

B 5000 – en

Synchronous motors (PMSM)

Manual with installation instructions





Read this manual

This manual contains the installation manual and other information for safe motor use.

Read this manual carefully prior to performing any work on or operating the motor. Always observe the instructions in this manual.

Keep this manual in the vicinity of the motor so that it is available if required.

Please also note the following documents:

- Catalogue IE4/IE5 synchronous motors ([TI60_0001](#)),
- Product documentation for equipment which is attached or provided.

Please contact Getriebebau NORD GmbH & Co. KG if you require further information.

Documentation

Title: B 5000
Order number: 6055002
Series: Three-phase synchronous motors
SK 56... to SK 132...

Version list

| Title, Date | Order number | Remarks |
|----------------------|----------------|---------|
| B 5000, June 2021 | 6055002 / 2621 | - |

Table 1: Version list B 5000

Copyright notice

As an integral component of the device described here, this document must be provided to all users in a suitable form.

Any editing or amendment or other utilisation of the document is prohibited.

Publisher

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Member of the NORD DRIVESYSTEMS Group

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1 Safety information

1.1 Intended use

The motor is used to generate a rotational movement. It is intended for use as a drive system in commercially used plant and machinery.

The motor is exclusively intended for operation with frequency inverters.

The motor may not be used in environments in which an explosive atmosphere can occur.

The motor has been designed with at least protection class IP55 (see name plate for protection class). The motor can be installed in dusty or humid environments. Depending on the conditions of use and the environment, additional protective measures may be necessary.

The motor must not be operated until it has been established that the plant or machinery can be safely operated with the motor. If motor operation, motor fault or failure could result in a risk to persons, suitable protective measures must be provided.

The motor may only be used as intended and according to the information in this manual. Pay particular attention to section 2.4 "Requirements for the use of the drive".

1.2 Do not make any modifications.

Unauthorized changes and the use of spare parts and additional equipment that has not been purchased from or recommended by NORD may cause fire, electric shock and injury.

Do not make any modifications to the drive. Do not remove any protective devices.

1.3 Only use in perfect condition

Only operate the drive if it is in technically perfect condition and if all associated protective devices are present and functional.

Take care that no components are bent, no insulation distances are changed and that no electrical components are mechanically damaged or destroyed during transport or handling.

1.4 Performing inspection and maintenance work

Due to lack of maintenance and damage, malfunctions may occur which can result in personal injury.

- Carry out all servicing and maintenance work at the specified intervals.
- Also note that servicing is necessary after long storage periods prior to commissioning.
- Do not operate damaged drives. The drive must not have any leaks.

1.5 Personnel qualification

All transport, storage, installation, commissioning and maintenance work must be carried out by qualified specialist personnel.

Qualified specialist personnel are persons who have the training and experience to recognise and avoid any possible risks.

1.6 Safety for particular activities

1.6.1 Check for transport damage

Transport damage may cause malfunctions of the drive, which may cause personal injury. Oil which escapes due to leaks may cause a slipping hazard.

- Check the packaging and the drive for transport damage.
- Do not commission the drive if it has been damaged during transport.

1.6.2 Hazards when lifting

The motor is heavy. Persons may be severely injured by falling or swinging motors. Therefore also observe the following information:

- Cordon off a wide area around the hazard area. Take care that there is adequate space to avoid swinging loads.
- Never stand under suspended loads.
- Use adequately dimensioned means of transport which are suitable for the purpose. Note the weight of the motor (please see chapter 3.1 "Transporting the drive").
- Only lift the motor by the eye bolts which are provided. The eye bolts must be fully screwed in. Only pull on the eye bolts vertically, never cross-wise or at an angle. Use all provided eye bolts.
- Only use the eye bolts to lift the motor without other components. The eye bolts are not designed for lifting the motor with attachments.
- Only use the lashing points provided for the entire machine unit to lift machine units. Machine units must not be lifted by attaching a single component.

1.6.3 Safety information for installation and maintenance

Before starting any work, disconnect the motor from the power supply and secure it against accidental switch-on. Let the motor cool down.

Damaged or defective components, attachment adapters and flanges may have sharp edges. Wear work gloves and work clothing.

The motor contains strong magnets. Dismantling without specialist knowledge and suitable aids may lead to crushing of hands. Only trained personnel are allowed to dismantle the motor.

1.7 Hazards

1.7.1 Hazards due to electric shock

An electric shock when touching live components may lead to severe injuries or death.

- Before switching on the voltage supply, ensure that all associated covers are closed and all associated protective devices are installed and functional.
- Even if the drive has been disconnected from the supply voltage, live components and power connections must not be touched immediately, because of possible charged capacitors. Observe the applicable information signs located on the drive. With the motor disconnected from the power supply, the drive can still rotate and possibly generate hazardous voltage.
- Installation of the drive and any work on the drive may only be carried out by qualified personnel (qualified electricians) in strict compliance with the instructions provided in this manual.
- Before starting any work on the drive, stop the motor and disconnect it from the voltage supply by disconnecting all poles. A motor standstill is not identical to electrical isolation from the mains. When the motor is at a standstill, e.g. due to the electronic block of a connected frequency inverter or a jammed drive unit, the connection terminals and supply cables may carry dangerous voltage.
- In addition to the main power circuits, also take any additional or auxiliary circuits into account.
- Prior to any work on the drive, observe the 5 safety rules:
 1. Disconnect
 2. Secure against switching on
 3. Check for no voltage
 4. Earth and short circuit
 5. Cover or cordon off adjacent live components

Do not reverse these measures until the work on the drive has been completed.

1.7.2 Hazards due to rotating parts

Rotating parts cause a risk of entanglement. This may lead to severe injuries such as crushing or strangling.

- Provide contact protection. In addition to shafts, this also applies to driven elements such as belt drives, chain drives, shrink discs and couplings. Take possible run-on of the machine into consideration for the design of protective devices.
- Do not operate the drive without covers or hoods.
- Secure the drive to prevent accidental activation during installation and maintenance work.
- For test operation do not switch on the drive without an installed driven element or secure the motor shaft key.
- Also observe the safety information in the operating and installation instructions provided by manufacturers of components supplied.

1.7.3 Hazards due to unexpected movement of driven machinery

The motor shaft may start moving under certain conditions, e.g. when the supply voltage is switched on or a holding brake is released. This way, the machinery driven by the drive can start to move unexpectedly. This may result in severe injuries, also for third parties.

- Before switching on or releasing a brake, first secure the relevant hazard zone of the machinery and make sure that there are no persons in the hazard zone.

1.7.4 Hazards due to loose parts

Loose parts may cause injuries to persons during transport, installation work or operation.

- Fasten or remove loose parts.
- Secure or remove free keys on the motor shafts.

1.7.5 Hazards due to high or low temperatures

The motor may heat up to 70°C during operation. Risk of burns on contact with hot surfaces. At very low ambient temperatures freezing may occur on contact.

- Only touch the motor when wearing gloves after operation or at very low ambient temperatures.
- Before starting maintenance work, allow the motor to cool down sufficiently after operation.
- Provide a contact guard if there is a risk that persons may touch the drive when it is in operation.
- Do not place any flammable materials on the drive.

1.7.6 Hazards due to noise

Some motors or attached components may cause hazardous noise levels during operation. Wear hearing protection if work has to be carried out close to such drives.

1.8 Explanation of markings

DANGER

Indicates an immediate danger, which may result in death or very serious injury if it is not avoided.

WARNING

Indicates a dangerous situation, which may result in death or very serious injury if it is not avoided.

CAUTION

Indicates a dangerous situation, which may result in minor injuries if it is not avoided.

NOTICE!

Indicates a situation, which may result in damage to the product or its environment if it is not avoided.

Information

Indicates hints for use and especially important information to ensure reliability of operation.

2 Description of the drive

2.1 Drive type and type designations

2.1.1 Type designations

| Drive type and type designations |
|---|
| Three-phase synchronous motors SK 56... to SK 132... |

Table 2: Drive type and type designations

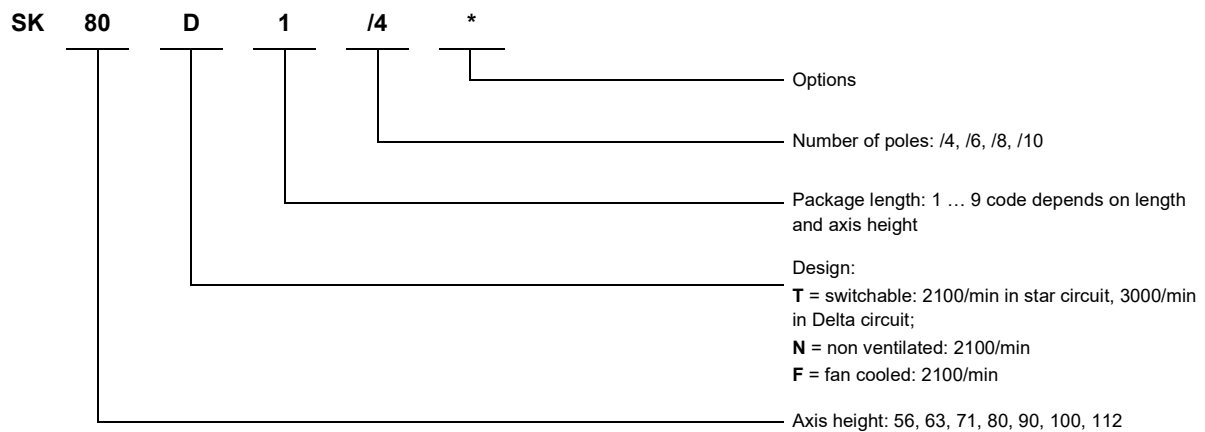


Figure 1: Explanation of type designation using an SK 80T1/4 as example

2.1.2 Options

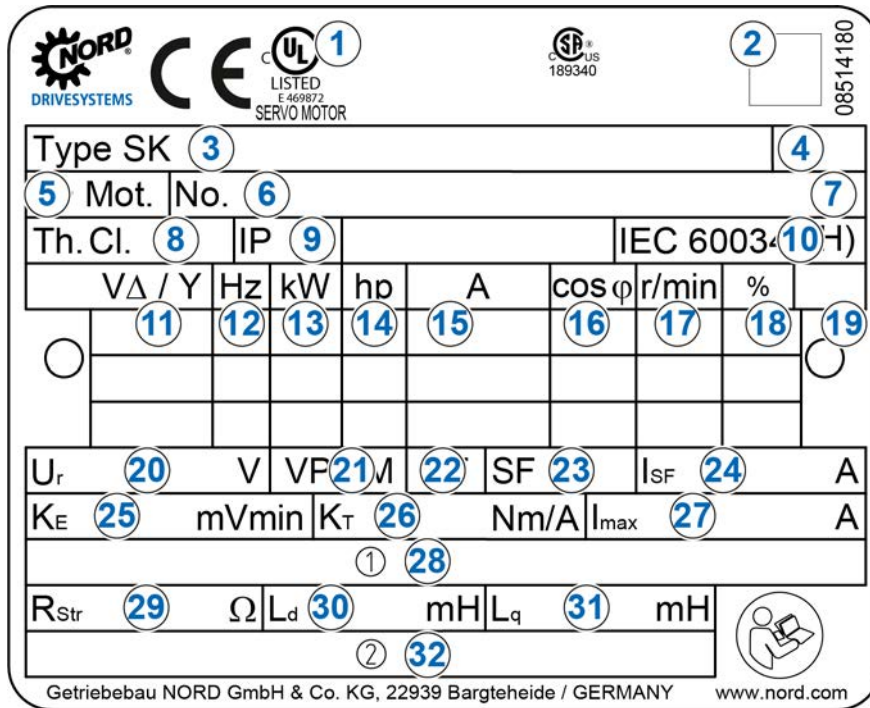
| Abbreviation | Description |
|-----------------|---|
| BRE | Holding brake |
| IG6 | (IG6, IG61, IG62) Incremental encoder, 2048 pulses |
| IGxxP | (IG62P5, IG61P8, IG62P5) Incremental encoder with 5-pin or 8-pin plug connector |
| IP69K | IP69K protection class |
| nsd tupH | nsd tupH surface treatment |
| MG | Magnetic encoder |
| MS | MS31, MS32, MS21, MSR, MSR VA |
| RDD | Double fan cover |
| TF | Temperature sensor, PTC resistor |

Table 3: Options for IE5 motors (SK ..N..., SK ..F...)

| Abbreviation | | Description |
|---------------|------------|---|
| AG | | Absolute encoder |
| BRE + | | Brake/brake torque + suboption |
| | RG | Rust-protected version |
| | SR | Dust- and rust-protected version |
| | FHL | Lockable manual release |
| | HL | Manual brake release |
| | MIK | Microswitch |
| EKK | | One-piece terminal box |
| ERD | | External earthing terminal |
| F | | External fan |
| FEU | | Humidity protection insulation |
| IG1 | (IG11, 12) | Incremental encoder, 1024 pulses |
| IG2 | (IG21, 22) | Incremental encoder, 2048 pulses |
| IG4 | (IG41, 42) | Incremental encoder, 4096 pulses |
| IG.K | | Encoder with terminal box |
| IG.P | | Incremental encoder with plug connector |
| KB | | Closed condensation drain hole |
| KKV | | Encapsulated terminal box |
| MG | | Magnetic incremental encoder |
| MS | | Motor plug connection |
| NRB1/2 | | Noise-reduced brake |
| OL | | Without fan |
| OL/H | | Without fan, without cover |
| RD | | Protective shield |
| RDD | | Double fan cover |
| RDT | | Protective shield, textile fan cover |
| RLS | | Back stop |
| SH | | Anti-condensation heater |
| TF | | Temperature sensor, PTC resistor |
| TRO | | Tropical protection insulation |
| TW | | Thermostat, bimetallic |
| WE+ | | Second shaft end |
| | HR | Handwheel |

Table 4: Options for IE4 motors (SK ..T...)

2.2 Name plate



Type SK **3** **4**
5 Mot. No. **6** **7**
 Th. Cl. **8** IP **9** IEC 60034-1 **10** (H)
 V Δ / Y **11** Hz **12** kW **13** hp **14** A **15** cos ϕ **16** r/min **17** % **18** **19**
 U_r **20** V VF **21** M **22** SF **23** I_{SF} **24** A
 K_E **25** mV/min K_T **26** Nm/A I_{max} **27** A
 ① **28**
 R_{Str} **29** Ω L_d **30** mH L_q **31** mH
 ② **32**

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Figure 2: Name plate

- | | |
|---|---|
| 1 Approvals | 17 Speed |
| 2 Matrix barcode | 18 Efficiency in % |
| 3 NORD type designation | 19 IE class |
| 4 Year of manufacture | 20 System voltage |
| 5 Number of phases | 21 VPWM: Modulation procedure of frequency inverter |
| 6 Order number/motor number | 22 CT: Constant torque |
| 7 Serial number | 23 Service factor |
| 8 Thermal class of insulation system | 24 Service factor current |
| 9 IP protection class | 25 Voltage constant |
| 10 Standard specifications | 26 Torque constant |
| 11 Stator voltage | 27 Maximum permitted current |
| 12 Nominal frequency | 28 Brake data (optional) |
| 13 Nominal power (mechanical shaft power) | 29 Resistance of windings |
| 14 Nominal horsepower | 30 Axial inductance |
| 15 Nominal current | 31 Radial inductance |
| 16 Power factor | 32 Customer line |

2.3 Description

2.3.1 Rotary encoders (option: IG, MG)

Rotary encoder with zero track (option: IG)

Depending on the application and customer requirements, a variety of rotary encoders are used. If possible, these encoders are adjusted by NORD. If this is not possible, an offset is determined and stated on a sticker inside the terminal box.

Some encoders cannot be read out by NORD due to their interfaces. In these cases, the encoder must be adjusted by the customer. Information on this can be found in the operating instructions of the encoder and the frequency inverter.

Magnetic encoder with zero track (option: MG)

The magnetic encoder is fastened to the fan cowl. The zero pulse is adjusted electronically.

2.3.2 Brake (option: BRE)

This option is equipped with a spring-loaded brake. This is a holding brake (safety brake) with emergency brake features that is activated in case of voltage drop.

The brake cannot be adjusted. Information on this can be found in the operating instructions of the brake.

2.4 Requirements for the use of the drive

2.4.1 Ambient conditions

The motor must be protected against intensive sunlight, e.g. by the use of a protective cover. The insulation is tropicalised.

Installation altitude: maximum 1000 m

Ambient temperature: -20°C to +40°C

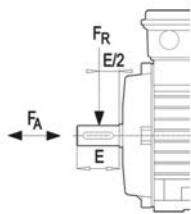
For standard motors (without options), an extended ambient temperature range from -20°C to +60°C is permissible. In this case, the rated power must be reduced to 82% of the value stated in the catalogue. If the maximum ambient temperature is between +40°C and +60°C, the power output should be inversely linearly interpolated between 100% and 82%.

The motor connection cables and the cable glands must be suitable for temperatures above 90°C.

2.4.2 Permissible axial and radial forces

The maximum permissible axial forces (F_A) and radial forces (F_R) for the A side end of the motor shaft can be obtained from the table below. Getriebebau NORD should be consulted if the radial force (F_R) is applied at a distance which is greater than the length $E/2$.

No axial forces (F_A) and radial forces (F_R) are permissible for the B side shaft end.



| Type | F_R [N] | F_A [N] |
|-------|-----------|-----------|
| 63 | 530 | 480 |
| 71 | 530 | 480 |
| 71./8 | 780 | 680 |
| 80 | 860 | 760 |
| 90 | 910 | 810 |
| 90./8 | 1100 | 1000 |
| 100 | 1300 | 1100 |
| 112 | 1950 | 1640 |
| 132 | 2790 | 2360 |

Table 5: Permissible axial forces F_A and radial forces F_R

2.4.3 Minimum cross-section of protective conductors

| Cross-section of phase conductor in installation S [mm ²] | Minimum cross-section of the associated protective conductor S_P [mm ²] |
|---|---|
| $S \leq 16$ | S |
| $16 < S \leq 35$ | 16 |
| $S > 35$ | 0.5 S |

Table 6: Minimum cross-section of protective conductors

2.4.4 Frequency inverters and encoders

The motors must only be operated with suitable frequency inverters.

For energy-efficient operation, the frequency inverter must detect the position of the rotor. For this, different options with and without an encoder are possible, see also [TI60_0010](#).

The drive was qualified for operation with link circuit inverters according to DIN EN 60034-18-41 (2014).

Please also observe the operating instructions for the frequency inverter in use.

The insulation system used by NORD consists of suitable varnished copper wire, phase insulation, homogeneous impregnation and groove lining as insulation against earth. The insulation system in the standard version is designed for the increased requirements of operation with link circuit inverters.

The maximum permissible FI input voltage is 500 V +10%. Link circuit voltages in excess of 750 V DC are not permissible. Peak voltages due to the system of inverter, cable and motor must not exceed the following values when the motor is warm due to operation.

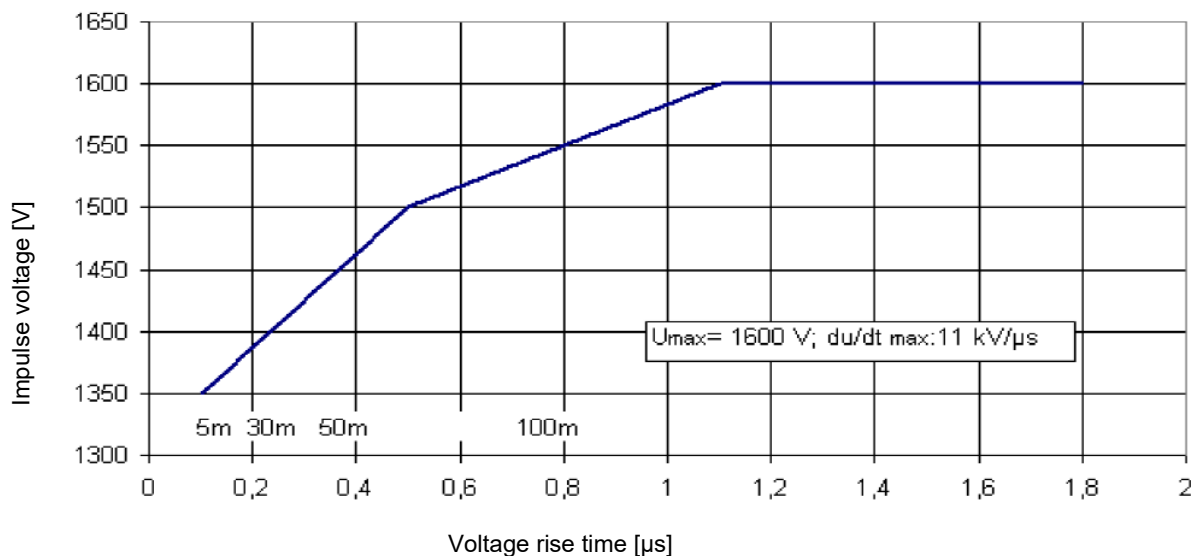


Figure 3: Permissible impulse voltages depending on the voltage rise time

If the values are outside of the permissible range, du/dt or sine wave filters may be used. Observe the additional voltage drop.

The cable lengths shown in the diagram are for guidance only and may deviate depending on the specific conditions.

2.4.5 Motor to frequency inverter assignment

The following assignments of the motors to the suitable frequency inverters apply to nominal operation. Deviating operating conditions require planning and, if necessary, an adjustment of the inverter assignment.

| Motor data | | | | | | | | | | | Classification of frequency inverters and motors |
|------------------|------------|------------|-------------|---------|--------|-------------------------|----------|----------------|--------------|----------------|--|
| Quantity | M_N [Nm] | P_N [kW] | n_N [rpm] | I [A] | η | J [kgm ²] | m [kg] | M_{max} [Nm] | k_T [Nm/A] | K_E [mV/rpm] | |
| 71N1/8 | 1,6 | 0,35 | 2100 | 0,76 | 89,1 | 0,00019 | 4,9 | 4,8 | 2,1 | 143 | -370-340 -550-340 |
| 71N2/8 | 3,2 | 0,7 | 2100 | 1,45 | 92,5 | 0,00038 | 6,0 | 9,6 | 2,2 | 144 | -750-340 |
| 71N3/8 | 4,8 | 1,1 | 2100 | 2,14 | 93,6 | 0,00057 | 7,0 | 14,4 | 2,2 | 144 | -111-340- |
| 80T1/4 | 5,0 | 1,1 | 2100 | 2,07 | 90,5 | 0,0011 | 8,0 | 14,4 | 2,5 | 154 | -111-123- -111-323- -111-340- |
| 80T1/4 HM | 3,41 | 0,75 | 2100 | 1,46 | 90,5 | 0,0011 | 7,8 | 14,4 | 2,3 | 154 | -111-123- -111-323- -111-340- |
| 80T1/4 Δ | 4,8 | 1,5 | 3000 | 3,44 | 90,4 | 0,0011 | 8,0 | 14,4 | 1,4 | 89 | -151-340- |
| 90N1/8 | 5,0 | 1,1 | 2100 | 2,1 | 94,0 | 0,0009 | 10,0 | 15,0 | 2,38 | 144 | -111-340- |
| 90N2/8 | 6,8 | 1,5 | 2100 | 3,01 | 94,0 | 0,0011 | 10,8 | 20,5 | 2,27 | 144 | -151-340- |
| 90N3/8 | 10,0 | 2,2 | 2100 | 4,35 | 94,6 | 0,00176 | 13,2 | 30,0 | 2,3 | 142 | -221-340- |
| 90T1/4 | 6,8 | 1,5 | 2100 | 2,82 | 89,9 | 0,0019 | 10,0 | 21,0 | 2,4 | 156 | -151-323- -151-340- |
| 90T1/4 Δ | 7,0 | 2,2 | 3000 | 5,09 | 89,6 | 0,0019 | 10,0 | 21,0 | 1,4 | 90 | -221-340- |
| 90T3/4 | 10,0 | 2,2 | 2100 | 4,13 | 90,5 | 0,0024 | 12,0 | 29,0 | 2,4 | 158 | -221-323- -221-340- |
| 90T3/4 HM | 5,0 | 1,1 | 2100 | 2,08 | 92,7 | 0,0024 | 11,6 | 28,3 | 2,4 | 156 | -151-323- -151-340- |
| 90T3/4 Δ | 9,5 | 3,0 | 3000 | 6,84 | 92,3 | 0,0024 | 12,0 | 29,0 | 1,4 | 91 | -301-340- |
| 100T2/4 | 13,6 | 3,0 | 2100 | 5,4 | 91,4 | 0,00416 | 18,0 | 42,0 | 2,6 | 161 | -301-323- -301-340- |
| 100T2/4 Δ | 12,7 | 4,0 | 3000 | 8,9 | 92,1 | 0,0046 | 18,0 | 42,0 | 1,5 | 93 | .401-340- |
| 100T5/4 | 18,2 | 4,0 | 2100 | 7,1 | 92,1 | 0,0060 | 21,0 | 57,0 | 2,6 | 165 | -401-323- -401-340- |
| 100T5/4 HM | 10,0 | 2,2 | 2100 | 4,16 | 91,0 | 0,0060 | 20,2 | 53,5 | 2,4 | 165 | -301-323- -301-340- |
| 100T5/4 Δ | 17,5 | 5,5 | 3000 | 11,9 | 92,2 | 0,0060 | 21,0 | 57,0 | 1,5 | 95 | -551-340- |

Table 7: Motor to frequency inverter assignment

2.4.6 Interference emission and resistance to interference

NORD motors comply with the EU Directive 2014/30/EU. Assembly or installation work must not cause impermissible interference emissions. Resistance to interference must still be given.

Interference emissions

Great differences of torque (e.g. when driving a piston compressor) induce a non-sine wave motor current, whose harmonics can cause an impermissible effect on the mains and therefore impermissible interference emissions.

With supply by frequency inverters, various strengths of interference are produced according to the design of the frequency inverter (type, interference suppression, manufacturer).

Always observe the EMC information provided by the inverter manufacturer. If a shielded motor supply cable is recommended by the manufacturer, the shielding is most effective if a large area is electrically connected to the metal terminal box of the motor (with a metal EMC cable gland).

For motors with integrated sensors (e.g. thermistors) interference voltages due to the inverter may be produced in the sensor cables.

Resistance to interference

For motors with integrated sensors (e.g. thermistors) the operator must ensure adequate immunity to interference by the selection of a suitable sensor cable (possibly with screening, with connection as for the motor supply cable) and evaluation device.

Before commissioning, observe the information and instructions given in the operating instructions for the inverter and all other instructions.

3 Transport, storage, assembly

3.1 Transporting the drive

WARNING

Hazard due to falling loads

- The thread of the eye bolt must be fully screwed in.
- Do not pull on the eye bolt at an angle.
- Note the centre of gravity of the motor.

Use every eye bolt attached to the drive for transport. Do not attach additional loads. The eye bolts are not designed for lifting the motor with attachments.

Only use the intended eye bolts or support pins for transporting machine units, e.g. gear unit attachments. Machine units must not be lifted by attaching them to the individual machines.

Use suitable lifting equipment to prevent any damage to the motor.

For the weight of the motor refer to the table below.

| Size | m [kg] |
|-----------------------------------|--------|
| 71N1/8 | 4,9 |
| 71N2/8 | 6,0 |
| 71N3/8 | 7,0 |
| 80T1/4, 80T1/4 Δ | 8,0 |
| 80T1/4 HM | 7,8 |
| 90N1/8 | 10,0 |
| 90N2/8 | 10,8 |
| 90N3/8 | 13,2 |
| 90T1/4, 90T1/4 Δ | 10,0 |
| 90T3/4, 90T3/4 Δ | 12,0 |
| 90T3/4 HM | 11,6 |
| 100T2/4, 100T2/4 Δ | 18,0 |
| 100T5/4, 100T5/4 Δ, 100T5/4 HM | 21,0 |

Table 8: Weights of the motor

3.2 Storage

Under favourable conditions, the drive can be stored for several years.

- If necessary, treat the unprotected, finished surfaces (e.g. flange surface, shaft end) with corrosion protection agents.
- Store the drive in a dry, dust-free space.
- The drive must not be exposed to vibration or oscillation.

Measures before commissioning

- Inspect the drive before commissioning.
- If the storage time has exceeded 4 years under the above mentioned conditions, replace the roller bearings. If stored under unfavourable conditions, the roller bearings must be replaced earlier.
- Check the insulation resistance of the winding (please see chapter 4.2 "Check insulation resistance" on page 30).

3.3 Preparing for installation

3.3.1 Check for damages

Please examine the delivery for transport and packaging damage immediately on receipt. Pay particular attention to radial shaft seals and sealing caps. Report any damage to the carrier immediately.

Do not put the drive into operation if damage such as leaks are visible.

3.3.2 Remove corrosion protection agents

All bare metal surfaces and shafts of the drive are protected with corrosion protection agents before shipping.

Thoroughly remove corrosion protection agents and any dirt (e.g. colour residues) from all shafts, flange surfaces and gear unit attachment surfaces before assembly.

3.3.3 Check rotational direction

If an incorrect rotational direction may result in damage or potential risk, check for the correct rotational direction of the output shaft during a test run before attaching it to the machine. Ensure the correct rotational direction during operation.

3.3.4 Check ambient conditions

Ensure that the drive is suited for the installation location with regard to requirements prescribed by standards, ambient conditions and the installation height.

3.3.5 Drives with nsd tupH surface treatment

Drives with **nsd tupH** surface treatment must be electrically decoupled from other components by the use of non-conductive intermediate layers in order to prevent galvanic corrosion.

3.4 Installation

Either tighten the eye bolts used for transport or remove them completely.

Protect the motor, rotating shafts and unused shaft ends against contact.

Secure unused shaft keys against being thrown out or remove them.

The top section of the terminal box can be rotated by 4 x 90 degrees.

For outdoor installation or vertical versions, such as V1 or V5 with the shaft facing downwards, a double fan cover should be used (option: RDD).

Condensation drain holes must always be located at the lowest point of the motor. If the motor is designed with closed condensation outlets (option: KB), make sure that they are closed. Open condensation drain holes would cause a reduction of the protection class.

3.5 Installation

3.5.1 Installation of driven elements

Attachments must not impair the flow of cooling air necessary for cooling. The driven elements must not rub.

Always mount and dismount the driven elements (coupling, pulleys, gear wheel, etc.) using a suitable device.

Apply the required touch guard of the driven elements. If a motor is put into operation without a driven element, secure the shaft key against being thrown out or remove the key. This also applies for any second shaft end.

3.5.2 Alignment

Align the shafts of the motor and the driven machinery axially and radially exactly to each other, especially in case of direct coupling. Incorrect alignment may result in damage to the bearings, excessive vibration and breakage of the shaft.

3.5.3 Balancing

As standard, the rotors are balanced with half key balancing. Observe the appropriate form of balancing if driven elements are installed on the motor shaft.

Driven elements must be balanced according to DIN ISO 1940.

In order to achieve smooth vibration-free running, align the coupling exactly and balance the drive element correctly (coupling, pulleys, fans etc.). Complete balancing of the motor and the driven element may be necessary.

3.5.4 Fasten the flanged bearing plate



Electric shock

If the fastening screws used are too long, the motor winding may be damaged. This creates a danger of potential transfer to the housing which may lead to an electric shock when touching.

- Use fastening screws that do not exceed the maximum insertion depth of 2 x d.
-

On IEC B14 motors, all four fastening screws must be screwed into the flanged bearing plate even if they are not required. The maximum insertion depth of $2 \times d$ must not be exceeded. The fastening screw threads must be inserted with a sealant, e.g. Loctite 242.

3.6 Subsequent painting

For retrospective painting of the drive, the radial shaft seals, rubber elements, vent screws, hoses, name plates, adhesive labels and motor coupling components must not come into contact with paints, lacquers or solvents, as otherwise the components may be damaged or made illegible.

3.7 Electrical connection

WARNING

Electric shock

Touching live components causes an electric shock. This may result in severe injuries or death.

- Installation of the drive may only be carried out by qualified personnel (qualified electricians).
- The drive must be disconnected.
- The electrical installation must be implemented as per the applicable regulations, e.g. with regard to cable cross-sections, fuses, earth lead connections).

The drive is exclusively intended for operation with frequency inverters. Pay attention to the operating instructions of the frequency inverter.

3.7.1 Overview of connections

Motors are normally supplied with a star circuit. Type SK ..Tx/4 motors can also be operated with a Delta circuit. For this, change the bridges according to the circuit diagram in the terminal box cover.

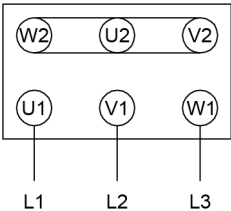
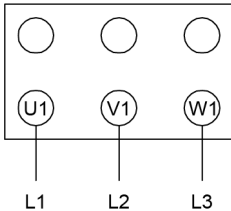
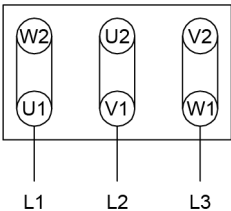
| Type SK ..Tx/4 | | Type SK ..Nx/8; SK ..Fx/8 | |
|--|--|--|--|
|  <p>Star circuit (Y) High voltage</p> | |  <p>Star circuit (Y)</p> | |
|  <p>Delta circuit (Δ) Low voltage</p> | | | |

Figure 4: Power connections

3.7.2 Auxiliary terminals

Please refer to the following table for the designations of the auxiliary terminals.

| Auxiliary terminal designation | | |
|--|--|---|
| Additional equipment | Labelling of auxiliary terminals New: EN 60034-8 | Comment |
| Thermistor Option: TF | TP1 – TP2 1TP1 – 1TP2 2TP1 – 2TP2 3TP1 – 3TP2 4TP1 – 4TP2 5TP1 – 5TP2 | Switch-off Warning Winding 1 Switch-off Winding 1 Warning Winding 2 Switch-off Winding 2 Brake |
| Bi-metal temperature sensor Normally closed Option: TW | 1TB1 – 1TB2 2TB1 – 2TB2 3TB1 – 3TB2 4TB1 – 4TB2 | Warning Winding 1 Switch-off Winding 1 Warning Winding 2 Switch-off Winding 2 |
| Bi-metal temperature sensor Normally open | 1TM1 – 1TM2 2TM1 – 2TM2 3TM1 – 3TM2 4TM1 – 4TM2 | Warning Winding 1 Switch-off Winding 1 Warning Winding 2 Switch-off Winding 2 |
| PT100/PT1000 | 1R1 – 1R2 2R1 – 2R2 3R1 – 3R2 | Winding 1 (Phase U) Winding 1 (Phase V) Winding 1 (Phase W) |
| KTY Silicon temperature sensor | (+) 4R1 – 4R2 (-) (+) 5R1 – 5R2 (-) | Winding 1 Winding 2 |
| Anti-condensation heater Option: SH | 1HE1 – 1HE2 2HE1 – 2HE2 | Motor heater Brake heater |

Table 9: Auxiliary terminal designations

The brake is supplied by a rectifier located in the motor terminal box or via direct DC voltage. Pay attention to the brake voltage specified on the name plate. Also pay attention to the operating instructions of the brake.

3.7.3 Cable connection

Refer to the information label on the motor to see whether the cables are subject to increased thermal requirements. The use of aluminium connection cables is not permitted.

The connection cables must be inserted into the terminal box using cable glands. If the provided cable gland is used, cables with circular cable cross-section must be used.

The cable glands must be approved for the ambient conditions.

When connecting, take care that the permissible clearance distances of at least 10 mm and the permissible creepage distances of at least 12 mm between the electrically live components or to components with the same potential as the housing are maintained.

Insulated cable lugs must be provided for connection.

1. Open the terminal box.
2. Insert the connection cable with cable glands into the terminal box.
3. Establish the connection and configuration of the jumpers according to the circuit diagram in the terminal box.

4. Tighten the nuts of the terminal board bolts according to the following table.


|  | Tightening torques for terminal board connections | | | | |
|---|---|-----|-----|-----|-----|
| | Thread diameter | M4 | M5 | M6 | M8 |
| | Tightening torque (Nm) | 1.2 | 2.0 | 3.0 | 6.0 |

Table 10: Tightening torques for terminal board connections

5. Tighten the cable gland's lock nuts with a torque according to the following table.


|  | Tightening torques for lock nut | | | | |
|---|---------------------------------|---------|---------|---------|---------|
| | Cable gland | M20x1.5 | M25x1.5 | M32x1.5 | M40x1.5 |
| | Tightening torque (Nm) | 3.0 | 6.0 | 12.0 | 14.0 |

Table 11: Tightening torques for lock nut

6. Seal unused openings with approved blind plugs in accordance with the manufacturer's instructions.

3.7.4 Sealing the terminal box

Before sealing the terminal box, ensure that all lock nuts and the earthing screw are tightened.

The terminal box must be sealed against dust and water. Because of this, take care that the seals of the cable glands and the terminal box seals are free from dirt, are correctly seated and are not damaged. Replace damaged seals.

The terminal box cover seal is captively mounted on the terminal box cover. Only use an original seal when replacing the seal.

If the terminal box has been opened during installation, maintenance, repair, troubleshooting or overhaul, re-fit the terminal box cover after the work is complete.

Tighten the terminal box cover's screws with a torque according to the following table.


|  | Tightening torques for the screws of the terminal box cover | | | | |
|---|---|-----------|-----------|-----------|-----------|
| | Thread diameter | M4 | M5 | M6 | M8 |
| | Tightening torque (Nm) | 0.8 – 1.2 | 1.2 – 1.8 | 1.5 – 2.5 | 3.0 – 5.0 |

Table 12: Tightening torques for the screws of the terminal box cover

4 Commissioning

4.1 Check encoder

Check the alignment of the rotary encoder.

If the rotary encoder is not aligned, or has come out of adjustment due to an impact or removal of the motor, the zero track of the encoder must again be adjusted to the rotor position. For more information, refer to the operating instructions of the encoder and the frequency inverter.

4.2 Check insulation resistance

WARNING

Danger of electric shock

The motor terminals still carry hazardous voltages also after the insulation resistance has been checked.

- Do not touch the terminals during or shortly after the check.

Prior to initial commissioning of the motor and after a long period of storage or standstill (approx. 6 months) the insulation resistance of the windings must be checked.

The insulation resistance of new, cleaned, repaired windings against the housing and against each other is $> 200 \text{ M}\Omega$.

Measure the insulation of the windings against the housing for operation voltages up to 400 V with 500 V DC. For operation voltages up to 725 V, measure with 1000 V DC. The temperature of the windings should be $25^\circ\text{C} \pm 15^\circ\text{C}$.

For new or cleaned windings or repaired motors, which have been stored or not used for long periods, the insulation resistance of the winding against earth can be less than $10 \text{ M}\Omega$. This may be due to moisture. Dry the windings.

The insulation resistance may reduce after long periods of operation. As long as the measured value does not fall below the calculated value for the critical insulation resistance of $< 50 \text{ M}\Omega$, operation of the motor may continue. If this value is undershot, determine the cause. Repair, clean and dry the windings or winding parts, if necessary.

4.3 Check the motor

Before commissioning, check the motor for correct function after installation.

If a change in the power consumption, higher temperatures or vibrations, unusual noises or odours etc. occur or a monitoring system responds, the motor function is impaired. Immediately inform the maintenance personnel responsible to avoid personal injury or material damage.

If in doubt, switch off the motor without delay.

4.4 Check the brake (option: BRE)

Check the correct function of the brake.

4.5 Checklist

| Checklist | | |
|---|----------------|-------------------------|
| Subject of check | Date of check: | Information see Section |
| Is the vent screw activated or the pressure vent screwed in? | | |
| Does the required orientation comply with the actual installation position? | | |
| Are rotating parts covered with a contact guard? | | |
| Is the rotary encoder aligned? | | 2.3.1, 4.1 |
| Is the insulation resistance sufficiently high? | | 4.2 |
| Checked the electrical connection? | | |
| Checked earthing? | | |
| Compared the parameterisation of the inverter with the name plate? | | 2.2 |

Table 13: Checklist

5 Service and maintenance

5.1 Service and maintenance intervals

The service and maintenance intervals highly depend on the ambient and operating conditions. They must therefore be individually adapted for the driven machine during project planning.

| Service and maintenance intervals | Service and maintenance work | Information see Section |
|---|---|-------------------------|
| Every 100 operating hours, at least weekly | • Check for running noises | 5.3.1 |
| | • Visual inspection for soiling, clean the drive surface from dust deposits and other contaminants. | |
| | • For motor options with closed condensation outlets (option: KB), drain off condensation. | 5.3.3 |
| At least every six months | • Visual inspection | 5.3.2 |
| every 10000 operating hours, at least every 2 years | • Replace radial shaft seals | |
| | • Check roller bearings, replace if necessary | |
| | • Check electrical connections, cables and wires for strength and any damage. Replace damaged cables, if necessary. | |
| | • Checking the function of the insulation system | 4.2 |
| At least every 5 years, can be considerably more often under special ambient conditions | • General overhaul | 5.3.5 |

Table 14: Service and maintenance intervals

5.2 Bearing replacement periods

The following table specifies the bearing replacement period in operating hours [h] depending on the motor speed and the coolant temperature. It applies for IEC motors under normal operating conditions and with horizontal motor installation.

In case of direct mounting of the gear units or special operating conditions, for example vertical motor installation, high vibration and impact loads, frequent reversing operation, etc., the operating hours stated in the table can be significantly reduced.

| | 25°C | 40°C | 60°C |
|----------------------------|------------------|------------------|-----------------|
| to 1,800 min ⁻¹ | approx. 40,000 h | approx. 20,000 h | approx. 8,000 h |
| to 3,600 rpm | approx. 20,000 h | approx. 10,000 h | approx. 4,000 h |

Table 15: Bearing replacement periods

5.3 Service and maintenance work

5.3.1 Check for running noises

If the motor produces unusual running noises or vibrations, this could indicate damage to the motor. In this case, the motor must be repaired immediately. Please contact the NORD Service department.

5.3.2 Visual inspection

Check the drive thoroughly considering valid standards and regulations. Pay special attention to any mechanical damage, free path of the cooling air, abnormal noises and correct electrical connection.

Only use original spare parts or standardised, customary and equivalent parts.

Changing parts from identical drives is not permissible.

5.3.3 Drain off condensation (option: KB)

Open the condensation outlets and let any accumulated condensation drain off.

After the condensation has drained off, apply Loctite 242 or Loxeal 82-21 to the threads of the screw plugs and reinsert the screw plugs immediately.

5.3.4 Brake (option: BRE)

The brake cannot be adjusted. If maintenance or repair work should be required at the brake, contact the NORD Service department.

5.3.5 General overhaul

The general overhaul must be carried out by a specialist workshop with suitable equipment and be qualified personnel with appropriate equipment in observance of national regulations and laws. We recommend that the general overhaul is carried out by the NORD Service Department.

During general overhaul, the drive is completely dismantled and the following work steps are carried out:

- All components are cleaned.
- All components are checked for damage.
- Damaged parts are replaced.
- All roller bearings are replaced.
- All seals and radial shaft seals are replaced.

5.4 Repairs

Repairs must be carried out by Getriebebau NORD or by a specialist. Only use original spare parts or standardised, customary or equivalent parts. This is also valid for seals and connection parts.

6 Disposal

The motor contains aluminium, iron, electronic components, plastic, copper and magnets.

Dispose the materials properly and observe the applicable regulations.

7 Appendix

7.1 Troubleshooting

NOTICE

Damage to the drive

- Shut down the drive immediately in case of malfunction.

| Motor fault | | |
|-------------------------------------|---|--|
| Fault | Possible cause | Remedy |
| Unusual running noises, vibrations | Defective bearing or warped motor shaft | Consult NORD Service department |
| Motor is too hot. | To high loads | Consult NORD Service department |
| | Incorrect parameterisation | Check parameterisation |
| | Too high ambient temperature | Comply with conditions in accordance with order confirmation |
| Shock when switching on, vibrations | Incorrect parameterisation | Check parameterisation |
| | Encoder alignment | Consult NORD Service department |
| Output shaft does not rotate | Defective connections | Check connections |
| | Incorrect parameterisation | Check parameterisation |
| | Encoder alignment | Consult NORD Service department |
| | Blocked brake | Check connections |

Table 16: Overview of malfunctions

7.2 Spare parts

Please note our spare parts catalogue PL 5000 under www.nord.com.

We will be pleased to send you the spare parts catalogue on request.

7.3 Repair information

For enquiries to our technical and mechanical service department, please have the exact drive type and, if applicable, the order number to hand. You can find this information on the name plate.

7.3.1 Repairs

In case of repair, remove any non-original parts from the drive. No guarantee can be given for any attached parts, such as rotary encoders or external fans.

Send the device to the following address:

Getriebebau NORD GmbH & Co. KG
Serviceabteilung
Getriebebau-Nord-Straße 1
22941 Bargteheide

Information

If possible, state the reason for returning the component/device. Specify a contact person for queries. This is important in order to keep repair times as short as possible.

7.3.2 Internet information

In addition, you will find the manuals in the available languages on our website: www.nord.com.

7.4 Warranty

NORD GmbH & Co. KG accepts no liability for damage to persons, materials or assets as a result of failure to observe this operating manual, operating errors or incorrect use. General wearing parts, e.g. radial seals are excluded from the warranty.

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