

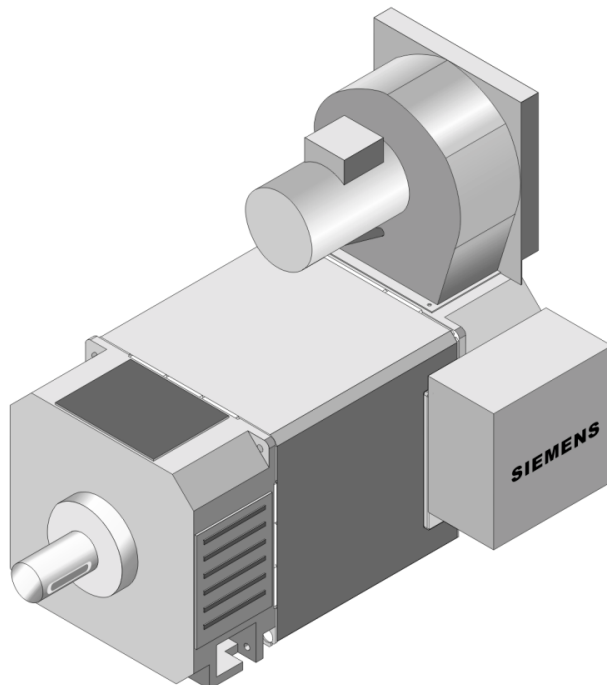
SIEMENS

Three-phase induction motor AC COMPACT DRIVES

Operating Instructions

Edition 12.2002

1PH728.



Order number: A5E00177602A

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Exclusion of Liability

We have conscientiously checked the contents of this manual to ensure that they coincide with the hardware and software described. Since deviations cannot be precluded entirely, we cannot guarantee complete conformance. However, the data in this manual is reviewed regularly and any necessary corrections included in subsequent editions.

For reasons of clarity, this manual does not contain all detailed information and cannot consider every conceivable application either.

We are thankful for any recommendations or suggestions. If you should require further information, or if particular problems should arise that are not dealt with in sufficient detail in the operating instructions, you can request the necessary information via your local Siemens branch office.

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Safety information

1

1.1 Definitions, warning information

Qualified persons

Only properly qualified persons should be entrusted with the commissioning and operation of machines and equipment. Qualified persons as far as the safety instructions given in this manual are those who have the necessary authorization to commission, earth and identify equipment, systems and circuits in accordance with the relevant safety standards.

Safety Guidelines

This manual contains instructions which must be followed closely in order to ensure personal safety and to avoid damage to the equipment and machines. These instructions are highlighted in the manual by a warning triangle and are marked as follows to the level of danger:



Danger

Danger means that death, grievous injury or extensive damage to property will occur if the appropriate precautions are not taken.



Warning

Warning means that death, grievous injury or extensive damage to property may occur if the appropriate precautions are not taken.



Caution

Caution with a warning triangle, means that minor personal injury may occur if the appropriate precautions are not taken.

Caution

Caution without a warning triangle, means that damage to property may occur if the appropriate precautions are not taken.

Notice

Notice means that an undesirable result or state might occur if the relevant instructions are not followed.

Note

Note is an important information concerning the product, its use or the corresponding section of the documentation which must be given special attention and is recommended to be adhered to because of the potential benefits.

Compliance with intended use

Please pay close attention to the following:



Warning

The electrical equipment contains items that are at a dangerous voltage. Failure to adhere to these instructions can result in serious injury and/or damage to the equipment.

Safe and satisfactory operation of the product presumes satisfactory transport, storage, installation and assembly and careful subsequent operation and maintenance.

Any local safety rules and regulations in force must be complied with.

1.2 Safety and application information

The safe use of electrical machines



Danger

These electrical machines are designed for use in industrial power systems. While in operation, the equipment has live, uninsulated parts as well as rotating parts. There is consequently a risk of severe personal injury or substantial damage to property, for example, if the necessary covers are removed without authorisation or if the equipment is handled improperly, operated incorrectly or maintained inadequately.

If the motors are used outside industrial areas, the installation site must be safeguarded against unauthorised access by means of suitable protection facilities (e.g. fencing) and appropriate warning signs.

The persons responsible for the safety of the system are under an obligation to ensure that:

- the basic planning work for the system and all work relating to transportation, assembly, installation, commissioning, maintenance and repairs are carried out by qualified persons and checked by responsible, suitably skilled persons.
- these instructions and the motor documentation are made available at all times while work is in progress.
- the technical data and specifications relating to the permissible installation, connection, ambient and operating conditions are taken into account at all times.
- the system-specific erection and safety regulations are observed and personal protective gear is used.
- work on these machines, or in the vicinity of these machines, by unqualified persons is prohibited.

These instructions therefore only contain the information which is necessary for the motors to be used by qualified persons in accordance with their intended purpose.

The instructions and the motor documentation are available in the languages specified in the supply contracts.

Note

We recommend engaging the support and services of your local SIEMENS Service Center for all planning, installation, commissioning and maintenance work.

Description

2

2.1 Applications

Overview

The three-phase motors of the 1PH7 series are used as industrial drives. They have been designed for a wide range of applications in the fields of drive engineering and power conversion.

They stand out thanks to their ruggedness, long lifetime and reliability. Not only this, they are extremely versatile, which allows them to be optimally adapted to the particular application and function.

2.2 SIEMENS Service Center

Contact for further information

Details about the design of the three-phase motor supplied and about the permissible operating conditions are described in these Operating Instructions.

If you have any questions or suggestions, or if you require further information, please contact the SIEMENS Service Center:

Industry Helpline (24-hour Service): 0180 – 5050111

A&D Technical Support: 0180 - 5050222

e-mail: adsupport@siemens.com

2.3 Scope of delivery

Checking the scope of 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 scope of the delivery matches up with the accompanying documents. SIEMENS will not accept any warranty claims relating to items missing from the delivery, that are submitted later.

Register a complaint about:

- any transport damage detected immediately with the delivery agent.

- any defects/incomplete delivery detected immediately with the SIEMENS representative responsible.

These Operating Instructions belong to the scope of delivery and must be kept where they can be easily accessed.

The nameplate enclosed as a loose item with the delivery is provided to enable the motor data also to be kept on or near the motor or installation.

2.4 Nameplate

Technical Data

The motor nameplate carries the technical data valid for the motor delivered.

○		SIEMENS				CE ○		
1	3~Mot. 1PH7 286-0HB000AA3			No N-		1112109020001 / 2002		9
2	IM B3	IP 55		Th.Cl. F	Gew./WT. 1474 kg		10	
3	V		A	kW	cosφ	Hz	1/min	11
4	400 A		180	100	0.86	17	500	12
5	480 A		180	120	0.86	20.3	600	13
6								14
7	EN/EC 60034-1				max 3300 1/min		15	
8	ENCODER H01 1024 S/R							
○		MADE IN GERMANY				○		
								DEW0243

Figure 2-1 Example: Motor nameplate 1PH7

The motor nameplate carries the following technical data:

Table 2-1 Motor Nameplate – Technical Data

Item	Technical Data
1	Motor type: Three-phase servomotor
2	Type of construction
3	Degree of protection
4	Rated voltage [V] and winding connections
5	Rated current [A]
6	Rated output [kW]
7	Standards and regulations

Item	Technical Data
8	Code, sensor type
9	Ident. No., serial number
10	Motor weight [kg]
11	Temperature class
12	Rated speed [rpm]
13	Rated frequency [Hz]
14	Power factor [cosφ]
15	Maximum speed [rpm]

2.5 Design

2.5.1 Cooling

Description

The three-phase motors of the 1PH7 series are externally ventilated, low-voltage induction motors with a squirrel-cage rotor and a separately driven fan unit mounted as standard. They are of an enclosed design, with an internal cooling circuit (cooling method IEC 60 034-6; DIN / EN IEC 60 034-6).

The separately driven fan unit and the terminal box can be mounted in a different position depending on the order.

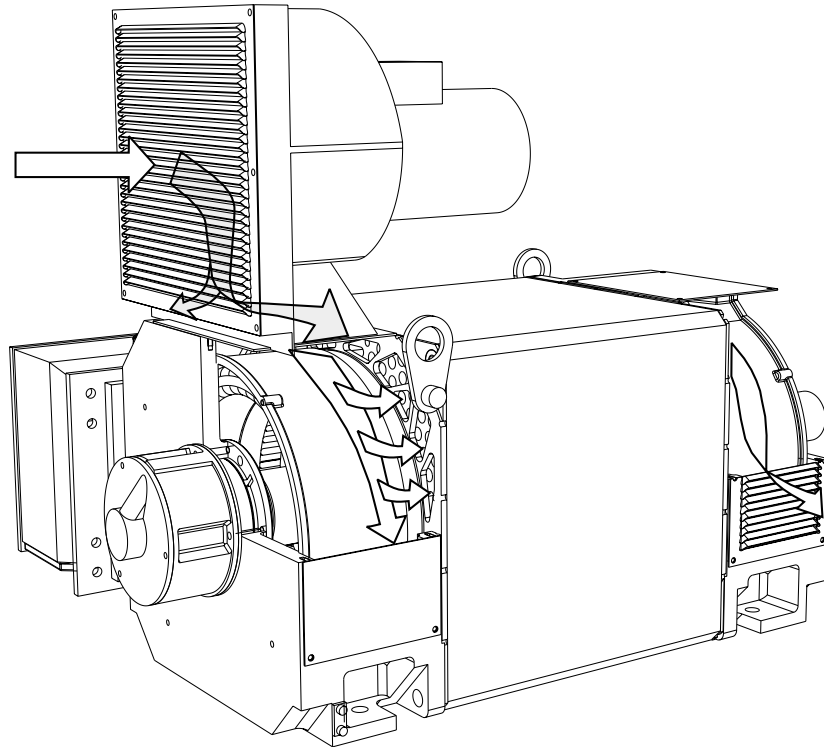


Figure 2-2 Cooling process for ventilating from the N-end to the D-end (basic type)

A KTY 84-130 temperature sensor is installed in the stator winding to monitor the winding.

Depending on the order, various additional devices, such as a space heater or sensor systems can be installed or built on.

Notice

A minimum clearance of 170 mm from devices added on by the customer must be observed at the air intake opening and at the air outlet openings, in order to guarantee the necessary flow of cooling air.

2.5.2 Drive

Description

The variable-speed, three-phase motors of the 1PH7 series are supplied with power by a frequency converter.

2.5.3 Types of construction

Further potential applications

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



Caution

During transportation, motors may only be hoisted in a position corresponding to their basic type of construction (i.e. horizontal construction types in horizontal position and construction types in vertical position).

Basic type of construction acc. to rating plate	Type	Other applications in type of construction
IM B3	1PH7 284...1PH7 288	IM B6, IM B7, IM B8
IM B35	1PH7 284...1PH7 288	

Optional basic types of construction	Type	Other applications in type of construction
IM V5	1PH7 284 ... 1PH7 288	IM V6
IM V 15	1PH7 284 ... 1PH7 288	IM V 36

Additional hoisting points for different types of construction

Additional hoisting points are provided for those types of construction that differ from the basic types of construction IM B3 and IM B35.

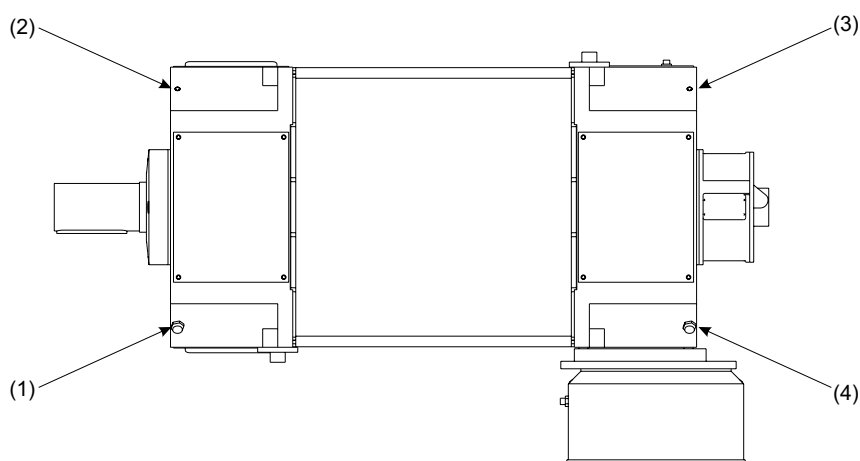


Figure 2-3 View from above onto type of construction IM B3

Two additional rotatable eyebolts are supplied with these types of construction, which must be bolted on as specified in the table below.

Table 2-2 Additional hoisting points for different types of construction

Type of construction	Hoisting points			
	1	2	3	4
IM B6		X	X	
IM B7	X			X
IM B8	X		X	
IM V5			X	X
IM V6	X	X		
IM V36	X	X		
IM V15			X	X

Layout of the louvered covers for various types of construction

For those types of construction that differ from basic types of construction IM B3 and IM B35, the louvered covers must be positioned as follows at the air inlet and air outlet in order to maintain the degree of protection:

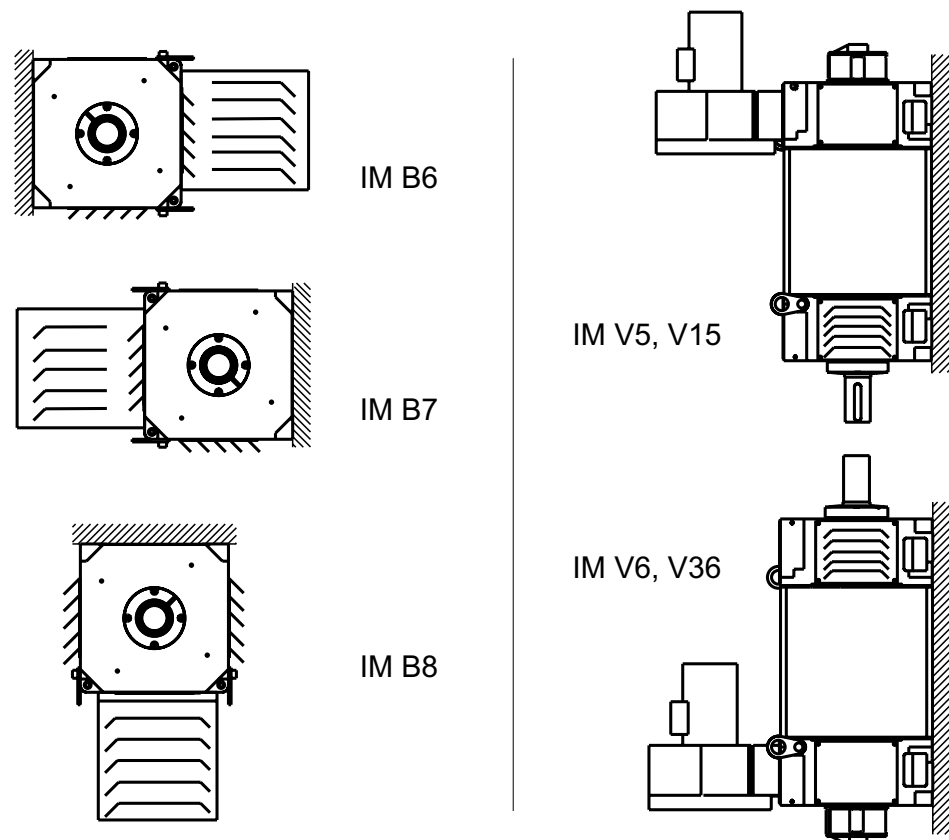


Figure 2-4 Layout of the louvered covers for various types of construction

In addition, the motor of the separately driven fan of motors of vertical types of construction must face upwards.

2.5.4 Regulations

Overview

The motors conform to the following regulations in accordance with IEC 60034 (previously VDE 0530):

Feature	Standard
Dimensions and operating characteristics	IEC / EN 60034-1
Degree of protection	IEC / EN 60034-5
Cooling	IEC / EN 60034-6
Type of construction	IEC / EN 60034-7
Noise emission	IEC / EN 60034--34-9
Vibration severity levels	IEC / EN 60034-14

2.5.5 Degree of protection

The three-phase motors of the 1PH7 series are built to degree of protection IP 55 in accordance with EN 60034-5 (or IEC 34-5).

The shaft gland at the drive end (D-end) is built to degree of protection IP 54 as standard.

The standard version of the motors is not suitable for operation in a salt-laden or corrosive atmosphere, nor for installation outdoors.

Installation / Assembly

3

3.1 Transport, storage

Instructions relevant for safety

Please observe the following instructions on the transportation and storage of motors.



Caution

Some motors may only be hooked up at and hoisted by the main eyebolts that are located at the end shields. Auxiliary eyebolts, e.g. on fan cowls and cooler attachments, are suitable only for hoisting the respective parts.

To hoist the motor, in particular at attachments and built-on assemblies, use suitable cable-guidance or spreading equipment.

Observe the lifting capacity of the hoisting gear.
(See rating plate for weight.)

Table 3-1 Weights of standard versions

Type	Weight
1PH7 284	1.3 t
1PH7 286	1.5 t
1PH7 288	1.8 t

Notice

If the motor is not immediately commissioned, then it should be stored in a dry room, which is free from vibration and shock.

Transporting motors with a rotor shipping brace

Motors with cylindrical-roller bearings have a rotor shipping brace (shaft block), in order to prevent the bearings from becoming damaged during transportation/shipping.

- Only remove this brace before fitting the drive element.

Notice

Take other suitable measures to axially fix the rotor if the motor has to be transported after you have fitted the drive element.

3.2 Installation

Instructions relevant for safety



Caution

High temperatures can arise at the enclosure components of electric motors (possibly > 100°C). Do not touch enclosure components while the motor is running or immediately after it has been running.

Caution

When positioning temperature-sensitive components (wires etc.), make sure that they are not in contact with the motor enclosure.

Notice

Also pay attention to the Technical Data on the rating plates on the motor enclosure.

Cooling conditions in general

- In the case of motors that are cooled by the ambient air, the cooling air must be able to flow unimpeded to and from the motors. Hot discharged air must not be reinducted (see also 2.5.1).
- Ventilation openings may only be covered by louvered covers in motors of those types of construction in which the openings point downwards.

Cooling conditions for motors with pipe connection

Motors that are configured to allow pipes to be connected and/or for operation with a separately driven fan must have pipes and a fan of suitable type and dimensioning mounted and connected to them.

Please refer to the table below for the potential pressure drop inside the motor for motors with a pipe connection:

Table 3-2 Pressure drop in motors with pipe connection

1PH7 28.	
Volumetric flow (V)	Pressure drop (Δp)
0.42 m ³ /s	600 Pa

Notice

Please consider the additional pressure drop that arises in the system when connecting the pipes.

Also ensure that:

- you comply with the conditions of the IP degree of protection. Higher IP requirements may necessitate the installation of suitable filters and special positioning of the intake and outlet openings.
- units and wires are mounted without distortion.
- the shipping covers of the ventilation openings are removed.

Balancing quality

The rotors are balanced dynamically. In the case of shaft ends with featherkeys, the method used to balance the rotors can be identified from the following coding to be found on the end face at the drive end of the shaft end:

- "H" means balancing with half a featherkey (standard version); i.e., in order to retain the balance quality, that part of the featherkey that projects out of the drive element and the contour of the shaft (in the case of a shorter power take-off element) may have to be machined off.
- "F" means balancing with a whole featherkey (optional version).

Make sure, that the balancing method of the power take-off element is correct!



Caution

Power take-off elements must only be fitted and pulled off with the aid of a suitable tool.

The featherkeys are only locked against falling out during shipping.

Noise emissions

Motors of the 1PH7 series have a measuring-surface sound pressure level $L_p(A)$ of approx. 74 dB(A) in a speed range from 0 through 3000 rpm.

The motors are certified for a wide range of installation and operating conditions. These conditions (e.g. rigid or vibration-isolated foundation design, use of sound-absorbing elements) have to some extent a very great influence on noise emissions.

When evaluating the noise levels at the workplaces of the system operators, consider the fact, that the A-weighted sound pressure level (measured in accordance with DIN EN 21680 Tl.1) of 70 dB(A) is exceeded when the three-phase motors are operated at nominal load.

3.3 Mounting

Prerequisites

In order to ensure smooth, vibration-free motor operation, a stable foundation design is required, the motor must be precisely aligned, and the components that are to be mounted on the shaft end must be correctly balanced.

Fixing by means of motor feet

If the motor needs to be aligned, position metal shims underneath the feet in order to prevent the motor from suffering distortion.

The number of shims should be kept as low as possible i.e. stack as few as possible.

Mounting bolts

To securely mount the motor and reliably transfer the drive torque, use motor mounting bolts with the required strength class (8.8) in accordance with ISO 8898-1.

Notice

All flange motors must have stable suspension and be supported by means of the end-shield feet (foot-flange type of construction). When commissioning, make sure that the vibration values permitted in accordance with DIN ISO 10816 are observed.

Motors that are mounted with their feet on the wall due to their type of construction must be fixed in position by means of an adequately dimensioned form closure (e.g. by pinning or using a wall mounting strip).

3.4 Connecting the stator winding

Terminal box connection

The type designation of the terminal box mounted and the details for connecting the supply feeder cables to the line supply can be found in the drawing (see chapter "Spare Parts").

Further details with respect to wiring and connecting the motor winding are laid down in the circuit diagram enclosed.

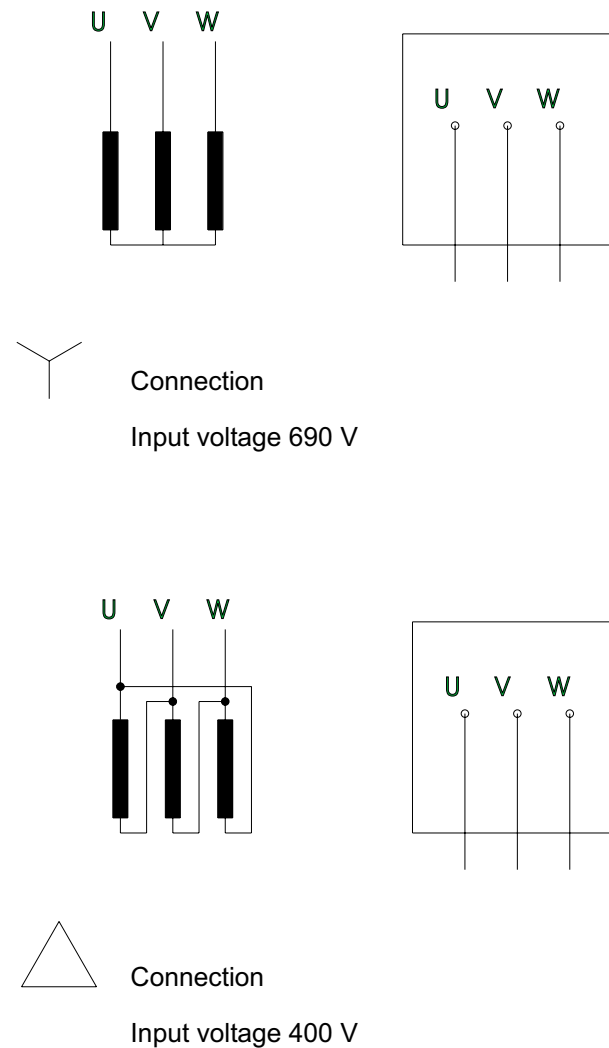


Figure 3-1 Circuit diagram

Select the connecting cables taking into account the rated current and the system specific conditions (e. g. ambient temperature, routing type etc. in accordance with IEC / EN 60204-1).

Connecting using cable lugs

To connect the cables to the main terminals, select cable lugs that match the necessary cable cross-section and bolt size M16.

Table 3-3 Terminal box assignments

Size	Motor type	Terminal box type	Cable entry	Max. poss. external cable diameter [mm]	No. of main terminals	Max. connectable cross-section per terminal [mm ²]	Max. poss. current per terminal ¹⁾ [A]
1PH7 motors, size 280							
280	1PH728-..B	1XB7712	3 x M63 x 1.5	53	(3+1) ² x 3 x M16	3 x 95	450
	1PH7284-..D						
	1PH7286-..D	1XB7712	3 x M75 x 1.5	68	(3+1) ² x 3 x M16	3 x 185	710
	1PH7288-..D						
	1PH728-..F						

(1) reduction factor 0.60

(2) including ground terminal

The cable lug size defines the cable cross-section which can be connected, e. g. cable lugs from 35 ... 185 mm² according to DIN 46235 or from 35 ... 185 mm² according to DIN 46235.

Note the possible outer diameter of 31 ... 68 mm of the connecting cable.

Remove the insulation from the conductor ends, so that the remaining insulation is almost long enough to reach the cable lug.

If necessary, insulate the cable lugs in order to maintain the minimum clearances in air of 10 mm and the 20 mm creepage distance normally present.

The tightening torque for contact nuts and M16 mounting bolts is 90 Nm.

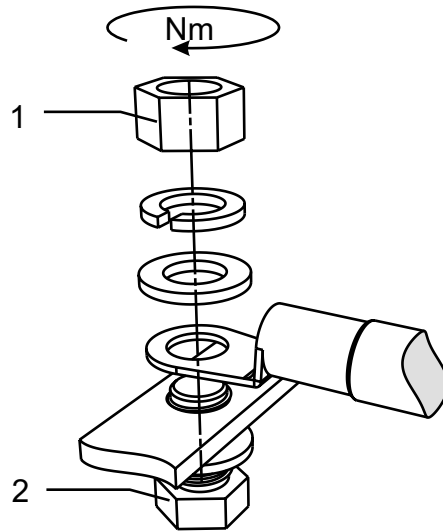


Figure 3-2 Tightening torques for contact nuts and mounting bolts

- (1) Contact nut
- (2) Mounting bolt

Principles of entering and laying cables

Lead in permanently laid entries using EMC cable glands. Screw the cable glands into the threaded holes in the unscrewable entry plate.

Arrange the exposed connecting cables in the terminal box such that the PE conductor has excess length and the insulation of the cable strands cannot be damaged.

Note

We recommend you use shielded cables, whose shields are conductively connected to a large area of the metal terminal box of the motor (with an EMC cable gland made of metal).

Notice

Unused threads must be sealed with a metallic screw plug.

Internal equipotential bonding

The equipotential bonding between the earth terminal in the terminal box housing and the motor frame is established via the terminal box mounting bolts. The contact points underneath the bolt heads are bare metal and are protected against corrosion.

The standard terminal box cover mounting screws are adequate as potential bonding between the terminal box cover and terminal box itself.

Note

Connecting points are provided on the enclosure or end shield to allow an outer PE conductor or equipotential bonding conductor to be connected (see section entitled "Connecting the ground conductor").

Final checks

Before closing the terminal box, please check that:

- the electrical connections in the terminal box are tight and are in full compliance with the specifications above.
- the clearances of 10 mm required are complied with.
- no wire ends are standing proud.
- the inside of the terminal box is clean and free of any cable pieces.
- all seals and sealing surfaces are not damaged.
- the connecting cables are laid in an open arrangement and the cable insulation cannot be damaged.
- cable entries which are not used are sealed and the plugs are tightly screwed-in (i.e. so that they can only be removed using the suitable tools).
- the right cable glands are fitted with respect to the correct degree of protection, method of laying, permissible cable diameter etc., as stated in the specifications.

Then close the terminal box.

Note

Tightening torque for the fixing screws of the lid: 22 Nm

3.5 Connecting the ground conductor

General

The cross-section of the ground conductor of the motor must comply with the regulations for electrical installations, e.g. IEC / EN 60204-1.

Connecting

Connect the ground conductor to the end shield of the motor. For this purpose, a clamping lug is provided at the appropriately marked connecting point for the ground conductor (1 + 2). This lug is suitable for connecting stranded conductors with cable lugs or ribbon cables with appropriately shaped conductor end.

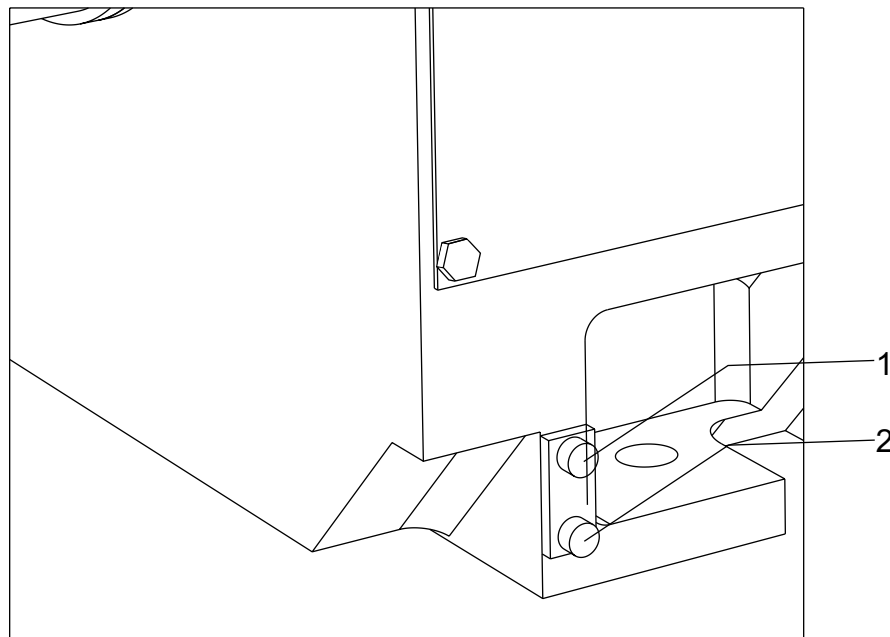


Figure 3-3 Detailed view: Connecting points for ground conductor (1 + 2)

When making connections, ensure that

- the contact surface is clean and bright, and is protected with a suitable anti-corrosion agent, e. g. acid-free Vaseline.
- the flat and spring washers are located under the bolt head.
- the minimum necessary screw-in depth and the tightening torque for the clamping bolts must be maintained.

These are:

Bolt (*)	Screw-in depth	Tightening torque
M8 x 30	>8 mm	20 Nm

3.6 Connecting the fan

Instructions relevant for safety

Please observe the following safety instructions relating to connecting a fan:

Caution

Provide a protective circuit that prevents the main motor from being switched on when the fan unit is not in operation.

Caution

Please note that the separately driven fan unit is only suitable for the direction of rotation shown by the direction-of-rotation arrow.

The fan must not be operated with the wrong direction of rotation as this could lead to the motor being destroyed.

Note

The direction-of-rotation arrow and the direction of movement of the fan impeller are indicated on the rear side of the blower.

If necessary, switch the direction of rotation by swapping over two phase conductors in the terminal box.

Connecting

Connect up the fan in the terminal box of the fan unit.

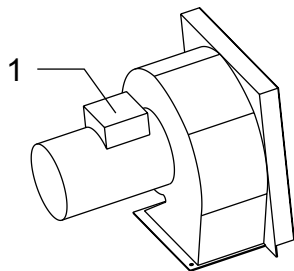


Figure 3-4 Detailed view of fan

(1) Fan terminal box

3.7 Connecting the speed sensor

Connecting

Connect the speed sensor to the terminal box by means of a plug-in connection (1). This is located at the side of the terminal box.

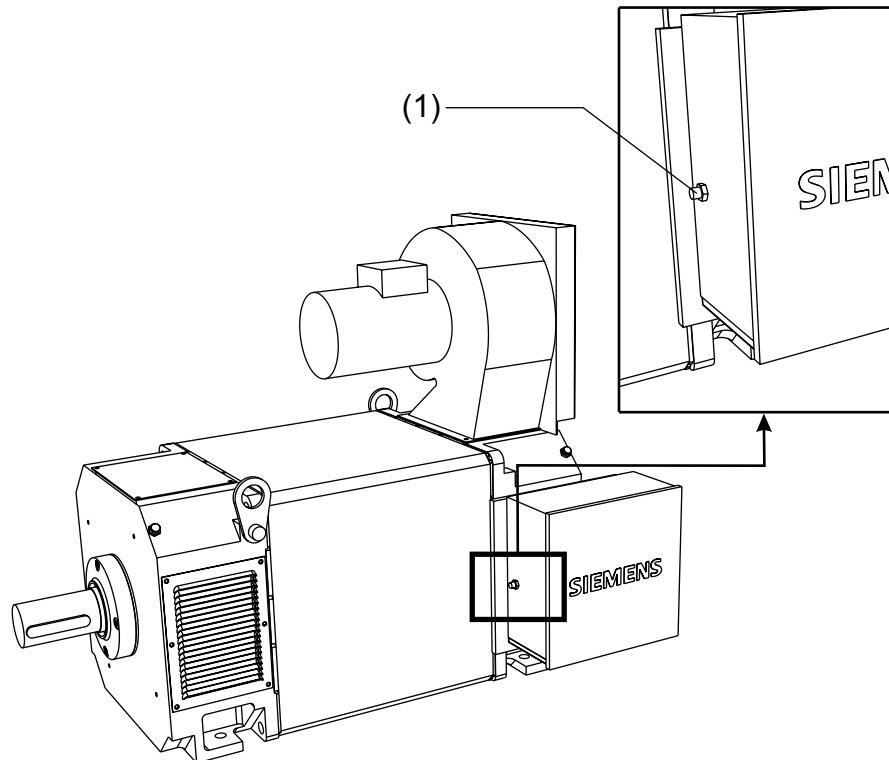


Figure 3-5 Detailed view: Speed sensor connection

3.8 Connecting the temperature sensor

Connecting

Connect the wires of the temperature sensor to the speed sensor connector with the aid of connecting leads (see section entitled "Connecting the speed sensor").

Note

The plug connection may differ from the standard layout in the case of special orders.

In the version "without sensor", an armored conduit union is located here.

The motors are fitted with a back-up temperature sensor, which is likewise connected to the auxiliary terminals and, if necessary, can be reconnected to the plug connector of the speed sensor (see auxiliary terminals diagram).

Commissioning

4

4.1 Preparations

Safety instruction



Warning

Only expert persons should be entrusted with work on power installations.

Checking the insulation resistance

Note

There is no need to check the insulation resistance when commissioning. We only recommend doing so after long storage or shutdown periods.

After long storage or shutdown periods, the insulation resistance of the windings must be measured to ground with direct voltage.

Caution

Before you begin measuring the insulation resistance, please read the manual of the insulation resistance meter you are going to use.



Warning

During the measurement, and immediately afterwards, some of the terminals are at hazardous voltage levels and must not be touched.

Check the supply feeder cables connected, in order to ensure that the line supply voltage cannot be connected.

Only ever measure the insulation resistance of the winding to the motor enclosure when the winding temperature is between 20 and 30°C:

When making the measurement, you must wait until the final resistance value is reached (approx. 1 minute).

Limit values

The table below specifies the measuring-circuit voltage and the limit values for the minimum insulation resistance and the critical insulation resistance with a rated motor voltage of $U_N < 2$ kV:

	Rated voltage $U_N < 2$ kV
Measuring-circuit voltage	500 V (min. 100 V)
Minimum insulation resistance with new, cleaned or repaired windings	10 M Ω
Critical specific insulation resistance after a long operating time	5 M Ω /kV

(Values apply for measurement at a winding temperature of 25°C)

Note the following points:

- Dry, new windings have insulation resistances of between 100 and 2000 M Ω , or possibly even higher values.
If the insulation resistance is close to the minimum value, then the cause could either be humidity and/or dirt accumulation.
- Over its operating lifetime, the motor winding insulation resistance can drop due to ambient and operational influences. The critical insulation resistance for a 25°C winding temperature can be calculated, depending on the rated voltage, by multiplying the rated voltage (kV) by the specific critical resistance value (5 M Ω /kV);

e.g. critical resistance for a rated voltage (U_N) of 690 V:
 $690 \text{ V} \times 5 \text{ M}\Omega/\text{kV} = 3.45 \text{ M}\Omega$

Notice

If the critical insulation resistance is reached or undershot, the windings must be dried or, if the fan is removed, cleaned thoroughly and dried.

After drying a cleaned winding, please note that the insulation resistance is lower for windings in the warm condition. The insulation resistance can only be evaluated properly as long as measurement is conducted on a winding that has been cooled down to room temperature (approx. 20 ... 30°C).

Notice

If the measured value is close to the critical value, the insulation resistance should be subsequently checked at appropriately shorter intervals.

4.2 Measures to be performed prior to commissioning

Overview



Warning

This list does not claim to be exhaustive.

It may be necessary to make additional checks and tests corresponding to the actual plant/system situation.

After assembling the motor in line with technical requirements and before commissioning the system, check that:

- the motor has been assembled and aligned properly.
- the operating conditions are in accordance with the data specified on the nameplate.
- any supplementary motor monitoring devices and equipment have been correctly connected and are functioning.
- appropriately configured control functions and speed monitoring equipment ensure that speeds higher than the permissible speeds stated on the rating plate do not arise.
- the power take-off elements have the correct parameters for their type (e.g. alignment and balancing of couplings, belt tension of a belt drive, backlash and crest clearance of a gear PTO drive, radial clearance).
- the minimum insulation resistance values are complied with.
- the earthing and equipotential grounding connections have been correctly made.
- all mounting screws, connecting elements and electrical connections are tight.
- the rotor can be spun without coming into contact with the stator.
- all shock protection measures for moving and live parts have been taken.
- if the second shaft end has not been used, its featherkey has been secured to prevent it being thrown out.
- all separately driven fans fitted are ready for operation and have been connected such that they rotate in the direction specified.
- the flow of cooling air is not impeded.
- brakes (if fitted) function perfectly.

4.3 Energizing

Measures

Before you energize the motor, make sure, that the parameters of the frequency converter have been assigned correctly.

We recommend you use appropriate commissioning tools (e.g. Drive ES).

Caution

If the motor is running irregularly or emitting abnormal noises, de-energize it and determine the cause of the fault as the motor runs down.

Notice

The critical speed $n_{\max} = 3300$ 1 rpm is the maximum operating speed permissible over short periods.

Operation

5

5.1 Operation

Safety information



Warning

Please observe the chapter entitled "Safety information" in these Operating Instructions precisely and ensure that only persons who have the necessary specialist know-how are entrusted to carry out work on power installations.

All covers which are designed to prevent active or rotating parts from being touched, or which are necessary to ensure correct air guidance and thus more effective cooling, must not be opened during operation.

An appropriately configured control system and speed monitoring equipment must be used to ensure that speeds higher than the permissible speeds stated on the rating plate do not arise.

Energizing

Always refer to the respective manual of the frequency converter when energizing.

After starting the motor, observe it for a while to see if it is running smoothly and check the monitoring devices.

Operation

Monitor operation and the monitoring devices regularly and record the values you read off.



Warning

All deviations from normal operation, such as higher power consumption, higher temperatures and vibration levels, unusual noises and odours and tripped monitoring devices, are indications that the motor is no longer functioning correctly.

In this case, the maintenance technician must be immediately notified in order to prevent disturbances that could either directly or indirectly lead to severe personal injury or substantial material damage.

If in doubt, switch off the drive in question immediately.

5.2 Stoppages

Measures when motors are at standstill and ready for operation

- For longer periods, where the motor is not being used, either energize the motor at regular intervals (roughly once a month) or at least spin the rotor.
- Please refer to the section "Energizing", before restarting the motor.

Notice

If the motor is out of service for a longer period of time, carry out suitable anti-corrosion, preservation, packaging and drying measures.

Note

When restarting the motor after a long shutdown period, carry out the measures recommended in the section entitled "Commissioning".

5.3 De-energizing

Measures

Always refer to the respective manual of the frequency converter when de-energizing.

If the motor is stopped for longer periods of time, switch off the fan unit and switch on the space heater (if fitted).

Faults


6

6.1 Fault diagnosis table

Diagnosis table for mechanical and electrical faults

The tables below list general faults caused by mechanical and electrical influences.

Table 6-1 Diagnosis table for mechanical faults

Overview – Mechanical faults				
Mechanical fault characteristics				
		<ul style="list-style-type: none"> - rubbing/grinding noise - high temperature rise - radial vibration - axial vibration 		
		Possible causes of fault		Remedial measures ¹⁾
x				- Rotating parts rubbing/grinding Determine cause and adjust parts
	x			- Air supply restricted, filter dirty, possibly wrong direction of rotation Check air passages, clean filter, replace fan if necessary
		x		- Rotor not balanced Decouple rotor and rebalance
		x		- Rotor out of true, shaft bent Consult the manufacturer
		x	x	- Poor alignment Align motor unit, check coupling ²⁾
		x		- Motor coupled up not balanced Rebalance motor coupled up
			x	- Shocks from motor coupled up Check motor coupled up
		x	x	- Imbalance originating from gearing Adjust/repair gearing
		x	x	- Resonance with the foundation After consultation, reinforce foundation
		x	x	- Changes in foundation Determine cause of changes and eliminate; realign motor

1. Apart from eliminating the cause of the fault (as described under "Remedial measures"), you must also rectify any damage the motor may have suffered.
2. Take any changes possible due to a rise in temperature into account.

Table 6-2 Diagnosis table for electrical faults

Overview - Electrical faults	
	Electrical fault characteristics
	- Motor will not start up
	- Motor starts up slowly
	- Drumming noise during startup
	- Drumming noise during operation
	- Drumming noise in time with twice slip frequency
	- High temperature rise at no load
	- High temperature rise under load
	- High temperature rise of individual winding sections

Note

If electrical faults arise, please refer to the manual of the frequency converter.

Maintenance

7

7.1 Maintenance

7.1.1 Maintenance instructions

Safety information



Warning

Please observe the chapter entitled "Safety information" in these Operating Instructions precisely and ensure that only persons who have the necessary specialist know-how are entrusted to carry out work on power installations.

In addition to the main circuits, also ensure that any supplementary and auxiliary circuits are also deenergized, and in particular, the anti-condensation heating.



Caution

Be careful of those parts of the three-phase motor that get hot and let them cool down before starting maintenance work.

Safety rules

Always comply with the following safety rules before starting maintenance work:



Danger

- Isolate
 - Safeguard against reclosure
 - Disconnect from supply
-

- Fence off or cover up adjacent live parts
-

Other safety-related measures



Caution

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

Caution

If you use chemical cleaning agents, observe the instructions and any warnings given in the relevant safety data sheet. Chemical agents must be compatible with the components/parts, especially when it involves plastics.

Note

If anything is unclear, we **urgently** recommend that you consult us stating the type and serial number of the three-phase motor or get one of the SIEMENS Service Centers (see section entitled "SIEMENS Service Centers") to carry out maintenance work for you.

7.1.2 Maintenance intervals

General

Careful and regular maintenance, inspections and overhauls are essential for detecting and eliminating faults in good time before they can lead to extensive damage.

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

Notice

In the event of faults or extraordinary conditions that lead to the three-phase motor being overloaded either electrically or mechanically (e.g. overload, short circuit, etc.), carry out the inspections immediately.

Measures, intervals

Measures after service period intervals have elapsed:

Table 7-1 Service period intervals

Measures	Service period intervals	Intervals
Initial inspection	after 500 operating hours	after 6 months at the latest
Relubrication	(see lubrication instruction plate)	after 12 months at the latest
Cleaning	depending on local degree of pollution	
Main service	approx. every 16,000 operating hours	after 2 years at the latest

7.1.3 Bearings

Description

The three-phase motors have grease-lubricated, rolling-contact bearings. A regreasing device is available.

A deep-groove ball bearing is installed at the non drive end as a locating bearing. Depending on the type of load, a deep-groove ball bearing or cylindrical-roller bearing is installed at the drive end as a floating bearing.

The respective bearing assignment, the correspondingly permissible lateral forces and the minimum loads when cylindrical-roller bearings are installed at the drive end can be found in the catalog or you can ask us for this data.

Preloading springs, thrust collars and/or equalizing rings are installed in the active part of the bearing at the drive end to provide backlash compensation for the outer races. With consideration for operation at the frequency converter, the bearing at the non drive end is electrically insulated.

7.1.4 Lubrication

Relubrication intervals

The relubrication intervals are stated on the lubrication instruction plate of the three-phase motor.

Notice

Observe the basic lubrication interval (see section entitled "Measures, intervals").

Notice

If the period between delivery and commissioning of the motor is long, the bearings must be relubricated.

The grease change intervals apply for normal loads, operation at speeds that accord to those specified on the nameplate, precision-balanced running, as good as neutral ambient air and the use of high-quality rolling-contact bearing greases.

Grease types

The following high-quality rolling-contact bearing greases have been tested and are suitable:

Table 7-2 Rolling-contact bearing greases

K3N-greases
ARAL / Aralub 4340
DEA / Glissando 30
ESSO / Beacon 3
FUCHS / Renolit FWA 220
SHELL / Alvania G 3
SHELL / Alvania R 3
WINTERSHALL / Wiolub LFK 3

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

Notice

Never mix greases that have different thickening agents and base oils.

Initial lubrication

SHELL Alvania G3 grease is normally used to initially lubricate the bearings.

Lubricating using the regreasing device

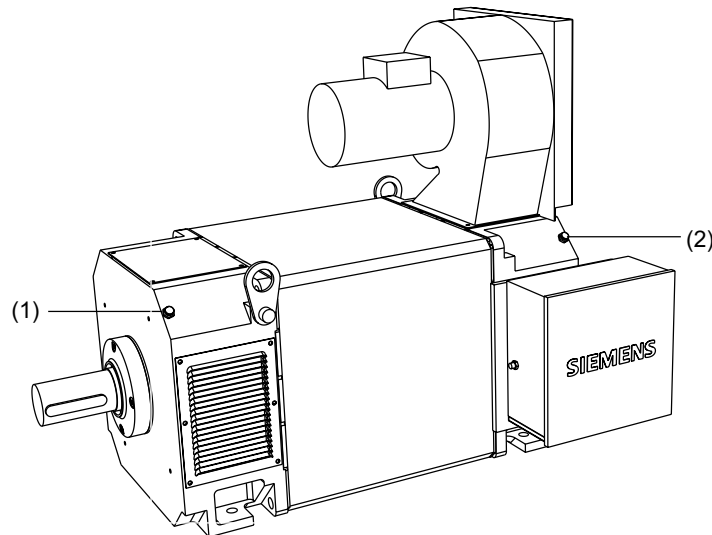


Figure 7-1 End shields at drive end and non drive end with grease nipples

- (1) Grease nipple, drive end (D-end)
- (2) Grease nipple, non drive end (N-end)

1. Clean the grease nipples at the drive end and non drive end.
2. Press in the grease and quantity of grease specified (see lubrication instruction plate).

Note

The shaft should rotate so that the new grease can be distributed throughout the bearing.

The bearing temperature rises sharply at first, then drops to the normal value again when the excess grease is displaced out of the bearing.

7.1.5 Cleaning

Cleaning the greasing channels and used grease chambers

The used grease collects outside each bearing in the used grease chamber of the outer bearing cap. Remove the used grease when you replace a bearing.

There are 2 opposing greasing channels in each of the end shields. These channels are fitted with a grease nipple and a screw plug on the opposite side (see graphic entitled "drive end and non drive end shields with grease nipples" in section entitled "Lubrication").

Notice

You have to separate the active parts of the bearings to replace the grease that is in the greasing channel.

Cleaning the cooling air passages

Clean the cooling air passages, through which the ambient air flows, regularly, e.g. using dry compressed air.

Notice

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



Warning

Particularly when cleaning using compressed air, make sure you use suitable extraction equipment and wear protective gear (safety goggles, breathe filter, etc.).

7.2 Inspection

7.2.1 General inspection specifications

Instructions relevant for safety

Notice

The required regreasing intervals for rolling-contact bearings are not the same as the servicing intervals. It is essential to adhere to them.

Note

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.

7.2.2 Initial inspection

Inspection interval for initial inspection

The initial inspection after assembly or commissioning of the three-phase motor is, under normal circumstances, conducted after approx. 500 operating hours, but at the latest after 6 months.

Conducting the initial inspection

- Check, while the motor is running, that:
 - the equipment conforms to the stated electrical characteristics.
 - the smooth running characteristics and motor noise during operation have not deteriorated.
- Check, while the motor is shut down, that:
 - the motor foundation has no indentations or cracks.

Notice

This list does not claim to be exhaustive.

Further tests are also necessary in line with the additional instruction manuals assigned (e.g. bearings, cooler, etc.) or in line with the particular system-specific conditions.

Notice

Impermissible deviations detected during this inspection must be eliminated immediately.

7.2.3 Main service

Inspection interval for major inspection

The major inspection is conducted after approx. 16,000 operating hours or at the latest after 2 operating years.

Conducting the major inspection

- Check, while the motor is running, that:
 - the equipment conforms to the stated electrical characteristics.
 - the smooth running characteristics and motor noise during operation have not deteriorated.
- Check, while the motor is shut down, that:
 - the motor foundation has no indentations or cracks.
 - the motor is aligned within the permissible tolerance ranges.
 - all of the mounting bolts for the mechanical and electrical connections are tight .
 - the winding insulation resistances are sufficiently high.
 - cables and insulating parts and components are in a good condition and are not discoloured.

Notice

Impermissible deviations detected during this inspection must be eliminated immediately.

7.3 Repair

7.3.1 Instructions for repair

Qualified persons

Only properly qualified persons should be entrusted with the commissioning and operation of machines and equipment. Qualified persons, as far as the safety instructions given in this manual are concerned, are those who have the necessary authorization to commission, earth and identify equipment, systems and circuits in accordance with the relevant safety standards.

Instructions relevant for safety



Warning

Before you begin working on the three-phase motor, in particular before you open the covers of active parts, make sure that the three-phase motor or system is properly isolated.

Notice

Whenever you have to transport the three-phase motor, pay attention to the instructions given in the section entitled "Transport, storage".

7.3.2 Dismantling

Instructions on disassembly

The drawings and parts lists do not contain any detailed information about the type and dimensions of retaining elements and the like.

Notice

For this reason, before you begin disassembling, mark up the respective assignment of retaining elements and the layout of the internal connections for assembly if they have to be disconnected to allow maintenance work to be conducted.

Notice

Use pullers or suitable devices to disassemble parts and components attached to the motor shaft.

Three-phase motors of a vertical type of construction can be dismantled in the horizontal position.

Working with three-phase motor in vertical position

Notice

When working on the locating bearing when the three-phase motor is in its vertical position, support the rotor.

When attaching the rotor in the vertical position, make sure that the centering recesses in the shaft ends ((DIN 332) - DS M24) have a recessed thread;

i.e. eye-bolts to DIN 580 are not suitable, as only a few thread turns would be engaged.

The rotor weights for the 1PH7 three-phase motor can be found in the following table:

1PH7 28. Rotor			
Size	284	286	288
Weight (kg)			
Overall	343	410	489

Disassembling the three-phase motor

To disassemble the motor, disconnect the connecting cables from the terminals and the entry plate from the terminal box housing.

In this way, the respective positioning of the cables to one another and sealing of the cables in the cable entries is largely maintained.

Disconnect the connecting cables in the terminal box of the fan motor and, if necessary, the cable from the ground terminal. Furthermore, disconnect the speed sensor plug connector.

Wiring

The terminal diagram (see 3.4) contains the conditions required for line connection.

Installing the active parts of the bearings

Notice

We recommend that you mark the components that comprise the active part of the bearing before disassembling them, in order to ensure correct reassembly.

Notice

When dismantling and assembling the bearings, ensure that you coordinate the components correctly (bearings, preloading springs, equalizing rings, caps with different centering length, etc.), especially when the bearings at the drive end and non drive end are of the same size.

Notice

Mark the components before dismantling.

Notice

Whenever you work on the locating bearing when the three-phase motor is in its vertical position, support/unload the rotor.

Sealing the bearings

The outer bearing seal comprises a rotary shaft seal.

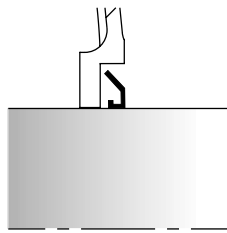


Figure 7-2 Disassembling the rotary shaft seal

Pull the rotary shaft seal together with the bearing cap and/or end shield off the shaft.

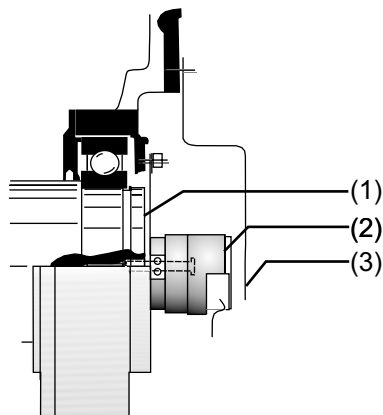
Disassembling the speed sensor

Figure 7-3 Detailed view of the speed sensor

- (1) Shaft
- (2) Speed sensor

(3) Sensor cover

Notice

Always disassemble the speed sensor before you dismantle the three-phase motor, in order to prevent it from becoming damaged.

To disassemble the speed sensor, proceed as follows:

- Screw off the sensor cover.
- Unscrew the screw connections of the sensor from the end shield and the sensor lead connection.
- Pull the sensor off the shaft with the aid of a puller.

7.3.3 Re-assembly

Re-assembly instructions

If possible, assemble the motor on a straightening plate. This ensures that the feet surfaces are all on the same level.

Notice

When mounting the end shield, make sure that the windings that project from the stator housing do not become damaged.

Notice

Take great care and pay attention to cleanliness when fitting and assembling the bearings.

Sealing measures when reassembling

Due to the stricter requirements of degree of protection IP55, joint sealant must be used for motors from the 1PH7 series.

Clean bare joints between parts before reassembling (e.g. between enclosures, end shields and the active parts of bearings).

Coat the bare joints between parts with a non-hardening sealant, e.g. MARSTON HYLOMAR SQM32M.

Note

You can purchase MARSTON HYLOMAR SQM32M sealant either from
W. Kopp Co., Schlesierstrasse 9 D-97268 Kirchheim or directly from
Marston Bentley Domsel GmbH, Bergheimer Str. 15, D-53909 Zülpich.

Notice

Please note that these joints between parts (e.g. the packed sealing gap between the enclosure and end shield) must also be resealed with a suitable, silicone-free sealant during assembly.

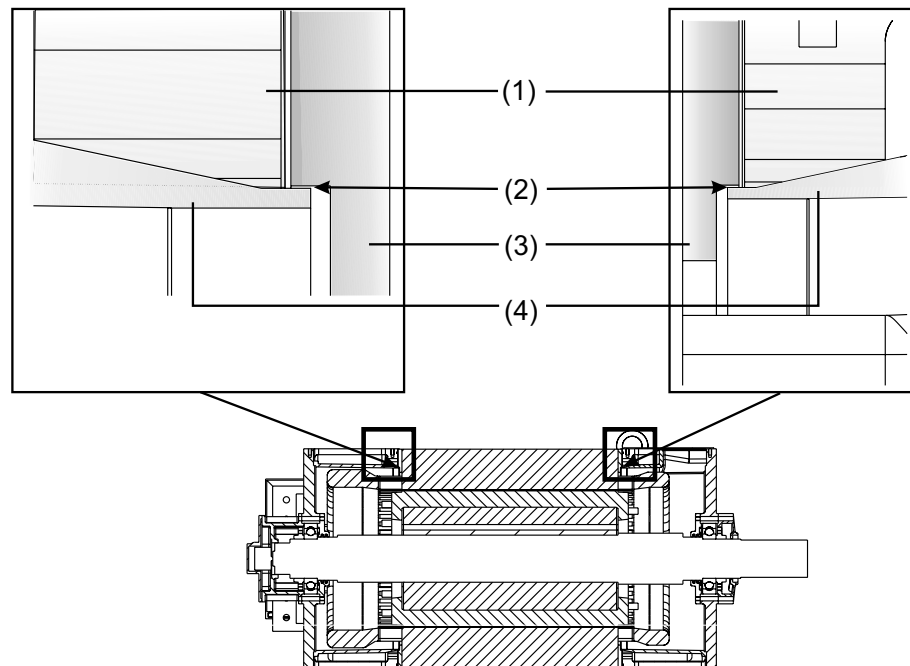


Figure 7-4
Packed sealing gap between enclosure and end shield

- (1) End shield
- (2) Packed sealing gap
- (3) Enclosure
- (4) Protective tube

Before you screw on the end shield, seal the gap (2) with MARSTON HYLOMAR SQ32M sealant.

Notice

Check the sealing elements fitted (e.g. at the terminal boxes) and replace them if they do not provide an adequate seal.

Notice

Follow the application and safety instructions of the manufacturer when using the sealant.

Installing the active parts of the bearings

Notice

Before mounting the bearings, ensure that the parts and components that are to be located on the shaft inside the bearing have been mounted beforehand!

To fit the bearings on the shaft, heat them up to about 80°C in oil or air.

Then push the bearings onto the shaft up to its shoulder.

Notice

Avoid any heavy blows that might damage the bearings.

Caution

When installing/replacing the bearing, make sure that an insulated bearing is installed again at the non drive end (N-end).

Fill the bearings with specified grease (see section entitled "Types of grease") until it is flush.

Also observe the following installation condition:

- If rotary shaft seals without helical spring are installed, the replacement part must also be installed without a spring.
-

Sealing the bearings

The outer bearing seal comprises a rotary shaft seal.

When installing the bearings, make sure that the seat of the shaft is not greased.

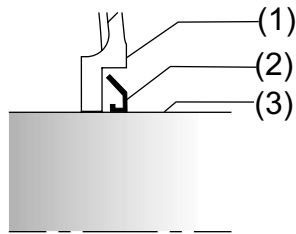


Bild 7-5 Installing the rotary shaft seal

- (1) Bearing cap end face
- (2) Rotary shaft seal
- (3) Shaft seat

The correct axial position of the rotary shaft seal is reached when the outer edges of the bearing cap end face (1) and rotary shaft seal (2) are flush.

See also

Lubrication [[→ Page 7-3](#)]

7.3.4 Bolted connections

Tightening torques for screw and bolt connections

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

Tightening torques (Nm, with a $\pm 10\%$ tolerance) for a thread size of

M6	M8	M10	M12	M16	M20	M24	
8	20	40	70	170	340	360	Nm

Please refer to the relevant sections and drawings for all other tightening torques (electrical connections and bolted connections for parts with flat gaskets).

Bolt locking devices

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

Always renew positive-action locking elements!

Spare parts

8

8.1 Orders for spare parts

General

In addition to the exact part designation, please specify the machine type and the serial number in all orders for spare parts.
The type and the serial number are indicated on the plates and are also embossed on the drive end of the shaft.

The part designation should be identical to the designation stated in the list of spare parts and specified together with the appropriate part number.

Example: End shield, drive end (Part 5.00)
for Type 1PH7288-1HF11-0AA0, Serial No. 1102033010001/2000

Commercially available, standard components can be used, but ensure that they have the same type of construction, dimensions, strength class etc..

When replacing rolling-contact bearings, in addition to the bearing identification code, the replacement code for the bearing version is required. Both of these characters are specified on the lubrication instruction plate and in the motor documentation, or can also be taken from the installed bearings.

8.2 Spare parts 1PH7

Spare parts list

Spare parts number	Description
3.20	Outer bearing cap (drive end)
3.25	Grease slinger
3.40	Deep-groove ball bearing (floating bearing)
3.41	Cylindrical-roller bearing
3.60	Inner bearing cap
4.20	Outer bearing cap (Non drive end)
4.35	Grease slinger
4.40	Deep-groove ball bearing, insulated (locating bearing)

Spare parts number	Description
4.50	Inner bearing cap
5.00	End shield (Drive end)
5.41	Louvered cover
6.00	End shield (Non drive end)
6.44	Cover
6.45	Cover with seal
6.80	Sensor cover
8.00	Rotor, complete
9.00	Protective tube (Drive end)
9.01	Protective tube (Non drive end)
10.00	Stator housing (with laminated core and winding)
10.53	Special eyebolt
13.80	Grease nipple
Terminal box Type 1XB7712	
20.08	Terminal box base
20.20	Housing (terminal box)
20.30	Lid (terminal box)
20.50	Entry plate (terminal box)
32.12	Housing with fan unit, complete
55.12	Speed sensor

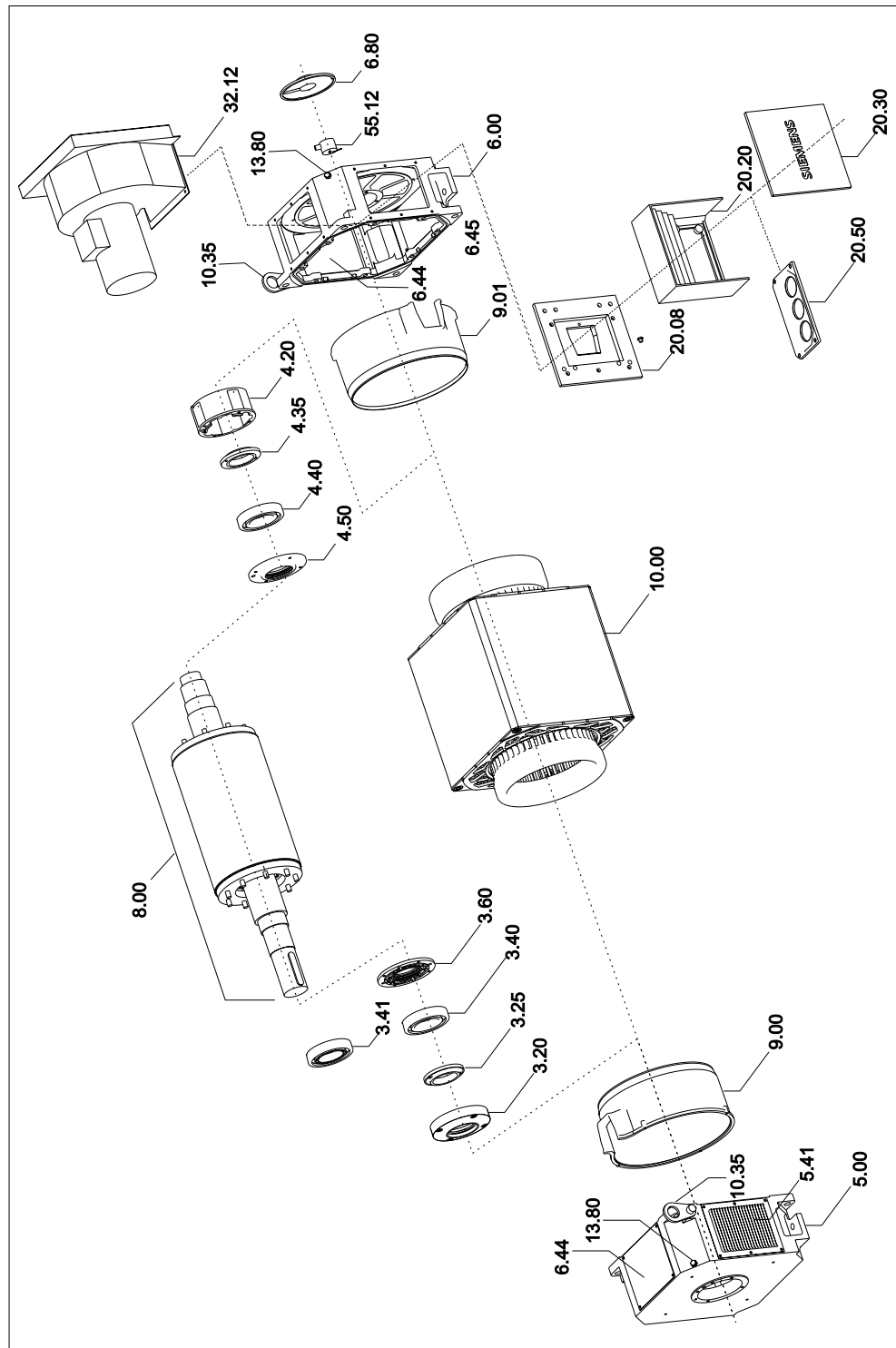


Figure 8-1 Spare parts 1PH7

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Siemens Aktiengesellschaft

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