SIEMENS

Edition
04/2022

OPERATING INSTRUCTIONS

SIMOTICS SD
Low Voltage Motors

1LE7
SH 71 ... 315

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SIEMENS

SIMOTICS SD

Low-Voltage Motors
1LE7 shaft heights 71 ... 315

Operating Instructions

04/2022
A5E51692753A-AA

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

indicates that minor personal injury can result if proper precautions are not taken.

NOTICE

indicates that property damage can result if proper precautions are not taken.

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 product/system described in this documentation may be operated only by **personnel qualified** for the specific task in accordance with the relevant documentation, in particular its warning notices and safety instructions. Qualified personnel are those who, based on their training and experience, are capable of identifying risks and avoiding potential hazards when working with these products/systems.

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 complied with. The information in the relevant documentation must be observed.

Trademarks

All names identified by ® are registered trademarks of 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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Table of contents

Introduction 1

1.1 About these instructions

These instructions describe the motor and explain how to handle it, from initial delivery to final disposal of the equipment. Keep these instructions for later use.

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

Safety instructions and handling-related warning notes are provided in these instructions. When carrying out any activity at or with the motor, carefully comply with all of these notes for your own safety, to protect other people and to avoid material damage.

Please contact the Service Center if you have any suggestions on how to improve this document.

Text format features

You can find the following text format features in these instructions:

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:

This note provides you with additional information about the product itself, handling the product - and the relevant documentation.

1.2 My support

mySupport

Extensive assistance and more information can be found under the following link:

My Support Links and Tools
(https://support.industry.siemens.com/my/WW/en/documentation)

You can individually compile your personal library, e.g. for your documentation based on Siemens content, and adapt it for your own machine documentation.

To do so, click "My Documentation".

Note

If you want to use this function, you must register once.

Later, you can log on with your login data.

You can create your own personal library under "mySupport" using the following procedure.

Precondition

You have registered for and logged on to "Siemens Industry Online Support", hereinafter referred to as "SIOS".

SIOS (https://support.industry.siemens.com/cs/ww/en/)

Procedure for creating a personal library

1. Open SIOS and log on.
2. Enter the product you are looking for under "Search for product info" and press "Enter".
3. Select the doc. class you want, e.g. "Manual", under "Entry type".
4. Click on your desired manual under the entries.
5. Click on "Add to mySupport documentation".
6. Enter a title.
7. Press "OK".

The selected manual can be found under "mySupport". To find further functions, click on the icon located to the right of the document.

In this way, you can create your own library and quickly access your documentation.

Safety information

2

2.1 Information for those responsible for the plant or system

This motor has been designed and built in accordance with the specifications contained in Directive 2014/35/EU ("Low-Voltage Directive") and IEC 60034, and is intended for use in industrial plants. Please observe the country-specific regulations when using the motor outside India. Follow the local and industry-specific safety and setup regulations.

The persons responsible for the plant must ensure the following:

- Planning and configuration work and all work carried out on and with the motor is only to be done by qualified personnel.
- The operating instructions must always be available for all work.
- The technical data as well as the specifications relating to the permissible installation, connection, ambient and operating conditions are taken into account at all times.
- The specific setup and safety regulations as well as regulations on the use of personal protective equipment are observed.

Note

Use the services and support provided by the local service center for planning, installation, commissioning and service work.

2.2 The 5 safety rules

To ensure your own personal safety as well as to avoid material damage, always comply with the safety-relevant instructions when carrying out any work. Also carefully comply with the 5 safety rules according to EN 50110-1 "Working in a no-voltage state" in the specified sequence.

5 safety rules

1. Disconnect the system.

   Also disconnect the ancillary circuits, for example, anti-condensation heating.

2. Secure against reconnection.
3. Verify absence of operating voltage.
4. Ground and short-circuit.
5. Provide protection against adjacent live parts.

To energize the system, apply the measures in reverse order.

2.3 Qualified personnel

All work at the motor must be carried out by qualified personnel only. For the purpose of this documentation, qualified personnel is taken to mean people who fulfill the following requirements:

- Through appropriate training and experience, they are able to recognize and avoid risks and potential dangers in their particular field of activity.
- They have been instructed to carry out work on the motor by the appropriate person responsible.

2.4 Safe handling

Workplace safety depends on the attentiveness, care, and common sense of the personnel who install, operate, and maintain the motor. In addition to the safety measures cited, as a matter of principle, the use of caution is necessary when you are near the motor. Always pay attention to your safety.

Also observe the following to prevent accidents:

- General safety regulations applicable in the country where the motor is deployed
- Manufacturer-specific and application-specific regulations
- Special agreements made with the operator
- Separate safety instructions supplied with the motor
- Safety symbols and instructions on the motor and its packaging

Danger as a result of stationary parts under voltage (live parts)

Live parts represent a hazard. Touch protection against active (live) parts is no longer guaranteed if covers are removed. The minimum clearance and creepage distances may be violated when coming close to live parts. Touching or coming close to them can result in death, serious injury or material damage.

- Ensure that all live parts are suitably covered.
- Switch off and disconnect the motor first if you want to remove covers. Observe the "5 safety rules" (Page 11).

Risk of injury due to rotating parts

Rotating parts are dangerous. Touch protection against rotating parts is no longer guaranteed if covers are removed. Touching rotating parts can result in death, serious injury or material damage.

- Ensure that all rotating parts are reliably covered.
- Switch off and disconnect the motor first if you want to remove covers. Observe the "5 safety rules" (Page 11).
- Only remove covers when the rotating parts have come to a complete standstill.

Risk of burns due to hot surfaces

Individual motor parts can become hot in operation. Burns can result when coming into contact with these parts.

- Never touch motor parts during operation.
- Allow the motor to cool before starting work on the motor.
- Check the temperature of parts before touching them. If required, wear suitable protective equipment.

Health hazard due to chemical substances

Chemical substances required for the setup, operation and maintenance of motors can present a health risk.

- Observe the product information provided by the manufacturer.

Flammable substances hazard

Chemical substances required for the setup, operation and maintenance of motors may be flammable. These substances can ignite if handled incorrectly. They can cause burns and property damage.

- Observe the product information provided by the manufacturer.

Noise emissions

During operation, the motor's noise emission levels can exceed those permitted at the workplace, which can cause hearing damage.

- Ensure that nobody is in the area of increased noise emissions during motor operation.
- Take steps to reduce noise so that the motor can be operated safely within your system. The following measures may help to reduce noise:
  - Covers
  - Noise insulation
  - Hearing protection measures

Prevention of hearing damage

If the permissible sound pressure level is exceeded, hearing damage can occur when operating three-phase motors at their rated power. The permissible sound pressure level is 70 dB (A).

2.5 Electromagnetic fields when operating electrical power engineering installations

Electrical power equipment generate electromagnetic fields during operation. Potentially lethal malfunctions can occur in medical implants, e.g. pacemakers, in the vicinity of electrical power equipment. Data may be lost on magnetic or electronic data carriers.

- Protect the personnel working in the plant by taking appropriate measures, such as erecting identifying markings, safety barriers and warning signs and giving safety talks.
- Observe the nationally applicable health and safety regulations.
- It is forbidden for people with pacemakers to be close to the motor.
- Do not carry any magnetic or electronic data media.

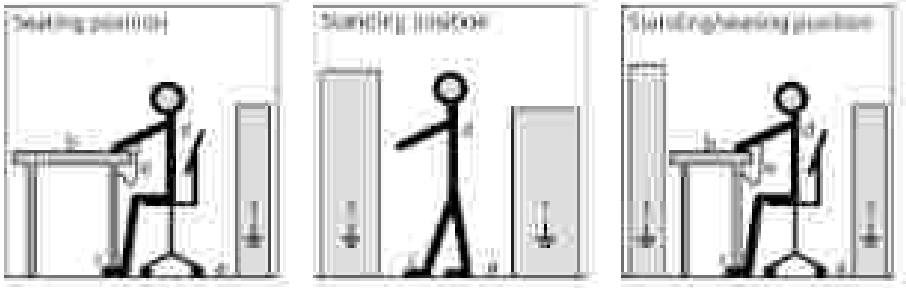
2.6 Electrostatic sensitive devices

Material damage due to electrostatic discharge

Electronic modules contain components that can be destroyed by electrostatic discharge. These components can be damaged or destroyed if they are not handled correctly. To protect equipment against damage, follow the instructions given below.

- Only touch electronic modules if you absolutely have to work on them.
- The body of the person concerned must have been electrostatically discharged and grounded immediately before any electronic modules are touched.
- Electronic modules should not be brought into contact with electrically insulating materials, such as:
  - Plastic film
  - Plastic parts
  - Insulating table supports
  - Clothing made of synthetic fibers
- Always place electrostatic sensitive devices on conductive bases.
- Always pack, store and transport electronic modules or components in conductive packaging, such as:
  - Metallized plastic or metal containers
  - Conductive foam material
  - Domestic aluminum foil

The ESD protective measures required for components that can be destroyed due to electrostatic discharge are shown in the following drawings.



a = conductive floor surface b = ESD table c = ESD shoes
d = ESD overall e = ESD wristband f = cabinet ground connection

2.7 Electromagnetic compatibility

This motor is designed in accordance with IEC/EN 61000-6, and when used as specified, it complies with the requirements of European Directive 2014/30/EU regarding Electromagnetic Compatibility.

2.8 Interference compatibility

By selecting suitable signal cables and evaluation units, ensure that the interference immunity of the motor is not diminished.

2.9 Influence on the line power supply through a strongly irregular torque

A strongly irregular torque, for example with the drive of a reciprocating motor, forces a non-sinusoidal motor current. The emerging harmonics can have an impermissible influence on the line power supply via the connection lines.

2.10 Interference voltages when operating the converter

When a converter is in operation, 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.

- Comply with the EMC information provided by the manufacturer of the converter. This is how you prevent the limit values stipulated by IEC/EN 61000-6-2 and IEC/EN 61000-6-4 for the drive system (consisting of the motor and converter) from being exceeded.
- You must put appropriate EMC measures in place.

2.11 Special designs and construction versions

Before carry out any work on the motor, determine the motor version.

If there are any deviations or uncertainty, contact the manufacturer, specifying the type designation and serial number (see the rating plate), or contact the Service Center.

Description

3

3.1 Area of application

⚠WARNING

Risk of explosion

This motor is not designed for use in hazardous areas. An explosion can occur if the motor is operated in these areas. This can result in death, serious injury or material damage.

- Never operate this motor in hazardous areas.

The rotating electrical motors of this series are used as industrial drives. They are designed for a wide range of drive applications both for line operation as well as in conjunction with frequency converters. They are characterized by their high power density, extreme robustness, long service life and outstanding reliability.

Correct and intended use of the motors

These motors are intended for industrial installations. They comply with the harmonized standards of the series EN / IEC 60034 (VDE 0530). It is prohibited to use these motors in hazardous zones if the marking on the motor rating plate does not explicitly permit line or converter operation. If furthermore wide-ranging demands (e.g. protection so that they cannot be touched by children) are made in special cases – i.e. use in non-industrial installations – these conditions must be complied by the customer.

Note

Motor directive

Low-voltage motors are components designed for installation in machines in accordance with the current Machinery Directive. Commissioning is prohibited until it has been absolutely identified that the end product is in conformance with this Directive. Comply with standard EN / IEC 60204-1.

CE

Use of motors without CE marking

Motors without CE marking are intended for operation outside the European Economic Area (EEA). Do not use any motors without a CE marking in the EEA!

UK CA

Using motors without UKCA marking

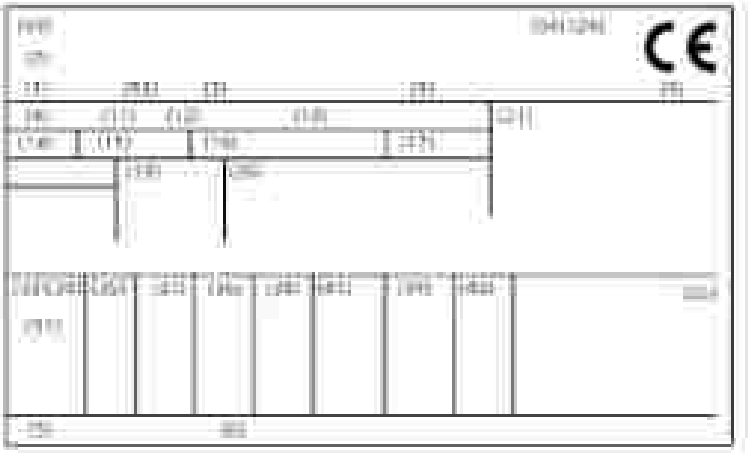
Do not use any motors without UKCA marking in Great Britain (England, Wales and Scotland).

3.2 Rating plates

Rating plate

The rating plate shows the identification data and the most important technical data. The data on the rating plate and the contractual agreements define the limits of proper usage.

Data on the rating plate



Item	Description	Item	Description
General data		Electrical data	
1	Type of motor	31	Electrical data
2	Motor type	32	Rated voltage V
3	Serial number (incl. date of manufacture YY.MM)	34	Winding connection
4	Standards	35	Frequency Hz
5	Additional details (optional)	36	Rated power kW
6	Customer data (optional)	37	Rated current A
7	Country of origin	38	Power factor cos φ
8	Identification number of testing agency (optional)	39	Rated speed rpm
09	Certifying logo	40	Efficiency class
56	Covered wheelset box	41	Efficiency
55	(S mark)		
Mechanical data			
11	Frame size	17	Installation altitude (only if higher than 1000 m)
12	Type of construction	18	Bearing type
13	Degree of protection	20	Refrigerant/oil data (specification) (optional)
14	Motor weight kg	21	Brake data (optional)
15	Temperature class	24	Feather key arrangement
16	Ambient temperature range (optional)		

3.3 Installation

The regulations and standards used as the base for designing and testing this motor are stamped on the rating plate. The motor design basically complies with the following standards:

Table 3-1 Applicable general regulations

Feature	Standard	
Dimensioning and operating behavior	EN / IEC 60034-1	IS 12615, IS/IEC 60034-1
Procedure for determining the losses and the efficiency of rotating electrical motors and inspections	EN / IEC 60034-2-1	IS 12615
Degree of protection	EN / IEC 60034-5	IS/IEC 60034-5
Cooling	EN / IEC 60034-6	
Type of construction	EN / IEC 60034-7	IS 2253
Dimensions of three-phase foot-mounted induction motors		IS 1231
Dimensions of three-phase flange-mounted induction motors		IS 2223
Terminal markings and direction of rotation	EN / IEC 60034-8	IS/IEC 60034-8
Starting characteristics of rotating motors	EN / IEC 60034-12	IS 13555
Vibration severity grades	EN / IEC 60034-14	IS 12075
Efficiency classification of three-phase squirrel-cage induction motors	EN / IEC 60034-30-1	IS 13555
IEC standard voltages	IEC 60038	IS 12360
Code of practice for earthing		IS 3043
Code of practice for installation and maintenance of induction motors		IS 900

1) For ratings with higher losses than the specified values in IEC 60034-12 for NK design, refer to the catalog.

1) LDT shaft heights 71 ... 315

Operating Instructions, 04/2022, A5E51495777A AA

3.3.1 Cooling and ventilation

3.3.1.1 General

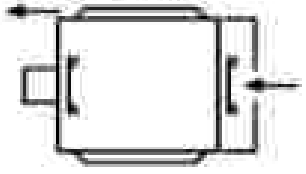
The motors of this series have a closed primary (internal) cooling circuit and an open secondary cooling circuit (surface cooling). The surface cooling varies depending on the version.

3.3.1.2 Motors with a fan

Self-ventilation (standard): Cooling method IC 411 according to EN / IEC 60034-6

Located at the NO end of the stator housing is an air intake cowl that guides the external air on its way to the motor. The external air is drawn in through openings in the air intake cowl and flows axially across the outer cooling ribs of the motor frame. The fan wheel for the external flow of cooling air is attached to the motor shaft.
The fan wheels are bidirectional.
Check the cooling effect below rated speed in the case of frequent switching or braking – or if the speed is controlled continuously below the rated speed.

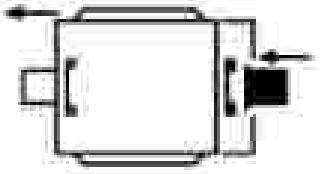
IC411 IC4A1A1



Forced ventilation (optional): Cooling method IC 416 according to EN / IEC 60034-6

Cooling that does not depend on the speed is achieved by means of a unit that is independent of the motor operating state (forced ventilation). This unit is cluded to the outside by a fan cover. It has its own main drive with fan impeller which creates the cooling air flow required for cooling the motor.

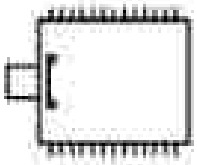
IC416 IC4A1A6



3.3.1.3 Motors without a fan (optional)

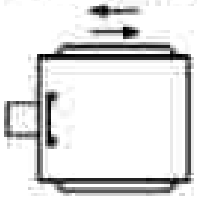
Surface cooling by free convection: Cooling method IC 410 according to EN / IEC 60034-6

IC410 IC4A1A0



Surface cooling by relative movement of cooling air: Cooling method IC 418 according to EN / IEC 60034-6

IC418 IC4A1A8



3.3.2 Bearings

In order to support the motor shaft and maintain its position in the non-moving part of the motor, only two rolling bearings are used. One rolling bearing performs the function of a location bearing that transfers axial and radial forces from the rotating motor shaft to the non-moving part of the motor. The second rolling bearing is implemented as a floating and support bearing in order to allow thermal expansion inside the motor and transfer radial forces.

The nominal (calculated) useful life of the bearings according to ISO 281 is at least 50,000 hours if the motor is coupled via a direct flexible coupling. However, the achievable useful life of the bearings can be significantly longer in the case of lower forces (e.g. operation with self-aligning couplings).

Rolling bearings with permanent lubrication are maintenance-free.

The motor is equipped with grease-lubricated rolling bearings.

- In the standard version, the bearings of motors up to shaft height 200 are permanently lubricated.
- The bearings of motors from shaft height 225 and above are equipped with a button head grease nipple.

3.3.3 Balancing

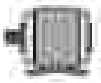
As standard, the motor is designed with vibration severity level A, the rotor is dynamically balanced with a half feather key (code "F").
Vibration severity level B can be ordered as option, and stamped on the rating plate.

1) LSY: shaft heights 71 ... 315

3.3.4 Types of construction/method of installation

The type of construction of the motor is stated on the rating plate.

Table 3-2 Type of construction

Basic type of construction code	Diagram	Other methods of installation	Diagram
IM B3 (IM 1001)		IM V5 (IM 1011)	
		IM V6 (IM 1031)	
		IM B6 (IM 1051)	
		IM B7 (IM 1061)	
		IM B8 (IM 1071)	
IM B5 (IM 3001)		IM V1 (IM 3011)	
		IM V3 (IM 3031)	
IM B14 (IM 3601)		IM V18 (IM 3611)	
		IM V19 (IM 3621)	
IM B35 (IM 2001)			
IM B34 (IM 2101)			

3.3.5 Degree of protection

The motor has a type of protection as stamped on the rating plate, and can be installed in dusty or humid environments.

3.3.6 Environmental conditions

Limit values for the standard version

Ambient temperature	-20 °C up +55 °C
Installation altitude	≤ 1000 m
Air with normal oxygen content, usually	21 % (v/v)

The standard motors are not suitable for use in corrosive atmospheres, atmospheres with a high salt content, or outdoor applications.

Limit values for the special versions

If the environmental conditions are different from the details listed here, then the values on the rating plate or in the catalog will apply.

3.3.7 Optional built-on and built-in accessories

Motors can be equipped with the following integrated components/devices:

- Temperature sensors integrated in the stator winding in order to monitor the temperature and protect the stator winding from overheating.
- Anti-condensation heating for motors whose windings are subject to a risk of condensation due to the climatic conditions.

Motors can be equipped with the following mounted components/devices:

- Brake
- Rotary pulse encoder
- Separately driven fan (forced ventilation)
- Measuring nipple for SPM shock pulse measurement for bearing monitoring

Note
Further documents

Observe all of the other documents provided with this motor.

Supplementary devices:

Depending on the order, various supplementary devices can be installed or mounted. These include sensors for bearing temperature monitoring or winding monitoring, for example.

Preparing for use

4

Good planning and preparation of motor applications are essential in terms of keeping installation simple and avoiding errors, ensuring safe operation, and allowing access to the motor for servicing and corrective maintenance.

This chapter outlines what you need to consider when engineering/configuring your plant in relation to the motor and the preparations you need to make before the motor is delivered.

4.1 Safety-related aspects to consider when configuring the plant

A number of residual risks are associated with the motor. These are described in Chapter "Safety information (Page 11)" and related sections.

Take appropriate safety precautions (covers, barriers, markings, etc.) to ensure the motor is operated safely within your plant.

4.2 Observing the operating mode

Observe the motor's operating mode. Use a suitable control system to prevent overspeeds, thus protecting the motor from damage.

4.3 Motors without final paint coating

For motors, which are only delivered with primer, you must paint them to comply with the applicable guidelines for the specific application. The primer alone does not provide adequate corrosion protection.

Please contact the Service Center for recommendations relating to the paint finish.

4.4 Delivery

Checking the delivery for completeness

The drive systems are put together on an individual basis. When you take receipt of the delivery, please check immediately whether the items delivered are in accordance with the accompanying documents. Siemens will not accept any claims relating to items missing from the delivery and which are submitted at a later date.

- Report any apparent transport damage to the delivery agent immediately.
- Report any apparent defects/missing components to the appropriate SIEMENS office immediately.

Archive the safety and commissioning notes provided in the scope of delivery as well as the optionally available operating instructions so that these documents are always easily accessible.

The rating plate optionally enclosed as a loose item with the delivery is provided to enable the motor data to be attached on or near the motor or installation.

4.5 Transport and storage

4.5.1 Safety instructions for transport

Observe the following when carrying out any work on the motor:

- Comply with the general safety instructions (Page 11).
- Comply with the applicable national and sector-specific regulations.
- When using the motor within the European Union, comply with the specifications laid down in EN 50110-1 regarding safe operation of electrical equipment.

The information required to correctly attach, lift and transport the motor - such as weight, center of gravity and attachment points - is provided here:

- Motor dimension drawing and the associated explanations or the technical data
- Transport data
- Rating plate and lifting plate, if available
- Shipping parts list
- Packaging

Danger when incorrectly lifting and transporting

Danger of death, serious injury, or substantial material damage caused by tipping or falling transported goods. Comply with the following safety instructions:

- All work must be performed with due caution and care.
- Comply with any notes in the shipping papers.
- Carefully comply with all of the handling information and markings on the packages whenever transporting and putting the equipment into storage according to ISO 780.
- Only use suitable and adequately dimensioned lifting equipment, transport equipment and industrial trucks.

Danger due to incorrect attachment and lifting

- Ensure that suitable lifting equipment is available.
- Only hoist the goods using the designated hoisting points and/or at marked positions. The attachment points are not dimensioned for additional loads.
- Use suitable strap guiding or spreading devices.
- If not specified otherwise in the transport data, always transport the motor in the position associated with its specific type of construction.

Danger due to damaged attachment points

- Carefully check the attachment points provided on the motor, e.g. attachment eyes, lifting lugs or ring bolts for possible damage. Replace any damaged attachment points.
- Before using, carefully ensure that the attachment points are correctly attached.

Danger when incorrectly transporting the motor suspended from cables or ropes

If you transport the motor suspended from cables or ropes, the cables or ropes can break, e.g. as a result of damage. Further, if not adequately attached, the motor can swing. This can result in death, serious injury, or material damage.

- Use additional, suitable lifting equipment for transport and during installation.
- Two cables alone must be able to carry the complete load.
- Prevent the lifting equipment from sliding by appropriately securing it.
- When using 2-cable lifting equipment, ensure that the maximum angle of inclination is ≤ 45° according to ISO 3266 (DIN 580).
- Align the eyebolts so that the cables used for lifting are aligned with the planes of the eyeplates.

Danger when incorrectly lifting and transporting

The motor can slide or topple over if it is not correctly lifted or transported. This can result in death, serious injury or material damage.

- Use all the lifting eyes on the motor.
- When using the lifting eyes on the motor, do not attach any additional loads or weight. The lifting eyes are only designed for the weight of the motor itself.
- Any eyes that are screwed in must be tightly fastened.
- Eyebolts must be screwed in right up to their supporting surface.
- Comply with the permissible eyebolt loads.
- When necessary, use suitably dimensioned lifting equipment, for example hoisting slings (EN 1492-1) and webbing load restraints (EN 12195-2).

Danger if the motor falls

The attachment points on the motor are designed for the weight of the motor only. If a machine set is lifted and transported at a single motor, this can fracture the attachment point. The motor or machine set may fall. This can result in death, serious injury or material damage.

- Do not lift machine sets by attaching lifting tackle to the individual motors.
- Use only the equipment provided, e.g. the openings or lugs on the base plates, for transporting machine sets. Note the maximum capacity of the lifting lug.
- Never remain under or in the immediate vicinity of the motor when it is lifted.

⚠ WARNING

Danger to life as a result of a motor falling

If the lifting gear or load handling attachments were to fail, the motor could fall. This can result in death, serious injury or material damage.

- In order to gain easy and safe access to the underside of the motor, place it in a secure and raised position.

Note

When lifting the motors for transport, only lift them in a position that corresponds to their basic construction type.

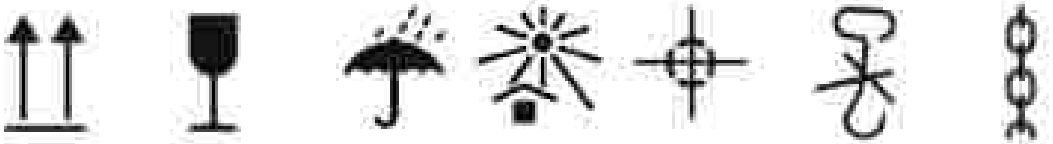
The type of construction of the motor is stated on the rating plate.

4.5.2 Transport

If any transport locks are in place, remove them before commissioning. Store the transport locks or disable them. Use the transport locks when transporting the motor again or reactivate the transport locks.

The motors are packed in different ways depending on how they are transported and their size. If not otherwise contractually agreed, the packaging corresponds to the packing guidelines according to ISPM (International Standards for Phytosanitary Measures).

Comply with the graphic symbols provided on the packaging. Their meaning is as follows:



This way up | Fragile goods | Protect against moisture | Protect against heat | Center of gravity | Hand hooks forbidden | Attach here

4.5.3 Storage

Storing outdoors

NOTICE
Damage to the motor
Damage can occur if incorrectly stored.
Take all precautions to protect the motor under extreme climatic conditions, e.g. salt-laden and/or dusty, moist/humid atmospheres.

Choose a dry storage location which is safe from flooding and free from vibration. Repair any damage to the packaging before putting the equipment into storage if this is necessary to ensure proper storage conditions. In order to ensure protection against ground moisture, locate motors, equipment and crates on pallets, wooden beams or foundations. Prevent equipment from sinking into the ground. Do not impede air circulation under the stored items.

Covers or tarpaulins used to protect the equipment against the weather must not come into contact with the surfaces of the equipment. Use wooden spacer elements to ensure that air can circulate freely around the equipment.

Storing indoors

The storage rooms must provide protection against extreme weather conditions. They must be dry, free from dust, frost and vibration and well ventilated.

Bare metal surfaces

For transport, the bare surfaces (shaft ends, flange surfaces, centering edges) should be coated with an anti-corrosion agent which will last for a limited amount of time (~6 months). Apply suitable anti-corrosion measures for longer storage times.

Condensation drain hole

Open any condensation drain holes to drain the condensation depending on the environmental conditions, every six months at the latest.

Storage temperature

Permissible temperature range: -20 °C to +30 °C

Maximum permissible air humidity: 60%

For motors that have a special design regarding the ambient temperature in the operating state or the installation altitude, other conditions could apply regarding the storage temperature. In this case, refer to the motor rating plate for data on the ambient temperature and installation altitude.

Storage time

Turn the shaft once every year to avoid bearing brinelling. Prolonged storage periods reduce the useful life of the bearing grease (aging).

Open bearings

- For open bearings, e.g. 1E, check the status of the grease when stored for longer than 12 months.
- Replace the grease if it is identified that the grease has lost its lubricating properties or is polluted. The consistency of the grease will change if condensation is allowed to enter.

Closed bearings

- For closed bearings, replace the 0E and N0E bearings after a storage time of 48 months.

NOTICE
Storage
The motor can be damaged if you use it or store it unprotected outdoors. • Protect the motor against intensive solar radiation, rain, snow, ice and dust. Use a superstructure or additional cover, for example. • If required, contact the service center, or technically coordinate outdoors use.

4.5.4 Securing the rotor

Depending on the version, the motor is fitted with a rotor shipping brace. This protects the bearings against damage due to shock and vibration during transport or storage.

NOTICE

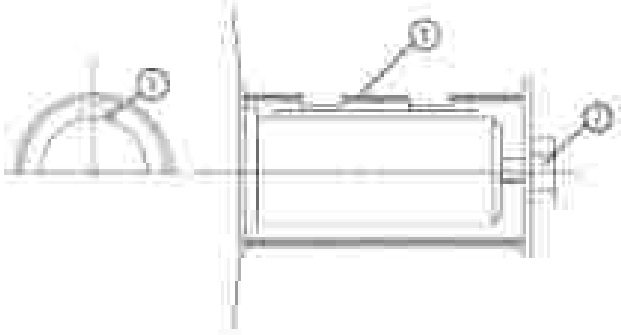
Motor damage due to vibrations

Not using the rotor shipping brace can cause damage to the motor if it is jolted during transport or storage. Material damage can result.

- If the motor is fitted with a rotor shipping brace, this should always be used when transporting the motor. The rotor shipping brace must be attached during the transport.
- Protect the motor against strong radial shocks and vibration when storing, as the rotor shipping brace cannot completely absorb these forces.
- Do not remove the rotor shipping brace until you are ready to push on the output element.
- If the customer already has mounted parts, such as a coupling or belt pulley, the bearings can be damaged during transport. In this case, make sure that the customer uses a rotor shipping brace.
- For motors with a vertical type of construction:
  - Do not remove the rotor shipping brace until the motor is in a vertical position.
  - If a motor has to be transported in a horizontal position, the rotor must be fixed in position before the motor is turned onto its side. Vertical motors can be supplied in the horizontal position from the manufacturing plant.

Alternative rotor bracing

- If you transport the motor after the output element has been pulled on, then you must axially fix the rotor in another way.



① Sleeve ② Shaft screw and washer

Figure 4-1 Axial fastening of the rotor

Thread in the shaft extension	Tightening torque
M16	40 Nm
M20	80 Nm
M24	150 Nm
M30	230 Nm

Tightening torques for solid rotor shipping brace types

- The thread in the shaft extension indicates the rotor weight. This indirectly specifies the required preload force when axially fastening the rotor.

Thread in the shaft extension	Preload
M16	13 kN
M20	20 kN
M24	30 kN
M30	40 kN

Axial preload force for solid rotor shipping brace types

Storing the rotor locking device

Store the rotor locking device in a safe place. It must be remounted if the motor is removed and shipped on further.

4.5.5 Commissioning after storage

4.5.5.1 Insulation resistance and polarization index

Measuring the insulation resistance and polarization index (PI) provides information on the condition of the motor. It is therefore important to check the insulation resistance and the polarization index at the following times:

- Before starting up a motor for the first time
- After an extended period in storage or downtime
- Within the scope of maintenance work

The following information is provided regarding the state of the winding insulation:

- Is the winding head insulation conductively contaminated?
- Has the winding insulation absorbed moisture?

As such, you can determine whether the motor needs commissioning or any necessary measures such as cleaning and/or drying the winding:

- Can the motor be put into operation?
- Must the windings be cleaned or dried?

Detailed information on testing and the limit values can be found here:

Checking the insulation resistance (Page 45)

4.5.5.2 Regreasing rolling bearings after storage periods of up to two years

- For motors with regreasing systems, briefly lubricate both bearings after commissioning with the motor running as a precautionary measure.
- Grease type, grease quantity and relubrication intervals for the regreasing system are stamped on the rating plate attached to the motor.

4.5.5.3 Releasing the rotor shipping brace before commissioning

If one is being used, release the rotor shipping brace before commissioning.

4.6 Ensure adequate cooling

⚠ WARNING

Overheating and failure of the motor

Death, severe injury or material damage can occur if you do not carefully observe the following points.

- Do not obstruct ventilation.
- Prevent the air expelled by neighboring equipment from being immediately sucked in again.
- For vertical types of motor construction with the air intake from above, protect the air intakes from the ingress of foreign bodies and water.
- If the shaft extension is facing upwards, liquid must be prevented from entering by moving along the shaft.

⚠ WARNING

Damage caused by small parts falling in

Material damage and injury can occur if the fan is destroyed and therefore the motor overheats.

- For types of construction with the shaft extention facing downwards, prevent small parts from falling into the fan cover by providing suitable covers.
- Ensure that the cooling air flow is not reduced as a result of covers and that the minimum air clearances are maintained.

For motors with separately driven fan, install an interlock circuit that prevents the main motor being switched on if the separately driven fan is not operational.

Table 4-7 Air guidance

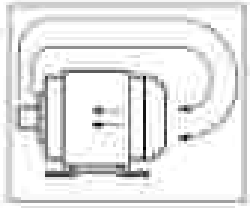
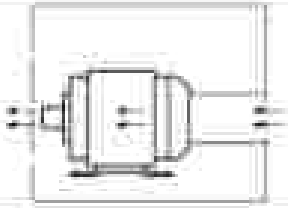
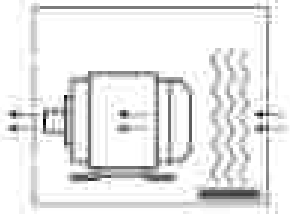
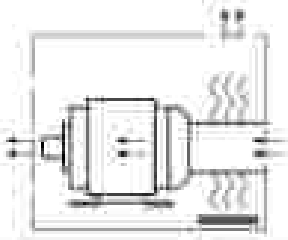
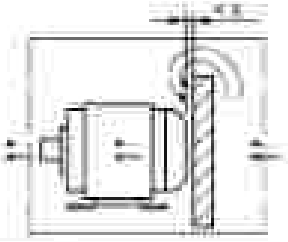
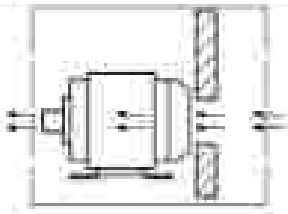
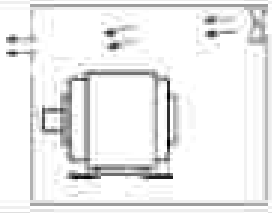
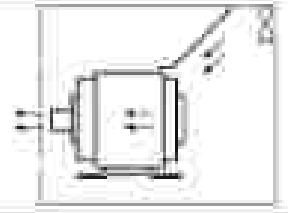
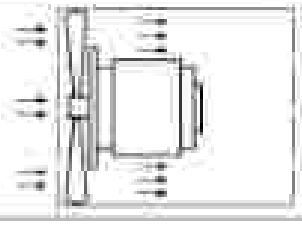
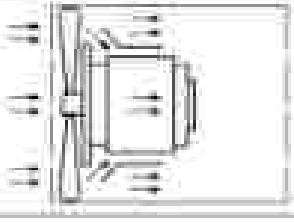
Incorrect	Correct
	
	
	
	
	

Table 4-2: Minimum dimension "a" for the distance between adjacent motors and the air intake of the motor

Shaft height	a mm
71	15
80 ... 100	20
112	25
132	35
160	40
180 ... 200	95
225 ... 250	100
280 ... 315	110

4.7 Interlock circuit for anti-condensation heating

If the anti-condensation heating is operated while the motor is running, this can increase the temperatures inside the motor.

- Install an interlock circuit that switches off the anti-condensation heating once the main motor is switched on.
- Only switch on the anti-condensation heating after the motor has been switched off. Comply with the data stamped on the plate of the anti-condensation heating, if available.

4.8 Noise emission

Prevention of hearing damage

If the permissible sound pressure level is exceeded, hearing damage can occur when operating three-phase motors at their rated power. The permissible sound pressure level is 70 dB (A).

4.9 Voltage and frequency fluctuations during line operation

Unless otherwise stated on the rating plate, the permissible voltage/frequency fluctuation is corresponds to Zone B in IEC / EN 60034-1. Permissible fluctuations that go beyond this are indicated on the rating plate – or for some versions, on a supplementary plate.

Operate the motor in continuous operation in Zone A. Prolonged operation in Zone B is not recommended.

- Exceeding the permissible tolerances for voltage and frequency can lead to an impermissibly high temperature rise of the winding. This can result in long-term damage to the winding.
- Limit excesses of this sort with regard to the values that arise, how often, and for how long they occur.
- Where possible and within a reasonable time take corrective actions such as reducing the power. In this way you can avoid that the service life of the motor is reduced as a result of thermal aging.

4.10 Rotational speed limit values

Danger as a result of resonance within certain speed ranges

At over-critical speeds, motors encounter resonance within certain speed ranges. Such vibrations can reach impermissibly high levels. This can result in death, serious injury or material damage.

- The controller must ensure that those speed ranges are blocked when the converter is in operation. Please note the data on the blocked speed ranges specified in the Electrical Data.
- The blocked speed ranges must be run through rapidly.

Motor damage due to excessively high speeds

Excessive rotational speed can lead to serious damage to the motor. This can result in death, serious injury or material damage.

- Avoid operation above the permissible speed by using the appropriate control function.
- Observe the speeds stamped on the rating plate and in the Electrical Data.

4.11 System-inherent frequencies

Excessively high vibration levels and system resonances can damage the machine set.

- Configure and match the system consisting of the foundation and machine set in such a way that no system resonances can arise and result in the permissible vibration levels being exceeded.
- The vibration values according to DIN ISO 10816-1 must not be exceeded.

4.12 Electromagnetic compatibility

Note

If the torque levels are very unequal (e.g. when a reciprocating compressor is being driven), a non-sinusoidal motor current will be induced whose harmonics can have an impermissible effect on the supply system and cause impermissible interference emissions as a result.

Note

Converter

- If operated with a frequency converter, the emitted interference varies in strength, depending on the design of the converter (type, interference suppression measures, manufacturer).
- Avoid that the specified limit values stipulated for the drive system (consisting of the motor and converter) are exceeded.
- You must observe the EMC information from the manufacturer of the converter.
- The most effective method of shielding is to conductively connect a shielded motor supply cable to the metal terminal box of the motor (with a metal screw connection) over a large surface area.
- On motors with integrated sensors (e.g. PTC thermistors), disturbance voltages caused by the converter may occur on the sensor cable.

When used in accordance with their intended purpose, and operated on a line supply with characteristics according to EN 50160, the encoded motors comply with the requirements of the EC Directive regarding electromagnetic compatibility.

Immunity to interference

The motors fulfill the requirements of interference immunity in conformity with EN / IEC 61000-6-2. For motors with integrated sensors, e.g. PTC thermistors, the operating company must ensure sufficient interference immunity by selecting a suitable sensor signal cable (possibly with shielding, connected in the same way as the motor feeder cable) and a suitable evaluation unit.
When operating the motors from a converter at speeds higher than the rated speed, carefully comply with the mechanical speed limits (safe operating speed EN / IEC 60034-1).

4.13 Converter operation

4.13.1 Parameterizing the converter

- If the design of the motor requires connection to a particular converter type, the rating plate will contain corresponding additional information.
- Correctly parameterize the converter. Parameterizing data can be taken from the motor rating plates.
  You can find parameter data here:
  - In the operating instructions for the converter
  - In the SIZER engineering tool
  - In the SINAMICS Configuration Manual.
- Do not exceed the specified maximum speed limit n_{max}.
- Set the skip frequency band between 38 Hz and 48 Hz (both inclusive) for SH 315 two-pole TEFC motors when operating on VFD.
- Check that the motor is cooled sufficiently for commissioning purposes.

4.13.2 Converter input voltage

The insulation system of SIMOTICS motors always complies with the requirements of stress category B (WC B = high stress). If voltage peaks higher than those specified according to WC B can occur, contact the Service Center.

- For a line supply voltage (converter input voltage) up to max. 480 V, and when controlled from a SINAMICS G/S/SINAMICS S converter with uncontrolled/controlled infeed: Comply with the guidelines for configuring motor and converter.
- Operation with a converter from another manufacturer: Comply with the permissible voltage peaks according to IEC 60034-17-4T in accordance with stress category B, dependent on the particular line voltage (converter input voltage) and the motor insulation system.

NOTICE
Material damage caused by an excessively high supply voltage
The insulation system will be damaged if the supply voltage is too high for the insulation system. This can completely destroy the motor. • Comply with the peak voltages as laid down in the guidelines above.

4.13.3 Reducing bearing currents during operation with converter (low voltage)

Taking the following actions will reduce the bearing currents:

- Ensure that the contacts are made over a large area. Solid copper cables are not suitable for high-frequency grounding because of the skin effect.

Equipotential bonding conductors:

Use equipotential bonding conductors:

- between motor and driven machine
- between motor and converter
- between the terminal box and the HF grounding point at the motor enclosure

Selecting and connecting the cable:

As far as possible, use symmetrically arranged, shielded connection cables. The cable shielding, made up of as many strands as possible, must have good electrical conductivity. Braided shields made of copper or aluminium are very suitable.

- The shield is connected at both ends, at the motor and converter.
- To ensure good discharging of high-frequency currents, provide contacting over a large surface area:
  - as contact established through HF at the converter
  - at the motor, for instance with EMC glands at the cable entries
- If the cable shield is connected as described, then it ensures the specified equipotential bonding between the motor enclosure and converter. A separate HF equipotential bonding conductor is then not necessary.

- If the cable shield is not connected due to special secondary conditions, or not adequately connected, then the specified equipotential bonding is not provided. In this particular case, use a separate HF equipotential bonding conductor.
  - Between the motor enclosure and protective ground rail of the converter.
  - Between motor enclosure and driven machine.
  - Use braided flat copper straps or high-frequency cables with finely-stranded conductors for the separate HF equipotential bonding cable.
  - Ensure that the contacts are made over a large area.

Measures to reduce bearing currents

To specifically reduce bearing currents, you must consider the system as a whole, which comprises the motor, converter, and driven machine. The following measures support you when reducing bearing currents and help to avoid damage:

- In the overall system, set up a properly meshed grounding system with low impedance.
- Use the common-mode filter (damping coil) at the converter output.
- Limit the rise in voltage by using output filters. Output filters dampen the harmonic content in the output voltage.
- The operating instructions for the converter are not part of this documentation. Refer to the configuration information for the converter.

NOTICE
Motor within itself does not induce shaft circulating current to cause bearing failure. Any bearing failure with fluting marks is not to be attributed to motor as a cause. Care must be taken while operating motor with converter to ensure the strict adherence to EMC guidelines by considering motor as a part of a complete system (motor + drive + cabling).

4.13.4 Insulated bearings for converter operation

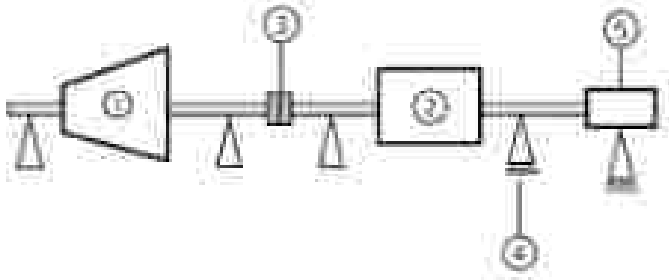
If the motor is controlled from a low-voltage converter, depending on the motor type, an insulated bearing can be fitted at the NDE.

Note

Insulated bearing at NDE is a generally recommended practice. Refer to IEC TS 60034-25 to plan effective countermeasures for reducing bearing currents.

An insulated speed encoder can be optionally mounted.

Comply with the information provided on the motor plates relating to bearing insulation and possible jumpers.



1 Driven machine
2 Motor
3 Coupling
4 Insulated bearings
5 Insulated anti-rotation fitting

Figure 4-2 Schematic representation of a single drive

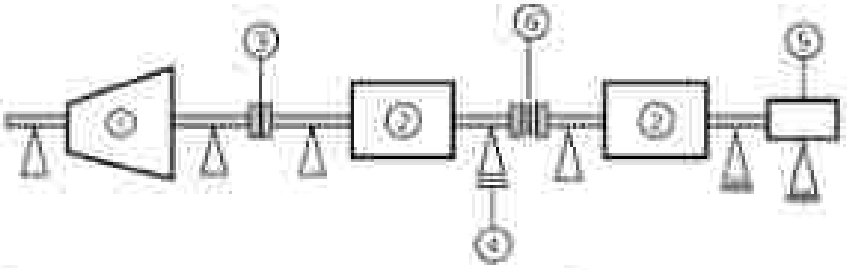
NOTICE

Bearing damage

The bearing insulation must not be bridged. Bearing currents can damage bearings.

- Do not bridge the bearing insulation for subsequent installation work, such as the installation of an automatic lubrication system or a non-insulated vibration sensor.
- Where necessary, contact the Service Center.

If you connect two motors in series in "tandem operation", install an insulated coupling between the motors.



(1) Driven machine
(2) Motor
(3) Coupling
(4) Insulated bearings
(5) Insulated turbomeasuring fitting
(6) Insulated coupling

Figure 4-8 Schematic representation of a tandem drive

NOTICE

Bearing damage

Bearing currents can flow if the coupling between the motors of the tandem drive is not insulated. This can damage the DE bearings of both motors.

- Use an insulated coupling to couple the motors.
- As an alternative for machine operation with low-voltage converter, insulated bearing at DE can be fitted depending on motor type, but a non-conductive coupling is recommended.

4.13.5 Tandem operation

If you connect two motors in series in "tandem operation", locate a coupling between the motors; this coupling should satisfy the Directive 2014/34/EU or the regulations that apply in the country where the equipment is installed.

Installation

5

Observe the following when carrying out any work on the motor:

- Comply with the general safety instructions (Page 11).
- Comply with the applicable national and sector-specific regulations.
- When using the motor within the European Union, comply with the specifications laid down in EN 60110-1 regarding safe operation of electrical equipment.

5.1 Safety instructions for installation

Injury and material damage caused by inappropriate fastening material

If screws of an incorrect property class have been selected or if they have been fastened to an incorrect tightening torque, they may break or become loose. This will cause the motor to move, which could damage the bearings. The rotor could smash into the motor enclosure and motor parts could be flung out of place. This can result in death, serious injury or material damage.

- Comply with the required property classes for screwed connections.
- Tighten the screwed connections to the specified tightening torques.

Injury and material damage caused by incorrect motor alignment

If the motor has not been properly aligned, this will mean the fastening parts are subjected to stress/distortion. Screws may become loose or break, the motor will move, motor parts could be flung out of place. This can result in death, serious injury or material damage.

- Carefully align the motor to the driven machine.

Material damage caused by improper handling

Mounting parts such as temperature sensors or speed sensors are attached to the motor and could be ripped off or destroyed as a result of improper handling. This could lead to motor malfunctions, extending even to total loss of the motor.

- Where necessary, use suitable steps when performing installation work on the motor.
- Do not stand on cables or attachments during installation. Do not use attachments as steps.

Loss of conformity with European directives

In the delivery state, the motor corresponds to the requirements of the European directives. Unauthorized changes or modifications to the motor lead to the loss of conformity with European Directives and the loss of the associated warranty.

5.2 Preparing for installation

5.2.1 Requirements for installation

The following requirements must be satisfied prior to starting installation work:

- Staff have access to the operating and installation instructions.
- The motor is unpacked and ready for mounting at the installation location.
- Measure the insulation resistance of the winding before starting any installation work. If the insulation resistance lies below the specified value, take appropriate remedial measures. These remedial measures may necessitate the motor being removed again and transported.

Note

Note also the technical data on the rating plates on the motor enclosure.

NOTICE

Damage to the motor

To avoid material damage, before commissioning, check whether the correct direction of rotation of the motor has been set on the customer side, e.g. by decoupling from the driven load.

Damage to mounted parts and components as a result of high temperatures

The motor components get very hot during operation. High temperatures can damage parts mounted by customers, such as cables, manufactured out of materials that are not heat resistant.

- Temperature-sensitive parts must not come into contact with or be attached to components mounted on the motor.
- Only use heat-resistant mounting parts. The connecting cables and cable entries must be suitable for the particular application.

5.2.2 Insulation resistance

5.2.2.1 Insulation resistance and polarization index

Measuring the insulation resistance and polarization index (PI) provides information on the condition of the motor. It is therefore important to check the insulation resistance and the polarization index at the following times:

- Before starting up a motor for the first time
- After an extended period in storage or downtime
- Within the scope of maintenance work

The following information is provided regarding the state of the winding insulation:

- Is the winding head insulation conductively contaminated?
- Has the winding insulation absorbed moisture?

As such, you can determine whether the motor needs commissioning or any necessary measures such as cleaning and/or drying the winding:

- Can the motor be put into operation?
- Must the windings be cleaned or dried?

Detailed information on testing and the limit values can be found here:

Checking the insulation resistance (Page 45)

5.2.2.2 Checking the insulation resistance

⚠WARNING

Hazardous voltage at the terminals

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

- If any power cables are connected, check to make sure line supply voltage cannot be delivered.
- Discharge the winding after measurement until the risk is eliminated, e.g. using the following measures:
  - Connect the terminals with the ground potential until the recharge voltage drops to a non-hazardous level.
  - Attach the connection cable.

Measure the insulation resistance

1. Before you begin measuring the insulation resistance, read the operating manual for the insulation resistance meter you are going to use.
2. Make sure that no power cables are connected.
3. Measure the winding temperature and the insulation resistance of the winding in relation to the motor enclosure. The winding temperature should not exceed 50 °C during the measurement. Convert the measured insulation resistances in accordance with the formula to the reference temperature of 50 °C. This thereby ensures that the minimum values specified can be compared.
4. Read out the insulation resistance one minute after applying the measuring voltage.

Conversion to the reference temperature

When measuring with winding temperatures other than 50 °C, convert the measuring value to the reference temperature of 50 °C according to the following equations from IEEE 43-2000.

(1) $R_{50} = K_t \cdot R_t$	R_{50}	Insulation resistance converted to 50 °C reference temperature
	K_t	Temperature coefficient according to equation (2)
	R_t	Measured insulation resistance for measuring winding temperature T in °C
(2) $K_t = [0.5]^{(50-T)/10}$	50	Reference temperature in °C
	10	Halving/doubling of the insulation resistance with 10 K
	T	Measuring/winding temperature in °C

In this case, doubling or halving the insulation resistance at a temperature change of 10 K is used as the basis.

- The insulation resistance halves every time the temperature rises by 10 K.
- The resistance doubles every time the temperature falls by 10 K.

For a winding temperature of approx. 25° C, the minimum insulation resistances are 50 MΩ ($U_N \leq 1000$ V) or 500 MΩ ($U_N > 1000$ V). The values apply for the complete winding to ground. Twice the minimum values apply to the measurement of individual assemblies.

- Dry, new windings have an insulation resistance of between 100 and 2000 MΩ, or possibly even higher values. An insulation resistance value close to the minimum value could be due to moisture and/or dirt accumulation. The size of the winding, the rated voltage and other characteristics affect the insulation resistance and may need to be taken into account when determining measures.
- Over its operating lifetime, the motor winding insulation resistance can drop due to ambient and operational influences. Calculate the critical insulation resistance value depending on the rated voltage by multiplying the rated voltage [kV] by the specific critical resistance value. Convert the value for the current winding temperature at the time of measurement, see above table.

Limit values of the anti-condensation heating insulation resistance

It is not permissible that the insulation resistance of the anti-condensation heating with respect to the motor enclosure falls below 7 MΩ when measured at 500 V DC.

5.2.3 Preparing the assembly area

1. Prepare a suitable assembly area (e.g. assembly stands). Make sure that the assembly area has sufficient clearance from the floor for the DE shaft end. The necessary data is provided in the motor dimension drawing.
2. Refer to the shipping documents to check that all motor components are available for assembly.

5.2.4 Lift the motor to where it will be mounted and position it

- For vertical installation, use all the eyebolts provided and when necessary, hoisting slings according to DIN EN 1492-1 and/or lashing straps according to DIN EN 12195-2 to stabilize the position.
- Prevent foreign bodies from falling into the fan cover. For vertical motor installation with the shaft end facing downwards, attach a protective canopy.
- If the shaft extension is facing upwards, the user must prevent liquid from moving along the shaft and entering the motor.
- Clean bare metal surfaces with anti-corrosion agent using white spirit to ensure proper installation and / or motor mounting.
- Do not obstruct the ventilation. Do not draw in the hot discharged air directly – also from adjacent equipment.
- Avoid exposing them to direct, intense solar radiation, rain, snow, ice, or also dust for extended periods. Attach a covering structure or an additional cover when using or storing outdoors.
- Do not exceed the permissible axial and radial forces.

5.2.5 Motors with type of construction IM B15, IM B9, IM V8 and IM V9

Types of construction without bearings on the drive side

These motors do not have their own bearing system for the motor shaft at the drive end (DE). The motor shaft is accepted by the (hollow) shaft or coupling of the system or driven machine.

- Using the centering edge, the motor is aligned with respect to enclosures, flanges or driven machines.
- Note that the temperature of the motor and motor shaft increases during operation. The thermal expansion of the motor shaft must be compensated by the customer by applying suitable measures.
  Use the spring washers provided to locate the NDE bearing without any play.

NOTICE

Damage to the motor

Material damage can occur if the following notes are not carefully observed.

- The IM B5 bearing shield with integrated distance ring mounted at the drive end (DE) is only used transport lock. A warning label is attached to this bearing shield.
- The spacer ring is not a roller bearing.
- Remove the bearing shield and the spacer ring.
- Remove the transport lock before commissioning.

5.2.6 Foot mounting

Note

Only authorized retrofit partners must be employed to relocate the bolted on mounting feet at the motor enclosure.

After attaching the mounting feet, you must note the following in order to avoid stressing and distorting the motor.

- Ensure that the foot mounting surfaces are aligned in one plane and are parallel to the motor shaft.
- Post-machine the foot mounting surfaces or use thin shims, for example.
- Professionally touch up damaged painted surfaces.
- Observe the information provided in Chapter "Aligning and fixing the motor (Page 49)".

5.3 Aligning and fixing the motor

Observe the following when aligning and mounting:

- Ensure a flat and uniform contact surface for foot and flange mounting.
- When mounting on the wall, support the motor from below, e.g. using a bracket, or bolt it.
- Precisely align the motor when couplings are used.
- Ensure that the mounting surfaces are clean and free of any dirt.
- Remove any anti-corrosion protection using white spirit.
- Avoid installation-related resonances with the rotating frequency and twice the line frequency.
- Note any unusual noise when the rotor is manually turned.
- Check the direction of rotation with the motor uncoupled.
- Avoid rigid couplings.
- Repair any damage to the paint; this must be done immediately and correctly.

5.3.1 Measures for alignment and mounting

The following measures are required in order to compensate any radial offset at the coupling and to horizontally adjust the motor with respect to the driven load.

- **Vertical positioning**
  For vertical mounting positions, avoid deforming the motor by placing shims under the mounting feet. Keep the number of shims low; only use a few stacked shims.
- **Horizontal positioning**
  To position the motor horizontally, shift it sideways on the foundation and ensure that the axial position is maintained (angularity error).
- When positioning the motor, ensure that a uniform axial gap is maintained around the coupling.
- **Smooth running**

  Preconditions for smooth, vibration-free operation:

  - Stable foundation design free of any shock or vibration.
  - A precisely aligned coupling.
  - A self-balanced drive output element (coupling, belt pulleys, fans, ...)

  Maintain the maximum permissible vibration values in operation according to ISO 10816-3.
  Avoid inadmissible vibration caused by imbalance, for example (drive output element), external vibration or any resonance over the complete speed range.
  It may be necessary to completely balance the motor with the drive output element or the system resonance frequency must be shifted.

- **Foot mounting/flange mounting**
  - Use the specified thread size laid down in EN 50347 / IS 1231 / IS 2223 when flanging the motor to a foundation or a motor flange.
  - Mount the motor at all the foot or flanged holes provided. The choice of fixing elements depends on the foundation and is the plant operator's responsibility. Comply with the required property classes for screwed connections and materials for fixing elements.
  - Select the correct screw length for IM B14 flanges.
  - Ensure that the screw heads are in full contact with the flange surface. Use additional flat washers (ISO 7093), especially for elongated foot mounting holes.

5.3.2 Flatness of the supporting surfaces for conventional motors

Shaft height	Flatness [mm]
≤ 132	0.10
160	0.15
≥ 180	0.20

5.3.3 Motor frame mounting feet (special design)

Please note that when the terminal box is mounted at the NDE (option M08), dimension C can deviate from EN 50347 / IS 1231 / IS 2223.
To comply with dimension C according to EN 50347 / IS 1231 / IS 2223 for motors with double or triple holes at the NDE, use the appropriate screw bore.

5.4 Installing the motor

5.4.1 Preconditions for smooth, vibration-free operation

Preconditions for smooth, vibration-free operation:

- Stable foundation design
- Precise alignment of the motor
- Correct balancing of parts to be fitted to the shaft end
- Vibration values in compliance with ISO 10816-3

5.4.2 Aligning the motor to the driven machine and mounting

5.4.2.1 Selecting bolts

- Unless specified otherwise, use fixing screws with at least strength class 8.8 to ISO 898-1 to ensure that the motor is securely mounted and to transmit the torque-generated forces.
- 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, etc.

  Request the foundation force values from the Service Center if required.

5.4.2.2 Horizontal types of construction with mounting feet

1. Refer to any instructions for aligning the driven machine and those of the coupling manufacturer.
2. Align the motor's with coupling output to the driven machine in such a manner that the center axes of the shafts are parallel with no offset. This ensures that no additional forces affect their bearings during operation.
3. For the vertical positioning ($x = 0$) place thin shims under the motor feet. The number of shims should be kept as low as possible, i.e. stack as few as possible. This also prevents the motor being subjected to any stress/distortion. If available, use the existing tapped holes for the forcing-off bolts to somewhat raise the motor.
4. When positioning the motor, ensure that a uniform axial gap ($y = 0$) is maintained around the coupling.
5. Fix the motor to the foundation. The choice of fixing elements depends on the foundation and is the plant operator's responsibility.

Note

Motor expansion

When aligning, make allowance for the thermal expansion of the motor when the temperature increases.

5.4.2.3 Horizontal types of construction with flange

The standard flange is provided with a centering. The choice of fit for the mating flange on the driven machine is the system manufacturer's or the plant operator's responsibility.

If the motor is not fitted with a standard flange, align the motor to suit the driven machine.

Procedure:

The motor axis must be horizontal when it is fitted and the flange must be parallel to the mating flange, so as to avoid seizing and stressing. Otherwise damage to the centering will result.

1. Grease the centering flange with assembly paste to make the process easier.
2. Screw three studs into tapped holes spaced about 120° apart around the driven machine flange. The studs act as positioning aids.
3. Position the motor so that its axis is aligned with that of the driven machine, but not yet quite touching. Advance the motor slowly towards the driven machine; advancing too quickly risks damaging the centering.
4. If necessary, rotate the motor into the right position so that the clearance holes in the flange are central to the tapped holes.
5. Move the motor fully up against the mating flange so that it is fully in contact.
6. Fix the motor using the flange fixing bolts, finishing by replacing the studs.

5.4.2.4 Vertical types of construction with flange

The standard flange is provided with a centering. The choice of fit for the mating flange on the driven machine is the system manufacturer's or the plant operator's responsibility.

If the motor is not fitted with a standard flange, align the motor to suit the driven machine.

Procedure

The motor axis must be vertical when it is lifted and the flange must be parallel to the mating flange, so as to avoid seizing and stressing. Otherwise damage to the centering will result.

1. Grease the centering flange with assembly paste to make the process easier.
2. Screw in two studs into tapped holes on opposite sides of the driven machine flange. The studs act as positioning aids.
3. Lower the motor slowly toward the driven machine and into the centering, so that the flanges do not quite touch. Lowering too quickly risks damaging the centering.
4. If necessary, rotate the motor into the right position so that the clearance holes in the flange are central to the tapped holes.
5. Lower the motor completely onto the mating flange so that it is fully in contact; then remove the studs.
6. Fix the motor using the flange fixing bolts.

5.4.3 Removing the rotor shipping brace

If a rotor shipping brace is attached to the motor, remove it at the last possible moment, for example, when you are ready to push on the output or drive element.

Storing the rotor locking device

Store the rotor locking device in a safe place. It must be remounted if the motor is removed and shipped on further.

5.4.4 Recommended alignment accuracy

The alignment accuracy required depends essentially on the configuration of the overall machine train. Observe the required alignment accuracy of the coupling manufacturer in all cases when aligning the motor.

Table 5- 1 Recommended alignment accuracy

Speed rpm	Parallel offset mm	Angular offset mm per 100 mm coupling diameter
750	0.09	0.09
1500	0.05	0.05
3000	0.03	0.025

1) LSY shaft heights 71 ... 315

5.4.5 Mounting the drive output elements

The motor is dynamically balanced. For shaft extensions with feather keys, the type of balancing is specified using the following coding on the face of the drive end of the shaft extension and on the rating plate:

- "H" means balancing with a half feather key (standard)
- "F" means balancing with a whole feather key
- "N" means balancing without a feather key.

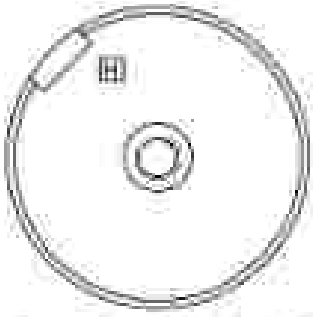


Figure 5-1 DE balancing type

⚠WARNING

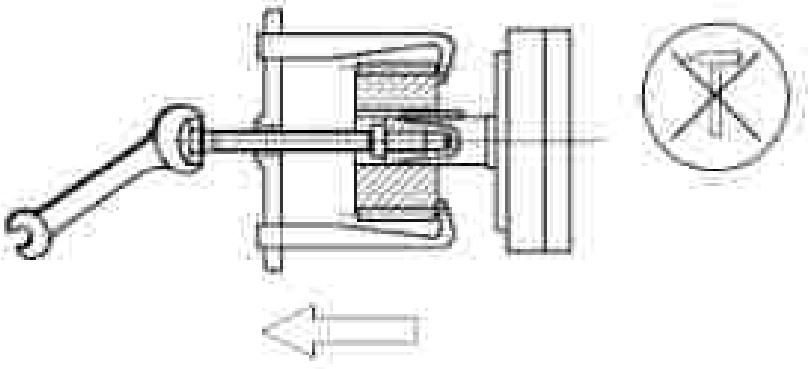
Risk of injury due to incorrect installation or removal

The feather key may be flying out if the motor is operated without drive output elements, such as coupling, etc. Carefully comply with the required measures.
This can result in death, serious injury or material damage.

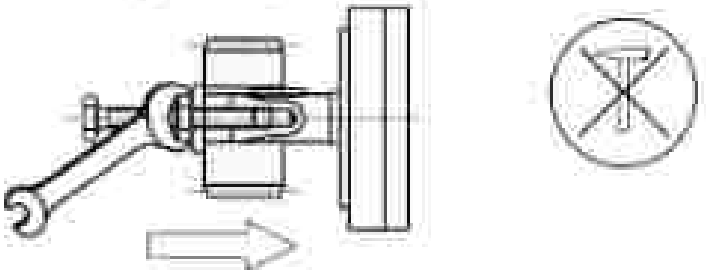
- The general touch protection measures for drive output elements must be observed.
- Only operate the motor with the drive output element mounted.
- Drive output elements may only be pulled on or pulled off with the correct equipment.
- The feather keys are only locked against falling out during shipping. For test operation or when commissioning **without drive output element**, carefully secure the feather key using a suitable locking element. When doing this, take into account the type of motor balancing.

Pulling on drive output elements

- Requirements:
  - The coupling and/or the drive output element must be appropriately dimensioned for the operating case at hand.
  - Observe the coupling manufacturer's instructions.
  - Make sure that the balancing type of the drive output element correctly matches the type of balance of the rotor.
  - Use only ready drilled and balanced drive output elements. Check the hole diameters and the balancing status before pulling them on. Thoroughly clean the shaft extension.
- Pulling on:
  - Heat up the drive output elements to expand them before pulling them on. Select the temperature difference for the heating process to suit the coupling diameter, fit and material. Observe the coupling manufacturer's instructions.
  - Drive output elements may only be pulled on or pulled off with the correct equipment. The drive output element must be pulled on in slow continuous operation via the front thread holes in the shaft or pushed on by hand.
  - Do not use a hammer, as this will damage the bearings.



Withdrawing drive output elements



Mounting drive output elements

Only transfer radial or axial forces specified in the catalog to the motor bearings via the shaft extension.

You can obtain the permissible values for axial and radial forces by contacting the Service Center or by referring to the motor catalog.

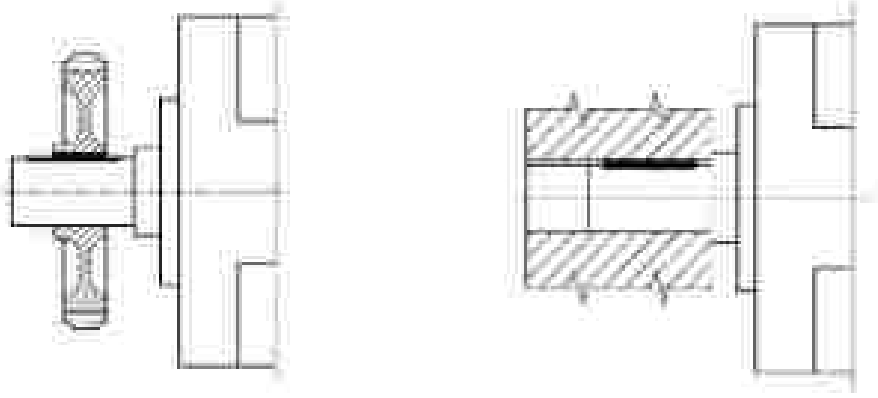
Shaft extensions with feather key

The feather key data for the shaft and drive output element must match and indicate the correct type of balancing. The drive output element must be correctly mounted.
The balance quality corresponds to vibration severity grade "A" for the complete motor. Vibration severity grade "B" is possible as an option. To ensure the required balance quality, it must be ensured that the feather key data on the hub and motor shaft match in the case of a shorter or longer drive output element.

- If the drive 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 drive output element in order to maintain the balance quality.
- If the drive output element is longer than the feather key, when balancing the coupling, take into account that the feather key does not take up all of the coupling slot.

The following applies to all four-pole motors with a frequency ≥ 60 Hz:

- The feather key must be shortened if the coupling hub is shorter than the feather key.
- The center of gravity of the coupling half should be within the length of the shaft end.
- The coupling used must be prepared for system balancing.



Align the offset at the coupling between motors and the driven machines so that the maximum permissible vibration values according to ISO 10816-3 are not exceeded.

Electrical connection

6

Observe the following when carrying out any work on the motor:

- Comply with the general safety instructions (Page 11).
- Comply with the applicable national and sector-specific regulations.
- When using the motor within the European Union, comply with the specifications laid down in EN 60110-1 regarding safe operation of electrical equipment.

6.1 Basic rules

The following generally applies to electrical connections:

- Ensure that there is a safe and reliable PE ground connection before starting any work.
- The connecting cables can be sealed and secured at every cable entry point into the terminal box.
- Lay the connecting cables and in particular the PE conductor in the terminal box in an open arrangement so that chafing of the cable insulation is prevented.
- Connect the motor in such a way that a permanent, safe electrical connection is maintained. Avoid protruding wire ends.
- Lay and secure external auxiliary cables separately from the main cable. Elements with cable ties may be present for this purpose.
- In case of high humidity or when installed outside, water drops can move along the cable jacket and enter the motor through the cable entry and cable gland.
  If you route the cable with an appropriate loop then water doesn't enter the terminal box, but simply drips off.

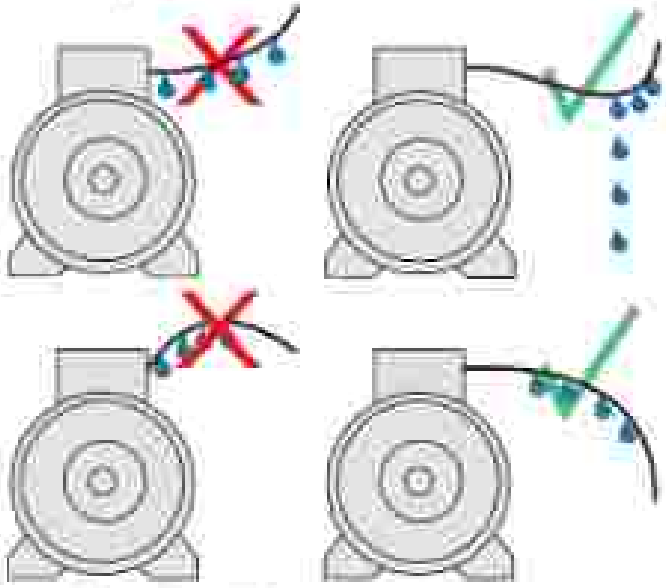


Figure 6-1 Water drip loop

6.2 Safety instructions for the electrical connection

Hazardous voltages on electrical connections

Dangerous voltages can arise on electric motors. Death, injury or material damage can occur. Observe the following safety information before connecting up the motor:

- Only qualified personnel should carry out work.
- Carefully follow the "5 safety rules (Page 11)".
- Disconnect the motor from the power supply and take measures to prevent it being reconnected. This also applies to auxiliary circuits.
- Check that the motor really is in a no-voltage condition.
- Ensure that there is a safe and reliable protective conductor connection before starting any work.
- If the incoming power supply system displays any deviations from the rated values in terms of voltage, frequency, curve form or symmetry, such deviations will increase the temperature and influence electromagnetic compatibility.
- Operating the motor on a line supply system with a non-grounded neutral point is only permitted over short time intervals that occur rarely, e.g. the time leading to a fault being eliminated (ground fault of a cable, IEC/TR 60364-4-1).

Material damage as a result of connection parts coming loose

If you use fixing elements made from the wrong material or apply the wrong tightening torque, this could impair current transfer or cause connecting parts to become loose. This could result in material damage to the motor or even in total failure, which could in turn lead indirectly to material damage to the system.

- Tighten the screwed connections to the specified tightening torques.
- Observe any specifications regarding the materials from which fixing elements must be made.
- When performing servicing, check the fastenings.

Note
Service Center

If you require support when electrically connecting up the motor, please contact the Service Center (Page 117).

6.3 Connecting the motor

Take the following criteria into account when selecting the connecting cables:

- Rated current
- Rated voltage
- If required, service factor
- System-dependent conditions, such as ambient temperature, routing type, cable cross-section as defined by required length of cable, etc.
- Configuration notes
- Requirements according to IEC/EN 60204-1
- Dimensioning for bundled cable routing, e.g. according to DIN VDE 0298 Part 4 or IEC 60364-5-52
- Carefully comply with the information provided in EN / IEC 60034-1 (VDE 0530-1) regarding operation at the limits of A and B zones, especially in respect of temperature increase and deviation of the operating data from the rated data stamped on the rating plate. Do not exceed these limits. Do not use motors in zone B that are marked for zone A.
- Connect up so that a permanently safe electrical connection is guaranteed (no protruding wire ends); use the assigned cable-end fittings (e.g. cable lugs, end sleeves). Connect up the line supply voltage and arranged the disconnecting line in accordance with the circuit diagram provided in the terminal box.
- Select the connecting cables in accordance with DIN VDE 0100 taking into account the rated current and the installation-specific conditions – e.g. ambient temperature, routing method etc. – according to DIN VDE 0298 and/or EN / IEC 60204-1.

The technical specifications stipulate the following that have to be taken into account 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

6.3.1 Terminal box

⚠DANGER

Hazardous voltage

Electric motors have high voltages. When incorrectly handled, this can result in death or severe injury.

Switch off the motor so that it is in a no-voltage condition before you open the terminal box.

NOTICE

Damage to the terminal box

If you incorrectly carry out work on or in the terminal box, this can result in material damage. You must observe the following to avoid damaging the terminal box:

- Ensure that the components inside the terminal box are not damaged.
- It must be ensured that there are no foreign bodies, dirt or moisture in the terminal box.
- Close the terminal box using the original seal so that it is dust-tight and water-tight.
- Use O-rings or suitable flat gaskets to seal entries in the terminal box (DIN 42925) and other open entries.
- Please observe the tightening torques for cable entries and other screws.

6.3.1.1 Circuit diagram inside the terminal box cover

Data on the connection and connecting the motor winding can be found in the circuit diagram in the cover of the terminal box.

6.3.1.2 Direction of rotation

The standard motors are suitable for clockwise and counter-clockwise rotation.

For defined directions of rotation (direction of rotation arrow), appropriately connect the line power cables.

- If you connect the line cables with phase sequence L1, L2, L3 at U, V, W or according to NEMA at T1, T2, T3, then the motor rotates in the clockwise direction.
- If you interchange 2 connections, e.g. L1, L2, L3 at V, U, W or according to NEMA at T2, T1, T3, then the motor rotates counterclockwise.

	Direction of rotation	According to IEC	According to NEMA
Line feeder cables		L1, L2, L3	L1, L2, L3
Terminal connection	Clockwise rotation	U, V, W	T1, T2, T3
Terminal connection	Counter-clockwise rotation	V, U, W	T2, T1, T3

Direction of rotation of the motor when viewing the DE

6.3.1.3 Terminal marking

According to IEC / EN 60034-8, the following basic definitions apply to the terminal markings for 3-phase motors:

Table 6- 1 Terminal markings using the 1LE1 1 as an example

1	U	1	-	1	Marking
x					Code for split winding, where applicable. Special case for pole assignment for pole-changing motors. A lower index signifies a lower speed.
	x				Phase designation (U, V, W
		x			Index for winding start (1) or end (2) or if there is more than one connection per winding
				x	Additional indices for cases in which it is obligatory to connect parallel power feed cables to several terminals with otherwise identical markings

6.3.1.4 Cable entry

Assembly and laying cables

Screw the screw-type connection (cable gland) into the cable entry or fasten with a nut.

Note

The screw-type connections must have been matched to the connecting cables used (diameter armoring, braid, shield).

For the screw-type connection, comply or exceed the requirements relating to IP degree of protection (water and dust) - as well as the temperature range in operation stamped on the rating plate.

6.3.1.5 Versions

The terminal box can be turned 4 x 90 degrees on the terminal face of the motor's housing.

6.3.1.6 Protruding connection cables

⚠WARNING

Risk of short-circuit and voltage hazard.

A short circuit can occur if connecting cables are clamped and crushed between parts of the enclosure and the cover plate.
This can result in death, severe injury and material damage.

- During disassembly and particularly when installing the cover plate, make sure that the connecting cables are not clamped between enclosure parts and the cover plate.

⚠ CAUTION

Damage to connecting cables that are freely led out

You must observe the following note to avoid damaging connecting cables that are freely led out:

- It must be ensured that there are no foreign bodies, dirt, or moisture in the terminal base of the motor enclosure.
- Use O-rings or suitable flat gaskets to seal entries in cover plates (DIN 42925) and other open entries.
- Seal the terminal base of the motor enclosure using the original seal of the cover plate to prevent dust and water from entering.
- Please observe the tightening torques for cable entries and other screws.

6.3.1.7 Connecting protruding cables

In the case of connection cables brought out of the motor, no terminal board is installed on the terminal base of the motor housing. The connection cables are directly connected to stator winding terminals at the factory.

The connection cables are color-coded or labeled. The customer directly connects individual cables in the control cabinet for their system in accordance with the labeling.

6.3.1.8 Minimum air clearances

After proper installation, verify that the minimum air clearances between non-insulated parts are maintained. Be aware of any protruding wire ends.

Table 6-2 Minimum air clearance dependent on rms value of the alternating voltage U_{AC}

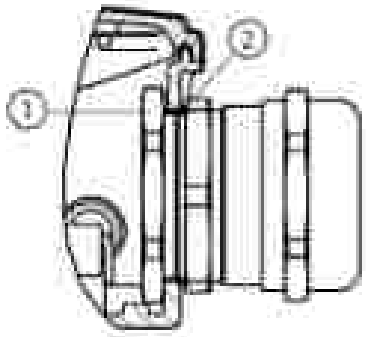
Rms value of the alternating voltage U_{AC}	Minimum air clearance mm
≤ 250 V	3.0
≤ 500 V	5.0
≤ 630 V	5.5
≤ 1000 V	8.0

Values apply at an installation altitude of up to 2000 m.

When determining the required minimum air clearance, the voltage value in the cable may be increased by a factor of 1.1, so that the rated input voltage range is taken into account during general use.

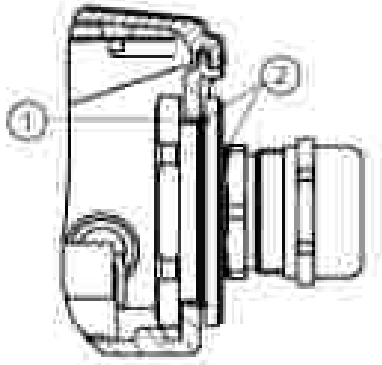
6.3.2 Cable glands

Cable glands with (sheet metal) nuts (EN 50262)



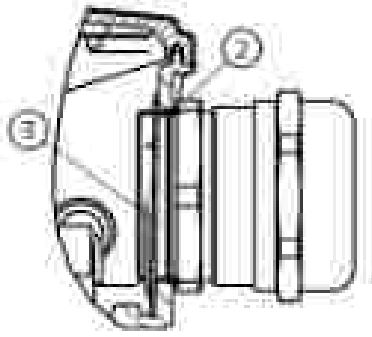
1 Nut
2 O ring

Cable glands with reductions and (sheet metal) nuts (EN 50262)



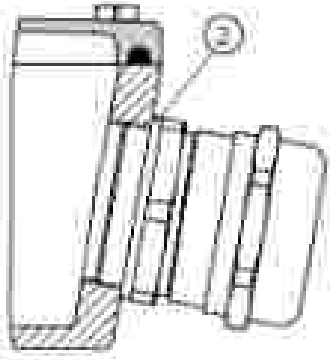
1 Nut
2 O ring

Mounting position of sheet metal nuts in screw-type connections



2 O ring
3 Mounting position of metal-sheet nuts

Cable glands with connecting thread in the terminal box (EN 50262)



2 O ring

6.3.3 Tightening torques

Note the information in Chapter "Tightening torques (Page 119)".

Cable entries, sealing plugs and thread adapters

Note the following when mounting:

- Avoid damaging the cable jacket.
- Adapt the tightening torques to the cable jacket materials.

Observe the documentation for tightening torques of the cable entries and sealing plugs for direct mounting at the motor as well as additional glands (e.g. adapters).

6.4 Connecting the grounding conductor

The motor's grounding conductor cross-section must comply with EN / IEC 60034-1.

Please also observe installation regulations such as those specified in EN / IEC 60204-1.

Basically, there are two ways of connecting a grounding conductor to the motor:

- Internal grounding with a connection in terminal box at the location intended for this purpose and marked accordingly.
- External grounding with connection at the stator housing at the locations intended for this purpose and marked accordingly.

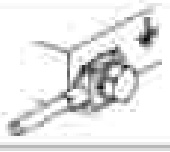
Type of enclosure grounding		Conductor cross-section mm²
Connection of an individual conductor under the external grounding bracket		... 10
Connection is made using a DIN cable lug under the external grounding bracket, DIN 46 234		... 25

Table 6- 3 Minimum cross-sectional area of grounding conductor

Minimum cross-section of the phase conductor for installation S [mm²]	Minimum cross-section of the associated grounding connection [mm²]
S ≤ 25	S
25 < S ≤ 50	25
S > 50	0.5 S

1) LET shaft heights 71 ... 315

Internal ground terminal

When making connections, ensure the following:

- Ensure that the connecting surface is bare and is protected against corrosion using a suitable substance, e.g. acid-free Vaseline.
- Arrange the flat washer and spring washer under the bolt head.
- Locate the cable lug under the clamping bracket.
- Use the terminals designated for the grounding conductor in the terminal box.
- Observe the tightening torque for the locking screw.

External ground terminal

When making connections, ensure the following:

- Ensure that the connecting surface is bare and is protected against corrosion using a suitable substance, e.g. acid-free Vaseline.
- Position the cable lug between the contact bracket and the grounding bracket; do not remove the contact bracket pressed into the enclosure!
- Arrange the flat washer and spring washer under the bolt head.
- Use the marked connection location for the grounding conductor on the stator housing.
- Observe the tightening torque for the locking screw.

6.5 Connecting a temperature sensor/anti-condensation heater

⚠WARNING

Hazard due to electric shock

The installation of the temperature sensors for the winding monitoring with respect to the winding is implemented according to the requirements for basic insulation. The temperature sensor connections are located in terminal boxes, safe to touch, and have no protective separation. This is the reason that in the case of a fault, a hazardous voltage can be present at the measuring sensor cable. When touched, this can result in death, severe bodily injury and material damage.

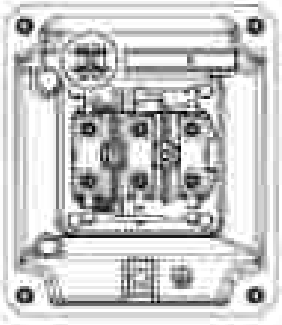
- When connecting the temperature sensor to external temperature monitoring devices, when required, apply additional measures to fully comply with the requirements set out in IEC 60664-1 or IEC 61800-5-1 "Hazard due to electric shock".

Connecting optional integrated devices and equipment

In addition to the current-dependent overload protective device located in the connection cables, use the optionally available integrated devices and equipment, for example, temperature sensors, anti-condensation heating.

Depending on the terminal box version, connect the auxiliary circuits to the terminal box.

Terminal block connection



6.6 Conductor connection

Cross-sections that can be connected depending on the size of the terminal (possibly reduced due to size of cable entries)

Table 6- 4 Max. conductor connection

Shaft height	Max. connectable conductor cross-section [mm²]
71 ... 90	1.5 2.5 with cable lug
100 ... 112	4.0
132	6.0
160 ... 180	16.0
200	25.0
225	35.0 with cable lug
250 ... 280	120.0
315	240.0

1) LZT shaft heights 71 ... 315

6.6.1 Type of conductor connection

Terminal board		Max. conductor cross-section [mm²]
Connection with cable lug DIN 46 234 Bend down the cable lug for the connection.		25
Connection of an individual conductor with terminal clamp copper cable		10

① Connecting line
② Line supply cable
③ Motor connecting cable

6.6.2 Connecting aluminum conductors

If you are using aluminum conductors, then comply with the following:

- Use only cable lugs that are suitable for connecting aluminum conductors.
- Immediately before inserting the aluminum conductor, remove the oxide layer from the contact areas on the conductor and/or the mating piece. Do this using a brush or file.
- Then grease the contact areas immediately using neutral Vaseline. This prevents a new oxide layer from forming.

NOTICE

Aluminum flow due to contact pressure

Aluminum flows following installation due to the contact pressure. The connection using clamping nuts can loosen as a result. The contact resistance increases, obstructing the current from being conducted. This can result in fire and material damage to the motor – or even in total failure, as well as material damage to the plant or system due to motor failure.

- Retighten the clamping nuts after approximately 24 hours and then again after approximately four weeks. Make sure that the terminals are de-energized before you tighten the nuts.

6.7 Connecting converters

NOTICE
Material damage caused by an excessively high supply voltage
Material damage can occur if the supply voltage is too high for the insulation system. • Observe the values in the following tables.

SIMOTICS motors can be operated with SINAMICS G converters and SINAMICS S converters (uncontrolled and controlled infeed) when maintaining the permissible peak voltages.

The insulation system of SIMOTICS motors corresponds to the specifications laid down in IEC 60034-18-41 according to voltage limit category B (IVIC B = high stress).

Table 6-5 Maximum voltage peaks at the motor terminals for line (DOL) motors, converter operation possible

Rated motor voltage V	Maximum peak voltage at the motor terminals		
	$\hat{U}_{motor\ terminals}$ V_{pk}	$\hat{U}_{motor\ terminals}$ V_{pk}	DC link U_{d} V
≤ 500 V	1500	1100	750

Table 6-6 Maximum voltage peaks at the motor terminals for motors specifically designed for converter operation (e.g. VSD 1)))

Rated motor voltage V	Maximum peak voltage at the motor terminals		
	$\hat{U}_{motor\ terminals}$ V_{pk}	$\hat{U}_{motor\ terminals}$ V_{pk}	DC link U_{d} V
≤ 500 V	1600	1600	750
> 500 V ... 690 V	2200	1500	1050

Depending on the step height, the voltage rise times for the individual voltage steps in the line-to-ground voltage at the motor end of the cable must not fall below the following values.

Table 6-7 Rise times as a function of voltage level

Step height V	Minimum rise time t_r µs
900	130
1050	200
1240	400

1) 1LE1 shaft heights 71 ... 315

6.8 Final checks

Before closing the terminal box/terminal base of the motor enclosure, check the following:

- Establish the electrical connections in the terminal box in accordance with the information in this documentation.
- Maintain the air clearances between non-insulated parts as described in Chapter "Minimum air clearances (Page 44)".
- Avoid protruding wire ends.
- In order not to damage the cable insulation, freely arrange the connecting cables.
- Connect the motor corresponding to the specified direction of rotation.
- Keep the inside of the terminal box clean and free from trimmed-off ends of wire.
- Ensure that all seals and sealing surfaces are undamaged and clean.
- Correctly and professionally close unused openings in the terminal boxes. Observe the information in this documentation.
- Observe the information on torques in this documentation.

Commissioning

7

Observe the following when carrying out any work on the motor:

- Comply with the general safety instructions (Page 11).
- Comply with the applicable national and sector-specific regulations.
- When using the motor within the European Union, comply with the specifications laid down in EN 50110-1 regarding safe operation of electrical equipment.

Note

Service Center

Please contact the Service Center if you require commissioning support.

7.1 Measures before commissioning

⚠ WARNING

Risk of injury due to the ejected feather key

During motor test run in a no-load condition, the feather key fitted on the decoupled shaft extension may be flung out if the key is not secured or if unintentional motor movements occur. These can result in severe injury.

- Before switching on the motor, ensure that the motor is firmly fixed to the foundation.
- Before switching on the motor, ensure that the feather key is carefully secured with a suitable locking element.

7.1.1 Checks to be carried out prior to commissioning

The following list of checks to be performed prior to commissioning does not claim to be complete. It may be necessary to perform further checks and tests in accordance with the specific situation on-site.

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

- The motor is undamaged.
- The motor has been properly installed and aligned.
- The output transmission elements are set correctly for their type, e.g. alignment and balancing of couplings, belt forces in the case of a belt drive, tooth forces and tooth-flank backlash in the case of geared output, radial and axial clearance in the case of coupled shafts.
- All fixing screws, connection elements, and electrical connections have been tightened to the specified tightening torques.
- The operating conditions match the data provided in accordance with the technical documentation, such as degree of protection, ambient temperature, etc.
- Moving parts, for example the coupling, move freely.
- All touch protection measures for both moving and live parts have been implemented.
- Screwed-in lifting eyes are removed after installation or secured to prevent them from becoming loose.
- Before commissioning, attach the covers to guarantee the correct air guidance.
- Ensure that all condensation drain holes are always located at the lowest part of the motor.
- Comply with the EMC guidelines when using the PT100/PT1000 sensors to ensure the correct feedback signals from the sensors.

Note

The voltage in RTD terminals can be induced due to the magnetic interference between the power cables and the signal cables. Therefore, the signals received can be false. Touching the terminals directly can result in injury.

Second shaft extension

If the second shaft extension is not used:

- Carefully secure the feather key to prevent it from being thrown out, and for balancing type "H" (standard type), ensure its weight is reduced to approximately 50 % of the original value.
- Using covers, carefully secure the unused shaft extension so that it cannot be touched.

Risk of losing the IP degree of protection as a result of damaged shaft sealing rings

This can result in death, serious injury, or material damage.

- Replace damaged components immediately.

7.1.2 Mechanical and electrical check

- Rotate the rotor to ensure that it does not touch the stator.
- Ensure that the bearing insulation is not bridged/jumpered.
- Using the appropriately designed and adjusted control and speed monitoring functions ensure that the permissible speeds specified on the rating plate cannot be exceeded.
- Ensure that any supplementary equipment used to monitor the motor is correctly connected and is functioning.

Electrical connection

- Carefully check the grounding and potential bonding connections.
- Connect the motor corresponding to the specified direction of rotation.
- Using the appropriate open-loop control and speed monitoring functions, carefully ensure that no higher speeds can be achieved than are permitted and specified in the technical data. For this purpose, compare the data on the rating plate or, if necessary, the system-specific documentation.
- Comply with the minimum insulation resistances.
- Comply with the minimum air clearances.
- Correctly connect possibly available motor monitoring devices and equipment - and carefully ensure that they are functioning correctly.
- Check the correct functioning of the brakes or backstops.
- Set the values for "Alarm" and "Shutdown" at the monitoring devices.
- Carefully ensure that temperature-sensitive parts and components, e.g. cables are not in contact with the motor enclosure.

7.1.3 Converter operation

- If the motor design requires connection to a specific converter type, carefully check the supplementary data on the rating plate/supplementary plate.
- Ensure that the converter is correctly parameterized. Depending on the design, you will find some parameterization data on the rating plate of the motor. Further information is provided in the converter documentation. If necessary, contact the Service Center.
- Check that the supplementary equipment and devices to monitor the motor are correctly connected and are functioning correctly.
- In continuous operation, carefully ensure that the motor cannot exceed the specified upper speed limit n_{max} or fall below the lower speed limit n_{min}.

  The permissible acceleration time to the limit speed n_{max} depends on the parameter assignment.

7.1.4 Insulation resistance and polarization index

Measuring the insulation resistance and polarization index (PI) provides information on the condition of the motor. It is therefore important to check the insulation resistance and the polarization index at the following times:

- Before starting up a motor for the first time
- After an extended period in storage or downtime
- Within the scope of maintenance work

The following information is provided regarding the state of the winding insulation:

- Is the winding head insulation conductively contaminated?
- Has the winding insulation absorbed moisture?

As such, you can determine whether the motor needs commissioning or any necessary measures such as cleaning and/or drying the winding:

- Can the motor be put into operation?
- Must the windings be cleaned or dried?

Detailed information on testing and the limit values can be found here:

Checking the insulation resistance (Page 45)

7.1.5 Testing the cooling of the motor

Check that the motor cooling is available for commissioning.

7.1.6 Commissioning a separately driven fan

The separately driven fan ensures that the motor is cooled irrespective of the motor speed or direction of rotation. The separately driven fan is only suitable for one direction of rotation.

Checks before the first test run

Before the first test run, carry out the following checks:

- The separately driven fan is correctly fitted and aligned.
- The rotor runs freely.
- All of the retaining elements and electrical connections are securely tightened.
- The grounding and equipotential bonding connections to the mains have been correctly made.
- The air flow is not impeded or shut off by flaps, covers or similar.
- If the cooling air is in open circulation, it has only weak, chemically agressive properties and a low dust content.
- All protection measures have been taken to prevent accidental contact with moving or live parts.

Performing the test run

1. Switch the separately driven fan motor on and off briefly.
2. Compare the direction of rotation of the separately driven fan with the specified direction of rotation. The direction of rotation of the separately driven fan is indicated with an arrow on the fan cover specifying the direction of rotation or with a terminal designation on the rating plate of the separately driven fan.

   Depending on the version, the fan impeller is visible through the air inlet opening in the fan cover on the separately driven fan motor.
3. If the direction of rotation is wrong, then interchange two line cables in the separately driven fan motor terminal box.

Note

Use these operating instructions for motors with separately driven fans.

7.1.7 Further documents

Note

Further documents

Observe all of the other documents provided with the motor.

7.1.8 Setpoint values for monitoring the bearing temperature

Prior to commissioning

If the motor is equipped with bearing thermometers, set the temperature value for disconnection on the monitoring equipment before the first motor run.

Table 7: 1 Set values for monitoring the bearing temperatures before commissioning

Set value	Temperature
Alarm	115 °C
Shutting down	120 °C

Normal operation

Determine the maximum operating temperature of the bearings $T_{bearing}$ taking into account the temperature, bearing load and influences of the plant on the motor in °C. Set the values for shutdown and warning corresponding to the operating temperature T_{op}.

Table 7: 2 Set values for monitoring the bearing temperatures

Set value	Temperature
Alarm	$T_{bearing}$ + 5 K ≤ 115 °C
Shutting down	$T_{bearing}$ + 10 K ≤ 120 °C

7.2 Switching on

Measures for start-up

After installation or inspections, the following measures are recommended for normal start-up of the motors:

- Start the motor without a load. To do this, close the circuit breaker and do not switch the motor off prematurely. Switching the motor off again while it is starting up and still running at slow speed should be kept to a bare minimum, for example for checking the direction of rotation or for checking in general. Allow the motor to run to a standstill before switching it back on again.
- Check mechanical operation for noise or vibration at the bearings or end shields.
- If the motor is not running smoothly or is emitting abnormal noises, switch it off, and determine the cause of the fault as it runs down.
- If mechanical operation improves immediately after the motor is switched off, then the cause is magnetic or electrical, e.g. voltage unbalance, magnetic unbalance. If mechanical operation does not improve immediately after switching the motor off, then the cause is mechanical, e.g. an unbalance in the electrical motors or in the driven machine, inadequate alignment of the machine set, operation of the motor with the system resonating (system = motor + base frame + foundations etc.).
- If the motor runs perfectly in terms of its mechanical operation, switch on any cooling devices present and continue to monitor the motor for a while as it idles.
- If it runs perfectly, connect a load. Check that it runs smoothly.
  Read off and document the values for voltage, current, and power.
  Where possible, read off corresponding values for the driven machine and document them as well.
- Monitor the bearing temperature, winding temperature, etc. until the system reaches a steady state.
  Document these, provided this is possible with existing measuring instruments.

NOTICE
Damage of the motor
The motor may get damaged if the vibration values are not strictly complied with.
• In operation, maintain vibration values in accordance with DIN ISO 10816-3.

Test run

After installation or inspection, carry out a test run:

1. Start up the motor without a load. To do this, close the circuit breaker and do not switch off permanently. Check whether it is running smoothly.

   Switching the motor off again while it is starting up and still running at slow speed should be kept to a bare minimum, for example for checking the direction of rotation or for checking in general.

   Allow the motor to run down before switching it on again.

2. If the motor is running smoothly and evenly, switch on the cooling equipment. Continue to observe the motor for a while in no-load operation.

3. If it runs perfectly, connect a load.

   NOTICE

   Thermal overload of motors connected directly to the line supply

   In addition to the load torque, the ramp-up (accelerating) time is essentially influenced by the moment of inertia to be accelerated. While ramping up when connected to the line supply, the inrush (starting) current is a multiple of the rated current. This can result in thermal overload. This can damage the motor.

   As a consequence, when ramping up, observe the following:

   - Monitor the ramp-up time and number of consecutive starts.
   - Comply with the limit values and/or ramp-up conditions specified in the catalog or the order documentation.

4. During the test run, check and document the following:
   - Check whether it is running smoothly.
   - Document the voltage, current and power values. As far as possible, document the corresponding values of the driven machine.
   - If this is possible using the available measuring equipment, check the bearing and stator winding temperatures until they have reached steady-state values.
   - Check the motor for noise or vibrations on the bearings or bearing shields as it runs.

5. In case of uneven running or abnormal noise, switch off the motor. As the motor runs down, identify the cause.
   - If the mechanical operation improves immediately after the motor is switched off, then the cause is magnetic or electrical.
   - If the mechanical running does not improve immediately after switching the motor off, then the cause is mechanical.

     - Imbalance of the electrical motor or the driven machine
     - The machine set has not been adequately aligned
     - The motor is being operated at the system resonance point. System = motor, base frame, foundation, ...

     NOTICE

     Serious damage to the motor

     If the vibration values in operation are not maintained in accordance with DIN ISO 10816-3, then the motor may get damaged.

     - During operation, observe the vibration values in accordance with DIN ISO 10816-3.

Operation

8

Observe the following when carrying out any work on the motor:

- Comply with the general safety instructions (Page 11).
- Comply with the applicable national and sector-specific regulations.
- When using the motor within the European Union, comply with the specifications laid down in EN 60204-1 regarding safe operation of electrical equipment.

8.1 Safety instructions for operation

Hazardous voltages at the motor

Electrical motors have hazardous voltage levels. Contact with these can result in death, serious injury or material damage.

Operating the motor on a line supply system with a non-grounded neutral point is only permissible for short periods of time that occur rarely, e.g. the time leading to a fault being eliminated. Cable ground fault EN / IEC 60364-1.

Risk of injury due to rotating parts

Rotating parts are dangerous. Touch protection against rotating parts is no longer guaranteed if covers are removed. Touching rotating parts can result in death, serious injury or material damage.

- Carefully ensure that all of the covers are closed while operational.
- First switch off and disconnect the motor if you must remove covers. Carefully comply with the "5 safety rules".
- Only remove the covers when the rotating parts have come to a complete standstill.

Danger as a result of stationary parts under voltage (live parts)

Live parts represent a hazard. Touch protection against active (live) parts is no longer guaranteed if covers are removed. The minimum air and creepage distances may be fallen below (violated) when coming close to active parts. Touching or coming close can result in death, serious injury or material damage.

- Carefully ensure that all of the covers are closed while operational.
- First switch off and disconnect the motor if you must remove covers. Carefully comply with the "5 safety rules".
- When the motor is in operation, the terminal boxes must remain closed at all times. Terminal boxes may be opened only when the motor is stopped and in a no-voltage condition.

Faults in operation

Any changes with respect to the normal condition can indicate that the motor is not functioning correctly.

- Higher power consumption, temperatures or vibration levels.
- Unusual noise or smells.
- Monitoring devices respond.

These changes can cause faults which can result in eventual or immediate death, serious injury or material damage.

- Immediately inform the service personnel.
- If you are in doubt, immediately switch off the motor, carefully observing the system-specific safety conditions.

Corrosion damage as a result of condensation

Humidity can condense inside the motor if the motor and/or ambient temperatures fluctuate, for intermittent operation or load fluctuations.
Condensation can accumulate. Moisture can have a negative impact on the winding insulation or result in damage, such as corrosion.

- Ensure that any condensation can freely flow away.
- If available, remove the screw plugs to drain the water depending on the ambient and operating conditions.
- If available, reinsert the screw plugs.

If the motor is equipped with drain plugs, then the water can drain away by itself.

Risk of burn injuries as a result of hot surfaces

Individual motor parts can become hot in operation. Burns can result when coming into contact with these parts.

- Never touch motor parts during operation.
- Allow the motor to cool down before starting work.
- Check the temperature of parts before touching them. If required, wear suitable protective equipment.

Hazardous substances

Chemical substances required for the setup, operation and maintenance of motors can present a health risk. Poisoning, skin damage, cauterization of the respiratory tract, and other health damage may result.

- Read the information in these operating instructions and the product information supplied by the manufacturer.
- Observe the relevant safety regulations and wear the personal protective equipment specified.

Substances that can be easily ignited and are flammable

Chemical substances required for the setup, operation and maintenance of motors may be flammable. Burns and other damage to health and material may result.

- Read the information in these operating instructions and the product information supplied by the manufacturer.
- Observe the relevant safety regulations and wear the personal protective equipment specified.

Damage to the motor or premature bearing failure

The bearings can be damaged if the following is not observed:

- It is absolutely crucial that you maintain the permission vibration values according to ISO 10816-3 to avoid damage to the motor or even its destruction.
- Under all circumstances maintain the minimum radial load of cylindrical rolling bearings of 50 % corresponding to what is specified in the catalog.
- Take the appropriate measures to reduce bearing currents. Comply with the information in Chapter "Converter operation (Page 39)".

Overheating as a result of the anti-condensation heating

If the anti-condensation heating is operated while the motor is operational, this can increase the temperatures inside the motor and cause material damage.

- Install an interlock circuit that switches off the anti-condensation heating once the main motor is switched on.
- Only switch on the anti-condensation heating after the motor has been switched off. Comply with the data stamped on the plate of the anti-condensation heating, if available.

8.1.1 Safety instructions relating to ventilation and cooling

8.1.1.1 Safety instructions for forced ventilation (option)

Forced ventilation (optional): Type of cooling IC 416 in accordance with EN / IEC 60034-6

⚠ WARNING

Risk of burning

Operating the motor without a separately driven fan results in overheating. This may result in death, personal injury and material damage.

- Never commission the motor without a separately driven fan.

8.1.1.2 Safety instructions when operating motors with fan

⚠ CAUTION

Risk of injury when touching the fan

There is a risk of injury at motors equipped with a fan cover (e.g. on motors in the textile industry), as the fan is not completely touch-protected.

- Do not touch the rotating fan.
- Do not put your fingers into the larger air discharge openings.
- Prevent manual intervention by using suitable measures, e.g. appropriate housings or a protective grating.

8.1.1.3 Motors with fan for the textile industry

In order to guarantee an essentially unobstructed flow of cooling air containing fluff, remains of materials or similar dirt, motors used in the textile industry have a larger air discharge cross-section between the edge of the cover and the cooling ribs of the motor frame.

These motors have a warning sticker on the fan cover.

8.2 Switching on the motor

1. If at all possible, run the motor without load and check that it is running smoothly.
2. If it runs perfectly, connect a load.

NOTICE

Thermal overload of motors connected directly to the line supply

In addition to the load torque, the ramp-up (accelerating) time is essentially influenced by the moment of inertia to be accelerated. While ramping up when connected to the line supply, the inrush (starting) current is a multiple of the rated current. This can result in thermal overload. This can damage the motor.

As a consequence, when ramping up, observe the following:

- Monitor the ramp-up time and number of consecutive starts.
- Comply with the limit values and/or ramp-up conditions specified in the catalog or the order documentation.

3. If this is possible using the available measuring equipment, check the bearing and stator winding temperatures.

8.3 Deactivating

Commission any devices provided for protection against condensation after switching off the motor.

Do not immediately switch off the separately driven (external) fan after switching off the motor. First wait for the motor to cool down. This will prevent the accumulation of residual heat.

8.4 Switching on again after an emergency switching-off

- Check the motor before recommissioning the driven machine after an Emergency Off.
- Eliminate all the causes that have led to the emergency off.

8.5 Stoppages

The stoppage is a shutdown for a period of time, during which the motor is stopped but remains at the location of use.

Under normal ambient conditions, e.g. the stationary motor not exposed to any vibration, no increased level of corrosion, the following measures are required:

Longer non-operational periods

- For longer non-operational periods (> 1 month), either operate the motor or at least turn the rotor regularly, approximately once per month.
- If attached, remove the rotor shipping brace before you turn the rotor.
- Carefully comply with the information in Section "Switching on" before switching on to recommission the motor.

NOTICE
Restricted motor function
If not used for longer periods of time, material damage or complete motor failure can occur.
If the motor is out of service for a period of more than 12 months, then environmental effects can damage the motor.
• Apply suitable corrosion protection, preservation, packaging and drying measures.

Switching on the anti-condensation heating, if available

Only switch on the anti-condensation heating after the motor has been switched off. Comply with the data stamped on the plate of the anti-condensation heating, if available.

Taking the motor out of service

Detailed information on how to take the motor out of service is provided in Chapter "Preparing for use (Page 25)".

Lubricating before recommissioning

NOTICE
Dry running bearings
Bearings can be damaged if they do not have sufficient grease.
• Re-grease the bearings if they have been out of service for more than one year. The shaft must rotate so that the grease can be distributed in the bearings. Follow the instructions on the lubricant plate.
• More information can be found in Chapter Rolling bearings (Page 68)".

8.5.1 Avoidance of damage to rolling bearings during stoppages

Extended stoppages at the identical or almost identical resting position of the rotor in the rolling bearings can result in damage, such as brinelling or corrosion.

- During stoppages, regularly start up the motor for a brief period once a month. As a minimum, turn the rotor several times.

  If you have uncoupled the motor from the driven machine and secured the rotor with a rotor shipping brace, then remove this before turning the rotor over or starting up the motor.

  Make sure that the resting position of the rotor after the rotor has been turned over is different from its previous position. Use the fitted key or the coupling halves as reference markers.

- When recommissioning, carefully comply with the information in Chapter "Commissioning (Page 71)".

8.5.2 Decommissioning the motor

- Record the decommissioning steps. This log will be useful upon recommissioning.
- If the motor is going to be out of service for longer than six months, then take the necessary measures for preservation and storage. Otherwise, the motor could be damaged as a result of not being operated.

8.5.3 Re-commissioning the motor

When you re-commission the motor, proceed as follows:

- Study the record made when the motor was decommissioned, and reverse the measures that were taken for conservation and storage.
- Perform the measures listed in Chapter "Commissioning (Page 71)".

8.6 Faults

8.6.1 Inspections in the event of faults

Natural disasters or impaired operating conditions, such as overloading or short circuit, are faults that overload the motor electrically or mechanically.

Immediately perform an inspection after such faults.

Correct the cause of the fault as described in the respective remedial measures section. Repair any damage to the motor.

8.6.2 Electrical faults

Note

If you are operating the motor with a converter, the operating instructions of the converter must also be observed if electrical faults occur.

Table 8-1 Electrical faults

1 Motor fails to start								
	2 Motor accelerates sluggishly							
		3 Rumbling noise during startup						
			4 Rumbling noise during operation					
				5 High temperature rise during no-load operation				
					6 High temperature rise with load			
						7 High temperature rise of individual winding sections		
							Possible causes of faults	Remedial measures
X	X		X		X		Overload	Reduce the load.
X							Interrupted phase in the supply cable	Check the switches and cables.
	X	X	X		X		Interrupted phase in the feeder cable after switching on	Check the switches and cables.
	X						Mains voltage too low, frequency too high	Check the power supply conditions.
				X			Mains voltage too high, frequency too low	Check the power supply conditions.
X	X	X	X			X	Stator winding incorrectly connected	Check the winding connection in the terminal box.
	X	X	X			X	Winding short circuit or phase short circuit in stator winding	Determine the winding resistances and insulation resistances. Carry out repair work after consultation with the manufacturer.
					X		Incorrect direction of rotation	Check the connection.

8.6.3 Mechanical faults

Table 8-2 Mechanical faults

1 Grinding noise				
	1 Radial vibrations			
		1 Axial vibrations		
			Possible causes of faults	Remedial measures
X			Rotating parts grind.	Establish the cause and realign the parts.
	X		Rotor or coupling not balanced.	Disconnect the motor or coupling and rebalance.
				If the motor has two shaft ends, and a transmission element is only fitted to one end, secure the fitted key on the other end to prevent it from being thrown out. If the rotor has balance type "H" (standard type), the fitted key must be cut back to roughly half of its length.
	X		Rotor out of round, shaft bent.	Consult the manufacturing plant.
	X	X	Poor alignment.	Align the machine set, check the coupling.
	X		Coupled machine not balanced.	Rebalance the coupled machine.
		X	Shocks from coupled machine.	Investigate the coupled machine.
	X	X	Unusual running of gear unit.	Fix the gearing.
	X	X	Resonance of the overall system comprising motor and foundation.	Stabilize the foundation following consultation.
	X	X	Changes in foundation.	Establish the cause of the changes and eliminate them if necessary; realign the motor.
Take any changes into account when warming up the motor.				

8.6.4 Rolling bearing faults

Damage to rolling bearings can be difficult to detect in some cases. If in doubt, replace the rolling bearing. Use other bearing designs only **after consulting the manufacturer**.

Table 8-3 Rolling bearing faults

1 Bearing overheats				
	1 Bearing "whistles"			
		1 Bearing "knocks"		
			Possible causes of faults	Remedial measures
X			High coupling pressure	Align the motor more accurately.
X			Belt tension too high	Reduce the drive belt tension.
X			Bearing contaminated	Clean or replace the bearing. Check the seals.
X			High ambient temperature	Use a suitable high temperature grease.
X	X		Insufficient lubrication	Grease the bearings as instructed.
X	X		Bearing corroded	Contact the service center.
X	X		Insufficient bearing play	Contact the service center.
		X	Excessive bearing play	Contact the service center.
X	X		Bearing corroded	Replace the bearing. Check the seals.
X			Too much grease in bearing	Remove surplus grease.
X			Wrong grease in the bearing	Use the correct grease.
		X	Fatigue marks on raceway	Replace the bearing.
		X	Brinelling or fluting	Replace the bearing. Avoid any vibration or vacuum.

1) LST shaft heights 71 ... 315

8.6.5 Faults on the separately driven fan

The following table shows the possible causes of and remedial measures for faults on forced-ventilated motors.

Table 8 - 4 Cooling system faults

1 High temperature rise with load		
	Possible causes of faults	Remedial measures
K	Wrong direction of rotation of the separately driven fan	Check the electrical connections on the separately driven fan
K	Separately driven fan is not running	Check the separately driven fan and its connections
K	Reduced air flow	Check the air ducts, clean the motor

Maintenance

9

Through careful and regular maintenance, inspections, and overhauls you can detect faults at an early stage and resolve them. This means that you can avoid consequential damage.

Operating conditions and characteristics can vary widely. For this reason, only general maintenance intervals can be specified here. Maintenance intervals should therefore be scheduled to suit the local conditions (dirt, starting frequency, load, etc.).

Observe the following when carrying out any work on the motor:

- Comply with the general safety instructions (Page 11).
- Comply with the applicable national and sector-specific regulations.
- When using the motor within the European Union, comply with the specifications laid down in EN 50110-1 regarding safe operation of electrical equipment.

Note

Please contact the Service Center (Page 117), if you require support with service, maintenance or repair.

9.1 Preparation and notes

Touch up any damaged paintwork

If the paint is damaged, it must be repaired in order to protect the unit against corrosion.

Note

Paint system

Contact the Service Center (Page 117) before you repair any damage to paint. They will provide you with more information about the correct paint system and methods of repairing paint damage.

9.2 Inspection and maintenance

9.2.1 Safety instructions for inspection and maintenance

Danger as a result of stationary parts under voltage (live parts)

Live parts represent a hazard. Touch protection against active (live) parts is no longer guaranteed if covers are removed. The minimum air and creepage distances may be fallen below (violated) when coming close to active parts. Touching or coming close can result in death, serious injury or material damage.

- Take the motor out of operation.
- Switch off the motor and ensure that it is in a no-voltage condition. Carefully comply with the "5 safety rules" (Page 11).
- Only open the terminal box when the motor is stationary and in a no voltage condition.

Risk of injury due to rotating parts

Rotating parts are dangerous. Touch protection against rotating parts is no longer guaranteed if covers are removed. Touching rotating parts can result in death, serious injury or material damage.

- Before carrying out any repair work on the motor, take it out of operation, and carefully lock it out so that it cannot be switched on again.
- Only remove the covers when the rotating parts have come to a complete standstill.

Risk of burn injuries due to hot surfaces

In operation, the temperature of individual motor parts can increase - and only decrease slowly after switching off. You can burn yourself if you touch hot surfaces.

- Allow the motor to cool before starting any maintenance and service work on the motor.
- Check the temperature of parts before touching them. If required, wear suitable protective equipment.

Danger when cleaning using compressed air

When cleaning parts of the motor using compressed air, loose parts or particles of dirt can be flung around and cause injury.

- Installed suitable extraction measures.
- Wear personal protective equipment, such as protective glasses, gloves, overall.
- Ensure that personnel not involved in the work are not in the danger area.

Damage if the motor is not maintained

The motor can be damaged if it is not appropriately maintained. This can cause faults which can result in eventual or immediate death, serious injury or material damage.

- Maintain the motor at the specified maintenance intervals.

Damage from foreign bodies in the motor

Foreign bodies such as dirt, tools or loose components can be left by accident inside the motor after maintenance is performed. These can cause short circuits, reduce the performance of the cooling system or increase noise in operation. They can also damage the motor.

- Ensure that no foreign bodies are left in or on the motor.
- Securely attach all loose parts once you have completed the work.
- Carefully remove any dirt.

9.2.2 Inspections in the event of faults

Natural disasters or unusual operating conditions, such as overloading or short circuit, are faults that overload the motor electrically or mechanically.

Immediately perform an inspection after such faults.

Note

Inspection specification

- Carefully comply with the relubrication intervals for rolling bearings that deviate from the inspection intervals.
- When servicing a three-phase motor, it is generally not necessary to dismantle it. The motor only has to be dismantled if the bearings are to be replaced.

9.2.3 First inspection after installation or repair

Perform the following checks after approximately 500 operating hours or at the latest six months after commissioning.

Table 9-1 Checks after assembly or repair

Check	When the motor is running	At standstill
The electrical parameters are maintained.	X	
The permissible bearing and winding temperatures are not exceeded (Page 76)	X	
The bearings running threshold velocity and motor running noise have not deteriorated.	X	
The foundation has no cracks or deformations. (*)	X	X

(*) You can perform these checks while the motor is running or at a standstill.

Additional tests may also be required according to the system-specific conditions.

NOTICE

Motor damage

When carrying out the inspection, if you detect any impermissible deviations from the nominal state, you must rectify them immediately. They may otherwise cause damage to the motor.

9.2.4 General inspection

Check that the installation conditions are observed. We recommend that the following checks are performed after approx. 15 000 operating hours or at the latest after two years.

Table 9-2 Checks that have to be performed during the general inspection

Checking	When the motor is running	At standstill
The electrical parameters are maintained	X	
The permissible bearing temperatures are not exceeded	X	
The smooth running characteristics and noise running noise have not deteriorated	X	
The foundation has no cracks or deformations (*)	X	X
The motor is aligned within the permissible tolerance ranges		X
All the fixing bolts/screws for the mechanical and electrical connections have been securely tightened		X
All the potential connections, grounding connections and shield supports are correctly seated and properly bonded		X
The winding insulation resistances are sufficiently high		X
Any missing insulation is fitted as shown on the plans and labels		X
The CABLES and insulating parts and components are in good condition and there is no evidence of discoloring		X

(*) You can perform these checks while the motor is at standstill or, if required, while running.

NOTICE
Motor damage
When carrying out the inspection, if you detect any impermissible deviations from the normal state, you must rectify them immediately. They may otherwise cause damage to the motor.

9.2.5 Assessing the rolling bearings

To assess the rolling bearings, it is generally not necessary to disassemble the motors. The motor only has to be dismantled if the bearings are to be replaced.

The state of a rolling bearing can be assessed by analyzing the bearing vibration. The measured values provide an indication and can be assessed by specialists. In this case, please contact the Service Center.

9.2.6 Maintenance intervals

Please note the following in order to identify faults at an early stage, rectify them and avoid follow-on damage:

- Maintain the motor regularly and carefully.
- Inspect the motor.
- Motors must be allocated a new/continuation number after inspection.

NOTICE

Motor failure

Material damage can occur if the motor develops faults or is overloaded.

- Immediately inspect the motor if faults occur.
- An immediate inspection is especially necessary, if the three-phase motor is excessively stressed, either electrically or mechanically (e.g. overload or short-circuit).

The motors are equipped with permanently lubricated rolling bearings. The motor may be equipped with a regreasing device.

⚠CAUTION

Skin irritations and eye inflammations

Many greases can cause skin irritations and eye inflammations.

- Follow all safety instructions of the manufacturer.

Measures, intervals and deadlines:

Measures after operating period intervals or deadlines have elapsed:

Operating situations and characteristics can vary widely. For this reason, only general maintenance intervals are specified here. Maintenance intervals should therefore be scheduled to suit the local conditions (dirt, starting frequency, load, etc.).

Table 9 - 3 Operating period intervals

Measures	Operating period intervals	Intervals
Initial inspection	After 500 operating hours	After 12 years at the latest
Relubrication (optional)	See the lubrication plate	
Clean	Depending on the degree of pollution	
Main inspection	Approximately every 14,000 operating hours	After two years at the latest
Drain condensate	Depending on the climatic conditions	

9.2.7 Re-greasing

For motors with regreasing system, relubrication intervals, grease quantity and grease grade are provided on the lubricant plate. Additional data can be taken from the main motor rating plate.

Grade of grease for standard motors UNIMEX N3 - ES50:

Below are the list of approved greases that can be used:

Table 9- 4 Approved rolling bearing greases for vertical and horizontal types of construction

Manufacturer	Grease type
Shell	Shell Gadus S3 V100 3
ExxonMobil/Esso	Unirex N3
ExxonMobil/Esso	Mobilgrease XHP 103

Note

It is not permissible to mix different types of grease. If an alternative grease is being used, make sure that the old grease has been cleaned from all grease chambers and grease paths (bearing covers, bearing, grease pipe and grease nipple).

Prolonged storage periods reduce the useful lifetime of the bearing grease. Check the condition of the grease if the equipment has been in storage for more than 12 months. If the grease is found to have lost oil content or to be contaminated, the motor must be immediately relubricated before commissioning. For information on permanently-greased bearings, please refer to the section titled Rolling bearings (Page 98).

Procedure

To relubricate the rolling bearings, proceed as follows:

1. Clean the grease nipples at the drive end and non-drive end.
2. Press in the specified grease and amount of grease according to the data stamped on the lubrication plate.
   - Please observe the information on the rating and lubricant plates.
   - Regreasing should be carried out when the motor is running (max. 3600 rpm).

The bearing temperature can rise significantly at first, and then drop to the normal value again when the excess grease is displaced out of the bearing.

⚠ WARNING

Rotor can fall out

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 relieve the rotor when carrying out work with the motor in a vertical position.

9.2.8 Cleaning

Cleaning the grease ducts and spent grease chambers

The spent grease collects outside each bearing in the spent grease chamber of the motor bearing cap. When replacing bearings, remove the spent grease.

Dismantle the bearing cartridges to replace the grease in the lubrication duct.

Cleaning the cooling air ducts

Regularly clean the cooling air ducts through which the ambient air flows.

The frequency of the cleaning intervals depends on the local degree of fouling.

Damage to the motor when cleaning with compressed air or water jets

- Do not direct compressed air or water jets in the direction of the shaft outlet or intake openings.
- Avoid direct impact of compressed air and water jets on sealing elements of the motor.

9.2.9 Cleaning the fan cover of motors for the textile industry

Regularly remove fluff balls, fabric remnants, and similar types of contamination from the fan cover of motors for the textile industry (particularly at the air passage opening between the fan cover and cooling fins of the motor enclosure) to ensure that the cooling air can flow without obstruction.

9.2.10 Drain condensate

If there are condensation drain holes present, open these at regular intervals, depending on climatic conditions.

⚠WARNING

Hazardous voltage

The winding can be damaged if objects are introduced into the condensation holes (optional). This can lead to death, serious injury or material damage.

Note the following to maintain the degree of protection:

- Switch off the motor so that it is in a no-voltage condition before you open the condensation drain holes.
- Close the condensation drain holes, e.g. using T-plugs, before commissioning the motor.

NOTICE

Reduction of the degree of protection

If condensation drain holes are not closed, then this can result in material damage to the motor.

In order to maintain the degree of protection, after the condensation has been drained, you must close all of the drain holes.

9.2.11 Insulation resistance and polarization index

Measuring the insulation resistance and polarization index (PI) provides information on the condition of the motor. It is therefore important to check the insulation resistance and the polarization index at the following times:

- Before starting up a motor for the first time
- After an extended period in storage or downtime
- Within the scope of maintenance work

The following information is provided regarding the state of the winding insulation:

- Is the winding head insulation conductively contaminated?
- Has the winding insulation absorbed moisture?

As such, you can determine whether the motor needs commissioning or any necessary measures such as cleaning and/or drying the winding:

- Can the motor be put into operation?
- Must the windings be cleaned or dried?

Detailed information on testing and the limit values can be found here:

Checking the insulation resistance (Page 45)

9.2.12 Servicing the separately driven fan

⚠ WARNING

Injury caused by rotating parts or live (under voltage) parts

Live electrical parts are dangerous. Contact with them can cause death, serious injury or material damage.

- Before carrying out any maintenance work on the separately driven fan, disconnect it from the mains, particularly before opening the terminal box.
- Make sure that the device cannot be switched back on.

Servicing the separately driven fan

However, dirt and dust deposits on the impeller and the motor, particularly in the gap between the impeller and the inlet nozzle can impair its function.

- Remove the dirt and dust deposits regularly; the intervals depend on how dirty the surrounding area is.
- Make sure that the impeller is cleaned evenly, as irregular deposits can lead to an imbalance.
- The full air flow can only be achieved when air can freely flow through the impeller.
- There must be a clearance of at least 1 x air intake diameter in the axial direction.
- A uniform gap must be maintained between the impeller and the air intake assembly.

Servicing the separately driven fan motor

- Perform an occasional visual inspection of the separately driven fan motor and check it electrically and mechanically every time the rolling bearings are replaced.
- Replace the permanently lubricated rolling bearing on the separately driven fan motor after 40000 operating hours or five years at the latest.

9.3 Corrective maintenance

Observe the following when carrying out any work on the motor:

- Comply with the general safety instructions (Page 11).
- Comply with the applicable national and sector-specific regulations.
- When using the motor within the European Union, comply with the specifications laid down in EN 50110-1 regarding safe operation of electrical equipment.

If the motor has to be transported, please observe the information and instructions in Chapter "Transport (Page 29)".

Note

Before commencing removal, you should mark how each of the fastening elements has been assigned, as well as how internal connections are arranged. This simplifies subsequent reassembly.

Avoid damaging the windings protruding out of the stator enclosure when assembling the end shield.

If possible, assemble the motor on and alignment plate. This ensures that the mounting feet surfaces are all on the same plane.

Sealing measures

1. Apply the necessary liquid sealant, e.g. Fluid-D, Hylomar, to the centering edge.
2. Check the terminal box seals, and if required, replace these.
3. Repair any damage to the paint, also to screwholts.
4. Take the necessary measures to ensure compliance with the applicable degree of protection.
5. Do not forget the foam rubber cover in the cable entry. Completely seal the holes, and ensure that cables do not come into contact with sharp edges.

9.3.1 Rolling bearings

Refer to the rating plate or the catalog for the designations of the bearings being used.

Bearing lifetime

Prolonged storage periods reduce the useful lifetime of the bearing grease. For permanently lubricated bearings, this reduces the bearing service life.
We recommend that the grease is replaced after a storage time of 12 months. Replace greased bearings also in the case of closed bearings (suffix 2Z or 2 RS). After 4 years in storage, generally replace all rolling bearings and grease.

Replacing bearings

Recommended interval after which bearings are to be replaced under normal operating conditions:

Table 9-1 Bearing replacement intervals

Ambient temperature	Principle of operation	Bearing replacement intervals
30 °C	Horizontal coupling operation	50,000 h
30 °C	With axial and radial forces	20,000 h

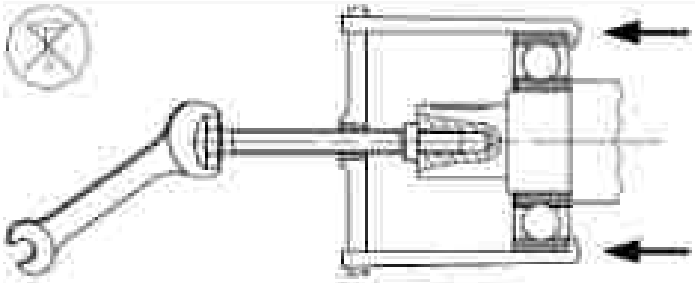
- Do not reuse bearings that have been removed.
- Remove the dirty spent grease from the bearing shield.
- Replace the existing grease with new grease.
- Replace the shaft seals when the bearings are replaced.
- Slightly grease the contact surfaces of the sealing lips.

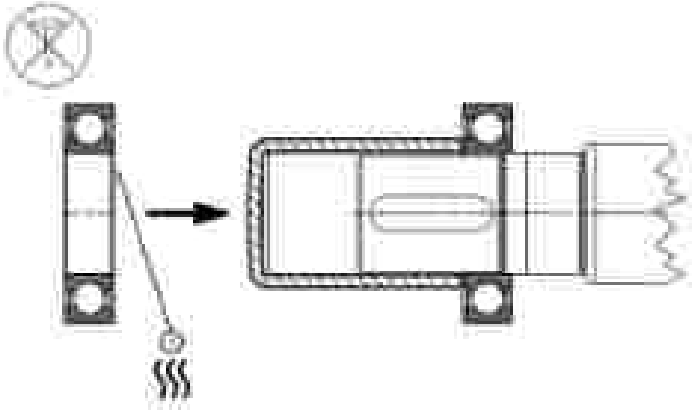
Note

Special operating conditions

The operating hours are reduced, e.g.:

- When motors are vertically mounted
- High vibration and surge loads
- Frequent reversing operation
- Higher ambient temperatures
- High speeds etc.





(1) Heat up 80 ... 100 °C

9.3.1.1 Bearing bushes

Protect the bearings against the ingress of dirt and moisture.

When fitting the bearing cartridges, observe the specified screw tightening torques (Page 119).

9.3.1.2 Installing bearings

Sealing the bearings

Note the following details:

- Shaft sealing rings are used to seal motors at the rotor shaft.
  - For V-ring, comply with the assembly dimension.
- Use the specified bearings.
- Ensure that the bearing sealing disks are in the correct position.
- Insert the elements for bearing preloading at the correct end.
- Fixed bearings can have a locking ring or bearing cover.
- Seal the bearing cap screws with the appropriate gaskets or with grease.
- Do not interchange the position of the bearing covers (DE and NDE or inner and outer).

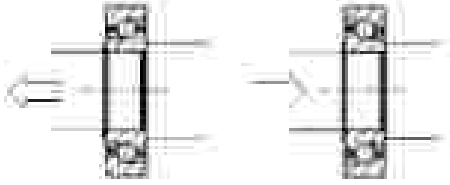
Danger as a result of rotor falling out

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 damage.

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

Installing rolling bearings

- Extreme caution and attention to cleanliness are vital when installing rolling bearings. Observe the correct assembly sequence of the components.
- Attach all components with the specified tightening torques (Page 119).
- For individually mounted angular contact ball bearings, carefully comply with the installation position corresponding to the permissible direction of force.



- Angular contact ball bearings arranged in pairs must always be installed in strict compliance with the manufacturer's specifications.
- Always use angular contact ball bearings of the same type.

Note

For further information about mounting the rolling bearing, please refer to the catalog or the information provided by the rolling bearing manufacturer.

Procedure

1. Replace the damaged components.
2. Remove any dirt from the components. Remove any grease and the remains of sealant or liquid thread locker.
3. Prepare the bearing seats:
   - Lightly oil the inner ring seat.
   - Grease the outer ring seat with a solid lubricant such as Klüberquiet BQH 72-102.
   - Press the inner bearing cover onto the shaft.
4. Warm up the rolling bearing.
5. Push the inner ring of the warmed up rolling bearing onto the shaft. Avoid any blows that might damage the bearing.
6. Ensure that the rolling bearing is resting against the shaft shoulder or the 2nd bearing.
7. Fill the bearing to the top with the specified lubricating grease as stamped on the lubricant plate.
8. Warm up the grease slinger (if one is available), and push it onto the shaft.
9. Depending on the particular version, fix the bearing with a locking ring or shaft nut.
10. Support the rotor when installing the bearing housing or bearing end shield.
11. Use a suitable sealant when assembling.
12. Assemble the bearing shield or bearing housing together with the bearing shield.
13. Install the outer bearing cover (if one is available).
14. Install the sealing elements.

9.3.2 Mounting dimension "x"

Mounting dimension "x" of V rings

Shaft height	x max.	
71	4.5 +0.5	Standard design
80 ... 112	6 +0.8	
132 ... 160	7 +1	
180 ... 225	11 +1	
250 ... 315	13.5 +1.2	

Special design

- Extreme caution and attention to the correct positioning are vital during installation and assembly.
- Make sure the sealing surface is free of dirt and damage.
- Lightly grease the sealing lips.

9.3.3 Fan

NOTICE
Destruction of the fan
Material damage can occur by forcefully removing the fan from the shaft.
Take care not to damage the snapping mechanisms on fans that are equipped with these.

Plastic fan

- Correctly expose the breakout openings provided in the fan plate.
- Heat up the fans to a temperature of approximately 50° C around the area of the hub.
- Use a suitable tool to pull off the fan (puller).
- Locate the arms of the pulling tool in the breakout openings and slightly tension the pressure screw of the tool.
- For fans with snapping mechanisms, simultaneously release the two snap-in lugs of the fan from the annular shaft groove.
  Keep the snap-in lugs in this position.
- Uniformly withdraw the fan from the shaft by turning the pressure screw of the pulling tool.
- Do not apply any hammer blows to avoid damaging the rotor shaft, the fan and the bearings.
- Order the appropriate new parts if damaged.

Metal fan

- Shaft heights 71...90: Release the M5 set screw so that the fan can rotate freely on the shaft.
- Shaft height 100...315: Remove the locking ring.
- Use a suitable tool to pull off the fan (puller).
- Locate the arms of the pulling tool in the openings in the fan in the vicinity of the hub.
- Alternatively, place the pulling tool at the outer edge of the fan plate.
- Uniformly withdraw the fan from the shaft by turning the pressure screw of the pulling tool.
- Do not apply any hammer blows to avoid damaging the rotor shaft, the fan and the bearings.
- Order the appropriate new parts if damaged.

Canopy

Canopies with spacer bolts or with screwed mounting brackets

Forcibly removing or separating can destroy the distance bolts, the connecting elements of the mounting bracket or the fan cover.

- Release the fixing screw on the outer surface of the canopy.
- Under no circumstances remove the spacer bolts of the mounting bracket – or forcibly separate them from one another or the cover.

Canopies with welded support brackets

- Release the fixing screws at the contact location (canopy foot - riveting nut) at the outer surface of the cover inlet.

9.3.4 Canopy, encoder under the canopy

- For screwed canopies, insert the fastening screws through the holes on the outer surface of the canopy. Tighten the fastening screws with a torque of 3 Nm ± 10 %.

9.3.5 Tightening torques

Note the information in Chapter "Tightening torques for screw and bolt connections (Page 119)".

9.3.6 Screw lock washers

Nuts or bolts that are mounted together with locking, resilient and/or force-distributing elements (e.g., safety plates, spring-lock washers, etc.) must be refitted together with identical, fully functional elements.

Locking and sealing elements must always be replaced!

9.3.7 Links

- Replace any corroded screws.
- Take care not to damage the insulation of live parts.
- Document the position of any rating and supplementary plates that have been removed.
- Avoid damaging the centering edges.

9.3.8 Reassembly: Miscellaneous information

- Position all rating and supplementary plates as in the original state.
- Where relevant, fix electric cables.
- Check the tightening torques of all screws, as well as those of screws that have not been released.

9.3.9 Optional add-on units

Note

Further documents

Observe all of the other documents provided with this motor.

You can find additional operating instructions here:

Service & support (Page 117)

Mounting a brake

Table 9-6 Assigning standard brakes for DLE motors

Shaft height	Pole	Brake maker	Model	Brake size	Brake torque (Nm)	Tightening torque for the manual release lever (Nm)
71	2	EMCO	14.458	8	8	2.8
	4...8	Intorq	BFK458	6	5	
80	2	EMCO	14.458	10	16	4.8
	4...8	Intorq	BFK458	8	10	2.8
90	2	EMCO	14.458	12	32	4.8
	4...8	Intorq	BFK458	10	20	
100	2	EMCO	14.458	16	80	12
	4...8	Intorq	BFK458	12	40	4.8
112	4...8	Intorq	BFK458	16	80	12
132	2...8	EMCO	14.458	18	150	23
160	2...8	EMCO	14.458	20	280	
180	2...8	EMCO	14.458	23	315	
200	2...8	EMCO	14.458	25	400	40
225	2...8	EMCO	14.458	25	400	

9.3.10 O-ring seal

If O-ring seals are present, you should check that they are in perfect condition and that the O-ring seals are properly seated in the grooves between the components. Replace damaged O-ring seals.

O-ring seals can be present on the following components, for instance:

- Adapters, tapers
- Entries, glands
- Bearing seals
- End shield seals
- Terminal box sealing

DLE1 shaft heights 71 ... 315

9.3.11 Encoder

Note
Further documents

Observe all the manufacturer's documentations provided with the encoder.

9.3.12 Grounding brush

- Ensure that the micro-switch, if available with grounding brush unit, is connected to the drive interlock.
- Check the wearing status of the grounding brush regularly and replace it if necessary.

Spare parts

10

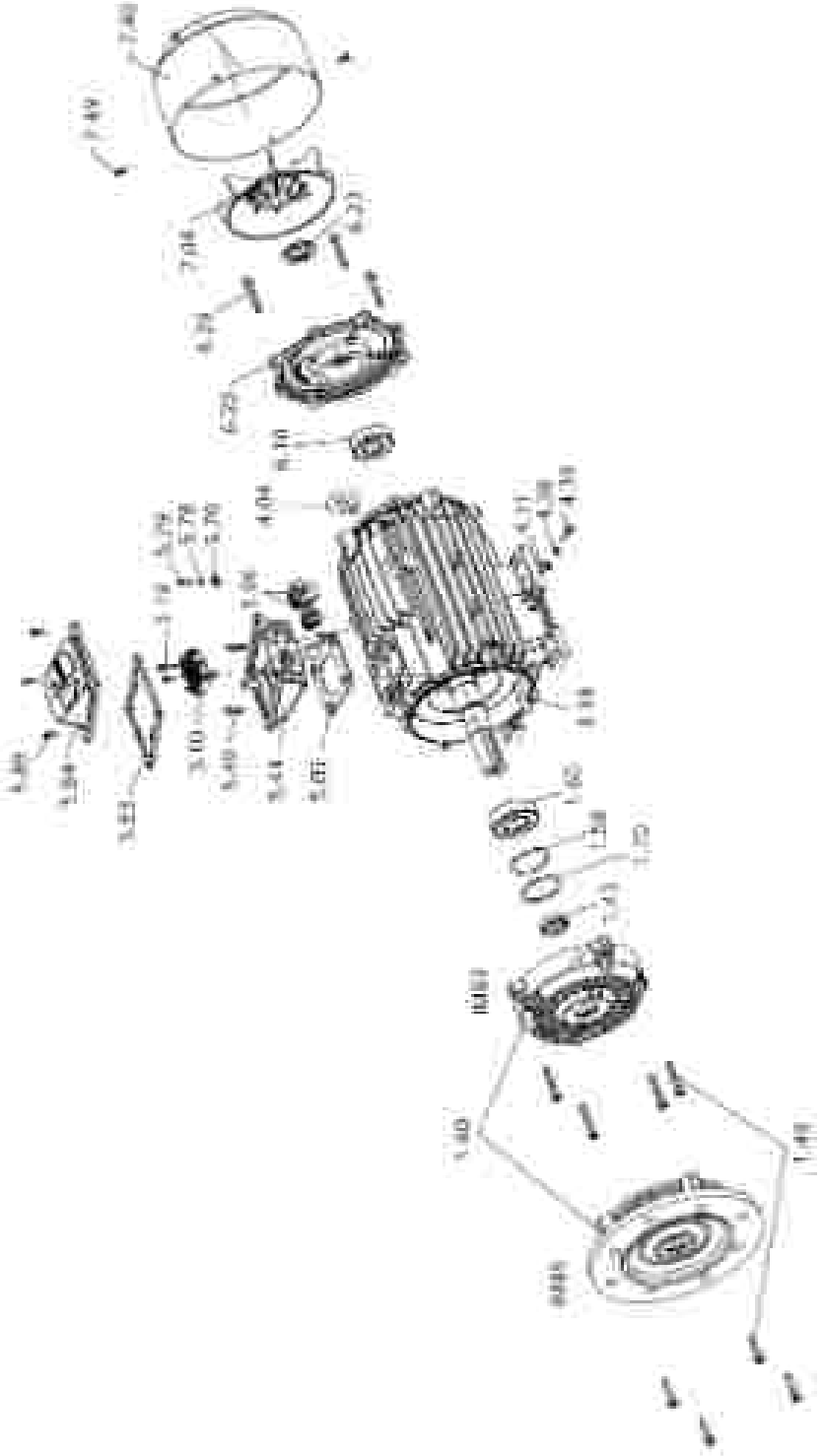
10.1 Part lists

Part	Description	Part	Description
1.40	End shield	5.69	Self tapping screw
1.41	Shaft sealing ring	5.70	Terminal clamp
1.44	Bearing cover DE, inner	5.78	Spring lock washer
1.45	Cover ring	5.79	Bolt
1.49	Bolt	5.80	Seal
1.58	Spring washer	5.84	Terminal box cover
1.60	Rolling bearing	5.89	Bolt
1.61	T-plug	5.96	Screw plug
1.62	Grease nipple	6.02	Locking ring
1.70	Shim	6.03	NDE bearing cover, inner (for 280 ... 315)
1.78	Feather key	6.10	Rolling bearing
1.96	Eyebolt (for 180 ... 315)	6.20	End shield
4.31	Grounding washer	6.23	Shaft sealing ring
4.37	Ground terminal plate	6.25	Lubrication sleeve
4.38	Spring lock washer	6.29	Self tapping screw
4.39	Grounding stud	6.45	Grease nipple
4.40	Washer	7.04	Fan
5.03	Seal	7.40	Fan cover
5.10	Complete terminal board	7.89	Bolt
5.16	Self-tapping screw		
5.23	Screw (drilled)		
5.36	Bushing holding plate for cable routing		
5.46	Upper section of the terminal box		

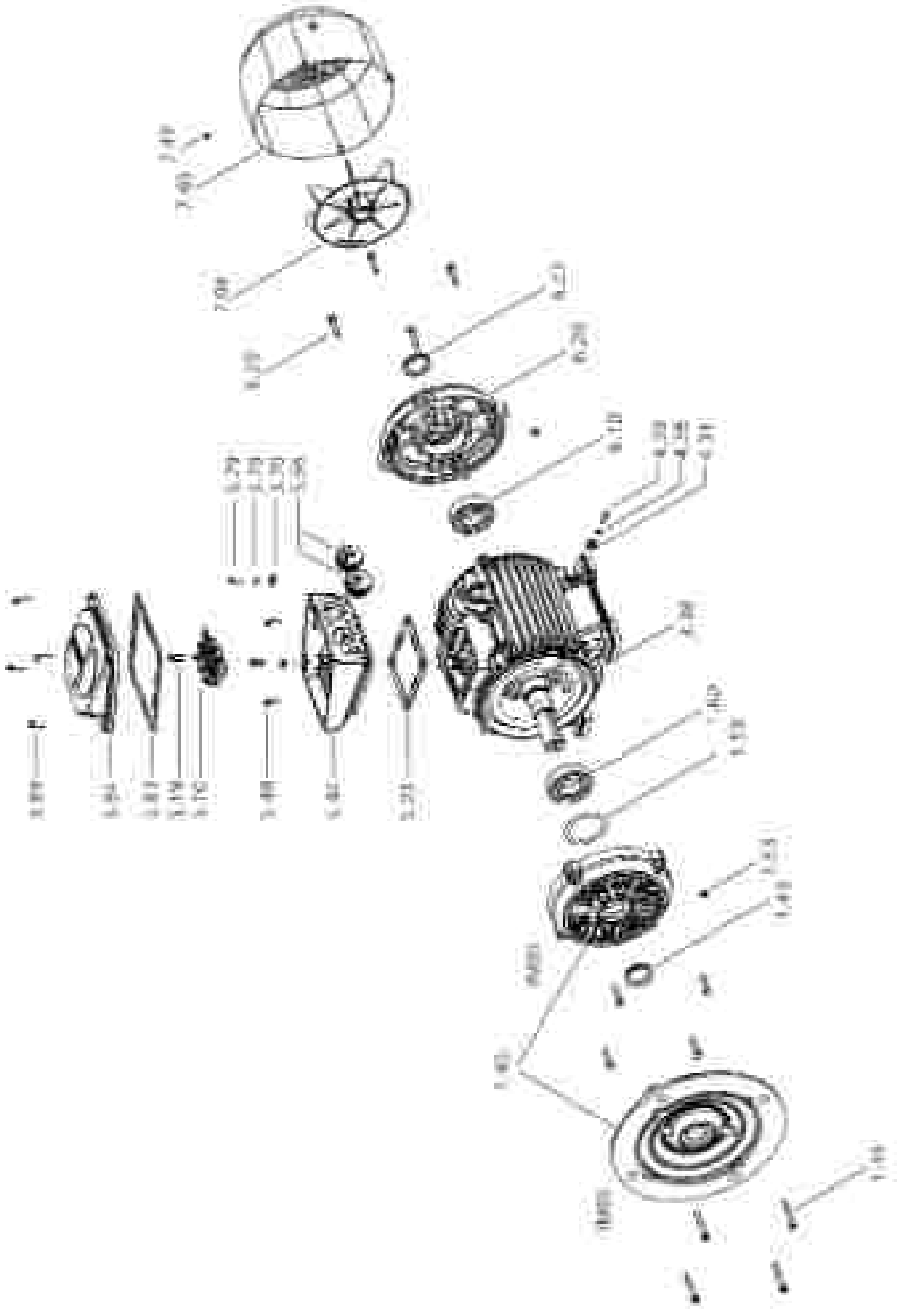
Tools for installing and withdrawing rolling bearings, fans and output transmission elements cannot be supplied.

10.2 Exploded drawings

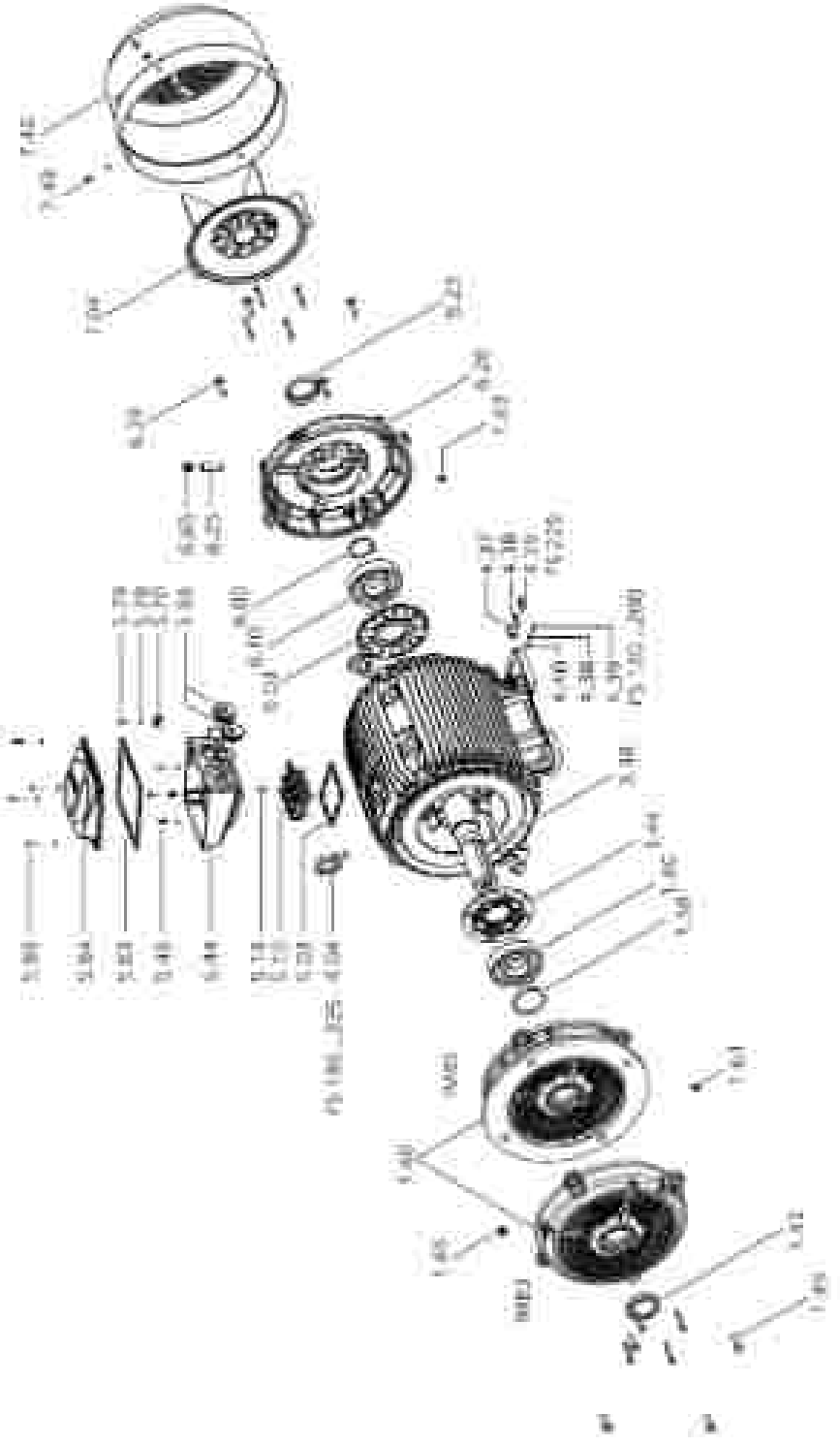
Shaft height 71...90



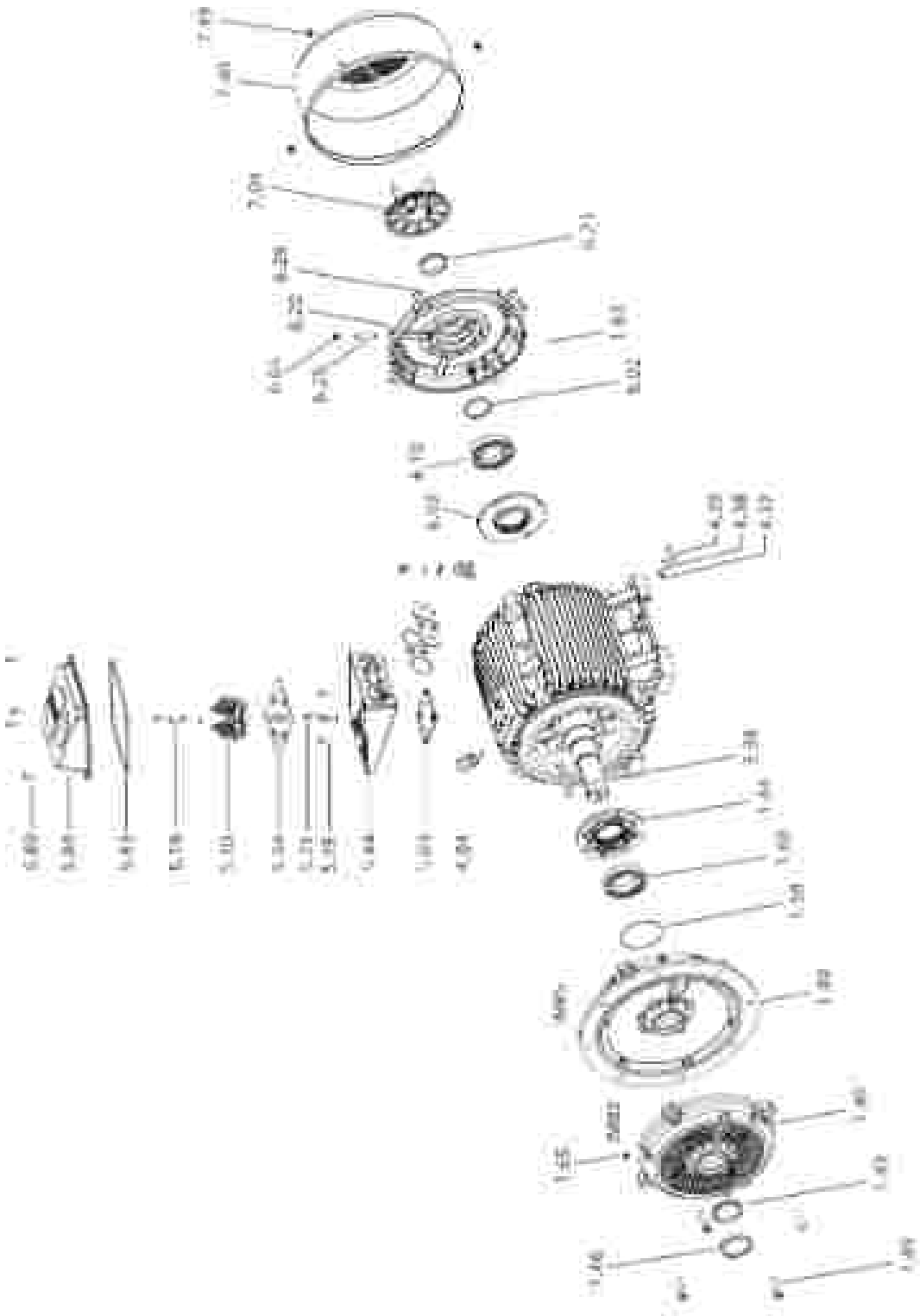
Shaft height 100...132



Shaft height 160…200



Shaft height 225...315



10.2 Exploded drawings

Disposal

11

Protecting the environment and preserving its resources are corporate goals of the highest priority for us. Our worldwide environmental management system to ISO 14001 ensures compliance with legislation and sets high standards in this regard. Environmentally friendly design, technical safety and health protection are always firm goals even at the product development stage.

Recommendations for the environmentally friendly disposal of the motor and its components are given in the following section. Be sure to comply with local disposal regulations.

Country-specific legislation

The motor uses materials that can be recovered or recycled. Correctly separating materials helps to simply recycle important materials.

- When disposing of the motor or of waste that is created during the individual phases of its life cycle, please observe the statutory requirements applicable in the country of use.
- Please contact your local authorities for more information about disposal.

11.1 RoHS - restricting the use of certain hazardous substances

In compliance with RoHS ("Restriction of certain Hazardous Substances") we replace substances that are damaging to the environment by those that are not based on state-of-the-art technology. In doing so, safety in operation and handling will take priority at all times.

11.2 Information according to Article 33 of the REACH regulation

This product contains one or several subproducts in which the following substance – belonging to the "list of candidates" – exists in a concentration exceeding 0.1 percent by weight:

- CAS No. 7439-92-1, lead

Based on the currently available information, we assume that this substance does not represent any risk when correctly used, including its disposal.

11.3 Preparing for disassembly

Disassembly of the motor must be carried out and/or supervised by qualified personnel with appropriate expert knowledge.

1. Contact a certified waste disposal organization in your vicinity. Clarify what is expected in terms of the quality of dismantling the motor and provision of the components.
2. Carefully follow the "5 safety rules" (Page 11).
3. Disconnect all electrical connections and remove all cables.
4. Remove all liquids such as oil and cooling liquids. Collect the liquids separately and dispose of them in a professional manner.
5. Detach the motor fixings.
6. Transport the motor to a suitable location for disassembly.

11.4 Dismantling the motor

Dismantle the motor using the general procedures commonly used in mechanical engineering.

⚠ WARNING

Motor parts can fall

The motor is made up of heavy parts. These parts are liable to fall during dismantling. This can result in death, serious injury or material damage.

- Before you release any motor parts, secure them so that they cannot fall.

11.5 Disposal of components

Components

The motors consist mainly of steel and various proportions of copper and aluminium. Metals are generally considered to be unlimitedly recyclable.

Sort the components for recycling according to whether they are:

- Iron and steel
- Aluminium
- Non-ferrous metal, e.g. windings

  The winding insulation is incinerated during copper recycling.
- Insulating materials
- Cables and wires
- Electronic waste

Process materials and chemicals

Sort the process materials and chemicals for recycling according to whether they are for example:

- Oil
- Grease
- Cleaning substances and solvents
- Paint residues
- Anti-corrosion agent
- Coolant additives such as inhibitors, antifreeze or biocides

Dispose of the separated components according to local regulations or via a specialist disposal company. The same applies for cloths and cleaning substances which have been used while working on the motor.

Packaging material

- If necessary, contact a suitable specialist disposal company.
- Wooden packaging for sea transport consists of impregnated wood. Observe the local regulations.
- The foil used for water-proof packaging is an aluminium composite foil. It can be recycled thermally. Dirty foil must be disposed of via waste incineration.

11.5 Disposal of components

Service & support

A

A.1 Siemens Service Center (Kalwa)

Log an online service request at: www.siemens.co.in/industry-services

For direct access to our technical experts contact:

- Online Support (http://www.siemens.com/automation/csi/callsupport)
- Support request (http://www.siemens.com/automation/supportrequest)
- Product training web link (https://www.siemens.co.in/sitrain)

Service numbers

Table A- 1 Siemens Customer Care Desk contact data:

	1800 209 0987 / 1800 200 0987
	+91-22-27690150
	+91 22 3325 3881
	in.cindia@siemens.com
Internet	www.siemens.co.in/industry-services

A.2 Siemens Industry Online Support

Technical questions or additional information

If you have any technical queries or you require additional information, please contact Technical Support (http://support.industry.siemens.com/cs/ww/en/ps/4868).
Please have the following data ready:

- Type
- Serial number

You can find this data on the rating plate.

Contact person:

If you wish to request on-site service or order spare parts, please contact your local office. This office will contact the responsible service center on your behalf. You can find your contact person in the relevant contact database:
http://www.siemens.com/yourcontact (http://www.siemens.com/yourcontact)

Siemens Support for on the move

With the "Siemens Industry Online Support" App, you can access more than 300,000 documents for Siemens Industry products – any time and anywhere. The App supports you in the following areas:

- Resolving problems when executing a project
- Troubleshooting when faults develop
- Expanding a system or planning a new system

Further, you have access to the Technical Forum and other articles that our experts have drawn up:

- FAQs
- Application examples
- Manuals
- Certificates
- Product announcements and many more

The app is available for Apple iOS, Android and Windows Phone.

A.3 Further documents

These operating instructions can also be obtained at the following internet site:
http://support.industry.siemens.com (Page 117)

Technical data

B

B.1 Configurator for drive technology

Configurator for drive technology

You can find product information on your motor according to ErP Directive 2019/1781 in the configurator for drive technology. If you enter the motor order number (MLFB), you will find technical documentation such as data sheets, characteristic curves and CAD drawings for your motor: https://mall.siemens.com/mlfb (https://mall.siemens.com/mlfb)

B.2 Tightening torques

B.2.1 Tightening torques for screw and bolt connections

Bolt locking devices

- Refit nuts or bolts that are mounted together with locking, resilient, and/or force-distributing elements with identical, fully-functional elements when re-assembling. 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 243) 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, such as 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 8-1 Tightening torques for bolted connections with a tolerance of ±10 %.

Thread Ø	M5	M6	M8	M10	M12	M16	M20	M24
Nm	5	8	22	40	70	170	340	600

The tightening torques stated above apply to screws with property class 8.8, A4-70 or A4-80 according to ISO 898-1, however only to bolts screwed into components made from materials with the same or higher property class, e.g. cast iron, steel or cast steel.

Non-standard tightening torques

Different tightening torques for electrical connections and bolted connections for parts with flat seals or insulating parts are specified in the relevant sections and drawings.

8.2.2 Terminal board and grounding

Table 8-2 Tightening torques for electrical connections on the terminal board and grounding

Thread Ø		M 3.5	M 4	M 5	M 6	M 8	M 10	M 12	M 16
Nm	min	0.8	0.8	1.8	2.7	5.5	9	14	27
	max	1.2	1.2	2.5	4	8	13	20	40

8.2.3 Terminal boxes, end shields, grounding conductors, sheet metal fan covers

If no other tightening torques are specified, then the values in the following table apply.

Table 8-3 Tightening torques for screws on the terminal box, end shields, screw type grounding conductor connections

Thread Ø		M 3.5	M 4	M 5	M 6	M 8	M 10	M 12	M 16	M20
Nm	min	0.8	2	3.5	6	16	26	46	110	225
	max	1.2	3	5	9	24	40	70	165	340

Table 8-4 Tightening torques for self tapping screws on the terminal box, end shields, screw type grounding conductor connections, sheet metal fan covers

Thread Ø		M 4	M 5	M 6
Nm	min	4	7.5	12.5
	max	5	9.5	15.5

B.2.4 Tightening torques for electrical connections of monitoring equipment and anti-condensation heating

Table B- 5 Tightening torques for monitoring equipment and anti-condensation heating

Main terminal box EN 60999-1: 2000 table 4 a)	≤ 4 Nm	
Auxiliary terminal box	min 0.6 Nm	max 0.8 Nm

B.2.5 Tightening torques for cable glands

Note

Avoid damaging the cable jacket.

Adapt the tightening torques to the cable jacket materials.

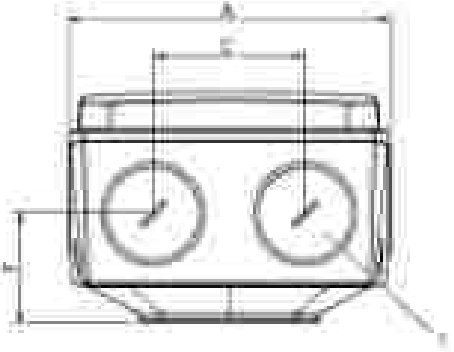
You should refer to the table in order to find the correct tightening torque for any metal and plastic cable glands that are to be mounted directly on the motor, as well as for any other screw-type connections (such as adapters).

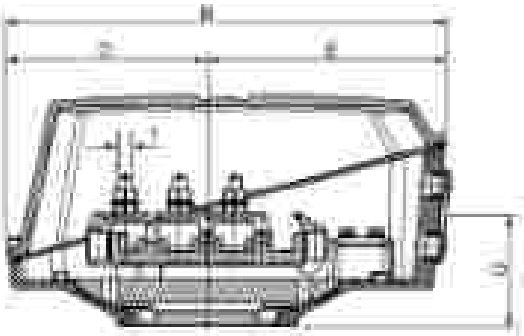
Table B- 6 Tightening torques for cable glands

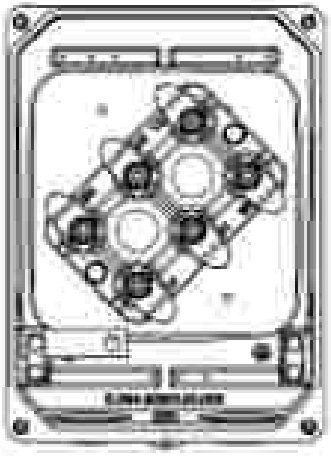
	Metal ±10 % Nm	Plastic ±10 % Nm	Clamping range [mm] Standard -30 °C ... 100 °C	O ring Cord dia. mm
M 12 x 1.5	4	2.5	3.0 ... 7.0	2
M 16 x 1.5	10	2	4.5 ... 10.0	
M 20 x 1.5	12	4	7.0 ... 13.0	
M 25 x 1.5			9.0 ... 17.0	
M 32 x 1.5	18	6	13.0 ... 21.0	
M 40 x 1.5			19.0 ... 28.0	
M 50 x 1.5	20		26.0 ... 35.0	
M 63 x 1.5			34.0 ... 45.0	

B.3 Technical data and drawings

B.3.1 Terminal box dimensions





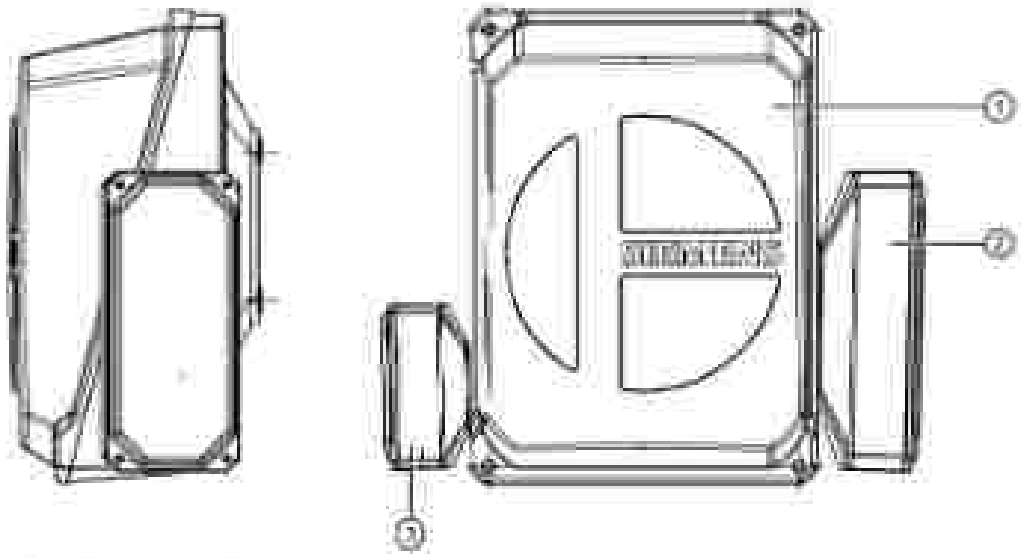


Shaft height	Terminal box	A	B	C	D	E	F	G	T	I Cable entry
71 ... 90	TB7.004	89	111	33	47.3	63.7	33.5	33.5	M4	1 x M16 x 1.5 1 x M25 x 1.5
100 ... 112	TB7.F04	126	163	48	80.5	82.5	33	33	M5	2 x M32 x 1.5
132	TB1.H04	134	163	48	80	83	48	48	M5	2 x M32 x 1.5
160 ... 180	TB1.J04	165	190	60	92	98	66	66	M5	2 x M40 x 1.5
200	TB1.L01	197	266	85	112	151	68	68	M6	2 x M50 x 1.5
225	TB1.L01	197	266	85	112	151	68	68	M8	2 x M50 x 1.5
250 ... 280	TB1.N01	233	319	110	145	174	79	79	M10	2 x M63 x 1.5
315	TB1.Q01	299	374	110	168	210	106	106	M12	2 x M63 x 1.5

Note

The dimensions stated above apply to the standard executions. For detailed information about the terminal box, refer to the Order Document respectively.

8.3.2 Arrangement of the auxiliary terminal box



1 Main terminal box
2 Auxiliary terminal box, type II
3 Auxiliary terminal box, type I

8.3 Technical sheet and drawings

Quality documents

C

C.1 Quality documents SIMOTICS in SIOS

You can find the quality documents here:
https://support.industry.siemens.com/cu/ww/de/ps/13310/cert
(http://support.industry.siemens.com/cs/ww/en/ps/13310/cert)

Index

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