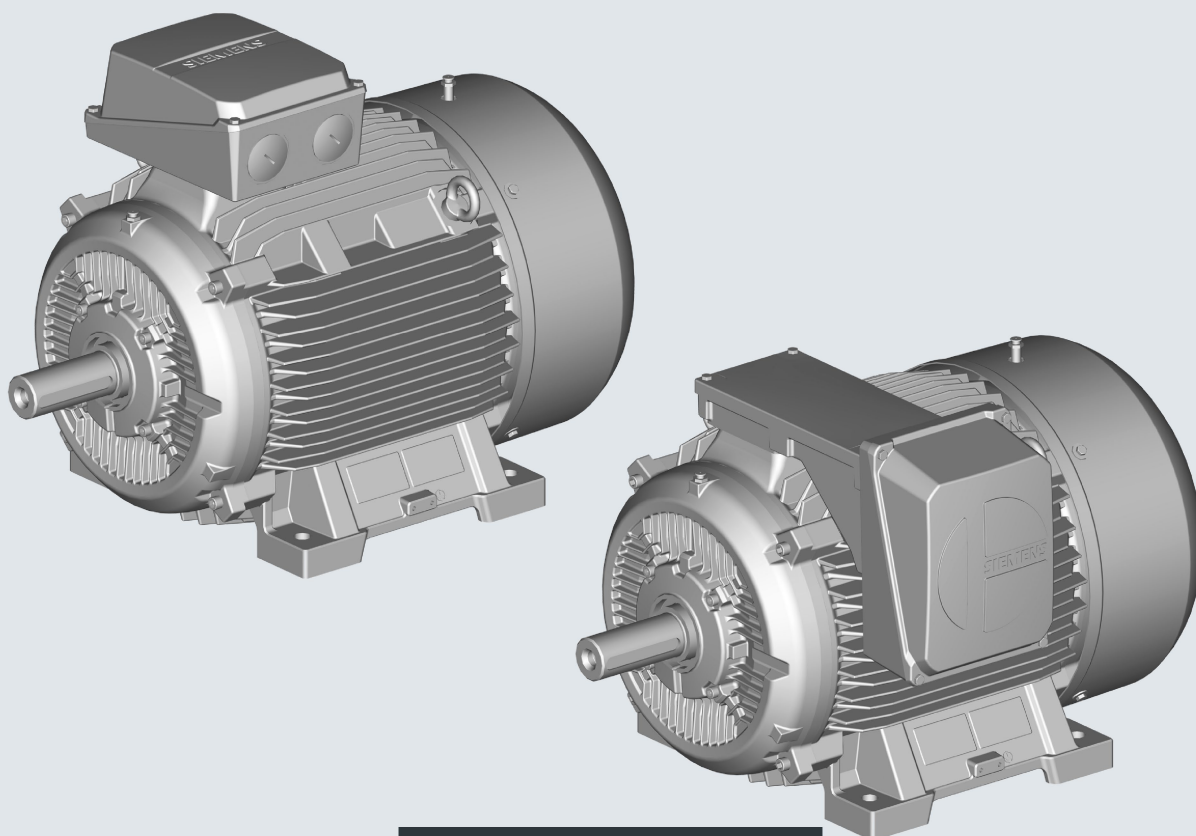


SIEMENS



Compact operating instructions

Low-voltage motors

SIMOTICS SD

1LE7

Edition

04/2018

www.siemens.com

SIEMENS

Low-voltage motors

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1LE7

Compact Operating Instructions

1 Introduction

These instructions describe the machine 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 machine and follow the instructions to become familiar with its design and operating principles and thus ensure safe, problem-free machine operation and long service life.

Please contact the service center if you have any suggestions on how to improve this document.

2 Safety notes

2.1 Information for those responsible for the plant or system

This electric machine has been designed and built in accordance with the specifications contained in Directive IS 12615, and is intended for use in industrial plants and systems. Please observe the country-specific regulations when using the electric machine 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 machine 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 appropriate service center (Page 38) for planning, installation, commissioning and service work.

You will find safety instructions in the individual sections of this document. Follow the safety instructions for your own safety, to protect other people and to avoid damage to property.

Observe the following safety instructions for all activities on and with the machine.

2.2 The 5 safety rules

For your own personal safety and to prevent material damage when carrying out any work, always observe the safety-relevant instructions and the following five safety rules according to EN 50110-1 "Working in a voltage-free state". Apply the five safety rules in the sequence stated before starting work.

5 safety rules

1. Disconnect the system.
Also disconnect the auxiliary 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 machine 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 machine 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 machine. In addition to the safety measures cited, as a matter of principle, the use of caution is necessary when you are near the machine. Always pay attention to your safety.

Also observe the following to prevent accidents:

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



! WARNING

Live parts

Electric machines contain live parts.

Fatal or severe injuries and substantial material damage can occur if the covers are removed or if the machine is not handled, operated, or maintained properly.

- Always observe the "five safety rules" (Page 1) when carrying out any work on the machine.
- Only remove covers in the manner described in the operating instructions.
- Operate the machine properly.
- Regularly and professionally maintain the machine according to the instructions provided in the "Maintenance" (Page 27) chapter of the operating instructions.



! WARNING

Rotating parts

Electric machines contain dangerous rotating parts.

Fatal or severe injuries and substantial material damage can occur if the covers are removed or if the machine is not handled, operated, or maintained properly.

- Only remove the covers using the methods described by these operating instructions.
- Operate the machine properly.
- Regularly and correctly maintain the machine.
- Secure free shaft extensions and other rotating part such as couplings and pulley belts so that they cannot be touched.



! WARNING

Hot surfaces

Electric machines have hot surfaces. Touching hot surfaces can result in severe burns.

- Allow the machine to cool before starting work on the machine.
- Only remove the covers using the methods described by these operating instructions.
- Operate the machine properly.



CAUTION

Hazardous substances

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

- 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.



CAUTION

Flammable substances

Chemical substances required for the setup, operation and maintenance of machines 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.

Interference to electronic devices caused by electrical power equipment

Electrical power equipment generate electric 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.

- It is forbidden for people with pacemakers to enter the vicinity of the machine.
- 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.
- Do not carry any magnetic or electronic data media.

3 Description

3.1 Applications

3.1.1 Intended use

Intended use of the machines

These machines are intended for industrial installations. They comply with the harmonized standards of the series EN / IEC 60034-1 (VDE 0530, IS 12615). It is prohibited to use these motors in hazardous zones if the marking on the rating plate does not explicitly permit line or converter operation. If other/more 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 ensured by the customer.

Note

Machine 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. Please observe the EN / IEC 60204-1 standard.



WARNING

Risk of explosion

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

- **Never** operate this machine in hazardous areas.

3.1.2 CE marking



Use of machines without CE marking

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

3.2 Design

3.2.1 Machine design

Machines of this series are low-voltage three-phase induction or reluctance-synchronous machines with a cylindrical shaft end and keyway. They can be supplied as single-speed machines with different efficiency classes or as pole changing machines for several speeds.

In the case of machines with feet (IM B3 type of construction), the feet are cast.

3.2.2 Regulations

The regulations and standards used as the basis for designing and testing this machine are stamped on the rating plate. The machine 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 machines and inspections	EN / IEC 60034-2-1	IS 12615
Degree of protection	EN / IEC 60034-5	
Cooling	EN / IEC 60034-6	
Type of construction	EN / IEC 60034-7	IS 2253
Maße von Drehstrom-Asynchronmotoren für Fußmontage Dimensions of three phase foot mounted induction motors		IS 1231
Maße von Drehstrom-Asynchronmotoren für Flanschmontage Dimensions of three phase flange mounted induction motors		IS 2223
Terminal markings and direction of rotation	EN / IEC 60034-8	
Starting characteristics of rotating electrical machines	EN / IEC 60034-12	
Vibration severity grades	EN / IEC 60034-14	IS 12075
Efficiency classification of three-phase squirrel-cage induction motors	EN / IEC 60034-30 -1	IS 12615
IEC standard voltages	IEC 60038	
Leitfaden für die Erdung Code of practice for earthing		IS 3043

3.2.3 Cooling and ventilation

Forced ventilation (optional): Type of cooling IC 416 in accordance with 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 closed 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.

See also

Commissioning an external fan (Page 22)

3.2.4 Bearings

In order to support the machine shaft and maintain its position in the non-moving part of the machine, only 2 rolling bearings are used. One rolling bearing performs the function of a location bearing that transfers axial and radial forces from the rotating machine shaft to the non-moving part of the machine. The second rolling bearing is implemented as floating and support bearing in order to allow thermal expansion inside the machine 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.


3.2.5 Balancing

As standard, the motor is balanced dynamically with a half feather key (code "H").

Vibration level "A" is standard and, if ordered as an option, vibration level B is specified on the rating plate.

3.2.6 Types of construction/method of installation







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




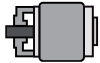


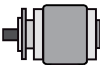

 WARNING
Machine parts can fall
The machine is made up of heavy parts. Incorrect assembly type can result in death, serious injury or material damage.
<ul style="list-style-type: none">Do not use machines in frame sizes $\geq 315L$ in the IM V3 type of assembly.

See also

Alignment and mounting (Page 16)

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)	

Basic type of construction code	Diagram	Other methods of installation	Diagram
IM B5 (IM 3001)		IM V1 (IM 3011)	
		IM V3 (IM 3031)	
Basic type of construction code	Diagram	Other methods of installation	Diagram
IM B14 (IM 3601)		IM V18 (IM 3611)	
		IM V19 (IM 3631)	
Basic type of construction code	Diagram		
IM B35 (IM 2001)			
IM B34 (IM 2101)			

3.2.7 Degree of protection

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

3.2.8 Environmental conditions

Limit values for the standard version

Ambient temperature	-20 °C to +50 °C
Installation altitude	≤ 1000 m
Air with normal oxygen content, usually	21 % (V/V)

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

4 Preparing for use

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

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

4.1 Safety-related aspects to consider when configuring the plant

A number of residual risks are associated with the machine. These are described in the chapter titled "Safety information" (Page 1) and in related sections.

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

4.2 Observing the operating mode

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

4.3 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 machine or installation.

4.4 Transportation and storage

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

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

4.4.1 Requirements for safe lifting and transporting

Preconditions for safe lifting and transporting

If you do not transport or lift the machine in a position appropriate for its construction, the machine can tip, slip into the lifting equipment or fall down. This can result in death, serious injury or material damage.

- Use only the load carrying device on the stator frame for lifting.
- Use the load carrying device appropriate for the machine position.
- Only use suitable rope guiding or spreading devices.

Center of gravity not centered

If the center of gravity of a load is not located centrally between the attachment points, the machine can tip over or slip out of the lifting equipment and fall when it is being transported or lifted. This can result in death, serious injury or material damage.

- Comply with the handling instructions on the machine when transporting it.
- Be aware of the possibility of different loads on the sling ropes or lifting straps and the carrying capacity of the lifting equipment.
- Always take account of the center of gravity when transporting or lifting the machine. If the center of gravity is not located centrally between the attachment points, then position the hoisting hook above the center of gravity.

4.4.2 Transport

Risk of dropping and swinging when transported suspended

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 $\leq 45^\circ$ according to ISO 3266 (DIN 580).
- Align the eyebolts so that the cables used for lifting are aligned with the planes of the eyebolts.

Toppling over or slipping of the motor

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 machine.
- When using the lifting eyes on the machine, do not attach any additional loads or weight. The lifting eyes are only designed for the weight of the machine 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 straps (EN1492-1) and load restraints (EN12195-2).

Note

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

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

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 motors again or reactivate the transport locks.

The machines 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 images shown on the packaging. Their meaning is as follows:



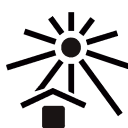
Up



Fragile goods



Protect against moisture



Protect against heat



Center of gravity



Hand hooks forbidden



Attach here

4.4.3 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 machines, 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 +50 °C

Maximum permissible air humidity: 60%

For machines 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 machine 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. 1Z, 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 DE and NDE bearings after a storage time of 48 months.

NOTICE
Storage The motor can be damaged if you use it or store it unprotected outdoors. <ul style="list-style-type: none">• 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 Electromagnetic compatibility

Note

If the torque levels are very unequal (e.g. when a reciprocating compressor is being driven), a non-sinusoidal machine 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 machine supply cable to the metal terminal box of the machine (with a metal screw connection) over a large surface area.
- On machines with integrated sensors (e.g. PTC thermistors), disturbance voltages caused by the converter may occur on the sensor cable.

4.6 Converter operation

4.6.1 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 machine rating plates. You can find parameter data here:
 - In the operating instructions for the converter.
 - In the SIZER engineering tool
 - In the SINAMICS Configuration Manuals.
- Do not exceed the specified maximum speed limit n_{\max} . You can either find this on the rating plate n_{\max} or on the supplementary plate for converter operation as the highest speed.
- Check that the machine is cooled sufficiently for commissioning purposes.

4.6.2 Converter input voltage

The insulation system of SIMOTICS machines significantly exceeds the requirements of stress category B (IVIC B = medium stress). If voltage peaks higher than those specified according to IVIC B can occur, then observe the data in the respective Catalog:

- For a line voltage (converter input voltage) up to max. 480 V and operation connected to a SINAMICS G / SINAMICS S converter with uncontrolled/controlled infeed: Comply with the guidelines for configuring motor and converter.
- For line voltages (converter input voltages) higher than 480 V, motors, which are ordered for converter operation, have an appropriate insulation system.
- Operation with a converter from another manufacturer: Comply with the permissible voltage peaks according to IEC 60034-18-41 in accordance with stress category C, 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 machine.

- Comply with the peak voltages as laid down in the guidelines above.

4.6.3 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:

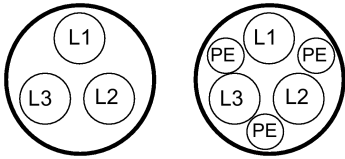
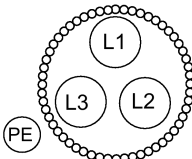
- between motor and driven machine
- between motor and converter
- between the terminal box and the RF grounding point at the motor enclosure.

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 aluminum 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 360° 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 RF equipotential bonding conductor is then not necessary.

	
Concentric copper or aluminum shield	Steel armor

- 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 RF 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 RF equipotential bonding cable.
 - Ensure that the contacts are made over a large area.

Overall system design

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 cores) 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.

4.6.4 Insulated bearings when operated with a converter

If the machine is operated from a low-voltage converter, insulated bearings are fitted at the NDE and an insulated encoder with insulated bearings (option).

Comply with the plates on the machine relating to bearing insulation and possible bridges.

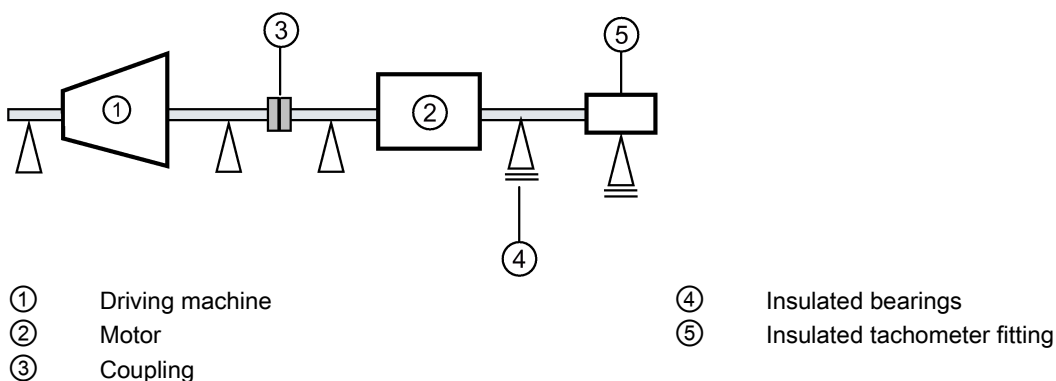


Figure 4-1 Schematic representation of a single drive

NOTICE

Bearing damage

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

- Also for subsequent installation work, such as the installation of an automatic lubrication system or a non-insulated vibration sensor, make sure that the bearing insulation cannot be bridged.
- Please contact the service center if necessary.

Tandem operation

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

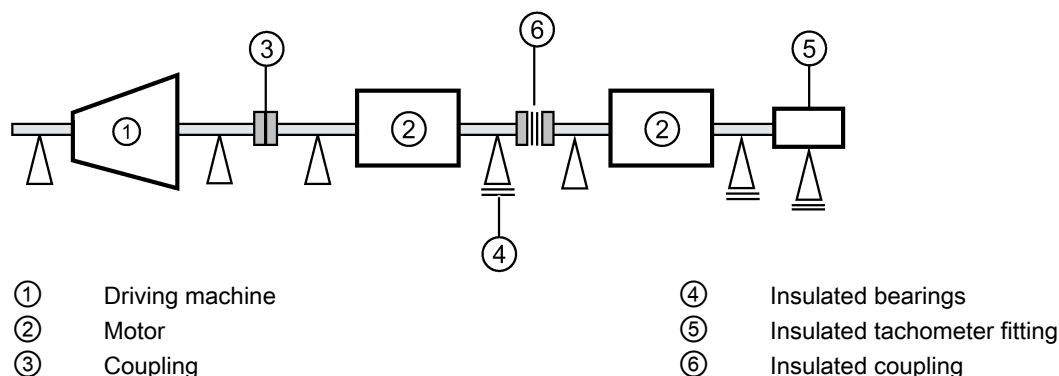


Figure 4-2 Schematic representation of a tandem drive

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 link the motors.

5 Installation

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

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

5.1 Conformity

Loss of conformity with European directives

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

5.2 Preparing for installation

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

- Staff have access to the operating and installation instructions.
- The machine is unpacked and ready for mounting at the installation location.

Note

Measure the insulation resistance of the winding before starting installation work

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 machine 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 machine has been set on the customer side, e.g. by decoupling from the driven load.

5.2.1 Insulation resistance

Measuring the insulation resistance provides information about the condition of the machine. It is therefore important to check the insulation resistance at the following times:

- Before starting up a machine 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 machine needs commissioning or any necessary measures such as cleaning and/or drying the winding:

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

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



! 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, please 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 machine enclosure. The winding temperature should not exceed 40 °C during the measurement. Convert the measured insulation resistances in accordance with the formula to the reference temperature of 40 °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.

Limit values for the stator winding insulation resistance

The following table specifies the measuring voltage and limit values for the insulation resistance. These values correspond to recommendations in IS 7816.

Table 5-1 Stator winding insulation resistance at 40 °C

U_N V	U_{meas} V	R_C MΩ
$U \leq 1000$	500	$R_C = 1 \text{ M}\Omega$ for each 1000 V $U_N + 1 \text{ M}\Omega$

U_{rated} = rated voltage, see the rating plate

U_{meas} = DC measuring voltage

R_C = minimum insulation resistance at reference temperature of 40 °C

e.g. For $U_N = 460 \text{ V}$: $R_C = 1 \text{ M}\Omega \cdot 0.46 + 1 \text{ M}\Omega = 1.46 \text{ M}\Omega$.

Conversion to the reference temperature

When measuring with winding temperatures other than 40 °C, convert the measuring value to the reference temperature of 40 °C according to the following equations from IEEE 43-2000.

(1)	R_C	Insulation resistance converted to 40 °C reference temperature
	k_T	Temperature coefficient according to equation (2)
	R_T	Measured insulation resistance for measuring/winding temperature T in °C
$R_C = k_T \cdot R_T$		
(2)	40	Reference temperature in °C
	10	Halving/doubling of the insulation resistance with 10 K
	T	Measuring/winding temperature in °C
$k_T = (0.5)^{(40-T)/10}$		

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 20 MΩ ($U \leq 1000 \text{ V}$) or 300 MΩ ($U > 1000 \text{ V}$). 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

The insulation resistance of the anti-condensation heating with respect to the machine housing should not be lower than 1 MΩ when measured at 500 V DC.

5.3 Installation

5.3.1 Machine installation

Note

In order to prevent the eyebolts loosening, after mounting, tighten these or remove them.

NOTICE


Damage to the mounted parts

To avoid material damage and injury, do not damage the mounted parts.

Only lift the motor at the lifting eyes provided for the purpose.

- For vertical installation, use all of the eyebolts provided and when necessary, hoisting straps (DIN EN 1492-1) and/or lashing straps (DIN EN 12195-2) to stabilize the position of the motor.
- Prevent foreign bodies from falling into the fan cover. For vertical machine 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 machine mounting.
- Do not obstruct the ventilation! Do not draw in the 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.

5.3.2 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. <ul style="list-style-type: none"> • Do not obstruct ventilation. • Prevent the air expelled by neighboring equipment from being immediately sucked in again. • For machines with a vertical type construction with air entry from above, prevent the ingress of foreign bodies and water in the air entry openings (standard IEC / EN 60079-0). • 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. <ul style="list-style-type: none"> • For types of construction with the shaft extension facing downwards, prevent small parts from falling into the fan cover by providing suitable covers (standard IEC / EN 60079-0). • Ensure that the cooling air flow is not reduced as a result of covers and that the minimum air clearances are maintained.

Table 5-2 Minimum dimension "X" for the distance between adjacent modules and the air intake of the machine

Shaft height	X mm
63 ... 71	15
80 ... 100	20
112	25
132	30
160	40
180 ... 200	90
225 ... 250	100
280 ... 315	110
355	140

5.3.3 Balancing

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

- "H" means balancing with a half feather key (standard)
- "F" means balancing with a whole feather key

CAUTION

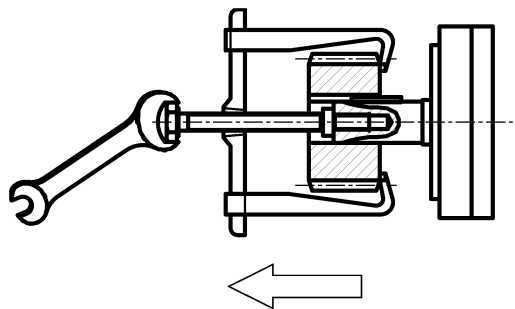
Risk of injury due to Incorrect installation or removal

If the required touch protection measures for drive output elements are not observed this can result in physical injury and material damage.

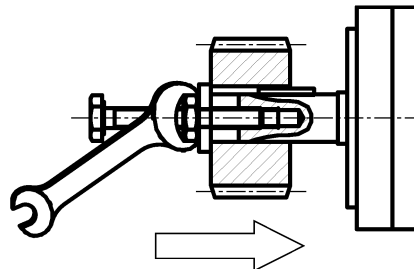
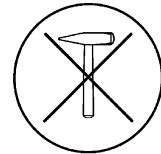
- The general touch protection measures for drive output elements must be observed.
- Drive output elements may only be pushed on or pulled off with the correct equipment.
- The feather keys are only locked against falling out during shipping. If you commission a machine without a drive output element, the feather keys must be secured to prevent them from being thrown out.

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

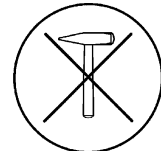
5.3.3.1 Mounting and withdrawing output transmission elements



Withdrawing output transmission elements



Mounting output transmission elements



- When mounting output transmission elements (coupling, gear wheel, belt pulley etc.) use the thread at the shaft end. If possible, heat up the output transmission elements as required.
- Use a suitable device when withdrawing output elements.
- When mounting or withdrawing, do not apply any blows, for example with a hammer or similar tool, to the parts to be mounted or withdrawn.
- Only transfer radial or axial forces specified in the catalog to the motor bearings via the shaft extension.

5.4 Alignment and mounting

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 machine from below, e.g. using a bracket, or bolt it.

- Precisely align the machine 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.

5.4.1 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 electrical machine with respect to the driven load:

- **Vertical positioning**
For vertical mounting positions, avoid deforming the machines by placing shims under the mounting feet. Keep the number of shims low; only use a few stacked shims.
- **Horizontal positioning**
To position the machine 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 well-balanced drive output element (coupling, belt pulleys, fans, ...)
 Maintain the maximum permissible vibration in operation according to ISO 10816.
 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 machine 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 IS 1231 when mounting the machine through its mounting feet or flange to the foundation or a machine flange.
 - Mount the machine at 4 foot or flanged holes that are at right angles to one another. The customer is responsible for selecting the strength (property class) of the mounting elements.
For mounting elements up to and including shaft height 160, property class 5.6 or higher is recommended, from shaft height 180, property class 8.8 or higher.
 - 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.
 - Ensure that the appropriate foot support is provided when mounting IM B6, IM B7, IM V5 and IM V6 machines onto walls and panels.
 - For IM B5 machines, with shaft heights ≥ 315 , support the enclosure.
It is absolutely crucial that you coordinate this installation together with your local service center.

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

5.4.2 Machine frame mounting feet (special design)

For terminal boxes mounted at the NDE (option H08), dimension C can deviate from IS1231.

For motors with double or triple holes at the NDE, maintain the foot mounting dimensions as specified in standard IS1231.

6 Electrical connection

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

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

6.1 Connecting the machine



! DANGER

Hazardous voltages

Death, injury or material damage can occur. Note the following safety information before connecting-up the machine:

- Only qualified and trained personnel should carry out work on the machine while it is stationary.
- Disconnect the machine from the power supply and take measures to prevent it being reconnected. This also applies to auxiliary circuits.
- Check that the machine really is in a no-voltage condition.
- Establish a safe 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 machine 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, EN 60034-1).

6.1.1 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 machine rotates in the clockwise direction.
- If you interchange two connections, e.g. L1, L2, L3 at V, U, W or according to NEMA at T₂ T₁ T₃, then the machine rotates counter-clockwise.

	According to IEC	According to NEMA
Clockwise rotation	U V W	T ₁ T ₂ T ₃
Counter-clockwise rotation	V U W	T ₂ T ₁ T ₃

Direction of rotation of the motor when looking at DE

6.2 Terminal box



DANGER

Hazardous voltage

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

6.2.1 Note regarding auxiliary terminal boxes

The auxiliary terminal boxes for connecting the different, customer-specific accessory parts are attached to the main terminal box.

6.2.2 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 6-1 Minimum air clearance dependent on rms value of the alternating voltage U_{rms}

Rms value of the alternating voltage U_{rms}	Minimum air clearance mm
≤ 250 V	3.0
≤ 500 V	3.0
≤ 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 table 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 Tightening torques

6.3.1 Terminal board and grounding

Table 6-2 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

6.3.2 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 machine, as well as for any other screw-type connections (such as adapters).

Table 6-3 Tightening torques for cable glands

	Metal ± 10 % Nm	Plastic ± 10 % Nm	Clamping range [mm]	O ring Cord dia. mm
			Standard -30 °C ... 100 °C	
M 12 x 1.5	8	1.5	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	11.0 ... 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	

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

Table 6-4 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	28	46	110	225
	max	1.2	3	5	9	24	42	70	165	340

6.4 Connecting the grounding conductor

The machine'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 machine.

- 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.

Enclosure grounding method		Conductor cross-section mm ²
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 6-5 Minimum cross-sectional area of grounding conductor

Minimum cross-section of the phase conductor for installation S [mm ²]	Minimum cross-section of the associated grounding connection [mm ²]
$S \leq 25$	S
$25 < S \leq 50$	25
$S > 50$	0.5 S

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 Final checks

Before closing the terminal box/terminal base of the machine 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 19)
- Avoid protruding wire ends.
- In order not to damage the cable insulation, freely arrange the connecting cables.
- Connect the machine 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.

7 Commissioning

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

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

7.1 Setpoint values for monitoring the bearing temperature

Prior to commissioning

If the machine is equipped with bearing thermometers, set the temperature value for disconnection on the monitoring equipment before the first machine 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 $T_{\text{operation}}$ 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	$T_{\text{operation}} + 5 \text{ K} \leq 115 \text{ °C}$
Shutting down	$T_{\text{operation}} + 10 \text{ K} \leq 120 \text{ °C}$

7.2 Commissioning an external fan

An external fan is suitable for use only in unidirectional operation; refer to the specification of the direction of rotation on the fan cowl or on the fan unit. The external fan ensures that the machine is cooled irrespective of the machine speed or direction of rotation.

If the cooling air is in open circulation, it must have only weak, chemically abrasive properties and only a low dust content.

Checks before the first test run

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

- The external 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.
- All protection measures have been taken to prevent accidental contact with moving or live parts.

Performing the test run

1. Switch the external fan motor on and off briefly.
2. Compare the the direction of rotation of the external fan with the arrow indicating the direction of rotation. If the direction of rotation and the arrow do not match, then switch two of the three phases of the external fan motor.

7.3 Measures before start-up

NOTICE

Damage to the machine

In order to avoid material damage, check the following points before commissioning the motor:

- Using appropriate measures, check whether the correct direction of rotation of the motor has been set by the customer, e.g. by decoupling from the driven load.
- Ensure that temperature-sensitive parts (cables, etc.) are not in contact with the machine enclosure.
- Ensure that the condensation drain holes are always located at the lowest part of the motor.

NOTICE

Damage caused by insufficient cooling

Effective cooling is no longer possible if air guidance of the machine is not provided as intended. This can damage the machine.

- Before commissioning, attach the covers to guarantee the intended air guidance.

Measures

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

- Ensure that the machine has been correctly installed and aligned.
- Connect the machine corresponding to the specified direction of rotation.
- Ensure that the operating conditions match the data specified on the rating plate.
- Lubricate the bearings, depending on the version. Ensure that machines with rolling bearings, which have been stored for longer than 12 months, are relubricated.
Also observe the notes in Chapter Preparation for use (Page 6).
- Ensure that any optional supplementary machine monitoring equipment has been connected correctly and is functioning as it should.
- For versions with bearing thermometers, check the bearing temperatures when the machine starts to run for the first time. Set the values for alarm and shutdown at the monitoring device. Also observe the notes in Chapter Setting values for monitoring the bearing temperature (Page 22).
- Corresponding to the control and speed monitoring functions implemented, ensure that the machine cannot exceed the permissible speeds specified on the rating plate.
- Ensure the correct setting conditions of the drive output elements depending on the type (e.g. alignment and balancing of couplings, belt forces in the case of a belt drive, tooth forces and tooth flank backlash/play in the case of gear wheel output, radial and axial clearance in the case of coupled shafts).
- Comply with the minimum insulation resistances and minimum air clearances.
- Ensure correct grounding and potential bonding connection of the protective conductor.
- Tighten all mounting bolts, connection elements and electrical connections to the specified torques.
- Remove any lifting eyes that were screwed after installation – or secure them to prevent them becoming loose.
- Rotate the rotor to ensure that it does not touch the stator.
- Implement all touch protection measures for both moving and live parts.
- Ensure that free shaft extensions cannot be touched, e.g. by attaching covers.
- Secure any featherkeys so that they cannot be flung out.
- Ensure that the optional external fan is ready for operation and connected so that it rotates in the specified direction.
- Ensure that the cooling airflow is not obstructed or diminished in any way.
- If an optional brake is being used, ensure that it is functioning perfectly.
- Comply with the specified mechanical limit speed n_{\max} , and ensure that it is not exceeded.

If the design of the machine requires the converter to be assigned in a particular way, the relevant information will be provided on the rating plate or an additional label.

Note

It may be necessary to perform additional checks and tests in accordance with the specific situation on site.

8 Operation

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

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

Switching on the machine



! DANGER

Hazardous voltages

Electrical machines are at hazardous voltage levels. Contact with these can result in death, serious injury or material damage.

Operating the machine on a line supply system with a non-grounded neutral point is only permitted for short periods of time that occur rarely, e.g. the time leading to a fault being eliminated. Cable ground fault EN / IEC 60034-1.

NOTICE

Damage to the machine or premature bearing failure

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

- It is absolutely crucial that you maintain the permissible vibration values to avoid damage to the machine or its destruction.
- In operation, observe the vibration values in accordance with ISO 10816-3.
- Under all circumstances maintain the minimum radial load of cylindrical roller bearings of 50% corresponding to what is specified in the catalog.
- Take the appropriate measures to reduce bearing currents. Observe the Chapter Converter operation.

! WARNING

Faults in operation

Changes with respect to normal operation indicate that there is an impaired function. This can cause faults which can result in eventual or immediate death, severe injury or material damage.

For instance, observe the following signs that could indicate a malfunction:

- Higher power drawn than usual
- Higher temperatures than usual
- Unusual noises
- Unusual smells
- Response of monitoring equipment

Immediately contact the maintenance personnel if you identify any irregularities. If you are in doubt, immediately switch off the machine, being sure to observe the system-specific safety conditions.

NOTICE


Risk of corrosion due to condensation


If the machine and/or ambient temperatures fluctuate, this can result in condensation inside the machine.

- If available, remove the drain plugs or drain screws to drain the water depending on the ambient and operating conditions.
- If available, re-attach the drain plugs or drain screws.

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

Switching on the machine with anti-condensation heating (optional)

 CAUTION
Machine overheating Minor injury or material damage can occur if you do not observe the following: <ul style="list-style-type: none">• If available, switch off the anti-condensation heating each time before switching on.

 CAUTION
Risk of injury when touching the fan There is a risk of injury at machines equipped with a fan cover (e.g. on machines in the textile industry), as the fan is not completely touch protected. <ul style="list-style-type: none">• 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 Stoppages

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

Under normal ambient conditions, e. g. the stopped machine is not exposed to any vibration, no increased level of corrosion, etc. in general, the following measures are necessary during stoppages.

8.1.1 Stoppages

Longer non-operational periods

Note

- For longer non-operational periods (> 1 month), either operate the machine or at least turn the rotor regularly, approximately once per month.
- Please refer to the section "Switching on" before switching on to recommission the motor.
- Remove any machine rotor locking devices before you turn the rotor.

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. <ul style="list-style-type: none">• Apply suitable corrosion protection, preservation, packing and drying measures.

Switching on the anti-condensation heater

Switch on any anti-condensation heating while the machine is not being operated.

Taking the machine out of service

Details regarding the necessary measures, Chapter Preparing for use (Page 6).

Lubricating before recommissioning

NOTICE
Dry running bearings Bearings can be damaged if they do not have sufficient grease. <ul style="list-style-type: none">• 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. Observe the data on the lubricant plate. Chapter Rolling bearings (Page 29).

8.1.2 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 machine for a brief period once a month. As a minimum, turn the rotor several times.

If you have uncoupled the machine 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 machine.

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.

- During recommissioning, refer to the information in Chapter "Commissioning".

See also

Commissioning (Page 22)

8.1.3 Decommissioning the machine

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

8.1.4 Re-commissioning the machine

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

- Study the record made when the machine was decommissioned, and reverse the measures that were taken for conservation and storage.
- Perform the measures listed in the "Commissioning" section.

See also


Commissioning (Page 22)

9 Maintenance

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

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

9.1 Safety instructions for inspection and maintenance

 WARNING
Rotating and live parts Electric machines contain live and rotating parts. Fatal or serious injuries and substantial material damage can occur if maintenance work is performed on the machine when it is not stopped or not de-energized. <ul style="list-style-type: none">• Perform maintenance work on the machine only when it is stopped. The only operation permissible while the machine is rotating is regreasing the rolling bearings.• When performing maintenance work, comply with the five safety rules.



WARNING

Machine damage

If the machine is not maintained it can suffer damage. This can cause faults which can result in eventual or immediate death, serious injury or material damage.

Perform regular maintenance on the machine.



CAUTION

Dust disturbances when working with compressed air

When cleaning with compressed air, dust, metal chips, or cleaning agents can be whirled up. Injuries can result.

When cleaning using compressed air, make sure you use suitable extraction equipment and wear protective equipment (safety goggles, protective suit, etc.).

NOTICE

Damage to insulation

If metal swarf enters the winding head when cleaning with compressed air, this can damage the insulation. Clearance and creepage distances can be undershot. This may cause damage to the machine extending to total failure.

When cleaning with compressed air, ensure there is adequate extraction.

NOTICE

Machine damage caused by foreign bodies

Foreign bodies such as dirt, tools or loose components, such as screws etc., can be left by accident inside the machine 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 machine.

- When carrying out maintenance work, make sure that no foreign bodies are left in or on the machine.
- Securely attach all loose parts again once you have completed the maintenance procedures.
- Carefully remove any dirt.

Note

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

9.2 Inspection and maintenance

9.2.1 Re-greasing

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

Grade of grease for standard motors (IP55) UNIREX N3 - ESSO.

Note

It is not permissible to mix different types of grease.

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 machine must be immediately relubricated before commissioning. For information on permanently-greased bearings, please refer to the section titled Rolling bearings (Page 29).

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.

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- Regreasing should be carried out when the motor is running (max. 3600 rpm).

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

WARNING

Rotor can fall out

If the machine 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 machine in a vertical position.

9.2.2 Cleaning

Cleaning the grease ducts and spent grease chambers

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

Note

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.

NOTICE

Damage to the machine

Material damage can occur if you direct compressed air in the direction of the shaft outlet or machine openings.

- Avoid pointing compressed air directly onto shaft sealing rings or labyrinth seals of the machine.

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

9.2.3 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 machine 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 machine.

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.

9.3 Repair

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

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

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.

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 screws/bolts.
 4. Take the necessary measures to ensure compliance with the applicable degree of protection.
 5. Do not forget the holding plate above the foam cover at the terminal box cable entry point. Completely seal the holes, and ensure that cables do not come into contact with sharp edges.
- 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.

9.3.1 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
50 °C	Horizontal coupling operation	50 000 h

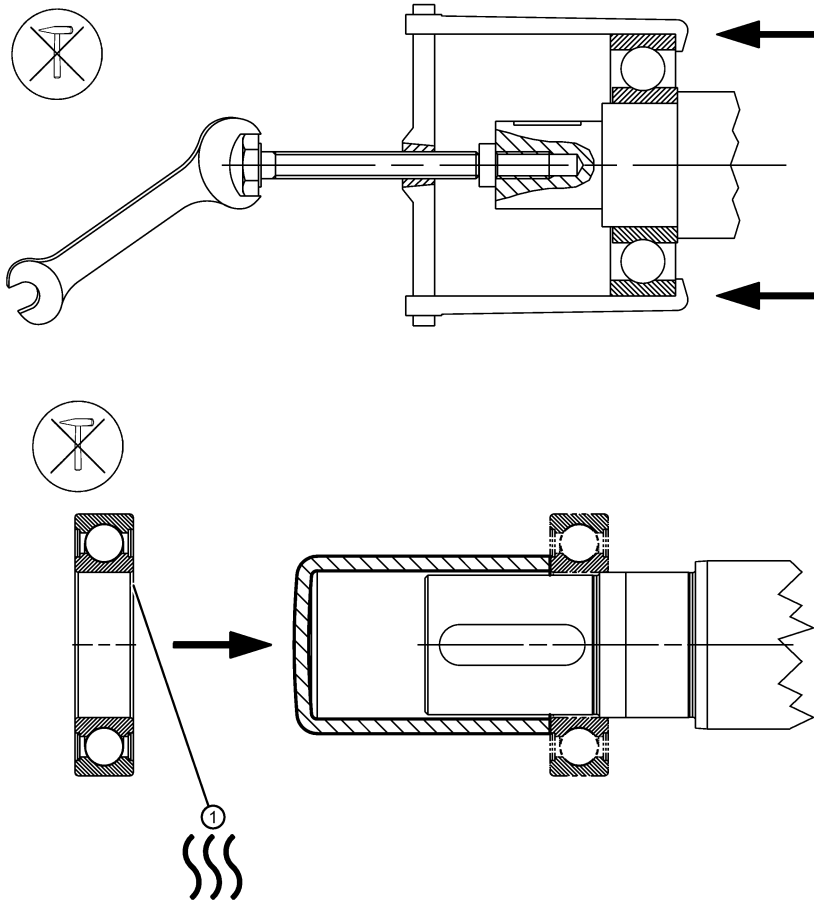
- Do not reuse bearings that have been removed.
- Remove the dirty spent grease from the bearing shield.
- Replace the existing grease with new grease.
- Replace the shaft seals when the bearings are replaced.
- Slightly grease the contact surfaces of the sealing lips.

Note

Special operating conditions

The operating hours are reduced, e.g.

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



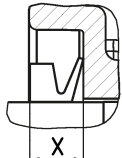
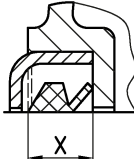
① Heat up 80 ... 100 °C

Sealing the bearings

Note the following details:

- Shaft sealing rings are used to seal machines at the rotor shaft.
 - For V rings, 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).

Mounting dimension "x" of V rings

Motor types	Shaft height	X mm	
1LE7	71	4.5 ±0.6	Standard design  Special design 
	80 ... 112	6 ±0.8	
	132 ... 160	7 ±1	

9.3.2 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

- 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.
- Take care not to damage the snapping mechanisms on fans that are equipped with these.
- To ensure this, the fans should be heated to a temperature of approximately 50 °C around the area of the hub.
- If any damage is caused, request new parts.

10 Spare parts

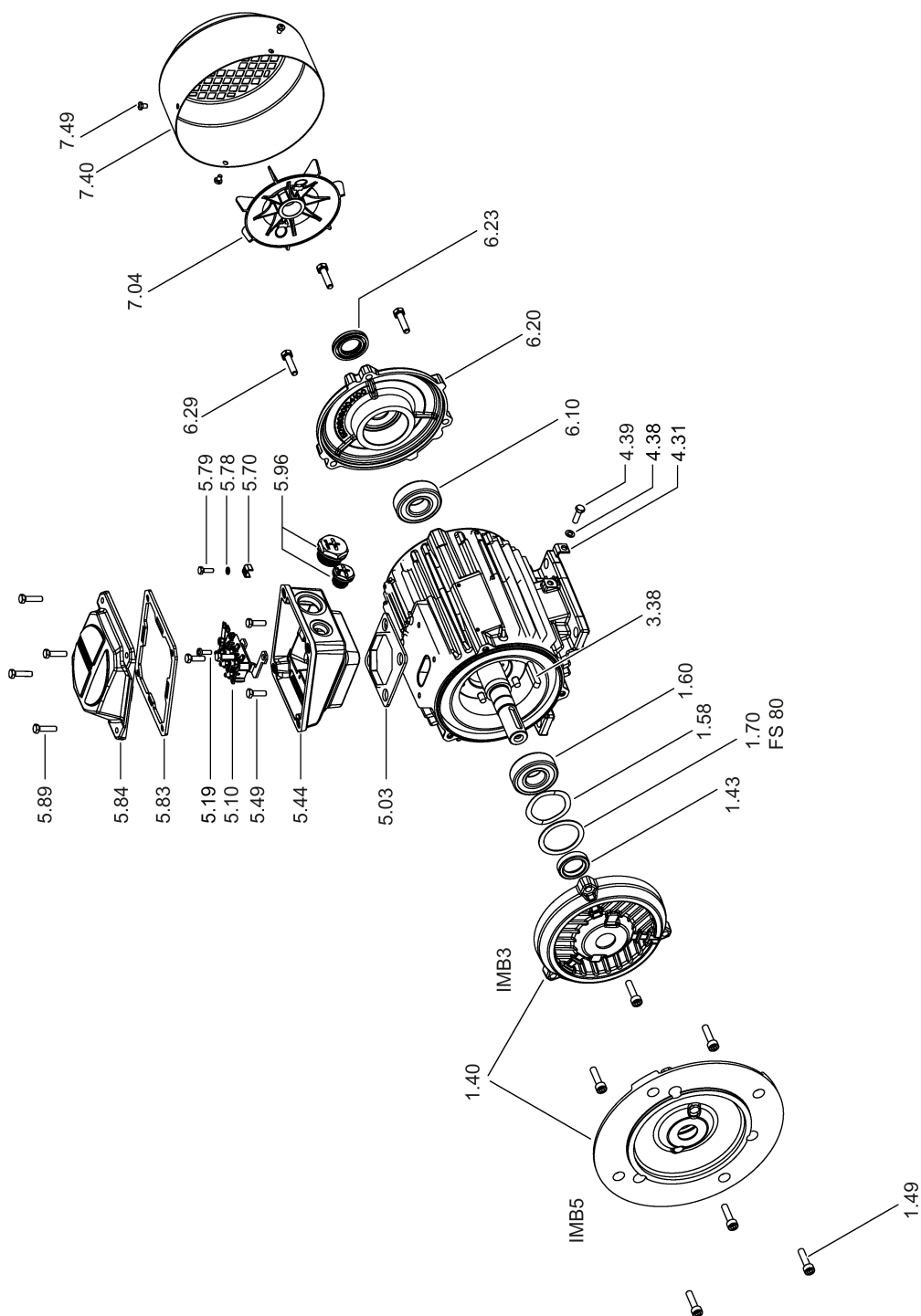
10.1 Part lists

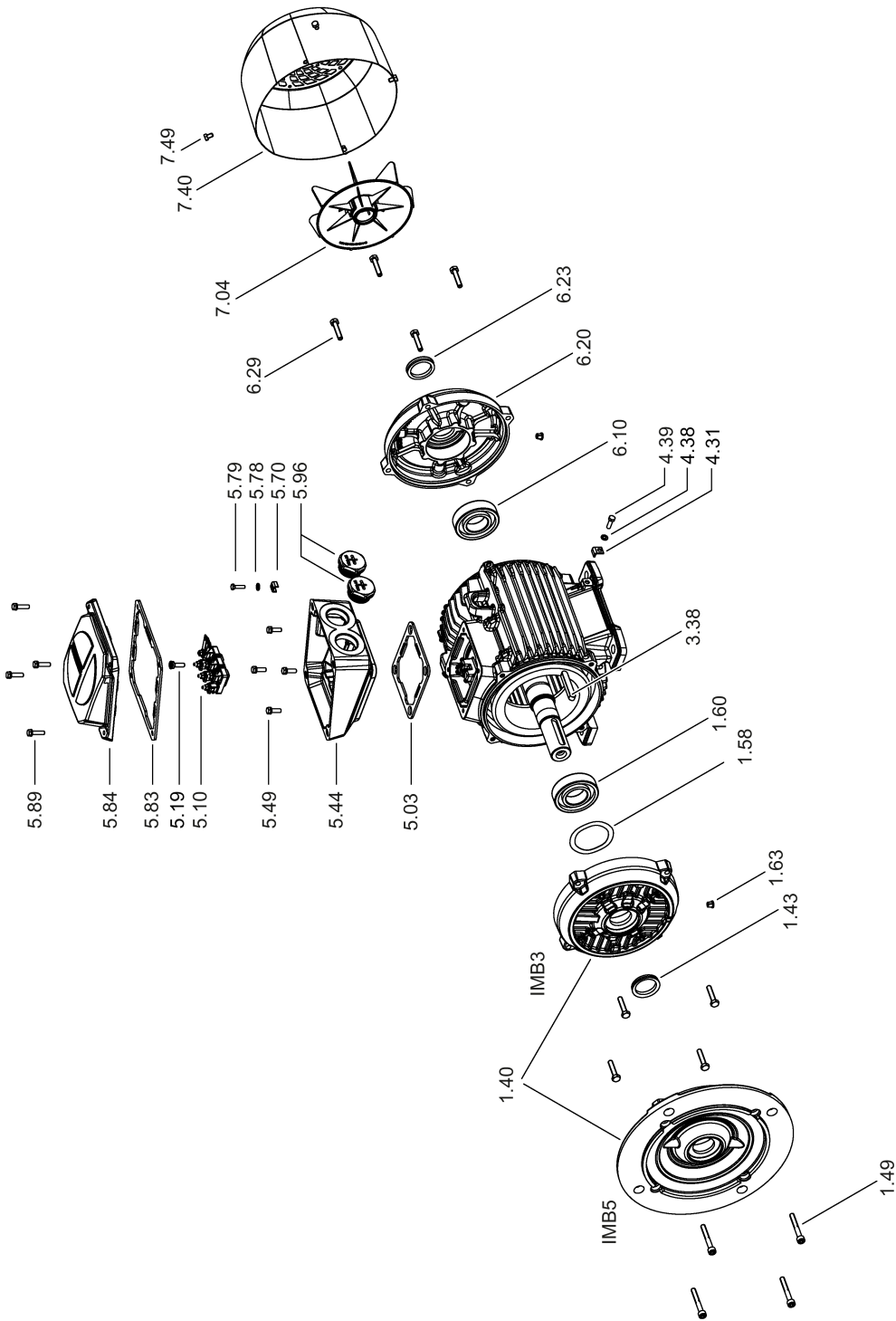
Part	Description
1.40	End shield
1.43	Shaft sealing ring
1.44	Bearing cover
1.46	Cover ring
1.49	Bolt
1.58	Spring washer
1.60	Rolling bearing
1.63	T plugs
1.65	Grease nipple
1.70	Shim (SH 80)
3.38	Featherkey
4.04	Eyebolt (SH 180...315)
4.31	Grounding bracket
4.37	Ground terminal plate
4.38	Spring lock washer
4.39	Grounding stud
4.40	Washer
5.03	Seal
5.10	Complete terminal board
5.19	Self-tapping screw
5.21	Screw (drilled)
5.34	Bushing holding plate for cable routing
5.44	Upper section of the terminal box
5.49	Self-tapping screw
5.70	Terminal clamp
5.78	Spring lock washer
5.79	Bolt
5.83	Seal
5.84	Terminal box cover
5.89	Bolt
6.02	Locking ring
6.10	Rolling bearing
6.20	End shield
6.23	Shaft sealing ring
6.24	Bearing cover NDE, outer (SH 280...315)
6.25	Lubrication sleeve
6.29	Self-tapping screw
6.65	Grease nipple
7.04	Fan
7.40	Fan cover
7.49	Bolt

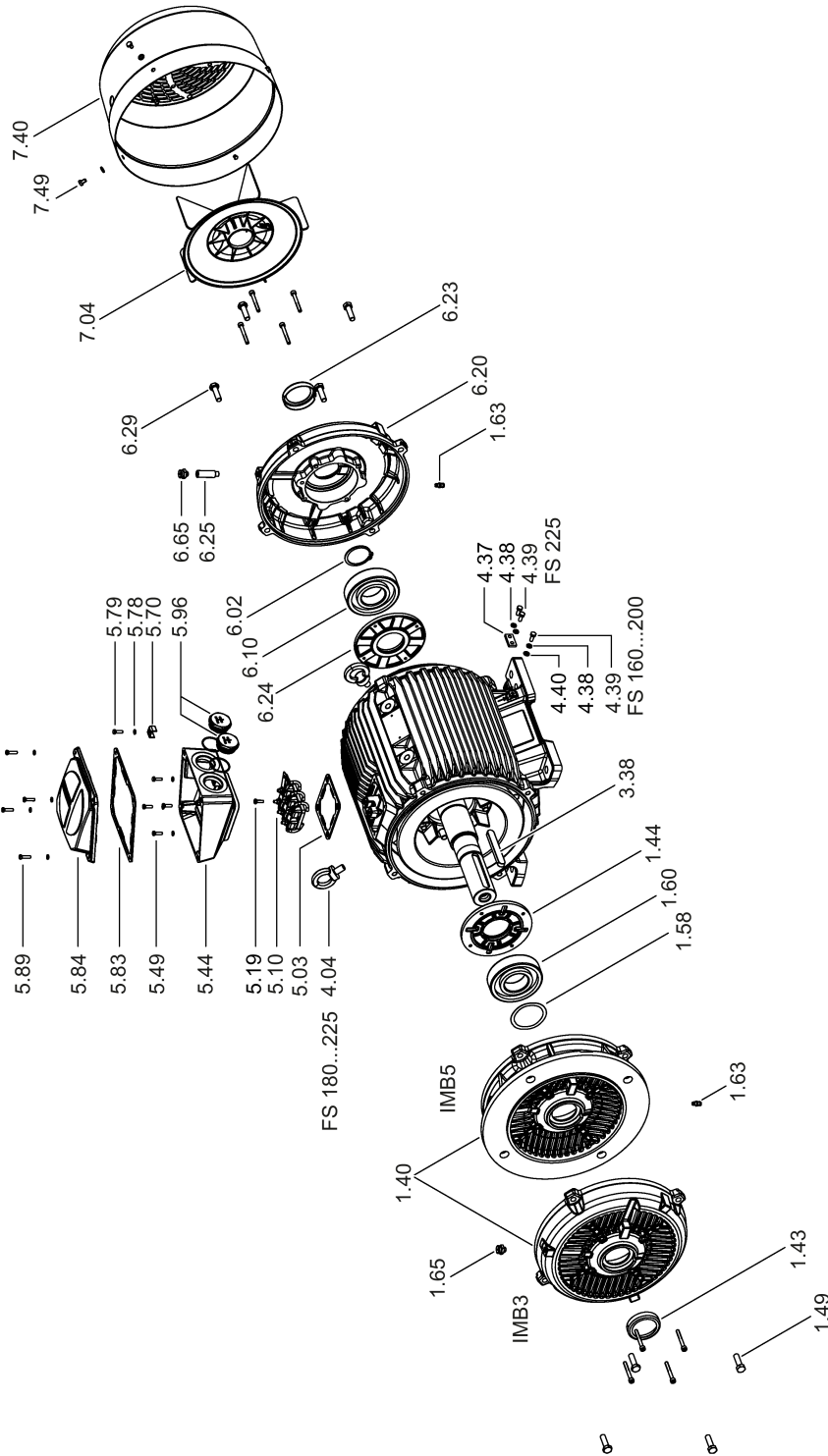
Tools for mounting and withdrawing rolling bearings; fans and output transmission elements cannot be supplied.

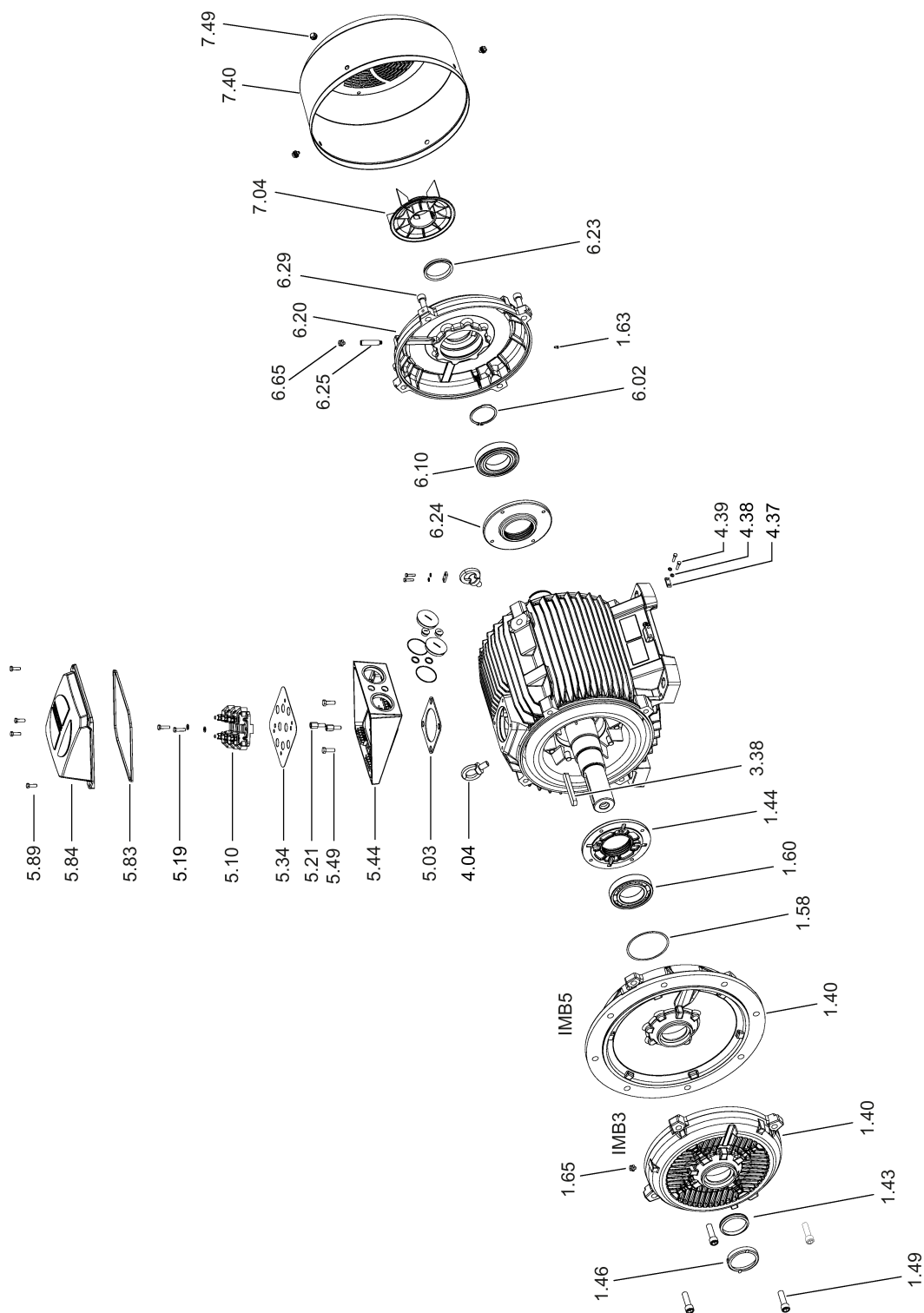
10.2 Exploded drawing

Size 71...90









11 Disposal

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 machine and its components are given in the following section. Be sure to comply with local disposal regulations.

11.1 Preparing for disassembly

Disassembly of the machine 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 machine and provision of the components.
2. Follow the five safety rules (Page 1).
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 machine fixings.
6. Transport the machine to a suitable location for disassembly.

11.2 Dismantling the machine

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



WARNING

Machine parts can fall

The machine 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 machine parts, secure them so that they cannot fall.

11.3 Disposal of components

Components

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

Sort the components for recycling according to whether they are:

- Iron and steel
- Aluminum
- 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 machine.

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 aluminum composite foil. It can be recycled thermally. Dirty foil must be disposed of via waste incineration.

A Service & support

A.1 Siemens Service Center (Kalwa)

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

For direct access to our technical experts contact:

- Online Support: <http://www.siemens.com/automation/service&support>
(<http://www.siemens.com/automation/service&support>)
- Support request: <http://www.siemens.com/automation/support-request> (<http://www.siemens.com/automation/support-request>)
- Product training web link: <https://www.sitrain-learning.siemens.com/india-pl/> (<https://www.sitrain-learning.siemens.com/india-pl/>)

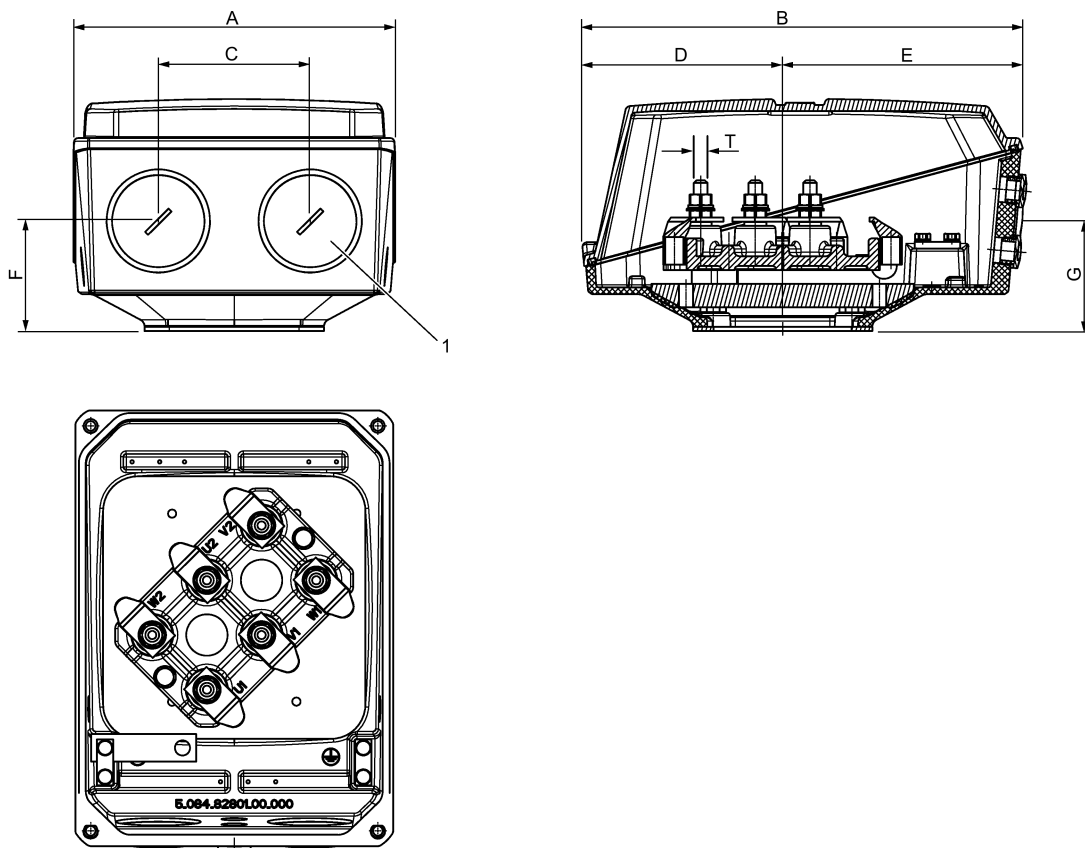
Service numbers

Table A-1 Siemens Customer Care Desk contact data:

	1800 209 0987 / 1800220987
	+91 22 27600150
	+91 22 33265381
	ics.india@siemens.com (mailto:ics.india@siemens.com)
Internet	www.siemens.co.in/industry-services (www.siemens.co.in/industry-services)

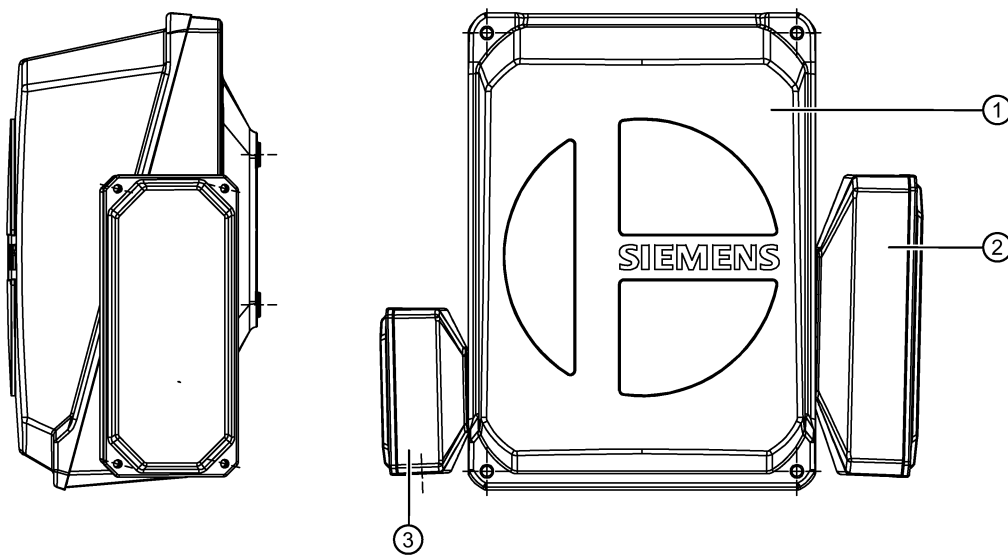
B Technical data and drawings

B.1 Terminal box dimensions



Shaft height	Terminal box	A	B	C	D	E	F	G	T	1 Cable entry
71 ... 90	TB1E04	102	126	36	62	64	48	88	M4	1 x M16 x 1.5 1 x M25 x 1.5
100 ... 112	TB1F04	134	163	48	80.5	82.5	48	95	M4	2 x M32 x 1.5
132	TB1H04	134	163	48	80.5	82.5	48	95	M4	2 x M32 x 1.5
160 ... 180	TB1J01	165	190	60	92	98	66.5	119	M5	2 x M40 x 1.5
200	TB1L01	197	266	85	112	151	68	126	M8	2 x M50 x 1.5
225	TB1L01	197	266	85	112	151	68	126	M8	2 x M50 x 1.5
250 ... 280	TB1N01	233	319	110	145	174	79	170	M10	2 x M63 x 1.5
315	TB1Q01	299	374	110	164	210	104	217	M12	2 x M63 x 1.5

B.2 Arrangement of the auxiliary terminal box



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

More information

www.siemens.com/drives/...

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Large Drives
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