Three-phase asynchronous motor
H-compact PLUS

Type 1RQ671...
N - Generic TEAAC / 2008

Operating Instructions • 06/2009
# Introduction

Three-phase asynchronous motor
H-compact PLUS
1RQ6

Operating Instructions

This documentation pertains to
N-WO Generic TEAAC / 2008
Type 1RQ671...-Z

Edition 06/2009
Legal information

Warning notice system

This manual contains notices you have to observe in order to ensure your personal safety, as well as to prevent damage to property. The notices referring to your personal safety are highlighted in the manual by a safety alert symbol, notices referring only to property damage have no safety alert symbol. These notices shown below are graded according to the degree of danger.

⚠️ DANGER
indicates that death or severe personal injury will result if proper precautions are not taken.

⚠️ WARNING
indicates that death or severe personal injury may result if proper precautions are not taken.

⚠️ CAUTION
with a safety alert symbol, indicates that minor personal injury can result if proper precautions are not taken.

⚠️ CAUTION
without a safety alert symbol, indicates that property damage can result if proper precautions are not taken.

⚠️ NOTICE
indicates that an unintended result or situation can occur if the corresponding information is not taken into account.

If more than one degree of danger is present, the warning notice representing the highest degree of danger will be used. A notice warning of injury to persons with a safety alert symbol may also include a warning relating to property damage.

Qualified Personnel

The device/system may only be set up and used in conjunction with this documentation. Commissioning and operation of a device/system may only be performed by qualified personnel. Within the context of the safety notes in this documentation qualified persons are defined as persons who are authorized to commission, ground and label devices, systems and circuits in accordance with established safety practices and standards.

Proper use of Siemens products

Note the following:

⚠️ WARNING
Siemens products may only be used for the applications described in the catalog and in the relevant technical documentation. If products and components from other manufacturers are used, these must be recommended or approved by Siemens. Proper transport, storage, installation, assembly, commissioning, operation and maintenance are required to ensure that the products operate safely and without any problems. The permissible ambient conditions must be adhered to. The information in the relevant documentation must be observed.

Trademarks

All names identified by ® are registered trademarks of the Siemens AG. The remaining trademarks in this publication may be trademarks whose use by third parties for their own purposes could violate the rights of the owner.

Disclaimer of Liability

We have reviewed the contents of this publication to ensure consistency with the hardware and software described. Since variance cannot be precluded entirely, we cannot guarantee full consistency. However, the information in this publication is reviewed regularly and any necessary corrections are included in subsequent editions.
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Introduction

1.1 About these operating instructions

These operating instructions describe the machine and explain best practices in machine handling, from initial delivery to final disposal of the equipment.

Read these instructions before you handle the machine to become familiar with its design and operating principles and thus ensure safe, problem-free machine operation and long service life.

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We strive continually to improve the quality of information provided in these instructions. Please therefore contact us if you discover any errors or wish to make suggestions for improvements. For contact information, please refer to Chapter "Siemens Service Center (Page 69)"

Always follow the safety instructions and notices in these instructions.

Text format features

In addition to the safety-related notices and instructions which you must read, you will find the text in these instructions is formatted in the following way:

1. Handling instructions are always formatted as a numbered list. Always perform the steps in the order given.

   • Lists are formatted as bulleted lists.
     – Lists on the second level are hyphenated.

Note

A Note is an important item of information about the product, handling of the product or the relevant section of the document. Notes provide you with help or further suggestions/ideas.
Safety information

2.1 Observing the five safety rules

For your personal safety and to prevent material damage when working on the device, always observe the safety instructions on the product and the following five safety rules: You must read the information provided in "Safety information".

The five safety rules:
1. isolate,
2. Protect against reconnection,
3. verify that the equipment is not live,
4. Ground and short circuit,
5. Cover or enclose adjacent components that are still live

Qualified personnel
Commissioning and operation of this machine are to be carried out by qualified personnel only. For the purpose of the safety information in this Instruction Manual, a "qualified person" is someone who is authorized to energize, ground, and tag equipment, systems, and circuits in accordance with established safety procedures.

2.2 Safety and application instructions

The safe use of electrical machines

| WARNING | Rotating or live parts |
|-----------------------------|
| ![WARNING] | Rotating or live parts are dangerous. |
|                | Fatal or severe injuries and substantial material damage can occur if the required covers are removed or if the machines are not handled, operated, or maintained properly. |
|                | Only remove covers in accordance with regulations and operate machines correctly. |
|                | Perform regular maintenance on the machine. |

Qualified personnel
These operating instructions only contain the information that is necessary for the machines to be used by qualified personnel in accordance with their intended purpose.
Safety information

2.3 Switching high-voltage motors

Those responsible for plant safety must ensure the following:

- The basic planning work for the system and all work relating to transportation, assembly, installation, commissioning, maintenance and repairs is carried out by qualified personnel and checked by responsible, suitably skilled personnel.
- The operating instructions and machine documentation are always available.
- The technical data and specifications relating to installation, connection, ambient and operating conditions are taken into account at all times.
- The system-specific installation and safety regulations are observed.
- Personal protective equipment is used.
- Work on or in the vicinity of these machines by unqualified persons is prohibited.
- If the machines are used outside industrial areas, the installation site must be safeguarded against unauthorized access by means of suitable protection facilities (e.g., safety gates) and appropriate warning signs.

Note

Siemens Service Center

We recommend engaging the support and services of your local Siemens Service Center (Page 69) for all planning, installation, commissioning, and maintenance work.

[ID 2.02]

2.3 Switching high-voltage motors

Switching overvoltages

If vacuum circuit breakers and vacuum contactors are used, what are known as multiple restrikes can occur when the machine is switched off. This depends on various factors, such as:

- arc-extinguishing principle of the switch,
- size of the motor,
- length of the power supply cable,
- system capacitance, etc.

CAUTION

Switching overvoltages

In some cases, multiple restrikes can result in switching overvoltages which are too high for the insulation of the motor stator winding. This occurs when high-voltage motors with starting currents $I_a \leq 600$ A are disconnected during startup or following a blockage. The peak voltages which arise as a result can damage the winding insulation.

If you are using vacuum circuit breakers and vacuum contactors, use an appropriate surge suppressor, such as the Siemens 3EF (zinc oxide varistor with spark gap).
Example

This current limit corresponds to the following upper power limits, depending on the relationship between the starting current $I_a$ and rated current $I_N$ and on the voltage dip (up to approximately 20%) while the motor is starting up:

- Approximately 750 kW at $I_N = 3$ kV
- Approximately 1500 kW at $I_N = 6$ kV
- Approximately 2500 kW at $I_N = 10$ kV

A limiter to ground is installed in the switchgear between the circuit breaker and the cable termination for each of the three conductors. The level of protection for the motor windings is sufficient given the correct choice of limiters (rated motor voltage/response voltage).

[Example 250.01]

2.4 Electromagnetic compatibility

Instructions relevant to safety

When used in accordance with their intended purpose and operated in an electrical supply system with characteristics to EN 50160, the enclosed motors (IP 54 and higher) comply with the requirements of the EC Directive concerning electromagnetic compatibility 89/336/EEC.

**WARNING**

Interference emissions from very irregular load torque

If the load torque is very irregular (e.g. when driving a reciprocating compressor) a non-sinusoidal motor current will be induced whose harmonics might bring about an excessive reaction on the supply system and so cause excessive emitted interference on the power supply connecting leads.

For example, the operation of heart pacemakers can be impaired, potentially leading to damage to a person’s health or even death. It is therefore forbidden for persons with heart pacemakers to enter these areas.

The plant operator is responsible for taking appropriate measures (labels and hazard warnings) to adequately protect operating personnel and others against any possible risk.

**WARNING**

Interference voltages when operated with frequency converter

If operated on a frequency converter, the emitted interference varies in strength, depending on the converter (manufacturer, type, interference suppression measures undertaken). On motors with integrated sensors (e.g. PTC thermistors), interference voltages caused by the converter may occur on the sensor lead. This can cause faults which can result in eventual or immediate death, serious injury, or material damage.

In order to avoid exceeding the limit values as per EN 50081 on the drive system (motor and converter), the EMC information given by the converter manufacturer must be strictly observed. You must put appropriate EMC measures in place.
The motor generally fulfills the requirements of interference immunity in conformity with EN 50082. If using motors with integrated sensors, the operator himself must ensure sufficient interference immunity by selecting a suitable sensor signal lead and a suitable evaluation unit.
3.1 Applications

Overview

1RQ6 three-phase AC motors have been designed for a very wide range of drive applications and also for energy conversion. They are characterized by their ruggedness, long service life and reliability. They are also extremely versatile, allowing them to be tailored to the particular function.

Details of the supplied motor and permissible operating conditions should be taken from this documentation. [ID 6]

3.2 Design of the motor

The 1RQ6 motors are squirrel-cage, three-phase AC motors.

Supplementary devices

Temperature sensors are integrated in the stator winding to monitor the winding temperature. Depending on the options ordered, various supplementary devices can be installed or attached, e.g., anti-condensation heating in the stator housing or sensors to monitor storage temperatures.

Construction standards

The motors comply with the following standards:

Table 3-1 Construction standards

<table>
<thead>
<tr>
<th>Feature</th>
<th>Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rating and performance</td>
<td>IEC / EN 60034-1</td>
</tr>
<tr>
<td>Degree of protection</td>
<td>IEC / EN 60034-5</td>
</tr>
<tr>
<td>Cooling</td>
<td>IEC / EN 60034-6</td>
</tr>
<tr>
<td>Type of construction</td>
<td>IEC / EN 60034-7</td>
</tr>
<tr>
<td>Noise emission</td>
<td>IEC / EN 60034-9</td>
</tr>
<tr>
<td>Vibration severity grades</td>
<td>IEC / EN 60034-14</td>
</tr>
</tbody>
</table>

Specifications for the degree of protection, cooling and type of construction can be taken from the "Technical specifications" section of this documentation or from the rating plate on the motor. [ID 1003.01]
3.3 Rating plate

Technical specifications

The rating plate shows the technical specifications for the supplied motor.

![Example of rating plate](image)

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>①</td>
<td>Type of motor</td>
<td>①0</td>
<td>Type</td>
</tr>
<tr>
<td>②</td>
<td>Three-Phase High-Voltage Motor</td>
<td>②0</td>
<td>Degree of protection</td>
</tr>
<tr>
<td>③</td>
<td>Rated voltage [V] and winding connections</td>
<td>③0</td>
<td>Thermal class</td>
</tr>
<tr>
<td>④</td>
<td>Rated frequency [Hz]</td>
<td>④0</td>
<td>Service Factor</td>
</tr>
<tr>
<td>⑤</td>
<td>Surface temperature code</td>
<td>⑤0</td>
<td>Certificate number</td>
</tr>
<tr>
<td>⑥</td>
<td>Rated current [A]</td>
<td>⑥0</td>
<td>Omitted</td>
</tr>
<tr>
<td>⑦</td>
<td>Rotor class</td>
<td>⑦0</td>
<td>Rated speed [rpm]</td>
</tr>
<tr>
<td>⑧</td>
<td>Omitted</td>
<td>⑧0</td>
<td>Rated efficiency factor</td>
</tr>
<tr>
<td>⑨</td>
<td>Direction of rotation</td>
<td>⑨0</td>
<td>Rated output [hp]</td>
</tr>
<tr>
<td>⑩</td>
<td>Serial number</td>
<td>⑩0</td>
<td>Motor weight [lbs]</td>
</tr>
<tr>
<td>⑪</td>
<td>Operating mode</td>
<td>⑪0</td>
<td></td>
</tr>
</tbody>
</table>

Figure 3-1 Example of rating plate

[ID 1164.01]
3.4 Arrangement of the plates on the motor

Horizontal construction type

![Diagram of motor with labeled plates]

- Additional plate - transportation warning
- Company name plate
- Additional plate - purging air outlet
- Additional plate: fan unit direction of rotation
- Additional plate - transport of construction type B3
- Additional plate - type of ignition protection Ex e
- Additional plate - purging air inlet
- Additional plate - balancing type 1/1 and 1/2
- Additional plate - anti-condensation heating warning
- Rating plate
- Lubricant plate
- Additional plate - bearing insulation drive end and non-drive end
- Rating plate - anti-condensation heating data
- Additional plate - running-up time
- Additional plate - asset number
- Additional plate - blank
- Additional plate - purging air data
- Additional plate - type of ignition protection Ex i
- CE label

1) only on terminal boxes in protection type Ex e, installed on motor in other protection types
2) only on terminal boxes with intrinsically safe circuits

Figure 3-2 Example: Arrangement of the plates on the horizontal construction type

[ID 1155.01]
Preparations for use

4.1 Transport and storage

4.1.1 Storage

CAUTION

Seizure damage to bearings
If storage conditions are inappropriate there is a risk of bearing seizure damage. This can result in brinelling, for example.
Read the following storage instructions.

Storing outdoors

Store the motor in a location that meets the following criteria:

- Choose a dry storage location of adequate size which is safe from flooding and free from vibrations.
- Repair any damage to the packaging before putting the equipment into storage insofar as this is necessary to ensure proper storage conditions.
- Position motors, devices and crates on pallets, wooden beams or foundations that guarantee protection against ground dampness.
- Prevent the motor from sinking into the ground.
- Ensure that the air circulation under the equipment is not impeded.
  - Covers or tarpaulins used to protect the equipment against the weather must not make contact with the surfaces of the equipment.
  - Covers or tarpaulins must not trail on the floor around the machine.
  - Place wooden spacer blocks between the covers and the motor.
Storing indoors

- Store the motor in an area that meets the following criteria:
  - Dry, dust-free, frost-free and vibration-free. The relative air humidity should be lower than 60% and the temperature should not drop below -15 °C in accordance with EN 60034-1.
  - Well ventilated.
  - Offers protection against extreme weather conditions.
  - The air in the storage area must not contain any harmful gases.
- Protect the motor from shocks and humidity.

Protection against humidity

- If a dry storage area is not available, then take the following precautions:
  - Wrap the motor in humidity-absorbent material and then wrap it in film to create an air tight unit.
  - Place a humidity meter inside the film wrapping.
  - Inspect the motor regularly.

Long-term storage

If you are storing a motor for more than six months, you must check its condition every six months.

- Check the motor for damage.
- Carry out any necessary maintenance work.
- Document all preservation measures taken so that they can be reversed before the machines are put back into service.
- Energize anti-condensation heaters (if provided) or otherwise provide a constant source of low heat to the motor windings, along with forced air ventilation.

Condensate

Condensate can collect in the motor as a result of sharp fluctuations in ambient temperature, exposure to direct sunlight, high levels of humidity in the storage location or intermittent operation/variations in load during operation. Make sure that the storage conditions are such that condensate cannot form in the motor.

<table>
<thead>
<tr>
<th>CAUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Damage due to condensate</strong></td>
</tr>
<tr>
<td>If the stator winding is damp, its insulation resistance is reduced. This results in voltage flashovers, which can destroy the winding. Condensate can also cause rust to form inside the motor.</td>
</tr>
<tr>
<td>Ensure that condensate can drain away.</td>
</tr>
</tbody>
</table>
In the bearing end shields on the drive end and non-drive end, water drainage holes are situated lower down and opposite the regreasing devices. They are sealed with small plastic plugs or screws. Depending on the type of installation, the water drainage holes are located at the bottom.

1. Remove the screws or the plastic plugs regularly to allow the condensate to drain away.
2. Replace them when you have finished.

**NOTICE**

**Degree of protection**

The degree of protection of motors with IP54 or higher is nominally reduced to IP44 by removal of the plastic plug or screw.

[ID 1079.03]
Installation

5.1 Noise emission

When the motor is in operation, the A-weighted sound pressure level (measured in accordance with ISO 1680) of 70 dB(A) is exceeded.

Take this into account when evaluating the noise levels at any operating personnel workstations. If necessary take suitable noise protection measures.

5.2 Installation

Safety instructions

<table>
<thead>
<tr>
<th>CAUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Heat-resistant components</strong></td>
</tr>
<tr>
<td>The machine components can become hot during operation. Parts such as cable insulation can be damaged by the high temperatures.</td>
</tr>
<tr>
<td>Only use heat-resistant parts. Temperature-sensitive parts such as normal cables or electronic components must not be allowed to touch nor be attached to these parts.</td>
</tr>
</tbody>
</table>

Note the technical specifications provided in this documentation and on the plates on the motor frame.

Removing the rotor shipping brace

If at all possible, wait to remove any rotor shipping braces until after the machine has been set up.

Cooling

The cooling air must be able to be drawn in and discharged unimpeded; ensure that warm discharged air is not drawn back in at the air intake.

- On the vertical motor design with air intake from above, the air inlets must be protected against the ingress of foreign bodies and water. If the ventilation openings have louvered covers, the openings must face downwards.

- In the case of internally cooled motors that are designed for pipe ventilation and/or operation with a separately driven fan depending on the intended cooling method, pipes and fan of an appropriate type of construction and rating must be connected.

- On motors with pipe ventilation, the cooling-air rate, direction of air flow and pressure drop inside the motor are stated on the rating plate. Shipping covers on the ventilation openings must be removed.
• If a higher degree of protection is required, it may be necessary to install appropriate filters and arrange the intake and/or outlet openings specially as needed.
• All parts must be mounted free from strain.
• In the case of motors with a built-on separately driven fan unit and with air-to-air or air-to-water coolers the relevant operating instructions must be observed.

**Loads on shaft extension**

The permissible values for longitudinal and cantilever forces must be requested if necessary. [ID 1005.01]

## 5.3 Aligning

### Requirements

Detailed specialist knowledge of the following measures is required in order to correctly align and securely fit the equipment.

- Preparing the foundation
- Selecting and mounting the coupling
- Measuring the concentricity and axial eccentricity tolerances
- Positioning

If you are not familiar with the prescribed measures and procedures, then you can make use of the services offered by the local Siemens Service Center (Page 69).

### Vertical and horizontal alignment

To compensate for the radial offset on the coupling, the electrical machine and the driven load must be aligned with each other.

- Place shims under the motor feet to position it vertically and to prevent stress/distortion. The number of shims should be kept as low as possible, so use as few thicker shims as possible, instead of several thinner shims.
- For horizontal positioning, push the motor sideways on the foundation Pay attention to maintaining the axial position.
- When positioning the motor, ensure that a uniform axial gap is maintained around the coupling.

### Alignment accuracy

A diameter of 0.05 mm is required to satisfy the coaxial requirements for the shafts of the motor and the driven machine. [ID 208.02]
5.4 Mounting

Requirements

Preconditions for smooth, vibration-free operation:

- Stable foundation design as per DIN 4024
- Precision alignment of the motor
- Correct balancing of parts to be fitted to the shaft end.
- ISO 10816-3-compliant vibration velocity

Proceed as follows

- Use machine fixing bolts with the necessary strength class to ISO 898-1 (e.g. 10.9) for reliable mounting and safe transmission of forces resulting from torque.
- When selecting the bolts and the design of the foundation, take into account the maximum forces occurring in the case of a fault such as short circuit or system transfers in phase opposition. The values for the foundation forces can be found in the configuring documentation or are available on request from the manufacturer.

<table>
<thead>
<tr>
<th>NOTICE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>System-inherent frequencies</strong></td>
</tr>
<tr>
<td>If the foundation has not been constructed correctly, frequencies that are inherent to the foundation can occur after the machine set has been installed (system-inherent frequencies). This can damage the machine set.</td>
</tr>
<tr>
<td>DIN 4024 must be taken into account when constructing the machine foundation.</td>
</tr>
</tbody>
</table>

See also

Aligning (Page 22)

5.5 Installation of the Coupling

Balance quality

The rotors are balanced dynamically. For shaft extensions with featherkeys, the balancing type is specified using the following coding on the face of the drive end of the shaft:

- "H" means balancing with a half feather key
- "F" means balancing with a whole feather key.
Installation

5.6 Cooling water quality

**Installation of the Coupling**

- Make sure that the balancing method of the output element is correct!
- If the power output element is shorter than the feather key with balancing type "H", then you must machine off the section of feather key protruding from the shaft contour and output element in order to maintain the balance quality.
- Power output elements may only be pushed on or pulled off with the correct equipment.

<table>
<thead>
<tr>
<th>WARNING</th>
</tr>
</thead>
<tbody>
<tr>
<td>The feather key can fall out</td>
</tr>
<tr>
<td>The featherkeys are only secured during transport to prevent them from falling out. If a machine with two shaft extensions does not have an output element on one shaft extension, the feather key can fall out during operation.</td>
</tr>
<tr>
<td>Death or serious injury can result.</td>
</tr>
<tr>
<td>On shaft extensions without output element, make sure that the feather key cannot fall out and shorten it by approximately half for balance type &quot;H&quot;.</td>
</tr>
</tbody>
</table>

**5.6 Cooling water quality**

The chemical composition of the cooling water must comply with the configuration specifications.

The materials used in the heat exchanger are chosen to suit the water conditions for which the heat exchanger has been ordered. The exchanger cannot necessarily be used under different water conditions. Refer to the dimension drawing text for the fouling factor.

In the case of a heat exchanger built for chemical purification (closed cooling-water circuit), the water quality must comply with the recommendations made by the manufacturer.

Refer to the operating instructions of the air-to-water heat exchanger, section headed "Supplementary operating instructions". [ID 1014.01]
Connection

6.1 Electrical connection

6.1.1 Grounding the motor

The cross-section of the machine grounding conductor must comply with the installation regulations, e.g., in accordance with IEC/EN 60204-1, for phase conductor cross-sections greater than 35 mm², with a minimum of 50% of the cross section of the phase conductor.

There is a hexagon bolt with flat and spring washer on the stator frame at the designated connecting point for the grounding conductor. This is suitable for connecting multi-core conductors with cable lugs or straps with appropriate conductor ends.

Connecting the grounding conductor

When making connections, ensure the following:

- The connecting surface is bare and is protected against corrosion using a suitable substance, e.g., acid-free Vaseline
- The spring lock and spacer washer are located under the bolt head
- The maximum permissible clamping thickness of 10 mm for the cable lug or strap is not exceeded
- The minimum required screw-in depth and the tightening torque for the clamping bolt as given in the table below are observed

The screw-in depth and tightening torque differ depending on whether cable lugs or ground terminals are used:

Table 6-1  Tightening torques of bolts (cable lug)

<table>
<thead>
<tr>
<th>Bolt</th>
<th>Screw-in depth</th>
<th>Tightening torque</th>
</tr>
</thead>
<tbody>
<tr>
<td>M12 x 25</td>
<td>&gt; 16 mm</td>
<td>38 Nm</td>
</tr>
<tr>
<td>M16 x 35</td>
<td>&gt; 20 mm</td>
<td>92 Nm</td>
</tr>
</tbody>
</table>

Table 6-2  Tightening torques of bolts (ground terminals)

<table>
<thead>
<tr>
<th>Bolt</th>
<th>Screw-in depth</th>
<th>Tightening torque</th>
</tr>
</thead>
<tbody>
<tr>
<td>M6</td>
<td>&gt; 9 mm</td>
<td>8 Nm</td>
</tr>
<tr>
<td>M8</td>
<td>&gt; 12 mm</td>
<td>20 Nm</td>
</tr>
<tr>
<td>M10</td>
<td>&gt; 15 mm</td>
<td>40 Nm</td>
</tr>
</tbody>
</table>

[ID 22.01]
6.1.2 Terminal designation

The following definitions apply to the terminal designations of three-phase machines in accordance with DIN VDE 0530 Part 8 or IEC / EN 60034-8:

Table 6-3 Terminal designations using the 1U1-1 as an example

<table>
<thead>
<tr>
<th>1</th>
<th>U</th>
<th>1</th>
<th>-</th>
<th>1</th>
<th>Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Index for pole assignment on pole-changing motors where applicable. A lower index signifies a lower speed. Special case for split winding.</td>
</tr>
<tr>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Phase designation U, V, W (IEC) T1, T2, T3 (NEMA)</td>
</tr>
<tr>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Index for winding start (1) or end (2) or if there is more than one connection per winding</td>
</tr>
<tr>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Additional index for cases in which it is obligatory to connect parallel power feed cables to several terminals with otherwise identical designations</td>
</tr>
</tbody>
</table>

[ID: 332.02.01]

6.1.3 Direction of rotation

The technical specifications stipulate the following with respect to the motor connection:
- Direction of rotation
- The number and arrangement of the terminal boxes
- The circuit and connection of the motor winding

Direction of rotation

On motors which are only allowed to run in one direction, the rating plate shows an arrow which indicates the permitted direction of rotation, and it also specifies the terminal connections in the required phase sequence.

If you connect the power cables in the phase sequence L1, L2, L3 to U, V, W, the motor will rotate clockwise. If two of the connections are swapped, then the motor will rotate counterclockwise (e.g. L1, L2, L3 to V, U, W).

Note

If you want to run the motor in the opposite direction to the direction stated in the order, please consult your contact partner at Siemens.

Rotational directions which may be required for application in a particular plant are not shown on the rating plate. Please take these requirements into consideration when connecting up the motor.
6.1.4 Cable entry and routing

Cable entry and routing

A plate is bolted into the terminal box enclosure via a rectangular cut-out, through which the connecting cables are introduced. Normally, this cable entry plate is supplied without threaded holes for the cable glands, so that the number and size of the cable glands can be adapted to the application conditions.

Proceed as follows:
1. Unscrew the cable entry plate.
2. Drill the required number of holes or a thread in the required size into the cable entry plate.
3. Mount the cable entry plate and the cables with the cable glands onto the terminal box.
4. Remove the insulation from the conductor ends so that the remaining insulation is almost long enough to reach the cable lug. Comply with the specified air gaps for uninsulated live components (see table).

Table 6-4 Minimum air gaps for uninsulated live components

<table>
<thead>
<tr>
<th>Voltages</th>
<th>Air clearance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 6.6 kV</td>
<td>Minimum 60 mm</td>
</tr>
<tr>
<td>Up to 11 kV</td>
<td>Minimum 100 mm</td>
</tr>
<tr>
<td>Up to 13.8 kV</td>
<td>Minimum 140 mm</td>
</tr>
</tbody>
</table>

6.1.5 Connecting the power cables

Terminal box

The type designation of the terminal box for connecting the power cables can be found in the "Technical specifications" section; see "Main terminal box" in the spare parts list for a diagram of the terminal box.

Normally, in-house terminal boxes are fitted. For special connection systems (e.g. boxes with segregated phases or plug-and-socket connection), follow the instructions provided by the manufacturer of these systems and comply with special conditions laid down in the certificate.

The in-house terminal boxes are usually certified for type of protection Ex e. In a special version (which must be specifically ordered), the entry holes may have one or more threads or holes suitable for the use of screwed joints that must be certified for use in Zone 1. You must observe the installation and operation conditions specified in the certificate for these screwed joints and check that they are complied with.

The following conditions for connection with cable lugs are defined in the certificates for in-house terminal boxes in the section "Connection with cable lugs". They must be observed.
Components provided by customer

You, the customer, provide the following components:

- Cable lug and component parts
- Cable glands
- Cable
- Parts for connection to equipment already on-site

Table 6-5  Parts for connection to equipment already on-site

<table>
<thead>
<tr>
<th>Part number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>22.92.1</td>
<td>Hexagon bolt ISO 4017-M12x50-8.8</td>
</tr>
<tr>
<td>22.92.2</td>
<td>Hexagon bolt ISO 4017 M16X50-8.8</td>
</tr>
<tr>
<td>22.92.3</td>
<td>Washer ISO 7089-12-200HV-A2</td>
</tr>
<tr>
<td>22.92.4</td>
<td>Washer ISO 7089-16-200HV-A2</td>
</tr>
<tr>
<td>22.92.5</td>
<td>Washer ISO 7093-1-12-200HV-A2</td>
</tr>
<tr>
<td>22.92.6</td>
<td>Washer ISO 7093-1-16-200HV-A2</td>
</tr>
<tr>
<td>22.92.7</td>
<td>Conical spring washer DIN 6796-12-FST-MECH.ZN12C</td>
</tr>
<tr>
<td>22.92.8</td>
<td>Conical spring washer DIN 6796-16-FST-MECH.ZN12C</td>
</tr>
<tr>
<td>22.92.9</td>
<td>Spring washer DIN 128-A12-FST-A3L</td>
</tr>
<tr>
<td>22.92.10</td>
<td>Spring washer DIN 128-A16-FST-A3L</td>
</tr>
<tr>
<td>22.92.11</td>
<td>Hexagonal nut ISO 4032-M12-8.8</td>
</tr>
<tr>
<td>22.92.12</td>
<td>Hexagonal nut ISO 4032-M16-8</td>
</tr>
</tbody>
</table>

Selecting the cables

- When choosing connecting cables, you must take into account the rated current, possibly the service factor, and the plant-specific conditions (e.g. ambient temperature, routing type, etc. to IEC/EN 60204-1).

Connecting using cable lugs

Connection with cable lugs is only permitted for conductor cross-sections ≥ 70 mm² to 300mm², to prevent the cable lugs twisting on connection.

- Select the cable lugs according to the required cable cross-section and screw size.

Table 6-6  Technical specifications for selecting the cable lug

<table>
<thead>
<tr>
<th></th>
<th>IEC</th>
<th>NEMA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Screw size</td>
<td>M16</td>
<td>M12</td>
</tr>
<tr>
<td>Max. cable cross section and max. number per phase</td>
<td>6 x 300 mm²</td>
<td>AWG 600 kcmil</td>
</tr>
<tr>
<td>Max. size of the cable lug</td>
<td>DIN 46235 16-300</td>
<td>Burndy YA36 2N</td>
</tr>
</tbody>
</table>
6.1 Electrical connection

DIN 46235 16-300 (IEC)  
Burndy YA36 2N (NEMA)

Tightening torques for the fixing screws when connecting with one cable lug

DIN 46235 16-300 (IEC)  
Burndy YA36 2N (NEMA)

Tightening torques for the fixing screws when connecting with two cable lugs

[ID 1015.02]

See also

Spare Parts (Page 59)
6.1.6 Connection with aluminum conductors

Proceed as follows to connect up an aluminum conductor:

- Remove the oxide coating layer using a brush or file prior to inserting the aluminum conductors in the clamps.
- Then grease the conductors immediately using neutral Vaseline in order to avoid re-oxidation.
- Close off unused threads with a metal threaded plug.

**NOTICE**

The aluminum flow is determined by contact.

The aluminum flow is determined by contact following installation. The connection with the clamping nuts can loosen as a result. Correct this by retightening the clamping nuts after approximately 24 hours and then again after approximately 4 weeks. Make sure that the terminals are de-energized before you tighten the nuts.

[ID: 332.02]

6.1.7 Internal equipotential bonding between main terminal box and motor frame

The equipotential bonding connection between the ground terminal in the terminal box enclosure and the machine housing is established via the terminal box fixing bolts and an additional grounding cable on the outside.

The contact points for the equipotential bonding connection between the terminal box cover and the terminal box enclosure are bare metal and protected against corrosion. [ID 1015.02]

6.1.8 Final steps

1. Before closing the terminal box, please check that:
   - The electrical connections in the terminal box are tight and in full compliance with the specifications above
   - The motor is connected so that it rotates in the direction specified
   - The inside of the terminal box is clean and free of any cable debris
   - All gaskets and seals are intact
   - The pressure relief device is intact Depending on the type of terminal box being used, the pressure relief device can be implemented either by sealing the slots or by using a pressure relief diaphragm.

      Any damage may only be repaired after prior discussion with the person responsible for the safety of the installation and only by using original parts.

2. Close the terminal box.

   See section "Tightening torques for screw and bolt connections (Page 56)" for the tightening torque of the M10 fixing bolts for the cover. [ID 1015.01x]
6.2 Connecting auxiliary circuits

6.2.1 Connecting the anti-condensation heating and auxiliary circuits

Anti-condensation heating

**NOTICE**

Only run anti-condensation heating when the motor is shut down

Running anti-condensation heating when the motor is in operation can cause motor temperatures to increase.

Only run anti-condensation heating when the motor is shut down. Include an appropriate interlocking circuit with the main switch of the machine when installing the electrical system. Before switching on the machine you should always check that the anti-condensation heating is not running.

Connecting the auxiliary circuit

The type designations of the mounted auxiliary terminal boxes, their arrangement, and the relevant connection terminals are documented in the "Technical specifications" section. The information required to connect anti-condensation heating and the auxiliary circuits is provided in the connection diagram, located on the inside of the terminal box cover, and in the "Technical specifications" section. The terminals are suitable for conductor cross-sections up to 4 mm².

Selecting the cables

- When choosing connecting cables, you must take into account the rated current and the plant-specific conditions (e.g., ambient temperature, routing type, etc. to IEC/EN 60204-1).

Cable entry and routing

A plate is bolted into the terminal box enclosure via a rectangular cut-out, through which the connecting cables are introduced. Normally, this plate is supplied without threaded holes for the cable glands, so that the number and size of the cable glands can be adapted to the application conditions.

1. Unscrew the cable entry plate.
2. Drill the required number of holes or a thread in the required size into the cable entry plate.
3. Mount the cable entry plate and the cables with the cable glands onto the terminal box.
4. Seal the screwed sockets on the cable glands to conform to the degree of protection.
6.2 Connecting auxiliary circuits

Equipotential bonding between terminal box and machine housing
The equipotential bonding between the PE terminals in the relevant terminal box enclosure and the motor housing is established via a fixing bolt on each terminal box housing. The contact point underneath the bolt head is bare metal and protected against corrosion. [ID 24.03]

6.2.2 Final steps

1. Before closing the terminal box, please check that:
   - The cables are connected in accordance with the terminal diagram inside the terminal box cover
   - The inside of the terminal box is clean and free of any cable residue
   - The cable glands are firmly tightened, are suitable with respect to the degree of protection, type of cable routing, permissible cable diameter, etc., and have been mounted in full compliance with specifications and regulations
   - The connecting cables are arranged so that they do not come into contact with the machine, and the cable insulation cannot be damaged
   - The threads in the terminal plate are sealed using cable entries or sealing plugs that are suitable for the applicable degree of protection.
   - If necessary, any cable entries that are not in use are sealed and the plugs are tightly screwed in (i.e., so that they can only be removed using the suitable tools)
   - All of the seals/gaskets and sealing surfaces of the terminal box are in good condition
   - If bolt terminals are being used, all of the terminal bolts have been firmly tightened. This also applies to any unused terminals

2. Close the terminal box. [ID 1195.00x]

See also
Tightening torques for screw and bolt connections (Page 56)
Start-up

7.1 Checking the insulation resistance

Checking the insulation resistance of the stator winding

The insulation resistance of the stator winding needs to be checked prior to commissioning and again after any extended periods of storage or periods during which the equipment is not in operation.

WARNING

Hazardous voltage

During and immediately after measurement of the stator winding insulation resistance, hazardous voltages can be present at some terminals. Contact with these can result in death, serious injury or material damage.

Check any power cables connected in order to ensure that the line supply voltage cannot be fed in. Once you have measured the insulation resistance, discharge the winding by connecting the ground potential.

Measuring the insulation resistance

- Before you begin measuring the insulation resistance, please read the manual for the insulation resistance meter you are going to use.
- Disconnect any connected main-circuit cables from the terminals before measuring the insulation resistance.
- Measure the insulation resistance of the winding to the machine housing when the winding temperature is between 20 and 30 °C. Other values for the insulation resistance apply at different temperatures.
- When measuring, wait until the final resistance value is reached. This happens after approximately 1 minute.
Limit values of the stator winding insulation resistance

The following table indicates the measuring circuit voltage and the limit values for the minimum insulation resistance and the critical insulation resistance of the stator winding.

<table>
<thead>
<tr>
<th>Measuring circuit voltage</th>
<th>Rated voltage $U_N &lt; 2$ kV</th>
<th>Rated voltage $U_N \geq 2$ kV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum insulation resistance with new, cleaned or repaired windings</td>
<td>10 MΩ</td>
<td>100 MΩ</td>
</tr>
<tr>
<td>Critical specific insulation resistance after a long operating time</td>
<td>0.5 MΩ/kV</td>
<td>5 MΩ/kV</td>
</tr>
</tbody>
</table>

Note the following:

- If the measurements are performed at winding temperatures other than 25°C, the measured value will need to be converted to the reference temperature of 25°C in order to be able to compare the values with the table above.
  - The insulation resistance halves every time the temperature rises by 10 K.
  - The resistance doubles every time the temperature falls by 10 K.
- Dry, new windings have insulation resistances of between 100 and 2000 MΩ, or possibly even higher values. Insulation resistance close to the minimum value could be due to humidity and/or dirt accumulation.
- Over its operating lifetime, the motor winding insulation resistance can drop due to ambient and operational influences. The critical insulation resistance value for a winding temperature of 25°C can be calculated, depending on the rated voltage, by multiplying the rated voltage (kV) by the specific critical resistance value;

  **Example:**

  Critical resistance for 3.3 kV rated voltage:

  $3.3 \text{ kV} \times 5 \text{ MΩ/kV} = 16.5 \text{ MΩ}$

**NOTICE**

Critical insulation resistance reached or undershot

If the critical insulation resistance is reached or undershot, this can result in damage to the insulation or voltage flashovers.

Dry the windings, or thoroughly clean and dry them (remove the rotor first).

- Once the clean windings have been dried and cooled to almost 25°C, a smaller insulation resistance will be measured. The insulation resistance can only be properly assessed after conversion to the reference temperature of 25°C. Allow the windings to cool down to 25°C, or convert the insulation resistance to the reference temperature of 25°C
- If the measured value is close to the critical value, you must check the insulation resistance at suitably frequent intervals.
Limit values of the anti-condensation heating insulation resistance
The insulation resistance of the anti-condensation heating with respect to the machine housing should not be lower than 1 MΩ when measured at 500 V DC. [ID 33.02]

7.2 Monitoring the temperature of the stator winding

Measures
The connection cables include a current-dependent overload protection circuit.
You can also monitor the temperature of the machine or the winding with the temperature sensors in the stator winding, which gives overload protection independent of the current.

7.3 Measures to be performed prior to commissioning

Overview
Once the system has been correctly installed, you should check the following prior to commissioning:

- The machine has been properly installed and aligned.
- The machine is connected so that it rotates in the direction specified.
- The operating conditions correspond to the data specified on the rating plate.
- Any supplementary motor monitoring devices and equipment have been correctly connected and are fully functional.
- If bearing thermometers have been fitted, the bearing temperatures are checked during the initial run of the machine and the warning and shutdown values are set on the monitoring device.
- The output elements are correctly set, e.g.:
  - Couplings are aligned and balanced.
  - The belt on the belt drive is tensioned.
  - At the gear element, there is gear tooth flank and crest clearance.
  - There is radial clearance.
- The minimum insulation resistance values and the minimum air gap values are observed.
- The grounding and equipotential bonding connections have been made correctly.
- Any bearing insulation has been fitted in accordance with the diagram.
- All fixing bolts, connecting elements, and electrical connections have been tightened to the specified torque.
- The rotor can spin without coming into contact with the stator.
- All touch protection measures for moving and live parts have been taken.
7.4 Lubrication of rolling contact bearings prior to commissioning

- If the second shaft end is not in use, its featherkey is secured to prevent it from being thrown out, and cut back to roughly half its length if the rotor has balance type "H" (standard type). The open shaft end is covered.

- For air cooling:
  - All external fans fitted are ready for operation and have been connected so that they rotate in the direction specified.
  - The flow of cooling air is not impeded.

- For water cooling: the cooling water supply is ready for operation.

- All brakes are operating correctly.

- Appropriately configured control and speed monitoring functions ensure that the motor cannot exceed the permissible speeds specified on the rating plate. See also the plant-specific documentation.

- While being operated on the converter, the motor cannot exceed the specified upper speed limit $n_{\text{max}}$ or undershoot the lower speed limit $n_{\text{min}}$.

  If the design of the motor requires that the converter is assigned in a particular way, the rating plate or certificate will contain corresponding additional information.

- When the motor is switched on, the oil supply pump is running (if the motor has been configured in this way).

- The rolling-contact bearings have been regreased as appropriate for the model. Rolling-contact bearing machines which have been in storage for more than one year must be regreased.

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**Note**

This list does not claim to be exhaustive. It may be necessary to make additional checks and tests in accordance with the situation specific to the particular place of installation. [ID 1021.00]

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7.4 Lubrication of rolling contact bearings prior to commissioning

- Before recommissioning, you must **regrease** the bearings if the machine stoppage has lasted longer than a year. The shaft must rotate so that the new grease can be distributed throughout the bearings.

- **New grease** must be used on the bearings before commissioning in the following circumstances.
  - When the machine has been in storage in favorable conditions, e.g. in dry rooms that are free of dust and vibrations. This applies to the period between delivery and commissioning, or longer periods of stoppage.
  - If the machine has been in storage in unfavorable conditions for more than two years. Pay attention to the instructions on the lubricant plate.
7.5 Switching high-voltage motors

Overvoltages resulting from switching operations

Regardless of the motor size and the arc-extinguishing principle of the switch being used (i.e., even in the case of oil-free, SF6 or air break switches), you must bear the following in mind when commissioning high-voltage motors/switchgear for high-voltage motors from 3 kV to 13.8 kV:

<table>
<thead>
<tr>
<th>CAUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overvoltages caused by shutting down the motor during startup</td>
</tr>
</tbody>
</table>

Shutting down the motor during startup can cause overvoltages. This can damage the motor.

Avoid shutting down the motor during startup by, for instance, checking for errors in the starting control or for excessively sensitive protection settings. Keep shutdowns during startup for checking the direction of rotation or other tests to an absolute minimum.

[ID 251.02]
8.1 Safety notes during operation

⚠️ WARNING

Do not remove covers when the motor is running
Rotating or live parts are dangerous. Death, serious injury, or material damage can result if the required covers are removed.
All covers that are designed to prevent active or rotating parts from being touched, ensure compliance with a particular degree of protection, or that are required for ensuring proper air guidance and, in turn, effective cooling must not be opened during operation.

⚠️ WARNING

Faults in operation
Deviations from normal operation such as increased power consumption, temperatures or vibrations, unusual noises or odors, tripping of monitoring devices, etc., indicate that the machine is not functioning properly. This can cause faults which can result in eventual or immediate death, serious injury, or material damage.
Immediately inform the maintenance personnel. If you are in doubt, immediately switch off the motor, being sure to observe the system-specific safety conditions!

⚠️ CAUTION

Fire hazard
Certain parts of the motor may reach temperatures above 50 °C. Touching them can result in burns.
Check the temperature of the parts before touching them and take appropriate protective measures if necessary.

CAUTION

Risk of corrosion due to condensate
During motor operation, humid air can condense inside the machine. Condensate can collect inside the motor. Damage such as rust can result.
Depending on the environmental and operating conditions, remove the condensate plugs or screw plugs to drain the water. When you have finished, reattach the condensate plugs or screw plugs.
If the motor is equipped with condensate drain holes and draining plugs, the water can drain off automatically.

[ID 36.03]
8.2 Operation with anti-condensation heating

**CAUTION**

Operate the anti-condensation heating only if the motor is shut down

Operating the anti-condensation heating when the motor is running can result in overheating. Material damage can result.

Only run anti-condensation heating when the motor is shut down. For this purpose, install an appropriate interlocking circuit with the main switch of the machine when setting up the electrical system. Before switching on the machine, ensure that the anti-condensation heating is de-energized.

8.3 Insulated bearings

**Bridging the bearing insulation**

This motor is fitted with electrically insulated bearings at the DE and/or NDE ends. An insulated bearing on the DE side is normally jumpered by an electrically conductive connection in order to keep the rotor at frame potential.

Observe the notices on the machine relating to bearing insulation and possible bridges.

**WARNING**

Do not open the bearing insulation bridge

Removing the factory-fitted bridging of the insulated DE bearing leads to potential differences between the rotor and the grounded motor. This can cause the generation of sparks, which especially in an explosive atmosphere ignite the surrounding gas. There is also a risk of an electric shock. This can result in death, serious injury or material damage.

Do not open the bridging of the bearing insulation on the DE side during operation.

If a special variant is used, among other things if the motor is connected to a converter, the shaft is grounded via a shaft grounding device on the DE or NDE side.

**WARNING**

Do not bridge the insulation on the insulated bearing

In the case of the version with a shaft grounding device and insulated bearings on the DE and NDE sides, bridging the insulated bearing results in electric current flowing via the motor frame and possibly via the coupling to the driven machine. This can lead to death or serious injury as a result of electric shock, or bearing damage caused by current flowing through the bearing.

Do not bridge the bearing insulation on the insulated bearing while the machine is running. Keep the insulation points clean. Use insulated couplings. [ID 199.4]
8.4 Switching on with anti-condensation heating

Procedure

1. Switch off the anti-condensation heating before switching on the motor.
2. See also the note in the "Downtimes" section.

CAUTION

Only run anti-condensation heating when the motor is shut down
Running anti-condensation heating when the motor is in operation can cause motor temperatures to increase. This can result in material damage.

Only run anti-condensation heating when the motor is shut down. Include an appropriate interlocking circuit with the main switch of the machine when installing the electrical system. Before switching on the machine you should always check that the anti-condensation heating is not running.

8.5 Switch on

Procedure

1. If at all possible, run the machine without load and check that it is running smoothly.
2. If it is running smoothly, connect a load.
3. If this is possible using the available measuring equipment, check the bearing and stator winding temperatures. [ID 40.02]
8.6 Stoppages

Rolling-contact bearings

- Operate the motor regularly, at least once monthly, in the event of downtimes lasting more than 1 month, for approximately one minute. Alternatively, turn the rotor as a minimum. If a rotor shipping brace has been fitted to the machine, remove it before you spin the rotor.

<table>
<thead>
<tr>
<th>CAUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Damage to the bearings of rolling contact bearing motors when stored over a long period.</td>
</tr>
<tr>
<td>Remaining in the same or almost the same position can damage the rolling contact bearings.</td>
</tr>
<tr>
<td>Turn the rotor at the intervals specified. Ensure that the bearings then come to rest in a position different from that they were in before. Use the feather key as a reference point.</td>
</tr>
</tbody>
</table>

- Please refer to the section "Energizing" before restarting the motor.

<table>
<thead>
<tr>
<th>CAUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Storing rolling contact bearing motors for longer than six months</td>
</tr>
<tr>
<td>If the motor is not to be used for a period in excess of six months, suitable anti-corrosion, mothballing, packaging and drying measures must be taken.</td>
</tr>
</tbody>
</table>

- Please refer to the section "Energizing" before restarting the motor.

See also

Storage (Page 17)
Switch on (Page 41)

8.7 Faults in operation

Note

In the event that electrical faults occur while operating the motor with a converter, please also refer to the converter operating instructions.

The tables below list general faults caused by mechanical and electrical influences.
8.7 Faults in operation

### Electrical faults

#### Table 8-1 Electrical faults

<table>
<thead>
<tr>
<th>Possible causes of faults</th>
<th>Remedial measures (1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overload</td>
<td>Reduce the load.</td>
</tr>
<tr>
<td>Interruption of a phase in the supply cable</td>
<td>Check the switches and cables.</td>
</tr>
<tr>
<td>Interruption of a phase in the supply after switching on</td>
<td>Check the switches and cables.</td>
</tr>
<tr>
<td>Mains voltage too low, frequency too high</td>
<td>Check the power supply conditions.</td>
</tr>
<tr>
<td>Mains voltage too high, frequency too low</td>
<td>Check the power supply conditions.</td>
</tr>
<tr>
<td>Stator winding incorrectly connected</td>
<td>Check the winding connection.</td>
</tr>
<tr>
<td>Winding short circuit or phase short circuit in stator winding</td>
<td>Determine the winding and insulation resistances. Make repairs following consultation with the manufacturer.</td>
</tr>
<tr>
<td>Wrong direction of rotation of the separately driven fan</td>
<td>Check the connection of the separately driven fan.</td>
</tr>
<tr>
<td>Separately driven fan is not running</td>
<td>Check the separately driven fan and its connection.</td>
</tr>
</tbody>
</table>

(1) As well as eliminating the cause of the fault (as described under "Remedial measures"), you must also rectify any damage the machine might have sustained.

### Mechanical faults

#### Table 8-2 Mechanical faults

<table>
<thead>
<tr>
<th>Possible causes of faults</th>
<th>Remedial measures (1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rotating parts are grinding</td>
<td>Establish the cause and realign the parts.</td>
</tr>
<tr>
<td>Reduced air supply, direction of rotation of separately driven fan possibly incorrect Separately driven fan is not running</td>
<td>Check the ventilation path; clean the machine.</td>
</tr>
</tbody>
</table>
### Possible causes of faults

<table>
<thead>
<tr>
<th>Possible causes of faults</th>
<th>Remedial measures (1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>X Stator or coupling not balanced.</td>
<td>Disconnect the stator or coupling and rebalance. If the machine has two shaft ends, and a power output element is only fitted to one end, secure the featherkey at the other end to prevent it from being thrown out. If the rotor has balance type &quot;H&quot; (standard type), the featherkey must be cut back to roughly half of its length.</td>
</tr>
<tr>
<td>X Rotor out of true, shaft bent</td>
<td>Consult the manufacturing plant.</td>
</tr>
<tr>
<td>X X Poor alignment</td>
<td>Align the machine set; check the coupling. (2)</td>
</tr>
<tr>
<td>X Coupled machine not balanced</td>
<td>Rebalance the coupled machine.</td>
</tr>
<tr>
<td>X Shocks from coupled machine</td>
<td>Check the coupled machine.</td>
</tr>
<tr>
<td>X X Imbalance originating from gearing and foundation</td>
<td>Fix the gearing.</td>
</tr>
<tr>
<td>X X Resonance of the overall system comprising motor and foundation</td>
<td>Stabilize the foundation following consultation.</td>
</tr>
<tr>
<td>X X Changes in foundation</td>
<td>Establish the cause of the changes and eliminate them if necessary; realign the machine.</td>
</tr>
</tbody>
</table>

(1) As well as eliminating the cause of the fault (as described under "Remedial measures"), you must also rectify any damage the machine might have sustained.

(2) Take any changes into account when warming up the machine.
9.1 Maintenance and servicing

9.1.1 Safety information

**DANGER**
Risk of electric shock from touching live parts
Electrical parts conduct hazardous voltages. Touching these parts will result in an electric shock,
which in turn causes death or serious injury.
Before starting work on the machines, make sure that the plant or system has been
disconnected in a manner that is compliant with the appropriate specifications and regulations. In addition to the main currents, make sure that supplementary and auxiliary circuits, particularly in heating devices, are also disconnected.

**WARNING**
Risk of burns
Certain parts of the machine may reach temperatures above 100 °C. Touching them can result in burns.
Check the temperature of the parts before touching them and take appropriate protective measures if necessary.

**CAUTION**
Personal protective gear when using chemical cleaning agents
Chemical cleaning agents can be caustic or give off dangerous fumes.
Contact with skin or breathing in fumes can cause injuries such as chemical burns on the skin or airways, or skin irritation.
During cleaning, make sure that appropriate methods of extracting fumes are in place and that personal protective gear such as gloves, goggles, face masks or similar are worn.
If you use chemical cleaning agents, observe the instructions and any warnings given in the relevant safety data sheet. The chemical cleaning agents used must be compatible with the machine’s components, particularly where plastic components are concerned.
9.1 Maintenance and servicing

Note
Operating conditions and characteristics can vary widely. For this reason, only general maintenance intervals can be specified here.

9.1.2 Regreasing intervals and types of grease for operating rolling-contact bearings

Regreasing intervals
The regreasing intervals in operating hours and the grease type are stated on the machine's lubricant plate. Regardless of the actual number of operating hours reached, the machine must be regreased at least once a year. The lubrication information can be found on the lubricant plate.

Grease types
For the standard range of applications, a grease for temperatures down to -20 °C is normally used for the initial greasing of the bearings. If the motors were ordered for use in the extended temperature range of below -20 °C, the permissible type of grease is indicated on the lubrication instruction plate. The following high-quality greases for rolling-contact bearings are suitable and tested for temperatures down to -20 °C.

Table 9-1 Suitable greases for rolling-contact bearings down to -20°C

<table>
<thead>
<tr>
<th>K3N greases</th>
<th>CP Nr. 337-161-916</th>
<th>NLGI Nr. 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>ARAL / Aralub 4340</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DEA / Glissando 30</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ESSO / Beacon 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ESSO / Unirex N3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FUCHS / Renolit FWA 220</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SHELL / Alvania RL3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WINTERSHALL / Wiolub LFK 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MOBIL / Mobilith SHC 100</td>
<td>CP Nr. 337-161-916</td>
<td>NLGI Nr. 2</td>
</tr>
<tr>
<td>SHELL / Cyprina</td>
<td>-</td>
<td>NLGI Nr. 3</td>
</tr>
</tbody>
</table>

These greases have lithium soap as the thickening agent and mineral oil as the base oil. They exceed the standard requirements of DIN 51825 in several important respects, and are therefore compatible with the specified regreasing intervals.

The regreasing intervals should be halved if other K3N greases that possibly only fulfill the minimum requirements laid down in DIN 51825 are used.
Damage due to mixing lubricant types
Mixing greases and oils which are based on different types of soap or oil can degrade their lubrication properties.
Mixing low temperature grease with normal temperature grease can cause lumps to form in the lubricant. This can result in thermal damage to the rolling-contact bearing.
Never mix greases that have different thickening agents and different base oils.

Regreasing

- Clean the grease nipples before regreasing, and then gradually press in an appropriate type and amount of grease, as per the information on the lubricant plate.

  The shaft must rotate so that the new grease can be distributed throughout the bearing. The bearing temperature rises sharply at first, then drops to the normal value again after the excess grease has been displaced out of the bearing. The chamber for the used grease is designed for at least 10 regreasing sessions.

- To remove used grease, loosen the outer bearing cap.

  Escaping oil at the bearing or oil escaping during regreasing is an indicator that the space for the used grease has been over-filled. [ID 1025.01]

9.1.3 Cleaning the cooling system

Cleaning the cooling system

To ensure proper functioning of the machine cooling system, the cooling circuits, e.g., the grilles, ducts, ribs, and pipes, must be free of dirt.

- Clean the cooling circuits regularly and remove all dirt.
- Clean the grilles and cooling ribs to remove any dust or dirt.

Risk of corrosion due to condensation

During machine operation, humid air can condense inside the machine. Condensation can collect inside the machine. Damage such as rust can result.

Depending on the environmental and operating conditions, remove the condensation water plugs or screw plugs to drain the water. When you have finished, reattach the condensation water plugs or screw plugs.

If the motor is equipped with condensate drain holes and draining plugs, the water can drain off automatically.

[ID 1087.01]
9.1.4 Servicing

9.1.4.1 Inspection notes for rolling-contact bearings

Inspections in the event of faults
Perform an inspection immediately in the event of faults or exceptional operating conditions indicating an electrical or mechanical overload, e.g., overload, short circuit.

Inspecting rolling-contact bearings
When inspecting rolling-contact bearings, it is generally not necessary to dismantle the machines. The motor only has to be dismantled if the bearings are to be replaced.

Note
Observe the regreasing intervals for the rolling-contact bearings
The regreasing intervals for rolling-contact bearings are different from the inspection intervals. Failure to regrease the rolling-contact bearings at the specified intervals can result in them sustaining damage.

Note
Remove spent grease before regreasing
The rolling-contact bearing's spent grease chamber only has room for a limited amount of spent grease. When the spent grease chamber is full, the spent grease must be removed before regreasing; otherwise it will escape into the interior of the machine. Escaping oil at the bearing or oil escaping during regreasing is an indicator that the space for the spent grease is full. [ID 53.01]

9.1.4.2 First service after installation or repair
Perform the following checks after approximately 500 operating hours or 1 year, whichever comes first:

• While the motor is running, check that:
  – The stated electrical characteristics are being observed
  – The permissible bearing temperatures are not being exceeded
  – The smooth running characteristics and machine running noise have not deteriorated

• Once the machine has been shut down, check that its foundation has no indentations or cracks

Further checks may be required if so specified in supplementary instructions or in accordance with the plant-specific conditions. Immediately eliminate impermissible deviations or changes detected while carrying out checks. [ID 56.02]
9.1.4.3 General inspection

Items for inspection

Perform the following checks after approx. 16,000 operating hours or 2 years, whichever comes first:

- While the motor is running, check that:
  - The stated electrical characteristics are being observed
  - The permissible bearing temperatures are not being exceeded
  - The smooth running characteristics and machine running noise have not deteriorated

- Once the machine has been shut down, check that:
  - The motor foundation has no indentations or cracks
  - The machine is aligned within the permissible tolerance ranges
  - All the fixing bolts/screws for the mechanical and electrical connections have been securely tightened
  - The winding insulation resistances are sufficiently high
  - Any bearing insulation has been fitted as shown on plates and labeling.
  - Cables and insulating parts and components are in good condition and there is no evidence of discoloring

CAUTION

If you detect any defects or malfunctions during the inspection, you must rectify them immediately. They may otherwise cause damage to the machine.

9.2 Corrective Maintenance

9.2.1 Dismantling

Note

If the motor has to be transported, please observe the information and instructions in the chapter titled "Transport and storage".
**Maintenance**

**9.2 Corrective Maintenance**

**Procedure**

1. The drawings and parts lists do not contain any detailed information about the type and dimensions of fixing elements. For this reason, you should establish this information when dismantling them and make a note of it for the purpose of reassembly.

2. Before pulling off any parts that have been screwed on, replace two of the fixing bolts at the top with excessively long or threaded bolts. This ensures that the part is supported after it is pulled off.

3. Use forcing-off bolts or suitable devices to disassemble parts and components attached to the motor shaft.

4. Before lifting off the upper part of the housing, loosen the equipotential bonding conductor and the fixing bolts on the stator housing. Only use the lifting lugs welded onto the upper part of the housing to lift it. The weight of the upper part of the housing can be found in the "Technical data" section.

5. Observe the following when attaching the rotor: The centering recesses in the shaft ends have recessed threads, i.e. DIN 580 eye-bolts are unsuitable to attach the rotor because only a few threads would be engaged. Depending on the rotor weight and load direction, if required, use other suitable elements with a screw-in depth of > 0.8 x thread diameter.

<table>
<thead>
<tr>
<th>WARNING</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Rotor can fall out</strong></td>
</tr>
</tbody>
</table>

If the motor is in a vertical position, the rotor can fall out while work is being performed on the locating bearing. This can result in death, serious injury or material damage.

Support or unload the rotor when carrying out work with the machine in a vertical position.

**See also**

Preparations for use (Page 17)

**9.2.2 Repairing the upper part of the enclosure.**

To make disassembly and assembly of the air intake cowl easier, remove the upper part of the enclosure.

**Dismounting**

Only remove the upper part of the enclosure when it is in a horizontal position.
WARNING

The upper part of the enclosure can fall down

The bracket stops the upper part of the enclosure from falling. If the bracket is removed when the machine is in a vertical position, or if the machine is placed in a vertical position without the upper part of the enclosure secured by the bracket, the upper part of the enclosure can fall. Death, serious injury, or material damage can result.

Only remove the bracket when the machine is in a horizontal position.

1. In machines of vertical construction type, remove the bracket for the upper part of the enclosure when the machine is horizontal.
2. Do not remove the fixing screws on the machine enclosure until then.
3. When assembling the machine, replace the bracket before the machine is placed in a vertical position. Lock the bolts.

- Only use the lifting lugs welded onto the upper part of the housing to lift it. The weight of the upper part of the housing can be found in the “Technical specifications” section.
- Before lifting off the upper part of the housing, loosen the equipotential bonding conductor and the fixing bolts on the stator housing.

Assembly

- Fit the air intake cowl before the upper part of the enclosure. Only fit the upper part of the enclosure and the air intake cowl when the machine is in a horizontal position.
- Do not change the arrangement of the flexible components underneath the bolt heads.
- Apply a soluble adhesive to the set screws e.g. Loctite 243. Tighten the set screws so that the joins with the stator housing are tight all the way round.
- Only use the hoisting lugs welded onto the upper part of the enclosure to lift it. The weight of the upper part of the housing can be found in the “Technical specifications” section.
- After putting it down, secure the equipotential bonding conductors and the fixing screws on the stator housing.
- When securing, ensure that the tensioning straps and the spherical disks are arranged correctly. Tightening torque for the fixing screws is 10Nm.
9.2 Corrective Maintenance

9.2.3 Repairing the air intake cowl

<table>
<thead>
<tr>
<th>![WARNING]</th>
<th>Rotating or live parts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Live electrical parts are dangerous. Contact with them can cause death, serious injury or material damage.</td>
<td></td>
</tr>
<tr>
<td>Before carrying out any maintenance work on the fan, disconnect the mains connection, particularly before opening the terminal box. Make sure that the device cannot be switched back on.</td>
<td></td>
</tr>
</tbody>
</table>

**Dismounting**

The fan cowl is made of sheet steel and welded together.

- Before the fan cowl is removed, unscrew the terminal box for the speed sensor completely so that it is not necessary to undo the connections.

**Assembly**

- When fitting the fan cowl, make sure that the retaining components are correctly installed.
- Check that there is a uniform gap of at least 2mm between the fan impeller and the air inlet nozzle.
- Before you bolt on the protective screen when assembling, make sure that the deflecting baffle with nozzle at the air intake opening is adjusted by means of the clamping pins provided. The radial gap between the air inlet nozzle and the fan impeller should be at least 2 mm.

9.2.4 Repairing the fan

Plastic radial fan impellers have two integrally molded tongues which engage with the circumferential groove of the shaft to provide axial fixing.

**Dismounting**

- Before pulling off the fan, disengage the two tongues hold them provisionally in the raised position, e.g. by means of inserted shim plates.
- Pull off the fan The fan discs each have two openings for the insertion of a pull-off device, which should be applied so as to act on the hub. Always use a suitable device for pulling off and pushing on. Do not use a hammer under any circumstances.

**Assembly**

- Before pushing the fan onto the shaft, make sure that the two integrally molded tongues which provide axial location in the annular groove are intact.
- Push the fan onto the shaft.
Fit the fan cowl

The fan cowl is made of sheet steel and welded together.

- When installing a fan cowl, make sure that the fastening parts such as the rubber bush and thrust pad are intact and installed correctly. Also see the "Ventilation" section in the spare parts list.
- In the case of unidirectional fans, also check the distance between the fan impeller and the air guide nozzle (≥ 2mm).

9.2.5 Repairing rolling-contact bearings

Installing rolling-contact bearings

1. Before installing the bearing, place the parts to be attached to the shaft inside the bearing.
2. Extreme caution and attention to cleanliness are vital to installation.
3. To install the rolling-contact bearing, warm it up using oil or air heated to around 80°C
4. Push the rolling-contact bearing onto the shaft. Avoid any heavy blows that might damage the bearing.
5. Fill the bearing to the top with the specified lubricating grease.
6. After cooling the bearing down, ensure that it is resting against the shaft shoulder. Otherwise, axial vibrations may occur. Use a feeler gauge to check this.

9.2.6 Repairing the rolling contact bearings with labyrinth ring

Dismounting

Apply a protective coating to the shaft in front of and underneath the labyrinth ring to prevent corrosion; the three locating setscrews are secured with adhesive (e.g. Loctite 243).

Figure 9-1 Dismantling the labyrinth ring

- Mark the components of the bearing units so that they can be assembled correctly.
- Remove the protective coating from the shaft in front of the labyrinth ring.
9.2 Corrective Maintenance

- Unscrew the three radially arranged setscrews that ensure axial retention of the ring.
- Screw suitable bolts or screws into the radial threads for pulling off. Be aware of the length of the thread, in order to avoid catching on the shaft or damage to the thread.
- Warm the labyrinth ring as you pull it off.

Assembly

Figure 9-2  Position of the locating setscrews on the labyrinth ring on the outer bearing cap

- Apply a soluble adhesive to the three set screws such as Loctite 243) and screw them partially into the labyrinth ring.
- Apply a coating of anti-corrosion agent to the shaft in the vicinity of the labyrinth ring.
- Before the anti-corrosion agent or the adhesive harden, push the labyrinth ring onto the set screws up to about 3 mm away from the bearing cap and turn the set screws to secure them. Check that the tips of the set screws engage with the keyway with a short axial movement.

The correct axial position is obtained when the locating setscrews screwed into the keyway engage.

9.2.7  Repairing the rolling contact bearings with V ring

The V ring for the outer bearing seal is fitted with a protecting ring.
Dismounting

1. Mark the components of the bearing units so that they can be correctly assembled.
2. When dismantling the V ring, do not dismantle the pressed-in protecting ring.
3. Remove the V ring and bearing cap/end shield from the shaft.
4. Using an appropriate tool, push out the protecting ring. Make sure you do not distort the shape of the ring when you are doing this.

Assembly

1. During installation, ensure that the seating on the shaft is not greased, but that the axial sealing surface is greased.

- The V ring is in the correct axial position when the end face of the bearing cap is flush with the outer edge of the V ring. Use an appropriate auxiliary installation disk for this purpose.
- If a protecting ring made from sheet metal has been fitted in the bearing cap to protect the V ring, when installing the ring, ensure that it is still has sufficient pretension and that one of its two slots lines up with the water drain slot toward the bottom of the bearing cap or end shield.
9.2.8 Installing felt rings for the inner bearing seal

Some motors have felt rings fitted on the inner bearing cover at the non-drive end. The felt ring prevents dust and grease from entering the interior of the machine.

Procedure

- Before installing new felt rings in the bearing cover, soak them in hot oil (approximately 80°C), such as DIN 51517-C100 lubricating oil.
- Dimension the felt ring so that the shaft can move freely, but is still tightly enclosed by the ring.
- Place the felt ring into its notch on the bearing cap and push the bearing cap onto the shaft.

9.2.9 Sealing the motor

Procedure

- Extreme caution and attention to cleanliness are vital to installation.
- Clean bare parts, e.g., between housings, end shields, and bearing bushes, and apply a non-setting permanently plastic sealing agent such as Hylomar MQ32. Follow the manufacturer's application and safety notes when doing this.
- Check the elasticity and age of all sealing elements, such as those on the terminal boxes, and renew them if they are no longer effective.

9.2.10 Tightening torques for screw and bolt connections

Bolt locking devices

- Nuts or bolts that are mounted together with locking, resilient, and/or force-distributing elements must be refitted together with identical, fully-functional elements. Always renew keyed elements.
- When screwing together threads secured with a liquid adhesive, use a suitable medium such as Loctite 243.
- Always use suitable securing devices or removable adhesives (e.g., Loctite) when installing fixing bolts with a clamping length of less than 25 mm. The clamping length is taken as the distance between the head of the bolt and the point at which the bolt is screwed in.
**Tightening torques**

The bolted connections with metal contact surfaces (end shields, bearing cartridge parts, terminal box parts bolted onto the stator frame) should be tightened to the following torques, depending on the thread size.

<table>
<thead>
<tr>
<th>Case</th>
<th>M4</th>
<th>M5</th>
<th>M6</th>
<th>M8</th>
<th>M10</th>
<th>M12</th>
<th>M16</th>
<th>M20</th>
<th>M24</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>1.2</td>
<td>2.5</td>
<td>4</td>
<td>8</td>
<td>13</td>
<td>20</td>
<td>40</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>B</td>
<td>1.3</td>
<td>2.6</td>
<td>4.5</td>
<td>10</td>
<td>20</td>
<td>34</td>
<td>83</td>
<td>160</td>
<td>280</td>
</tr>
<tr>
<td>C</td>
<td>3</td>
<td>5</td>
<td>8</td>
<td>20</td>
<td>40</td>
<td>70</td>
<td>170</td>
<td>340</td>
<td>600</td>
</tr>
</tbody>
</table>

The tightening torques in the different rows apply to the following cases:

- **Case A**
  Applies to electrical connections in which the permissible torque is normally limited by the bolt materials and/or the current carrying capacity of the insulators, with the exception of the busbar connections in case B.

- **Case B**
  Applies to bolts made from lower-strength components (e.g., aluminum) or of property class 8.8 (acc. to ISO 898-1).

- **Case C**
  Applies to bolts of property class 8.8 or A4-70 (acc. to ISO 898-1), but only in connections made from higher-strength components (e.g., gray cast iron, steel or cast steel).

Please refer to the relevant sections and drawings for all other tightening torques (electrical connections and bolted connections for parts with flat gaskets). [ID 78.01]
Spare Parts

10.1 Ordering data

When ordering spare parts, in addition to the precise designation of the spare part, specify the motor type and the serial number of the motor. Ensure that the spare part designation matches the designation in the spare part lists and add the associated part number.

Example:

Bearing shield, drive end (Part 5.00)
Motor type 1RQ6
Serial number N-WOGeneric TEAAC000010001

The machine type and the serial number are indicated on the rating plate and in the technical data, and are also embossed on the drive end of the shaft.

The graphical representations in this chapter show schematic diagrams of the basic versions. They are used for spare parts definitions. The supplied version may differ in details from these representations.

10.2 Replacing rolling-contact bearings

When ordering rolling-contact bearings, in addition to the bearing identification code, the supplementary specifying code is also necessary for the bearing version. Both of these codes are stamped on the lubricant plate and specified in the motor documentation, or can also be taken from the installed bearings.

<table>
<thead>
<tr>
<th>NOTICE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insulating rolling-contact bearings</td>
</tr>
<tr>
<td>If rolling-contact bearings with an insulated outer ring are installed, then you must reinstall such bearings in order to avoid any damage caused by bearing currents.</td>
</tr>
</tbody>
</table>

10.3 Using commercially available spare parts

You can use commercially available, standard components, but ensure that they have the same construction type, dimensions, strength class etc.
10.4 Stator and rotor

Spare Parts

Figure 10-1  Stators and rotors with ventilation on one side.

Table 10-1  Spare parts - Stator and rotor

<table>
<thead>
<tr>
<th>Part</th>
<th>Description</th>
<th>Part</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.20</td>
<td>Fan impeller</td>
<td>10.70</td>
<td>Cover</td>
</tr>
<tr>
<td>7.30</td>
<td>Fan hub</td>
<td>10.71</td>
<td>Cover</td>
</tr>
<tr>
<td>8.03</td>
<td>Rotor, complete (with spider shaft)</td>
<td>10.72</td>
<td>Cover</td>
</tr>
<tr>
<td>10.00</td>
<td>Stator frame with core and winding</td>
<td>30.15</td>
<td>Seal</td>
</tr>
<tr>
<td>10.30</td>
<td>Air guide panel, drive end</td>
<td>30.89</td>
<td>Fastening elements</td>
</tr>
<tr>
<td>10.40</td>
<td>Non drive end air guide panel, two-part (optional)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

[ID 1159.01]
10.5 Upper part of the enclosure

Spare parts

Figure 10-2 Upper part of the enclosure

Table 10-2 Spare parts for the upper part of the enclosure

<table>
<thead>
<tr>
<th>Part</th>
<th>Description</th>
<th>Part</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>17.01</td>
<td>Air intake housing</td>
<td>17.10</td>
<td>Enclosure seal</td>
</tr>
<tr>
<td>17.02</td>
<td>Deflecting baffle with nozzle</td>
<td>17.26</td>
<td>Fan impeller</td>
</tr>
<tr>
<td>17.04</td>
<td>Sealing wall, two-section</td>
<td>17.27</td>
<td>Fan hub (shrunk on)</td>
</tr>
<tr>
<td>17.05</td>
<td>Cover (shaft protection)</td>
<td>31.10</td>
<td>enclosure</td>
</tr>
</tbody>
</table>
10.6 Upper part of the enclosure

Spare parts

<table>
<thead>
<tr>
<th>Part</th>
<th>Description</th>
<th>Part</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>17.051</td>
<td>Fastening elements</td>
<td>31.20</td>
<td>Cover for assembly hatch (with seal)</td>
</tr>
<tr>
<td>17.06</td>
<td>Cover plate for upper part of the enclosure</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

[ID 1160.00]

Figure 10-3 Upper part of the enclosure WPII - fig. 2

Table 10-3  Spare parts for the upper part of the enclosure WPII

<table>
<thead>
<tr>
<th>part</th>
<th>Description</th>
<th>part</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>31.10</td>
<td>enclosure</td>
<td>34.10</td>
<td>Coarse dust panel filter</td>
</tr>
<tr>
<td>31.20</td>
<td>Cover for assembly hatch with seal</td>
<td>34.25</td>
<td>Cover for service hatch</td>
</tr>
</tbody>
</table>

[ID 1040.00]
10.7 Rolling-contact bearings, drive end

Spare parts

Figure 10-4  Rolling contact bearings drive end for model B3

Table 10-4  Spare parts for the rolling contact bearing on the drive end

<table>
<thead>
<tr>
<th>part</th>
<th>Description</th>
<th>part</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.15</td>
<td>Sealing ring (circular)</td>
<td>3.50</td>
<td>Bearing housing</td>
</tr>
<tr>
<td>3.20</td>
<td>Outer bearing cover</td>
<td>3.51</td>
<td>Insulating washer</td>
</tr>
<tr>
<td>3.30</td>
<td>Locking ring</td>
<td>3.52</td>
<td>Insulating ring</td>
</tr>
<tr>
<td>3.35</td>
<td>Grease slinger</td>
<td>3.61</td>
<td>Inner bearing cover</td>
</tr>
<tr>
<td>3.40</td>
<td>Deep-groove ball bearing (locating bearing)</td>
<td>3.85</td>
<td>Grease feed</td>
</tr>
</tbody>
</table>
### 10.8 Rolling-contact bearings, non-drive end

Spare parts

![Diagram of rolling contact bearings non-drive end for model B3](image)

#### Table 10-5  Spare parts for the rolling contact bearing with cover on the non-drive end

<table>
<thead>
<tr>
<th>part</th>
<th>Description</th>
<th>part</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.15</td>
<td>Sealing ring (circular)</td>
<td>4.51</td>
<td>Housing without axial guide, for floating bearing</td>
</tr>
<tr>
<td>4.20</td>
<td>Outer bearing cover</td>
<td>4.52</td>
<td>Bearing housing bushing</td>
</tr>
</tbody>
</table>
### 10.9 Terminal box 1XE1...

#### Spare parts

The neutral box only contains the neutral point. It is not permitted to install any additional equipment.

The base plate is screwed on and is made out of steel. It is not permitted to use it as a cable entry plate. If the terminal box is to be used as a connection box following conversion, a brass plate should be used as the cable entry plate.

Conversion may only be undertaken following consultation with the person responsible for the safety of the equipment and only original parts should be used.

---

<table>
<thead>
<tr>
<th>part</th>
<th>Description</th>
<th>part</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.30</td>
<td>Locking ring</td>
<td>4.61</td>
<td>Inner bearing cover</td>
</tr>
<tr>
<td>4.35</td>
<td>Grease slinger</td>
<td>4.85</td>
<td>Grease feed</td>
</tr>
<tr>
<td>4.40</td>
<td>Cylindrical-roller bearing (floating bearing)</td>
<td>4.94</td>
<td>Fastening elements</td>
</tr>
<tr>
<td>4.50</td>
<td>Bearing housing</td>
<td>6.00</td>
<td>End shield, non-drive end</td>
</tr>
</tbody>
</table>

[ID 1052.01]
### Table 10-6  
**Spare parts list for terminal box 1XE1..**

<table>
<thead>
<tr>
<th>Part</th>
<th>Description</th>
<th>Part</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>20.20</td>
<td>Enclosure</td>
<td>20.50</td>
<td>Entry plate</td>
</tr>
<tr>
<td>20.28</td>
<td>Seal</td>
<td>21.30</td>
<td>Bushing for primary current, complete</td>
</tr>
<tr>
<td>20.30</td>
<td>Cover</td>
<td>22.39</td>
<td>Neutral connection</td>
</tr>
<tr>
<td>20.43</td>
<td>Pressure relief diaphragm</td>
<td>22.92</td>
<td>Hexagon bolt and conical spring washer</td>
</tr>
<tr>
<td>21.43</td>
<td>Pin insulator, large</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

[ID 1058.01]
10.10 Terminal box 1XF4..

Spare parts

The neutral box only contains the neutral point. It is not permitted to install any additional equipment.

Table 10-7 Spare parts list for terminal box 1XF4..

<table>
<thead>
<tr>
<th>Part</th>
<th>Description</th>
<th>Part</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>20.20</td>
<td>Enclosure</td>
<td>21.43</td>
<td>Pin insulator, large</td>
</tr>
<tr>
<td>20.28</td>
<td>Seal</td>
<td>21.44</td>
<td>Pin insulator, small</td>
</tr>
<tr>
<td>20.30</td>
<td>Cover</td>
<td>22.30</td>
<td>Connecting bar for primary current</td>
</tr>
<tr>
<td>20.43</td>
<td>Pressure relief diaphragm</td>
<td>22.39</td>
<td>Neutral connection</td>
</tr>
<tr>
<td>20.50</td>
<td>Entry plate</td>
<td>22.92</td>
<td>Hexagon bolt and conical spring washer</td>
</tr>
<tr>
<td>21.30</td>
<td>Bushing for primary current, complete</td>
<td>22.93</td>
<td>Heating</td>
</tr>
</tbody>
</table>

[ID 1061.01]
10.11 Terminal box 1XD4...

Spare parts

Table 10-8  Spare parts list for terminal box 1XD4..

<table>
<thead>
<tr>
<th>Part</th>
<th>Description</th>
<th>Part</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>20.20</td>
<td>Enclosure</td>
<td>20.50</td>
<td>Entry plate</td>
</tr>
<tr>
<td>20.28</td>
<td>Seal</td>
<td>21.30</td>
<td>Bushing for primary current, complete</td>
</tr>
<tr>
<td>20.30</td>
<td>Cover</td>
<td>22.92</td>
<td>Hexagon bolt and conical spring washer</td>
</tr>
<tr>
<td>20.43</td>
<td>Pressure relief diaphragm</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

[ID 1059.02]
Appendix

A.1 SIEMENS Service Center

Contact for further information

Details regarding the design of this electrical machine and the permissible operating conditions are described in these operating instructions.

If you wish to request a field service visit or order spare parts, please contact your local Siemens sales office. This office will contact the responsible service center on your behalf.

If you have any technical queries or you require additional information, please contact the Siemens Service Center.

Table A-1 Technical support

<table>
<thead>
<tr>
<th></th>
<th>Phone:</th>
<th>Fax:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Europe - Germany:</td>
<td>+49 (0)180 - 50 50 222</td>
<td>+49 (0)180 - 50 50 223</td>
</tr>
<tr>
<td>America - USA:</td>
<td>+1 423 262 2522</td>
<td></td>
</tr>
<tr>
<td>Asia - China:</td>
<td>+86 1064 719 990</td>
<td></td>
</tr>
<tr>
<td>E-Mail:</td>
<td><a href="mailto:support.automation@siemens.com">support.automation@siemens.com</a></td>
<td></td>
</tr>
<tr>
<td>Internet English:</td>
<td><a href="http://www.siemens.com/automation/support-request">http://www.siemens.com/automation/support-request</a></td>
<td></td>
</tr>
<tr>
<td>Internet Deutsch:</td>
<td><a href="http://www.siemens.de/automation/support-request">http://www.siemens.de/automation/support-request</a></td>
<td></td>
</tr>
</tbody>
</table>

A.2 Abbreviations

List of abbreviations/acronyms

Table A-2 Meaning of abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>ATEX</td>
<td>Atmosphères Explosibles</td>
</tr>
<tr>
<td>BGR</td>
<td>Health and safety at work regulations</td>
</tr>
<tr>
<td>BGV</td>
<td>National health and safety at work regulations</td>
</tr>
<tr>
<td>GER</td>
<td>Drive-end(Drive end)</td>
</tr>
<tr>
<td>DIN</td>
<td>German Institute for Standardization (DIN)</td>
</tr>
<tr>
<td>EMC</td>
<td>Electromagnetic Compatibility</td>
</tr>
<tr>
<td>EN</td>
<td>European Standard</td>
</tr>
<tr>
<td>GFP</td>
<td>Glass fiber reinforced plastic</td>
</tr>
<tr>
<td>IEC</td>
<td>International Electrotechnical Commission</td>
</tr>
<tr>
<td>Abbreviation</td>
<td>Meaning</td>
</tr>
<tr>
<td>--------------</td>
<td>-------------------------------------------------------------------------</td>
</tr>
<tr>
<td>IM</td>
<td>International Mounting (installation methods)</td>
</tr>
<tr>
<td>IP</td>
<td>International Protection</td>
</tr>
<tr>
<td>ISO</td>
<td>International Organisation for Standardization (International Standards Organization)</td>
</tr>
<tr>
<td>NDE</td>
<td>Non-drive-end (Non-drive end)</td>
</tr>
<tr>
<td>NEC</td>
<td>National Electrical Code</td>
</tr>
<tr>
<td>NEMA</td>
<td>National Electrical Manufacturers Association</td>
</tr>
<tr>
<td>NTC</td>
<td>Negative Temperature Coefficient (Negative Temperature coefficient)</td>
</tr>
<tr>
<td>PTC</td>
<td>Positive Temperature Coefficient (Positive Temperature Coefficient)</td>
</tr>
<tr>
<td>WP II</td>
<td>Weather Protected II</td>
</tr>
</tbody>
</table>
A.3 Technical specifications

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