

# Explosion-protected Motors

Operating Instructions




**Zone 2**  
**Zone 21**  
**Zone 22**

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### Legal information

#### Warning notice system

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


	 <b>DANGER</b> indicates that death or severe personal injury will result if proper precautions are not taken.
	 <b>DANGER</b> indicates that death or severe personal injury may result if proper precautions are not taken.
	 <b>CAUTION</b> indicates that minor personal injury can result if proper precautions are not taken.
	<b>NOTICE</b> indicates that property damage can result if proper precautions are not taken.

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

#### Qualified Personnel

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

#### Proper use of Siemens products Note the following:

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

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#### Disclaimer of Liability

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

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## 1 Introduction

### 1.1 Machine types

1TE1 / 7AA / 9AA / 14BG / 16BG

	1	2	3	4	5	6	7	-	8	9	10	11	12	-	13	14	15	16	
Hazardous Area Motor Type	1	T	E	1															
Cast iron frame					5														
Ex tb IIIC (Ex Zone 21)	Motors with High Efficiency IE2					1	1												
	Motors with Standard Efficiency IE1					1	2												
	Motors with Premium Efficiency IE3					1	3												
Ex tc IIIB (Ex Zone 22)	Motors with High Efficiency IE2					2	1												
	Motors with Standard Efficiency IE1					2	2												
	Motors with Premium Efficiency IE3					2	3												
Ex nA IIC T3 (Ex Zone 2)	Motors with High Efficiency IE2					3	1												
	Motors with Standard Efficiency IE1					3	2												
	Motors with Premium Efficiency IE3					3	3												
Motor frame size									0	A		0							
									to	to		to							
									3	E		6							
Poles											A								
											to								
											D								
Voltage & Frequency													0	-	0				
													to		to				
													9	-	7				
Mounting position																		A	
																		to	
																		J	
Terminal box position																			4
																			to
																			7
Indication of additional optional execution																			
																			Z

### 1.2 Information for the reader

#### Ikonen-Erklärung



Note for 1TE1 machines



Note for 1TE1 machines, frame sizes 80 and 90 with central terminal box locking



Information about explosion-protected machines

## 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 2006/95/EC ("Low-Voltage Directive") and is intended for use in industrial plants. Please observe the country-specific regulations when using the electric machine outside the European Community. 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

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Use the services and support provided by the appropriate Service Center for planning, installation, commissioning and servicing work.

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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 five safety rules:

For your personal safety and to prevent material damage when carrying out any work, always observe the safety 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.

#### Five safety rules

- Disconnect the system. Disconnect the auxiliary circuits, for example anti-condensation heating.
- Protect against reconnection.
- Make sure that the equipment is de-energized (in a no-voltage condition).
- Ground and short-circuit.
- Cover or provide barriers around adjacent components that are still live.

## 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..

		<b>WARNING</b>
	<p><b>Live parts</b> Electrical machines contain live parts. Fatal or severe injuries and substantial material damage can occur if the required covers are removed or if the machines are not handled, operated, or maintained properly.</p> <ul style="list-style-type: none"> <li>• Only remove covers in compliance with the applicable regulations.</li> <li>• Operate the machines properly.</li> <li>• Perform regular maintenance on the machine.</li> </ul>	

		<b>WARNING</b>
	<p><b>Rotating parts</b> Electrical machines contain dangerous rotating parts. Fatal or severe injuries and substantial material damage can occur if the required covers are removed or if the machines are not handled, operated, or maintained properly.</p> <ol style="list-style-type: none"> <li>(1) Only remove covers in compliance with the applicable regulations.</li> <li>(2) Operate the machines properly.</li> <li>(3) Perform regular maintenance on the machine.</li> </ol> <ul style="list-style-type: none"> <li>• Secure free-standing shaft extensions.</li> </ul>	

		<b>WARNING</b>
	<p><b>Hot surfaces</b> Electrical machines have hot surfaces. Fatal or severe injuries and substantial material damage can occur if the required covers are removed or if the machines are not handled, operated, or maintained properly.</p> <ol style="list-style-type: none"> <li>1) Allow the machine to cool down before starting any work on it.</li> <li>2) Only remove covers in compliance with the applicable regulations.</li> </ol> <ul style="list-style-type: none"> <li>• Operate the machines properly.</li> </ul>	

		<b>CAUTION</b>
	<p>The increased level of danger in hazardous areas marked with  demands that you pay particular attention to the notes</p>	

## 2.4 Special conditions for explosion-proof machines



Special conditions for the safe application of explosion-protected machines marked with X (excerpt from the EC type-examination certificate, point 17)

Flameproof enclosure "d"

Flameproof joints may only be repaired strictly in accordance with the manufacturer's design specifications. Repair in accordance with the values in Tables 1 and 2 of EN / IEC 60079-1 is not permitted.

Zone 21

- Do not operate the motors with excessively thick deposits of dust.
- When the motors are mounted with the free shaft end pointing upwards, prevent foreign bodies from dropping into the ventilation openings using an appropriate mechanical design.
- For motors with a fixed connecting cable: The free end of the cable must be connected according to valid regulations for electrical installations.

### 3 Description

#### More Information

...can be found on the Internet [www.lammers.de](http://www.lammers.de).

#### Intended use of the machines

These machines are intended for industrial installations. They comply with the harmonized standards of the series EN / IEC 60034 (VDE 0530). Their use in hazardous areas is forbidden unless the marking on the rating plate expressly permits this operation. If other/more wideranging 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 have been complied with in the plant or system itself when the motors are installed.

#### Note

##### Machine directive

Low-voltage motors are components designed for installation in machines in accordance with the current Machinery Directive. They must not be commissioned until it has been verified that the end product complies with this directive (refer to EN 60204-1).

### 3.1 Regulations

#### Machine design

The regulations and standards used as basis to design and test 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
Ratings and operating performance	EN / IEC 60034-1
Procedure for determining the losses and the efficiency of rotating electrical machines and inspections	EN / IEC 60034-2-1 EN / IEC 60034-2-2 EN / IEC 60034-2-3
Degree of protection	EN / IEC 60034-5
Cooling	EN / IEC 60034-6
Type of construction	EN / IEC 60034-7
Terminal designations and direction of rotation	EN / IEC 60034-8
Noise emission	EN / IEC 60034-9
Restart characteristics for rotating electrical machines	EN / IEC 60034-12
Vibration severity grades	EN / IEC 60034-14
Efficiency classification of three-phase squirrelcage induction motors	EN / IEC 60034-30
IEC standard voltages	IEC 60038



### 3.2 Regulations for explosion-proof machines


#### Supplementary regulations for explosion-proof machines



Table 3-2 Regulations applied for explosion-proof machines

Feature	Standard
Electrical equipment for hazardous gas atmospheres, Part 0: General requirements	EN / IEC 60079-0
Electrical equipment for hazardous gas atmospheres, Part 1: Flameproof enclosure "d"	EN / IEC 60079-1
Electrical equipment for hazardous gas atmospheres, Part 7: Increased safety "e"	EN / IEC 60079-7
Electrical equipment for hazardous gas atmospheres, Part 14: Electric installations for endangered atmospheres (except underground excavation)	EN / IEC 60079-14
Electrical equipment for hazardous gas atmospheres, Part 15: Type of protection "n"	EN / IEC 60079-15
Electrical equipment for hazardous gas atmospheres, Part 19: Repairs and overhauls	EN / IEC 60079-19
Potentially explosive atmosphere - Part 31: Device dust explosion protection by enclosure "t"	EN / IEC 60079-31
Electrical equipment for use in the presence of combustible dust - Part 17: Inspection and maintenance of electrical systems in hazardous areas (except underground excavation)	EN / IEC 60079-17
Directive on the approximation of the laws of the Member RL94/9/EC States concerning equipment and protective systems intended for use in hazardous areas.	RL94/9/EG

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

	<p><b>WARNING</b></p>
	<p>Hot surfaces Operating the machine without external fan results in overheating. This may result in personal injury and material damage. Never commission the machine without an external fan.</p>

Cooling that does not depend on the speed is achieved by means of a separately driven fan wheel (forced ventilation). Forced ventilation does not depend on the operating state of the machine.

The fan wheel for the external flow of cooling air is powered by an independent module and is enclosed by the fan cover.

**Types of construction/Installation conditions for explosion-proof machines**



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

	<b>DANGER</b>
	<p>In the case of explosion-proof machines where the shaft extensions point downwards (types of construction IM V5, IM V1 or IM V18 ) a protective top cover is mandatory. Explosion-proof machines with IM V5, IM V1 and IM V18 types of construction are fitted with a canopy at the factory.</p> <ul style="list-style-type: none"> <li>• For types of construction with a shaft extension facing upwards, a suitable cover must be fitted to prevent small parts from falling into the fan cover (see also standard IEC / EN 60079-0).</li> <li>• Prevent the cooling airflow from being reduced as a result of covers that might be in place.</li> </ul>

The degree of protection the machines feature is stated on the rating plate. They can be installed in dusty or humid environments.

	<b>WARNING</b>
	<p>Dangerous voltage Condensation drain holes (optional) Inserting objects into the condensation drain holes can damage the winding and can result in death, serious injury and damage to property! Note the following to maintain the degree of protection:</p> <ol style="list-style-type: none"> <li>1. Switch off the machine so that it is in a no-voltage condition, before you open the condensation drain holes.</li> </ol> <ul style="list-style-type: none"> <li>• Close the condensation drain holes (e.g. using T-plugs) before commissioning the machine.</li> </ul>

**Note**

**Storage**

If the machines are used or stored outdoors, we recommend keeping them under a shelter or an additional cover.

- Avoid exposing them to direct, intense solar radiation, rain, snow, ice, or dust for extended periods.
- If necessary, please consult us or seek advice regarding technical issues.

**Environmental requirements**

The machines are suitable for operation in tropical climates.

Guide value for the standard version 60 % relative humidity at an ambient temperature of (T<sub>amb</sub>) 40 °C.

Ambient temperature: -20 °C to +40 °C

Installation altitude: ≤ 1000 m

Air with normal oxygen content, usually 21 % (V/V)

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



**Optional built-on and built in accessories for explosion proof machines**

Investigate the influence of sources of heat and cold on the finished installation when it includes built-on accessories compliant with EN 60079-14!

# Explosion-protected Motors


## Operating Instructions


Table 3-3 Recommended maximum interface temperatures for flange motors

Type of protection	Ex d		Ex e, Ex nA	
Supply voltage	Line	Converter	Line	
Control range	-	10 Hz bis $f_N$ ( $\leq 60$ Hz)	-	
Cooling method	Self-ventilated			
Frame size	63 ... 200			
Mechanical design	EN 50347			
Ambient temperature	-20 °C ... +60 °C		-20 °C ... +40 °C	
Temperature class	T3, T4		T3	
Number of poles	2, 4		2	4
Max. shaft temperature	100 °C		60 °C	75 °C
Max. flange temperature	100 °C		60 °C	75 °C

Select mounted equipment such as brakes, forced ventilation or incremental encoders according to the requirements of the Directive 94/9/EC.

## 4 Preparing for use

 <b>WARNING</b>
<p>Use lifting eyes The machine must only be transported and lifted using the lifting eyes, in a position that is appropriate for its type of construction. Otherwise, it could fall over or slip in the lifting tackle.</p> <p>This can result in death, serious injury, or material damage.</p> <ul style="list-style-type: none"><li>• Use all the lifting eyes on the machine.</li><li>• Any eyes that are screwed in must be tightly fastened.</li><li>• Eyebolts must be screwed in right up to their supporting surface.<ul style="list-style-type: none"><li>• If necessary, use suitable, sufficiently-sized transport equipment such as lifting straps (EN1492-1) and lashing straps (EN12195-2).</li></ul></li></ul>

 <b>WARNING</b>
<p>Suspended transport If several items of transport material are used for fastening, two straps must be able to carry the whole load.</p> <ul style="list-style-type: none"><li>• Use additional, suitable means of support for transport and during installation.<ul style="list-style-type: none"><li>• Secure the support equipment to prevent it from slipping.</li></ul></li></ul>

### Storage time

Turn the shafts 1x 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 state of the bearing grease over 12 months.
- Replace the grease if it can be identified that the grease has lost oil content or has become dirty (ingress of condensation leads to consistency changes of the grease).

#### Closed bearings

- For closed bearings, replace the DE and NDE bearings after a storage time of 48 months




### 5 Mounting, installation

	 <b>WARNING</b>
	<p>Hot surfaces Electrical machines have hot surfaces. Fatal or severe injuries and substantial material damage can occur if the required covers are removed or if the machines are not handled, operated, or maintained properly.</p> <ul style="list-style-type: none"><li>• Allow the machine to cool down before starting any work on it.</li><li>• Only remove covers in compliance with the applicable regulations.</li><li>• Operate the machines properly.</li></ul> <p>It must be ensured that parts (cables etc.) do not come into contact with the machine enclosure.</p>

	<b>NOTICE</b>
	<p>Before start-up, please check that</p> <ul style="list-style-type: none"><li>• the customer has set the correct direction of rotation of the machine - e.g. by decoupling from the driven machine - by taking appropriate measures!</li><li>• there are no temperature-sensitive parts (cables etc.), which are in contact with the machine enclosure.<ul style="list-style-type: none"><li>• condensation drain holes are always located at the lowest point of the motor!</li></ul></li></ul>

#### Note

Please note the technical data on the rating plates on the machine enclosure.


	 <b>CAUTION</b>
	<p>The increased level of danger in hazardous areas demands that you pay particular attention to the notes marked with . </p>



## 5.1 Installation of explosion-proof machines

- Only use explosion-protected machines in appropriate areas in accordance with directive 1999/92/EG .  
If the certificate is supplemented by an X, observe the special conditions listed in the EC type examination certificate.  
Special conditions for explosion-proof machines (Page 9)
- When installing electrical systems in hazardous zones, observe EN / IEC 60079-14 and the corresponding country regulations.
- Die auf dem Leistungsschild angegebene Temperaturklasse der Maschine muss mit der Temperaturklasse der möglicherweise auftretenden brennbaren Gase gleich oder höher sein.

## 5.2 Ventilation

	 <b>CAUTION</b>
	<b>Ventilation</b> <ul style="list-style-type: none"> <li>• Do not obstruct ventilation.</li> <li>• Prevent the air expelled by neighboring equipment from being immediately sucked in again.</li> <li>• On the vertical type of machine construction with air intake from above, protect the air inlets from the ingress of foreign bodies and water.</li> <li>• If the shaft extension is facing upwards, liquid must be prevented from entering by moving along the shaft.</li> </ul>

## 5.3 Minimum dimension "X" for the distance between neighboring modules

Table 5-1 Minimum dimension "X" for the distance between neighboring modules

Frame size	X [mm]
63 ... 71	15
80 ... 100	20
112	25
132	30
160	40
180 ... 225	45
180 ... 200 (1LG)	90
225 ... 250 (1LG, 1MA6)	100
280 ... 315	110

## 5.4 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).
- Prevent the limit values stipulated by EN / IEC 61000-6-3 for the drive system (consisting of the machine and converter) from being 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.

## 5.5 Balancing

 CAUTION
Safety precautions
<ul style="list-style-type: none"><li>• The general touch protection measures for drive output elements must be observed.</li><li>• Output elements may only be attached or withdrawn using the correct equipment.</li><li>• The feather keys are only secured against falling out during shipping. If you commission a machine without an output element, the feather keys must be secured to prevent them from being thrown out.</li></ul>

The rotors are balanced dynamically. The balancing quality corresponds to vibration severity grade "A" for the complete machine as standard. The optional vibration severity grade "B" is indicated on the rating plate.

The declaration regarding the type of featherkey for balancing is generally marked on the rating plate and optionally on the face of the shaft end.

### Designation:

- As a standard measure, balancing is carried out dynamically with a half featherkey (code "H") in accordance with ISO 8821.
- "F" means balancing with a whole featherkey (optional version).
- "N" means balancing without a featherkey (optional version).

### Note

Measures conforming to ISO 10816 must be taken in order to compensate any offset between electrical machines and driven machines.

The foundation must be designed according to DIN 4024.

## 5.6 Alignment and fastening

### General

When aligning and fastening the machine, please bear the following in mind:



- The machine must be level.
- Feet and flanges must be fastened securely.
- Alignment must be precise in the case of direct coupling.
- Fastening surfaces must be clean
- Look out for any damage to paint; this must be rectified immediately and correctly.
- Look out for traces of anti-corrosion protection agents; these must be removed using mineral turpentine.
- Look out for installation-related resonances with the rotating frequency and double line frequency; these must be prevented.
- Listen for unusual noises when turning the rotor manually.
- Check the direction of rotation with the machine decoupled.
- Avoid using rigid coupling measures.



### Flatness of the supporting surfaces for conventional motors

Frame size	Flatness
≤ 132	0,10
160	0,15
≥ 180	0,20



## 6 Electrical connection

	<p> <b>WARNING</b></p> <p>Note the following safety information before connecting-up the machine:</p> <ul style="list-style-type: none"> <li>• Only qualified and trained personnel should carry out work on the machine while it is stationary.</li> <li>• Disconnect the machine from the power supply and take measures to prevent it being reconnected. This also applies to auxiliary circuits, e.g. anti-condensation heating.</li> <li>• Check that the machine really is in a no-voltage condition.</li> <li>• Establish a safe protective conductor connection before starting any work.</li> <li>• 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.</li> </ul>
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	<p> <b>WARNING</b></p> <p>Line supply with non-grounded neutral point</p> <p>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).</p>
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### The following features make this type of electrical connection different from that for standard machines:

- Maintain the area A in EN / IEC 60034-1 (VDE 0530-1) ( $\pm 5\%$  voltage or  $\pm 2\%$  frequency deviation, waveform, line supply symmetry) so that the temperature rise remains within the permissible limits.
- Larger deviations from the rated data may result in electrical machines heating up to impermissible levels. This information must be specified on the rating plate. Under no circumstances exceed the limits!
- Protect every machine with type of protection increased safety "e" in accordance with EN / IEC 60079-14 against an inadmissible temperature rise using a current-dependent, delayed circuit breaker with phase failure protection and asymmetry detection corresponding to EN / IEC 60947 or using an equivalent device in all phases.
- For machines with type of protection increased safety "e", select the overcurrent device with current-dependent delayed trip so that the tripping time, which should be taken from the characteristic of the switch for the ratio  $I_A / I_N$  of the machine to be protected, is no longer than the safe-locked rotor time  $t_E$ . Take the ratio  $I_A / I_N$  as well as the safe-locked rotor time  $t_E$  from the rating plate. Set the protective device to the rated current. Use a certified tripping unit in accordance with RL 94/9/EC For machines with increased safety "e" type of protection, in the event of a locked rotor the protective device must disconnect within the  $t_E$  time specified for the relevant temperature class. Protect electrical machines for heavy duty starting (acceleration time  $> 1.7 \times t_E$  time) according to the specifications of the EC-type examination certificate using a starting monitoring function. Direct monitoring of the winding temperature is permissible as a means of thermal machine protection, provided that this is certified and specified on the rating plate.
- With pole-changing machines, separate, interlocked protective devices are required for each speed step. Devices with an EC-type examination certificate are recommended.

### 6.1 Terminal Box

	<p> <b>DANGER</b></p>
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	<p><b>Dangerous voltage</b> Electric machines contain hazardous voltages. If the machine is not de-energized and brought into a no-voltage condition, death or serious injury will occur. When work is carried out on the machine with the terminal box open, it must not be electrically connected!</p>
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	<p><b>NOTICE</b></p> <p><b>Damage to property</b> Note the following information to avoid damage to the terminal box.</p> <ul style="list-style-type: none"> <li>• Make sure that the components inside the terminal box e.g. terminal board and cable connections) are not damaged!</li> <li>• It must be ensured that there are no foreign bodies, dirt or moisture in the terminal box. Cable entries into the terminal box according to DIN 42925.</li> <li>• Close any additional open cable entries with O-rings or suitable flat gaskets, the terminal box itself must be sealed so that it is dust and water tight using the original seal.</li> <li>• Please observe the tightening torques for cable glands and other screws.</li> <li>• When performing a test run, secure the feather keys without output elements.</li> </ul>
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### Note

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The terminal box must be sealed so that dust and water cannot enter.

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### Standardausführung

It is possible to turn the top side of a machine terminal box 4 x 90 degrees (if screwed on).

### 6.1.1 Connection with cable lug for explosion-protected machines

	<p><b>NOTICE</b></p> <p><b>Connection using cable lugs</b> You must bend single-core line conductors into a U shape in order to prevent the contact force being transferred at just one side. In order to prevent the cable lug from rotating, for a line connection using a cable lug, angle single- or multi-core cables through approx. 40° downwards!</p>
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### 6.1.2 Protruding connection cables

	<p><b>! WARNING</b></p> <p><b>Short-circuit hazard</b> During disassembly and particularly when installing the cover plate, make sure that the connection cables are not clamped between enclosure parts and the cover plate.</p>
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 CAUTION

It must be ensured that there are no foreign bodies, dirt, or moisture in the terminal base of the machine enclosure.

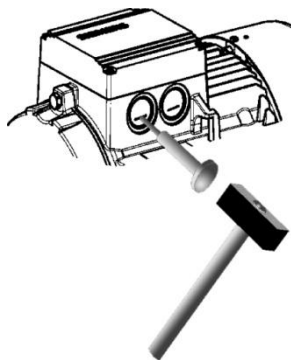
- Use O-rings or suitable flat gaskets to seal entries in cover plates (DIN 42925) and other open entries.
- Seal the terminal base of the machine enclosure using the original seal of the cover plate to prevent dust and water from entering.
- Please observe the tightening torques for cable glands and other screws.
- When performing a test run, secure the feather keys without output elements.

### 6.1.3 Knockout openings

#### Note

Knockout openings

- Knockout openings in the terminal box must be knocked out using appropriate methods.
- Take care not to damage the terminal box or its interior components (the terminal board, cable connections, and so on).



### 6.1.4 Installation and routing



#### NOTICE

Damage to terminal board

Observe the following measures to prevent damage to the terminal board:

- Remove the screw-type connections (EN 50262) only when the terminal box is closed.
- Tighten the screw-type connections to rated torque value only when the terminal box is closed.
- Tighten the screw-type connections only finger tight when the terminal box is open.
- Make sure that the three large snap hooks are engaged when tightening the screw-type connections!

### 6.1.5 Thread sizes



Table 6-1 Thread sizes in the cast iron terminal box

Frame size	Standard thread		Additional thread with mounting parts	
80				
90				
100	M32x1,5	2 Stk.	M16x1,5	1 Stk.
112	M32x1,5	2 Stk.	M16x1,5	1 Stk.
132	M32x1,5	2 Stk.	M16x1,5	1 Stk.
160	M40x1,5	2 Stk.	M16x1,5	1 Stk.
180	M40x1,5	2 Stk.	M16x1,5	1 Stk.
200	M50x1,5	2 Stk.	M20x1,5	1 Stk.
225	M50x1,5	2 Stk.	M20x1,5	1 Stk.
250	M63x1,5	2 Stk.	M20x1,5	1 Stk.
280	M63x1,5	2 Stk.	M20x1,5	1 Stk.
315	M63x1,5	2 Stk.	M20x1,5	1 Stk.

## 6.2 Tightening torques

### 6.2.1 Cable glands

#### Note

Take care not to damage the cable jacket.  
Tightening torques must be adapted to suit the type of cable jacket material in use.

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 Ex -30 °C ... 90 °C	Ex-60 °C ... 105 °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	6,0 ... 10,0	
M 20 x 1,5	12	4	7,0 ... 13,0	6,0 ... 12,0	
M 25 x 1,5			9,0 ... 17,0	10,0 ... 16,0	
M 32 x 1,5	18	6	11,0 ... 21,0	13,0 ... 20,0	
M 40 x 1,5	20		19,0 ... 28,0	20,0 ... 26,0	
M 50 x 1,5			26,0 ... 35,0	25,0 ... 31,0	
M 63 x 1,5			34,0 ... 45,0	-	



The cable glands must have an EC-type examination certificate and be certified for the respective hazardous zone.

- Any openings that are not being used must be sealed using using the appropriate certified plugs.
- Please observe the manufacturer's specifications when fitting cable glands.

## 6.2.2 Terminal boxes, end shields, grounding conductors, sheet metal fan covers

### Note

The specified tightening torques are applicable unless other values are indicated.

Table 6-4 Tightening torques for screws on the terminal box, end shields, screw-type grounding conductor connections



	Thread $\emptyset$		M 4	M 5	M 6	M 8	M 10	M 12	M 16	M20
	Nm	min	2	3,5	6	16	28	46	110	225
		max	3	5	9	24	42	70	165	340



Table 6-5 Tightening torques for self-tapping screws on the terminal box, end shields, screw-type grounding conductor connections, sheet metal fan covers

	Gewinde $\emptyset$		M 4	M 5	M 6
	Nm	min	4	7,5	12,5
		max	5	9,5	15,5

### 6.3 Conductor connection

#### 6.3.1 General information on conductor connection



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


 <b>WARNING</b>
<p>Short-circuit hazard Electric machines contain hazardous voltages. If the appropriate precautions are not taken, death or serious physical injury can occur.</p> <ul style="list-style-type: none"> <li>• Do not lay connection cables over the central dome of the terminal board.</li> <li>• Observe the opening direction and the mounting position of the cover washers on the terminal board.</li> </ul>

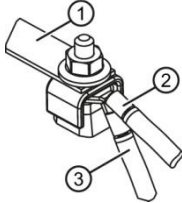
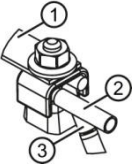
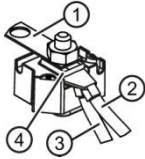
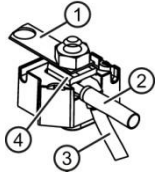
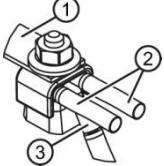
Table 6-6 Max. conductor connection for standard machines and Zone 22

Frame size	Max. connectable conductor cross-section [mm <sup>2</sup> ]
56 ... 90	1,5 2,5 with cable lug
100 ... 112	4,0
132	6,0
160 ... 180	16,0
200	25,0
225	35,0 with cable lug
250 ... 280	120,0
315	240,0

Table 6-7 Max. conductor connection for explosion-proof machines (with the exception of Zone 22 and 1MJ) and VIK standard version

Baugröße	Max. anschließbarer Leiterquerschnitt [mm <sup>2</sup> ]
56 ... 112	4,0
132	6,0
160	16,0
180	10,0
180 (1LG4, 1LG6)	16,0
200 ... 225	50,0
250 ... 280	120,0
315	240,0

### 6.3.2 Type of conductor connection

Terminal board				Conductor cross-section [mm <sup>2</sup> ]
Connection with cable lug DIN 46 234 Bend down the cable lug for the connection!				... 25
Connection of an individual conductor with terminal clamp				... 10
Connection of two conductors of approximately the same thickness with terminal clamp				... 25

- ① Link rail
- ② Power supply cord
- ③ Motor connection cable
- ④ Cover washer



### 6.4 General information on connecting the grounding conductor

#### 6.4.1 General information on connecting the grounding conductor

##### Note

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.

#### 6.4.2 Grounding connection type

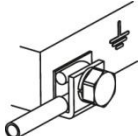
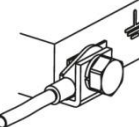
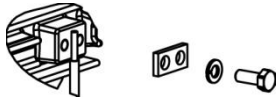
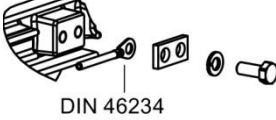
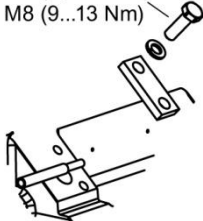
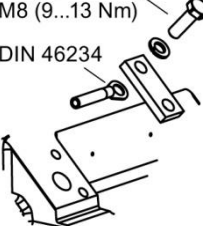
Enclosure grounding method			Conductor cross-section [mm <sup>2</sup> ]
Connection of an individual conductor under the external grounding bracket.			... 10
Connection is made using a DIN cable lug under the external grounding bracket. DIN 46 234			... 25
External grounding			... 25
		 <p>DIN 46234</p>	... 35
		<p>M6 (2,7...4 Nm) M8 (9...13 Nm)</p> 	.. 35
		<p>M6 (2,7...4 Nm) M8 (9...13 Nm) DIN 46234</p> 	... 50

Table 6-9 Minimum cross-sectional area of grounding conductor

Minimum cross-sectional area of phase conductor for installation S [mm <sup>2</sup> ]	Minimum surface area of associated grounding connection [mm <sup>2</sup> ]
$S \leq 16$	S
$16 < S \leq 35$	16
$S > 35$	0,5 S

Table 6-10 Size of grounding conductor screw (except for 1MJ machines)

Frame size	Thread size for the grounding conductor
63 ... 90	M3,5 / M4
100 ... 112	M5
132 ... 180	M6
200 ... 225	M8
200 1LG4/6, 1TE1	2x M6
200 ... 315 1LG, 1TE1, 1MA	2x M8

For machines of size 80 ... 90 with central terminal-box locking, the ground conductor can also be connected with a cable lug in accordance with DIN46237, size M4.

Table 6-11 Size of grounding conductor screw for 1MJ machines.

Frame size	Thread size for the grounding conductor
71 ... 180	2x M6
200 ... 315	2x M8

## 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 details in the sections above and tighten with the correct torque.
- The clearances between non-insulated parts have been maintained:  $\geq 5.5$  mm to 690 V,  $\geq 8$  mm to 1000 V.
- 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.

## 6.6 Connecting to the converter



- Correctly and professionally close unused openings in the terminal boxes.
- The pressure relief device is undamaged (depending on the type of terminal box, this involves either cast-in slots or an overpressure diaphragm). Only repair damage after prior consultation with the person responsible for the safety of the equipment and use only original parts.




Before closing the terminal box, check that

- the air clearances for explosion-protected machines (with the exception of machines for Zone 22) between non-insulated parts are maintained:  $\geq 10$  mm to 690 V.
- the minimum creepage distance for explosion-protected machines (with the exception of machines for Zone 22) between non-insulated parts is maintained:  $\geq 12$  mm to 690 V.

## 6.6 Connecting to the converter

	 CAUTION
	The standard insulation system is designed so that operation on the converter is possible for supply voltages up to 500 V +10% in motorized operation. Use a special insulation system or adopt special measures, e.g. output filter, for higher voltages.



	NOTICE
	Machines must always be connected to frequency converters using shielded machine supply cables. The most effective method of shielding is to conductively connect the cable to the metal terminal box of the machine (with metal screw connections) over a large surface area.

### Note

EMC  
Please observe the section containing instructions on ensuring electromagnetic compatibility.

See the list of additional operating instructions: SIEMENS Service Center (Page 61)



	 WARNING
	Operating explosion-protected machines on a converter Always with PTC thermistor monitoring. For this purpose, tripping units according to directive 94/9/EC are necessary.

### Machines with increased safety "e" type of protection

Converter operation for these machines must be expressly certified. It is essential that you observe the separate manufacturer's information and instructions. Converter and protective devices must be marked as belonging together and the permitted operating data must be defined in the common EC-type examination certificate.

### Machines operated from a converter for Zone 21 and Zone 22

These machines are generally equipped with three PTC thermistors in accordance with DIN 44082 with a rated response temperature that depends on the maximum possible surface temperature. Select the PTC thermistors in accordance with this standard. The maximum temperature at the cable entries is 120° C. Use suitable cables for this temperature. Do not exceed the maximum frequency dependent on the number of poles, which is stamped on the rating plate.

### System, converter-cable-electrical machine

Please observe the information in accordance with EN / IEC 60034-17 and EN / IEC 60034-25 regarding winding stress. For line supplies with operating voltages up to 690 V, the maximum value of the voltage peaks at the end of the cable must not exceed twice the value of the converter's DC-link voltage.

### **Machines with type of protection flameproof enclosure "d" or "de"**

Temperature sensors for tripping



These machines are equipped with three temperature sensors in the winding and one temperature sensor in the gland plate in order that the temperature class is maintained. Connect the temperature sensors in series according to the circuit diagram.



Temperature sensors for alarm and trip

These machines have for warning and shutdown three temperature sensors in the winding and one temperature sensor in the gland plate. Connect the temperature sensors in series according to the circuit diagram.

## 7 Commissioning

### 7.1 Insulation resistance

	 <b>WARNING</b>
	Working on electrical power installations Only appropriately trained personnel may carry out this work. Before starting commissioning, install all covers that are designed to prevent active or rotating parts from being touched, or which are necessary to ensure correct air guidance and thus effective cooling.

	 <b>WARNING</b>
	Hazardous voltage at the terminals Dangerous voltages are sometimes present on the terminals during and immediately after measurement of the winding insulation resistance. 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 connected. Once you have measured the insulation resistance, discharge the winding by connecting to the ground potential

### Checking the insulation resistance

	<b>NOTICE</b>
	The insulation resistance needs to be checked prior to start-up and again after any extended periods of storage or periods during which the equipment is not in operation. Before you begin measuring the insulation resistance, please read the operating manual for the insulation resistance meter you are going to use. Disconnect any main-circuit cables that are connected to the terminals before measuring the insulation resistance.

#### Note

If the critical insulation resistance is less than or equal to this value, the windings must be dried or, if the fan is removed, cleaned thoroughly and dried.

Please note that the insulation resistance of dried, clean windings is lower than that of warm windings. The insulation resistance can only be properly assessed after conversion to the reference temperature of 25 °C.

#### Note

If the measured value is close to the critical value, you must check the insulation resistance at suitably frequent intervals.

### Measuring 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. Disconnect any main circuit cables from the terminals before measuring the insulation resistance.
3. Where possible, measure the insulation resistance of the winding with respect to the motor enclosure when the winding temperature is between 20 ... 30 °C. Different insulation resistance values apply for other temperatures.
4. When measuring, wait until the final resistance value is reached. This is reached after approximately one minute. Then read off the insulation resistance.

### Limit values of the stator winding insulation resistance

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

Table 7-1 Insulation resistance of the stator unwinding at 25 °C

	Rated voltage $U_{\text{rated}} < 2 \text{ kV}$
Measuring circuit voltage	500 V
Minimum insulation resistance for new, cleaned or repaired windings	10 MΩ
Critical specific insulation resistance after a long operating time	0,5 MΩ / kV

Note the following:

#### • 7.2 Measures

- If the measurements are performed at winding temperatures  $\neq 25 \text{ °C}$ , convert the measured value to the reference temperature of 25 °C in order to be able to compare the values with the table above.
  - The insulation resistance halves every time the temperature rises by 10 K.
  - The resistance doubles every time the temperature falls by 10 K.
- Dry, new windings have a typical insulation resistance of more than 100 ... 2000 MΩ depending on the winding size, design and rated voltage. An insulation resistance value close to the minimum value could be due to moisture and/or dirt accumulation.
- During operation, the insulation resistance of the windings can fall to the critical insulation resistance due to ambient and operational influences. The critical insulation resistance value for a winding temperature of 25 °C can be calculated by multiplying the rated voltage (kV) by the specific critical resistance value (0,5 MΩ / kV).

Example:

Critical resistance for rated voltage  $U_N = 690 \text{ V}$ :  $690 \text{ V} \times 0,5 \text{ M}\Omega / \text{kV} = 0,345 \text{ M}\Omega$

### Note

#### Critical insulation resistance reached or fallen below

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

- Contact your Siemens Service Center.
- If the measured value is close to the critical value, you must check the insulation resistance at suitably frequent intervals.

## 7.2 Measures

### Measures before commissioning

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

- The machine has been assembled and aligned correctly.
- The machine has been connected so that it rotates in the direction specified.
- The operating conditions match the data specified on the rating plate.
- The bearings have been lubricated as appropriate for the version used. Rolling-contact bearing machines which have been in storage for more than 24 months have been relubricated.
- Any supplementary machine monitoring equipment has been connected correctly and is functioning as it should.

### 7.2 Measures

- For versions with bearing thermometers, the bearing temperatures must be checked during the machine's first period of operation. The warning and shutdown values are set on the monitoring device.
- Appropriately configured control and speed monitoring functions ensure that the machine cannot exceed the permissible speeds specified on the rating plate.
- The output elements have the correct settings for their type (e.g. alignment and balancing of couplings, belt forces in the case of a belt drive, tooth forces and tooth face clearance in the case of toothed-wheel power output, radial and axial clearance in the case of coupled shafts).
- The minimum insulation resistance and minimum clearance values have been adhered to. • The grounding and equipotential bonding connections have been established correctly.
- All fixing screws, connection elements, and electrical connections have been tightened to the specified torques.
- Lifting eyes that were screwed in have been removed following installation or secured to prevent them becoming loose.
- The rotor can turn without coming into contact with the stator.
- All touch protection measures for both moving and live parts have been implemented.
- In cases where the shaft extension is not being used and is, therefore, exposed, it has been covered and the feather key has been secured to prevent it from being thrown out.
- If being used, the external fan is ready for operation and connected so that it rotates in the direction specified.
- The flow of cooling air is not obstructed.
- If a brake is being used, it is functioning correctly.
- The specified mechanical limit speed  $n_{max}$  is adhered to.

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.

### Measures for start-up

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


- Start the machine without a load; to do this, close the motor starter protector and do not switch the machine off prematurely. You should limit how often you switch the machine off while it is starting up and still running at a slow speed, for checking the direction of rotation or the required dimensions, for example. Allow the machine to run to a standstill before switching it back on again.



# Explosion-protected Motors

## Operating Instructions

- Check the mechanical operation for noises or vibrations at the bearings and bearing end shields.
- If the motor does not run smoothly and/or there are any abnormal noises, switch it off and determine the cause as it slows down.
- If mechanical operation improves immediately after the machine is switched off, then the cause is magnetic or electrical. If mechanical operation does not improve immediately after switching the machine off, then the cause is mechanical, such as an imbalance in the electrical machines or in the driven machine, inadequate alignment of the machine set, operation of the machine with the system resonating (system = machine + base frame + foundation, etc.).
- If there are no problems with the machine's mechanical operation, switch on any cooling devices that are being used and continue to monitor the machine for a while during no-load operation.
- If it runs perfectly, connect a load. Check that it runs smoothly, and read off and document the values for voltage, current and power. As far as possible, read off and document the corresponding values for the driven machine as well.

	<b>WARNING</b>
	The vibration values encountered during operation comply with ISO 10816 (otherwise the machine could be damaged or destroyed).

- Monitor and document the temperatures of the bearings, windings, etc. until the system reaches a steady state, in as much as this is possible with the available measuring instruments.




### Measures to take when commissioning explosion-proof machines

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


- Start the machine without a load; to do this, close the motor starter protector and do not switch the machine off prematurely.
- You should limit how often you switch the machine off while it is starting up and still running at a slow speed, for checking the direction of rotation or the required dimensions, for example.
- Allow machines to reach a standstill before switching them back on.







## 7.3 Operation

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




	<b>CAUTION</b>
	Before switching on, always make sure that the (optional) anti-condensation heating is switched off.

### Machine operation

	<b>WARNING</b>
	Line supply with non-grounded neutral point 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 / IEC 60034-1).

	<p> <b>WARNING</b></p> <p>Do not remove covers when the motor is running Rotating or live parts are dangerous. Death, serious injury, or material damage can result if the required covers are removed.</p> <ul style="list-style-type: none"> <li>• De-energize the machine and bring it into a no voltage condition before removing any covers.</li> <li>• Ensure that any covers, which are designed to prevent active or rotating parts from being touched, which are necessary to ensure correct air guidance and thus effective cooling, or which guarantee the degree of protection of the machine, remain closed during operation.</li> </ul>
	<p> <b>CAUTION</b></p> <p>The surfaces of the machines can reach high temperatures, which can lead to burns if touched.</p>
	<p><b>NOTICE</b></p> <p>Minimum load for cylindrical roller bearings Be sure to comply with the minimum radial load of 30% of the cylindrical roller bearings in accordance with catalog data.</p>
	<p> <b>WARNING</b></p> <p>Faults during operation Deviations from conditions during normal operation, such as an increase in power consumption, temperatures or vibrations, unusual noises or odors, tripping of monitoring devices, etc., indicate that the machine is not functioning properly. This can cause faults which can result in eventual or immediate death, severe injury or material damage.</p> <ul style="list-style-type: none"> <li>• Immediately inform the maintenance personnel.</li> <li>• If you are in doubt, immediately switch off the machine, being sure to observe the systemspecific safety conditions.</li> </ul>
	<p><b>NOTICE</b></p> <p>Risk of corrosion due to condensation When changing machines and/or ambient temperatures, air humidity can condense within the machines.</p> <ul style="list-style-type: none"> <li>• If available, remove the screw plugs to drain the water depending on the ambient and operating conditions.</li> <li>• Reinsert them afterwards.</li> </ul> <p>If the machine is equipped with drainage plugs, the water can drain away automatically.</p>
	<p> <b>WARNING</b></p> <p>Machines with textile fan covers The machine fan is not completely protected against contact. The customer must put suitable measures in place, e.g. housings or protective grating, to prevent manual intervention.</p>

### 7.3.1 Sicherheitshinweise für explosionsgeschützte Maschinen im Betrieb

	 <b>DANGER</b>
	<p>Explosion hazard</p> <p> This electrical equipment is not suitable for hybrid explosive environments. This can result in death, serious injury or material damage. Usage in atmospheres where there is a risk of explosion caused by both gas and dust is prohibited.</p>



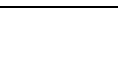
Only install machines with type of protection flameproof enclosure "d", increased safety "e", and machines for Zone 2 in hazardous areas, according to the regulations laid down by the responsible supervisory authority. They are responsible for determining the hazard level of each area (division into zones). Layers of dust on machines for Zone 21 and Zone 22 must – under no circumstances – be higher than 5 mm.

- If there are no other specifications in the EC-type examination certificate or on the rating plate regarding operating mode and tolerance, electrical machines are designed for continuous duty and normal startup procedures that are performed infrequently and do not result in excessive temperature rise. Only use these machines for the operating mode specified on the rating plate.
- Measures for maintaining the temperature class:  
 For S1 line supply operation, a function-tested, current-dependent protective device that monitors all three phase conductors provides sufficient protection for the machine. This protective device is set to the rated current and must switch off machines with 1.2x the rated current within 2 hours or less. Do not switch off for 1.05-fold or smaller rated current. Pole-changing machines require a separate switch for each number of poles. If an anticondensation heating system is available, it may only be switched on when the machines are not in operation.  
 For S2 to S9 line supply operation, machines with type of protection Flameproof Enclosure "d" must be equipped with at least three temperature sensors (one per phase), a temperature sensor in the gland plate and with a suitable electronic switchoff device with a temperature sensor.

### 7.3.2 Stoppages

#### Overview

If the machine remains out of service for an extended period of time (> 1 month), it should be commissioned regularly (around once a month) or, at the very least, the rotor should be turned. Please refer to the instructions in the section titled "Switching on" before recommissioning the machine. If a rotor locking device has been fitted to the machine, you must remove it before the rotor starts to turn.

	<b>NOTICE</b>
	<p>If the machine is to be out of service for a period in excess of 12 months, you must take suitable anti-corrosion, mothballing, packaging, and drying measures.</p>

#### Switching on the anti-condensation heater

If an anti-condensation heater is provided, switch it on during the machine stoppages.

#### Taking the machine out of service

For details of measures that need to be implemented, please refer to Section Preparing for use (Page 17).

### Lubricating before recommissioning

	NOTICE
	The machine must be relubricated during commissioning if it has been out of service for more than 1 year, in order to ensure that the grease is distributed throughout the bearings. The shaft must rotate for the grease to be distributed. Please observe the information on the lubricant plate if carrying out relubrication using relubrication equipment. See also the section titled "Application planning - Bearing lifetime".

### 7.3.3 Fault tables

#### Overview

#### Note

Before rectifying any faults, please read the information in the section titled Safety notes (Page 7).

#### Note

In the event that electrical faults occur while the machine is being operated with a converter, please also refer to the operating instructions for the frequency converter.

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

Table 7-2 Fault table, electrical causes

							Electrical fault characteristics		
↓							Machine will not start up		
	↓						Machine starts up reluctantly		
		↓					Rumbling noise during startup		
			↓				Rumbling noise during operation		
				↓			Overheating during no-load operation		
					↓			Overheating when under load	
						↓	Overheating of individual winding sections		
							Possible causes of faults	Remedial measures <sup>1)</sup>	
X	X		X			X	Overload	Reduce load	
X							Interruption of a phase in the supply line.	Check switches and supply lines	
	X	X	X			X	X	Interruption of a phase in the supply line after switching on	Check switches and supply lines
X	X							Supply voltage too low, frequency too high	Check power supply conditions
X	X	X	X					Supply voltage too high, frequency too low	Check power supply conditions
	X	X	X				X	Stator winding incorrectly connected	Check winding connections

# Explosion-protected Motors

## Operating Instructions

							X	Winding short circuit or phase short circuit in stator winding	Measure the winding resistances and insulation resistances, repair after consultation with manufacturer
							X	Incorrect direction of rotation of axial fan	Check connections

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

Table 7-3 Fault table, mechanical causes

Mechanical fault characteristics							
↓							
Grinding noise							
↓							
Overheating							
↓							
Radial vibrations							
↓							
Axial vibrations							
↓							
				Possible causes of faults	Remedial measures <sup>1)</sup>		
X				Rotating parts are grinding	Determine cause and adjust parts concerned		
	X			Reduced air supply, fan possibly rotating in the wrong direction	Check airways, clean machine		
		X		Rotor not balanced.	Check feather key declaration (H, F, N)		
		X		Rotor out of true, shaft bent	Please consult the manufacturer.		
		X	X	Poor alignment	Align machine set, check coupling <sup>2)</sup>		
		X		Coupled machine not balanced	Re-balance coupled machine		
			X	Surges from coupled machine	Inspect coupled machine		
		X	X	Imbalance originating from gearing	Adjust/repair gearing		
		X	X	Resonance in the overall system (comprising machine and foundation)	Reinforce foundation following consultation		
		X	X	Changes in foundation	Determine cause of changes; eliminate if necessary; realign machine		

(1) As well as eliminating the cause of the fault (as described under "Remedial measures"), you must also rectify any damage the machine may have suffered. 2) Note any changes that take place while the temperature is rising.

### 7.3.4 Marking explosion proofmachines

Table 7-4 Zone 1 with Ex de IIC Gb type of protection (flameproof enclosure)

CE	158	Ex	II	2	G	Ex	d	e	IIC	T4	Gb
----	-----	----	----	---	---	----	---	---	-----	----	----

Table 7-5 Zone 1 with Ex e IIC Gb type of protection (increased safety "e")

CE		Ex	II	3	G	Ex	nA		IIC	T3	Gc
----	--	----	----	---	---	----	----	--	-----	----	----

Table 7-6 Zone 2 with type of protection Ex nA IIC Gc, (non sparking)

CE		Ex	II	3	G	Ex	nA		IIC	T3	Gc
----	--	----	----	---	---	----	----	--	-----	----	----

Table 7-7 Zone 21



CE	158	Ex	II	2	D	Ex	t		IIIC	T125°C	Db
----	-----	----	----	---	---	----	---	--	------	--------	----

Table 7-8 Zone 22

CE		Ex	II	3	D	Ex	t		IIIB	T125°C	Dc
----	--	----	----	---	---	----	---	--	------	--------	----

## 8 Maintenance

### 8.1 Preparation and notes

	<p> <b>WARNING</b></p> <p>Safety instructions</p> <ul style="list-style-type: none"><li>• Before starting work on the machines, make sure that the plant or system has been disconnected in a manner that is compliant with the appropriate specifications and regulations.</li><li>• In addition to the main currents, make sure that supplementary and auxiliary circuits, particularly in heating devices, are also disconnected.</li><li>• Certain parts of the machine may reach temperatures above 50 °C. Physical contact with the machine could result in burn injuries! Check the temperature of parts before touching them.</li><li>• When carrying out cleaning using compressed air, make sure that appropriate methods of extracting fumes are in place and that personal protective gear such as gloves, goggles, face masks, or similar are worn. If you are using chemical cleaning agents, observe the instructions and any warnings provided in the relevant safety data sheet. Chemical agents must be compatible with the machine's components, especially if these contain plastics.</li></ul>
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#### Note


Operation characteristics can vary widely. For this reason, only general maintenance intervals can be specified here.



#### Preparation and notes for explosion protected machine

- Only have the machines repaired in authorized Siemens workshops!
- For machines intended for use in hazardous areas, only have modifications, repairs and overhaul work carried out by appropriately qualified personnel.  
It is imperative that you observe the regulations according to EN / IEC 60079-19 !
- When making changes or performing repair or overhauling work on machines intended for use with combustible dust, please observe the regulations laid down by EN / IEC 60079-17!

### 8.1.1 Repainting

	 <b>WARNING</b> Explosion danger caused by incorrect painting The paint coat can become electrostatically charged where there is a thick coat. Electrostatic discharges can occur. There is a risk of explosion if potentially explosive mixtures are also present at this moment. This can result in death, serious injury or material damage.
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You must comply with one of the following requirements when you repaint painted surfaces:

- Limit the total paint coating thickness in accordance with the explosion protection group:– IIA, IIB: Total paint coating thickness ≤ 2 mm  
 – IIC: Overall coating thickness ≤ 0.330 mm for motors of group II (gas)
- Limit the surface resistance of the paint used:  
 – IIA, IIB, IIC, III: Surface resistance ≤ 1 GΩ for motors of groups II and III (gas and dust)
- Breakdown voltage ≤ 4 kV for explosion group III (dust only)
- An overall coating thickness of > 120 µm is inadmissible for processes which generate strong charges.

## 8.2 Regreasing (optional)

### General

As a standard feature, the machines have rolling-contact bearings which are permanently lubricated with grease (UNIREX N3, made by ESSO). A regreasing device is possible as an option. In this case, you can find information about relubrication intervals, quantities and types of grease, and, if required, additional data on the rating plate or lubricant plate.

### Note

Do not mix different types of grease!

Prolonged storage periods reduce the useful life 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

### 8.3 Cleaning

relubricated before commissioning. For information on permanently-greased bearings, please refer to the section titled Bearings (Page 54).

### Note

#### Regreasing

1. Clean the grease nipples at the drive end and non-drive end.
2. Press in the type and quantity of grease specified (see rating/lubricant plate data).
  - Please observe the information on the rating and lubricant plates.
  - Regreasing should be carried out when the machine is running (max. 3600 rpm)!

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



# Explosion-protected Motors




## Operating Instructions

### 8.3 Cleaning

#### 8.3.1 Safety instructions for cleaning

##### Cleaning

To ensure problem-free machine cooling, the air ducts (ventilation grilles, channels, cooling fins, tubes) must be free of pollution.

	 <b>DANGER</b>
	Explosion hazard  It is forbidden to clean the machine in an explosive atmosphere! This can result in death, serious injury or material damage. Surfaces can become statically charged and discharge to ignite potentially explosive atmospheres.

#### 8.3.2 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. When replacing bearings, remove the used grease.

##### Note

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

Regularly clean the cooling air passages through which the ambient air flows, e.g. using dry compressed air.


##### Note

Never direct compressed air in the direction of the shaft outlet or machine openings.

In the case of machines with textile fan covers, regularly remove fluff balls, fabric remnants, and similar types of contamination (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.

##### Note

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

	<b>WARNING</b>
	Particularly when carrying out cleaning using compressed air, make sure you use suitable extraction equipment and wear personal protective gear (safety goggles, respiratory filter, etc.).

## 8.4 Bearings



Take the bearing used up to frame size 90 only for special versions, and generally for frame size 100 and higher from the rating plate.

### Bearing lifetime

Prolonged storage periods reduce the useful lifetime of the bearing grease. In the case of permanently lubricated bearings, this leads to a shorter bearing lifetime.

Bearing or grease replacement is recommended after a storage time of 12 months, for longer than four years, replace the bearings or grease.

## 8.5 Dismantling

### Replacing bearings

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

Table 8-1 Bearing replacement intervals

Ambient temperature	Principle of operation	Bearing replacement intervals
40° C	Horizontal coupling operation	40 000 h
40° C	With axial and radial forces	20 000 h

### Note

Special operating conditions

Examples of factors that can reduce operating hours are vertical machine installation, high vibrational and impact loads, frequent reversing, higher ambient temperature, higher speeds, etc.

### Note

- Do not reuse bearings that have been removed.
- Remove any existing contaminated old grease from the bearing shield!
- Replace old grease with new grease!
- Replace the shaft seals when the bearings are replaced.
- Lightly grease the contact surfaces of the sealing lips!

### 8.4.1 Replacing bearings in explosion-proofmachines



- When changing the bearings, renew the sealing rings and only use original Siemens spare parts.
- When installing the sealing rings for the motor series 1LA., 1MA.06. to 20., 1MJ6., fill completely the space in the sealing ring and in the end shield hub with a suitable type of grease.

## 8.5 Dismantling

### Note

Before commencing disassembly, you should mark how each of the fastening elements has been assigned, as well as how internal connections are arranged, for re-assembly purposes.

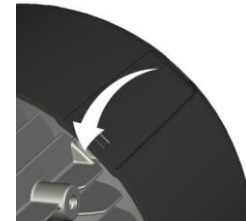
### Fan

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.

### Fancover



1. Carefully lever the snap openings on the cover out of the snap-in lugs one after the other; do not apply the lever directly under the web (risk of breakage).
2. Do not damage the snap mechanisms. If any damage is caused, request new parts.



### Canopy, incremental encoder under the canopy



Loosen the fixing screws on the external surface of the protective cover.

Under no circumstances should the spacing bolts or the mounting bracket be disassembled or forcibly separated from each other or the cover. Forcibly removing or separating can destroy the distance bolts, the connecting elements of the mounting bracket or the fan cover.

## 8.6 Reassembly

### Note

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

### 8.6.1 Assembly

- Apply Fluid-D to the centering edge.
- Check the terminal box seals and if required, replace.
- Repair any damage to the paint (also on screws/bolts).
- Take the necessary measures to ensure compliance with the applicable degree of protection.
- Do not forget the foam cover in the cable entry (seal all holes completely and prevent cables from touching any sharp edges).

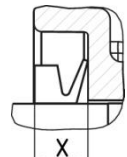
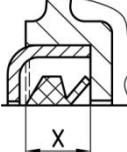


For flameproof machines, apply just a small amount of acid-free, non-resinous grease to the centering edges (e.g. Renolit H 442 supplied by Fuchs). Do not use any sealing agents.

### Sealing the bearings

- V rings on shaft
- Use the prescribed bearings and check that sealing washers are in the correct position
- Do not forget the elements for keeping the bearings in position (correct side)
- Fixed bearings (retaining ring or bearing cover)

Table 8-2 Mounting dimension "x" of V rings

Frame size		X [mm]
100 ... 112	6 ±0,8	
132 ... 225	7 ±1	
225 4 ... 8-polig	11 ±1	
250 ... 315 4 ... 8-polig	13,5 ±1,2	
225 2-polig	11 ±1	
250 ... 315 2 polig	13,5 ±1,2	

### 8.6.2 Reassembling fans

#### Fans

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.

#### Fan cover



- When fitting the cover, do not overstretch it (risk of breakage).
- First engage two snap openings positioned next to one other, then carefully press the cover into position with the two openings situated opposite these using the snap-in lugs, and snap it into place.
- Latch all snap openings cleanly into the snap-in lugs.

#### Canopy; incremental encoder under the canopy



Guide the fixing screws through the holes on the external surface of the canopy and tighten to a torque of 3 Nm ±10%.

#### Miscellaneous

- Number and position of rating plates and additional labels as in original condition • If necessary, fix cables in place.
- Check the tightening torques of all screws, as well as those of screws which have not been unscrewed.



The number on the EC-type examination certificate for machines with flameproof enclosure "d" type of protection is represented by an X, since the flameproof joints deviate from standard EN / IEC 60079-1, Table 2. Only perform repairs following consultation with the manufacturer and be sure to use original parts.

## 9 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 and repair parts.

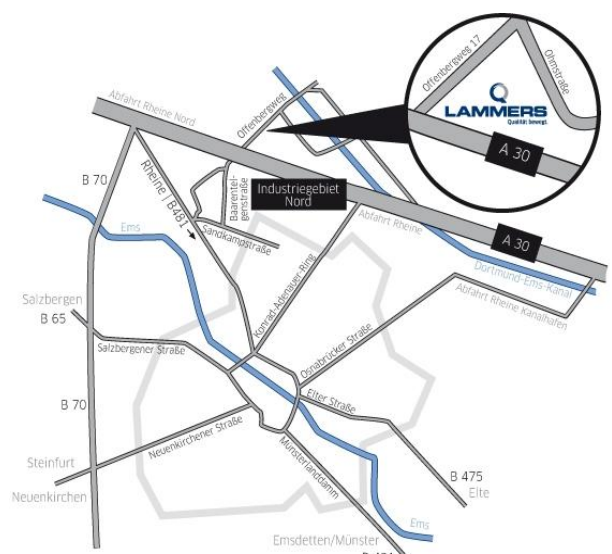
### Technische Anfragen oder zusätzliche Informationen

**Bei technischen Fragen oder benötigten Informationen, bitte kontaktieren Sie**

**Clemens Lammers GmbH & Co. KG**

**Folgende Informationen werden benötigt**

- **Motortyp (Typenschild)**
- **Seriennummer (Typenschild)**
- **Auftragsnummer**



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