

Brushless Neodymium magnet Motors

Installation, operating and Maintenance instructions

Series BL-N-100S to BL-N-200XL

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1 General safety notes

1.1 Safety

This electric motor was built referring to the current state of the art of safety technology and was checked on its operational safety before it left the company.

Please, consider the following to ensure a proper commissioning as well as the safe use:

- The present commissioning and maintenance instruction and its enclosed additional parts
- The enclosed safety and commissioning instructions
- The technical documents of the product
- The commissioning and safety notes of the manufacturer of the converter
- The national, local and plant-specific regulations related to the finished product

When using this product the following dangers must be considered:

- Dangers due to
- Lifting and transport processes
 - Electrical current
 - Moving parts
 - Hot surfaces
 - EMC interferences
 - Mechanical overload
 - Thermal overload

In order to avoid dangers against persons and material assets or to minimize existing risks please regard all safety notes especially those which are marked by symbols.



Danger to life from electrical current

Non-observance can cause the death or severe injuries.



Warning about general dangers

Non-observance can cause severe injuries or material damage.



Warning about dangerous situation

Non-observance can damage the system and also the vicinity.



Do not touch!

Non-observance can cause severe injuries.



No Inadmissible actions!

Non-observance can cause severe injuries



Warning about hot surfaces

Non-observance can cause severe injuries



Electrostatic sensitive parts

Non-observance can damage the system or the vicinity

1.2 Intended use

The use of the electric motor is permitted within its intended use. In this connection the electric motor may only be used in the provided applications in the technical documents considering all notes of this commissioning and maintenance instruction.

All workings regarding the mounting, commissioning and maintenance as well as during operation may be carried out by **qualified personnel**, only.

Qualified personnel is to be understood a trained and authorized person in the sense of the safety engineering notes qualified within a subject area who has the right to install, to mount, to commission and to operate devices, systems and circuits on the basis of the safety standards established. (DIN EN 50110-1) .

Improper behavior can cause **severe injuries and damage**.

This **electric motor** is **used** in **industrial systems** and complies to the following **standards and directives**:

Standards

EN 60034-1, EN 60034-5, EN 60034-6, EN 60034-7, EN 60034-9, EN 60034-11, EN 60034-14, EN 60204-1

EC Low Voltage Directive

Electric motors of this series comply with the requirements of the Low Voltage Directive (conformity)

EU EMC Directory

The operation of the electric motor within its intended use must meet the protective requirements of the EMC Directory. The constructor of the system as well as the system provider are responsible for the appropriate installation (e.g. spatial separation of signal cables and power cables, screened lines and cables etc.). In converter operation the EMC notes of the current converter, the encoder as well as of the brake manufacturer must be complied with.

All national, local and system-specific regulation must be complied with as well!

The electric motor is designed for the following **environmental conditions**:

- Environmental temperature: 0 °C bis +40 °C
- Installation height: ≤1000 m above sea level
- Relative humidity: 5 % to 85 %


Please, regard possible deviating statements on the type plate or in the technical documents. The conditions at the operation site must comply with all specifications defined on the type plate.




The use in hazardous areas **is forbidden**, unless explicitly provided for this purpose (regard additional notes). Furthermore, there may not be flammable gas mixes and dangerous dust concentrations in the vicinity of the electric motor. Voltage-carrying and hot motor parts could catch fire and cause severe injuries and material damages.

If there should be the special case of the use in systems which are not industrial, higher demands are required (e.g. protection against children's fingers), these conditions must be ensured at the system.


Motor type with rare earth magnets:

| | |
|---|---|
|  | <p>Near a drawn or exposed rotor having a strong magnet the following danger can occur:</p> <ul style="list-style-type: none"> • Persons having electronic or metallic implants (e.g. pacemakers, hearing devices, plates or nails) are endangered, if the distance between the implant and the magnet pole is less than 0.5 m. • Due to the forces of attraction towards ferromagnetic parts the following can occur: <ul style="list-style-type: none"> ○ Risk of crushing injury ○ Risk of destruction of measuring and assembly tools, check cards, watches etc. ○ Pollution of the rotor package caused by drawn-in metal chips or powder. |
|---|---|

Thermal danger:

| | |
|---|---|
|  | <p>Danger of burning!</p> <p>Surface temperatures of over 70°C can occur at the motors. If required provide touch protection!</p> <p>At hot surfaces temperature-sensitive parts as for example normal supply lines or electronic parts may not be applied or fixed.</p> <p>A thermal overload of the motors can cause the destruction of the winding, of the bearings and the demagnetizing of the rare earth magnets. Use the temperature sensor to check the temperature.</p> |
|---|---|

Prohibition of arbitrary modifications and changes

| | |
|---|---|
|  | <p>Any kind of arbitrary modifications and changes at the electric motor is not permitted. If required, please, contact the motor manufacturer.</p> <p>It is not permitted to demount or shut down safety equipment in order to operate the electric motor.</p> |
|---|---|

2 Operating requirements

2.1 Product description

The three-phase synchronous motors of the **BL-N** series are air-cooled or water-cooled permanently excited synchronous motors. Designed for a very high power density, a very high efficiency and high dynamic the motors are ideally suited for high-end applications in the machine building industry. This is even more supported by its high overload capability. Furthermore, the robust and compact motors are to the greatest possible extent maintenance free, which is an additional benefit to the economical operation. The structure is very compact due to the use of liquid cooling and the noise emission is considerably reduced.

2.2 Scope of supply

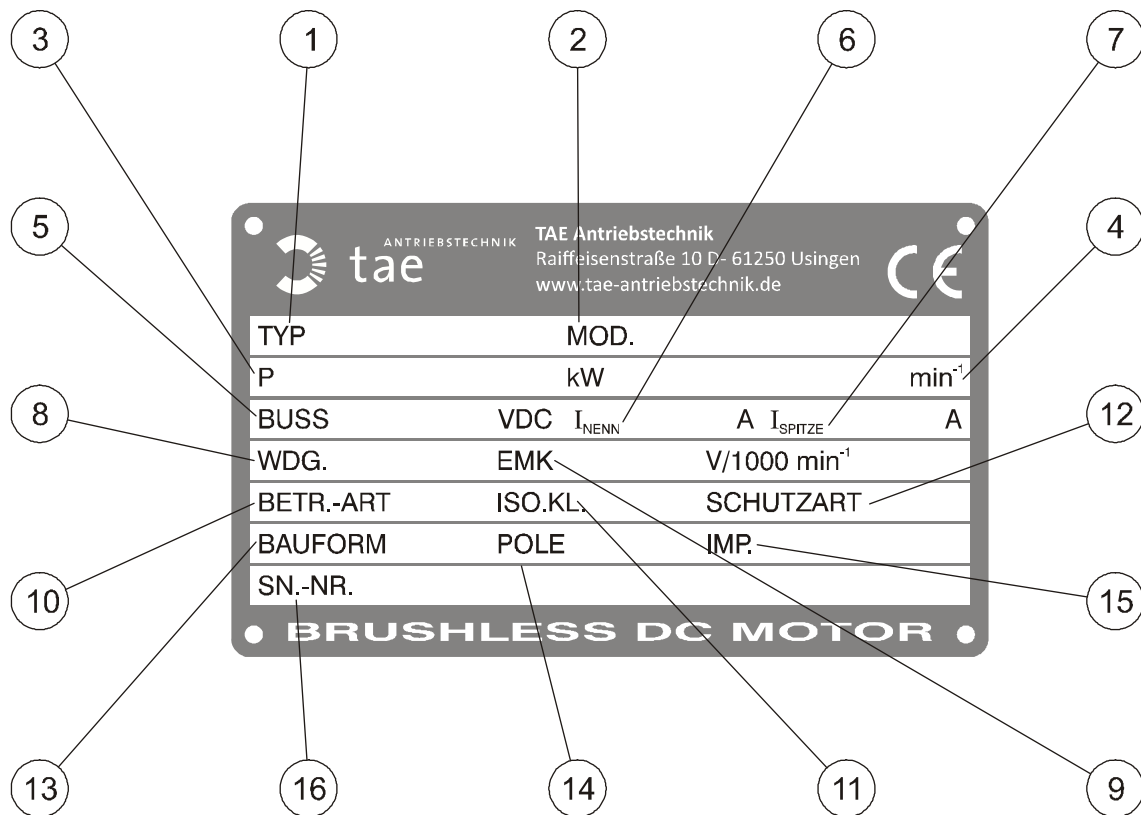
The supply is compiled order-related.

- Damage that incurred during transit must immediately be reported to the transport company.
- Immediately after receiving the delivery compare the performance data of the delivered motor with your ordering data. If visible defects or insufficient delivery is determined then immediately contact the responsible TAE Antriebstechnik subsidiary or the main TAE Antriebstechnik company in Usingen.

In both cases the defect must be corrected at first before the motor can be commissioned.

2.3 Type plate

The type plate (figure 1 and figure 2) is the identifier for each electric motor. Especially, the accordant motor number is distinctive for each electric motor – this number is essential to make a backtracing in our company possible. Therefore the type plate always must be readable. Never remove the type plate from your motor.




- | | |
|---|--|
| <p>1 Type designation</p> <p>2 Model number</p> <p>3 Rated output power in kW</p> <p>4 Rated speed</p> <p>5 Nominal rated bus voltage</p> <p>6 Nominal rated current (effective value at the nominal rated data)</p> <p>7 Peak current (The effective peak current may never be exceeded, since otherwise the motor windings will overheat too quickly and ultimately burn out)</p> <p>8 Winding type, e.g. Q, P, O, N or L</p> | <p>9 EMK motor under no-load running conditions at 1000 rpm at 25°C</p> <p>10 Type of operation as per VDE 0530</p> <p>11 Insulation class as per VDE 0530</p> <p>12 Type of protection (IP23 or IP54) as per IEC 34-5 and DIN 40050</p> <p>13 Construction (B3, B5 or B14) as per IEC 34-7 and DIN 42950</p> <p>14 Number of poles of motor, 4-pole, 6-pole or 8-pole</p> <p>15 Pulse count from speed encoder, 30 or 60 pulses</p> <p>16 Serial number</p> |
|---|--|

2.4 Technical data

2.4.1 Technical data in general

| | | |
|---|--|---|
| Size | B3 | Size 100-200 |
| | B5 | Size 100-200 (size 200 water-cooled only) |
| | B35 | Size 100-200 |
| Connection | Main connection | U V W (terminal box) |
| | Encoder connection | Connector socket 12- or 17-pole, plug 9-pole for EnDat 2.2 |
| | Temperature sensor | In the main connection |
| | Brake | Axial ventilation: Plug 8-pole Radial ventilation or water cooling: Terminal version |
| Temperature sensor | KTY84-130 | Linear temperature sensor to evaluate in the controller |
| Temperature increase | $\Delta\delta \leq 105 \text{ K}$ | Insulation class F acc. to EN 60034 |
| Environmental conditions in the company | Class 3K3/3Z12 according to DIN EN 60721-3-3, however: Temperature range 0 to 40°C | Accords to 0 to 40 °C at 5 % to 85 % rel. humidity and an absolute humidity of 1 g/m ³ to 25 g/m ³ and an altitude up to about 1400 m |
| Environmental conditions at long-term storage | Class 1K2/1M1 according to DIN EN 60721-3-1, however temperature range - 15 to 60°C | Accords to - 15 to 60°C at 5 % to 85 % rel. humidity and an absolute humidity of 1 g/m ³ to 25 g/m ³ ; to avoid frost damages at temperatures lower than 3°C the cooling water must be drained. |
| Environmental conditions at transport | Class 2K2/2M1 according to DIN EN 60721-3-2, however: Temperature range - 15 to 60°C | entspricht - 15 bis 60°C bei 5 % bis 85 % rel. Feuchte und einer absoluten Feuchte von 1 g/m ³ bis 25 g/m ³ ; to avoid frost damages at temperatures lower than 3°C the cooling water must be drained. |
| Surface | Black matt | RAL 9005 |
| Bearings | A end | Floating bearing: Ball bearing (standard); option roller bearing |
| | B end | Fixed bearing: Ball bearing |
| Service life of bearing | L _{H10} 20.000 h | Guide value, for-life grease-lubricated rolling-contact bearing |
| Quality of vibration | A | Standard: Acc. to DIN EN 60034-14:2004-09 |
| | B | Option: Size 100-160, ball bearing only |
| Concentricity | N | Standard: Normal acc. to DIN 42955 |
| | R | Option: Size 100-160, ball bearing only |
| Vibration-resistant to | radial 3 g / axial 1 g | Standard: 10 Hz to 55 Hz acc. to EN 60068-2-6 |
| Flange | FF flange | According to IEC standard |
| Shaft end | Cylindrical | According to DIN 748; centering with inside thread according to DIN 332 form D Option; with featherkey according to DIN 6885 |
| Actual speed value encoder | Resolver 2-pole | Standard: See Appendix 1 |
| | Sincos/EnDat encoder | Option: See Appendix 1 |

| | | |
|---------------|---|--|
| Holding brake | Disk brakes | Option: Addition B ended as a module (size 100-160) Other brands on request |
| Approvals | CE,  | Standard |
| | CE | BL-N-160 including an axially integrated fan |

2.4.2 Technical data for air-cooled motors

| | | |
|--|--|---|
| Cooling method / type of protection | IC 06 / IP23 | Ventilated machine with fan |
| | IC 416 / IP54 | Ventilated machine with fan |
| Attention: All mentioned degrees of protection are reached only, if the plug connectors are mounted completely and the terminal box is completely closed. | | |
| Forced ventilation | Normal fan motor for radial ventilation on the B end Fan filter | Direction of air flow from B to A IC 06: Air escape laterally to the A end IC 416 Air escape axial A end Option: Flat filter or rectangle filter |
| | Normal fan motor for axial ventilation on the B end | Direction of air flow from A to B Direction of air flow laterally to the B side |
| | Axially integrated fan for axial ventilation on the B end | Direction of air flow from A to B Air escape laterally to the B end |
| Connection fan motor | Added-on standard motor | Terminal box standard motor |
| | Added-on fan motor | Connector 6-pole |
| Terminal box | B end | Positioning options see Separately driven fan |
| | A end | On request |



2.4.3 Technical data for liquid-cooled motors

| | | |
|--|---------------|--|
| Cooling method / degree of protection | IC3W7 / IP54 | Water-cooled machine |
| Attention: All mentioned degrees of protection are reached only, if the plug connectors are mounted completely (main and control connection) and the terminal box is completely closed. | | |
| Terminal box | B end | Top |
| Coolant inlet temperature | 10°C to 25 °C | Maximal 5 K lower than the environmental temperature |
| Water connections | A end | Laterally |

Other characteristic values are to be found in our technical product list **BL-N 100 –200** on the Internet page: www.tae-antriebstechnik.de in the download area in "Technical documentations". Please, contact us for further documents.

Attention!

If the supplied electric motor doesn't correspond to the general version according to the technical list or if special agreements were stipulated, the technical deviations corresponding to this commissioning and maintenance instruction can occur. In this case, please, contact us to receive the corresponding technical additions.

2.5 Definition of performance

2.5.1 Definition of performance for air-cooled machines

The performances (torques) mentioned in the technical product list apply to the continuous operation (S1 having the nominal speed at a maximum environmental temperature of 40°C if the machines are built up beneath 1000 m above sea level. If motors are to be used within an environmental temperature of more than 40°C or at higher altitudes over 1000 m above sea level. If motors are to be used in an environmental temperature of more than 40°C or in altitudes over 1000 m above sea level, the required list performance P_l results (list torque M_n) from the product in **Table 1** of the specified factors k_1 , k_2 and of the demanded performance P (torque M).

| Environmental temperature | 40°C | 45°C | 50°C | 55°C |
|--------------------------------|--------|--------|--------|--------|
| Correction factor k_1 | 1 | 1,06 | 1,13 | 1,22 |
| Altitude above sea level up to | 1000 m | 2000 m | 3000 m | 4000 m |
| Correction factor k_2 | 1 | 1,07 | 1,16 | 1,27 |

Table 1: Correction factors for air-cooled motors

At environmental temperatures over 40°C and if the motors were built in encapsulated, please contact the manufacturer as it could be that mechanical measures to cool the motor must be taken into account.

If the environmental temperature sinks by about 10°C per 1000 m height growth, then no correction of the performance is required (pay attention to the minimum operating temperature).



2.5.2 Performance definition for water-cooled machines

The mentioned performances (torques) in the technical product list apply to the continuous operation S1 with rated speed as long as the demands to the cooling system for water-cooled motors are complied with!


During the operation of the BL-N motors with higher coolant inlet temperatures the reduction factors in **Table 2** must be considered:

| Coolant inlet temperature | 25 °C | 30 °C | 35 °C | 40 °C | 45 °C |
|---|-------|-------|-------|-------|-------|
| Percentage of list performance (torque) | 100 % | 97 % | 95 % | 92 % | 89 % |


Table 2: Reduction factors

2.6 Transport, temporary storage

Water-cooled motors:


| | |
|---|---|
|  | <p>In order to avoid frost damage it must be ensured that there is no coolant in the motor during the transport or at a temporary storage at environmental temperatures $< 3\text{ }^{\circ}\text{C}$. The coolant can be purged with compressed air.</p> |
|---|---|

Transport:

| | |
|---|--|
|  | <p>The permitted environmental conditions that may act on the motor during the transport is to be taken of DIN EN 60721-3-2 (class 2K2/2M1). The permitted temperature range was contrary to the DIN reduced to $-15\text{ }^{\circ}\text{C}$ to $+60\text{ }^{\circ}\text{C}$.</p> <p>Suitable load carrying devices are to be used as for example belt straps, single slings etc. If the motor provides lifting lugs they as well can be used for lifting purposes.</p> <p>The terminal boxes and motor connectors may not be used as transport safety or as lifting lugs.</p> <p>During transport the correspondent country-specific regulations must be complied with. Lifting devices, transport and load bearing devices must comply with the regulations.</p> |
|---|--|

The weight of the individual electric motors is given in the technical documents of the product.

Bearing protection: (at motors with cylindrical roller bearings)

| | |
|---|---|
|  | <p>To avoid transport damages at motors with cylindrical roller bearings the rotor is blocked by means of a transport protection at the shaft end.</p> <p>This transport protection must be used for further transports again.</p> <p>If this protection cannot be used anymore due to the fitting of an output element, other measures must be made to axially fix the rotor for transport.</p> |
|---|---|

Temporary storage:

If a motor isn't taken into operation promptly after delivery it must be stored in an internal space which is dry, low-vibrated and with little dust ($V_{\text{eff}} \leq 0,2\text{mm/s}$).

The electric motors should not be stored more than 2 years at a preferably consistent temperature and not outside the temperature range between -15 and $+60\text{ }^{\circ}\text{C}$. Higher storing temperatures as those of the service temperature will cause accelerated aging of the seals and of the bearing grease and conclusively will have negative effects on the operating life before commissioning. Furthermore, direct sunlight, UV light and ozone as well cause aging of the sealing elements and should absolutely be avoided as well!

Please, consider that the warranty period is guaranteed from date of delivery. We, therefore, recommend reducing storage time to a minimum.

However, if a longer storage time cannot be avoided then comply with the environmental conditions of the DIN EN 60721-3-1 (class 1K2/1M1). Contrary to the DIN the temperature range may be expanded to $-15\text{ }^{\circ}\text{C}$ bis $+60\text{ }^{\circ}\text{C}$.

2.7 Installation conditions; cooling information



Please, comply with chapter 8 additionally if having motors with water cooling

Environment:

Accordant to its degree of protection (see motor type plate) the motor can be installed in a roofed room in a dusty or humid environment as well as in normal climatical conditions.

As long as no special agreements were made the drive is applied to the following climatical using conditions:

- Environment temperature 0 °C to 40 °C
- Installation altitude ≤1000 m above sea level
- Relative humidity 5 % to 85 %

All the other permitted operating conditions are to be taken from the DIN EN 60721-3-3 (class 3K3/3Z12).

These climatical conditions are essentially to be considered at installation.

Aggressive, corrosive, abrasive as well as plastic-dissolving media must be kept away from the motor in general.

The motor manufacturer must be contacted if an outdoor installation is intended.

Air cooling:

Attention should be paid to the following:

- The thermal convection and the heat radiation may not be affected by the installation conditions
- The cooling air must be able to freely flow in at forced air cooling and the warm air must be able to freely flow off. The heated exit air may not be drawn in again.
- The distance to the adjacent machine parts should not fall below 100 mm.
- The housing surface as well as the ventilating paths are to be cleaned if there is a strong dirt accumulation.


Details on the required cooling volume

The following cooling volumes are required to cool the BL-N motors (**Table 3**):

| Size | 100 | 132 | 160 | 200 |
|--|-------|-------|-------|--------|
| Air quantity at least in m ³ /min | ≥ 2,4 | ≥ 5,8 | ≥ 9,5 | ≥ 16,5 |
| Pressure altitude at least in Pa | ≥ 180 | ≥ 370 | ≥ 640 | ≥ 850 |

Table 3: Required cooling quantity

2.8 Balancing, output elements and vibrations

| | |
|---|--|
|  | <p>Don't stress the shaft and the bearings with shocks.</p> <p>Axial forces aren't permitted during the mounting and demounting of output elements. The required measures referring to the contact protection of the output elements in general must be regarded</p> <p>If a motor is put into operation without output elements then the featherkey must be protected against being ejected..</p> |
|---|--|

Balancing:

In the standard version the rotor is dynamically balanced with a half featherkey (accordant to EN 60034-14 / ISO 8821 / ISO 1940)

Note: Regard the identification of the balancing type at the shaft end face:

H = Balancing with half the featherkey **Standard version**

F = Balancing with the complete featherkey **Special version**

Output elements:

When mounting the output elements the accordant balancing must be considered. The output elements must be balanced complying with ISO 1940.

When fitting and removing the output elements (e.g. coupling disks, rack-wheels, pulley wheels) adequate facilities must be used.

- Use thread hole in the end of the shaft.
- During removal use spacing washers to mechanically protect the shaft.
- If required before fitting warm up the output elements (max. permitted temperature at the shaft end is 150 °C for a short time).

Attention:

- At the shaft version without featherkey the drive elements are to be fixed on the output shaft **by means of appropriate clamping sets**.
- At shaft versions with featherkey it must be considered that the **output elements are applied to the shaft shoulder**. Note:: The bevel and the radius at the output element and the shaft radius towards the shoulder (accordant to DIN748-1) must be compatible.
- If the threaded hole in the shaft end is used to protect the output elements axially (e.g. pulley wheels), the tightening torques in **Table 4** may not be exceeded:

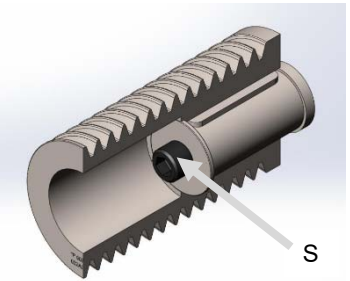

| | | |
|---|---------------|------------------------------------|
|  | Thread | Tightening torque in Nm |
| | M10 | 19,0 |
| | M12 | 33,0 |
| | M16 | 80,0 |
| | M20 | 160,0 |

Table 4: Tightening torques using the example of a locking bolt S of a pulley wheel

Appropriate measures are to be used to protect the screws!


Vibrations:

| | |
|---|--|
|  | <p>The system's vibration response at the location caused by output elements, installation options, alignment and setup as well as influences of external vibrations can cause an increase of vibration values at the motor.</p> <p>Considering a correct functioning of the motor and a long bearing service life the permitted vibration values accordant to EN 60034-14 may not be exceeded. It may be necessary to balance the complete rotor with the drive element (according to ISO 1940).</p> <p>The imitated vibrations after the mounting may not exceed the admissible accelerations (compare the Technical data chapter 2.4)</p> <p>At changes compared with the normal operation – e.g. increased temperatures, noises, vibrations – the motor is to be switched off in case of doubt, the cause is to be evaluated and the manufacturer is to be contacted if required.</p> |
|---|--|



3 Mounting

3.1 Safety notes

Before the mounting:

| | |
|---|---|
|  | <p>Never mount or take an defect electric motor into operation.</p> <p>Never install the electric motor in a defect machine.</p> <p>Make sure that the electric motor is appropriate for your machine before installing it.</p> |
|---|---|

During the mounting:

| | |
|---|--|
|  | <p>Mount the motor to provided fastening options only.</p> <p>Avoid shocks or inadmissible shock loads during the mounting.</p> <p>Attach all covers and safety equipment. All the safety equipment must comply with the applicable regulations (e.g. EN 60204).</p> <p> Water cooling:</p> <p>In order to avoid damages of the housing screw-in glands with cylindrical internal thread may be used for the water connections (inlet / outlet), only.</p> <p>From cooling pipes tensile loads, compression loads and torsional loads may not be applied to the motor connections.</p> <p>The connection may only be executed by specialists. Thereby, the motor must be without current and voltage.</p> <p>It must be considered that the cooling liquid doesn't reach the motor terminal box when coupling and uncoupling the cooling cables.</p> |
|---|--|


3.2 Installing, attaching

Check the following before and during mounting

- The motor must be intact (e.g. in no way the shaft seal may be damaged by sharp and pointed objects.).
- The motor may not be mounted within the danger range of other facilities.
- The intended use must be complied with (see **chapter 1.2 and 2.4**)
Observe the type plate specifications and warning and information signs
- The anticorrosive must be removed residue-free at the shaft end.
When using commercial resolvents such as acetone or cleaning solvent the shaft seal may not be wetted!
- The motor must comply with the environmental conditions and the environmental influences on-site (see **chapter 2.4**).
- The internal space in the machine must comply with the cooling type of the electric motor.
The motor must be installed to guarantee that the connection of cooling cables is possible.
- In order to connect the motor and to execute inspection and maintenance workings there must be sufficient space in the machine.
The mounting dimensions of the motor including the tolerance specifications can be taken from the technical documents or from the dimension drawing handed over.
- The motor must be able to be mounted and operated with the available connection data and the fastening options.
*When flanging to the motor a good and even contact area must be regarded. The guide fittings and contact areas must be undamaged and clean. They should be in the exact positioning to the shafts to be connected, to avoid harmful loads due to offset of the bearings, shafts and housings in the entire system. When tightening the flange screws (**at least strength class 8.8**) avoid distortions at the flange connection.*
- At a vertical assembly with the shaft end to the top assure that there is a protection against ingress of liquids onto the upper bearings.
- The permitted radial forces may not exceed the accordant performance characteristics of the technical documents of the product (if required clarify by a TAE Antriebstechnik subsidiary).
If there are axial forces this must be approved by the motor manufacturer.
- It must be possible to release the brake (optional) after applying the operating voltage (audible operating noise)
- The rotor must be able to turn uniformly and without chafing noise.
The brake must be released beforehand if the motor has an integrated brake.
- The version of the motor and encoder lines must comply with the technical documents of the product.
- The output elements as well as the drive elements must be protected.
- The complete cooling system must be sealed and functionally as well as protected against foreign objects that have fallen in.



3.3 Electric connection

Important notes:

| | |
|---|---|
|  | <p>All works must be processed by qualified specialists, only.</p> <p>All works must be processed at the de-energized and provide a safeguard to prevent unintentional reclosing (auxiliary circuits as well).</p> <p>All works must be processed at motor standstill, only.</p> <p>When having three phase synchronous motors with permanent-magnet excitation voltages that are > 60 V can occur at the motor terminals at a rotating rotor.</p> <p>Comply with the regulations for works on electrical systems!</p> |
|---|---|

Attention! It must be complied with the safety regulations for works in electrical engineering systems according to EN 50110-1:

- Disable
- Provide a safeguard to prevent unintentional reclosing
- Verification of safe isolation from supply
- Grounding and short-circuiting
- Cover or safeguard adjacent live parts

| | |
|--|--|
|  | <p>The operation of the electric motor is permissible with an accordantly configured converter. The direct connection to the three-phase system can cause the destruction of the motor.</p> <p>Pay attention to the correct phase sequence and the connection assignment!</p> |
|  | <p>The electric connections, protective conductor connections and shield connections (when using screened cables) must be designed permanently safe!</p> <p>Never touch the contacts of the encoders and temperature sensors with your hands or with tools which are loaded electrostatically. Encoders and temperature sensors are electrostatic sensitive devices.</p> |

Electric installation:

- The constructor is responsible for the proper installation of the system.
- The motor data on the type plate must be considered.
- Connection cables and connectors must be calculated correctly for the occurring voltages and current and must be suited for the installation type.
- The motor connection including its modules (brake, encoder, etc.) must be made according to the specifications of the connection diagrams (see enclosed connection diagrams and **Appendix 1**)
- To avoid electromagnetic EMC troubles of supply cables and the consequences thereof on the encoder and control systems shielded power and encoder cables are to be used. Please, observe the EMC notes of the converter manufacturer.
- For reasons of operational safety TAE Antriebstechnik recommends to use their preassembled connection cable connections.
- Before the connection the receptacle boxes, the connector as well as the terminal box must be checked for damage, corrosion, dirt and humidity.
- To guarantee the degree of protection the correct and tight fit of the connector screw fittings, the seals and the sealing surfaces of the connectors and of the terminal boxes must be observed. **Note!** The rotatable outlet boxes shouldn't be turned more than five times towards their connecting direction to observe the degree of protection as well.
- Plug and terminal box connections must not be exposed to mechanical stress. If required apply anti-rotation, strain and thrust reliefs as well as a bend protection.

Please, pay attention to the following at the main connection via the terminal box:


- The cable ends must be stripped so far as the isolation nearly reaches the cable lugs and terminals. . Protuding wiring ends must be avoided, absolutely.
- The cable lugs must be matched to the measurings and cross sections of the terminals and cables.
- The screw connections of the electrical connection must be tightened by the specified tightening torque. (see **Appendix 1 Table 6**)
- The degree of protection remains

Note: All inlets which are not required must be closed with metallic fastening elements. The sealing elements of the terminal box must be functionable and undamaged.



4 Commissioning, operation

4.1 Safety notes


Workings at the electric motor:

| | |
|---|---|
|  | <p>Perform all workings at the electric motor only if the motor is at a standstill, free from tension and cooled off. All connections that were loosened during the workings at the motor must be fastened again before commissioning.</p> <p>Please, pay attention to the technical notes in the accordant chapters of this commissioning and maintenance instruction.</p> <p>Attention! The optional holding brake may not take over safety functions during the works at the motor (e.g. the holding of loads).</p> |
|---|---|



Danger to life by electrical current:

| | |
|--|---|
|   | <p>Assure that the electric motor released and without tension.</p> <p>Never loosen the connections at the motor during operation.</p> <p>Connect measuring devices in the de-energized and off circuit state, only</p> <p>Start the works at the motor connections after you assured that neither potential nor voltage is existent.</p> <p>During operation there is electrical potential at the motor terminals/motor contacts and at the motor windings. Never touch these modules / elements during the operation.</p> |
|--|---|

Mounting and demounting of safety equipment:

| | |
|---|--|
|  | <p>The electric motor may not be operated without safety equipment.</p> <p>In order to mount or demount components and systems that are intended to monitor the safe motor operation the motor must be shutdown.</p> |
|---|--|

Danger! Do not touch!


| | |
|---|---|
|  | Assure that the electric motor is at standstill and protected against being switched on before you touch it. |
|  | Risk of burns! Never touch the motor housing during the rated load operation. The surface temperatures of over 70°C can arise at the motors |

4.2 Tests before commissioning

- The drive is undamaged and is within the range of other equipment.
- The motor was properly aligned and tightened. The screws are fastened correctly. Unused connection threads must be closed at the flange Connecting thread which are not required are to be sealed at the flange bearing end shield.
- All the associated protective equipment is to be mounted (mechanical, thermal, electrical).
- The motor connections were processed correctly.
- The ground conductor system was processed correctly and was tested for functioning.
- The cables do not touch the motor surface.
- The drive doesn't block (release brake where applicable).
- EMERGENCY OFF functions were checked
- The coolant lines were properly processed and the water cooling was tested for functioning.
- The fan is correctly connected and the functioning was checked.

4.3 Commissioning, operation

Notes regarding the functioning of the brake (where applicable):

| | |
|---|---|
|  | The brake is a holding brake including an emergency stop function. (power failure, emergency stop) Don't use the brake as a working brake. |
|---|---|

Commissioning must be processed by qualified personnel, only.

Thereby, the commissioning instructions of the converter and of the cooling installation must be observed.

Tests during commissioning:




- Have all modules of the motor such as the encoder, the brake, the cooling and so on been tested on functioning and are all application conditions observed. Release brake as appropriate.
- Have all electrical connections and terminals been properly completed and fastened (observe connection diagrams / **Appendix 1 and enclosed connection diagrams**)
- Have all protective measures been met and is it operating correctly which excludes the touching of energized parts, hot surfaces, rotating and moving parts and modules.
- Were all output elements mounted and set complying with the specifications of the manufacturer.
- Is ensured that the maximum permitted speed n_{max} of the motor cannot be exceeded. The maximum permitted speed n_{max} is the highest short-term permissible operating speed.

Tests during operation:

- Pay attention to unusual noises.
- If scratching and scraping noises, grinding noises or the like occur shut down the drive immediately and find out the causes.
- Check the motor surface and connection lines for pollutions for example dust deposits, oil pollution, humidity, leakage etc.
- Check the maintenance intervals
- Check the air inlets and the air outlets for pollutions.

4.4 Failures

Safety notes:

| | |
|---|---|
|  | The error detection and the troubleshooting made be executed by qualified personell only. |
|  | Don't take the protective equipment out of operation – neither in the testing operation. |
|  | Demount the cooling lines in the unpressurized state |
| | The connection lines must be deenergized and in a safe state to loosen and mount them. |
| | Observe the five safety regulations regarding “release” (see chapter 3.3). |
| | Pay attention to hot surfaces! |

Observe to the following at failures

- Observe the operation instruction of the machine/installation
- Observe the operation instruction of the converter
- If required contact the manufacturer of the motor or converter

Keep the following parameters ready:

Type plate data
 Type and extent of the failure
 Surrounding circumstances of the failure
 Application data (cycle of torque; speed and forces via the time, environmental conditions)

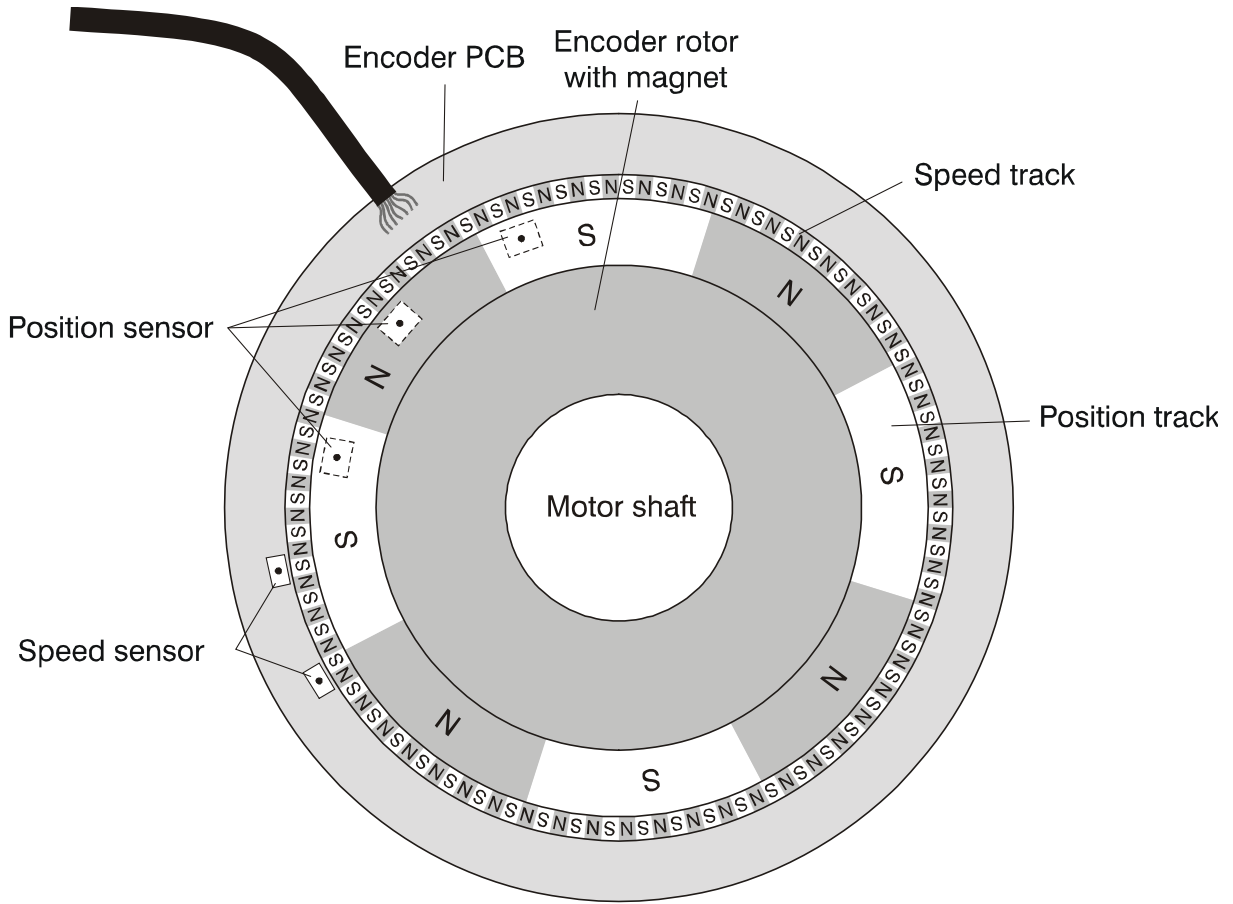
The following list could help in case of failures (**Table 5**):

| Failure | Error cause | Correction |
|---------------------|--|--|
| Motor doesn't start | Controller release is missing | Activate controller release |
| | Controller–error, encoder-error | Error listing at the converter or read the controller, correct the error |
| | Voltage supply is missing | Check connection and voltage supply |
| | Rotating field | Check phase sequence and exchange connection line if needed |
| | Brake doesn't release | Check control, connection and voltage supply |
| Irregular running | Shielding in the connection lines is insufficient | Check shield connection and grounding |
| | Controller parameter too high | Optimize controller parameters |
| Vibrations | Coupling elements or driven machines were incorrectly balanced | Rebalance |
| | Incorrect alignment of the powertrain control | Realign machine set |
| | Fastening screws are lose | Check screw connections and fasten them |

| Failure | Error cause | Correction |
|--|---|---|
| Running noises | Foreign particles in the motor | Repair by manufacturer |
| | Bearing damage | Repair by manufacturer |
| Motor warms up too much Motor temperature monitoring responds | Drive overload Water cooling inactive. Cooling supply insufficient - Filter is very dirty - Deposits in the cooling channels - Failures in the external cooling system Insufficient release of the brake – grinding brake | Check motor load and compare it with the type plate data Check and switch on if required Check water circuit - Check and clean if required - Check and clean if required - Refer to notes of the plant manufacturer Repair by motor manufacturer |
| Overpressure in the cooling system | Strongly polluted coolant Cooling channels blocked Failures in the external cooling system | Filter the coolant Check and clean if required Refer to notes of the plant manufacturer |
| Current input too high, motor torque too low | Encoder position incorrect | Check encoder position and set if required |
| The shaft of the motor moves backwards and forwards (only at position encoder) | The motor cable between the regulator and the motor has not been connected properly. The sensor cable has not been connected correctly or the cable or the sensor are defective. | It should be noted that U must be connected to U, V to V and W to W In order to check this, remove the motor cable at the regulator (sensor cable remains connected). Now turn on only the mains voltage to the regulator and turn the motor shaft by hand anti-clockwise. You can check the correct functioning of the Hall sensors with the aid of LED's, 18 to 22 at the TA-BL, resp. HS1 - HS5 at the TA-BL/P, resp. U, V, W, A, B at the TA-U section of the regulator and light sequences diagram (refer to illustration Position encoder) |

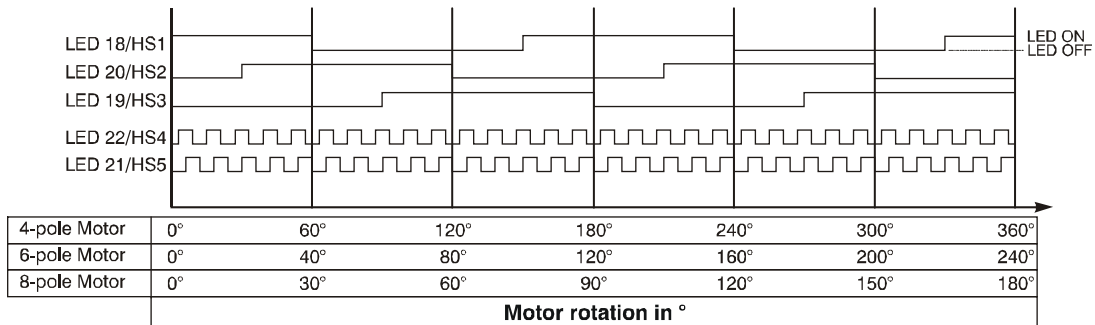
Tabelle 3: Betriebsstörungen

Illustration - Position encoder 8-pole 120 PPR




- Diagram light sequences

with motor rotation counter-clockwise (ccw) as seen at the output shaft



5 Inspection and maintenance

Works at the electric motor:

| | |
|---|--|
|  | <p>Execute the works at the electric motor only if the motor is at standstill, de-energized and has cooled off. Fasten all loose connections such as screws, cables etc. after the inspection or maintenance again.</p> <p>Observe the technical notes in the accordant chapters of this commissioning and maintenance instruction in the works.</p> <p>Observe the safety notes during the maintenance works, which are the same as for the commissioning of the motor (see Chapter 4.1).</p> <p>Attention! If there is an optional holding brake it may not take up a safety function (e.g. holding of loads).</p> |
|---|--|

5.1 Inspection

Accordant to the local degree of pollution regular cleaning must be made to ensure a permanent adequate dissipation of the heat loss. Thereby, the volume rate and the pressure ratio of the cooling system must be checked.

If a brake was optionally installed then the wear limits must be specified (e.g. maximum permitted operating air gap, limited number of emergency brakings). The current wear degree of the brake is to be checked regularly. When reaching the permitted wear limits the brake is to be exchanged (see **Chapter 5.2**).

If, optionally a shaft sealing ring is used this must be checked regularly for its proper functioning (leakage).

5.2 Maintenance

Dependent of the operating conditions (such as operation mode, temperature, speed load, mounting position) very different times of service life can be referring to the lubricants, sealing elements and bearing locations.

We recommend the following maintenance guide values at a fault-free operation:

- Change the bearing after approximately 20000 operating hours (the bearings reach a storage service life Lh 10 of 20000 operating hours).
Exceptions must be defined separately (e.g. lubrication).
- The changing of the **shaft seal** is made after about 5.000 operating hours, if applicable and if no leakage was determined prior to that.

If a **brake** was built in optionally, it is essential to exchange it, if the wear limit was reached.

Maintenance works must be executed by TAE Antriebstechnik or by a specialized company that was assigned by TAE Antriebstechnik.

The following independent maintenance work is to be done by the operating company:

- The cleaning of the motor surfaces and of the air channels.
- The changing or cleaning of the filter mats when using dust filters

Normally, **dust filters** should be cleaned or exchanged after 100 operating hours. If the soiling is very high the maintenance intervals are to be reduced.

Dry-soiled filters can be cleaned by suction, air-cleaning or by tapping off. Moisty soiled filters can be rinsed in lukewarm water by adding commercial detergents and then be dried.

Note: When exchanging the filter mats the original replacement filters of the motor manufacturer should be used. These can be obtained at TAE Antriebstechnik's by specifying the motor or part number (see type plate).

5.2.1 Bearings and Permissible radial forces

| Motor type | Deep groove ball bearings Drive End | | | Ball bearings Encoder End | Roller bearings Drive End | | |
|-----------------------|-------------------------------------|--------------------------------|---|---------------------------|---------------------------|--------------------------------|---|
| | Bearing | | Permissible radial force F_r in N at 2000 min ⁻¹ | | Bearing | | Permissible radial force F_r in N at 2000 min ⁻¹ |
| | Description | Dynamic Basic Load Rating in N | | Description | Description | Dynamic Basic Load Rating in N | |
| 100 | 6209 2ZRC3 | 31000 | 1700 | 6209 2ZRC3 | NU 209E | 72000 | 4600 |
| 100 ICW | 6209 2ZRC3 | 31000 | 1600 | 6306 2ZRC3 | NU 209E | 72000 | 4400 |
| 132 | 6212 2ZRC3 | 52000 | 2500 | 6212 2ZRC3 | NU 212E | 111000 | 7600 |
| 132 ICW | 6312 2ZRC3 | 81500 | 4500 | 6310 2ZRC3 | NU 312E | 177000 | 11000 |
| 160 | 6313 2ZRC3 | 93000 | 4900 | 6311 2ZRC3 | NU 313E | 214000 | 13500 |
| 160 ICW | 6313 2ZRC3 | 93000 | 4900 | 6311 2ZRC3 | NU 313E | 214000 | 13500 |
| 200 | 6315 2ZRC3 | 114000 | 5800 | 6313 2ZRC3 | NU 315E | 285000 | 18500 |
| 200 ICW | 6315 2ZRC3 | 114000 | 5800 | 6313 2ZRC3 | NU 315E | 285000 | 18500 |
| Bearing life 20 000 h | | | | | | | |

Permissible force F_r in N at half the length of the shaft (middle)

- A suitable grease is ASONIC HQ 72-102. Company Klüber (www.klueber.com). Technical data of the grease refer to the last page of this manual.
- By filling the bearing with grease, no dirt must get into the bearing. Gaps between the bearings between the balls or rollers must be completely filled with grease. Cavities around the bearings caused by the bearing caps may only be filled to 30 - 40%.

In the version with grease quantity control, the relubrication tube and the inner bearing cap must be completely filled with grease.

5.3 Adjustment of the position encoder

5.3.1 Adjustment of the encoder with TA-BL & TA-BL/P

If it is necessary to dismantle the encoder, before dismantling it mark the position of the encoder rotor with respect to the motor shaft and the position of the encoder PCB to the bracket. When the motor is dismantled, the encoder must be installed such that it lines up with the magnets of the rotor as well as the windings in the stator.

If the encoder is to be replaced or the stator is to have new windings, it is necessary to recalibrate the position encoder.

1. Connect the motor to the regulator according to the operating instructions. Before switching it on, reduce the current limits for 1Q with parameter 1/07 (current limit potentiometer VR4) *) and 4Q operation with parameter 1/09 (current limit potentiometer VR3) *) to the minimum current. Remove the cores 26 (17), 27 (18), 28 (19) *) of the sensor cable from the terminals of the controller PCB at the regulator. Jumper terminal 28 (19) *) with terminal 23 (14) *) or to the casing of the unit.

Switch the regulator on for clockwise (cw) and enter a set value of around 10%. Increase the current by means of parameter 1/07 (current limit potentiometer VR4) *) until the rotor of the motor has rotated to the next pole. Switch off now and connect the sensor cable correctly again. Ensure that the rotor does not turn any further.

2. Switch the regulator on, but without activating the motor for operation (only mains voltage). LED's HS1 to HS3 (LED's 18 to 20) *) indicate the switching status of the Hall sensors in the position encoder. Now turn the encoder rotor clockwise (cw) on the motor shaft (without turning the motor shaft) so that HS3 (LED 19) *) lights up, HS2 (LED 20) *) does not light up and HS1 (LED 18) *) just lights up.

If that is achieved, fix the encoder rotor, using the two screws on the motor shaft at a distance of about 2.5mm to sensor board (tip: „Take an aluminum sheet of 2.5 mm thickness in order to check the distance „). Please make sure that the encoder rotor have no contact with any part of the sensor board. The rotor should be set accurate to about 3 ° now.

5.3.2 Adjustment of the encoder with U-Drive

If it is necessary to dismantle the encoder, before dismantling it mark the position of the encoder rotor with respect to the motor shaft and the position of the encoder PCB to the bracket. When the motor is dismantled, the encoder must be installed such that it lines up with the magnets of the rotor as well as the windings in the stator.

If the encoder is to be replaced or the stator is to have new windings, it is necessary to recalibrate the position encoder.

1. Connect the motor and the sensor line according to instruction on the control unit. Enable via U-Drive Manager, in parameter group 2, with parameter 39 bit 1 „adjust speed encoder“ and „fix the motor rotor“ with bit 3. Enter about 30% of the rated motor current with parameter 49 „SM Adjusting current“. Please make sure that the motor shaft is disconnected from the machine!
2. Start the controller! The LEDs LED U, V and W indicate the switching state of the Hall sensors on the position sensor. Now rotate the encoder rotor clockwise (CW) on the motor shaft (without twisting motor shaft), so that LED V lights, U does not light and W just lights. If that is achieved, fix the encoder rotor, using the two screws on the motor shaft at a distance of about 2.5mm to sensor board (tip: „Take an aluminum sheet of 2.5 mm thickness in order to check the distance „). Please make sure that the encoder rotor have no contact with any part of the sensor board. The rotor should be set accurate to about 3 ° now.
3. Turn the drive off and set „adjust speed encoder“ and „fix motor rotor“ back.
4. The encoder is now adjusted and the motor is operational.

6 **Disposal**

The motor must be disposed in the normal recyclable material process by complying with the national and local regulations.

Attention: The rotor of the BL-N motors contain rare-earth magnets with high magnetical energy density. See note in **Chapter 1.2**.

The encoder electronics (if available) must be disposed of correctly as electronic waste.

7 Appendix 1: Pole assignments (power and control connections)

7.1 Main connection via terminal box

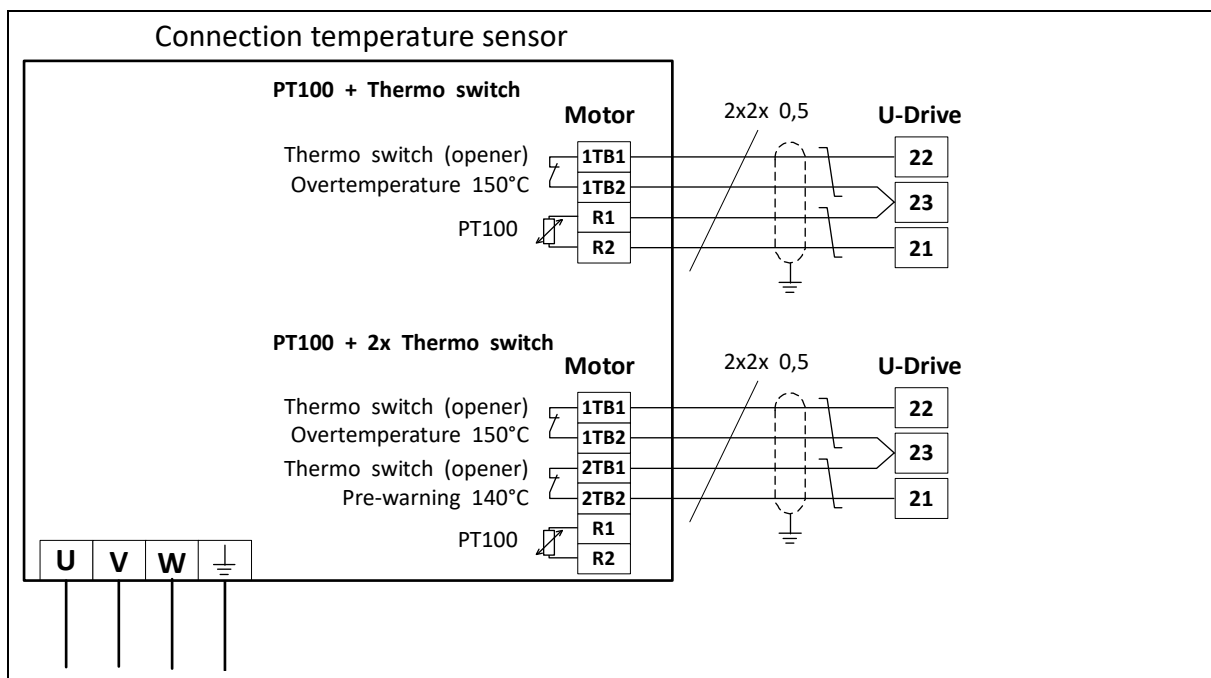


Figure 1: Main connection with terminal box

We recommend to use EMC screw connections at the fittings for the cable entries.

While tightening the clamping screw we recommend to hold up at the conductor to avoid a deformation of the mounting rail and to keep the base of the terminal free of torsional forces.

The following terminal box versions for the terminals are available including the tightening torques which are to be complied with (Table 6):

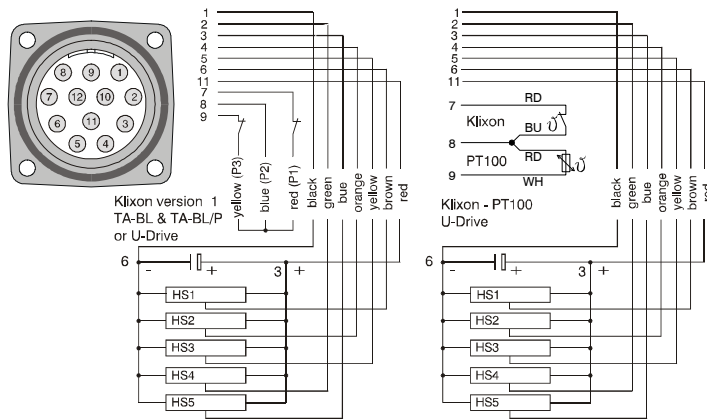
| Motor size | Cable entry | Number of main connection terminals | Tightening torques of terminals in Nm |
|------------|-------------------------------------|-------------------------------------|---------------------------------------|
| 100 | 2 x M 25x1,5 | 3 x M 8 | 6,0 |
| | 1 x M 25x1,5 + 1 x M 25x1,5 | | |
| | 1 x M 63x1,5 + 1 x M 25x1,5 | | |
| 132 | 3 x M 25x1,5 | 3 x M 8 | 6,0 |
| | 2 x M 40x1,5 + 1 x M 25x1,5 | | |
| | 2 x M 63x1,5 + 1 x M 25x1,5 | | |
| | 2 x M 63x1,5 + 1 x M 25x1,5 | 3 x M 10 | 10,0 |
| 160 | 2 x Ø 40,5 + 1 x Ø 25,5 | 3 x M 6 | 3,0 |
| | 2 x Ø 64 + 1 x Ø 25,5 | 3 x M 10 | 10,0 |
| | 2 x Ø 76 ¹⁾ + 1 x Ø 25,5 | 3 x M 12 | 15,5 |
| 200 | 1 x Ø 64 + 1 x Ø 25,5 | 3 x M 10 | 10,0 |
| | 2 x Ø 64 + 1 x Ø 25,5 | 3 x M 10 | 10,0 |
| | 2 x Ø 76 ¹⁾ + 1 x Ø 25,5 | 3 x M 12 | 15,5 |
| | 6 x Ø 51 + 1 x Ø 25,5 + 2 x Ø 40,5 | 3 x M 16 | 30,0 |

Table 4: Terminal box versions with tightening torques for nuts

¹⁾ Cable shield led with the cable lug on the housing into the terminal box

7.2 Pin-outs of the position and pulse encoders

Fig. - Pin-outs of socket (Pins) at terminal box (view from the soldering side)



| Pin | Colour | Description |
|-----|------------------|---|
| 1 | BK | earth 0V |
| 2 | GN | Speed sensor (HS4) |
| 3 | BU | Speed sensor (HS5) |
| 4 | OG | Position sensor (HS2) |
| 5 | YE | Position sensor (HS3) |
| 6 | BN | Position sensor (HS1) |
| 7 | RT | Thermoschalter zur Abschaltung |
| 8 | BL/RD | Gemeinsamer Anschluss |
| 9 | YE oder WH | Thermal switch or PT100 for pre-warning |
| 10 | - | Reserve |
| 11 | RD | +5 Volt |
| 12 | - | Reserve |

Maximum contact loading 48VDC/500mA or 48VAC/100mA

The cable (sensor cable) to the position and pulse encoders must be screened. In addition to the seven cores of the encoder there are three additional cores in the sensor cable to assess the thermal protective switching of the motor. A sensor cable is connected to the motor via a 12-pin plug at the motor terminal box.

The pin-outs of the connection at the regulator can be taken from the corresponding operating instructions. It is essential to ensure that the earthing is done correctly. The screen of the sensor cable is to be connected to the regulator.

7.2.1 Connections for thermal monitoring

Evaluation of the thermal monitoring is absolutely essential for the safe operation of the drive unit. Incorrect use of the thermal switch can cause the motor to be destroyed.

The thermal monitoring of brushless DC motors consists thermal switches and temperature evaluation PT100.
Pre-Warning temperature: 140 °C

Switch-off temperature: 150°C.

The thermal monitoring of brushless DC motors works better than for conventional DC motors. The reason for this is that the thermal switch is located directly in the stator coil. It is there located at the very point where most of the heat is generated.

7.3 Control connection: Resolver

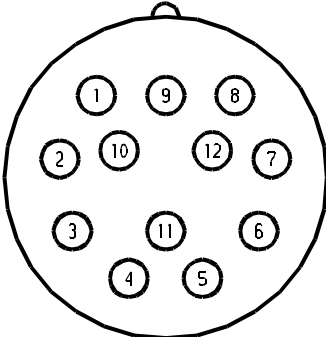
|  <p data-bbox="384 577 715 633">View on the contact side of the mounting box</p> | Pin | Signal |
|---|-----|--------|
| | | 1 |
| | 2 | Ref - |
| | 3 | cos + |
| | 4 | cos - |
| | 5 | sin + |
| | 6 | sin - |
| | 7 | |
| | 8 | |
| | 9 | |
| | 10 | |
| | 11 | |
| | 12 | |

Figure 2: Pole assignment resolver

7.4 Control connection : SRS / SRM 50

(absolute value encoder with hipurface interface of the company SICK / Stegmann)

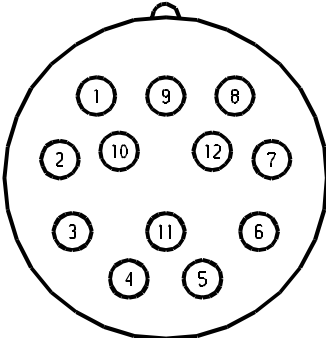
|  <p data-bbox="384 1579 715 1635">View on the contact side of the mounting box</p> | Pin | Signal |
|---|-----|---------|
| | | 1 |
| | 2 | + 485 |
| | 3 | |
| | 4 | |
| | 5 | sin |
| | 6 | ref sin |
| | 7 | - 485 |
| | 8 | cos |
| | 9 | Shield |
| | 10 | Gnd |
| | 11 | |
| | 12 | + U |

Figure 3: Pole assignment SRS / SRM 50

7.5 Control connection : ECN 1313 / EQN 1325

(absolute value encoder with Endat 2.1-interface of the company Heidenhain)

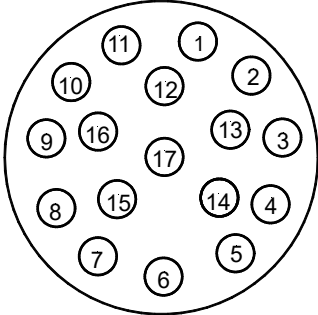
|  <p data-bbox="384 667 715 719">View on the contact side of the mounting box</p> | Pin | Signal |
|---|-----|----------------|
| | | 1 |
| | 2 | |
| | 3 | |
| | 4 | 0V |
| | 5 | |
| | 6 | |
| | 7 | U _p |
| | 8 | Clock |
| | 9 | Clock inv. |
| | 10 | 0V |
| | 11 | |
| | 12 | B+ |
| | 13 | B- |
| | 14 | Data |
| | 15 | A+ |
| | 16 | A- |
| | 17 | Data inv. |

Figure 4: Pole assignment ECN 1313 / EQN 1325

7.6 Control connection : ECN 1325 / EQN 1337

(absolute value encoder with Endat 2.2-interface of the company Heidenhain)

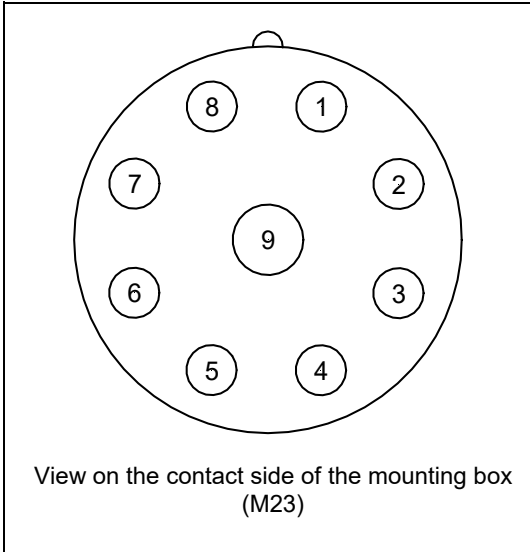
|  <p>View on the contact side of the mounting box (M23)</p> | Pin | Signal |
|---|-----|------------|
| | | 1 |
| | 2 | Clock inv. |
| | 3 | Up |
| | 4 | 0 V |
| | | Data |
| | 6 | Data inv. |
| | | Sensor Up |
| | 8 | Sensor 0 V |
| | | - |

Figure 7: Pole assignment ECN 1325 / EQN 1337 (M23)

Note:

- Please, take the pole assignment from the accordingly enclosed connection diagrams or from the technical documents concerning encoder types which were not mentioned here and at an optional cable of the temperature sensor via the encoder cable.
- The encoders mentioned from **point 7.3 to 7.5** are ESD-sensitive devices.
- The specifications of the technical data were provided by the encoder manufacturer and we assume no liability for its correctness.

7.7 Fan connection / terminal markings

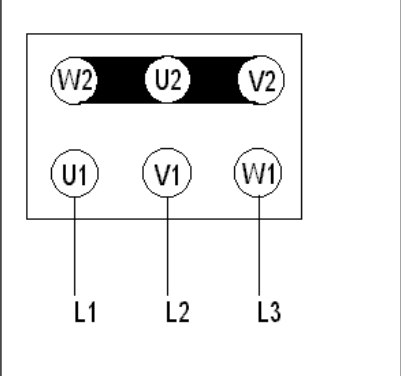
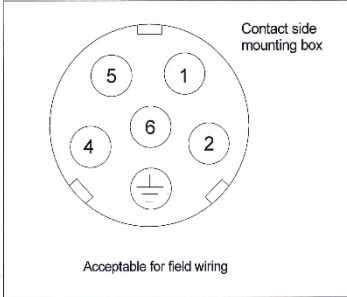
| Fan connection at the standard fan motor via the terminal box | Fan connection at the installed fan motor | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|--|--|------------------------------------|---|---|--|------------------------------------|---|-----|------|------|------|------|------|------|-----|-----|--------|------|-----|-----|------|-----|-----|------|-----|-----|-----|------|--|------|--------------------------|-----|-------------|-------------|------|-----|------------------------------------|---|---|-----|-----|--|--|-----|--|--|--|
| <p>Connection diagram</p>  <p>U V W Power connection</p> | <p>Connection diagram</p>  <p>Acceptable for field wiring</p> <table border="1" data-bbox="890 568 1238 734"> <tr> <td>Pin</td> <td>1</td> <td>2</td> <td>4</td> <td>5</td> </tr> <tr> <td>Signal</td> <td>V</td> <td>W</td> <td>/</td> <td>U</td> </tr> <tr> <td>Pin</td> <td>6</td> <td>⊥</td> <td></td> <td></td> </tr> <tr> <td>Signal</td> <td>/</td> <td>⊥</td> <td></td> <td></td> </tr> </table> <p>Connection diagram: Fan-Motor 6 - pole box</p> <p style="text-align: right;">KA 20711u 09.10.08 Be</p> | Pin | 1 | 2 | 4 | 5 | Signal | V | W | / | U | Pin | 6 | ⊥ | | | Signal | / | ⊥ | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Pin | 1 | 2 | 4 | 5 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Signal | V | W | / | U | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Pin | 6 | ⊥ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Signal | / | ⊥ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <p>Axially added-on standard fan</p> <table border="1" data-bbox="220 882 831 1189"> <thead> <tr> <th rowspan="2">Size</th> <th colspan="3">Rated current in A at Δ/Y:</th> </tr> <tr> <th>Standard 200-265 V 50 Hz 345-460 V 60 Hz</th> <th>265-345 V 50 Hz 460-600 V 60 Hz</th> <th>UL approved 240-420 V 50 Hz 280-480 V 60 Hz</th> </tr> </thead> <tbody> <tr> <td rowspan="2">132</td> <td>0,57</td> <td>0,45</td> <td>0,48</td> </tr> <tr> <td>0,33</td> <td>0,26</td> <td>0,28</td> </tr> <tr> <td rowspan="2">160</td> <td>1,4</td> <td>1,1</td> <td>1,07</td> </tr> <tr> <td>0,8</td> <td>0,6</td> <td>0,62</td> </tr> <tr> <td rowspan="2">200</td> <td>2,4</td> <td>2,25</td> <td>1,8</td> </tr> <tr> <td>1,4</td> <td>1,3</td> <td>1,05</td> </tr> </tbody> </table> <p>The rated currents are maximum values.</p> | Size | Rated current in A at Δ/Y : | | | Standard 200-265 V 50 Hz 345-460 V 60 Hz | 265-345 V 50 Hz 460-600 V 60 Hz | UL approved 240-420 V 50 Hz 280-480 V 60 Hz | 132 | 0,57 | 0,45 | 0,48 | 0,33 | 0,26 | 0,28 | 160 | 1,4 | 1,1 | 1,07 | 0,8 | 0,6 | 0,62 | 200 | 2,4 | 2,25 | 1,8 | 1,4 | 1,3 | 1,05 | <p>Axially added-on fan motor</p> <table border="1" data-bbox="914 882 1334 1039"> <thead> <tr> <th rowspan="2">Size</th> <th colspan="2">Rated current in A at Y:</th> </tr> <tr> <th>400 V 50 Hz</th> <th>460 V 60 Hz</th> </tr> </thead> <tbody> <tr> <td>160</td> <td>0,7</td> <td>0,75</td> </tr> </tbody> </table> <p>The rated currents are maximum values</p> | Size | Rated current in A at Y: | | 400 V 50 Hz | 460 V 60 Hz | 160 | 0,7 | 0,75 | | | | | | | | | | |
| Size | | Rated current in A at Δ/Y : | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Standard 200-265 V 50 Hz 345-460 V 60 Hz | 265-345 V 50 Hz 460-600 V 60 Hz | UL approved 240-420 V 50 Hz 280-480 V 60 Hz | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 132 | 0,57 | 0,45 | 0,48 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 0,33 | 0,26 | 0,28 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 160 | 1,4 | 1,1 | 1,07 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 0,8 | 0,6 | 0,62 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 200 | 2,4 | 2,25 | 1,8 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 1,4 | 1,3 | 1,05 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Size | Rated current in A at Y: | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 400 V 50 Hz | 460 V 60 Hz | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 160 | 0,7 | 0,75 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <p>Radially added-on standard fan motor</p> <table border="1" data-bbox="220 1330 831 1883"> <thead> <tr> <th rowspan="2">Size</th> <th colspan="3">Rated current in A at Δ/Y:</th> </tr> <tr> <th>Standard 200-265 V 50 Hz 345-460 V 60 Hz</th> <th>265-345 V 50 Hz 460-600 V 60 Hz</th> <th>UL approved 240-420 V 50 Hz 280-480 V 60 Hz</th> </tr> </thead> <tbody> <tr> <td rowspan="2">100</td> <td>0,57</td> <td>0,45</td> <td>0,48</td> </tr> <tr> <td>0,33</td> <td>0,26</td> <td>0,28</td> </tr> <tr> <td rowspan="2">132</td> <td>1,4</td> <td>1,1</td> <td>1,07</td> </tr> <tr> <td>0,8</td> <td>0,6</td> <td>0,62</td> </tr> <tr> <td rowspan="2">160</td> <td>2,4</td> <td>2,25</td> <td>1,8</td> </tr> <tr> <td>1,4</td> <td>1,3</td> <td>1,05</td> </tr> <tr> <td rowspan="2">200</td> <td>-</td> <td>-</td> <td>3,7</td> </tr> <tr> <td></td> <td></td> <td>2,15</td> </tr> <tr> <td></td> <td>230-400 V 50 Hz 280-480 V 60 Hz</td> <td>-</td> <td>-</td> </tr> <tr> <td rowspan="2">200</td> <td>5,5</td> <td></td> <td></td> </tr> <tr> <td>3,2</td> <td></td> <td></td> </tr> </tbody> </table> <p>The rated currents are maximum values.</p> | Size | Rated current in A at Δ/Y : | | | Standard 200-265 V 50 Hz 345-460 V 60 Hz | 265-345 V 50 Hz 460-600 V 60 Hz | UL approved 240-420 V 50 Hz 280-480 V 60 Hz | 100 | 0,57 | 0,45 | 0,48 | 0,33 | 0,26 | 0,28 | 132 | 1,4 | 1,1 | 1,07 | 0,8 | 0,6 | 0,62 | 160 | 2,4 | 2,25 | 1,8 | 1,4 | 1,3 | 1,05 | 200 | - | - | 3,7 | | | 2,15 | | 230-400 V 50 Hz 280-480 V 60 Hz | - | - | 200 | 5,5 | | | 3,2 | | | |
| Size | | Rated current in A at Δ/Y : | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Standard 200-265 V 50 Hz 345-460 V 60 Hz | 265-345 V 50 Hz 460-600 V 60 Hz | UL approved 240-420 V 50 Hz 280-480 V 60 Hz | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 100 | 0,57 | 0,45 | 0,48 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 0,33 | 0,26 | 0,28 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 132 | 1,4 | 1,1 | 1,07 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 0,8 | 0,6 | 0,62 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 160 | 2,4 | 2,25 | 1,8 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 1,4 | 1,3 | 1,05 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 200 | - | - | 3,7 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | 2,15 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 230-400 V 50 Hz 280-480 V 60 Hz | - | - | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 200 | 5,5 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 3,2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

Table 5: Data fan connection

8 Anhang 2: Water cooling

Additionally to the preceding chapters the following must be observed at water-cooled motors (EN 60034-6; IC 3W7):

8.1 Specifications referring to the required cooling flows

| Motor type | Volume current [l/min] | Pressure drop $\pm 15\%$ [bar] | Heating [K] | Max. coolant pressure [bar] | Connection (G –inside thread) |
|------------|------------------------|--------------------------------|-------------|-----------------------------|---|
| BL-N-100S | 7 | 0,4 | 4 | 6 | 2 x G 1/2" 1x forward motion 1x return motion |
| BL-N-100M | | | 5 | | |
| BL-N-100L | | | 6 | | |
| BL-N-100XL | | | 7 | | |
| BL-N-132S | 9 | 0,25 | 4 | 6 | 2 x G 1/2" 1x forward motion 1x return motion |
| BL-N-132M | | | 5 | | |
| BL-N-132L | | | 6 | | |
| BL-N-132XL | | | 7 | | |
| BL-N-160S | 10 | 0,45 | 5 | 6 | 4 x G 1/4" 2x forward motion 2x return motion |
| BL-N-160M | | 0,5 | 6 | | |
| BL-N-160L | | 0,55 | 7 | | |
| BL-N-160XL | | 0,6 | 8 | | |
| BL-N-200S | 13 | 1,3 | 5 | 6 | 4 x G 1/4" 2x forward motion 2x return motion |
| BL-N-200M | | 1,45 | 7 | | |
| BL-N-200L | | 1,6 | 8 | | |

Tabelle 6: benötigte Kühlvolumenströme

8.2 Media-contacting materials in the motor

The following media-contacting materials are used in the motor:

Size 100-132:

Cooling system: Aluminium KTL coatet

Connections: Steel zinc-plated

Seals: NBR

Size 160-200:


Cooling system: Stainless steel

Connections: Brass

Seals: Vulcanized fibre


8.3 Motor cooling


Additions of corrosion and nucleation protections may be used in closed cooling systems performed accordingly to the coolant's characteristic complying with **Chapter 8.6**. Type and quantity is based upon the accordant recommendations of the manufacturer and of the prevailing environmental conditions.

| | |
|---|--|
|  | <p>The safety regulations of the accordant corrosion and nucleation protection manufacturer must be observed.</p> <p>Coolants from operating processes may not be used to cool the motor!</p> <p>In view of harmful deposits the filling of a closed cooling system should be made in the cooling channels or cables using filtering at all times (filtering resolution < 0,1 mm). At the open cooling system in any case a filtering must be provided.</p> |
|---|--|

Note: The system manufacturer is responsible for the engineering of the entire cooling system. Condensation of water must be avoided in any case.

8.4 Mounting notes

| | |
|---|--|
|  | <p>Cooling system connection:</p> <p>On the motor connections from the coolant pipes no tensile loads, thrust loads or torsional stress may be applied.</p> <p>The connection may be executed by specialists only. Thereby the motor must be currentless and without tension.</p> <p>When coupling or decoupling the coolant pipes it must be observed that no cooling liquid gets into the motor terminal box.</p> |
|---|--|

| | |
|---|--|
|  | <p>Sealing test complying with EN 50178:</p> <p>The sealing of the cooling system must be tested before commissioning by a pressure-test with the coolant (water). The testing pressure must be twice the operating pressure. (Minimum test pressure 1 bar). The used coolant must thereby not be brought to the operating temperature. The pressure must be maintained. (Minimum testing time 10 minutes).</p> |
|---|--|

8.5 Electrical connection

The power connection is made in the water-cooled motors compliant with the dimension drawing in the technical documentation.

8.6 Cooling water status

The cooling water must comply with the following requirements:

| Conditions | Unit | Value |
|--|----------|-------------|
| Permitted system pressure at maximum | bar | 6 |
| Temperature of coolant for motor | °C | 10 to 25 |
| pH-value (bei 20 °C) | --- | 6,5 to 9 |
| Total hardness | mmol / l | 1,43 to 2,5 |
| Chloride - Cl | mg / l | < 200 |
| Sulfate - SO ₄ ²⁻ | mg / l | < 200 |
| Oil | mg / l | < 1 |
| Permissible particle size, solid bodies, particles (e.g. sand) | mm | < 0,1 |

Table 9: Cooling water status

As a coolant, water, which is clear and free of suspended solids and free of soiling is to be used.

8.7 Minimum coolant temperature in dependence of the environmental conditions.

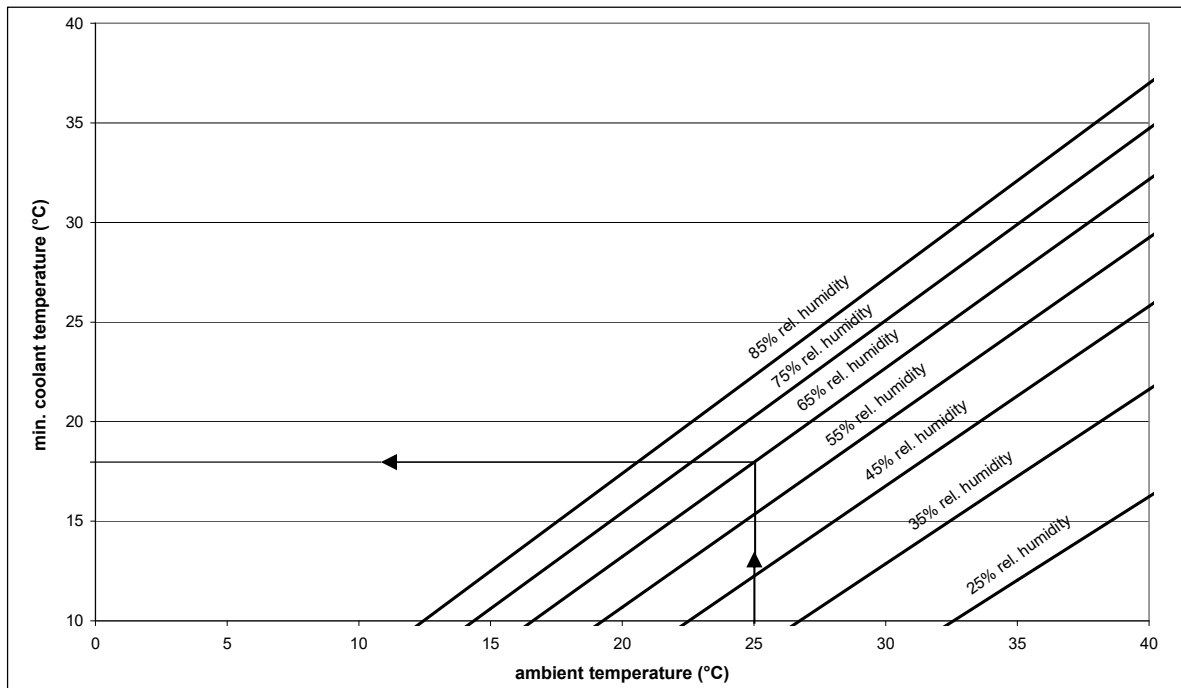


Figure 8: Evaluation of coolant temperature

The permitted temperature of the coolant is dependent of the relative humidity during the operation and the environmental temperature. For example a minimum coolant entry temperature of 18°C is permitted at an environmental temperature of 25°C and a relative humidity of 65%. The presented characteristics in the diagrams are limit characteristics. Therefore, in the example a coolant entry temperature of greater 18°C should be selected.

If the minimum permitted coolant entry temperature is fallen below, the 2-point controller of the TAE Antriebstechnik drive electronics must be used, to avoid condensation (see displayed function chart – **Figure 9**).

Note:

At a longer standstill of the motor the coolant supply must be interrupted (avoidance of condensation).

At a longer standstill environmental temperatures <3 °C can occur, the coolant is to be drained as a precautionary measure. (Avoidance of frost damage).

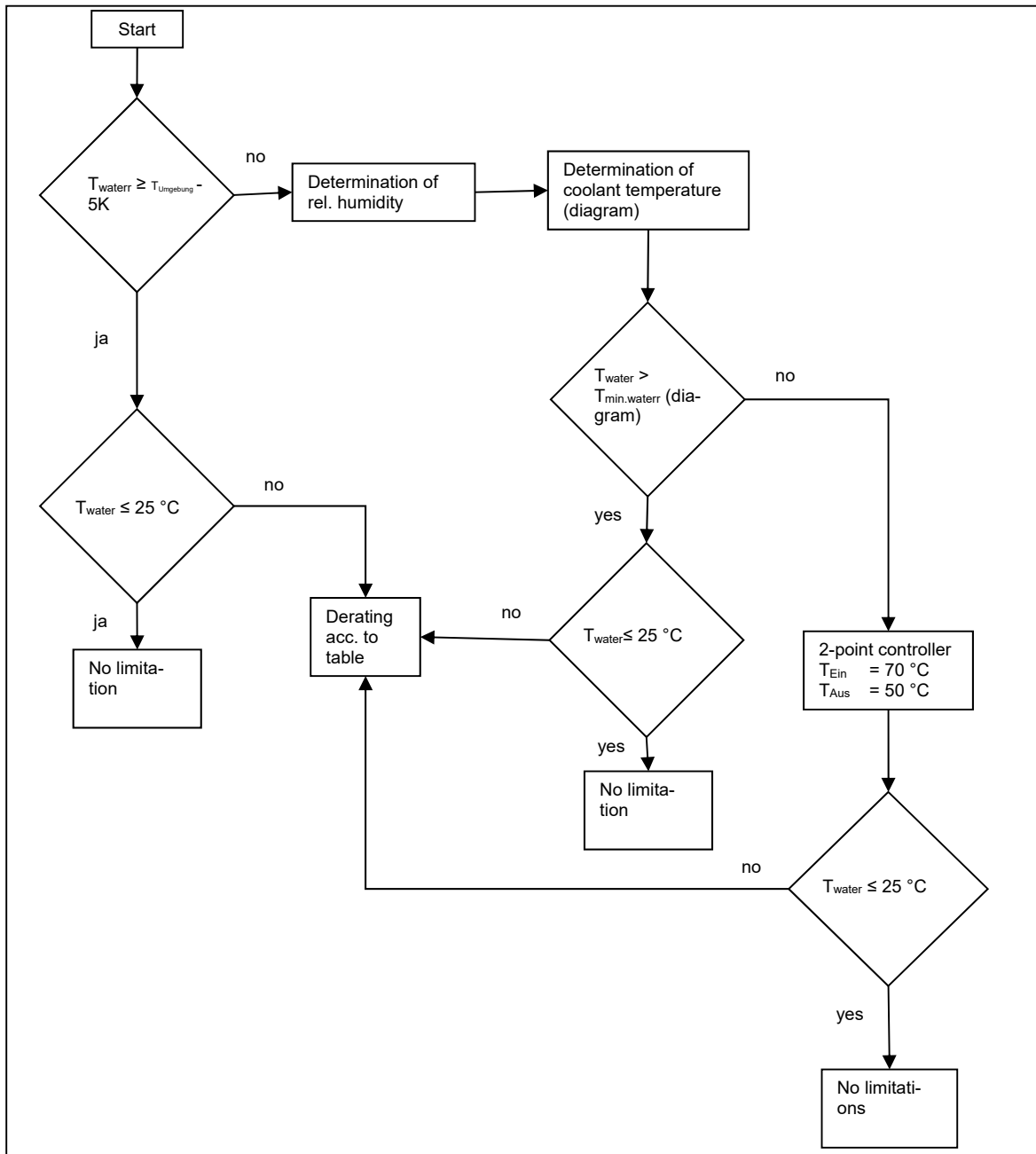


Figure 5: Function chart coolant entry temperature

8.8 Failures

| Failure | Cause of failure | Correction |
|--|---|--|
| Overtemperature in the motor Motor temperature monitoring responses | Water cooling is not active Coolant supply insufficient - Deposits in the cooling channels - Failures in the external cooling system - | Check and switch on if required Check water circuit - Check and clean if required - Notes provided by the installation manufacturer |
| Overpressure in the cooling system | Coolant is heavily soiled Cooling channels are blocked up Failures in the external cooling system | Filter coolant Check and clean if required Notes provided by the installation manufacturer |

Table 10: Operating failures water cooling

8.9 Inspection

The pressure ratio of the cooling system and the volume current must be checked during the regular cleaning.

Warranty and liability

All data/information in this documentation are non-binding customer information, subject to constant further development and are constantly updated by our permanent modification service. Warranty and liability claims against the company Pikatron GmbH, division TAE Antriebstechnik are excluded if in particular one or more of the following causes have caused the damage:

- You disregarded instructions in this documentation.
- The system wasn't used for the intended use.
- The system
 - o was incorrectly mounted, connected, put into operation, operated as well as not maintained,
 - o was mounted, connected, put into operation, and operated and / or maintained by unqualified personnel,
 - o is overloaded,
 - is operated with
 - o defective safety equipment,
 - o not properly fixed or without safety equipment,
 - o not functioning safety and protective equipment.
 - Isn't operated within the specified environmental conditions.
- You modified the system without having a written approval of the company TAE Antriebstechnik Usingen.
- You disregarded the instructions referring to the maintenance in the component descriptions.
- You monitored the parts, which are subject to wear, inadequately.
- You performed a repair incorrectly.
- You combined the system incorrectly with products of other manufacturers.
- You combined the drive system with faulty and / or faulty documented products of other manufacturers.

The latest version of the "Terms and Conditions of Sale and Delivery" of the company Pikatron GmbH, division TAE Antriebstechnik applies.

These were provided at the latest upon conclusion of contract.

Description:

ASONIC HQ 72-102 is a synthetic high-temperature lubricating grease. Due to the careful selection of product components and the clean manufacturing environment, ASONIC HQ 72-102 is a rolling bearing grease with a particularly low noise level.

Application:

In a wide variety of ball bearings operating under extreme thermal stress, ASONIC HQ 72-102 is used for economical long-term or lifetime lubrication. Examples are ball bearings in electric motors, fans, power-tool pumps, textile machinery, office equipment, household appliances and automobile components such as belt tensioners, guide pulleys and air conditioners.

Application notes:

The lubricant is applied by means of a spatula, brush, grease gun or grease cartridge. For use in automatic lubricating systems, the pumpability of the lubricant should be checked.

Certain polyurea greases solidify during elongated periods of storage. Normally, such increase in consistency does not affect the performance of the lubricating grease and is reversible when the grease is subjected to shearing or working stress.

Pack sizes:

400-g cartridge
1-kg can
25-kg bucket

ASONIC HQ 72-102

- High-temperature lubricating grease for rolling bearings
- High purity
- Low noise
- Good water resistance

Behaviour towards elastomers and plastics

The following elastomers were statically tested for resistance to ASONIC HQ 72-102.

| Medium | Material | Time/temp. h / °C | Change in volume (%) | Shore hard- ness A | Tensile strength (%) | Elonga- tion at break (%) |
|------------------|---------------|----------------------|-------------------------------|-----------------------------|----------------------------|------------------------------------|
| ASONIC HQ 72-102 | 70 ACM 174997 | 168 / 150 | 21.4 | - 21 | - 26 | 80 |
| ASONIC HQ 72-102 | 75 FKM 585 | 168 / 150 | 4 | 0 | 16 | - 49 |
| ASONIC HQ 72-102 | 70 FKM 175825 | 168 / 150 | 7.2 | - 5 | - 10 | - 7 |
| ASONIC HQ 72-102 | 72 NBR 902 | 168 / 100 | 17 | - 8 | - 17 | - 22 |

Prior to series application we recommend testing the compatibility of the grease and the pertinent materials.

(Our test results were obtained with random samples and cannot substitute your own in-house tests.)

Product data:

| | |
|---|----------------------|
| Base oil / thickener | Ester oil / polyurea |
| Service temperature range*, °C | - 40 to 180 |
| Colour | beige |
| Drop point, DIN ISO 2176, °C | > 240 |
| Worked penetration, DIN ISO 2137, at 25 °C; 0.1 mm | 250 to 280 |
| Apparent dynamic viscosity, Klüber viscosity grade** | L / M |
| Water resistance, DIN 51 807, pt. 1, 3 h / 90 °, rating level | 0 - 90 |
| Corrosion protection of lubricating greases, DIN 51 802, (SKF-Emcor), test duration: 1 week, distilled water, degree of corrosion | max. 1 |
| Kinematic viscosity of base oil, DIN 51 562, pt. 01, Ubbelohde at 40 °C, mm ² /s, approx. at 100 °C, mm ² /s, approx. | 100 12 |
| Speed factor*** for deep groove ball bearings, (n x d _m) mm/min. approx. | 700,000 |
| Low-temperature torque in acc. with IP 186/93 at - 40 °C Starting torque, Nmm Running torque, Nmm | < 1,000 < 150 |
| SKF-ROF test rig for rolling bearing grease 10,000 min ⁻¹ , F _a = 100 N, F _r = 50 N, 170 °C, F ₅₀ in h | > 1,000 |

* Service temperatures are guide values which depend on the lubricant's composition, the intended use and the application method. Lubricants change their consistency, apparent dynamic viscosity or viscosity depending on the mechano-dynamical loads, time, pressure and temperature. These changes in product characteristics may affect the function of a component.

** Klüber viscosity grades: EL = extra-light lubricating grease; L = light lubricating grease; M = medium lubricating grease; S = heavy lubricating grease; ES = extra-heavy lubricating grease

*** Speed factors are guide values which depend on the type and size of the rolling bearing type and the local operating conditions, which is why they have to be confirmed in tests carried out by the user in each individual case.

ASONIC® HQ 72-102

Safety Data Sheet

| | |
|---|--|
| 1.1 Product name: ASONIC HQ 72-102 Code-No.: 094 060 23.12.1999 | 9. Physical and chemical properties Form: paste Colour: beige Odour: characteristic Drop point: > 240 °C, DIN ISO 2176 Flash point: > 200 °C (base oil) Flammability: not applicable Ignition temperature: not applicable Autoflammability: not applicable Lower explosion limit: not applicable Upper explosion limit: not applicable Vapour pressure-first: not applicable Density: approx. 0.97 g/cm ³ , 20 °C Water solubility: insoluble pH value: not applicable Kinematic viscosity: not applicable Further information: none |
| 1.2 Klüber Lubrication München KG Geisenhausenerstraße 7 D-81379 München Tel. ++49 - 89 78 76 - 0 telephone exchange Fax: ++49 - 89 78 76 - 333 | Emergency telephone no.: ++49 - 89 7876 - 0 |
| 2. Composition / information on ingredients Chemical characterization (preparation): Ester oil, polyurea Additional information: No hazardous ingredients | |
| 3. Hazards identification No particular hazards known | |
| 4. First aid measures After inhalation: Not applicable After contact with skin: Wash off with soap and plenty of water After contact with eyes: Rinse with plenty of water After ingestion: Do not induce vomiting. Obtain medical attention Advice to doctor: Treat symptomatically | 10. Stability and reactivity Conditions to avoid: None Materials to avoid: Strong oxidizing agents Hazardous decomposition products: None under normal use Additional information: None |
| 5. Fire-fighting measures Suitable extinguishing media: Water spray, foam, dry powder, carbon dioxide (CO ₂) Unsuitable extinguishing media: High volume water jet Special Hazards: In case of fire the following can be released: Carbon monoxide, hydrocarbons Special protective equipment for firefighters: Standard procedure for chemical fires Additional information: Water mist may be used to cool closed containers. In the event of fire and/or explosion do not breathe fumes | 11. Toxicological information The toxicological data has been taken from products of similar composition Acute toxicity: LD ₅₀ /oral/rat = > 2 g/kg (literature data) Chronic toxicity: None Human experience: Prolonged skin contact may cause skin irritation and/or dermatitis |
| 6. Accidental release measures Personal precautions: Not required Environmental precautions: Do not flush into surface water or sanitary sewer system Methods for cleaning up / taking up: Use mechanical handling equipment. Dispose of absorbed material in accordance with the regulations Additional information: None | 12. Ecological information Information on elimination (persistence and degradability): Product is insoluble in water. May be separated out mechanically in purification plants Behaviour in environmental compartments: Ecological injuries are not known or expected under normal use Ecotoxic effects: Aquatic toxicity is unlikely due to low solubility Additional information: Should not be released into the environment |
| 7. Handling and storage Advice on safe handling: No special handling advice required Advice on protection against fire and explosion: No special precautions required Requirements on storage rooms and vessels: No special storage conditions required Incompatible materials: Incompatible with oxidizing agents. Do not store together with food Further information on storage conditions: Store at room temperature in the original container | 13. Advice on Disposal Disposal: Can be incinerated when in compliance with local, state and federal regulations Dispose of contaminated packaging and recommended cleaning: Offer rinsed packaging material to local recycling facilities |
| 8. Exposure controls / personal protection Additional advice on system design: Not applicable Ingredients and specific control parameters: None Respiratory protection: No special protective equipment required Hand protection: No special protective equipment required Eye protection: No special protective equipment required Body protection: No special protective equipment required Other protection measures: No special protective equipment required General protection and hygiene measures: Avoid prolonged and/or repeated contact with skin. Remove soiled or soaked clothing immediately. Clean skin thoroughly after work; apply skin cream | 14. Transport information GGVS / GGVE: not applicable ADN / ADN: not applicable IMDG-Code: not applicable ICAO / IATA-DGR: not applicable Further information: Not classified as dangerous in the meaning of transport regulations |
| | 15. Regulatory information Labelling according to EU-guidelines: The product does not require a hazard warning label in accordance with EC-directives/German regulations on dangerous substances National regulations |
| | 16. Other information Issue-department of Safety Data Sheet: Chemical Documentation, Tel.: ++49 - 89 7876 - 564 |

The data in this product information is based on our general experience and knowledge at the time of printing and is intended to give information of possible applications to a reader with technical experience. It constitutes neither an assurance of product properties nor does it release the user from the obligation of performing preliminary tests with the selected product. We recommend contacting our Technical Consulting Staff to discuss your specific application. If required and possible we will be pleased to provide a sample for testing. Klüber products are continually improved. Therefore, Klüber Lubrication reserves the right to change all the technical data in this product information at any time without notice.



Klüber Lubrication München KG, a member of the Freudenberg group