) and pull the brake off the motor end shield.
3. Clean the brake and remove any debris.
4. Check armature disc (6) and friction plate (14) (only present on D..08 and D..09 motors) and replace if there are large 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 Tab. 24, p. 49.
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. 26, p. 50. No further work is necessary.
   - If there is wear, further maintenance work is required, see chapter 11.3.5, p. 41.
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. 40

**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. 40.
   - 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. 28, p. 51.
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 Cleaning and maintenance

***NOTICE***

**Improper cleaning of the paint layer**

Corrosion protection is impaired. The drive or its surroundings may be damaged.

▷ Only use non-abrasive cleaning tools.

***NOTICE***

Penetration of liquid into device.

This may result in damage to the drives and the surrounding area/system.

▷ 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. 20, 6.4, p. 22, 7, p. 32, and Tab. 8, p. 35, and proceed in reverse order.

# 13 Disassembly

Follow the instructions and notes for installation and commissioning in chapters 6.2, p. 20, 6.4, p. 22, 7, p. 32, and 8, p. 33, 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 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 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. 11: Permissible ambient conditions

The power and torque data given on the rating plate is fully available at the output shaft.
Specific technical data can be requested from Bauer Gear Motor by specifying the serial and/or article number.

## 16.2 Motors

### 16.2.1 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

### 16.2.2 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. 12: PMSM parameters

## 16.3 Motor attachments and accessories

### 16.3.1 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. 13: Technical data, external fans

### 16.3.2 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<br>Braking torque tolerance: -10/+30% 1), 2)<br>Braking torque tolerance: -20/+30% when run in. Up to -30% is possible when new. 3) |
| ZF | Number of springs<br>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)<br>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<br>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)<br>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.<br>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.<br>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.<br>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.<br>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.<br>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)<br>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.<br>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<br>2) Only for holding brakes with emergency stop feature of type ES.../ZS...<br>3) Only for service brakes of type ES(X).../ZS(X)... | |

Tab. 14: 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. 15: 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. 16: 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] | $W_{max}$ [$10^3$J] | $W_{th}$ [$10^3$J] | $W_L$ [$10^6$J] | | $t_A$ [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. 17: 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.

### 16.3.3 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. 18: 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. 19: 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. 20: 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. 21: 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<br>• Parameter [1], [3] | Class 1 and 2<br>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] | 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<br>• RPM<br>• Operating temperature | ≥3.9 * $10^{10}$ rotations at<br>≤ 6,000 rpm<br>≤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]<br>• 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. 22: Technical data for incremental rotary encoders

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

### 16.3.4 Backstop (RR, RL)

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

## 16.4 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:<br>Tolerance: +0.15 mm<br>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<br>[2] Only for single-disc holding brakes ES010A ... ES250A, EH027A ... EH400A<br>[3] Only for single-disc service brakes ESX010A ... ESX250A, EHX027A ... EHX400A<br>[4] Only for double-disc service brakes ZSX300A ... ZSX500A | |

Tab. 23: Abbreviations for brake maintenance

### 16.4.1 Spring-loaded brake of series E003B or E004B

| Type | $M_{Br}$ [Nm] | $d_{min}$ [mm] | $M_A$ [Nm] |
|---|---|---|---|
| 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 |

Tab. 24: Technical data for maintenance of spring-loaded brakes of series E003B or E004B

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

| Typ | $M_{Br}$ [Nm] | $s_{LN}$ [mm] | $s_{Lmax}$ [mm] | | $M_A$ [Nm] |
|---|---|---|---|---|---|
| | | | 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 | |
| * nur mit MSG-Gleichrichter zulässig, da Übererregung erforderlich<br>[1)] Bremse mit Sonder-Federbohrung. Umbau auf ein anderes Bremsmoment ist nicht möglich. | | | | | |

Tab. 25: Technical data for maintenance of single-disc holding brakes ES010A ... ES250A, EH027A ... EH400A

### 16.4.3 Double-disc holding brakes ZS300A ... ZS500A

| Type | $M_{Br}$ [Nm] | $s_{LN}$ [mm] | $s_{Lmax}$ [mm] | | $M_A$ [Nm] |
|---|---|---|---|---|---|
| | | | 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. 26: Technical data for maintenance of double-disc holding brakes ZS300A ... ZS500A

### 16.4.4 Single-disc service brakes ESX010A … ESX250A, EHX027A … EHX400A

| Type | $M_{Br}$ [Nm] | $s_{LN}$ [mm] | $s_{Lmax}$ [mm] | | $M_A$ [Nm] | $d_{min}$ [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 | 19.0 |

* nur mit MSG-Gleichrichter zulässig, da Übererregung erforderlich

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

Tab. 27: Technical data for maintenance of single-disc service brakes ESX010A ... ESX250A, EHX027A ... EHX400A

### 16.4.5 Double-disc working brakes ZSX300A ... ZSX500A

| Type | $M_{Br}$ [Nm] | $s_{LN}$ [mm] | $s_{Lmax}$ [mm] | | $M_A$ [Nm] | $d_{min}$ [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. 28: Technical data for maintenance of double-disc service brakes ZSX300A ... ZSX500A

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