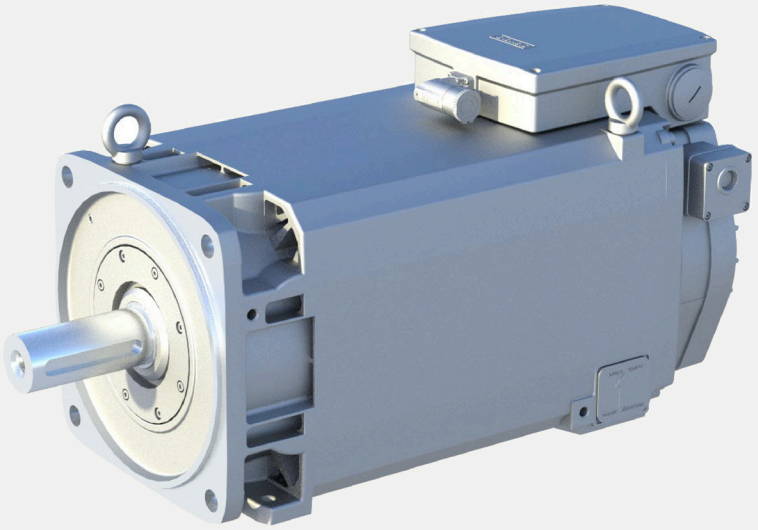
SIEMENS



Edition 09/2021

OPERATING INSTRUCTIONS

SIMOTICS

SIMOTICS M-1PH8 main motors

1PH813/1PH816

www.siemens.com

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SIMOTICS

Drive technology
Main motors 1PH813_1PH816

Operating Instructions

Introduction

Fundamental safety instructions 1

Description 2

Preparations for use 3

Mechanical mounting 4

Connection 5

Commissioning 6

Operation 7

Maintenance 8

Spare parts 9

Decommissioning and disposal 10

Appendix A

09/2021

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Legal information

Warning notice system

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

⚠**DANGER**
indicates that death or severe personal injury **will** result if proper precautions are not taken.

⚠**WARNING**
indicates that death or severe personal injury **may** result if proper precautions are not taken.

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

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

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

Qualified Personnel

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

Proper use of Siemens products

Note the following:

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

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Disclaimer of Liability

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

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Introduction

Keeping the documentation safe

This documentation should be kept in a location where it can be easily accessed and made available to the personnel responsible.

Target group

These operating instructions are intended for electricians, fitters, service technicians and warehouse personnel.

About these operating instructions

These operating instructions describe 1PH813 and 1PH816 motors and explain how to handle the motor from delivery to disposal.

- You must read these operating instructions before you start using the motor. This will ensure safe, problem-free operation and maximize the service life of the motor.

These operating instructions are valid in conjunction with the relevant Siemens configuration manual.

Siemens strives to continually 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, contact the Siemens Service Center.
- Always observe the safety instructions in these operating instructions, especially those concerning explosion protection.

The warning notice system is explained on the rear of the inside front.

Text features

In addition to the notes that you must observe for your own personal safety as well as to avoid material damage, in this document you will find the following text features:

Operating instructions

Operating instructions with the specified sequence indicates the start by the word "Procedure". The individual handling steps are numbered.

1. Execute the operating instructions in the specified sequence.

❒

The square indicates the end of the operating instruction.

Operating instructions without a specified sequence are identified using a bullet point:

- Execute the operating instructions.

Enumerations

- Enumerations are identified by a bullet point without any additional symbols.
  - Enumerations at the second level are hyphenated.

Notes

Notes are shown as follows:

Note

A Note is an important item of information about the product, handling of the product or the relevant section of the document. Notes provide you with help or further suggestions/ideas.

More information

Information on the following topics is available at:

- Ordering documentation / overview of documentation
- Additional links to download documents
- Using documentation online (find and search in manuals / information)

More information (https://support.industry.siemens.com/cs/de/en/view/108998034)

If you have any questions regarding the technical documentation (e.g. suggestions, corrections), please send an e-mail to the following address E-mail (mailto:docu.motioncontrol@siemens.com).

mySupport

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

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

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

To do so, click "My Documentation".

Note

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

Later, you can log on with your login data.

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

Precondition

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

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

Procedure for creating a personal library

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

❒

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

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

Training

The following link provides information on SITRAIN - training from Siemens for products, systems and automation engineering solutions:

SITRAIN (http://siemens.com/sitrain)

Technical support

If you have any technical questions, contact Technical Support (https://support.industry.siemens.com/cs/ww/en/).

To make a support request, proceed as follows:

Precondition

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

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

Procedure

1. Click on "Your direct way to the Support Request" or follow the link Support Request (https://support.industry.siemens.com/cs/ww/en/my)
2. Follow the instructions in the online form.

❒

Websites of third parties

This publication contains hyperlinks to websites of third parties. Siemens does not take any responsibility for the contents of these websites or adopt any of these websites or their contents as their own, because Siemens does not control the information on these websites and is also not responsible for the contents and information provided there. Use of these websites is at the risk of the person doing so.

Internet address for products

Products (http://www.siemens.com/motioncontrol)

Table of contents

Introduction **3**

1 Fundamental safety instructions **11**

1.1 General safety instructions 11

1.2 Equipment damage due to electric fields or electrostatic discharge 15

1.3 Security information 16

1.4 Residual risks of power drive systems 17

2 Description **19**

2.1 Use for the intended purpose 19

2.2 Technical characteristics and ambient conditions 20
2.2.1 Directives and standards 20
2.2.2 Technical characteristics 22
2.2.3 Ambient conditions 23
2.2.4 Degree of protection 23
2.2.5 Noise emission 24

2.3 Rating plate data (type plate) 25

2.4 Design 27
2.4.1 Types of construction 27
2.4.2 Cooling 28
2.4.3 Holding brake (option) 31
2.4.3.1 Properties 31
2.4.3.2 Mounted holding brake for SH 132 and SH 160 35

3 Preparations for use **37**

3.1 Shipment and packaging 37

3.2 Transportation and storage 37
3.2.1 Transporting 38
3.2.2 Storage 40

4 Mechanical mounting **43**

4.1 Installation 43

4.2 Mounting 44

4.3 Attaching the output elements 45

4.4 Vibration stressing 47

4.5 Mounting of rotating unions on 1PH8 hollow-shaft motors 48
4.5.1 Rotor-supported rotating union 51
4.5.2 Bearingless, frame-supported rotating union 55
4.5.3 Mounting information and instructions 60
4.5.4 Suggestion for an adapter for bearing-free, frame-supported rotating unions 62

5 Connection 63

5.1 Mechanical connection of water cooling system 63

5.2 Electrical connection 63
5.2.1 Cable routing 65
5.2.2 Circuit diagram 66
5.2.3 Terminal box 67
5.2.4 Power connector (for 1PH813 only) 70
5.2.5 Electrical connection data 70
5.2.6 Motors with DRIVE-CLiQ interface 71
5.2.7 Motors without DRIVE-CLiQ interface 73
5.2.8 Connecting an HTL incremental encoder 75
5.2.9 Connecting the temperature sensor 76
5.2.10 Connecting a grounding conductor in the terminal box 76
5.2.11 Connecting the external fan 77
5.2.12 Connecting-up a converter 80
5.2.13 Connecting a holding brake (option) 80
5.2.14 Sealing air connection (option Q12) 81

6 Commissioning 83

6.1 Safety instructions for commissioning 83

6.2 Checklists for commissioning 86

6.3 Checking the insulation resistance 89

6.4 Switching-on and switching-off 90

6.5 Cooling 92

7 Operation 93

7.1 Faults 94

7.2 Non-operational periods 96

8 Maintenance 97

8.1 Inspection and maintenance 98
8.1.1 General inspection guidelines 98
8.1.2 Maintenance and inspection intervals 98
8.1.3 Initial inspection 99
8.1.4 General inspection 100
8.1.5 Bearing replacement intervals 101
8.1.6 Cleaning the motor and fan (external fan) 102
8.1.7 Replacing an encoder 104

8.2 Corrective maintenance 104
8.2.1 Removing/installing the motor 105
8.2.2 Removing/installing the speed encoder 107
8.2.3 Removing/installing the toothed-wheel encoder 109
8.2.4 Replacing the DRIVE-CLiQ interface (encoder module) 111
8.2.5 Tightening torque for screwed connections 111
8.2.6 Removing/mounting a holding brake (option) 112

9 Spare parts 113

10 Decommissioning and disposal 115

10.1 Decommissioning 115
10.2 Disposal 116
A Appendix 117
A.1 Note regarding a holding brake 117
A.2 Operating Instructions for the holding brake 118
A.3 Operating Instructions for the external fan, SH132 148
A.3.1 Operating instructions for the external fan, Type K2D200AB1806 148
A.3.2 Operating instructions for the external fan, Type K2D200AB1808 160
A.3.3 Operating instructions for the external fan, Type K2D200AB2405 172
A.3.4 Operating instructions for the external fan, Type K2D200AB2407 184
A.4 Operating Instructions for the external fan, SH160 196
A.4.1 Operating instructions for the external fan, Type K2D250AB3205 196
A.4.2 Operating instructions for the external fan, Type K2D250AB3206 208
A.4.3 Operating instructions for the external fan, Type K2D250AB3207 220
A.4.4 Operating instructions for the external fan, Type K2D250AB3208 232
Index 245

Fundamental safety instructions

1

1.1 General safety instructions



⚠ WARNING

Electric shock and danger to life due to other energy sources

Touching live components can result in death or severe injury.

- Only work on electrical devices when you are qualified for this job.
- Always observe the country-specific safety rules.

Generally, the following steps apply when establishing safety:

1. Prepare for disconnection. Notify all those who will be affected by the procedure.
2. Isolate the drive system from the power supply and take measures to prevent it being switched back on again.
3. Wait until the discharge time specified on the warning labels has elapsed.
4. Check that there is no voltage between any of the power connections, and between any of the power connections and the protective conductor connection.
5. Check whether the existing auxiliary supply circuits are de-energized.
6. Ensure that the motors cannot move.
7. Identify all other dangerous energy sources, e.g. compressed air, hydraulic systems, or water. Switch the energy sources to a safe state.
8. Check that the correct drive system is completely locked.

After you have completed the work, restore the operational readiness in the inverse sequence.



⚠ WARNING

Electric shock due to connection to an unsuitable power supply

When equipment is connected to an unsuitable power supply, exposed components may carry a hazardous voltage. Contact with hazardous voltage can result in severe injury or death.

- Only use power supplies that provide SELV (Safety Extra Low Voltage) or PELV-(Protective Extra Low Voltage) output voltages for all connections and terminals of the electronics modules.



⚠WARNING

Electric shock due to damaged motors or devices

Improper handling of motors or devices can damage them.

Hazardous voltages can be present at the enclosure or at exposed components on damaged motors or devices.

- Ensure compliance with the limit values specified in the technical data during transport, storage and operation.
- Do not use any damaged motors or devices.



⚠WARNING

Electric shock due to unconnected cable shield

Hazardous touch voltages can occur through capacitive cross-coupling due to unconnected cable shields.

- As a minimum, connect cable shields and the conductors of power cables that are not used (e.g. brake cores) at one end at the grounded housing potential.



⚠WARNING

Electric shock if there is no ground connection

For missing or incorrectly implemented protective conductor connection for devices with protection class I, high voltages can be present at open, exposed parts, which when touched, can result in death or severe injury.

- Ground the device in compliance with the applicable regulations.



⚠WARNING

Arcing when a plug connection is opened during operation

Opening a plug connection when a system is operation can result in arcing that may cause serious injury or death.

- Only open plug connections when the equipment is in a voltage-free state, unless it has been explicitly stated that they can be opened in operation.

NOTICE

Property damage due to loose power connections

Insufficient tightening torques or vibration can result in loose power connections. This can result in damage due to fire, device defects or malfunctions.

- Tighten all power connections to the prescribed torque.
- Check all power connections at regular intervals, particularly after equipment has been transported.

NOTICE

Damage to equipment due to unsuitable tightening tools.

Unsuitable tightening tools or fastening methods can damage the screws of the equipment.

- Be sure to only use screwdrivers which exactly match the heads of the screws.
- Tighten the screws with the torque specified in the technical documentation.
- Use a torque wrench or a mechanical precision nut runner with a dynamic torque sensor and speed limitation system.

⚠WARNING

Unexpected movement of machines caused by radio devices or mobile phones

Using radio devices or mobile telephones in the immediate vicinity of the components can result in equipment malfunction. Malfunctions may impair the functional safety of machines and can therefore put people in danger or lead to property damage.

- Therefore, if you move closer than 20 cm to the components, be sure to switch off radio devices or mobile telephones.
- Use the "SIEMENS Industry Online Support app" only on equipment that has already been switched off.

⚠WARNING

Unrecognized dangers due to missing or illegible warning labels

Dangers might not be recognized if warning labels are missing or illegible. Unrecognized dangers may cause accidents resulting in serious injury or death.

- Check that the warning labels are complete based on the documentation.
- Attach any missing warning labels to the components, where necessary in the national language.
- Replace illegible warning labels.

⚠WARNING

Unexpected movement of machines caused by inactive safety functions

Inactive or non-adapted safety functions can trigger unexpected machine movements that may result in serious injury or death.

- Observe the information in the appropriate product documentation before commissioning.
- Carry out a safety inspection for functions relevant to safety on the entire system, including all safety-related components.
- Ensure that the safety functions used in your drives and automation tasks are adjusted and activated through appropriate parameterizing.
- Perform a function test.
- Only put your plant into live operation once you have guaranteed that the functions relevant to safety are running correctly.

Note

Important safety notices for Safety Integrated functions

If you want to use Safety Integrated functions, you must observe the safety notices in the Safety Integrated manuals.

⚠WARNING

Active implant malfunctions due to electromagnetic fields

Electromagnetic fields (EMF) are generated by the operation of electrical power equipment, such as transformers, converters, or motors. People with pacemakers or implants are at particular risk in the immediate vicinity of this equipment.

- If this affects you, maintain the minimum distance to such equipment that is specified in the "Intended use" chapter.



⚠WARNING

Active implant malfunctions due to permanent-magnet fields

Even when switched off, electric motors with permanent magnets represent a potential risk for persons with heart pacemakers or implants if they are close to converters/motors.

- If this affects you, maintain the minimum distance to such equipment that is specified in the "Intended use" chapter.
- When transporting or storing permanent-magnet motors always use the original packing materials with the warning labels attached.
- Clearly mark the storage locations with the appropriate warning labels.
- IATA regulations must be observed when transported by air.

⚠WARNING

Injury caused by moving or ejected parts

Contact with moving motor parts or drive output elements and the ejection of loose motor parts (e.g. feather keys) out of the motor enclosure can result in severe injury or death.

- Remove any loose parts or secure them so that they cannot be flung out.
- Do not touch any moving parts.
- Safeguard all moving parts using the appropriate safety guards.

⚠WARNING

Fire due to inadequate cooling

Inadequate cooling can cause the motor to overheat, resulting in death or severe injury as a result of smoke and fire. This can also result in increased failures and reduced service lives of motors.

- Comply with the specified cooling requirements for the motor.

⚠WARNING

Fire due to incorrect operation of the motor

When incorrectly operated and in the case of a fault, the motor can overheat resulting in fire and smoke. This can result in severe injury or death. Further, excessively high temperatures destroy motor components and result in increased failures as well as shorter service lives of motors.

- Operate the motor according to the relevant specifications.
- Only operate the motors in conjunction with effective temperature monitoring.
- Immediately switch off the motor if excessively high temperatures occur.



⚠CAUTION

Burn injuries caused by hot surfaces

In operation, the motor can reach high temperatures, which can cause burns if touched.

- Mount the motor so that it is not accessible in operation.

Measures when maintenance is required:

- Allow the motor to cool down before starting any work.
- Use the appropriate personnel protection equipment, e.g. gloves.

1.2 Equipment damage due to electric fields or electrostatic discharge

Electrostatic sensitive devices (ESD) are individual components, integrated circuits, modules or devices that may be damaged by either electric fields or electrostatic discharge.



NOTICE

Equipment damage due to electric fields or electrostatic discharge

Electric fields or electrostatic discharge can cause malfunctions through damaged individual components, integrated circuits, modules or devices.

- Only pack, store, transport and send electronic components, modules or devices in their original packaging or in other suitable materials, e.g conductive foam rubber of aluminum foil.
- Only touch components, modules and devices when you are grounded by one of the following methods:
  - Wearing an ESD wrist strap
  - Wearing ESD shoes or ESD grounding straps in ESD areas with conductive flooring
- Only place electronic components, modules or devices on conductive surfaces (table with ESD surface, conductive ESD foam, ESD packaging, ESD transport container).

1.3 Security information

Siemens provides products and solutions with industrial security functions that support the secure operation of plants, systems, machines and networks.

In order to protect plants, systems, machines and networks against cyber threats, it is necessary to implement – and continuously maintain – a holistic, state-of-the-art industrial security concept. Siemens' products and solutions constitute one element of such a concept.

Customers are responsible for preventing unauthorized access to their plants, systems, machines and networks. Such systems, machines and components should only be connected to an enterprise network or the internet if and to the extent such a connection is necessary and only when appropriate security measures (e.g. firewalls and/or network segmentation) are in place.

For additional information on industrial security measures that may be implemented, please visit
https://www.siemens.com/industrialsecurity (https://www.siemens.com/industrialsecurity).

Siemens' products and solutions undergo continuous development to make them more secure. Siemens strongly recommends that product updates are applied as soon as they are available and that the latest product versions are used. Use of product versions that are no longer supported, and failure to apply the latest updates may increase customer's exposure to cyber threats.

To stay informed about product updates, subscribe to the Siemens Industrial Security RSS Feed under
https://www.siemens.com/industrialsecurity
(https://new.siemens.com/global/en/products/services/cert.html#Subscriptions).

Further information is provided on the Internet:

Industrial Security Configuration Manual
(https://support.industry.siemens.com/cs/ww/en/view/108862708)

⚠ WARNING

Unsafe operating states resulting from software manipulation

Software manipulations, e.g. viruses, Trojans, or worms, can cause unsafe operating states in your system that may lead to death, serious injury, and property damage.

- Keep the software up to date.
- Incorporate the automation and drive components into a holistic, state-of-the-art industrial security concept for the installation or machine.
- Make sure that you include all installed products into the holistic industrial security concept.
- Protect files stored on exchangeable storage media from malicious software by with suitable protection measures, e.g. virus scanners.
- On completion of commissioning, check all security-related settings.

1.4 Residual risks of power drive systems

When assessing the machine- or system-related risk in accordance with the respective local regulations (e.g., EC Machinery Directive), the machine manufacturer or system installer must take into account the following residual risks emanating from the control and drive components of a drive system:

1. Unintentional movements of driven machine or system components during commissioning, operation, maintenance, and repairs caused by, for example,
   - Hardware and/or software errors in the sensors, control system, actuators, and cables and connections
   - Response times of the control system and of the drive
   - Operation and/or environmental conditions outside the specification
   - Condensation/conductive contamination
   - Parameterization, programming, cabling, and installation errors
   - Use of wireless devices/mobile phones in the immediate vicinity of electronic components
   - External influences/damage
   - X-ray, ionizing radiation and cosmic radiation
2. Unusually high temperatures, including open flames, as well as emissions of light, noise, particles, gases, etc., can occur inside and outside the components under fault conditions caused by, for example:
   - Component failure
   - Software errors
   - Operation and/or environmental conditions outside the specification
   - External influences/damage
3. Hazardous shock voltages caused by, for example:
   - Component failure
   - Influence during electrostatic charging
   - Induction of voltages in moving motors
   - Operation and/or environmental conditions outside the specification
   - Condensation/conductive contamination
   - External influences/damage
4. Electrical, magnetic and electromagnetic fields generated in operation that can pose a risk to people with a pacemaker, implants or metal replacement joints, etc., if they are too close
5. Release of environmental pollutants or emissions as a result of improper operation of the system and/or failure to dispose of components safely and correctly
6. Influence of network-connected communication systems, e.g. ripple-control transmitters or data communication via the network

For more information about the residual risks of the drive system components, see the relevant sections in the technical user documentation.

Description

2

2.1 Use for the intended purpose

⚠WARNING

Danger to life and material damage when incorrectly used

If you do not use the motors or their components correctly, there is a risk of death, severe injury and/or material damage.

- Only use the motors for industrial or commercial plants and systems.
- If, in an exceptional case, you do not use the motors in industrial or commercial plants and systems, ensure that increased requirements are complied with (e.g. regarding touch protection).
- Do not use the motors in hazardous areas (where there is a risk of explosion), if the motors have not been expressly released and authorized for these types of applications. Carefully observe any special supplementary notes that may be attached.
- Only use the motors and their components for the applications specified by Siemens.
- Protect the motors against dirt and contact with aggressive substances.
- Ensure that the site conditions comply with the rating plate data and the conditions specified in this documentation. When necessary, take into account deviations regarding approvals or country-specific regulations.
- If you have any questions regarding the intended use, please contact your local Siemens office.
- If you wish to use special versions and design variants whose specifications vary from the motors described in this document, then first contact your local Siemens office.

⚠WARNING

Danger to life for wearers of active implants due to magnetic and electrical fields

Electric motors pose a danger to people with active medical implants, e.g. cardiac stimulators, who come close to the motors.

- If you are affected, stay at a minimum distance of 500 mm from the motors (tripping threshold for static magnetic fields of 0.5 mT according to the Directive 2013/35/EU).

The motors are designed for use in covered areas, such as production areas (see Chapter Environmental conditions (Page 23))

The 1PH813 and 1PH816 three-phase induction and synchronous motors are used as industrial drives for machine tools and production machines. They are designed for use in a wide range of drive engineering applications. The variable-speed three-phase motors are supplied by a frequency converter and are characterized by their high power density, ruggedness, long lifetime, and overall reliability.

2.2 Technical characteristics and ambient conditions

2.2.1 Directives and standards

Standards that are complied with

The motors of the type series SIMOTICS S, SIMOTICS M, SIMOTICS L, SIMOTICS T, SIMOTICS A, called "SIMOTICS motor series" below, fulfill the requirements of the following directives and standards:

- EN 60034-1 - Rotating electrical machines – Dimensioning and operating behavior
- EN 60204-1 - Safety of machinery – Electrical equipment of machines; general requirements

Where applicable, the SIMOTICS motor series are in conformance with the following parts of EN 60034:

Feature	Standard
Degree of protection	EN 60034-5
Cooling [1)]	EN 60034-6
Type of construction	EN 60034-7
Connection designations	EN 60034-8
Noise levels [1)]	EN 60034-9
Temperature monitoring	EN 60034-11
Vibration severity grades [1)]	EN 60034-14

[1)] Standard component, e.g. cannot be applied to built-in motors

Relevant directives

The following directives are relevant for SIMOTICS motors.

CE

European Low-Voltage Directive

SIMOTICS motors comply with the Low-Voltage Directive 2014/35/EU.

European Machinery Directive

SIMOTICS motors do not fall within the scope covered by the Machinery Directive.

However, the use of the products in a typical machine application has been fully assessed for compliance with the main regulations in this directive concerning health and safety.

European EMC Directive

SIMOTICS motors do not fall within the scope covered by the EMC Directive. The products are not considered as devices in the sense of the directive. Installed and operated with a converter, the motor - together with the Power Drive System - must comply with the requirements laid down in the applicable EMC Directive.

European RoHS Directive

The SIMOTICS motor series complies with the Directive 2011/65/EU regarding limiting the use of certain hazardous substances.

European Directive on Waste Electrical and Electronic Equipment (WEEE)

The SIMOTICS motor series complies with the 2012/19/EU directive on taking back and recycling waste electrical and electronic equipment.

European Directive 2005/32/EC defining requirements for environmentally friendly design of electric motors

The SIMOTICS motor series is not subject to Regulation (EC) No. 640/2009 for implementation of this directive.

European Directive 2009/125/EC defining ecodesign requirements of electric motors and speed controls

The SIMOTICS motor series is not subject to Regulation (EU) 2019/1781 for implementation of this directive.

Eurasian conformity

SIMOTICS motors comply with the requirements of the Russia/Belarus/Kazakhstan (EAC) customs union.

China Compulsory Certification

SIMOTICS motors do not fall within the scope covered by the China Compulsory Certification (CCC).

CCC negative certification:

CCC product certification (https://support.industry.siemens.com/cs/ww/en/view/93013317)

Underwriters Laboratories

SIMOTICS motors are generally in compliance with UL and cUL as components of motor applications, and are appropriately listed.

Specifically developed motors and functions are the exceptions in this case. Here, it is crucial that you carefully observe the content of the quotation and that there is a UL or cUL mark on the rating plate!

Quality systems

Siemens AG employs a quality management system that meets the requirements of ISO 9001 and ISO 14001.

Certificates for SIMOTICS motors can be downloaded from the Internet at the following link:

Certificates for SIMOTICS motors (https://support.industry.siemens.com/cs/ww/en/ps/13347/cert)

China RoHS

SIMOTICS motors comply with the China RoHS.

You can find more information at:

China RoHS (https://support.industry.siemens.com/cs/ww/en/view/109738670)

China Energy Label (CEL)

The 1PH8 synchronous motors with permanent magnets are subject to the requirements of the China national standard GB30253-2013. The China energy label is attached to the applicable motors.



Figure 2-1 Example of the "China Energy Label"

The following motor specifications are listed on the CEL:

- Motor type
- Efficiency in %
- Rated power in kW
- Rated speed in rpm

2.2.2 Technical characteristics

The most important technical characteristics of the motors can be found on the rating plate (type plate): You will find detailed overviews of the technical characteristics of the motors in the Configuration Manual "SIMOTICS M-1PH8 Main Motors for SINAMICS S120" or in catalogs D 21.4 and NC 61.

2.2.3 Ambient conditions

The following temperature ranges apply to motors with forced ventilation.

Permissible temperature range during operation: T = -15 °C to +40 °C

Under conditions other than those specified above (ambient temperature > 40°C or installation altitude > 1000 m above sea level), the permissible torque/power must be determined from the following table. Ambient temperatures and installation altitudes are rounded off to 5°C and 500 m respectively.

Table 2- 1 Power derating as a function of the installation altitude and ambient temperature

Installation altitude above sea level in m	Ambient temperature in °C			
	30 ... 40	45	50	55
1000	1.00	0.96	0.92	0.87
1500	0.97	0.93	0.89	0.84
2000	0.94	0.90	0.86	0.82
2500	0.90	0.86	0.83	0.78
3000	0.86	0.82	0.79	0.75
3500	0.82	0.79	0.75	0.71
4000	0.77	0.74	0.71	0.67

Note

Unsuitable installation locations

The motors are not suitable for operation

- in salt-laden or corrosive atmospheres
- outdoors

2.2.4 Degree of protection

The motors with forced ventilation (1PH813 or 1PH816) have degree of protection IP55.

The water-cooled motors (1PH813 or 1PH816) have degree of protection IP65.

2.2.5 Noise emission

⚠WARNING

Hearing damage

Hearing damage may occur if the motor exceeds a sound pressure level of 70 dB (A) due to the type of mounting or pulse frequency.

- Reduce the sound pressure level by implementing sound damping and/or soundproofing measures.

When operated in the speed range from 0 to 5000 rpm, 1PH813 and 1PH816 motors can reach the following measuring-surface sound-pressure level L_{pA} in accordance with DIN EN ISO 1680:

Table 2- 2 Measuring-surface sound-pressure level for 1PH813

Cooling method	Measuring-surface sound-pressure level L_{pA} (1 m) at rated load and 4 kHz rated pulse frequency
Forced ventilation[1)]	70 dB(A) + 3 dB tolerance
Water-cooled	68 dB(A) + 3 dB tolerance

1) External fan operation 50 Hz

Table 2- 3 Measuring-surface sound-pressure level for 1PH816

Cooling method	Measuring-surface sound-pressure level L_{pA} (1 m) at rated load and 4 kHz rated pulse frequency
Forced ventilation[1)]	73 dB (A) + 3 dB tolerance
Water-cooled	69 dB (A) + 3 dB tolerance

1) External fan operation 50 Hz

The motors are certified for a wide range of installation and operating conditions. These conditions such as rigid or vibration-isolated foundation design influence noise emission, sometimes significantly.

2.3 Rating plate data (type plate)

The nameplate (rating plate) shows the technical specifications for the supplied motor.

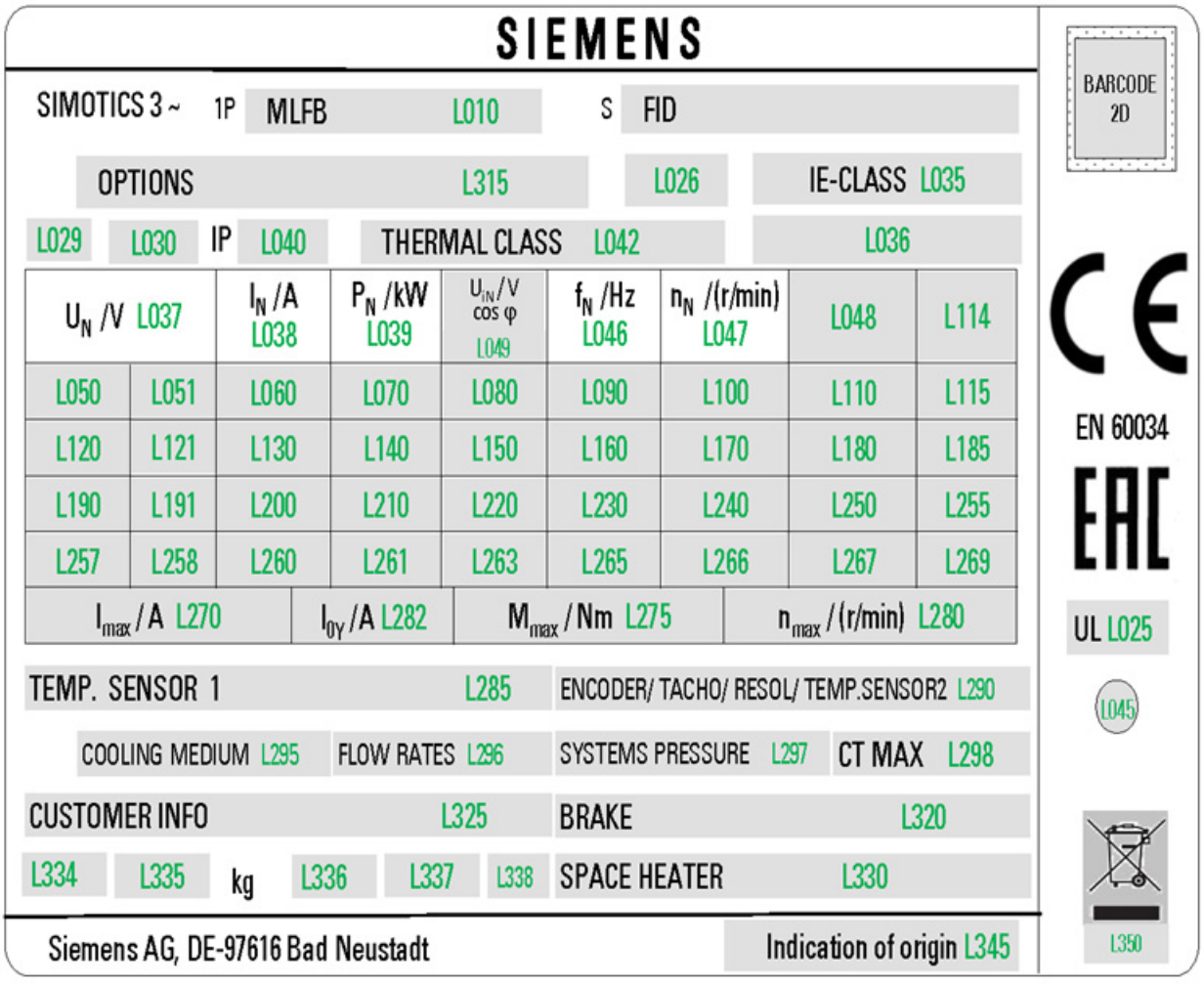


Figure 2-2 Nameplate layout for 1PH808 to 1PH816

Table 2- 4 Elements on the rating plate

No.	Description	No.	Description
L010	Article No. (MLFB)	L190	Rated voltage U_N (3)
L025	UL mark	L191	Connection method (3)
L029	Type of construction	L200	Rated current I_N (3)
L030	Type of construction	L210	Rated power P_N (3)
L035	Efficiency rating/ IE class (for reluctance motors only)	L220	cos φ (3)
L037	Rated voltage U_N	L230	Rated frequency f_N (3)
L038	Rated current I_N	L240	Rated speed n_N (3)
L039	Rated power P_N	L250	Operating mode (3)
L040	Degree of protection	L255	Motor code (3)
L042	Thermal class	L257	Rated voltage U_N (4)
L045	Balancing code	L258	Connection method (4)
L046	Rated frequency f_N	L260	Rated current I_N (4)
L047	Rated speed n_N	L261	Rated power P_N (4)
L048	Operating mode	L263	cos φ (4)
L049	for synchronous motors: induced voltage U_{IN} at rated speed	L265	Rated frequency f_N (4)
	for induction motors: cos φ	L266	Rated speed n_N (4)
	for reluctance motors: cos φ	L267	Operating mode (4)
L050	Rated voltage U_N (1)	L269	Motor code (4)
L051	Connection method (1)	L270	Maximum current I_{max}
L060	Rated current I_N (1)	L275	Maximum torque M_{max}
L070	Rated power P_N (1)	L280	Maximum speed n_{max}
L080	cos φ (1)	L282	Motor stillstand current
L090	Rated frequency f_N (1)	L285	Temperature sensor
L100	Rated speed n_N (1)	L290	Encoder/Tacho/Resolver/Temp.sensor
L110	Operating mode (1)	L295	Cooling medium
L114	Motor code	L296	Flow rate l/min (m^3/s)
L115	Motor code (1)	L297	System pressure
L120	Rated voltage U_N (2)	L298	Maximum coolant temperature
L121	Connection method (2)	L315	Options: Z-options
L130	Rated current I_N (2)	L320	Options II: Brake
L140	Rated power P_N (2)	L325	Optional customer information
L150	cos φ (2)	L330	Space heater
L160	Rated frequency f_N (2)	L334	Weight
L170	Rated speed n_N (2)	L335	Weight
L180	Operating mode (2)	L345	Indication of origin
L185	Motor code (2)	L350	WEEE mark

2.4 Design

2.4.1 Types of construction

The motor can have the following types of construction:

Table 2- 5 Types of construction

Motor	Types of construction
1PH813	IM B3 (IM V5, IM V6, IM B6, IM B7, IM B8)
	IM B5 (IM V1, IM V3)
	IM B35 (IM V15, IM V35)
1PH816	IM B3 (IM V5, IM V6, IM B6, IM B7, IM B8)
	IM B5 (IM V1, IM V3)
	IM B35 (IM V15, IM V35)

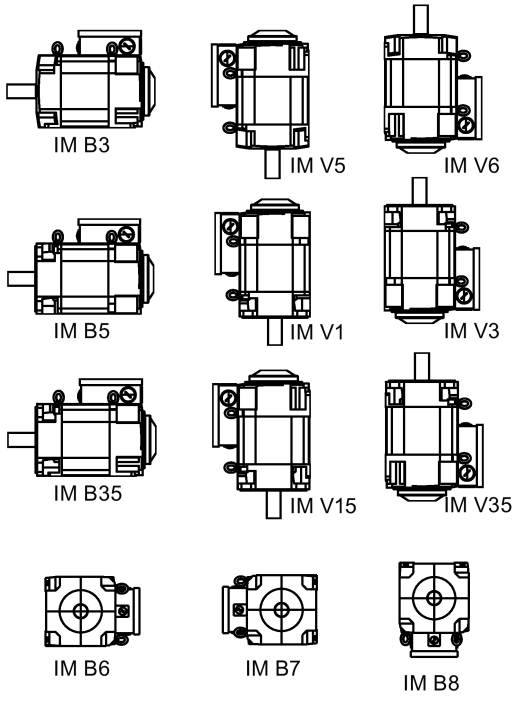


Figure 2-3 Types of construction

Two lifting eyebolts, which can be screwed onto the motor in accordance with its type of construction, are supplied with the motor for transportation purposes.

2.4.2 Cooling

Forced ventilation

This cooling method is realized using a separate ventilation module equipped with a fan (external fan) that operates independently of the motor.



NOTICE

Risk of overheating if external cooling is inadequate

If the external fan fails or the motor is operated for a short time without forced ventilation, this can cause it to overheat. Overheating can cause failures and shorten the service life of devices/systems.

- Always operate the motor together with an external fan.

⚠WARNING

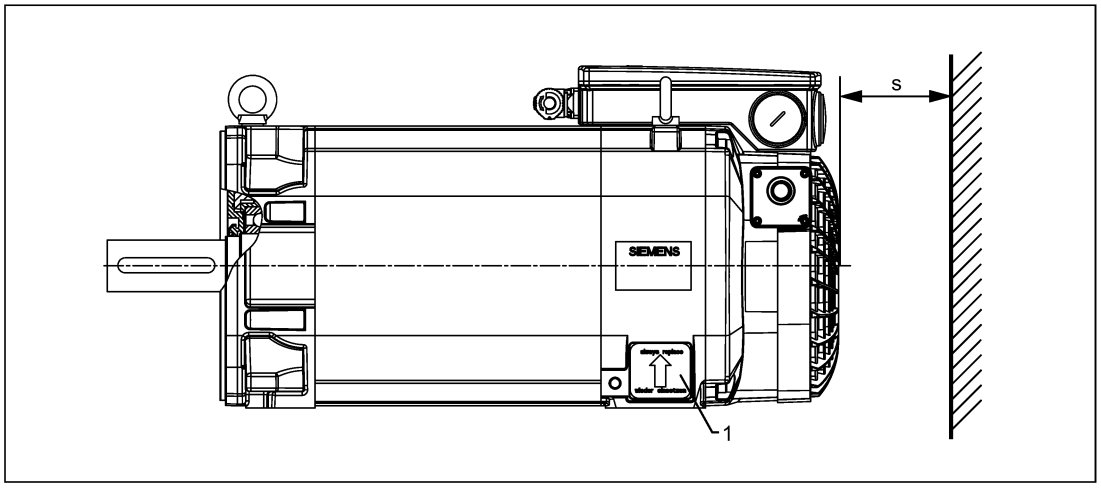
Danger to life caused by fire if ventilation clearances are inadequate

Inadequate ventilation/cooling clearances can result in overheating and fire. Overheating can cause failures and shorten the service life of devices/systems.

- Ensure compliance with the specified minimum clearance as ventilation/cooling clearance for the particular motor.

The motors must be arranged in such a way that the cooling air can flow in and out without obstruction and that the minimum distance (s) between the inlet/outlet air openings and adjacent components is maintained (see "Minimum distance" diagram below). Steps must be taken to ensure that hot discharged air cannot be drawn back into the system.

The covers (Pos. 1 in "Minimum distance" diagram below), which were removed to allow the motors to be secured, must be reattached before the system is commissioned. The arrow must point upwards.



s A minimum clearance of 60 mm applies to 1PH813.
A minimum clearance of 80 mm applies to 1PH816.

1 Cover for NDE mounting foot

Figure 2-4 Minimum distance (s)

Water cooling

The motor can only be operated in a closed cooling-water circuit with a heat-exchanger unit. The motor is connected to the cooling circuit by means of two female threads on the rear of the motor. The operator can decide on the best method of connecting the inlet and outlet.

Table 2- 6 Technical data relating to water cooling

Cooling water connection	G3/8" for 1PH813 G1/2" for 1PH816
Cooling water flow	12 l/min for 1PH813 15 l/min for 1PH816
Max. pressure at inlet	max. 6 bar
Pressure loss between inlet and outlet	< 0.9 bar for minimum cooling water flow with 1PH813 < 0.2 bar for minimum cooling water flow with 1PH816
Maximum cooling water inlet temperature, without derating	≤ 30 °C, higher values will result in derating

Note

Cooling water inlet temperature

Select the cooling water inlet temperature so that condensation does not form on the surface of the motor.

Cooling water temperatures that are lower than the ambient temperature tend to result in increased water condensation. The difference between the cooling water inlet temperature and the ambient temperature depends on the relative humidity. For example, 50% humidity at 40 °C ambient temperature corresponds to a temperature difference of 10 K:
$T_{cool} > T_{ambient}$ – temperature difference

Further, you must also shutoff the flow of cooling water when the motor is not operational for prolonged periods of time.

Only water enriched with appropriate quantities of additives to protect against corrosion and minimize the growth of algae can be used as a coolant. Other coolants (e.g. cooling-lubricating medium, water-oil mixtures with 10% oil and higher) can lead to derating.

If there is a risk of frost, preventive measures must be taken during operation, storage, and transportation (anti-freeze, emptying and blowing out with air, etc.). Use and concentration of the anti-freeze according to the manufacturer's data (max. 25%). Different anti-freeze agents should not be mixed.

A filter (100 µm) must be installed in the inlet pipe to protect the motor against pollution. Additional protection for the motor must be provided by means of a pressure relief valve installed downstream from the filter.

Pipes and valves can be made out of stainless steel or plastic. If different materials are used in close proximity to each other, however, the electrochemical series must be taken into account, which is why zinc must not be used in cooling water circuits.

If a throttle is needed to restrict the flow, it is best to install it downstream of the motor. It must not be installed directly in front of the inlet because the effects of cavitation may damage the motor.

The values specified for the cooling water (refer to the following table) correspond to the requirements of closed cooling circuits. Not all of the specified concentrations will occur in the cooling water at the same time.

Table 2- 7 Cooling water specifications

Component	**Quality of the water used as coolant for motors with stainless steel tubes + cast iron or steel jacket**
pH value	6 ... 9
Total hardness	< 170 ppm
Electrical conductivity	< 500 µS/cm
Chloride ions	< 40 ppm, can be achieved by adding deionized water.
Sulfate ions	< 50 ppm
Nitrate ions	< 50 ppm
Dissolved solids	< 340 ppm
Maximum particle size	< 100 µm
Operating pressure	< max. 6 bar
Pressure drop at V(N)	< 1 bar
Inlet temperature	< 30 °C
Anti-freeze protection / corrosion protection	20 ... 30%
NALCO 00GE056 inhibitor	0.2 ... 0.25%

Note

Storing or transporting the motor

The cooling circuit must be emptied when storing the motor, when the motor is out of service for a long period, and when the motor is being transported.

2.4.3 Holding brake (option)

2.4.3.1 Properties

Operation with holding brake on the SINAMICS S

The SINAMICS S drive system has various types of brake control. A detailed description of the individual functions and corresponding parameter assignment information can be found in the following manuals:

- SINAMICS S120 Function Manual (6SL3097-4AB00-0□P□) Chapter 6.14
- SINAMICS S120/S150 List Manual (6SL3097-4AP00-0□P□) Chapter 2.12

Information on the current carrying capacity for the brake outputs/adapters of the individual SINAMICS power units can be found in the corresponding manuals. Control of the brake via additional switching elements may be required.

Make sure the parameter assignments for the brake data in the SINAMICS are correct. This is particularly important for the setting values:

- Maximum motor speed (reduced value for the "holding brake" option)
- Release and engaging times of the holding brake
- Moment of inertia of the holding brake

The corresponding setting values are listed for the specific brakes in the "Technical data of the holding brake" table.

Functional principle of the holding brake

A brake can be mounted at the DE side of 1PH8 motors, shaft heights 132 and 160.

These brakes are electromagnetic units for dry-running operation. An electromagnetic field is used to release the brake which is applied using spring force. They function according to the closed-circuit principle, i.e. the spring-applied brake is triggered when the current is interrupted and holds the drive. When power is applied to the brake, it is released and the drive is free to rotate.

When the power fails or an emergency stop is issued, the drive is braked from its actual speed down to standstill.

Connection of the brakes (must be provided by the customer)

- Alternating voltage 230 V AC, 50 ... 60 Hz
- DC voltage of 24 V DC

Ambient temperature

The brake module is designed for an ambient temperature of -5 °C to +40 °C. At temperatures below -5 °C and longer periods without power being applied to the brake, then it cannot be excluded that the friction disk freezes. In this case, special measures must be applied after first contacting the manufacturer.

Note

Restricted maximum motor speed for a motor equipped with brake

The maximum speed of a motor with brake is limited to the maximum speed of the brake (see $n_{max, Br}$ speed specified in the characteristic curves).

Note

Selection and ordering data

The selection and ordering data can be found in the Configuration Manual "SIMOTICS M-1PH8 main motors", Chapter "Selection and ordering data".

Note

Disclaimer of liability

The customer is responsible for choosing of contactors.

Technical data of the holding brakes

Shaft height	Motor type	Brake type	Holding torque	Maximum speed	Moment of inertia	Weight	Supply current		Permissible single switching energy	Total moment of inertia (Emergency stop)	Speed (emergency stop)	Number of emergency stops [1]	Opening time	Closing time [2]
							230 V AC ±10%	24 V DC ±10%						
			in Nm	n_{max} / rpm	J_{Br} / kgm²	$m_{Br.}$ / kg	in A	in A	W_E / KJ	J_{tot} / kgm²	n / rpm	z	t_0 / ms	t_{c1} / ms
132	1PH813□	Size 24	140...310	4500	0.0141	46	1.7	6.9	16	0.218	3600	2000	650	1000 (100)
160	1PH816□	Size 29	280...500	4000	0.0266	66	1.9	6.7	24	0.456	3100	2000	750	1100 (150)

1) Max. 3 switching operations per hour.
2) Closing time at 230 V AC. Time in bracket refers to the reduced closing time at DC power supply.

Figure 2-5 Technical data of the mounted holding brake (DE) with emergency stop function

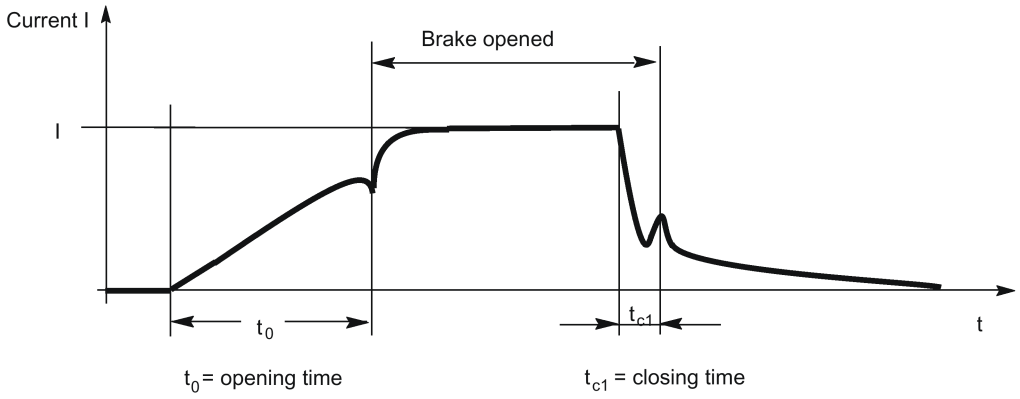


Figure 2-6 Terminology (time) for holding operation

Explanation of terminology in the table

Holding torque in Nm: on motors with shaft heights 100 ... 160, the holding torque can be continuously set in the specified value range using an adjusting ring. The dynamic braking torque is approximately 70% of the set holding torque.

Maximum speed n_{max} / rpm: Maximum permissible speed.

Perm. single switching energy W_E / kJ: Permissible operating energy during an emergency stop,
$W_E = J_{total}$. x $n^2/182.4 \times 10^{-3}$ (J in kgm^2, n in rpm)

Lifetime switching energy W_{max} / MJ: Max. possible switching energy of the brake (for emergency stop) until the friction disk has to be replaced, $W_{max} = W_E \times z$.

Number of emergency stops z: The specified number of emergency stops refers to the specified conditions. A conversion can be made for operation under different conditions: Number of emergency stops $z = W_{max}/W_E$

Coil current in A: Current to release the brake.

Opening time t_0 / ms: Separating time until the brake releases (the specified values refer to the maximum braking torque and rated voltage).

Closing time t_{c1} / ms: Connecting time until the brake engages according to the diagram "Terminology (time) for holding operation." (The values refer to the maximum braking torque and rated voltage.)

Use for the intended purpose

"Spring-applied single-disk brake modules" are for mounting on induction or synchronous motors and intended for use in commercial or industrial systems. It is prohibited to use the brake in hazardous areas and zones or areas with firedamp. The externally mounted spring-applied single-disk brake (electromagnetically released system) is designed as a holding brake. Occasional emergency stop operations are possible.

⚠WARNING

Danger to life when incorrectly using the holding brake

If you incorrectly use the holding brake, e.g. you use it as safety brake, this can lead to severe accidents with personal injury and/or material damage.

- Depending on the particular application, observe the corresponding accident prevention regulations.

NOTICE

Irreversible reduction of the braking effect

The braking effect can be irreversibly reduced if you do not observe the permissible number of braking operations per hour and/or the maximum permissible operating energy per hour. Further, this can have a negative impact on the function of the holding brake.

- When setting up machines and systems (when using the jog mode), observe the information provided in the Table "Technical data of holding brakes".
- The holding brake can be equipped with a manual release to remove the holding torque.

NOTICE

Inadvertent actuation of the holding brake

Material damage can occur if you inadvertently actuate (release) the holding brake.

- Secure the holding brake against inadvertent actuation and misuse. The mechanical manual brake release must always be in the center position when not actuated (see the diagram “Spring-applied single-disk brake module"). Only then is the brake completely engaged, and it is ensured that the spring-applied single-disk brake module can provide its full braking effect.
- You can remove the manual release lever. Observe the specific system-related regulations, e.g. in the crane construction area relating to whether manual release is permissible.
- The rated operating conditions refer to DIN VDE 0580: 1994-10. The degree of protection refers to DIN VDE 0470, part 1. Coordinate possible special measures with the manufacturer if deviations exist.

Note

Special measures

Ask the manufacturer for support when already designing the plant or system if you find references to special measures and/or it is necessary to contact the manufacturer.

See also

Note regarding a holding brake (Page 117)

2.4.3.2 Mounted holding brake for SH 132 and SH 160

Mounting the holding brake (option) is described in the Appendix "Holding brake operating instructions".

Note

Radial and axial forces

The specifications for the "standard" bearing version apply for the permissible radial and axial forces.

(Refer to the Configuration Manual "SIMOTICS M-1PH8 main motors")

See also

Note regarding a holding brake (Page 117)

Operating Instructions for the holding brake (Page 118)

Preparations for use 3

3.1 Shipment and packaging

Checking the delivery for completeness

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

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

These safety instructions are part of the scope of supply; keep them in a location where they can be easily accessed.

The additional rating plate supplied separately with the consignment is intended as a means of displaying the motor data in the vicinity of the motor.

The rating plate is supplied separately, and for

- motors with terminal boxes, it is inside the terminal box;
- motors with connectors, it is included with the safety data sheet.

3.2 Transportation and storage

⚠WARNING

Danger to life when lifting and transporting

Improper lifting and transport procedures, unsuitable or damaged lifting gear and load handling equipment can cause death, severe injury and/or material damage.

- Only use suitable and intact lifting gear and load handling equipment which comply with the specific national regulations.
- Only use lifting gear and load handling equipment which are suitable for the weight of the motor. The weight of the motor appears on the rating plate.
- Do not attach any additional loads to lifting gear and load handling equipment.
- Only use suitable strap-guiding systems rope guides and spreading devices for lifting and transporting the motor.

⚠WARNING

Danger to life as a result of incorrect transport and/or lifting of the motor

Incorrectly transporting and/or lifting the motor can lead to severe injuries and/or material damage. For instance, the motor can fall.

- Only lift the motor using the lifting eyebolts on the bearing end shields.
- Use all of the lifting eyebolts when transporting.
- Do not attach a lifting eyebolt to the shaft extension.
- Never lift the motor using the Sensor Module or the cooling water pipe system.
- Use a crossbeam if you lift and/or transport the motor using the eyebolts provided (according to DIN 580). Note the following:
  - Completely screw in the eyebolts (lifting eyebolts) and tighten by hand, approx. 8 Nm. Do not overtighten the eyebolts.
  - Do not remove the pressboard washers and do not use deformed or damaged eyebolts.
  - Loads that run transverse to the ring plane are not permitted.
  - If the motor is installed with the shaft extension pointing downwards or upwards, the lifting eyebolts must be changed over as indicated in the following diagrams showing the arrangement of the eyebolts.

3.2.1 Transporting

Information will be provided in this chapter on how to correctly lift and transport the motors.

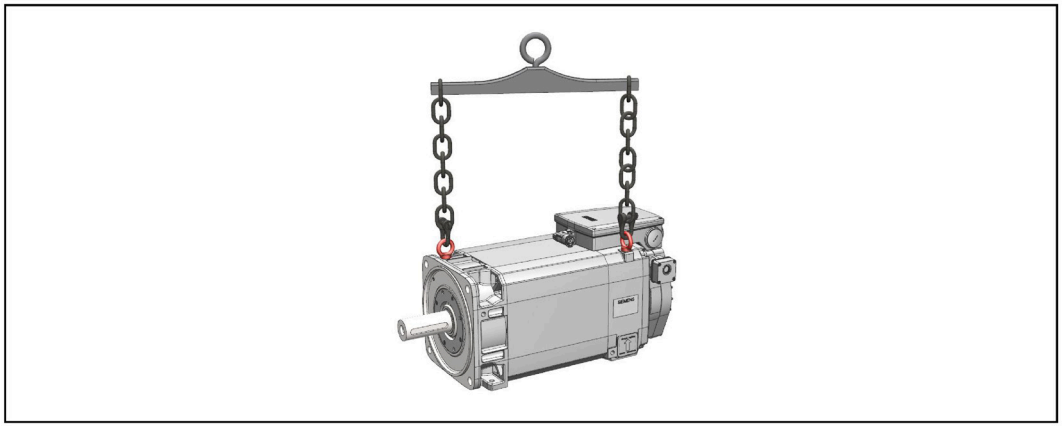
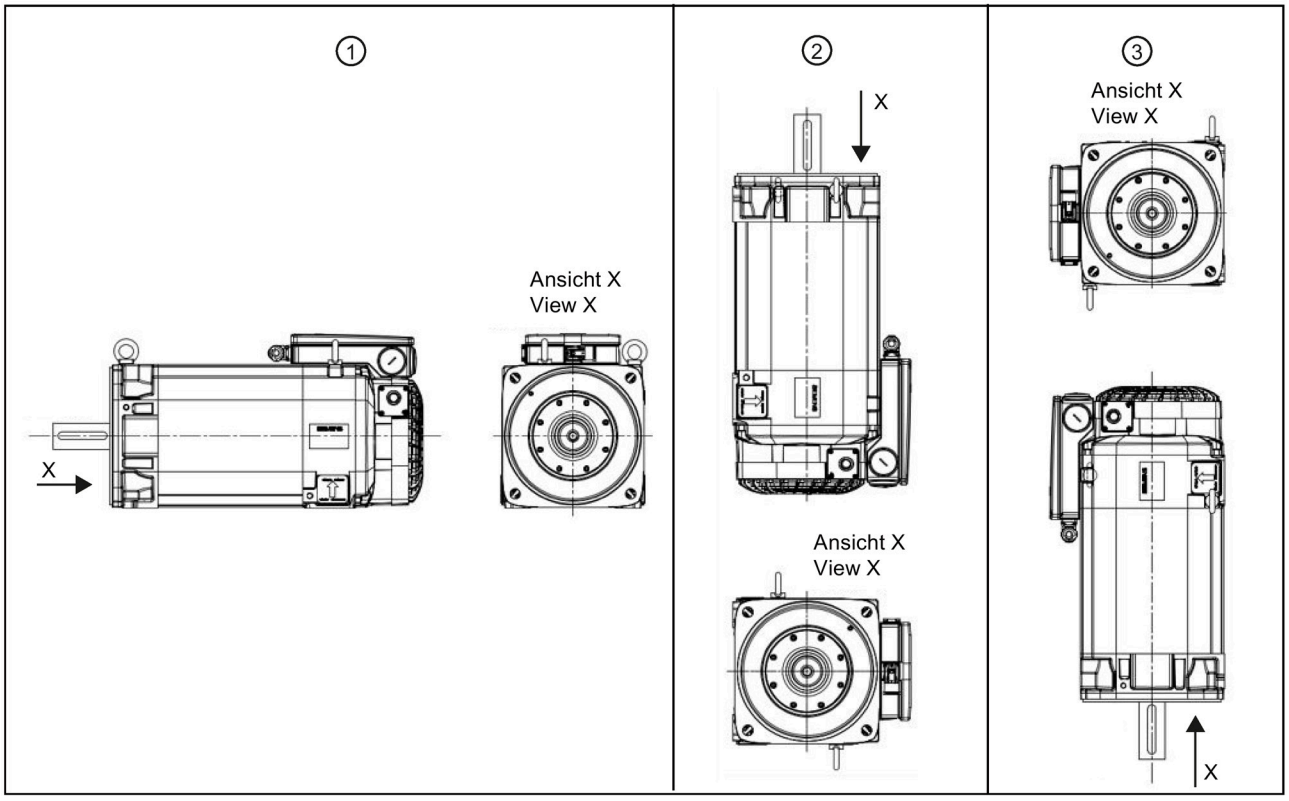


Figure 3-1 Lifting and transporting the motor with a cross beam (example)



① Horizontal shaft extension (standard)
② Shaft extension pointing upwards
③ Shaft extension pointing downwards

Figure 3-2 Location of the lifting eyebolts on 1PH813 and 1PH816

Transporting a motor that has already been in operation

Procedure

If you want to transport a motor that has already been in operation, proceed as follows:

1. Allow the motor to cool down.
2. Remove the connections provided by the customer.
3. Empty the motor of any cooling water and purge it carefully with air.
4. Always transport and lift the motor by the lifting eyebolts on the bearing end shields.

❒

3.2.2 Storage

Note

Replacing roller bearings

- Even if the motor was stored for more than three years under favorable conditions (i.e. in a dry, dust-free room that is not susceptible to vibration), you must replace the bearings.
- If the motor was stored under unfavorable conditions, you must replace the bearings after approx. 18 months.

NOTICE

Seizure damage to bearings

If the motors are stored incorrectly, bearing seizure damage can occur (e.g. brinelling) as a result of vibrations.

- Observe the instructions for putting into storage.

The motors can be stored for up to two years in a dry, dust-free room that is not susceptible to vibration (v_{eff} < 0.2 mm/s) without the specified storage time being reduced.

Storing indoors

- Apply a preservation agent (e.g. Tectyl) to bare, external components (e.g. shaft extensions) if this has not already been carried out in the factory.
- Store the motor in an area that fulfills the following requirements:
  - Dry, dust-free, frost-free and vibration-free. The relative air humidity should be less than 60% and the temperature should not drop below -15 °C in accordance with EN 60034-1.
  - Well ventilated
  - Offers protection against extreme weather conditions
  - The air in the storage area must not contain any harmful gases.
- Protect the motor against shocks and humidity.
- Make sure that motor is covered properly.
- Avoid contact corrosion. You are advised to rotate the shaft extension manually every three months.

Protection against humidity

If a dry storage area is not available, the following measures must be taken:

- Wrap the motor in humidity-absorbent material and then wrap it in film so that it is air tight.
- Include several bags of desiccant in the seal-tight packaging. Check the desiccant and replace as required.
- Place a humidity meter in the seal-tight packaging to indicate the level of air humidity inside it.
- Inspect the motor on a regular basis.

Long-term storage

If you intend to place the motor in storage for longer than six months, you must check its condition every six months.

- Check the motor for any damage.
- Carry out any necessary maintenance work.
- Document all preservation measures taken so that they can be reversed before the machines are recommissioned.
- Control the climate in the storage room if the conditions for storage cannot be complied with.
- Rotate the shaft extension by hand.

Protecting the cooling-water system

When the units are delivered, the stainless steel/cast iron cooling-water pipe system is not filled with cooling water.

- When you place the motor in storage after use, drain the cooling water ducts and purge them with air so that they are completely empty.

Mechanical mounting

4

4.1 Installation

NOTICE
Thermal damage to temperature-sensitive parts Some parts of the motor enclosure can reach temperatures that exceed 100°C. If temperature-sensitive parts, e.g. electric cables or electronic components are in contact with hot surfaces, they can be damaged. • Ensure that no temperature-sensitive parts are in contact with hot surfaces.

NOTICE
Damage to the motor caused by incorrect installation Blows and pressure to the shaft extension can damage the motor. • When installing and mounting the motor ensure that the shaft extension is neither subject to any blows nor to any pressure.

Note

Technical data on the motor enclosure

- Observe the technical data on the rating plate (type plate) on the motor enclosure.

Notes on installing the motors

- Observe the type of construction and degree of protection stamped on the rating plate and check that they comply with the conditions at the installation location.
- Refer to the configuration manual for the permissible radial and axial forces.
- Check that they match the conditions (temperature, installation altitude) at the installation location.
- Ensure that the end of the shaft is completely free of any anti-corrosion protection (use a commercially available solvent).
- Ensure that the flange or mounting foot has even contact with the mounting surface. No stress or strain is permissible.
- If the motor is installed vertically with the end of the shaft facing up, ensure that no liquid can enter into the upper bearing.
- Rotate the output elements by hand. If you hear any grinding noise, rectify the cause or contact the manufacturer.

- Make sure that you either tighten or remove eyebolts that have been screwed in after installation.
- Make sure that you install air-cooled motors in such a way that the cooling air can flow in and out without any obstruction and that the minimum distance s is maintained between the air inlet and discharge openings and adjacent components (see "Minimum distance" diagram in "Cooling" section). It is not permissible that the hot air is drawn-in again.

Note

Covers attached to the motor

- You must remount the covers for air-cooled motors, which were removed to allow the motors to be secured, before commissioning.

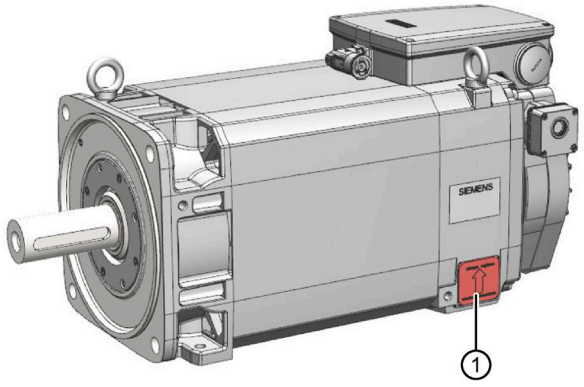


Figure 4-1 Cover for foot mounting ① at NDE (example)

4.2 Mounting

To ensure smooth, vibration-free operation, the foundation must be designed in accordance with DIN 4024, the motor must be precisely aligned, and the components to be mounted on the shaft extension must be correctly balanced.

Mounting the motor using its motor feet (foot mounting)

The contact surfaces of the motor feet must lie on one plane.

1PH motors in type of construction IMB3 or IMB35 (with mounting feet) must be mounted on flat surfaces with a planeness specification of ≤ 0.15 mm.

If the motor needs to be aligned, locate metal shims below the motor feet in order to prevent the motor from being subject to any strain. The number of shims should be kept as low as possible i.e. stack as few as possible.

Mounting using the motor flange (flange mounting)

Note

Flange mounting

When the motor is flange-mounted, this creates a system that is capable of oscillation with specific natural mounting frequencies. In operation, this can result in excessive vibration. To counter this, additional support can be provided at the NDE. Ensure that the motor is not subject to excessive tension.

Tightening torques for foot/flange mounting

Table 4- 1 Tightening torques 1PH813

Retaining type	Screw	Washer ISO 7092	Tightening torque ± 10% in Nm
Foot mounting	M10	10 (d2 = 18)	42
Flange mounting	M16	16 (d2 = 28)	165
Depending on the installation space, corresponding screws must be used. Use screws of property class 8.8 or higher.			

Table 4- 2 Tightening torques 1PH816

Retaining type	Screw	Washer ISO 7092	Tightening torque ± 10% in Nm
Foot mounting	M12	12 (d2 = 20)	70
Flange mounting	M16	16 (d2 = 28)	165
Depending on the installation space, corresponding screws must be used. Use screws of property class 8.8 or higher.			

Alignment accuracy for coupling output

The maximum permissible concentricity deviation of the shafts of the motor and the driven machine is 0.05 mm in the diameter.

4.3 Attaching the output elements

Balancing

The rotors are balanced dynamically. The motors are equipped with a smooth shaft as standard. For shaft extensions with feather keys, the balancing method at the DE of the shaft is indicated as follows:

- "H" means half feather key = balancing with a half feather key
- "F" means fullkey = balancing with a whole feather key

Attaching the output elements

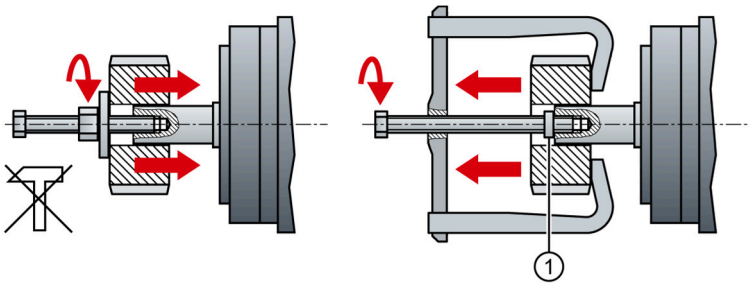
- Make sure that the balancing method of the output element is correct! The output elements must be balanced to balance quality grade G2.5 to ISO 1940. Rotary forces that exceed this are not permissible. Note that rotary forces can also occur with coupling output.
- If the output element is shorter than the feather key with balancing method "H", the section of the feather key that protrudes from the shaft contour and output element must be removed to maintain the balance quality.
- Fit/remove the output elements only by means of suitable equipment:
  - Use the threaded hole in the shaft extension (front).
  - If necessary, heat up the output element.
  - When removing output elements, use a washer to maintain the centering in the shaft extension.

⚠ WARNING

Danger to life if rotating output elements have no guard

Exposed rotating output elements can result in severe injury.

- Cover all exposed output elements using an appropriate guard.



① Intermediate washer (for maintaining the centering in the shaft extension)

Figure 4-2 Mounting/removing output elements

Motor without output element

⚠ WARNING

Danger to life if feather keys are flung out

The feather key in a shaft is only secured during transport to prevent it from falling out. An open feather key sitting in the shaft will be flung out in operation.

Death or serious injury can result.

- Remove an open feather key sitting in the shaft, or secure it so that it cannot be flung out.

4.4 Vibration stressing

The on-site mechanical system vibration characteristics depend on factors such as the output elements, mounting situation, alignment, installation, and external vibration and can increase the level of motor vibration.

Under certain circumstances, the rotor may have to be balanced completely with the output element.

To ensure problem-free operation and a long service life, the vibration values specified to ISO 10816 must not be exceeded at the defined measuring points on the motor.

Table 4- 3 Max. permissible radial vibration values [1)]

Vibration frequency	Vibration values
< 6.3 Hz	Vibration displacement s ≤ 0.16 mm
6.3 ... 250 Hz	Vibration velocity v_{rms} ≤ 4.5 mm/s
> 250 Hz	Vibration acceleration a ≤ 10 m/s²

1) Both values must be maintained simultaneously.

Table 4- 4 Max. permissible axial vibration values[1)]

Vibration velocity	Vibration acceleration
v_{rms} = 4.5 mm/s	a_{peak} = 2.25 m/s²

1) Both values must be maintained simultaneously.

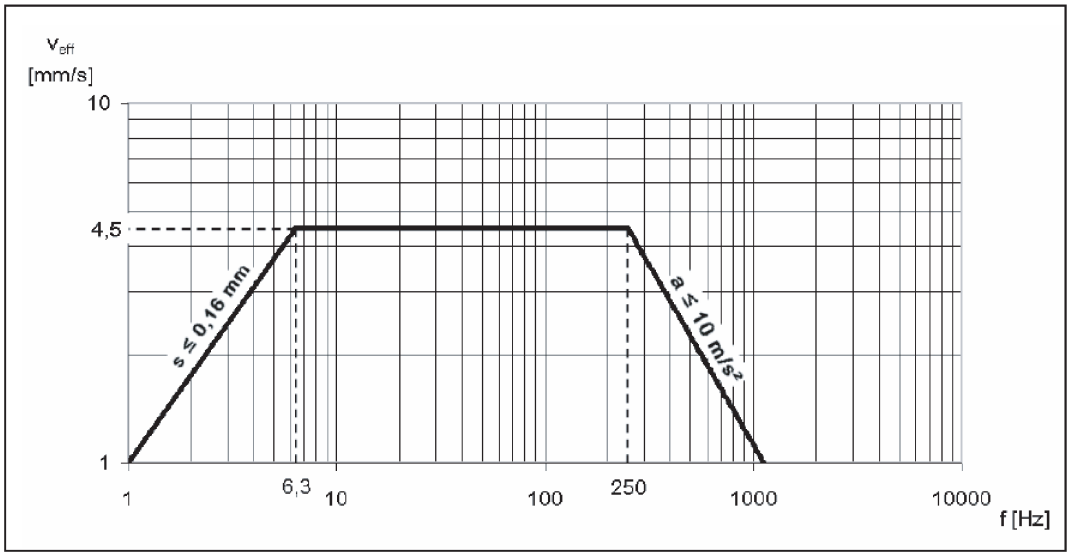


Figure 4-3 Max. permissible vibration velocity, taking into account the vibration displacement and vibration acceleration

To measure the vibration velocity, the measuring equipment must fulfill the requirements of ISO 2954. The vibration acceleration must be measured as a peak value in the time range in a frequency band of 10 to 2000 Hz.

If appreciable vibration excitation in excess of 2000 Hz (e.g. gear teeth meshing frequencies) can be expected, the measurement range must be adapted accordingly. This does not alter the maximum permissible values.

4.5 Mounting of rotating unions on 1PH8 hollow-shaft motors

General information

1PH8 main motors with a hollow shaft (13th position in the Article No.: " 3 ") are designed as main spindle motors for machine tools and machining centers with internal tool cooling. A rotating union is required for the provision of the coolant in the rotating motor shaft. A rotor-supported or, for a motor ordered with option Y64, a bearingless, frame-supported rotating union can be mounted on the NDE shaft extension. In addition to coolant, suitable rotating unions can also transfer oil mist (minimum quantity lubrication), cutting oils or even compressed air at standstill.

Rotor-supported rotating unions consist of the following components:

- Rotor with bearing
- Stator
- Enclosure with cable connections
- Floating-ring shaft seal

Rotor-supported rotating unions are easy to fit and change. They are screwed into the motor shaft via the thread on the rotor. The advantage of these rotating unions is the leading off of the leakage via the housing and the integrated leakage connection.

Bearingless, frame-supported rotating unions are made up of two separate parts, the rotating part with a mechanical seal and the static part with a mechanical seal and supply connection. By eliminating the bearings, higher speeds can be achieved and the rotating union is less sensitive to vibrations and lateral loads. However, an adapter such as is described in Ch. "Suggestion for an adapter for bearingless, frame-supported rotating unions" for installing the rotating union is required.
Installation must be performed very carefully because the sealing surfaces of the mechanical seal are not protected.

The rotating part is bolted into the NDE end of the motor shaft. The static part is mounted on the encoder cover of the motor via an adapter. The adapter must include a facility for draining leakage. The adapter must be designed in such a way that the motor is not flooded by the leakage and the degree of protection of the motor is complied with. It may be necessary to use sealing air.

For use of a bearingless rotating union, the motor must be ordered with option Y64 and the interface on the encoder cover must be located concentrically with respect to the shaft. The mounting conditions stated by the manufacturer of the rotating union must be met.

Depending on the type of rotating unions, the sealing rings may be permanently or temporarily in contact.

Example of a closed seal: DEUBLIN series 1116 and 1108

Example of an opening seal: DEUBLIN series 902 and 1109

With opening seals, the sealing surfaces are separated when there is no coolant pressure, e.g. during a tool change. In this case, coolant runs out of the supply line and out of the motor shaft through the opened seal. This leakage and also the leakage due to wear of the sealing rings must be guided away via the leakage lines.

NOTICE

Motor failure due to incorrectly mounted leakage line

If the leakage line does not lead downward, the leakage can flood the rotating union and the motor. This can result in failure of the rotating union and motor.

To ensure the leakage is led away, the leakage line must always lead downward so that nothing can flow back.

- When mounting, ensure that the leakage line always leads downward.

NOTICE

Axial forces due to coolant pressure

Coolant under high pressure (usually 40 to 90 bar) flows via the mounted rotating union through the sequence of holes in the drive train:

- Rotating union
- Motor
- Spindle
- Tool.

Due to the different hole diameters and the gap, different cross sections (areas) occur along the coolant flow, which can produce axial forces due to the coolant pressure. These can be 4 to 12.7 N/mm^2, depending on the coolant pressure.

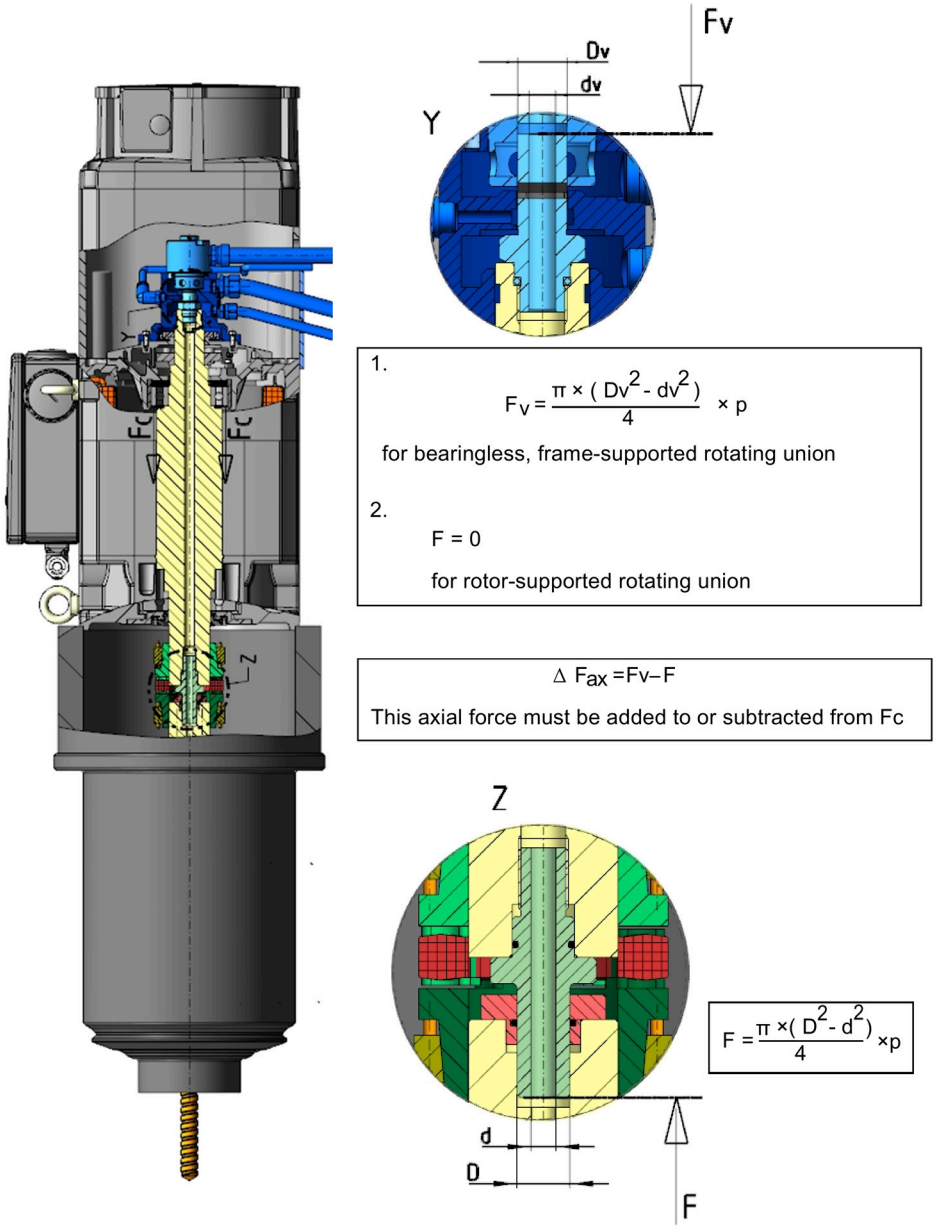


Figure 4-4 Mounting the rotating union

Figure "Mounting the rotating union," illustrates how an axial force arises due to joint pressure, for example, in the gap between the motor shaft (hole bolt) and the spindle shaft. This acts upon the motor shaft against the bearing preloading force F_c. This reduces or even eliminates the preloading force of the motor bearing.
For bearingless, frame-supported rotating unions, axial forces can also arise depending on the internal differing hole diameters. These act against the forces from the joint, so they have a smaller effect on the bearing preloading force. Ensure that the axial forces from the rotating union are greater than those from the joint (see case 1 in the graphic). This has the advantage that the bearing preloading force remains unchanged. The bearing preloading force is important for non-slip running of the motor bearing and must not be eliminated.

This advantage does not apply to rotor-supported rotating unions. It is important to ensure that the preloading force of the motor bearing is not eliminated (see figure "Mounting the rotating union" case 2). The axial force toward the motor must not be in the interval $F_{AZ} = F_c$ +/- 25% for horizontally mounted motors and $F_{AZ} = (F_c$ +/-25%) + FL for vertically mounted motors with the shaft extension pointing downward. For maximum permissible axial forces at the shaft extension, the specifications stated in Chapter "Radial and axial forces" apply. The axial forces that act in the rotating union must be requested from the manufacturer.

Hollow shaft version

Table 4- 5 Hollow shaft version

	1PH813□ ... 1PH816□
Thread on DE	M16 x 1.5-RH
Centering on DE	∅20H7
Thread on NDE	M16 x 1.5-LH
Centering on NDE	∅18 +0.007/-0.003
Through-hole	∅11.5
Key surface NDE	SW27

4.5.1 Rotor-supported rotating union

NOTICE
Leaks in the rotating union If there are leaks in the rotating union and the hoses, the motor may be flooded and fail! • Avoid leaks in the rotating union.

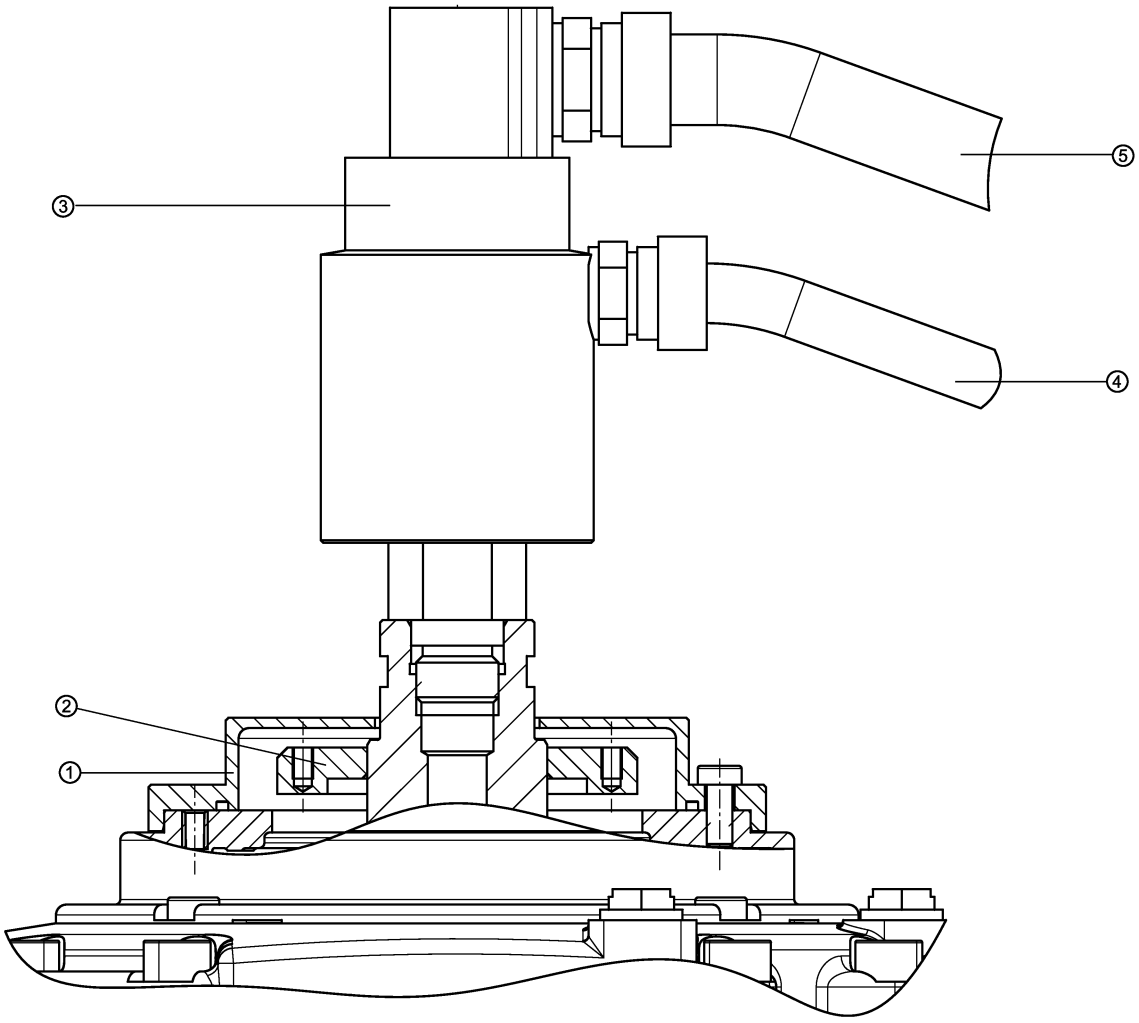
Note the following points when mounting the rotating union:

- When you mount the rotating union, pay attention to special aspects that differ between air-cooled and water-cooled motors.
- When installing the rotating union, observe the manufacturer's data.

Mounting on water-cooled motors

Water-cooled motors have a "2" in the 11th position in the Article No. With water-cooled motors, you can mount the rotating union directly on the motor. Use rotating unions with radial or axial connections.

Mounting rotor-supported rotating union on water-cooled motors



① Sealing cover
② Balancing disk
③ Rotor-supported rotating union, e.g. DEUBLIN 1109-020-188
④ Leakage hose
⑤ Inlet hose

Mounting on air-cooled motors

Air-cooled motors have a "0" or a "1" in the 11th position of the Article No. Air-cooled motors are equipped with an intermediate housing between the motor and the axially mounted fan. The intermediate housing is used to accommodate the rotating union.

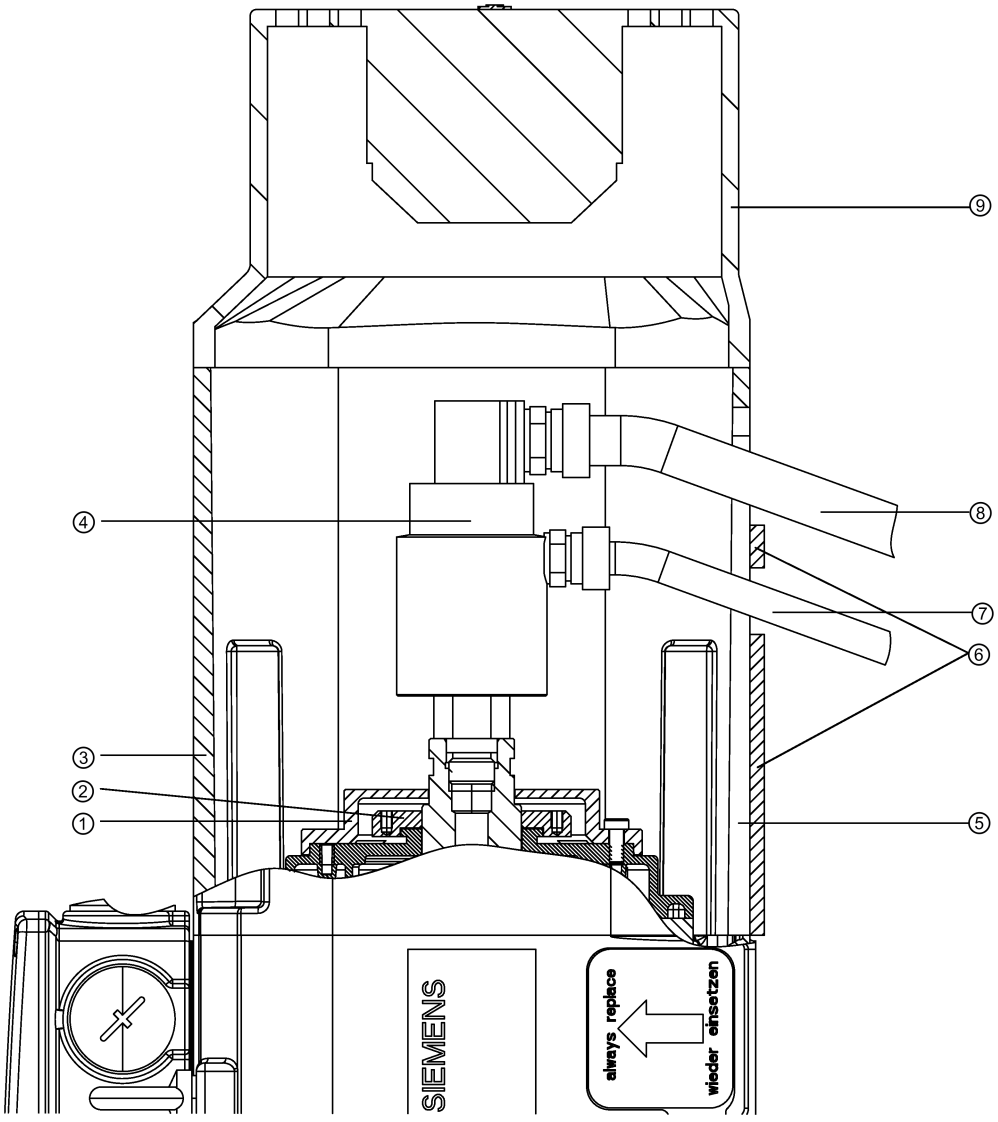
The intermediate housing is suitable for rotating unions with the following dimensions:

- Length up to 120 mm (without rotor connection thread and centering)
- Diameter up to 55 mm

Due to limitations of space, rotating unions with radial connections are advisable for air-cooled motors, e.g. DEUBLIN 1109-020-188.

Rotating unions with axial connections are not suitable!

Mounting rotor-supported rotating unions on air-cooled motors



① Sealing cover
② Balancing disk
③ Intermediate housing
④ Rotor-supported rotating union, e.g. DEUBLIN 1109-020-188
⑤ Cutout
⑥ Cover (openings for connections must be closed again)
⑦ Leakage hose
⑧ Inlet hose
⑨ Fan

Note

When air-cooled motors are connected, only rotating unions with a radial connection are used.

Mounting steps

Procedure

Note

Mounting steps for air-cooled motors

The mounting steps 1, 11, 12, 13, and 14 are only required for air-cooled motors.

1. Remove the fan and intermediate housing from the motor.
2. If necessary, perform complete balancing of the motor using the exterior balancing disks. To do this, remove the sealing cover.

   Note

   Sealing cover

   - Remount the sealing cover after balancing.
   - The sealing cover is required to comply with the degree of protection.

3. Attach hoses for the inlet and leakage to the rotating union. Use angle elements if necessary.

   Note

   Rotating union to be used

   - Use a rotating union with radial connections.

4. Screw the rotating union into the NDE motor shaft extension. Tighten the rotating union with the correct tightening torque. For this, use the wrench grip surface on the NDE motor shaft extension to hold the other side.
5. Position the rotating union horizontally in such a way that the leakage connection is at the lowest point.
6. Always connect the hose for leakage sloping downward at least 15°.
7. Also connect the hose for the inlet sloping downward.
8. If necessary, provide a ventilation hose for the leakage chamber. It equalizes the negative pressure caused by the fan. Lead the ventilation hose upward.
9. Manually check that the rotor turns easily.
10. Test the mounting under pressure for leaks.
11. Make a burr-free cutout in the intermediate housing for the inlet and leakage hoses.
12. Push the intermediate housing with the cutout over the hoses. Screw the intermediate housing onto the motor. Protect the hoses from mechanical stresses.
13. Screw the fan onto the intermediate housing.
14. Seal the remaining openings between the cutout and the hoses.

❒

4.5.2 Bearingless, frame-supported rotating union

The bearingless frame-supported rotating union cannot be mounted directly on the motor. An adapter is required for the static part of the rotating union. The adapter is not included in the scope of delivery and must be made by the customer to match the rotating union to be used.

Please follow the following design instructions:

- The adapter for holding the static part must be matched to the rotating union to be used. For this purpose, the dimensions of the manufacturer of the rotating union must be complied with. The adapter should be designed as shown in Chapter "Suggestion for an adapter for bearingless, frame-supported rotating unions".
- The gap between the adapter and the NDE shaft extension in the radial direction must be as small as possible (approx. 0.25 mm) and be as long as possible in the axial direction so that exiting coolant cannot penetrate the motor. The leakage connections must be as large as possible and must be provided at the lowest point in the leakage chamber. The leakage connection (G3/8") located nearest the static part of the rotating union is for draining leakage away during operation. The second leakage connection (G1/4") is a backup for draining away increased leakage due to faults.

NOTICE

Monitoring the backup line

To detect a fault in the rotating union in good time and to protect the motor from flooding, it is necessary to monitor the flow rate of the backup line.

- Make sure that a signal is output in the event of leakage.
- Make sure that the system (coolant supply) is switched off in case of a fault.

- The star-shaped drainage holes in the mounting surface with the encoder cover should be implemented as shown in Chapter "Suggestion for an adapter for bearingless, frame-supported rotating unions" so that no liquid can penetrate the motor through the labyrinth seal between the encoder cover and the balancing disk. If the motor is mounted vertically, all 6 drainage holes should be opened; if the motor is mounted horizontally, it is enough to open the two lower drainage holes.

Note

It is advantageous to provide a sealing air connection to protect the motor from penetration of coolant.

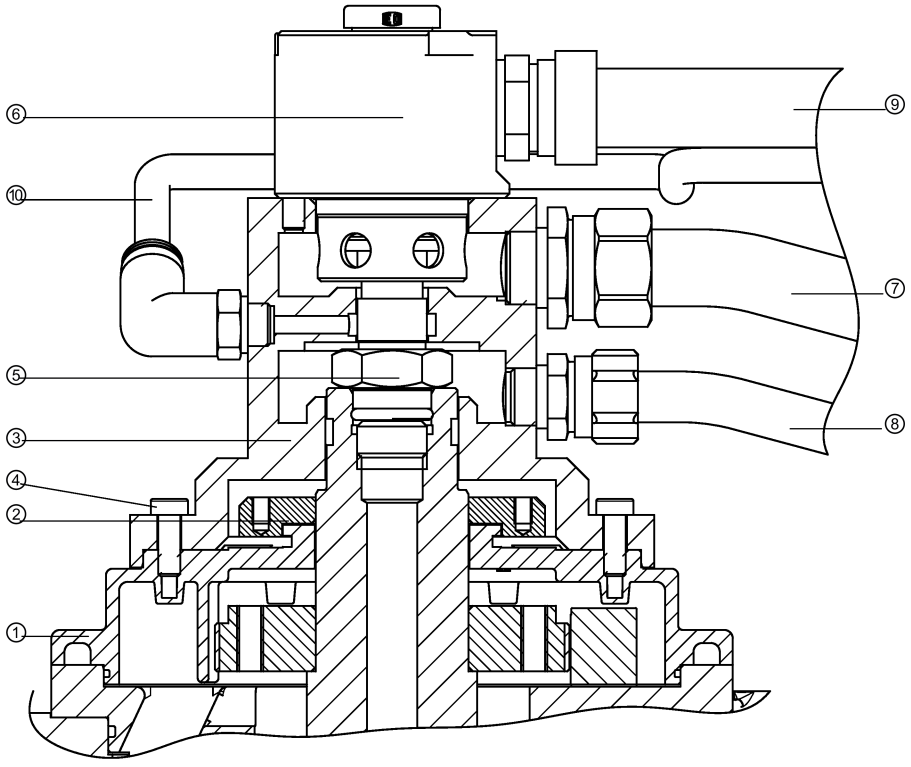
- The diameters and end faces of the adapter for supporting the encoder cover or the static part of the rotating union should be turned in one clamping if possible. For simpler machining, the adapter can be axially split. It is important that the finish-machining of the support diameter and end faces is performed in the assembled condition and in one clamping.

Mounting on water-cooled motors

Water-cooled motors have a "2" in the 11th position of Article No. together with option Y64.

Rotating unions with radial or axial connections can be used.

Mounting a bearingless rotating union on a water-cooled motor



1 Encoder cover
2 Balancing disk
3 Adapter
4 6 x M5 bolts
5 Rotating part of the rotating union, e.g. DEUBLIN 1129-050-301
6 Static part of the rotating union, e.g. DEUBLIN 1129-050-301
7 Leakage hose (min. diam. 12 mm inside)
8 Leakage hose as backup and for faults
9 Inlet hose
10 Sealing air connection

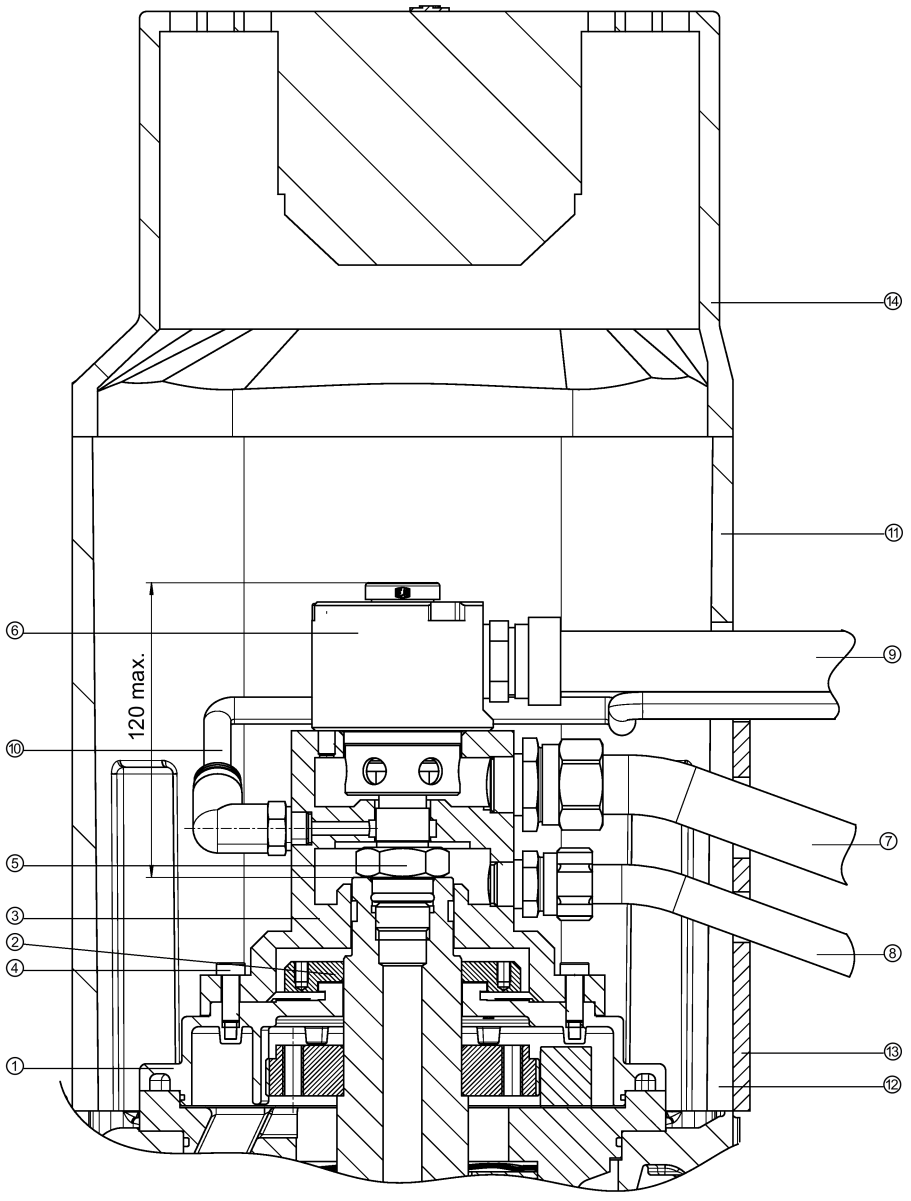
Mounting on air-cooled motors

Air-cooled motors have a "0" or a "1" in the 11th position of Article No. together with option Y64.

Air-cooled motors are equipped with an intermediate housing between the motor and the axially mounted fan. The intermediate housing is used to accommodate the rotating union. It is suitable for rotating unions up to a length (without rotor connection thread and centering) of 120 mm and a diameter of up to 55 mm. Due to limitations of space, rotating unions with radial connections are recommended for air-cooled motors, e.g. DEUBLIN 1129-050-301. Rotating unions with axial connections are also possible in short versions, e.g. DEUBLIN 1129-730-731. In that case, an angled element must be used on the axial connection to which the supply hose is connected. The dimension 120 mm must not be exceeded with the angled element.

NOTICE
Sealing the remaining holes Seal the remaining holes again between the cutout and the hoses to ensure that motor cooling is still effective.

Mounting of bearingless rotating union on an air-cooled motor



1	Encoder cover	8	Leakage hose as backup and for faults
2	Balancing disk	9	Inlet hose
3	Adapter	10	Sealing air connection
4	6 x M5 bolts	11	Intermediate housing
5	Rotating part of the rotating union, e.g. DEUBLIN 1129-050-301	12	Cutout
6	Static part of the rotating union, e.g. DEUBLIN 1129-050-301	13	Cover (openings for connections must be closed again)
7	Leakage hose (min. internal diam. 12 mm)	14	Fan

Mounting steps

Procedure

Note

Mounting steps for air-cooled motors

The mounting steps 1, 13, 14, 15, and 16 are only required for air-cooled motors.

1. Disassemble the fan and intermediate housing from the motor.
2. Removing the sealing cover
3. If necessary, perform complete balancing of the motor with external balancing disks
4. Screw the rotating part of the rotating union into the NDE motor shaft extension and tighten with the appropriate torque (against the wrench grip surface on the NDE motor shaft extension).
5. Mount the adapter for the static part (not included in the scope of delivery) on the encoder cover with 6x M5 screws. Position the adapter in such a way that the leakage connection is at the lowest point (with horizontal mounting).
6. Mount the hoses for leakage and sealing air on the adapter, if necessary using angled elements
7. Mount the hose for the supply to the static part of the rotating union, if necessary using angled elements
8. Screw the static part onto the adapter
9. Always connect the hoses for leakage sloping downward (min. 15°).
10. Also connect the hose for the inlet sloping downward.
11. Manually check that the rotor turns easily.
12. Perform a hydrostatic test for leaks
13. Make a cutout for the inlet and leakage hoses in the intermediate housing.
14. Push the intermediate housing with the inlet over the hoses and screw it to the motor. Protect the hoses from mechanical loads
15. Screw the fan on to the intermediate housing
16. Seal the remaining openings between the cutout and the hoses

❒

4.5.3 Mounting information and instructions

- Do not mount any additional anti-rotation pins on rotor-supported rotating unions
- Never screw pipes directly to the rotating union.
- Always use a hose between the rotating union and the fixed piping. To do this, route the hoses in curves and torsion-free.
- First screw the flexible hoses onto the rotor-supported rotating union. Then screw the rotating union onto the shaft with the specified torque.
- Avoid stressing due to incorrect hose lengths and unsuitable mounting material.
- The rotating union must be easy to turn when mounted.
- Keep rotating unions free of chips and burrs.
- Position the rotating union horizontally in such a way that the leakage connection is at the lowest point.
- Always route the leakage hose downward at at least 15° with a large cross-section.
- If the leakage hose is higher than the leakage connection and the mechanical seal is open, the rotating union and possibly also the motor will be flooded. The motor can fail.
- Also route the inlet hose downward. This causes the coolant to flow back in the supply line when the mechanical seal is open (e.g. tool change or standstill) and not through the motor shaft and the leakage connection.
- Filter the coolant so that no particles or chips can reach the mechanical seal and damage it.

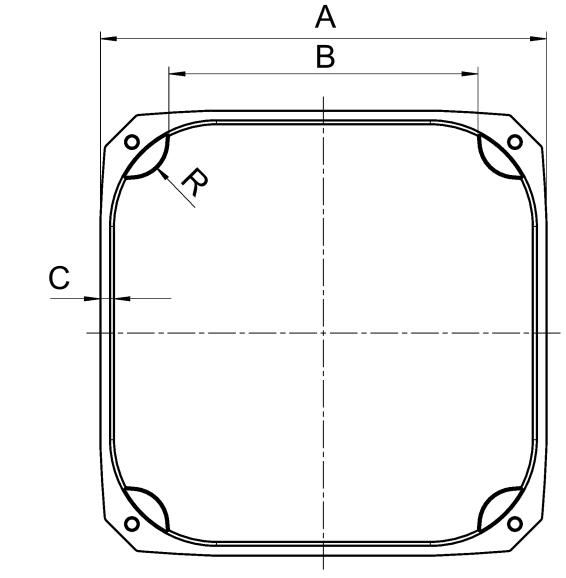
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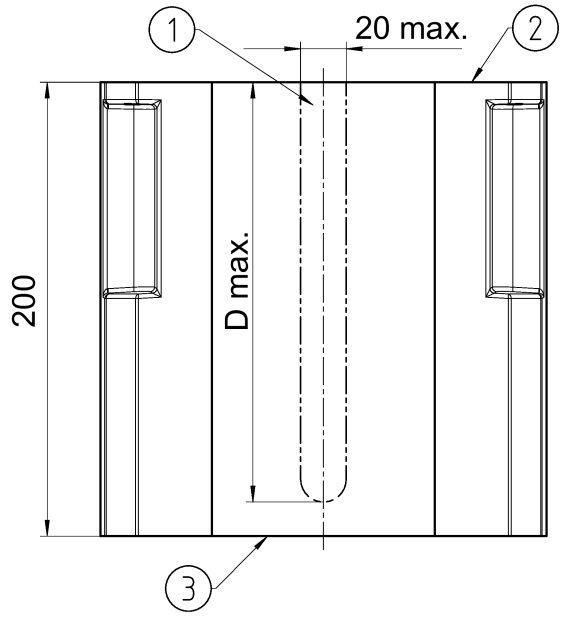
Mounting the rotating union

- During assembly, screw the thread absolutely tightly into the NDE shaft extension. Ensure that no coolant can leak.

- Check the rotating union and hoses regularly for tightness.

Intermediate housing for air-cooled motors





① Cutout for hoses (to be made by the customer)
② Motor side
③ Fan side

Slot dimensions for the intermediate housing

	SH132	SH160
A	260	314
B	183	225
C	7	7
R	19	19
D	175	180

4.5.4 Suggestion for an adapter for bearing-free, frame-supported rotating unions

Note

Comply with the manufacturer's specifications

Comply with the specifications and instructions provided by the manufacturer when installing the rotating union.

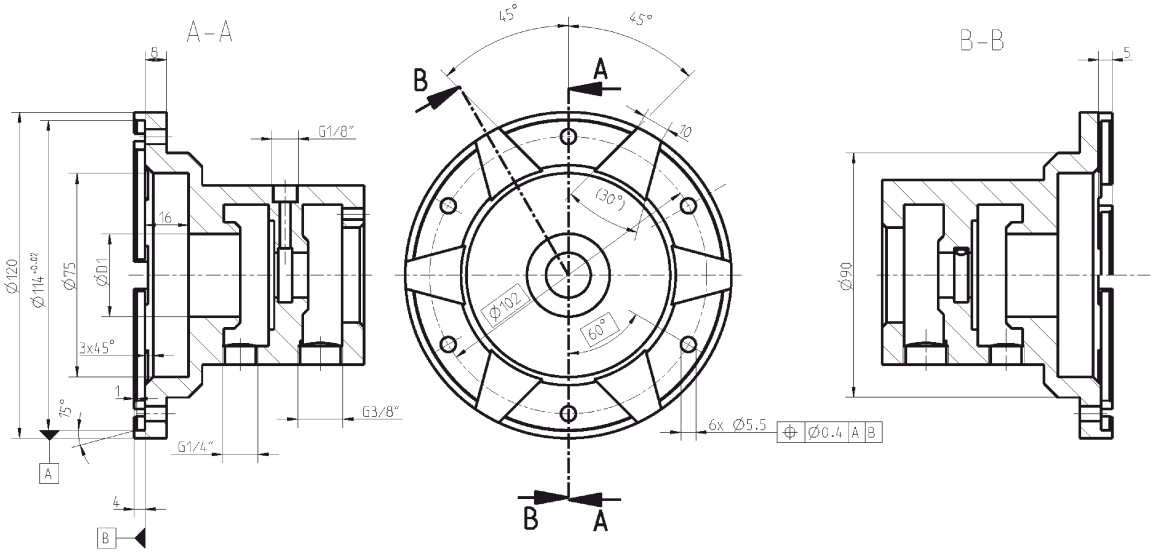


Figure 4-5 Example of the version of an adapter for supporting the static part of a bearingless, frame-supported rotating union

	1PH813.-1PH816.
Diameter D1	Diam. 30.5 H7

Connection 5

5.1 Mechanical connection of water cooling system

The inlet and outlet holes for the cooling water supply are located on the NDE in the bearing shield.

Procedure

1. Make sure that the cooling water fulfills the required cooling water specification, see the chapter titled "Cooling".
2. Make sure that the appropriate volume of cooling water is available, see the rating plate (type plate).
3. Screw the cooling water pipes into the female thread. You can connect the inlet and outlet as required.
4. Ensure that the maximum permissible operating pressure does not exceed 6 bar.

❒

5.2 Electrical connection



⚠ WARNING

Danger to life through electric shock

As a result of the permanent magnets in the rotors of 1PH8 synchronous motors, when the motors rotate this induces a voltage. If you use defective cable ports, you could suffer an electric shock.

- Do not touch the cable ports.
- Connect the motor cable ports correctly, or insulate them properly.

⚠ WARNING

Risk of electric shock if the insulating foil is removed

The insulating foil in the terminal box is used to protect against voltage flashover to the cover.

- Never remove the insulating foil in the terminal box.

NOTICE

Destruction of the motor if it is directly connected to the three-phase line supply

The motor will be destroyed if it is directly connected to the three-phase line supply.

- Only operate the motors with the appropriately configured converters.

NOTICE

Damage to components that are sensitive to electrostatic discharge

The DRIVE-CLiQ interface has direct contact to components that can be damaged/destroyed by electrostatic discharge (ESDS). Encoder systems and temperature sensors are components that can be destroyed by electrostatic discharge (ESD).

Components that are sensitive to electrostatic discharge can be damaged if you touch the connections with your hands or with electrostatically charged tools.

- Carefully observe the information in Chapter "Handling electrostatic sensitive devices (ESD)".

Note

Comply with the protective requirements regarding EMC

Systems and machines with converter-fed low-voltage three-phase motors must fulfill the protective requirements of the EMC Directive. The machine manufacturer is responsible for ensuring that installation is carried out properly. The signal and power cables to the motor must be shielded. Apply the EMC installation guideline of the converter manufacturer. For Siemens converters, this is available under document order number 6FC5297-☐AD30-0☐P☐.

5.2.1 Cable routing

- When selecting the required connecting cables, make sure that you take into account the rated current and plant-specific conditions, such as ambient temperature, routing type, etc. according to IEC / EN 60364-5-52 and IEC / EN 60204-1.
- Use EMC cable glands for permanently installed cable entries.
- Use shielded cables whose shields are conductively connected to a large area of the terminal box of the motor using EMC cable glands. Make sure that the cable shields are properly connected.
- Arrange the exposed connecting cables in the terminal box so that the PE conductor has an excess length and the insulation of the cable conductors cannot be damaged.
- Only remove insulation from the cable ends so that the insulation reaches up to the cable lug, terminal, or wire end ferrule.
- Adapt the size of the cable lugs or end sleeves in line with the dimensions of the terminal board connections and the cross-section of the power cable (use parallel connecting cables, if necessary).
- Make sure that the inside of the terminal box or connector is clean and free of cable cuttings and moisture.
- Tighten all of the screws for the electrical connections (terminal board connections, with the exception of the terminal strips) to the specified torque:

Table 5- 1 Tightening torques

Thread ∅	**M4**	**M5**	**M6**	**M8**	**M10**
Tightening torque [Nm]	0.8 ... 1.2	1.8 ... 2.5	2.7 ... 4	5.5 ... 8	9 ... 13

- When connecting or changing internal connection cables, always observe the minimum air clearance of 5.5 mm.
- Avoid protruding cable ends.
- Seal unused cable entries and screw in sealing elements so that they are secure and airtight.
- Check seals and sealing surfaces of the terminal box or connector to ensure that the degree of protection is maintained.
- Take measures to ensure that connecting cables cannot rotate, are not subject to strain and pushing force and also provide anti-kink protection. It is not permissible to subject the connector to continuous force.
- The coding slot for the plug-in connections must be aligned when inserted into the socket connector. The union nut must be tightened by hand up to the endstop.
- Plug in or remove the connector only when the system is de-energized.
- The insulating film must be present in the terminal box.

Current-carrying capacity for power and signal cables

The current-carrying capacity of PVC/PUR-insulated copper cables is specified in EN 60204-1.

5.2.2 Circuit diagram

The circuit diagram contains information about wiring and connecting the motor winding. The circuit diagram can be found on the lid of the terminal box.

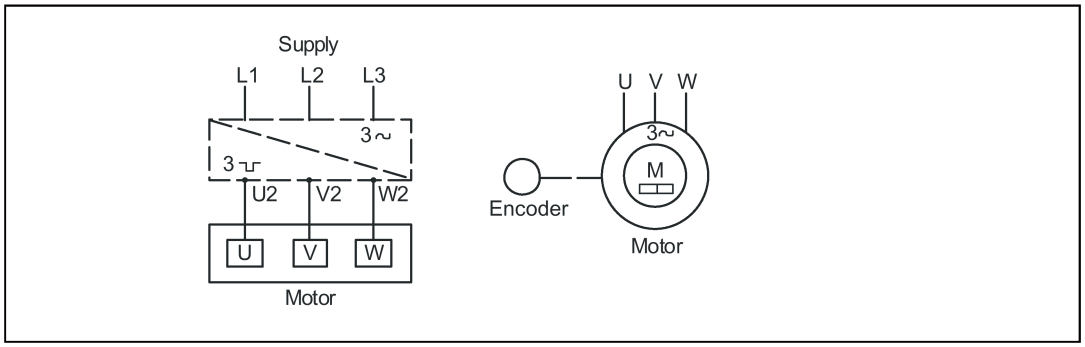
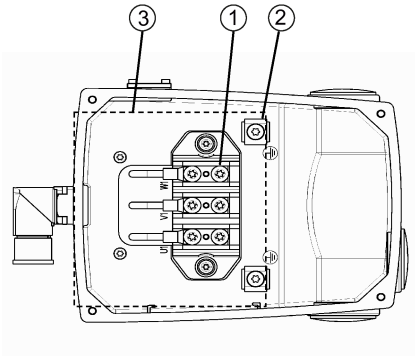


Figure 5-1 Circuit diagram

NOTICE
Cable damage caused by inappropriately changing the cable outlet direction
You will damage connecting cables if you inappropriately change the cable outlet direction. • The direction of the cable outlet must not be changed as this invalidates warranty claims.

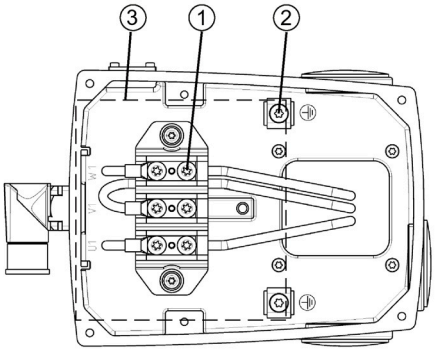
5.2.3 Terminal box

- Assign the terminals in the terminal box as shown in the diagrams "Terminal box: 3-pole" and "Terminal box: 6-pole".
- Connect the PE conductor.
- Use cable lugs to DIN 46234.
- Do not remove the insulation strips.
- Screw the terminal box cover on again (tightening torque 5 Nm).



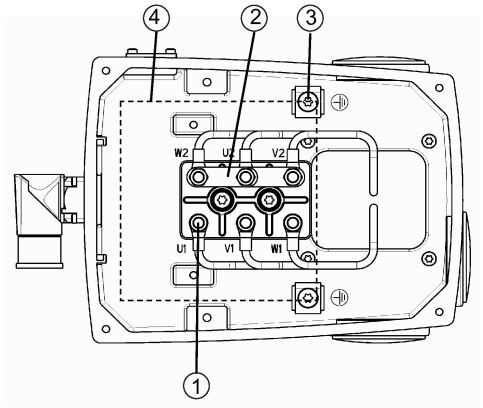
① Terminal screw M6
② Grounding screw M6
③ Insulation strips

Figure 5-2 Terminal box gk833 and gk863, 3-pole



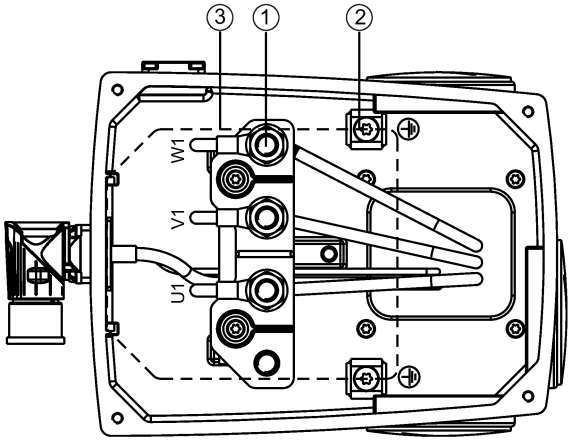
① Terminal screw M6
② Grounding screw M6
③ Insulation strips

Figure 5-3 Terminal box gk843 and gk873, 3-pole



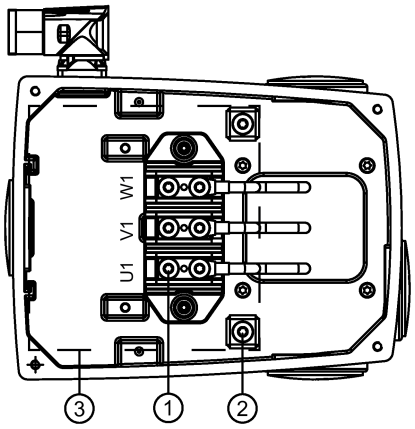
① Terminal stud M6
② Jumper
③ Grounding screw M6
④ Insulation strips

Figure 5-4 Terminal box gk846 (1PH813) and gk876 (1PH816), 6-pole (can be switched between star and delta)



① Terminal screw M10
② Grounding screw M6
③ Insulation strips

Figure 5-5 Terminal box gk874, 3-pole (for synchronous motors and reluctance motors)



① Terminal screw M6
② Grounding screw M6
③ Insulation strips

Figure 5-6 Terminal box gk843 (1PH813), gk873 (1PH816), 3-pole, cable entry DE

Note

Cable exit direction DE

The motor with the cable exit direction DE has a "D" in the 15th position of the Article No.

Star/delta connection

A star/delta connection is implemented by means of an external contactor circuit or as a fixed configuration in terminal box gk846 (1PH813) and gk876 (1PH816).

Standard configuration: star connection via jumpers

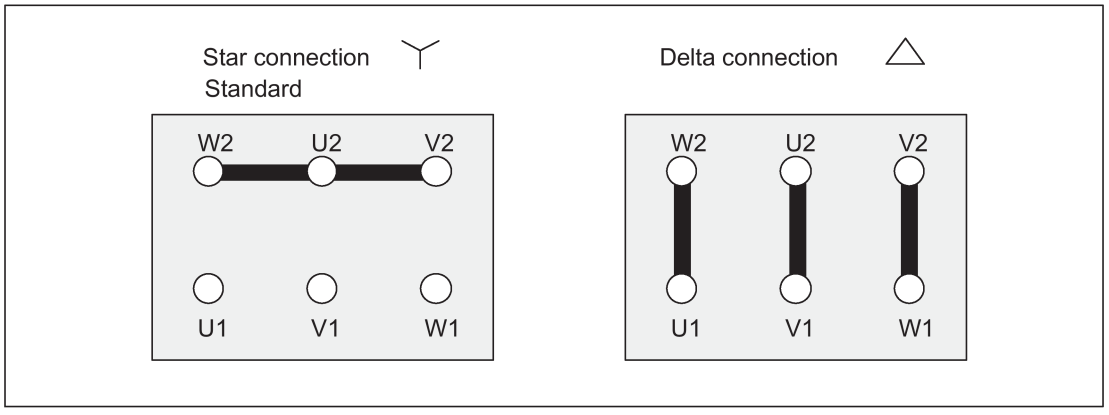
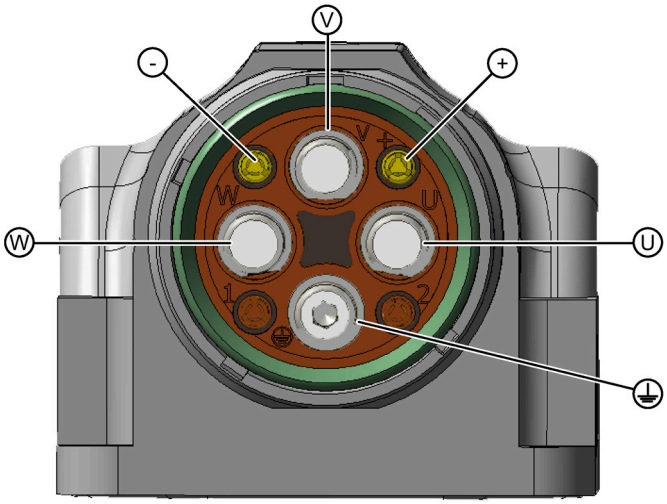


Figure 5-7 Fixed star/delta connection in the terminal box

5.2.4 Power connector (for 1PH813 only)

- Use connector M63.
- Assign the connector as shown in the "Power connector" diagram. Connect the protective conductor.



Brake connection 24 V: "+" = BD1+; "-" = BD2

Figure 5-8 Power connector (view of connector pins)

5.2.5 Electrical connection data

Table 5- 2 1PH8 motors, shaft height 132

Terminal box type	Cable entry (power)	Cable entry (external signals)	Max. external cable diameter [2]	Number of main terminals	Max. cross-section per terminal	Max. current per terminal [3]
gk833	1 x M40 x 1.5	1 x M16 x 1.5[1]	32 mm	Phases: 3 x M6 Grounding: 2 x M6	1 x 35 mm²	110 A
gk843	1 x M50 x 1.5	1 x M16 x 1.5[1]	38 mm	Phases: 3 x M6 Grounding: 2 x M6	1 x 50 mm²	133 A
gk846	1 x M50 x 1.5	1 x M16 x 1.5[1]	38 mm	Phases: 6 x M6 Grounding: 2 x M6	1 x 25 mm²	88 A

[1] Thread M16 x 1.5 arranged with 90° to signal connection; thread only for options A12, A25 and encoder version A (without encoder)

[2] Depending on design of metric cable gland

[3] Current-carrying capacity based on EN 60204-1 and IEC 60364-5-52, routing type E

Table 5- 3 1PH8 motors, shaft height 160

Terminal box type	Cable entry (power)	Cable entry (external signals)	Max. external cable diameter [2]	Number of main terminals	Max. cross-section per terminal	Max. current per terminal [3]
gk863	1 x M50 x 1.5	1 x M16 x 1.5[1]	38 mm	Phases: 3 x M6 Grounding: 2 x M6	1 x 50 mm^2	133 A
gk873	1 x M63 x 1.5	1 x M16 x 1.5[1]	42.6 mm	Phases: 3 x M6 Grounding: 2 x M6	1 x 50 mm^2	133 A
gk876	1 x M63 x 1.5	1 x M16 x 1.5[1]	42.6 mm	Phases: 6 x M6 Grounding: 2 x M6	1 x 25 mm^2	88 A
gk874	1 x M63 x 1.5	1 x M16 x 1.5[1]	42.6 mm	Phases: 3 x M10 Grounding: 2 x M6	2 x 70 mm^2	240 A

[1] Thread M16 x 1.5 arranged with 90° to signal connection; thread only for options A12, A25 and encoder version A (without encoder)

[2] Depending on design of metric cable gland

[3] Current-carrying capacity based on EN 60204-1 and IEC 60364-5-52, routing type E

5.2.6 Motors with DRIVE-CLiQ interface

NOTICE

Damage to components that are sensitive to electrostatic discharge

The DRIVE-CLiQ interface has direct contact to components that can be damaged/destroyed by electrostatic discharge (ESDS). Encoder systems and temperature sensors are components that can be destroyed by electrostatic discharge (ESD).

Components that are sensitive to electrostatic discharge can be damaged if you touch the connections with your hands or with electrostatically charged tools.

- Carefully observe the information in Chapter "Handling electrostatic sensitive devices (ESD)".

Motors designed for SINAMICS drive systems are equipped with an internal Sensor Module, which contains an encoder and temperature evaluation system as well as an electronic rating plate. The Sensor Module is mounted instead of the signal connector and is equipped with a 10-pin RJ45plus socket. This is known as a DRIVE-CLiQ interface. The pin assignment is independent of the motor-internal encoder. The Sensor Module can be rotated through approx. 180°. The typical torsional torque is between 4 and 8 Nm. The Sensor Module must only be rotated by hand. The use of pipe wrenches, hammers etc. is not permitted.

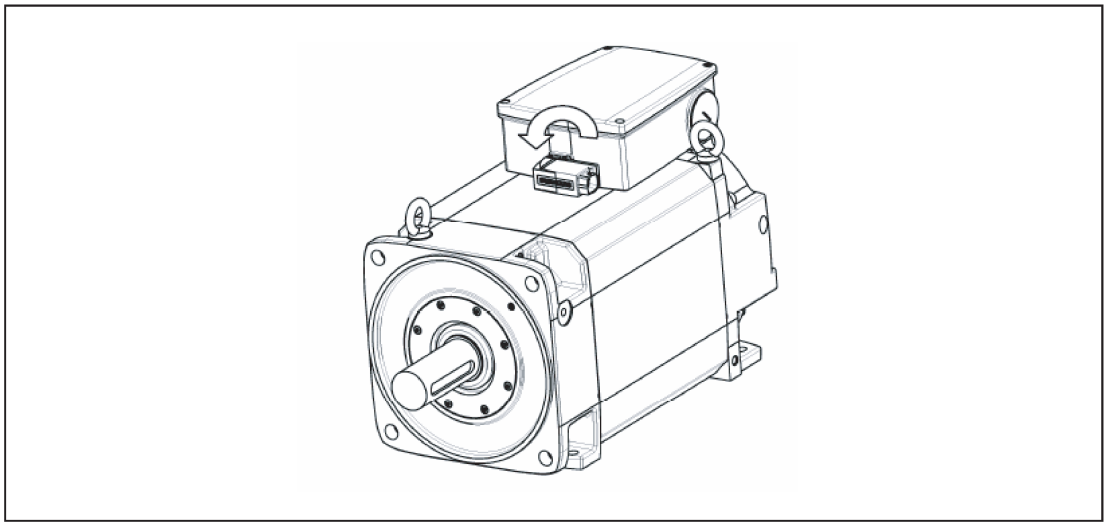


Figure 5-9 Motor with DRIVE-CLiQ interface (example)

The signal connection between the motor and Motor Module is established by means of a MOTION-CONNECT DRIVE-CLiQ cable. The MOTION-CONNECT DRIVE-CLiQ cable connector must be inserted far enough so that the catch springs engage.

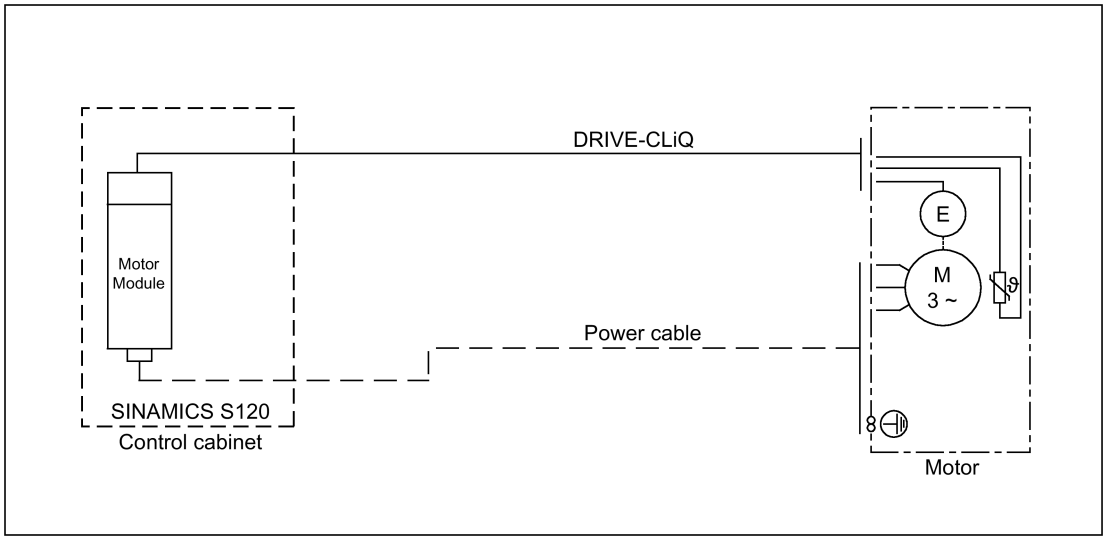


Figure 5-10 Encoder interface with DRIVE-CLiQ

5.2.7 Motors without DRIVE-CLiQ interface

If a motor is not equipped with a DRIVE-CLiQ interface, the speed encoder and temperature sensor are connected via a signal connector.

Motors that are not equipped with DRIVE-CLiQ require a Sensor Module Cabinet-Mounted (SMC) or a Sensor Module External (SME) when operated with SINAMICS S120. The motor is connected to the SMC or the SME via the signal cable. The SMC or SME is connected to the Motor Module via a MOTION-CONNECT DRIVE-CLiQ cable.

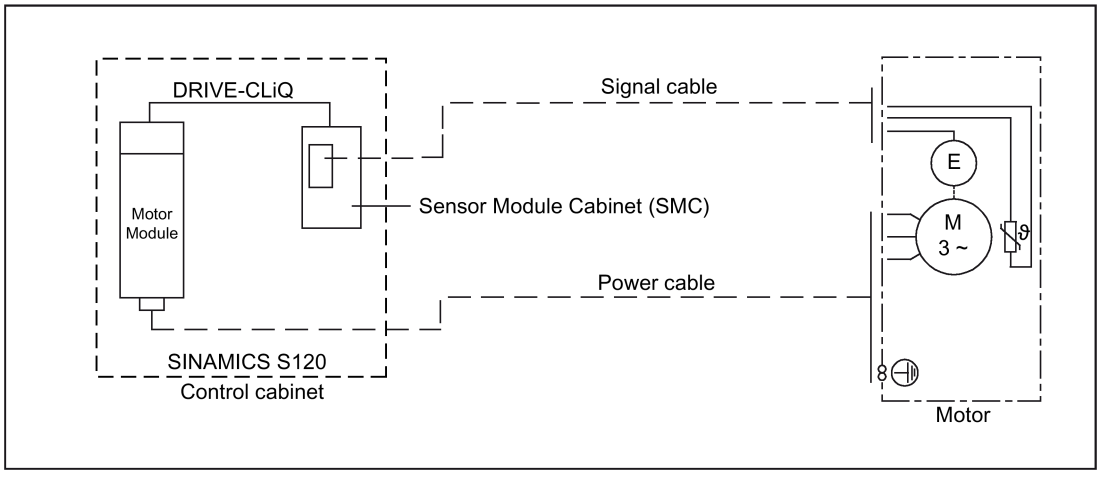
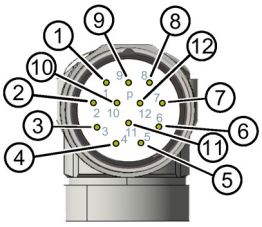
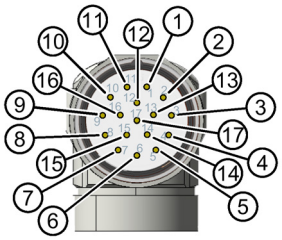


Figure 5-11 Encoder interface without DRIVE-CLiQ

Design of signal connectors

Pin assignment, 12-pin signal connector	**Pin assignment, 17-pin signal connector**		
			
Incremental encoder HTL 2048 S/R HTL 1024 S/R	Incremental encoder IC 2048 S/R	Incremental encoder IN 256 S/R IN 512 S/R	Absolute encoder AM 2048 S/R
1 = B*	1 = A	1 = A	1 = A
2 = +1R1	2 = A*	2 = A*	2 = A*
3 = R	3 = R	3 = R	3 = data
4 = R*	4 = D*	4 = not connected	4 = not connected
5 = A	5 = C	5 = not connected	5 = clock
6 = A*	6 = C*	6 = not connected	6 = not connected
7 = CTRL	7 = M encoder	7 = M encoder	7 = M encoder
8 = B	8 = +1R1	8 = +1R1	8 = +1R1
9 = not connected	9 = -1R2	9 = -1R2	9 = -1R2
10 = M encoder	10 = P encoder	10 = P encoder	10 = P encoder
11 = -1R2	11 = B	11 = B	11 = B
12 = P encoder	12 = B*	12 = B*	12 = B*
	13 = R*	13 = R*	13 = data*
	14 = D	14 = not connected	14 = clock*
	15 = M sense	15 = M sense	15 = M sense
	16 = P sense	16 = P sense	16 = P sense
	17 = not connected	17 = not connected	17 = not connected

A suitable socket connector can be used to rotate the angle plug. Make sure that the socket connector is completely secure to avoid damaging the pin contacts.

5.2.8 Connecting an HTL incremental encoder

Encoder connection with terminal block using an additional terminal box

Induction motors can be equipped with an additional terminal box. This means that you can connect the following HTL incremental encoders for operation with a SINAMICS G via a terminal block:

- HTL1024 S/R and
- HTL2048 S/R

The additional terminal box is shown in the following diagram.

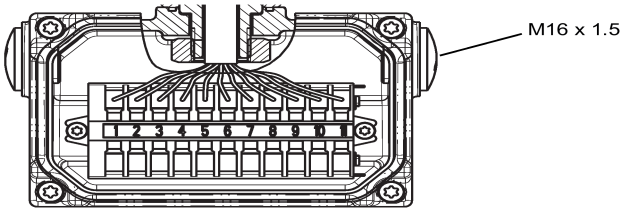


Figure 5-12 Encoder connection via additional terminal box

The following signal assignment applies for connecting an HTL incremental encoder:

Terminal	Signal assignment
1	-1R2
2	+1R1
3	B*
4	R
5	R*
6	A
7	A*
8	CTRL
9	B
10	M encoder
11	P encoder

Note

Additionally supplied sensors

Connect the following additional sensors in the terminal box according to Chapter "Terminal boxes":

- Temperature sensor as a standby or
- PTC thermistor circuit for warning and shutdown

Note

Temperature sensor

The type of temperature sensor is to be found on the rating plate.

5.2.9 Connecting the temperature sensor

The temperature sensor in the motor winding is connected to the signal connector together with the speed encoder signal.

NOTICE
Thermal motor damage Windings and bearings can be destroyed if the motor overheats. • Make sure that the temperature sensor is evaluated.

5.2.10 Connecting a grounding conductor in the terminal box

The motor grounding conductor cross-section must be in full compliance with the installation regulation, e.g. according to IEC / EN 60204-1. The grounding conductor is connected in the terminal box.

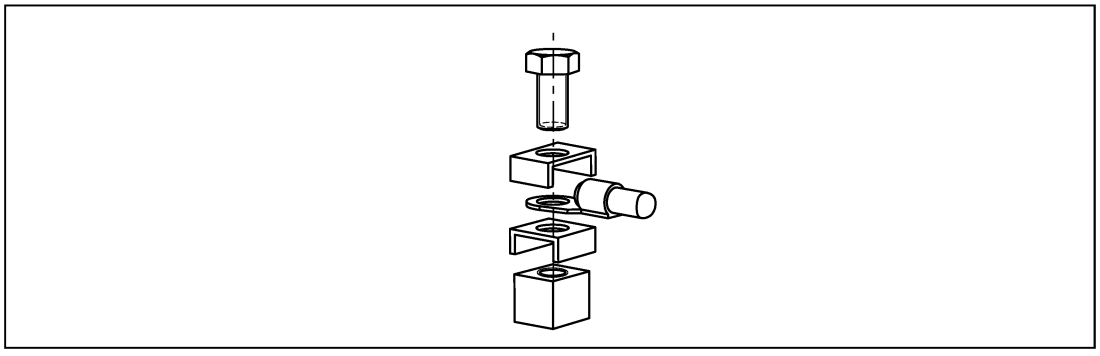


Figure 5-13 Connecting the grounding conductor

Equipotential bonding

The motor design provides for internal equipotential bonding between the grounding terminal in the box enclosure and the motor enclosure. The contact locations underneath the bolt heads are bare metal and protected against corrosion.

The standard cover fixing screws are sufficient for equipotential bonding between the terminal box cover and terminal box enclosure.

Note

External ground connection

Motors with a power rating of more than 100 kW must be grounded via the additional grounding screw M12 at the mounting flange. A cable lug in accordance with DIN 46234 must be used.

5.2.11 Connecting the external fan

The fan connection is located in the fan terminal box.

Table 5- 4 Connection specifications for external fans on 1PH813

Air flow direction	Max. current consumption at		
	400 V / 50 Hz (±10 %) in A	400 V / 60 Hz (±10 %) in A	480 V / 60 Hz (±10 %) in A
DE --> NDE	0.1	0.12	0.12
NDE --> DE	0.11	0.13	0.13

Table 5- 5 Connection specifications for external fans on 1PH816

Air flow direction	Max. current consumption at		
	400 V / 50 Hz (±10 %) in A	400 V / 60 Hz (±10 %) in A	480 V / 60 Hz (±10 %) in A
DE --> NDE	0.16	0.21	0.21
NDE --> DE	0.16	0.21	0.21

Note the following information regarding connections:

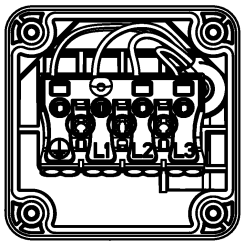
- Observe the information provided in the Appendix "Operating instructions of the external fan".
- Only use cables that comply with the relevant installation regulations regarding voltage, current, insulation material, and load-carrying capacity.
- Only use cable connectors that are made out of plastic.
- Before connecting the device, make sure that the line voltage matches the device voltage.
- Check whether the data on the fan rating plate matches the connection data.
- Open the terminal box and route the cables (not supplied) into the terminal box.
- Connection cables must not be subject to excessive tensile stress.
- Connect the protective conductor (PE).
- Connect the other cables to the relevant terminals (refer to the connection diagrams).

NOTICE

Fan damage caused by moisture

The fan can be damaged, for example if water enters the terminal box along the cables.

- Use suitable cables and terminal box cable glands.
- Ensure that the terminal box cover is correctly fitted and completely closed.



L1 Black
L2 Blue
L3 Brown
PE Green/yellow

Figure 5-14 Connection of external fan in the terminal box

NOTICE

Damage to the fan when inappropriately operated

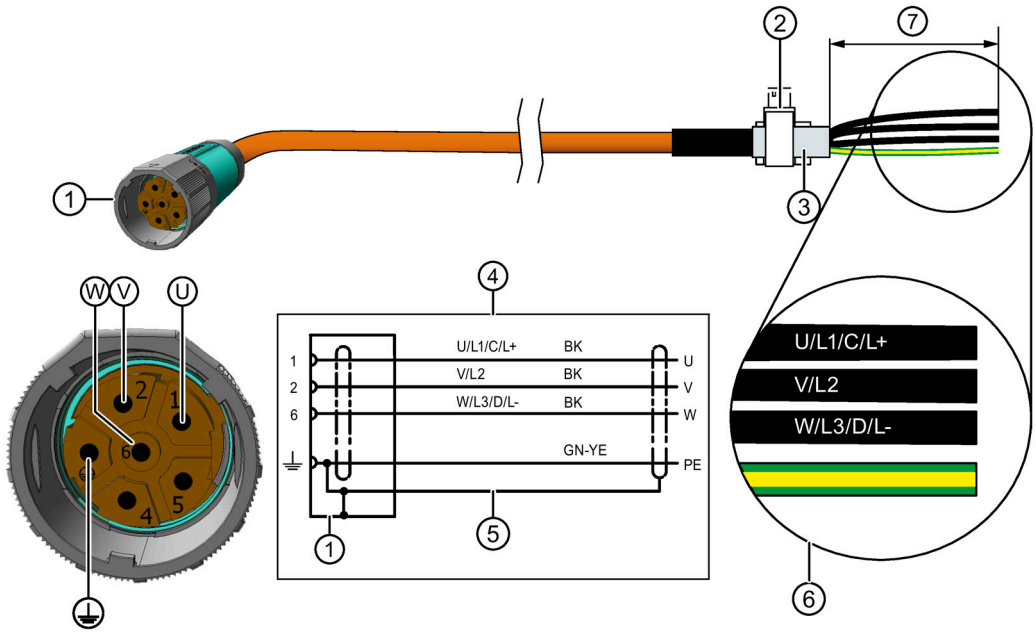
The fan can be destroyed if inappropriately operated.

- Use blocking protection (stall protection) to protect the fan against inappropriate operation. To do this, use a suitable motor circuit breaker where all poles can be disconnected. Operate the fan using this circuit breaker.
- Provide an interlocking circuit that prevents the main motor from being switched on when the fan unit is not operational.

Connection of the external fan by means of connector for 1PH813

Note

If you order the motor with a power connector, the external fan is connected with an M23 power connector.



① SPEED CONNECT connector, M23
② Terminal for the cable shield
③ Cable shield
④ Circuit diagram
U, V, W = power cable, 1.5 mm^2, each cable with separate shielding
PE = protective conductor
⑤ Cable shield
⑥ Conductor designations
⑦ Recommended length of the cable ends: 105 mm

Figure 5-15 3-phase connection of external fan via connector

5.2.12 Connecting-up a converter

Selecting and connecting the cables

- To connect the motor to a converter, use MOTION-CONNECT cables or shielded connecting cables.

Note

The cable shielding, made up of as many strands as possible, must have a high electrical conductivity. Braided shields made of copper or aluminum are well suited.

- Connect the shield at both ends at the motor and at the converter.
- Keep unshielded cable ends as short as possible.
- Establish the connection through a larger surface area so that high-frequency currents are suitably discharged. Establish a 360° connection at the converter and at the motor, for instance using EMC cable glands at the cable entries.

5.2.13 Connecting a holding brake (option)

Electrically connecting a holding brake (option) is described in the Appendix "Holding brake operating instructions".

See also

Operating Instructions for the holding brake (Page 118)

Note regarding a holding brake (Page 117)

5.2.14 Sealing air connection (option Q12)

Cooling lubricants containing oil with creepage, which can also be aggressive, are mainly used for machine tools and transfer machines. For critical applications involving media with extremely high creepage rates, generally degree of protection against water (according to EN 60034-5/IEC 60034-5) is not sufficient. To address these particular applications, 1PH8 main motors can be ordered with sealing air connection by specifying option Q12.

Note

Improved protection against oils and media that can creep

You do not increase the IP degree of protection against water with sealing air. However, you improve the protection against oils and media that can creep.

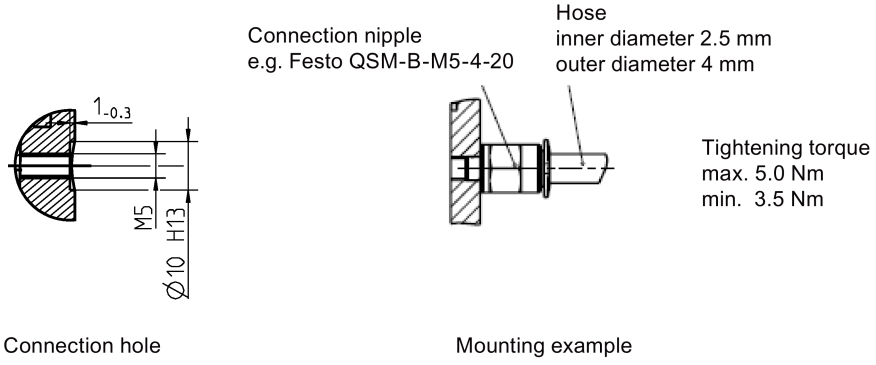


Figure 5-16 Sealing air connection (option Q12)

Conditioning A: 1PH8 motors without shaft sealing ring (option K18)	
Min. air intake temperature in °C	Ambient temperature
Max. air intake temperature in °C	40
Max. residual water content in g/m³	0.12
Max. residual oil content in g/m³	0.01
Max. residual dust in mg/m³	0.1
Min. supply pressure in Pa	2.5×10^5
Max. supply pressure in Pa	3×10^5
Particle size for hollow shaft encoders in µm	< 8
Particle size for optical encoders in µm	< 3

Volumes *)	
Volumes in Nm³/h (Nm³ = standard cubic meter)	Approx. 2.3 at 2 bar

*) The volume data refers to the specified minimum supply pressure. For higher supply pressures, the flow rate increases corresponding to the motor flow resistance.

A permanent flow of sealing air results in an improved level of protection.

The sealing air must comply with the specified air quality.

Conditioning B: 1PH8 motors with shaft sealing ring (option K18)	
Min. air intake temperature in °C	Ambient temperature
Max. air intake temperature in °C	40
Max. residual water content in g/m³	0.12
Max. residual oil content in g/m³	0.01
Max. residual dust in mg/m³	0.1
Min. supply pressure in Pa	0.05×10^5
Max. supply pressure in Pa	0.1×10^5
Particle size for hollow shaft encoders in µm	< 8
Particle size for optical encoders in µm	< 3

An improved level of protection is achieved by applying a low static pressure, without having a permanent flow of sealing air.

The sealing air must comply with the specified air quality.

Commissioning

6

6.1 Safety instructions for commissioning



⚠WARNING

Danger to life as a result of hazardous voltages when connected to inadequately grounded line supplies

In the case of a fault, connecting a motor to an inadequately grounded line supply can result in death, severe injury and/or motor damage.

- Connect motors, as part of the drive system, to TN and TT line supplies with grounded neutral point or to IT line supplies.
- Verify that the SINAMICS devices and motors are compatible with the residual current device according to EN 61800-5-1 before you connect the devices and motors to the line supply using residual current devices (RCDs).
- For line supplies with grounded line conductor, e.g. TT line supplies, use an isolating transformer with grounded neutral point (on the secondary side) between the line supply and the drive system, so that the motor insulation is not overstressed.
- When connected to IT line supplies, a monitoring device must signal the first fault between an active part and ground. Remove this fault immediately.



⚠WARNING

Danger to life when the insulation is damaged as a result of the high-voltage test

The motor insulation can be damaged when a motor high voltage test is carried out. You can get an electric shock when touching live components. Further, electronic components can be destroyed. The components involved include temperature sensors and encoders, for example.

- Do not carry out a high-voltage test on the motor.

⚠WARNING

Danger to life as a result of rotating output elements and loose parts that are flung out

Rotating output elements and feather keys that are flung out while the motor is operational can result in severe injuries.

- Remove any loose feather keys or secure them so that they cannot be flung out.
- Do not touch any rotating parts.
- Secure output elements using the appropriate safety guards.



⚠WARNING

Danger to life when the cooling system bursts

The motor will overheat if it is operated without cooling. When cooling water enters the hot motor, this immediately and suddenly generates hot steam that escapes under high pressure. This can cause the cooling water system to burst, resulting in death, severe injury and material damage.

- Never operate the motor without cooling.
- Only commission the cooling water circuit when the motor is in a cool condition.

⚠WARNING

Danger to life when the forced ventilation draws in hair and articles of clothing

There is a danger of being drawn into the machine (by means of hair, ties, loose articles of clothing, etc.) at the air intake.

- Remove any ties or similar.
- Wear a hat or hair net to prevent hair from being drawn in.
- Keep the air intake area free of any loose objects.
- Take the appropriate protective measures to prevent hair and articles of clothing from being drawn in.



NOTICE

Thermal damage to temperature-sensitive parts

The motors can have surface temperatures of over +100° C. Temperature-sensitive parts in contact with the motor or attached to the motor can be damaged. Temperature-sensitive parts include cables and electronic components, for example.

- Never attach temperature-sensitive parts to the motor.
- Ensure that no temperature-sensitive parts are in contact with the motor.



NOTICE

Thermal motor damage

Windings and bearings can be destroyed if the motor overheats. Further, if a synchronous motor overheats, this can demagnetize the permanent magnets.

- Only operate the motors in conjunction with effective temperature control!

NOTICE

Motor damage when the maximum speed is exceeded

The maximum speed n_{max} is the highest permissible operating speed. The maximum speed n_{max} is stamped on the rating plate (nameplate).

The motor can be damaged if operated at inadmissible speeds.

- Ensure that the maximum permissible speed is not exceeded. Realize this using a suitable control system or activate the speed monitoring function in the drive.

NOTICE

Damage or destruction of the holding brake

If the holding brake is used as an operating brake, then it will be damaged or destroyed.

- Control the holding brake so that it can never be used as an operating brake.
- The holding brake microswitch must be connected to the control and evaluated (also refer to the supplementary sheet on the holding brake 4BZFM 100).
- It must be completely ruled out that the motor is operated with the holding brake closed.
- It is only permissible to control the holding brake when the motor is at a standstill.

Note

Grease distribution operation for "Performance" and "High Performance" bearing version

The manufacturer operates 1PH8 Performance and High Performance drives for approximately 15 min. to distribute the grease. After this run-in time, users can operate the motors up to the maximum speed without causing bearing damage.
The grease distribution with the optimum formation of a lubricating film in the roller bearing is completed after an operating time of approx. 30 hours.
When excess grease is being pressed out of the bearing cage certain noises can occur, which do not necessarily mean potential bearing damage.

6.2 Checklists for commissioning

Note

Checks that are required

This list below does not claim to be complete. It may be necessary to perform additional checks and tests in accordance with the situation specific to the particular installation site.

- Before commissioning the system, check that it is properly installed and connected.
- Commission the drive system corresponding to the operating instructions of the converter or inverter.
- Thoroughly familiarize yourself with the safety instructions and observe the checklists below before starting any work.

Table 6- 1 Checklist (1) - general checks

Check	OK
Are all of the necessary components of the configured drive line-up available, correctly dimensioned, installed and connected?	
Are the manufacturer's documentation for the system components (e.g. drive system, encoder, cooling system, brake) and the "SIMOTICS M-1PH8 main motors" Configuration Manual available?	
If the 1PH8 motor is to be fed from a SINAMICS S120 drive system: Is the following, current SINAMICS documentation available? • SINAMICS S120 Commissioning Manual • Getting Started S120 • S120 Function Manual • S120/150 List Manual	
If the 1PH8 motor is to be fed from a SINAMICS S120 drive system: Was the Chapter "Checklists for commissioning SINAMICS S" in the SINAMICS S120 Commissioning Manual carefully observed?	
Is the motor type to be commissioned known? (e.g. 1PH8 _ _ _ – _ _ _ _ _ – _ _ _ _)	
Are the environmental conditions in the permissible range?	

Table 6- 2 Checklist (2) - checks regarding the mechanical system

Check	OK
Have all touch protection measures for moving and live parts been taken?	
Has the motor been correctly mounted and aligned?	
Can you rotate the rotor without it touching the stator?	
Do the operating conditions correspond to the data specified on the rating plate?	
Are all mounting screws, connecting elements, and electrical connections tight and attached properly?	
Do the output elements have the correct setting conditions according to type? Examples: • Have the couplings been aligned and balanced? • Has the tension of a belt drive been correctly adjusted? • Have the gear tooth flank and gear tooth tip play as well as radial play been correctly adjusted for geared outputs?	

Table 6- 3 Checklist (3) - checks regarding the electrical system

Check	OK
Has the motor been connected so that it rotates in the specified direction?	
Have the minimum insulation resistance values been maintained?	
Have the grounding and equipotential bonding connections been correctly established?	
Do the brakes function perfectly?	

Table 6- 4 Checklist (4) - checks regarding monitoring devices

Check	OK
Has it been ensured that speeds no higher than the maximum speed n_{max} can be reached (is the drive speed limited)?	
Have all supplementary motor monitoring devices and equipment been correctly connected – and are they functioning correctly?	

Table 6- 5 Checklist (5) - checks regarding the cooling system

Check	OK
Water cooling Has the cooling water supply been connected and is it ready for operation? Is the cooling water circulation (flow rate, temperature) in compliance with the specifications?	
Forced ventilation Have you checked all safety-related and function-relevant details? Examples: • Have you compared the data of the external cooling unit with the supply data? It is not permissible that the external cooling unit is connected if the supply data deviates from the data of the external cooling unit to such an extent that an overload condition would occur. • Is the electrical installation of the external cooling unit, including accessories OK, e.g. has the protective conductor been connected? • Are the mechanical installation and electrical installation of the safety-relevant components OK? These include the installation of a circuit breaker and attaching protective guards. • Are the cable entry glands correctly sealed? • Are the fan air intake and the area around the fan blades free of foreign bodies? • Does the fan have the correct direction of rotation? An arrow is stamped on the fan rating plate. This arrow indicates the correct direction of rotation of the fan. An arrow is also marked on the fan blades. When the fan starts, you can visually check the direction of rotation using the arrows. The fan functions correctly if the direction of rotation matches the direction of the arrow on the fan rating plate.	

Table 6- 6 Checklist (6) - checks regarding the optional brake

Check	OK
Does the brake open when the operating voltage is connected?	
Does the brake open and close correctly?	

Table 6- 7 Checklist (7) - checks regarding roller bearings

Check	OK
Are the roller bearings OK?	
For motors that were stored, were the storage conditions according to Chapter "Storage" and the bearing change intervals according to Chapter "Bearing change interval" complied with?	

6.3 Checking the insulation resistance

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



⚠WARNING

Danger to life through electric shock

During and immediately after the measurement, the terminals are in some cases at hazardous voltages, which can lead to death when touched.

- Only check the insulation resistance if you are appropriately qualified to do this.
- Before measuring the insulation resistance, read the manual for the insulation resistance meter you are going to use.
- Never touch the terminals when making measurements or immediately after the measurement.
- Check the connected supply feeder cables to ensure that the line supply voltage cannot be connected.

- Always measure the insulation resistance of the winding to the motor enclosure when the winding temperature is between 20 and 30 °C.
- When performing the measurement, wait until the final resistance value is reached (this takes approx. one minute).

Limits

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

Table 6- 8 Stator winding insulation resistance at 25 °C

	Rated voltage $U_N < 2$ kV
Measurement voltage	500 V (at least 100 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

Note the following:

- Dry, new windings have an insulation resistance of between 100 and 2000 MΩ (sometimes higher).

  If the insulation resistance is close to the minimum value, this could be due to humidity and/or an accumulation of dirt.

- The insulation resistance of the motor winding can drop during the course of its service life can drop due to ambient and operational influences. The critical insulation resistance for a temperature of 25 °C on the winding can be calculated by multiplying the rated voltage (kV) by the specific critical resistance value (0.5 MΩ/kV);

  Example: Critical resistance for a rated voltage (V_N) of 0.6 kV:

  0.6 kV x 0.5 MΩ/kV = 0.3 MΩ

Note

Cleaning and/or drying the windings when reaching critical insulation resistance

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.

Note that the insulation resistance of dried, clean windings is lower than that of warm windings. The insulation resistance can only be evaluated accurately when measured on a winding that has been cooled down to room temperature (approx. 20 to 30°C).

Note

Measured value close to critical value

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

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

6.4 Switching-on and switching-off

Note

EMERGENCY OFF

To avoid accidents, inform yourself about the EMERGENCY OFF function before you switch on the system.

The motor is switched on and off using the converter.

- Read about this topic in the converter operating instructions.

Switching on

Precondition

- Ensure that the converter is correctly parameterized.
- Use the appropriate commissioning tools, for example, "Drive ES" or "STARTER".
- Switch on the cooling system.

Procedure

1. Switch on the motor at the converter.
2. Ensure smooth motor operation.
3. Check the function of the motor cooling system.
4. Check the function of the safety equipment.
5. Check whether the motor reaches the required parameters

❒

Switching off

- Switch-off the motor at the converter.

The motor has been commissioned.

6.5 Cooling

Water cooling

The motor must always be connected to the cooling water supply when in operation.



⚠ WARNING

Danger to life when the cooling system bursts

The motor will overheat if it is operated without cooling. When cooling water enters the hot motor, this immediately and suddenly generates hot steam that escapes under high pressure. This can cause the cooling water system to burst, resulting in death, severe injury and material damage.

- Never operate the motor without cooling.
- Only commission the cooling water circuit when the motor is in a cool condition.



NOTICE

Overheating because there is no cooling water

If the cooling water supply fails or the motor is operated for a short time without cooling water, this can cause it to overheat. This can result in material damage or destroy the motor completely.

- Never operate the motor without the cooling water supply. Monitor the permissible water inlet temperatures.

Forced ventilation

Steps must be taken to ensure that the motor is only operated in conjunction with the external fan.



NOTICE

Risk of overheating if external cooling is inadequate

If the external fan fails or the motor is operated for a short time without forced ventilation, this can cause it to overheat. Overheating can cause failures and shorten the service life of devices/systems.

- Always operate the motor together with an external fan.

Operation

7

Note

EMERGENCY OFF

To avoid accidents, inform yourself about the EMERGENCY OFF function before you switch on the system.

Switching on

⚠WARNING

Danger to life caused by the machine moving and loose objects

Machine movement and loose objects, which can fall or are flung out, can cause severe injury.

- Ensure that the machine has been completely installed and all of the setting work completed.
- Ensure that nobody is at risk at switch on.
- Before switching on, check that there are no loose objects in or on the motor that can fall or can be flung off.

The motor is switched on at the converter.

- Read about this topic in the converter operating instructions.

Operation

While the motor is operational ensure that the specified parameters are maintained.

Make sure that:

- The current drawn is in the specified range
- Cooling is ensured
  - For water cooling: Check the liquid level and coolant circulation.
  - For forced ventilation: Check that the heat can be dissipated unobstructed.
- There are no abnormal motor noises
- The motor does not overheat
- If available, the sealing air intake functions

NOTICE

Motor damage caused by worn bearings

Worn bearings cause motor damage.

- Always comply with the bearing change intervals depending on the operating state.

Switching off

The motor is switched off at the converter.

- Read about this topic in the converter operating instructions.

7.1 Faults

⚠WARNING

Injuries caused by the drive system as a result of ineffective protective devices

Injuries can be caused if protective devices are deactivated while troubleshooting.

- Only operate the drive system with functioning protective devices.

Note

Damage to the machine caused by faults

- Correct the cause of the fault as specified in the remedial measures section.
- Repair any damage to the machine/motor.

Note

When faults occur, observe the converter operating instructions.

- If changes occur with respect to normal operation or faults, determine the cause using the "Possible faults" table.
- If you have identified the cause, attempt to resolve the fault using the "Key – fault causes and remedial measures" table.
- In this regard, observe the relevant chapter in the documentation associated with the components of the complete drive system.

Table 7- 1 Possible faults

Fault	Cause of fault (see key table)																	
Motor does not start	A	B			E													
Motor starts slowly	A		C		E	F												
Rumbling noise when starting			C		E	F												
Rumbling noise in operation	A		C		E	F												
High temperature rise under no load operation				D			G	H	I									
High temperature rise under load	A		C				G	H	I									
High temperature rise of individual winding sections					E	F												
Uneven running										J	K							
Grinding sound, running noise												L						
Radial vibration													M	N	O	P	R	
Axial vibration															O	Q	R	
Water is leaking																		S

Table 7- 2 Key to causes of faults and remedial measures

No.	Cause of fault	Remedial measures
A	Overload	Reduce load
B	Interrupted phase in the supply cable/motor winding	Check the converter and supply cables/measure the winding resistances and insulation resistances, repair after consultation with manufacturer
C	Interrupted phase in the feeder cable after switching on	Check the converter and supply cables/check the winding resistances.
D	Converter output voltage too high, frequency too low	Check the converter settings, perform automatic motor identification.
F	Winding short circuit or phase short circuit in stator winding	Measure the winding resistances and insulation resistances, repair after consultation with manufacturer
G	Cooling water not connected or switched off	Check cooling water connection, switch on cooling water
H	Cooling water flow rate too low	Increase cooling water flow rate
	Inlet temperature too high	Set correct inlet temperature
E	Stator winding incorrectly connected	Check winding connection
I	Heat dissipation obstructed by deposits	Clean the drive surfaces. Ensure that the cooling air can flow in and out unimpeded
	Cooling air inlet/outlet is blocked by foreign bodies	Remove the blockage. Ensure that the cooling air can flow in and out unimpeded
	Fan motor does not start	Check the function of the fan motor
J	Insufficient shielding for motor and/or encoder cable	Check the shielding and grounding.
K	Drive controller gain too high	Adjust the controller.
L	Rotating parts are grinding	Determine cause and adjust parts concerned
	Foreign bodies in the motor	Send to manufacturer for repair
	Bearing damage	Send to manufacturer for repair
M	Rotor not balanced	Decouple rotor and rebalance.
N	Rotor out of true, shaft bent	Consult the manufacturer
O	Poor alignment	Align machine set, check coupling.
P	Coupled machine not balanced	Rebalance coupled machine.
Q	Mechanical shocks from coupled machine	Inspect coupled machine.
R	Uneven gearbox operation	Repair the gearbox.
S	Cooling water pipe / water connection defective	Locate leaks and seal as necessary, or consult the manufacturer

If the fault still cannot be resolved after applying the measures specified above, please contact the manufacturer or the Siemens Service Center.

7.2 Non-operational periods

Measures for longer non-operational periods

NOTICE
Damage due to improper storage The motor can be damaged if it is not stored properly. • If the motor is not operational for longer periods of time, preserve it by using anti-corrosion protection and ensure that it remains dry (e.g. appropriate drying agents). • When recommissioning after longer non-operational periods of the motor, perform the checks and measures listed in Chapter, "Commissioning".

- Disconnect the motor from the cooling water system.
- Remove any cooling water from the motor.
- Blow out the cooling ducts with compressed air to dry them.
- If the motor is not operational for extended periods of time, run it at regular intervals (roughly once a month) or spin the rotor by hand.
- Before switching on to commission the drive, carefully read the Section "Switching on" in the Chapter "Switching on and switching off".

Maintenance

8

⚠ CAUTION

Risk of burns when hot cooling water escapes

There is a risk of burns caused by escaping hot cooling water and steam if you open the cooling circuit of a motor that was previously in operation.

- Do not open the motor cooling circuit until the motor has cooled down.



⚠ CAUTION

Risk of injury through contact with cleaning agents and solvents

Contact with cleaning agents and solvents can cause chemical burns and irritate the skin and mucous membranes.

- Carefully observe all of the safety and application notes provided on the packaging of the cleaning agents and solvents.
- Ensure that any vapors that are released are drawn out and that the work area is well ventilated.
- Use the appropriate personnel protection equipment (e.g. protective eyewear, gloves, respiration filter).

⚠ CAUTION

Injuries caused by blown particles

When you clean using compressed air, this can stir up dust, metal chips and cleaning agents, which can cause injury.

- When cleaning with compressed air, ensure there is adequate extraction equipment.
- Use the appropriate personnel protection equipment, e.g. gloves, protective overall.

8.1 Inspection and maintenance

8.1.1 General inspection guidelines

The motor is not disassembled for inspection.

If you have any questions, please contact the manufacturer, informing them of the machine type and serial number.

We recommend that a Siemens Service Center carries out inspection and maintenance work. The contact data is provided in the introduction under "Technical support".

8.1.2 Maintenance and inspection intervals

General

- Inspect and maintain the motor at regular intervals to be able to identify faults at an early stage and remove them.

NOTICE
Resulting damage to the machine
Unusual conditions or faults of the motor, e.g. overload or short circuit can result in consequential damage to the machine. • Immediately inspect the motor if faults or exceptional conditions occur.

Cleaning

- Regularly clean the drive system to ensure that it is adequately cooled.

Inspection/maintenance intervals, periods, measures

The maintenance intervals depend on the operating conditions.

- Adapt the maintenance intervals to match the local conditions, such as pollution/dirt, switching frequency, load, etc.
- Carry out the following measures according to what is specified in the table.

Table 8- 1 Operating intervals or periods and measures

Operating intervals or periods	Measures
After 500 operating hours, after 6 months at the latest	Initial inspection
Approx. every 8000 operating hours, after 2 years at the latest Approx. every 5000 operating hours, after 2 years at the latest	General inspection Without radial shaft sealing ring With radial shaft sealing ring
Note the recommended bearing replacement intervals (see "Bearing replacement intervals")	Replace the bearings
Approx. every 5000 operating hours	Replace the radial shaft sealing rings
Depending on local degree of pollution	Clean the fan for forced ventilation cooling systems
Maintenance-free, provided that the required cooling water quality is ensured	Cooling water system (water cooling)

8.1.3 Initial inspection

Carry out a first inspection after

- installation
- 500 operating hours, at the latest after 6 months
- corrective maintenance of the motor.

Note

Adapt the inspection to the plant-specific conditions.

Further tests are also necessary in line with the component documentation or corresponding to the particular system-specific conditions.

Test scope

While the motor is running, check that

- the equipment conforms to the stated electrical characteristics.
- the smooth running characteristics and motor noise during operation have not changed.

NOTICE

Machine damage when ignoring abnormalities identified during the inspection

Abnormalities identified during inspection that are subsequently ignored can result in machine damage.

- Analyze and remove any abnormalities identified, taking into consideration Chapters, "Faults" and "Maintenance".
- Contact the Siemens Service Center if you require any support.

8.1.4 General inspection

Note

Adapt the inspection to the plant-specific conditions.

Further tests are also necessary in line with the component documentation or corresponding to the particular system-specific conditions.

Test scope

While the motor is running, check that

- the electrical parameters are maintained.
- the smooth running characteristics and motor noise during operation have not changed.

When the motor is at a standstill, check that

- the motor foundation has no indentations or cracks.
- the machine is aligned within the permissible tolerance ranges.
- all of the mounting bolts/screws for the mechanical and electrical connections are tight.
- the insulation resistance of windings lies in the permissible tolerance range.
- any bearing insulation is fitted in accordance with the labeling.
- cables and insulating parts and components are in a good condition and are not discolored.
- the permissible radial forces (cantilever forces) of the roller bearings are complied with.

Note

The permissible radial forces are listed in Catalog NC 62, D 21.4 and in the Configuration Manual "SIMOTICS M-1PH8 main motors".

NOTICE

Machine damage when ignoring abnormalities identified during the inspection

Abnormalities identified during inspection that are subsequently ignored can result in machine damage.

- Analyze and remove any abnormalities identified, taking into consideration Chapters, "Faults" and "Maintenance".
- Contact the Siemens Service Center if you require any support.

8.1.5 Bearing replacement intervals

The bearings are subject to wear and must be replaced after a defined number of operating hours. The recommended bearing replacement intervals t_{LW} are listed in the following table.

Bearing replacement intervals can be extended if the motor is operated under favorable conditions, e.g. low or medium speeds, low radial forces (cantilever forces), vibration load.

Note

Difficult operating conditions

Under difficult operating conditions, the bearing replacement intervals t_{LW} are reduced by up to 50%.

Difficult operating conditions include, for example

- continuous operation with n_{max}
- high vibration and surge loads
- frequent reversing operation

Table 8- 2 Bearing version, maximum speeds and bearing replacement intervals

Shaft height	Bearing version	Maximum speed n_{max} in rpm	Average operating speed n_m in rpm	Statistical bearing lifetime L_{10h} in h	Recommended bearing replacement interval t_{LW} in h	
					Permanent lubrication	Relubrication
132	Standard with locating bearing	8000	< 6500	20000	20000	-
	Standard	8000	< 4500	20000	20000	-
	Performance	10000	< 8500	12000	12000	-
	High Performance	15000	< 10000	12000	12000	-
	Advanced Lifetime	4500	< 2500	40000	40000	-
	Increased radial forces	6500	< 1800	20000	20000	-
160	Standard with locating bearing	6500	< 5400	20000	20000	-
	Standard with locating bearing (option L96)	5000	< 3500	20000	20000	-
	Standard	6500	< 3500	20000	20000	-
	Standard with option L96	5000	< 3500	20000	20000	-
	Performance	9000	< 7000	12000	12000	-
	High Performance	10000	< 8000	12000	12000	-
	Advanced Lifetime	4000	< 2300	40000	40000	-
	Increased radial forces	5300	< 1500	16000	16000	-

Calculating the average speed

$$n_m = \frac{n_1 t_1 + n_2 t_2 + \ldots n_i t_i}{100}$$

Table 8- 3 Recommended bearing replacement intervals at maximum speed

Shaft height	Bearing version	Maximum speed n_{max} in rpm	Statistical bearing lifetime L_{10h} in h	Recommended bearing replacement interval t_{LW} in h	
				Permanent lubrication	Relubrication
132	Performance	10000	8000	8000	-
	High Performance	15000	8000	8000	-
160	Performance	9000	8000	8000	-
	High Performance	10000	8000	8000	-

Note

1PH8 motors require special bearings, which can be obtained via the Siemens Service Center.

8.1.6 Cleaning the motor and fan (external fan)

- Check the degree of pollution of the motor and the external cooling unit at regular intervals.
- Clean the motor and the external cooling unit if cooling is no longer adequate.

Preparing for cleaning

⚠WARNING

Danger to life as a result of rotating fan blades

When carrying out repair and maintenance work on the external cooling unit, rotating fan blades can cause severe injury.

- Switch off the external cooling unit.
- Disconnect the external cooling unit circuit and lock out the external cooling unit so that it cannot be switched on again.
- If at all possible, lock the fan blades so that they cannot rotate.

1. Switch off the motor and external cooling unit.
2. Disconnect both of them from the power supply by disconnecting all phases.
3. Ensure that they both cannot be accidentally switched on again.
4. Once the voltage has been disconnected on all poles, wait for five minutes before touching the device.
5. Allow the motor and external cooling unit to cool down.
6. To clean the fan blades, remove the guard from the cooling unit. The motor remains attached to the guard.
7. If at all possible, lock the fan blades so that they cannot rotate.

❒

Cleaning



⚠WARNING

Danger to life due to risk of explosion caused by solvents

When using solvents, vapors are released, which can explode if they come into contact with a source of ignition. The explosion can cause death or severe injury.

- Remove or extinguish all sources of ignition.
- Only use tools where sparking can be completely ruled out.
- Ensure good ventilation.



⚠CAUTION

Risk of injury through contact with cleaning agents and solvents

Contact with cleaning agents and solvents can cause chemical burns and irritate the skin and mucous membranes.

- Carefully observe all of the safety and application notes provided on the packaging of the cleaning agents and solvents.
- Ensure that any vapors that are released are drawn out and that the work area is well ventilated.
- Use the appropriate personnel protection equipment (e.g. protective eyewear, gloves, respiration filter).

NOTICE

Damaged fan blades as a result of excessive force

Fan blades can be damaged if subject to excessive force.

- Avoid applying excessive force to the fan.

Note

Use a lint-free cloth or a soft brush to clean the fan blades; ensure that no moisture enters the inside of the motor.

- Clean the motor and the external cooling unit with commercially available cleaning agents.

After cleaning

Procedure

1. Allow the motor and external cooling unit to dry.
2. After wet cleaning, check the insulation resistance.
3. If available, remove the rotation locking element of the fan blades.
4. Screw the guard (with fan) back onto the fan unit.
   To do so, tighten the four screws (for 1PH813) or six screws (for 1PH816) with a torque of 3.5 Nm ± 0.5 Nm.
5. Check that you have removed all of the cleaning equipment and cleaning agents.
6. Check that you have reattached all of the parts that were removed for cleaning.
7. Reconnect the power supply.
8. Switch on the motor and external fan unit again.

❒

8.1.7 Replacing an encoder

When replacing the motor bearings, we also recommend that you replace the encoder equipped with their own bearings.

8.2 Corrective maintenance

⚠WARNING

Danger to life from permanent magnet fields

The permanent magnets of synchronous motor rotors generate strong magnetic fields and forces of attraction. The permanent magnets represents a danger for people with active medical implants, who come close to the motors. Examples of such implants include: Heart pacemakers, metal implants, insulin pumps. Further, people that have magnetic or electrically conductive implants are at risk.

- If you are such a person (with heart pacemaker or implant) then keep a minimum distance of 2 m from an opened motor.
- Only the Siemens Service Center should remove the rotor.

NOTICE

Data loss due to strong magnetic fields

The permanent magnets of synchronous motor rotors generate strong magnetic fields and forces of attraction.

If you are located close to the rotor, any magnetic or electronic data storage media as well as electronic devices that you might be carrying could be damaged.

- Do not wear or carry any magnetic or electronic data storage media (e.g. credit cards, USB sticks, floppy disks) and no electronic devices (e.g. watches) if you are close to a rotor!

NOTICE

Damage to components that are sensitive to electrostatic discharge

The DRIVE-CLiQ interface has direct contact to components that can be damaged/destroyed by electrostatic discharge (ESDS). Encoder systems and temperature sensors are components that can be destroyed by electrostatic discharge (ESD).

Components that are sensitive to electrostatic discharge can be damaged if you touch the connections with your hands or with electrostatically charged tools.

- Carefully observe the information in Chapter "Handling electrostatic sensitive devices (ESD)".

The Siemens Service Center Bad Neustadt, Germany should be contacted when carrying out motor repair work.

You can replace a defective encoder on site where the motor is installed.

- Read and follow the notes and descriptions in this documentation.

8.2.1 Removing/installing the motor

Removal

- When removing the motor, mark the original position of the components with respect to each other (e.g. using a colored pen, scribing iron) to make subsequent installation easier.
- Removing the encoder, see Chapter "Removing/mounting the encoder".
- Unscrew the NDE bearing shield screws and carefully remove the NDE bearing shield.
- Unscrew the bearing cap screws (see "Spare parts", item 1.02).
- Remove the grease slingers from the shaft shoulder (DE).
- Remove the rotors from the motor. Use a suitable device to remove the rolling-contact bearings.

⚠ CAUTION

Carefully remove the reluctance rotor

Due to the fine rotor lamination structure, the rotor might get deformed when stricking against other parts.

Mounting

- Do not reuse rolling-contact bearings that have been removed.
- Heat up the new rolling-contact bearings evenly to 80 - 100°C and attach them. When doing so, make sure that the bearing inner ring lies on the shaft shoulder.
- The device must not be subject to hard knocks (e.g. do not use a hammer etc.).
- Insert the motor rotor into the stator.
- Secure the bearing cap.
- Insert the NDE bearing (with shaft spring) into the NDE flange (keep the bearing straight) and tighten the screws.
- Press on the grease slinger (gamma ring housing 9RB... without sealing lip) with a suitable sleeve (dimension x = 0 mm (flush with cover)), see figure "Installing the gamma ring". When disassembling, do not reuse damaged grease slingers.
  With the bearing type "increased radial forces" (14th position of the Article No. = "F"), the grease slinger must protrude 1 mm over the cover, i.e. dimension x = 1 mm.

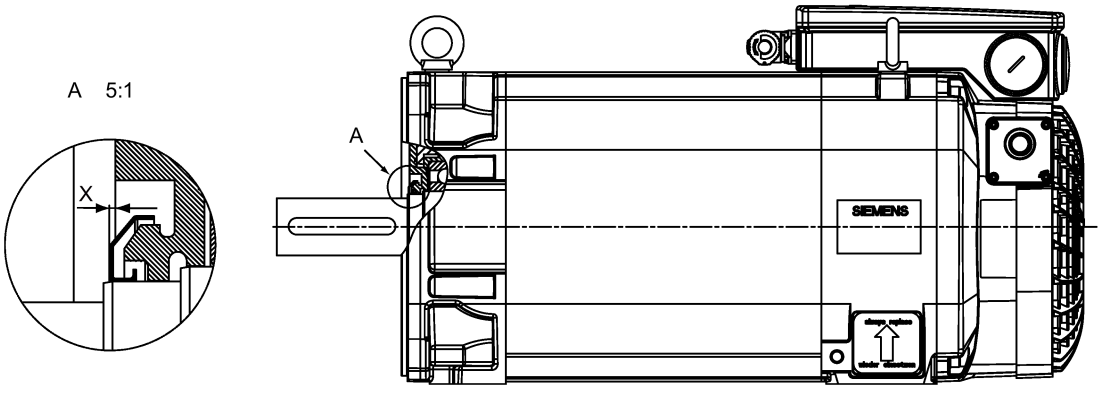


Figure 8-1 Installing the gamma ring

Running in the bearings

Once you have replaced the bearings, allow the rolling-contact bearings to run in to distribute the grease evenly. When doing so, the motors should be initially run continuously from 0 to approx. 75% of the maximum speed n_{max} over a period of 15 minutes.

8.2.2 Removing/installing the speed encoder

⚠WARNING

Uncontrolled motor motion as a result of incorrect adjustment

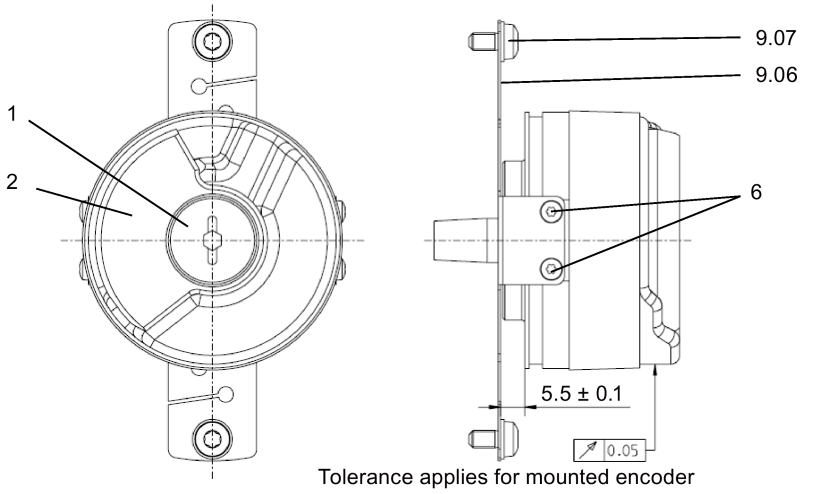
Incorrect adjustment of the encoder regarding motor EMF can lead to uncontrolled motion which can cause personal injury and/or material damage.

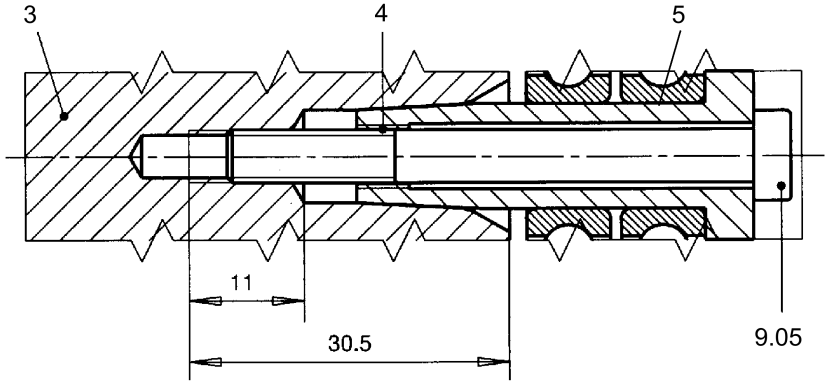
- Only change an encoder and adjust it if you are appropriately qualified to do so.

Note

Removing/installing the encoder

- Unscrew the terminal box cover and disconnect the power cables.
- Unscrew the external fan unit (if installed) and the encoder cover.





1	Screw	5	Encoder shaft
2	Connector cover	6	Screws
3	Motor shaft	9.xx	See section "Spare parts"
4	Jacking thread		

Figure 8-2 Motor shaft - encoder shaft connection

Removing the encoder

Procedure

1. Unscrew the screw (1).
2. Remove the connector cover (2).
3. Remove the connector with signal cable.
4. Unscrew the screws (9.07) for the torque bracket.
5. Unscrew the encoder screw (9.05) (make sure that the motor rotor does not also start to rotate).
6. Removing the encoder from the motor shaft:
   Screw the threaded pin, e.g. DIN 913 M5 x 15 for protection of the centering bore thread into the motor shaft extension as a disassembly aid and then separate the encoder by inserting an M6 x min. 40 screw.

❒

Mounting the encoder

Procedure

1. Screw the torque bracket (9.06) onto the encoder by means of screws (6) and secure in place (e.g. with Loctite 243). Observe the distance between the torque bracket and encoder! (this step does not need to be carried out if the encoder is already mounted).
2. If necessary, remove the threaded pin (used earlier to remove the encoder).
3. Unscrew the screw (1) for the replacement encoder.
4. Remove the connector cover (2) for the replacement encoder. Place the encoder (with torque bracket) (9.06) onto the cone of the motor rotor and screw in the encoder screw (9.05) (tightening torque 5 $^{-1}$ Nm). Prevent the motor rotor from starting to rotate as well!
5. Secure the torque bracket (9.06) by means of screws (9.07) on the bearing shield (6.01) (note the radial deflection of the encoder).
6. Press on the metal sleeve for the connector cable.
7. Insert the connector with signal cable and place the cable into the guide.
8. Fix the plug cover (2) with the screw (1) and secure in place, e.g. with Loctite 243.

❒

Note

Re-adjusting the encoder system

With synchronous motors, the encoder system has to be realigned!

8.2.3 Removing/installing the toothed-wheel encoder

Note

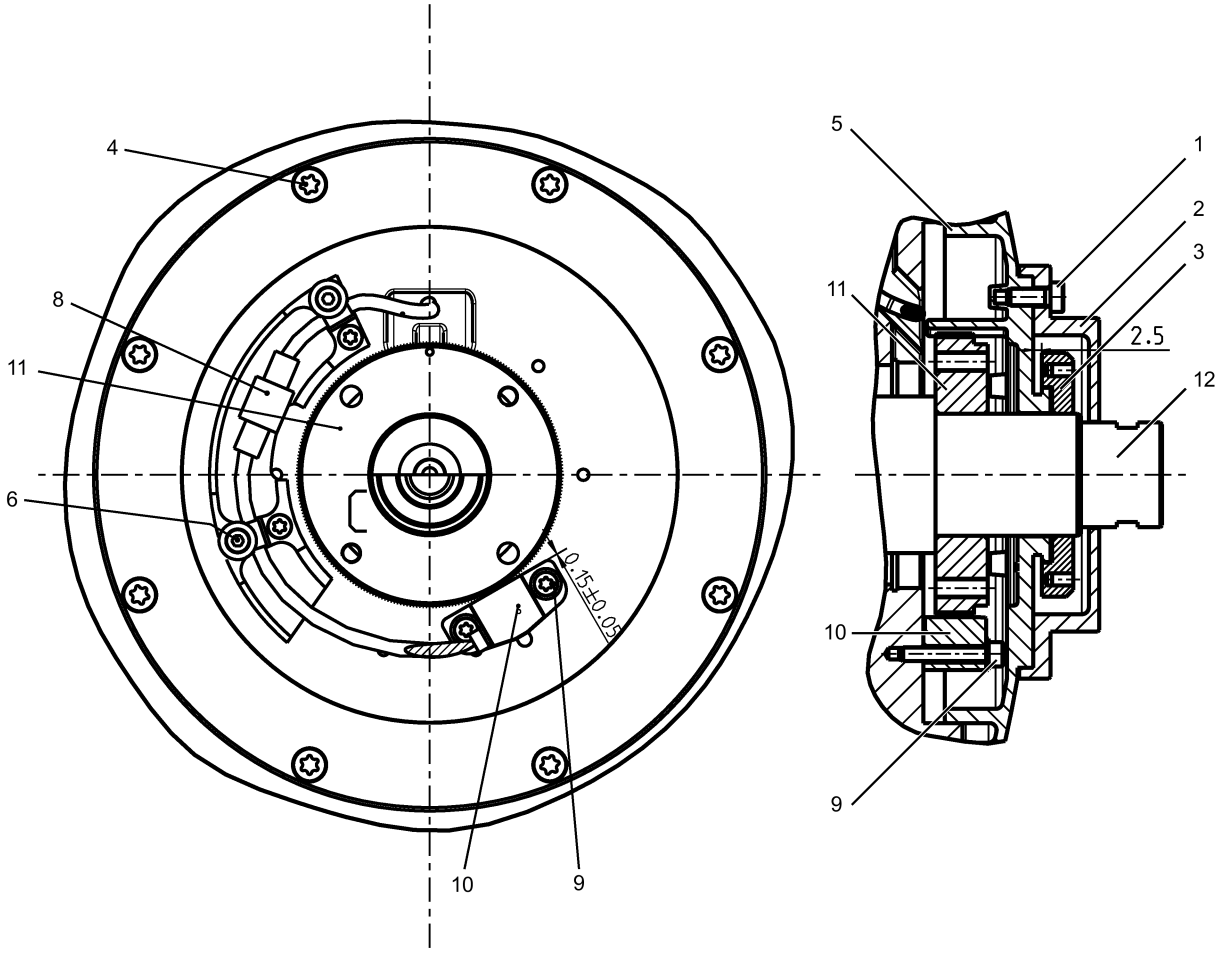
Toothed-wheel encoder

The toothed-wheel encoder has the following description without the DRIVE-CLiQ interface: "Incremental encoder sin/cos 1 Vpp 256 S/R without C and D tracks (encoder IN256 S/R)."

The marking is: 1PH8□□□-□**C**□□□-□□□□

The toothed-wheel encoder has the following description with the DRIVE-CLiQ interface: "Incremental encoder 19-bit without commutation position (encoder IN19DQ)."

The marking is: 1PH8□□□-□**S**□□□-□□□□



1	Screws	8	Connector
2	Cover	9	Screws
3	Balancing weight	10	Scanning unit
4	Screws	11	Toothed wheel
5	Cover	12	Motor shaft
6	Screw		

Figure 8-3 Installing the toothed-wheel encoder

Removing the encoder

Procedure

1. Unscrew the screws (1) and remove the cover (2).
2. Pull out the balancing weight (3).
3. Unscrew the screws (4) and remove the cover (5).
4. Scanning unit:
   - Unscrew the screw (6).
   - Remove the connector (8) for the signal cable.
   - Remove the screws (9) with washers and remove the scanning unit (10).
5. Toothed wheel:
   - Pull off the toothed wheel (11).

❒

Mounting the encoder

Procedure

Mount the toothed-wheel encoder in the reverse order to the order in which you removed it, with the following differences:

1. Heat up the toothed wheel (11) (approx. 150 °C), push it onto the motor shaft (12) and allow it to cool down.
2. Lock the screws (9) for attaching the scanning unit (10), e.g. with Loctite 243.
3. Observe the mounting dimensions (see Fig. "Installing the toothed-wheel encoder").

❒

8.2.4 Replacing the DRIVE-CLiQ interface (encoder module)

⚠WARNING

Danger to life when using an incorrect encoder module

The DRIVE-CLiQ encoder contains motor and encoder-specific data and an electronic type plate. If you use an incorrect DRIVE-CLiQ encoder, this can result in death, severe injury and severe material damage.

- Only use the DRIVE-CLiQ encoder and the electronic type plate for the original motor.
- Do not mount the DRIVE-CLiQ encoder onto other motors.
- Do not replace a DRIVE-CLiQ encoder by a DRIVE-CLiQ encoder belonging to another motor.
- Only appropriately trained Siemens service personnel should replace DRIVE-CLiQ encoders.

NOTICE

Electrostatic discharge

Electronic modules contain components that can be destroyed by electrostatic discharge. These modules can be easily destroyed if they are not handled properly.

- To protect your equipment against damage, follow the instructions given in the chapter ESD Guidelines.

8.2.5 Tightening torque for screwed connections

For screwed connections with metal contact surfaces (e.g. bearing end shields, active bearing components, or terminal box parts screwed onto the stator housing), the following tightening torques apply (depending on the thread size) with a tolerance of ±10 %, property class 8.8 and 8 or higher, to DIN ISO 898.

Table 8- 4 Tightening torque for screwed connections

Thread diameter	M4	M5	M6	M8	M10	M12	M16
Tightening torque [Nm]	3	5	9	24	42	70	165

Bolt locking devices

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 renew keyed elements.

8.2.6 Removing/mounting a holding brake (option)

Removing/mounting a holding brake (option) is described in the Appendix "Holding brake operating instructions".

Spare parts

9

Note

The diagram provided is merely intended as an example of the different motor versions and does not detail every aspect of the different versions.

The spare parts are available from our Service Centers in parts kits and can be ordered by specifying the motor designation.

"Spares on Web" provides a quick and uncomplicated way for you to determine the article numbers of standard spare parts and parts kits for motors. Simply enter the article number (machine type) and serial number at: www.siemens.com/sow

1.00	**DE bearing assembly, complete**	
	1.01	Bearing cap
	1.02	Screw
	1.03	USIT washer
	1.04	O-ring
	1.05	Cover
	1.06	Grease slinger
	1.07	Roller bearings
	1.08	Screw
6.00	**NDE bearing assembly (complete)**	
	6.02	Roller bearings
	6.03	Screw
	6.04	O-ring
	6.05	O-ring bearing
	6.06	Distance piece
	6.07	Corrugated spring
7.00	**Fan module, complete**	
	7.01	Fan
	7.02	Screw
	-	Shaft sealing ring (shaft sealing ring, rotor sleeve (not in diagram "Replacement parts (example)")
9.00	**Encoder kit for the individual encoder version - solid shaft**	
	9.01	Encoders
	9.04	O-ring
	9.05	Screw
	9.06	Torque bracket
	9.07	Screw
	-	Encoder kit for hollow-shaft encoders (not in diagram "Replacement parts (example)")
		Measuring wheel
		O-ring
		Sensor head
	-	DRIVE-CLiQ interface (not in diagram "Replacement parts (example)")

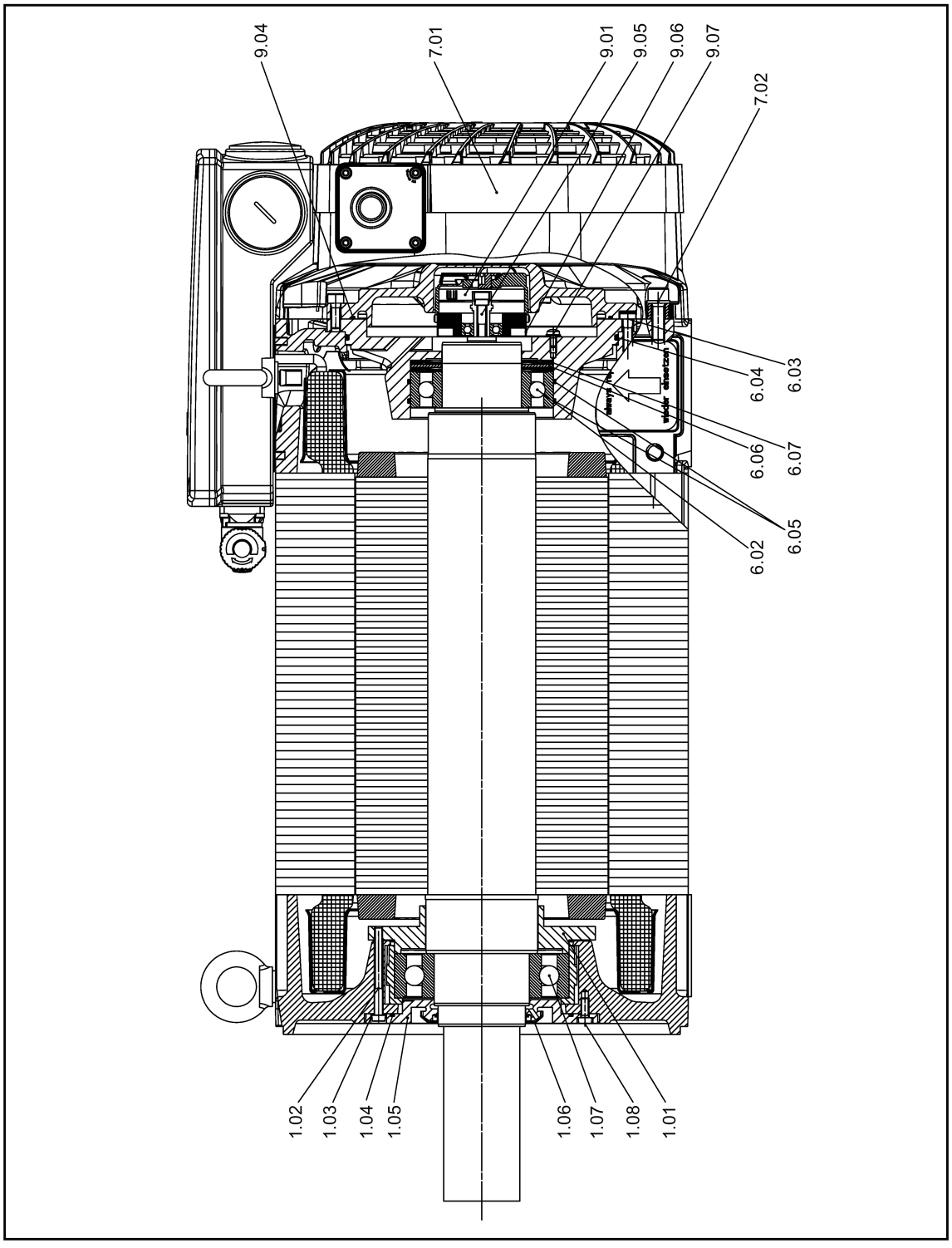


Figure 9-1 Spare parts (example)

Decommissioning and disposal 10

10.1 Decommissioning

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

Preparing for disassembling the motor

Procedure

1. Contact a certified waste disposal organization in your vicinity. Clarify what is expected in terms of the quality of dismantling the motor and provision of the components.
2. You must carefully follow the five safety rules as listed in Chapter "Fundamental safety instructions (Page 11)".
3. Disconnect all electrical connections.
4. Remove all liquids such as oil, water.
5. Remove all cables.
6. Remove the fixing elements from the motor.
7. Transport the motor to a suitable location for disassembly.

❒

- Also observe the notes provided in Chapter "Maintenance".
- Dismantle the motor using the general motor-typical procedures.

⚠WARNING

Danger to life caused by falling machine parts

The machine partially comprises heavy individual components. When removing the machine, these components can fall. This can result in death, serious injury or material damage.

- Secure the machine components that are being released so that they cannot fall.

- The motors must be disposed of in accordance with national and local regulations as part of the standard recycling process or they can be returned to the manufacturer.
- The encoder electronics must be properly disposed of electronic waste.

10.2 Disposal

Recycling and disposal



For environmentally-friendly recycling and disposal of your old device, please contact a company certified for the disposal of waste electrical and electronic equipment, and dispose of the old device as prescribed in the respective country of use.

Appendix

A

A.1 Note regarding a holding brake

Depending on what has been ordered, a holding brake can be mounted on the motor.

Notes on operation are provided in the operating instructions provided.

Note

Maintenance and corrective maintenance

Maintenance and corrective maintenance must only be carried out by personnel that have been appropriately authorized by Siemens!

See also

Properties (Page 31)

Operating Instructions for the holding brake (Page 118)

A.2 Operating Instructions for the holding brake



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INDUSTRIAL DRIVE SYSTEMS

Contents

1. General information ... 3
1.1 Introduction ... 3
1.2 Standards and directives ... 3
1.3 Manufacturer's liability ... 3
1.4 Declaration of Incorporation (in accordance with Annex II, part 1, Section B of Machinery Directive 2006/42/EC) ... 4
2. Safety ... 5
2.1 Safety and warning symbols / Safety information ... 5
2.2 Intended use ... 5
2.3 General safety information ... 6
2.3.1 Installation ... 6
2.3.2 Start-up ... 6
2.3.3 Operation ... 6
2.3.4 Maintenance and repair ... 7
3. Emissions ... 7
3.1 Noise ... 7
3.2 Heat ... 7
3.3 Electromagnetic compatibility ... 7
4. Product description ... 10
4.1 Operating principle ... 10
4.2 Design ... 10
5. Installation ... 12
5.1 Mechanical installation ... 12
5.1.1 Brake shaft (13) installation ... 12
5.1.2 Mounting the brake module to the motor ... 13
5.2 Installation of accessories (not applicable to the brake shaft (13)) ... 14
5.3 Electrical connection and operation ... 15
5.3.1 DC power supply ... 17
5.3.2 AC power supply ... 17
5.3.3 Electrical connection of brake modules with microswitch (27) ... 18
5.4 Set-up and start-up ... 18
5.4.1 Manual brake release ... 19
5.5 M_4 transmissible torque adjustments ... 20
6. Maintenance ... 21
6.1 Checks and service ... 21
6.2 Brake module removal from motor and replacement of component parts ... 22
6.3 Microswitch (27) adjustment (only applicable to brake modules with microswitch (27)) ... 23
6.4 Brake shaft (13) removal ... 24
7. Motor design ... 25
8. Driven components, balancing ... 26
9. Condition at delivery ... 26
10. Troubleshooting ... 27
11. Definitions ... 28
12. Technical specifications ... 28
13. Revision history ... 29

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INDUSTRIAL DRIVE SYSTEMS

1. General information

1.1 Introduction

These Operating Instructions describe the operating principle and features of Kendrion Binder spring-applied single-disc brake modules type 77 500..B...
The safety information provided in this manual must be strictly observed during the set-up of the machine (e.g. motor) and during the start-up, operation and maintenance of the spring-applied brake module.
Should any queries arise with respect to torques, torque variations, installation position, wear, wear reserve, switching work, break-in conditions, release range, ambient conditions and the like, please contact Kendrion Binder and ask for clarification before starting to use the brake.
Kendrion Binder spring-applied single-disc brake modules type 77 500..B.. are not ready-to-use devices, but are intended to be incorporated into or assembled with other equipment. Consequently, these brakes will be referred to as components in the following sections. The output side of the spring-applied single-disc brake modules has the same fitting dimensions as the motor end shield. As a result, the brakes are designed as fail-safe holding brakes with emergency stop function for attachment to electric motors.

1.2 Standards and directives

The state-of-the-art spring-applied brakes have been designed, built and tested in accordance with the requirements of DIN VDE 0580 concerning electromagnetic devices and components. Being classified as "electromagnetic components", spring-applied single-disc brake modules are not subject to the Low Voltage Directive and must not bear a CE mark of conformity. The user is required to employ suitable switching devices and controls to ensure use of the brakes in accordance with EMC Directive 2004/108/EC.

1.3 Manufacturer's liability

The manufacturer will not assume any responsibility for damage caused by failure to use the products in accordance with their intended use or by failure to observe safety information and other instructions provided in this manual. The information in this manual was correct and up-to-date before going to print. The information contained herein shall not entitle users to raise claims with respect to components purchased at an earlier date.

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INDUSTRIAL DRIVE SYSTEMS

1.4 Declaration of Incorporation
(in accordance with Annex II, part 1, Section B of Machinery Directive 2006/42/EC)

We hereby declare that the products below comply with the essential health and safety requirements specified in Annex I of Machinery Directive 2006/42/EC:

Annex I General Principles, Annex I Sections 1.1.2, 1.1.3, 1.1.5, 1.3.2, 1.5.1

The partly completed machinery must not be put into service until the final machinery into which it is to be incorporated has been declared in conformity with the provisions of Machinery Directive 2006/42/EC. The relevant technical documentation required for the partly completed machinery has been compiled in accordance with Annex VII, part B of Machinery Directive 2006/42/EC. The manufacturer undertakes to submit an electronic copy of the relevant technical documentation compiled for the partly completed machinery if reasonably requested by national authorities.

Standards and directives:

EN 60529	Enclosure protection ratings
DIN VDE 0580	Electromagnetic devices and components

Products: Electromagnetically released spring-applied single-disc brake module
77 50013B16
77 50019B15
77 50024B15
77 50029B15

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12 Dec. 2013

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INDUSTRIAL DRIVE SYSTEMS

2. Safety

2.1 Safety and warning symbols / Safety information

Personal injury or equipment damage			
Symbol / Signal word		**Warns against ...**	**Potential risks and hazards**
	Danger	imminent personal injury	fatal accidents or serious injury
	Warning	potential risk of serious personal injury	fatal accidents or serious injury
	Caution	potential risk of personal injury	minor injury
	Attention	potential risk of equipment damage	damage to components or other equipment
Information			
Symbol / Signal word		**Provides information on …**	
	Note	the safe use and operation of the product	

The brakes described in these Operating Instructions have been designed and built on the basis of an analysis of hazards and in accordance with the requirements of the applicable harmonized standards and technical specifications. They correspond to the state of the art and provide maximum safety. However, safety hazards can only be avoided if the user of the equipment takes adequate precautions and makes sure that safety instructions are strictly adhered to. It is the duty of the user of the machine to plan these measures and to check their implementation.

The user is required to ensure that:

- the brakes are only used in accordance with their intended use (see "Product description" section).
- the brakes are in perfect working order and checked at regular intervals.
- a complete copy of these Operating Instructions is kept available at the place of use of the brakes at all times.
- all applicable local and machinery-specific regulations and requirements are followed.
- start-up, maintenance and repair work is only done by authorized and suitably qualified personnel.
- such personnel are kept informed on all relevant occupational safety and environmental protection issues and familiar with these Operating Instructions and with the safety information contained herein.
- brake functionality is not interfered with by an external magnetic field.

2.2 Intended use

The brake modules described in these Operating Instructions are intended to be assembled with electric machines, in particular electric motors, for use on industrial equipment. Operation in potentially explosive or firedamp atmospheres is not allowed. The brake modules must be used in accordance with the operating requirements detailed in this manual. The rated power limits specified herein must not be exceeded. Use of the brake modules as service brakes or safety brakes is not permitted.

2.3 General safety information

Brakes fitted to motors feature hazardous live components and rotating parts and may exhibit hot surfaces.
Any work associated with the transport, connection, start-up and periodical maintenance of the brakes must be carried out by authorized and qualified specialist personnel (in accordance with VDE 0105; IEC 364). Failure to observe safety, operating and maintenance instructions may cause serious personal injury and severe damage to the equipment. Whenever special measures are required in accordance with the instructions contained herein, such measures should be agreed with the brake manufacturer before the machinery into which the brake is to be incorporated is set up.
Should any queries arise with respect to torques, torque variations, installation positions, wear, wear reserve, switching work, break-in conditions, release range, ambient conditions and the like, please contact Kendrion Binder and ask for clarification before using the brake.
Retrofitting or modification work to be carried out on the brake is subject to the approval from Kendrion Binder.
Accident prevention regulations applying to the specific field of application of the brake must be strictly observed.
The brakes described in this manual are not designed for use as "safety brakes". This means that torque reductions caused by factors beyond the user's control cannot be excluded.

2.3.1 Installation

When connecting the brakes described in these Operating Instructions check that the voltage and voltage type comply with the specifications on the rating plate. Sufficient heat dissipation must be ensured when the brake is fitted to or incorporated into other equipment.
Adequate precautions must be taken to avoid overvoltage during disconnection or voltage peaks. The magnetic field of the products may cause interference outside the brake or even feedback to the brake in case of adverse installation conditions. Should you have queries concerning mounting and fitting conditions, please contact the brake manufacturer and ask for clarification.

Adequate safety measures (DIN VDE 0848, part 4; DIN 31000/VDE 1000; DIN VDE 0100, part 0420) must be taken by the brake user to avoid hazards to persons or damage to equipment caused by:

- direct or indirect effects of electromagnetic fields,
- heated components,
- moving parts.

2.3.2 Start-up

The brakes must not be started up when:

- power supply cables/wires or connections are damaged.
- the solenoid housing or coil sheath is damaged.
- other defects are suspected.

2.3.3 Operation

Make sure that live components such as plug contacts or the field coil are not exposed to water.
The brake cable connections must not be crushed, squeezed or exposed to mechanical loads.
Check that the friction surfaces of the friction elements are not contaminated with grease, oil or other fluids to avoid substantial torque reduction. Bear in mind that the original torque cannot be restored even if the friction surfaces are cleaned after contact with fluids.
The gradual brake wear towards the end of the brake service life may cause an approximately 10% torque reduction. This must be taken into consideration in the set-up of the machine or overall system.
Due to the diverse ambient conditions in which the brakes may be used, always check that the brake module is in perfect working order before start-up.
Torque reductions cannot be excluded if the brake module is used for applications where only minimum friction work is required. In such cases, the user should ensure that the brake occasionally performs sufficient friction work.

Note!

The maximum air gap s_{max} (see Table 28/1: air gap s_{nom} and s_{max}) must not be exceeded throughout the entire brake module service life. (Please refer to Section 6 “Maintenance” for details.)

2.3.4 Maintenance and repair

Repair work must only be carried out by qualified specialist personnel (definition to IEC 364). Failure to perform repairs according to requirements may cause serious personal injury or equipment damage.
Make sure that no voltage is applied to the brakes when carrying out maintenance work.

3. Emissions

3.1 Noise

The spring-applied single-disc brake module produces switching noise during engagement and release. The noise level is determined by the installation conditions, circuitry and air gap. Depending on the mounting position, operating conditions and state of the friction surfaces, audible vibrations (squealing) may be produced during braking.

3.2 Heat

Braking operations and gradual heating of the field coil cause the solenoid housing temperature to increase substantially. Under adverse conditions, the surface temperature may rise to well over 100°C.

Caution!

Risk of burns in case of contact with hot surfaces! Suitable covers and hand guards must be installed to provide protection against accidental contact.

3.3 Electromagnetic compatibility

As required by the German Electromagnetic Compatibility Act (EMVG), electromagnetic compatibility must be guaranteed to ensure immunity to external electromagnetic fields and conducted interference.
Furthermore, the emission of electromagnetic fields and line-conducted interference during brake operation must be minimized. Since the brake features depend on the circuitry and operation, a declaration of conformity with the applicable EMC standard can only be furnished for the wiring type, but not for a specific brake.
The spring-applied single-disc brake modules type 77 500..B.. are designed for industrial applications to which the following EMC standards apply: Generic Immunity Standard EN 61000-6-2 and Generic Emission Standard EN 61000-6-3 / EN 61000-6-4.
Other applications may be subject to different generic standards which must be considered by the manufacturer of the overall system. The requirements in terms of electromagnetic compatibility of devices and components are determined by basic standards derived from the generic standards. Brake wiring recommendations will be provided in the following sections to ensure compliance with the individual basic standards that are relevant for industrial use of the brake and some other applications.
For additional information on electromagnetic compatibility, especially with respect to the recommended electronic rectifiers specified in Section 5.3, please refer to the applicable data sheets.

Immunity according to EN 61000-4:

EN 61000-4-2 Electrostatic discharge:
The spring-applied single-disc brake modules comply at least with severity level 3 without requiring additional measures. The recommended rectifiers specified in Section 5.3 conform to severity level 3 without additional measures.

EN 61000-4-3 Electromagnetic fields:
The spring-applied single-disc brake modules comply at least with severity level 3 without requiring additional measures. The recommended rectifiers conform to severity level 3 without additional measures.

EN 61000-4-4 Fast transients (burst):
The spring-applied single-disc brake modules comply at least with severity level 3 without requiring additional measures. The recommended rectifiers conform to severity level 3.

EN 61000-4-5 Surge:
The spring-applied single-disc brake modules comply at least with severity level 3 without requiring additional measures. The recommended rectifiers conform to severity level 3.

EN 61000-4-9 Pulse magnetic fields, EN 61000-4-10 Damped oscillatory magnetic fields:
Since the operating magnetic fields of the electromagnetic brakes are stronger many times over than interference fields, the brake function will remain unaffected. The spring-applied single-disc brake modules comply at least with severity level 4. The recommended rectifiers conform at least to severity level 3.

EN 61000-4-11 Voltage dips, short interruptions, and short supply voltage variations:

a) Voltage interruptions:
Spring-applied single-disc brake modules that comply with the requirements of DIN VDE 0580 are de-energized after the specified switching times at the latest. The switching time depends on the control and mains conditions (e.g. generator effect of running down motors). Voltage interruptions of shorter duration than the response delay specified by DIN VDE 0580 will not cause any malfunctions. The user must ensure that any consequential damage is avoided (e.g. motor start-up before the brake has been released caused by phase failure in the case of two-phase energized motors or by the slipping of an electromagnetically engaged system due to torque drop). The functional reliability of the electromagnetic brake and its electronic accessories remains unaffected provided that the aforementioned consequential damage is avoided.

b) Voltage dips and short supply voltage variations:
Electromagnetically released systems:
Voltage dips and supply voltage variations to below 60% of the rated voltage and lasting longer than the response delay specified by DIN VDE 0580 may cause the brake to be de-energized temporarily. Consequential damage as described under a) above must be avoided by the user by taking adequate precautions.
Electromagnetically engaged systems:
Voltage dips and supply voltage variations to below the minimum tolerance threshold will cause torque reductions. The user is required to take adequate precautions to avoid consequential damage.

Radio interference suppression in accordance with EN 55011:
The brake modules and the recommended electronic rectifiers are classified as Group 1 equipment in accordance with EN 55011. As far as the emissions from this equipment are concerned, one distinguishes between field guided radiated interference and line-conducted interference.

a) Radiated interference:
When operated with DC voltage or rectified 50/60 Hz AC voltage, all brakes comply with the limit values applicable to Class B equipment.

b) Conducted interference:
When connected to a DC power source, the electromagnetic brakes meet the limit values applicable to Class A equipment. If the brakes are connected to a 50/60 Hz AC power source and equipped with electronic rectifiers or other electronic controls, interference suppression measures as shown in Fig. 9/1 must be taken to ensure compliance with the limit values applicable to Class A equipment.

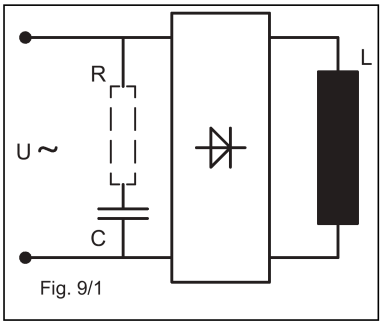


Fig. 9/1

Interference suppression capacitors should be used which must be dimensioned to suit the connection data of the electromagnetic components and the specific mains conditions. The recommended rectifiers specified in Section 5.3 are CE mark certified in accordance with the EMC Directive. They have built-in interference suppression components and comply at least with the requirements of EN 55011 for Class A equipment, unless otherwise specified in the specification sheets. When brakes are used with the specified rectifiers or with other types of rectifiers, the recommended values listed in Table 9/1 should be observed.
Interference suppression components should be installed as close as possible to the consumer. Interference caused during switching operations of the electromagnetic component is generally attributable to the inductive load.
Where necessary, assemblies designed to limit the disconnection voltage (e.g. anti-parallel diode) or voltage limiting components (e.g. varistors, suppressor diodes, resistance diodes and the like) can be installed. However, such components will inevitably change the switching times of the brake and increase the generated noise level. The rectifiers specified in Section 5.3 are equipped with free-wheel diodes and/or varistors to limit the disconnection voltage.
In case of DC side switching, a varistor rated for the type-specific maximum operating voltage and connected in parallel with the field coil (1.2) limits the peak voltage to the values specified in Table 9/2.

Note!

If the brake is used in connection with other electronic accessories, the user is responsible to ensure compliance with EMC requirements. Compliance with applicable standards concerning the design and operation of components, sub-assemblies or equipment employed shall not relieve the user and manufacturer of the overall system from their obligation to furnish proof of conformity of the overall system with such standards.

Rectifier type	Rated input voltage range U_1/VAC (40-60 Hz)	DC at L-load (ADC)	Capacitor (nF/VAC)
Half-wave rectifier 32 07332B40	up to 500 (⊠10%)	up to 2.0	no additional interference suppression measures required

Table 9/1

Max. rectifier operating voltage (VAC)	Recommended disconnection voltage for DC side switching (V)
250	700

Table 9/2

4. Product description

4.1 Operating principle

The brake module is an electromagnetic component with built-in electromagnetically released spring-applied single-disc brake designed to operate dry. The braking effect is produced by the spring force and neutralized electromagnetically. The brake module with ball bearing supported brake shaft should preferably be mounted to the A-face end shield of electric motors. The brake can also be equipped with an optional hand release so that it can be released manually.

4.2 Design

The solenoid housing (1.1) with the encapsulated field coil (1.2) accommodates the armature (2), friction disc (4) and flange (3). The flange is fixed by means of the cheese head screws (10). The compression springs (7) located in the solenoid housing (1.1) are supported on the adjusting ring (9) and solenoid housing (1.1) by the studs (8) (size 13 brakes: compression springs (7) only). These compression springs generate an axial force that is transmitted to the friction disc (4) through the armature (2). As a result, the friction disc (4) is clamped between the firmly fixed flange (3) and the armature (2) and the braking effect (torque) is produced. Straight pins (5) are provided which act as tangential torque supports for the armature (2) relative to the solenoid housing (1.1).
When DC voltage is applied to the field coil (1.2), the electromagnetic force thus generated causes the armature (2) to be attracted, overcoming the force of the compression springs (7). The friction disc (4) is thus released and the braking effect is neutralized.
As the brake module is a closed system, no forces are transmitted outwards away from the brake. Transmission of the braking force from the axially moveable friction disc (4) to the brake shaft (13) is achieved through the form-fit connection of the square socket in the friction disc with the brake shaft (13), with the brake shaft being rigidly connected with the motor shaft. This applies to size 13, 19 and 24 brakes. When a size 29 brake is used, the friction disc is connected with the brake shaft by means of the teeth provided on the disc and shaft. The ball bearing (15) located between the solenoid housing (1.1) and brake shaft (13) ensures that the brake can be centred relative to the brake shaft (13) and motor shaft when it is mounted to the motor flange. The bearing also absorbs transverse forces that act radially on the brake shaft (13). The ball bearing is factory-sealed.
An additional sealing ring (6) is provided which protects the friction disc (4) against dirt, grease or oil ingress in case the factory-installed ball bearing sealing rings are damaged and ensures that abrasive grit and dust produced by the friction disc cannot escape.
On the drive side, the flange (3) and brake shaft (13) are sealed by the sealing ring (11). The optional hand release (24) allows the spring-applied single-disc brake module to be released manually (e.g. in case of power failure). The brake must be connected directly to the terminals in the connector box (19).
The transmissible torque of the brake module can be changed with the adjusting ring (9). Rubber bolts (18) and an O-ring (26) are provided to reduce the noise and vibration produced by the friction disc (4).

Key to Fig. 11/1:

1.1	Solenoid housing	15	Ball bearing
1.2	Field coil	16	Circlip
2	Armature	17	Screw plug [1]
3	Flange	18	Rubber bolt [2]
4	Friction disc	19	Connector box
5	Straight pin	20	Feather key
6	Sealing ring		
7	Compression spring	22	Sealing washer
8	Stud (not used in size 13 brakes)	23	Cover (2 x arranged at 180°) [3]
9	Adjusting ring (not used in size 13 brakes)	24	Hand release (accessories)
10	Cheese head screw	25	Set screw [1]
11	Sealing ring	26	O-ring [4]
12	Disc	E	Adjusting ring clearance
13	Brake shaft	A	Contact surface motor side
14	Spring washer	B	Contact surface brake shaft (13)

[1] bonded with Loctite 243; installed in brake shaft (13)
[2] accessories for size 19 and 24 brakes; included as standard parts of friction disc (4) in size 13 brakes
[3] only used in brakes without hand release (24)
[4] only in size 29 brakes

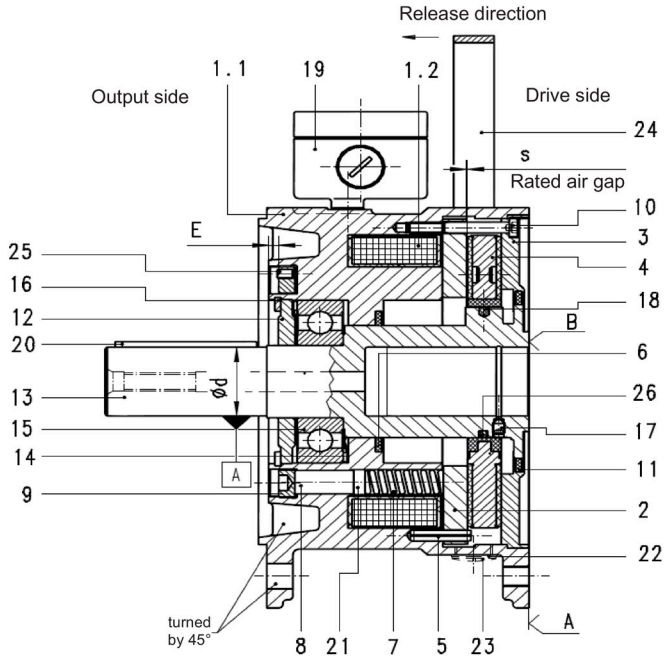


Fig. 11/1: Spring-applied single-disc brake module 77 500..B15

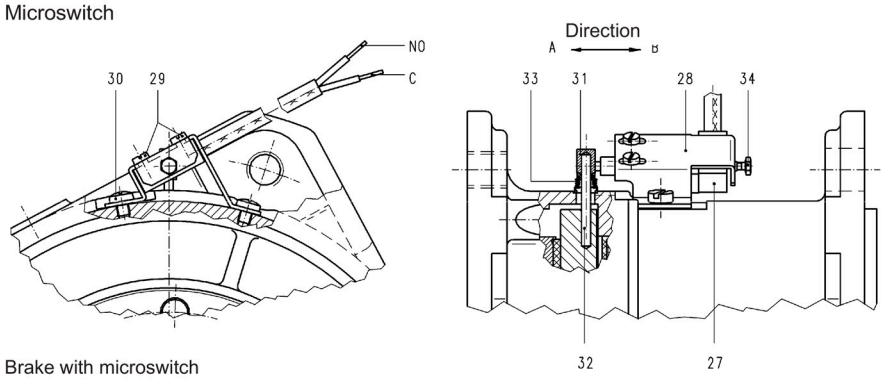


Fig. 11/2: Microswitch installation on spring-applied single-disc brake module 77 500..B15

Key to Fig. 11/2:

27	Microswitch	31	Stud
28	Strap	32	Straight pin
29	Cheese head screw (2x)	33	Bellows
30	Oval head screw (2x)	34	Hexagon head cap screw M2.5x8 (not supplied)

5. Installation

Attention!

Every time the spring-applied single-disc brake module is reassembled, the fixing screws and cheese head screws (10) must be tightened to the M_A tightening torques specified in Table 13/1 and Table 22/1. The adjusting ring (9) must be secured with the set screw (25) (tightening torque M_A = 3 Nm). Loctite 243 must be applied to the set screw (25). When maintenance work is carried out on the connector box (19) (see Section 5.3), the cheese head screws (19.3) must be tightened to M_A = 1.6 Nm when installing the cover (19.1) with the connector box (19). Damage to the seal between the connector box (19) and cover (19.1) must be avoided.

5.1 Mechanical installation

5.1.1 Brake shaft (13) installation

The press-fit connection of the brake shaft (13) with the motor shaft provides reliable transmission of the brake torque. An additional form-fit connection in the form of a feather key, for example, is not allowed. The motor shaft must not have a feather key groove.

Attention!

The fits and surface roughness required for the motor shaft must be chosen by the brake user according to the adjusted transmissible brake torque and must be suitable to ensure reliable transmission of the generated brake torques.

1. Before heating the brake shaft (13), make sure that both the brake shaft (13) and the motor shaft end are dry and free from grease and that the following parts have been removed:
   screw plug (17) – any brake size,
   rubber bolts (18) (accessories) – sizes 19 + 24,
   O-ring (26) (accessories) – size 29.
2. Check the position of the motor shaft contact shoulder relative to the contact surface of the brake on the motor flange and correct it by installing shim rings, if necessary. The permitted tolerance is ⊠ 0.5 mm.
3. Before mounting the brake shaft (13), check the radial runout on the motor shaft end and mark the maximum runout angle on the front face of the motor shaft.
4. After completion of the above operations, the brake shaft (13) must be evenly heated in an electric oven or by means of an inductive heating system until it has reached a temperature of 280°C to 300°C. Once heated, the brake shaft (13) must be slipped onto the motor shaft end until it touches the contact shoulder and secured in axial direction until is has cooled down. Make sure that the brake shaft (13) is mounted in such a way that the radial runout mark is offset by 180° relative to the runout mark on the motor shaft.
5. After the brake shaft has cooled down, screw the screw plug (17) into the brake shaft (13) and secure it with Loctite type 222. This applies to all brake sizes.
6. When rubber bolts (18) are used (size 19 and 24 brakes), insert the bolts (18) into the bores provided in the brake shaft (13) (see Fig. 11/1) after the shaft has cooled down.
7. When using a size 29 brake, insert the O-ring (26) into the groove in the brake shaft (13) (see Fig. 11/1).
8. If rubber bolts (18) (size 19 + 24 brakes) or an O-ring (26) (size 29 brakes) are used, check that they are correctly positioned (rubber bolts (18): rounded end pointing outwards in the bores of the brake shaft (13) square socket; O-ring (26): located in the groove near the brake shaft teeth).
9. During brake mounting, apply talc to the projecting surface of the rubber bolts (18) or O-ring (26) to reduce slip-on forces.

5.1.2 Mounting the brake module to the motor

Attention!

The friction surfaces of the friction disc (4), the guide surfaces of the square socket (size 13, 19, 24 brakes) or the teeth of the friction disc (4) (size 29 brakes) must be free from grease or oil. Do not use any lubricant to improve the axial guide properties of the friction disc (4) and make sure to avoid damage to the sealing rings (6 and 11).

1. Mount the brake module in vertical position with the motor shaft pointing upwards.
2. Close the oil supply bore in the brake shaft (13) with the screw plug (17). Apply Loctite 222.
3. Mount the brake module to the motor by slipping it onto the brake shaft (13) until it makes contact with the motor flange. Ensure that the brake is parallel to the motor shaft and that a form-fit connection is established between the brake shaft (13) and the square socket (size 13, 19, 24 brakes) or with the internal teeth (size 29 brakes) of the friction disc (4).
4. The friction disc (4) is factory-centred in the spring-applied single-disc brake module to ensure easy installation.
5. Slightly tighten the fixing screws after having taken the preliminary assembly steps described above. Ensure that the brake is released electromagnetically after the spring-applied single-disc brake module has been connected (see Section 5.3).
6. Manual brake release by means of an attached hand release (24), for example, is not allowed. To complete brake mounting, use the ball bearing set (accessories).
7. The spring washers (14) must be placed into the solenoid housing (1.1) as shown in Fig. 11/1. Size 13 and 19 brakes require only one spring washer each, whereas size 24 and 29 brakes must be equipped with two spring washers.

Attention!

The brake shaft and ball bearing must not be exposed to any axial shocks. The disc (12) is essential to the correct operation of the brake module and must only be replaced by an original spare part.

8. In order to install the ball bearing (15), pressure must be evenly applied both to the inner and outer rings of the bearing (15) to force it onto the motor shaft until it touches the shaft shoulder of the brake shaft (13). The necessary pressure is generated through a mounting sleeve and the thread provided at the front end of the brake shaft (13).
9. The solenoid housing (1.1) is thus centred through the ball bearing. Proceed to install the disc (12) and circlip (16).

Attention!

The M_A tightening torque (Table 13/1) specified for the fixing screws must be strictly observed. The screws must be tightened evenly in diametrically opposite sequence.

10. Tighten the fixing screws to the M_A tightening torques specified in Table 13/1.

	Size			
	13	19	24	29
M_A tightening torque (fixing screws) [Nm]	42	70	165	165

Table 13/1: M_A tightening torques for fixing screws

5.2 Installation of accessories (not applicable to the brake shaft (13))

Hand release (24) (only applicable to retrofitted hand release):

1. Remove the two covers (23) located opposite each other on the circumference of the solenoid housing (1.1) (see Fig. 14/1).
2. Screw the cams (24.1) with the threaded bush into the bores of the covers (23), making sure they are correctly positioned (see figure to the right). Apply Loctite 243 to secure the cams.
3. Insert the hand release lever (24.2) into the square socket provided in the cams (24.1). The hand release can be operated by pushing the lever (24.2) in one direction (see Fig. 14/1).
4. The mechanical release forces F required to release the brake and the maximum permitted release forces (actuation forces) F_{max} are specified in Table 14/1. The release forces F are based on the highest transmissible (standard) torque (see "Technical specifications").

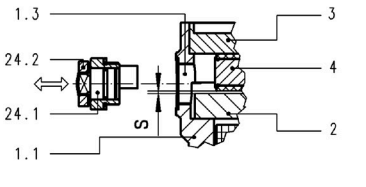


Fig. 14/1: Hand release and air gap control

Key to Fig. 14/1:

1.1	Solenoid housing	4	Friction disc
1.3	Bore for air gap measurement	24.1	Cam (complete)
2	Armature	24.2	Hand release lever
3	Flange	s	Air gap

	Size			
	13	19	24	29
Threaded bush tightening torque M_A [Nm]	20	26	35	35
Release force F [Nm]	80	130	200	240
Max. permitted release force (actuation force) F_{max} [N]	120	180	280	330

Table 14/1: Release force F, max. permitted release force (actuation force) F_{max} of hand release (24), M_A tightening torque of threaded bush of cams (24.1)

Warning!

Check that the mechanical hand release (24) is in a central position (see Fig. 11/1) when not in use. This is crucial to ensure reliable brake engagement. Otherwise, the full braking effect of the spring-applied single-disc brake module may not be reached. In this case, the machine (e.g. motor) must be stopped immediately and must not be restarted until correct operation of the hand release (24) and automatic return of the hand release lever in its central position (see Fig. 11/1) has been ensured.

Caution!

The brake torque can be neutralized manually by means of an attached hand release (24). Consequently, the brake must be mounted in such a way that any unintentional actuation of the hand release (24), e.g. by removing the hand release lever, is excluded.

Note!

Machinery-specific regulations and requirements (e.g. for hoists, cranes and elevators) must be observed when using brakes with hand release (24).

Ball bearing set (ball bearing (15), spring washer (14), circlip (16)):

The ball bearing set is required as a second bearing for the motor shaft. The complete ball bearing set must be installed as described in Section 5.1.1.

Rubber bolts (18) (size 19 and 24 brakes), O-ring (26) (size 29 brakes):

To reduce the noise produced by the brake module during operation, rubber bolts (18) (size 19 and 24 brakes) or an O-ring (26) (size 29 brakes) can be installed in the brake shaft (13) as described in Section 5.1.1.

5.3 Electrical connection and operation

Warning!

The brake module is a DC operated system. Permanent voltage variations on the power source of the electromagnetic brake must be limited to +/-10% of the rated voltage.

The following checks must be carried out when connecting the brake:

- Check that the connecting cables are suitable for the intended use and for the voltage and amperage of the brake.
- Check that the connecting cables are secured with screws, clamps or other suitable fixtures to avoid interruptions in the power supply.
- Check that the connecting cables are long enough for the intended use and that suitable torsion, strain and shear relief features as well as bending protections are provided.
- Check that the PE conductor (only for protection class I) is connected to the earthing point.
- Check that no foreign matter, dirt or humidity is trapped inside the terminal box.
- Check that unused cable entries and the terminal box are suitably sealed to ensure compliance with the protection class requirements to EN 60529.

The spring-applied single-disc brake module must be supplied with DC voltage.
Connection to an AC power source is via a half-wave rectifier (19.2). Brakes equipped with a built-in rectifier (19.2) can be connected directly to the AC power source. The contact assignment is shown in Fig. 16/1.
Brakes equipped with connecting terminal (19.2) must be connected directly to DC voltage. The customer-specific connecting cable must be connected to the terminal (19.2) or built-in rectifier (19.2) by means of a cable gland (M16x1.5 for cross-sections of between 5 and 10 mm.
Remove the cover (19.1) of the connector box (19) so that the individual strands of the connecting cable can be connected to the terminal (19.2) or to the contacts of the built-in rectifier (19.2).

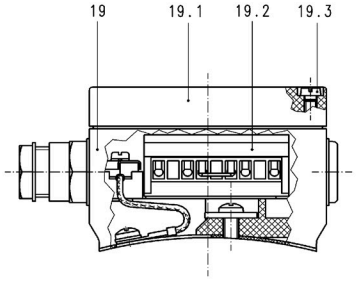


Fig. 15/1: Connector box (19) with terminal (19.2) or rectifier (19.2)

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Rectifier series	Rectifier type	Rated input voltage range U_1/VAC (40-60 Hz)	Output voltage U_2/VDC	Max. output current R-load I/ADC	Max. output current L-load I/ADC
32 07332B40	half-wave	0-500 (⊠10%)	U_1 ⊠ 0.445	1.6	2.0
Specific rectifier specification sheets must be observed!					

Table 16/1: Rectifier for single-phase AC voltage supply via connecting terminal (19.2)

Attention!

When installing the cover (19.1) and connector box (19), the cheese head screws (19.3) must be tightened to M_A = 1.6 Nm. Damage to the seal between the connector box (19) and cover (19.1) must be avoided.

Brakes equipped with built-in rectifiers (19.2) use half-wave rectification.
The built-in rectifier (19.2) can be wired in such a way that AC side switching (normal coupling time t_1) or DC side switching (short coupling time t_1) is possible (see Fig. 16/1).
Depending on the brake size and torque, voltage ripple due to intermittent power supply may cause brake humming or incorrect brake operation.
Perfect brake operation must be ensured by the user or system manufacturer by providing suitable electrical controls.

Attention!

When connecting the rectifier (19.2), the terminals must be tightened to a tightening torque of M_A = 0.4 Nm.

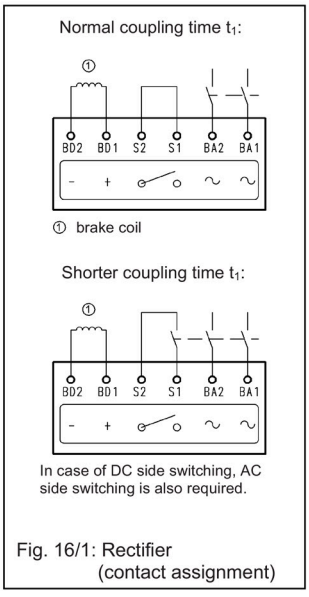
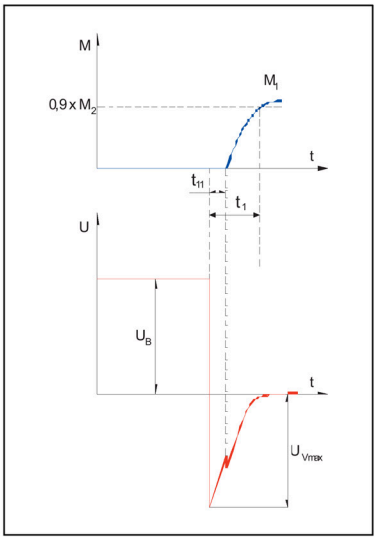


Fig. 16/1: Rectifier (contact assignment)

5.3.1 DC power supply

The figure to the right shows the voltage curve after the field coil (1.2) has been de-energized.



U_B operating voltage (coil voltage)
U_{Vmax} disconnection voltage

Attention!

The peak voltage U_{Vmax} during disconnection without protective circuit may reach **several thousand V** in the millisecond region. This may cause irreversible damage to the field coil (1.2), switching contacts and electronic components.
Sparking will occur on the switch during disconnection. Consequently, a protective circuit must be provided to reduce the current during disconnection and to limit the voltage. The maximum permitted overvoltage during disconnection is 1500 V.
If Kendrion Binder rectifiers are used (see Table 16/1), the protective circuit required for the built-in electronic components and field coil (1.2) is included in the rectifier and limits the disconnection voltage to approx. 300 V. This also applies to contacts S1 and S2 (DC side disconnection).

Attention!

In case of DC side switching and connection to a DC power source, the brake must be operated with a protective circuit to avoid overvoltage. Additional protective elements (e.g. varistors, spark arresters, etc.) must be installed to avoid damage such as burns or fusing of contacts.

Attention!

Sensitive electronic components (e.g. logical components) may also be damaged by the lower voltage.

5.3.2 AC power supply

Warning!

Work on the brake must only be carried out by qualified specialist personnel. Make sure that no voltage is applied during brake connection. The specifications on the rating plate and the information provided in the circuit diagram in the terminal box or in the Operating Instructions must be strictly observed.

Direct connection of the spring-applied single-disc brake to an AC power source is only possible if a rectifier is used. The coupling times vary depending on the switching type (DC side switching or AC side switching) (see Section 5.3).

Half-wave rectification:

In case of half-wave rectification, the U_2 coil voltage is lower by factor 0.445 than the rectifier input voltage. Half-wave rectifiers produce voltage with high residual ripple which, depending on the brake size, may slightly reduce the switching times when compared to bridge rectifiers. Due to the shorter switching times and the lower coil voltage, half-wave rectifiers are generally preferred to bridge rectifiers. However, brake humming may occur when small size brakes are used.

DC side switching:

In case of DC side brake switching, an auxiliary contact is provided on the motor contactor, for example. This auxiliary contact is designed to interrupt the power supply on the DC side.

5.3.3 Electrical connection of brake modules with microswitch (27)

Note!

Machinery-specific regulations and requirements (e.g. for hoists, cranes and elevators) must be observed when using brakes with microswitches (27).
When the brake is used for applications during which a load torque is generated, the system user is responsible to ensure correct and safe wiring of the microswitch (27) and brake module.

Warning!

The motor circuit must be protected in such a way that no accidental motor start-up can occur when the microswitch (27) contact closes.

If brakes are equipped with a microswitch (27) to control the release status (released/engaged) of the spring-applied single-disc brake module, the microswitch (27) must be tied into the control circuit of the machine (e.g. motor). This is crucial to ensure that the microswitch (27) prevents start-up of the machine (e.g. motor) before the spring-applied single-disc brake module has been released. The optional microswitch (27) must be ordered together with the brake as it cannot be retrofitted to the brake at a later date. The microswitch (27) is factory-adjusted prior to shipment of the brake module.

5.4 Set-up and start-up

Warning!

The functional check of the brake must not be performed unless the machine (e.g. motor) has been switched off (disconnected) and secured against accidental or unintentional start-up.

Attention!

When using machines (e.g. motors) with vertically upward directed shaft end, any ingress of fluids (water or cooling lubricant) into the ball bearing (15) of the brake module must be avoided. The brake module must be mounted in such a way that sufficient heat dissipation is ensured.

Attention!

Check that the brake has been connected in accordance with the specifications provided on the rating plate before it is started. Even short-term operation outside the specified supply voltage limits may cause irreversible damage to the brake or electronic accessories. Such damage may not be apparent immediately. DC side brake switching without protective circuit as described in Section 3.3 will cause damage to electronic rectifiers, electronic accessories, switching contacts and to the field coil (1.2).

Warning!

Before starting the machine (e.g. motor) test run without driven components, the feather key (if used) must be secured in such a way that it cannot be hurled out. The shaft must not be exposed to load torques. Before the machine (e.g. motor) is re-started, the brake must be de-energized.

Caution!

The brake surface temperature may rise to over 100°C. Heat-sensitive parts such as conventional cables or electronic components must not be fixed to or be in contact with these surfaces. If necessary, suitable protections and hand guards must be installed to avoid accidental contact with hot surfaces!

Attention!

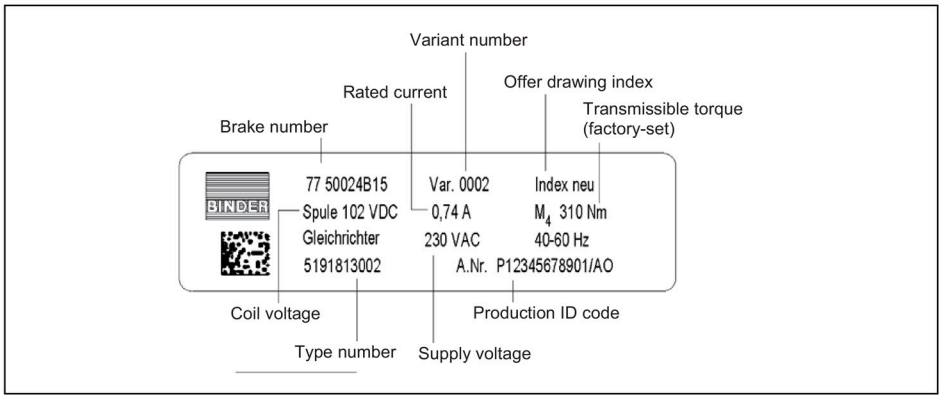
High-voltage tests performed during brake mounting within an overall system or during start-up must be carried out in such a way that damage to the built-in electronic accessories is avoided. The limits for high-voltage tests and follow-up tests specified by DIN VDE 0580 must be observed.

The following checks must be carried out:

- Check compliance with the specifications provided on the rating plate with respect to the mounting position and protection class.
- Ensure that power is supplied separately to the spring-applied single-disc brake module (and not to the motor) and turn the motor shaft while the brake is released to check that the friction disc (4) and brake shaft (13) move smoothly. Proceed to perform a functional test of the axial armature movement.
- Check that the axial and radial runout is within the tolerance range specified in EN 50347-N.
- Information on ball bearing break-in conditions, bearing lubrication intervals etc. is provided in the specification sheets of the bearing manufacturers and in the motor manual.

After completion of mounting, all necessary covers and guards must be installed.

Specifications on rating plates (example):



5.4.1 Manual brake release

Warning!

Extreme caution is advised during manual release (jog mode) of the spring-applied single-disc brake module (e.g. for maintenance work on the machine (e.g. motor) or in case of failure of the regular power supply and use of a UPS system). If the drive system is unbalanced, the load torque may accelerate the drive. The brake user is required to take adequate precautions to ensure that no hazardous situations are caused by the load torque when the brake module is released and engaged in jog mode.

The spring-applied single-disc brake module can be released "manually" by means of a mechanical hand release (24) (accessories). In case of failure of the regular power supply, it is also possible to use a commercial UPS (e.g. UPS battery system) for the electrical release of the brake module. For this purpose, the brake user is required to install a UPS system that complies with the voltage specifications given on the brake module rating plate.

5.5 M_4 transmissible torque adjustments

Attention!

When adjusting the adjusting ring (9) on the basis of the values given in the offer drawing, make absolutely sure that the M_4 transmissible torque is not below the minimum torque required.
The changed adjusting ring clearance "E" must be marked on the bottom of the solenoid housing. The adjusted theoretical M_4 transmissible torque must be entered in the blank field provided on the rating plate of the brake module (see rating plate example).
After adjustment of the M_4 transmissible torque, the brake user is required to ensure that the adjusting ring (9) is secured with the set screw (25), applying a tightening torque of M_A = 3 Nm.
The adjusting ring (9) must be turned in such a way that the set screw (25) can be located between the studs (8). The M_4 torque tolerance is +15%/-5%.

1. The brake modules are factory-adjusted to the standard M_4 transmissible torque specified in the specification sheet. The M_4 transmissible torque applicable at the time of shipment is specified on the rating plate.
2. The torque can be adjusted by means of the adjusting ring (9). After completion of adjustment, the ring must be locked by means of the set screw (25). The adjusting ring clearance "E" (see Fig. 11/1) is marked on the bottom of the solenoid housing near the set screw (25). After having loosened the set screw (25), the M_4 standard torque can be changed by changing the adjusting ring clearance "E" by means of a pin spanner.
3. After having changed the torque, the new adjusting ring clearance "E" must be marked on the solenoid housing. The adjusting ring must be locked by means of the set screw (25), making sure, however, that the set screw is not within the reach of the studs (8).
4. Secure the set screw (25) with Loctite 243, for example.
5. While torque variations only have a minor impact on coupling times t_1, the disconnection time t_2 is reduced proportionally to the torque reduction.

	Size		
	19	24	29
Transmissible torque change ⊠M_4/mm [%]	approx. 15	approx. 12	approx. 14
M_4 transmissible torque (standard value) [Nm]	150	310	500
Maximum transmissible torque $M_{4\ max.}$	150	310	500

Table 20/1: Change in the M_4 transmissible torque [%] from 1 mm axial adjustment of the adjusting ring (9); M_4 transmissible torque (standard value) and maximum transmissible torque $M_{4\ max.}$

Note: Torque adjustments are not possible for size 13 brakes.

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6. Maintenance

Warning!

Whenever carrying out inspection and maintenance work, ensure that

- the machine (e.g. motor) is secured against accidental or unintentional start-up.
- no load torque acts on the shaft.
- the lock provided to prevent accidental start-up of the machine (e.g. motor) is removed after completion of inspection and maintenance work.
- all friction surfaces are free from grease and oil. An oily or greasy friction disc (4) cannot be cleaned.
- no swelling of the friction lining has occurred (to be checked by air gap measurement).
- no hardening (glazing) of the friction lining has occurred (only visible when the brake is released).
- the brake module has been switched off and disconnected from the power supply.

6.1 Checks and service

Attention!

Depending on its operating condition, it may no longer be possible to release the spring-applied single-disc brake when the maximum air gap s_{max} (see Table 28/1: air gap s_{nom} and s_{max}) has been exceeded. In this case, the braking effect cannot be neutralized. This may cause thermal overloading of and irreversible damage to the brake module if the machine (e.g. motor) is started before the brake has been released. Thermal overloading of the machine (e.g. motor) may occur if the machine (e.g. motor) is not started while the brake is still engaged.

1. The spring-applied single-disc brake module does not require any particular maintenance except that the air gap 's' (see Table 28/1: air gap s_{nom} and s_{max}) and the degree of wear of the friction disc (4) must be measured at regular intervals.
2. For this purpose, the brake must be released electromagnetically during motor standstill to allow the air gap 's' between the armature (2) and friction disc (4) to be measured through the threaded bore (1.3) by means of a feeler gauge. The air gap can only be measured after having removed the cover (23) or – when using brakes with hand release – after having removed the hand release lever (24.2) and complete cam assembly (24.1) (see Fig. 14/1).
3. If the maximum air gap s_{max} (see Table 28/1) is reached the friction disc (4) must be replaced to ensure functional reliability and safety of the brake. When replacing the friction disc (4), check the friction surfaces of the armature (2) and flange (3). It is not possible to perform adjustments (air gap adjustments) to compensate for wear.
4. If the ball bearing (15) (accessories) needs to be replaced, make sure to use bearings of the same type or of identical design.
5. The sealing rings (6 and 11) do not require any maintenance. However, they should be replaced every time the brake unit is opened.
6. The new sealing rings (6 and 11) must be glued in place after having cleaned the contact surfaces. To this end, Loctite 480 or an equivalent adhesive must be applied to individual spots on the front face of the solenoid housing (1.1) and on the circumference of the flange (3) before the sealing rings (6 and 11) are inserted and pressed on.

6.2 Brake module removal from motor and replacement of component parts

The following instructions must be strictly followed when replacing individual brake components:

- Centre the friction disc (4) relative to the centre of the brake module.
- Adjust the microswitch (27) when using brakes equipped with microswitch.
- Ensure that the friction disc is free from grease and oil.
- Adjust the required clearance "E" of the adjusting ring (9) (see marking on bottom of solenoid housing).
- Tighten the cheese head screws (10) in the flange (3) to the tightening torques specified in Table 22/1.
- Before removing the brake module from the motor, cautiously remove all components still fitted to the brake shaft (13), such as gear, feather key, etc. Loosen the fixing screws to allow the brake to be removed.

1. After having removed the fixing screws, the brake module can be pulled off the motor shaft by means of a withdrawal device. This device must be applied to the fixing corners on the output side flange of the solenoid housing (1.1) and supported on the front face of the brake shaft (13).
2. To avoid damage to the centring bore in the brake shaft (13), a shim ring can be inserted under the withdrawal device.

Note!

Substantial forces may have to be applied as the ball bearing (15) needs to be pulled off together with the brake module. Extreme caution is advised during these operations. If the brake module is in a horizontal position when removing it from the motor shaft, the brake must be supported in radial direction. Ball bearings (15) must not be reused after removal, regardless of their service life.

1. If individual components of the brake module need to be replaced, loosen the set screw (25) and unscrew the adjusting ring (9) to unload the compression springs (7).
2. Unscrew the cheese head screws (10) so that the flange (3) and all other components can be removed.
3. Use only grease-free cleaning agents to clean the brake components, when necessary. Bear in mind that the friction disc (4) cannot be cleaned. When using brakes equipped with microswitch (27), the armature (2) can only be removed after having taken off the stud (31) and the straight pin (32). Used studs (31) and straight pins (32) must be replaced by new parts after the brake module has been reassembled.

Installation of the brake module must be carried out in reverse order of removal.

	Size			
	13	19	24	29
M_A tightening torques of cheese head screws (10) of flange (3)	5	9	14	22

Table 22/1: M_A tightening torques of cheese head screws (10) for flange (3)

6.3 Microswitch (27) adjustment (only applicable to brake modules with microswitch (27))

Warning!

The motor circuit must be protected in such a way that no accidental motor start-up can occur when the microswitch (27) contact closes. The cheese head screws (29) must be tightened to the specified M_A tightening torques.

When using brake modules equipped with a microswitch (27), the microswitch may need to be adjusted during maintenance and service work.

1. The microswitch can only be adjusted after the brake has been released electrically and the cheese head screws (29) have been slightly loosened. Check whether the microswitch status is "open" or "closed" by using a continuity tester connected to "NO" and "C" (see Fig. 11/2).
2. When "closed", push the microswitch (27) back beyond the change-over point in the direction indicated by "B" (see Fig. 11/2). When "open", screw in the screw (34) (hexagon head cap screw M2.5x8, not supplied) to push the microswitch in the direction indicated by "A" up to the change-over point.
3. At this point, continue to tighten the screw (34) by the adjustment length "L" or by the screw-in angle specified in Table 23/1 and position it correctly by tightening one of the cheese head screws (29).
4. Secure the second cheese head screw (29) with Loctite type 241 and tighten it (M_A tightening torque specified in Table 23/1). Loosen the first cheese head screw (29), apply Loctite 241 and re-tighten it.
5. Remove the screw (34) after completion of the microswitch adjustment.
6. Switch the brake module on and off to check that the microswitch (27) works correctly.

C = common contact
NO = normally open contact

	Size			
	13	19	24	29
Adjustment length L of screw (34) [mm]	0.11	0.15	0.2	0.2
Screw-in angle of screw (34) [°]	90	120	160	160
M_A tightening torque of machine screw (29) [Nm]	0.7	0.7	0.7	0.7

Table 23/1: M_A tightening torque of cheese head screws (29), adjustment length L and screw-in angle of screw (34)

6.4 Brake shaft (13) removal

Caution!

As high pressures are generated during the removal of the brake shaft, personal protection equipment, such as face guards, gloves etc., and protective covers must be used.

Proceed with extreme caution and follow all relevant safety instructions when removing the brake shaft (13). The brake shaft (13) must be removed by means of an oil pressure system (see Fig. 24/1).

1. To this end, a withdrawal device consisting of a forcing screw (37), a forcing pin (35) and an oil injector or oil pump (36) must be used. Remove the screw plug (17) and screw the oil injector or oil pump (36) connection into the oil inlet bore (17.1).
2. Insert the forcing pin (35) on the front face of the brake shaft (13) up to the limit stop and slightly tighten it by means of the forcing screw (37).
3. The pressure oil must be supplied through the oil inlet bore. The oil pressure should be gradually increased to about 60 % of the maximum pressure p_{max}. Then the pressure should be kept constant for about 60 minutes.
4. Proceed to increase the pressure to the maximum oil pressure p_{max}. After the maximum pressure has been reached, screw in the forcing screw (37) smoothly and evenly so that the brake shaft (13) can be pulled off the motor shaft. While removing the brake shaft, the tangential torque arm should be applied to the square socket (size 13, 19, 24 brakes) or to the external teeth of the brake shaft (13) (size 29 brakes). The technical specifications applicable to the brake shaft (13) removal are given in Table 25/1.

Note!

Pressure oil type LHDF900 with a viscosity of 900 mm^2/s at 20°C supplied by SKF can be used, for instance.

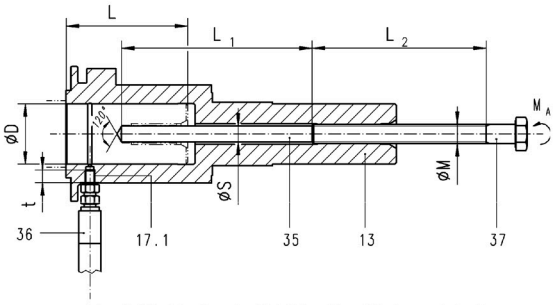


Fig. 24/1: Brake shaft (13) with withdrawal device

Key to Fig. 24/1:

13	Brake shaft	L_1	Forcing pin (35) length
17.1	Oil inlet bore	L_2	Forcing screw (37) thread length
35	Forcing pin	D	Shaft end diameter (motor)
36	Oil pump	S	Forcing pin (35) diameter
37	Forcing screw	M	Forcing screw (37) thread diameter
L	Shaft end length (motor)	M_A	Forcing screw (37) loosening torque

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	Size			
	13	19	24	29
Motor shaft height	AH 80	AH 100	AH 132	AH 160
Oil inlet bore / screw-in depth t [mm]	M6/7.5	M6/8	Rp1/8''/9.5	Rp1/8''/10
Oil pressure p_{max} [bar]	1400	1400	1400	1400
Forcing pin (35) length L_1 [mm]	124	124	160	170
Forcing screw (37) thread length L_2 [mm]	130	130	170	170
Forcing pin (35) diameter S [mm]	9.8	9.8	13	17
Forcing screw (37) thread diameter M [mm]	12	12	16	20
Forcing screw tightening torque M_A [Nm]	15	35	60	90
Oil pump / oil injector connection tightening torque M_A [Nm]	4	4	10	10

Table 25/1: Technical specifications for brake shaft (13) removal

7. Motor design

The brake module must be mounted to a motor that complies with the following requirements:

- Motor mounting type IMB5 or IMB35
- Motor shaft end and flange tolerances (axial and radial runout) to EN 50347-R
- Brake module shaft end and flange tolerances to EN 50347-N after mounting to motor
- Motor shaft without feather key due to brake shaft removal from motor shaft by means of an oil pressure system
- The fits and surface roughness depths of the brake shaft bore and motor shaft (Rz<6.3) required to ensure reliable press-fit must be agreed with the brake manufacturer.
- Balancing of the brake shaft with a half key (half key balancing) to DIN ISO 8821

The permitted transverse forces acting on the shaft end of the motor/brake unit and the permitted axial forces are specified in the motor specification sheet.

Note!

Mounting of the brake module to the motor may cause heat build-up on the A-face motor end shield as heat dissipation towards the machine wall is inhibited. Consequently, only fan-cooled motors must be used.

8. Driven components, balancing

The installation and removal of driven components, such as clutch, gear, pulley, etc., on the brake shaft must be carried out using suitable devices and tools. Use the thread in the brake shaft for installation purposes and heat the components prior to assembly, if possible. In order to protect the centring piece and thread in the brake shaft, a shim must be inserted before removing driven components (see Fig. 26/1). The brake shaft is balanced with a half key (half key balancing to DIN ISO 8821). Check that the correct balancing method is used when installing the driven components.

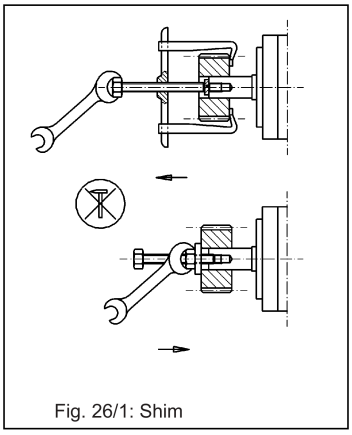


Fig. 26/1: Shim

Note!

General precautions must be taken to prevent accidental contact with driven components. The brake is an electromagnetic device which may generate electromagnetic stray flux. In general, driven components remain unaffected by the presence of such stray flux.

9. Condition at delivery

The brake module is delivered in a preassembled condition with factory-adjusted (standard) transmissible torque M_4. The brake shaft with screw plug, spring washer, ball bearing, circlip, feather key, hand release, rubber bolts (size 19 and 24 brakes) and O-ring (size 29 brakes) are not included in the scope of supply.
The ball bearing set (ball bearing, spring washer, circlip), hand release, brake shaft with screw plug, rubber bolts (size 19 and 24 brakes) or O-ring (size 29 brakes) can be ordered as accessories.
The brake module can be equipped with an optional microswitch.
The friction disc is centred relative to the brake centre to facilitate brake mounting.

Attention!

In order to avoid any shift of the friction disc, the brake unit should only be released electromagnetically or by means of the hand release lever when the friction disc is guided by the brake shaft. Brakes equipped with microswitches are delivered with factory-adjusted microswitch.

Upon receipt of the shipment, the brake must be checked for transit damage before storage.

Ordered accessories are delivered together with the brake.

The spring-applied single-disc brake module is delivered ready for mounting with factory-adjusted M_4 transmissible torque and factory-adjusted rated air gap 's'.

Attention!

The brake module should be transported and stored in vertical position with the output side solenoid housing (1.1) flange pointing upwards. This flange must be provided with eye bolts (e.g. to DIN 580) fixed to two diagonally opposite fixing bores. These eye bolts are required to attach handling equipment secured with nuts for internal transport purposes or for mounting the brake module to the motor.

Note!

If the brake module is equipped with a microswitch, make sure the microswitch is not exposed to shocks and vibrations during brake transport and storage. This is crucial to avoid any changes in the microswitch adjustment. The same applies to the connector box of the brake module. If the brake is not installed immediately upon delivery, it must be stored in a dry, dust-free and vibration-proof place.

10. Troubleshooting

Fault	Cause	Corrective actions
Brake release failure	Air gap too large	Check the air gap. Install a new friction disc, if necessary.
	No voltage applied to brake	Check the electrical connection and correct faults, if found.
	Voltage applied to field coil too low	Check the field coil supply voltage and correct faults, if found.
	Armature plate blocked mechanically	Eliminate mechanical blocks. Install a new brake, if necessary.
	Damaged rectifier	Check the rectifier and replace it, if necessary.
	Damaged field coil	Check the field coil resistance. Install a new brake, if necessary.
	Friction disc thermally overloaded	Install a new friction disc.
Delayed brake release	Air gap too large	Check the air gap. Install a new friction disc, if necessary.
	Voltage applied to field coil too low	Check the field coil supply voltage and correct faults, if found.
Brake engagement failure	Voltage applied to field coil in unpowered condition too high (residual voltage)	Check whether residual voltage is applied to the field coil and correct faults, if found.
	Armature plate blocked mechanically	Eliminate mechanical blocks. Install a new brake, if necessary.
Delayed brake engagement	Voltage applied to field coil too high	Check the field coil supply voltage and correct faults, if found.
Brake torque too low	Air gap too large	Check the air gap. Install a new friction disc, if necessary.
	Oily or greasy friction surfaces	Install a new friction disc.
	Broken compression spring	Install a new brake module.
Microswitch failure	Damaged microswitch	Install a new microswitch.
	Adjustment error of microswitch switching point	Readjust the microswitch switching point.

Table 27/1: Possible faults, causes and corrective actions (list not exhaustive)

11. Definitions

(based on: DIN VDE 0580 November 2011, not exhaustive)

Transmissible torque M_4	highest torque that can be applied to the engaged brake or clutch without causing the brake/clutch to slip
Rated voltage U_N	supply voltage specified by the manufacturer for voltage windings to identify the device or component
Rated air gap s	air gap of a new brake
Maximum air gap s_{max}	maximum possible air gap at the wear limit during brake operation

The switching times are defined in DIN VDE 0580. When using static systems (holding operation), the switching times can also be determined on the basis of the current flow (see Fig. 28/1).

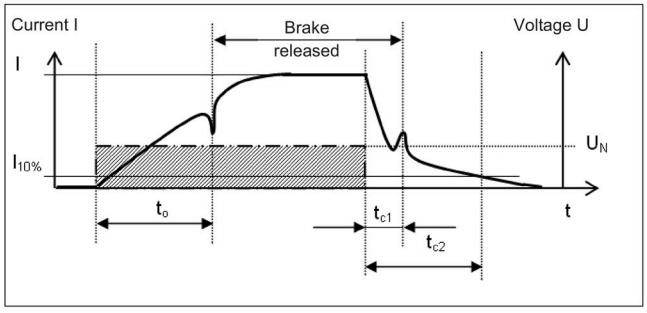


Fig. 28/1: Definition of switching times for (static) holding operation

Definitions:

t_o	opening time (**o**pen) –	brake mechanically open
t_{c1}	closing time (**c**lose) –	brake mechanically closed
t_{c2}	activation time –	brake mechanically closed and full holding torque reached almost completely

12. Technical specifications

	13	19	24	29
Rated air gap s [mm]	$0.3^{+0.2}$	$0.35^{+0.2}$	$0.4^{+0.25}$	$0.45^{+0.25}$
Max. air gap s_{max} (at 70% of rated current) [mm]	0.65	0.8	1.05	1.2

Table 28/1: Air gap s_{nom} and s_{max}

	Size			
	13	19	24	29
Speed n [rpm]	250	125	125	125
Coil ON time t_5 [s]	6	6	6	6
Coil OFF time t_6 [s]	1	1	1	1
Break-in period t_{tot} [min]	3	3	3	3

Table 28/2: Break-in process parameters for the spring-applied single-disc brake module

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	Technical specifications
Switching capacity	250 VAC, 5 A
	400 VAC, 1.5 A
	24 VAC, 2 A
Min. switching power	12 VDC, 10 mA
Mech. service life [switching operations]	5 x 10^7
Contact type	normally open contact
Temperature range [°C]	–40 to +130
Protection	IP 67

Table 29/1: Microswitch specifications

The required operating conditions specified in **DIN VDE 0580** must be observed during operation of the spring-applied single-disc brake module!

Specifications subject to change without notice!

13. Revision history

Date of issue:	**Modifications:**
Issue dated 12 December 2013	Text revisions on page 16 and 17
Issue dated 2 July 2012 (initial issue)	–


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A.3 Operating Instructions for the external fan, SH132

A.3.1 Operating instructions for the external fan, Type K2D200AB1806

K2D200-AB18-06
Siemens AG DF MC MF-M

Operating instructions

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CONTENTS

1. SAFETY REGULATIONS AND INFORMATION 1
1.1 Hazard levels for warnings 1
1.2 Staff qualifications 1
1.3 Basic safety rules 1
1.4 Voltage 2
1.5 Safety and protective features 2
1.6 Electromagnetic radiation 2
1.7 Mechanical movement 2
1.8 Emissions 2
1.9 Hot surface 2
1.10 Transport 2
1.11 Storage 2

2. INTENDED USE 3

3. TECHNICAL DATA 4
3.1 Product drawing 4
3.2 Nominal data 5
3.3 Technical description 5
3.4 Mounting data 5
3.5 Transport and storage conditions 5

4. CONNECTION AND STARTUP 6
4.1 Mechanical connection 6
4.2 Electrical connection 6
4.3 Connection in terminal box 6
4.4 Connection diagram 8
4.5 Checking connections 9
4.6 Switching on the device 9
4.7 Switching off the device 9

5. MAINTENANCE, MALFUNCTIONS, POSSIBLE CAUSES AND REMEDIES 9
5.1 Cleaning 9
5.2 Safety inspection 10
5.3 Disposal 10

Translation of the original operating instructions

1. SAFETY REGULATIONS AND INFORMATION

Read these operating instructions carefully before starting work on the device. Observe the following warnings to prevent malfunctions or danger to persons.
These operating instructions are to be regarded as part of the device. The device is only to be sold or passed on together with the operating instructions.
These operating instructions may be duplicated and distributed to inform about potential dangers and their prevention.

1.1 Hazard levels for warnings

These operating instructions use the following hazard levels to indicate potentially hazardous situations and important safety regulations:

DANGER
Indicates an imminently hazardous situation which will result in death or serious injury if the specified actions are not taken. Compliance with the instructions is imperative.

WARNING
Indicates a potentially hazardous situation which can result in death or serious injury if the specified actions are not taken. Exercise extreme caution while working.

CAUTION
Indicates a potentially hazardous situation which can result in minor or moderate injury or damage to property if the specified actions are not taken.

NOTE
A potentially harmful situation can occur and, if not avoided, can lead to property damage.

1.2 Staff qualifications

The device may only be transported, unpacked, installed, operated, maintained and otherwise used by suitably qualified, trained and authorized technical staff.
Only authorized specialists are permitted to install the device, to carry out a test run and to perform work on the electrical installation.

1.3 Basic safety rules

The motor may only be operated with an impeller. The result is a motor-fan combination. Motor and impeller assignment may only be done by ebm-papst.
Protection against such things as:

- electric shock
- Contact with rotating parts
- Ingress of foreign bodies or moisture
- Excessive condensation

The safety hazards associated with the device must be assessed again following installation in the final product.
The locally applicable industrial safety regulations are always to be observed when working on the device.
Keep the workplace clean and tidy. Untidiness in the work area increases the risk of accidents.
Note the following when working on the device:

⇒ Do not perform any modifications, additions or conversions on the device without the approval of ebm-papst.

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Operating instructions

1.4 Voltage

⇒ Check the device's electrical equipment at regular intervals; see Chapter 5.2 Safety inspection.

⇒ Replace loose connections and defective cables immediately.

DANGER
Electrically charged device
Risk of electric shock

→ When working on an electrically charged device, stand on a rubber mat.

CAUTION
In the event of a fault, the rotor and the impeller will be energized
The rotor and the impeller have basic insulation.

→ Do not touch the rotor and impeller once installed.

CAUTION
The motor restarts automatically when operating voltage is applied, e.g. after a power failure.
Risk of injury

→ Keep out of the device's danger zone.

→ When working on the device, switch off the line voltage and ensure that it cannot be switched back on.

→ Wait until the device comes to a stop.

1.5 Safety and protective features

DANGER
Guard missing and guard not functioning
Without a guard, hands may become caught up in the device during operation for example, resulting in serious injury. Loose parts or items of clothing could be drawn in.

→ The device is a built-in component. As the owner, you are responsible for ensuring that the device is adequately safeguarded.# Operate the device only with a fixed protective device and guard grill.

→ Stop the device immediately if a protective device is found to be missing or ineffective.

1.6 Electromagnetic radiation

Interference from electromagnetic radiation is possible, e.g. in conjunction with open- and closed-loop control devices.
If impermissible radiation levels occur following installation, appropriate shielding measures have to be taken by the user.

1.7 Mechanical movement

DANGER
Rotating device
Risk of injury to body parts coming into contact with the rotor or the impeller.

→ Secure the device against accidental contact.

→ Before working on the system/machine, wait until all parts have come to a standstill.

WARNING
Rotating device
Long hair and dangling items of clothing, jewelry and the like can become entangled and be pulled into the device. Injuries can result.

→ Do not wear any loose-fitting or dangling clothing or jewelry while working on rotating parts.

→ Protect long hair with a cap.

1.8 Emissions

WARNING
Depending on the installation and operating conditions, the sound pressure level may exceed 70 dB(A).
Risk of noise-induced hearing loss

→ Take appropriate technical safety measures.

→ Protect operating personnel with appropriate safety equipment such as hearing protection.

→ Also observe the requirements of local agencies.

1.9 Hot surface

NOTE
Risk of fire
The risk of fire or flame propagation by ebm-papst products must be assessed by the commissioning party following installation in the final product.

1.10 Transport

NOTE
Transporting the device

→ Transport the device in its original packaging only.

→ Secure the device so it cannot slip, e.g. by using a lashing strip.

1.11 Storage

⇒ Store the device, partially or fully assembled, in a dry place, protected against the weather and free from vibration, in the original packaging in a clean environment.

⇒ Protect the device against environmental effects and dirt until final installation.

⇒ We recommend storing the device for no longer than one year in order to guarantee trouble-free operation and the longest possible service life.

⇒ Even devices explicitly intended for outdoor use are to be stored as described prior to commissioning.

⇒ Maintain the storage temperature, see Chapter 3.5 Transport and storage conditions.

⇒ Make sure that all cable glands are fitted with dummy plugs.

Translation of the original operating instructions

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Operating instructions

2. INTENDED USE

Intended use also includes

- Using the device only in power systems with grounded neutral (TN/ TT power systems).
- Conveying air at an ambient air pressure between 800 mbar and 1050 mbar.
- Using the device within the permitted ambient temperature range; see Chapter 3.5 Transport and storage conditions and Chapter 3.2 Nominal data.
- Operating the device with all protective devices.
- Following the operating instructions.

Improper use

In particular, operating the device in the following ways is prohibited and could be hazardous:

- Operating the device in an unbalanced state, e.g. due to dirt deposits or ice formation.
- Resonant operation, operation with severe vibration. This also includes vibration transmitted to the fan from the customer installation.
- Operation in medical equipment with a life-sustaining or life-support function.
- Conveying solids in the flow medium.
- Painting the device
- Connections (e.g. screws) coming loose during operation.
- Opening the terminal box during operation.
- Conveying air that contains abrasive particles.
- Conveying highly corrosive air, e.g. salt spray. Exception: devices designed for salt spray and correspondingly protected.
- Conveying air with high dust content, e.g. suctioning off sawdust.
- Operating the device close to flammable materials or components.
- Operating the device in an explosive atmosphere.
- Using the device as a safety component or to perform safety-related functions.
- Operation with completely or partially disassembled or manipulated protective devices.
- In addition, all applications not listed among the intended uses.

Translation of the original operating instructions

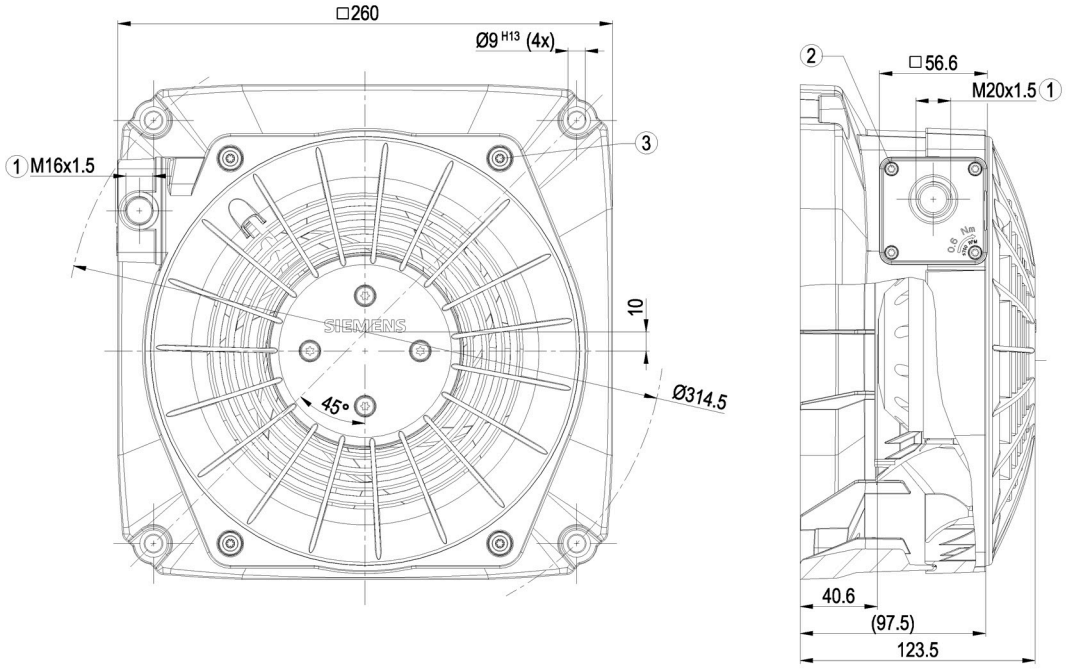
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Operating instructions

3. TECHNICAL DATA

3.1 Product drawing



All dimensions in mm.

1	Max. screw-in depth 9 mm
2	Tightening torque 0.6±0.1 Nm, fit manually
3	Tightening torque 3.5 ± 0.3 Nm; fit screws by hand

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Operating instructions

3.2 Nominal data

Motor	M2D068-CF		
Phase	3~	3~	3~
Nominal voltage / VAC	400	400	480
Wiring	Y	Y	Y
Frequency / Hz	50	60	60
Method of obtaining data	ce	ce	ce
Valid for approval/ standard	CE	CE	CE
Speed (rpm) / min^{-1}	2450	2600	2850
Power consumption / W	60	80	95
Current draw / A	0.1	0.12	0.13
Min. back pressure / Pa	0	0	0
Min. ambient temperature / °C	-25	-25	-25
Max. ambient temperature / °C	80	80	80
Starting current / A	0.28	0.27	0.31

ml = Max. load · me = Max. efficiency · fa = Free air
cs = Customer specification · ce = Customer equipment

Subject to change

Imax:
340-440V 50/60Hz 0.11A/0.13A
408-528V 60Hz 0.13A

3.3 Technical description

Weight	2.6 kg
Size	200 mm
Motor size	68
Rotor surface	Painted black
Terminal box material	PA plastic
Impeller material	PA plastic
Housing material	PA plastic
Guard grille material	PA plastic
Number of blades	7
Direction of rotation	Counterclockwise, viewed toward rotor
Degree of protection	IP55
Insulation class	"F"
Moisture (F) / Environmental (H) protection class	H1+
Installation position	Any
Condensation drainage holes	None
Mode	S1
Motor bearing	Ball bearing
Touch current according to IEC 60990 (measuring circuit Fig. 4, TN system)	< 0.75 mA
Electrical hookup	Terminal box
Protection class	I (with customer connection of protective earth)
Conformity with standards	EN 60034-1; EN 60204-1; EN 60335-1; CE
Approval	UL 1004-1; EAC; CSA C22.2 No. 100

Translation of the original operating instructions

With regard to cyclic speed loads, note that the rotating parts of the device are designed for a maximum of one million load cycles. If you have special questions, consult ebm-papst for support.

⇒ Use the device in accordance with its degree of protection.

Information on surface quality

The surfaces of the products conform to the generally applicable industrial standard. The surface quality may change during the production period. This has no effect on strength, dimensional stability and dimensional accuracy.
The color pigments in the paints used perceptibly react to UV light over the course of time. The product is to be protected against UV radiation to prevent the formation of patches and fading. Changes in color are not a reason for complaint and are not covered by the warranty. UV radiation in the frequency range and the intensity of natural solar radiation has no effect on the technical properties of the products.

3.4 Mounting data

Any further mounting data required can be taken from the product drawing or Section Chapter 4.1 Mechanical connection.

Strength class of screws	8.8

⇒ Secure the screws against unintentional loosening (e.g. use self-locking screws).

3.5 Transport and storage conditions

NOTE
The degree of protection is only valid in conjunction with the main motor.

Max. permitted ambient temp. for motor (transport/ storage)	+80 °C
Min. permitted ambient temp. for motor (transport/ storage)	-40 °C

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Operating instructions

4. CONNECTION AND STARTUP

4.1 Mechanical connection

CAUTION
Risk of cutting and crushing when removing device from packaging

→ Carefully remove the device from the packaging by grasping hold of the frame. Never subject to any impact.

→ Wear safety shoes and cut-resistant safety gloves.

NOTE
Damage to the device from vibration
Bearing damage, shorter service life

→ The fan must not be subjected to force or excessive vibration from sections of the installation.

→ If the fan is connected to air ducts, the connection should be isolated from vibration, e.g. using compensators or similar elements.

→ Ensure stress-free attachment of the fan to the substructure.

⇒ The fan may not be handled in the area around the inlet nozzle during transport and installation.
There is a risk of damage to the impeller.

⇒ Check the device for transport damage. Damaged devices are not to be installed.

⇒ Install the undamaged device in accordance with your application.

CAUTION
Possible damage to the device
If the device slips during installation, serious damage can result.

→ Ensure that the device is securely positioned at its place of installation until all fastening screws have been tightened.

- The fan must not be strained on fastening.

4.2 Electrical connection

DANGER
Voltage on the device
Electric shock

→ Always connect a protective earth first.

→ Check the protective earth.

DANGER
Faulty insulation
Risk of fatal injury from electric shock

→ Use only cables that meet the specified installation regulations for voltage, current, insulation material, capacity, etc.

→ Route cables so that they cannot be touched by any rotating parts.

CAUTION
Voltage
The device is a built-in component and has no disconnecting switch.

→ Only connect the device to circuits that can be switched off with an all-pole disconnection switch.

→ When working on the device, secure the system/ machine in which the device is installed so as to prevent it from being switched back on.

NOTE
Water ingress into wires or cables
Water ingress at the customer end of the cable can damage the device.

→ Make sure the end of the cable is connected in a dry environment.

Only connect the device to circuits that can be switched off with an all-pole disconnection switch.

4.2.1 Requirements

⇒ Check whether the information on the nameplate matches the connection data.

⇒ Before connecting the device, make sure the power supply matches the device voltage.

⇒ Only use cables designed for the current level indicated on the nameplate.
For determining the cross-section, note the sizing criteria according to EN 61800-5-1. The protective earth must have a cross-section equal to or greater than that of the phase conductor.
We recommend the use of 105 °C cables. Ensure that the minimum cable cross-section is at least
AWG 26 / 0.13 mm².

⇒ For a M20x1.5 cable gland, measure the maximum cable cross-section of 2.5 mm² and for a M16x1.5 cable gland the maximum cable cross-section of 1.5 mm².

Forced-ventilation units with no thermal overload protector must be safeguarded by a motor circuit breaker prior to startup.

Protective earth contact resistance according to EN 60335

Compliance with the resistance specifications according to EN 60335 for the protective earth connection circuit must be verified in the end application. Depending on the installation situation, it may be necessary to connect an additional protective earth conductor by way of the extra protective earth terminal provided on the device.

4.2.2 Residual current circuit breaker (RCCB)

If the use of a residual current device (RCD) is required in your installation, only AC/DC-sensitive residual current devices of type B are permissible.

4.3 Connection in terminal box

4.3.1 Preparing cables for connection

Only strip the cable as far as necessary, ensuring that the cable gland is sealed and there is no strain on the connections. For tightening torques, see Chapter 3.1 Product drawing.

NOTE
Tightness and strain relief are dependent on the cable used.

→ This must be checked by the user.

⇒ When connecting, make sure the ground conductor is longer than the phase conductors.

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4.3.2 Connecting wires to terminals

⇒ To ensure the IP protection, a cable gland with seal must be used for the cable entry.

⇒ Only use cable glands made of plastic.

⇒ Route the cables into the intended openings on the terminal box.

⇒ First connect the "PE" (protective earth).

An external ground connection can also be made at uninsulated points on the housing or using the external ground connection in the terminal box.

⇒ Connect the wires to the corresponding terminals.

Use a screwdriver to do so.
When connecting, ensure that no wire ends fan out.

⇒ Insert the leads until they meet resistance.

⇒ The cable bushing to the add-on device must be free of burrs and in accordance with the degree of protection (IP code).

4.3.3 Cable routing

Water must be prevented from reaching the cable gland along the cable.

NOTE
Damage caused by moisture penetration.
Moisture can penetrate into the terminal box if water is constantly present at the cable glands.

→ To prevent the constant accumulation of water at the cable glands, the cable should be routed in a U-shaped loop wherever possible.

→ If this is not possible, a drip edge can be produced by fitting a cable tie directly in front of the cable gland for example.

— Make sure the cable is routed in a U-shaped loop.

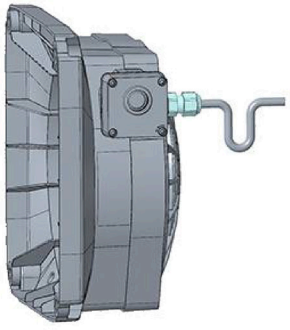


Fig. 1: Cable routing in U-shaped loop

4.3.4 Motor protection

Motor protection switch

WARNING
Device has no locked-rotor protection
As delivered, the forced-ventilation unit has no automatic protection against incorrect operation (locked-rotor protection). The device can become hot and catch fire.

→ For the version without thermal overload protector, also install a suitable motor protection switch or a suitable tripping unit for the PTC thermistor.

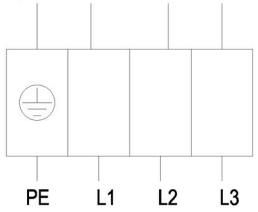
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Siemens AG DF MC MF-M

Operating instructions

4.4 Connection diagram



PE	green/yellow
L1	black
L2	blue
L3	brown

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Siemens AG DF MC MF-M

Operating instructions

4.5 Checking connections

- ⇒ Ensure isolation from supply (all phases).
- ⇒ Make sure a restart is impossible
- ⇒ Check the cables for proper fit.
- ⇒ Check the mechanical and electrical installation of safety-related components (e.g. motor protection switch, guard grille etc.).
- ⇒ Screw the terminal box cover back on again. Terminal box tightening torque, see Chapter 3.1 Product drawing.
- ⇒ Make sure the terminal box is completely closed and sealed and that all screws and cable glands have been properly tightened.

4.6 Switching on the device

The device may only be switched on if it has been installed properly and in accordance with its intended use, including the required safety mechanisms and professional electrical hookup. This also applies for devices which have already been equipped with plugs and terminals or similar connectors by the customer.

WARNING
Hot motor housing
Risk of fire

→ Ensure that no combustible or flammable materials are located close to the fan.

- ⇒ Before switching on, check the device for visible external damage and make sure the protective devices are functional.
- ⇒ Check the fan's air flow paths for foreign matter and remove any foreign matter found.
- ⇒ Apply the nominal supply voltage.

NOTE
Damage to the device from vibration
Bearing damage, shorter service life

→ Low-vibration operation of the fan must be ensured over the entire speed control range.

→ Severe vibration can arise for instance from inexpert handling, transportation damage and resultant imbalance or be caused by component or structural resonance.

→ Speed ranges with excessively high vibration levels and possibly resonant frequencies must be determined in the course of fan commissioning.

→ Either run through the resonant range as quickly as possible with speed control or find another remedy.

→ Operation with excessively high vibration levels can lead to premature failure.

4.7 Switching off the device

- ⇒ Disconnect the device from the power supply at the supply line's main switch.
- ⇒ When disconnecting, be sure to disconnect the ground connection last.

Translation of the original operating instructions

5. MAINTENANCE, MALFUNCTIONS, POSSIBLE CAUSES AND REMEDIES

The fan in the forced-ventilation unit is maintenance-free thanks to the use of special bearing greases.
During maintenance work on the ventilation unit, e.g. when cleaning the fan blades, the fan must be stationary and the ventilation unit's electrical circuit must be interrupted and secured against being switched on again.

CAUTION
The motor restarts automatically when operating voltage is applied, e.g. after a power failure.
Risk of injury

→ Keep out of the device's danger zone.

→ When working on the device, switch off the line voltage and ensure that it cannot be switched back on.

→ Wait until the device comes to a stop.

If the device is out of use for some time, e.g. when in storage, we recommend switching it on for at least two hours to allow any condensation to evaporate and to move the bearings.

- ⇒ Do not perform any repairs on the forced-ventilation unit. Send the blower to ebm-papst for repair or replacement.

Malfunction/fault	Possible cause	Possible remedy
Impeller not running smoothly	Imbalance in rotating parts	Clean the device; replace it if imbalance persists after cleaning. Make sure no weight clips are removed during cleaning.
Motor not turning	Mechanical blockage	Switch off, isolate from supply and remove mechanical blockage.
	Line voltage faulty	Check line voltage, restore power supply.
	Faulty connection	Isolate from supply, correct connection; see connection diagram.
	Broken motor winding	Replace device
	Impermissible point of operation	Check point of operation
Motor overtemperature	Ambient temperature too high	Reduce ambient temperature if possible
	Deficient cooling	Improve cooling

In the event of further malfunctions, contact ebm-papst.

5.1 Cleaning

To ensure a long service life, check the fans regularly for proper operation and soiling. The frequency of checking is to be adapted accordingly depending on the degree of soiling.

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K2D200-AB18-06
Siemens AG DF MC MF-M

Operating instructions

DANGER
Risk of injury from rotating fan.
→ Only clean when not in motion. Interrupt the power supply, secure against renewed switch-on. Secure against start-up, prevent air flow.

- ⇒ Dirt deposits on the motor housing can cause overheating of the motor.
- ⇒ Soiling of the impeller can cause vibration that will shorten the service life of the fan.
- ⇒ Severe vibration can destroy the fan.
- ⇒ In such cases, switch off the fan immediately and clean it.
- ⇒ The preferred method of cleaning is dry cleaning, e.g. using compressed air.
- ⇒ Do not use aggressive cleaning agents!

NOTE
Damage to the device during cleaning
Malfunction possible
→ Do not clean the device using a high-pressure cleaner.# Do not use acid, alkali or solvent-based cleaning agents.
→ Do not use any pointed or sharp-edged objects for cleaning.

- ⇒ Clean the fan using a suitable cloth or brush, taking care not to allow moisture to reach the motor's interior.
- ⇒ Take care not to damage or bend the fan blades.
- ⇒ Completely remove any cleaning agents used.
- ⇒ If severe corrosion is visible on load-bearing or rotating parts, switch off the device immediately and replace it.
- ⇒ Repair of load-bearing or rotating parts is not permitted!
- ⇒ Operate the fan for 2 hours at maximum speed so that any water that has ingressed can evaporate.
- ⇒ If cleaning does not eliminate vibrations, the fan may need to be rebalanced. To have it rebalanced, contact ebm-papst.
- ⇒ The fan is equipped with maintenance-free ball bearings. The lifetime lubrication of the ball bearings is designed for a service life of 40,000 hours.
- ⇒ If bearing replacement is necessary after that period, contact ebm-papst.
- ⇒ Adapt the maintenance intervals to the actual level of dust exposure.

5.2 Safety inspection

What to check	How to check	How often	What action?
Contact protection cover for intactness or damage	Visual inspection	At least every 6 months	Repair or replacement of device
Device for damage	Visual inspection	At least every 6 months	Replace device
Fastening the cables	Visual inspection	At least every 6 months	Fasten
Fastening the protective earth terminal	Visual inspection	At least every 6 months	Fasten
Insulation of cables for damage	Visual inspection	At least every 6 months	Replace cables
Impeller for wear/deposits/ corrosion and damage	Visual inspection	At least every 6 months	Clean impeller or replace device
Tightness of cable gland	Visual inspection	At least every 6 months	Retighten, replace if damaged
Distance between impeller and housing or plastic ring	Measurement	At least every 6 months	Replace device
Insulation resistance check	Measurement	Following completion of electrical work	Replace device
Abnormal bearing noise	acoustic	At least every 6 months	Replace device

5.3 Disposal

For ebm-papst, environmental protection and resource preservation are top priority corporate goals.
ebm-papst operates an environmental management system which is certified in accordance with ISO 14001 and rigorously implemented around the world on the basis of German standards.
Right from the development stage, ecological design, technical safety and health protection are fixed criteria.
The following section contains recommendations for ecological disposal of the product and its components.

5.3.1 Country-specific legal requirements

NOTE
Country-specific legal requirements
Always observe the applicable country-specific legal regulations with regard to the disposal of products or waste occurring in the various phases of the life cycle. The corresponding disposal standards are also to be heeded.

5.3.2 Disassembly

Disassembly of the product must be performed or supervised by qualified personnel with the appropriate technical knowledge.
The product is to be disassembled into suitable components for disposal employing standard procedures for motors.

WARNING
Heavy parts of the product may drop off. Some of the product components are heavy. These components could drop off during disassembly.
This can result in fatal or serious injury and material damage.
→ Secure components before unfastening to stop them falling.

5.3.3 Component disposal

The products are mostly made of steel, copper, aluminum and plastic. Metallic materials are generally considered to be fully recyclable.
Separate the components for recycling into the following categories:

- Steel and iron
- Aluminum
- Non-ferrous metal, e.g. motor windings
- Plastics, particularly with brominated flame retardants, in accordance with marking
- Insulating materials
- Cables and wires

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- Electronic scrap, e.g. circuit boards

Only ferrite magnets and not rare earth magnets are used in external rotor motors from ebm-papst Mulfingen GmbH & Co. KG.

⇒ Ferrite magnets can be disposed of in the same way as normal iron and steel.

Electrical insulating materials on the product, in cables and wires are made of similar materials and are therefore to be treated in the same manner.
The materials concerned are as follows:

- Miscellaneous insulators used in the terminal box
- Power cables
- Cables for internal wiring
- Electrolytic capacitors

Dispose of electronic components employing the proper procedures for electronic scrap.

→ Please contact ebm-papst for any other questions on disposal.

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A.3.2 Operating instructions for the external fan, Type K2D200AB1808

K2D200-AB18-08
Siemens AG DF MC MF-M

Operating instructions

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CONTENTS

1. SAFETY REGULATIONS AND INFORMATION 1
1.1 Hazard levels for warnings 1
1.2 Staff qualifications 1
1.3 Basic safety rules 1
1.4 Voltage 2
1.5 Safety and protective features 2
1.6 Electromagnetic radiation 2
1.7 Mechanical movement 2
1.8 Emissions 2
1.9 Hot surface 2
1.10 Transport 2
1.11 Storage 2

2. INTENDED USE 3

3. TECHNICAL DATA 4
3.1 Product drawing 4
3.2 Nominal data 5
3.3 Technical description 5
3.4 Mounting data 5
3.5 Transport and storage conditions 5

4. CONNECTION AND STARTUP 6
4.1 Mechanical connection 6
4.2 Electrical connection 6
4.3 Connection in terminal box 6
4.4 Connection diagram 8
4.5 Checking connections 9
4.6 Switching on the device 9
4.7 Switching off the device 9

5. MAINTENANCE, MALFUNCTIONS, POSSIBLE CAUSES AND REMEDIES 9
5.1 Cleaning 9
5.2 Safety inspection 10
5.3 Disposal 10

Translation of the original operating instructions

1. SAFETY REGULATIONS AND INFORMATION

Read these operating instructions carefully before starting work on the device. Observe the following warnings to prevent malfunctions or danger to persons.
These operating instructions are to be regarded as part of the device. The device is only to be sold or passed on together with the operating instructions.
These operating instructions may be duplicated and distributed to inform about potential dangers and their prevention.

1.1 Hazard levels for warnings

These operating instructions use the following hazard levels to indicate potentially hazardous situations and important safety regulations:

DANGER
Indicates an imminently hazardous situation which will result in death or serious injury if the specified actions are not taken. Compliance with the instructions is imperative.

WARNING
Indicates a potentially hazardous situation which can result in death or serious injury if the specified actions are not taken. Exercise extreme caution while working.

CAUTION
Indicates a potentially hazardous situation which can result in minor or moderate injury or damage to property if the specified actions are not taken.

NOTE
A potentially harmful situation can occur and, if not avoided, can lead to property damage.

1.2 Staff qualifications

The device may only be transported, unpacked, installed, operated, maintained and otherwise used by suitably qualified, trained and authorized technical staff.
Only authorized specialists are permitted to install the device, to carry out a test run and to perform work on the electrical installation.

1.3 Basic safety rules

The motor may only be operated with an impeller. The result is a motor-fan combination. Motor and impeller assignment may only be done by ebm-papst.
Protection against such things as:

- electric shock
- Contact with rotating parts
- Ingress of foreign bodies or moisture
- Excessive condensation

The safety hazards associated with the device must be assessed again following installation in the final product.
The locally applicable industrial safety regulations are always to be observed when working on the device.
Keep the workplace clean and tidy. Untidiness in the work area increases the risk of accidents.
Note the following when working on the device:

⇒ Do not perform any modifications, additions or conversions on the device without the approval of ebm-papst.

K2D200-AB18-08
Siemens AG DF MC MF-M

Operating instructions

1.4 Voltage

⇒ Check the device's electrical equipment at regular intervals; see Chapter 5.2 Safety inspection.

⇒ Replace loose connections and defective cables immediately.

DANGER
Electrically charged device
Risk of electric shock

→ When working on an electrically charged device, stand on a rubber mat.

CAUTION
In the event of a fault, the rotor and the impeller will be energized
The rotor and the impeller have basic insulation.

→ Do not touch the rotor and impeller once installed.

CAUTION
The motor restarts automatically when operating voltage is applied, e.g. after a power failure.
Risk of injury

→ Keep out of the device's danger zone.

→ When working on the device, switch off the line voltage and ensure that it cannot be switched back on.

→ Wait until the device comes to a stop.

1.5 Safety and protective features

DANGER
Guard missing and guard not functioning
Without a guard, hands may become caught up in the device during operation for example, resulting in serious injury. Loose parts or items of clothing could be drawn in.

→ The device is a built-in component. As the owner, you are responsible for ensuring that the device is adequately safeguarded.# Operate the device only with a fixed protective device and guard grill.

→ Stop the device immediately if a protective device is found to be missing or ineffective.

1.6 Electromagnetic radiation

Interference from electromagnetic radiation is possible, e.g. in conjunction with open- and closed-loop control devices.
If impermissible radiation levels occur following installation, appropriate shielding measures have to be taken by the user.

1.7 Mechanical movement

DANGER
Rotating device
Risk of injury to body parts coming into contact with the rotor or the impeller.

→ Secure the device against accidental contact.

→ Before working on the system/machine, wait until all parts have come to a standstill.

WARNING
Rotating device
Long hair and dangling items of clothing, jewelry and the like can become entangled and be pulled into the device. Injuries can result.

→ Do not wear any loose-fitting or dangling clothing or jewelry while working on rotating parts.

→ Protect long hair with a cap.

1.8 Emissions

WARNING
Depending on the installation and operating conditions, the sound pressure level may exceed 70 dB(A).
Risk of noise-induced hearing loss

→ Take appropriate technical safety measures.

→ Protect operating personnel with appropriate safety equipment such as hearing protection.

→ Also observe the requirements of local agencies.

1.9 Hot surface

NOTE
Risk of fire
The risk of fire or flame propagation by ebm-papst products must be assessed by the commissioning party following installation in the final product.

1.10 Transport

NOTE
Transporting the device

→ Transport the device in its original packaging only.

→ Secure the device so it cannot slip, e.g. by using a lashing strip.

1.11 Storage

⇒ Store the device, partially or fully assembled, in a dry place, protected against the weather and free from vibration, in the original packaging in a clean environment.

⇒ Protect the device against environmental effects and dirt until final installation.

⇒ We recommend storing the device for no longer than one year in order to guarantee trouble-free operation and the longest possible service life.

⇒ Even devices explicitly intended for outdoor use are to be stored as described prior to commissioning.

⇒ Maintain the storage temperature, see Chapter 3.5 Transport and storage conditions.

⇒ Make sure that all cable glands are fitted with dummy plugs.

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Siemens AG DF MC MF-M

Operating instructions

2. INTENDED USE

Intended use also includes

- Using the device only in power systems with grounded neutral (TN/ TT power systems).
- Conveying air at an ambient air pressure between 800 mbar and 1050 mbar.
- Using the device within the permitted ambient temperature range; see Chapter 3.5 Transport and storage conditions and Chapter 3.2 Nominal data.
- Operating the device with all protective devices.
- Following the operating instructions.

Improper use

In particular, operating the device in the following ways is prohibited and could be hazardous:

- Operating the device in an unbalanced state, e.g. due to dirt deposits or ice formation.
- Resonant operation, operation with severe vibration. This also includes vibration transmitted to the fan from the customer installation.
- Operation in medical equipment with a life-sustaining or life-support function.
- Conveying solids in the flow medium.
- Painting the device
- Connections (e.g. screws) coming loose during operation.
- Opening the terminal box during operation.
- Conveying air that contains abrasive particles.
- Conveying highly corrosive air, e.g. salt spray. Exception: devices designed for salt spray and correspondingly protected.
- Conveying air with high dust content, e.g. suctioning off sawdust.
- Operating the device close to flammable materials or components.
- Operating the device in an explosive atmosphere.
- Using the device as a safety component or to perform safety-related functions.
- Operation with completely or partially disassembled or manipulated protective devices.
- In addition, all applications not listed among the intended uses.

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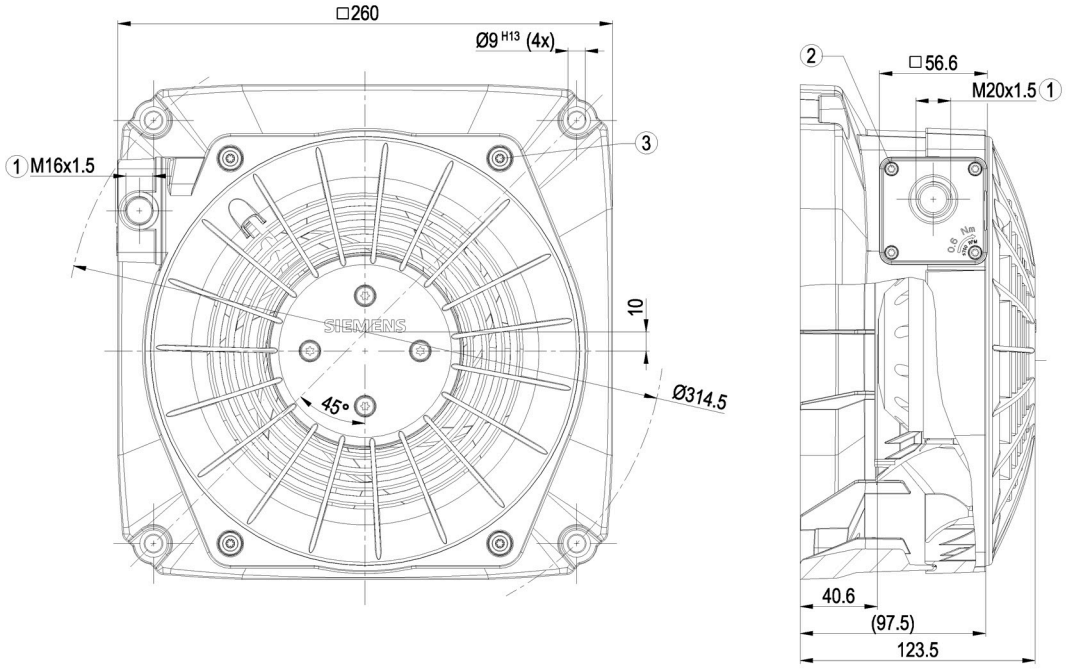
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Siemens AG DF MC MF-M

Operating instructions

3. TECHNICAL DATA

3.1 Product drawing



All dimensions in mm.

1	Max. screw-in depth 9 mm
2	Tightening torque 0.6±0.1 Nm, fit manually
3	Tightening torque 3.5 ± 0.3 Nm; fit screws by hand

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K2D200-AB18-08
Siemens AG DF MC MF-M

Operating instructions

3.2 Nominal data

Motor	M2D068-CF		
Phase	3~	3~	3~
Nominal voltage / VAC	400	400	480
Wiring	Y	Y	Y
Frequency / Hz	50	60	60
Method of obtaining data	ce	ce	ce
Valid for approval/ standard	CE	CE	CE
Speed (rpm) / min^{-1}	2450	2600	2850
Power consumption / W	60	80	95
Current draw / A	0.1	0.12	0.13
Min. back pressure / Pa	0	0	0
Min. ambient temperature / °C	-25	-25	-25
Max. ambient temperature / °C	80	80	80
Starting current / A	0.28	0.27	0.31

ml = Max. load · me = Max. efficiency · fa = Free air
cs = Customer specification · ce = Customer equipment

Subject to change

Imax:
340-440V 50/60Hz 0.11A/0.13A
408-528V 60Hz 0.13A

3.3 Technical description

Weight	2.8 kg
Size	200 mm
Motor size	68
Rotor surface	Painted black
Terminal box material	PA plastic
Impeller material	PA plastic
Housing material	PA plastic
Guard grille material	PA plastic
Number of blades	7
Direction of rotation	Counterclockwise, viewed toward rotor
Degree of protection	IP65
Insulation class	"F"
Moisture (F) / Environmental (H) protection class	H1+
Installation position	Any
Condensation drainage holes	None
Mode	S1
Motor bearing	Ball bearing
Touch current according to IEC 60990 (measuring circuit Fig. 4, TN system)	< 0.75 mA
Electrical hookup	Terminal box
Protection class	I (with customer connection of protective earth)
Conformity with standards	EN 60034-1; EN 60204-1; EN 60335-1; CE
Approval	EAC; CSA C22.2 No. 100; UL 1004-1

With regard to cyclic speed loads, note that the rotating parts of the device are designed for a maximum of one million load cycles. If you have special questions, consult ebm-papst for support.

⇒ Use the device in accordance with its degree of protection.

Information on surface quality

The surfaces of the products conform to the generally applicable industrial standard. The surface quality may change during the production period. This has no effect on strength, dimensional stability and dimensional accuracy.
The color pigments in the paints used perceptibly react to UV light over the course of time. The product is to be protected against UV radiation to prevent the formation of patches and fading. Changes in color are not a reason for complaint and are not covered by the warranty. UV radiation in the frequency range and the intensity of natural solar radiation has no effect on the technical properties of the products.

3.4 Mounting data

Any further mounting data required can be taken from the product drawing or Section Chapter 4.1 Mechanical connection.

Strength class of screws	8.8

⇒ Secure the screws against unintentional loosening (e.g. use self-locking screws).

3.5 Transport and storage conditions

NOTE
The degree of protection is only valid in conjunction with the main motor.

Max. permitted ambient temp. for motor (transport/ storage)	+80 °C
Min. permitted ambient temp. for motor (transport/ storage)	-40 °C

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K2D200-AB18-08
Siemens AG DF MC MF-M

Operating instructions

4. CONNECTION AND STARTUP

4.1 Mechanical connection

CAUTION
Risk of cutting and crushing when removing device from packaging

→ Carefully remove the device from the packaging by grasping hold of the frame. Never subject to any impact.

→ Wear safety shoes and cut-resistant safety gloves.

NOTE
Damage to the device from vibration
Bearing damage, shorter service life

→ The fan must not be subjected to force or excessive vibration from sections of the installation.

→ If the fan is connected to air ducts, the connection should be isolated from vibration, e.g. using compensators or similar elements.

→ Ensure stress-free attachment of the fan to the substructure.

⇒ The fan may not be handled in the area around the inlet nozzle during transport and installation.
There is a risk of damage to the impeller.

⇒ Check the device for transport damage. Damaged devices are not to be installed.

⇒ Install the undamaged device in accordance with your application.

CAUTION
Possible damage to the device
If the device slips during installation, serious damage can result.

→ Ensure that the device is securely positioned at its place of installation until all fastening screws have been tightened.

- The fan must not be strained on fastening.

4.2 Electrical connection

DANGER
Voltage on the device
Electric shock

→ Always connect a protective earth first.

→ Check the protective earth.

DANGER
Faulty insulation
Risk of fatal injury from electric shock

→ Use only cables that meet the specified installation regulations for voltage, current, insulation material, capacity, etc.

→ Route cables so that they cannot be touched by any rotating parts.

CAUTION
Voltage
The device is a built-in component and has no disconnecting switch.

→ Only connect the device to circuits that can be switched off with an all-pole disconnection switch.

→ When working on the device, secure the system/ machine in which the device is installed so as to prevent it from being switched back on.

NOTE
Water ingress into wires or cables
Water ingress at the customer end of the cable can damage the device.

→ Make sure the end of the cable is connected in a dry environment.

Only connect the device to circuits that can be switched off with an all-pole disconnection switch.

4.2.1 Requirements

⇒ Check whether the information on the nameplate matches the connection data.

⇒ Before connecting the device, make sure the power supply matches the device voltage.

⇒ Only use cables designed for the current level indicated on the nameplate.
For determining the cross-section, note the sizing criteria according to EN 61800-5-1. The protective earth must have a cross-section equal to or greater than that of the phase conductor.
We recommend the use of 105 °C cables. Ensure that the minimum cable cross-section is at least
AWG 26 / 0.13 mm².

⇒ For a M20x1.5 cable gland, measure the maximum cable cross-section of 2.5 mm² and for a M16x1.5 cable gland the maximum cable cross-section of 1.5 mm².

Forced-ventilation units with no thermal overload protector must be safeguarded by a motor circuit breaker prior to startup.

Protective earth contact resistance according to EN 60335

Compliance with the resistance specifications according to EN 60335 for the protective earth connection circuit must be verified in the end application. Depending on the installation situation, it may be necessary to connect an additional protective earth conductor by way of the extra protective earth terminal provided on the device.

4.2.2 Residual current circuit breaker (RCCB)

If the use of a residual current device (RCD) is required in your installation, only AC/DC-sensitive residual current devices of type B are permissible.

4.3 Connection in terminal box

4.3.1 Preparing cables for connection

Only strip the cable as far as necessary, ensuring that the cable gland is sealed and there is no strain on the connections. For tightening torques, see Chapter 3.1 Product drawing.

NOTE
Tightness and strain relief are dependent on the cable used.

→ This must be checked by the user.

⇒ When connecting, make sure the ground conductor is longer than the phase conductors.

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4.3.2 Connecting wires to terminals

⇒ To ensure the IP protection, a cable gland with seal must be used for the cable entry.

⇒ Only use cable glands made of plastic.

⇒ Route the cables into the intended openings on the terminal box.

⇒ First connect the "PE" (protective earth).

An external ground connection can also be made at uninsulated points on the housing or using the external ground connection in the terminal box.

⇒ Connect the wires to the corresponding terminals.

Use a screwdriver to do so.
When connecting, ensure that no wire ends fan out.

⇒ Insert the leads until they meet resistance.

⇒ The cable bushing to the add-on device must be free of burrs and in accordance with the degree of protection (IP code).

4.3.3 Cable routing

Water must be prevented from reaching the cable gland along the cable.

NOTE
Damage caused by moisture penetration.
Moisture can penetrate into the terminal box if water is constantly present at the cable glands.

→ To prevent the constant accumulation of water at the cable glands, the cable should be routed in a U-shaped loop wherever possible.

→ If this is not possible, a drip edge can be produced by fitting a cable tie directly in front of the cable gland for example.

— Make sure the cable is routed in a U-shaped loop.

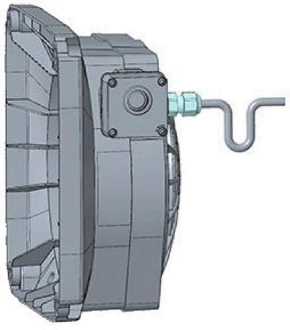


Fig. 1: Cable routing in U-shaped loop

4.3.4 Motor protection

Motor protection switch

WARNING
Device has no locked-rotor protection
As delivered, the forced-ventilation unit has no automatic protection against incorrect operation (locked-rotor protection). The device can become hot and catch fire.

→ For the version without thermal overload protector, also install a suitable motor protection switch or a suitable tripping unit for the PTC thermistor.

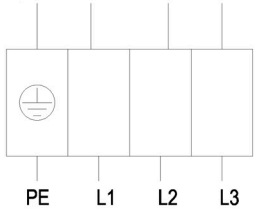
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K2D200-AB18-08
Siemens AG DF MC MF-M

Operating instructions

4.4 Connection diagram



PE	green/yellow
L1	black
L2	blue
L3	brown

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4.5 Checking connections

- ⇒ Ensure isolation from supply (all phases).
- ⇒ Make sure a restart is impossible
- ⇒ Check the cables for proper fit.
- ⇒ Check the mechanical and electrical installation of safety-related components (e.g. motor protection switch, guard grille etc.).
- ⇒ Screw the terminal box cover back on again. Terminal box tightening torque, see Chapter 3.1 Product drawing.
- ⇒ Make sure the terminal box is completely closed and sealed and that all screws and cable glands have been properly tightened.

4.6 Switching on the device

The device may only be switched on if it has been installed properly and in accordance with its intended use, including the required safety mechanisms and professional electrical hookup. This also applies for devices which have already been equipped with plugs and terminals or similar connectors by the customer.

WARNING
Hot motor housing
Risk of fire
→ Ensure that no combustible or flammable materials are located close to the fan.

- ⇒ Before switching on, check the device for visible external damage and make sure the protective devices are functional.
- ⇒ Check the fan's air flow paths for foreign matter and remove any foreign matter found.
- ⇒ Apply the nominal supply voltage.

NOTE
Damage to the device from vibration
Bearing damage, shorter service life
→ Low-vibration operation of the fan must be ensured over the entire speed control range.
→ Severe vibration can arise for instance from inexpert handling, transportation damage and resultant imbalance or be caused by component or structural resonance.
→ Speed ranges with excessively high vibration levels and possibly resonant frequencies must be determined in the course of fan commissioning.
→ Either run through the resonant range as quickly as possible with speed control or find another remedy.
→ Operation with excessively high vibration levels can lead to premature failure.

4.7 Switching off the device

- ⇒ Disconnect the device from the power supply at the supply line's main switch.
- ⇒ When disconnecting, be sure to disconnect the ground connection last.

Translation of the original operating instructions

5. MAINTENANCE, MALFUNCTIONS, POSSIBLE CAUSES AND REMEDIES

The fan in the forced-ventilation unit is maintenance-free thanks to the use of special bearing greases.
During maintenance work on the ventilation unit, e.g. when cleaning the fan blades, the fan must be stationary and the ventilation unit's electrical circuit must be interrupted and secured against being switched on again.

CAUTION
The motor restarts automatically when operating voltage is applied, e.g. after a power failure.
Risk of injury
→ Keep out of the device's danger zone.
→ When working on the device, switch off the line voltage and ensure that it cannot be switched back on.
→ Wait until the device comes to a stop.

If the device is out of use for some time, e.g. when in storage, we recommend switching it on for at least two hours to allow any condensation to evaporate and to move the bearings.

- ⇒ Do not perform any repairs on the forced-ventilation unit. Send the blower to ebm-papst for repair or replacement.

Malfunction/fault	Possible cause	Possible remedy
Impeller not running smoothly	Imbalance in rotating parts	Clean the device; replace it if imbalance persists after cleaning. Make sure no weight clips are removed during cleaning.
Motor not turning	Mechanical blockage	Switch off, isolate from supply and remove mechanical blockage.
	Line voltage faulty	Check line voltage, restore power supply.
	Faulty connection	Isolate from supply, correct connection; see connection diagram.
	Broken motor winding	Replace device
	Impermissible point of operation	Check point of operation
Motor overtemperature	Ambient temperature too high	Reduce ambient temperature if possible
	Deficient cooling	Improve cooling

In the event of further malfunctions, contact ebm-papst.

5.1 Cleaning

To ensure a long service life, check the fans regularly for proper operation and soiling. The frequency of checking is to be adapted accordingly depending on the degree of soiling.

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K2D200-AB18-08
Siemens AG DF MC MF-M

Operating instructions

DANGER
Risk of injury from rotating fan.
→ Only clean when not in motion. Interrupt the power supply, secure against renewed switch-on. Secure against start-up, prevent air flow.

- ⇒ Dirt deposits on the motor housing can cause overheating of the motor.
- ⇒ Soiling of the impeller can cause vibration that will shorten the service life of the fan.
- ⇒ Severe vibration can destroy the fan.
- ⇒ In such cases, switch off the fan immediately and clean it.
- ⇒ The preferred method of cleaning is dry cleaning, e.g. using compressed air.
- ⇒ Do not use aggressive cleaning agents!

NOTE
Damage to the device during cleaning
Malfunction possible
→ Do not clean the device using a high-pressure cleaner.# Do not use acid, alkali or solvent-based cleaning agents.
→ Do not use any pointed or sharp-edged objects for cleaning.

- ⇒ Clean the fan using a suitable cloth or brush, taking care not to allow moisture to reach the motor's interior.
- ⇒ Take care not to damage or bend the fan blades.
- ⇒ Completely remove any cleaning agents used.
- ⇒ If severe corrosion is visible on load-bearing or rotating parts, switch off the device immediately and replace it.
- ⇒ Repair of load-bearing or rotating parts is not permitted!
- ⇒ Operate the fan for 2 hours at maximum speed so that any water that has ingressed can evaporate.
- ⇒ If cleaning does not eliminate vibrations, the fan may need to be rebalanced. To have it rebalanced, contact ebm-papst.
- ⇒ The fan is equipped with maintenance-free ball bearings. The lifetime lubrication of the ball bearings is designed for a service life of 40,000 hours.
- ⇒ If bearing replacement is necessary after that period, contact ebm-papst.
- ⇒ Adapt the maintenance intervals to the actual level of dust exposure.

5.2 Safety inspection

What to check	How to check	How often	What action?
Contact protection cover for intactness or damage	Visual inspection	At least every 6 months	Repair or replacement of device
Device for damage	Visual inspection	At least every 6 months	Replace device
Fastening the cables	Visual inspection	At least every 6 months	Fasten
Fastening the protective earth terminal	Visual inspection	At least every 6 months	Fasten
Insulation of cables for damage	Visual inspection	At least every 6 months	Replace cables
Impeller for wear/deposits/ corrosion and damage	Visual inspection	At least every 6 months	Clean impeller or replace device
Tightness of cable gland	Visual inspection	At least every 6 months	Retighten, replace if damaged
Distance between impeller and housing or plastic ring	Measurement	At least every 6 months	Replace device
Insulation resistance check	Measurement	Following completion of electrical work	Replace device
Abnormal bearing noise	acoustic	At least every 6 months	Replace device

5.3 Disposal

For ebm-papst, environmental protection and resource preservation are top priority corporate goals.
ebm-papst operates an environmental management system which is certified in accordance with ISO 14001 and rigorously implemented around the world on the basis of German standards.
Right from the development stage, ecological design, technical safety and health protection are fixed criteria.
The following section contains recommendations for ecological disposal of the product and its components.

5.3.1 Country-specific legal requirements

NOTE
Country-specific legal requirements
Always observe the applicable country-specific legal regulations with regard to the disposal of products or waste occurring in the various phases of the life cycle. The corresponding disposal standards are also to be heeded.

5.3.2 Disassembly

Disassembly of the product must be performed or supervised by qualified personnel with the appropriate technical knowledge.
The product is to be disassembled into suitable components for disposal employing standard procedures for motors.

WARNING
Heavy parts of the product may drop off. Some of the product components are heavy. These components could drop off during disassembly.
This can result in fatal or serious injury and material damage.
→ Secure components before unfastening to stop them falling.

5.3.3 Component disposal

The products are mostly made of steel, copper, aluminum and plastic.
Metallic materials are generally considered to be fully recyclable.
Separate the components for recycling into the following categories:

- Steel and iron
- Aluminum
- Non-ferrous metal, e.g. motor windings
- Plastics, particularly with brominated flame retardants, in accordance with marking
- Insulating materials
- Cables and wires

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- Electronic scrap, e.g. circuit boards

Only ferrite magnets and not rare earth magnets are used in external rotor motors from ebm-papst Mulfingen GmbH & Co. KG.

⇒ Ferrite magnets can be disposed of in the same way as normal iron and steel.

Electrical insulating materials on the product, in cables and wires are made of similar materials and are therefore to be treated in the same manner.
The materials concerned are as follows:

- Miscellaneous insulators used in the terminal box
- Power cables
- Cables for internal wiring
- Electrolytic capacitors

Dispose of electronic components employing the proper procedures for electronic scrap.

→ Please contact ebm-papst for any other questions on disposal.

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A.3.3 Operating instructions for the external fan, Type K2D200AB2405

K2D200-AB24-05
Siemens AG DF MC MF-M

Operating instructions

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CONTENTS

1. SAFETY REGULATIONS AND INFORMATION 1
1.1 Hazard levels for warnings 1
1.2 Staff qualifications 1
1.3 Basic safety rules 1
1.4 Voltage 2
1.5 Safety and protective features 2
1.6 Electromagnetic radiation 2
1.7 Mechanical movement 2
1.8 Emissions 2
1.9 Hot surface 2
1.10 Transport 2
1.11 Storage 2

2. INTENDED USE 3

3. TECHNICAL DATA 4
3.1 Product drawing 4
3.2 Nominal data 5
3.3 Technical description 5
3.4 Mounting data 5
3.5 Transport and storage conditions 5

4. CONNECTION AND STARTUP 6
4.1 Mechanical connection 6
4.2 Electrical connection 6
4.3 Connection in terminal box 6
4.4 Connection diagram 8
4.5 Checking connections 9
4.6 Switching on the device 9
4.7 Switching off the device 9

5. MAINTENANCE, MALFUNCTIONS, POSSIBLE CAUSES AND REMEDIES 9
5.1 Cleaning 9
5.2 Safety inspection 10
5.3 Disposal 10

Translation of the original operating instructions

1. SAFETY REGULATIONS AND INFORMATION

Read these operating instructions carefully before starting work on the device. Observe the following warnings to prevent malfunctions or danger to persons.
These operating instructions are to be regarded as part of the device. The device is only to be sold or passed on together with the operating instructions.
These operating instructions may be duplicated and distributed to inform about potential dangers and their prevention.

1.1 Hazard levels for warnings

These operating instructions use the following hazard levels to indicate potentially hazardous situations and important safety regulations:

DANGER
Indicates an imminently hazardous situation which will result in death or serious injury if the specified actions are not taken. Compliance with the instructions is imperative.

WARNING
Indicates a potentially hazardous situation which can result in death or serious injury if the specified actions are not taken. Exercise extreme caution while working.

CAUTION
Indicates a potentially hazardous situation which can result in minor or moderate injury or damage to property if the specified actions are not taken.

NOTE
A potentially harmful situation can occur and, if not avoided, can lead to property damage.

1.2 Staff qualifications

The device may only be transported, unpacked, installed, operated, maintained and otherwise used by suitably qualified, trained and authorized technical staff.
Only authorized specialists are permitted to install the device, to carry out a test run and to perform work on the electrical installation.

1.3 Basic safety rules

The motor may only be operated with an impeller. The result is a motor-fan combination. Motor and impeller assignment may only be done by ebm-papst.
Protection against such things as:

- electric shock
- Contact with rotating parts
- Ingress of foreign bodies or moisture
- Excessive condensation

The safety hazards associated with the device must be assessed again following installation in the final product.
The locally applicable industrial safety regulations are always to be observed when working on the device.
Keep the workplace clean and tidy. Untidiness in the work area increases the risk of accidents.
Note the following when working on the device:

⇒ Do not perform any modifications, additions or conversions on the device without the approval of ebm-papst.

K2D200-AB24-05
Siemens AG DF MC MF-M

Operating instructions

1.4 Voltage

⇒ Check the device's electrical equipment at regular intervals; see Chapter 5.2 Safety inspection.

⇒ Replace loose connections and defective cables immediately.

DANGER
Electrically charged device
Risk of electric shock

→ When working on an electrically charged device, stand on a rubber mat.

CAUTION
In the event of a fault, the rotor and the impeller will be energized
The rotor and the impeller have basic insulation.

→ Do not touch the rotor and impeller once installed.

CAUTION
The motor restarts automatically when operating voltage is applied, e.g. after a power failure.
Risk of injury

→ Keep out of the device's danger zone.

→ When working on the device, switch off the line voltage and ensure that it cannot be switched back on.

→ Wait until the device comes to a stop.

1.5 Safety and protective features

DANGER
Guard missing and guard not functioning
Without a guard, hands may become caught up in the device during operation for example, resulting in serious injury. Loose parts or items of clothing could be drawn in.

→ The device is a built-in component. As the owner, you are responsible for ensuring that the device is adequately safeguarded.# Operate the device only with a fixed protective device and guard grill.

→ Stop the device immediately if a protective device is found to be missing or ineffective.

1.6 Electromagnetic radiation

Interference from electromagnetic radiation is possible, e.g. in conjunction with open- and closed-loop control devices.
If impermissible radiation levels occur following installation, appropriate shielding measures have to be taken by the user.

1.7 Mechanical movement

DANGER
Rotating device
Risk of injury to body parts coming into contact with the rotor or the impeller.

→ Secure the device against accidental contact.

→ Before working on the system/machine, wait until all parts have come to a standstill.

WARNING
Rotating device
Long hair and dangling items of clothing, jewelry and the like can become entangled and be pulled into the device. Injuries can result.

→ Do not wear any loose-fitting or dangling clothing or jewelry while working on rotating parts.

→ Protect long hair with a cap.

1.8 Emissions

WARNING
Depending on the installation and operating conditions, the sound pressure level may exceed 70 dB(A).
Risk of noise-induced hearing loss

→ Take appropriate technical safety measures.

→ Protect operating personnel with appropriate safety equipment such as hearing protection.

→ Also observe the requirements of local agencies.

1.9 Hot surface

NOTE
Risk of fire
The risk of fire or flame propagation by ebm-papst products must be assessed by the commissioning party following installation in the final product.

1.10 Transport

NOTE
Transporting the device

→ Transport the device in its original packaging only.

→ Secure the device so it cannot slip, e.g. by using a lashing strip.

1.11 Storage

⇒ Store the device, partially or fully assembled, in a dry place, protected against the weather and free from vibration, in the original packaging in a clean environment.

⇒ Protect the device against environmental effects and dirt until final installation.

⇒ We recommend storing the device for no longer than one year in order to guarantee trouble-free operation and the longest possible service life.

⇒ Even devices explicitly intended for outdoor use are to be stored as described prior to commissioning.

⇒ Maintain the storage temperature, see Chapter 3.5 Transport and storage conditions.

⇒ Make sure that all cable glands are fitted with dummy plugs.

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Siemens AG DF MC MF-M

Operating instructions

2. INTENDED USE

Intended use also includes

- Using the device only in power systems with grounded neutral (TN/ TT power systems).
- Conveying air at an ambient air pressure between 800 mbar and 1050 mbar.
- Using the device within the permitted ambient temperature range; see Chapter 3.5 Transport and storage conditions and Chapter 3.2 Nominal data.
- Operating the device with all protective devices.
- Following the operating instructions.

Improper use

In particular, operating the device in the following ways is prohibited and could be hazardous:

- Operating the device in an unbalanced state, e.g. due to dirt deposits or ice formation.
- Resonant operation, operation with severe vibration. This also includes vibration transmitted to the fan from the customer installation.
- Operation in medical equipment with a life-sustaining or life-support function.
- Conveying solids in the flow medium.
- Painting the device
- Connections (e.g. screws) coming loose during operation.
- Opening the terminal box during operation.
- Conveying air that contains abrasive particles.
- Conveying highly corrosive air, e.g. salt spray. Exception: devices designed for salt spray and correspondingly protected.
- Conveying air with high dust content, e.g. suctioning off sawdust.
- Operating the device close to flammable materials or components.
- Operating the device in an explosive atmosphere.
- Using the device as a safety component or to perform safety-related functions.
- Operation with completely or partially disassembled or manipulated protective devices.
- In addition, all applications not listed among the intended uses.

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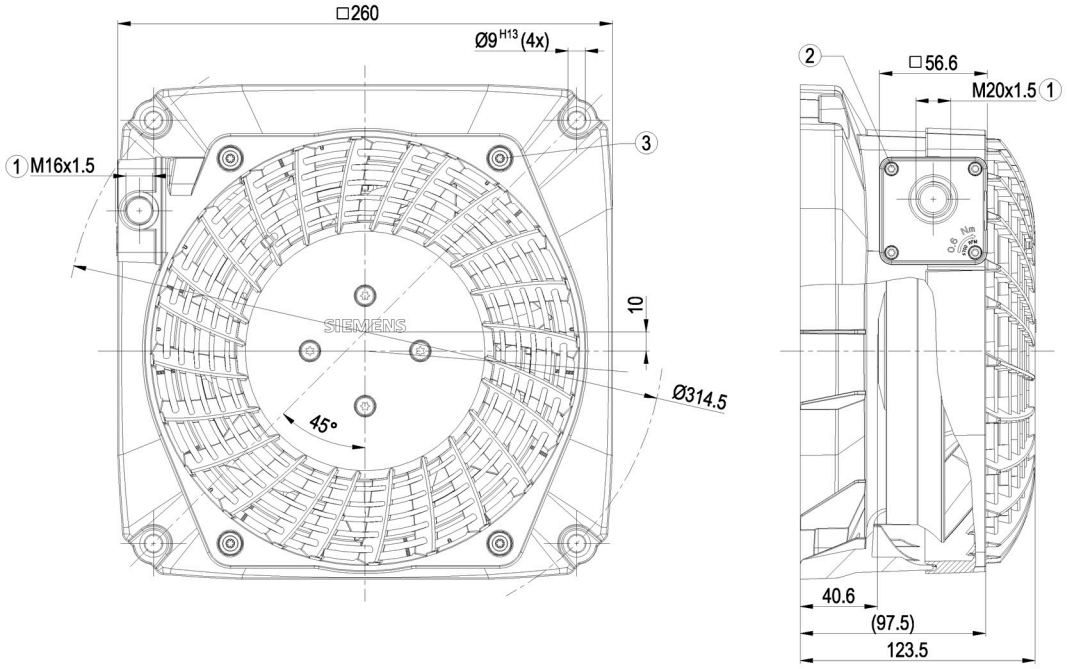
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K2D200-AB24-05
Siemens AG DF MC MF-M

Operating instructions

3. TECHNICAL DATA

3.1 Product drawing



All dimensions in mm.

1	Max. screw-in depth 9 mm
2	Tightening torque 0.6±0.1 Nm, fit manually
3	Tightening torque 3.5 ± 0.3 Nm; fit screws by hand

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K2D200-AB24-05
Siemens AG DF MC MF-M

Operating instructions

3.2 Nominal data

Motor	M2D068-CF		
Phase	3~	3~	3~
Nominal voltage / VAC	400	400	480
Wiring	Y	Y	Y
Frequency / Hz	50	60	60
Method of obtaining data	ce	ce	ce
Valid for approval/ standard	CE	CE	CE
Speed (rpm) / min^{-1}	2400	2450	2700
Power consumption / W	56	75	90
Current draw / A	0.1	0.12	0.12
Min. ambient temperature / °C	-25	-25	-25
Max. ambient temperature / °C	80	80	80
Starting current / A	0.4	0.24	0.29

ml = Max. load · me = Max. efficiency · fa = Free air
cs = Customer specification · ce = Customer equipment

Subject to change

Imax:
340-440V 50/60Hz 0.1A/0.12A
408-528V 60Hz 0.12A

3.3 Technical description

Weight	2.74 kg
Size	200 mm
Motor size	68
Rotor surface	Painted black
Terminal box material	PA plastic
Impeller material	PA plastic
Housing material	PA plastic
Guard grille material	PA plastic
Number of blades	7
Direction of rotation	Clockwise, viewed toward rotor
Degree of protection	IP55
Insulation class	"F"
Moisture (F) / Environmental (H) protection class	H1+
Installation position	Any
Condensation drainage holes	None
Mode	S1
Motor bearing	Ball bearing
Touch current according to IEC 60990 (measuring circuit Fig. 4, TN system)	< 0.75 mA
Electrical hookup	Terminal box
Protection class	I (with customer connection of protective earth)
Conformity with standards	EN 60034-1; EN 60204-1; EN 60335-1; CE
Approval	EAC; CSA C22.2 No. 100; UL 1004-1

Translation of the original operating instructions

With regard to cyclic speed loads, note that the rotating parts of the device are designed for a maximum of one million load cycles. If you have special questions, consult ebm-papst for support.

⇒ Use the device in accordance with its degree of protection.

Information on surface quality

The surfaces of the products conform to the generally applicable industrial standard. The surface quality may change during the production period. This has no effect on strength, dimensional stability and dimensional accuracy.
The color pigments in the paints used perceptibly react to UV light over the course of time. The product is to be protected against UV radiation to prevent the formation of patches and fading. Changes in color are not a reason for complaint and are not covered by the warranty. UV radiation in the frequency range and the intensity of natural solar radiation has no effect on the technical properties of the products.

3.4 Mounting data

Any further mounting data required can be taken from the product drawing or Section Chapter 4.1 Mechanical connection.

Strength class of screws	8.8

⇒ Secure the screws against unintentional loosening (e.g. use self-locking screws).

3.5 Transport and storage conditions

NOTE
The degree of protection is only valid in conjunction with the main motor.

Max. permitted ambient temp. for motor (transport/ storage)	+80 °C
Min. permitted ambient temp. for motor (transport/ storage)	-40 °C

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K2D200-AB24-05
Siemens AG DF MC MF-M

Operating instructions

4. CONNECTION AND STARTUP

4.1 Mechanical connection

CAUTION
Risk of cutting and crushing when removing device from packaging

→ Carefully remove the device from the packaging by grasping hold of the frame. Never subject to any impact.

→ Wear safety shoes and cut-resistant safety gloves.

NOTE
Damage to the device from vibration
Bearing damage, shorter service life

→ The fan must not be subjected to force or excessive vibration from sections of the installation.

→ If the fan is connected to air ducts, the connection should be isolated from vibration, e.g. using compensators or similar elements.

→ Ensure stress-free attachment of the fan to the substructure.

⇒ The fan may not be handled in the area around the inlet nozzle during transport and installation.
There is a risk of damage to the impeller.

⇒ Check the device for transport damage. Damaged devices are not to be installed.

⇒ Install the undamaged device in accordance with your application.

CAUTION
Possible damage to the device
If the device slips during installation, serious damage can result.

→ Ensure that the device is securely positioned at its place of installation until all fastening screws have been tightened.

- The fan must not be strained on fastening.

4.2 Electrical connection

DANGER
Voltage on the device
Electric shock

→ Always connect a protective earth first.

→ Check the protective earth.

DANGER
Faulty insulation
Risk of fatal injury from electric shock

→ Use only cables that meet the specified installation regulations for voltage, current, insulation material, capacity, etc.

→ Route cables so that they cannot be touched by any rotating parts.

CAUTION
Voltage
The device is a built-in component and has no disconnecting switch.

→ Only connect the device to circuits that can be switched off with an all-pole disconnection switch.

→ When working on the device, secure the system/ machine in which the device is installed so as to prevent it from being switched back on.

NOTE
Water ingress into wires or cables
Water ingress at the customer end of the cable can damage the device.

→ Make sure the end of the cable is connected in a dry environment.

Only connect the device to circuits that can be switched off with an all-pole disconnection switch.

4.2.1 Requirements

⇒ Check whether the information on the nameplate matches the connection data.

⇒ Before connecting the device, make sure the power supply matches the device voltage.

⇒ Only use cables designed for the current level indicated on the nameplate.
For determining the cross-section, note the sizing criteria according to EN 61800-5-1. The protective earth must have a cross-section equal to or greater than that of the phase conductor.
We recommend the use of 105 °C cables. Ensure that the minimum cable cross-section is at least
AWG 26 / 0.13 mm².

⇒ For a M20x1.5 cable gland, measure the maximum cable cross-section of 2.5 mm² and for a M16x1.5 cable gland the maximum cable cross-section of 1.5 mm².

Forced-ventilation units with no thermal overload protector must be safeguarded by a motor circuit breaker prior to startup.

Protective earth contact resistance according to EN 60335

Compliance with the resistance specifications according to EN 60335 for the protective earth connection circuit must be verified in the end application. Depending on the installation situation, it may be necessary to connect an additional protective earth conductor by way of the extra protective earth terminal provided on the device.

4.2.2 Residual current circuit breaker (RCCB)

If the use of a residual current device (RCD) is required in your installation, only AC/DC-sensitive residual current devices of type B are permissible.

4.3 Connection in terminal box

4.3.1 Preparing cables for connection

Only strip the cable as far as necessary, ensuring that the cable gland is sealed and there is no strain on the connections. For tightening torques, see Chapter 3.1 Product drawing.

NOTE
Tightness and strain relief are dependent on the cable used.

→ This must be checked by the user.

⇒ When connecting, make sure the ground conductor is longer than the phase conductors.

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Siemens AG DF MC MF-M

Operating instructions

4.3.2 Connecting wires to terminals

⇒ To ensure the IP protection, a cable gland with seal must be used for the cable entry.

⇒ Only use cable glands made of plastic.

⇒ Route the cables into the intended openings on the terminal box.

⇒ First connect the "PE" (protective earth).

An external ground connection can also be made at uninsulated points on the housing or using the external ground connection in the terminal box.

⇒ Connect the wires to the corresponding terminals.

Use a screwdriver to do so.
When connecting, ensure that no wire ends fan out.

⇒ Insert the leads until they meet resistance.

⇒ The cable bushing to the add-on device must be free of burrs and in accordance with the degree of protection (IP code).

4.3.3 Cable routing

Water must be prevented from reaching the cable gland along the cable.

NOTE
Damage caused by moisture penetration.
Moisture can penetrate into the terminal box if water is constantly present at the cable glands.

→ To prevent the constant accumulation of water at the cable glands, the cable should be routed in a U-shaped loop wherever possible.

→ If this is not possible, a drip edge can be produced by fitting a cable tie directly in front of the cable gland for example.

— Make sure the cable is routed in a U-shaped loop.

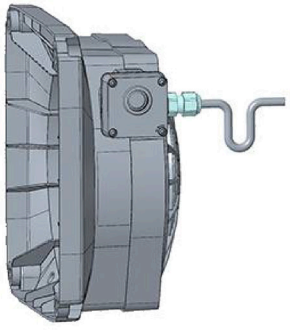


Fig. 1: Cable routing in U-shaped loop

4.3.4 Motor protection

Motor protection switch

WARNING
Device has no locked-rotor protection
As delivered, the forced-ventilation unit has no automatic protection against incorrect operation (locked-rotor protection). The device can become hot and catch fire.

→ For the version without thermal overload protector, also install a suitable motor protection switch or a suitable tripping unit for the PTC thermistor.

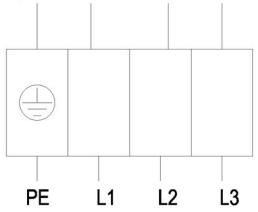
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Siemens AG DF MC MF-M

Operating instructions

4.4 Connection diagram



PE	green/yellow
L1	black
L2	blue
L3	brown

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K2D200-AB24-05
Siemens AG DF MC MF-M

Operating instructions

4.5 Checking connections

- ⇒ Ensure isolation from supply (all phases).
- ⇒ Make sure a restart is impossible
- ⇒ Check the cables for proper fit.
- ⇒ Check the mechanical and electrical installation of safety-related components (e.g. motor protection switch, guard grille etc.).
- ⇒ Screw the terminal box cover back on again. Terminal box tightening torque, see Chapter 3.1 Product drawing.
- ⇒ Make sure the terminal box is completely closed and sealed and that all screws and cable glands have been properly tightened.

4.6 Switching on the device

The device may only be switched on if it has been installed properly and in accordance with its intended use, including the required safety mechanisms and professional electrical hookup. This also applies for devices which have already been equipped with plugs and terminals or similar connectors by the customer.

WARNING
Hot motor housing
Risk of fire
→ Ensure that no combustible or flammable materials are located close to the fan.

- ⇒ Before switching on, check the device for visible external damage and make sure the protective devices are functional.
- ⇒ Check the fan's air flow paths for foreign matter and remove any foreign matter found.
- ⇒ Apply the nominal supply voltage.

NOTE
Damage to the device from vibration
Bearing damage, shorter service life
→ Low-vibration operation of the fan must be ensured over the entire speed control range.
→ Severe vibration can arise for instance from inexpert handling, transportation damage and resultant imbalance or be caused by component or structural resonance.
→ Speed ranges with excessively high vibration levels and possibly resonant frequencies must be determined in the course of fan commissioning.
→ Either run through the resonant range as quickly as possible with speed control or find another remedy.
→ Operation with excessively high vibration levels can lead to premature failure.

4.7 Switching off the device

- ⇒ Disconnect the device from the power supply at the supply line's main switch.
- ⇒ When disconnecting, be sure to disconnect the ground connection last.

Translation of the original operating instructions

5. MAINTENANCE, MALFUNCTIONS, POSSIBLE CAUSES AND REMEDIES

The fan in the forced-ventilation unit is maintenance-free thanks to the use of special bearing greases.
During maintenance work on the ventilation unit, e.g. when cleaning the fan blades, the fan must be stationary and the ventilation unit's electrical circuit must be interrupted and secured against being switched on again.

CAUTION
The motor restarts automatically when operating voltage is applied, e.g. after a power failure.
Risk of injury
→ Keep out of the device's danger zone.
→ When working on the device, switch off the line voltage and ensure that it cannot be switched back on.
→ Wait until the device comes to a stop.

If the device is out of use for some time, e.g. when in storage, we recommend switching it on for at least two hours to allow any condensation to evaporate and to move the bearings.

- ⇒ Do not perform any repairs on the forced-ventilation unit. Send the blower to ebm-papst for repair or replacement.

Malfunction/fault	Possible cause	Possible remedy
Impeller not running smoothly	Imbalance in rotating parts	Clean the device; replace it if imbalance persists after cleaning. Make sure no weight clips are removed during cleaning.
Motor not turning	Mechanical blockage	Switch off, isolate from supply and remove mechanical blockage.
	Line voltage faulty	Check line voltage, restore power supply.
	Faulty connection	Isolate from supply, correct connection; see connection diagram.
	Broken motor winding	Replace device
	Impermissible point of operation	Check point of operation
Motor overtemperature	Ambient temperature too high	Reduce ambient temperature if possible
	Deficient cooling	Improve cooling

In the event of further malfunctions, contact ebm-papst.

5.1 Cleaning

To ensure a long service life, check the fans regularly for proper operation and soiling. The frequency of checking is to be adapted accordingly depending on the degree of soiling.

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K2D200-AB24-05
Siemens AG DF MC MF-M

Operating instructions

DANGER
Risk of injury from rotating fan.
→ Only clean when not in motion. Interrupt the power supply, secure against renewed switch-on. Secure against start-up, prevent air flow.

- ⇒ Dirt deposits on the motor housing can cause overheating of the motor.
- ⇒ Soiling of the impeller can cause vibration that will shorten the service life of the fan.
- ⇒ Severe vibration can destroy the fan.
- ⇒ In such cases, switch off the fan immediately and clean it.
- ⇒ The preferred method of cleaning is dry cleaning, e.g. using compressed air.
- ⇒ Do not use aggressive cleaning agents!

NOTE
Damage to the device during cleaning
Malfunction possible
→ Do not clean the device using a high-pressure cleaner.# Do not use acid, alkali or solvent-based cleaning agents.
→ Do not use any pointed or sharp-edged objects for cleaning.

- ⇒ Clean the fan using a suitable cloth or brush, taking care not to allow moisture to reach the motor's interior.
- ⇒ Take care not to damage or bend the fan blades.
- ⇒ Completely remove any cleaning agents used.
- ⇒ If severe corrosion is visible on load-bearing or rotating parts, switch off the device immediately and replace it.
- ⇒ Repair of load-bearing or rotating parts is not permitted!
- ⇒ Operate the fan for 2 hours at maximum speed so that any water that has ingressed can evaporate.
- ⇒ If cleaning does not eliminate vibrations, the fan may need to be rebalanced. To have it rebalanced, contact ebm-papst.
- ⇒ The fan is equipped with maintenance-free ball bearings. The lifetime lubrication of the ball bearings is designed for a service life of 40,000 hours.
- ⇒ If bearing replacement is necessary after that period, contact ebm-papst.
- ⇒ Adapt the maintenance intervals to the actual level of dust exposure.

5.2 Safety inspection

What to check	How to check	How often	What action?
Contact protection cover for intactness or damage	Visual inspection	At least every 6 months	Repair or replacement of device
Device for damage	Visual inspection	At least every 6 months	Replace device
Fastening the cables	Visual inspection	At least every 6 months	Fasten
Fastening the protective earth terminal	Visual inspection	At least every 6 months	Fasten
Insulation of cables for damage	Visual inspection	At least every 6 months	Replace cables
Impeller for wear/deposits/ corrosion and damage	Visual inspection	At least every 6 months	Clean impeller or replace device
Tightness of cable gland	Visual inspection	At least every 6 months	Retighten, replace if damaged
Distance between impeller and housing or plastic ring	Measurement	At least every 6 months	Replace device
Insulation resistance check	Measurement	Following completion of electrical work	Replace device
Abnormal bearing noise	acoustic	At least every 6 months	Replace device

5.3 Disposal

For ebm-papst, environmental protection and resource preservation are top priority corporate goals.
ebm-papst operates an environmental management system which is certified in accordance with ISO 14001 and rigorously implemented around the world on the basis of German standards.
Right from the development stage, ecological design, technical safety and health protection are fixed criteria.
The following section contains recommendations for ecological disposal of the product and its components.

5.3.1 Country-specific legal requirements

NOTE
Country-specific legal requirements
Always observe the applicable country-specific legal regulations with regard to the disposal of products or waste occurring in the various phases of the life cycle. The corresponding disposal standards are also to be heeded.

5.3.2 Disassembly

Disassembly of the product must be performed or supervised by qualified personnel with the appropriate technical knowledge.
The product is to be disassembled into suitable components for disposal employing standard procedures for motors.

WARNING
Heavy parts of the product may drop off. Some of the product components are heavy. These components could drop off during disassembly.
This can result in fatal or serious injury and material damage.
→ Secure components before unfastening to stop them falling.

5.3.3 Component disposal

The products are mostly made of steel, copper, aluminum and plastic. Metallic materials are generally considered to be fully recyclable.
Separate the components for recycling into the following categories:

- Steel and iron
- Aluminum
- Non-ferrous metal, e.g. motor windings
- Plastics, particularly with brominated flame retardants, in accordance with marking
- Insulating materials
- Cables and wires

Translation of the original operating instructions

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K2D200-AB24-05
Siemens AG DF MC MF-M

Operating instructions

- Electronic scrap, e.g. circuit boards

Only ferrite magnets and not rare earth magnets are used in external rotor motors from ebm-papst Mulfingen GmbH & Co. KG.

⇒ Ferrite magnets can be disposed of in the same way as normal iron and steel.

Electrical insulating materials on the product, in cables and wires are made of similar materials and are therefore to be treated in the same manner.
The materials concerned are as follows:

- Miscellaneous insulators used in the terminal box
- Power cables
- Cables for internal wiring
- Electrolytic capacitors

Dispose of electronic components employing the proper procedures for electronic scrap.

→ Please contact ebm-papst for any other questions on disposal.

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A.3.4 Operating instructions for the external fan, Type K2D200AB2407

K2D200-AB24-07
Siemens AG DF MC MF-M

Operating instructions

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CONTENTS

1. SAFETY REGULATIONS AND INFORMATION 1
1.1 Hazard levels for warnings 1
1.2 Staff qualifications 1
1.3 Basic safety rules 1
1.4 Voltage 2
1.5 Safety and protective features 2
1.6 Electromagnetic radiation 2
1.7 Mechanical movement 2
1.8 Emissions 2
1.9 Hot surface 2
1.10 Transport 2
1.11 Storage 2

2. INTENDED USE 3

3. TECHNICAL DATA 4
3.1 Product drawing 4
3.2 Nominal data 5
3.3 Technical description 5
3.4 Mounting data 5
3.5 Transport and storage conditions 5

4. CONNECTION AND STARTUP 6
4.1 Mechanical connection 6
4.2 Electrical connection 6
4.3 Connection in terminal box 6
4.4 Connection diagram 8
4.5 Checking connections 9
4.6 Switching on the device 9
4.7 Switching off the device 9

5. MAINTENANCE, MALFUNCTIONS, POSSIBLE CAUSES AND REMEDIES 9
5.1 Cleaning 9
5.2 Safety inspection 10
5.3 Disposal 10

Translation of the original operating instructions

1. SAFETY REGULATIONS AND INFORMATION

Read these operating instructions carefully before starting work on the device. Observe the following warnings to prevent malfunctions or danger to persons.
These operating instructions are to be regarded as part of the device. The device is only to be sold or passed on together with the operating instructions.
These operating instructions may be duplicated and distributed to inform about potential dangers and their prevention.

1.1 Hazard levels for warnings

These operating instructions use the following hazard levels to indicate potentially hazardous situations and important safety regulations:

DANGER
Indicates an imminently hazardous situation which will result in death or serious injury if the specified actions are not taken. Compliance with the instructions is imperative.

WARNING
Indicates a potentially hazardous situation which can result in death or serious injury if the specified actions are not taken. Exercise extreme caution while working.

CAUTION
Indicates a potentially hazardous situation which can result in minor or moderate injury or damage to property if the specified actions are not taken.

NOTE
A potentially harmful situation can occur and, if not avoided, can lead to property damage.

1.2 Staff qualifications

The device may only be transported, unpacked, installed, operated, maintained and otherwise used by suitably qualified, trained and authorized technical staff.
Only authorized specialists are permitted to install the device, to carry out a test run and to perform work on the electrical installation.

1.3 Basic safety rules

The motor may only be operated with an impeller. The result is a motor-fan combination. Motor and impeller assignment may only be done by ebm-papst.
Protection against such things as:

- electric shock
- Contact with rotating parts
- Ingress of foreign bodies or moisture
- Excessive condensation

The safety hazards associated with the device must be assessed again following installation in the final product.
The locally applicable industrial safety regulations are always to be observed when working on the device.
Keep the workplace clean and tidy. Untidiness in the work area increases the risk of accidents.
Note the following when working on the device:

⇒ Do not perform any modifications, additions or conversions on the device without the approval of ebm-papst.

K2D200-AB24-07
Siemens AG DF MC MF-M

Operating instructions

1.4 Voltage

⇒ Check the device's electrical equipment at regular intervals; see Chapter 5.2 Safety inspection.

⇒ Replace loose connections and defective cables immediately.

DANGER
Electrically charged device
Risk of electric shock

→ When working on an electrically charged device, stand on a rubber mat.

CAUTION
In the event of a fault, the rotor and the impeller will be energized
The rotor and the impeller have basic insulation.

→ Do not touch the rotor and impeller once installed.

CAUTION
The motor restarts automatically when operating voltage is applied, e.g. after a power failure.
Risk of injury

→ Keep out of the device's danger zone.

→ When working on the device, switch off the line voltage and ensure that it cannot be switched back on.

→ Wait until the device comes to a stop.

1.5 Safety and protective features

DANGER
Guard missing and guard not functioning
Without a guard, hands may become caught up in the device during operation for example, resulting in serious injury. Loose parts or items of clothing could be drawn in.

→ The device is a built-in component. As the owner, you are responsible for ensuring that the device is adequately safeguarded.# Operate the device only with a fixed protective device and guard grill.

→ Stop the device immediately if a protective device is found to be missing or ineffective.

1.6 Electromagnetic radiation

Interference from electromagnetic radiation is possible, e.g. in conjunction with open- and closed-loop control devices.
If impermissible radiation levels occur following installation, appropriate shielding measures have to be taken by the user.

1.7 Mechanical movement

DANGER
Rotating device
Risk of injury to body parts coming into contact with the rotor or the impeller.

→ Secure the device against accidental contact.

→ Before working on the system/machine, wait until all parts have come to a standstill.

WARNING
Rotating device
Long hair and dangling items of clothing, jewelry and the like can become entangled and be pulled into the device. Injuries can result.

→ Do not wear any loose-fitting or dangling clothing or jewelry while working on rotating parts.

→ Protect long hair with a cap.

1.8 Emissions

WARNING
Depending on the installation and operating conditions, the sound pressure level may exceed 70 dB(A).
Risk of noise-induced hearing loss

→ Take appropriate technical safety measures.

→ Protect operating personnel with appropriate safety equipment such as hearing protection.

→ Also observe the requirements of local agencies.

1.9 Hot surface

NOTE
Risk of fire
The risk of fire or flame propagation by ebm-papst products must be assessed by the commissioning party following installation in the final product.

1.10 Transport

NOTE
Transporting the device

→ Transport the device in its original packaging only.

→ Secure the device so it cannot slip, e.g. by using a lashing strip.

1.11 Storage

⇒ Store the device, partially or fully assembled, in a dry place, protected against the weather and free from vibration, in the original packaging in a clean environment.

⇒ Protect the device against environmental effects and dirt until final installation.

⇒ We recommend storing the device for no longer than one year in order to guarantee trouble-free operation and the longest possible service life.

⇒ Even devices explicitly intended for outdoor use are to be stored as described prior to commissioning.

⇒ Maintain the storage temperature, see Chapter 3.5 Transport and storage conditions.

⇒ Make sure that all cable glands are fitted with dummy plugs.

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Siemens AG DF MC MF-M

Operating instructions

2. INTENDED USE

Intended use also includes

- Using the device only in power systems with grounded neutral (TN/ TT power systems).
- Conveying air at an ambient air pressure between 800 mbar and 1050 mbar.
- Using the device within the permitted ambient temperature range; see Chapter 3.5 Transport and storage conditions and Chapter 3.2 Nominal data.
- Operating the device with all protective devices.
- Following the operating instructions.

Improper use

In particular, operating the device in the following ways is prohibited and could be hazardous:

- Operating the device in an unbalanced state, e.g. due to dirt deposits or ice formation.
- Resonant operation, operation with severe vibration. This also includes vibration transmitted to the fan from the customer installation.
- Operation in medical equipment with a life-sustaining or life-support function.
- Conveying solids in the flow medium.
- Painting the device
- Connections (e.g. screws) coming loose during operation.
- Opening the terminal box during operation.
- Conveying air that contains abrasive particles.
- Conveying highly corrosive air, e.g. salt spray. Exception: devices designed for salt spray and correspondingly protected.
- Conveying air with high dust content, e.g. suctioning off sawdust.
- Operating the device close to flammable materials or components.
- Operating the device in an explosive atmosphere.
- Using the device as a safety component or to perform safety-related functions.
- Operation with completely or partially disassembled or manipulated protective devices.
- In addition, all applications not listed among the intended uses.

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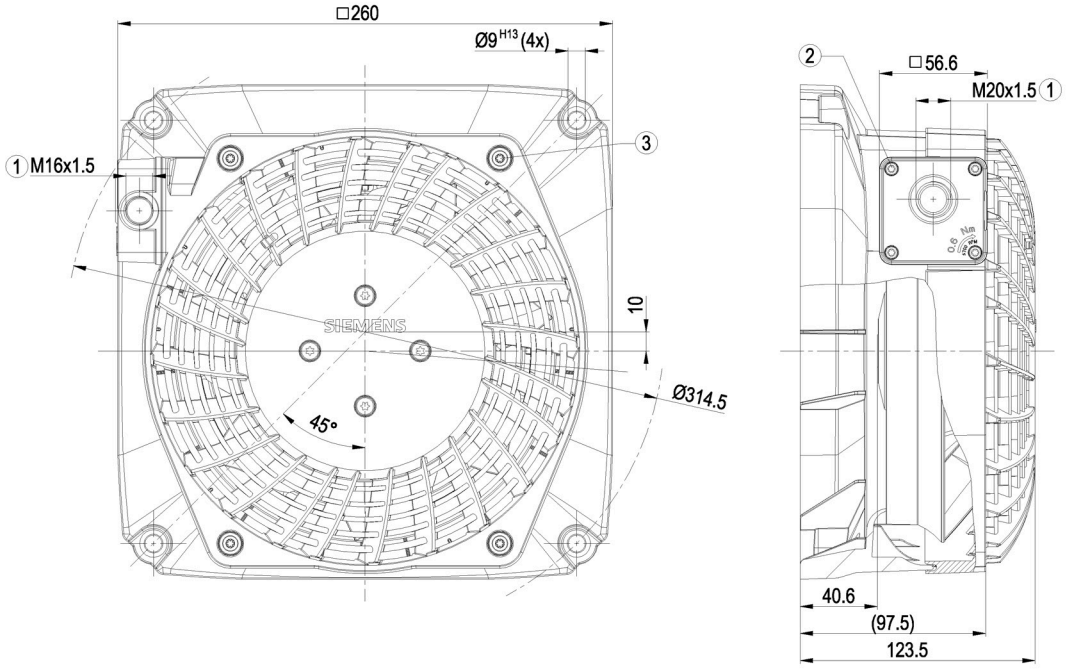
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Siemens AG DF MC MF-M

Operating instructions

3. TECHNICAL DATA

3.1 Product drawing



All dimensions in mm.

1	Max. screw-in depth 9 mm
2	Tightening torque 0.6±0.1 Nm, fit manually
3	Tightening torque 3.5 ± 0.3 Nm; fit screws by hand

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K2D200-AB24-07
Siemens AG DF MC MF-M

Operating instructions

3.2 Nominal data

Motor	M2D068-CF		
Phase	3~	3~	3~
Nominal voltage / VAC	400	400	480
Wiring	Y	Y	Y
Frequency / Hz	50	60	60
Method of obtaining data	ce	ce	ce
Valid for approval/ standard	CE	CE	CE
Speed (rpm) / min^{-1}	2400	2450	2700
Power consumption / W	56	75	90
Current draw / A	0.1	0.12	0.12
Min. ambient temperature / °C	-25	-25	-25
Max. ambient temperature / °C	80	80	80
Starting current / A	0.4	0.24	0.29

ml = Max. load · me = Max. efficiency · fa = Free air
cs = Customer specification · ce = Customer equipment

Subject to change

Imax:
340-440V 50/60Hz 0.1A/0.12A
408-528V 60Hz 0.12A

3.3 Technical description

Weight	2.7 kg
Size	200 mm
Motor size	68
Rotor surface	Painted black
Terminal box material	PA plastic
Impeller material	PA plastic
Housing material	PA plastic
Guard grille material	PA plastic
Number of blades	7
Direction of rotation	Clockwise, viewed toward rotor
Degree of protection	IP65
Insulation class	"F"
Moisture (F) / Environmental (H) protection class	H1+
Installation position	Any
Condensation drainage holes	None
Mode	S1
Motor bearing	Ball bearing
Touch current according to IEC 60990 (measuring circuit Fig. 4, TN system)	< 0.75 mA
Electrical hookup	Terminal box
Protection class	I (with customer connection of protective earth)
Conformity with standards	EN 60034-1; EN 60204-1; EN 60335-1; CE
Approval	EAC; CSA C22.2 No. 100; UL 1004-1

With regard to cyclic speed loads, note that the rotating parts of the device are designed for a maximum of one million load cycles. If you have special questions, consult ebm-papst for support.

⇒ Use the device in accordance with its degree of protection.

Information on surface quality

The surfaces of the products conform to the generally applicable industrial standard. The surface quality may change during the production period. This has no effect on strength, dimensional stability and dimensional accuracy.
The color pigments in the paints used perceptibly react to UV light over the course of time. The product is to be protected against UV radiation to prevent the formation of patches and fading. Changes in color are not a reason for complaint and are not covered by the warranty. UV radiation in the frequency range and the intensity of natural solar radiation has no effect on the technical properties of the products.

3.4 Mounting data

Any further mounting data required can be taken from the product drawing or Section Chapter 4.1 Mechanical connection.

Strength class of screws	8.8

⇒ Secure the screws against unintentional loosening (e.g. use self-locking screws).

3.5 Transport and storage conditions

NOTE
The degree of protection is only valid in conjunction with the main motor.

Max. permitted ambient temp. for motor (transport/ storage)	+80 °C
Min. permitted ambient temp. for motor (transport/ storage)	-40 °C

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K2D200-AB24-07
Siemens AG DF MC MF-M

Operating instructions

4. CONNECTION AND STARTUP

4.1 Mechanical connection

CAUTION
Risk of cutting and crushing when removing device from packaging

→ Carefully remove the device from the packaging by grasping hold of the frame. Never subject to any impact.

→ Wear safety shoes and cut-resistant safety gloves.

NOTE
Damage to the device from vibration
Bearing damage, shorter service life

→ The fan must not be subjected to force or excessive vibration from sections of the installation.

→ If the fan is connected to air ducts, the connection should be isolated from vibration, e.g. using compensators or similar elements.

→ Ensure stress-free attachment of the fan to the substructure.

⇒ The fan may not be handled in the area around the inlet nozzle during transport and installation.
There is a risk of damage to the impeller.

⇒ Check the device for transport damage. Damaged devices are not to be installed.

⇒ Install the undamaged device in accordance with your application.

CAUTION
Possible damage to the device
If the device slips during installation, serious damage can result.

→ Ensure that the device is securely positioned at its place of installation until all fastening screws have been tightened.

- The fan must not be strained on fastening.

4.2 Electrical connection

DANGER
Voltage on the device
Electric shock

→ Always connect a protective earth first.

→ Check the protective earth.

DANGER
Faulty insulation
Risk of fatal injury from electric shock

→ Use only cables that meet the specified installation regulations for voltage, current, insulation material, capacity, etc.

→ Route cables so that they cannot be touched by any rotating parts.

CAUTION
Voltage
The device is a built-in component and has no disconnecting switch.

→ Only connect the device to circuits that can be switched off with an all-pole disconnection switch.

→ When working on the device, secure the system/ machine in which the device is installed so as to prevent it from being switched back on.

NOTE
Water ingress into wires or cables
Water ingress at the customer end of the cable can damage the device.

→ Make sure the end of the cable is connected in a dry environment.

Only connect the device to circuits that can be switched off with an all-pole disconnection switch.

4.2.1 Requirements

⇒ Check whether the information on the nameplate matches the connection data.

⇒ Before connecting the device, make sure the power supply matches the device voltage.

⇒ Only use cables designed for the current level indicated on the nameplate.
For determining the cross-section, note the sizing criteria according to EN 61800-5-1. The protective earth must have a cross-section equal to or greater than that of the phase conductor.
We recommend the use of 105 °C cables. Ensure that the minimum cable cross-section is at least
AWG 26 / 0.13 mm².

⇒ For a M20x1.5 cable gland, measure the maximum cable cross-section of 2.5 mm² and for a M16x1.5 cable gland the maximum cable cross-section of 1.5 mm².

Forced-ventilation units with no thermal overload protector must be safeguarded by a motor circuit breaker prior to startup.

Protective earth contact resistance according to EN 60335

Compliance with the resistance specifications according to EN 60335 for the protective earth connection circuit must be verified in the end application. Depending on the installation situation, it may be necessary to connect an additional protective earth conductor by way of the extra protective earth terminal provided on the device.

4.2.2 Residual current circuit breaker (RCCB)

If the use of a residual current device (RCD) is required in your installation, only AC/DC-sensitive residual current devices of type B are permissible.

4.3 Connection in terminal box

4.3.1 Preparing cables for connection

Only strip the cable as far as necessary, ensuring that the cable gland is sealed and there is no strain on the connections. For tightening torques, see Chapter 3.1 Product drawing.

NOTE
Tightness and strain relief are dependent on the cable used.

→ This must be checked by the user.

⇒ When connecting, make sure the ground conductor is longer than the phase conductors.

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4.3.2 Connecting wires to terminals

⇒ To ensure the IP protection, a cable gland with seal must be used for the cable entry.

⇒ Only use cable glands made of plastic.

⇒ Route the cables into the intended openings on the terminal box.

⇒ First connect the "PE" (protective earth).

An external ground connection can also be made at uninsulated points on the housing or using the external ground connection in the terminal box.

⇒ Connect the wires to the corresponding terminals.

Use a screwdriver to do so.
When connecting, ensure that no wire ends fan out.

⇒ Insert the leads until they meet resistance.

⇒ The cable bushing to the add-on device must be free of burrs and in accordance with the degree of protection (IP code).

4.3.3 Cable routing

Water must be prevented from reaching the cable gland along the cable.

NOTE
Damage caused by moisture penetration.
Moisture can penetrate into the terminal box if water is constantly present at the cable glands.

→ To prevent the constant accumulation of water at the cable glands, the cable should be routed in a U-shaped loop wherever possible.

→ If this is not possible, a drip edge can be produced by fitting a cable tie directly in front of the cable gland for example.

— Make sure the cable is routed in a U-shaped loop.

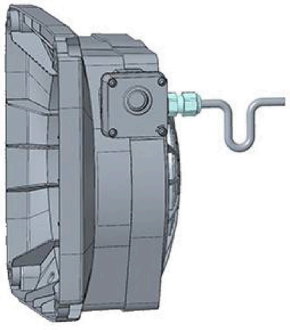


Fig. 1: Cable routing in U-shaped loop

4.3.4 Motor protection

Motor protection switch

WARNING
Device has no locked-rotor protection
As delivered, the forced-ventilation unit has no automatic protection against incorrect operation (locked-rotor protection). The device can become hot and catch fire.

→ For the version without thermal overload protector, also install a suitable motor protection switch or a suitable tripping unit for the PTC thermistor.

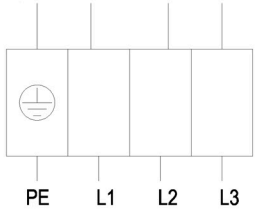
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K2D200-AB24-07
Siemens AG DF MC MF-M

Operating instructions

4.4 Connection diagram



PE	green/yellow
L1	black
L2	blue
L3	brown

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Operating instructions

4.5 Checking connections

- ⇛ Ensure isolation from supply (all phases).
- ⇛ Make sure a restart is impossible
- ⇛ Check the cables for proper fit.
- ⇛ Check the mechanical and electrical installation of safety-related components (e.g. motor protection switch, guard grille etc.).
- ⇛ Screw the terminal box cover back on again. Terminal box tightening torque, see Chapter 3.1 Product drawing.
- ⇛ Make sure the terminal box is completely closed and sealed and that all screws and cable glands have been properly tightened.

4.6 Switching on the device

The device may only be switched on if it has been installed properly and in accordance with its intended use, including the required safety mechanisms and professional electrical hookup. This also applies for devices which have already been equipped with plugs and terminals or similar connectors by the customer.

WARNING
Hot motor housing
Risk of fire
→ Ensure that no combustible or flammable materials are located close to the fan.

- ⇛ Before switching on, check the device for visible external damage and make sure the protective devices are functional.
- ⇛ Check the fan's air flow paths for foreign matter and remove any foreign matter found.
- ⇛ Apply the nominal supply voltage.

NOTE
Damage to the device from vibration
Bearing damage, shorter service life
→ Low-vibration operation of the fan must be ensured over the entire speed control range.
→ Severe vibration can arise for instance from inexpert handling, transportation damage and resultant imbalance or be caused by component or structural resonance.
→ Speed ranges with excessively high vibration levels and possibly resonant frequencies must be determined in the course of fan commissioning.
→ Either run through the resonant range as quickly as possible with speed control or find another remedy.
→ Operation with excessively high vibration levels can lead to premature failure.

4.7 Switching off the device

- ⇛ Disconnect the device from the power supply at the supply line's main switch.
- ⇛ When disconnecting, be sure to disconnect the ground connection last.

Translation of the original operating instructions

5. MAINTENANCE, MALFUNCTIONS, POSSIBLE CAUSES AND REMEDIES

The fan in the forced-ventilation unit is maintenance-free thanks to the use of special bearing greases.
During maintenance work on the ventilation unit, e.g. when cleaning the fan blades, the fan must be stationary and the ventilation unit's electrical circuit must be interrupted and secured against being switched on again.

CAUTION
The motor restarts automatically when operating voltage is applied, e.g. after a power failure.
Risk of injury
→ Keep out of the device's danger zone.
→ When working on the device, switch off the line voltage and ensure that it cannot be switched back on.
→ Wait until the device comes to a stop.

If the device is out of use for some time, e.g. when in storage, we recommend switching it on for at least two hours to allow any condensation to evaporate and to move the bearings.

- ⇛ Do not perform any repairs on the forced-ventilation unit. Send the blower to ebm-papst for repair or replacement.

Malfunction/fault	Possible cause	Possible remedy
Impeller not running smoothly	Imbalance in rotating parts	Clean the device; replace it if imbalance persists after cleaning. Make sure no weight clips are removed during cleaning.
Motor not turning	Mechanical blockage	Switch off, isolate from supply and remove mechanical blockage.
	Line voltage faulty	Check line voltage, restore power supply.
	Faulty connection	Isolate from supply, correct connection; see connection diagram.
	Broken motor winding	Replace device
	Impermissible point of operation	Check point of operation
Motor overtemperature	Ambient temperature too high	Reduce ambient temperature if possible
	Deficient cooling	Improve cooling

In the event of further malfunctions, contact ebm-papst.

5.1 Cleaning

To ensure a long service life, check the fans regularly for proper operation and soiling. The frequency of checking is to be adapted accordingly depending on the degree of soiling.

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K2D200-AB24-07
Siemens AG DF MC MF-M

Operating instructions

DANGER
Risk of injury from rotating fan.
→ Only clean when not in motion. Interrupt the power supply, secure against renewed switch-on. Secure against start-up, prevent air flow.

- ⇒ Dirt deposits on the motor housing can cause overheating of the motor.
- ⇒ Soiling of the impeller can cause vibration that will shorten the service life of the fan.
- ⇒ Severe vibration can destroy the fan.
- ⇒ In such cases, switch off the fan immediately and clean it.
- ⇒ The preferred method of cleaning is dry cleaning, e.g. using compressed air.
- ⇒ Do not use aggressive cleaning agents!

NOTE
Damage to the device during cleaning
Malfunction possible
→ Do not clean the device using a high-pressure cleaner.# Do not use acid, alkali or solvent-based cleaning agents.
→ Do not use any pointed or sharp-edged objects for cleaning.

- ⇒ Clean the fan using a suitable cloth or brush, taking care not to allow moisture to reach the motor's interior.
- ⇒ Take care not to damage or bend the fan blades.
- ⇒ Completely remove any cleaning agents used.
- ⇒ If severe corrosion is visible on load-bearing or rotating parts, switch off the device immediately and replace it.
- ⇒ Repair of load-bearing or rotating parts is not permitted!
- ⇒ Operate the fan for 2 hours at maximum speed so that any water that has ingressed can evaporate.
- ⇒ If cleaning does not eliminate vibrations, the fan may need to be rebalanced. To have it rebalanced, contact ebm-papst.
- ⇒ The fan is equipped with maintenance-free ball bearings. The lifetime lubrication of the ball bearings is designed for a service life of 40,000 hours.
- ⇒ If bearing replacement is necessary after that period, contact ebm-papst.
- ⇒ Adapt the maintenance intervals to the actual level of dust exposure.

5.2 Safety inspection

What to check	How to check	How often	What action?
Contact protection cover for intactness or damage	Visual inspection	At least every 6 months	Repair or replacement of device
Device for damage	Visual inspection	At least every 6 months	Replace device
Fastening the cables	Visual inspection	At least every 6 months	Fasten
Fastening the protective earth terminal	Visual inspection	At least every 6 months	Fasten
Insulation of cables for damage	Visual inspection	At least every 6 months	Replace cables
Impeller for wear/deposits/ corrosion and damage	Visual inspection	At least every 6 months	Clean impeller or replace device
Tightness of cable gland	Visual inspection	At least every 6 months	Retighten, replace if damaged
Distance between impeller and housing or plastic ring	Measurement	At least every 6 months	Replace device
Insulation resistance check	Measurement	Following completion of electrical work	Replace device
Abnormal bearing noise	acoustic	At least every 6 months	Replace device

5.3 Disposal

For ebm-papst, environmental protection and resource preservation are top priority corporate goals.
ebm-papst operates an environmental management system which is certified in accordance with ISO 14001 and rigorously implemented around the world on the basis of German standards.
Right from the development stage, ecological design, technical safety and health protection are fixed criteria.
The following section contains recommendations for ecological disposal of the product and its components.

5.3.1 Country-specific legal requirements

NOTE
Country-specific legal requirements
Always observe the applicable country-specific legal regulations with regard to the disposal of products or waste occurring in the various phases of the life cycle. The corresponding disposal standards are also to be heeded.

5.3.2 Disassembly

Disassembly of the product must be performed or supervised by qualified personnel with the appropriate technical knowledge.
The product is to be disassembled into suitable components for disposal employing standard procedures for motors.

WARNING
Heavy parts of the product may drop off. Some of the product components are heavy. These components could drop off during disassembly.
This can result in fatal or serious injury and material damage.
→ Secure components before unfastening to stop them falling.

5.3.3 Component disposal

The products are mostly made of steel, copper, aluminum and plastic. Metallic materials are generally considered to be fully recyclable.
Separate the components for recycling into the following categories:

- Steel and iron
- Aluminum
- Non-ferrous metal, e.g. motor windings
- Plastics, particularly with brominated flame retardants, in accordance with marking
- Insulating materials
- Cables and wires

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K2D200-AB24-07
Siemens AG DF MC MF-M

Operating instructions

- Electronic scrap, e.g. circuit boards

Only ferrite magnets and not rare earth magnets are used in external rotor motors from ebm-papst Mulfingen GmbH & Co. KG.

⇒ Ferrite magnets can be disposed of in the same way as normal iron and steel.

Electrical insulating materials on the product, in cables and wires are made of similar materials and are therefore to be treated in the same manner.
The materials concerned are as follows:

- Miscellaneous insulators used in the terminal box
- Power cables
- Cables for internal wiring
- Electrolytic capacitors

Dispose of electronic components employing the proper procedures for electronic scrap.

→ Please contact ebm-papst for any other questions on disposal.

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A.4 Operating Instructions for the external fan, SH160

A.4.1 Operating instructions for the external fan, Type K2D250AB3205

K2D250-AB32-05
Siemens AG DF MC MF-M

Operating instructions

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CONTENTS

1. SAFETY REGULATIONS AND INFORMATION 1
1.1 Hazard levels for warnings 1
1.2 Staff qualifications 1
1.3 Basic safety rules 1
1.4 Voltage 2
1.5 Safety and protective features 2
1.6 Electromagnetic radiation 2
1.7 Mechanical movement 2
1.8 Emissions 2
1.9 Hot surface 2
1.10 Transport 2
1.11 Storage 2

2. INTENDED USE 3

3. TECHNICAL DATA 4
3.1 Product drawing 4
3.2 Nominal data 5
3.3 Technical description 5
3.4 Mounting data 5
3.5 Transport and storage conditions 5

4. CONNECTION AND STARTUP 6
4.1 Mechanical connection 6
4.2 Electrical connection 6
4.3 Connection in terminal box 6
4.4 Connection diagram 8
4.5 Checking connections 9
4.6 Switching on the device 9
4.7 Switching off the device 9

5. MAINTENANCE, MALFUNCTIONS, POSSIBLE CAUSES AND REMEDIES 9
5.1 Cleaning 9
5.2 Safety inspection 10
5.3 Disposal 10

Translation of the original operating instructions

1. SAFETY REGULATIONS AND INFORMATION

Read these operating instructions carefully before starting work on the device. Observe the following warnings to prevent malfunctions or danger to persons.
These operating instructions are to be regarded as part of the device. The device is only to be sold or passed on together with the operating instructions.
These operating instructions may be duplicated and distributed to inform about potential dangers and their prevention.

1.1 Hazard levels for warnings

These operating instructions use the following hazard levels to indicate potentially hazardous situations and important safety regulations:

DANGER
Indicates an imminently hazardous situation which will result in death or serious injury if the specified actions are not taken. Compliance with the instructions is imperative.

WARNING
Indicates a potentially hazardous situation which can result in death or serious injury if the specified actions are not taken. Exercise extreme caution while working.

CAUTION
Indicates a potentially hazardous situation which can result in minor or moderate injury or damage to property if the specified actions are not taken.

NOTE
A potentially harmful situation can occur and, if not avoided, can lead to property damage.

1.2 Staff qualifications

The device may only be transported, unpacked, installed, operated, maintained and otherwise used by suitably qualified, trained and authorized technical staff.
Only authorized specialists are permitted to install the device, to carry out a test run and to perform work on the electrical installation.

1.3 Basic safety rules

The motor may only be operated with an impeller. The result is a motor-fan combination. Motor and impeller assignment may only be done by ebm-papst.
Protection against such things as:

- electric shock
- Contact with rotating parts
- Ingress of foreign bodies or moisture
- Excessive condensation

The safety hazards associated with the device must be assessed again following installation in the final product.
The locally applicable industrial safety regulations are always to be observed when working on the device.
Keep the workplace clean and tidy. Untidiness in the work area increases the risk of accidents.
Note the following when working on the device:

⇒ Do not perform any modifications, additions or conversions on the device without the approval of ebm-papst.

K2D250-AB32-05
Siemens AG DF MC MF-M

Operating instructions

1.4 Voltage

⇒ Check the device's electrical equipment at regular intervals; see Chapter 5.2 Safety inspection.

⇒ Replace loose connections and defective cables immediately.

DANGER
Electrically charged device
Risk of electric shock

→ When working on an electrically charged device, stand on a rubber mat.

CAUTION
In the event of a fault, the rotor and the impeller will be energized
The rotor and the impeller have basic insulation.

→ Do not touch the rotor and impeller once installed.

CAUTION
The motor restarts automatically when operating voltage is applied, e.g. after a power failure.
Risk of injury

→ Keep out of the device's danger zone.

→ When working on the device, switch off the line voltage and ensure that it cannot be switched back on.

→ Wait until the device comes to a stop.

1.5 Safety and protective features

DANGER
Guard missing and guard not functioning
Without a guard, hands may become caught up in the device during operation for example, resulting in serious injury. Loose parts or items of clothing could be drawn in.

→ The device is a built-in component. As the owner, you are responsible for ensuring that the device is adequately safeguarded.# Operate the device only with a fixed protective device and guard grill.

→ Stop the device immediately if a protective device is found to be missing or ineffective.

1.6 Electromagnetic radiation

Interference from electromagnetic radiation is possible, e.g. in conjunction with open- and closed-loop control devices.
If impermissible radiation levels occur following installation, appropriate shielding measures have to be taken by the user.

1.7 Mechanical movement

DANGER
Rotating device
Risk of injury to body parts coming into contact with the rotor or the impeller.

→ Secure the device against accidental contact.

→ Before working on the system/machine, wait until all parts have come to a standstill.

WARNING
Rotating device
Long hair and dangling items of clothing, jewelry and the like can become entangled and be pulled into the device. Injuries can result.

→ Do not wear any loose-fitting or dangling clothing or jewelry while working on rotating parts.

→ Protect long hair with a cap.

1.8 Emissions

WARNING
Depending on the installation and operating conditions, the sound pressure level may exceed 70 dB(A).
Risk of noise-induced hearing loss

→ Take appropriate technical safety measures.

→ Protect operating personnel with appropriate safety equipment such as hearing protection.

→ Also observe the requirements of local agencies.

1.9 Hot surface

NOTE
Risk of fire
The risk of fire or flame propagation by ebm-papst products must be assessed by the commissioning party following installation in the final product.

1.10 Transport

NOTE
Transporting the device

→ Transport the device in its original packaging only.

→ Secure the device so it cannot slip, e.g. by using a lashing strip.

1.11 Storage

⇒ Store the device, partially or fully assembled, in a dry place, protected against the weather and free from vibration, in the original packaging in a clean environment.

⇒ Protect the device against environmental effects and dirt until final installation.

⇒ We recommend storing the device for no longer than one year in order to guarantee trouble-free operation and the longest possible service life.

⇒ Even devices explicitly intended for outdoor use are to be stored as described prior to commissioning.

⇒ Maintain the storage temperature, see Chapter 3.5 Transport and storage conditions.

⇒ Make sure that all cable glands are fitted with dummy plugs.

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K2D250-AB32-05
Siemens AG DF MC MF-M

Operating instructions

2. INTENDED USE

Intended use also includes

- Using the device only in power systems with grounded neutral (TN/ TT power systems).
- Conveying air at an ambient air pressure between 800 mbar and 1050 mbar.
- Using the device within the permitted ambient temperature range; see Chapter 3.5 Transport and storage conditions and Chapter 3.2 Nominal data.
- Operating the device with all protective devices.
- Following the operating instructions.

Improper use

In particular, operating the device in the following ways is prohibited and could be hazardous:

- Operating the device in an unbalanced state, e.g. due to dirt deposits or ice formation.
- Resonant operation, operation with severe vibration. This also includes vibration transmitted to the fan from the customer installation.
- Operation in medical equipment with a life-sustaining or life-support function.
- Conveying solids in the flow medium.
- Painting the device
- Connections (e.g. screws) coming loose during operation.
- Opening the terminal box during operation.
- Conveying air that contains abrasive particles.
- Conveying highly corrosive air, e.g. salt spray. Exception: devices designed for salt spray and correspondingly protected.
- Conveying air with high dust content, e.g. suctioning off sawdust.
- Operating the device close to flammable materials or components.
- Operating the device in an explosive atmosphere.
- Using the device as a safety component or to perform safety-related functions.
- Operation with completely or partially disassembled or manipulated protective devices.
- In addition, all applications not listed among the intended uses.

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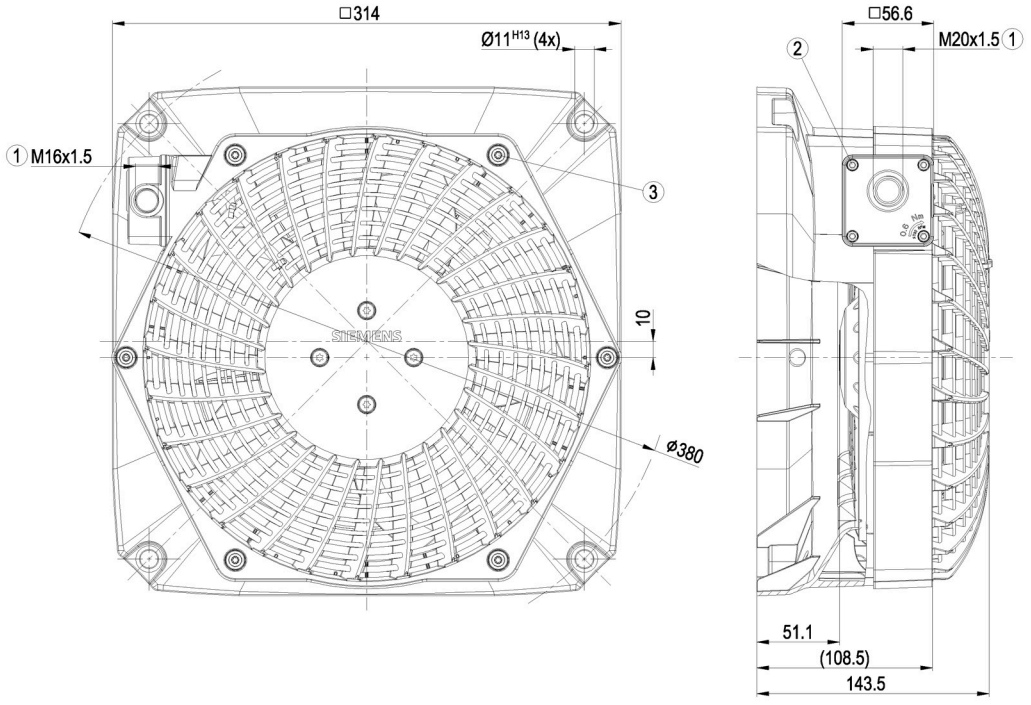
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K2D250-AB32-05
Siemens AG DF MC MF-M

Operating instructions

3. TECHNICAL DATA

3.1 Product drawing



All dimensions in mm.

1	Max. screw-in depth 9 mm
2	Tightening torque 0.6±0.1 Nm, fit manually
3	Tightening torque 3.5 ± 0.3 Nm; fit screws by hand

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K2D250-AB32-05
Siemens AG DF MC MF-M

Operating instructions

3.2 Nominal data

Motor	M2D068-DF		
Phase	3~	3~	3~
Nominal voltage / VAC	400	400	480
Wiring	Y	Y	Y
Frequency / Hz	50	60	60
Method of obtaining data	ce	ce	ce
Valid for approval/ standard	CE	CE	CE
Speed (rpm) / min^{-1}	2450	2500	2800
Power consumption / W	100	135	155
Current draw / A	0.16	0.21	0.21
Min. back pressure / Pa	0	0	0
Min. ambient temperature / °C	-25	-25	-25
Max. ambient temperature / °C	80	75	75
Starting current / A	0.45	0.45	0.52

ml = Max. load · me = Max. efficiency · fa = Free air
cs = Customer specification · ce = Customer equipment

Subject to change

Imax:
340-440 V, 50/60 Hz, 0.16 A/0.21 A
408-528 V, 60 Hz, 0.21 A

3.3 Technical description

Weight	3.68 kg
Size	250 mm
Motor size	68
Rotor surface	Painted black
Terminal box material	PA plastic
Impeller material	PA plastic
Housing material	PA plastic
Guard grille material	PA plastic
Number of blades	5
Direction of rotation	Clockwise, viewed toward rotor
Degree of protection	IP55
Insulation class	"F"
Moisture (F) / Environmental (H) protection class	H1+
Installation position	Any
Condensation drainage holes	None
Mode	S1
Motor bearing	Ball bearing
Touch current according to IEC 60990 (measuring circuit Fig. 4, TN system)	< 0.75 mA
Electrical hookup	Terminal box
Protection class	I (with customer connection of protective earth)
Conformity with standards	EN 60034-1; EN 60204-1; EN 60335-1; CE
Approval	UL 1004-1; EAC; CSA C22.2 No. 100

Translation of the original operating instructions

With regard to cyclic speed loads, note that the rotating parts of the device are designed for a maximum of one million load cycles. If you have special questions, consult ebm-papst for support.

⇒ Use the device in accordance with its degree of protection.

Information on surface quality

The surfaces of the products conform to the generally applicable industrial standard. The surface quality may change during the production period. This has no effect on strength, dimensional stability and dimensional accuracy.
The color pigments in the paints used perceptibly react to UV light over the course of time. The product is to be protected against UV radiation to prevent the formation of patches and fading. Changes in color are not a reason for complaint and are not covered by the warranty. UV radiation in the frequency range and the intensity of natural solar radiation has no effect on the technical properties of the products.

3.4 Mounting data

Any further mounting data required can be taken from the product drawing or Section Chapter 4.1 Mechanical connection.

Strength class of screws	8.8

⇒ Secure the screws against unintentional loosening (e.g. use self-locking screws).

3.5 Transport and storage conditions

NOTE
The degree of protection is only valid in conjunction with the main motor.

Max. permitted ambient temp. for motor (transport/ storage)	+80 °C
Min. permitted ambient temp. for motor (transport/ storage)	-40 °C

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K2D250-AB32-05
Siemens AG DF MC MF-M

Operating instructions

4. CONNECTION AND STARTUP

4.1 Mechanical connection

CAUTION
Risk of cutting and crushing when removing device from packaging

→ Carefully remove the device from the packaging by grasping hold of the frame. Never subject to any impact.

→ Wear safety shoes and cut-resistant safety gloves.

NOTE
Damage to the device from vibration
Bearing damage, shorter service life

→ The fan must not be subjected to force or excessive vibration from sections of the installation.

→ If the fan is connected to air ducts, the connection should be isolated from vibration, e.g. using compensators or similar elements.

→ Ensure stress-free attachment of the fan to the substructure.

⇒ The fan may not be handled in the area around the inlet nozzle during transport and installation.
There is a risk of damage to the impeller.

⇒ Check the device for transport damage. Damaged devices are not to be installed.

⇒ Install the undamaged device in accordance with your application.

CAUTION
Possible damage to the device
If the device slips during installation, serious damage can result.

→ Ensure that the device is securely positioned at its place of installation until all fastening screws have been tightened.

- The fan must not be strained on fastening.

4.2 Electrical connection

DANGER
Voltage on the device
Electric shock

→ Always connect a protective earth first.

→ Check the protective earth.

DANGER
Faulty insulation
Risk of fatal injury from electric shock

→ Use only cables that meet the specified installation regulations for voltage, current, insulation material, capacity, etc.

→ Route cables so that they cannot be touched by any rotating parts.

CAUTION
Voltage
The device is a built-in component and has no disconnecting switch.

→ Only connect the device to circuits that can be switched off with an all-pole disconnection switch.

→ When working on the device, secure the system/ machine in which the device is installed so as to prevent it from being switched back on.

NOTE
Water ingress into wires or cables
Water ingress at the customer end of the cable can damage the device.

→ Make sure the end of the cable is connected in a dry environment.

Only connect the device to circuits that can be switched off with an all-pole disconnection switch.

4.2.1 Requirements

⇒ Check whether the information on the nameplate matches the connection data.

⇒ Before connecting the device, make sure the power supply matches the device voltage.

⇒ Only use cables designed for the current level indicated on the nameplate.
For determining the cross-section, note the sizing criteria according to EN 61800-5-1. The protective earth must have a cross-section equal to or greater than that of the phase conductor.
We recommend the use of 105 °C cables. Ensure that the minimum cable cross-section is at least
AWG 26 / 0.13 mm².

⇒ For a M20x1.5 cable gland, measure the maximum cable cross-section of 2.5 mm² and for a M16x1.5 cable gland the maximum cable cross-section of 1.5 mm².

Forced-ventilation units with no thermal overload protector must be safeguarded by a motor circuit breaker prior to startup.

Protective earth contact resistance according to EN 60335

Compliance with the resistance specifications according to EN 60335 for the protective earth connection circuit must be verified in the end application. Depending on the installation situation, it may be necessary to connect an additional protective earth conductor by way of the extra protective earth terminal provided on the device.

4.2.2 Residual current circuit breaker (RCCB)

If the use of a residual current device (RCD) is required in your installation, only AC/DC-sensitive residual current devices of type B are permissible.

4.3 Connection in terminal box

4.3.1 Preparing cables for connection

Only strip the cable as far as necessary, ensuring that the cable gland is sealed and there is no strain on the connections. For tightening torques, see Chapter 3.1 Product drawing.

NOTE
Tightness and strain relief are dependent on the cable used.

→ This must be checked by the user.

⇒ When connecting, make sure the ground conductor is longer than the phase conductors.

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4.3.2 Connecting wires to terminals

⇒ To ensure the IP protection, a cable gland with seal must be used for the cable entry.

⇒ Only use cable glands made of plastic.

⇒ Route the cables into the intended openings on the terminal box.

⇒ First connect the "PE" (protective earth).

An external ground connection can also be made at uninsulated points on the housing or using the external ground connection in the terminal box.

⇒ Connect the wires to the corresponding terminals.

Use a screwdriver to do so.
When connecting, ensure that no wire ends fan out.

⇒ Insert the leads until they meet resistance.

⇒ The cable bushing to the add-on device must be free of burrs and in accordance with the degree of protection (IP code).

4.3.3 Cable routing

Water must be prevented from reaching the cable gland along the cable.

NOTE
Damage caused by moisture penetration.
Moisture can penetrate into the terminal box if water is constantly present at the cable glands.

→ To prevent the constant accumulation of water at the cable glands, the cable should be routed in a U-shaped loop wherever possible.

→ If this is not possible, a drip edge can be produced by fitting a cable tie directly in front of the cable gland for example.

— Make sure the cable is routed in a U-shaped loop.

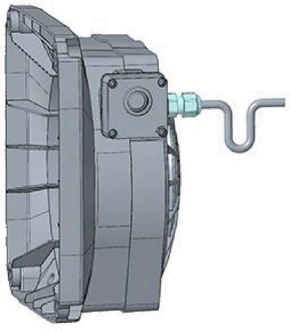


Fig. 1: Cable routing in U-shaped loop

4.3.4 Motor protection

Motor protection switch

WARNING
Device has no locked-rotor protection
As delivered, the forced-ventilation unit has no automatic protection against incorrect operation (locked-rotor protection). The device can become hot and catch fire.

→ For the version without thermal overload protector, also install a suitable motor protection switch or a suitable tripping unit for the PTC thermistor.

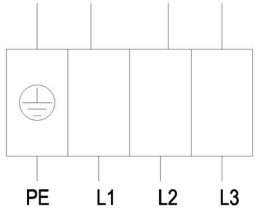
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Siemens AG DF MC MF-M

Operating instructions

4.4 Connection diagram



PE	green/yellow
L1	black
L2	blue
L3	brown

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Siemens AG DF MC MF-M

Operating instructions

4.5 Checking connections

- ⇒ Ensure isolation from supply (all phases).
- ⇒ Make sure a restart is impossible
- ⇒ Check the cables for proper fit.
- ⇒ Check the mechanical and electrical installation of safety-related components (e.g. motor protection switch, guard grille etc.).
- ⇒ Screw the terminal box cover back on again. Terminal box tightening torque, see Chapter 3.1 Product drawing.
- ⇒ Make sure the terminal box is completely closed and sealed and that all screws and cable glands have been properly tightened.

4.6 Switching on the device

The device may only be switched on if it has been installed properly and in accordance with its intended use, including the required safety mechanisms and professional electrical hookup. This also applies for devices which have already been equipped with plugs and terminals or similar connectors by the customer.

WARNING
Hot motor housing
Risk of fire

→ Ensure that no combustible or flammable materials are located close to the fan.

- ⇒ Before switching on, check the device for visible external damage and make sure the protective devices are functional.
- ⇒ Check the fan's air flow paths for foreign matter and remove any foreign matter found.
- ⇒ Apply the nominal supply voltage.

NOTE
Damage to the device from vibration
Bearing damage, shorter service life

→ Low-vibration operation of the fan must be ensured over the entire speed control range.

→ Severe vibration can arise for instance from inexpert handling, transportation damage and resultant imbalance or be caused by component or structural resonance.

→ Speed ranges with excessively high vibration levels and possibly resonant frequencies must be determined in the course of fan commissioning.

→ Either run through the resonant range as quickly as possible with speed control or find another remedy.

→ Operation with excessively high vibration levels can lead to premature failure.

4.7 Switching off the device

- ⇒ Disconnect the device from the power supply at the supply line's main switch.
- ⇒ When disconnecting, be sure to disconnect the ground connection last.

Translation of the original operating instructions

5. MAINTENANCE, MALFUNCTIONS, POSSIBLE CAUSES AND REMEDIES

The fan in the forced-ventilation unit is maintenance-free thanks to the use of special bearing greases.
During maintenance work on the ventilation unit, e.g. when cleaning the fan blades, the fan must be stationary and the ventilation unit's electrical circuit must be interrupted and secured against being switched on again.

CAUTION
The motor restarts automatically when operating voltage is applied, e.g. after a power failure.
Risk of injury

→ Keep out of the device's danger zone.

→ When working on the device, switch off the line voltage and ensure that it cannot be switched back on.

→ Wait until the device comes to a stop.

If the device is out of use for some time, e.g. when in storage, we recommend switching it on for at least two hours to allow any condensation to evaporate and to move the bearings.

- ⇒ Do not perform any repairs on the forced-ventilation unit. Send the blower to ebm-papst for repair or replacement.

Malfunction/fault	Possible cause	Possible remedy
Impeller not running smoothly	Imbalance in rotating parts	Clean the device; replace it if imbalance persists after cleaning. Make sure no weight clips are removed during cleaning.
Motor not turning	Mechanical blockage	Switch off, isolate from supply and remove mechanical blockage.
	Line voltage faulty	Check line voltage, restore power supply.
	Faulty connection	Isolate from supply, correct connection; see connection diagram.
	Broken motor winding	Replace device
	Impermissible point of operation	Check point of operation
Motor overtemperature	Ambient temperature too high	Reduce ambient temperature if possible
	Deficient cooling	Improve cooling

In the event of further malfunctions, contact ebm-papst.

5.1 Cleaning

To ensure a long service life, check the fans regularly for proper operation and soiling. The frequency of checking is to be adapted accordingly depending on the degree of soiling.

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Siemens AG DF MC MF-M

Operating instructions

DANGER
Risk of injury from rotating fan.
→ Only clean when not in motion. Interrupt the power supply, secure against renewed switch-on. Secure against start-up, prevent air flow.

- ⇒ Dirt deposits on the motor housing can cause overheating of the motor.
- ⇒ Soiling of the impeller can cause vibration that will shorten the service life of the fan.
- ⇒ Severe vibration can destroy the fan.
- ⇒ In such cases, switch off the fan immediately and clean it.
- ⇒ The preferred method of cleaning is dry cleaning, e.g. using compressed air.
- ⇒ Do not use aggressive cleaning agents!

NOTE
Damage to the device during cleaning
Malfunction possible
→ Do not clean the device using a high-pressure cleaner.# Do not use acid, alkali or solvent-based cleaning agents.
→ Do not use any pointed or sharp-edged objects for cleaning.

- ⇒ Clean the fan using a suitable cloth or brush, taking care not to allow moisture to reach the motor's interior.
- ⇒ Take care not to damage or bend the fan blades.
- ⇒ Completely remove any cleaning agents used.
- ⇒ If severe corrosion is visible on load-bearing or rotating parts, switch off the device immediately and replace it.
- ⇒ Repair of load-bearing or rotating parts is not permitted!
- ⇒ Operate the fan for 2 hours at maximum speed so that any water that has ingressed can evaporate.
- ⇒ If cleaning does not eliminate vibrations, the fan may need to be rebalanced. To have it rebalanced, contact ebm-papst.
- ⇒ The fan is equipped with maintenance-free ball bearings. The lifetime lubrication of the ball bearings is designed for a service life of 40,000 hours.
- ⇒ If bearing replacement is necessary after that period, contact ebm-papst.
- ⇒ Adapt the maintenance intervals to the actual level of dust exposure.

5.2 Safety inspection

What to check	How to check	How often	What action?
Contact protection cover for intactness or damage	Visual inspection	At least every 6 months	Repair or replacement of device
Device for damage	Visual inspection	At least every 6 months	Replace device
Fastening the cables	Visual inspection	At least every 6 months	Fasten
Fastening the protective earth terminal	Visual inspection	At least every 6 months	Fasten
Insulation of cables for damage	Visual inspection	At least every 6 months	Replace cables
Impeller for wear/deposits/ corrosion and damage	Visual inspection	At least every 6 months	Clean impeller or replace device
Tightness of cable gland	Visual inspection	At least every 6 months	Retighten, replace if damaged
Distance between impeller and housing or plastic ring	Measurement	At least every 6 months	Replace device
Insulation resistance check	Measurement	Following completion of electrical work	Replace device
Abnormal bearing noise	acoustic	At least every 6 months	Replace device

5.3 Disposal

For ebm-papst, environmental protection and resource preservation are top priority corporate goals.
ebm-papst operates an environmental management system which is certified in accordance with ISO 14001 and rigorously implemented around the world on the basis of German standards.
Right from the development stage, ecological design, technical safety and health protection are fixed criteria.
The following section contains recommendations for ecological disposal of the product and its components.

5.3.1 Country-specific legal requirements

NOTE
Country-specific legal requirements
Always observe the applicable country-specific legal regulations with regard to the disposal of products or waste occurring in the various phases of the life cycle. The corresponding disposal standards are also to be heeded.

5.3.2 Disassembly

Disassembly of the product must be performed or supervised by qualified personnel with the appropriate technical knowledge.
The product is to be disassembled into suitable components for disposal employing standard procedures for motors.

WARNING
Heavy parts of the product may drop off. Some of the product components are heavy. These components could drop off during disassembly.
This can result in fatal or serious injury and material damage.
→ Secure components before unfastening to stop them falling.

5.3.3 Component disposal

The products are mostly made of steel, copper, aluminum and plastic. Metallic materials are generally considered to be fully recyclable.
Separate the components for recycling into the following categories:

- Steel and iron
- Aluminum
- Non-ferrous metal, e.g. motor windings
- Plastics, particularly with brominated flame retardants, in accordance with marking
- Insulating materials
- Cables and wires

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- Electronic scrap, e.g. circuit boards

Only ferrite magnets and not rare earth magnets are used in external rotor motors from ebm-papst Mulfingen GmbH & Co. KG.

⇒ Ferrite magnets can be disposed of in the same way as normal iron and steel.

Electrical insulating materials on the product, in cables and wires are made of similar materials and are therefore to be treated in the same manner.
The materials concerned are as follows:

- Miscellaneous insulators used in the terminal box
- Power cables
- Cables for internal wiring
- Electrolytic capacitors

Dispose of electronic components employing the proper procedures for electronic scrap.

→ Please contact ebm-papst for any other questions on disposal.

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A.4.2 Operating instructions for the external fan, Type K2D250AB3206

K2D250-AB32-06
Siemens AG DF MC MF-M

Operating instructions

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CONTENTS

1. SAFETY REGULATIONS AND INFORMATION 1
1.1 Hazard levels for warnings 1
1.2 Staff qualifications 1
1.3 Basic safety rules 1
1.4 Voltage 2
1.5 Safety and protective features 2
1.6 Electromagnetic radiation 2
1.7 Mechanical movement 2
1.8 Emissions 2
1.9 Hot surface 2
1.10 Transport 2
1.11 Storage 2

2. INTENDED USE 3

3. TECHNICAL DATA 4
3.1 Product drawing 4
3.2 Nominal data 5
3.3 Technical description 5
3.4 Mounting data 5
3.5 Transport and storage conditions 5

4. CONNECTION AND STARTUP 6
4.1 Mechanical connection 6
4.2 Electrical connection 6
4.3 Connection in terminal box 6
4.4 Connection diagram 8
4.5 Checking connections 9
4.6 Switching on the device 9
4.7 Switching off the device 9

5. MAINTENANCE, MALFUNCTIONS, POSSIBLE CAUSES AND REMEDIES 9
5.1 Cleaning 9
5.2 Safety inspection 10
5.3 Disposal 10

Translation of the original operating instructions

1. SAFETY REGULATIONS AND INFORMATION

Read these operating instructions carefully before starting work on the device. Observe the following warnings to prevent malfunctions or danger to persons.
These operating instructions are to be regarded as part of the device. The device is only to be sold or passed on together with the operating instructions.
These operating instructions may be duplicated and distributed to inform about potential dangers and their prevention.

1.1 Hazard levels for warnings

These operating instructions use the following hazard levels to indicate potentially hazardous situations and important safety regulations:

DANGER
Indicates an imminently hazardous situation which will result in death or serious injury if the specified actions are not taken. Compliance with the instructions is imperative.

WARNING
Indicates a potentially hazardous situation which can result in death or serious injury if the specified actions are not taken. Exercise extreme caution while working.

CAUTION
Indicates a potentially hazardous situation which can result in minor or moderate injury or damage to property if the specified actions are not taken.

NOTE
A potentially harmful situation can occur and, if not avoided, can lead to property damage.

1.2 Staff qualifications

The device may only be transported, unpacked, installed, operated, maintained and otherwise used by suitably qualified, trained and authorized technical staff.
Only authorized specialists are permitted to install the device, to carry out a test run and to perform work on the electrical installation.

1.3 Basic safety rules

The motor may only be operated with an impeller. The result is a motor-fan combination. Motor and impeller assignment may only be done by ebm-papst.
Protection against such things as:

- electric shock
- Contact with rotating parts
- Ingress of foreign bodies or moisture
- Excessive condensation

The safety hazards associated with the device must be assessed again following installation in the final product.
The locally applicable industrial safety regulations are always to be observed when working on the device.
Keep the workplace clean and tidy. Untidiness in the work area increases the risk of accidents.
Note the following when working on the device:

⇒ Do not perform any modifications, additions or conversions on the device without the approval of ebm-papst.

K2D250-AB32-06
Siemens AG DF MC MF-M

Operating instructions

1.4 Voltage

⇒ Check the device's electrical equipment at regular intervals; see Chapter 5.2 Safety inspection.

⇒ Replace loose connections and defective cables immediately.

DANGER
Electrically charged device
Risk of electric shock

→ When working on an electrically charged device, stand on a rubber mat.

CAUTION
In the event of a fault, the rotor and the impeller will be energized
The rotor and the impeller have basic insulation.

→ Do not touch the rotor and impeller once installed.

CAUTION
The motor restarts automatically when operating voltage is applied, e.g. after a power failure.
Risk of injury

→ Keep out of the device's danger zone.

→ When working on the device, switch off the line voltage and ensure that it cannot be switched back on.

→ Wait until the device comes to a stop.

1.5 Safety and protective features

DANGER
Guard missing and guard not functioning
Without a guard, hands may become caught up in the device during operation for example, resulting in serious injury. Loose parts or items of clothing could be drawn in.

→ The device is a built-in component. As the owner, you are responsible for ensuring that the device is adequately safeguarded.# Operate the device only with a fixed protective device and guard grill.

→ Stop the device immediately if a protective device is found to be missing or ineffective.

1.6 Electromagnetic radiation

Interference from electromagnetic radiation is possible, e.g. in conjunction with open- and closed-loop control devices.
If impermissible radiation levels occur following installation, appropriate shielding measures have to be taken by the user.

1.7 Mechanical movement

DANGER
Rotating device
Risk of injury to body parts coming into contact with the rotor or the impeller.

→ Secure the device against accidental contact.

→ Before working on the system/machine, wait until all parts have come to a standstill.

WARNING
Rotating device
Long hair and dangling items of clothing, jewelry and the like can become entangled and be pulled into the device. Injuries can result.

→ Do not wear any loose-fitting or dangling clothing or jewelry while working on rotating parts.

→ Protect long hair with a cap.

1.8 Emissions

WARNING
Depending on the installation and operating conditions, the sound pressure level may exceed 70 dB(A).
Risk of noise-induced hearing loss

→ Take appropriate technical safety measures.

→ Protect operating personnel with appropriate safety equipment such as hearing protection.

→ Also observe the requirements of local agencies.

1.9 Hot surface

NOTE
Risk of fire
The risk of fire or flame propagation by ebm-papst products must be assessed by the commissioning party following installation in the final product.

1.10 Transport

NOTE
Transporting the device

→ Transport the device in its original packaging only.

→ Secure the device so it cannot slip, e.g. by using a lashing strip.

1.11 Storage

⇒ Store the device, partially or fully assembled, in a dry place, protected against the weather and free from vibration, in the original packaging in a clean environment.

⇒ Protect the device against environmental effects and dirt until final installation.

⇒ We recommend storing the device for no longer than one year in order to guarantee trouble-free operation and the longest possible service life.

⇒ Even devices explicitly intended for outdoor use are to be stored as described prior to commissioning.

⇒ Maintain the storage temperature, see Chapter 3.5 Transport and storage conditions.

⇒ Make sure that all cable glands are fitted with dummy plugs.

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Operating instructions

2. INTENDED USE

Intended use also includes

- Using the device only in power systems with grounded neutral (TN/ TT power systems).
- Conveying air at an ambient air pressure between 800 mbar and 1050 mbar.
- Using the device within the permitted ambient temperature range; see Chapter 3.5 Transport and storage conditions and Chapter 3.2 Nominal data.
- Operating the device with all protective devices.
- Following the operating instructions.

Improper use

In particular, operating the device in the following ways is prohibited and could be hazardous:

- Operating the device in an unbalanced state, e.g. due to dirt deposits or ice formation.
- Resonant operation, operation with severe vibration. This also includes vibration transmitted to the fan from the customer installation.
- Operation in medical equipment with a life-sustaining or life-support function.
- Conveying solids in the flow medium.
- Painting the device
- Connections (e.g. screws) coming loose during operation.
- Opening the terminal box during operation.
- Conveying air that contains abrasive particles.
- Conveying highly corrosive air, e.g. salt spray. Exception: devices designed for salt spray and correspondingly protected.
- Conveying air with high dust content, e.g. suctioning off sawdust.
- Operating the device close to flammable materials or components.
- Operating the device in an explosive atmosphere.
- Using the device as a safety component or to perform safety-related functions.
- Operation with completely or partially disassembled or manipulated protective devices.
- In addition, all applications not listed among the intended uses.

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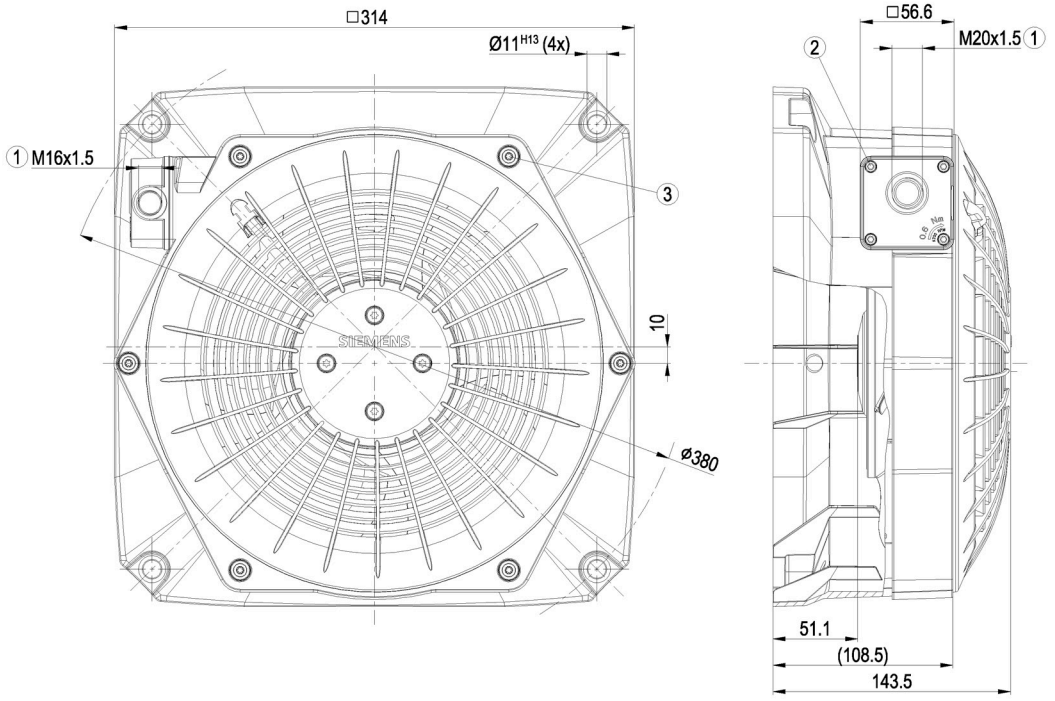
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Siemens AG DF MC MF-M

Operating instructions

3. TECHNICAL DATA

3.1 Product drawing



All dimensions in mm.

1	Max. screw-in depth 9 mm
2	Tightening torque 0.6±0.1 Nm, fit manually
3	Tightening torque 3.5 ± 0.3 Nm; fit screws by hand

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K2D250-AB32-06
Siemens AG DF MC MF-M

Operating instructions

3.2 Nominal data

Motor	M2D068-DF		
Phase	3~	3~	3~
Nominal voltage / VAC	400	400	480
Wiring	Y	Y	Y
Frequency / Hz	50	60	60
Method of obtaining data	ce	ce	ce
Valid for approval/ standard	CE	CE	CE
Speed (rpm) / min^{-1}	2450	2500	2800
Power consumption / W	100	135	155
Current draw / A	0.16	0.21	0.21
Min. back pressure / Pa	0	0	0
Min. ambient temperature / °C	-25	-25	-25
Max. ambient temperature / °C	80	70	70
Starting current / A	0.45	0.45	0.52

ml = Max. load · me = Max. efficiency · fa = Free air
cs = Customer specification · ce = Customer equipment

Subject to change

Imax:
340-440 V, 50/60 Hz, 0.16 A/0.21 A
408-528 V, 60 Hz, 0.21 A

3.3 Technical description

Weight	3.38 kg
Size	250 mm
Motor size	68
Rotor surface	Painted black
Terminal box material	PA plastic
Impeller material	PA plastic
Housing material	PA plastic
Guard grille material	PA plastic
Number of blades	5
Direction of rotation	Counterclockwise, viewed toward rotor
Degree of protection	IP55
Insulation class	"F"
Moisture (F) / Environmental (H) protection class	H1+
Installation position	Any
Condensation drainage holes	None
Mode	S1
Motor bearing	Ball bearing
Touch current according to IEC 60990 (measuring circuit Fig. 4, TN system)	< 0.75 mA
Electrical hookup	Terminal box
Protection class	I (with customer connection of protective earth)
Conformity with standards	EN 60034-1; EN 60204-1; EN 60335-1; CE
Approval	UL 1004-1; EAC; CSA C22.2 No. 100

Translation of the original operating instructions

With regard to cyclic speed loads, note that the rotating parts of the device are designed for a maximum of one million load cycles. If you have special questions, consult ebm-papst for support.

⇒ Use the device in accordance with its degree of protection.

Information on surface quality

The surfaces of the products conform to the generally applicable industrial standard. The surface quality may change during the production period. This has no effect on strength, dimensional stability and dimensional accuracy.
The color pigments in the paints used perceptibly react to UV light over the course of time. The product is to be protected against UV radiation to prevent the formation of patches and fading. Changes in color are not a reason for complaint and are not covered by the warranty. UV radiation in the frequency range and the intensity of natural solar radiation has no effect on the technical properties of the products.

3.4 Mounting data

Any further mounting data required can be taken from the product drawing or Section Chapter 4.1 Mechanical connection.

Strength class of screws	8.8

⇒ Secure the screws against unintentional loosening (e.g. use self-locking screws).

3.5 Transport and storage conditions

NOTE
The degree of protection is only valid in conjunction with the main motor.

Max. permitted ambient temp. for motor (transport/ storage)	+80 °C
Min. permitted ambient temp. for motor (transport/ storage)	-40 °C

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K2D250-AB32-06
Siemens AG DF MC MF-M

Operating instructions

4. CONNECTION AND STARTUP

4.1 Mechanical connection

CAUTION
Risk of cutting and crushing when removing device from packaging

→ Carefully remove the device from the packaging by grasping hold of the frame. Never subject to any impact.

→ Wear safety shoes and cut-resistant safety gloves.

NOTE
Damage to the device from vibration
Bearing damage, shorter service life

→ The fan must not be subjected to force or excessive vibration from sections of the installation.

→ If the fan is connected to air ducts, the connection should be isolated from vibration, e.g. using compensators or similar elements.

→ Ensure stress-free attachment of the fan to the substructure.

⇒ The fan may not be handled in the area around the inlet nozzle during transport and installation.
There is a risk of damage to the impeller.

⇒ Check the device for transport damage. Damaged devices are not to be installed.

⇒ Install the undamaged device in accordance with your application.

CAUTION
Possible damage to the device
If the device slips during installation, serious damage can result.

→ Ensure that the device is securely positioned at its place of installation until all fastening screws have been tightened.

- The fan must not be strained on fastening.

4.2 Electrical connection

DANGER
Voltage on the device
Electric shock

→ Always connect a protective earth first.

→ Check the protective earth.

DANGER
Faulty insulation
Risk of fatal injury from electric shock

→ Use only cables that meet the specified installation regulations for voltage, current, insulation material, capacity, etc.

→ Route cables so that they cannot be touched by any rotating parts.

CAUTION
Voltage
The device is a built-in component and has no disconnecting switch.

→ Only connect the device to circuits that can be switched off with an all-pole disconnection switch.

→ When working on the device, secure the system/ machine in which the device is installed so as to prevent it from being switched back on.

NOTE
Water ingress into wires or cables
Water ingress at the customer end of the cable can damage the device.

→ Make sure the end of the cable is connected in a dry environment.

Only connect the device to circuits that can be switched off with an all-pole disconnection switch.

4.2.1 Requirements

⇒ Check whether the information on the nameplate matches the connection data.

⇒ Before connecting the device, make sure the power supply matches the device voltage.

⇒ Only use cables designed for the current level indicated on the nameplate.
For determining the cross-section, note the sizing criteria according to EN 61800-5-1. The protective earth must have a cross-section equal to or greater than that of the phase conductor.
We recommend the use of 105 °C cables. Ensure that the minimum cable cross-section is at least
AWG 26 / 0.13 mm².

⇒ For a M20x1.5 cable gland, measure the maximum cable cross-section of 2.5 mm² and for a M16x1.5 cable gland the maximum cable cross-section of 1.5 mm².

Forced-ventilation units with no thermal overload protector must be safeguarded by a motor circuit breaker prior to startup.

Protective earth contact resistance according to EN 60335

Compliance with the resistance specifications according to EN 60335 for the protective earth connection circuit must be verified in the end application. Depending on the installation situation, it may be necessary to connect an additional protective earth conductor by way of the extra protective earth terminal provided on the device.

4.2.2 Residual current circuit breaker (RCCB)

If the use of a residual current device (RCD) is required in your installation, only AC/DC-sensitive residual current devices of type B are permissible.

4.3 Connection in terminal box

4.3.1 Preparing cables for connection

Only strip the cable as far as necessary, ensuring that the cable gland is sealed and there is no strain on the connections. For tightening torques, see Chapter 3.1 Product drawing.

NOTE
Tightness and strain relief are dependent on the cable used.

→ This must be checked by the user.

⇒ When connecting, make sure the ground conductor is longer than the phase conductors.

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4.3.2 Connecting wires to terminals

⇒ To ensure the IP protection, a cable gland with seal must be used for the cable entry.

⇒ Only use cable glands made of plastic.

⇒ Route the cables into the intended openings on the terminal box.

⇒ First connect the "PE" (protective earth).

An external ground connection can also be made at uninsulated points on the housing or using the external ground connection in the terminal box.

⇒ Connect the wires to the corresponding terminals.

Use a screwdriver to do so.
When connecting, ensure that no wire ends fan out.

⇒ Insert the leads until they meet resistance.

⇒ The cable bushing to the add-on device must be free of burrs and in accordance with the degree of protection (IP code).

4.3.3 Cable routing

Water must be prevented from reaching the cable gland along the cable.

NOTE
Damage caused by moisture penetration.
Moisture can penetrate into the terminal box if water is constantly present at the cable glands.

→ To prevent the constant accumulation of water at the cable glands, the cable should be routed in a U-shaped loop wherever possible.

→ If this is not possible, a drip edge can be produced by fitting a cable tie directly in front of the cable gland for example.

— Make sure the cable is routed in a U-shaped loop.

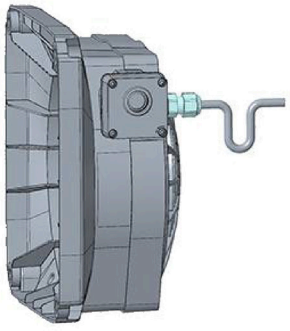


Fig. 1: Cable routing in U-shaped loop

4.3.4 Motor protection

Motor protection switch

WARNING
Device has no locked-rotor protection
As delivered, the forced-ventilation unit has no automatic protection against incorrect operation (locked-rotor protection). The device can become hot and catch fire.

→ For the version without thermal overload protector, also install a suitable motor protection switch or a suitable tripping unit for the PTC thermistor.

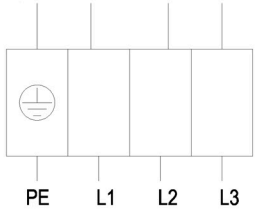
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Operating instructions

4.4 Connection diagram



PE	green/yellow
L1	black
L2	blue
L3	brown

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Siemens AG DF MC MF-M

Operating instructions

4.5 Checking connections

- ⇒ Ensure isolation from supply (all phases).
- ⇒ Make sure a restart is impossible
- ⇒ Check the cables for proper fit.
- ⇒ Check the mechanical and electrical installation of safety-related components (e.g. motor protection switch, guard grille etc.).
- ⇒ Screw the terminal box cover back on again. Terminal box tightening torque, see Chapter 3.1 Product drawing.
- ⇒ Make sure the terminal box is completely closed and sealed and that all screws and cable glands have been properly tightened.

4.6 Switching on the device

The device may only be switched on if it has been installed properly and in accordance with its intended use, including the required safety mechanisms and professional electrical hookup. This also applies for devices which have already been equipped with plugs and terminals or similar connectors by the customer.

WARNING
Hot motor housing
Risk of fire

→ Ensure that no combustible or flammable materials are located close to the fan.

- ⇒ Before switching on, check the device for visible external damage and make sure the protective devices are functional.
- ⇒ Check the fan's air flow paths for foreign matter and remove any foreign matter found.
- ⇒ Apply the nominal supply voltage.

NOTE
Damage to the device from vibration
Bearing damage, shorter service life

→ Low-vibration operation of the fan must be ensured over the entire speed control range.

→ Severe vibration can arise for instance from inexpert handling, transportation damage and resultant imbalance or be caused by component or structural resonance.

→ Speed ranges with excessively high vibration levels and possibly resonant frequencies must be determined in the course of fan commissioning.

→ Either run through the resonant range as quickly as possible with speed control or find another remedy.

→ Operation with excessively high vibration levels can lead to premature failure.

4.7 Switching off the device

- ⇒ Disconnect the device from the power supply at the supply line's main switch.
- ⇒ When disconnecting, be sure to disconnect the ground connection last.

Translation of the original operating instructions

5. MAINTENANCE, MALFUNCTIONS, POSSIBLE CAUSES AND REMEDIES

The fan in the forced-ventilation unit is maintenance-free thanks to the use of special bearing greases.
During maintenance work on the ventilation unit, e.g. when cleaning the fan blades, the fan must be stationary and the ventilation unit's electrical circuit must be interrupted and secured against being switched on again.

CAUTION
The motor restarts automatically when operating voltage is applied, e.g. after a power failure.
Risk of injury

→ Keep out of the device's danger zone.

→ When working on the device, switch off the line voltage and ensure that it cannot be switched back on.

→ Wait until the device comes to a stop.

If the device is out of use for some time, e.g. when in storage, we recommend switching it on for at least two hours to allow any condensation to evaporate and to move the bearings.

- ⇒ Do not perform any repairs on the forced-ventilation unit. Send the blower to ebm-papst for repair or replacement.

Malfunction/fault	Possible cause	Possible remedy
Impeller not running smoothly	Imbalance in rotating parts	Clean the device; replace it if imbalance persists after cleaning. Make sure no weight clips are removed during cleaning.
Motor not turning	Mechanical blockage	Switch off, isolate from supply and remove mechanical blockage.
	Line voltage faulty	Check line voltage, restore power supply.
	Faulty connection	Isolate from supply, correct connection; see connection diagram.
	Broken motor winding	Replace device
	Impermissible point of operation	Check point of operation
Motor overtemperature	Ambient temperature too high	Reduce ambient temperature if possible
	Deficient cooling	Improve cooling

In the event of further malfunctions, contact ebm-papst.

5.1 Cleaning

To ensure a long service life, check the fans regularly for proper operation and soiling. The frequency of checking is to be adapted accordingly depending on the degree of soiling.

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Siemens AG DF MC MF-M

Operating instructions

DANGER
Risk of injury from rotating fan.
→ Only clean when not in motion. Interrupt the power supply, secure against renewed switch-on. Secure against start-up, prevent air flow.

- ⇒ Dirt deposits on the motor housing can cause overheating of the motor.
- ⇒ Soiling of the impeller can cause vibration that will shorten the service life of the fan.
- ⇒ Severe vibration can destroy the fan.
- ⇒ In such cases, switch off the fan immediately and clean it.
- ⇒ The preferred method of cleaning is dry cleaning, e.g. using compressed air.
- ⇒ Do not use aggressive cleaning agents!

NOTE
Damage to the device during cleaning
Malfunction possible
→ Do not clean the device using a high-pressure cleaner.# Do not use acid, alkali or solvent-based cleaning agents.
→ Do not use any pointed or sharp-edged objects for cleaning.

- ⇒ Clean the fan using a suitable cloth or brush, taking care not to allow moisture to reach the motor's interior.
- ⇒ Take care not to damage or bend the fan blades.
- ⇒ Completely remove any cleaning agents used.
- ⇒ If severe corrosion is visible on load-bearing or rotating parts, switch off the device immediately and replace it.
- ⇒ Repair of load-bearing or rotating parts is not permitted!
- ⇒ Operate the fan for 2 hours at maximum speed so that any water that has ingressed can evaporate.
- ⇒ If cleaning does not eliminate vibrations, the fan may need to be rebalanced. To have it rebalanced, contact ebm-papst.
- ⇒ The fan is equipped with maintenance-free ball bearings. The lifetime lubrication of the ball bearings is designed for a service life of 40,000 hours.
- ⇒ If bearing replacement is necessary after that period, contact ebm-papst.
- ⇒ Adapt the maintenance intervals to the actual level of dust exposure.

5.2 Safety inspection

What to check	How to check	How often	What action?
Contact protection cover for intactness or damage	Visual inspection	At least every 6 months	Repair or replacement of device
Device for damage	Visual inspection	At least every 6 months	Replace device
Fastening the cables	Visual inspection	At least every 6 months	Fasten
Fastening the protective earth terminal	Visual inspection	At least every 6 months	Fasten
Insulation of cables for damage	Visual inspection	At least every 6 months	Replace cables
Impeller for wear/deposits/ corrosion and damage	Visual inspection	At least every 6 months	Clean impeller or replace device
Tightness of cable gland	Visual inspection	At least every 6 months	Retighten, replace if damaged
Distance between impeller and housing or plastic ring	Measurement	At least every 6 months	Replace device
Insulation resistance check	Measurement	Following completion of electrical work	Replace device
Abnormal bearing noise	acoustic	At least every 6 months	Replace device

5.3 Disposal

For ebm-papst, environmental protection and resource preservation are top priority corporate goals.
ebm-papst operates an environmental management system which is certified in accordance with ISO 14001 and rigorously implemented around the world on the basis of German standards.
Right from the development stage, ecological design, technical safety and health protection are fixed criteria.
The following section contains recommendations for ecological disposal of the product and its components.

5.3.1 Country-specific legal requirements

NOTE
Country-specific legal requirements
Always observe the applicable country-specific legal regulations with regard to the disposal of products or waste occurring in the various phases of the life cycle. The corresponding disposal standards are also to be heeded.

5.3.2 Disassembly

Disassembly of the product must be performed or supervised by qualified personnel with the appropriate technical knowledge.
The product is to be disassembled into suitable components for disposal employing standard procedures for motors.

WARNING
Heavy parts of the product may drop off. Some of the product components are heavy. These components could drop off during disassembly.
This can result in fatal or serious injury and material damage.
→ Secure components before unfastening to stop them falling.

5.3.3 Component disposal

The products are mostly made of steel, copper, aluminum and plastic. Metallic materials are generally considered to be fully recyclable.
Separate the components for recycling into the following categories:

- Steel and iron
- Aluminum
- Non-ferrous metal, e.g. motor windings
- Plastics, particularly with brominated flame retardants, in accordance with marking
- Insulating materials
- Cables and wires

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- Electronic scrap, e.g. circuit boards

Only ferrite magnets and not rare earth magnets are used in external rotor motors from ebm-papst Mulfingen GmbH & Co. KG.

⇒ Ferrite magnets can be disposed of in the same way as normal iron and steel.

Electrical insulating materials on the product, in cables and wires are made of similar materials and are therefore to be treated in the same manner.
The materials concerned are as follows:

- Miscellaneous insulators used in the terminal box
- Power cables
- Cables for internal wiring
- Electrolytic capacitors

Dispose of electronic components employing the proper procedures for electronic scrap.

→ Please contact ebm-papst for any other questions on disposal.

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A.4.3 Operating instructions for the external fan, Type K2D250AB3207

K2D250-AB32-07
Siemens AG DF MC MF-M

Operating instructions

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CONTENTS

1. SAFETY REGULATIONS AND INFORMATION 1
1.1 Hazard levels for warnings 1
1.2 Staff qualifications 1
1.3 Basic safety rules 1
1.4 Voltage 2
1.5 Safety and protective features 2
1.6 Electromagnetic radiation 2
1.7 Mechanical movement 2
1.8 Emissions 2
1.9 Hot surface 2
1.10 Transport 2
1.11 Storage 2

2. INTENDED USE 3

3. TECHNICAL DATA 4
3.1 Product drawing 4
3.2 Nominal data 5
3.3 Technical description 5
3.4 Mounting data 5
3.5 Transport and storage conditions 5

4. CONNECTION AND STARTUP 6
4.1 Mechanical connection 6
4.2 Electrical connection 6
4.3 Connection in terminal box 6
4.4 Connection diagram 8
4.5 Checking connections 9
4.6 Switching on the device 9
4.7 Switching off the device 9

5. MAINTENANCE, MALFUNCTIONS, POSSIBLE CAUSES AND REMEDIES 9
5.1 Cleaning 9
5.2 Safety inspection 10
5.3 Disposal 10

Translation of the original operating instructions

1. SAFETY REGULATIONS AND INFORMATION

Read these operating instructions carefully before starting work on the device. Observe the following warnings to prevent malfunctions or danger to persons.
These operating instructions are to be regarded as part of the device. The device is only to be sold or passed on together with the operating instructions.
These operating instructions may be duplicated and distributed to inform about potential dangers and their prevention.

1.1 Hazard levels for warnings

These operating instructions use the following hazard levels to indicate potentially hazardous situations and important safety regulations:

DANGER
Indicates an imminently hazardous situation which will result in death or serious injury if the specified actions are not taken. Compliance with the instructions is imperative.

WARNING
Indicates a potentially hazardous situation which can result in death or serious injury if the specified actions are not taken. Exercise extreme caution while working.

CAUTION
Indicates a potentially hazardous situation which can result in minor or moderate injury or damage to property if the specified actions are not taken.

NOTE
A potentially harmful situation can occur and, if not avoided, can lead to property damage.

1.2 Staff qualifications

The device may only be transported, unpacked, installed, operated, maintained and otherwise used by suitably qualified, trained and authorized technical staff.
Only authorized specialists are permitted to install the device, to carry out a test run and to perform work on the electrical installation.

1.3 Basic safety rules

The motor may only be operated with an impeller. The result is a motor-fan combination. Motor and impeller assignment may only be done by ebm-papst.
Protection against such things as:

- electric shock
- Contact with rotating parts
- Ingress of foreign bodies or moisture
- Excessive condensation

The safety hazards associated with the device must be assessed again following installation in the final product.
The locally applicable industrial safety regulations are always to be observed when working on the device.
Keep the workplace clean and tidy. Untidiness in the work area increases the risk of accidents.
Note the following when working on the device:

⇒ Do not perform any modifications, additions or conversions on the device without the approval of ebm-papst.

K2D250-AB32-07
Siemens AG DF MC MF-M

Operating instructions

1.4 Voltage

⇒ Check the device's electrical equipment at regular intervals; see Chapter 5.2 Safety inspection.

⇒ Replace loose connections and defective cables immediately.

DANGER
Electrically charged device
Risk of electric shock

→ When working on an electrically charged device, stand on a rubber mat.

CAUTION
In the event of a fault, the rotor and the impeller will be energized
The rotor and the impeller have basic insulation.

→ Do not touch the rotor and impeller once installed.

CAUTION
The motor restarts automatically when operating voltage is applied, e.g. after a power failure.
Risk of injury

→ Keep out of the device's danger zone.

→ When working on the device, switch off the line voltage and ensure that it cannot be switched back on.

→ Wait until the device comes to a stop.

1.5 Safety and protective features

DANGER
Guard missing and guard not functioning
Without a guard, hands may become caught up in the device during operation for example, resulting in serious injury. Loose parts or items of clothing could be drawn in.

→ The device is a built-in component. As the owner, you are responsible for ensuring that the device is adequately safeguarded.# Operate the device only with a fixed protective device and guard grill.

→ Stop the device immediately if a protective device is found to be missing or ineffective.

1.6 Electromagnetic radiation

Interference from electromagnetic radiation is possible, e.g. in conjunction with open- and closed-loop control devices.
If impermissible radiation levels occur following installation, appropriate shielding measures have to be taken by the user.

1.7 Mechanical movement

DANGER
Rotating device
Risk of injury to body parts coming into contact with the rotor or the impeller.

→ Secure the device against accidental contact.

→ Before working on the system/machine, wait until all parts have come to a standstill.

WARNING
Rotating device
Long hair and dangling items of clothing, jewelry and the like can become entangled and be pulled into the device. Injuries can result.

→ Do not wear any loose-fitting or dangling clothing or jewelry while working on rotating parts.

→ Protect long hair with a cap.

1.8 Emissions

WARNING
Depending on the installation and operating conditions, the sound pressure level may exceed 70 dB(A).
Risk of noise-induced hearing loss

→ Take appropriate technical safety measures.

→ Protect operating personnel with appropriate safety equipment such as hearing protection.

→ Also observe the requirements of local agencies.

1.9 Hot surface

NOTE
Risk of fire
The risk of fire or flame propagation by ebm-papst products must be assessed by the commissioning party following installation in the final product.

1.10 Transport

NOTE
Transporting the device

→ Transport the device in its original packaging only.

→ Secure the device so it cannot slip, e.g. by using a lashing strip.

1.11 Storage

⇒ Store the device, partially or fully assembled, in a dry place, protected against the weather and free from vibration, in the original packaging in a clean environment.

⇒ Protect the device against environmental effects and dirt until final installation.

⇒ We recommend storing the device for no longer than one year in order to guarantee trouble-free operation and the longest possible service life.

⇒ Even devices explicitly intended for outdoor use are to be stored as described prior to commissioning.

⇒ Maintain the storage temperature, see Chapter 3.5 Transport and storage conditions.

⇒ Make sure that all cable glands are fitted with dummy plugs.

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Siemens AG DF MC MF-M

Operating instructions

2. INTENDED USE

Intended use also includes

- Using the device only in power systems with grounded neutral (TN/ TT power systems).
- Conveying air at an ambient air pressure between 800 mbar and 1050 mbar.
- Using the device within the permitted ambient temperature range; see Chapter 3.5 Transport and storage conditions and Chapter 3.2 Nominal data.
- Operating the device with all protective devices.
- Following the operating instructions.

Improper use

In particular, operating the device in the following ways is prohibited and could be hazardous:

- Operating the device in an unbalanced state, e.g. due to dirt deposits or ice formation.
- Resonant operation, operation with severe vibration. This also includes vibration transmitted to the fan from the customer installation.
- Operation in medical equipment with a life-sustaining or life-support function.
- Conveying solids in the flow medium.
- Painting the device
- Connections (e.g. screws) coming loose during operation.
- Opening the terminal box during operation.
- Conveying air that contains abrasive particles.
- Conveying highly corrosive air, e.g. salt spray. Exception: devices designed for salt spray and correspondingly protected.
- Conveying air with high dust content, e.g. suctioning off sawdust.
- Operating the device close to flammable materials or components.
- Operating the device in an explosive atmosphere.
- Using the device as a safety component or to perform safety-related functions.
- Operation with completely or partially disassembled or manipulated protective devices.
- In addition, all applications not listed among the intended uses.

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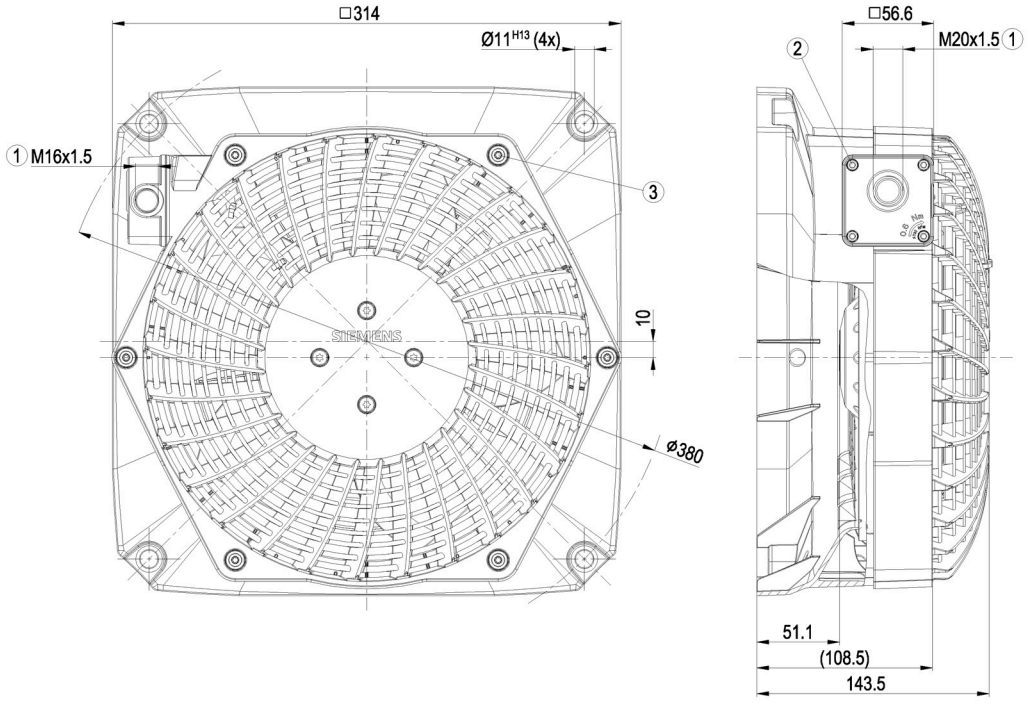
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Siemens AG DF MC MF-M

Operating instructions

3. TECHNICAL DATA

3.1 Product drawing



All dimensions in mm.

1	Max. screw-in depth 9 mm
2	Tightening torque 0.6±0.1 Nm, fit manually
3	Tightening torque 3.5 ± 0.3 Nm; fit screws by hand

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K2D250-AB32-07
Siemens AG DF MC MF-M

Operating instructions

3.2 Nominal data

Motor	M2D068-DF		
Phase	3~	3~	3~
Nominal voltage / VAC	400	400	480
Wiring	Y	Y	Y
Frequency / Hz	50	60	60
Method of obtaining data	ce	ce	ce
Valid for approval/ standard	CE	CE	CE
Speed (rpm) / min^{-1}	2450	2500	2800
Power consumption / W	100	135	155
Current draw / A	0.16	0.21	0.21
Min. back pressure / Pa	0	0	0
Min. ambient temperature / °C	-25	-25	-25
Max. ambient temperature / °C	80	75	75
Starting current / A	0.45	0.45	0.52

ml = Max. load · me = Max. efficiency · fa = Free air
cs = Customer specification · ce = Customer equipment

Subject to change

Imax:
340-440 V, 50/60 Hz, 0.16 A/0.21 A
408-528 V, 60 Hz, 0.21 A

3.3 Technical description

Weight	3.8 kg
Size	250 mm
Motor size	68
Rotor surface	Painted black
Terminal box material	PA plastic
Impeller material	PA plastic
Housing material	PA plastic
Guard grille material	PA plastic
Number of blades	5
Direction of rotation	Clockwise, viewed toward rotor
Degree of protection	IP65
Insulation class	"F"
Moisture (F) / Environmental (H) protection class	H1+
Installation position	Any
Condensation drainage holes	None
Mode	S1
Motor bearing	Ball bearing
Touch current according to IEC 60990 (measuring circuit Fig. 4, TN system)	< 0.75 mA
Electrical hookup	Terminal box
Protection class	I (with customer connection of protective earth)
Conformity with standards	EN 60034-1; EN 60204-1; EN 60335-1; CE
Approval	EAC; CSA C22.2 No. 100; UL 1004-1

With regard to cyclic speed loads, note that the rotating parts of the device are designed for a maximum of one million load cycles. If you have special questions, consult ebm-papst for support.

⇒ Use the device in accordance with its degree of protection.

Information on surface quality

The surfaces of the products conform to the generally applicable industrial standard. The surface quality may change during the production period. This has no effect on strength, dimensional stability and dimensional accuracy.
The color pigments in the paints used perceptibly react to UV light over the course of time. The product is to be protected against UV radiation to prevent the formation of patches and fading. Changes in color are not a reason for complaint and are not covered by the warranty. UV radiation in the frequency range and the intensity of natural solar radiation has no effect on the technical properties of the products.

3.4 Mounting data

Any further mounting data required can be taken from the product drawing or Section Chapter 4.1 Mechanical connection.

Strength class of screws	8.8

⇒ Secure the screws against unintentional loosening (e.g. use self-locking screws).

3.5 Transport and storage conditions

NOTE
The degree of protection is only valid in conjunction with the main motor.

Max. permitted ambient temp. for motor (transport/ storage)	+80 °C
Min. permitted ambient temp. for motor (transport/ storage)	-40 °C

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K2D250-AB32-07
Siemens AG DF MC MF-M

Operating instructions

4. CONNECTION AND STARTUP

4.1 Mechanical connection

CAUTION
Risk of cutting and crushing when removing device from packaging

→ Carefully remove the device from the packaging by grasping hold of the frame. Never subject to any impact.

→ Wear safety shoes and cut-resistant safety gloves.

NOTE
Damage to the device from vibration
Bearing damage, shorter service life

→ The fan must not be subjected to force or excessive vibration from sections of the installation.

→ If the fan is connected to air ducts, the connection should be isolated from vibration, e.g. using compensators or similar elements.

→ Ensure stress-free attachment of the fan to the substructure.

⇒ The fan may not be handled in the area around the inlet nozzle during transport and installation.
There is a risk of damage to the impeller.

⇒ Check the device for transport damage. Damaged devices are not to be installed.

⇒ Install the undamaged device in accordance with your application.

CAUTION
Possible damage to the device
If the device slips during installation, serious damage can result.

→ Ensure that the device is securely positioned at its place of installation until all fastening screws have been tightened.

- The fan must not be strained on fastening.

4.2 Electrical connection

DANGER
Voltage on the device
Electric shock

→ Always connect a protective earth first.

→ Check the protective earth.

DANGER
Faulty insulation
Risk of fatal injury from electric shock

→ Use only cables that meet the specified installation regulations for voltage, current, insulation material, capacity, etc.

→ Route cables so that they cannot be touched by any rotating parts.

CAUTION
Voltage
The device is a built-in component and has no disconnecting switch.

→ Only connect the device to circuits that can be switched off with an all-pole disconnection switch.

→ When working on the device, secure the system/ machine in which the device is installed so as to prevent it from being switched back on.

NOTE
Water ingress into wires or cables
Water ingress at the customer end of the cable can damage the device.

→ Make sure the end of the cable is connected in a dry environment.

Only connect the device to circuits that can be switched off with an all-pole disconnection switch.

4.2.1 Requirements

⇒ Check whether the information on the nameplate matches the connection data.

⇒ Before connecting the device, make sure the power supply matches the device voltage.

⇒ Only use cables designed for the current level indicated on the nameplate.
For determining the cross-section, note the sizing criteria according to EN 61800-5-1. The protective earth must have a cross-section equal to or greater than that of the phase conductor.
We recommend the use of 105 °C cables. Ensure that the minimum cable cross-section is at least
AWG 26 / 0.13 mm².

⇒ For a M20x1.5 cable gland, measure the maximum cable cross-section of 2.5 mm² and for a M16x1.5 cable gland the maximum cable cross-section of 1.5 mm².

Forced-ventilation units with no thermal overload protector must be safeguarded by a motor circuit breaker prior to startup.

Protective earth contact resistance according to EN 60335

Compliance with the resistance specifications according to EN 60335 for the protective earth connection circuit must be verified in the end application. Depending on the installation situation, it may be necessary to connect an additional protective earth conductor by way of the extra protective earth terminal provided on the device.

4.2.2 Residual current circuit breaker (RCCB)

If the use of a residual current device (RCD) is required in your installation, only AC/DC-sensitive residual current devices of type B are permissible.

4.3 Connection in terminal box

4.3.1 Preparing cables for connection

Only strip the cable as far as necessary, ensuring that the cable gland is sealed and there is no strain on the connections. For tightening torques, see Chapter 3.1 Product drawing.

NOTE
Tightness and strain relief are dependent on the cable used.

→ This must be checked by the user.

⇒ When connecting, make sure the ground conductor is longer than the phase conductors.

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4.3.2 Connecting wires to terminals

⇒ To ensure the IP protection, a cable gland with seal must be used for the cable entry.

⇒ Only use cable glands made of plastic.

⇒ Route the cables into the intended openings on the terminal box.

⇒ First connect the "PE" (protective earth).

An external ground connection can also be made at uninsulated points on the housing or using the external ground connection in the terminal box.

⇒ Connect the wires to the corresponding terminals.

Use a screwdriver to do so.
When connecting, ensure that no wire ends fan out.

⇒ Insert the leads until they meet resistance.

⇒ The cable bushing to the add-on device must be free of burrs and in accordance with the degree of protection (IP code).

4.3.3 Cable routing

Water must be prevented from reaching the cable gland along the cable.

NOTE
Damage caused by moisture penetration.
Moisture can penetrate into the terminal box if water is constantly present at the cable glands.

→ To prevent the constant accumulation of water at the cable glands, the cable should be routed in a U-shaped loop wherever possible.

→ If this is not possible, a drip edge can be produced by fitting a cable tie directly in front of the cable gland for example.

— Make sure the cable is routed in a U-shaped loop.

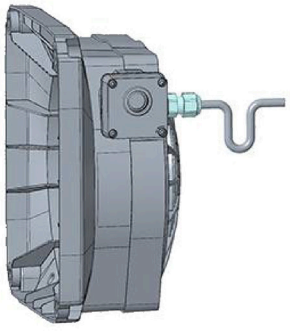


Fig. 1: Cable routing in U-shaped loop

4.3.4 Motor protection

Motor protection switch

WARNING
Device has no locked-rotor protection
As delivered, the forced-ventilation unit has no automatic protection against incorrect operation (locked-rotor protection). The device can become hot and catch fire.

→ For the version without thermal overload protector, also install a suitable motor protection switch or a suitable tripping unit for the PTC thermistor.

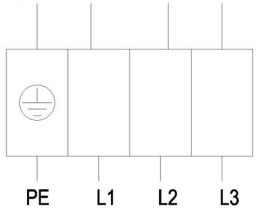
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K2D250-AB32-07
Siemens AG DF MC MF-M

Operating instructions

4.4 Connection diagram



PE	green/yellow
L1	black
L2	blue
L3	brown

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K2D250-AB32-07
Siemens AG DF MC MF-M

Operating instructions

4.5 Checking connections

- ⇛ Ensure isolation from supply (all phases).
- ⇛ Make sure a restart is impossible
- ⇛ Check the cables for proper fit.
- ⇛ Check the mechanical and electrical installation of safety-related components (e.g. motor protection switch, guard grille etc.).
- ⇛ Screw the terminal box cover back on again. Terminal box tightening torque, see Chapter 3.1 Product drawing.
- ⇛ Make sure the terminal box is completely closed and sealed and that all screws and cable glands have been properly tightened.

4.6 Switching on the device

The device may only be switched on if it has been installed properly and in accordance with its intended use, including the required safety mechanisms and professional electrical hookup. This also applies for devices which have already been equipped with plugs and terminals or similar connectors by the customer.

WARNING
Hot motor housing
Risk of fire

→ Ensure that no combustible or flammable materials are located close to the fan.

- ⇛ Before switching on, check the device for visible external damage and make sure the protective devices are functional.
- ⇛ Check the fan's air flow paths for foreign matter and remove any foreign matter found.
- ⇛ Apply the nominal supply voltage.

NOTE
Damage to the device from vibration
Bearing damage, shorter service life

→ Low-vibration operation of the fan must be ensured over the entire speed control range.

→ Severe vibration can arise for instance from inexpert handling, transportation damage and resultant imbalance or be caused by component or structural resonance.

→ Speed ranges with excessively high vibration levels and possibly resonant frequencies must be determined in the course of fan commissioning.

→ Either run through the resonant range as quickly as possible with speed control or find another remedy.

→ Operation with excessively high vibration levels can lead to premature failure.

4.7 Switching off the device

- ⇛ Disconnect the device from the power supply at the supply line's main switch.
- ⇛ When disconnecting, be sure to disconnect the ground connection last.

Translation of the original operating instructions

5. MAINTENANCE, MALFUNCTIONS, POSSIBLE CAUSES AND REMEDIES

The fan in the forced-ventilation unit is maintenance-free thanks to the use of special bearing greases.
During maintenance work on the ventilation unit, e.g. when cleaning the fan blades, the fan must be stationary and the ventilation unit's electrical circuit must be interrupted and secured against being switched on again.

CAUTION
The motor restarts automatically when operating voltage is applied, e.g. after a power failure.
Risk of injury

→ Keep out of the device's danger zone.

→ When working on the device, switch off the line voltage and ensure that it cannot be switched back on.

→ Wait until the device comes to a stop.

If the device is out of use for some time, e.g. when in storage, we recommend switching it on for at least two hours to allow any condensation to evaporate and to move the bearings.

- ⇛ Do not perform any repairs on the forced-ventilation unit. Send the blower to ebm-papst for repair or replacement.

Malfunction/fault	Possible cause	Possible remedy
Impeller not running smoothly	Imbalance in rotating parts	Clean the device; replace it if imbalance persists after cleaning. Make sure no weight clips are removed during cleaning.
Motor not turning	Mechanical blockage	Switch off, isolate from supply and remove mechanical blockage.
	Line voltage faulty	Check line voltage, restore power supply.
	Faulty connection	Isolate from supply, correct connection; see connection diagram.
	Broken motor winding	Replace device
	Impermissible point of operation	Check point of operation
Motor overtemperature	Ambient temperature too high	Reduce ambient temperature if possible
	Deficient cooling	Improve cooling

In the event of further malfunctions, contact ebm-papst.

5.1 Cleaning

To ensure a long service life, check the fans regularly for proper operation and soiling. The frequency of checking is to be adapted accordingly depending on the degree of soiling.

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K2D250-AB32-07
Siemens AG DF MC MF-M

Operating instructions

DANGER
Risk of injury from rotating fan.
→ Only clean when not in motion. Interrupt the power supply, secure against renewed switch-on. Secure against start-up, prevent air flow.

- ⇒ Dirt deposits on the motor housing can cause overheating of the motor.
- ⇒ Soiling of the impeller can cause vibration that will shorten the service life of the fan.
- ⇒ Severe vibration can destroy the fan.
- ⇒ In such cases, switch off the fan immediately and clean it.
- ⇒ The preferred method of cleaning is dry cleaning, e.g. using compressed air.
- ⇒ Do not use aggressive cleaning agents!

NOTE
Damage to the device during cleaning
Malfunction possible
→ Do not clean the device using a high-pressure cleaner.# Do not use acid, alkali or solvent-based cleaning agents.
→ Do not use any pointed or sharp-edged objects for cleaning.

- ⇒ Clean the fan using a suitable cloth or brush, taking care not to allow moisture to reach the motor's interior.
- ⇒ Take care not to damage or bend the fan blades.
- ⇒ Completely remove any cleaning agents used.
- ⇒ If severe corrosion is visible on load-bearing or rotating parts, switch off the device immediately and replace it.
- ⇒ Repair of load-bearing or rotating parts is not permitted!
- ⇒ Operate the fan for 2 hours at maximum speed so that any water that has ingressed can evaporate.
- ⇒ If cleaning does not eliminate vibrations, the fan may need to be rebalanced. To have it rebalanced, contact ebm-papst.
- ⇒ The fan is equipped with maintenance-free ball bearings. The lifetime lubrication of the ball bearings is designed for a service life of 40,000 hours.
- ⇒ If bearing replacement is necessary after that period, contact ebm-papst.
- ⇒ Adapt the maintenance intervals to the actual level of dust exposure.

5.2 Safety inspection

What to check	How to check	How often	What action?
Contact protection cover for intactness or damage	Visual inspection	At least every 6 months	Repair or replacement of device
Device for damage	Visual inspection	At least every 6 months	Replace device
Fastening the cables	Visual inspection	At least every 6 months	Fasten
Fastening the protective earth terminal	Visual inspection	At least every 6 months	Fasten
Insulation of cables for damage	Visual inspection	At least every 6 months	Replace cables
Impeller for wear/deposits/ corrosion and damage	Visual inspection	At least every 6 months	Clean impeller or replace device
Tightness of cable gland	Visual inspection	At least every 6 months	Retighten, replace if damaged
Distance between impeller and housing or plastic ring	Measurement	At least every 6 months	Replace device
Insulation resistance check	Measurement	Following completion of electrical work	Replace device
Abnormal bearing noise	acoustic	At least every 6 months	Replace device

5.3 Disposal

For ebm-papst, environmental protection and resource preservation are top priority corporate goals.
ebm-papst operates an environmental management system which is certified in accordance with ISO 14001 and rigorously implemented around the world on the basis of German standards.
Right from the development stage, ecological design, technical safety and health protection are fixed criteria.
The following section contains recommendations for ecological disposal of the product and its components.

5.3.1 Country-specific legal requirements

NOTE
Country-specific legal requirements
Always observe the applicable country-specific legal regulations with regard to the disposal of products or waste occurring in the various phases of the life cycle. The corresponding disposal standards are also to be heeded.

5.3.2 Disassembly

Disassembly of the product must be performed or supervised by qualified personnel with the appropriate technical knowledge.
The product is to be disassembled into suitable components for disposal employing standard procedures for motors.

WARNING
Heavy parts of the product may drop off. Some of the product components are heavy. These components could drop off during disassembly.
This can result in fatal or serious injury and material damage.
→ Secure components before unfastening to stop them falling.

5.3.3 Component disposal

The products are mostly made of steel, copper, aluminum and plastic. Metallic materials are generally considered to be fully recyclable.
Separate the components for recycling into the following categories:

- Steel and iron
- Aluminum
- Non-ferrous metal, e.g. motor windings
- Plastics, particularly with brominated flame retardants, in accordance with marking
- Insulating materials
- Cables and wires

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- Electronic scrap, e.g. circuit boards

Only ferrite magnets and not rare earth magnets are used in external rotor motors from ebm-papst Mulfingen GmbH & Co. KG.

⇒ Ferrite magnets can be disposed of in the same way as normal iron and steel.

Electrical insulating materials on the product, in cables and wires are made of similar materials and are therefore to be treated in the same manner.
The materials concerned are as follows:

- Miscellaneous insulators used in the terminal box
- Power cables
- Cables for internal wiring
- Electrolytic capacitors

Dispose of electronic components employing the proper procedures for electronic scrap.

→ Please contact ebm-papst for any other questions on disposal.

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A.4.4 Operating instructions for the external fan, Type K2D250AB3208

K2D250-AB32-08
Siemens AG DF MC MF-M

Operating instructions

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CONTENTS

1. SAFETY REGULATIONS AND INFORMATION 1
1.1 Hazard levels for warnings 1
1.2 Staff qualifications 1
1.3 Basic safety rules 1
1.4 Voltage 2
1.5 Safety and protective features 2
1.6 Electromagnetic radiation 2
1.7 Mechanical movement 2
1.8 Emissions 2
1.9 Hot surface 2
1.10 Transport 2
1.11 Storage 2

2. INTENDED USE 3

3. TECHNICAL DATA 4
3.1 Product drawing 4
3.2 Nominal data 5
3.3 Technical description 5
3.4 Mounting data 5
3.5 Transport and storage conditions 5

4. CONNECTION AND STARTUP 6
4.1 Mechanical connection 6
4.2 Electrical connection 6
4.3 Connection in terminal box 6
4.4 Connection diagram 8
4.5 Checking connections 9
4.6 Switching on the device 9
4.7 Switching off the device 9

5. MAINTENANCE, MALFUNCTIONS, POSSIBLE CAUSES AND REMEDIES 9
5.1 Cleaning 9
5.2 Safety inspection 10
5.3 Disposal 10

Translation of the original operating instructions

1. SAFETY REGULATIONS AND INFORMATION

Read these operating instructions carefully before starting work on the device. Observe the following warnings to prevent malfunctions or danger to persons.
These operating instructions are to be regarded as part of the device. The device is only to be sold or passed on together with the operating instructions.
These operating instructions may be duplicated and distributed to inform about potential dangers and their prevention.

1.1 Hazard levels for warnings

These operating instructions use the following hazard levels to indicate potentially hazardous situations and important safety regulations:

DANGER
Indicates an imminently hazardous situation which will result in death or serious injury if the specified actions are not taken. Compliance with the instructions is imperative.

WARNING
Indicates a potentially hazardous situation which can result in death or serious injury if the specified actions are not taken. Exercise extreme caution while working.

CAUTION
Indicates a potentially hazardous situation which can result in minor or moderate injury or damage to property if the specified actions are not taken.

NOTE
A potentially harmful situation can occur and, if not avoided, can lead to property damage.

1.2 Staff qualifications

The device may only be transported, unpacked, installed, operated, maintained and otherwise used by suitably qualified, trained and authorized technical staff.
Only authorized specialists are permitted to install the device, to carry out a test run and to perform work on the electrical installation.

1.3 Basic safety rules

The motor may only be operated with an impeller. The result is a motor-fan combination. Motor and impeller assignment may only be done by ebm-papst.
Protection against such things as:

- electric shock
- Contact with rotating parts
- Ingress of foreign bodies or moisture
- Excessive condensation

The safety hazards associated with the device must be assessed again following installation in the final product.
The locally applicable industrial safety regulations are always to be observed when working on the device.
Keep the workplace clean and tidy. Untidiness in the work area increases the risk of accidents.
Note the following when working on the device:

⇒ Do not perform any modifications, additions or conversions on the device without the approval of ebm-papst.

K2D250-AB32-08
Siemens AG DF MC MF-M

Operating instructions

1.4 Voltage

⇒ Check the device's electrical equipment at regular intervals; see Chapter 5.2 Safety inspection.

⇒ Replace loose connections and defective cables immediately.

DANGER
Electrically charged device
Risk of electric shock

→ When working on an electrically charged device, stand on a rubber mat.

CAUTION
In the event of a fault, the rotor and the impeller will be energized
The rotor and the impeller have basic insulation.

→ Do not touch the rotor and impeller once installed.

CAUTION
The motor restarts automatically when operating voltage is applied, e.g. after a power failure.
Risk of injury

→ Keep out of the device's danger zone.

→ When working on the device, switch off the line voltage and ensure that it cannot be switched back on.

→ Wait until the device comes to a stop.

1.5 Safety and protective features

DANGER
Guard missing and guard not functioning
Without a guard, hands may become caught up in the device during operation for example, resulting in serious injury. Loose parts or items of clothing could be drawn in.

→ The device is a built-in component. As the owner, you are responsible for ensuring that the device is adequately safeguarded.# Operate the device only with a fixed protective device and guard grill.

→ Stop the device immediately if a protective device is found to be missing or ineffective.

1.6 Electromagnetic radiation

Interference from electromagnetic radiation is possible, e.g. in conjunction with open- and closed-loop control devices.
If impermissible radiation levels occur following installation, appropriate shielding measures have to be taken by the user.

1.7 Mechanical movement

DANGER
Rotating device
Risk of injury to body parts coming into contact with the rotor or the impeller.

→ Secure the device against accidental contact.

→ Before working on the system/machine, wait until all parts have come to a standstill.

WARNING
Rotating device
Long hair and dangling items of clothing, jewelry and the like can become entangled and be pulled into the device. Injuries can result.

→ Do not wear any loose-fitting or dangling clothing or jewelry while working on rotating parts.

→ Protect long hair with a cap.

1.8 Emissions

WARNING
Depending on the installation and operating conditions, the sound pressure level may exceed 70 dB(A).
Risk of noise-induced hearing loss

→ Take appropriate technical safety measures.

→ Protect operating personnel with appropriate safety equipment such as hearing protection.

→ Also observe the requirements of local agencies.

1.9 Hot surface

NOTE
Risk of fire
The risk of fire or flame propagation by ebm-papst products must be assessed by the commissioning party following installation in the final product.

1.10 Transport

NOTE
Transporting the device

→ Transport the device in its original packaging only.

→ Secure the device so it cannot slip, e.g. by using a lashing strip.

1.11 Storage

⇒ Store the device, partially or fully assembled, in a dry place, protected against the weather and free from vibration, in the original packaging in a clean environment.

⇒ Protect the device against environmental effects and dirt until final installation.

⇒ We recommend storing the device for no longer than one year in order to guarantee trouble-free operation and the longest possible service life.

⇒ Even devices explicitly intended for outdoor use are to be stored as described prior to commissioning.

⇒ Maintain the storage temperature, see Chapter 3.5 Transport and storage conditions.

⇒ Make sure that all cable glands are fitted with dummy plugs.

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Siemens AG DF MC MF-M

Operating instructions

2. INTENDED USE

Intended use also includes

- Using the device only in power systems with grounded neutral (TN/ TT power systems).
- Conveying air at an ambient air pressure between 800 mbar and 1050 mbar.
- Using the device within the permitted ambient temperature range; see Chapter 3.5 Transport and storage conditions and Chapter 3.2 Nominal data.
- Operating the device with all protective devices.
- Following the operating instructions.

Improper use

In particular, operating the device in the following ways is prohibited and could be hazardous:

- Operating the device in an unbalanced state, e.g. due to dirt deposits or ice formation.
- Resonant operation, operation with severe vibration. This also includes vibration transmitted to the fan from the customer installation.
- Operation in medical equipment with a life-sustaining or life-support function.
- Conveying solids in the flow medium.
- Painting the device
- Connections (e.g. screws) coming loose during operation.
- Opening the terminal box during operation.
- Conveying air that contains abrasive particles.
- Conveying highly corrosive air, e.g. salt spray. Exception: devices designed for salt spray and correspondingly protected.
- Conveying air with high dust content, e.g. suctioning off sawdust.
- Operating the device close to flammable materials or components.
- Operating the device in an explosive atmosphere.
- Using the device as a safety component or to perform safety-related functions.
- Operation with completely or partially disassembled or manipulated protective devices.
- In addition, all applications not listed among the intended uses.

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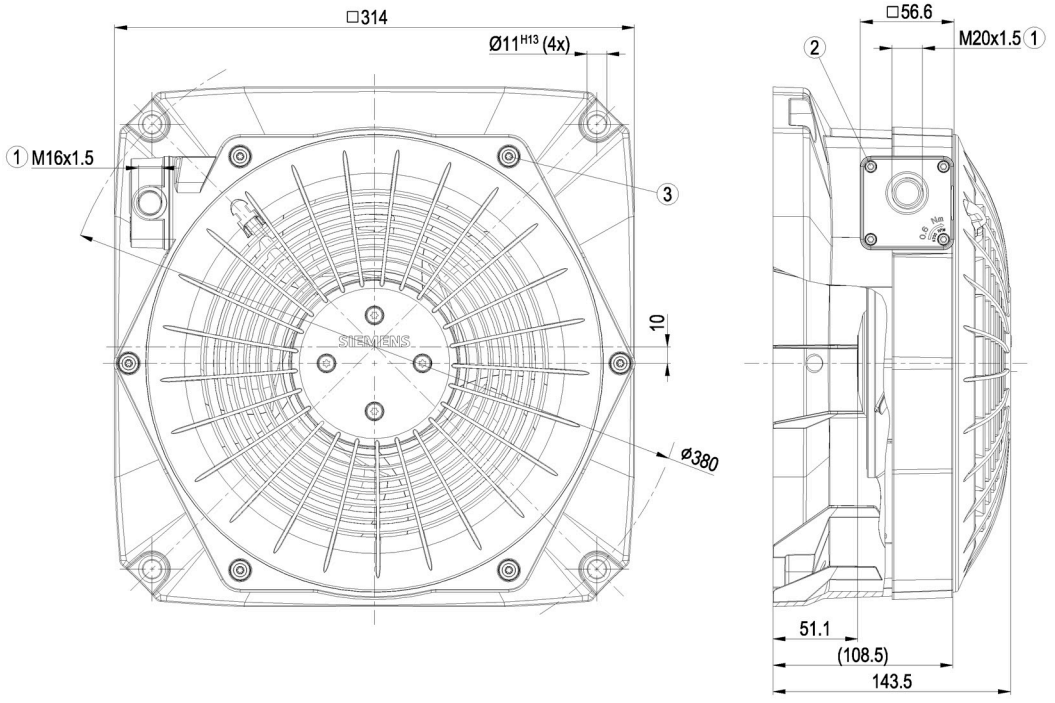
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Siemens AG DF MC MF-M

Operating instructions

3. TECHNICAL DATA

3.1 Product drawing



All dimensions in mm.

1	Max. screw-in depth 9 mm
2	Tightening torque 0.6±0.1 Nm, fit manually
3	Tightening torque 3.5 ± 0.3 Nm; fit screws by hand

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K2D250-AB32-08
Siemens AG DF MC MF-M

Operating instructions

3.2 Nominal data

Motor	M2D068-DF		
Phase	3~	3~	3~
Nominal voltage / VAC	400	400	480
Wiring	Y	Y	Y
Frequency / Hz	50	60	60
Method of obtaining data	ce	ce	ce
Valid for approval/ standard	CE	CE	CE
Speed (rpm) / min^{-1}	2450	2500	2800
Power consumption / W	100	135	155
Current draw / A	0.16	0.21	0.21
Min. back pressure / Pa	0	0	0
Min. ambient temperature / °C	-25	-25	-25
Max. ambient temperature / °C	80	70	70
Starting current / A	0.45	0.45	0.52

ml = Max. load · me = Max. efficiency · fa = Free air
cs = Customer specification · ce = Customer equipment

Subject to change

Imax:
340-440 V, 50/60 Hz, 0.16 A/0.21 A
408-528 V, 60 Hz, 0.21 A

3.3 Technical description

Weight	3.5 kg
Size	250 mm
Motor size	68
Rotor surface	Painted black
Terminal box material	PA plastic
Impeller material	PA plastic
Housing material	PA plastic
Guard grille material	PA plastic
Number of blades	5
Direction of rotation	Counterclockwise, viewed toward rotor
Degree of protection	IP65
Insulation class	"F"
Moisture (F) / Environmental (H) protection class	H1+
Installation position	Any
Condensation drainage holes	None
Mode	S1
Motor bearing	Ball bearing
Touch current according to IEC 60990 (measuring circuit Fig. 4, TN system)	< 0.75 mA
Electrical hookup	Terminal box
Protection class	I (with customer connection of protective earth)
Conformity with standards	EN 60034-1; EN 60204-1; EN 60335-1; CE
Approval	UL 1004-1; EAC; CSA C22.2 No. 100

Translation of the original operating instructions

With regard to cyclic speed loads, note that the rotating parts of the device are designed for a maximum of one million load cycles. If you have special questions, consult ebm-papst for support.

⇒ Use the device in accordance with its degree of protection.

Information on surface quality

The surfaces of the products conform to the generally applicable industrial standard. The surface quality may change during the production period. This has no effect on strength, dimensional stability and dimensional accuracy.
The color pigments in the paints used perceptibly react to UV light over the course of time. The product is to be protected against UV radiation to prevent the formation of patches and fading. Changes in color are not a reason for complaint and are not covered by the warranty. UV radiation in the frequency range and the intensity of natural solar radiation has no effect on the technical properties of the products.

3.4 Mounting data

Any further mounting data required can be taken from the product drawing or Section Chapter 4.1 Mechanical connection.

Strength class of screws	8.8

⇒ Secure the screws against unintentional loosening (e.g. use self-locking screws).

3.5 Transport and storage conditions

NOTE
The degree of protection is only valid in conjunction with the main motor.

Max. permitted ambient temp. for motor (transport/ storage)	+80 °C
Min. permitted ambient temp. for motor (transport/ storage)	-40 °C

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Siemens AG DF MC MF-M

Operating instructions

4. CONNECTION AND STARTUP

4.1 Mechanical connection

CAUTION
Risk of cutting and crushing when removing device from packaging

→ Carefully remove the device from the packaging by grasping hold of the frame. Never subject to any impact.

→ Wear safety shoes and cut-resistant safety gloves.

NOTE
Damage to the device from vibration
Bearing damage, shorter service life

→ The fan must not be subjected to force or excessive vibration from sections of the installation.

→ If the fan is connected to air ducts, the connection should be isolated from vibration, e.g. using compensators or similar elements.

→ Ensure stress-free attachment of the fan to the substructure.

⇒ The fan may not be handled in the area around the inlet nozzle during transport and installation.
There is a risk of damage to the impeller.

⇒ Check the device for transport damage. Damaged devices are not to be installed.

⇒ Install the undamaged device in accordance with your application.

CAUTION
Possible damage to the device
If the device slips during installation, serious damage can result.

→ Ensure that the device is securely positioned at its place of installation until all fastening screws have been tightened.

- The fan must not be strained on fastening.

4.2 Electrical connection

DANGER
Voltage on the device
Electric shock

→ Always connect a protective earth first.

→ Check the protective earth.

DANGER
Faulty insulation
Risk of fatal injury from electric shock

→ Use only cables that meet the specified installation regulations for voltage, current, insulation material, capacity, etc.

→ Route cables so that they cannot be touched by any rotating parts.

CAUTION
Voltage
The device is a built-in component and has no disconnecting switch.

→ Only connect the device to circuits that can be switched off with an all-pole disconnection switch.

→ When working on the device, secure the system/ machine in which the device is installed so as to prevent it from being switched back on.

NOTE
Water ingress into wires or cables
Water ingress at the customer end of the cable can damage the device.

→ Make sure the end of the cable is connected in a dry environment.

Only connect the device to circuits that can be switched off with an all-pole disconnection switch.

4.2.1 Requirements

⇒ Check whether the information on the nameplate matches the connection data.

⇒ Before connecting the device, make sure the power supply matches the device voltage.

⇒ Only use cables designed for the current level indicated on the nameplate.
For determining the cross-section, note the sizing criteria according to EN 61800-5-1. The protective earth must have a cross-section equal to or greater than that of the phase conductor.
We recommend the use of 105 °C cables. Ensure that the minimum cable cross-section is at least
AWG 26 / 0.13 mm².

⇒ For a M20x1.5 cable gland, measure the maximum cable cross-section of 2.5 mm² and for a M16x1.5 cable gland the maximum cable cross-section of 1.5 mm².

Forced-ventilation units with no thermal overload protector must be safeguarded by a motor circuit breaker prior to startup.

Protective earth contact resistance according to EN 60335

Compliance with the resistance specifications according to EN 60335 for the protective earth connection circuit must be verified in the end application. Depending on the installation situation, it may be necessary to connect an additional protective earth conductor by way of the extra protective earth terminal provided on the device.

4.2.2 Residual current circuit breaker (RCCB)

If the use of a residual current device (RCD) is required in your installation, only AC/DC-sensitive residual current devices of type B are permissible.

4.3 Connection in terminal box

4.3.1 Preparing cables for connection

Only strip the cable as far as necessary, ensuring that the cable gland is sealed and there is no strain on the connections. For tightening torques, see Chapter 3.1 Product drawing.

NOTE
Tightness and strain relief are dependent on the cable used.

→ This must be checked by the user.

⇒ When connecting, make sure the ground conductor is longer than the phase conductors.

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4.3.2 Connecting wires to terminals

⇒ To ensure the IP protection, a cable gland with seal must be used for the cable entry.

⇒ Only use cable glands made of plastic.

⇒ Route the cables into the intended openings on the terminal box.

⇒ First connect the "PE" (protective earth).

An external ground connection can also be made at uninsulated points on the housing or using the external ground connection in the terminal box.

⇒ Connect the wires to the corresponding terminals.

Use a screwdriver to do so.
When connecting, ensure that no wire ends fan out.

⇒ Insert the leads until they meet resistance.

⇒ The cable bushing to the add-on device must be free of burrs and in accordance with the degree of protection (IP code).

4.3.3 Cable routing

Water must be prevented from reaching the cable gland along the cable.

NOTE
Damage caused by moisture penetration.
Moisture can penetrate into the terminal box if water is constantly present at the cable glands.

→ To prevent the constant accumulation of water at the cable glands, the cable should be routed in a U-shaped loop wherever possible.

→ If this is not possible, a drip edge can be produced by fitting a cable tie directly in front of the cable gland for example.

— Make sure the cable is routed in a U-shaped loop.

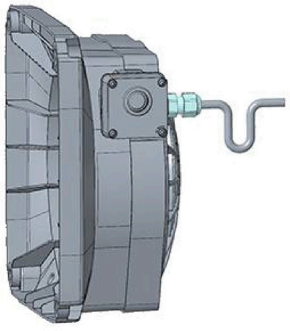


Fig. 1: Cable routing in U-shaped loop

4.3.4 Motor protection

Motor protection switch

WARNING
Device has no locked-rotor protection
As delivered, the forced-ventilation unit has no automatic protection against incorrect operation (locked-rotor protection). The device can become hot and catch fire.

→ For the version without thermal overload protector, also install a suitable motor protection switch or a suitable tripping unit for the PTC thermistor.

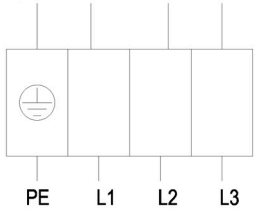
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K2D250-AB32-08
Siemens AG DF MC MF-M

Operating instructions

4.4 Connection diagram



PE	green/yellow
L1	black
L2	blue
L3	brown

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K2D250-AB32-08
Siemens AG DF MC MF-M

Operating instructions

4.5 Checking connections

- ⇛ Ensure isolation from supply (all phases).
- ⇛ Make sure a restart is impossible
- ⇛ Check the cables for proper fit.
- ⇛ Check the mechanical and electrical installation of safety-related components (e.g. motor protection switch, guard grille etc.).
- ⇛ Screw the terminal box cover back on again. Terminal box tightening torque, see Chapter 3.1 Product drawing.
- ⇛ Make sure the terminal box is completely closed and sealed and that all screws and cable glands have been properly tightened.

4.6 Switching on the device

The device may only be switched on if it has been installed properly and in accordance with its intended use, including the required safety mechanisms and professional electrical hookup. This also applies for devices which have already been equipped with plugs and terminals or similar connectors by the customer.

WARNING
Hot motor housing
Risk of fire
→ Ensure that no combustible or flammable materials are located close to the fan.

- ⇛ Before switching on, check the device for visible external damage and make sure the protective devices are functional.
- ⇛ Check the fan's air flow paths for foreign matter and remove any foreign matter found.
- ⇛ Apply the nominal supply voltage.

NOTE
Damage to the device from vibration
Bearing damage, shorter service life
→ Low-vibration operation of the fan must be ensured over the entire speed control range.
→ Severe vibration can arise for instance from inexpert handling, transportation damage and resultant imbalance or be caused by component or structural resonance.
→ Speed ranges with excessively high vibration levels and possibly resonant frequencies must be determined in the course of fan commissioning.
→ Either run through the resonant range as quickly as possible with speed control or find another remedy.
→ Operation with excessively high vibration levels can lead to premature failure.

4.7 Switching off the device

- ⇛ Disconnect the device from the power supply at the supply line's main switch.
- ⇛ When disconnecting, be sure to disconnect the ground connection last.

Translation of the original operating instructions

5. MAINTENANCE, MALFUNCTIONS, POSSIBLE CAUSES AND REMEDIES

The fan in the forced-ventilation unit is maintenance-free thanks to the use of special bearing greases.
During maintenance work on the ventilation unit, e.g. when cleaning the fan blades, the fan must be stationary and the ventilation unit's electrical circuit must be interrupted and secured against being switched on again.

CAUTION
The motor restarts automatically when operating voltage is applied, e.g. after a power failure.
Risk of injury
→ Keep out of the device's danger zone.
→ When working on the device, switch off the line voltage and ensure that it cannot be switched back on.
→ Wait until the device comes to a stop.

If the device is out of use for some time, e.g. when in storage, we recommend switching it on for at least two hours to allow any condensation to evaporate and to move the bearings.

- ⇛ Do not perform any repairs on the forced-ventilation unit. Send the blower to ebm-papst for repair or replacement.

Malfunction/fault	Possible cause	Possible remedy
Impeller not running smoothly	Imbalance in rotating parts	Clean the device; replace it if imbalance persists after cleaning. Make sure no weight clips are removed during cleaning.
Motor not turning	Mechanical blockage	Switch off, isolate from supply and remove mechanical blockage.
	Line voltage faulty	Check line voltage, restore power supply.
	Faulty connection	Isolate from supply, correct connection; see connection diagram.
	Broken motor winding	Replace device
	Impermissible point of operation	Check point of operation
Motor overtemperature	Ambient temperature too high	Reduce ambient temperature if possible
	Deficient cooling	Improve cooling

In the event of further malfunctions, contact ebm-papst.

5.1 Cleaning

To ensure a long service life, check the fans regularly for proper operation and soiling. The frequency of checking is to be adapted accordingly depending on the degree of soiling.

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K2D250-AB32-08
Siemens AG DF MC MF-M

Operating instructions

DANGER
Risk of injury from rotating fan.
→ Only clean when not in motion. Interrupt the power supply, secure against renewed switch-on. Secure against start-up, prevent air flow.

- ⇒ Dirt deposits on the motor housing can cause overheating of the motor.
- ⇒ Soiling of the impeller can cause vibration that will shorten the service life of the fan.
- ⇒ Severe vibration can destroy the fan.
- ⇒ In such cases, switch off the fan immediately and clean it.
- ⇒ The preferred method of cleaning is dry cleaning, e.g. using compressed air.
- ⇒ Do not use aggressive cleaning agents!

NOTE
Damage to the device during cleaning
Malfunction possible
→ Do not clean the device using a high-pressure cleaner.# Do not use acid, alkali or solvent-based cleaning agents.
→ Do not use any pointed or sharp-edged objects for cleaning.

- ⇒ Clean the fan using a suitable cloth or brush, taking care not to allow moisture to reach the motor's interior.
- ⇒ Take care not to damage or bend the fan blades.
- ⇒ Completely remove any cleaning agents used.
- ⇒ If severe corrosion is visible on load-bearing or rotating parts, switch off the device immediately and replace it.
- ⇒ Repair of load-bearing or rotating parts is not permitted!
- ⇒ Operate the fan for 2 hours at maximum speed so that any water that has ingressed can evaporate.
- ⇒ If cleaning does not eliminate vibrations, the fan may need to be rebalanced. To have it rebalanced, contact ebm-papst.
- ⇒ The fan is equipped with maintenance-free ball bearings. The lifetime lubrication of the ball bearings is designed for a service life of 40,000 hours.
- ⇒ If bearing replacement is necessary after that period, contact ebm-papst.
- ⇒ Adapt the maintenance intervals to the actual level of dust exposure.

5.2 Safety inspection

What to check	How to check	How often	What action?
Contact protection cover for intactness or damage	Visual inspection	At least every 6 months	Repair or replacement of device
Device for damage	Visual inspection	At least every 6 months	Replace device
Fastening the cables	Visual inspection	At least every 6 months	Fasten
Fastening the protective earth terminal	Visual inspection	At least every 6 months	Fasten
Insulation of cables for damage	Visual inspection	At least every 6 months	Replace cables
Impeller for wear/deposits/ corrosion and damage	Visual inspection	At least every 6 months	Clean impeller or replace device
Tightness of cable gland	Visual inspection	At least every 6 months	Retighten, replace if damaged
Distance between impeller and housing or plastic ring	Measurement	At least every 6 months	Replace device
Insulation resistance check	Measurement	Following completion of electrical work	Replace device
Abnormal bearing noise	acoustic	At least every 6 months	Replace device

5.3 Disposal

For ebm-papst, environmental protection and resource preservation are top priority corporate goals.
ebm-papst operates an environmental management system which is certified in accordance with ISO 14001 and rigorously implemented around the world on the basis of German standards.
Right from the development stage, ecological design, technical safety and health protection are fixed criteria.
The following section contains recommendations for ecological disposal of the product and its components.

5.3.1 Country-specific legal requirements

NOTE
Country-specific legal requirements
Always observe the applicable country-specific legal regulations with regard to the disposal of products or waste occurring in the various phases of the life cycle. The corresponding disposal standards are also to be heeded.

5.3.2 Disassembly

Disassembly of the product must be performed or supervised by qualified personnel with the appropriate technical knowledge.
The product is to be disassembled into suitable components for disposal employing standard procedures for motors.

WARNING
Heavy parts of the product may drop off. Some of the product components are heavy. These components could drop off during disassembly.
This can result in fatal or serious injury and material damage.
→ Secure components before unfastening to stop them falling.

5.3.3 Component disposal

The products are mostly made of steel, copper, aluminum and plastic. Metallic materials are generally considered to be fully recyclable.
Separate the components for recycling into the following categories:

- Steel and iron
- Aluminum
- Non-ferrous metal, e.g. motor windings
- Plastics, particularly with brominated flame retardants, in accordance with marking
- Insulating materials
- Cables and wires

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Operating instructions

- Electronic scrap, e.g. circuit boards

Only ferrite magnets and not rare earth magnets are used in external rotor motors from ebm-papst Mulfingen GmbH & Co. KG.

⇒ Ferrite magnets can be disposed of in the same way as normal iron and steel.

Electrical insulating materials on the product, in cables and wires are made of similar materials and are therefore to be treated in the same manner.
The materials concerned are as follows:

- Miscellaneous insulators used in the terminal box
- Power cables
- Cables for internal wiring
- Electrolytic capacitors

Dispose of electronic components employing the proper procedures for electronic scrap.

→ Please contact ebm-papst for any other questions on disposal.

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Index

A

Ambient conditions, 23
Area of application, 19

B

Bearing replacement intervals, 101

C

Certificates
  EAC, 21
  EC Declaration of Conformity, 21
  UL and cUL, 21
Circuit diagram, 66
Cleaning, 98
Commissioning, 86
Connecting the temperature sensor, 76
Connection, 63
Corrective maintenance, 105

D

Degree of protection, 23

F

Faults, 94
Flange mounting, 45
Foot mounting, 44
Forced ventilation, 28

G

Gamma ring, 106

H

Holding brake (option)
  Connecting, 80
  Mounting, 35, 112
  Removal, 112
Holding brakes, 31

I

Inspection and maintenance, 98

M

Maintenance intervals, 98
Mounting the motor, 44

N

Nameplate, 25
Noise emission, 24
Non-operational periods of the motor, 96

O

Output elements, 46

R

Rating plate, 25
Removal/installation
  Motor, 106
  Speed encoder, 107
  Toothed-wheel encoder, 110
Replacing an encoder, 104
Replacing the DRIVE-CLiQ interface, 111
RoHS, 21

S

Safety instructions
  Commissioning, 83
  Electrical connection, 64
  Maintenance, 97
  Mounting, 43
  Operation, 95
  Transportation, 37
Spare parts, 113
Storage, 40

T

Technical Support
Hotline, (Siemens Service Center), 5
Terminal box, 67
Tightening torques
Electrical connections, 65
Foot/flange mounting, 45
Screwed union connections, 111
Training, 5
Transportation, 38
Types of construction, 27

U

Use for the intended purpose, 19

V

Vibration strength, 47
Vibration values, 47

W

Water cooling, 29

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