

IEC Motors

1LA5/6/7/9, 1LP7/9, 1PP6/7/9,
1MA6/7, 1MF6/7, 1MJ6,
1LE1

Operating Instructions · 10/2008
en



Low-Voltage Motors

SIEMENS

Low-Voltage Motors 1LA5/6/7/9, 1LP7/9, 1PP6/7/9, 1MA6/7, 1MF6/7, 1MJ6, 1LE1

Operating Instructions

<u>Introduction</u>	1
<u>Safety information</u>	2
<u>Description</u>	3
<u>Assignment planning</u>	4
<u>Mounting, installation</u>	5
<u>Commissioning</u>	6
<u>Operation</u>	7
<u>Maintenance</u>	8
<u>Spare parts/accessories</u>	9
<u>Notes</u>	10
<u>Appendix</u>	A

Legal information

Warning notice system

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

 DANGER
indicates that death or severe personal injury will result if proper precautions are not taken.
 WARNING
indicates that death or severe personal injury may result if proper precautions are not taken.
 CAUTION
with a safety alert symbol, indicates that minor personal injury can result if proper precautions are not taken.
CAUTION
without a safety alert symbol, indicates that property damage can result if proper precautions are not taken.
NOTICE
indicates that an unintended result or situation can occur if the corresponding information is not taken into account.

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

Qualified Personnel

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

Proper use of Siemens products

Note the following:

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

Trademarks

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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.

Table of contents

1	Introduction	7
1.1	About these operating instructions	7
2	Safety information	9
2.1	General safety instructions	9
2.2	Special conditions for explosion-proof machines	10
3	Description	11
3.1	Contact	11
3.1.1	SIEMENS Service Center	11
3.1.2	Language versions on the Internet	11
3.2	Range of application	12
3.3	Delivery	12
3.4	Rating plate	13
3.5	Installation	15
3.5.1	Machine design	15
3.5.2	Regulations	15
3.5.3	Cooling and ventilation	17
3.5.3.1	General	17
3.5.3.2	Machines with a fan	17
3.5.3.3	Machines without a fan (optional)	19
3.5.4	Bearings	19
3.5.5	Balancing	19
3.5.6	Types of construction/method of installation	20
3.5.7	Degree of protection	21
3.5.8	Optional built-on and built-in accessories	22
4	Assignment planning	23
4.1	Transport	23
4.2	Storage	24
4.3	Bearing lifetime	24
4.4	Electromagnetic compatibility	25
4.5	Disposal	25
5	Mounting, installation	27
5.1	Installation	27
5.1.1	Safety instructions	27
5.1.2	Machine installation	27
5.1.3	Balancing	30
5.1.4	Noise emission	32
5.2	Alignment and fastening	32
5.2.1	General measures	32
5.2.1.1	Foot dimensions	33

5.3	Connecting.....	34
5.3.1	Connection of the machine.....	34
5.3.1.1	Electrical connection.....	34
5.3.1.2	Terminal designations.....	35
5.3.1.3	Direction of rotation.....	36
5.3.1.4	Connection with/without cable lugs.....	36
5.3.1.5	Connecting protruding cables.....	36
5.3.1.6	Cable entry.....	37
5.3.1.7	Terminal box.....	41
5.3.2	Tightening torques.....	44
5.3.2.1	General notes.....	44
5.3.2.2	Electrical connections - Terminal board connections.....	44
5.3.2.3	Cable glands.....	45
5.3.2.4	Terminal boxes, end shields, grounding conductors, sheet metal fan covers.....	45
5.3.2.5	Conductor connection.....	46
5.3.3	Connecting the ground conductor.....	49
5.3.4	Connection of optional add-on units.....	51
5.3.4.1	External fan, incremental encoder, brake.....	51
5.3.5	Connection to the converter.....	52
6	Commissioning.....	53
6.1	Checking the insulation resistance.....	53
6.2	Measures before start-up.....	55
6.3	Switching on.....	56
7	Operation.....	57
7.1	Safety instructions.....	57
7.2	Stoppages.....	59
7.3	Fault tables.....	60
7.4	Deactivating.....	61
7.5	Class.....	62
7.5.1	Zone 1 with type of protection Ex de II (Flameproof Enclosure "d" for the machine and Increased Safety "e" for the terminal box).....	62
7.5.2	Zone 1 with Ex e II type of protection (Increased Safety "e").....	62
7.5.3	Zone 2 with type of protection Ex nA II (non-sparking).....	63
7.5.4	Zone 21.....	63
7.5.5	Zone 22.....	64
8	Maintenance.....	65
8.1	Preparation and notes.....	65
8.2	Maintenance.....	66
8.2.1	Maintenance intervals.....	66
8.2.2	Regreasing (optional).....	67
8.2.3	Cleaning.....	67
8.2.4	Drain condensate.....	68
8.3	Inspection.....	68
8.3.1	General inspection specifications.....	68
8.3.2	Optional add-on units.....	69
8.3.3	Initial inspection.....	69
8.3.4	Main inspection.....	70

8.4	Corrective maintenance	70
8.4.1	Instructions for repair.....	70
8.4.2	Storage	71
8.4.3	Dismantling.....	72
8.4.4	Assembly	74
8.4.5	Screw-type connections	76
8.4.6	Electrical connections - Terminal board connections	76
8.4.7	Cable glands.....	76
8.4.8	Terminal boxes, end shields, grounding conductors, sheet metal fan covers	77
8.4.9	Optional add-on units	78
9	Spare parts/accessories.....	79
9.1	Spare parts ordering.....	79
9.2	Spare parts	80
9.3	Standardized parts	83
9.4	Exploded drawings	85
9.4.1	1LA, 1LP, 1MA, 1MF, 1PP6/7/9 FS 56...90L	85
9.4.2	1LA, 1LP, 1MA, 1MF, 1PP6/7/9 FS 100...160	86
9.4.3	1LA5180...225	87
9.4.4	1MA6180...200	88
9.4.5	Terminal box 1MA6180...200	89
9.4.6	1MJ6070...200	90
9.4.7	Terminal box 1MJ6070...160	91
9.4.8	Terminal box 1MJ6180...200 (Ex e)	92
9.4.9	Terminal box 1MJ6180...200 (Ex d)	93
9.4.10	1LE1...	94
10	Notes.....	95
A	Appendix.....	97
A.1	Directory	97
	Glossary.....	99

Introduction

1.1 About these operating instructions

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

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

Siemens strives continually to improve the quality of information provided in these operating instructions. If you find any mistakes or would like to offer suggestions about how this document could be improved, please contact the SIEMENS Service Center (Page 11).

Always follow the safety instructions and notices in these operating instructions. The warning notice system is explained on the rear of the inside front.

Note on reading the operating instructions

Explanation of icons



Note for 1LE1 machines



Note for explosion-proof machines

Safety information

2.1 General safety instructions

The safe use of electrical machines



WARNING

Rotating or live parts

Rotating or live parts are dangerous.

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

Only remove covers in accordance with regulations and operate machines correctly. Perform regular maintenance on the machine.

Qualified personnel

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

Those responsible for plant safety must ensure the following:

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

Note

Siemens Service Center

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



! WARNING

Electrical machines have hazardous, live and rotating parts and may also have hot surfaces.

NOTICE

Special designs and construction versions

If any problems or uncertainties arise, we urgently recommend that you contact the manufacturer specifying the type designation and serial number (No., see rating plate) or have the equipment repaired by a Siemens Service Center.

2.2 Special conditions for explosion-proof machines

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



Flameproof enclosure "d"

Flameproof joints may only be repaired in accordance with the manufacturer's design specifications. Repairing in accordance with the values in Table 1 and 2 of EN 60079-1 is not permitted.

Zone 21

- Motors may not be in operated in excessively deep dust deposits.
- When installing motors with the free shaft end facing upwards, foreign bodies must be prevented from falling into vent holes through the mounting.
- For motors with a fixed connection cable: The free end of the cable must be connected according to valid regulations for electrical installations.

Description

3.1 Contact

3.1.1 SIEMENS Service Center

Contact for further information

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

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

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

Table 3- 1 Technical support

Europe - Germany:	Phone:	+49 (0)180 - 50 50 222
	Fax	+49 (0)180 - 50 50 223
America - USA:	Phone:	+1 423 262 2522
Asia - China:	Phone:	+86 1064 719 990
E-Mail:		support.automation@siemens.com
Internet English:		http://www.siemens.com/automation/support-request
Internet Deutsch:		http://www.siemens.de/automation/support-request

3.1.2 Language versions on the Internet

Internet page: <<http://www.siemens.com/motors>>

If you require additional language versions, please contact the above-named Siemens Service Center.

3.2 Range of application

Overview

The three-phase machines of this series are used as industrial drives. They are designed for a wide range of drive technology applications both for mains operation as well as in conjunction with frequency converters.

They are characterized by their high power density, extreme robustness, long service life and outstanding reliability.

Intended use of the machines

These machines are intended for industrial installations. They comply with the harmonized standards of the series IEC / EN 60034-1 (VDE 0530-1). Their use in hazardous areas is forbidden unless the marking on the rating plate expressly permits this operation. If other/more wide-ranging demands (e.g. protection against touching by children) are made in special cases – i.e. use in non-industrial installations – these conditions must have been complied with in the installation when the motors are installed.

Note

Machine directive

Low-voltage machines are components for installation in machines which comply with machine directive 2006/42/EC. They must not be started up until the end product has been verified as complying with this directive (refer to EN 60204-1).

3.3 Delivery

Checking the delivery for completeness

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

Register a complaint about

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

The safety and start-up instructions are part of the scope of supply and must therefore be stored in an accessible place. This also applies to the operating instructions, which are available as an option.

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

3.4 Rating plate

Technical specifications

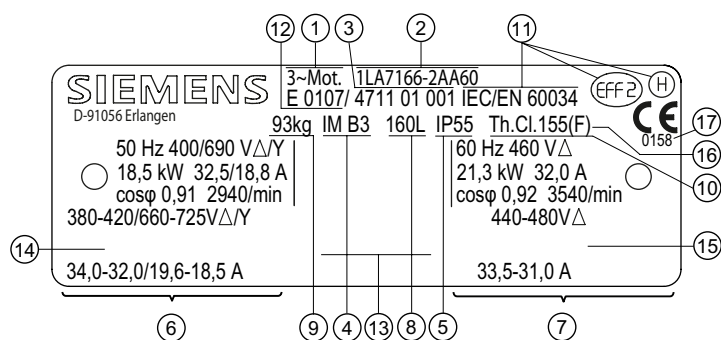
The machine rating plate contains the technical specifications valid for the delivered machine.

The machine rating plate consists of the following technical specifications:

Examples of rating plates

Table 3- 2 Machine rating plate

Item	Technical specifications	Item	Technical specifications
1	Machine type: Three-phase low-voltage machine	10	Temperature class
2	Order no.	11	Standards and regulations
3	Factory number (ID no., serial number)	12	Date of manufacture YYMM
4	Type of construction	13	Additional approvals (optional)
5	Degree of protection	14	Installation altitude (only if higher than 1000 m)
6	50 Hz data	15	Customer data (optional)
7	60 Hz data	16	Operating temperature range (only if different from the standard)
8	Frame size	17	Identification number of testing agency (optional)
9	Machine weight		



Description

3.4 Rating plate



Table 3- 3 Machine rating plate 1LE1

Item	Technical specifications	Item	Technical specifications
1	Machine type: Three-phase low-voltage machine	13	Voltage range V
2	Order no.	14	Current range A
3	Factory number (ID no., serial number)	15	
4	Type of construction	16	Machine weight kg
5	Degree of protection	17	Standards and regulations
6	Rated voltage [V] and winding connection	18	Temperature class
7	Frequency Hz	19	Frame size
8	Rated current A	20	Additional details (optional)
9	Rated power kW	21	Operating temperature range (only if different from the standard)
10	Power factor cosφ	22	Installation altitude (only if higher than 1000 m)
11	Efficiency	23	Customer data (optional)
12	Rated speed [rpm]	24	Date of manufacture YYMM

V	Hz	A	kW	cosφ	eta	1/min	V	A
400 Δ	50	29,5	15	0,82	89,4%	1460	380-420	30,0-30,2
690 Y	50	17,1	15	0,82	89,4%	1460	660-725	17,4-17,5
460 Δ	60	29,5	17,3	0,82	89,4%	1760	440-480	30,2-29,8

3.5 Installation

3.5.1 Machine design

Machines of this series are self-ventilated low-voltage three-phase asynchronous drives with a cylindrical shaft end and featherkey way. They can be supplied as single-speed machines with different efficiency classes or as pole changing machines for several speeds.

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

The position of the feet bolted onto the housing of the machine can be changed, e.g. in order to change the position of the terminal box, but this must only be done by authorized partners. The surfaces on which the feet rested must then be evened out and made parallel with the machine shaft, if necessary by placing shims underneath the machine. Any damaged paintwork must be correctly repaired.

3.5.2 Regulations

Overview

The machines comply with the following standards:

Table 3- 4 Applicable general regulations

Feature	Standard
Dimensions and operating performance	IEC / EN 60034-1
Degree of protection	IEC / EN 60034-5
Cooling	IEC / EN 60034-6
Type of construction	IEC / EN 60034-7
Terminal designations and direction of rotation	IEC / EN 60034-8
Noise emission	IEC / EN 60034-9
Restart characteristics for rotating electrical machines	IEC / EN 60034-12
Vibration severity grades	IEC / EN 60034-14
IEC standard voltages	IEC 60038

Supplementary regulations for explosion-proof machines

Table 3- 5 Regulations applied for explosion-proof machines

Feature	Standard
Electrical equipment for hazardous gas atmospheres, Part 0: General requirements	IEC / EN 60079-0
Electrical equipment for hazardous gas atmospheres, Part 1: Flameproof enclosure "d"	IEC / EN 60079-1
Electrical equipment for hazardous gas atmospheres, Part 7: Increased safety "e"	IEC / EN 60079-7
Electrical equipment for hazardous gas atmospheres, Part 14: Electric installations for endangered atmospheres (except underground excavation)	IEC / EN 60079-14
Electrical equipment for hazardous gas atmospheres, Part 15: Type of protection "n"	IEC / EN 60079-15
Electrical equipment for hazardous gas atmospheres, Part 19: Repairs and overhauls	IEC / EN 60079-19
Electrical equipment for use in the presence of combustible dust - Part 0: General requirements	IEC / EN 61241-0
Electrical equipment for use in the presence of combustible dust - Part 1: Protection by enclosure "tD"	IEC / EN 61241-1
Electrical equipment for use in the presence of combustible dust - Part 17: Inspection and maintenance of electrical systems in hazardous areas (except underground excavation)	IEC / EN 61241-17
Directive on the approximation of the laws of the Member States concerning equipment and protective systems intended for use in hazardous areas.	RL94/9/EC

3.5.3 Cooling and ventilation

3.5.3.1 General

The machines of this series are three-phase asynchronous machines with a closed primary (internal) cooling circuit and an open secondary cooling circuit (surface cooling). The form of surface cooling can vary depending on the type of cooling provided:

3.5.3.2 Machines with a fan

Self-ventilation (standard): Type of cooling IC 411 in accordance with IEC / EN 60034-6

Located at the ND end of the stator housing is an air intake cowl that guides the external air on its way to the motor. The external air is drawn in through openings in the air intake cowl and flows axially across the outer cooling ribs of the motor frame. The fan wheel responsible for the external flow of cool air is fastened to the machine shaft.

The fan wheels are independent of the direction of rotation.

In the case of frequent switching or braking or if the speed is controlled continually below the nominal speed, the cooling effect must be checked.



Machines for use in Zone 21 and Zone 22 have a metal fan.

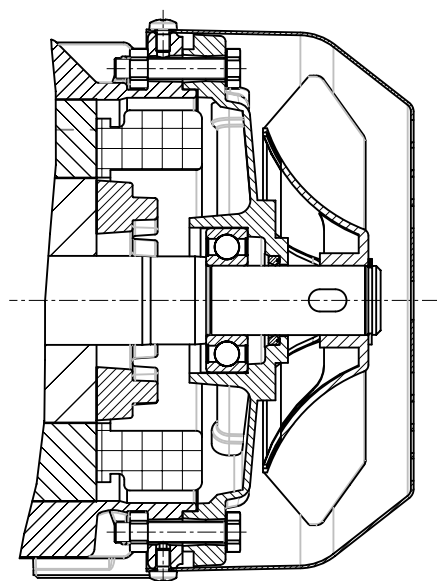


Figure 3-1 Self-ventilation

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

Cooling independent of the speed is achieved by means of a separately driven fan wheel (forced ventilation). Forced ventilation is independent of the operating state of the machine. It must be ensured that the machine is not operated without starting the external fan. The fan wheel for the external flow of cold air is powered by an independent module and is enclosed by the fan cowl.

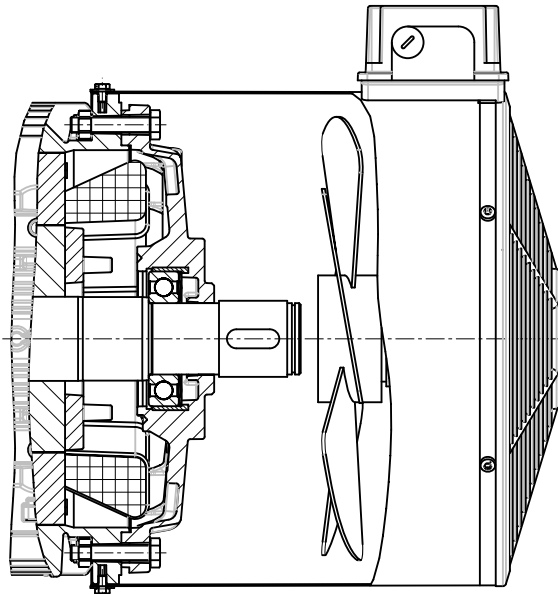


Figure 3-2 Forced ventilation

3.5.3.3 Machines without a fan (optional)

Surface cooling by free convection: Type of cooling IC 410 in accordance with IEC / EN 60034-6

IC410 IC4A1A0

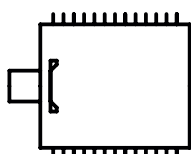


Figure 3-3 IC410

Surface cooling by relative movement of cooling air: Type of cooling IC 418 in accordance with IEC / EN 60034-6

IC418 IC4A1A8

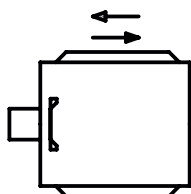


Figure 3-4 IC418

3.5.4 Bearings

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

The nominal (calculated) useful life of the bearings (ISO 281) is 20,000 hours if the permissible radial/axial forces are fully utilized. However, the achievable useful life of the bearings can be considerably longer in the case of smaller forces (e.g. coupling mode).

The rolling-contact bearings are lubricated for life (standard feature) and therefore do not require maintenance.

If the option for re-lubrication is taken up, the information on the rating plate must be complied with.

3.5.5 Balancing

The machines are balanced dynamically with a half featherkey (code "H") in accordance with ISO 8821.

The balancing quality corresponds to vibration severity grade "A" for the complete machine; vibration severity grade "B" is possible as an option.

3.5.6 Types of construction/method of installation

Further possible fields of application

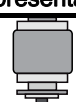
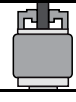
The type of construction of the machine is stated on the rating plate.



CAUTION

During transport, machines may only be hoisted in a position corresponding to their basic type of construction.

Table 3- 6 Type of construction

Basic type of construction code	Graphics-Based Representation	Other methods of installation	Graphics-Based Representation
IM B3 (IM 1001)		IM V5 (IM 1011)	
		IM V6 (IM 1031)	
		IM B6 (IM 1051)	
		IM B7 (IM 1061)	
		IM B8 (IM 1071)	
Basic type of construction code	Graphics-Based Representation	Other methods of installation	Graphics-Based Representation
IM B5 (IM 3001)		IM V1 (IM 3011)	
		IM V3 (IM 3031)	
Basic type of construction code	Graphics-Based Representation	Other methods of installation	Graphics-Based Representation
IM B14 (IM 3601)		IM V18 (IM 3611)	
		IM V19 (IM 3631)	
Basic type of construction code	Graphics-Based Representation		
IM B35 (IM 2001)			
IM B34 (IM 2101)			



Other possible fields of application for explosion-proof machines

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



DANGER

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. A protective top cover is automatically installed at the factory for explosion-proof motors with IM V5, IM V1 or IM V18 types of construction. For types of construction with shaft extension pointing upwards, a suitable cover must be implemented to prevent small parts from falling into the fan cover (see the standard IEC/EN 60079-0). The cover must not block the cooling air flow.

Table 3- 7 Construction type with protective top cover

Conditions of installation	Graphics-Based Representation
IM V5 (IM 1011)	
IM V1 (IM 3011)	
IM V18 (IM 3611)	

3.5.7 Degree of protection

The machines have degree of protection IP 55 (see rating plate). They can be installed in dusty or humid environments.

NOTICE

Condensation holes

In order to comply with the degree of protection, any existing condensation holes are to be sealed!

If the machines are used or are stored outdoors, we recommend that they be kept under some sort of additional cover so that they are not subjected to direct intensive solar radiation, rain, snow, ice or dust over a long period of time.
In such cases, technical consultation may be appropriate.

The machines are suitable for use in the tropics.
Guide value of 60% relative humidity at a coolant temperature (CT) of 40° C.
Ambient temperature: -20° C to +40° C
Installation altitude: ≤ 1000 m

If the specified ambient conditions are different to these values, they must be indicated on the rating plate. These values will then be applicable.



Machines intended for use in Zone 1 (type of protection Flameproof Enclosure "d" or Increased Safety "e") or in Zone 2 (type of protection "n") are designed with IP 55 degree of protection.

Machines intended for use in Zone 21 have IP 65 degree of protection. Machines intended for use in Zone 22 have IP 55 degree of protection and can be used in dusty environments such as grinders, silos, animal feed plants, and malthouses, as well as in certain areas of the chemical industry.

3.5.8 Optional built-on and built-in accessories

In addition to the current-dependent overload protective device located in the connecting leads, we recommend that you use temperature sensors embedded in the stator winding in order to monitor the temperature and protect the stator winding from overheating.

Machines whose winding is exposed to the danger of condensation due to the climate, e.g. machines at a standstill in a damp environment or machines which are exposed to large temperature fluctuations, can be fitted with an anti-condensation heater.

As an option, the machines can be fitted with additional built-on accessories on the ventilation side (e.g. brake, rotary pulse encoder).



No additional measures are required in the case of external sources of heat or cold, provided that the temperatures are within limits at the relevant location. Special application cases involving external sources of heat and cold should be investigated in respect of how maximum surface and operating temperatures are affected. This should be carried out by means of type tests, and appropriate measures implemented as necessary.

Built-on accessories such as brakes, forced ventilation or pulse encoders must be selected for conformity to the specifications of Directive 94/9/EC.

Assignment planning

4.1 Transport

Use lifting eyes



CAUTION

During transport, all the lifting eyes on the machine are to be used and any eyes which are screwed in must be firmly tightened. They are designed to bear the weight of the machine alone and therefore no additional loads should be added. Eyebolts are to be screwed in right up to their supporting surface. If necessary, use suitable rated transport materials such as lifting straps (EN 1492-1) and lashing straps (EN12195-2).

Suspended transport



WARNING

Use suitable means of conveyance for transport and during installation. If several items of transport material are used for fastening, two straps must be able to carry the whole load. Secure lifting materials to make sure they cannot slip!

Remove any transport locks before start-up and either keep them in a safe place or unlock them. You can then use them again for transporting further items or you can apply them again.

The machines are packed in different ways depending on how they are transported and their size. Unless agreed otherwise in the contract, the packaging is in accordance with the packing guidelines of ISPM (International Standards for Phytosanitary Measures).

Comply with the images shown on the packaging. Their meaning is as follows:



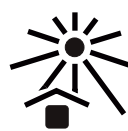
Up



Fragile
goods



Protect
against moisture



Protect
against
heat



Center of
gravity



Hand hooks
forbidden



Attach
here

4.2 Storage

Storing outdoors

If possible, choose a dry storage location which is safe from flooding and free from vibrations. Repair any damage to the packaging before putting the equipment in storage in so far as this is necessary to ensure proper storage conditions. Position machines, devices and crates on pallets, wooden beams or foundations that guarantee protection against ground dampness. Prevent the equipment from sinking into the ground and also make sure that the circulation of air underneath the equipment is not impeded.

Covers or tarpaulins used to protect the equipment against the weather must not make contact with the surfaces of the stored equipment. Ensure adequate air circulation by positioning wooden spacer blocks between the equipment and such covers.

CAUTION
Under extreme climatic conditions, e.g., saline and/or dusty atmospheres, suitable precautions are to be taken.

Storing indoors

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

Bare metal surfaces

For transport, the bare parts are to be coated with anti-corrosion paint which will last for a limited amount of time (<6 months). For longer storage times, the customer must take suitable anti-corrosion measures to protect bare metal surfaces (shaft end, flanging surface, surfaces where feet are bolted on).

4.3 Bearing lifetime

Storage time

Prolonged storage periods reduce the useful life of the bearing grease. If stored for more than 12 months, the condition of the grease must be checked. If the grease is found to have lost some of its oil content or is contaminated (ingress of condensation leads to changes in the consistency of the grease), the grease must be replaced.

Rolling-contact bearings

The shafts must be turned once a year to prevent marks due to the shafts resting in the same position for a long time. The rolling-contact bearings should be renewed if the time from delivery to start-up of the machine is longer than 4 years. The probability of the bearing system's surviving decreases, the longer the storage time is.

4.4 Electromagnetic compatibility

When used in accordance with their intended purpose and operated in an electrical supply system with characteristics to EN 50160, the enclosed motors (IP 55 and higher) comply with the requirements of the EC Directive concerning electromagnetic compatibility 89/336/EEC.

NOTICE

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 bring about an excessive reaction on the supply system and so cause excessive emitted interference.

NOTICE

If operated with a frequency converter, the emitted interference varies in strength, depending on the design of the converter (type, interference suppression measures, manufacturer). In order to prevent exceeding of the limit values stipulated by EN 50081 for the drive system, consisting of machine and converter, the EMC instructions specified by the converter manufacturer must be strictly observed. If the manufacturer recommends that the cable leading to the machine be shielded, the shield is most effective if it is conductively connected over a large surface area to the metal terminal box of the machine (with metal screw-type connections).

In the case of machines with built-in sensors (e.g. PTC thermistors), interference voltages resulting from the converter can occur and affect the sensor cable.

Immunity to interference

The machines fulfil the requirements of interference immunity in conformity with EN 50082. If machines with integrated sensors (e.g. PTC thermistors) are used, the operator himself must ensure sufficient interference immunity by selecting a suitable sensor signal lead (possible with shielding, connected in the same way as supply cable leading to machine) and a suitable evaluation unit.

If the machines are operated with a converter at higher speeds than the rated speed, the mechanical speed limits (safe operating speed IEC / EN 60034-1) are to be complied with.

4.5 Disposal

Machines must be disposed of carefully taking into account national and local regulations in the normal recycling process or by returning the machines to the manufacturer.

The following must be taken into account when disposing of a machine:

- Oil and grease in accordance with the directive on used oil. No mixing with solvents, cleaner solvents or paint residues
- For the purposes of recycling, the components must be separated into:
 - electronic scrap (encoder electronics)
 - scrap iron
 - aluminum
 - non-ferrous heavy metal (machine windings, worm gears)
 - plastic (polyamide, glass-fiber reinforced polyamide, polypropylene)

Mounting, installation

5.1 Installation

5.1.1 Safety instructions



CAUTION
--

The housing parts of electrical machines can become very hot!

CAUTION

It must be ensured that parts which are sensitive to temperature changes (cables etc.) do not rest against the housing of the machine.
--

NOTICE

Comply with the technical data on the plates fitted to the housing of the machine!
--

5.1.2 Machine installation

- When motors are being mounted vertically, all the existing lifting eyes and hoisting straps, if any, (DIN EN 1492-1) and/or belts (DIN EN 12195-2) should be used to stabilize the position of the motor.
- When the machine is installed vertically with the shaft end facing downwards, a protective cover for the fan cover is recommended to prevent foreign bodies from falling into the machine.
- If the motor is installed with the shaft end facing upwards, the end user must prevent the ingress of fluid along the shaft.
- Do not impede ventilation! It must be ensured that discharged air - including that of adjacent items of equipment - is not immediately sucked in again.

- If the motors are used or stored outdoors, we recommend that they be kept under some sort of additional cover so that they are not subjected to direct intensive solar radiation, rain, snow, ice or dust over a long period of time.
- It must be ensured that the maximum permissible axial and radial forces are not exceeded.

Note

Built-on parts (e.g. incremental encoders) are not to be used for lifting!

NOTICE
Screwed-in lifting eyes are to be tightened or removed after installation.

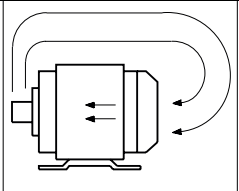
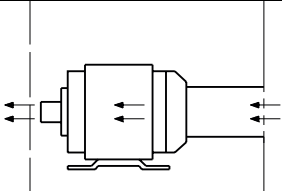
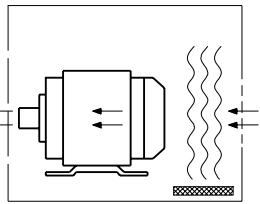
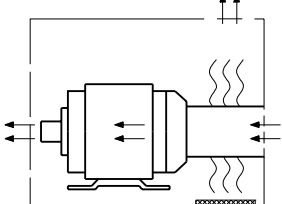
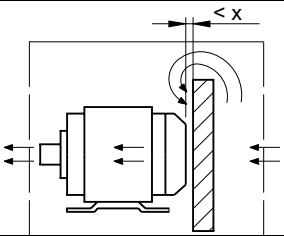
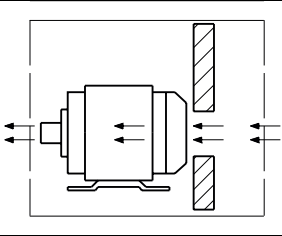
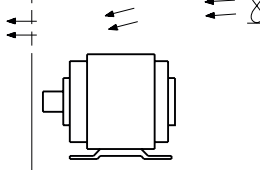
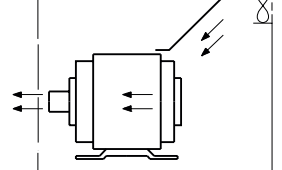
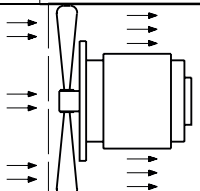
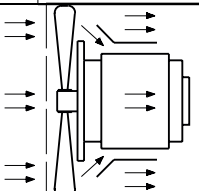
CAUTION
The increased level of danger in hazardous areas demands that you pay particular attention to the notes marked with .



- Explosion-proof machines may only be used in suitable areas and as prescribed by the responsible supervisory body. They are responsible for determining the hazard level of each area (division into zones).
An **X** on the certificate denotes that special conditions of the EC-type examination certification must be observed.
Special conditions for explosion-proof machines (Page 10)
- In Germany, DIN EN 60079-14 and the German Health and Safety at Work Regulations must be observed when installing electrical systems in hazardous areas. Elsewhere, the equivalent local regulations must be observed.
- The machine temperature class specified on the rating plate must be equal to or greater than the temperature class of any combustible gases that may develop.

Do not impede ventilation! It must be ensured that discharged air - including that of adjacent items of equipment - is not immediately sucked in again.

Table 5- 1 Air guidance

Incorrect		Correct	
			
			
			
			
			

The minimum dimension "x" for the distance between neighboring modules

Frame size (FS)	X mm
63 ... 71	15
80 ... 100	20
112	25
132	30
160	40
180 ... 225	45

In the case of vertical types of machine where air enters from above, the ingress of foreign bodies and water into the air inlets is to be prevented, e.g. by using a protective cover.
If the shaft end is facing upwards, the user must prevent liquid from entering along the shaft.

5.1.3 Balancing

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.

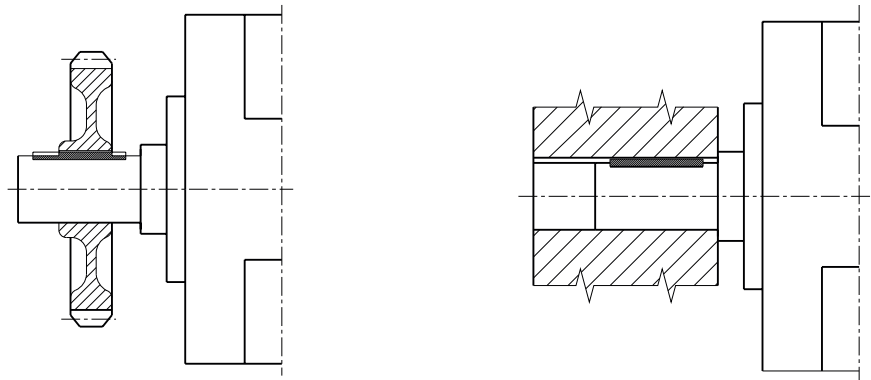
The declaration regarding the type of featherkey for balancing is marked on the face of the shaft end and on the rating plate.

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).

The featherkey declaration on the shaft and transmission element must indicate the correct type of balancing in each case and must be correctly mounted.

The balancing quality corresponds to vibration severity grade "A" for the complete machine; vibration severity grade "B" is possible as an option, i.e. in order to ensure the desired balancing quality, it must be ensured that the featherkey declarations on the hub and machine shaft complement each other in the case of a shorter or longer transmission element.

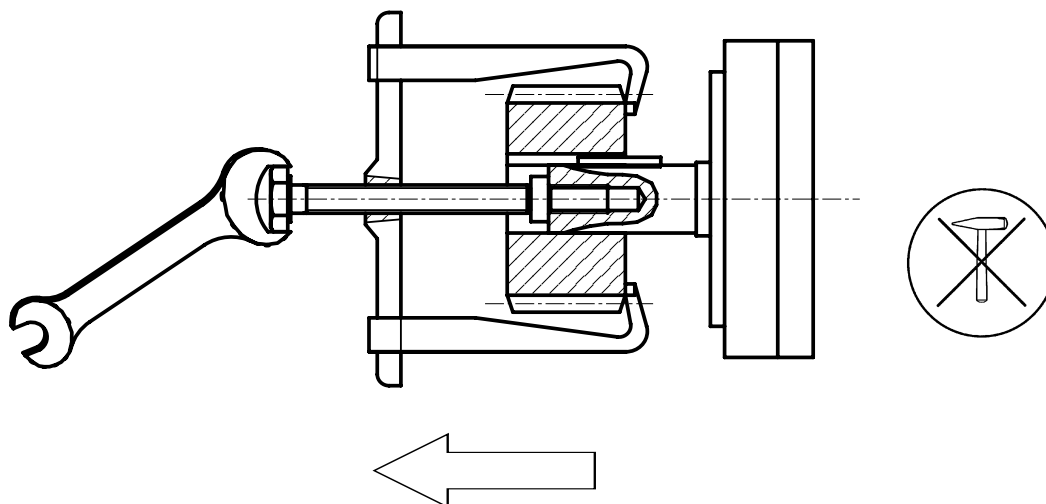


Note

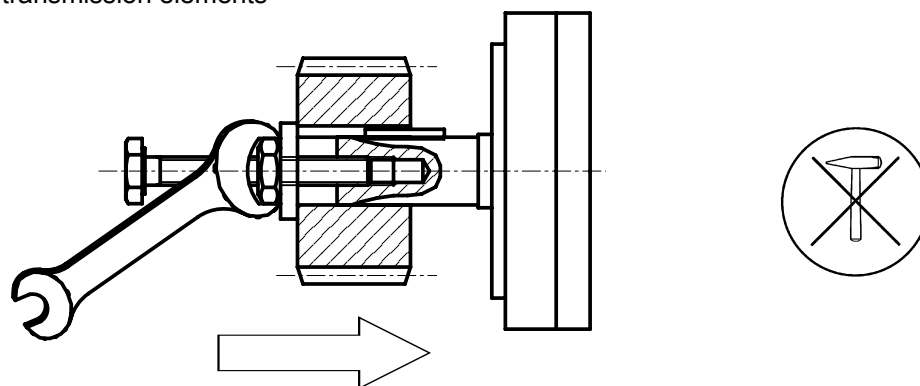
The permissible vibration levels in line with the evaluation zones according to ISO 10816 determine whether mounting and balancing have been carried out correctly. If the coupled machine does not comply with the vibration level according to EN 10816, complete dynamic balancing or an alteration to the foundations may be necessary.

CAUTION

It is permissible to push on or pull off transmission elements only with suitable equipment. The featherkeys are to be secured during transport to prevent them falling out. The generally required measures for touch protection of the transmission elements are to be observed.



Pulling off transmission elements



Pushing on transmission elements

NOTICE

If a machine without a transmission element is started up, the featherkey must be secured to prevent it from being thrown out.

When pushing on transmission elements (coupling, gear wheel, belt pulley etc.), use the thread at the shaft end and - if possible - heat the transmission elements as required. Use suitable tools for pulling transmission elements off. When the elements are being pushed on or pulled off, it is not permissible to hit the elements (with a hammer or similar) or to apply greater radial or axial forces to the machine bearings via the shaft end than those permitted according to the catalog.

5.1.4 Noise emission

NOTICE

When the noise that is emitted at workplaces of the personnel responsible for operating the equipment is assessed, it must be borne in mind that the A-weighted sound pressure level, measured in accordance with ISO 1680, namely 70 dB(A), is not exceeded if the three-phase machines are operated with the rated output.
--

5.2 Alignment and fastening

5.2.1 General measures

Make sure that the machine is level and ensure secure fastening of feet and flanges, precise alignment in the case of direct coupling, and also cleanliness of the fastening surfaces. Avoid installation-related resonances with the rotating frequency and double line frequency. Turn rotor by hand and pay attention to any unusual noises. Check the direction of rotation with the motor uncoupled.

NOTICE

Any paint damage that occurs when the machine is being aligned and fastened is to be immediately repaired in a technically appropriate manner.
--

Measures

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

- **Vertical positioning**
Place shims under the machine feet to position it vertically and to prevent stress/distortion. The number of shims should be kept as low as possible, i.e. stack as few as possible.
- **Horizontal positioning**
To position the machine horizontally, push it sideways on the foundations and ensure that the axial position is maintained (angularity error).
- When positioning the motor, ensure that there is a uniform axial gap around the coupling.
- **Smooth running**
Stable, vibration-free design of the foundations in accordance with DIN 4024 and precise alignment of the coupling, as well as a well-balanced transmission element (coupling, belt pulleys, fans, etc.), are prerequisites for smooth running with low vibration.
- Complete balancing of the machine with the transmission element may be necessary. For details and evaluation criteria, see ISO 10816.

- **Foot/Flange mounting**

The thread sizes prescribed in EN 50347 should be used for mounting the feet and flanges of the machine on the foundations or at the machine flange. The machine is to be fastened in place with 4 foot-mounting bolts and, where necessary, all the flange fastening screws. In the case of IM B14 flanges, the correct screw length must be chosen.

Note

The feet bolted onto the housing of the machine can be re-positioned, e.g. in order to change the position of the terminal box, but this must only be done by authorized partners.

The surfaces on which the feet were resting must then be made level by machining them or placing thin metal plates under the machine and must also be made parallel to the machine shaft in order to prevent distortion of/stress on the machine.

- **Flatness of the supporting surfaces for conventional motors**

Frame size (FS)	Flatness mm
≤ 132	0,10
160	0,15
≥ 180	0,20

5.2.1.1 Foot dimensions

Frame size (FS)	Type of feet
1LA / 1MA FS 90S/L	Cast-on feet with double hole
1MA6/1MJ6 FS 180M/L	Screwed-on feet with double hole

NOTICE

As far as type of construction IM B3 is concerned, the standard foot dimensions prescribed by EN 50347 should be used.
--

5.3 Connecting

5.3.1 Connection of the machine

5.3.1.1 Electrical connection



WARNING

Any work on the stationary machine must be performed by qualified personnel, with the machine isolated from the supply and secured so that it cannot be switched back on again. This also applies to auxiliary circuits (e.g. anti-condensation heater). Check for isolation from supply!

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 magnify the increase in temperature and influence electromagnetic compatibility.

Before starting work, make sure that a protective conductor is securely connected.

The stipulations in IEC / EN 60034-1 (VDE 0530-1) regarding operation at the limits of the A zones ($\pm 5\%$ voltage difference or $\pm 2\%$ frequency difference) and the B zones, especially in respect of temperature increase and deviation of the operating data from the rated data on the rating plate, are to be complied with. Under no circumstances may the limits be exceeded.



WARNING

Mains with non-grounded neutral point

Operating the machine on a mains with a non-grounded neutral point is only permitted during rarely occurring, short time intervals, e.g. until elimination of an error (ground fault of a cable, EN 60034-1).

The connection must be made in such a way that a permanently safe electrical connection is guaranteed (no protruding wire ends); use the assigned cable-end fittings (e.g. cable lugs, end sleeves).

Connect the supply voltage and arrange the jumpers according to the circuit diagram in the terminal box.

Select the connecting cables in accordance with DIN VDE 0100 and in accordance with the rated current and the installation-specific conditions (e.g. ambient temperature, routing method etc. according to DIN VDE 0298 or IEC/EN 60204-1).

The necessary connection data regarding

- the direction of rotation,
- the number and arrangement of the terminal boxes,
- the circuit and connection of the machine winding,

are defined in the "Technical specifications".



The following features make this type of electrical connection different from that for standard machines:

- Area A in IEC/EN 60034-1 (VDE 0530-1) ($\pm 5\%$ voltage or $\pm 2\%$ frequency deviation, curve, supply symmetry) must be maintained 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 may the limits be exceeded.
- Any machine with type of protection Increased Safety "e" must be protected against overheating in accordance with EN 60079-14 using an inverse-time delay circuit-breaker with phase loss protection and asymmetry detection to EN 60947, or using an equivalent device in all phases.
- In the case of machines with type of protection Increased Safety "e", the overcurrent device with an inverse-time delay tripping mechanism should be selected so that the time to disengagement (taken from the characteristic of the switch for the I_A/I_N ratio of the machine to be protected) is no greater than the machine heating time t_E . The I_A/I_N ratio and the heating time t_E should be taken from the rating plate. The protective device should also be set to the rated current. A tripping device that conforms to RL94/9/EC should be used.
- As regards machines with type of protection Increased Safety "e", in the event of a locked rotor the protective device must disconnect within the t_E time specified for the relevant temperature class. In accordance with the specifications of the EC-type examination certificate, electrical machines used for heavy starting (ramp-up time $> 1.7 \times t_E$ time) should be protected by startup monitoring.
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.

5.3.1.2 Terminal designations

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

Table 5- 2 Terminal designations (with the 1U1-1 as an example)

1	U	1	-	1	Designation
x					Index showing the pole assignment for pole-changing machines (where applicable, a lower number indicates a lower speed) or, in special cases, for a subdivided winding.
	x				Phase designation (U, V, W)
		x			Index showing the start (1) / end (2) or tapping point of the winding (if there is more than one connection per winding)
				x	Additional index for cases in which it is obligatory to connect parallel power feed cables to several terminals with otherwise identical designations

5.3.1.3 Direction of rotation

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

Connection of the power cables in the phase sequence L1, L2, L3 to U, V, W results in clockwise rotation (looking at the DE shaft end on the drive side). If two of the connections are swapped, then the resulting direction of rotation is counter-clockwise (e.g. L1, L2, L3 to V, U, W).

In the case of machines intended for only one direction of rotation, the prescribed direction of rotation is marked by a direction arrow on the machine.

5.3.1.4 Connection with/without cable lugs

In the case of terminals with terminal clips, the conductors are to be spread out in such a way that the terminating heights on both sides of the web are about the same. This method of connection requires that a single conductor must be bent into a U shape or is to be connected with a cable lug. The same applies to the inner and outer terminals of the ground conductor

When using cable lugs to make the connection, the choice of cable lug size must match the required conductor cross-section and the bolt size. A skewed arrangement is only permissible if the required air gaps and creepage distances are adhered to.

Strip the insulation from conductor ends in such a way that the remaining insulation almost reaches the cable lug.

Note

The direct contact between the cable lug surfaces and the contact nuts ensure that the connection can carry current.

5.3.1.5 Connecting protruding cables

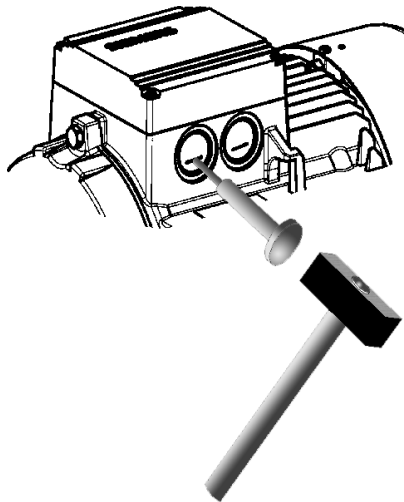
In the case of connection cables protruding out of the machine, no terminal board is installed on the terminal base of the machine housing. The connection cables are directly connected to stator winding terminals at the factory.

The connection cables are color coded or labeled and are provided with end sleeves by the customer. The customer directly connects individual cables in the control cabinet for their system in accordance with the labeling.

5.3.1.6 Cable entry

Knockout openings

NOTICE
Knockout openings in the terminal box must be knocked out appropriately. Care must be taken to ensure that the terminal box and the terminal board and cable connections, etc., that it contains are not damaged.

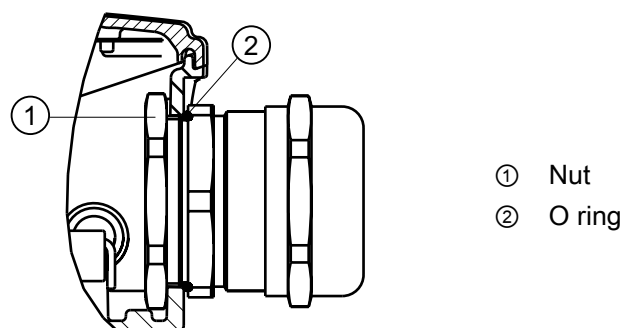


Assembly and laying of cables

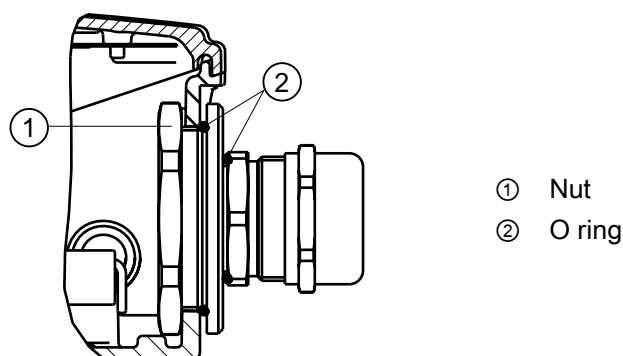
Screw the screw-type connection into the housing or fasten with a nut.

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

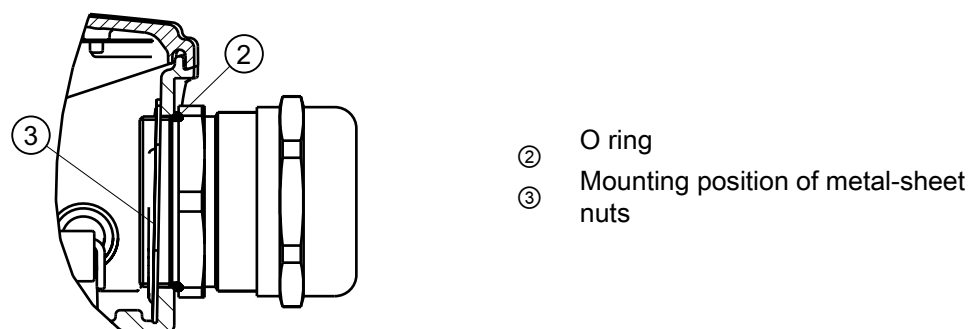
Screw-type connections with (sheet metal) nuts (DIN EN 50262)



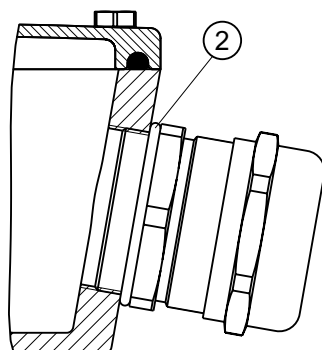
Screw-type connections with adapters and (sheet metal) nuts (DIN EN 50262)



Mounting position of sheet metal nuts in screw-type connections



Screw-type connections with connecting thread in terminal box (DIN EN 50262)



② O ring

Cable entries for explosion-proof machines



Cable entries must be permitted for use in hazardous areas. Openings that are not being used must be sealed with approved plugs. Pay attention to the manufacturer documentation in respect of cable entries.

Thread sizes in terminal box

Table 5- 3 Thread sizes in the cast iron terminal box

Frame size (FS)	Type	Type of protection/Zone	Standard thread		Additional threads with mounting parts	
			Size	Number	Size	Number
71 ... 90	1MJ6	Increased Safety "e" Zone 21	M 25x1.5 M 16x1.5	2 1		
71 ... 90	1MJ6	Increased Safety "d" Zone 21	M 25 x 1.5	2	M 20 x 1.5	1
100 ... 132	1LA6 1MA6	Without Increased Safety "e" Non-sparking "n" Zone 22	M 32 x 1.5	2	M 16 x 1.5	1
100 ... 132	1MJ6	Increased Safety "e" Zone 21	M 32x1.5 M 16x1.5	2 1		
100 ... 132	1MJ6	Flameproof Enclosure "d" Zone 21	M 32 x 1.5	1	M 20 x 1.5	1
160	1LA6 1MA6	Without Increased Safety "e" Zone 22	M 40 x 1.5	4	M 16 x 1.5	1
160M/L	1MJ6	Increased Safety "e" Zone 21	M 40 x 1.5	2	M 20 x 1.5	2
160	1MJ6	Flameproof Enclosure "d" Zone 21	M 40 x 1.5	1	M 20 x 1.5	1

5.3 Connecting

			Standard thread		Additional threads with mounting parts	
180	1MA6 1MJ6	Increased Safety "e" Zone 21	M 40 x 1.5	2	M 16 x 1.5	2
180	1MJ6	Flameproof Enclosure "d" Zone 21	M 40 x 1.5	1	M 20 x 1.5	1
200	1MA6 1MJ6	Increased Safety "e" Zone 21	M 50 x 1.5	2	M 16 x 1.5	2
200	1MJ6	Flameproof Enclosure "d" Zone 21	M 50 x 1.5	1	M 20 x 1.5	1

Table 5- 4 Thread sizes in the aluminum terminal box

Frame size (FS)	Type	Type of protection/Zone	Standard thread		Additional threads with mounting parts	
			Size	Number	Size	Number
63 ... 90	1LA7 1LA9 1MA7	Without Increased Safety "e" Non-sparking "n" Zone 21 Zone 22	M 16 x 1.5 M 25 x 1.5	1 1		
71 ... 90	1MJ6	Increased Safety "e" Zone 21	M 25 x 1.5	2	M 16 x 1.5	1
100 ... 132	1LA7 1LA9 1MA7	Without Increased Safety "e" Non-sparking "n" Zone 21 Zone 22	M 32 x 1.5	4		
100 ... 132	1MJ6	Increased Safety "e" Zone 21	M 32 x 1.5	2	M 16 x 1.5	1
160	1LA7 1LA9 1MA7	Without Increased Safety "e" Zone 21 Zone 22	M 40 x 1.5	4		
160M	1MJ6	Increased Safety "e" Zone 21	M 40 x 1.5	2	M 16 x 1.5	1
180	1LA5	Without Zone 21 Zone 22	M 40 x 1.5	2	M 16 x 1.5	1
180	1MA6 1MJ6	Increased Safety "e" Zone 21	M 40 x 1.5	2	M 16 x 1.5	2
200 ... 225	1LA5	Without Zone 21 Zone 22	M 50 x 1.5	2	M 16 x 1.5	1
200	1MA6 1MJ6	Increased Safety "e" Zone 21	M 50 x 1.5	2	M 16 x 1.5	2

5.3.1.7 Terminal box

Terminal box

Standard design

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



The terminal box can be turned 4x90 degrees on the terminal base of the machine's housing in the case of a terminal board with 6 terminal studs (standard design).

CAUTION

It must be ensured that the terminal box, terminal board and cable connections etc. inside the terminal box are not damaged.

NOTICE

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

CAUTION

It must be ensured that there are no foreign bodies, dirt or moisture in the terminal box. Entries in the terminal box (see DIN 42925) and other open entries are to be sealed with an O ring or a suitable flat gasket so that dust and water cannot enter, whereas the terminal box itself is to be sealed against dust and water with the original seal. Comply with the specified tightening torques for cable glands and other screw-type connections. Secure featherkey for trial operation without transmission elements.



Explosion-proof machines (with the exception of machines for Zone 22) are fitted with terminal boxes with type of protection Increased Safety "e".

In the case of 1MJ machines, terminal boxes with type of protection Flameproof Enclosure "d" - explosion group IIC are available as an option. For information on installation, connection options and spare parts, see Chapter 8. Please pay attention to the notes on hazardous areas in the operating instructions. Repairs must only be carried out in or by authorized Siemens workshops.

Protruding connection cables



! CAUTION

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

Entries in the cover plates (see DIN 42925) and other open entries are to be sealed with an O ring or a suitable flat gasket so that dust and water cannot enter, whereas the terminal base of the machine housing itself is to be sealed against dust and water with the original seal of the cover plate. Observe the correct tightening torque for cable glands and other screws. Secure the featherkey for a test run without drive elements.



! WARNING

During disassembly and particularly when installing the cover plate, ensure that the connection cables are not clamped between enclosure parts and cover plates. Short-circuit hazard!

Connecting the temperature sensor/anti-condensation heater

The temperature sensor / anti-condensation heater is connected in the terminal box.

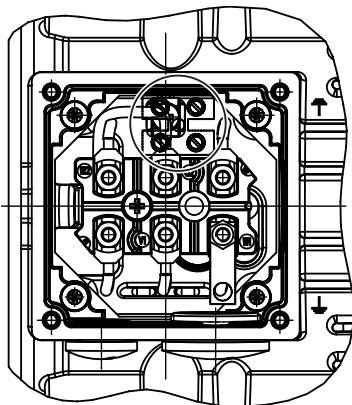


Figure 5-1 Connection to terminal strip

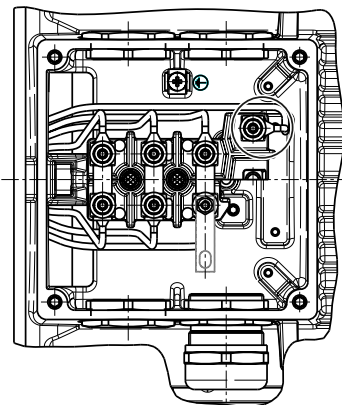


Figure 5-2 Connection to terminal board



The temperature sensor / anti-condensation heater is connected in the terminal box.

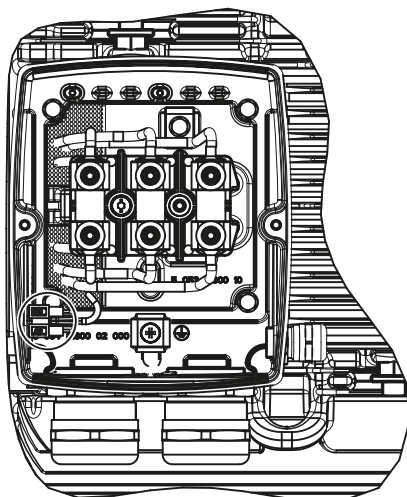


Figure 5-3 Connection to terminal strip

Final checks

Before closing the terminal box/terminal base of the machine housing check that:

- The electrical connections in the terminal box have been made in accordance with the specifications above and tightened to the required tightening torque.
- the air clearances between non-insulated parts are maintained:
 $\geq 5.5 \text{ mm}$ to 690 V, $\geq 8 \text{ mm}$ to 1000 V.
- No wire ends are protruding
- The connecting cables are laid without touching the machine, and the cable insulation cannot be damaged.
- The machine is connected up corresponding to the specified direction of rotation.
- The inside of the terminal box is clean and free of any cable pieces.
- All seals and sealing surfaces are clean and not damaged.
- Unused openings in the terminal boxes are properly closed off.
- The pressure relief device must be undamaged (depending on the type of terminal box: either cast-in slots or an overpressure diaphragm). Any damage may only be repaired after prior discussion with the person responsible for the safety of the installation and only by using original parts.

Before closing the terminal box, check that



- the air clearances for explosion-proof machines (with the exception of machines for Zone 22) between non-insulated parts are maintained: ≥ 10 mm to 690 V.
- the creepage distance for explosion-proof machines (with the exception of machines for Zone 22) between non-insulated parts are maintained: ≥ 12 mm to 690 V.

5.3.2 Tightening torques

5.3.2.1 General notes

CAUTION

It must be ensured that there are no foreign bodies, dirt or moisture in the terminal box. Cable glands in the terminal box (see DIN 42925) and other open entries with dummy plugs are to be sealed with an O ring or a suitable flat gasket so that dust and water cannot enter, whereas the terminal box itself is to be sealed against dust and water with the original seal. Comply with the specified tightening torques for cable glands and other screw-type connections.
Secure featherkey for trial operation without transmission elements.

5.3.2.2 Electrical connections - Terminal board connections

Table 5- 5 Tightening torques for electrical connections on the terminal board

	Thread Ø		M 4	M 5	M 6	M 8	M 10	M 12	M 16
	Nm	min	0,8	1,8	2,7	5,5	9	14	27
		max	1,2	2,5	4	8	13	20	40

5.3.2.3 Cable glands

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 5- 6 Tightening torques for cable glands

	Metal ± 10% Nm	Plastic ± 10% Nm	O ring String Ø mm
M 12 x 1,5	8	1,5	2
M 16 x 1,5	10	2	
M 20 x 1,5	12	4	
M 25 x 1,5			
M 32 x 1,5	18	6	
M 40 x 1,5			
M 50 x 1,5	20		
M 63 x 1,5			

NOTICE

If different kinds of cable sheath material are used, smaller tightening torques are to be used.
Damage to cable sheaths is to be prevented by using smaller tightening torques.



Cable glands must be permitted for use in hazardous areas. Openings that are not being used must be sealed with approved plugs. Pay attention to the manufacturer documentation in respect of cable glands.

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

Note

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

Table 5- 7 Tightening torques for screws on the terminal box, end shields, screw-type grounding conductor connections

	Thread Ø		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

5.3 Connecting



Table 5- 8 Tightening torques for self-tapping screws on the terminal box, end shields, screw-type grounding conductor connections, sheet metal fan covers

	Thread Ø		M 4	M 5	M 6
	Nm	min	4	7,5	12,5
		max	5	9,5	15,5

5.3.2.5 Conductor connection

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)

Table 5- 9 Max. conductor connection for standard machines and Zone 22

Frame size (FS)	Max. connectable conductor cross-section mm ²	
	with end sleeve	with cable lug
56 ... 90	1,5	2,5
100 ... 112	4,0	4,0
132	6,0	6,0
160 ... 180	16,0	16,0
200	25,0	25,0
225	35,0	35,0

Table 5- 10 Max. conductor connection for explosion-proof machines (with the exception of Zone 22) and VIK standard version

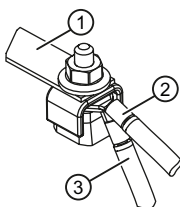
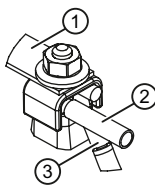
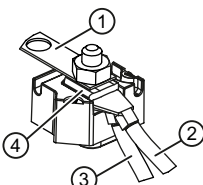
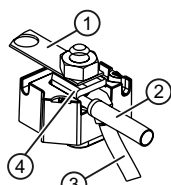
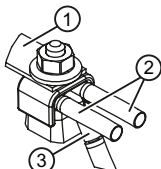
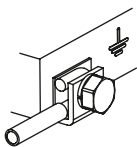
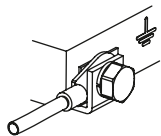
Frame size (FS)	Max. connectable conductor cross-section mm ²	
	with end sleeve	with cable lug
56 ... 112	4,0	4,0
132	6,0	6,0
160	16,0	16,0
180	10,0	10,0
200 ... 225	50,0	50,0

Table 5- 11 Max. conductor connection for standard 1MJ machines

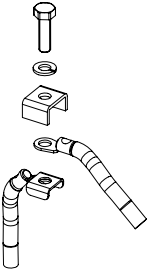
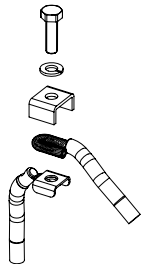
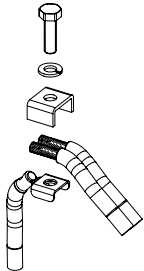
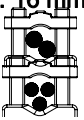
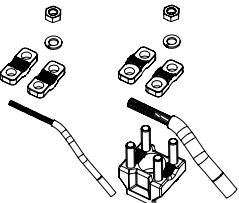
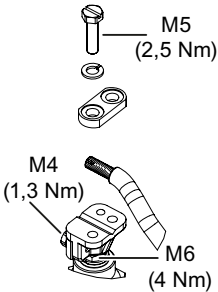
Frame size (FS)	Max. connectable conductor cross-section mm ²	
	with end sleeve	with cable lug
71 ... 80	4,0	4,0
90 ... 160 M	6,0	6,0
160 L	16,0	16,0
180	25,0	25,0
200	50,0	50,0

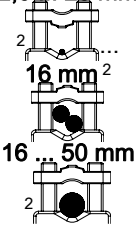
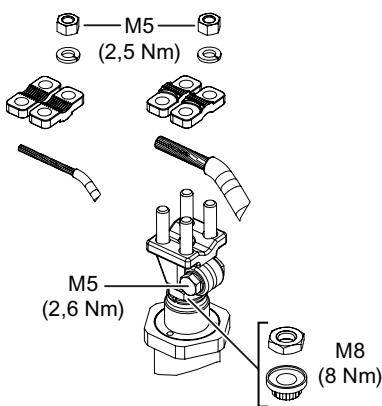
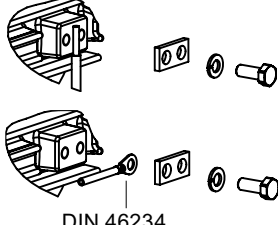
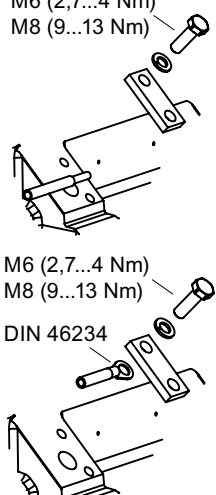
Type of conductor connection

Table 5- 12 Type of connection

... 25 mm ²				If a connection is made with a DIN cable lug, the latter must be angled downwards. DIN 46234
... 10 mm ²				Connection of an individual conductor with terminal clamp.
... 25 mm ²				Connection of two conductors of approximately the same thickness with terminal clamp.
① Link rail ② Power supply cord ③ Motor connection cable ④ Cover washer				
... 10 mm ²				Connection of an individual conductor under external grounding angle.
... 25 mm ²				In the case of connection with a DIN cable lug under the external grounding angle. DIN 46234

5.3 Connecting

... 10 mm² AH 180 ... 35 mm² AH 200		If a connection is made with a DIN cable lug, the latter must be angled downwards. 1MA618. - 20.
... 25 mm²		Connection of an individual conductor with terminal clamp 1MA618. - 20.
... 25 mm²		Connection of two conductors of the same thickness with terminal clamp 1MA618. - 20.
... 16 mm²  2.5 ... 25 mm²  16 ... 50 mm² 		Connecting terminal for large cross sections 1MA618. - 20.
2,5 ... 25 mm 		Connecting terminal 1MJ6180 M/L

2,5 ... 25 mm² 16 mm² 16 ... 50 mm² 	 M5 (2,5 Nm) M5 (2,6 Nm) M8 (8 Nm)	Connecting terminal 1MJ6200 M/L
... 25 mm² AH 71 ... 132 ... 35 mm² AH 160	 DIN 46234 M6 (2,7...4 Nm) M8 (9...13 Nm)	External grounding 1MJ6071... 160 L
... 35 mm² AH 180 ... 50 mm² AH 200	 M6 (2,7...4 Nm) M8 (9...13 Nm) DIN 46234 M6 (2,7...4 Nm) M8 (9...13 Nm)	External grounding 1MJ6180 M ... 200 L

5.3.3 Connecting the ground conductor

General

Basically, there are two ways of connecting a grounding conductor to the machine.

- Internal grounding with connection in terminal box at the place intended for this purpose and marked accordingly.
- External grounding with connection at the stator housing at one of the four places intended for this purpose and marked accordingly.

5.3 Connecting

The cross-section of the grounding conductor of the machine must comply with the regulations for electrical installations, e.g. DIN EN IEC 60204-1.

Table 5- 13 Minimum surface area of grounding conductor

Minimum surface area of insulation phase conductor S mm^2	Minimum surface area of associated grounding connection mm^2
$S \leq 16$	S
$16 < S \leq 35$	16
$S > 35$	$0.5 S$

Interior ground terminal

Please note the following when connecting-up:

- The contact surface must be clean and bright, and protected with a suitable anti-corrosion agent, e. g. acid-free Vaseline.
- The cable lug must be inserted between the terminal clamps.
- The spring washer must be under the head of the screw.

Exterior ground terminal

Please note the following when connecting-up:

- The contact surface must be clean and bright, and protected with a suitable anti-corrosion agent, e. g. acid-free Vaseline.
- The cable lug must be inserted between the contact angle and the grounding angle; it is not permissible to remove the contact angle pressed into the housing.
- The spring washer must be under the head of the screw.
- The tightening torque of the terminal screw must be as specified in the table.

Table 5- 14 Size of grounding conductor screw (except for 1MJ machines)

Frame size (FS)	Thread size for the grounding conductor
63 ... 90	M4
100 ... 112	M5
132 ... 180	M6
200 ... 225	M8

Table 5- 15 Size of grounding conductor screw for 1MJ machines

Frame size (FS)	Thread size for the grounding conductor
71 ... 180	M6
200	M8

5.3.4 Connection of optional add-on units

5.3.4.1 External fan, incremental encoder, brake

External fan, incremental encoder, brake

See list of additional operating instructions attached:



Add-on units such as external fans, incremental encoders or brakes must be selected for conformity to the specifications of Directive 94/9/EC.

Fitting brakes on 1LE1



Table 5- 16 Assigning standard brakes for 1LE1 machines

Frame size (FS)	Brake type	Size assignment by INTORQ	Tightening torque of manual lifting lever Nm
100	2LM8 040–5NA10	12	4,8
112	2LM8 060–6NA10	14	12
132	2LM8 100–7NA10	16	12
160	2LM8 260–8NA10	20	23

Fitting external fans on 1LE1



Tightening torque applied to the fastening screws used for attaching external fans to the housing, see Terminal boxes, end shields, grounding conductors, sheet metal fan covers (Page 45)

5.3.5 Connection to the converter



⚠ CAUTION

The standard insulating system is suitable for converter voltages up to 460 V. For higher voltages, a special insulating system must be used or special measures must be taken, e.g. an output filter.

Note

EMC

Comply with the instructions given in the section regarding electromagnetic compatibility.

See list of additional operating instructions in appendix



Where machines with type of protection Increased Safety "e" are concerned, connection to a converter must be expressly certified. The separate manufacturer notes must be observed. For type of protection Increased Safety "e", the machine, converter and protective devices must be labeled as working in conjunction with one another, and the permitted operating data must be specified in the devices' collective EC-type examination certificate.

Machines connected to a converter for Zone 21 and Zone 22 are generally fitted with 3 PTC thermistors in accordance with DIN 44082 with a rated intervention temperature that depends on the maximum possible surface temperature. PTC thermistor evaluators should be selected for conformity to this standard. The maximum temperature at the cable entries is 120°C. Appropriate cables for this temperature must be used. The maximum frequency, which is dependent on the number of poles, is stamped on the rating plate and must not be exceeded. In cases where the system linking the converter, cable and electrical machine draws its power from a public grid with an operating voltage of up to 690 V, the maximum value of the transients at the end of the cable must not be more than twice the DC link voltage of the converter (approx. 2 kV).

Machines with flameproof enclosure "d" or "de" protection are equipped with three temperature sensors inserted in the windings and one temperature sensor in the gland plate to ensure that the temperature class is maintained. The temperature sensors are to be connected in series according to the circuit diagram.

Machines with temperature sensors for warning and tripping each have three temperature sensors in the winding and one temperature sensor in the gland plate. Temperature sensors are to be connected in series in according to the circuit diagram.

6

Commissioning

6.1 Checking the insulation resistance

Safety information

**! WARNING**

Only expert personnel should be entrusted with 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 effective cooling, must be installed prior to start-up.

Checking the insulation resistance

CAUTION

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 manual for the insulation resistance meter you are going to use. Any cables of the main circuit which are already connected should be disconnected from the terminals in order to carry out the insulation measurements.

**! WARNING**

During the measurement, and immediately afterwards, some of the terminals are at hazardous voltage levels and must not be touched. Carry out a check with the power cables connected that no voltage can be applied.

Measure the minimum insulation resistance of the winding to the machine housing, if possible at a winding temperature between 20 and 30°C. Different insulation resistance values apply at other temperatures. When making the measurement, you must wait until the final resistance value is reached (approx. 1 minute).

The critical insulation resistance is reached at the operating temperature of the winding.

Limit values

The following table indicates the measuring circuit voltage together with the minimum insulation resistance and the critical insulation resistance.

Table 6- 1 Insulation resistance

	Rated voltage $U_{\text{rated}} < 2 \text{ kV}$
Measuring circuit voltage	500 V
Minimum insulation resistance with new, cleaned or repaired windings	10 MΩ
Critical specific insulation resistance after a long operating time	0.5 MΩ/kV

(values apply at a winding temperature of 25 °C)

Note the following points:

- If the measurements are performed at winding temperatures other than 25°C, the measured value will need to be converted to the reference temperature of 25°C in order to be able to compare the values with the table above. The insulation resistance is reduced by a factor of a half for every 10 K increase in temperature, and it is increased by a factor of two for every 10 K decrease in temperature.
- New, dry windings have an insulation resistance of between 100 and 2000 MΩ, or even higher values, if required. If the insulation resistance is close to or below the minimum value, the cause could be humidity and/or dirt accumulation. The windings must then be dried.
- 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 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 (0.5 MΩ/kV);
e.g. critical resistance for a rated voltage (U_N) 690 V:
 $690 \text{ V} \times 0.5 \text{ MΩ/kV} = 0.345 \text{ MΩ}$

NOTICE

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.

NOTICE

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

6.2 Measures before start-up

Overview

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

- The machine has been assembled and aligned properly.
- The machine has been connected up in accordance with the specified direction of rotation.
- The operating conditions are in accordance with the data specified on the rating plate.
- The bearings have been regreased (depending on model). Rolling-contact bearing machines which have been in storage for more than 24 months must be regreased.
- Any supplementary motor monitoring devices and equipment have been correctly connected and are functioning correctly.
- If bearing thermometers are fitted, the bearing temperatures are checked during the initial run of the motor and the values for warning and switch-off are set on the monitoring device.
- Appropriately configured control functions and speed monitoring equipment ensure that the motor cannot reach speeds higher than the permissible speeds stated on the rating plate.
- The transmission 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 values and the minimum air gap values have been complied with.
- The grounding and equipotential bonding connections have been correctly made.
- all retaining bolts, connecting elements and electrical connections have been tightened to the specified torque.
- Screwed-in lifting eyes are to be removed after installation or secured to prevent them from becoming loose.
- 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 end of the shaft is not used, its featherkey has been secured so that it cannot fall out and the open shaft end is covered.
- 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.
- all brakes are operating correctly.
- The specified mechanical limit speed $n_{\max}$ is not exceeded.

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

Note

It may be necessary to make additional checks and tests in accordance with the situation specific to the particular place of installation.

6.3 Switching on

Measures for start-up

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

- Start the motor without a load; to do this, close the circuit-breaker and preferably do not switch it off prematurely. Switching the motor back off again while it is starting up and still running at slow speed should be kept to a bare minimum, for example for checking the direction of rotation or for checking the operation of the motor. Allow the machine to run to a standstill before switching it back on again.
- 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 the mechanical operation improves immediately after switching the motor off, then the cause is magnetic or electrical. If the mechanical operation does not improve immediately after switching the motor off, then the cause is mechanical: e.g. 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 + foundations etc.).
- If the motor runs perfectly in terms of its mechanical operation, switch on any cooling devices which exist and continue to monitor the machine for a while as it idles.
- 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.

WARNING
--

The vibration values encountered during operation must be in accordance with DIN ISO 10816, as 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 equipment.

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 power switch and preferably do not switch it off prematurely. Switching the motor back off again while it is starting up and still running at slow speed should be kept to a bare minimum, for example for checking the direction of rotation or for checking the operation of the motor. Allow the machine to run to a standstill before switching it back on again.

Operation

7.1 Safety instructions

Energizing the machine with anti-condensation heating (optional)



! CAUTION

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

Machine operation



! WARNING

Mains with non-grounded neutral point

Operating the machine on a mains with a non-grounded neutral point is only permitted during rarely occurring, short time intervals, e.g. until elimination of an error (ground fault of a cable, EN 60034-1).



! WARNING

Do not remove covers when the motor is running

Rotating or live parts are dangerous. Death, serious injury, or material damage can result if the required covers are removed.

All covers that are designed to prevent active or rotating parts from being touched, ensure compliance with a particular degree of protection, or that are required for ensuring proper air guidance and, in turn effective cooling, must not be opened during operation.

Firstly de-energize the machine if any covers need to be removed.



! CAUTION

The surfaces of the machines can reach high temperatures, which can lead to burns if touched.



! WARNING

Faults during operation

Deviations from normal operation e.g. increased power consumption, temperatures or vibrations, unusual noises or odors, tripping of monitoring devices, etc. indicate that the motor is not functioning properly. This can cause faults which can result in eventual or immediate death, severe injury or material damage.

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

CAUTION

Risk of corrosion due to condensation

When changing machines and/or ambient temperatures, air humidity can condense within the machines.

Depending on the ambient and operating conditions, remove the screw plugs, if available, to drain away the water. Afterwards, reinsert the screw plugs.

If the machine is equipped with drainage plugs, the water can drain away automatically.

Cleaning

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



Machines with type of protection Flameproof Enclosure "d" and Increased Safety "e", and machines for Zone 2, may only be used in hazardous areas as prescribed by the responsible supervisory body. 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 not 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. The machines may only be used for the operating mode specified on the rating plate.
- **Measures for maintaining the temperature class:**
 With S1 line supply operation, a function-tested, current-dependent protective device that monitors all three line 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. At 1.05x the rated current, machines must not be switched off within 2 hours.
 Pole-changing machines require a separate switch for each pole number. Any anti-condensation heaters used must only supply heat when the machines are not in operation.
 With S2 to S9 line supply operation, machines with type of protection Flameproof Enclosure "d" must be equipped with at least 3 temperature sensors (one per phase) and a suitable electronic switchoff device with a temperature sensor in the gland plate.



! DANGER

Ex This electrical equipment is not suitable for hybrid explosive environments.

Usage in atmospheres where there is a risk of explosion caused by both gas and dust is prohibited.

7.2 Stoppages

Overview

If the machine remains out of service for an extended period of time (> 1 month), it should be started up about once a month or at least the rotor should be turned. Refer to the instructions in the "Switching on" section before restarting the machine. If a rotor locking device has been fitted to the machine, you must remove it before you spin the rotor.

CAUTION

If the motor is not to be used for a period in excess of 12 months, suitable anti-corrosion, mothballing, packaging and drying measures must be taken.

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 required measures, see "Transport" and "Storage" sections.

Lubricating before recommissioning

CAUTION

If the motor has not been used for more than 1 year, it must be regreased before being restarted. The shaft must rotate so that the new grease can be distributed throughout the bearings.
When relubricating, comply with the information on the lubrication plate. Only in the case of relubrication; otherwise, similarly to section entitled "Application planning - Useful life of bearings"

Overview

Before rectifying the fault, refer to section entitled "Safety instructions".

In the event that electrical faults occur during operation of the machine with a converter, please also refer to the operating instructions of the frequency converter.

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

Table 7- 1 Fault table, electrical causes

								Electrical fault characteristics						
↓								Machine will not start up						
	↓								Machine starts up slowly					
		↓								Rumbling noise during start-up				
			↓								Rumbling noise during operation			
					↓								High temperature rise during idling	
						↓								High temperature rise under load
								↓						
							Possible causes of faults				Remedial measures ¹⁾			
	X	X		X			X		Overload	Reduce load				
X								Interruption of a phase in the supply cable	Check switches and supply cables					
	X	X	X			X	X	Interruption of a phase in the supply after switching on	Check switches and supply cables					
X	X							Mains voltage too low, frequency too high	Check mains conditions					
					X			Mains voltage too high, frequency too low	Check mains conditions					
X	X	X	X				X	Stator winding incorrectly connected	Check winding connections					
	X	X	X				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) Apart from eliminating the cause of the fault (as described under "Remedial measures"), you must also rectify any damage the machine may have suffered.

Table 7- 2 Fault table, mechanical causes

Mechanical fault characteristics				
↓				Grinding noise
	↓			High temperature rise
		↓		Radial vibrations
			↓	Axial vibrations
				Possible causes of faults
				Remedial measures¹⁾
X				Rotating parts rubbing/grinding
	X			Determine cause and adjust parts
				Reduced air supply, fan possibly running in the incorrect direction of rotation
		X		Check airways, clean motor
		X		Rotor not balanced
		X		Check featherkey declaration (H, F, N)
		X		Rotor out of true, shaft bent
		X		Consult the manufacturer
		X	X	Poor alignment
		X		Align motor unit, check coupling ²⁾
		X		Coupled machine not balanced
		X		Rebalance coupled motor
		X		Shocks from coupled machine
		X		Check coupled motor
		X	X	Imbalance originating from gearing
		X	X	Adjust/repair gearing
		X	X	Resonance of the overall system comprising machine and foundations
		X	X	After consultation, reinforce foundations
		X	X	Changes in foundation
		X	X	Determine cause of changes, eliminate if necessary; realign motor

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

2) Take into account possible changes due to a rise in temperature.

7.4 Deactivating

Note

Machine must be completely isolated from the supply.

Measures for shutting down the machine

Any devices provided for protection against condensation are to be started up after the machine has been shut down, e.g. anti-condensation heater.

7.5 Class

7.5.1 Zone 1 with type of protection Ex de II (Flameproof Enclosure "d" for the machine and Increased Safety "e" for the terminal box)

CE	158		II	2	G	Ex	d	e	IIC	T4
①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩	⑪

- ① CE marking
- ② Identification number of designated testing agency
- ③ Code for prevention of explosions
- ④ Device group: II For hazardous areas, except mines
- ⑤ Device category: 2 For occasional danger, and for use in Zone 1
- ⑥ Atmosphere: G For gas
- ⑦ Explosion protection: International
- ⑧ Type of protection: "d" Flameproof Enclosure of machine
- ⑨ Type of protection: "e" Increased Safety of terminal box
- ⑩ Explosion group: IIC For acetylene
- ⑪ Temperature class: T4 For maximum surface temperature of 135°C

7.5.2 Zone 1 with Ex e II type of protection (Increased Safety "e")

CE	158		II	2	G	Ex	e	II	T3
①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩

- ① CE marking
- ② Identification number of designated testing agency
- ③ Code for prevention of explosions
- ④ Device group: II For hazardous areas, except mines
- ⑤ Device category: 2 for occasional danger
- ⑥ Atmosphere: G For gas
- ⑦ Explosion protection: International
- ⑧ Type of protection: "e" Increased Safety
- ⑨ Device group: II For hazardous areas, except mines
- ⑩ Temperature class: T3 For maximum surface temperature of 200°C

7.5.3 Zone 2 with type of protection Ex nA II (non-sparking)

CE	PTB 05 ATEX 3006		II	3	G	Ex	nA	II	T3
①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩

- ① CE marking
- ② Declaration of conformity no. for designated testing agency
- ③ Code for prevention of explosions
- ④ Device group: II For hazardous areas, except mines
- ⑤ Device category: 3 For infrequent, short-term danger
- ⑥ Atmosphere: G For gas
- ⑦ Explosion protection: International
- ⑧ Type of protection: "nA" For non-sparking
- ⑨ Device group: II For hazardous areas, except mines
- ⑩ Temperature class: T3 For maximum surface temperature of 200°C

7.5.4 Zone 21

CE	158		II	2	D	Ex	tD	A	21	IP65	T125°C
①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩	⑪	⑫

- ① CE marking
- ② Identification number of designated testing agency
- ③ Code for prevention of explosions
- ④ Device group: II For hazardous areas, except mines
- ⑤ Device category: 2 For occasional danger
- ⑥ Atmosphere: D For dust
- ⑦ Explosion protection: International
- ⑧ Type of protection: "tD" For protection by enclosure
- ⑨ Version: A For process A to EN 61241-1
- ⑩ Zone in which the equipment can be used: 21 For Zone 21
- ⑪ Degree of protection of enclosure: IP 65
- ⑫ Maximum surface temperature: T 125° C or T 135° C

7.5.5 Zone 22

		II	3	D	Ex	tD	A	22	IP55	T125°C
①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩	⑪

- ① CE marking
- ② Code for prevention of explosions
- ③ Device group: II For hazardous areas, except mines
- ④ Device category: 3 For infrequent, short-term danger
- ⑤ Atmosphere: D For dust
- ⑥ Explosion protection: International
- ⑦ Type of protection: "tD" For protection by enclosure
- ⑧ Version: A For process A to EN 61241-1
- ⑨ Zone in which the equipment can be used: 22 For Zone 22
- ⑩ Degree of protection of enclosure: IP 55
- ⑪ Maximum surface temperature: T 125° C or T 135° C

Maintenance

8.1 Preparation and notes

Safety instructions



WARNING

Before starting any work on the machines, make sure that the system has been isolated from the supply in accordance with the regulations. In addition to the main circuits, also make sure that that supplementary and auxiliary circuits are isolated from the supply, especially the anti-condensation heater.

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.

When cleaning the machine with compressed air, ensure that suitable exhaustion measures are used and you use personal protective gear (goggles, face mask/filter or similar)!

If chemical cleaning agents are used, observe the instructions and any warnings indicated on the associated safety data sheets. Chemical agents must be compatible with the machine's components/parts, especially when they contain plastics.

Note

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

Machines for the North American market (optional)

If any changes are made to the listed machines or if repairs are carried out on them, the corresponding construction standards are to be complied with. These machines are labeled on the rating plate with the following markings.

Table 8- 1 Markings for the North American market



Underwriters Laboratories



Canadian Standard Association



Canadian Standard Association Energy Efficiency Verification

Note for explosion-proof machines



Repairs must be carried out in or by authorized Siemens workshops!

Changes, repairs and overhauls on machines for **hazardous areas** must only be carried out by qualified personnel. It is imperative that you pay attention to the regulations laid down by IEC 60079-19.

It is imperative that you pay attention to the regulations laid down by EN 61241-17 regarding changes, repairs and overhauls on machines for use with **combustible dust**.

8.2 Maintenance

8.2.1 Maintenance intervals

General

The machines have grease-lubricated, rolling-contact bearings. A regreasing device is optional.

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

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

NOTICE

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

Measures, intervals

Measures after operating period intervals have elapsed:

Table 8- 2 Operating period intervals

Measures	Operating period intervals	Intervals
Initial inspection	After 500 operating hours	After 6 months at the latest
Relubrication (optional)	(see lubrication instruction plate)	
Clean	depending on local degree of pollution	
Main inspection	Approximately every 16000 operating hours	After 2 years at the latest
Drain condensate	depending on climatic conditions	

8.2.2 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, information on regreasing intervals, the amount and types of grease, and, if required, additional data are indicated on the rating or lubricant plate.

Note

Do not mix different types of grease!

Prolonged storage periods reduce the useful life of the bearing grease. If stored for more than 12 months, the condition of the grease must be checked. If the grease is found to have lost oil content or has become contaminated, regreasing must be carried out before start-up. For permanently greased bearings, see section entitled "Repair".

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)

Note

The information on the rating and lubricant plate must be adhered to. 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 after the excess grease has been displaced out of the bearing.

8.2.3 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.

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

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

In the case of machines with textile fan covers, regularly remove fluff balls, fabric remnants or similar contamination, particularly at the air passage opening between the fan cover and cooling fins of the machine housing to ensure an unobstructed cooling air flow.

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



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

8.2.4 Drain condensate

If there are condensate drain holes present, these must be opened at regular intervals, depending on climatic conditions.

NOTICE
In order to comply with the degree of protection, any existing condensate drain holes must be closed!

8.3 Inspection

8.3.1 General inspection specifications

Safety-relevant information

NOTICE
The required regreasing intervals for rolling-contact bearings are not the same as the inspection intervals and must be adhered to.

Note

When servicing a three-phase machine, it is generally not necessary to dismantle it. The machine only has to be dismantled if the bearings are to be replaced.

8.3.2 Optional add-on units

External fan, incremental encoder, brake

See list of additional operating instructions attached:

8.3.3 Initial inspection

Inspection interval

The first inspection after installation or repair of the three-phase machine is, under normal circumstances, conducted after approx. 500 operating hours, but at the latest after 6 months.

Procedure

While the motor is running, check that:

- The equipment conforms to the stated electrical characteristics.
- The permissible bearing temperatures are not exceeded.
- The smooth running characteristics and machine noise during operation have not deteriorated.

With the machine at a standstill, check that:

- The motor foundations have no indentations or cracks.

NOTICE
Further tests are also necessary in line with the additional instructions assigned or in line with the particular system-specific conditions.

NOTICE
Any inadmissible deviations from these requirements which are detected during this inspection must be eliminated immediately.

8.3.4 Main inspection

Inspection interval

1x yearly

Procedure

While the motor is running, check that:

- The equipment conforms to the stated electrical characteristics.
- The permissible bearing temperatures are not exceeded.
- The smooth running characteristics and machine noise during operation have not deteriorated.

With the machine at a standstill, check that:

- The machine foundations have no indentations or cracks.
- The three-phase machine is within the permissible tolerance ranges.
- All of the mounting bolts for the mechanical and electrical connections have been securely tightened.
- The winding isolation resistances are sufficiently high.
- Cables and insulating parts and components are in a good condition and are not discolored.

NOTICE
Any inadmissible deviations from these requirements which are detected during this inspection must be eliminated immediately.

8.4 Corrective maintenance

8.4.1 Instructions for repair

Qualified personnel

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, ground and identify equipment, systems and circuits in accordance with the relevant safety standards.

Instructions relevant to safety

WARNING

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

NOTICE

If the machine has to be transported, comply with the instructions in the section entitled "Application planning".

8.4.2 Storage

Description

The bearings used are indicated on the rating plate.

Bearing lifetime

Prolonged storage periods reduce the useful life of the bearing grease. In the case of permanently lubricated bearings, this leads to a reduction of the bearings' useful life. Replacement of the bearings is recommended after only 12 months of storage. If the bearings are stored for more than 4 years, they must be replaced.

Replacement of bearings

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

Table 8- 3 Bearing replacement intervals

Coolant 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

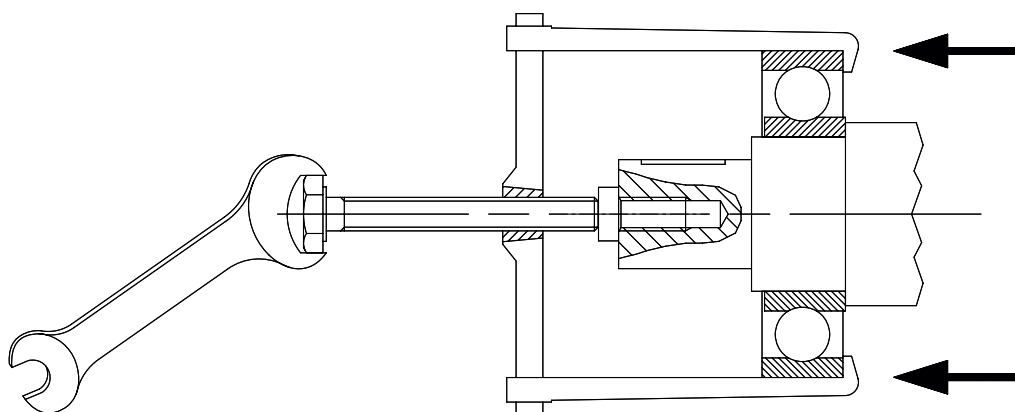
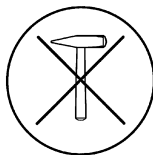
Note

Special operating conditions

The operating hours decrease in the case of, e.g., vertical machine installation, large vibrational and impact stress, frequent reversing, higher coolant temperature, higher speeds etc.

NOTICE

It is not permissible to reuse bearings that have been removed.



Replacement of bearings

Replacing bearings in explosion-proof machines



When replacing bearings, seals must also be replaced. With machines for use in Zone 21, you should use AS type rotary shaft seals without ring springs, which conform to DIN 3760 and are made from a suitable material. For machines with a shaft height of up to and including 132, rotary shaft seals made from acrylonitrile butadiene rubber (NBR) are used; from shaft height 160, rotary shaft seals made from fluorine rubber (FKR) are used. When installing the seals, the space in the middle of the seal and in the end shield hub should be completely filled with a suitable type of grease. When replacing seals on machines for use in Zone 22, you should use A type rotary shaft seals without ring springs or CD rings.

8.4.3 Dismantling

NOTICE

Before dismantling is started, the respective assignment of fastening elements as well as the location of internal connections are to be marked for re-assembly.

Fan

If a fan has a snapping mechanism, make sure that this is not damaged. If any damage is caused, request new parts.

Fan cover



- 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)
- Do not damage the snap mechanisms. If any damage is caused, request new parts.



Protective cover, incremental encoder under protective cover



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

Under no circumstances should the spacing bolts be disassembled or forcibly separated from each other or the cover. Forcibly removing or separating the spacing bolts or fan cover can result in damage to them.

Bearing bushes

Protect bearings against the ingress of dirt and moisture.

Links

- Replace any corroded screws/bolts
- Avoid damage to the insulation of parts which carry voltage
- Record the position of any rating plates or auxiliary plates which have to be removed.
- Avoid damage to the centering flanges

8.4.4 Assembly

Notes on assembly

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

NOTICE

Avoid damage to the windings protruding out of the stator housing when fitting the end shield.

Sealing measures

- Apply Fluid-D to the centering flange
- Check terminal box seals and, if necessary, replace.
- Repair any coating damage (also on screws/bolts)
- Take necessary measures to ensure compliance with required 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)



With flameproof machines, apply just a small amount of acid-free, non-resinous grease to the centering flanges. Sealing agents may not be used.

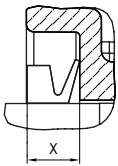
Installation of the bearing bushes

Observe the specified screw tightening torques (Page 77).

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- 4 Mounting dimension "x" of V rings

Frame size (FS)	X mm	
100 ... 112	6 ±0,8	
132 ... 225	7 ±1	

Fan

If a fan has a snapping mechanism, make sure that this is not damaged. If any damage is caused, request new parts.

Fan cover



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

Protective cover, incremental encoder under protective cover



Guide the fastening screws through the holes on the external surface of the protective cover and tighten with a torque of $3 \text{ Nm} \pm 10\%$.

Miscellaneous

- Number and position of rating plates and auxiliary plates as in original condition
- If necessary, fix electrical cables in place
- Check tightening torques of all screws, also those of screws which have not been unscrewed



The number on the EC-type examination certificate for machines with type of protection Flameproof Enclosure "d" is represented by an X, since the flameproof joints deviate from IEC standard 60079-1, Table 2. Repairs must only be carried out following consultation with the manufacturer and only original parts must be used.

8.4.5 Screw-type connections

Screw lock washers

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

Always replace locking elements.

8.4.6 Electrical connections - Terminal board connections

Table 8- 5 Tightening torques for electrical connections on the terminal board

	Thread Ø		M 4	M 5	M 6	M 8	M 10	M 12	M 16
	Nm	min	0,8	1,8	2,7	5,5	9	14	27
		max	1,2	2,5	4	8	13	20	40

8.4.7 Cable glands

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 8- 6 Tightening torques for cable glands

	Metal ± 10% Nm	Plastic ± 10% Nm	O ring String Ø mm
M 12 x 1,5	8	1,5	2
M 16 x 1,5	10	2	
M 20 x 1,5	12	4	
M 25 x 1,5			
M 32 x 1,5	18	6	
M 40 x 1,5			
M 50 x 1,5	20		
M 63 x 1,5			

NOTICE

If different kinds of cable sheath material are used, smaller tightening torques are to be used.
Damage to cable sheaths is to be prevented by using smaller tightening torques.



Cable glands must be permitted for use in hazardous areas. Openings that are not being used must be sealed with approved plugs. Pay attention to the manufacturer documentation in respect of cable glands.

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

Note

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

Table 8- 7 Tightening torques for screws on the terminal box, end shields, screw-type grounding conductor connections

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

	Thread Ø		M 4	M 5	M 6
	Nm	min	4	7,5	12,5
		max	5	9,5	15,5

8.4.9 Optional add-on units

External fan, incremental encoder, brake

See list of additional operating instructions attached:



Table 8- 9 Assigning standard brakes for 1LE1 machines

Frame size (FS)	Brake type	Size assignment by INTORQ	Tightening torque of manual lifting lever Nm
100	2LM8 040–5NA10	12	4,8
112	2LM8 060–6NA10	14	12
132	2LM8 100–7NA10	16	12
160	2LM8 260–8NA10	20	23



Tightening torque applied to the fastening screws used for attaching external fans to the housing, see Terminal boxes, end shields, grounding conductors, sheet metal fan covers (Page 45)

Spare parts/accessories

9.1 Spare parts ordering

General

In addition to the exact part designation, please specify the machine type and the factory serial number in all orders for spare parts. The part designation should be identical to the designation stated in the list of spare parts and specified together with the appropriate part number.

Table 9- 1 Ordering example

End shield, drive end	1.40 End shield
Machine type *	1LA7163-4AA60
ID no. *	E0705/1234567 01 001

* analogously to rating plate



Table 9- 2 Ordering example

End shield, drive end	1.40 End shield
Machine type *	1LE1002-1DB43-4AA0
ID no. *	E0605/0496382 02 001

* analogously to rating plate

The type and serial number can be found on the rating plate and in the machine documentation.

When replacing rolling-contact bearings, in addition to the bearing identification code, the replacement code for the bearing version is required. Both of these codes are specified on the rating plate and in the machine documentation. They are also shown on the installed bearings.

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

9.2 Spare parts

Part	Description
1.00	D end bearings
1.40	End shield
1.43	Shaft sealing ring
1.44	Bearing cover
1.46	Cover ring
1.47	O ring
1.56	Plain washer
1.58	Spring washer
1.60	Rolling-contact bearing
1.61	Spring band for end shield hub (FS 90 only)
1.64	AS bearing cover, internal
3.00	Rotor, complete
3.88	Featherkey for fan
4.00	Stator, complete
4.07	Housing foot
4.08	Housing foot, left
4.09	Housing foot, right
4.12	Nut
4.14	Nut
4.18	Rating plate
4.19	Thread-tapping screw
4.20	Cover
4.30	Contact angle
4.31	Grounding angle
4.37	Terminal Board
4.39	Grounding screw (thread-tapping screw)
5.00	Terminal box, complete
5.02	spacer
5.03	Seal
5.04	Seal
5.08	Spacer sleeve
5.10	Complete terminal board
5.11	Terminal strip (for 1MJ machines: Bushing)
5.12	Ex d terminal box (1MJ6) (star point connection)
5.13	Link rail
5.14	Terminal box underside
5.15	Plug (1MJ6)
5.20	Cable duct, complete
5.22	Connecting terminal
5.23	Cable duct, complete
5.30	Rubber stopper (1MA618.-20.)

Part	Description
5.31	Terminal clamp (1MA618.-20.)
5.32	Angle (1MA618.-20.)
5.33	Washer (1MA618.-20.)
5.43	Cable gland
5.44	Terminal box top side
5.52	Cable gland
5.53	Screw plug
5.54	O ring
5.70	Terminal clamp
5.72	Contact angle
5.76	Terminal Board
5.79	Bolt
5.82	O ring
5.83	Seal
5.84	Terminal box cover
5.86	Protection mark
5.89	Bolt
5.90	The top side of the terminal box can be rotated 4 x 90 degrees, complete (for subsequent mounting)
5.92	Terminal box cover
5.93	Seal
5.95	Terminal box top side
5.96	Sealing plug
5.97	Nut
5.98	Metal-sheet nut
5.98	Seal
5.99	Adapter plate
6.00	NDE bearings
6.10	Rolling-contact bearing
6.11	Spring band for end shield hub
6.20	End shield
6.23	Shaft sealing ring
6.24	Bearing cover BS, external
6.26	Cover
6.64	Nut
6.30	Bearing cover BS, internal
7.00	Complete ventilation (does not apply to 1LP6, 1LP7, 1LP9, 1PP6, 1PP7, 1PP9, 1MF6, 1MF7)
7.04	Fan
7.40	Fan cover
7.41	bracket
7.47	Sleeve

Devices for pushing on and pulling off rolling-contact bearings; fans and transmission elements cannot be supplied!

9.2 Spare parts

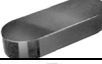


Part	Description
1.00	D end bearings
1.40	End shield
1.43	Shaft sealing ring
1.49	Thread-tapping screw (frame size 100/112)
1.50	Flanged nut
1.58	Spring washer
1.60	Rolling-contact bearing
1.61	Spring band for end shield hub (not for FS160)
4.00	Stator, complete
4.07	Housing foot
4.08	Housing foot, left
4.09	Housing foot, right
4.12	Flanged nut
4.18	Rating plate
4.19	Thread-tapping screw
4.20	Cover
4.30	Contact angle
4.31	Grounding angle
4.39	Grounding screw (thread-tapping screw)
5.00	Terminal box, complete
5.10	Complete terminal board
5.11	Terminal strip
5.19	Thread-tapping screw
5.44	Terminal box housing, including gasket
5.49	Thread-tapping screw
5.70	Terminal clamp
5.79	Thread-tapping screw
5.84	Terminal box cover, including gasket
5.89	Thread-tapping screw
5.96	Sealing plug
5.97	Nut
5.98	Metal-sheet nut
6.00	NDE bearings
6.10	Rolling-contact bearing
6.11	Spring band for end shield hub (not for FS160)
6.20	End shield
6.23	Shaft sealing ring
6.29	Thread-tapping screw (frame size 100/112)
6.30	Flanged nut
7.00	Complete ventilation
7.04	Fan
7.40	Fan cover

Devices for pushing on and pulling off rolling-contact bearings; fans and transmission elements cannot be supplied!

9.3 Standardized parts

Table 9- 3 Standardized parts are to be obtained from free trade outlets in accordance with their necessary dimensions, materials and surface finish.

No	Standard	Picture	No	Standard	Picture
1.31 4.10 4.38 5.08 5.16 5.18 5.48 5.78 5.88 7.48	DIN 128		1.30 1.32 1.45 1.49 4.11 5.09 5.17 5.19 5.24 5.42 5.49 5.79 5.87 5.89 5.91 5.94 6.29 6.45 7.49	DIN 939	
3.02 6.02 7.12	DIN 471			DIN 6912	
	DIN 472			DIN 7964	
4.04	DIN 580			DIN EN ISO 4014	
	DIN 582			DIN EN ISO 4017	
1.60 6.10	DIN 625			DIN EN ISO 4762	
3.38	DIN 6885			DIN EN ISO 7045	
1.33 6.30	DIN EN 24032			DIN EN ISO 7049	
			4.05 7.48	DIN EN ISO 7089 DIN EN ISO 7090	

9.3 Standardized parts

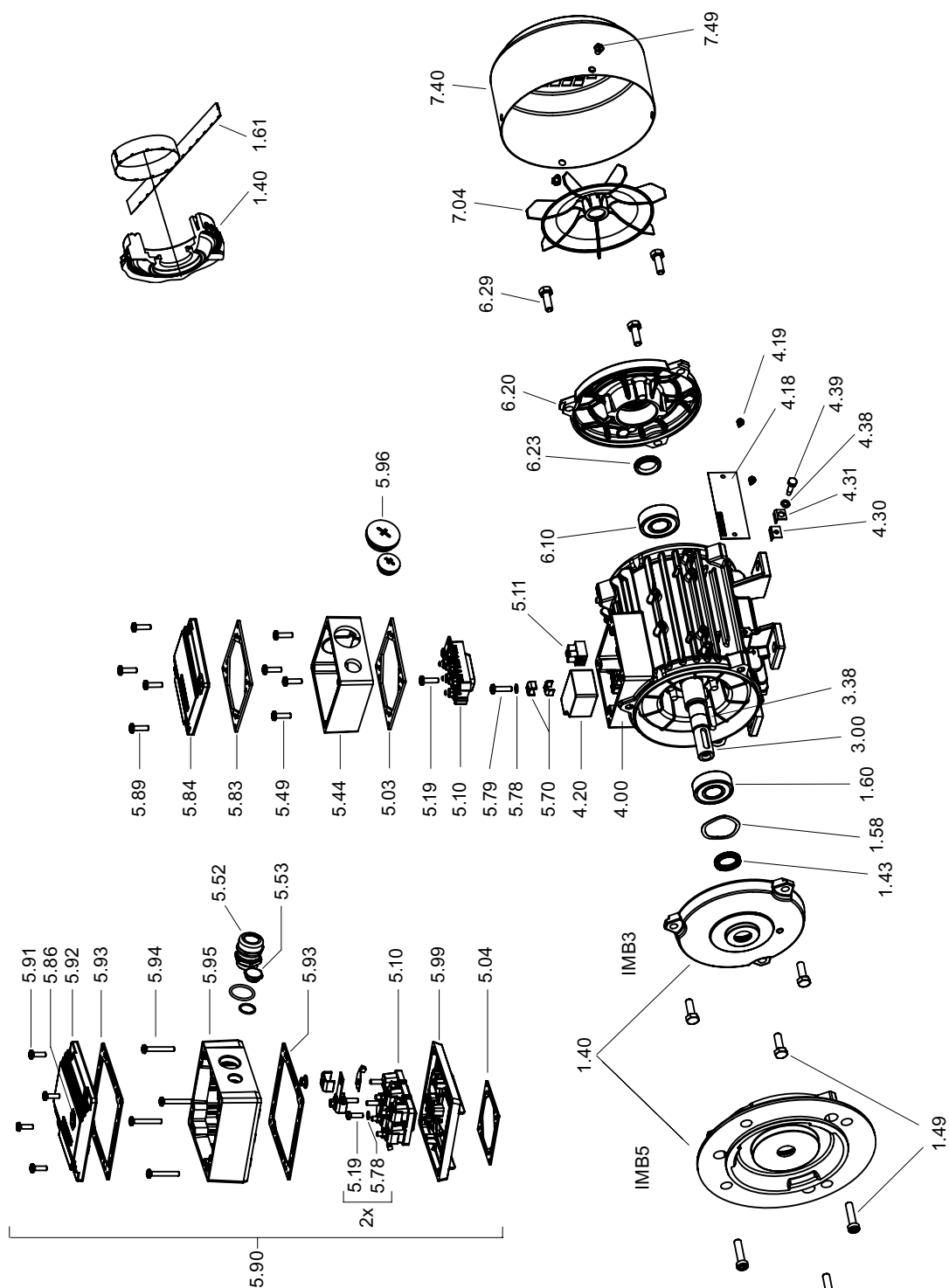


Table 9- 4 Standardized parts are to be obtained from free trade outlets in accordance with their necessary dimensions, materials and surface finish.

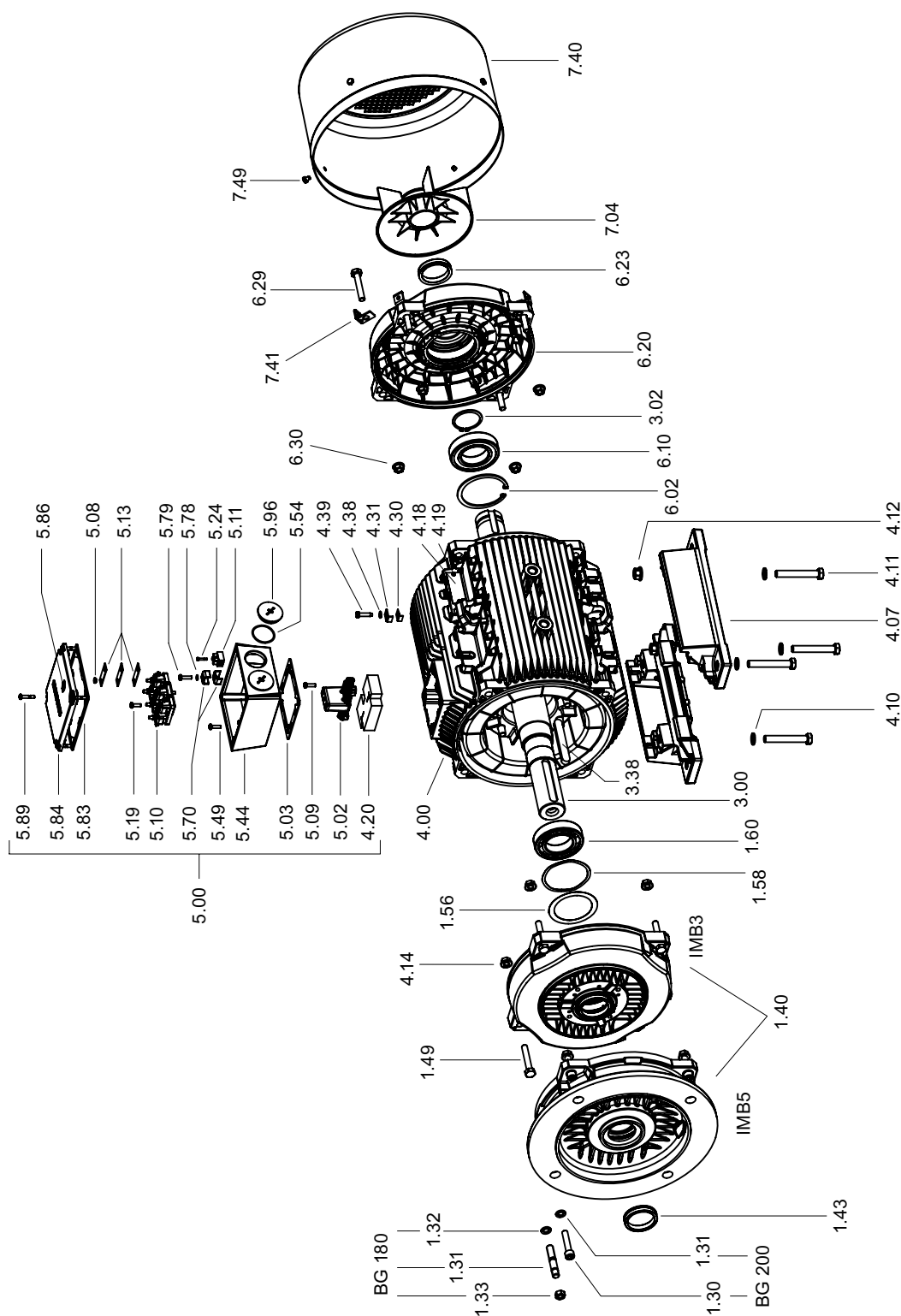
No	Standard	Picture	No	Standard	Picture
4.10 4.38 5.78	DIN 128		1.49 (frame size 132/160) 4.11 6.29 (frame size 132/160)	DIN EN ISO 4014	
6.02	DIN 472 (frame size 160)			DIN EN ISO 4017	
4.04	DIN 580			DIN EN ISO 4762	
3.38	DIN 6685		4.05	DIN EN ISO 7089 DIN EN ISO 7090	

9.4 Exploded drawings

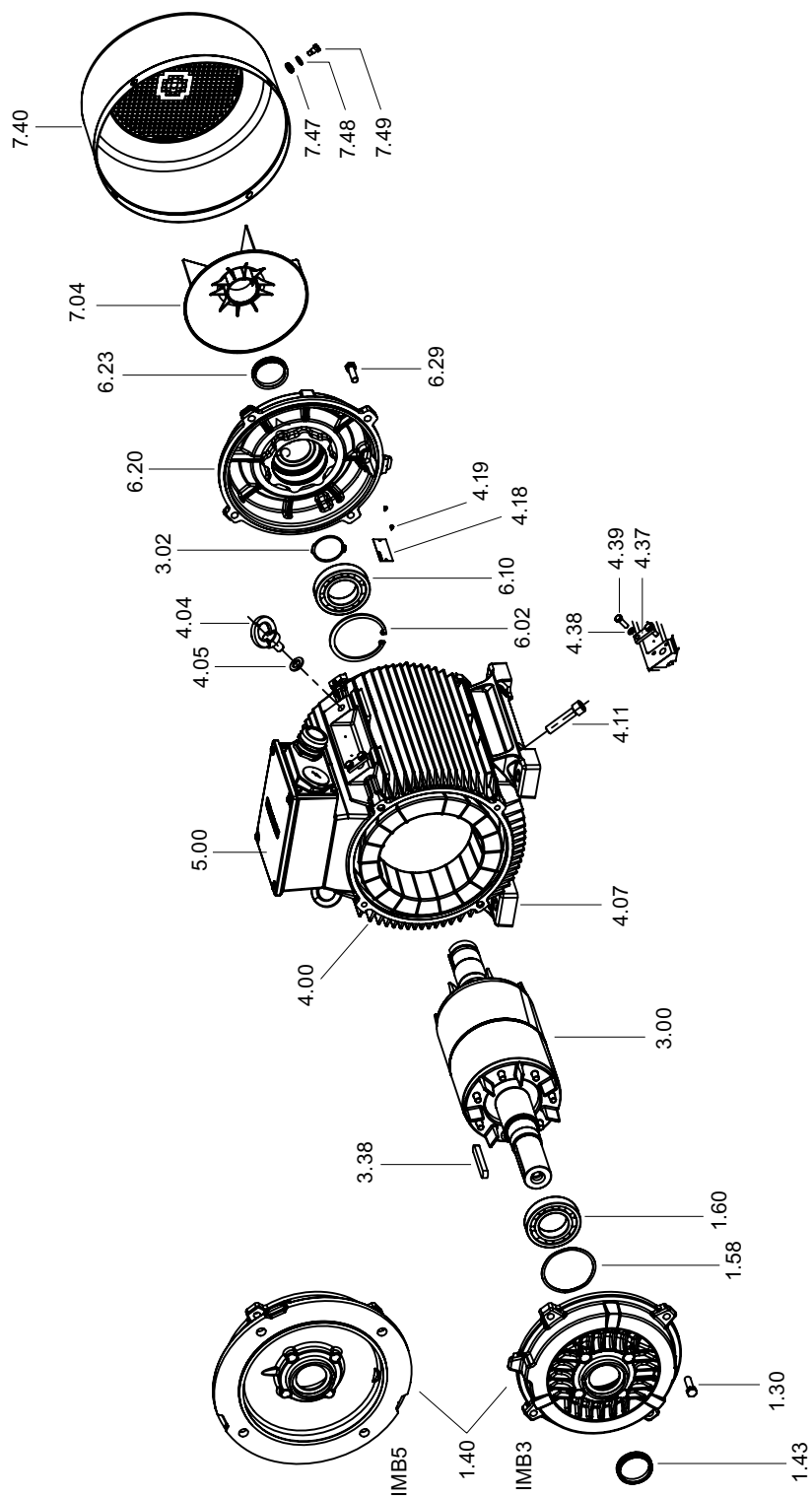
9.4.1 1LA,1LP,1MA,1MF,1PP6/7/9 FS 56...90L



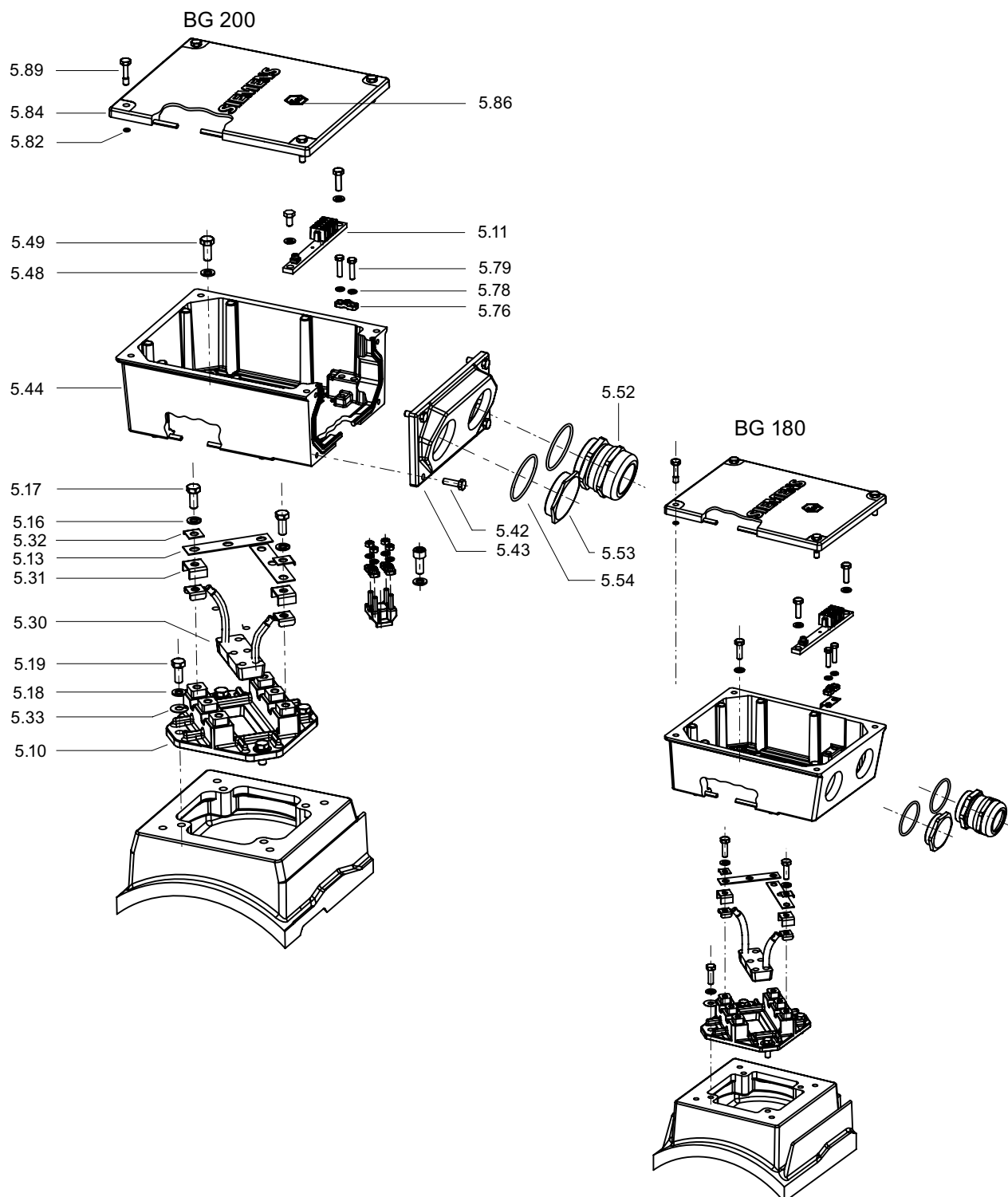
9.4.3 1LA5180...225



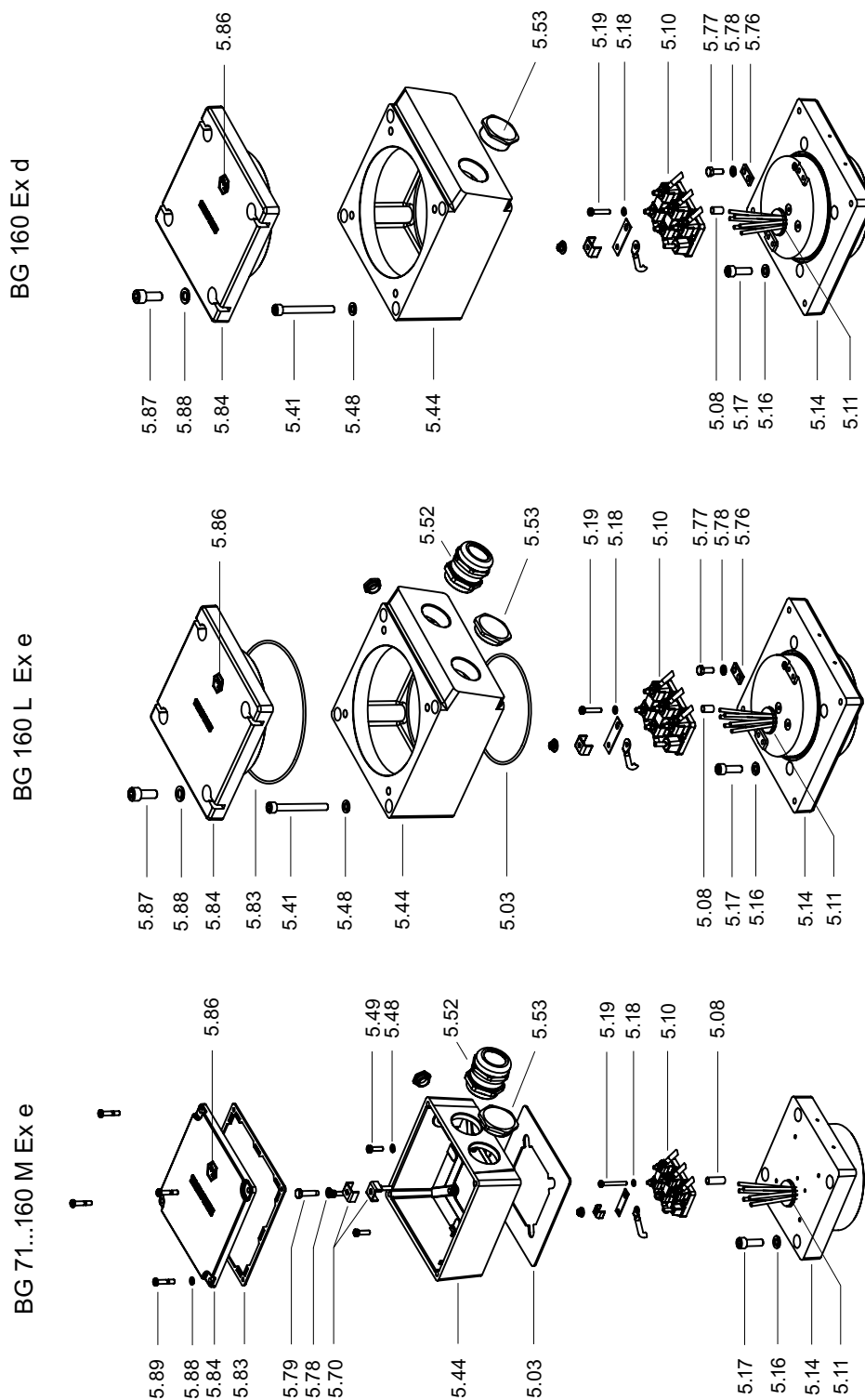
9.4.4 1MA6180...200



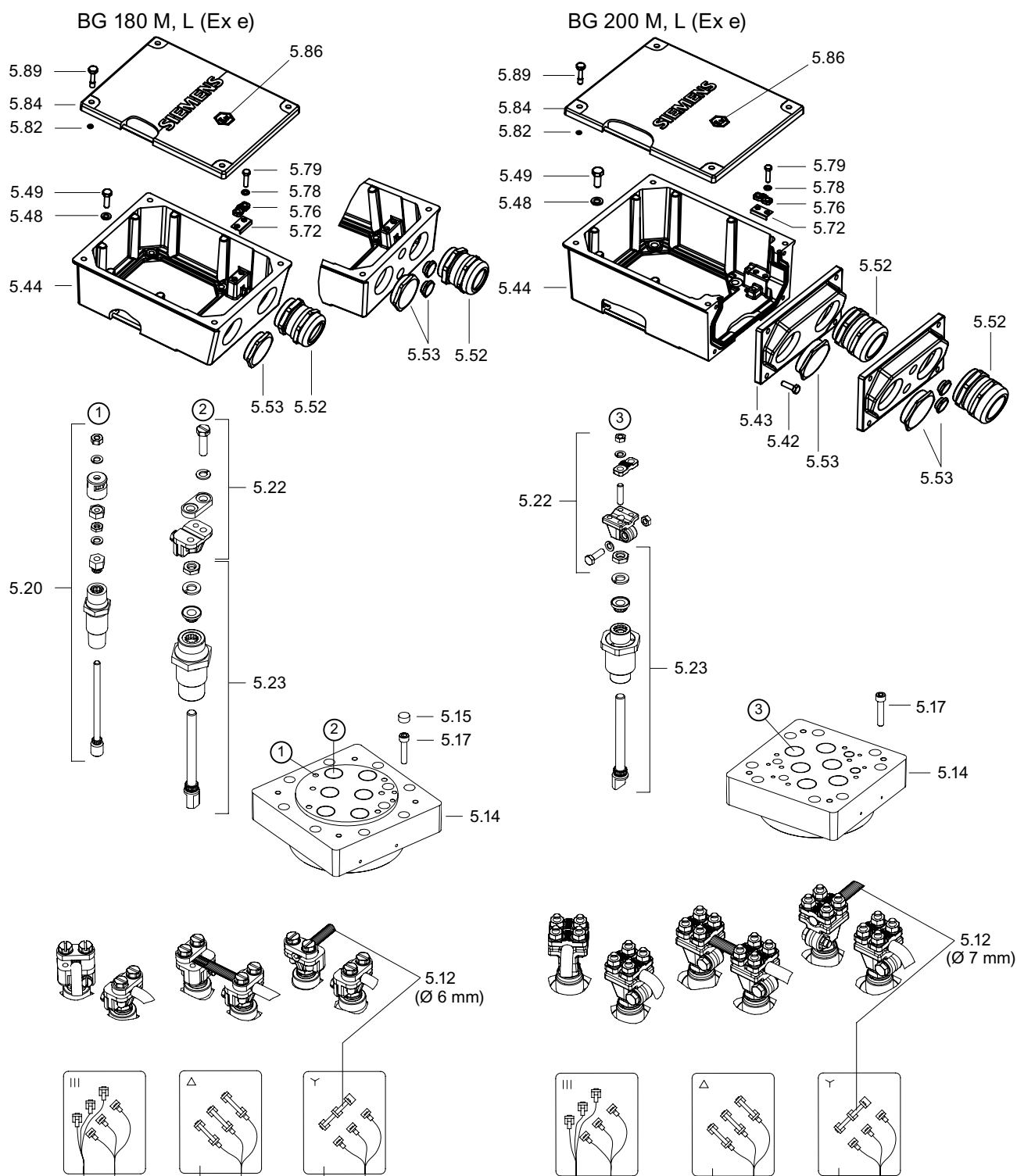
9.4.5 Terminal box 1MA6180...200



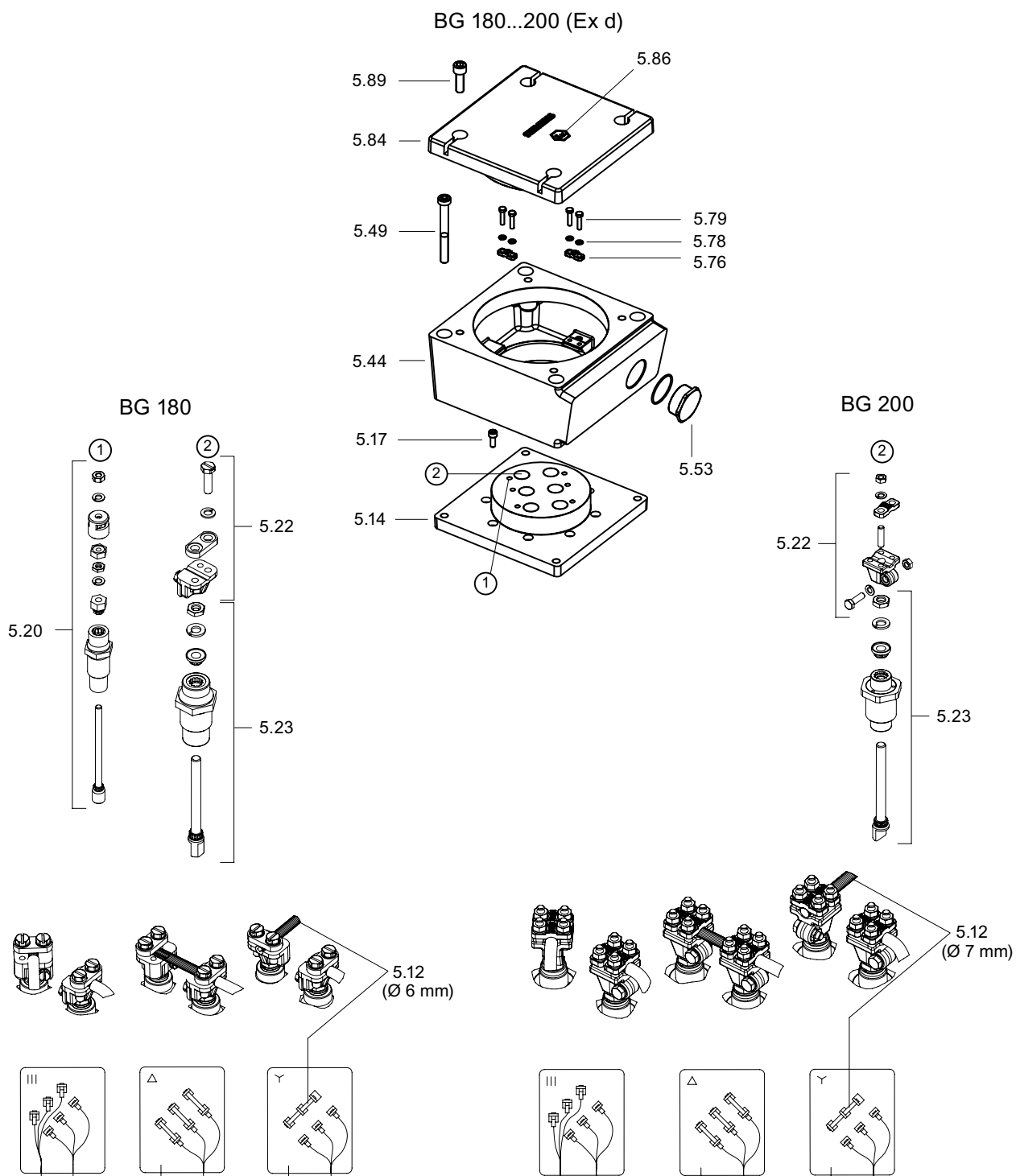
9.4.7 Terminal box 1MJ6070...160



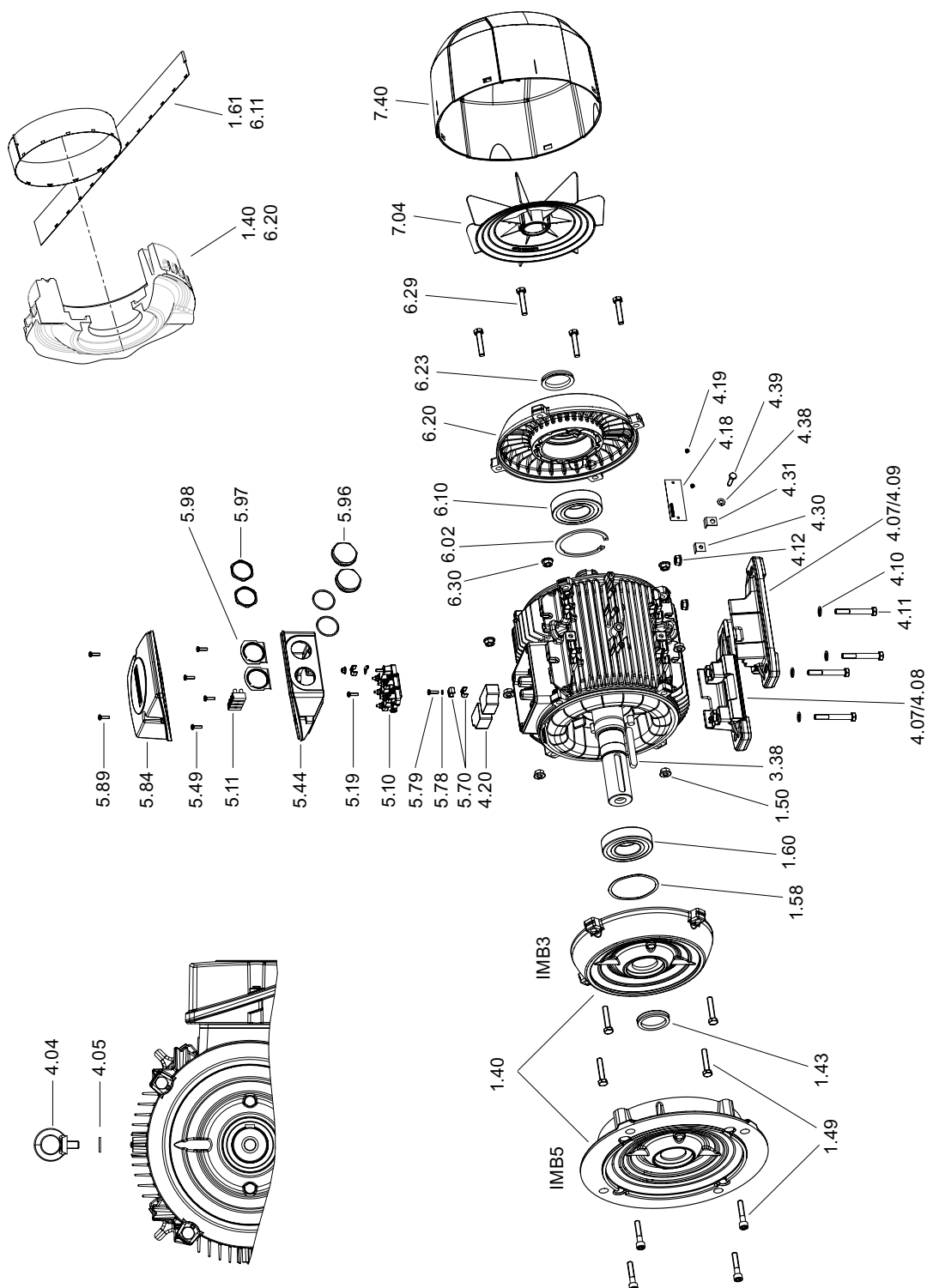
9.4.8 Terminal box 1MJ6180...200 (Ex e)



9.4.9 Terminal box 1MJ6180...200 (Ex d)



9.4.10 1LE1...



Notes

10

Appendix

A.1 Directory

These operating instructions can also be obtained at the following Internet site:

<<http://www.siemens.com/motors>>

General Documentation

1.517.30777.30.000	1XP8001 encoder
5.610.70000.02.015	External fan
5.610.70000.10.020	Spring-loaded brake
5 610 00002 09 000	Incremental encoder 1XP8012-1x
5 610 00002 09 001	Incremental encoder 1XP8012-2x

Glossary

AS

Drive end (DE)

BA

Operating instructions

BG

Frame size

Code F

Balanced with whole featherkey (full)

Code H

Balanced with half featherkey (half)

CSA

Canadian Standard Association

CSA E

Canadian Standard Association Energie Efficiency Verification

CT

Coolant temperature

DE

Drive end (D end of shaft)

EC type-examination certificate

Evidence of a machine certified by an inspection body

EMC

Electromagnetic compatibility

Ex

Codes for explosion-protected equipment

IC

International Cooling (standard)

IM

International mounting standard design

Internet

www.siemens.com/motors

IP

Degree of protection

ISPM

International Standards for Phytosanitary Measures

N code

Balanced without featherkey (non)

NDE

Non-drive end

NE/NDE

Non-drive end

SH

Shaft height

UL

Underwriters Laboratories

VIK

Verband der industriellen Energie- und Kraftwirtschaft e.V. (German Association of Industrial Energy Users and Self-Generators)

Zone 1

Atmosphere: Gas; Danger level: Occasional danger; Type of protection: Increased Safety "e" + Flameproof Enclosure "d"

Zone 2

Atmosphere: Gas; Danger level: Infrequent and short-term danger; Type of protection: Non-sparking "n"

Zone 21

Atmosphere: Dust; Danger level: Occasional danger; Type of protection: Protection by enclosure "tD"

Zone 22

Atmosphere: Dust; Danger level: Infrequent and short-term danger; Type of protection: Protection by enclosure "tD"

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Standard Drives
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