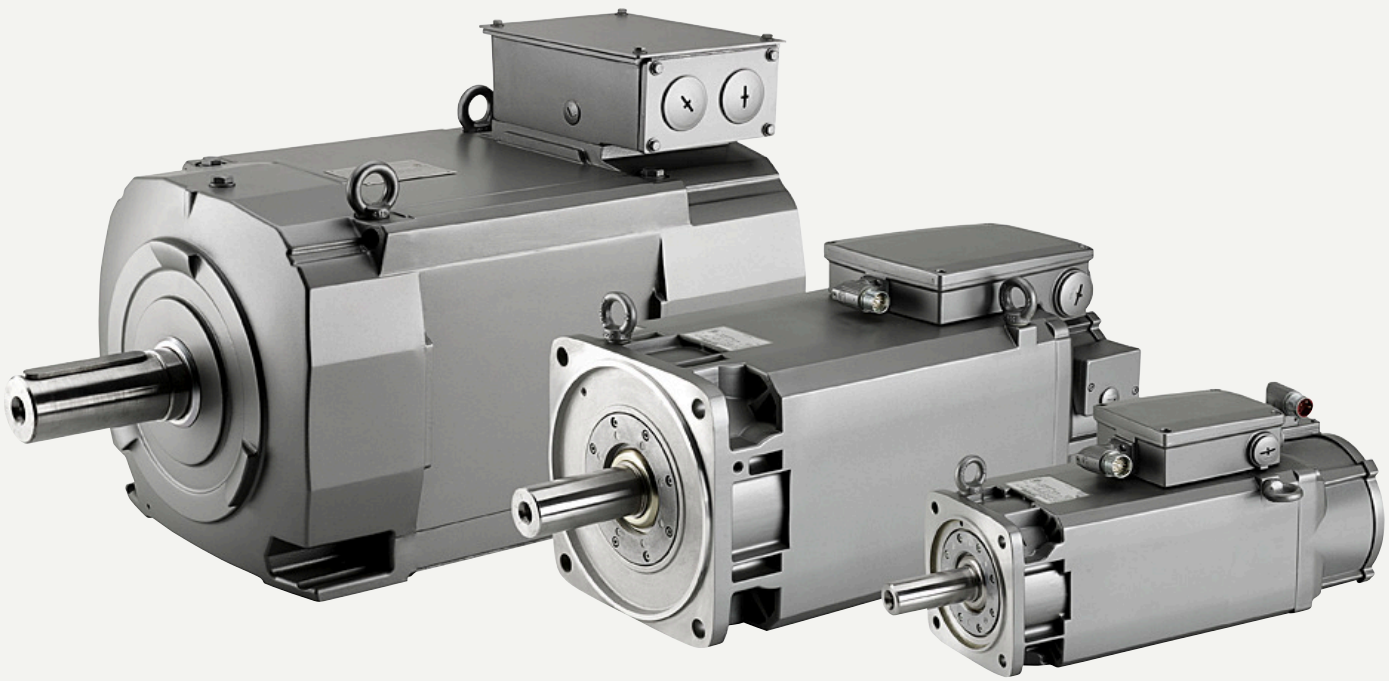
SIEMENS



Edition 12/2022

CONFIGURATION MANUAL

SIMOTICS M

Main motors

1PH8

www.siemens.com/drives

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SIEMENS

SIMOTICS M

Drive technology
1PH8 SIMOTICS M main motors

Configuration Manual

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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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GERMANY

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Ⓟ 02/2023 Subject to change

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Introduction 1

1.1 About SIMOTICS

Description

SIMOTICS is the Siemens family of electric motors addressing the complete motor spectrum in Digital Industry.

1.2 About this manual

1.2.1 Content

Description

This Configuration Manual supports you when selecting motors for your application. The Configuration Manual refers to rules and guidelines for configuring motors.

To illustrate possible application areas for our products, typical use cases are listed in this product documentation and in the online help. These are purely exemplary and do not constitute a statement on the suitability of the respective product for applications in specific individual cases. Unless explicitly contractually agreed, Siemens assumes no liability for such suitability. Suitability for a particular application in specific individual cases must be assessed by the user, taking into account all technical, legal, and other requirements on a case-by-case basis. Always observe the descriptions of the technical properties and the relevant constraints of the respective product contained in the product documentation.

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

Information regarding third-party products

Note

Recommendation relating to third-party products

This document contains recommendations relating to third-party products. Siemens accepts the fundamental suitability of these third-party products.

You can use equivalent products from other manufacturers.

Siemens does not accept any warranty for the properties of third-party products.

1.2.2 Target group

Description

This Configuration Manual addresses:

- Planning engineers
- Design engineers
- Mechanical design engineers

1.2.3 Standard scope

Description

This documentation describes the functionality of the standard scope. This scope may differ from the scope of the functionality of the system that is actually supplied. Please refer to the ordering documentation only for the functionality of the supplied drive system.

Further functions may be executable in the system, which are not explained in this documentation. However, there is no entitlement to these functions in the case of a new delivery or service.

This documentation does not contain all detailed information on all types of the product. Furthermore, this documentation cannot take into consideration every conceivable type of installation, operation and service/maintenance.

The machine manufacturer must document any additions or modifications they make to the product themselves.

1.2.4 Websites of third-party companies

Description

This document may contain hyperlinks to third-party websites. Siemens is not responsible for and shall not be liable for these websites and their content. Siemens has no control over the information which appears on these websites and is not responsible for the content and information provided there. The user bears the risk for their use.

1.3 SIMOTICS documentation

Description

Comprehensive documentation on SIMOTICS, SIMOGEAR and on the SINAMICS converter family are provided in Internet (https://support.industry.siemens.com/cs/ww/de/ps/13204/man).

You can display documents or download them in PDF and HTML5 format.

The documentation is divided into the following categories:

Table 1-1 SIMOTICS / SIMOGEAR / SINAMICS documentation

Information	Documentation class[1)]	Content	Target group
General information	Configuration Manual	Rules, guidelines, and tools for configuring products, systems, and plants. Also contains information on the operating and ambient conditions for hardware and software, the use of functions, as well as on circuit diagrams and terminal diagrams and the installation of software insofar as this is necessary for commissioning.	Planners, configuration engineers
Device information	Installation Instructions	All relevant information on setting up, installing and cabling, as well as the required dimensional drawings and circuit diagrams	Installation personnel, commissioning engineers, service and maintenance personnel
Basic information	Operating instructions	Comprehensive collection of all information necessary for the safe operation of products, plant/system parts and complete plants (IEC 82079)	Machine operators, plant operators
	Compact instructions	Essential contents of the operating instructions in a reduced and condensed form	Machine operators, plant operators
	Product Information	Information that only becomes known shortly before or even after start of delivery and is therefore not included in the associated user documentation	Planners, configuration engineers, technologists, installation personnel, constructors; commissioning engineers, machine operators, programmers, service and maintenance personnel
	Online help	Instructions for configuring, programming, and commissioning	Configuration engineers, programmers, commissioning engineers

[1)] Not all documentation classes are available for every SIMOTICS / SIMOGEAR / SINAMICS product.

1.4 Documentation in the Internet

The manuals for the motors, gearboxes and geared motors are available here: SI web page (https://support.industry.siemens.com/cs/ww/en/view/109813641)

1.5 Service and support

1.5.1 Siemens Industry Online Support on the Web

Description

The following is available via Siemens Industry Online Support (https://support.industry.siemens.com/cs/ww/en/), among others:

- Product support
- Global forum for information and best practice sharing between users and specialists
- Local contact persons via the contact person database (→ Contact)
- Information about field services, repairs, spare parts, and much more (→ Services)
- Search for product info
- Important topics at a glance
- FAQs (frequently asked questions)
- Application examples
- Manuals
- Downloads
- Compatibility tool
- Newsletters with information about your products
- Catalogs/brochures

1.5.2 Siemens Industry Online Support on the road

Description

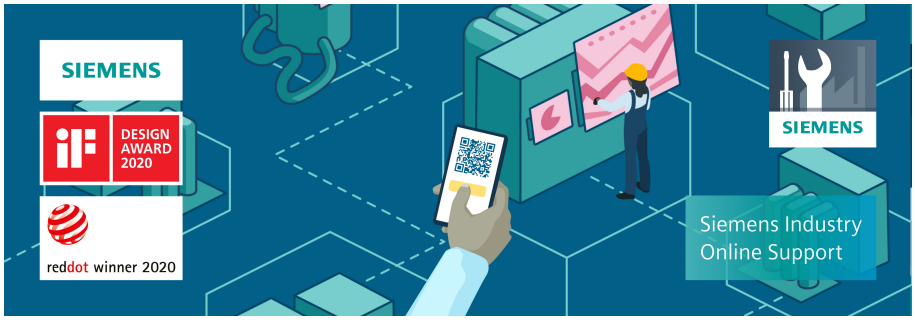


Figure 1-1 "Siemens Industry Online Support" app

The "Industry Online Support" app supports you in the following areas, for example:

- Resolving problems when executing a project
- Troubleshooting when faults develop
- Expanding a system or planning a new system

Furthermore, you have access to the Technical Forum and other articles that our experts have drawn up:

- FAQs
- Application examples
- Manuals
- Certificates
- Product announcements and much more

There is a Data Matrix code on the nameplate of your product. You can obtain technical information about the device if you scan the code using the "Industry Online Support" app.

The app is available for Apple iOS and Android.

See also

App (https://support.industry.siemens.com/cs/ww/en/sc/2067)

1.5.3 Feedback on the technical documentation

Description

We welcome your questions, suggestions, and corrections for this technical documentation. Please use the "Provide feedback" link at the end of the entries in Siemens Industry Online Support.

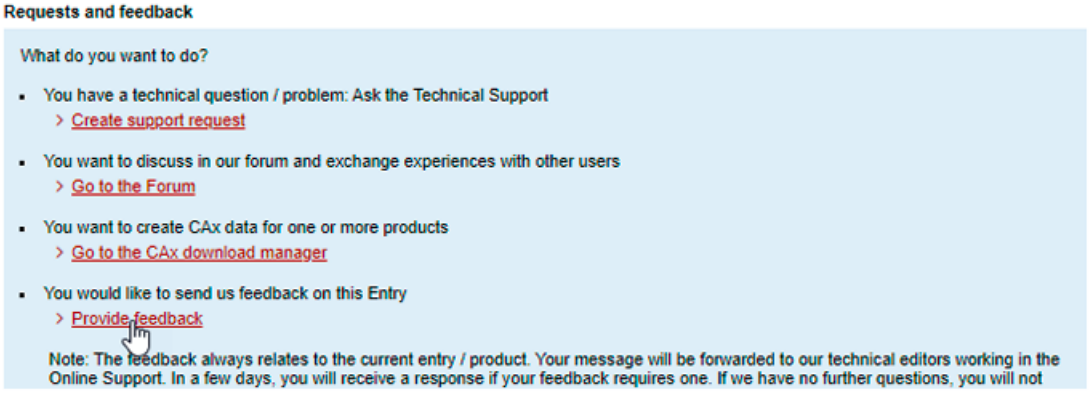


Figure 1-2 Requests and feedback

1.5.4 mySupport documentation

Description

With the "mySupport documentation" web-based system, you can compile your own individual documentation based on Siemens content and adapt this for your own machine documentation.

To start the application, click the "My Documentation" tile on the mySupport homepage (https://support.industry.siemens.com/cs/ww/en/my):

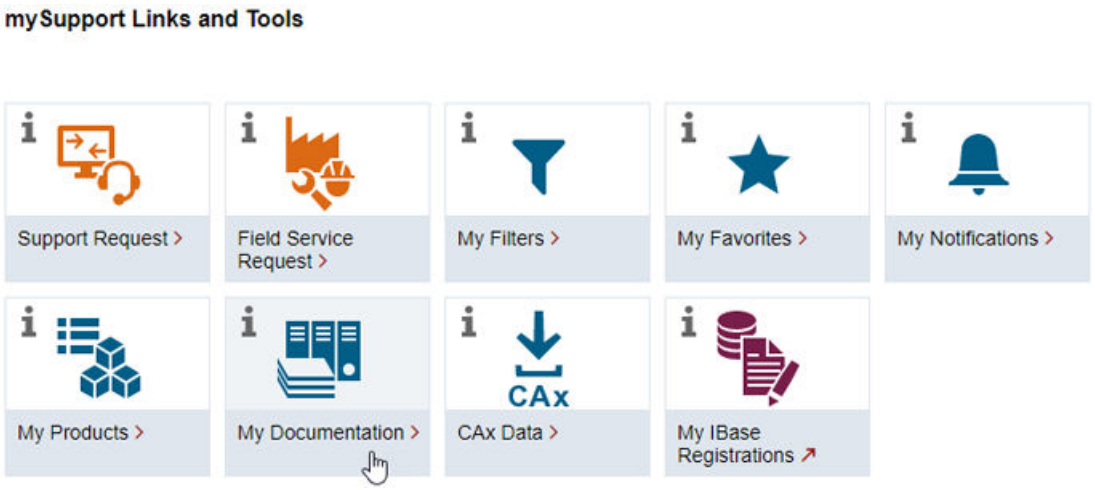


Figure 1-3 mySupport

The configured manual can be exported in the PDF or XML format.

Siemens content that supports the mySupport documentation can be identified by the "Configure" link.

1.5.5 Technical support

Description

Your routes to technical support (https://support.industry.siemens.com/cs/ww/en/sc/4868):

- Support Request (https://www.siemens.com/SupportRequest)
- Contact person database (https://www.automation.siemens.com/aspa_app)
- "Industry Online Support" mobile app

The Support Request is the most important input channel for questions relating to products from Siemens Industry. This will assign your request a unique ticket number for tracking purposes. The Support Request offers you:

- Direct access to technical experts
- Recommended solutions for various questions (e.g. FAQs)
- Status tracking of your requests

Technical support also assists you in some cases via remote support (https://support.industry.siemens.com/cs/de/en/view/106665159) to resolve your requests. A Support representative will assist you in diagnosing or resolving the problem through screen transfer.

More information on the Support service packages is available on the Internet via the following address (https://support.industry.siemens.com/cs/ww/en/sc/4869).

1.5.6 Training

Description

SITRAIN – Digital Industry Academy offers a comprehensive range of training courses on Siemens industrial products – directly from the manufacturer, for all industries and use cases, for all knowledge levels from beginner to expert.

More information can be found on the Internet via the following address (https://www.siemens.com/sitrain).

1.5.7 Spare parts services

Description

By using the online spare parts service "Spares on Web", you ensure the smooth operation of your product. The spare parts service is aimed at the following:

- Improved spare parts inventories by balancing stock and spare parts on call
- Minimized downtimes during a plant standstill
- Reduced costs

More information can be found on the Internet via the following address (https://www.sow.siemens.com).

1.6 Important product information

The 1PH8 three-phase motors are used as industrial drives for machine tools and production machines.

Based on seamless technology, 1PH8 motors can be used in conjunction with the SINAMICS S120 or G120 drive system (version PM 240) in a wide range of applications:

- Compact machine tools
- Complex machining centers and lathes
- Milling machines with full enclosure
- Milling spindles subject to high loads

- Counterspindles or power tools for turning machines
- Direct power tools with internal cooling
- Main drives in presses and extruders, converting applications
- Rotary axes in the paper and printing industry
- For use in crane systems (power house)
- Flying shears, coilers and winder drives
- Customized machines

⚠ 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. Comply with the separately added supplementary notes.
- 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. Take into consideration deviations regarding approvals or country-specific regulations.
- If you have any questions regarding the intended use, please contact your local sales partner.
- If you wish to use special versions and design variants, whose technical data differ from the motors described in this document, then first contact your local sales partner.

⚠ WARNING

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

Persons with active implants, for example cardiac pacemakers, standing close to the motors can be negatively affected, which could cause serious damage to their health or even death.

- 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 operation in covered areas under normal climatic conditions, such as those found in production environments.

See also

Classifying environmental conditions according to climate classes (Page 33)

Fundamental safety instructions

2

2.1 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.

- Only use screw inserts that exactly match the screw head.
- 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.
- Adjust the tools used regularly.

⚠ WARNING

Unexpected machine movement caused by radio devices or mobile phones

Using radio devices, cellphones, or mobile WLAN devices 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, cellphones or WLAN devices.
- 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 instructions for Safety Integrated

If you want to use Safety Integrated functions, you must observe the Safety instructions in the Safety Integrated documentation.

⚠ 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 "Important product information" 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 "Important product information" 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 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

Burns and thermal damage caused by hot surfaces

Temperatures above 100 °C may occur on the surfaces of motors, converters, and other drive components.

Touching hot surfaces may result in burns. Hot surfaces may damage or destroy temperature sensitive parts.

- Ensure that temperature-sensitive parts do not come into contact with hot surfaces.
- Mount drive components so that they are not accessible during operation.

Measures when maintenance is required:

- Allow drive components to cool off before starting any work.
- Use appropriate personnel protection equipment, e.g. gloves.

2.2 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).

2.3 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.

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/cert.

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.

2.4 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 integrator 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 faults and/or software errors in the sensors, control system, actuators, 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
7. Motors for use in potentially explosive areas:
   When moving components such as bearings become worn, this can cause enclosure components to exhibit unexpectedly high temperatures during operation, creating a hazard in areas with a potentially explosive atmosphere.

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

Motor description

3

3.1 Highlights and benefits

Overview

The SIMOTICS M-1PH8 motor series, referred to as 1PH8 in the following, is a motor generation developed for universal implementation in plants and machines with motion control applications. The motors are based on a flexible, modular principle and are available as induction, synchronous-reluctance and compact synchronous variants, with either forced ventilation or water cooling.

In comparison to the freely selectable performance of vector and servo control with the SINAMICS S120 drive system, it is possible to select between induction, synchronous-reluctance or synchronous variants in the case of the new SIMOTICS M-1PH8 motor series.

Thanks to this flexible interplay between converter and motor, it is now even easier to implement applications which involve

- extreme duty cycles,
- short rise times,
- high precision with respect to speed, torque and positioning.

The motors have been designed specifically for use in conjunction with the SINAMICS S120 drive system. Depending on the control requirements, appropriate encoder systems are available for the motors for sensing the motor speed and indirect position.

Encoder systems for C-axis operation are also available for machine tools.

1PH8 motors are available in two different cooling types:

- Forced ventilation
- Water cooling

SH 80 to SH 160
Forced ventilation



SH 80 to SH 160
Water cooling



SH 180 to SH 280
Water cooling



SH 180 to SH 225
Forced ventilation



SH 280
Forced ventilation



Highlights and benefits

- Wide power spectrum with low envelope dimensions
- Wide speed control ranges
- High degree of flexibility due to the choice of
  - Induction, synchronous-reluctance or synchronous version
  - Forced ventilation or water cooling
  - Solid or hollow shaft
  - Various bearing concepts
  - Different encoder types for speed control and precision positioning
- Outstanding performance characteristics
  - Maximum speeds up to 24,000 r/min
  - Minimal torque oscillations up to 10 µm
  - Excellent vibration magnitudes
  - High dynamic response (short ramp-up times)
- Low noise emission
- Simple and flexible connection system
- Commissioning with electronic type plate and DRIVE-CLiQ interface

3.2 Technical characteristics and environmental conditions

3.2.1 Directives and standards

The chapter lists the standards and directives that are applicable for the motor and which the motor complies with.

Standards that are complied with

Note

The standards listed in this manual are not dated.

You can take the currently relevant and valid dates from the Declaration of Conformity.

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 part, e.g. cannot be used for 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)

SIMOTICS motors comply 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 (EU) Regulation 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 (https://support.industry.siemens.com/cs/de/de/view/109769143)

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 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/de/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/de/de/view/109738670/en)

China Energy Label

Name of the standard	Minimum allowable values for energy efficiency and energy efficiency class of permanent-magnet synchronous motors (GB30253).
Date of entry into force	July 1, 2020
Affected motors	Permanent-magnet synchronous motors (without integrated brake) with a rated power of 0.55 kW to 90 kW and a rated speed of 500 r/min to 3000 r/min controlled from a converter with variable frequency on a line supply less than 1000 V.
Motor requirements	As of the implementation date of the guideline, all motors involved must have the "China Energy Label".
Affected Siemens products	The SIEMENS motors involved are subject to the requirements of Guideline GB30253.

Examples of the "China Energy Label" and the motor rating plate:

China Energy Label



Figure 3-1 ① Article number (diagram showing a typical 1PH8)

Motor rating plate

The specified "1PH8184-2DD0" motor only serves as representative of the 1PH8 motor list.

This explanation is provided to the left of the Chinese title (specified for Chinese custom authorities).



Figure 3-2 ② Article number of the basic motor type (example for a 1PH8)

The permissible motor list can then be called using button ③ at the bottom right.

The QR code on the China Energy Label includes a link to the listed motor folder.

Example: By clicking on the link http://elmm.bbqk.com/index.html?a=hb6zs (https://ela.bbqk.com/index.html?uid=hb6zs), a folder opens with all of the listed 1PH8 motors, shaft heights 180 and 225.

Note

The article number ① stated on the China Energy Label corresponds to the article number of the basic motor type ② (boldface type) in the motor article number.

UKCA - United Kingdom Conformity Assessed

The SIMOTICS motor series satisfies the conformity requirements for England, Wales and Scotland.

3.2.2 Technical features

The technical features specified in the tables below refer to basic 1PH8 motors and are applicable for induction, synchronous-reluctance and synchronous variants.

Depending on the electrical and mechanical configuration, it is possible to add options to the basic model in order to adapt it to a specific drive application (refer to Options, Selection and Ordering data).

Table 3-1 Forced ventilation

Insulation of the stator winding in accordance with EN 60034–1 (IEC 60034–1)	For an ambient temperature of up to 40 °C SH 80 to SH 280 temperature class 180 (H)	
Cooling in accordance with EN 60034-6 (IEC 60034-6)	Forced ventilation SH 80 ... SH 225: Fan mounted axially at NDE SH 280: Fan mounted radially at NDE	
Temperature monitoring	Temperature sensor in the stator winding SH 180 ... SH 280: Additional temperature sensor as a standby	
Fan supply voltage (see "Technical data")	SH 80: SH 100 ... SH 160: SH 180 ... SH 225: SH 280:	1 AC 230 V 50/60 Hz, 1 AC 265 V 60 Hz 3 AC 400 V, 50/60 Hz, 3 AC 480 V 60 Hz 1 AC 200 V ... 277 V, 50/60 Hz (EC fan) 3 AC 380 V ... 480 V, 50/60 Hz (EC fan)
Type in accordance with EN 60034-7 (IEC 60034-7)	SH 80: SH 100 ... SH 280:	IM B3, IM B5 IM B3, IM B5, IM B35
Degree of protection in accordance with EN 60034-5 (IEC 60034-5)	SH 80 ... SH 280: SH 180 ... SH 280:	IP55 IP23
Shaft extension at the drive end (DE) in accordance with DIN 748-3 (IEC 60072-1)	Plain shaft or feather key for full key or half-key balancing	
Shaft and flange accuracy in accordance with DIN 42955 (IEC 60072-1)[1)]	SH 80 ... SH 160 :SH 180 ... SH 280:	Tolerance R (reduced), SPECIAL[2)] Tolerance N (normal)
Vibration magnitudes in accordance with Siemens / EN 60034-14 (IEC 60034-14)	SH 80 ... SH 160 SH 180 ... SH 280	Level R/A, SPECIAL/B Level A

Sound pressure level in accordance with DIN EN ISO 1680, max. tolerance +3 dB, external fan 50 Hz	SH 80 ... SH 132:	70 dB at a rated pulse frequency of 4 kHz and a speed range up to 5000 r/min
	SH 160:	73 dB at a rated pulse frequency of 4 kHz and a speed range up to 5000 r/min
	SH 180 and SH 225:	73 dB at a rated pulse frequency of 2 kHz and a speed range: Forced ventilation (IP55) • SH180 to 5000 r/min • SH225 to 3500 r/min Open-circuit ventilation (IP23) • SH180 to 3000 r/min • SH225 to 2000 r/min
	SH 280	74 dB at a rated pulse frequency of 2 kHz and a speed range: up to 3300 r/min Forced ventilation (IP55) • SH280 to 3300 r/min Open-circuit ventilation (IP23) • SH280 to 2800 r/min
Bearing versions and maximum speeds	See Chapter "Mechanical properties of the motors"	
Encoder systems, built-in without DRIVE-CLiQ interface	• Absolute encoder EnDat 2048 S/R (AM2048 S/R encoder) • Incremental encoder sin/cos 1 Vpp 2048 S/R with C and D tracks (encoder IC2048S/R) • Incremental encoder sin/cos 1 Vpp 512 S/R without C and D tracks (encoder IN512S/R) • Incremental encoder sin/cos 1 Vpp 256 S/R without C and D track (encoder IN256S/R) • Incremental encoder HTL 1024 S/R (encoder HTL1024 S/R) • Incremental encoder HTL 2048 S/R (encoder HTL2048 S/R)	
Encoder systems, built-in with DRIVE-CLiQ interface	• Absolute encoder 22 bit singleturn + 12 bit multiturn (encoder AM22DQ) • Incremental encoder 22 bit with commutation position (encoder IC22DQ) • Incremental encoder 20 bit without commutation position (encoder IN20DQ) • Incremental encoder 19 bit without commutation position (encoder IN19DQ)	
Connection	Connector for signals or DRIVE-CLiQ interface (mating connector not included in scope of supply) SH 80 to SH 132: Terminal box NDE top / power connector SH 160 to SH 225: Terminal box NDE top SH 280: Terminal box NDE right	
Rating plate (adhesive label)	1x glued on the motor 1x supplied loose in the terminal box	
Paint finish	Standard paint finish anthracite RAL 7016	
Options	See Options and Selection and Ordering data	
Approvals, in accordance with	cURus	

1) Radial eccentricity of the shaft end, coaxiality of the centering wheel and axial eccentricity of the mounting flange with respect to the axis of the shaft end.

2) Applicable for "Performance", "High Performance" and "Premium Performance" versions

SH = Shaft Height
S/R = Signal/Revolution
DE = Drive End (motor drive end)
NDE = Non-Drive End (motor fan end)

Table 3-2 Water cooling

Insulation of the stator winding according to EN 60034–1 (IEC 60034–1)	For a coolant intake temperature of up to +30 °C SH 80 ... SH 280: Temperature class 180 (H)[3)]	
Cooling in accordance with EN 60034-6 (IEC 60034-6)	Water cooling max. Cooling water pressure at inlet: 6 bar connection thread at NDE (for additional data, see Chapter "Mechanical properties of the motors")	
Temperature monitoring	Temperature sensor in the stator winding SH 180 ... SH 280: Additional temperature sensor as a standby	
Type in accordance with EN 60034-7 (IEC 60034-7)	SH 80: SH 100 ... SH 280:	IM B3, IM B5 IM B3, IM B5, IM B35
Degree of protection in accordance with EN 60034-5 (IEC 60034-5)	SH 80 ... SH 160: SH 180 ... SH 280:	IP65 IP55
Shaft extension at the drive end (DE) in accordance with DIN 748-3 (IEC 60072-1)	Plain shaft or feather key for full key or half-key balancing	
Shaft and flange accuracy in accordance with DIN 42955 (IEC 60072-1)[1)]	SH 80 ... SH 160: SH 180 ... SH 280:	Tolerance R/A (reduced), SPECIAL[2)] Tolerance N (normal)
Vibration magnitudes in accordance with Siemens / EN 60034-14 (IEC 60034-14)	SH 80 ... SH 160 :SH 180 ... SH 280:	Level R/A, SPECIAL[2)] Level A
Sound pressure level in accordance with DIN EN ISO 1680, max. Tolerance +3 dB	SH 80 ... SH 132:	68 dB at a rated pulse frequency of 4 kHz and a speed range up to 5000 r/min
	SH 160:	69 dB at a rated pulse frequency of 4 kHz and a speed range up to 5000 r/min
	SH 180 and SH 225:	70 dB at a rated pulse frequency of 2 or 4 kHz and speed ranges: • SH 180 to 5000 r/min • SH 225 to 4500 r/min
	SH 280:	72 dB at a rated pulse frequency of 2 kHz and a speed range up to 3300 r/min
	(For further data, see Section "Mechanical properties of the motors")	
Bearing versions and maximum speeds	See Chapter "Mechanical properties of the motors"	

Encoder systems, built-in without DRIVE-CLiQ interface	• Absolute encoder EnDat 2048 S/R (AM2048 S/R encoder) • Incremental encoder sin/cos 1 Vpp 2048 S/R with C and D tracks (encoder IC2048S/R) • Incremental encoder sin/cos 1 Vpp 512 S/R without C and D tracks (encoder IN512S/R) • Incremental encoder sin/cos 1 Vpp 256 S/R without C and D track (encoder IN256S/R) • Incremental encoder HTL 1024 S/R (encoder HTL1024 S/R) • Incremental encoder HTL 2048 S/R (encoder HTL2048 S/R)
Encoder systems, built-in with DRIVE-CLiQ interface	• Absolute encoder 22 bit singleturn + 12 bit multiturn (encoder AM22DQ) • Incremental encoder 22 bit with commutation position (encoder IC22DQ) • Incremental encoder 20 bit without commutation position (encoder IN20DQ) • Incremental encoder 19 bit without commutation position (encoder IN19DQ)
Connection	Connector for signals or DRIVE-CLiQ interface (mating connector not included in scope of supply) SH 80 ... SH 132: Terminal box NDE top / power connector SH 160 ... SH 280: Terminal box NDE top
Rating plate (adhesive label)	1x glued on the motor 1x supplied loose in the terminal box
Paint finish	Standard paint finish anthracite RAL 7016
Options	See Options and Selection and Ordering data
Approvals, in accordance with	cURus

1) Radial eccentricity of the shaft end, coaxiality of the centering wheel and axial eccentricity of the mounting flange with respect to the axis of the shaft end.

2) Applicable for "Performance", "High Performance" and "Premium Performance" versions

3) Based on the design, the following motors have temperature class 155 (F):
1PH8107-1□F2
1PH8138-2
1PH8107-1□M2
1PH8164
1PH8166
1PH8168

SH = Shaft height

S/R = signals/revolution

DE = Drive End (motor drive side; A side of the motor)

NDE = Non Drive End (motor fan side; B side of the motor)

3.2.3 Classifying environmental conditions according to climate classes

You can classify the environmental conditions for stationary use at weather-protected locations according to standard DIN IEC 60721-3-3. The environmental parameters and their limit values are defined in various classes in this standard.

You can assign the SIMOTICS M-1PH8 main motors to climate class 3K4 with the exception of the environmental parameter "condensation". Condensation is not permissible.

The higher the last number in the climate class 3K□, the greater the requirements of the motor.

Table 3-3 **Environmental conditions are based on climate class 3K4**

Environmental parameter		Unit	3K4 class
a)	Low air temperature	°C	+ 5
b)	High air temperature	°C	+ 40
c)	Low relative humidity	%	5
d)	High relative humidity	%	95
e)	Low absolute humidity	g/m^3	1
f)	High absolute humidity	g/m^3	29
g)	Rate of temperature change[1)]	°C/min	0.5
h)	Low air pressure	kPa	70
i)	High air pressure	kPa	106
j)	Solar radiation[3)]	W/m^2	700
k)	Thermal radiation	-	[2)]
l)	Movement of the air	m/s	1.0
m)	Condensation	-	Not permissible
n)	Wind-driven precipitation (rain, snow, hail, etc.)	-	-
o)	Water (other than rain)	-	[2)]
p)	Formation of ice	-	-

1) *Averaged over a period of 5 min*

2) *See types of protection*

3) *In Central Europe, the midday sun stands at 60 ° to 65 ° and, in ideal weather conditions, shines with an irradiance of approx. 700 watts/square meter. In winter, the angles are only 13 ° to 18 ° and, even at noon, the irradiance is only approx. 247 watts/square meter.*

You will find additional data on the ambient conditions, such as ambient temperatures or conditions for transport and storage of the motors, in the relevant chapters of this documentation.

3.3 Derating factors

Derating for ambient/coolant temperature

Operation: T = -15 °C bis +40 °C (without restriction)
Under conditions other than those specified above (ambient temperature > 40 °C or installation altitude > 1000 m above sea level), the permissible torque/power reduction must be considered (see Chapter "Ambient/coolant temperature (Page 67)")

Derating for coolant inlet temperature

The motors are designed for operation up to a cooling water inlet temperature of +30 °C, provided that all of the specified motor data is complied with. If the inlet temperature of the cooling water deviates from this, the continuous torque will change (see Chapter "Cooling water inlet temperature (Page 71)").

Derating factors for power and signal cables

The current-carrying capacity of PVC/PUR-insulated copper cables is specified for cable installation types B1, B2, C and E under continuous operating conditions with reference to an ambient air temperature of 40° C. For other ambient temperatures, the corresponding derating factors must be considered (see Chapter "Derating factors for power and signal cables (Page 228)").

3.3.1 Reduction of the max. DC-link voltage

At installation altitudes of 2000 m above sea level or higher, the voltage stress on the motors must be reduced accordingly based on the table "Factors for reducing the maximum DC-link voltage" (reciprocal values from EN 60664-1 Table A. 2).

Table 3-4 Factors for reducing the maximum DC-link voltage

Installation altitude above sea level up to m	Factor
2000	1
3000	0.877
4000	0.775
5000	0.656
6000	0.588
7000	0.513
8000	0.444

As the DC link voltage is reduced, the converter output voltage also decreases. This reduces the working range in the torque-speed diagram.

You will find the torque-speed diagrams in this Chapter "Technical data."

Operation in a vacuum is not permissible because of the low dielectric strength and poor heat dissipation.

3.4 Selection and ordering data

The Article No. supplements specified in the tables below define the ordering logic for 1PH8 motors and apply to induction and synchronous motors.

The Article No. supplements are also in the catalogs. These supplements correspond to the technical selection and ordering data of these catalogs.

Supplementary to the information in the catalogs, the technical selection and ordering data are integrated in Chapter "Technical data and characteristics" of this Configuration Manual.

Depending on the electrical and mechanical configuration, Z options can be appended to the Article No. suffixes.

3.4.1 Article No. suffixes for shaft height 80 to 160

Descriptions	Data position in Article No.																			
	1	2	3	4	5	6	7	-	8	9	10	11	12	-	13	14	15	16	-	Z
	1	P	H	8																
Shaft height 80					0	8														
Shaft height 100					1	0														
Shaft height 132					1	3														
Shaft height 160					1	6														
Overall length (cannot be selected, determined by the choice of rated power)																				
Induction version									1											
Synchronous version (only shaft height 132 and 160)									2											
Encoder systems for Motors without a DRIVE-CLiQ interface	Without encoder [1]									A								2		
	Absolute encoder EnDat 2048 S/R (encoder AM2048S/R) [2]									E								2		
	Incremental encoder HTL 1024 S/R (encoder HTL1024S/R) [1] [3]									H								2		
	Incremental encoder HTL 2048 S/R (encoder HTL2048S/R) [1] [4]									J								2		
	Incremental encoder sin/cos 1 V_{pp} 2048 S/R with C and D tracks (encoder IC2048S/R) [2]									M								2		
	Incremental encoder sin/cos 1 V_{pp} 512 S/R without C and D tracks (encoder IN512S/R) [1] [5] [10]									T								2		
	Incremental encoder sin/cos 1 V_{pp} 256 S/R without C and D tracks (encoder IN256S/R) [1] [10]									C								2		
Encoder systems for Motors with DRIVE-CLiQ interfaces	Absolute encoder 22-bit- singleturn + 12-bit multiturn (encoder AM22DQ) [2]									F								1		
	Incremental encoder 22-bit with commutation position (encoder IC22DQ) [2]									D								1		
	Incremental encoder 20 bit without commutation position (encoder IN20DQ) [1] [5] [10]									U								1		
	Incremental encoder 19-bit without commutation position (encoder IN19DQ) [1] [10]									S								1		
Winding version	Rated speeds (3 AC 380 V to 480 V)	400 r/min, 500 r/min, 600 r/min, 700 r/min									B									
		1000 r/min, 1150 r/min, 1350 r/min, 1500 r/min									D									
		1500 r/min, 1750 r/min, 2000 r/min, 2200 r/min									F									
		2000 r/min, 2300 r/min, 2650 r/min, 2800 r/min									G									
		2500 r/min, 2800 r/min, 3000 r/min									L									
		3000 r/min, 3300 r/min, 3600 r/min, 3900 r/min									M									
		4500 r/min, 5000 r/min, 5500 r/min, 6000 r/min									N									

Descriptions		Data position in Article No.																			
		1	2	3	4	5	6	7	-	8	9	10	11	12	-	13	14	15	16	-	Z
	Star-delta connection [1] (3 AC 380 V to 480 V))				1500/4000 r/min, 2000/5000 r/min, 2500/6000 r/min							**S**									
Cooling	Forced ventilation DE -> NDE				(degree of protection IP 55)								**0**								
	Forced ventilation NDE -> DE				(degree of protection IP 55)								**1**								
	Water cooling				(degree of protection IP 65)								**2**								
Type of construction	IM B3 (IM V5, IM V6, IM B6, IM B7, IM B8)													**0**							
	IM B5 (IM V1, IM V3) [14]													**2**							
	IM B35 (IM V15, IM V35) [6]													**3**							
Shaft extension (DE)	**Balancing**																				
Plain shaft	---															**0**					
Fitted key [11]	Full-key															**1**					
Fitted key [11]	Half-key															**2**					
Plain hollow shaft [1] [10] [18]	---															**3**					
Bearings	**Vibration quality acc. to Siemens/EN 60034-14**				**Shaft and flange accuracy**																
Standard with location bearing [15]	R/A				R												**B**				
Standard with location bearing [15]	S/A				R												**C**				
Standard with location bearing [1] [15]	SR/A				R												**D**				
Standard [15]	R/A				R												**G**				
Standard [15]	S/A				R												**H**				
Increased radial forces [15] [17]	R/A				R												**F**				
Performance [7]	SPECIAL/B				SPECIAL												**L**				
High Performance [13]	SPECIAL/B				SPECIAL												**M**				
Advanced Lifetime [8] [15]	S/A				R												**Q**				
Power connection	**Cable entry**				**Signal connection (looking onto DE)**																
Terminal box (top)	Right				DE													**A**			
Terminal box (top)	Left				DE													**B**			
Terminal box (top)	NDE				Left													**C**			
Terminal box (top) [16]	DE				Left													**D**			
Power connector (top) [9] [12]	Right				DE													**E**			
Power connector (top) [9] [12]	Left				DE													**F**			

Descriptions		Data position in Article No.																			
		1	2	3	4	5	6	7	-	8	9	10	11	12	-	13	14	15	16	-	Z
Power connector (top) [9) 12)]	NDE				Left													G			
Power connector (top) [9) 12)]	DE				Left													H			
Version																					
Without a DRIVE-CLiQ interface, PT1000 temperature sensor in the stator winding																			2		
With a DRIVE-CLiQ interface																			1		
Special version (order codes are required for options)																					Z

1) Only possible if the 8th data position is "1" (induction version)

2) Limited to n_{max} = 12,000 r/min

3) Limited to n_{max} = 9000 r/min

4) Limited to n_{max} = 4600 r/min

5) Limited to n_{max} = 15,000 r/min

6) Only possible for shaft height 100, 132, and 160.

7) Only possible if 8th data position is "1" (induction version)
Shaft height 80: Limited to n_{max} = 15,000 r/min
shaft height 100: Limited to n_{max} = 12,000 r/min
shaft height 132: Limited to n_{max} = 10,000 r/min
shaft height 160: Limited to n_{max} = 9000 r/min, not possible if 12th data position is "2" (IM B5)

8) Limited to n_{max} = 5000 r/min, shaft height 132: n_{max} = 4500 r/min, shaft height 160: n_{max} = 4000 r/min

9) For a shaft height of 100, a power connector is only possible up to a maximum stall current of Io = 36 A,
for a shaft height of 132, a power connector is only possible up to a maximum stall current of Io = 85 A,
a power connector is not possible for shaft height 160

10) Only possible if 14th data position: L, M

11) Not possible if 14th data position: M

12) Not possible for motors in a star-delta (wye-delta) circuit if the 10th data position is "S"

13) Only possible if 8th data position is "1" (induction version)
Shaft height 80: Limited to n_{max} = 20,000 r/min
shaft height 100: Limited to n_{max} = 18,000 r/min
shaft height 132: Limited to n_{max} = 15,000 r/min
shaft height 160: Limited to n_{max} = 10,000 r/min, not possible if 12th data position is "2" (IM B5)

14) Not possible with shaft height 160 and 14th data position: L, M

15) Not possible if 9th data position: T, U

16) Not possible with shaft height 160 and 8th data position is "2" or "4" (synchronous version).

17) Limited to shaft height 100: n_{max} = 7000 r/min, shaft height 132: n_{max} = 6500 r/min, shaft height 160: n_{max} = 5300 r/min

18) Only possible for the 9th data position: A, C, and S

3.4.2 Article No. suffixes for SH 80 Premium Performance

Descriptions		Data position in Article No.																		
		1	2	3	4	5	6	7	-	8	9	10	11	12	-	13	14	15	16	-	Z
		1	**P**	**H**	**8**																
Shaft height 80						**0**	**8**														
Overall length								**1**													
								3													
								7													
Induction version										**1**											
Encoder systems for motors without a DRIVE-CLiQ interface	Incremental encoder sin/cos 1 V_{pp} 256 S/R without C and D tracks (encoder N256S/R)										**C**								**2**		
Encoder systems for motors with a DRIVE-CLiQ interface	Incremental encoder 19 bit without commutation position (encoder IN19DQ)										**S**								**1**		
Winding version	Rated speeds (3 AC 380 V to 480 V)											**T**									
												U									
												V									
												W									
Cooling	Forced ventilation DE -> NDE	(degree of protection IP 55)											**0**								
	Forced ventilation NDE -> DE	(degree of protection IP 55)											**1**								
	Water cooling	(degree of protection IP 65)											**2**								
Type of construction	IM B5 (IM V1, IM V3)													**2**							
Shaft extension (DE) [1]	**Balancing**																				
Plain shaft	---															**0**					
Plain hollow shaft [2]	---															**3**					
Bearings	**Vibration severity acc. to Siemens/EN 60034-14**	**Shaft and flange accuracy**																			
Premium Performance [3]	SPECIAL/B	SPECIAL															**N**				
Terminal box	**Cable entry**	**Signal connection**				**(looking onto DE)**															
Top	Right	DE																**A**			

Descriptions		**Data position in Article No.**																			
		1	**2**	**3**	**4**	**5**	**6**	**7**	**-**	**8**	**9**	**10**	**11**	**12**	**-**	**13**	**14**	**15**	**16**	**-**	**Z**
Top	Left	DE																**B**			
Top	NDE	Left																**C**			
Top	DE	Left																**D**			
Power connector	**Cable entry**	**Signal connection**				**(looking onto DE)**															
Top	Right	DE																**E**			
Top	Left	DE																**F**			
Top	NDE	Left																**G**			
Top	DE	Left																**H**			
Version																					
Without a DRIVE-CLiQ interface, PT1000 temperature sensor in the stator winding																			**2**		
With a DRIVE-CLiQ interface																			**1**		
Options for SH 80 Premium Performance:																					
Prepared for bearingless rotary unions																					**Y64**
Sealing air connection																					**Q12**
Flange for design IM B5 with 4 x M8 threaded holes																					**Q52**

1) Shaft end 24 mm x 50 mm (d x l)

2) Only possible in combination with option Y64.

3) For cooling the greased bearing (to lengthen bearing replacement intervals) and to protect against penetrating liquid, Option Q12 (sealing air connection) is recommended for the Premium Performance version.

3.4.3 Article No. supplements for SH 132 and 160, synchronous-reluctance

Descriptions	Data position of the order No.																			
	1	2	3	4	5	6	7	-	8	9	10	11	12	-	13	14	15	16	-	Z
	1	**P**	**H**	**8**																
Shaft height 132					**1**	**3**														
Shaft height 160					**1**	**6**														
Overall length (cannot be selected, determined by the choice of rated power)																				
Reluctance version Efficiency									**5**											
Reluctance version Performance									**7**											
Encoder systems for motors without a DRIVE-CLiQ interface — Without encoder										**A**								**2**		
Absolute encoder EnDat 2048 S/R (encoder AM2048S/R)										**E**								**2**		
Incremental encoder HTL 1024 S/R (encoder HTL1024S/R)										**H**								**2**		
Incremental encoder HTL 2048 S/R (encoder HTL2048S/R)										**J**								**2**		
Incremental encoder sin/cos 1 V_{pp} 2048 S/R with C and D track (encoder IC2048S/R)										**M**								**2**		
Encoder systems for motors with a DRIVE-CLiQ interface — Absolute encoder 22 bit singleturn + 12 bit multiturn (encoder AM22DQ)										**F**								**1**		
Incremental encoder 22 bit with commutation position (encoder IC22DQ)										**D**								**1**		
Winding version — Rated speeds (3 AC 380 V to 480 V) — 1000 r/min, 1150 r/min, 1350 r/min, 1500 r/min (only for forced ventilation)											**D**									
1500 r/min, 1750 r/min, 2000 r/min, 2200 r/min											**F**									
2000 r/min, 2300 r/min, 2650 r/min, 2800 r/min											**G**									
Cooling — Forced ventilation, DE-->NDE — (degree of protection IP 55)												**0**								
Forced ventilation, NDE-->DE — (degree of protection IP 55)												**1**								
Water cooling — (degree of protection IP 65)												**2**								
Type of construction — IM B3 (IM V5, IM V6, IM B6, IM B7, IM B8)													**0**							
IM B5 (IM V1, IM V3)													**2**							
IM B35 (IM V15, IM V35)													**3**							
Shaft extension (DE) — **Balancing**																				
Plain shaft — ---															**0**					
Fitted key — Full-key															**1**					
Fitted key — Half-key															**2**					

Descriptions		**Data position of the order No.**																		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**-**	**8**	**9**	**10**	**11**	**12**	**-**	**13**	**14**	**15**	**16**	**-**	**Z**
Bearings	**Vibration severity acc. to Siemens/EN 60034-14**		**Shaft and flange accuracy**																	
Standard with locating bearing	R/A		R														**B**			
Standard with locating bearing	S/A		R														**C**			
Standard with locating bearing	SR/A		R														**D**			
Increased radial forces	R/A		R														**F**			
Power connection	**Cable entry**		**Signal connection**					**(looking onto DE)**												
Terminal box (top)	Right		DE															**A**		
Terminal box (top)	Left		DE															**B**		
Terminal box (top)	NDE		Left															**C**		
Terminal box (top) [1]	DE		Left															**D**		
Version																				
With a DRIVE-CLiQ interface																			**1**	
Without a DRIVE-CLiQ interface, PT1000 temperature sensor in the stator winding																			**2**	
Special version (order codes are required for options)																				**Z**

1) Not possible for gk874 terminal boxes (1PH816 and 1PH8138-xxG2x)

3.4.4 Article No. suffixes for SH 180 to 280

Descriptions			Data position of the order No.																			
			1	2	3	4	5	6	7	-	8	9	10	11	12	-	13	14	15	16	-	Z
			1	P	H	8																
Shaft height 180							1	8														
Shaft height 225							2	2														
Shaft height 280 (only induction version and water cooling)							2	8														
Overall length (cannot be selected, determined by the choice of rated power)																						
Induction version											1											
Synchronous version											2											
Encoder systems for motors without a DRIVE-CLiQ interface	Without encoder [1]											A								2		
	Absolute encoder EnDat 2048 S/R (encoder AM2048S/R)											E								2		
	Incremental encoder HTL 1024 S/R (encoder HTL1024S/R) [1]											H								2		
	Incremental encoder HTL 2048 S/R (encoder HTL2048S/R) [1] [4]											J								2		
	Incremental encoder sin/cos 1 V_{pp} 2048 S/R with C and D track (encoder IC2048S/R)											M								2		
Encoder systems for motors with a DRIVE-CLiQ interface	Absolute encoder 22 bit singleturn + 12 bit multiturn (encoder AM22DQ)											F								1		
	Incremental encoder 22 bit with commutation position (encoder IC22DQ)											D								1		
Winding version	Rated speeds (3 AC 380 V to 480 V)	400 r/min, 500 r/min, 600 r/min, 700 r/min											B									
		700 r/min, 800 r/min, 1000 r/min, 1100 r/min											C									
		1000 r/min, 1150 r/min, 1350 r/min, 1500 r/min											D									
		1500 r/min, 1750 r/min, 2000 r/min, 2200 r/min											F									
		2500 r/min, 2900 r/min, 3200 (3400) r/min											L									
	Rated speeds (3 AC 690 V) for shaft height 280	400 r/min, 500 r/min											H									
		700 r/min, 800 r/min											K									
		1000 r/min, 1150 r/min											U									
		1500 r/min, 1750 r/min											W									
Cooling	Forced ventilation, DE-->NDE	(degree of protection IP 55)												0								
	Forced ventilation, NDE-->DE	(degree of protection IP 55)												1								
	Water cooling	(degree of protection IP 55)												2								

Descriptions		Data position of the order No.																			
		1	2	3	4	5	6	7	-	8	9	10	11	12	-	13	14	15	16	-	Z
	Open-circuit ventilation, DE-->NDE (for induction version only)				(degree of protection IP 23)								**3**								
	Open-circuit ventilation, NDE-->DE (induction version only)												**4**								
Type of construction	**Shaft height 180**		**Shaft height 225**					**Shaft height 280**													
	IM B3 (IM B6, IM B7, IM B8, IM V6)							IM B3 (IM V6)						**0**							
	IM V5							M V5 [9]						**1**							
	IM B5 with A450 flange (IM V3) [5]		IM B5 with A550 flange (IM V3) [6]					IM B5 with A660 flange (IM V3) [7] [9]						**2**							
	IM B35 with A450 flange (IM V35)		IM B35 with A550 flange (IM V35)					IM B35 with A660 flange (IM V35)						**3**							
	IM V15 with A450 flange		IM V15 with A550 flange					IM V15 with A660 flange						**5**							
Shaft extension (DE)	**Balancing**																				
Plain shaft	---															**0**					
Fitted key	Full-key															**1**					
Fitted key	Half-key															**2**					
Bearings	**Vibration severity acc. to Siemens/EN 60034-14**		**Shaft and flange accuracy**																		
Standard	A		N														**A**				
Standard	R/A		R														**B**				
Increased radial forces	A		N														**E**				
Increased radial forces	R/A		R														**F**				
Also possible for shaft heights 180 and 225:																					
Standard	S/A		R														**C**				
Standard [1]	SR/A		R														**D**				
Performance [1] [8]	SR/A		R														**L**				
Power connection	**Cable entry**		**Signal connection**					**(looking onto DE)**													
Terminal box (top)	Right		DE															**A**			
Terminal box (top)	Left		DE															**B**			
Terminal box (top)	NDE		Right															**C**			
Terminal box (top)	DE		Right															**D**			

Descriptions	Data position of the order No.																		
	1	2	3	4	5	6	7	-	8	9	10	11	12	-	13	14	15	16	-	Z
Version																				
Without a DRIVE-CLiQ interface, PT1000 temperature sensor in the stator winding																		**2**		
With a DRIVE-CLiQ interface																		**1**		
Special version (order codes are required for options)																				**Z**

1) Only possible if the 8th data position is "1" (induction version)

4) Limited to n_{max} = 4600 r/min

5) Limited to n_{max} = 3000 r/min, not possible if 14th data position is "L" (Performance).

6) Limited to n_{max} = 2500 r/min, not possible if 14th data position is "L" (Performance).

7) Limited to n_{max} = 2000 r/min

8) Only possible with shaft height 180: Limited to n_{max} = 7500 r/min,
not possible if the 12th data position is "2" (IM B5) and the 11th data position is "3" and "4" (open-circuit ventilation)
only possible for shaft height 225: Limited to n_{max} = 6000 r/min,
not possible if the 12th data position is "2" (IM B5) and the 11th data position is "3" and "4" (open-circuit ventilation)

9) Only possible if 14th data position is "A" or "B" (standard bearings)

3.4.5 Article No. suffixes for SH 280

Descriptions		Data position of the order No.																			
		1	2	3	4	5	6	7	-	8	9	10	11	12	-	13	14	15	16	-	Z
		1	P	H	8																
Shaft height 280 (forced ventilation and open-circuit ventilation)						2	8														
Overall length (cannot be selected, determined by the choice of rated power)																					
Induction version										1											
Encoder systems for motors without a DRIVE-CLiQ interface	Without encoder										A								2		
	Absolute encoder EnDat 2048 S/R (encoder AM2048S/R)										E								2		
	Incremental encoder HTL 1024 S/R (encoder HTL1024S/R)										H								2		
	Incremental encoder HTL 2048 S/R (encoder HTL2048S/R)										J								2		
	Incremental encoder sin/cos 1 V_{pp}, 2048 S/R with C and D track (encoder IC2048S/R)										M								2		
Encoder systems for motors with a DRIVE-CLiQ interface	Absolute encoder, 22-bit singleturn + 12-bit multiturn (encoder AM22DQ)										F								1		
	Incremental encoder, 22-bit, with commutation position (encoder IC22DQ)										D								1		
External encoder systems	Incremental encoder HTL 1024 S/R POG 22 (Baumer-Hübner), prepared for mounting [1]										G										
	Incremental encoder HTL 1024 S/R POG 10 (Baumer-Hübner), prepared for mounting [2]										K										
Winding version	Rated speeds (3 AC 380 V to 480 V)	400 r/min, 500 r/min, 600 r/min, 700 r/min										B									
		700 r/min, 800 r/min, 1000 r/min, 1100 r/min										C									
		1000 r/min, 1150 r/min, 1350 r/min, 1500 r/min										D									
		1500 r/min, 1750 r/min, 2000 r/min, 2200 r/min										F									
	Rated speeds (690 V 3 AC)	400 r/min, 500 r/min										H									
		700 r/min, 800 r/min										K									
		1000 r/min, 1150 r/min										U									
		1500 r/min, 1750 r/min										W									
Cooling	Forced ventilation	(degree of protection IP 55)											1								
	Forced ventilation	(open-circuit ventilation with degree of protection IP 23)											4								
Type of construction	IM B3 (IM V6)													0							
	IM V5 [6]													1							
	IM B5 with A660 flange (IM V3) [6]													2							
	IM B35 with A660 flange (IM V35)													3							
	IM V15 with A660 flange													5							

Descriptions		**Data position of the order No.**																			
		1	**2**	**3**	**4**	**5**	**6**	**7**	**-**	**8**	**9**	**10**	**11**	**12**	**-**	**13**	**14**	**15**	**16**	**-**	**Z**
Shaft extension (DE)	**Balancing**																				
Smooth shaft (without keyway)	---															**0**					
Fitted key	Full-key															**1**					
Fitted key	Half-key															**2**					
Bearings	**Vibration severity acc. to Siemens/EN 60034-14**	**Shaft and flange accuracy**																			
Standard	A	N															**A**				
Standard	R/A	R															**B**				
Increased radial forces	A	N															**E**				
Increased radial forces	R/A	R															**F**				
Power connection	**Cable entry**	**Signal connection**				**External fan**															
Terminal box NDE right	Bottom	DE																**U**			
						NDE top, air inlet from NDE, air-flow direction NDE-->DE															---
						NDE left, air inlet from NDE, air-flow direction NDE-->DE															**G00**
Terminal box NDE left	Bottom	DE																**V**			
						NDE top, air inlet from NDE, air-flow direction NDE-->DE															---
						NDE right, air inlet from NDE, air-flow direction NDE-->DE															**G02**
Terminal box NDE top	Right	DE																**W**			
						NDE left, air inlet from NDE, air-flow direction NDE-->DE															**G00**
						NDE right, air inlet from NDE, air-flow direction NDE-->DE															**G02**
Terminal box DE top [4]	Right	NDE																**X**			
						NDE top, air inlet from NDE, air-flow direction NDE-->DE [4] [5]															---
						NDE left, air inlet from NDE, air-flow direction NDE-->DE [4]															**G00**
						NDE right, air inlet from NDE, air-flow direction NDE-->DE [4]															**G02**
Version																					
Without a DRIVE-CLiQ interface, PT1000 temperature sensor in the stator winding																			**2**		
With a DRIVE-CLiQ interface																			**1**		
For other versions, see options																					**Z**

1) When ordering, also select option H75

2) When ordering, also select options H56 or G80

4) Only possible if 12th data position is "0" (IM B3) and "1" (IM V5).

5) Only possible for assignments with terminal box 1XB7712-P..

6) Only possible if 14th data position is "A" and "B" (standard bearings); n_{max} limited to 2000 r/min

7) Only possible for the following combinations:

12th data position is "0" or "1" if 15th data position is "W" or "X"

12th data position is "2," "3," or "5" if 15th data position "W"

3.4.6 Article No. supplement for shaft height 80 to 160 + holding brake DE

Descriptions		Data position of the order No.																		
		1	2	3	4	5	6	7	-	8	9	10	11	12	-	13	14	15	16	-	Z
		1	P	H	8																
Shaft height 80						0	8														
Shaft height 100						1	0														
Shaft height 132						1	3														
Shaft height 160						1	6														
Overall length (cannot be selected, determined by the choice of rated power)																					
Induction version with holding brake [1]										3											
Synchronous version with holding brake (only shaft heights 132 and 160) [1]										4											
Encoder systems for motors without a DRIVE-CLiQ interface	without encoder [2]										A								2		
	Absolute encoder EnDat 2048 S/R (encoder AM2048S/R)										E								2		
	Incremental encoder HTL 1024 S/R (encoder HTL1024S/R) [2]										H								2		
	Incremental encoder HTL 2048 S/R (encoder HTL2048S/R) [2]										J								2		
	Incremental encoder sin/cos 1 V_{pp}, 2048 S/R with C and D track (encoder IC2048S/R)										M								2		
Encoder systems for motors with a DRIVE-CLiQ interface	Absolute encoder, 22-bit singleturn + 12-bit multiturn (encoder AM22DQ)										F								1		
	Incremental encoder, 22-bit, with commutation position (encoder IC22DQ)										D								1		
Winding version																					
Cooling	Forced ventilation DE -> NDE	(degree of protection IP 55)											0								
	Forced ventilation NDE -> DE	(degree of protection IP 55)											1								
	Water cooling	(degree of protection **IP 55**) [4]											2								
Type of construction	IM B5 (IM V1, IM V3) [5]													2							
	IM B35 (IM V15, IM V35) [8]													3							
Shaft extension (DE)	**Balancing**																				
Smooth shaft (without keyway)	---															0					
Fitted key	Half-key															2					
Bearings	**Vibration severity acc. to**	**Shaft and**																			

Descriptions		Data position of the order No.																					
		1	2	3	4	5	6	7	-	8	9	10	11	12	-	13	14	15	16	-	Z
	Siemens/EN 60034-14	**flange accuracy**																			
Standard	A	N															**A**				
Advanced Life-time	A	N															**P**				
Power connection [6]	**Cable entry**	**Signal connection**				**(looking onto DE)**															
Terminal box (top)	Right	DE																**A**			
Terminal box (top)	Left	DE																**B**			
Terminal box (top)	NDE	Left																**C**			
Terminal box (top) [10]	DE	Left																**D**			
Power connector (top) [3] [7]	Right	DE																**E**			
Power connector (top) [3] [7]	Left	DE																**F**			
Power connector (top) [3] [7]	NDE	Left																**G**			
Power connector (top) [3] [7]	DE	Left																**H**			
Version																					
Without a DRIVE-CLiQ interface, PT1000 temperature sensor in the stator winding																			**2**		
With a DRIVE-CLiQ interface																			**1**		
Brake versions:																					
Brake supply voltage 230 V 1 AC, 50/60 Hz	Holding brake DE																			**U60**	
	Holding brake DE with microswitch																			**U61**	
	Holding brake DE with manual brake release lever																			**U62**	
	Holding brake DE with microswitch and manual brake release lever																			**U63**	
Brake supply voltage 24 V DC	Holding brake DE																			**U65**	
	Holding brake DE with microswitch																			**U66**	
	Holding brake DE with manual brake release lever																			**U67**	
	Holding brake DE with microswitch and manual brake release lever																			**U68**	
Z options that cannot be combined with holding brake DE: K18, V91, M03, M39																					

1) A U option must also be stated in the order to specify the holding brake version.
Shaft height 80: limited to n_{max} = 5000 r/min
Shaft height 100: limited to n_{max} = 5000 r/min
Shaft height 132: limited to n_{max} = 4500 r/min
Shaft height 160: limited to n_{max} = 4000 r/min

2) Only possible if 8th data position is "3" (induction version)

4) With holding brake, degree of protection is limited to IP55.

5) Not possible with shaft height 160.

6) A holding brake can only be connected via a terminal box (top).
7) Power connector for motor only (not with holding brake):
Power connector for shaft height 100 only possible up to a maximum stall current of Io = 36 A.
Power connector for shaft height 132 only possible up to a maximum stall current of Io = 85 A.
Power connector not possible for shaft height 160
8) Not possible for shaft height 80
9) Only possible if 15th data position: A and B
10) Not possible with shaft height 160 and 8th data position is "4" (synchronous version)

3.4.7 Article No. supplement for SH 132 and 160, synchronous-reluctance + holding brake

Descriptions		Data position of the order No.																			
		1	2	3	4	5	6	7	-	8	9	10	11	12	-	13	14	15	16	-	Z
		1	**P**	**H**	**8**																
Shaft height 132						**1**	**3**														
Shaft height 160						**1**	**6**														
Overall length (cannot be selected, determined by the choice of rated power)																					
Reluctance version Efficiency with holding brake										**6**											
Reluctance version Performance with holding brake										**8**											
Encoder systems for motors without a DRIVE-CLiQ interface	Without encoder										**A**								2		
	Absolute encoder EnDat 2048 S/R (encoder AM2048S/R)										**E**								2		
	Incremental encoder HTL 1024 S/R (encoder HTL1024S/R)										**H**								2		
	Incremental encoder HTL 2048 S/R (encoder HTL2048S/R)										**J**								2		
	Incremental encoder sin/cos 1 V_{pp}, 2048 S/R with C and D track (encoder IC2048S/R)										**M**								2		
Encoder systems for motors with a DRIVE-CLiQ interface	Absolute encoder, 22-bit singleturn + 12-bit multiturn (encoder AM22DQ)										**F**								**1**		
	Incremental encoder, 22-bit, with commutation position (encoder IC22DQ)										**D**								**1**		
Winding version	Rated speeds (3 AC 380 V to 480 V)	1000 r/min, 1150 r/min, 1350 r/min, 1500 r/min (only for forced ventilation)										**D**									
		1500 r/min, 1750 r/min, 2000 r/min, 2200 r/min										**F**									
		2000 r/min, 2300 r/min, 2650 r/min, 2800 r/min										**G**									
Cooling	Forced ventilation DE -> NDE	(degree of protection IP 55)											**0**								
	Forced ventilation NDE -> DE	(degree of protection IP 55)											**1**								
	Water cooling	(degree of protection **IP 55**)											**2**								
Type of construction	IM B5 (IM V1, IM V3)	(not possible for shaft height 160)												**2**							
	IM B35 (IM V15, IM V35)													**3**							
Shaft extension (DE)	**Balancing**																				
Smooth shaft (without keyway)	---															**0**					
Fitted key	Half-key															**2**					
Bearings	**Vibration severity acc. to**	**Shaft and**																			

Descriptions		**Data position of the order No.**																			
		1	**2**	**3**	**4**	**5**	**6**	**7**	**-**	**8**	**9**	**10**	**11**	**12**	**-**	**13**	**14**	**15**	**16**	**-**	**Z**
	Siemens/EN 60034-14	**flange accuracy**																			
Standard	A	N															**A**				
Power connection	**Cable entry**	**Signal connection**				**(looking onto DE)**															
Terminal box (top)	Right	DE																**A**			
Terminal box (top)	Left	DE																**B**			
Terminal box (top)	NDE	Left																**C**			
Terminal box (top) [1]	DE	Left																**D**			
Version																					
With a DRIVE-CLiQ interface																			**1**		
Without a DRIVE-CLiQ interface, PT1000 temperature sensor in the stator winding																			**2**		
Special version (order codes are required for options)																					**Z**

1) Not possible for gk874 terminal boxes (1PH816 and 1PH8138-xxG2x)

3.4.8 Article No. supplements for SH 180 to 225 + holding brake

Descriptions		Data position of the order No.																	
		1	2	3	4	5	6	7	-	8	9	10	11	12	-	13	14	15	16	-	Z
		1	P	H	8																
Shaft height 180						1	8														
Shaft height 225						2	2														
Overall length																					
Induction version with holding brake [1]										3											
Synchronous version with holding brake [1]										4											
Encoder systems for motors without a DRIVE-CLiQ interface	without encoder [2]										A								2		
	Absolute encoder EnDat 2048 S/R (encoder AM2048S/R)										E								2		
	Incremental encoder HTL 1024 S/R (encoder HTL1024S/R) [2]										H								2		
	Incremental encoder HTL 2048 S/R (encoder HTL2048S/R) [2]										J								2		
	Incremental encoder sin/cos 1 V_{pp}, 2048 S/R with C and D track (encoder IC2048S/R)										M								2		
Encoder systems for motors with a DRIVE-CLiQ interface	Absolute encoder, 22-bit singleturn + 12-bit multiturn (encoder AM22DQ)										F								1		
	Incremental encoder, 22-bit, with commutation position (encoder IC22DQ)										D								1		
Winding version																					
Cooling	Forced ventilation, DE-->NDE	(degree of protection IP 55)											0								
	Forced ventilation, NDE-->DE	(degree of protection IP 55)											1								
	Water cooling	(degree of protection IP 55)											2								
	Open-circuit ventilation, NDE-->DE (induction version only)	(degree of protection IP 23)											4								
Type of construction	IM B3 (IM B6, IM B7, IM B8)													0							
Shaft extension (DE)	**Balancing**																				
Fitted key	Half-key															2					
Bearings	**Vibration severity acc. to Siemens/EN 60034-14**	**Shaft and flange accuracy**																			
Standard	A	N															A				
Power connection [3]	**Cable entry**	**Signal connection**	**(looking onto DE)**																		

Descriptions		Data position of the order No.																			
		1	2	3	4	5	6	7	-	8	9	10	11	12	-	13	14	15	16	-	Z
Terminal box (top)	Right	DE																**A**			
Terminal box (top)	Left	DE																**B**			
Terminal box (top)	NDE	Right																**C**			
Terminal box (top)	DE	Right																**D**			
Version																					
Without a DRIVE-CLiQ interface, PT1000 temperature sensor in the stator winding																			**2**		
With a DRIVE-CLiQ interface																			**1**		
Brake versions:																					
Brake supply voltage 230 V 1 AC, 50/60 Hz		Holding brake DE with microswitch and manual brake release lever																			**U63**
Z options that cannot be combined with holding brake DE: K18, K90, L03, V92, M39																					

1) A U option must also be stated in the order to specify the holding brake version.
   Shaft height 180: limited to n_{max} = 3500 r/min
   Shaft height 225: limited to n_{max} = 3100 r/min
2) Only possible if 8th data position is "3" (induction version)
3) A holding brake can only be connected via a brake terminal box (top).

3.4.9 Options

Order code	Option description	For use with motors "✓" = Option possible, "---" = Option not possible		
	When ordering a motor with options, add a -Z to the order number. Specify the order code for every option required. For order codes, avoid repeating the order codes in text form in the order.	**Shaft height 80 to 160**	**Shaft height 180 to 280**	**Shaft height 280 For forced ventilation only (11th data position is "1" or "4")**
A12	Additional PTC thermistor circuit for alarm and trip (only possible for version with terminal box)	✓	✓	✓
A25	Additional temperature sensor as reserve connected to signal terminal strip (only possible for version with terminal box)	✓	Standard	Standard
A72	2 PT100 resistance thermometers for bearing temperature monitoring (DE and NDE)	---	✓	✓
B02	Factory test certificate in accordance with EN 10204 2.3 (for motor ordered)	✓	Standard	Standard

Order code	Option description	For use with motors "✓" = Option possible, "---" = Option not possible		
	When ordering a motor with options, add a -Z to the order number. Specify the order code for every option required. For order codes, avoid repeating the order codes in text form in the order.	**Shaft height 80 to 160**	**Shaft height 180 to 280**	**Shaft height 280 For forced ventilation only (11th data position is "1" or "4")**
B35	Factory test certificate for vibration log	✓	✓ 5)	✓ 5)
B36	Factory test certificate for run-out log	✓	Only for SH 180 and SH 225	---
G00	External fan NDE left, air inlet at NDE (possible if 15th data position is U, W, or X)	---	---	✓
G02	External fan NDE right, air inlet at NDE (possible if 15th data position is V, W, or X)	---	---	✓
G06	External fan DE left, air inlet NDE (possible if 11th position =1 and 15th position = U, V, or W; possible if 11th position =4 and 15th position = W)	---	---	✓
G07	External fan DE left, air inlet DE (possible if 11th position =1 and 15th position = U, V, or W; possible if 11th position =4 and 15th position = W)	---	---	✓
G08	External fan DE right, air inlet NDE (possible if 11th position =1 and 15th position = U, V, or W; possible if 11th position =4 and 15th position = W)	---	---	✓
G09	External fan DE right, air inlet DE (possible if 11th position =1 and 15th position = U, V, or W; possible if 11th position =4 and 15th position = W)	---	---	✓
G11	External fan DE top, air inlet DE (possible if 11th position =1 and 15th position = U, V, or W; possible if 11th position =4 and 15th position = W)	---	---	✓
G14	With external fan (only possible if 11th data position is "1" or "4")	Only for SH 132 and SH 160	✓	✓
G50	Nipple for SPM, with M8 adapter	---	✓	✓
G80	Mounting of a POG 10 incremental encoder supplied by customer (possible if 9th data position is "K")	---	---	✓
H56	Mounting an incremental encoder POG 10 D 1024 (encoder HTL1024S/R) (possible if the 9th data position is "K")	---	---	✓
H75	Mounting of a hollow shaft encoder HOG 22 supplied by the customer (possible if the 9th data position is "G")	---	---	✓
K08	Encoder connection or DRIVE-CLiQ mounted on the opposite side (not possible if 15th data position is "X")	---	✓	✓

Order code	Option description	For use with motors "✓" = Option possible, "---" = Option not possible		
	When ordering a motor with options, add a -Z to the order number. Specify the order code for every option required. For order codes, avoid repeating the order codes in text form in the order.	**Shaft height 80 to 160**	**Shaft height 180 to 280**	**Shaft height 280 For forced ventilation only (11th data position is "1" or "4")**
K09	Terminal box or power connector NDE right	Only for SH 100 [1] to SH 160	---	---
	Terminal box NDE right, cable entry DE, signal connection top (possible if the 15th data position is "A")	---	✓	---
K10	Terminal box or power connector NDE left	Only for SH 100 [1] to SH 160	---	---
	Terminal box NDE left, cable entry DE, signal connection top (possible if the 15th data position is "A")	---	✓	---
K16	Second shaft extension (d x l: 95 mm x 170 mm) (possible if the 9th data position is "A" or "G" and 12th data position is "0" or "3")	---	---	✓
K17	Labyrinth seal DE for Performance version (14th data position "L")	---	Only for SH 180	---
K18	Radial shaft sealing ring DE [2]	✓	✓	---
K40	Regreasing system, DE and NDE	---	Only for SH 180 and SH 225	Standard
K45	AC 230 V anti-condensation heating	---	✓	✓
K69	Prepared for pipe connection NDE right (only possible for forced ventilation, not for G00 to G11)	---	---	✓
K70	Prepared for pipe connection NDE left (only possible for forced ventilation, not for G00 to G11)	---	---	✓
K71	Prepared for pipe connection NDE top (only possible for forced ventilation, not for G00 to G11)	---	---	✓
K80	Axial pipe connection NDE (only possible with forced ventilation)	---	Only for SH 180 and SH 225	Options K69, K70, K71
K83	Rotation of the terminal box through +90 degrees (possible in combination with option K09 or K10 or if the 15th data position is "U", "V" or "W")	---	✓ [4]	✓
K84	Rotation of the terminal box through -90 degrees (possible in combination with option K09 or K10 or if the 15th data position is "U", "V", "W" or "X")	---	✓ [4]	✓
K85	Rotation of the terminal box through +180 degrees (possible in combination with option K09 or K10 or if the 15th data position is "U", "V", "W" or "X")	---	✓	✓

Order code	Option description	For use with motors "✓" = Option possible, "---" = Option not possible		
	When ordering a motor with options, add a -Z to the order number. Specify the order code for every option required. For order codes, avoid repeating the order codes in text form in the order.	**Shaft height 80 to 160**	**Shaft height 180 to 280**	**Shaft height 280 For forced ventilation only (11th data position is "1" or "4")**
K90	Version with flange size A400 (possible if 12th data position is "2", "3" or "5")	---	Only for SH 180	---
L00	Replace terminal box (standard) with the next largest terminal box (note dimension implications in the SPC)	---	✓	✓
L03	Increased resistance to vibration	---	Only for SH 180 and SH 225	---
L12	Condensation drain hole	---	Standard for water cooling	Only if the 11th data position is "1"
L27	NDE bearing in insulated version	---	Only for SH 180	Standard
L29	Enhanced corrosion protection for installation in industrial/marine climates	---	---	✓
L72	Shaft made of special steel (note: option results in longer delivery times)	---	---	✓
L74	Fan version in IP65 degree of protection [3)]	✓	---	---
L76	EC fan 3 AC 400 V 50/60 Hz	---	Only for SH 180 and SH 225	---
M03	Version for potentially explosive atmospheres Zone 2	Only for SH 100 to SH 160	---	---
M39	Version for potentially explosive atmospheres Zone 22	Only for SH 100 to SH 160	Only for SH 180 and SH 225	---
M83	Additional back-off thread on motor feet (only possible if 12th data position is "0" or "3")	---	---	✓
P00	Undrilled cable entry plate	---	✓	Not for 1XB7820-P00
P01	Cable entry plate 3 x M63 x 1.5	---	Only for 1XB7700-P02 1XB7712-P03	Only for 1XB7712-P03
P02	Cable entry plate 3 x M75 x 1.5	---	Only for 1XB7712-P03	Only for 1XB7712-P01 1XB7712-P03
P03	Cable entry plate 4 x M75 x 1.5	---	---	Only for 1XB7712-P01

Order code	Option description	For use with motors "✓" = Option possible, "---" = Option not possible		
	When ordering a motor with options, add a -Z to the order number. Specify the order code for every option required. For order codes, avoid repeating the order codes in text form in the order.	**Shaft height 80 to 160**	**Shaft height 180 to 280**	**Shaft height 280 For forced ventilation only (11th data position is "1" or "4")**
P04	Cable entry plate 4 x M63 x 1.5	---	Only for 1XB7712-P03	Only for 1XB7712-P01 1XB7712-P03
Q00	Increase number of grounding terminals in the terminal box	---	---	✓
Q12	Sealing air connection	✓	---	---
Q21	Screw locked with Loctite	---	✓	⇓
Q25	Q25 fan connection NDE or at the top with M16x1.5	Only for SH 100 to SH 160	---	---
Q31	Metal nameplate instead of adhesive label	✓	✓	✓
Q52	Flange for design IM B5 with 4 x M8 threaded holes (only possible when 14th data position is "N")	Only for SH 80	---	---
Q81	Increased bearing preloading (only possible if the 14th data position "B", "C" and "D")	✓	---	---
U60	230 V holding brake	✓	---	---
U61	230 V holding brake with micro-switch	✓	---	---
U62	230 V holding brake with manual brake release lever	✓	---	---
U63	230 V holding brake with micro-switch and manual brake release lever	✓	Only for SH 180 and SH 225	---
U65	24 V DC holding brake	✓	---	---
U66	24 V DC holding brake with microswitch	✓	---	---
U67	24 V DC holding brake with manual brake release lever	✓	---	---
U68	24 V DC holding brake with micro-switch and manual brake release lever	✓	---	---
V90	1PH7-compatible shaft extension (d x l: 42 mm x 110 mm) (reduced radial forces must be observed; only possible if the 8th data position is "1" or "3")	Only for SH 132	---	---
V91	1FT6-compatible shaft extension (d x l: 48 mm x 82 mm) (only possible for 8th data position is "2")	Only for SH 132	---	---
V92	1PH7184-/1PL6184-compatible shaft extension (d x l: 60 mm x 140 mm) (possible if the 8th data position is "1")	---	Only for 1PH8184	---
Y64	Hollow shaft prepared for bearingless rotary unions with flange diameter 114H6	✓	---	---
Y82	Extra nameplate with customer specifications (plain text required)	---	✓	✓
Y84	Customer specifications on nameplate (max. 30 characters)	✓	✓	✓
---	**Paint finish anthracite RAL 7016**	Standard	Standard	Standard

Order code	Option description	For use with motors "✓" = Option possible, "---" = Option not possible		
	When ordering a motor with options, add a -Z to the order number. Specify the order code for every option required. For order codes, avoid repeating the order codes in text form in the order.	**Shaft height 80 to 160**	**Shaft height 180 to 280**	**Shaft height 280 For forced ventilation only (11th data position is "1" or "4")**
X01	Paint finish in RAL 9005 (jet black)	✓	✓	✓
X02	Paint finish in RAL 9001 (cream white)	✓	✓	✓
X03	Paint finish in RAL 6011 (reseda green)	✓	✓	✓
X04	Paint finish in RAL 7032 (pebble gray)	✓	✓	✓
X05	Paint finish in RAL 5015 (sky blue)	✓	✓	✓
X06	Paint finish in RAL 1015 (light ivory)	✓	✓	✓
X08	Paint finish in RAL 9006 (white aluminum)	✓	✓	✓
X11	Paint finish in RAL 6019 (pastel green)	✓	✓	✓
X12	Paint finish in RAL 5010 (gentian blue)	✓	✓	✓
X13	Paint finish in RAL 5024 (pastel blue)	✓	✓	✓
X14	Paint finish in RAL 5017 (traffic blue)	✓	✓	✓
X15	Paint finish in RAL 9010 (pure white)	✓	✓	✓
X16	Paint finish in RAL 6018 (yellow green)	✓	✓	✓
X17	Paint finish in RAL 5014 (pigeon blue)	✓	✓	✓
X18	Paint finish in RAL 9018 (papyrus white)	✓	✓	✓
X19	Paint finish in RAL 2004 (pure orange)	✓	✓	✓
X20	Paint finish in HWS (gray)	✓	✓	✓
X21	Paint finish in RAL 9003 (signal white)	✓	✓	✓
X22	Paint finish in RAL 9002 (gray white)	✓	✓	✓
X23	Paint finish in RAL 5005 (signal blue)	✓	✓	✓
X24	Paint finish in RAL 7001 (sliver gray)	✓	✓	✓
X25	Paint finish in RAL 1000 (green beige)	✓	✓	✓
X26	Paint finish in RAL 6017 (May green)	✓	✓	✓
X27	Paint finish in RAL 9023 (pearl dark gray)	✓	✓	✓
X28	Paint finish in RAL 5009 (azure blue)	✓	✓	✓
X29	Paint finish in RAL 7005 (mouse gray)	✓	✓	✓
X30	Paint finish in RAL 1014 (ivory)	✓	✓	✓
X31	Paint finish in RAL 5007 (brilliant blue)	✓	✓	✓
X44	Paint finish in RAL 1023 (traffic yellow)	✓	✓	✓
X50	Paint finish in RAL 3004 (purple red)	✓	✓	✓
X51	Paint finish in RAL 2003 (pastel orange)	✓	✓	✓
X52	Paint finish in RAL 3000 (flame red)	✓	✓	✓
X53	Paint finish in RAL 7035 (light gray)	✓	✓	✓
X54	Paint finish in RAL 7004 (signal gray)	✓	✓	✓

Order code	Option description	For use with motors "✓" = Option possible, "---" = Option not possible		
	When ordering a motor with options, add a -Z to the order number. Specify the order code for every option required. For order codes, avoid repeating the order codes in text form in the order.	**Shaft height 80 to 160**	**Shaft height 180 to 280**	**Shaft height 280 For forced ventilation only (11th data position is "1" or "4")**
X55	Paint finish in RAL 7038 (agate gray)	✓	✓	✓
X56	Paint finish in RAL 1013 (oyster white)	✓	✓	✓
X57	Paint finish in RAL 5012 (light blue)	✓	✓	✓
X58	Paint finish in RAL 2001 (red orange)	✓	✓	✓
X59	Paint finish in RAL 7030 (stone gray)	✓	✓	✓
X91	Paint finish in RAL 7011 (iron gray)	✓	✓	✓
K24	Primer	Pale green	Red brown	Red brown
K23	Special paint finish "Worldwide" (anthracite RAL 7016)	✓	✓	✓
K23 + X..	Special finish "Worldwide" in another color (X01 to X91)	✓	✓	✓

1) Not possible if 12th data position is "2" (type of construction IM B5)

2) Only recommended if oil spray/mist occasionally gets onto the sealing ring. Radial shaft sealing ring not possible if: 14th data position is "E", "F" and "L", "M"

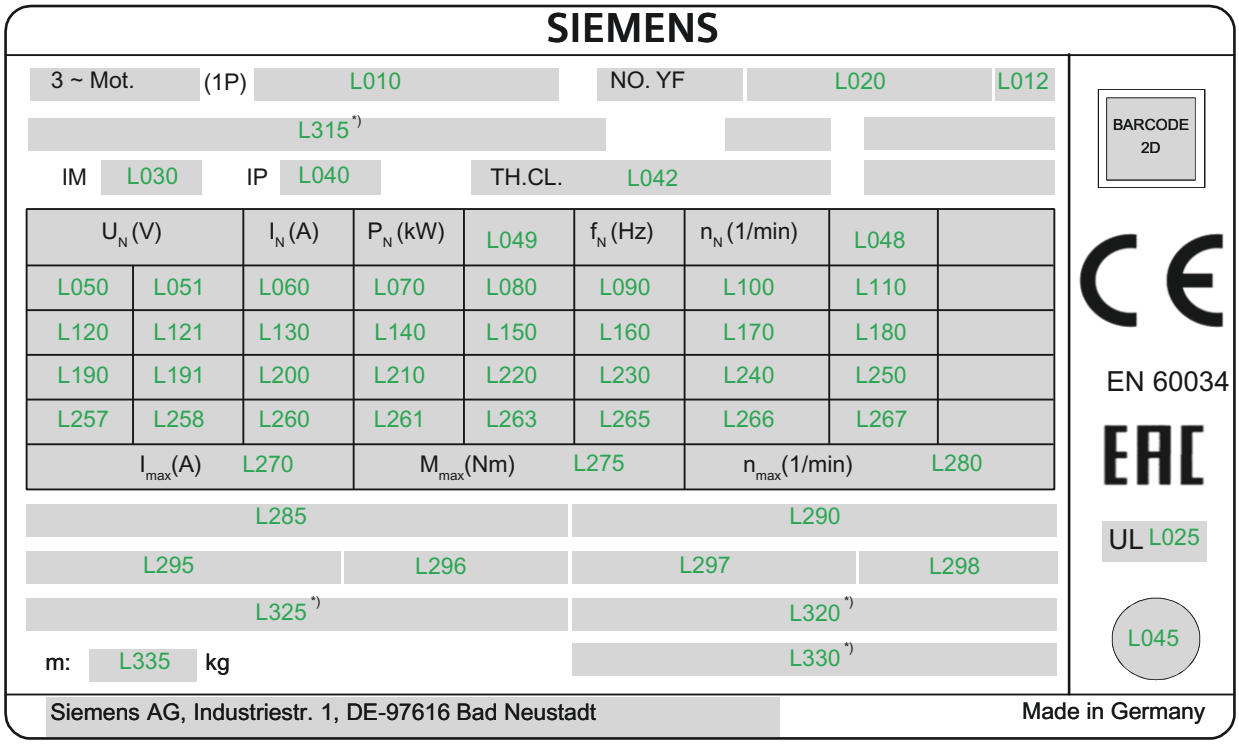
3) Regardless of the degree of protection, for high pollution levels of the ambient air, the fan must be cleaned.

4) Not possible for 1PH822 and terminal box 1XB7712-P03

5) Not possible if the 14th data position is "E" and "F"

3.5 Rating plate data

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



*) Some fields may also be empty (options, customer data)

Figure 3-3 Nameplate layout for 1PH808 to 1PH816

Table 3-5 Elements on the rating plate

No.	Description	No.	Description
L010	Article No.	L210	Rated power P_N (3)
L012	Consecutive number	L220	cos φ (3)
L020	Factory serial number	L230	Rated frequency f_N (3)
L025	UL mark	L240	Rated speed n_N (3)
L030	Type of construction	L250	Operating mode (3)
L040	Degree of protection	L257	Rated voltage U_N (4)
L042	Temperature class	L258	Connection method (4)
L045	Balancing code	L260	Rated current I_N (4)
L048	Operating mode	L261	Rated power P_N (4)
L049	for synchronous motors: induced voltage at rated speed V_{IN}	L263	cos φ (4)
	for induction motors: cos φ	L265	Rated frequency f_N (4)
L050	Rated voltage U_N (1)	L266	Rated speed n_N (4)
L051	Connection method (1)	L267	Operating mode (4)
L060	Rated current I_N (1)	L270	Maximum current I_{max}

No.	Description	No.	Description
L070	Rated power P_N (1)	L275	Maximum torque M_{max}
L080	cos φ (1)	L280	Maximum speed n_{max}
L090	Rated frequency f_N (1)	L285	Temperature sensor
L100	Rated speed n_N (1)	L290	Encoder
L110	Operating mode (1)	L295	Cooling method
L120	Rated voltage U_N (2)	L296	Throughput l/min (m^3/s)
L121	Connection method (2)	L297	System pressure
L130	Rated current I_N (2)	L298	Maximum coolant temperature
L140	Rated power P_N (2)	L315	Options (I)
L150	cos φ (2)	L320	Options (II)
L160	Rated frequency f_N (2)	L325	Optional customer information
L170	Rated speed n_N (2)	L330	Anti-condensation heating
L180	Operating mode (2)	L335	Weight
L190	Rated voltage U_N (3)		
L191	Connection method (3)		
L200	Rated current I_N (3)		

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

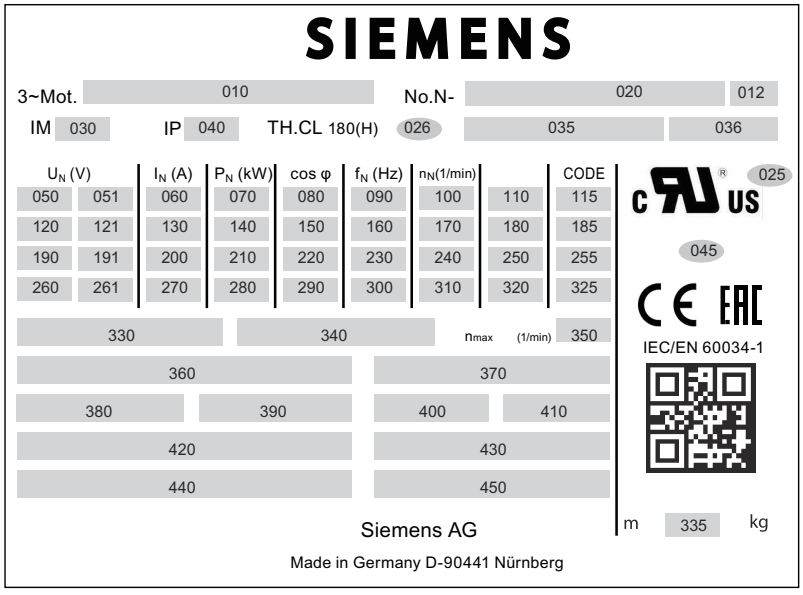


Figure 3-4 Nameplate layout for 1PH818 to 1PH828

Table 3-6 Elements on the rating plate

No.	Description	No.	Description
010	Article No.	200	Rated current I_N (3)
012	Consecutive number, part of serial number	210	Rated power P_N (3)
020	Serial number	220	cos φ (3)

No.	Description	No.	Description
025	UL mark	230	Rated frequency f_N (3)
026	(blank)	240	Rated speed n_N (3)
030	Type of construction	250	Operating mode (3)
035	(blank)	255	Code for operating point 3
036	(blank)	260	Rated voltage U_N (4)
040	Degree of protection	261	Switching mode 4
045	Type of balancing	270	Rated current I_N (4)
050	Rated voltage U_N (1)	280	Rated power P_N (4)
051	Switching mode 1	290	cos φ (4)
060	Rated current I_N (1)	300	Rated frequency f_N (4)
070	Rated power P_N (1)	310	Rated speed n_N (4)
080	cos φ (1)	320	Operating mode (4)
090	Rated frequency f_N (1)	325	Code for operating point 4
100	Rated speed n_N (1)	330	Maximum current I_{MAX}
110	Operating mode (1)	335	Weight
115	Code for operating point 1	340	Maximum torque M_{MAX}
120	Rated voltage U_N (2)	350	Maximum speed n_{MAX}
121	Switching mode 2	360	Temperature sensor
130	Rated current I_N (2)	370	Tachometer/resolver
140	Rated power P_N (2)	380	Cooling method
150	cos φ (2)	390	Throughput l/min (m^3/s)
160	Rated frequency f_N (2)	400	System pressure
170	Rated speed n_N (2)	410	Maximum coolant temperature
180	Operating mode (2)	420	Options (I)
185	Code for operating point 2	430	Options (II)
190	Rated voltage U_N (3)	440	Optional customer information
191	Switching mode 3	450	Anti-condensation heating / dummy

Mechanical properties

4

4.1 Cooling

4.1.1 General

The following table shows an overview of the available variants of cooling system.

Table 4-1 Cooling system variants of 1PH8 motors

Shaft height	Motor type	Forced ventilation	Water cooling
80	Induction	⇓	⇓
100	Induction	⇓	⇓
132	Induction, synchronous-reluctance and synchronous	⇓	⇓
160	Induction, synchronous-reluctance and synchronous	⇓	⇓
180	Induction and synchronous	⇓	⇓
225	Induction and synchronous	⇓	⇓
280	Induction	⇓	⇓

4.1.2 Forced ventilation

When mounting the forced ventilated motor, make sure the motor is well ventilated. Good ventilation is especially important for encapsulated installation. Avoid warm exhaust air being drawn in again. The cooling air must flow in and out without restriction. Avoid accumulated dirt in the cooling ducts as this can reduce the cooling air flow.

All catalog data refer to an ambient temperature of 40 °C and an installation altitude up to 1000 m above sea level.

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.

Ambient/coolant temperature

Operation: T = -15 °C to +40 °C (without any restrictions)
Under conditions other than those specified above (ambient temperature > 40 °C or installation altitude > 1000 m above sea level), you must determine the permissible torque/power reduction from the following table. Ambient temperatures and installation altitudes are rounded off to 5 °C or 500 m respectively.

Table 4-2 Factors for reducing the torque/power acc. to EN 60034-6

Installation altitude above sea level	Ambient temperature in ° C			
	40	45	50	55[1)]
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

1) Only permitted for the "NDE" ⇒ "DE" direction of air flow

Note

Higher ambient temperatures

For ambient temperatures > 55 °C, contact your local sales partner.

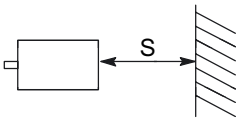
The standard motors are not suitable for use in corrosive atmospheres, atmospheres with a high salt content, or in outdoor applications.

Mounting a fan and minimum clearance to parts and components mounted by the customer

Table 4-3 Fan mounting

Shaft height mm	Fan mounting
80 to 225	NDE axial, can be rotated through 180°
280	NDE radial, different mounting types can be ordered

Table 4-4 Minimum distance S between the air intake/outlet openings and other adjacent components

Shaft height **mm**	**Minimum clearance S** **mm**	
80	30	
100	30	
132	60	
160	80	
180/225	100	
280	120	

Ventilation data and sound pressure levels

Table 4-5 Ventilation data and sound pressure levels

Shaft height **mm**	**Air flow direction**	**Degree of protection**	**Airflow rate, min.** **m^3/s**	**Air discharge**	**Sound pressure level L_{pA} (1 m) Motor + operation with an external fan 50 Hz rated load, tolerance +3 dB** **dB**	**Pressure drop (Δp)** **Pa**
80	NDE → DE DE → NDE	IP55	0.02	Axial	70[1)]	95
100	NDE → DE DE → NDE	IP55	0.04			110
132	NDE → DE DE → NDE	IP55	0.09			140
160	NDE → DE DE → NDE	IP55	0.16		73[1)]	200
180	NDE → DE	IP23	0.21		73[2)]	450
	DE → NDE	IP55	0.17			550
225	NDE → DE	IP23	0.33			600
	DE → NDE	IP55	0.31			650
280	NDE → DE	IP23	0.52	Radial	74[2)]	600
	DE → NDE	IP55	0.42			600

1) At a rated pulse frequency of 4 kHz and a speed range up to 5000 r/min
2) At a rated pulse frequency of 2 kHz and speed range
   - Forced ventilation (IP55)
     - Shaft height 180 to 5000 r/min
     - Shaft height 225 to 3500 r/min
     - Shaft height 280 to 3300 r/min
   - Open-circuit ventilation (IP23)
     - Shaft height 180 to 3000 r/min
     - Shaft height 225 to 2000 r/min
     - Shaft height 280 to 2800 r/min

Note

Ambient air

If the ambient air is polluted by particles of dust or similar substances, the preferred air flow direction is NDE → DE.

From shaft height 132 and higher, the motors with air flow direction NDE → DE are optionally available with an air filter (option G14).

Cleaning the cooling air ducts

On air-cooled motors, you must regularly clean the cooling air ducts through which the ambient air flows. The degree of pollution depends on the location of use. Clean the air cooling ducts, for example, with dry, oil-free compressed air.

Motors with pipe connection

1PH8 motors with "Forced ventilation" and shaft heights 180...280 can optionally be ordered with "pipe connection." The external fan, which is normally mounted as standard, is omitted in this version. A molded pipe connection replaces the external fan.

The diameter of the pipe connection is based on the standard DIN EN 1506 or DIN EN 13180. This means that commercially available pipes and molded parts for air-conditioning systems can be used.

Note

Minimum air flow and pressure drop

Pipes and external fans of suitable type and dimensioning must be installed and connected. The required minimum air flow and the pressure drop at the motor must be taken into account for the design and dimensioning.

Table 4-6 Diameter, minimum air flow and pressure drop

Shaft height mm	Diameter mm	Degree of protection	Minimum air quantity m^3/s	Pressure drop Pa
180	300	IP23	0.21	450
		IP55	0.17	550
225	350	IP23	0.33	600
		IP55	0.31	650
280	Adapter required	IP23	0.52	600
		IP55	0.42	600

4.1.3 Water cooling

⚠ WARNING

Defective work on the cooling circuit

Defective work on the cooling circuit can cause injury and/or damage to property.

- Only qualified personnel may assemble, install, and commission the cooling circuit.
- Perform installation or service work on the cooling circuit only when the system is de-energized.

The electrochemical processes that take place in a cooling system must be minimized by choosing the right materials. For this reason, mixed installations, i.e. a combination of different materials, such as copper, brass, iron, or halogenated plastic (PVC hoses and seals), should not be used or should be limited to the absolutely essential minimum.

There are 3 types of cooling circuits:

- Closed cooling circuit
- Semi-open cooling circuit
- Open cooling circuit

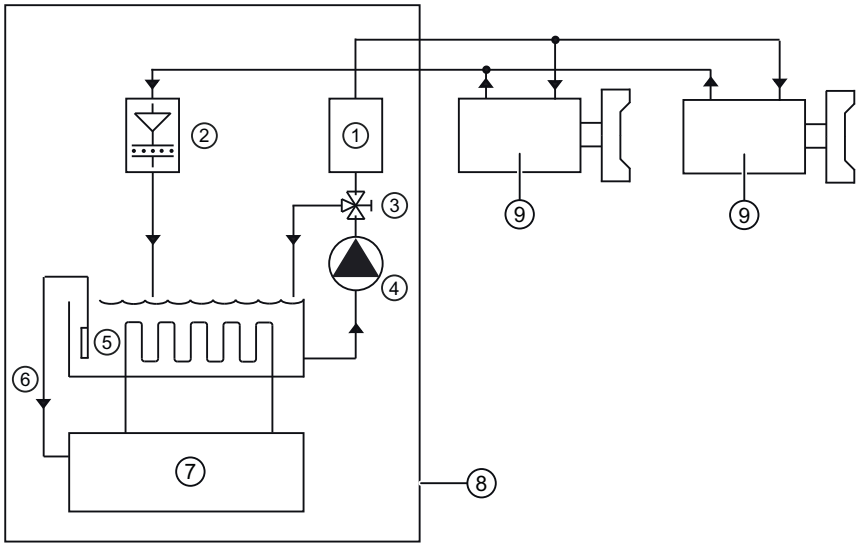
Table 4-7 Description of the various cooling circuits

Definition	Description
Closed cooling circuit	The pressure equalizing vessel is closed (oxygen cannot enter the system) and has a pressure relief valve. The coolant is only routed in the motors and converters as well as the components required to dissipate heat.
Semi-open cooling circuit	Oxygen can only enter the cooling system through the pressure equalization vessel, otherwise the same as "closed cooling circuit."
Open cooling circuit (tower system)	The coolant is cooled in a tower. In this case, there is intensive oxygen contact.

Note

Cooling circuits

Only closed and semi-open cooling circuits are permissible for motors. Converter systems must be connected before the motors in the cooling circuit.



1	Filter [1]	6	Temperature measurement cooling water
2	Flow meter [1]	7	Compressor / cooling unit
3	Pressure relief valve, setting valve flow rate [1]	8	Cooling unit
4	Pump	9	Motor
5	Cooling water tank		

[1] These components are not absolutely necessary.

Figure 4-1 Example of a semi-open cooling circuit

Equipotential bonding

Provide all components in the cooling system (motor, heat exchanger, piping system, pump, pressure equalization tank, etc.) with equipotential bonding. Implement the equipotential bonding using a copper rail or finely stranded copper cable with the appropriate conductor cross-sections.

Note

Installation of the cooling water pipes

Electrically conductive cooling water pipes must not come into contact with live components.

- Ensure adequate insulation.
- Securely fasten the pipe.

Materials used in the motor cooling circuit

The materials used in the cooling circuit must be coordinated with the materials in the motor.

Table 4-8 Materials used in the cooling circuit of the 1PH8 motor

Shaft height	Bearing shield	Pipes in the stator (designation)
80	Cast iron (EN-GJL-200)	Stainless steel
100	Cast iron (EN-GJL-200)	Stainless steel
132	Cast iron (EN-GJL-200)	Stainless steel
160	Cast iron (EN-GJL-200)	Stainless steel
180	-	Stainless steel (V4A)
225	-	Stainless steel (V4A)
280	-	Stainless steel (V4A)

Materials and components in the cooling circuit

The following table lists a wide variety of materials and components which may or may not be used in a cooling circuit.

Table 4-9 Materials and components of a cooling circuit

Material	Used as	Description
Zinc	Pipes, valves and fittings	Use is not permitted.
Brass	Pipes, valves and fittings	Can be used in closed circuits with inhibitor.
Copper	Pipes, valves and fittings	Can be used only in closed circuits with inhibitors in which the heat sink and copper component are separated (e.g. connection hose on devices).
Common steel (e.g. St37)	Pipes	Permissible in closed circuits and semi-open circuits with inhibitors or Antifrogen N, check for oxide formation, inspection window recommended.
Cast steel, cast iron	Pipes, motors	Closed circuit and use of strainers and flushback filters. Fe separator for stainless heat sink.
High-alloy steel, Group 1 (V2A)	Pipes, valves and fittings	Can be used for drinking or municipal water with a chloride content up to <250 ppm, suitable according to definition in Section "Coolant definition".
High-alloy steel, Group 2 (V4A)	Pipes, valves and fittings	Can be used for drinking or municipal water with a chloride content up to <500 ppm, suitable according to definition in Section "Coolant definition".
ABS (**A**crylnitrile**B**utadiene**S**tyrene)	Pipes, valves and fittings	Suitable according to the definition in Section "Coolant definition". Suitable for mixing with inhibitor and/or biocide as well as Antifrogen N.
Installation comprising different materials (mixed installation)	Pipes, valves and fittings	Use is not permitted.

Material	Used as	Description
PVC	Pipes, valves, fittings and hoses	Use is not permitted.
Hoses		Reduce the use of hoses to a minimum (device connection). Must not be used as the main pipe for the whole system. Recommendation: EPDM hoses with an electrical resistance > 10^9 Ω (e.g. Semperflex FKD supplied from Semperit or DEMITTEL; from PE/EPD, supplied from Telle).
Gaskets	Pipes, valves and fittings	Use of Viton, AFM34, EPDM is recommended.
Hose connections	Transition Hose - pipe	Secure with clips conforming to DIN 2817, available e.g. from the Telle company.

The following recommendation applies in order to achieve an optimum motor heatsink (enclosure) lifetime:

- Engineer a closed cooling circuit with cooling unit manufactured out of stainless steel that dissipates the heat through a water-water heat exchanger.
- All other components such as cooling circuit cables and fittings manufactured out of ABS, stainless steel or general construction steel.

Cooling system manufacturers

ait-deutschland GmbH	www.kkt-chillers.com
BKW Kälte-Wärme-Versorgungstechnik GmbH	www.bkw-kuema.de
DELTATHERM Hirmer GmbH	www.deltatherm.de
Glen Dimplex Deutschland GmbH	www.riedel-cooling.com
Helmut Schimpke und Team Industriekühlanlagen GmbH + Co. KG	www.schimpke.org
Hydac System GmbH	www.hydac.com
Hyfra Industriekühlanlagen GmbH	www.hyfra.de
Pfannenberg GmbH	www.pfannenberg.com

Note

Other manufacturers

You can also use equivalent products from other manufacturers.

Responsibility for the properties of third-party products resides with the plant manufacturer.

Consider the following pressure conditions when designing the cooling circuit.

Permissible pressure

- Define the working pressure based on the flow conditions in the supply and return pipes of the cooling circuit.

The maximum permitted pressure in the cooling circuit is 0.6 MPa (6 bar).

Note

If you use a pump that reaches a higher pressure, maintain a maximum pressure of 0.6 MPa by taking appropriate measures (pressure relief valve, pressure control, etc.).

- Design the cooling circuit to have the smallest possible pressure difference between the supply and return pipes so that pumps with a shallow characteristic curve can be used.
- Design the cooling circuit with a self-cleaning filter to avoid blockage and corrosion.

Pressure drop in the motor

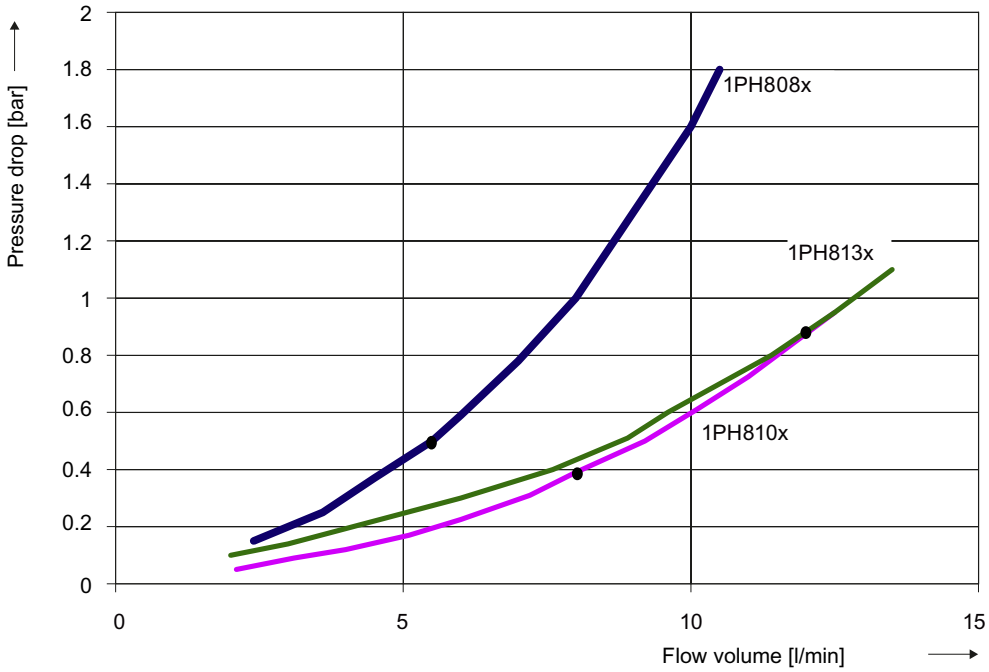


Figure 4-2 Pressure drop in the cooling pipe system, shaft heights 80 to 132

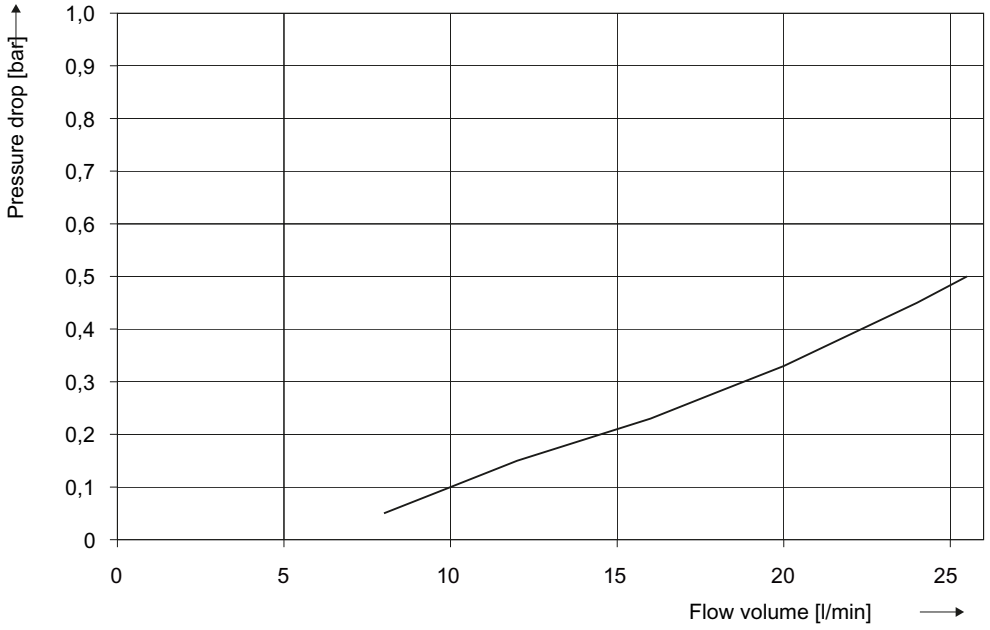


Figure 4-3 Pressure drop in the cooling pipe system, shaft height 160

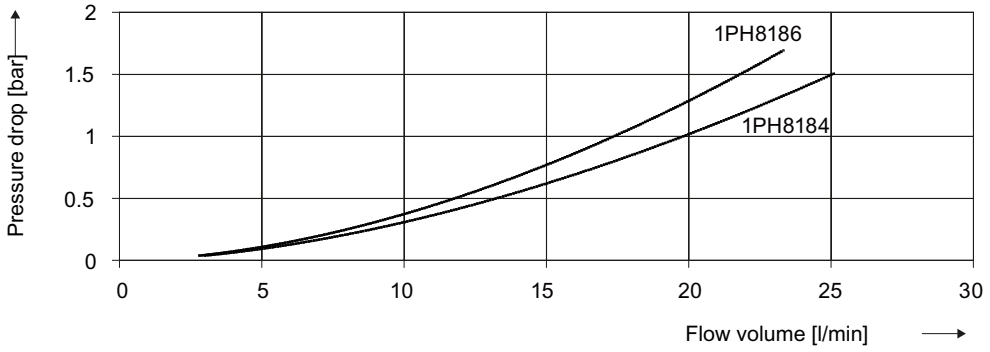


Figure 4-4 Pressure drop in the cooling pipe system, shaft height 180

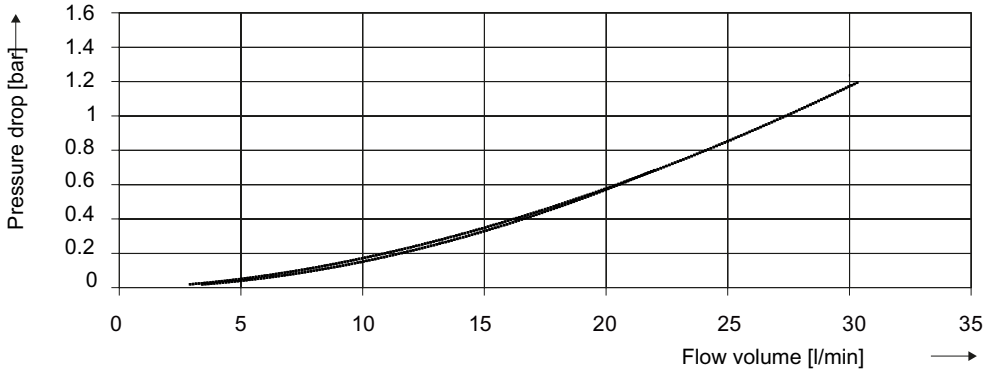


Figure 4-5 Pressure drop in the cooling pipe system, shaft height 225

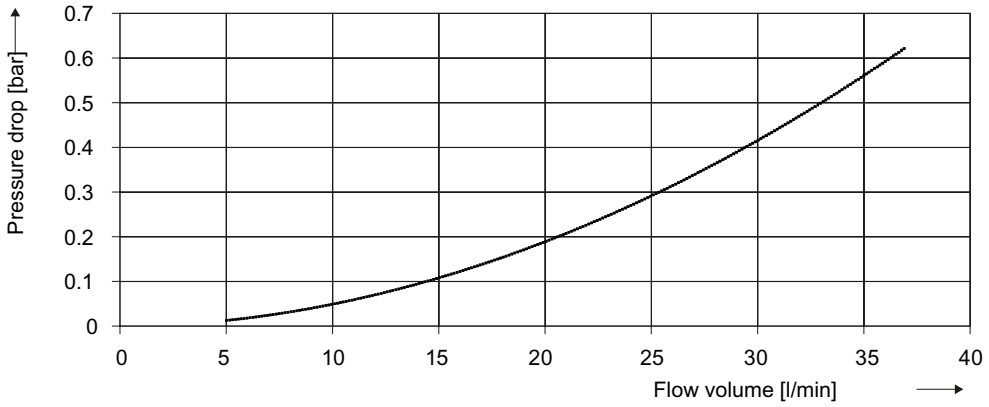


Figure 4-6 Pressure drop in the cooling pipe system, shaft height 280

Note

Ensuring adequate cooling

To ensure adequate cooling, comply with the minimum flow rates specified under Point "Cooling data and sound pressure levels".

Pressure equalization

If various components are connected up in the cooling circuit, it may be necessary to provide pressure equalization.

Note

Arrangement of the reactor element

Flow restrictors must be mounted on the cooling water outlet of the motor or the relevant component!

Avoiding cavitation

During uninterrupted duty, the pressure drop across a converter or motor must not exceed 0.2 MPa (2 bar). Otherwise, the high flow rate results in damage due to cavitation and/or abrasion.

Connecting motors in series

For the following reasons, Siemens only conditionally recommends connecting motors in series:

- The required flow rates of the motors must be approximately the same (< a factor of 2)
- An increase in the cooling water temperature can result in having to derate the second or third motor if the maximum cooling water inlet temperature is exceeded.

Cooling water inlet temperature

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 which 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 air humidity. For instance, 50 % air humidity at an ambient temperature of 40 °C corresponds to a temperature difference of 10 K:
$T_{cool} > T_{ambient}$ – temperature difference

Please note that you must also shut off the flow of cooling water when the motor is not operational for prolonged periods of time.

The motors are designed for operation up to a cooling water inlet temperature of +30 °C, provided that all of the specified motor data is complied with. If the cooling water inlet temperature deviates from this, the continuous torque will change (see table "Derating factors").

Table 4-10 Derating factors

Installation altitude above sea level	Cooling water inlet temperature			
m	≤ 30 °C	35 °C	40 °C	45 °C
1000	1.00	0.95	0.90	0.84
1500	0.97	0.92	0.87	0.81
2000	0.93	0.88	0.84	0.78
2500	0.91	0.86	0.82	0.76
3000	0.89	0.85	0.80	0.75
3500	0.87	0.83	0.78	0.73
4000	0.85	0.81	0.77	0.71

Cooling data and sound pressure levels

The specified values refer to operation at the rated speed with rated torque. The cooling water temperature must be ≤ 30° C.

Table 4-11 Cooling data and sound pressure levels

Shaft height	Flow rate, min. l/min	Pressure drop bar	Sound pressure level L_{pA} (1 m) Motor rated load, tolerance +3 dB dB	Thread connection at NDE Inch
80	6	0.6	68 [1]	G 1/8
100	8	0.4		G 1/4
132	12	0.9		G 3/8
160	15	0.2	69 [1]	G1/2

Shaft height	Flow rate, min. l/min	Pressure drop bar	Sound pressure level L_{pA} (1 m) Motor rated load, tolerance +3 dB dB	Thread connection at NDE Inch
180 (1PH8184)	15	0.6	70 [2]	G 3/8
180 (1PH8186)	15	0.7		G3/8
225 (1PH822.-1) (asynchronous)	20	0.6		G 3/8
225 (1PH822.-2) (synchronous)	25	0.9	70 [3]	G 3/8
280	35	0.6	72 [3]	G 1/2

1) For a rated pulse frequency of 4 kHz and speed range up to 5000 r/min

2) For a rated pulse frequency of 2 kHz or 4 kHz and speed ranges for
SH 180 of up to 5000 r/min
SH 225 up to 4500 r/min

3) For a rated pulse frequency of 2 kHz and speed ranges for
SH 225 of up to 4500 per r/min
SH 280 up to 3300 r/min

Heat loss to be dissipated

The values for the heat loss to be dissipated are specified according to the rated point in Chapter "Technical tables and characteristics."

Water specification

Cooling water quality

The values specified for the cooling water correspond to the requirements for a closed cooling circuit. Not all specified concentrations will occur in the cooling water at the same time.

A filter can be used to ensure smooth operation. The grade of filtration should be no less than 100 µm.

Cooling water inlet temperature

The maximum cooling water inlet temperature is 30 °C (86 °F)

Cooling water specifications

Table 4-12 Cooling water specifications (SH 80 to 160)

Component	Quality of the water used as coolant for motors with stainless steel pipes + 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

Component	Quality of the water used as coolant for motors with stainless steel pipes + cast iron or steel jacket
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%

Table 4-13 Cooling water specifications (SH 180 to 280)

Component	Quality of the water used as coolant for motors with stainless steel pipes
pH value	6 ... 9
Total hardness	< 170 ppm
Electrical conductivity	< 2000 µS/cm
Chloride ions	< 250 ppm, can be obtained by adding deionized water.
Sulfate ions	< 240 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

Deionized water (for Cooling water specifications tables)

We recommend using deionized water with reduced conductivity (5 ... 10 µS/cm). If necessary, ask your water utility to provide the values. According to 98/83/EC, drinking water may contain up to 2500 ppm of chloride!

Manufacturers of chemical additives can provide support when analyzing the water that is available on the plant side.

Note

Inhibitor (for Cooling water specifications tables)

The inhibitor is not required if it ensured that the concentration of Antifrogen N is > 20%.

Derating is required for an anti-freeze content of > 30%

Biocide

The risk of corrosion caused by microbes is virtually non-existent in chlorinated drinking water systems.

Closed cooling circuits with soft water are susceptible to microbes.

The following types of microbes are encountered in practice:

- Slime-forming bacteria
- Corrosive bacteria
- Iron-depositing bacteria

The suitability of a biocide depends on the type of microbe.

- Analyze the cooling water for microbes at least once a year.

Necessary biocides can be obtained from the manufacturer, e.g. Nalco. Ask the manufacturer for compatibility with an inhibitor used in your system.

- Dose the biocide as recommended by the manufacturer.

Antifrogen N already acts like a biocide at the minimum concentration of > 20%.

Note

Compatibility of coolant additives

Biocides and Antifrogen N must not be mixed.

There are other manufacturers of chemical additives in the market. You can use equivalent products from other manufacturers. Have the suitability of the third-party products determined.

Other coolants (not water-based)

If you use different cooling media (e.g. oil, cooling lubricant), derating may be necessary in order to comply with the thermal motor limit.

Note

Derating when using other cooling lubricants

Derating is required for water-oil mixtures with more than 10% oil.

To determine the derating, you need the following values of the coolant at a temperature of 30 °C:

Density	ρ / kg/m^3
Specific thermal capacitance	c_ρ / J/(kg•K)
Thermal conductivity	λ / W/(K•m)
Kinematic viscosity	v / m^2/s
Flow rate	V / l/min

The required derating can be obtained from Technical support.

Please send your enquiry to Technical support.

Manufacturers of chemical additives

Tyforop Chemie GmbH	http://www.tyfo.de
Clariant Produkte Deutschland GmbH (Antifrogen)	https://www.clariant.com
Cimcool Industrial Products Inc	http://www.cimcool.net
FUCHS PETROLUB SE	http://www.fuchs.com
Hebro Chemie GmbH	http://www.hebro-chemie.de
HOUGHTON Deutschland GmbH	http://www.houghton.com
Nalco Water in Germany (Ecolab)	http://www.nalco.com
Schweitzer-Chemie GmbH	http://www.schweitzer-chemie.de

Information regarding third-party products

Note

Recommendation relating to third-party products

This document contains recommendations relating to third-party products. Siemens accepts the fundamental suitability of these third-party products.

You can use equivalent products from other manufacturers.

Siemens does not accept any warranty for the properties of third-party products.

Maintenance and service

Check the level and discoloration or turbidity of the cooling water at least once a year. In addition, every year carefully check as to whether the cooling water still has the permissible specification.

If cooling water has been lost, refill with a previously prepared mixture of deionized water and inhibitor or Antifrogen N.

The motor is connected to the cooling circuit by means of two female threads on the rear of the motor. Which one is the inlet and which one is the outlet can be freely connected.

Coolant connection: See table "Cooling data and sound pressure levels"

The units should be connected with hoses to provide mechanical decoupling (refer to the table "Materials and components of a cooling circuit").

Commissioning

When required, before connecting the motors and converters to the cooling circuit, the pipes should be flushed in order to avoid dirt entering the motors and converters.

After the units have been installed in the plant, the coolant circuit must be commissioned before the electrical systems.

4.2 Degree of protection

Degree of protection designation

The degree of protection designation in accordance with EN 60034-5 (IEC 60034-5) is described using the letters "IP" and two digits (e.g. IP64).

IP = International Protection
1st digit = protection against the ingress of foreign bodies
2nd digit = protection against water

When assigning motors to a specific degree of protection class, a standardized, brief test procedure is applied. This can deviate significantly from the actual ambient conditions where the motor is installed.

Attention must be paid to providing suitable sealing of the motor shaft for the selected degree of protection for the motor.

Note

Suitability of the motor depending on the ambient conditions

Depending on these ambient conditions - such as the chemical properties of dusts or the cooling media used at the installation site - it is only conditionally possible to evaluate the suitability of the motor for the particular environment using the degree of protection (e.g. electrically conductive dusts or aggressive coolant vapors or liquids).

In these cases, the motor must be additionally protected using the appropriate measures.

Note

Liquids that have collected and/or oil jets

Liquid must be prevented from collecting on the motor shaft as well as jets of oil (or are not permissible at all) - even for versions with radial shaft sealing ring.

Degrees of protection

The degrees of protection which are available for the 1PH8 motor series are listed in the following table.

Table 4-14 Description of degrees of protection

Motor	Degree of protection	1st code number		2nd code number
		Touch protection	Protection against ingress of solid foreign bodies	
Forced ventilation (open-circuit ventilation)	IP23	Protection against finger contact	Protection against medium-sized, solid foreign bodies above 12 mm ∅	Protection against spray water up to 60° from the vertical
Forced ventilation (surface cooling)	IP55	Full protection against contact	Protection against damaging dust deposits	Splashwater from any direction
Water cooling	IP65	Full protection against contact	Protection against dust	Splashwater from any direction

Note

Routing cables in humid/moist environments

If the motor is mounted in a humid environment, the power and signal cables must be routed as shown in the following figure.

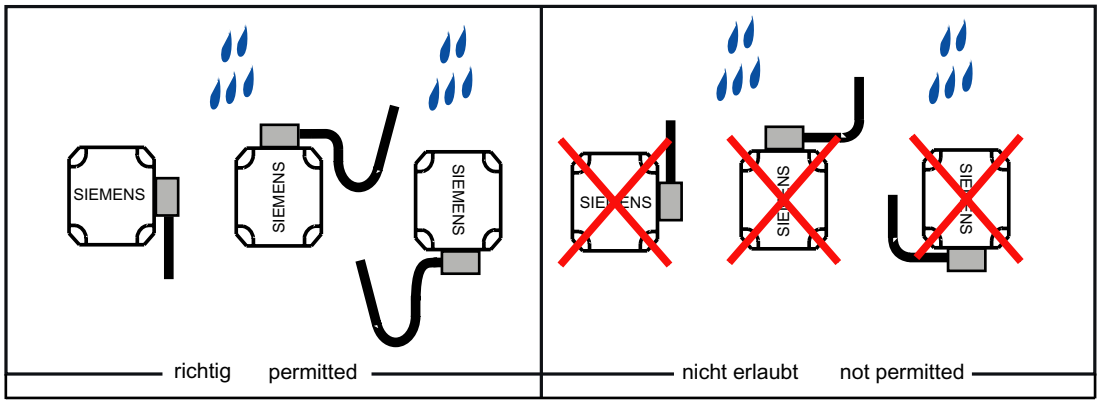
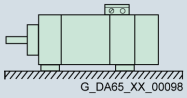
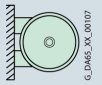
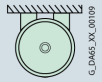
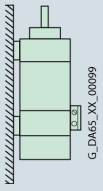
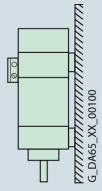
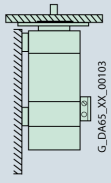
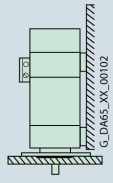
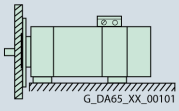
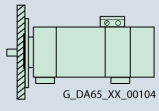
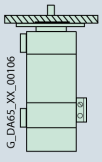
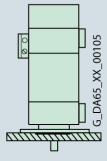


Figure 4-7 Principle of cable routing in a wet/moist environment

4.3 Construction types

For correct motor selection, the following types of construction according to EN 60034-7 (IEC 60034-7) apply:

Types of construction/Mounting positions	Types of construction/Mounting positions
IM B3	**IM B6**
	
IM B7	**IM B8**
	
IM V6	**IM V5**
	
IM V35 [1]	**IM V15** [1]
	
IM B35 [1]	**IM B5, IM B 14**
	
IM V3, IM V19	**IM V1, IM V18**
	

1) Fixing on the flange and feet is necessary.

Figure 4-8 Types of construction

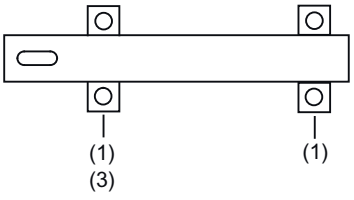
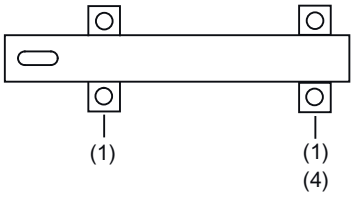
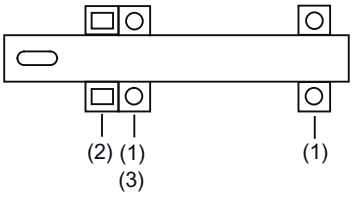
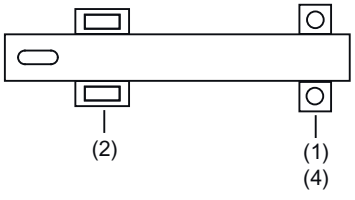
You will find the available types of construction in Chapter "Selection and ordering data."

4.4 Types of bearing

4.4.1 Drive output types and bearing versions

1PH8 motors are suitable for coupling output and belt coupling. The bearing versions and their applications are summarized in the following table.

Table 4-15 Drive output type with the appropriate bearing design

Application	Bearing version	
• Coupling output • Planetary gearboxes, low radial forces	SH 80 to 160 	SH 180 to 280 
• Belt coupling with normal radial force • Pinion output with straight teeth • Belt coupling with increased radial force	SH 100 to 160 	SH 180 to 280 

1) Deep-groove ball bearing

2) Cylindrical-roller bearings (only in versions for increased radial forces - 14th data position = E or F)

3) For the bearing version G or H as a floating bearing (as for 1PH7); all other bearing types have a location bearing at the drive end - 14th data position = A, B, C, D, F, L, M, P, Q, or N

4) Version as a location bearing

Bearing version, maximum speed and bearing change intervals

Table 4-16 Bearing version, maximum speed and bearing change intervals

Shaft height	Bearing design	Maximum speed n_{max} r/min	Average operating speed n_m r/min	Statistical bearing service life L_{10h} h	Recommended bearing replacement interval t_{LW} h		Bearing type for condition monitoring	
					Permanently lubricated	Relubrication	DE	NDE
80	Standard with locating bearing	10,000	≤ 8000	20,000	20,000	-	62207	62207
	Standard	10,000	≤ 6000	20,000	20,000	-	6207	6207
	Performance	15,000	≤ 11,500	12,000	12,000	-	62207	62207
	High Performance	20,000	≤ 13,000	12,000	12,000	-	62207	62207
	Advanced Lifetime	5000	≤ 3500	40,000	40,000	-	7205	7205
100	Standard with locating bearing	9000	≤ 7000	20,000	20,000	-	6308	62208
	Standard	9000	≤ 5000	20,000	20,000	-	6308	6208
	Performance	12,000	≤ 10,500	12,000	12,000	-	62208	62208
	High Performance	18,000	≤ 11,500	12,000	12,000	-	62208	62208
	Advanced Lifetime	5000	≤ 3000	40,000	40,000	-	62210	62208
	Increased radial forces	7000	≤ 2300	20,000	20,000	-	NU208 radial. 6208 axial	62208
132	Standard with locating bearing	8000	≤ 6500	20,000	20,000	-	6310	62210
	Standard	8000	≤ 4500	20,000	20,000	-	6310	6210
	Performance	10,000	≤ 8500	12,000	12,000	-	62210	62210
	High Performance	15,000	≤ 10,000	12,000	12,000	-	62210	62210
	Advanced Lifetime	4500	≤ 2500	40,000	40,000	-	62212	62210
	Increased radial forces	6500	≤ 1800	20,000	20,000	-	NU210 radial. 6210 axial	62210

Shaft height	Bearing design	Maximum speed n_{max} r/min	Average operating speed n_m r/min	Statistical bearing service life L_{10h} h	Recommended bearing replacement interval t_{LW} h		Bearing type for condition monitoring	
					Permanently lubricated	Re-lubrication	DE	NDE
160	Standard with locating bearing	6500	≤ 5400	20,000	20,000	-	6312	62212
	Standard	6500	≤ 3500	20,000	20,000	-	6312	6212
	Performance	9000	≤ 7000	12,000	12,000	-	62212	62212
	High Performance	10,000	≤ 8000	12,000	12,000	-	62212	62212
	Advanced Lifetime	4000	≤ 2300	40,000	40,000	-	62215	62212
	Increased radial forces	5300	≤ 1500	16,000	16,000	-	NU212 radial. 6212 axial	62212
180	Standard with locating bearing	5000 (3000)[2]	≤ 2000	40,000 (24,000)[1]	20,000	40,000 (24,000)[1]	6214-C3	6214-C3
	Increased radial forces	5000 (3000)[2]	≤ 2000	20,000 (12,000)[1]	12,000	20,000 (12,000)[1]	NU2214-ECP	6214-C3
	Performance	7500	≤ 5000	20,000	12,000	20,000	6214-M/C3	6214-M/C3
225	Standard with locating bearing	4500 (2500)[2]	≤ 1800	40,000 (24,000)[1]	20,000	40,000 (24,000)[1]	6216-C3	6216-C3 (insulated)
	Increased radial forces	4500 (2500)[2]	≤ 1800	20,000 (12,000)[1]	12,000	20,000 (12,000)[1]	NU2216-ECP	6216-C3 (insulated)
	Performance	6000	≤ 4000	20,000	12,000	20,000	6216-C3	6216-C3 (insulated)
280	Standard with locating bearing	3300 (2000)[2]	≤ 1500	40,000 (24,000)[1]	20,000	40,000 (24,000)[1]	6220-C3	6220-C3 (insulated)
	Increased radial forces	3300 (2000)[2]	≤ 1500	20,000 (12,000)[1]	12,000	20,000 (12,000)[1]	NU220-C3	6220-C3 (insulated)

1) When vertically mounted

2) For types of construction IM V3, IM B5, and IM V1

You can calculate the average operating speed n_m for alternating bearing load by the following formula:

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

Formula symbol	Unit	Description
$t_1 \ldots t_n$	%	Time percentage of the bearing load
$n_1 \ldots n_n$	r/min	Operating speed

You therefore calculate an average speed from the different speeds according to their time percentages.

Table 4-17 Recommended bearing change intervals at maximum speed

Shaft height	Bearing version	Maximum speed n_{max} r/min	Statistical bearing service life L_{10h} h	Recommended bearing replacement interval t_{LW} h	
				Permanent lubrication	Relubrication
80	Performance	15,000	8000	8000	-
	High Performance	20,000	8000	8000	-
100	Performance	12,000	8000	8000	-
	High Performance	18,000	8000	8000	-
132	Performance	10,000	8000	8000	-
	High Performance	15,000	8000	8000	-
160	Performance	9000	8000	8000	-
	High Performance	10,000	8000	8000	-

Table 4-18 "Premium Performance" bearing version, maximum speed and bearing change intervals

Shaft height	Maximum speed n_{max} r/min	Average operating speed n_m r/min	Recommended bearing replacement interval t_{LW} h	
			with sealing air (Option Q12)	without sealing air
80	24,000	< 16,000	12,000	
		< 19,200*	10,000	8000
		24,000	7000	4000

Speed backlash with:

t1 = 10 min, n1 = 0

t2 = 30 min, n2 = 16,000 r/min

t3 = 60 min, n3 = 24,000 r/min

Note

Difficult operating conditions in operation at n_{max}

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

Difficult operating conditions include

- large vibrations and shocks
- frequent reversing operation

Note

Reduced maximum motor speeds

The maximum speeds might be reduced on motors with integrated encoder as a result of mechanical conditions or limitations imposed by signal conditioning capacity.

The reduced maximum speeds can be found in the table "Encoder types for motors with DRIVE-CLiQ" in Chapter Encoder assignment as a function of maximum permissible speeds (Page 160).

Note

Permanently switching on the sealing air

For the "Premium Performance" bearing version, Siemens recommends that the sealing air be permanently switched on during continuous operation at n_{max}. Sealing air connection and conditioning are described in Chapter "Sealing air connection (option Q12) (Page 169)."

4.4.2 Bearing lifetime

The bearing lifetime is limited by material fatigue (fatigue service life) and/or lubrication failure (grease service life). The fatigue lifetime (statistical bearing lifetime L_{10h}) mainly depends the mechanical load. The correlation is shown in the radial force/axial force diagrams. The values are determined according to DIN/ISO 281.

The grease lifetime is mainly dependent on the bearing size, speed, temperature as well as the vibrational load.

The grease lifetime can be extended by especially favorable operating conditions (low or average speed, low bearing temperatures, low radial force or vibration load).

A reduction of the grease lifetime can be expected for difficult operating conditions and when motors are mounted vertically.

Lifetime lubrication (without relubrication)

Note

For lifetime lubrication, the grease lifetime is harmonized with the bearing lifetime L_{10h}.

Bearing change interval (t_{LW})

The recommended bearing change intervals are obtained from the inter-dependencies mentioned above for a specific operating point such as:

- Coupling output or belt coupling
- Coolant temperature up to max. +40 °C (forced ventilation)
- Cooling water inlet temperature up to max. +30 °C (water cooling)
- Complying with the permissible radial and axial forces (refer to Chapter "Radial and axial forces")

- Complying with the maximum permissible speeds (refer to Chapter "Technical data and characteristics")
- The bearing change intervals are reduced for unfavorable operating conditions, for example
  - average speed > than the value specified in Table 4-16
  - continuous operation at n_{max}
  - Vibration and shock load
  - Frequent reversing operation

Note

Replacing the motor bearings

When replacing the motor bearings, we also recommend that encoders with their own bearings are also replaced.

The fatigue life and the grease consumption time are calculated, statistical values and cannot be warranted.

Note

Axial bearing loads for vertical mounting

The increased axial loads imposed on the bearings on vertically mounted motors can reduce the bearing lifetime by almost 50%. This applies to shaft heights 180 to 280 due to the rotor weights.

Relubrication

In motors that can be relubricated, the bearing life can be extended by complying with fixed relubrication intervals.

Depending on the frame size, some restrictions have to be taken into account - e.g. vertical mounting/shaft position.

It is possible to relubricate motors, shaft heights 180 and 225. A lubricating nipple is optionally provided, Code K40.

Relubrication intervals

Relubrication intervals are specified:

- on the lubrication plate of the motor
- in the table "Relubrication intervals"

Note

Longer time periods between delivering and commissioning the motor

For longer periods of time (e.g. longer than 1 relubrication interval) between shipping and commissioning the motor, the bearings must be lubricated. When relubricating, the shaft must be rotated in order to distribute the grease around the bearings (for additional information, see the Operating Instructions).

The values specified in the table below apply to the same conditions as are described above for bearing change intervals:

Table 4-19 Relubrication intervals

Shaft height	Bearing version	Relubrication interval in operating hours[4] h	Quantity of grease for each relubrication operation[1] g	Grease chamber[2] g	Possible number of relubrication intervals[3]
180	Standard	7000	15	80	5
	Increased radial forces	4000	20	80	4
	Performance	4000	15	80	5
225	Standard	7000	30	180	6
	Increased radial forces	4000	40	180	4
	Performance	4000	30	180	6
280	Standard	7000	40	400	10
	Increased radial forces	4000	50	400	8

[1] Grease quantity for relubrication for normal conditions (ambient temperature up to 40°C, horizontal mounting.

[2] Holding capacity of the grease chamber with precise adherence to the grease quantity for each relubrication interval.

[3] Calculated number of re-lubricating intervals; the bearing lifetime is specified statistically by means of the L_{10h} definition.

[4] Relubricating intervals must be halved for vertically mounted units.

Note

Adapting relubricating intervals

Unfavorable factors such as the effects of mounting/installation, speed or mechanical loads require that the relubricating intervals are appropriately adapted. Situations such as these require special consideration or must be calculated - and must be engineered according to the limitations and constraints together with the responsible motor plant.

The increased axial loads imposed on the bearings on vertically mounted motors can reduce the bearing lifetime by almost 50%. This applies to shaft heights 180 to 280 due to the rotor weights.

A check which takes into account the relevant boundary conditions must be performed on SH 280 in the relevant motor factory.

4.4.3 NDE bearings, insulated version (option L27)

Relevant, additional bearing currents

When compared to a pure sinusoidal supply, the pulsed output voltage of a frequency converter results in additional motor bearing currents. The relevant additional bearing currents are:

- Circulating currents
- EDM currents
- Rotor ground currents

Factors that influence bearing currents

Above a certain magnitude, bearing currents result in localized melting at the bearing rings and rolling assemblies as well as lubricant wear. This reduces the bearing lifetime. Essential influencing factors include:

- Motor speed and associated operating time
- Pulse frequency of the frequency converter
- Grounding relationships between the motor and the connected load

Application for option L27

At speeds 500 r/min, the load due to bearing currents increases significantly. Option L27 is always required if the motor is operated in the speed range between 0 ... 500 r/min for a longer period of time. Without option L27, the total operating time in the speed range 0 ... 500 r/min may be a maximum of 800 h (for an assumed bearing change interval (t_{LW}) of the bearings of 20,000 h).

Table 4-20 Measures that are required for operation in the speed range < 500 r/min

Shaft height	Bearing change interval (t_{LW}) for lifetime lubrication h [1)]	Options that are required	Comment
80 - 160	20,000	-	Due to the experience from the field (in practice) no dangers have been identified due to bearing currents
180		L27	Insulated NDE bearings
225		-	Generally insulated NDE bearings
280		-	Generally insulated NDE bearings

1) Definition, refer to the table "Recommended bearing change intervals"

Motor grounding

In order to avoid rotor ground currents, the motor frame should be well grounded - e.g. by using shielded motor cables. The motor cable shield should be connected at both ends through the largest possible surface area.

For specific applications, the grounding of the motor Z_{hg} can be more unfavorable than the grounding of the connected loads Z_{rg}, e.g. for long motor cables and when the motor is mounted in an insulated fashion. In this case, the capacitive discharge (leakage) current of the motor flows from the motor frame through the motor shaft to the connected load and from there to ground.

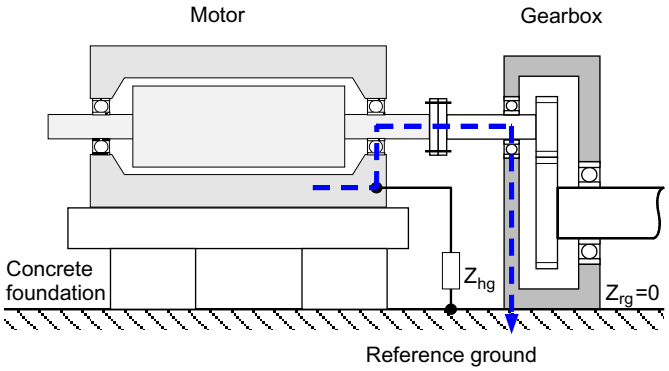


Figure 4-9 Bearing current due to the grounding situation (=rotor ground current)

The rotor ground current should be avoided by using an electrically insulating coupling. If such a coupling cannot be used for mechanical reasons, then the motor frame must be connected to the load through the largest possible surface area. The capacitive discharge (leakage) current then flows from the motor frame to the load and not through the bearings. The connection between the motor frame and load is only effective if it represents an extremely low impedance for the high-frequency discharge (leakage) current. To achieve this, use several flat straps, e.g. grounding straps, metal plates.

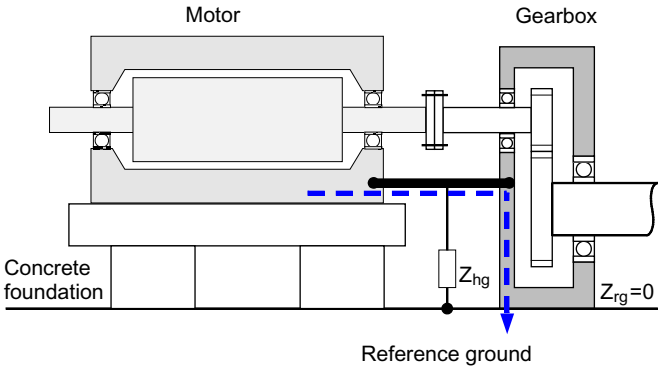


Figure 4-10 Connection between the motor frame and load to avoid rotor ground currents

4.5 Shaft end

The DE shaft end is cylindrical in accordance with DIN 748 Part 3 (IEC 60072-1).

4.6 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.

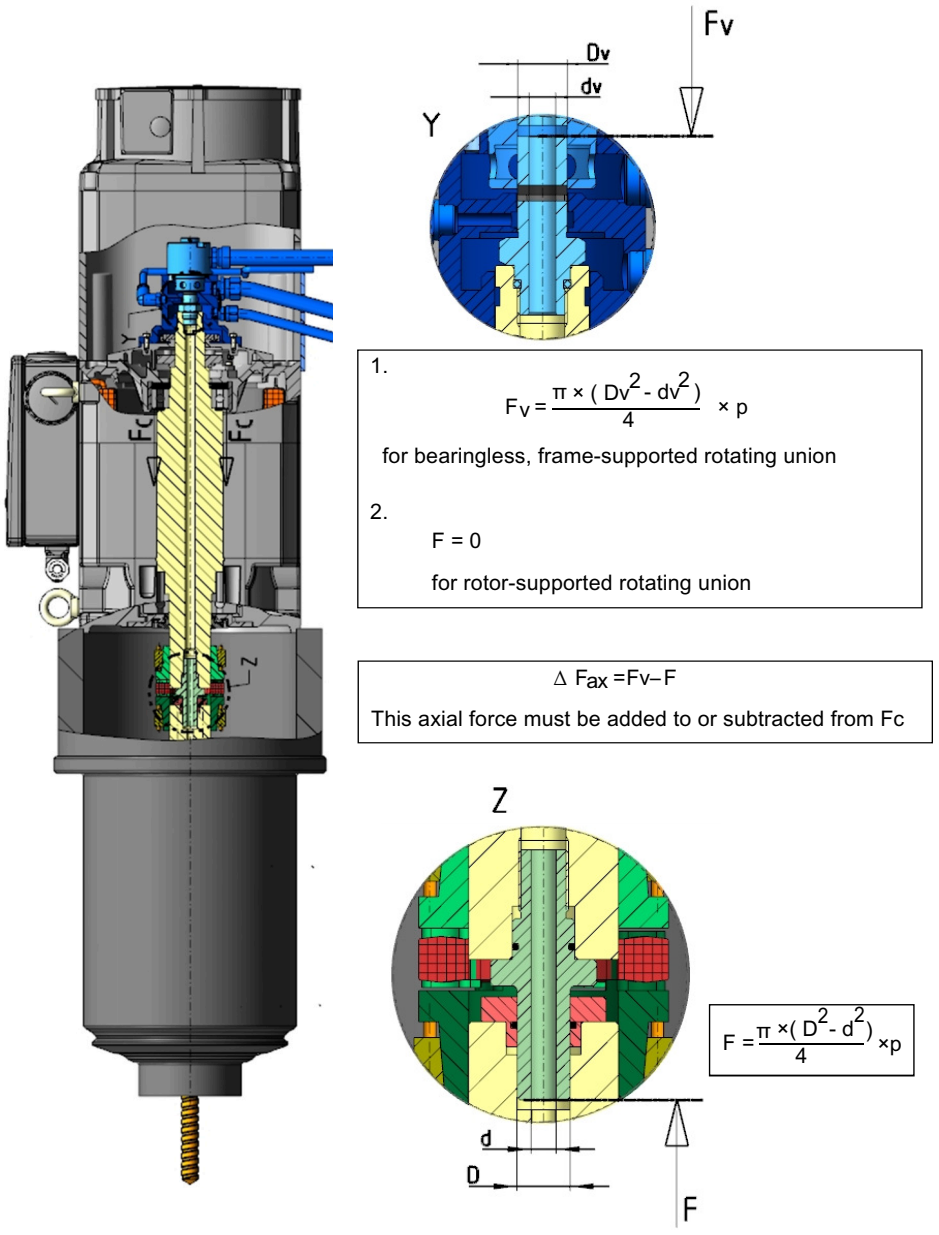


Figure 4-11 Mounting the rotating union

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 4-21 Hollow shaft version

	1PH808□	**1PH810□ ... 1PH816□**
Thread on DE	M12 x 1.25-RH	M16 x 1.5-RH
Centering on DE	∅16H7	∅20H7
Thread on NDE	M12 x 1.25-LH	M16 x 1.5-LH
Centering on NDE	∅14 +0.008/+0.001	∅18 +0.007/-0.003
Through-hole	∅8	∅11.5
Key surface NDE	SW19	SW27

4.6.1 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.

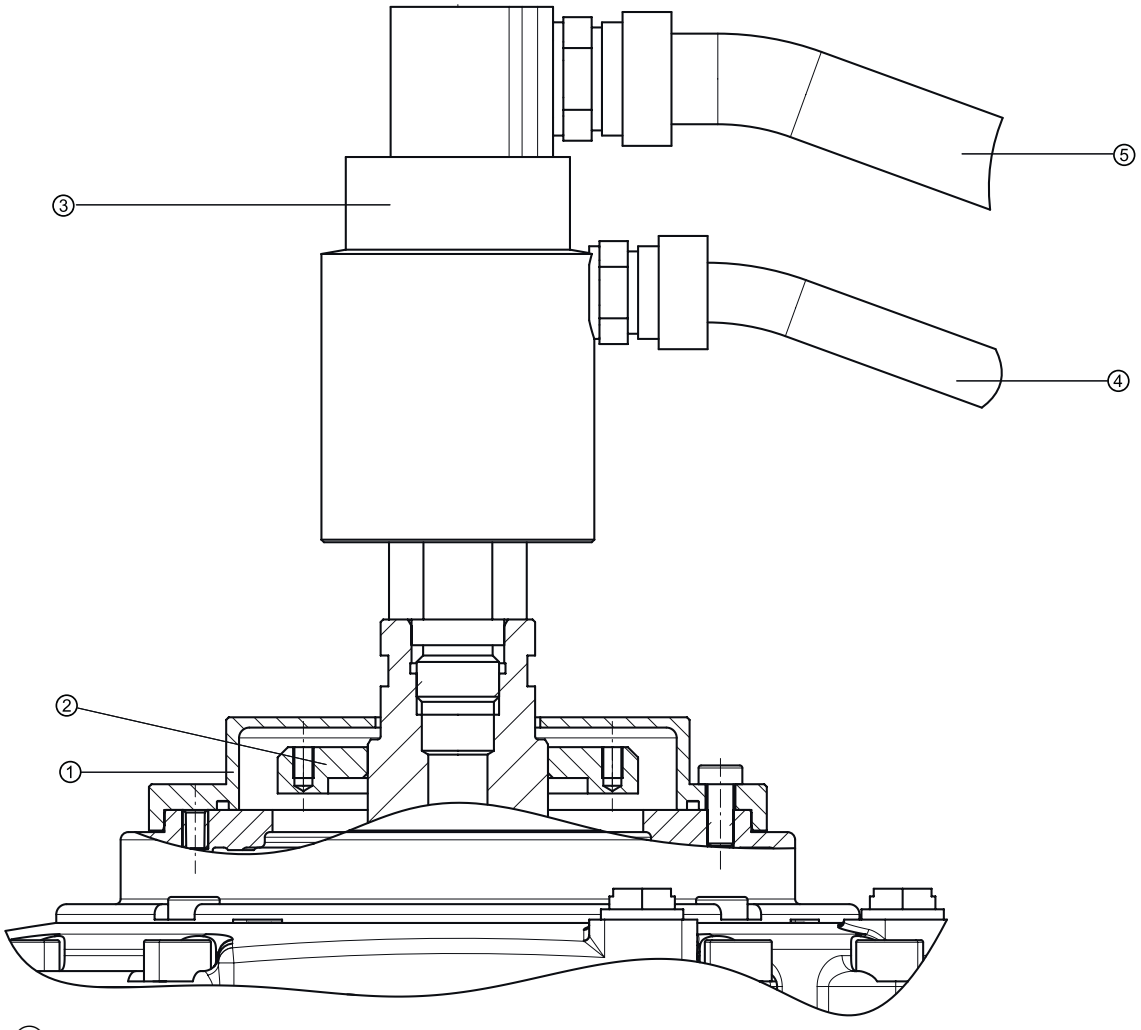
Note the following points when mounting the rotating union:

- 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.

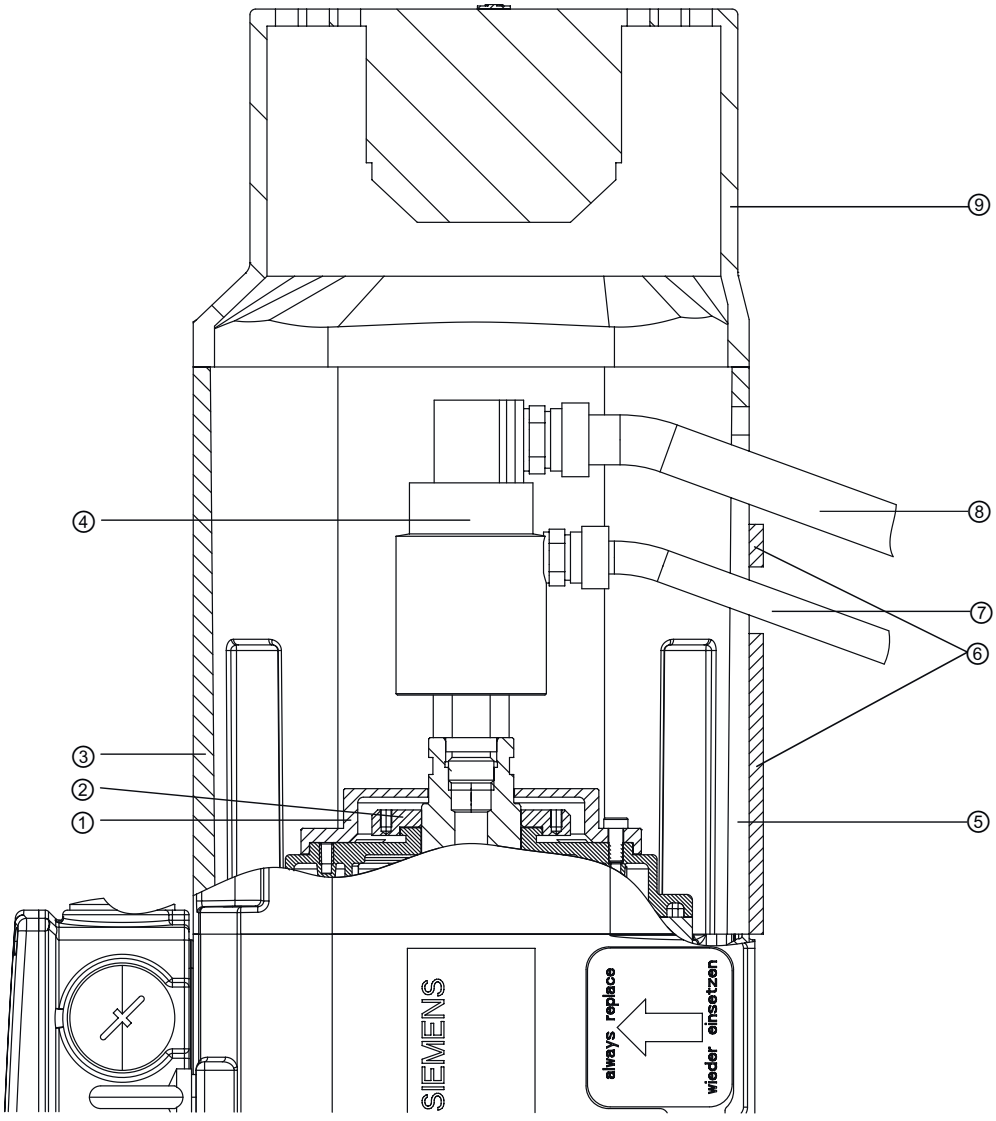
The intermediate housing is suitable for rotating unions with the following dimensions:

- 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



1.
2.

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.

4.6.2 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.

Carefully comply with the design notes:

- Match the adapter to hold the static part to the rotating union to be used. To do this, carefully comply with the dimensions of the manufacturer of the rotating union. Implement the adapter as shown in Chapter "Suggestion for an adapter for bearingless, frame-supported rotating unions".
- The gap between the adapter and the NDE shaft extension must be as small as possible in the radial direction (approx. 0.25 mm) and be as long as possible in the axial direction so that coolant that escapes cannot enter 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 Monitor the flow rate of the backup line to detect any faults in the rotating union in good time, and to protect the motor from flooding. • 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.

- Implement the star-shaped drainage openings in the mounting surface to the encoder cover as shown in Chapter "Suggestion for an adapter for bearingless, frame-supported rotating unions" so that liquid cannot 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

Provide a sealing air connection to protect the motor against the penetration of coolant.

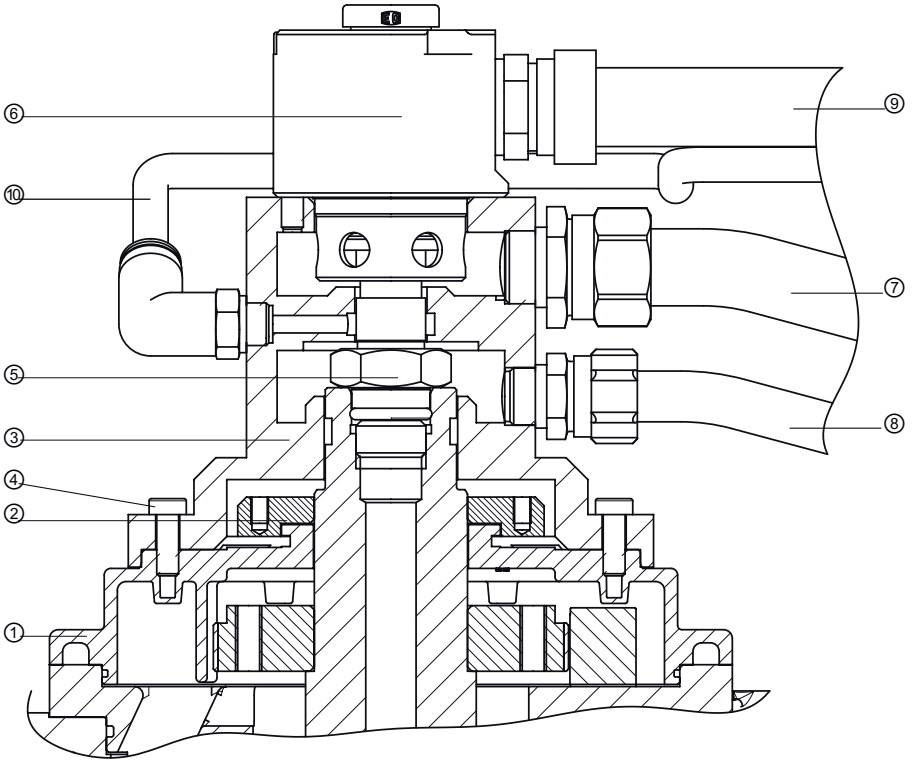
- The diameters and end faces of the adapter for supporting the encoder cover or the static part of the rotating union should be turned in one clamping if possible. For simpler machining, the adapter can be axially split. It is important that the finish-machining of the support diameter and end faces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

Use rotating unions with radial or axial connections.

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. internal diam. 12 mm)
8 Leakage hose as backup and for faults
9 Inlet hose
10 Sealing air connection

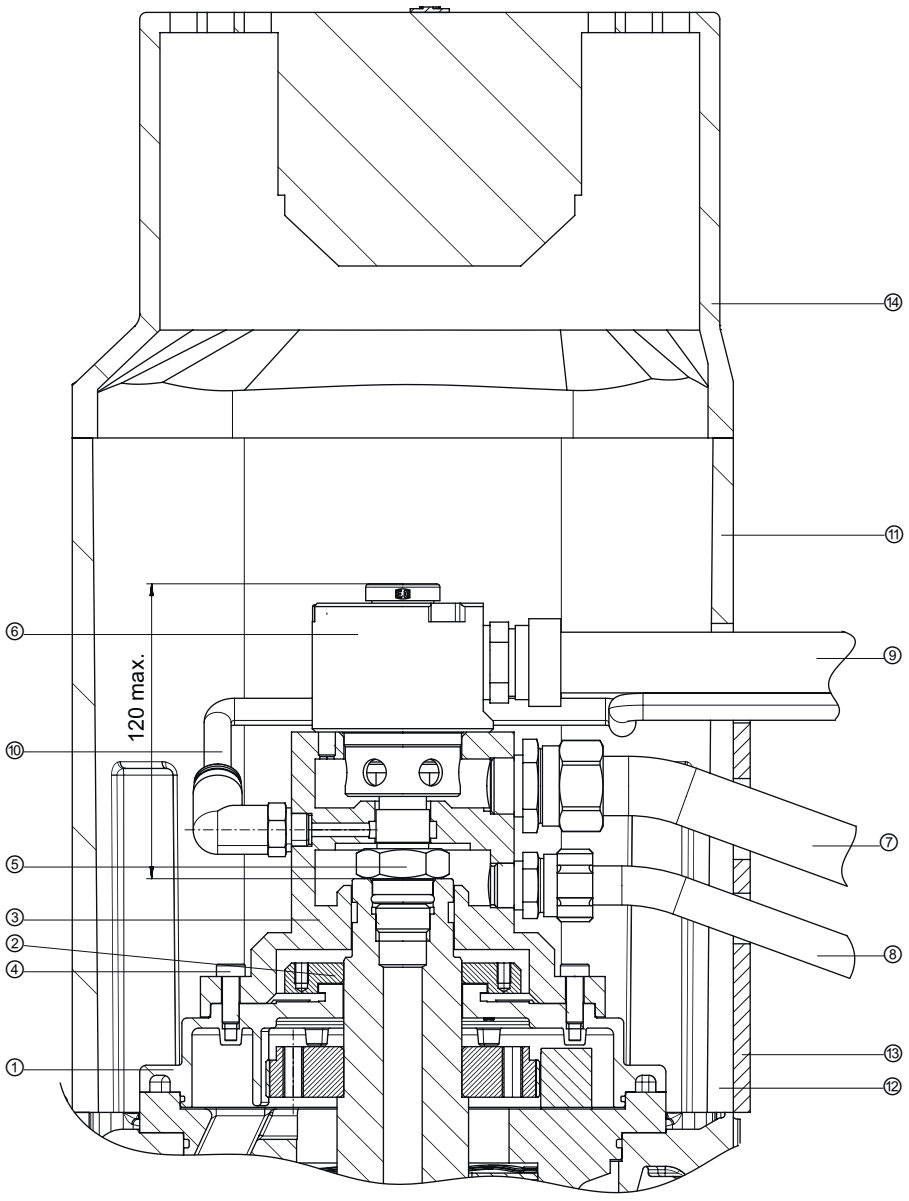
Mounting on air-cooled motors

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 rotary glands up to a length (without rotor connection thread and centering) of 120 mm and a diameter of up to 55 mm. Due to space limitations, 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 this case, a bracket must be used at the axial connection to which the supply hose is connected. The 120 mm dimension must not be exceeded when a bracket is used.

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 (reclose the openings for the connections)
7	Leakage hose (min. internal diam. 12 mm)	14	Fan

Mounting steps

1.
2.

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 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

4.6.3 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.

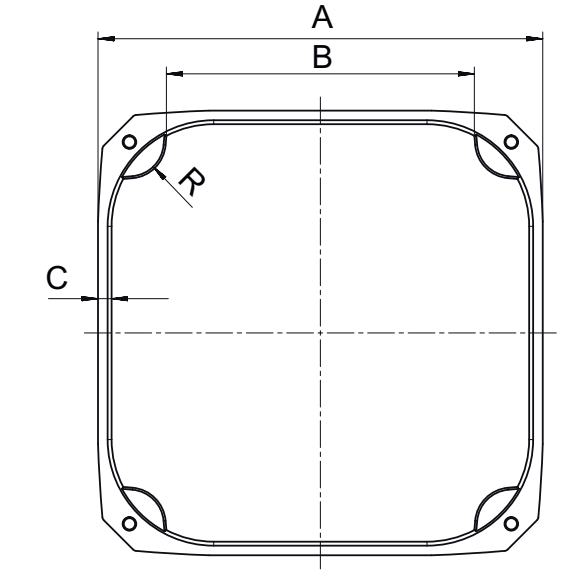
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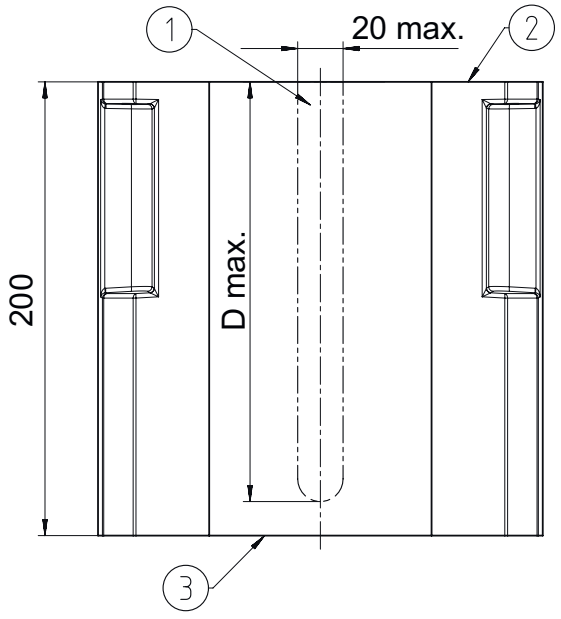
Mounting the rotating union

- 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

	SH 80	SH100	SH132	SH160
A	155	196	260	314
B	99	133	183	225
C	6	6	7	7
R	16	16	19	19
D	170	185	175	180

4.6.4 Suggestion for an adapter for bearingless, 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.

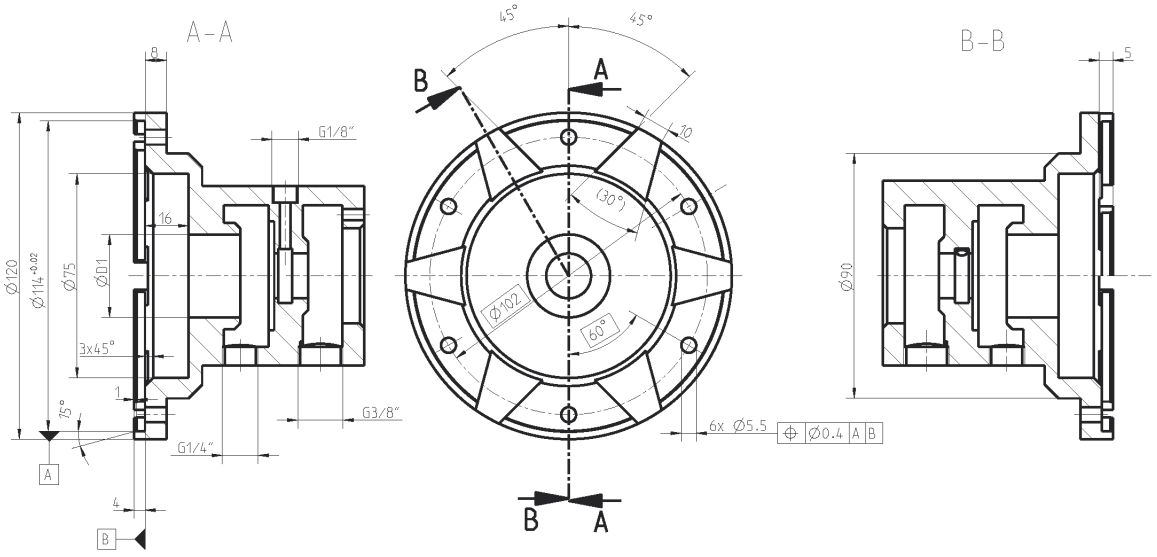


Figure 4-12 Example of the version of an adapter for supporting the static part of a bearingless, frame-supported rotating union

	1PH808.	1PH810.-1PH816.
Diameter D1	Diam. 22.5 H7	Diam. 30.5 H7

4.7 Radial and axial forces

4.7.1 Radial force

Do not exceed specific radial forces in order to guarantee perfect operation.

Never exceed the minimum force for any of the different shaft heights. This minimum force is indicated in the radial force diagrams. The diagrams show the radial force F_R

- At various operating speeds
- As a function of the bearing lifetime

The force diagrams and tables apply to standard shaft ends at the DE. For smaller shaft diameters, only reduced radial forces may be transmitted or none at all.

For force levels going beyond these, contact your local sales partner.

NOTICE
Premature damage to bearings and shaft breakage due to strong radial forces Bearings can be prematurely damaged and shafts may break if force transmission elements apply too much load to the shaft end as a result of radial forces. • When using mechanical transmission elements, ensure that the maximum limit values specified in the radial force diagrams are not exceeded.

NOTICE
Premature damage to bearings due to insufficient radial forces Only for bearings with increased radial force (shaft height 100 to 280): Insufficiently high radial forces can cause the bearings to roll in an undefined fashion. This results in increased bearing wear. • For applications with an extremely low radial force load, ensure that the motor shaft is subject to at least the minimum radial force specified in the diagrams. Where the radial force load is less than the minimum radial force, e.g. on a coupling drive, you must not use the bearings for increased radial force. Use a motor with standard bearings for these applications.

NOTICE
Destruction of bearing seats The motor bearings are designed for operation with radial force. Rotating forces from the process or imbalance > Q 2.5 can destroy the bearing seats. Rotating forces and imbalance can also occur on coupling drives. • Avoid rotating forces and imbalance.

NOTICE

Mechanical destruction of the motor

If the motor supports the higher forces when force/torque boosting elements are used, the flange or the feet of the motor, for example, can be torn off.

- Make sure that the force/torque boosting elements, e.g. gearbox or brakes, absorb the greater forces.
  Examples of remedies:
  - Choose the correct type of construction.
  - Pay attention to correct mechanical mounting of the force/torque boosting elements.

Note

Complying with the belt manufacturer's guidelines

- When dimensioning the radial forces at the shaft extension, ensure that you comply with the regulations of the belt manufacturers.
- Set the belt tension by means of appropriate measuring instruments.

Calculating the total radial force F_R for belt couplings

If the belt manufacturer has not provided precise radial force data, the radial force can be approximately determined using the following formula:

$F_R\,[N] = c \cdot F_U \qquad F_U\,[N] = 2 \cdot 10^7 \cdot P\,/\,(n \cdot D)$

Table 4-22 Explanation of the formula abbreviations

Formula abbreviations	Unit	Description
c	--	Pre-tensioning factor: The pre-tensioning factor is an experience value provided by the belt manufacturer. Values as follows: • V-belt: c = 1.5 to 2.5 • Special plastic belts (flat belts), depending on the load type and belt type c = 2.0 to 2.5
F_U	N	Circumferential force
P	kW	Motor output
n	r/min	Motor speed
D	mm	Diameter of belt pulley

4.7.2 Axial force

The axial force acting on the locating bearings comprises the following components:

- Axial force in operation

- Axial forces acting externally on the motor (e.g. gearbox with helical gearing, machining forces through the tool)
- Axial forces from the coolant pressure of the coolant fed through the rotating union

- Force due to spring loading of the bearing

- Where applicable, force exerted by the rotor weight when the motor is vertically mounted

This results in a maximum axial force that is a function of the direction.

⚠ CAUTION

Axial force due to effective hydraulic diameter of the rotating union

Pay attention to the axial force due to the effective hydraulic diameter (area) of the rotating union.

Force = A x p

- Force = F [N]
- A = area [m^2]
- p = coolant pressure [N/m^2]

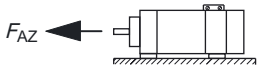
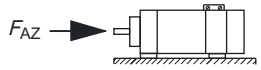
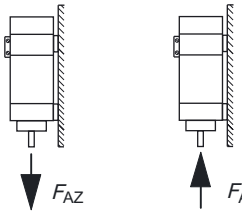
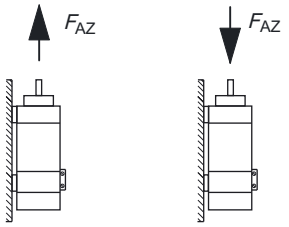
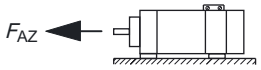
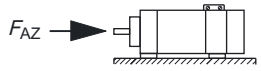
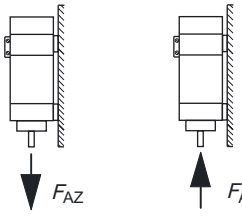
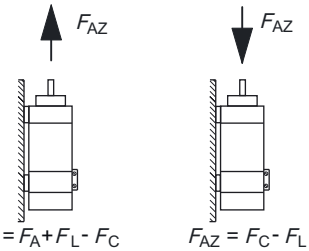
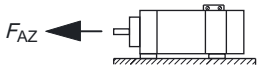
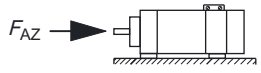
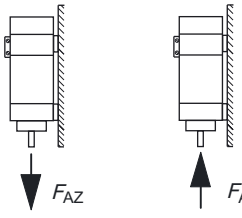
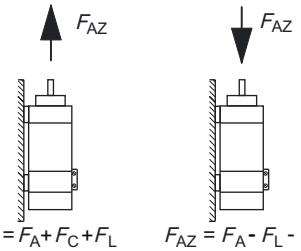
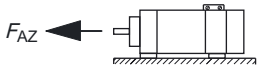
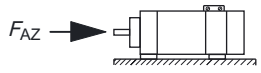
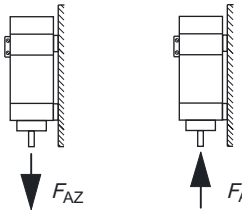
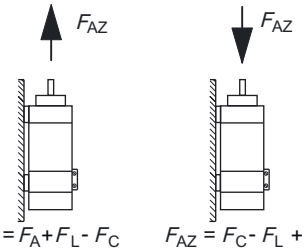
1 bar = 10^5 N/m^2

For axial forces in the direction of the motor, the spring-loading of the bearings can be overcome so that the rotor moves in accordance with the axial bearing play (up to 0.2mm). The permissible axial force F_{AZ} in operation depends on the motor mounting position.

When, for example, helical toothed wheels are used as the drive element, an axial force is exerted on the motor bearings in addition to the radial force. For axial forces in the direction of the motor, the spring-loading of the bearing can be overcome. This must be prevented as otherwise it could reduce the bearing and encoder service life.

The permissible axial force F_{AZ} in operation depends on the motor mounting position (see table "Calculating the permissible axial force").

Table 4-23 Calculating the permissible axial force

Horizontal arrangement	**Shaft end facing downwards**	**Shaft end facing upwards**
SH 80 - SH 160 with bearing version Standard with locating bearing, Performance, High Performance, Advanced Lifetime		
 $F_{AZ} = F_A - F_C$  $F_{AZ} = F_C + F_A$	 $F_{AZ} = F_A - F_L - F_C$ $F_{AZ} = F_L + F_C + F_A$	 $F_{AZ} = F_A + F_L - F_C$ $F_{AZ} = F_C - F_L + F_A$
SH 80 - SH 160 with bearing version Standard		
 $F_{AZ} = F_A - F_C$  $F_{AZ} = F_C$	 $F_{AZ} = F_A - F_L - F_C$ $F_{AZ} = F_L + F_C$	 $F_{AZ} = F_A + F_L - F_C$ $F_{AZ} = F_C - F_L$
SH 180 and SH 225		
 $F_{AZ} = F_A + F_C$  $F_{AZ} = F_A - F_C$	 $F_{AZ} = F_A + F_C - F_L$ $F_{AZ} = F_A - F_C + F_L$	 $F_{AZ} = F_A + F_C + F_L$ $F_{AZ} = F_A - F_L - F_C$
SH 280		
 $F_{AZ} = F_A - F_C$  $F_{AZ} = F_C + F_A$	 $F_{AZ} = F_A - F_L - F_C$ $F_{AZ} = F_L + F_C + F_A$	 $F_{AZ} = F_A + F_L - F_C$ $F_{AZ} = F_C - F_L + F_A$
F_{AZ}	Permissible axial force in operation	
F_A	Permissible axial force as a function of the average operating speed nm in each case, ignoring the preloading force and the force due to the weight of the rotor	
F_C	Pre-loading force	
F_L	Force due to weight of rotor	

4.7.3 Permissible radial and axial forces for 1PH808 Premium Performance

For the Premium Performance version of the 1PH808, the following radial and axial forces of the motor shaft are permissible:

Radial force = 100 N	Axial force = 1400 N
The axial force address comprises:	
Rotating union = 950 N	Preloading F_c = 450 N

Maximum permissible mechanical load

		DE shaft extension	NDE shaft extension
Maximum radial force		100 N	100 N
Maximum radial force	Solid shaft		
	1 Toward the motor	350 N	-
	2 Away from the motor	950 N	-
	Hollow shaft		
	1 Toward the motor	350 N	950 N
	2 Away from the motor	950 N	350 N

4.7.4 Radial and axial force diagrams

Permissible radial forces for SH 80

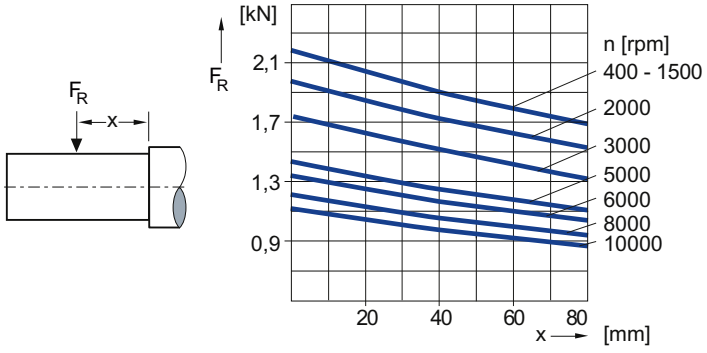


Figure 4-13 SH 80, Standard, and Standard with locating bearing, 20,000 h bearing lifetime

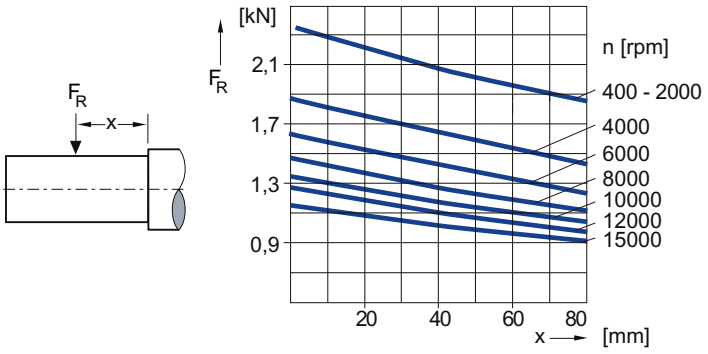


Figure 4-14 SH 80, Performance, High Performance, 12,000 h bearing lifetime

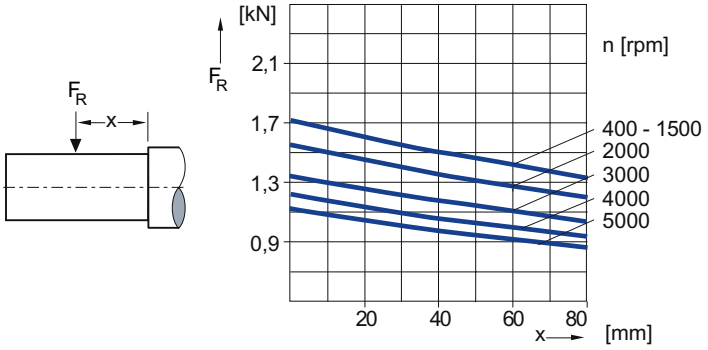


Figure 4-15 SH 80, Advanced Lifetime, 40,000 h bearing lifetime

Permissible radial forces for SH 100

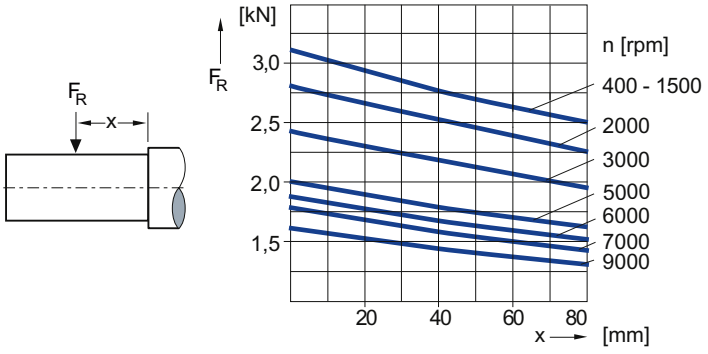


Figure 4-16 SH 100, Standard, and Standard with locating bearing, 20,000 h bearing lifetime

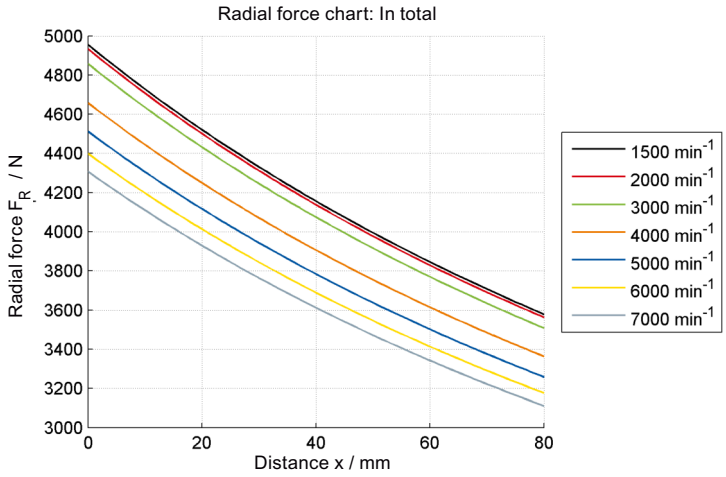


Figure 4-17 SH 100, increased radial force, 20,000 h bearing lifetime, minimum radial force: 0.5 kN

Note

Bearing with increased radial force

The roller bearings used here could sustain damage if they are operated under no load.

Observe the specified minimum radial forces!

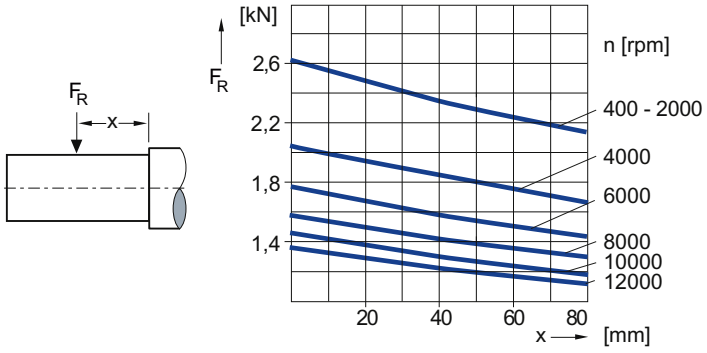


Figure 4-18 SH 100, Performance, 12,000 h bearing lifetime

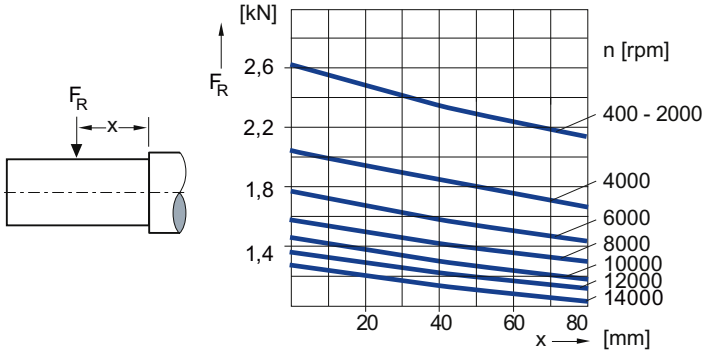


Figure 4-19 SH 100, High Performance, 12,000 h bearing lifetime

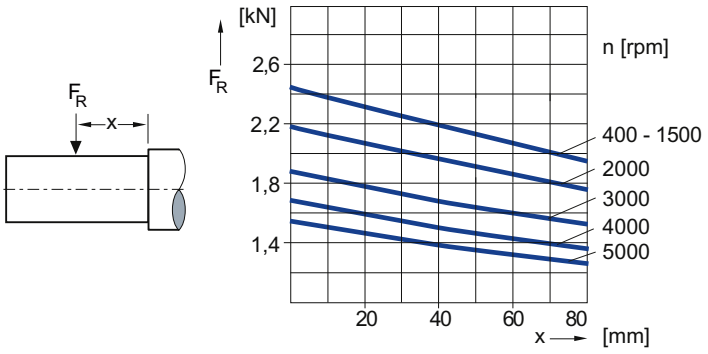


Figure 4-20 SH 100, Advanced Lifetime, 40,000 h bearing lifetime

Permissible radial forces for SH 132

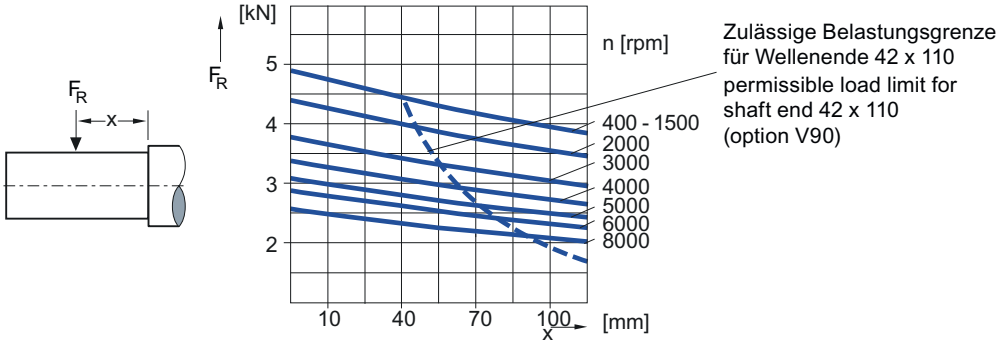


Figure 4-21 SH 132, Standard, and Standard with locating bearing, 20,000 h bearing lifetime

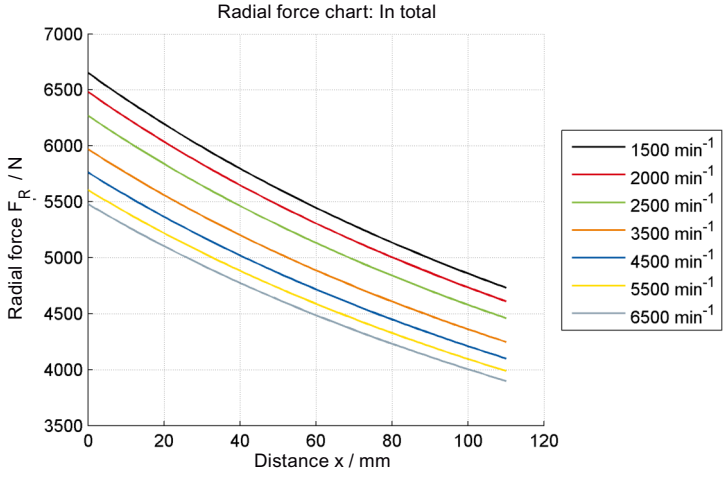


Figure 4-22 SH 132, increased radial force, 20,000 h bearing lifetime, minimum radial force: 0.7 kN

Note

Bearing with increased radial force

The roller bearings used here could sustain damage if they are operated under no load.

Observe the specified minimum radial forces!

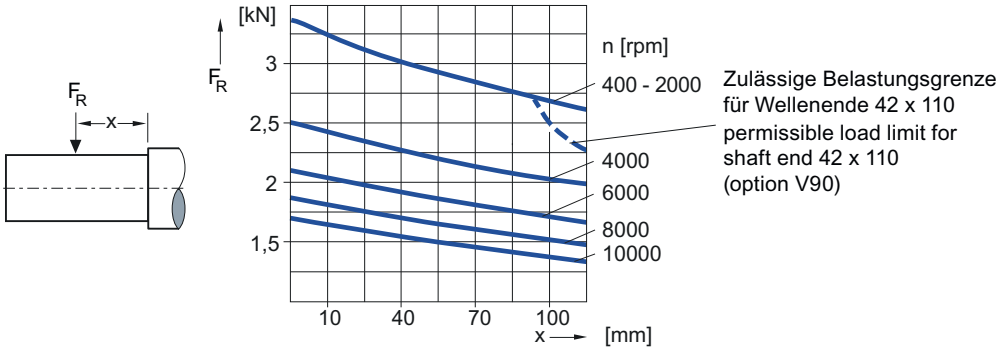


Figure 4-23 SH 132, Performance, 12,000 h bearing lifetime

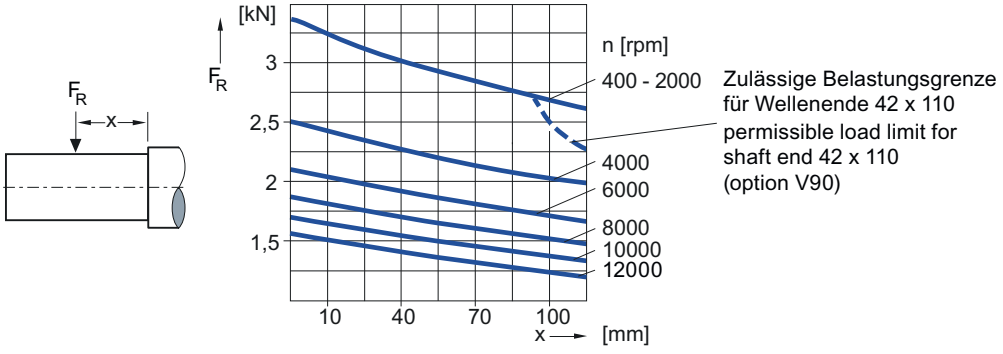


Figure 4-24 SH 132, High Performance, 12,000 h bearing lifetime

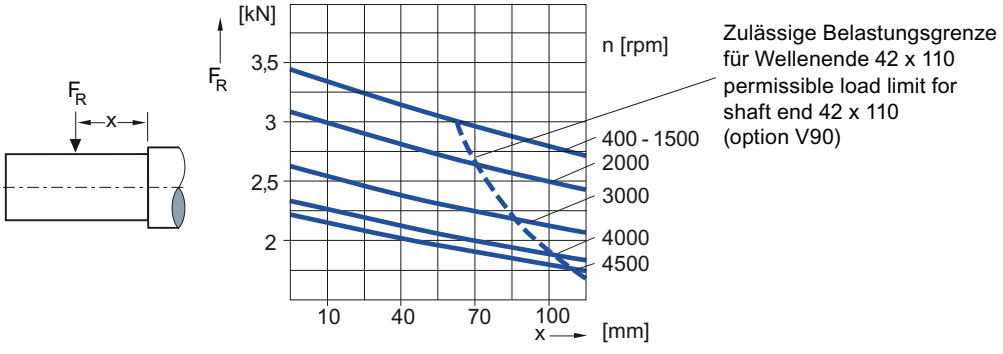


Figure 4-25 SH 132, Advanced Lifetime, 40,000 h bearing lifetime

Permissible radial forces for SH 160

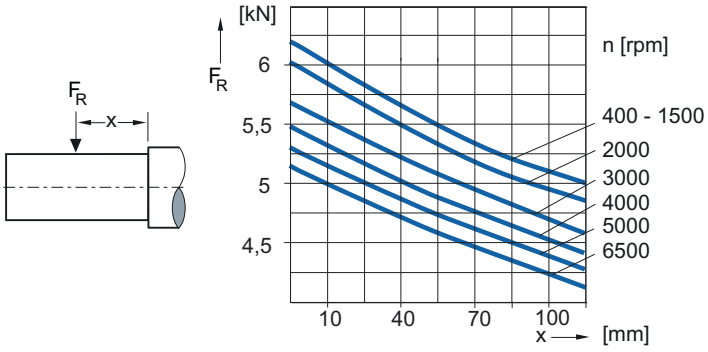


Figure 4-26 SH 160, Standard, and Standard with locating bearing, 20,000 h bearing lifetime

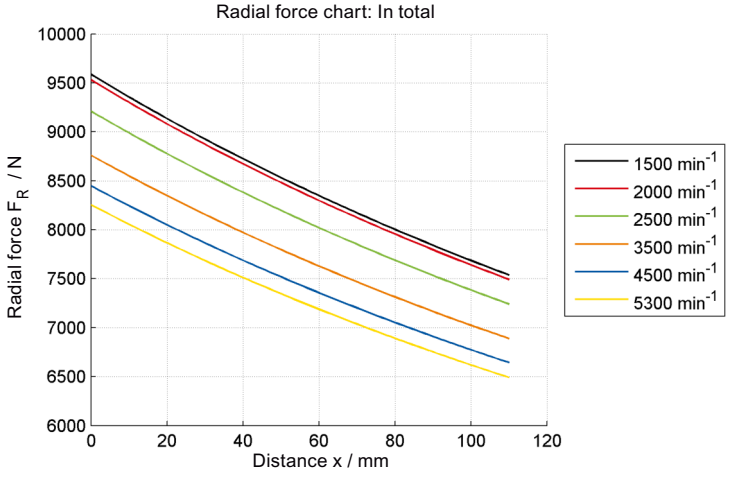


Figure 4-27 SH 160, increased radial force, 16,000 h bearing lifetime, minimum radial force: 1 kN

Note

Bearing with increased radial force

The roller bearings used here could sustain damage if they are operated under no load.

Observe the specified minimum radial forces!

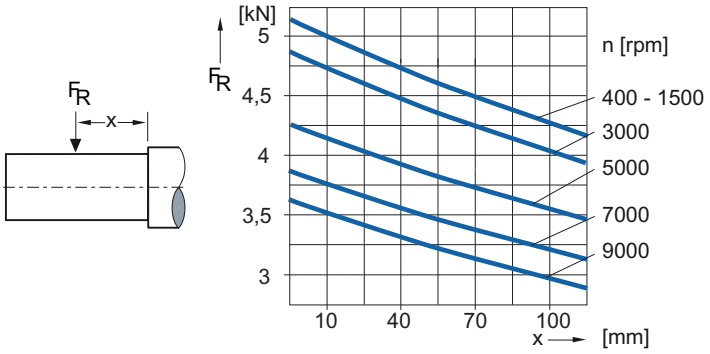


Figure 4-28 SH 160, Performance, 12,000 h bearing lifetime

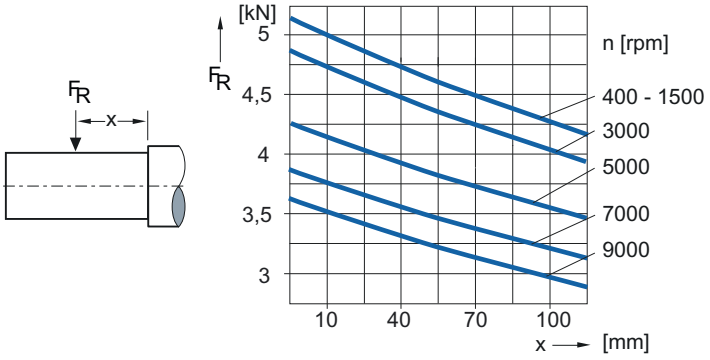


Figure 4-29 SH 160, High Performance, 12,000 h bearing lifetime

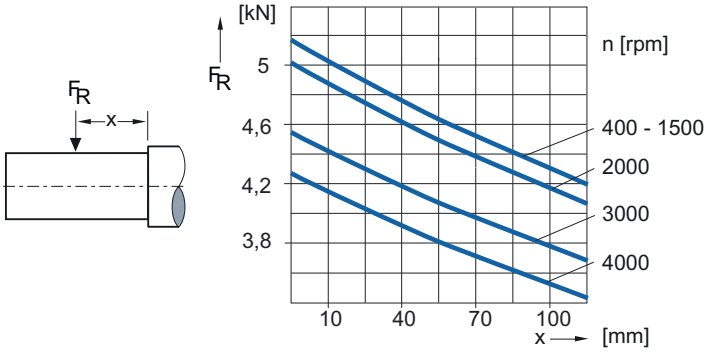


Figure 4-30 SH 160, Advanced Lifetime, 40,000 h bearing lifetime

Permissible radial forces for SH 180

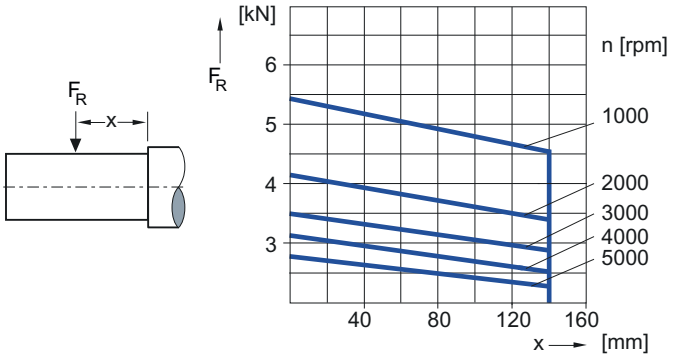


Figure 4-31 SH 180, Standard with locating bearing, 20,000 h bearing lifetime

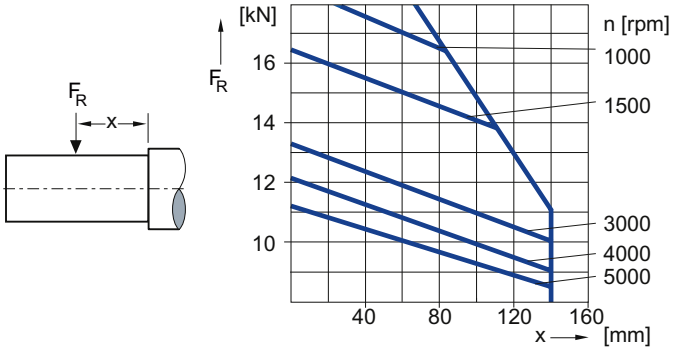


Figure 4-32 SH 180, increased radial force, 12,000 h bearing lifetime, minimum radial force: 4 kN

Note

Bearing with increased radial force

The roller bearings used here could sustain damage if they are operated under no load.

Observe the specified minimum radial forces!

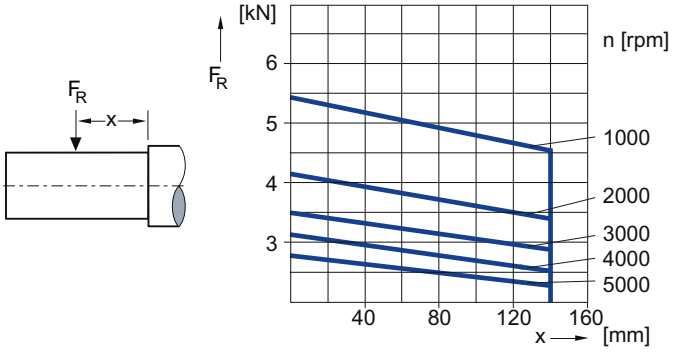


Figure 4-33 SH 180, Performance, 12,000 h bearing lifetime

Permissible radial forces for SH 225

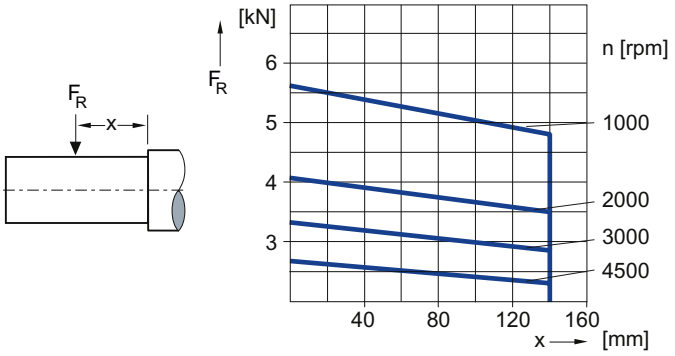


Figure 4-34 SH 225, Standard with locating bearing, 20,000 h bearing lifetime

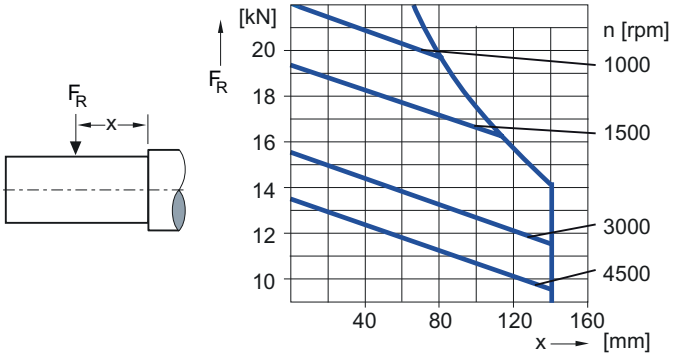


Figure 4-35 SH 225, increased radial force, 12,000 h bearing lifetime, minimum radial force: 5 kN

Note

Bearing with increased radial force

The roller bearings used here could sustain damage if they are operated under no load.

Observe the specified minimum radial forces!

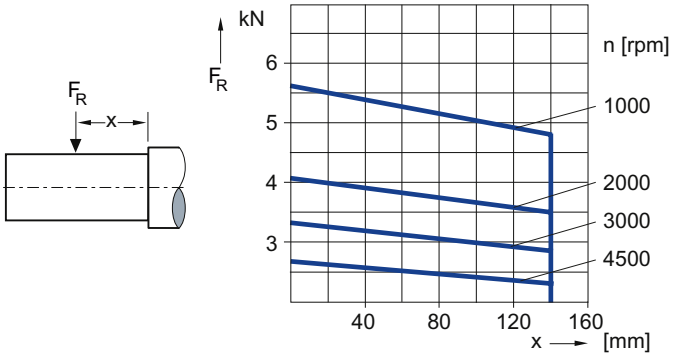


Figure 4-36 SH 225, Performance, 12,000 h bearing lifetime

Permissible radial forces for SH 280

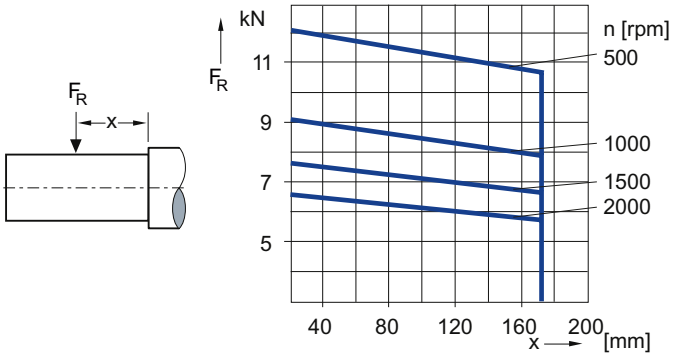


Figure 4-37 SH 280, Standard with locating bearing, 20,000 h bearing lifetime

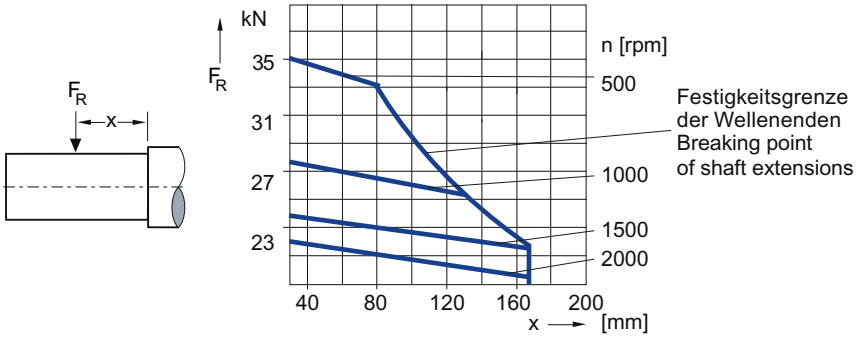


Figure 4-38 SH 280, increased radial force, 12,000 h bearing lifetime,minimum radial force: 9 kN

Note

Bearing with increased radial force

The roller bearings used here could sustain damage if they are operated under no load.

Observe the specified minimum radial forces!

Axial forces

Deep-groove ball bearings can absorb both radial as well as axial forces.

The maximum axial forces F_A as a function of the radial force are shown in the following force diagrams.

The permissible bearing forces are specified without taking into account the force due to spring-loaded bearings, the rotor weight for vertical mounting as well as the direction of the force.

Note

Determining the permissible axial forces

The permissible axial forces at the shaft extension $F_{A\ perm}$ are dependent on the application (mounting, force direction) and must be calculated.

Forces due to the rotor weight and spring-loading forces

Table 4-24 Force due to weight and spring-loading of the rotor

Motor type	Force due to weight F_L N	Force due to spring-loading F_C +/- 25 % N
1PH8081	65	450
1PH8083	90	
1PH8087	115	
1PH8101	120	550
1PH8103	150	
1PH8105	195	
1PH8107	220	
1PH8131	270	900
1PH8133	330	
1PH8135	390	
1PH8137	445	
1PH8138		
1PH8163	600	1200
1PH8164		
1PH8165	715	
1PH8166		
1PH8167	655	
1PH8168		
1PH8184	900	880
1PH8184 (type of construction IM V5, V15)		2300
1PH8186	1150	880
1PH8186 (type of construction IM V5, V15)		2300
1PH8224	1710	880
1PH8226	2160	
1PH8228	2570	
1PH8284	3300	1100
1PH8286	4000	
1PH8288	4700	

Note

For motors, shaft heights 80 to 160, the spring loading of the bearing F_c can be increased by using option Q81. For description of option Q81, see Chapter "Motor components and options".

Permissible axial forces for shaft height 80

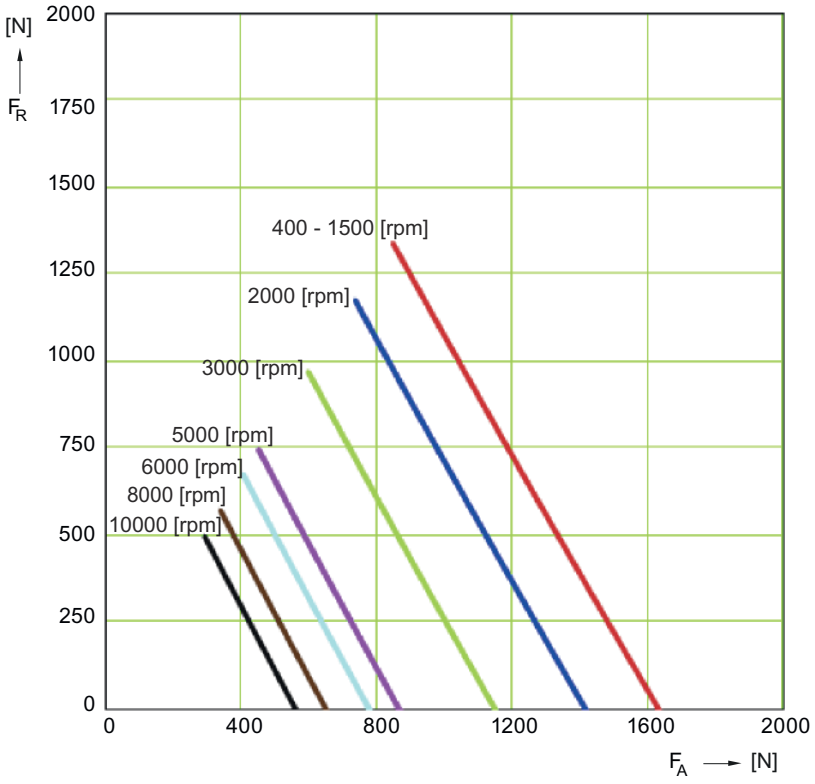


Figure 4-39 SH 80, Standard, and Standard with locating bearing, 20,000 h bearing lifetime

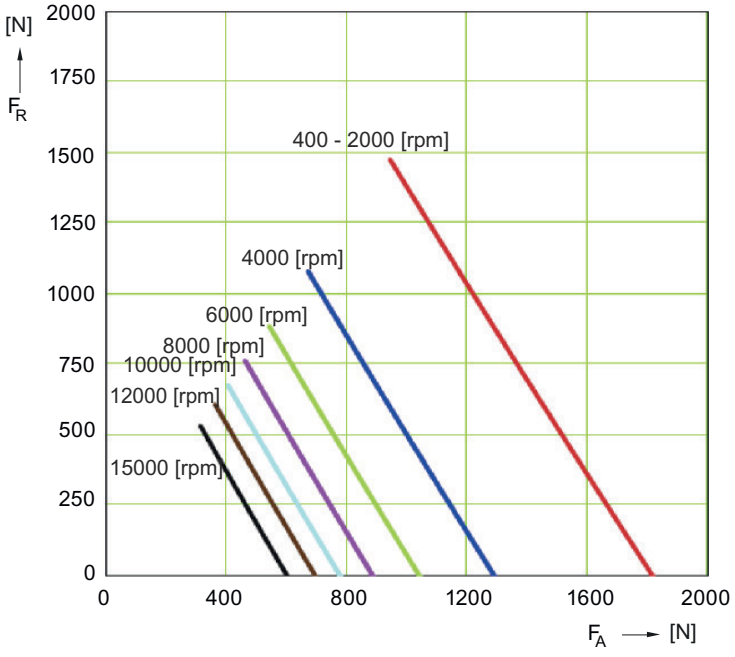


Figure 4-40 SH 80, Performance, High Performance, 12,000 h bearing lifetime

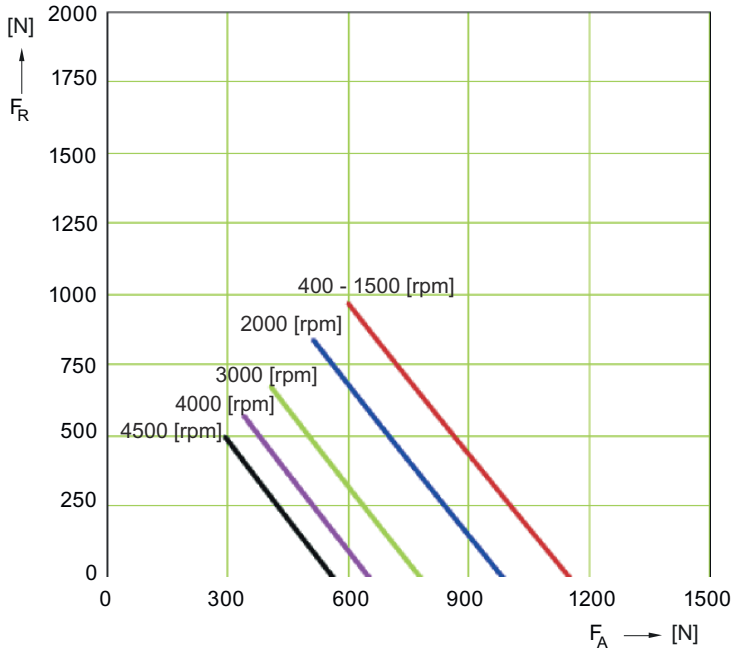


Figure 4-41 SH 80, Advanced Lifetime, 40,000 h bearing lifetime

Permissible axial forces for shaft height 100

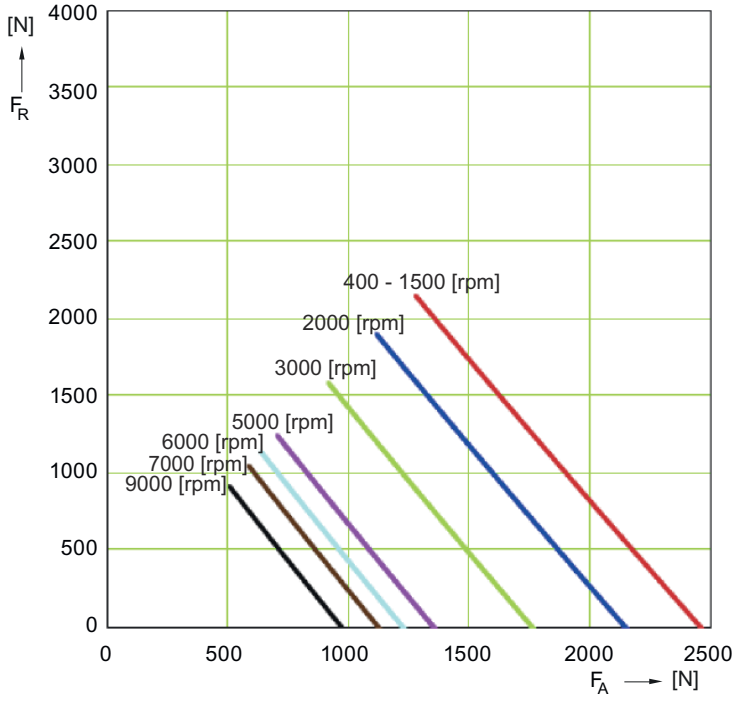


Figure 4-42 SH 100, Standard, and Standard with locating bearing, 20,000 h bearing lifetime

Table 4-25 SH 100, increased radial force, 20,000 h bearing lifetime

Motor type		**Max. permissible axial force as a function of speed**						
1PH810	Speed n r/min	1500	2000	3000	4000	5000	6000	7000
	Axial force F_A N	2100	2050	1950	1850	1750	1700	1650

Note

The permissible axial force is absorbed exclusively by the deep-groove ball bearing of the duplex bearing. The cylindrical roller bearing absorbs the radial force. The axial force F_{AZ} that is permissible during operation is calculated as stated in table "Calculating the permissible axial force (Page 113)."

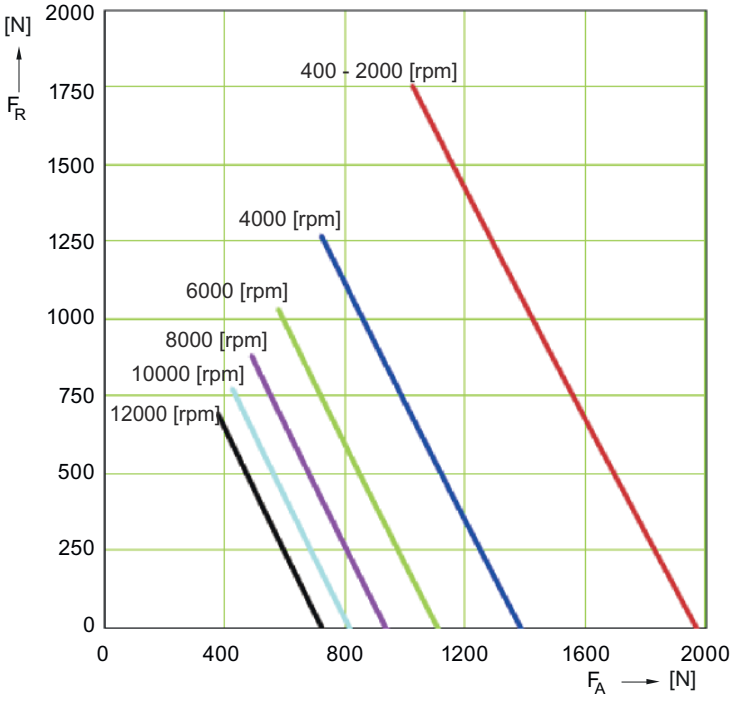


Figure 4-43 SH 100, Performance, 12,000 h bearing lifetime

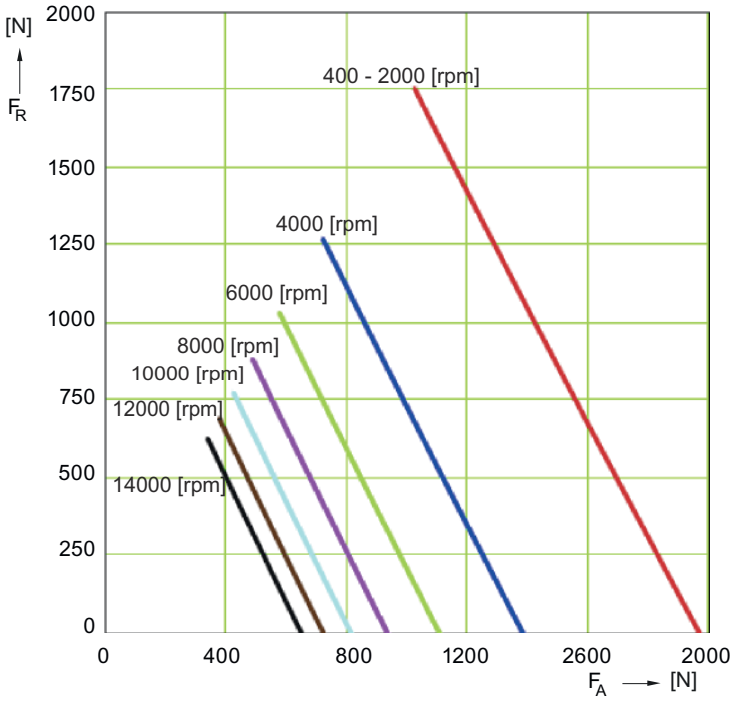


Figure 4-44 SH 100, High Performance, 12,000 h bearing lifetime

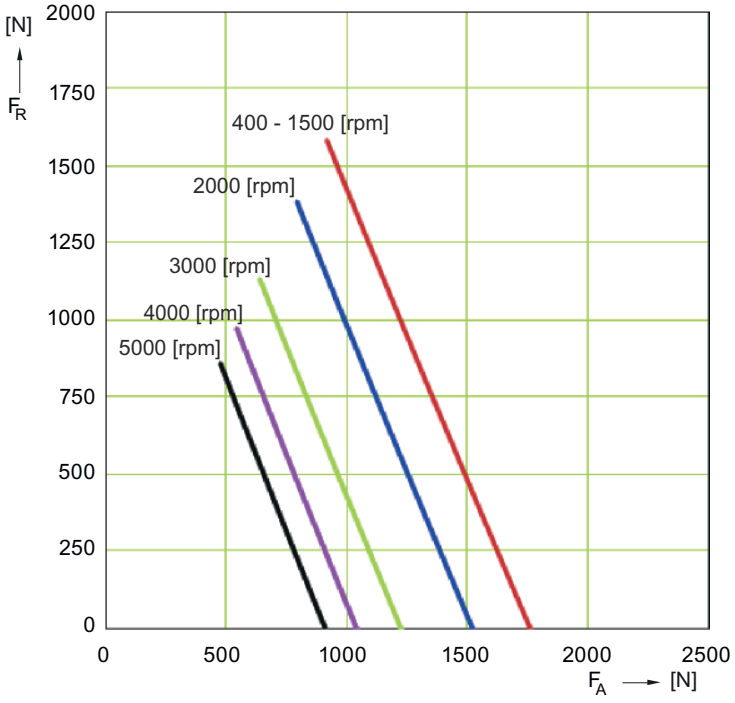


Figure 4-45 SH 100, Advanced Lifetime, 40,000 h bearing lifetime

Permissible axial forces for SH 132

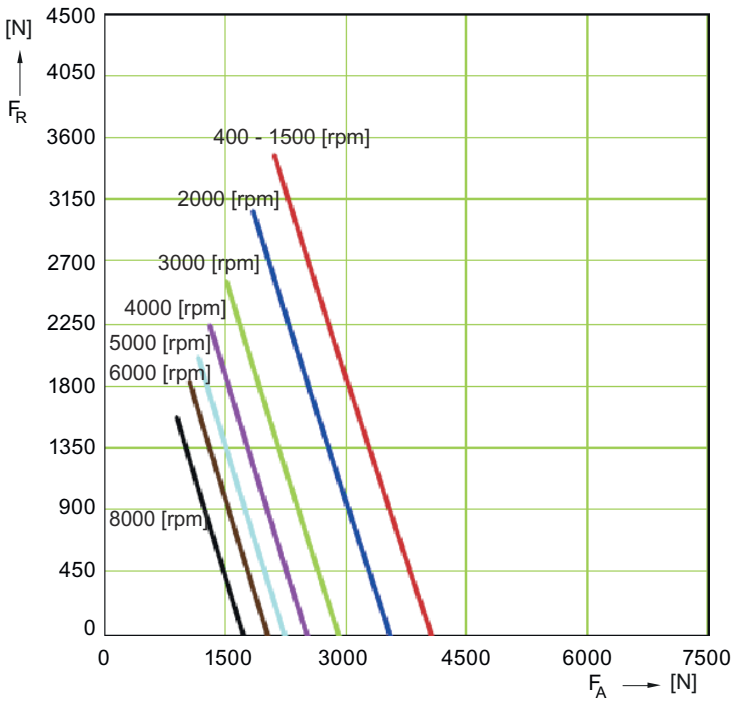


Figure 4-46 SH 132, Standard, and Standard with locating bearing, 20,000 h bearing lifetime

Table 4-26 SH 132, increased radial force, 20,000 h bearing lifetime

Motor type		**Max. permissible axial force as a function of speed**						
1PH813	Speed n r/min	1500	2000	3000	4000	5000	6500	-
	Axial force F_A N	2600	2550	2400	2250	2200	2100	-

Note

The permissible axial force is absorbed exclusively by the deep-groove ball bearing of the duplex bearing. The cylindrical roller bearing absorbs the radial force. The axial force F_{AZ} that is permissible during operation is calculated as stated in table "Calculating the permissible axial force (Page 113)."

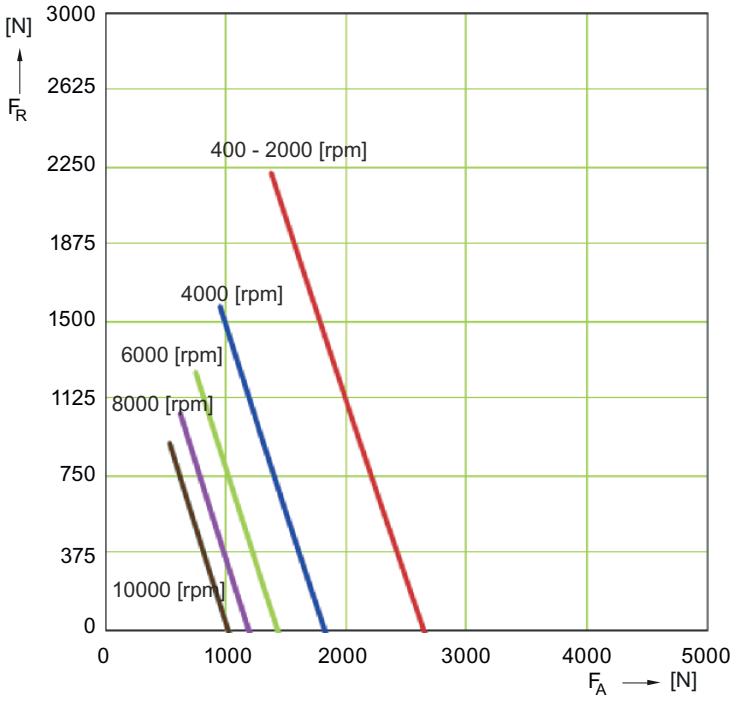


Figure 4-47 SH 132, Performance, 12,000 h bearing lifetime

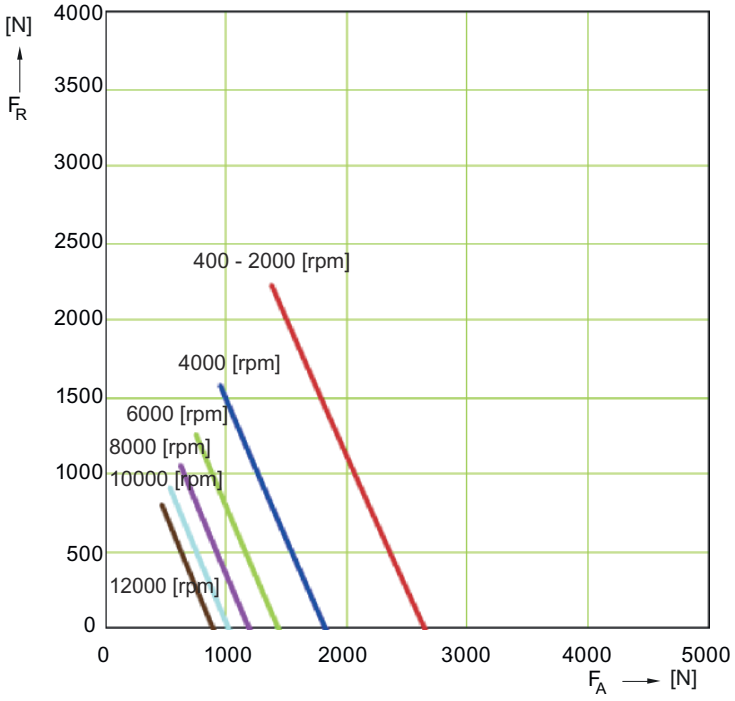


Figure 4-48 SH 132, High Performance, 12,000 h bearing lifetime

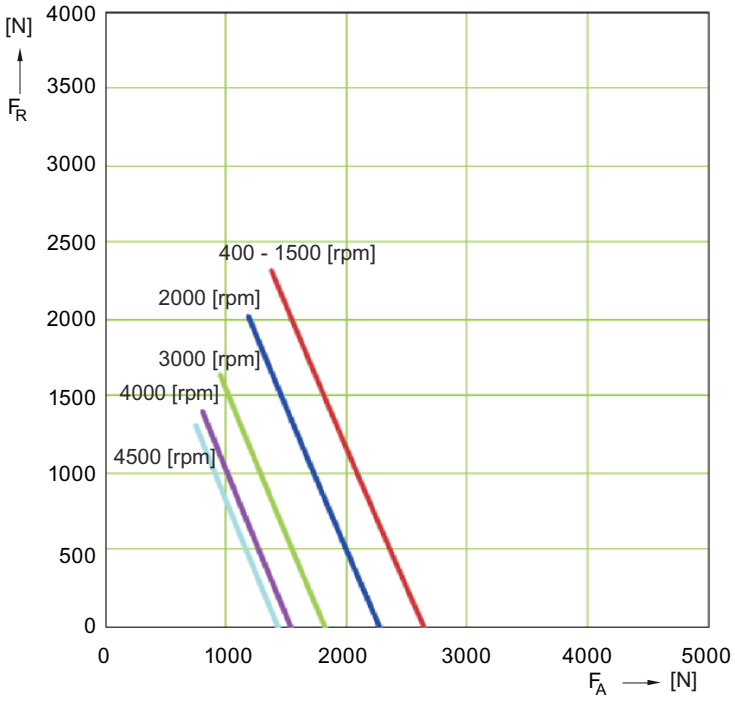


Figure 4-49 SH 132, Advanced Lifetime, 40,000 h bearing lifetime

Permissible axial forces for SH 160

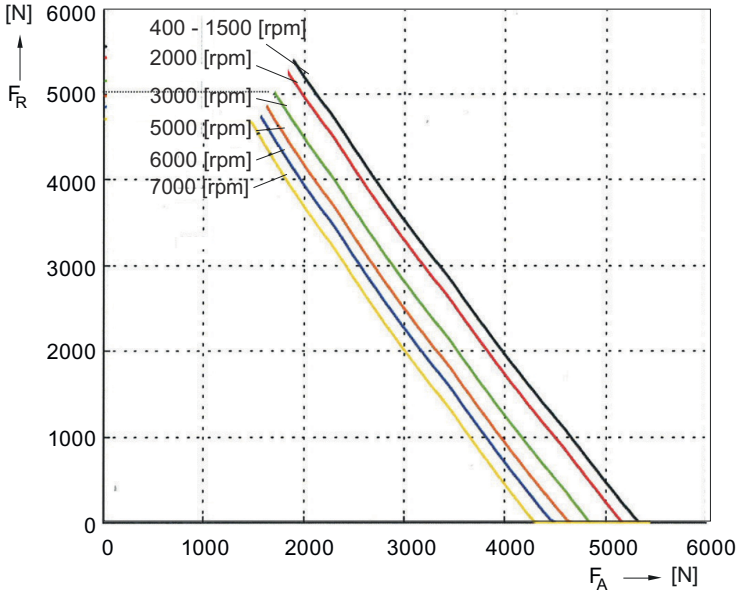


Figure 4-50 SH 160, Standard, and Standard with locating bearing, 20,000 h bearing lifetime

Table 4-27 SH 160, increased radial force, 16,000 h bearing lifetime

Motor type		**Max. permissible axial force as a function of speed**						
1PH816	Speed n r/min	1500	2000	3000	4000	5300	-	-
	Axial force F_A N	4000	3800	3550	3400	3250	-	-

Note

The permissible axial force is absorbed exclusively by the deep-groove ball bearing of the duplex bearing. The cylindrical roller bearing absorbs the radial force. The axial force F_{AZ} that is permissible during operation is calculated as stated in table "Calculating the permissible axial force."

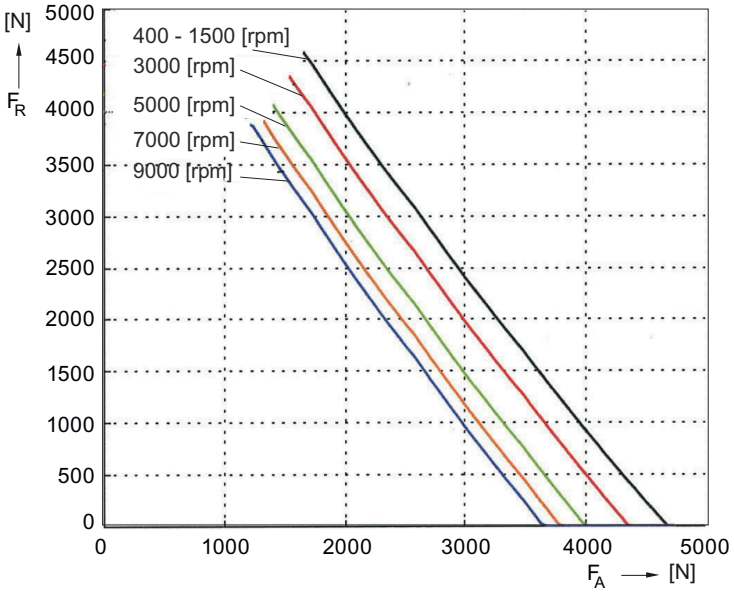


Figure 4-51 SH 160, Performance, 12,000 h bearing lifetime

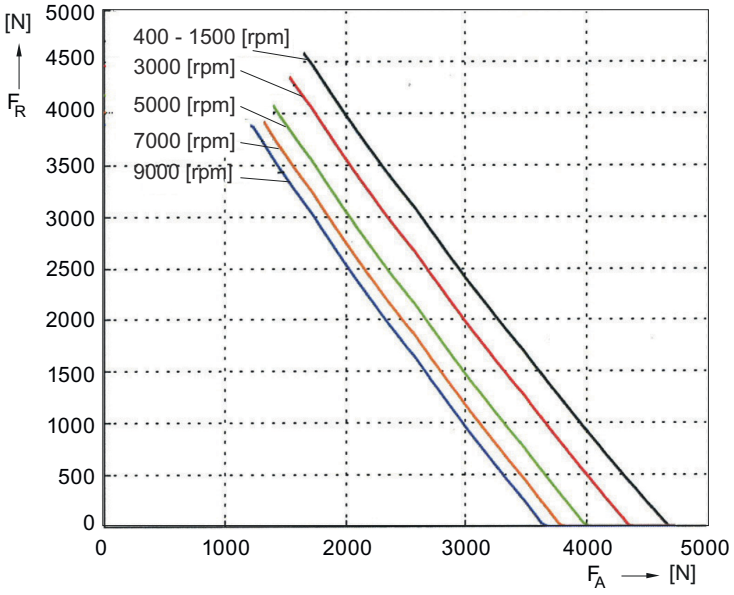


Figure 4-52 SH 160, High Performance, 12,000 h bearing lifetime

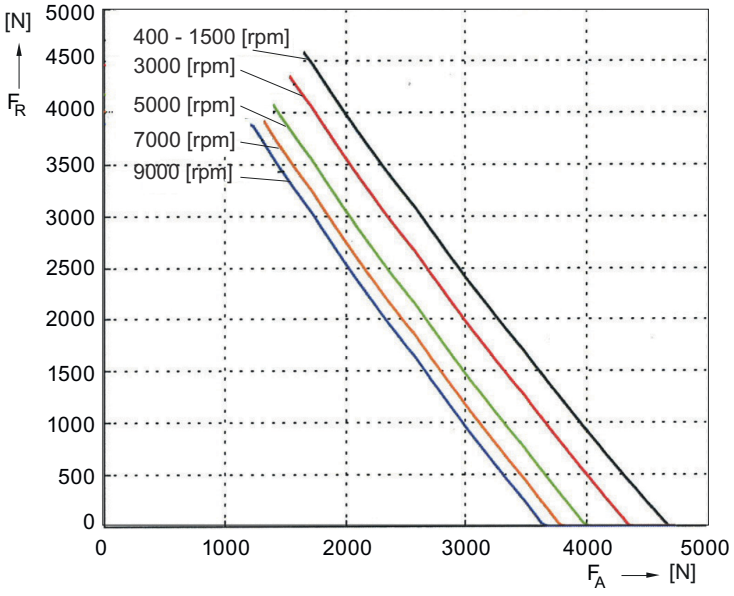


Figure 4-53 SH 160, Performance, 12,000 h bearing lifetime

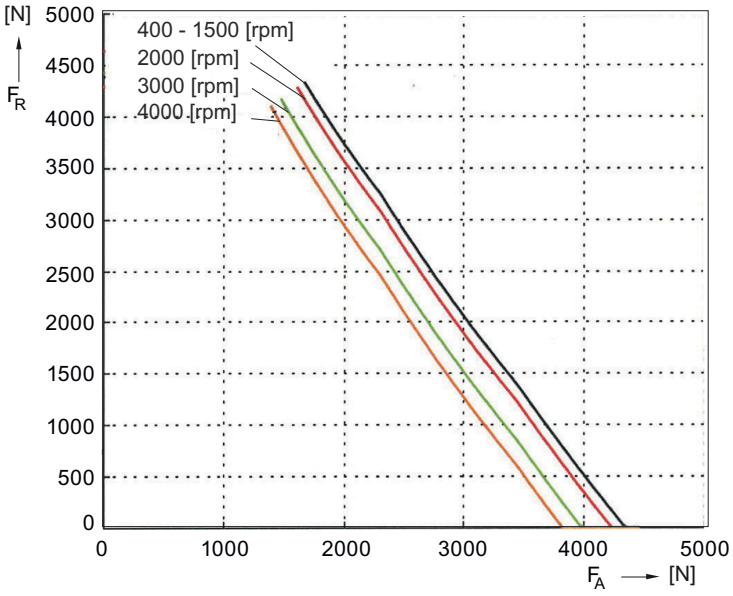


Figure 4-54 SH 160, Advanced Lifetime, 40,000 h bearing lifetime

See also

Axial force (Page 113)

Permissible axial forces for SH 180

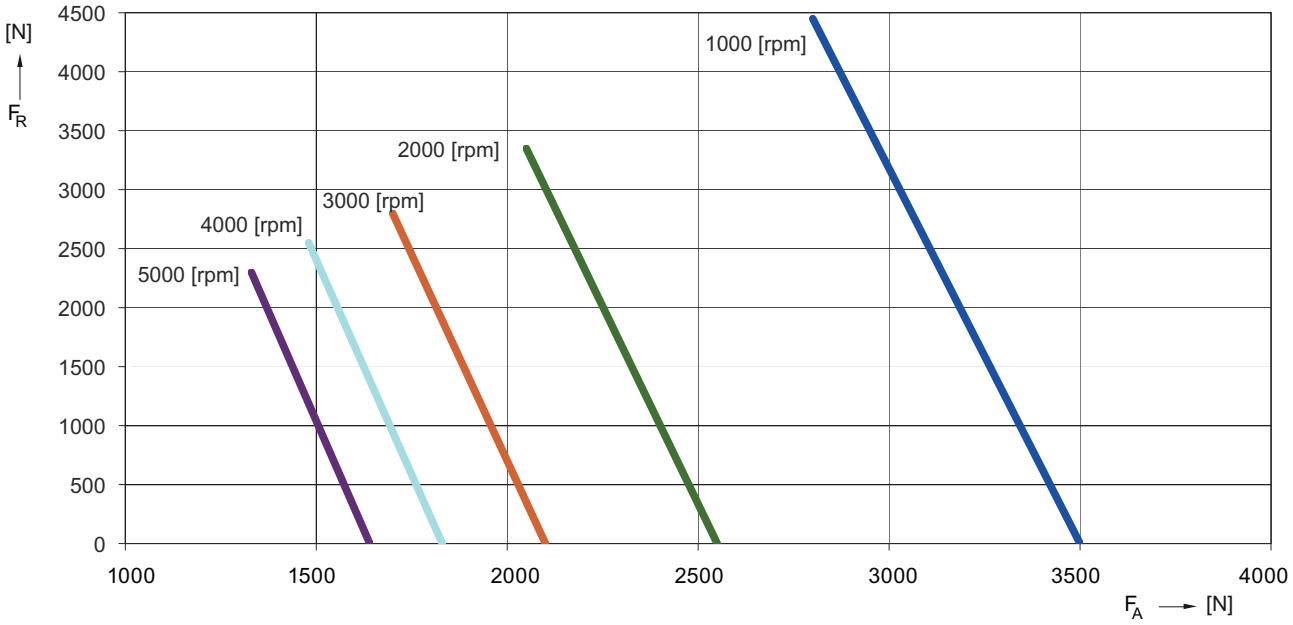


Figure 4-55 SH 180, Standard/Performance, 20,000/12,000 h bearing lifetime

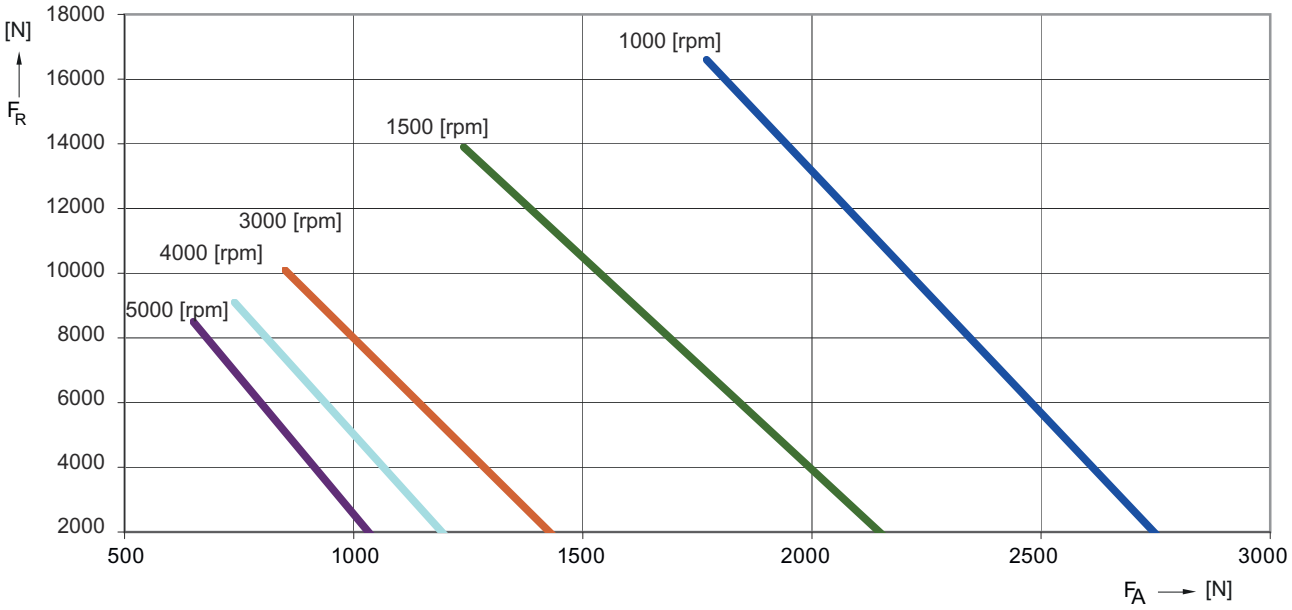


Figure 4-56 SH 180, increased cantilever forces, 12,000 h bearing lifetime

Permissible axial forces for SH 225

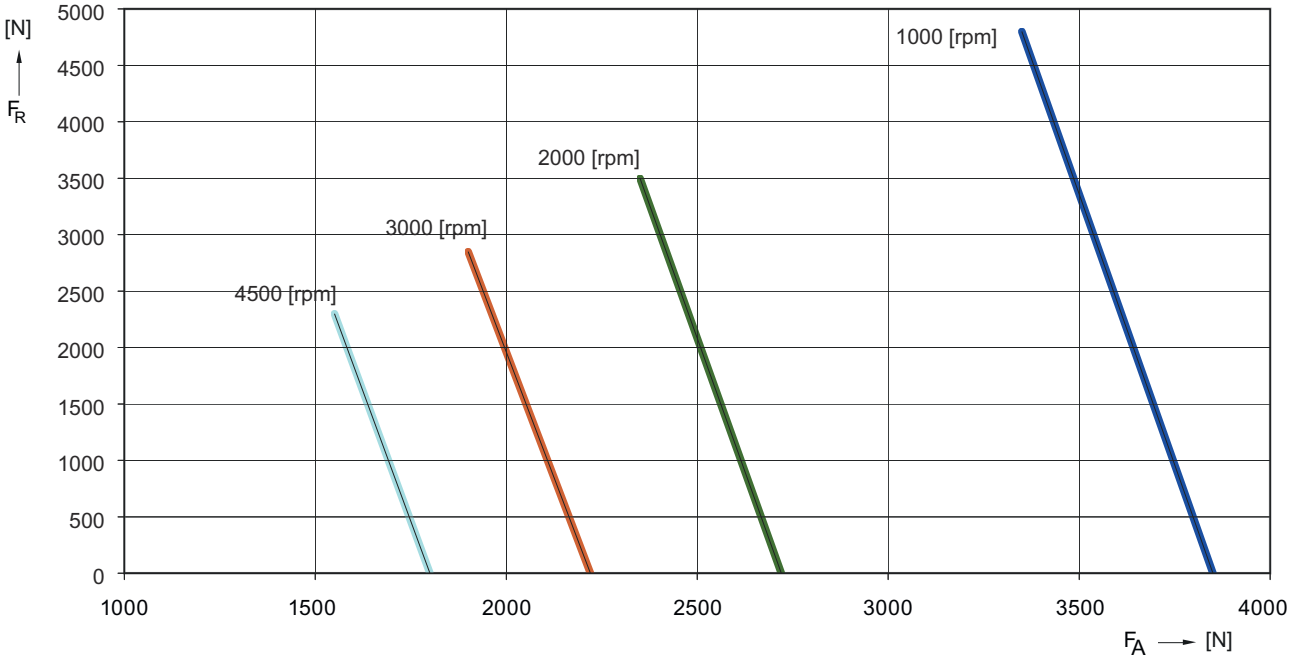


Figure 4-57 SH 225, Standard/Performance, 20,000/12,000 h bearing lifetime

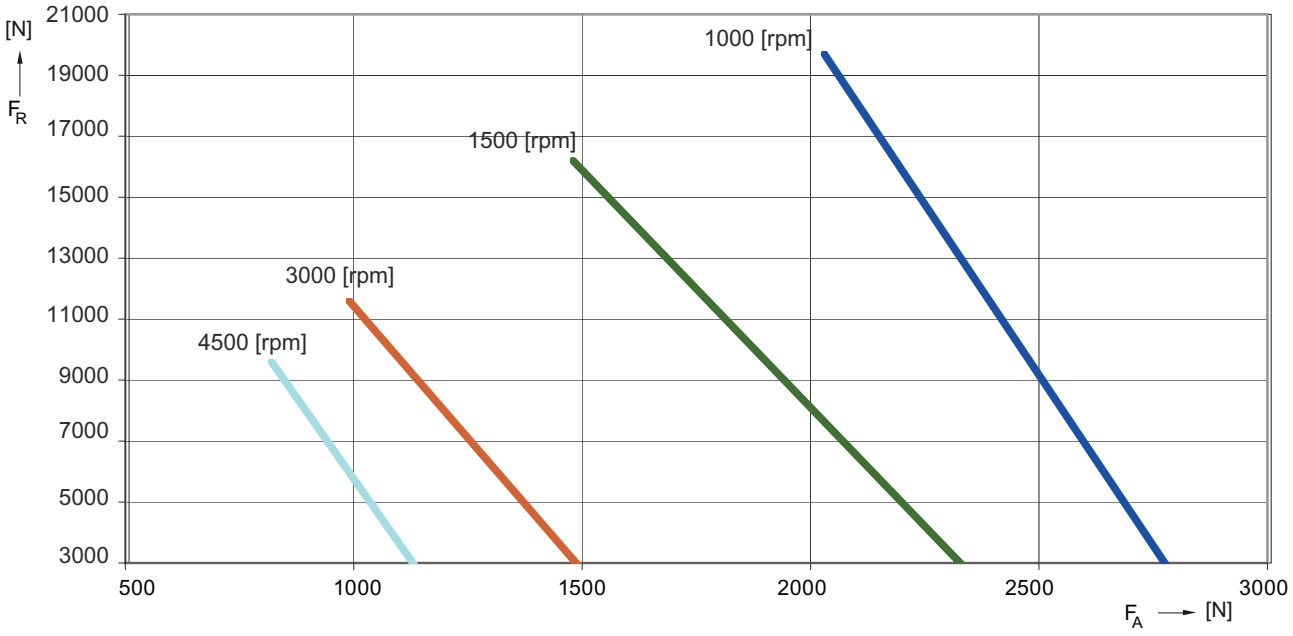


Figure 4-58 SH 225, increased cantilever forces, 12,000 h bearing lifetime

Permissible axial forces for SH 280

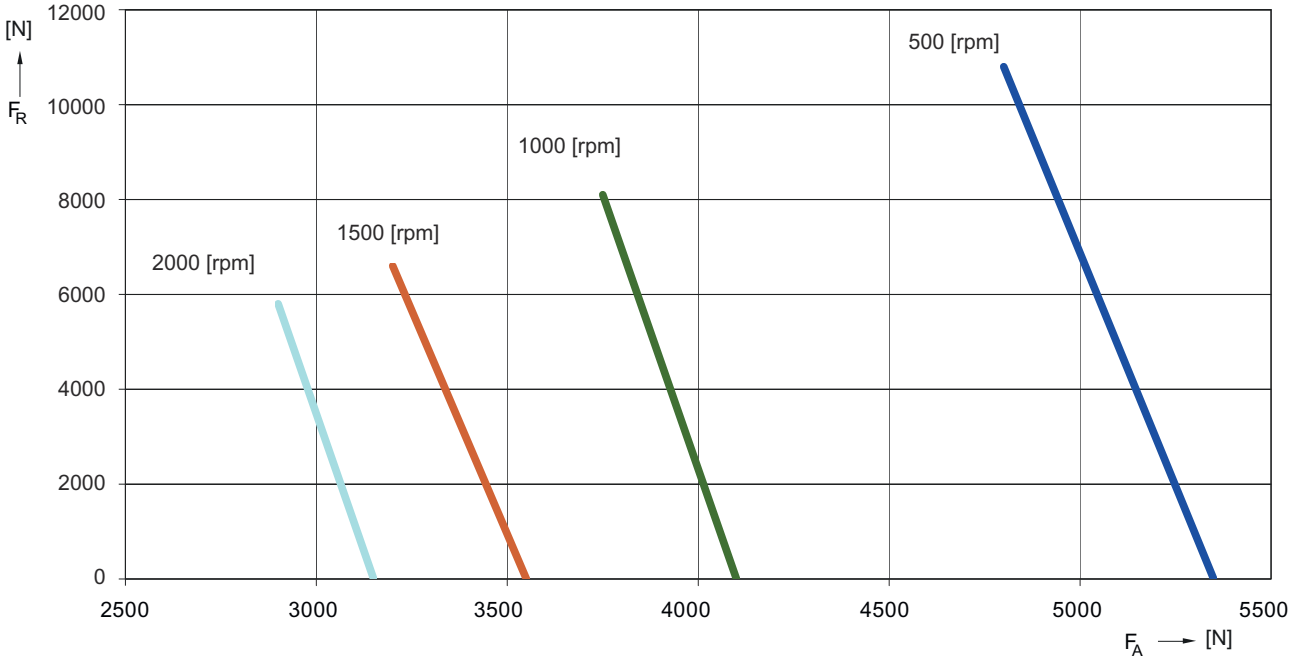


Figure 4-59 SH 280, Standard, 20000 h bearing lifetime

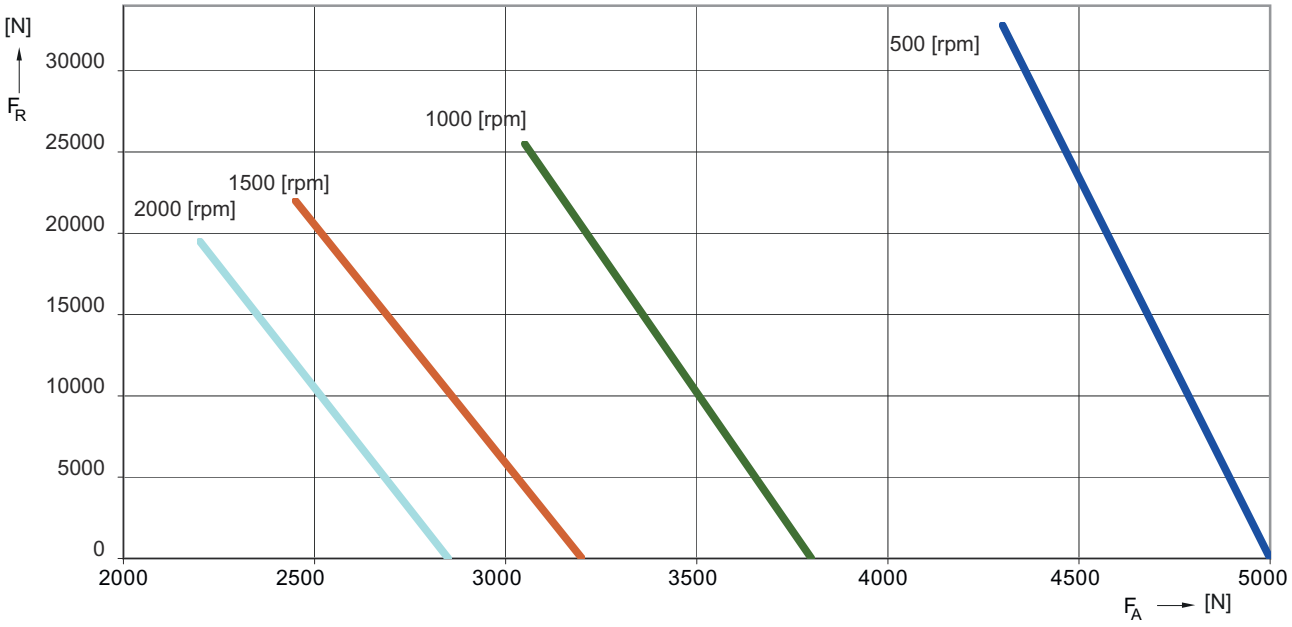


Figure 4-60 SH 280, increased cantilever forces, 12,000 h bearing lifetime

4.8 Radial eccentricity, concentricity and axial eccentricity

The shaft and flange accuracies are always checked in accordance with DIN 42955, IEC 60072. For shaft heights 180, 225 and 280, however, the flange accuracy is checked in accordance with DIN 50347. Data deviating from these values are indicated in the dimension drawings.

Table 4-28 Radial eccentricity tolerance of the shaft to the frame axis (in relation to the cylindrical shaft extensions)

Shaft height	Tolerance level N	Tolerance level R	Tolerance SPECIAL
80	0.05	0.025	0.01
100	0.05	0.025	0.01
132	0.05	0.025	0.01
160	0.06	0.03	0.01
180	0.06	0.03	-
225	0.06	0.03	-
280	0.07	0.035	-

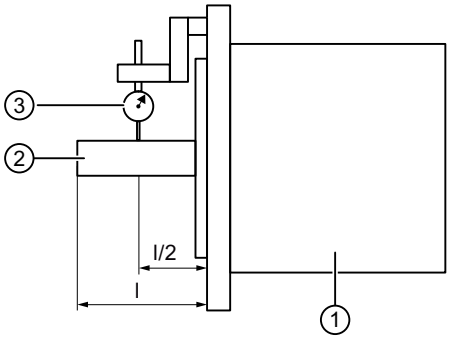


Figure 4-61 Checking the radial eccentricity

Table 4-29 Concentricity and axial eccentricity tolerance of the flange surface to the shaft axis (referred to the centering diameter of the mounting flange)

Shaft height	Tolerance level N	Tolerance level R	Tolerance SPECIAL
80	0.1	0.05	0.03
100	0.1	0.05	0.04
132	0.125	0.063	0.04
160	0.125	0.063	0.04
180	0.125	0.063	-
225	0.125	0.063	-
280	0.16	0.08	-

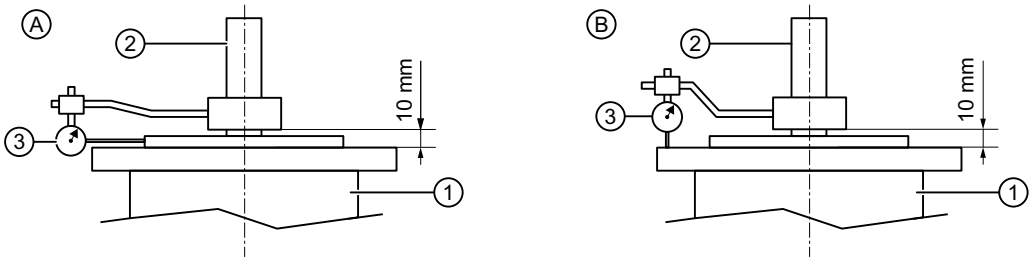


Figure 4-62 Checking the concentricity and axial eccentricity

Note

Acceptance test certificate

The runout, concentricity and axial eccentricity are tested in the Siemens factories as standard. For 1PH8 motors, an acceptance test certificate with the values actual measured can be ordered with option B36.

4.9 Balancing

4.9.1 Requirements

Requirements placed on the process when balancing mounted components - especially belt pulleys

In addition to the balance quality of the motor, the vibration quality of motors with mounted belt pulleys and coupling is essentially determined by the balance quality of the mounted component.

If the motor and mounted component are separately balanced before they are assembled, then the process used to balance the belt pulley or coupling must be adapted to the motor balancing type.

For asynchronous motors, a differentiation should be made between the following balancing types:

- Half-key balancing (an "H" is stamped on the shaft face)
- Full-key balancing (an "F" is stamped on the shaft face)
- Smooth shaft end (no keyway)

The balancing type is coded in the order designation.

Note

Machining the feather key

In the case of a half-key balanced shaft end and short output element, remove if necessary the part of the feather key which protrudes out of the output element and beyond the shaft contour. This is urgently recommended at speeds above 1000 r/min, and where the balance quality must comply with high demands.

For the highest demands placed on the system balance quality, we recommend that motors with smooth shaft (without keyway) are used. For motors balanced with full key, we recommend belt pulleys with two keyways on opposite sides, however, with only one key in the shaft end.

Table 4-30 Requirements placed on the balancing process as a function of the motor balancing type

Balancing equipment/ Process step	Motor Half key balanced	Motor balanced with full key	Motor with plain shaft end
Auxiliary shaft to balance the mounted component	• Auxiliary shaft with keyway • Keyway with the same dimensions as in the motor shaft end • Auxiliary shaft half key balanced	• Auxiliary shaft with keyway • Slot design with the exception of the slot width (as the motor) can be freely selected • Auxiliary shaft full key balanced	• Auxiliary shaft without keyway • If required, use a tapered auxiliary shaft
	• Balance quality of the auxiliary shaft ≤ 10 % of the required balance quality of the component to be mounted to the motor		
Attaching the mounted component to the auxiliary shaft for balancing	• Attached using a key • Key design, dimensions and materials the same as at the motor shaft end	• Attached using a key • Key design, dimensions and material the same as used for the full key balancing of the auxiliary shaft	• Attach the component as far as possible without any play, e.g. using a light press fit on the tapered shaft
Position the mounted component on the auxiliary shaft	• Select a position between the mounted component and the key of the auxiliary shaft so that it is the same when mounted on the actual motor	• No special requirements	
Balance the mounted component	• Two-plane balancing is recommended - i.e. balancing in two planes at both sides of the mounted components at right angles to the axis of rotation		

Special requirements

If special requirements are placed on the smooth running operation of the machine, we recommend that the motor together with the output components is completely balanced. In this case, balancing should be carried out in two planes of the output component.

4.9.2 Balancing 1PH8 motors with "Premium Performance" bearing version

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.

1PH8 motors are supplied with "special" vibration severity. Mounting a coupling element on the shaft extension changes the rotor balancing state. As a consequence, after mounting coupling elements, the rotor must be completely balanced. The following description shows, using an example, the procedure for 1PH8 motors with "Premium Performance" bearing version. You must determine the vibration severity and the position of the imbalance by making the appropriate measurements. You can then remove the imbalance.

Measuring unit required

2-channel vibration measuring unit

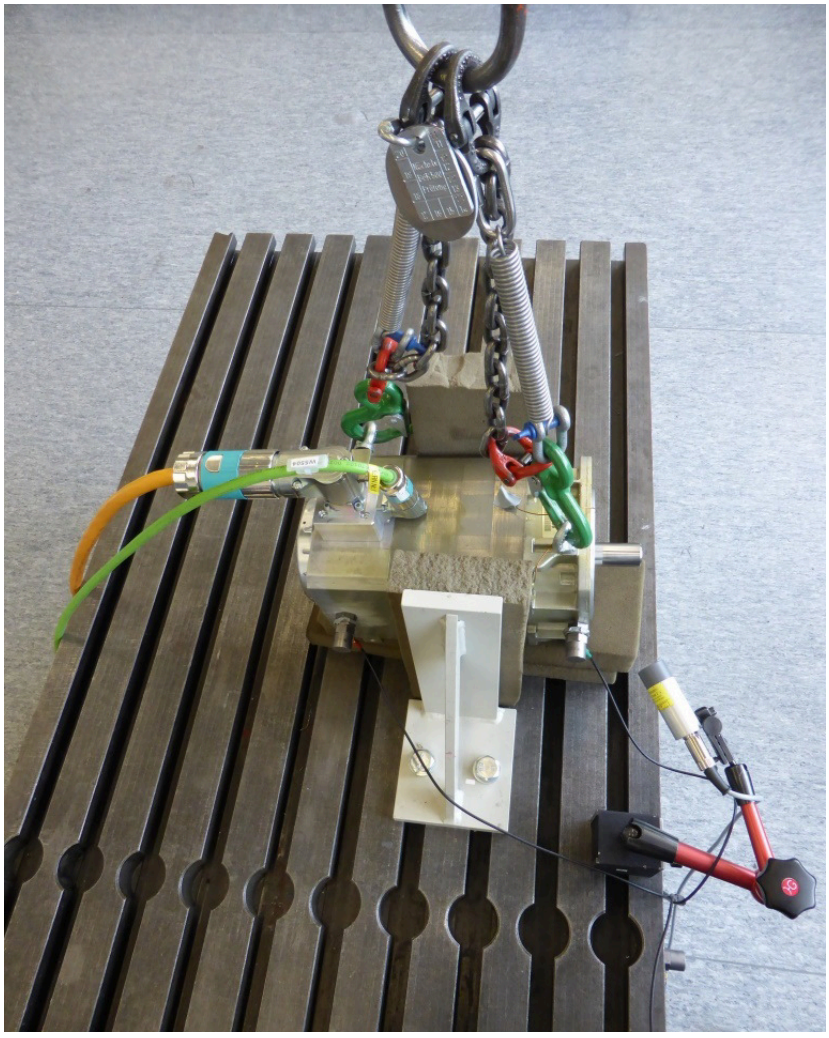
Frequency bandwidth: 10 Hz to 1000 Hz

The measuring unit must be equipped with a function to analyze orders of frequency components. Using this function, you can display the imbalance (1st order vibration component).

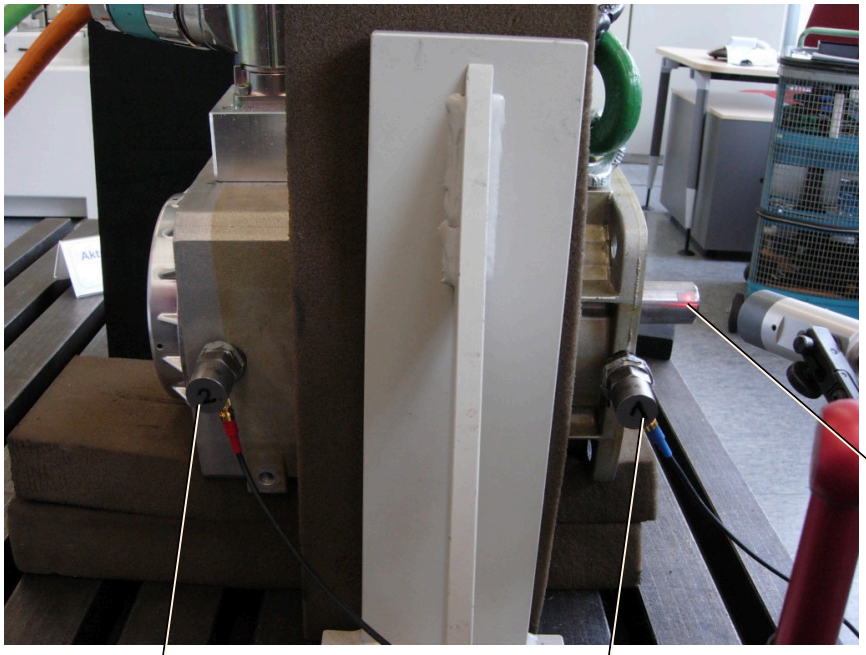
Typical approach

1.
2.

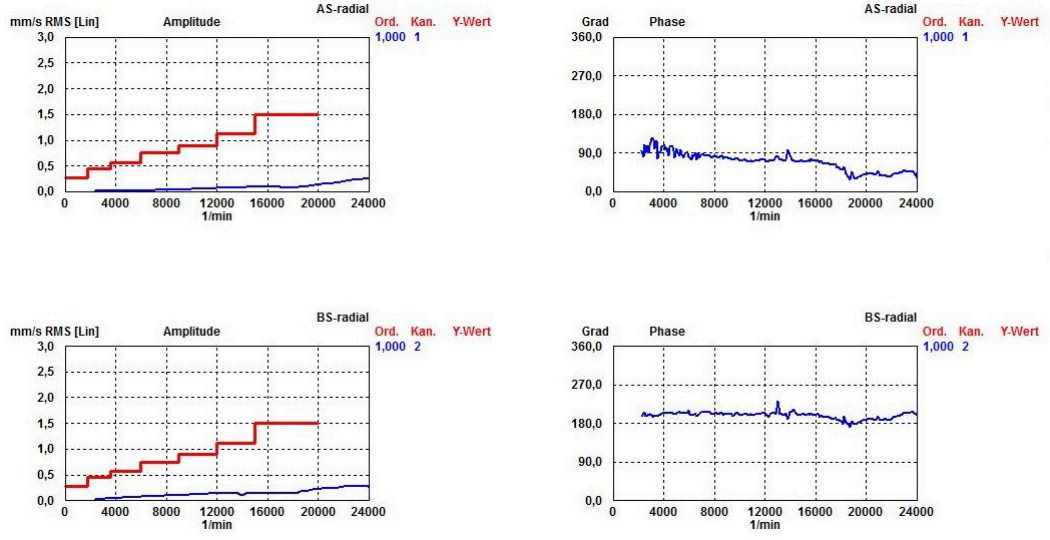
1. Prepare to make the reference measurement. Freely suspend the motor according to IEC 60034-14.
   The natural frequency of the motor-spring system must be less than 3 Hz. As a consequence, use springs that are adapted to the motor mass. The motor must be freely suspended so that the reference measurement can provide a correct measurement result.



2. Make a reference mark on the shaft (DE) for the speed and angle detection.



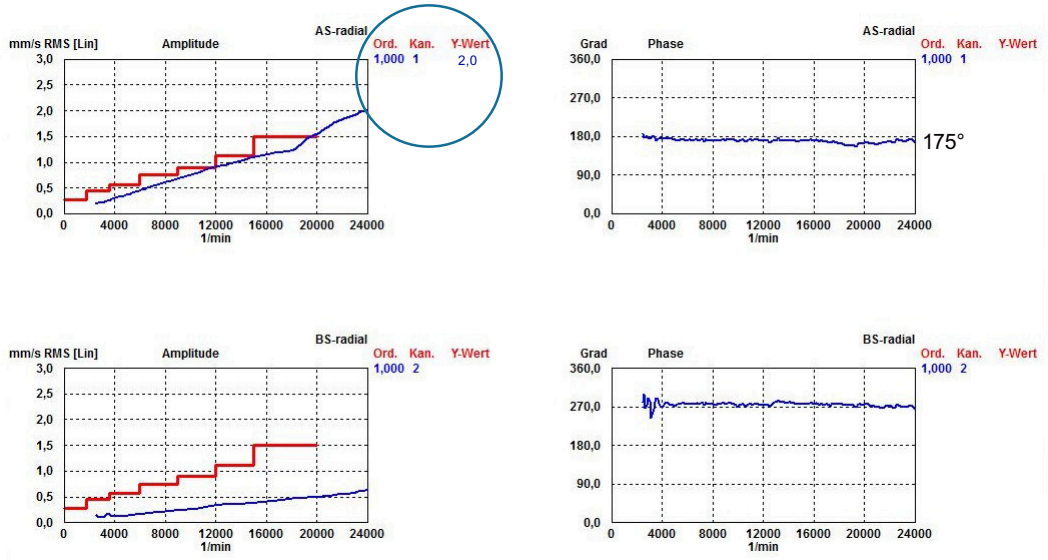
3. Position the measuring sensors: Sensor 1 for the DE, sensor 2 for the NDE.
4. Perform the reference measurement on the freely suspended motor for the DE and the NDE. Measure the absolute value and angular position of the imbalance (1st order).

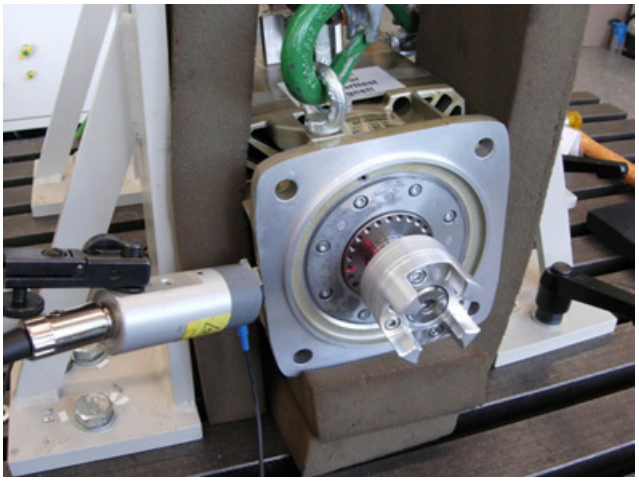


5. Attach the coupling to the shaft extension (DE).

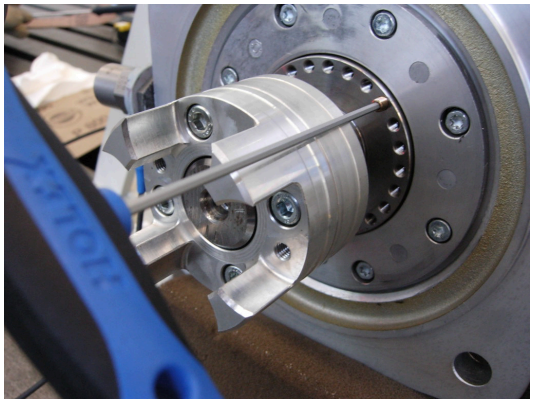
6. Perform the measurement on the coupled motor for the DE and the NDE. Also in this case, measure the absolute value and angular position of the imbalance (1st order).

largest imbalance amount

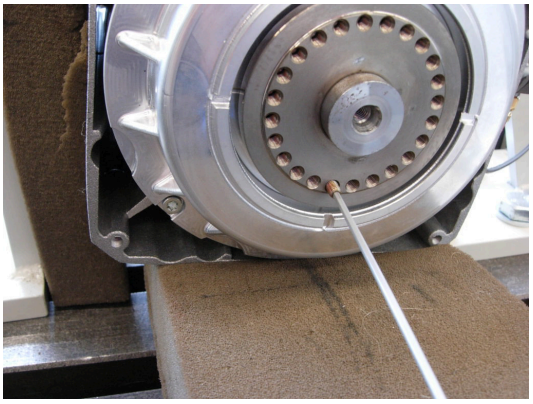




7. Remove the imbalance. To do this, screw one or several balancing screws into the rotor. Start at the side with the highest absolute imbalance. For instance, if you detect an imbalance at the DE at an angle of 175°, then you must screw in a balancing screw on the opposite side at an angle of 355° (175° + 180° = 355°).



Insert balancing screw at the DE



Insert balancing screw at the NDE

8. It may be necessary to repeat Point 6 and Point 7 several times until the imbalance has been completely removed.

4.10 Vibration response

4.10.1 Mounting and mounting instructions

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

The following mounting instructions must be carefully observed:

- For high-speed machines, we recommend that the complete unit is dynamically balanced after couplings or belt pulleys have been mounted.
- Use suitable equipment when mounting drive elements. Use the thread at the shaft extension.
- Do not apply any shocks or axial pressure to the shaft extension.
- Especially for high-speed motors with flange mounting, it is important that the mounting is stiff in order to locate any natural frequency as high as possible so that it remains above the maximum rotational frequency.

- Thin sheets (shims) can be placed under the motor mounting feet to align the motor and to avoid mechanically stressing the motor. The number of shims used should be kept to a minimum.
- In order to securely mount the motors and reliably and safely transfer the drive torque, bolts with strength class 8.8 according to ISO 898-1 should be used.

Note

Comply with permissible vibration values

All flange-mounted motors must have a stable motor suspension assembly and for high field weakening speeds must be supported using the appropriate feet at the bearing end shield (foot/flange type of construction, also refer to Section "Vibration severity limit values").

Support using feet at the bearing end shield is not required if the following conditions are maintained:

- For flange-mounted motors, there is a stable motor suspension design

- The permissible vibration values according to DIN ISO 10816 are maintained

- The maximum speed is limited (refer to Table "Restricting the maximum speed")

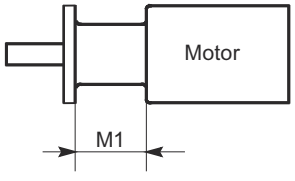
Motors that are mounted, as a result of their type of construction, to the wall using the motor feet, must be fixed in place using an adequately dimensioned positive form fit (e.g. using studs or mounting rails).

When commissioning the motors, it must be ensured that the permissible vibration values according to DIN ISO 10816 are maintained.

Table 4-31 Limiting the maximum speed

Shaft height mm	Max. permissible speed r/min
180	3000
225	2500
280	2000

Table 4-32 Flange mounting with threaded studs and nuts

Shaft height mm	M1 mm	
180	32	
225	45	
280	45	

Note

Flange mounting SH 180 to SH 280

For SH 180 to SH 280, flange mounting is only possible using studs and nuts. Clearance M1 for threading the nut between the motor flange and motor frame according to DIN 42948.

NOTICE

Check the bearing

If liquid accumulates at the flange because of vertical or horizontal mounting, the bearing and the bearing grease may be adversely affected.

- Prevent liquid from collecting at the flange.

Note

Attaching plastic covers for SH 80 up to SH 160

- With the forced-ventilated versions of shaft heights 80 to 160, before the motor is commissioned you must replace the plastic covers that were removed so that the mounting bolts could be tightened.

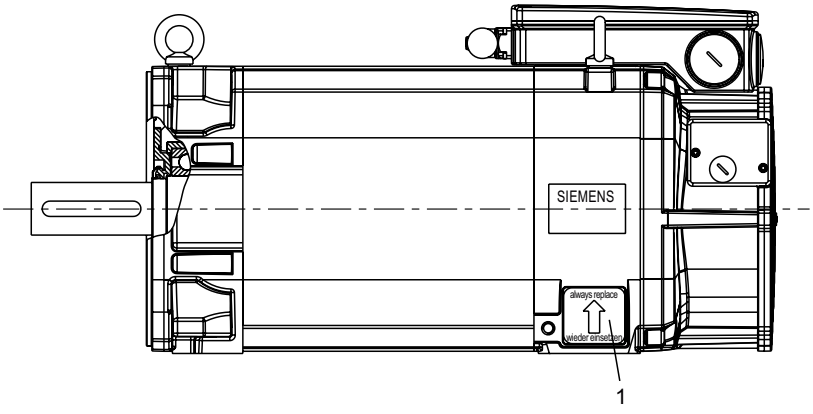


Figure 4-63 Cover for mounting foot

Note

Mounting air-cooled motors

- Air-cooled motors must be mounted in such a way that the cooling air can enter and be discharged without any obstruction (see also Chapter "Cooling").

4.10.2 Natural frequency when mounted

The motor is a system which is capable of vibration at its natural frequency. For all motors, this natural frequency lies above the specified maximum speed.

When the motor is mounted onto a machine, a new system, which is capable of vibration, is created with modified natural frequencies. These can lie within the motor speed range.

This can result in undesirable vibrations in the mechanical drive transmission.

Note

Avoiding natural frequencies when mounting

Motors must be carefully mounted on adequately stiff foundations or bedplates. Additional elasticities of the foundation/bedplates can result in resonance effects of the natural frequency at the operating speed and therefore result in inadmissibly high vibration values.

The magnitude of the natural frequency when the motor is mounted depends on various factors and can be influenced by the following points:

- Mechanical transmission elements (gearboxes, belts, couplings, pinions, etc.)
- Stiffness of the machine design to which the motor is mounted
- Stiffness of the motor in the area around the foot or customer flange
- Motor weight
- Machine weight and the weight of the mechanical system in the vicinity of the motor
- Damping properties of the motor and the driven machine
- Mounting type, mounting position (IM B5, IM B3, IM B35, IM V1, etc.)
- Motor weight distribution, i.e. length, shaft height

4.10.3 Misalignment

To avoid or minimize misalignment, a compensating coupling should be used (see the diagram).

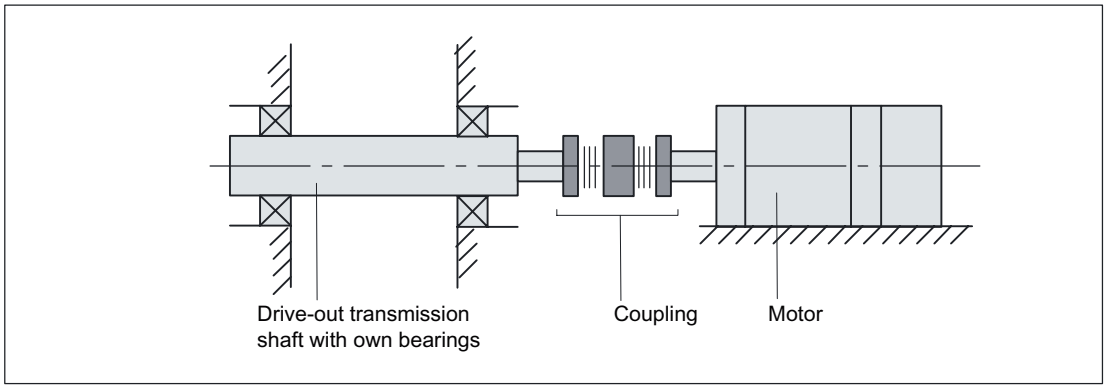


Figure 4-64 Mechanical output transmission shaft with its own bearings and compensating coupling

If possible, the motor should not be directly and rigidly coupled to an output transmission shaft which has its own bearings.

However, if a rigid coupling is absolutely necessary for mechanical design reasons, misalignment deviations must be avoided. In this case, a careful check must be made by making the appropriate measurements.

Vertical and horizontal alignment

The following measures are required to compensate for any radial offset at the coupling and to horizontally adjust the electric motor with respect to the driven load:

- Place shims under the motor feet to position it vertically and to prevent stress in the machine. The number of shims should be kept as low as possible, so use as few thicker shims as possible instead of several thinner shims.
- For horizontal positioning, push the motor sideways on the foundation Pay attention to maintaining the axial position.
- When positioning the motor, ensure that a uniform axial gap is maintained around the coupling. Note on alignment accuracy: Remember to take account of data concerning the alignment accuracy of the driven load and the coupling.

Alignment accuracy

1. Align the motors with coupling output in such a manner that the center lines of the shafts are parallel with no offset. This ensures that no additional forces affect their bearings during operation.
2. Perform the fine adjustments with shims under the entire motor foot.

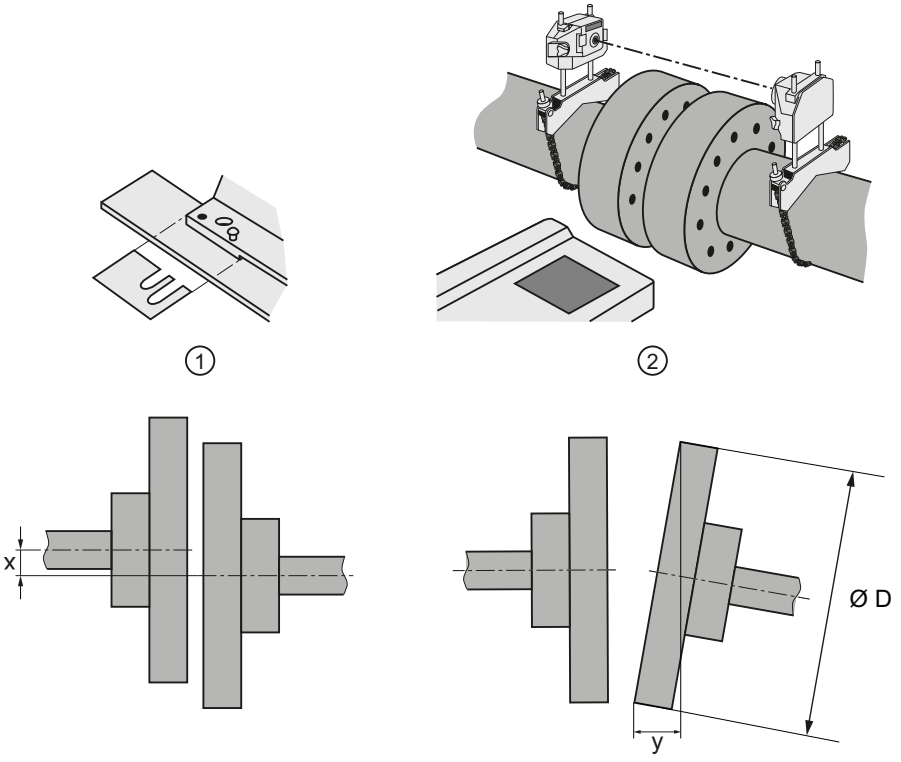


Figure 4-65 Aligning the drive

Table 4-33 Permissible deviations when aligning the motor

Permissible deviations	Radial shaft offset x	Axial shaft offset y
Flexible coupling	0.05 mm	0.05 mm

4.10.4 Flywheels

Flywheels with a high mass, which are rigidly mounted to the end of the motor shaft, modify the vibration characteristics of the motor and shift the critical rotational frequencies of the motor into the lower speed ranges.

The overall system should be precision balanced in order to minimize/avoid exciting vibration, when external masses are directly mounted onto the motor shaft.

Operation in the resonance range must be avoided.

4.10.5 Vibration stressing

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

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

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

Table 4-34 Maximum permissible radial vibration values for SH 80 to 160[1)]

Vibration frequency	Vibration values
< 6.3 Hz	Vibration amplitude s ≤ 0.16 mm
6.3 ... 250 Hz	Vibration velocity v_{rms} ≤ 4.5 mm/s
> 250 Hz	Vibration acceleration a ≤ 10 m/s^2

Table 4-35 Maximum permissible radial vibration values for SH 180 to 280[1)]

Vibration frequency	Vibration values
< 6.3 Hz	Vibration amplitude s ≤ 0.25 mm
6.3 ... 63 Hz	Vibration velocity v_{rms} ≤ 7.1 mm/s
> 63 Hz	Vibration acceleration a ≤ 4.0 m/s^2

Table 4-36 Maximum permissible axial vibration values for SH 80 to 160[1)]

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

1) Both values must be maintained simultaneously

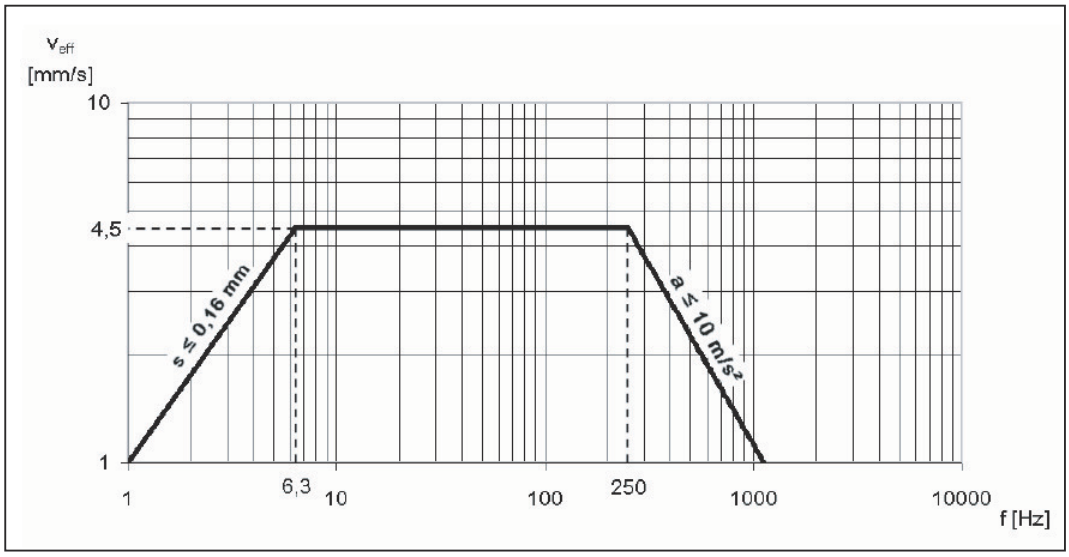


Figure 4-66 Maximum permissible vibration velocity including vibration amplitude and vibration acceleration for SH 80 to 160

Table 4-37 Maximum permissible axial vibration values for SH 180 to 280[1)]

Vibration velocity	Vibration acceleration
v_{rms} = 7.1 mm/s	a_{peak} = 3.55 m/s²

1) Both values must be maintained simultaneously

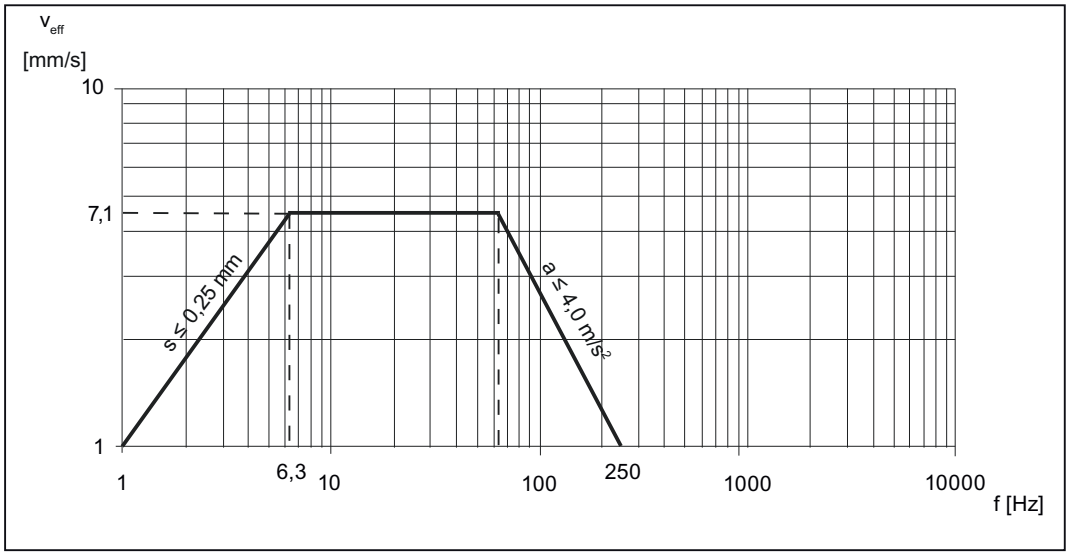


Figure 4-67 Maximum permissible vibration velocity including vibration amplitude and vibration acceleration for SH 180 to 280

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.

Note

Avoiding continuous operation at natural frequencies

Uninterrupted duty in the natural frequencies of the installed/mounted system should be avoided, as this generally leads to the permissible vibration values being exceeded and the system being damaged. To reduce vibration, flanged-mounted motors can be supported at the NDE.

Note

Measuring vibration values according to the standard

Vibration must be analyzed and measured (measuring points, etc.) according to standard ISO 10816-3.

Note

Increased resistance to vibration

1PH8 motors with shaft heights 180 and 225 and with the option L03 can be used in compliance with certain operating conditions for applications with increased resistance to vibration (see Chapter "Increased resistance to vibration (Page 178)"). Possible applications are, for example, applications such as servo presses.

4.11 Vibration severity grade

The 1PH8 motors conform to vibration severity level A in accordance with EN 60034-14 (IEC 600-34-14). The values indicated refer only to the motor. The system vibration response depends on the conditions at the installation location and can result in higher vibration values at the motor.

Note

Vibration severity limit values

According to the vibration severity limit value diagrams below, the motors operate within the limit values stipulated for versions R, S, SR or SPECIAL over the specified speed range. Furthermore, within the rated speed range, they correspond to vibration severity grades A or B as defined by EN 60034-14 (IEC 600-34-14).

The balance quality depending on the bearing is encoded in the Article No., see Chapter "Selection and ordering data."

As a general rule, high radial force load capacity is not compatible with high speed and high vibration quality. The reason for this is that the different applications require different bearings.

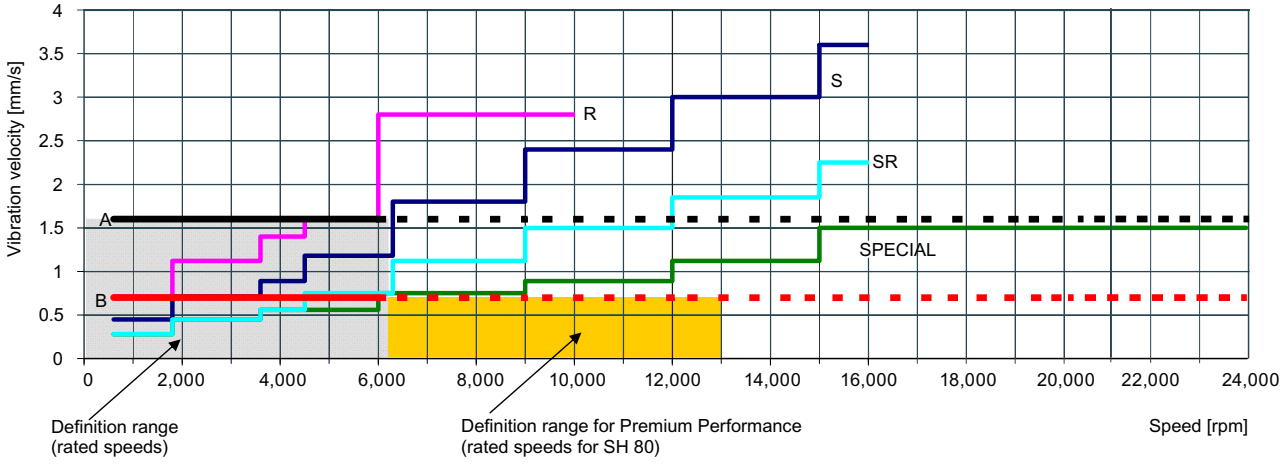


Figure 4-68 Vibration severity limit values for SH 80 to 132

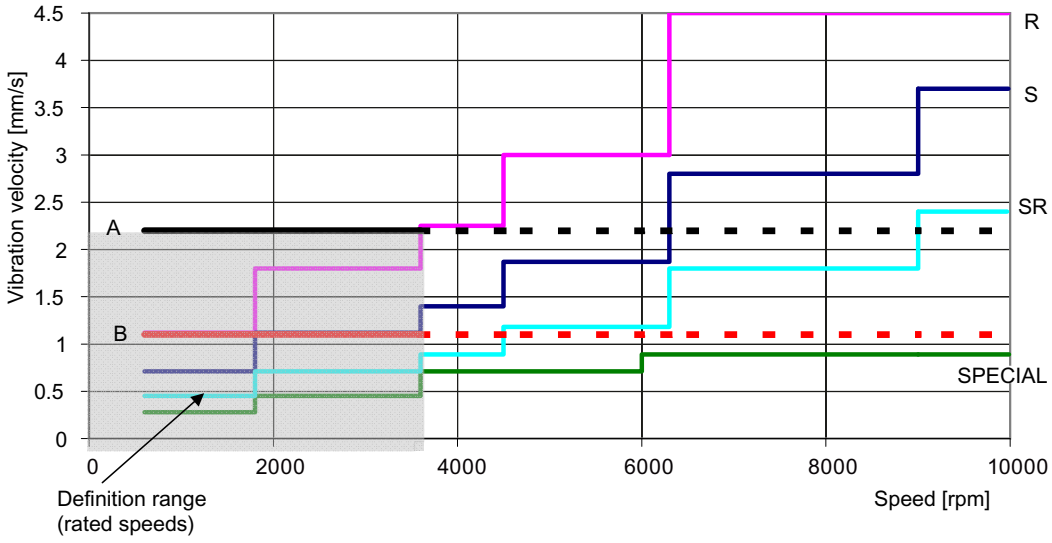


Figure 4-69 Vibration severity limit values for SH 160 to 280

Note

Acceptance test certificate

Compliance with the limits, depending on the vibration severity grade ordered, is ensured in the Siemens factories as standard. For 1PH8 motors, an acceptance test certificate with the vibration velocities actually measured can be ordered with option B35.

4.12 Noise emission

The noise emissions of the 1PH8 depend on the type of cooling and are therefore described in Chapter "Cooling (Page 67)."

Motor components and options

5

5.1 Motor components

5.1.1 Thermal motor protection

A Pt1000 temperature sensor is integrated in the stator winding to monitor the winding temperature. The exact type of temperature sensor is stated on the nameplate.

Table 5-1 Features and technical data

Type	Pt1000
Resistance when cold (20 °C)	Approx. 1090 Ω
Resistance when hot (100 °C)	Approx. 1390 Ω
Connection	Via signal cable
Response temperature [1]	Prewarning < 150 °C Alarm/trip at max. 170 °C ±5 °C

[1] With SH80: Prewarning < 130 °C; Alarm/trip at max. 150 °C ±5 °C

The resistance change is proportional to the winding temperature change. The temperature characteristic is taken into account in the closed-loop control.

The prewarning signal from the evaluation circuit in the SINAMICS drive converter can be externally evaluated.

High short-term overload conditions require additional protective measures as a result of the thermal coupling time of the temperature sensor.

The conductors for the temperature sensor are routed in one cable together with the encoder conductors.

NOTICE
Destruction of the temperature sensor if the insulation resistance is tested improperly. If the test voltage is connected to only one temperature sensor terminal, the temperature sensor will be destroyed. • Short-circuit the ends of the temperature sensor cables before applying the test voltage.

NOTICE
Destruction of the motor for a thermally critical load There is no adequate protection during a thermally critical load, e.g. a high overload at motor standstill. • Take additional protective measures, e.g. an overcurrent relay. • The "thermal motor model i2t monitoring" function must be activated in the converter.

Note

Connector for temperature sensors

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

1PH8 motors without an encoder can only be ordered as induction motors. In this case, the temperature sensor is connected to the signal terminal strip in the terminal box. An additional M16 x 1.5 cable entry is provided in the terminal box to establish a connection. For encoderless 1PH8 motors connected using a connector, the temperature sensor is connected to the encoder connector (connector version and assignment the same as for HTL encoders).

The spare temperature sensor (option A25 for shaft heights 80 to 160) and the circuit of PTC thermistors for alarm/trip (option A12) are connected to a signal terminal block in the terminal box.

5.1.2 Encoder

5.1.2.1 Encoder overview

The encoder is encrypted at the 9th position of the motor Article number using the appropriate letters.

Note

Different encoder types for motors with or without DRIVE-CLiQ

The identification letters at the 9th position of the Article No. for the encoder type required is different for motors with and without DRIVE-CLiQ.

Table 5-2 Encoder types for motors without DRIVE-CLiQ

Encoder type	9th position of the Article No.
Without encoder	A
Absolute encoder EnDat 2048 S/R (encoder AM2048S/R)	E
Incremental encoder HTL 1024 S/R (encoder HTL 1024 S/R)	H
Incremental encoder HTL 2048 S/R (encoder HTL 2048 S/R)	J

Encoder type	9th position of the Article No.
Incremental encoder sin/cos 1 Vpp 2048 S/R with C and D tracks (encoder IC 2048 S/R)	M
Incremental encoder sin/cos 1 Vpp 512 S/R without C and D tracks (encoder IN 512 S/R)	T
Incremental encoder sin/cos 1 Vpp 256 S/R without C and D tracks (encoder IN 256 S/R)	C

Table 5-3 Encoder types for motors with DRIVE-CLiQ

Encoder type	9th position of the Article No.
Absolute encoder, 22-bit singleturn + 12-bit multiturn (encoder AM22DQ)	F
Incremental encoder, 22-bit, with commutation position (encoder IC22DQ)	D
Incremental encoder 20-bit without commutation position (encoder N20DQ)	U
Incremental encoder 19-bit without commutation position (encoder IN19DQ)	S
External encoder (only possible for shaft height 280 and forced ventilation)	
Incremental encoder HTL 1024 S/R HOG 22 (Baumer-Hübner) Mounting prepared (additional Z options must be considered)	G
Incremental encoder HTL 1024 pulses/revolution POG 10 (Baumer-Hübner) Mounting prepared (additional Z options must be considered)	K

5.1.2.2 Encoder connection for motors with a DRIVE-CLiQ interface

⚠ 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.

Motors with DRIVE-CLiQ interface have an internal Sensor Module. This Sensor Module includes an electronic rating plate. This simplifies commissioning for the SINAMICS S110 / S120 drive system, since all the motor parameters are set automatically.

5.1.2.3 Encoder connection for motors without DRIVE-CLiQ (12/17-pole)

Motors without DRIVE-CLiQ are connected using the 12 or 17-pin flange socket by default.

See also

Incremental encoder HTL 1024 S/R or HTL 2048 S/R (Page 163)

5.1.2.4 Encoder assignment as a function of maximum permissible speeds

The following tables show the possible assignments of encoders to the 1PH8 motor series as a function of maximum permissible speeds.

Table 5-4 Encoder types for motors without DRIVE-CLiQ

Encoder type		**Without encoder**	**AM2048 S/R**	**HTL1024 S/R**	**HTL2048 S/R**	**IC2048 S/R**	**IN512 S/R**	**IN256 S/R**
9th data position		**A**	**E**	**H**	**J**	**M**	**T**	**C**
Permissible n_{max} speeds (encoder) in r/min		**-**	**12,000**	**9000**	**4600**	**12,000**	**15,000**	**24,000**
Motor version and bearing system	**n_{max} (motor) r/min**							
1PH808□-1□□□□-□□□2	10,000	✓	✓	✓2)	✓4)	✓	-	-
1PH808□-1□□□□-□L□2	15,000	✓	-	-	-	✓3)	✓	✓
1PH808□-1□□□□-□M□2	20,000	✓	-	-	-	✓3)	✓5)	✓
1PH808□-1□□□□-□N□2	24,000	-	-	-	-	-	-	✓
1PH808□-1□□□□-□Q□2	5000	✓	✓	✓	✓4)	✓	-	-

Encoder type		**Without encoder**	**AM2048 S/R**	**HTL1024 S/R**	**HTL2048 S/R**	**IC2048 S/R**	**IN512 S/R**	**IN256 S/R**
9th data position		**A**	**E**	**H**	**J**	**M**	**T**	**C**
Permissible n_{max} speeds (encoder) in r/min		**-**	**12,000**	**9000**	**4600**	**12,000**	**15,000**	**24,000**
Motor version and bearing system	**n_{max} (motor) r/min**							
1PH810□-1□□□□-□□□2	9000	✓	✓	✓	✓4)	✓	-	-
1PH810□-1□□□□-□L□2	12,000	✓	✓	-	-	✓	✓	✓
1PH810□-1□□□□-□M□2	18,000	✓	-	-	-	✓3)	✓5)	✓
1PH810□-1□□□□-□Q□2	5000	✓	✓	✓	✓4)	✓	-	-
1PH813□-1□□□□-□□□2	8000	✓	✓	✓	✓4)	✓	-	-
1PH813□-1□□□□-□L□2	10,000	✓	✓	-	-	✓	✓	✓
1PH813□-1□□□□-□M□2	15,000	✓	-	-	-	✓3)	✓	✓
1PH813□-1□□□□-□Q□2	4500	✓	✓	✓	✓	✓	-	-
1PH813□-2□□□□-□□□2	4500	-	✓	-	-	✓	-	-
1PH813□-5□□□□-□□□2	6500	✓	✓	✓	✓	✓	-	-
1PH813□-7□□□□-□□□2	6500	✓	✓	✓	✓	✓	-	-
1PH816□-1□□□□-□□□2	6500	✓	✓	✓	✓4)	✓	-	-
1PH816□-1□□□□-□L□2	9000	✓	✓	✓	-	✓	✓	✓
1PH816□-1□□□□-□M□2	10,000	✓	-	-	-	✓	✓	✓
1PH816□-1□□□□-□Q□2	4000	✓	✓	✓	✓	✓	-	-
1PH816□-2□□□□-□□□2	4000	-	✓	-	-	✓	-	-
1PH816□-5□□□□-□□□2	5000	✓	✓	✓	✓	✓	-	-
1PH816□-7□□□□-□□□2	5000	✓	✓	✓	✓	✓	-	-
1PH818□-1□□□□-□□□2	5000	✓	✓	✓	✓4)	✓	-	-
1PH818□-1□□□□-□L□2	7500	✓	✓	✓	-	✓	-	-

Encoder type		**Without encoder**	**AM2048 S/R**	**HTL1024 S/R**	**HTL2048 S/R**	**IC2048 S/R**	**IN512 S/R**	**IN256 S/R**
9th data position		**A**	**E**	**H**	**J**	**M**	**T**	**C**
Permissible n_{max} speeds (encoder) in r/min		**-**	**12,000**	**9000**	**4600**	**12,000**	**15,000**	**24,000**
Motor version and bearing system	**n_{max} (motor) r/min**							
1PH818□-2□□□□-□□□2	3800	-	✓	-	-	✓	-	-
1PH822□-1□□□□-□□□2	4500	✓	✓	✓	✓	✓	-	-
1PH822□-1□□□□-□L□2	6000	✓	✓	✓	-	✓	-	-
1PH822□-2□□□□-□□□2	3500	-	✓	-	-	✓	-	-
1PH828□-1□□□□-□□□2	3300	✓	✓	✓	✓	✓	-	-

✓ Assignment possible

2) Motor/encoder assignment limited to 9000 r/min

3) Motor/encoder assignment limited to 12,000 r/min

4) Motor/encoder assignment limited to 4600 r/min

5) Motor/encoder assignment limited to 15,000 r/min

Table 5-5 Encoder types for motors with DRIVE-CLiQ

Encoder type		**AM22DQ**	**IC22DQ**	**IN20DQ**	**IN19DQ**
9th data position		**F**	**D**	**U**	**S**
Permissible n_{max} speeds (encoder) in r/min		**12,000**	**12,000**	**15,000**	**24,000**
Motor version and bearing system	**n_{max} (motor) r/min**				
1PH808□-1□□□□-□□□1	10,000	✓	✓	-	-
1PH808□-1□□□□-□L□1	15,000	-	✓3)	✓	✓
1PH808□-1□□□□-□M□1	20,000	-	✓3)	✓5)	✓
1PH808□-1□□□□-□N□1	24,000	-	-	-	✓
1PH808□-1□□□□-□Q□1	5000	✓	✓	-	-
1PH810□-1□□□□-□□□1	9000	✓	✓	-	-
1PH810□-1□□□□-□L□1	12,000	✓	✓	✓	✓
1PH810□-1□□□□-□M□1	18,000	-	✓3)	✓5)	✓
1PH810□-1□□□□-□Q□1	5000	✓	✓	-	-
1PH813□-1□□□□-□□□1	8000	✓	✓	-	-
1PH813□-1□□□□-□L□1	10,000	✓	✓	✓	✓
1PH813□-1□□□□-□M□1	15,000	-	✓3)	✓	✓
1PH813□-1□□□□-□Q□1	4500	✓	✓	-	-

Encoder type		**AM22DQ**	**IC22DQ**	**IN20DQ**	**IN19DQ**
9th data position		**F**	**D**	**U**	**S**
Permissible n_{max} speeds (encoder) in r/min		**12,000**	**12,000**	**15,000**	**24,000**
Motor version and bearing system	**n_{max} (motor) r/min**				
1PH813□-2□□□□-□□□1	4500	✓	✓	-	-
1PH813□-5□□□□-□□□1	6500	✓	✓	-	-
1PH813□-7□□□□-□□□1	6500	✓	✓	-	-
1PH816□-1□□□□-□□□1	6500	✓	✓	-	-
1PH816□-1□□□□-□L□1	9000	✓	✓	✓	✓
1PH816□-1□□□□-□M□1	10,000	-	✓	✓	✓
1PH816□-1□□□□-□Q□1	4000	✓	✓	-	-
1PH816□-2□□□□-□□□1	4000	✓	✓	-	-
1PH816□-5□□□□-□□□1	5000	✓	✓	-	-
1PH816□-7□□□□-□□□1	5000	✓	✓	-	-
1PH818□-1□□□□-□□□1	5000	✓	✓	-	-
1PH818□-1□□□□-□L□1	7500	✓	✓	-	-
1PH818□-2□□□□-□□□1	3800	✓	✓	-	-
1PH822□-1□□□□-□□□1	4500	✓	✓	-	-
1PH822□-1□□□□-□L□1	6000	✓	✓	-	-
1PH822□-2□□□□-□□□1	3500	✓	✓	-	-
1PH828□-1□□□□-□□□1	3300	✓	✓	-	-

✓ Assignment possible

3) Motor/encoder assignment limited to 12,000 r/min

5) Motor/encoder assignment limited to 15,000 r/min

5.1.2.5 Incremental encoder HTL 1024 S/R or HTL 2048 S/R

Function

- Speed actual value sensing
- Indirect incremental measuring system for the position control loop
- One zero pulse (reference mark) per revolution

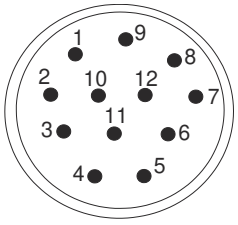
Table 5-6 Properties and technical data

Properties	**Incremental encoder HTL**
Coupling at the NDE	• with SH 80 to 225: Integrated in the motor • with SH 280: Built on to the motor
Operating voltage	+10 ... +30 V
Current consumption	max. 150 mA
Incremental resolution (periods per revolution)	1024 S/R or 2048 S/R

Properties	Incremental encoder HTL
Incremental signals	HTL Track A, track B, Zero pulse and inverted signals
Angular error	±1'
Maximum permissible speeds	• With 1024 S/R: 9000 r/min • With 2048 S/R: 4600 r/min

Connection

Table 5-7 Connection assignment, 12-pin flange-mounted socket

PIN No.	Signal	
1	B*	 When viewing the plug-in side (pins)
2	+1R1	
3	R	
4	R*	
5	A	
6	A*	
7	CTRL TACH	
8	B	
9	not connected	
10	M encoder	
11	-1R2	
12	P encoder	

Cables

Mating connector: 6FX2003-0SU12

Table 5-8 Pre-fabricated cable for SINAMICS:

6FX	□	002	-	2AH00	-	□□□	0
	↓ ↓ 5 MOTION-CONNECT®500 8 MOTION-CONNECT®800					↓↓↓ Length Max. cable lengths: without transfer of inverted signals,150 m with transfer of inverted signals, 300 m	

For other technical data and length code, refer to catalog, Chapter "MOTION-CONNECT connection system"

5.1.2.6 Incremental encoders IC 2048 S/R, IN 512 S/R and IN 256 S/R

Function

- Angular measuring system for the commutation
- Speed actual value sensing
- Indirect incremental measuring system for the position control loop
- One zero pulse (reference mark) per revolution

Properties	**Incremental encoder sin/cos 1Vpp**
Coupling at the NDE	• with SH 80 to 225: Integrated in the motor • with SH 280: Built on to the motor
Operating voltage	+5 V ±5 %
Current consumption	max. 150 mA
Incremental resolution (periods per revolution)	• 2048 S/R • 512 S/R • 256 S/R
Incremental signals	1 Vpp
Angular error	±40 ", for 256 S/R: ±93 "
Maximum permissible speeds	• With 2048 S/R: 12,000 r/min • With 512 S/R: 15,000 r/min • With 256 S/R: 24,000 r/min

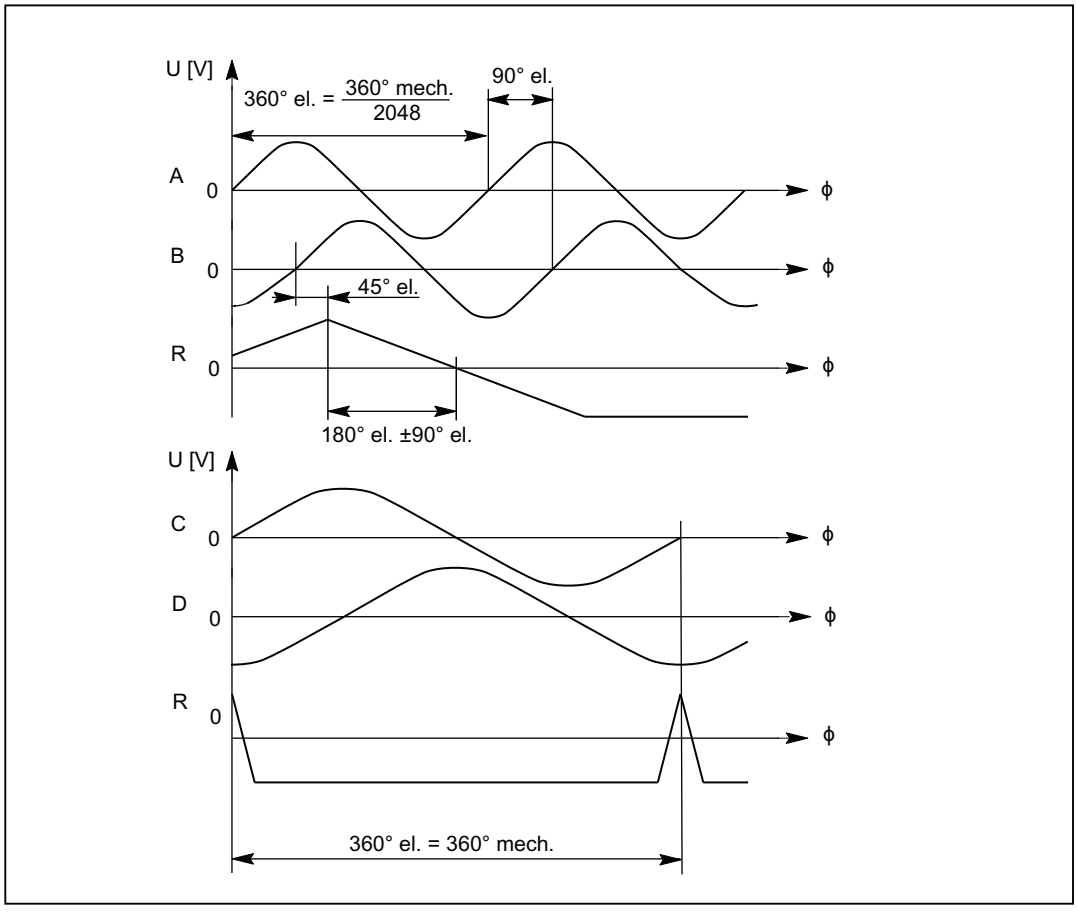
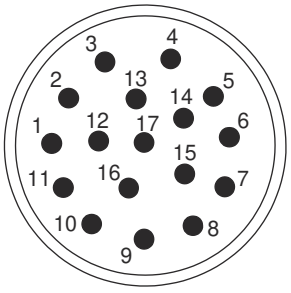


Figure 5-1 Signal sequence and assignment for a positive direction of rotation (clockwise direction of rotation when viewed from the drive end)

Connection

Table 5-9 Connection assignment, 17-pin flange-mounted socket

PIN No.	Signal	
1	A	 When viewing the plug-in side (pins)
2	A*	
3	R	
4	D*	
5	C	
6	C*	
7	M encoder	
8	+1R1	
9	-1R2	
10	P encoder	
11	B	
12	B*	
13	R*	
14	D	
15	0 V sense	
16	5 V sense	
17	not connected	

Cables

Mating connector: 6FX2003-0SU17

Table 5-10 Pre-fabricated cable for SINAMICS

6FX	□	002	-	2CA31	-	□□□	0
	↓ 5 MOTION-CONNECT®500 8 MOTION-CONNECT®800					↓↓↓ Length Max. cable length 100 m	

For other technical data and length code, refer to catalog, Chapter "MOTION-CONNECT connection system"

5.1.2.7 Absolute encoder AM 2048 S/R

Function

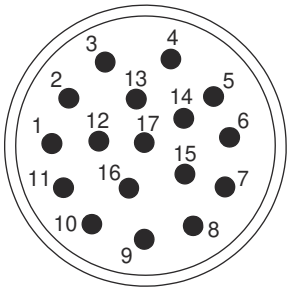
- Angular measuring system for the commutation
- Speed actual value sensing
- Indirect absolute measuring system for the position control loop

Table 5-11 Properties and technical data

Properties	Absolute encoder (EnDat)
Coupling at the NDE	• with SH 80 to 225: Integrated in the motor • with SH 280: Built on to the motor
Operating voltage	+5 V ±5 %
Current consumption	max. 300 mA
Incremental resolution (periods per revolution)	2048 S/R
Absolute resolution (coded revolution)	4096
Incremental signals	1 Vpp
Serial absolute position interface	EnDat
Angular error	±40"
Maximum permissible speeds	With 2048 S/R: 12,000 r/min

Connection

Table 5-12 Connection assignment, 17-pin flange-mounted socket

PIN No.	Signal	
1	A	 When viewing the plug-in side (pins)
2	A*	
3	data	
4	not connected	
5	clock	
6	not connected	
7	M encoder	
8	+1R1	
9	-1R2	
10	P encoder	
11	B	
12	B*	
13	data*	
14	clock*	
15	0 V sense	
16	5 V sense	
17	not connected	

Cables

Mating connector: 6FX2003-0SU17

Table 5-13 Pre-fabricated cable for SINAMICS

6FX	□	002	-	2EQ10	-	□□□	0
	↓ ↓ 5 MOTION-CONNECT®500 8 MOTION-CONNECT®800					↓↓↓ Length Max. cable length 100 m	

For other technical data and length code, refer to catalog, Chapter "MOTION-CONNECT connection system"

5.2 Options

5.2.1 Overview of options

Chapter "Selection and ordering data (Page 35)" contains an overview of which options are available for which shaft heights.

5.2.2 Sealing air connection (option Q12)

Cooling lubricants containing oil capable of creepage, which can also be corrosive, 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) alone is not sufficient. To address these particular applications, 1PH8 main motors can be ordered with sealing air connection by specifying option Q12. The sealing air connection can be implemented both when using a terminal box and a power connector.

Note

Improved protection against oils and media that can creep

Sealing air does not increase the IP degree of protection against water. It does, however, improve protection against oils and media that can creep.

Note

This option is only permissible for motors without relubrication.

Note

Increase the pressure for "Premium Performance" bearing version

For the "Premium Performance" bearing version, you must increase the supply pressure to min. 2.0×10^5 Pa up to max. 5×10^5 Pa.

Conditioning: A Main drives without a shaft sealing ring

Min. inlet temperature (°C)	Ambient temperature
Max. inlet temperature (°C)	40
Max. residual water content (g/m³)	0.12
Max. residual oil content (g/m³)	0.01
Max. residual dust (mg/m³)	0.1
Min. supply pressure (Pa)	2.0×10^5
Max. supply pressure (Pa)	3×10^5
Particle size for hollow shaft encoder (µm)	< 8
Particle size for optical encoders (µm)	< 3

Conditioning: B Main drives with a shaft sealing ring

Min. inlet temperature (°C)	Ambient temperature
Max. inlet temperature (°C)	40
Max. residual water content (g/m³)	0.12
Max. residual oil content (g/m³)	0.01
Max. residual dust (mg/m³)	0.1
Min. supply pressure (Pa)	0.05×10^5
Max. supply pressure (Pa)	0.1×10^5
Particle size for hollow shaft encoder (µm)	< 8
Particle size for optical encoders (µm)	< 3

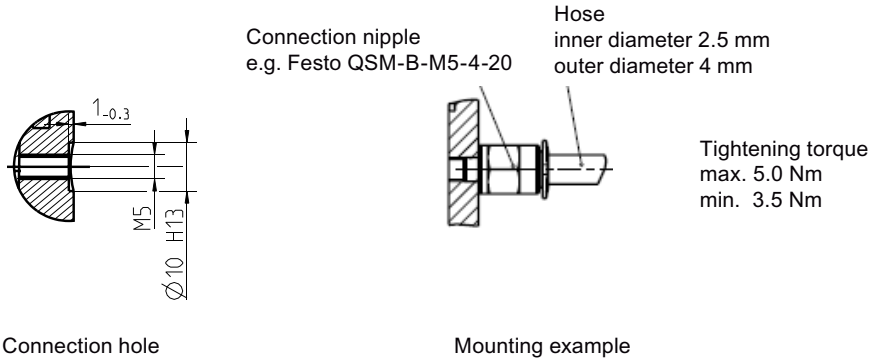


Figure 5-2 Sealing air connection (option Q12)

Necessary sealing air volume

Volume (Nm^3/h) (Nm = standard cubic meter)	Approx. 2.3 (at 2 bar)

Note

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

5.2.3 Protection against explosion (options M03 and M39)

Overview

The 1PH8 motors can be used in hazardous areas if certain operating conditions are met.

Explosion protection zone	Option	Shaft heights
2	M03	SH 100 to SH 160
22	M39	SH 100 to SH 160 SH 180 and SH 225

This intended use in a hazardous area Zone 2 or Zone 22 complies with directives 2014/34/EU and 1999/92/EC – as well as the series of IEC/EN 60079 standards.

Design criteria for shaft heights 100 to 160

Descriptions			(data position in Article No.)																			
			1	2	3	4	5	6	7	-	8	9	10	11	12	-	13	14	15	16	-	Z
			1	P	H	8																
Shaft height 100							1	0														
Shaft height 132							1	3														
Shaft height 160							1	6														
Overall length (cannot be selected, determined by the choice of rated power)																						
Induction version											1											
Synchronous version (only shaft height 132 and 160)											2											
Encoder systems for motors without a DRIVE-CLiQ interface	Without encoder [1]											A										
	Absolute encoder EnDat 2048 S/R (encoder AM2048S/R) [2]											E										
	Incremental encoder HTL 1024 S/R (encoder HTL1024S/R) [1] [3]											H										
	Incremental encoder HTL 2048 S/R (encoder HTL2048S/R) [1] [4]											J										
	Incremental encoder sin/cos 1 V_{pp} 2048 S/R with C and D tracks (encoder IC2048S/R) [2]											M										
Winding version	Rated speeds (3 AC 380 V to 480 V)	400 r/min, 500 r/min, 600 r/min											B									
		1000 r/min, 1150 r/min, 1350 r/min											D									
		1500 r/min, 1750 r/min, 2000 r/min											F									
		2000 r/min, 2300 r/min, 2650 r/min											G									
Cooling	Forced ventilation NDE -> DE	(degree of protection IP 55)												1								
	Water cooling	(degree of protection IP 55)												2								
Type of construction	IM B3 (IM V5, IM V6)														0							
	IM B5 (IM V1, IM V3)														2							
	IM B35 (IM V15, IM V35) [5]														3							
Shaft extension (DE)	**Balancing**																					
Plain shaft	---																0					
Fitted key	Full-key																1					
Fitted key	Half-key																2					
Bearings	**Vibration severity acc. to Siemens/EN 60034-14**	**Shaft and flange accuracy**																				
Standard with locating bearing	R/A	R																B				
Standard with locating bearing	S/A	R																C				
Standard with location bearing[1]	SR/A	R																D				
Standard	R/A	R																G				

Descriptions		**(data position in Article No.)**																		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**-**	**8**	**9**	**10**	**11**	**12**	**-**	**13**	**14**	**15**	**16**	**-**	**Z**
Standard	S/A	R															**H**				
Advanced Lifetime [6]	S/A	R															**Q**				
Power connection	**Cable entry**	**Signal connection**					**(looking onto DE)**														
Terminal box (top)	Right	DE																**A**			
Terminal box (top)	Left	DE																**B**			
Terminal box (top)	NDE	Left																**C**			
Version																					
Version for potentially explosive atmospheres Zone 2																					**M03**
Version for potentially explosive atmospheres Zone 22																					**M39**
In the version for hazardous areas zone 2 and zone 22, the following options are not possible: A12, A25, G14, K80, L74, Q12, U60, U61, U62, U63, U65, U66, U67, U68, Y64,																					**Z**

1) Only possible if the 8th data position is "1" (induction version)

2) Limited to n_{max} = 12,000 r/min

3) Limited to n_{max} = 9000 r/min

4) Limited to n_{max} = 4600 r/min

5) Only possible for shaft height 100, 132, and 160.

6) Limited to n_{max} = 5000 r/min, shaft height 132: n_{max} = 4500 r/min, shaft height 160: n_{max} = 4000 r/min

Motors for hazardous areas have been released for SINAMICS S120 or SINAMICS G120 converters (version with PM 240). Carefully comply with the following constraints when operating the motors with third-party converters:

- Converters/inverters with pulse width modulation (PWM)
- The pulse clock frequency must be at least 4 kHz
- Converter output voltage according to the following table

Line supply voltage	Line Module (line-side converter/inverter infeed type)	Converter output voltage [1]
3 AC 400 V	Smart Line Module (SLM) unregulated	380 V
	Active Line Module (ALM) regulated	425 V
3 AC 480 V	Smart Line Module (SLM) unregulated	460 V
	Active Line Module (ALM) regulated	500 V

[1] Minimum output voltage required for motor operation in order to achieve data according to the data sheet.

The rated powers for motors for use in hazardous zones are reduced both in S1 and S6 duty in relation to the non-explosion protected version (standard version). The deratings are taken into account in the rating plate data:

Article No.	Version	Derating
1PH8xxx-1xx1x-xxx1-Z, M03, or M39	Induction, forced ventilation	10 %
1PH8xxx-1xx2x-xxx1-Z, M03, or M39	Induction, water cooling	20 %
1PH8xxx-2xx1x-xxx1-Z, M03, or M39	Synchronous, forced ventilation	20 %
1PH8xxx-2xx2x-xxx1-Z, M03, or M39	Synchronous, water cooling	20 %

In hazardous areas of Zone 2 (option M03), for induction motor versions, reduce the permissible maximum speeds (n_{max}):

Article No.	Version	Maximum speed n_{max}
1PH810x-1xxxx-xxx1-Z, M03	Induction	4350 r/min
1PH813x-1xxxx-xxx1-Z, M03	Induction	3000 r/min
1PH816x-1xxxx-xxx1-Z, M03	Induction	2250 r/min

The motors with forced ventilation have newly developed separately driven fans for use in hazardous areas. These are in conformance with the applicable directives and standards. Take the modified dimensions from dimension drawings (SIEMENS Product Configurator).

The supply values for the separately driven fans are specified in the following table:

Article No.	Max. current consumption at		
	3 AC 400 V / 50 Hz (±10 %) **A**	3 AC 400 V / 60 Hz (±10 %) **A**	3 AC 480 V / 60 Hz (±10 %) **A**
1PH810x-1xx1x-xxx1-Z, M03 or M39	0.16	0.13	0.16
1PH813x-1xx1x-xxx1-Z, M03 or M39 1PH813x-2xx1x-xxx1-Z, M03 or M39	0.26	0.24	0.28
1PH816x-1xx1x-xxx1-Z, M03 or M39 1PH816x-2xx1x-xxx1-Z, M03 or M39	0.25	0.22	0.27

Note

All of the separately driven fans are equipped with 3-phase motors.

Operating conditions for shaft heights 100 to 160

When operating SIMOTICS M-1PH8 motors in Zone 2 or Zone 22 hazardous areas, carefully take into consideration the following application conditions:

- Provide specific operating instructions for the motors for when they are used in hazardous areas (see link and documentation in the Intranet/Internet).
- Motor versions for use in hazardous areas are not UL-approved. As a consequence, these motors do not bear the cUR marking.

- Zone 2 (option M03):
  - Marking: II 3 G Ex nA IIB T3 Gc -15 °C ≤ Ta ≤ +40 °C
  - Device group II, category 3G, temperature class T3
  - EN 60079-15: 2010 type of protection "nA" (no sparking)
  - Use in ambient temperatures -15 °C up to +40 °C at installation altitudes up to 1000 m
  - Motors with forced ventilation comply with the requirements for a low risk class with reference to shock resistance tests carried out at the fan housing.
  - Motors, Category 3G, are intended for use in hazardous Zone 2. In hazardous Zone 2, the occurrence of an explosive atmosphere is improbable; however, if it does occur in normal operation, then only very infrequently and only very briefly. A potentially explosive atmosphere can comprise, for example, of air and flammable gases, vapors or mist.
  - According to standard EN 60079-14, the ignition temperature of the potentially explosive gas atmosphere must be higher than 200 °C (temperature class T3).
- Zone 22 (option M39):
  - Marking: II 3D Ex tc IIIB T160 °C Dc IP55 -15 °C ≤ Ta ≤ +40 °C
  - Device group II, category 3D
  - Protection afforded by the enclosure tc, degree of protection IP55
  - EN 60079-31: 2014 Protection afforded by the enclosure
  - Maximum surface temperature 160 °C (according to EN 60079-0: 2012 general requirements)
  - Use in ambient temperatures -15 °C up to +40 °C at installation altitudes up to 1000 m
  - Motors with forced ventilation comply with the requirements for a low risk class with reference to shock resistance tests carried out at the fan housing.
  - Motors, Category 3D, are intended for use in hazardous Zone 22 (non-conductive dust). In hazardous Zone 22, the occurrence of an explosive atmosphere is improbable; however, if it does occur in normal operation, then only very infrequently and only very briefly. The potentially explosive atmosphere comprises a mixture of dust and air.
  - According to standard EN 60079-14, the ignition temperature of a dust cloud must be 50 % higher than the maximum surface temperature of the equipment being used. In this case, the ignition temperature of a dust cloud must be > 240 °C. The ignition temperature of a layer of dust with a maximum thickness of 5 mm must be 75 Kelvin higher than the maximum surface temperature of the motor. In this case, the ignition temperature of a dust cloud must be > 235 °C.
- Evaluate the temperature sensor embedded in the motor winding.
- Set the tripping temperature of the sensor to 135 °C.
- Safely and reliably shut down explosion protected separately driven fans when an overload condition occurs. PTC sensors are integrated as standard for overload protection, which must be evaluated according to EN 60079-14. Alternatively, a suitable motor circuit breaker can be used for overload protection.
- The explosion-protected, forced ventilated and water-cooled SIMOTICS M-1PH8 motors have degree of protection IP55.

- Attach the twist protection provided for the signal connector in compliance with regulations.
- Use Ex-certified cable glands for the power connection. Close and seal unused threads using Ex-certified screw plugs.
- The thermal stability of the connecting cables must be at least 80 °C. Plastic-insulated, flexible cables must have the same durability as heavy-duty, rubber-insulated cables. SIEMENS MOTION-CONNECT power and signal cables meet these requirements.
- The motors have a ground connection at the bearing shield/enclosure. Additionally ground the motors at this connection point.
- Belt drives are only permissible if buildup of a static charge is ruled out in the machinery.
- Do not repaint/touch up explosion-proof motors. However, if this is required, then comply with the following requirements:
  - Limit the surface resistance of the paint used: Surface resistance ≤ 1 GΩ for motors belonging to device group III
  - Breakdown voltage ≤ 4 kV for device group III
- Contact Technical Support (Chapter "Introduction") for the correct paint structure.

Note

For additional information, please contact Technical Support or your local sales partner.

Design criteria for shaft heights 180 to 225

The motors with option M39 can be selected with the following article number suffix.

1PH818x-1Ax1x-xxx1-Z, Z=M39

1PH818x-1Ex1x-xxx1-Z, Z=M39

1PH818x-1Hx1x-xxx1-Z, Z=M39

1PH818x-1Jx1x-xxx1-Z, Z=M39

1PH818x-1Mx1x-xxx1-Z, Z=M39

1PH822x-1Ax1x-xxx1-Z, Z=M39

1PH822x-1Ex1x-xxx1-Z, Z=M39

1PH822x-1Hx1x-xxx1-Z, Z=M39

1PH822x-1Jx1x-xxx1-Z, Z=M39

1PH822x-1Mx1x-xxx1-Z, Z=M39

The listed motors cannot be supplied with the Performance bearings (14th data position = "L").
1PH8 motors, shaft heights 180 and 225 with option M39 are implemented with insulated NDE bearings as standard.

The supply values for the separately driven fans are specified in the following table:

Article No.	Max. current consumption at		
	3 AC 400 V (±10 %); 50 Hz A	3 AC 400 V (±10 %); 60 Hz A	3 AC 480 V (+5 % / -10 %); 60 Hz A
1PH818□-	0.6	0.65	0.6
1PH822□-	1.6	1.3	1.5

Note

All of the separately driven fans are equipped with 3-phase motors.

Operating conditions for shaft heights 180 and 225

Carefully take into account the following operating conditions when operating motors in a Zone 22 hazardous area:

- Provide specific operating instructions for the motors for when they are used in hazardous areas (see link and documentation in the Intranet/Internet).
- Zone 22 (option M39):
  - Marking: II 3D Ex tc IIIB T155 °C Dc IP55 -15 °C ≤ Ta ≤ +40 °C
  - Device group II, category 3D
  - Protection afforded by the enclosure, tc
  - Maximum surface temperature 155 °C (according to EN 60079-0: 2012 general requirements)
  - Use in ambient temperatures -15 °C up to +40 °C at installation altitudes up to 1000 m
- Evaluate the temperature sensor embedded in the motor winding.
- Safely and reliably shut down explosion protected separately driven fans when an overload condition occurs. PTC sensors are integrated as standard for overload protection, which must be evaluated according to EN 60079-14.
- Attach the twist protection provided for the signal connector in compliance with regulations.
- Use Ex-certified cable glands for the power connection. Close and seal unused threads using Ex-certified screw plugs.
- The thermal stability of the connecting cables must be at least 80 °C. Plastic-insulated, flexible cables must have the same durability as heavy-duty, rubber-insulated cables. SIEMENS MOTION-CONNECT power and signal cables meet these requirements.
- The motors have a ground connection at the bearing shield/enclosure. Additionally ground the motors at this connection point.
- Belt drives are only permissible if buildup of a static charge is ruled out in the machinery.
- Keep the motors free of dust layers > 5 mm.

- The type of construction IM V5 is only permissible with a protective roof (protection from falling parts)
- Do not repaint/touch up explosion-proof motors. However, if this is required, then comply with the following requirements:
  - Limit the surface resistance of the paint used: Surface resistance ≤ 1 GΩ for motors belonging to device group III
  - Breakdown voltage ≤ 4 kV for device group III

Contact Technical Support (Chapter "Introduction") for the correct paint structure.

Note

For additional information, please contact Technical Support or your local sales partner.

5.2.4 Increased resistance to vibration (option L03)

Overview

1PH8 motors with shaft heights 180 and 225 and with the option L03 can be used in compliance with certain operating conditions for applications with an increased vibration load. Possible applications, for example on servo presses.

Design criteria for shaft heights 180 and 225

In conjunction with the option L03, the following motors can be selected:

1PH818x-1Ax00-xxx1-Z, Z=L03

1PH818x-1Ax10-xxx1-Z, Z=L03

1PH818x-1Ex00-xxx1-Z, Z=L03

1PH818x-1Ex10-xxx1-Z, Z=L03

1PH818x-1Hx00-xxx1-Z, Z=L03

1PH818x-1Hx10-xxx1-Z, Z=L03

1PH818x-1Jx00-xxx1-Z, Z=L03

1PH818x-1Jx10-xxx1-Z, Z=L03

1PH818x-1Mx00-xxx1-Z, Z=L03

1PH818x-1Mx10-xxx1-Z, Z=L03

1PH818x-2Ex00-xxx1-Z, Z=L03

1PH818x-2Ex10-xxx1-Z, Z=L03

1PH818x-2Mx00-xxx1-Z, Z=L03

1PH818x-2Mx10-xxx1-Z, Z=L03

1PH822x-1Ax00-xxx1-Z, Z=L03

1PH822x-1Ax10-xxx1-Z, Z=L03

1PH822x-1Ex00-xxx1-Z, Z=L03

1PH822x-1Ex10-xxx1-Z, Z=L03

1PH822x-1Hx00-xxx1-Z, Z=L03

1PH822x-1Hx10-xxx1-Z, Z=L03

1PH822x-1Jx00-xxx1-Z, Z=L03

1PH822x-1Jx10-xxx1-Z, Z=L03

1PH822x-1Mx00-xxx1-Z, Z=L03

1PH822x-1Mx10-xxx1-Z, Z=L03

1PH822x-2Ex00-xxx1-Z, Z=L03

1PH822x-2Ex10-xxx1-Z, Z=L03

1PH822x-2Mx00-xxx1-Z, Z=L03

1PH822x-2Mx10-xxx1-Z, Z=L03

Operating conditions of shaft heights 180 and 225

The vibration load that is permissible by default for the 1PH8 main motors is described in Chapter "Vibration response." Take the maximum permissible vibration acceleration rates in conjunction with option L03 from the following table:

Table 5-14 Maximum permissible vibration accelerations

	Standard SH 180 and SH 225	**Option L03 SH 180**	**Option L03 SH 225**
Vertical	1.0 g	4.0 g	3.5 g
Horizontal	1.0 g	3.5 g	3.2 g
Axial	1.0 g	3.5 g	3.2 g

Vibration acceleration rates (0 peak) in the frequency range from 0 Hz to 1 kHz at the bearings must not exceed the values listed in the table. The position of the measuring points is defined in ISO 10816-1. The customer must pin the 1PH8 motor at the DE and NDE using a cylindrical grooved pin according to ISO 8740. To do this, place the motor down on a metal foundation. For easier removal, do not use blind holes in the foundation for the pinning. Recommendation: Through holes for pressing through the cylindrical grooved pins.

Grooved pins acc. to ISO 8740	**SH 180**	**SH 225**
Grooved pin diameter	5 mm	6 mm

Measures included

- Reinforced version of a DE bearing shield
- Fan unit (EC fan) with upgraded electronic components
- Screws locked with Loctite 270

Otherwise, the statements and regulations in this Configuration Manual apply.

Note

For additional information, please contact Technical Support or your local sales partner.

5.2.5 Holding brake (option)

5.2.5.1 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 is provided in the following manuals:

- SINAMICS S120 Function Manual (6SL3097-4AB00-0AP1)
- SINAMICS S120/S150 List Manual (6SL3097-4AP00-0AP3)

Information on the current carrying capacity of the brake outputs/adapters of the individual SINAMICS power units can be found in the corresponding manuals. It may be necessary to control the brake using additional switching elements.

Ensure that the brake data are correctly parameterized in SINAMICS. This is particularly important for the setting values:

- Maximum motor speed (reduced value for the "holding brake" option)
- Opening and closing 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 80, 100, 132, 160, 180 and 225.

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. when in a no-current state, the spring-actuated brake closes and holds the drive. When power is applied to the brake, it is released and the drive is free to rotate.

In the event of a power failure or an Emergency Stop, the drive is braked from its actual speed down to standstill.

Brake connection (must be provided on the system side)

- Alternating voltage 230 VAC, 50 ... 60 Hz
- 24 V DC up to shaft height 160

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, contact the manufacturer regarding special measures that are required.

Note

Restricted maximum motor speed for a motor equipped with brake

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

Note

Selection and ordering data

The selection and ordering data is contained in the chapter of the same name.

Note

No UL approval for the holding brakes for 1PH8, shaft heights 180 and 225

The holding brakes for motors, shaft heights 180 and 225 are not UL approved. As a consequence, these motors with mounted brake do not have the cUR marking.

Technical data of the holding brakes

Table 5-15 Technical data of the mounted holding brake (DE) with emergency stop function

Shaft height	80	100	132	160	180	225
Motor type	1PH808□	1PH810□	1PH813□	1PH816□	1PH818□	1PH822□
Brake type	Size 13	Size 13	Size 13	Size 13	NFF-A 63	NFF-A 100
Holding torque Nm	29	60...15	140...310	280...500	1000	1600
Maximum speed n_{max} r/min	5000	5000	4500	4000	3500	3100
Moment of inertia J_B kgm^2	0.00093	0.0048	0.0141	0.0266	0.022	0.051
Weight m_{Br} kg	10	21	46	66	63	88
Coil current 230 V AC ±10 % A	0.8	1.0	1.3	1.9	2.2	2.7

Shaft height	80	100	132	160	180	225
Coil current AC 24 V ±10 % A	4.1	4.7	6.9	6.7	-	-
Permitted single-use operating energy W_E kJ	2.2	7	16	24	98	210
Total moment of inertia (Emergency Stop) J_{tot} kgm^2	0.0174	0.063	0.218	0.456	13	3.9
Emergency stop speed n r/min	4800	4500	3600	3100	3000	2800
Number of emergency stops z [1]	2000	2000	2000	2000	2000	1200
Opening time t_0 ms	150	500	650	750	300	300
Closing time t_{C1} [2] ms	300 (40)	500 (60)	1000 (100)	1100 (150)	80	100

[1] Max. 3 switching operations per hour

[2] Closing time at 230 V AC (the time in brackets refers to the closing time for a 24 V DC power supply, and the reduced closing time when using a DC circuit with 230 V AC power supply)

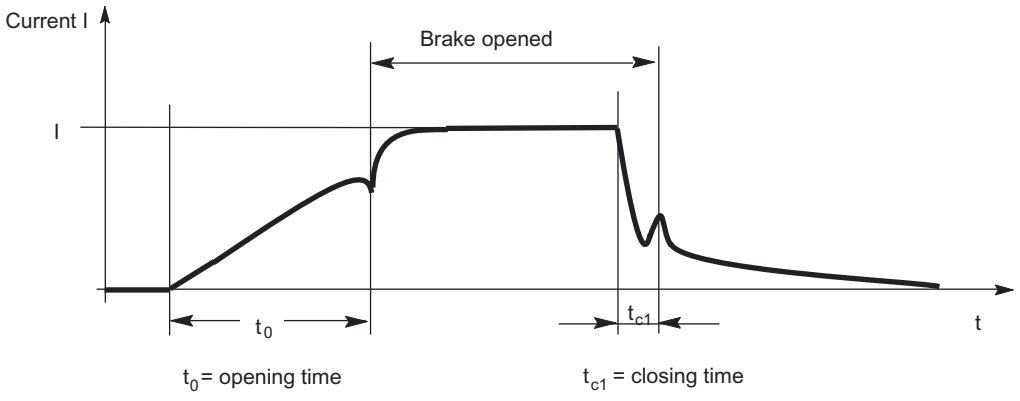


Figure 5-3 Terminology (time) for holding operation

Explanation of terminology in the table

Holding torque 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.

Speed n_{max} r/min: Maximum permissible speed.

Permitted single-use operating energy W_E kJ: Permissible operating energy for an emergency stop,
$W_E = J_{tot}$. x $n^2/182.4 \times 10^{-3}$ (J in kgm^2, n in r/min)

Lifetime operating energy W_{max} MJ: Max. possible switching energy of the brake (for emergency stop) until the brake linings have 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 A: Current to release the brake.

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

Closing time t_{C1} ms: Interlocking time until the brake closes according to diagram "Terminology (time) for holding operation." (the values refer to the maximum braking torque and at rated voltage.).

Use for the intended purpose

"Single-disk spring-operated brake control modules" are for mounting on induction or synchronous motors and intended for use in commercial or industrial systems. Use in hazardous areas is absolutely prohibited. The integrated single-disk spring-operated brake (electromagnetically opening system) is designed as holding brake. Occasional Emergency Stop operations are possible.

NOTICE
Irreversible reduction of the braking effect The braking effect can be irreversibly reduced if you do not comply with 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), carefully observe the information provided in the Table "Technical data of holding brakes". • You can equip the holding brake with a manual brake release to remove the holding torque.

NOTICE
Inadvertent operation of the holding brake Material damage can occur if you inadvertently apply or release the holding brake. • Secure the holding brake against inadvertent operation and misuse. The mechanical manual brake release must be in the center position when not actuated (see the diagram “Spring-actuated single-disk brake module"). Only then is the brake completely closed, and it is ensured that the spring-actuated single-disk brake module can provide its full braking effect. • You can remove the manual release lever. Strictly observe the specific system-related regulations, e.g. in the crane construction area relating to whether manual brake release is permissible. • For the rated operating conditions, see DIN VDE 0580: 1994-10. For the degree of protection see DIN VDE 0470, part 1. If deviations exist, coordinate special measures with the manufacturer.

⚠ WARNING

Danger to life if the holding brake is used incorrectly

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

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

Note

Special measures

If you find references to special measures and/or it is necessary to consult the manufacturer, already obtain the manufacturer's advice when you configure the system.

5.2.5.2 Mounted holding brake for SH 80 to SH 160

Properties

The holding brakes for motors, shaft heights 80, 100, 132 and 160 are brake modules (manufactured by Kendrion Binder Magnete) with their own bearings, flange and shaft extension. The dimensions of the flange and shaft extension of the brake module are identical with those of the motor. If a motor is to be equipped with a brake, then a motor version with a flange-type of construction and a smooth shaft (without keyway and key) is used. The shaft of the brake module can then be shrunk onto the motor shaft (thermal technique). It can be released using pressurized oil. The brake module is bolted to the motor flange.

Note

Radial and axial forces

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

See also

Radial and axial force diagrams (Page 115)

Method of operation

The brake module is an electromagnetic component with integrated electromagnetically opening single-disk spring-operated brake for dry running, in which the braking effect is applied by the spring force and canceled electromagnetically.

If required, the braking effect can also be canceled by an additional mounted manual release. The brake module is a mounted brake, preferably on the DE end shield of electric motors, as built-on unit with bearing supported driver pin shaft.

Structure

The solenoid housing ⑦ with the cast excitation winding ⑥ is used to accommodate the armature ②, the friction disk ③ and the flange ④ that is attached using cylinder head screws. The compression springs in the solenoid housing that are supported via the thrust studs (size 13) on the adjustment ring ⑨, apply a force to the friction disk via the anchor in the axial direction and thus clamp the friction disk between the rigidly mounted flange and the anchor and produce the braking effect (torque). The tangent torque support of the armature against the solenoid housing is performed by the dowel pins.

When a direct voltage is applied to the excitation winding, the resulting electromagnetic force pulls the armature against the force of the compression springs, the friction disk is released and thus the braking effect canceled.

As the brake module represents a self-contained system, no forces are applied externally.

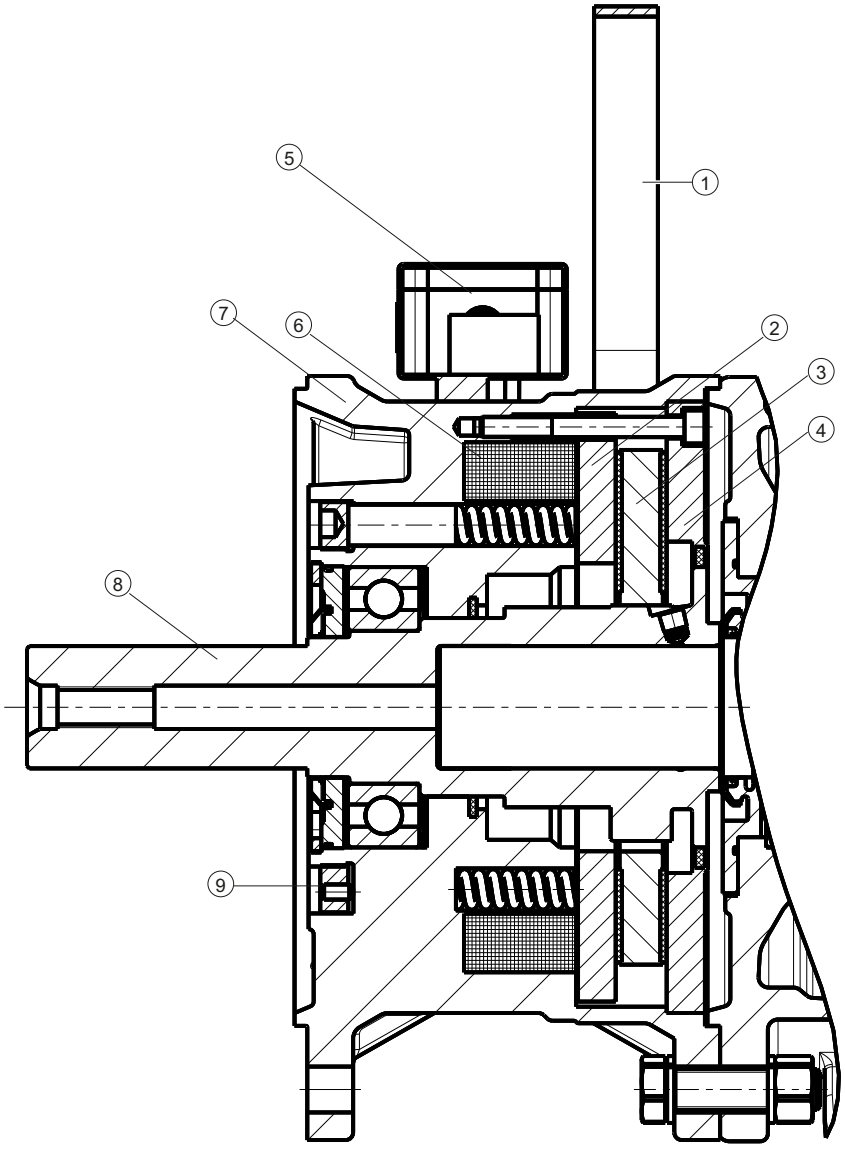
The braking effect of the axial moving friction disk is transmitted to the driver pin shaft ⑧ fixed to the motor shaft via the keyed connection of the internal square socket (sizes 13, 19 and 24) and/or via internal gearing (size 29).

The ball bearing located between the solenoid housing and the driver pin shaft is used to center the brake to the driver pin shaft and therefore to the motor shaft when mounting the brake on the motor flange and also to absorb the transverse forces acting radially on the driver pin shaft.

The ball bearing comes sealed from the factory. As additional protection against pollution and to prevent grease from a defective ball bearing seal reaching the friction disk, a sealing ring is mounted that prevents dirt, grease or oil reaching the area of the friction disk from the outside and abraded particles due to the wear of the friction disk escaping.

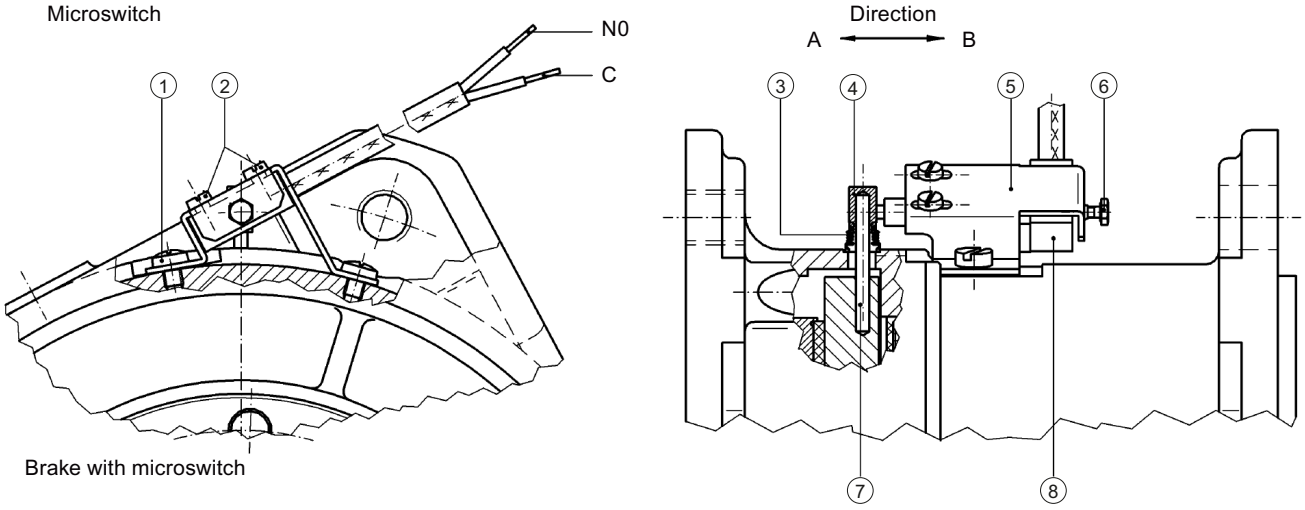
The sealing ring provides the drive-side sealing between the flange and the driver pin shaft. The single-disk spring-operated brake module can be opened mechanically by hand, e.g. in the event of a power failure, via the optional manual release ①. The electrical connection is established directly in the terminal box ⑤.

The transmissible torque of the brake module can be set via the adjustment ring.



① Manual brake release, optional
② Armature
③ Friction disk
④ Flange
⑤ Terminal box
⑥ Winding
⑦ Housing
⑧ Shaft
⑨ Adjustment ring (not for 1PH808)

Figure 5-4 Single-disk spring-operated brake module 77 500...B15



①	Oval head screw (2x)	⑤	Bracket
②	Cylinder head screw (2x)	⑥	Hexagon bolt M2.5x8 (not included in the scope of delivery)
③	Bellows	⑦	Dowel pin
④	Bolt	⑧	Microswitch

Figure 5-5 Microswitch mounting of a single-disk spring-operated brake module 77 500...B15

Electrical connection

⚠ WARNING

Fire hazard and risk of destroying the brake module

The brake module is an electromagnetic component and a DC system. An impermissibly high connection voltage at the brake module can cause the rectifier or the winding to burn. This can block the brake module, causing it to overheat.

If the connection voltage is too low, the magnetic excitation will also be too low, preventing the brake from being released. The brake goes into the brake mechanism although this is not wanted.

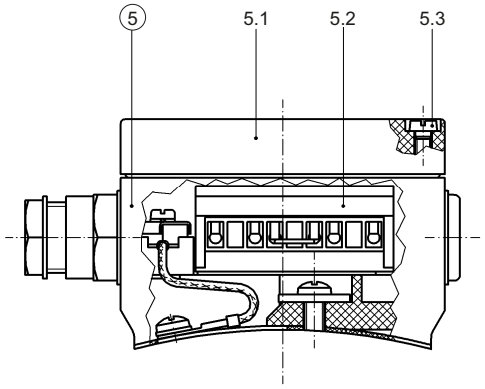
- Make sure that the connection voltage of the brake module remains within the permissible tolerance of +10 % to -10 % of the nominal voltage. Comply with the legal standards for connection to the grid. Pay attention to the correct dimensioning of the cable lengths and conductor cross-sections in the connection cables.

- Check the electrical connection of the holding brake based on the following checklist.

Table 5-16 Checklist for checking the electrical connection of the holding brake

Check	OK
The connection cables are suitable for the type of use and the voltages and currents that occur.	
The connection cables are connected correctly by means of screws, clamps or other equivalent means, so that the electrical connection is maintained permanently.	

Check	OK
Adequately dimensioned connecting cables, torsion, strain and shear relief as well as anti-kink protection are provided for the connection cables.	
The protective conductor (only for protection class I) is connected at the grounding point.	
There is no foreign matter, dirt or moisture in the terminal box.	
Unused cable entries and the terminal box itself are sealed so that the specified degree of protection according to EN 60529 is maintained.	



⑤ Terminal box

5.1 Cover

5.2 Connecting terminal or rectifier

5.3 Fixing screw for cover

Figure 5-6 Holding brake terminal box ⑤ optionally with terminal or rectifier

- Connect the spring-applied single-disk brake module to the direct voltage. Use a rectifier bridge or half-wave rectifier for electrical connection to an AC power system.
- For brakes with integrated rectifiers, you can connect the spring-applied single-disk brake module directly to alternating voltage.
- See the figure for the terminal assignment.
- For brakes with a connecting terminal, you must connect the brake module directly to direct voltage. Connect the customer-specific connection cable to the terminals or to the integrated rectifier. Use a screwed cable gland (M16 x 1.5) for the connection.
- You must remove the cover of the terminal box to connect the individual cores of the connecting cable to the connecting terminals or to the terminals of the integrated rectifier.

Table 5-17 Rectifier for operation on single-phase AC with electrical connection via connection terminal (5.2)

Type	**Method**	**Rated input voltage range U_1 AC (40 ... 60 Hz)**	**Output voltage U_2 DC**	**Max. output current I DC**	
		V	**V**	**R load A**	**L load A**
32 07332B40	Half-wave	0 ... 500 (±10 %)	$U_1 \cdot 0.445$	1.6	2.0

Brakes with integrated rectifiers are either equipped with a half-wave rectifier or with a rectifier bridge.

By appropriately connecting the integrated rectifier, you switch between AC (normal interlocking time t_1) or DC (short interlocking time t_1).

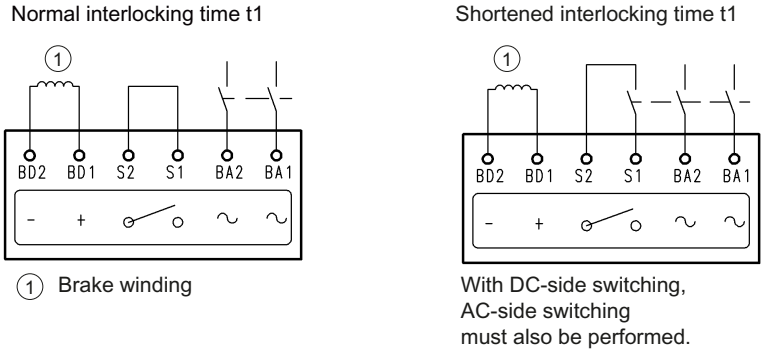


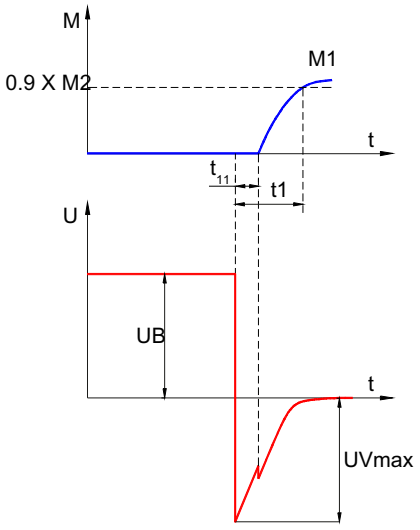
Figure 5-7 Pin assignment of the rectifier

Voltage ripples caused by switched-mode power supplies can cause humming or unintended behavior of the component depending on the size and torque.

The user or the system manufacturer has to ensure proper operation by means of the electrical control.

DC connection

The basic curve of the voltage when the excitation winding (coil) (1.2) is switched off is as follows.



U_B Operating voltage (coil voltage)

U Transient voltage

Figure 5-8 Basic curve of the voltage when turning off the excitation winding

NOTICE
Overvoltages when switching off The voltage peak U_{Vmax} when switching off can reach several 1000 V in the millisecond range without a protective circuit. The excitation winding (coil) (1.2), switching contacts and electronic components can be destroyed. Sparks form at the switch on switch-off. • When it is switched off, the current must therefore be reduced via a snubber circuit. This also limits the voltages. The maximum permissible overvoltage when switching off must not exceed 1500 V.

If Kendrion Binder rectifiers are used, the protective circuit for the internal electronic components and for the excitation winding (coil) (1.2) is integrated. This does not apply

for the external contacts required for the DC-side switching because the galvanic isolation of the external contact is then no longer achieved.

NOTICE
Component damage resulting from a lower voltage Sensitive electronic components (e.g. logic components) and mechanical contact elements can also be damaged by the lower voltage. • Make sure that the voltage does not fall below the specified value, e.g. due to insufficient conductor cross-sections.

AC connection

NOTICE
Impermissible overvoltages If you operate the brake module without a snubber circuit in a circuit on the DC side, impermissible overvoltages can arise. • Use a snubber circuit. • Avoid damage, e.g. due to contact erosion or contact welding of the external contact elements by taking additional protection measures, e.g. varistors or spark suppression elements.

Direct connection to an AC voltage is only possible via a rectifier. Depending on the connection method (DC or AC operation), different interlocking times can be achieved.

- Half-wave rectification
  With half-wave rectification, the coil voltage U_2 is less than the input voltage on the rectifier by a factor of 0.445. Half-wave rectifiers have a high residual ripple which have somewhat shorter switching times compared to the bridge rectification, depending on the module size. The half-wave rectifier is therefore preferable (also because of the smaller coil voltages). However, humming can occur in brake modules of small size.
- DC operation
  With DC-side circuitry of the brake module, an additional auxiliary contact is plugged into the motor contactor, which interrupts the current supply to the brake module on the DC side.

Electrical connection of brake modules with microswitches

Note

Use of microswitches

- Observe the special regulations regarding the permissible use of microswitches, e.g. for lifting gear and crane construction.

⚠ WARNING

Accidental motor starting

In an unsecured motor circuit, the motor can start accidentally when the microswitch is closed. This can result in injury and/or material damage.

- Secure the motor circuit accordingly.

In brake modules with microswitches, the microswitch monitors the operating state of the spring-applied single-disk brake module. The brake module is either open or closed.

- For example, integrate the microswitch into the control circuit for controlling the machine or the motor.

The microswitch prevents the machine or motor from starting against a closed brake module if it is integrated correctly.

When ordering, the microswitch is available as an option. It is not possible to subsequently mount a microswitch.

When the brake module is supplied, the microswitch is adjusted in the factory.

Manual opening of the brake module

⚠ WARNING

Accidental drive acceleration after manually operating the brake control module

If you manually open the spring-applied single-disk brake module, the load torque will accelerate an unbalanced drive. This can result in injury and/or material damage.

- Take special care when inching the brake module open or closed. Make sure that no danger is posed by the load torque.

Examples of situations in which manual operation of the brake module is necessary include

- Maintenance on the machine or the motor
- Failure of the regular power supply during UPS operation

The spring-applied single-disk brake module can be manually opened via an externally mounted mechanical manual brake release (accessory).

If you use a commercially available UPS power supply, e.g. a UPS battery system, the brake module can be opened electrically during a failure of the regular power supply.

- Observe the voltage stated on the nameplate of the brake module when installing a UPS power supply.

Setting of the transmissible torque M_4

Note

Torque M_4

The transmissible torque must not fall below the minimum value M_4 when you adjust the adjustment ring according to table "Change of the transmissible torque."

- Always mark the modified adjustment ring distance E in the base of the solenoid housing pocket using a punch prick.
- Mark the theoretically set transmissible torque M_4 on the nameplate of the motor. The empty field "Optional customer information" on the nameplate is available for this.
- After you have set the transmissible torque M_4, make sure that you secure the adjustment ring with a threaded pin. Comply with the tightening torque of M_A = 3 Nm.
- Turn the adjustment ring in such a way that the threaded pin can be located between the thrust studs. Deviations of the transmissible torque M_4 from -5% to +15% are possible.

The brake module is delivered with the transmissible torque M_4 set to the default value according to the data sheet. You will find the transmissible torque M_4 on the nameplate of the brake module.

Table 5-18 Change of the transmissible torque M_4 [%] for an axial travel path of the adjustment ring by 1 mm; transmissible torque (default value) M_4

	Size 19	Size 24	Size 29
Change of the transmissible torque ΔM_4/mm %	Approx. 15	Approx. 12	Approx. 14
Transmissible torque (standard value) M_4 Nm	150	310	500

5.2.5.3 Mounted holding brake for SH 180 and SH 225

Properties

For these motors, the brake (manufactured by Stromag) is mounted on the DE end shield. In this case, the motor shaft is extended using a shrunk-on stub shaft. The torque is transmitted through a feather key according to DIN 6885/1. The stub shaft can also be axially secured using a spring washer and a central screw (M20). The holding brake does not have its own bearings. The output forces are therefore absorbed by the motor bearings. Belt pulleys cannot be mounted due to space reasons and also due to the high associated cantilever forces. When selecting the coupling to couple to the motor - brake combination - it should be carefully noted that the shaft extension diameter is larger than the diameter of the motor shaft extension. REVOLEX bolt-type couplings 2LF6337 for shaft height 180 and 2LF6338 for shaft height 225 should be preferably used. Ordering data and dimensions, refer to catalog M 11 or D 81.1.

Note

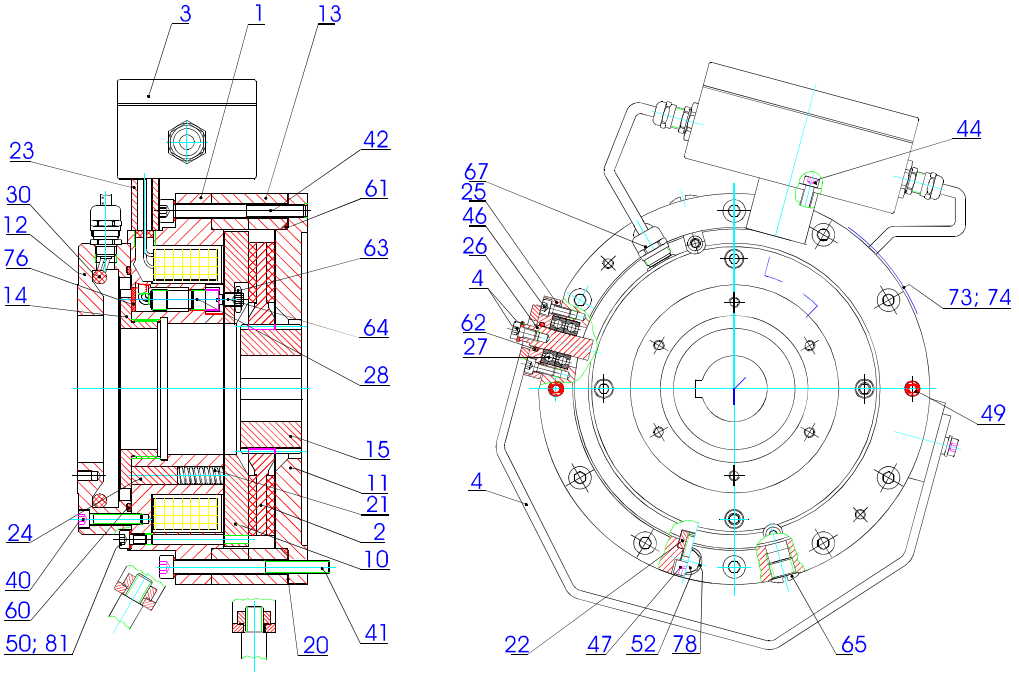
Radial and axial forces

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

See also

Radial and axial forces (Page 111)

Design, method of operation and construction features



1	Coil form with coil	40	Screw for tacho flange
2	Friction disk with friction lining	41	Fixing screw
3	Terminal box, complete	42	Cylinder head screw
4	Manual brake release, complete	46	Fixing screw for manual release cover
10	Armature disk	47	Screw for sliding block
11	Brake flange	49	Emergency release screw
12	Tacho flange	50	Screw plug for emergency release
13	Socket	52	Screw for blockable manual release
14	Adjustment ring	60	O-ring for tacho
15	Pinion	61	O-ring for brake flange
20	Shim	63	Lock nut for microswitch
21	Compression springs	64	Grub screw (microswitch)
22	Sliding block	65	Screw plug for air gap measurement
23	Spacer for terminal box	67	Screw connection
24	Spring bolt	73	Rating plate
25	Manual release cover	74	Pin (rating plate mounting)
26	Eccentric bolt	76	Adhesive
27	Deep-groove ball bearing	78	Washer for item 52
28	Microswitch	81	Sealing ring for item 50

Figure 5-9 Mounting of holding brake SH 180 and SH 225

The NFF brake is a spring-loaded electromagnetic twin-disk brake that brakes in the de-energized state and releases electromagnetically.

The NFF brake type satisfies the highest requirements for fatigue strength, robustness and resistance to sea water. The brakes are constructed and tested in compliance with DIN VDE 0580.

The brake is attached to a motor or another machine part using cylinder head screws (fixing screws, item 41).

The bobbin contains a coil that is permanently encapsulated in synthetic resin of thermal class 155 (F, max. temperature limit 155° C).

When the coil is de-energized, the compression springs (21) press the armature disk (10) axially against the friction disk with friction lining (2). This is clamped between the armature disk (10) and the brake flange (11) and thus prevented from rotating. The braking effect is transmitted to the shaft from the friction disk with friction lining (2) via the pinion (15) and a feather key.

If the coil is connected to a rated DC voltage according to the specifications on the rating plate (73), the armature disk (10) is pulled against the spring pressure to the coil form (1) through the electromagnetic force. The friction disk with friction lining (2) is therefore freed and the braking effect is canceled. The brake is released.

Mechanical release using the manual release bar

By pulling the manual release bar (4) through approx. 30° against the rear side of the brake, the armature disk (10) is pulled axially against the coil form (1) and the friction disk with friction lining (2) is then free.

⚠ WARNING

Incorrect use of the emergency release

If you use the emergency release to maintain operation temporarily, you may damage the brake. This can result in personal injury and damage to property.

- Only ever use the emergency release in an emergency.

Power supply line and electrical connection of the brake

The electrical connection must be made in compliance with the installation regulations (e.g. DIN 92). The power connection provided by the customer is 230 V AC +/- 10%.

The coil is dimensioned for the DC voltage specified on the rating plate (residual ripple < 0.5) and 100% cyclic duration. The continuously permissible voltage change is +6% to -10% of the rated voltage.

To protect the coil or the power supply, a varistor of the appropriate operating voltage range and the required power should be connected to the coil input.

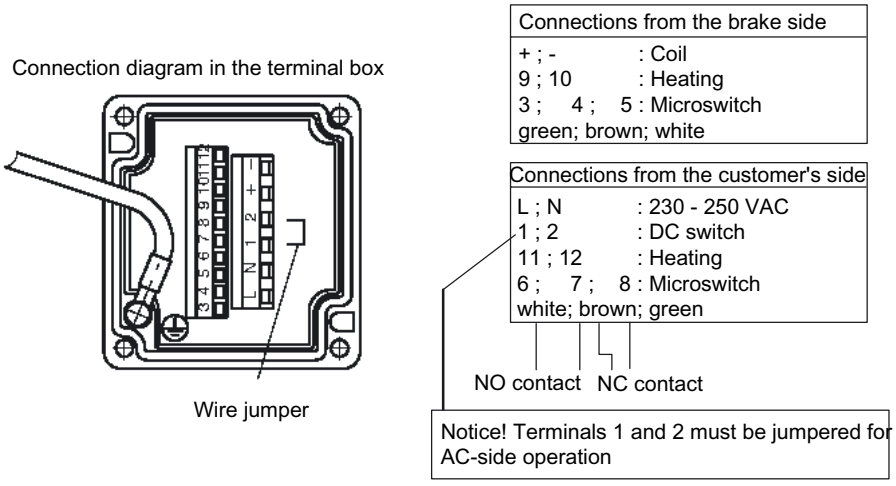


Figure 5-10 Circuit configurations

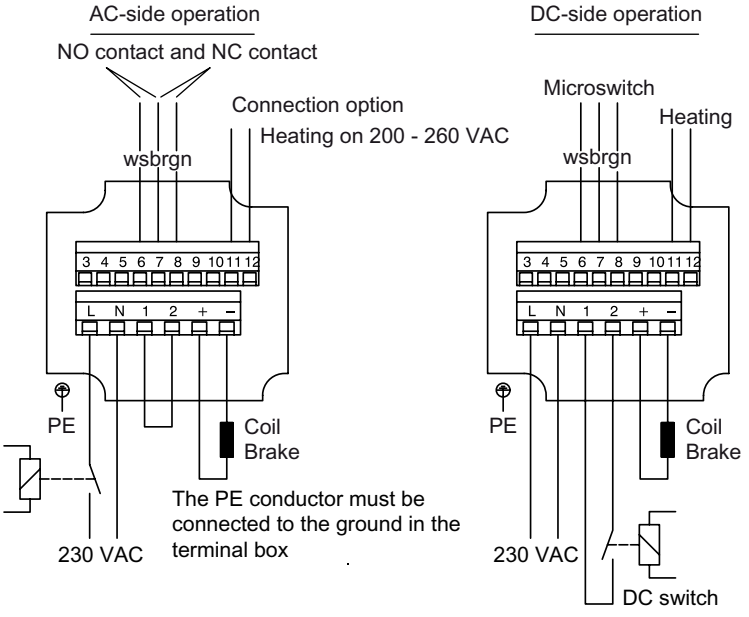


Figure 5-11 Circuit configurations

Version with microswitch

If monitoring of the switching state is required for a brake, a microswitch (28) can be used.

If the armature disk (10) is moved against the coil form (1) through the electromagnetic force of the coil or through the mechanical emergency release, it actuates the microswitch (28) via the grub screw (64).

The microswitch (28) can be integrated as an NC or NO contact in an electrical control or monitoring circuit.

5.2.6 Anti-condensation heating (option K45)

Larger motors are prone to more frequent condensation on the winding caused by the climatic conditions because of the larger surfaces. Condensation can occur, for example, when motors are not operational in a humid environment or if motors are exposed to significant temperature fluctuations. Anti-condensation heaters heat the air in the motor by a few Kelvin above the ambient temperature and thus prevent precipitation inside the motor.

For 1PH8 motors, using option K45, order anti-condensation heating for shaft heights 180, 225 and 280. Option K45 comprises an anti condensation heater attached to the winding overhang with a heating power of 100 W for a supply voltage of 230 V AC (50/60 Hz). The 2 connection ends are routed into the main motor terminal box. Connect this via the auxiliary terminal strip. The connection ends are marked "1HE1" and "1HE2".

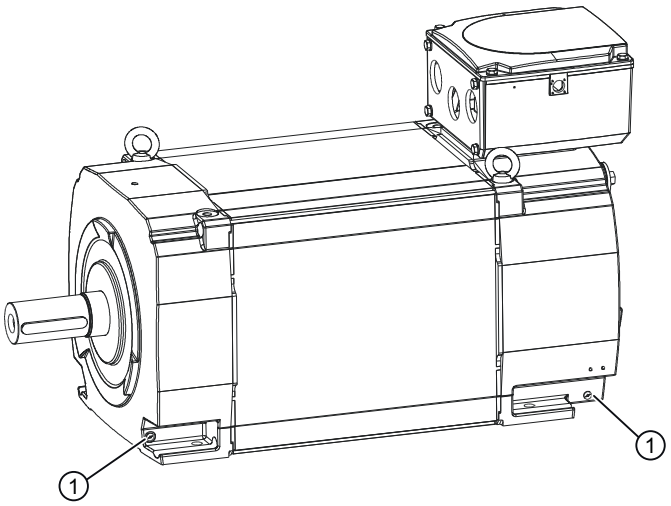
Note:

- For shaft heights 180, 225, 280, the same strip heater is used.
- Do not switch on the anti-condensation heating while the motor is operational.
- The anti-condensation heaters for 1PH8 motors are UL-approved.
- In addition to the anti-condensation heating, for motors with degree of protection IP55, always take into consideration the condensation drain holes (Chapter "Condensation drain hole (option L12)").

5.2.7 Condensation drain hole (option L12)

In larger motors, there is a risk of condensation or accumulation of condensed water inside the motor due to the climatic conditions. Condensation drain holes prevent the accumulation of a damaging quantity of water in the motor. These are frequently used as the primary measure against condensation as they are easy to implement in the design.

For 1PH8 motors, the condensation drain holes are located at the lowest point in the NDE and DE end shields. As a consequence, they are only suitable for horizontal mounting in types of construction IM B3, IM B5 and IM B35. The condensation drain holes for shaft heights 180 and 225 are provided with a special insert (drainage plug); this insert is not required for shaft height 280.



① Water drainage hole

Figure 5-12 1PH8 motor with condensation drain holes

Table 5-19 1PH8 motors with condensation drain holes (optional)

Article No.	Cooling	Degree of protection	Required option	Comment
1PH818x-xxx0 1PH818x-xxx1	Forced ventilation	IP 55	L12	Bearing shield NDE and DE
1PH822x-xxx0 1PH822x-xxx1				
1PH828x-xxx1				
1PH818x-xxx2	Water cooling	IP 55	-	NDE and DE bearing shield (condensation drain hole always included as standard)
1PH822x-xxx2				
1PH828x-xxx2				

Note

- Condensation drain holes are only used in motors with degree of protection IP 55.
  For motors with degree of protection IP 23 (open-circuit ventilation), the open design does not require condensation drain holes. It is not possible that a potentially damaging amount of condensation can collect.
- Anti-condensation heating (see Chapter "Anti-condensation heating") can be used to supplement condensation drain holes.

5.2.8 Higher number of grounding terminals in the terminal box (Q00)

For option Q00 (higher number of grounding terminals in the terminal box), symmetrical power cables with a grounding conductor split into 3 can be connected more easily in the terminal box for high power ratings. For option Q00, the grounding bar in the terminal box has a higher number of terminals.

Table 5-20 Definition of Q00 according to the type of terminal box:

Shaft height SH	Terminal box type	Number of terminals (grounding) standard	Number of terminals (grounding) option Q00
280	1XB7712-P..	4 x M16	12 x M6

Option Q00 has no influence on the dimension drawings, 3D drawings, and electrical configuration. This is the reason that this option is not included in the SIEMENS Product Configurator (SPC) nor in the TST.

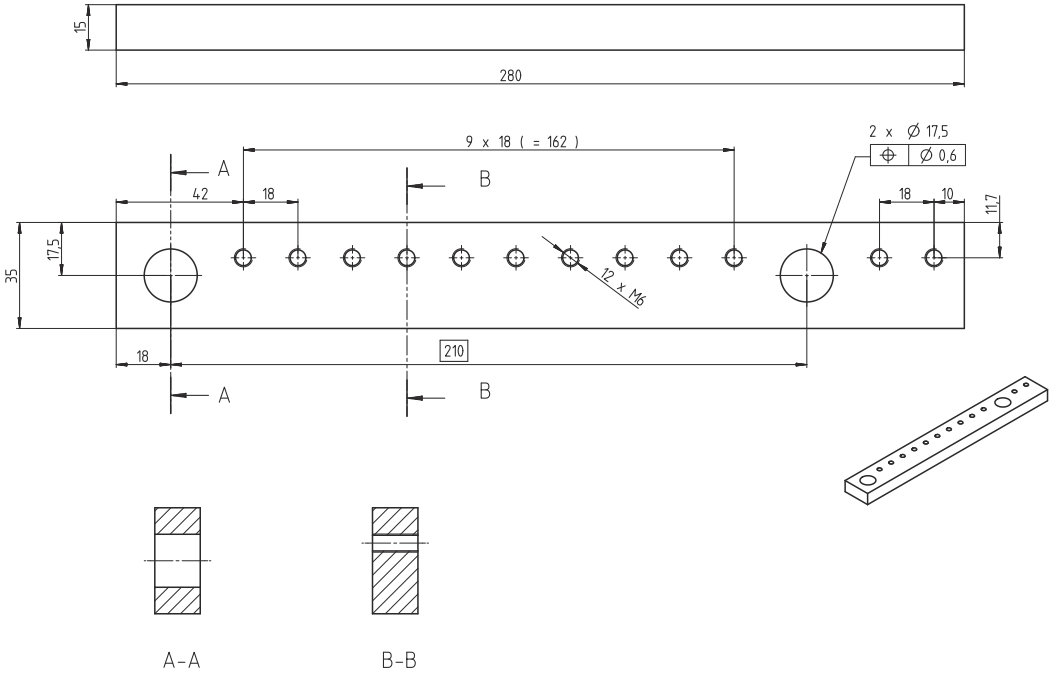


Figure 5-13 Grounding bar with option Q00

5.2.9 Chain of PTC thermistors for alarm and trip (option A12)

Overview

In the 1PH8 motors, in addition to the standard temperature sensor in the stator winding (see Ch. "Thermal motor protection"), a chain of PTC thermistors for alarm and trip can be ordered with option A12.

The chain of PTC thermistors can also monitor the winding temperature. PTC thermistors are thermistors that exhibit a sudden increase in resistance at a certain trigger temperature. The trip units detect this resistance change and signal the trigger temperature. PTC thermistors are standardized in DIN 44081.

Circuit design

Option A12 consists of two chains of PTC thermistors, each with 3 PTC thermistors for alarm and trip. The chain of PTC thermistors is installed in the phase elements on the winding overhang. The temperature difference between alarm and trip is 10 K.

The terminal designations for the two connection ends of the chain of PTC thermistors for alarm are 1TP1 and 1TP2; the terminal designations for the two connection ends of the PTC thermistor circuit for tripping are 2TP1 and 2TP2.

The circuit diagram and the terminal assignments are provided in the terminal box of the 1PH8 motor.

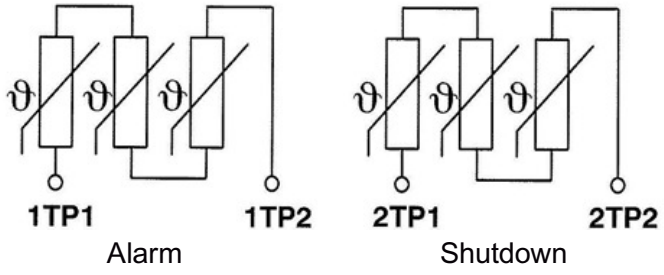


Figure 5-14 Chains of PTC thermistors option A12

Configuration

6

6.1 Configuring software

6.1.1 TST engineering tool (TIA-Selection-Tool)

Overview

The TIA-Selection-Tool (TST) engineering tool supports you when dimensioning the hardware and firmware components required for a drive application.

TST supports the following configuration steps:

- Configuring the power supply
- Designing the motor and gearbox, including calculation of mechanical transmission elements
- Configuring the drive components
- Compiling the required accessories
- Selection of the line-side and motor-side power options

The configuration process produces the following results:

- A parts list of components required (Export to Excel)
- Technical specifications of the system
- Characteristic curves
- Comments on system reactions
- Design information of the drive and control components
- Energy considerations of the configured drive systems

You can find additional information that you can download in the Internet at TST (https://support.industry.siemens.com/cs/ww/en/view/109767888).

6.2 Procedure when engineering

6.2.1 SINAMICS configuring procedure

Motion Control

1PH8 motors are optimized for motion control applications. They execute linear or rotary movements within a defined movement cycle. All movements must be performed in a time-optimized manner. As a result of these considerations, 1PH8 motors must meet the following requirements:

- High dynamic response, e.g. short rise times
- Capable of overload, i.e. high acceleration margin
- Wide control range, i.e. high resolution for precise positioning.

The following table "Configuring procedure" is applicable for induction, synchronous-reluctance and synchronous motors.

General procedure when engineering

The function description of the machine provides the basis when engineering the drive application. The components are selected according to physical interdependencies and the selection process is usually carried out in the following sequence of steps:

Table 6-1 Planning

Step	Description of configuration activity	
1.	Clarification of type of drive	See the next chapter
2.	Definition of supplementary conditions and integration into an automation system	
3.	Definition of the load, calculation of the maximum load torque and selection of the motor	
4.	Selection of the SINAMICS Motor Module	See catalog
5.	Repetition of steps 3 and 4 for additional axes	
6.	Calculation of the required DC link power and selection of the SINAMICS Line Module	
7.	Selection of the line-side options (main switch, fuses, line filters, etc.)	
8.	Specification of the required control performance and selection of the Control Unit, definition of component cabling	
9.	Definition of other system components (e.g. braking resistors)	
10.	Calculation of the current demand of the 24 V DC supply for the components and specification of the power supplies (SITOP devices, Control Supply Modules)	
11.	Selection of the components for the connection system	
12.	Configuration of drive line-up components	
13.	Calculation of the required cable cross sections for power supply and motor connections	
14.	Inclusion of mandatory installation clearances	

Clarification of the type of drive

The motor is selected on the basis of the required torque, which is defined by the application, e.g. traveling drives, hoisting drives, test stands, centrifuges, paper and rolling mill drives, feed drives or main spindle drives. Gearboxes to convert motion or to adapt the motor speed and motor torque to the load conditions must also be considered.

As well as the load torque, which is determined by the application, the following mechanical data is among those required to calculate the torque to be provided by the motor:

- Masses to be moved
- Diameter of the drive wheel
- Leadscrew pitch, gear ratios
- Frictional resistance
- Mechanical efficiency
- Traversing paths
- Maximum velocity
- Maximum acceleration and maximum deceleration
- Cycle time

A basic decision must be made as to whether induction, synchronous-reluctance or synchronous motors should be used.

Synchronous motors are the best choice if it is important to have low envelope dimensions, low rotor moment of inertia and therefore maximum dynamic response ("Servo" control type).

Asynchronous motors can be used to increase maximum speeds in the field-weakening range. Asynchronous motors for higher power ratings are also available.

Synchronous-reluctance motors in the medium power range can represent a good alternative configuration to induction motors if higher power ratings with high efficiencies are required.

The following factors are especially important when engineering a drive application:

- The ambient temperatures and the installation altitude of the motors and drive components.
- Heat dissipation from the motors through forced ventilation or water cooling

The motor-specific limiting characteristics provide the basis for defining the motors.

These define the torque or power characteristic versus the speed and take into account the motor limits based on the DC-link voltage of the Power Module or Motor Module. The DC-link voltage is in turn dependent on the supply voltage and, in the case of torque drives, on the type of Line Module.

Other constraints apply when integrating the drives into an automation environment such as SINUMERIK or SIMOTION.

The motor is selected based on the load which is specified by the application. Different characteristic curves must be used for different load events.

The following operating scenarios have been defined:

- Duty cycle with constant ON period.
- Duty cycles with varying ON period.
- Free duty cycle.

The objective is to identify characteristic torque and speed operating points that can be used as a basis for selecting the motor depending on the load.

6.2.2 Specifying the duty cycle

Duty cycles with constant ON period

For duty cycles with constant ON period, there are specific requirements for the torque characteristic curve as a function of the speed, for example:

M = constant, M ~ n^2, M ~ n or P = constant.

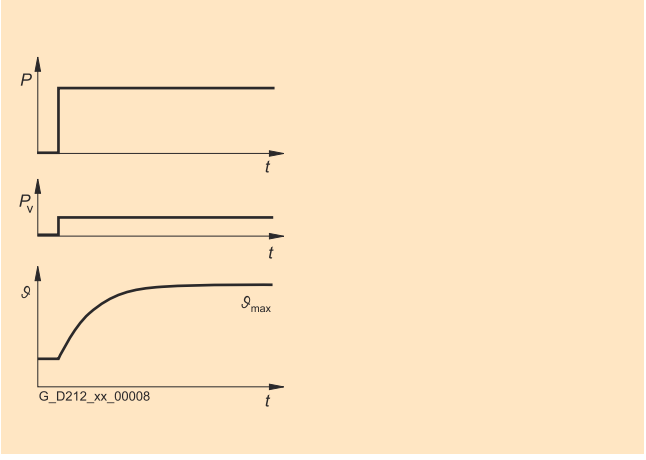


Figure 6-1 S1 duty (continuous operation)

These drives typically operate at a specific operating point. Drives such as these are dimensioned for a base load. The base load torque must lie below the S1 characteristic curve. An overload rating is provided for transient overloads (e.g. during acceleration). The overload current must be calculated relative to the required overload torque. The peak torque must lie below the voltage limiting characteristic.

Duty cycles with varying ON period

As well as continuous duty (S1), standard intermittent duty types (S6) are also defined for duty cycles with varying ON periods. This is a mode of operation consisting of a series of similar cycles, each one comprising one time period with a constant load and one idle time. There is no pause.

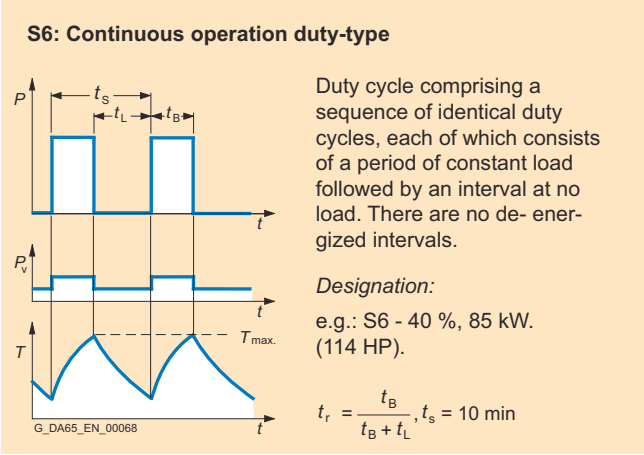


Figure 6-2 S6 duty (continuous duty with intermittent load)

Fixed variables (overload factors) are usually applied for the relative ON period:

- S6 – 60%
- S6 – 40%
- S6 – 25%

The overload factors for the corresponding intermittent duty types (S6) referred to the S1 characteristic (continuous duty) can be found in Chapter "Technical data and characteristics."

For induction motors, in addition to the S1 characteristic, the S6 characteristics are also shown.

see Chapter "Technical data and characteristics" (Page 219)

Note

S3 duty

The overload factors for continuous duty with intermittent load (S6) can also be applied for the S3 intermittent duty types (S3-60%, S3-40% or S3-25%) for 1PH8 motors with forced ventilation or water cooling.

Free duty cycle

A load duty cycle defines the characteristics of the motor speed and the torque with respect to time.

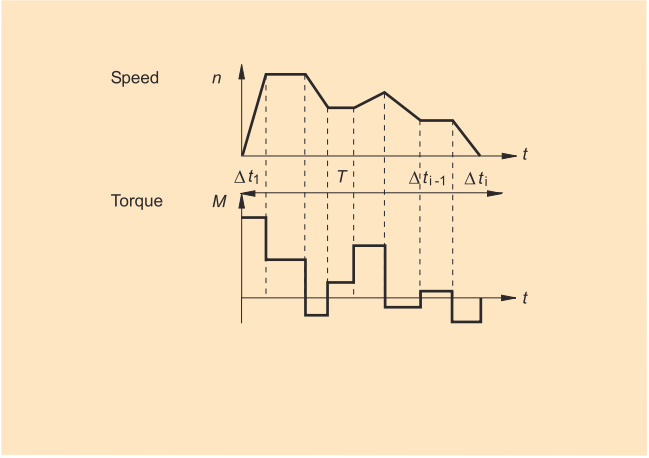


Figure 6-3 Example of a duty cycle

A load torque is specified for each time period. In addition to the load torque, the average load moment of inertia and motor moment of inertia must be taken into account for acceleration. It may be necessary to take into account a frictional torque that opposes the direction of motion.

For gearbox mounting:
In determining the load and acceleration torque required by the motor, the gear ratio and the gear efficiency must be considered. A higher gear ratio increases positioning accuracy in terms of encoder resolution. For any given motor encoder resolution, as the gear ratio increases, so does the resolution of the machine position to be detected.

Note

Duty cycles in the field-weakening range

For duty cycles in the field-weakening range, the drive system must be engineered using the TST engineering tool.

Permissible motor torque

Once the application has been defined and specified, the maximum motor torque is calculated. Generally, the maximum motor torque is required when accelerating. The load torque and the torque required to accelerate the motor are added.

The maximum motor torque is then verified with the limiting characteristic curves of the motors.

The following criteria must be taken into account when selecting the motor:

- The dynamic limits must be adhered to, i.e. all speed-torque points of the relevant load event must lie below the relevant limiting characteristic curve.
- The thermal limits must be adhered to, i.e. the rms motor torque at the average motor speed resulting from the duty cycle must lie below the S1 characteristic curve (continuous duty). The rms value of the motor current within a duty cycle must be less than the rated motor current.
- In the field-weakening range, the permissible motor torque is restricted by the voltage limit characteristic (stability limit).

Note

Rated pulse frequencies

The rated motor data is valid only for 4 kHz (booksize or blocksize Motor Modules) or 2 kHz (chassis motor module). Operation of the motors with rated pulse frequencies < 2 kHz is not permitted!

6.2.3 Selecting induction motors

Characteristic curves for asynchronous motors

Speed-power diagrams P = f(n) and speed-torque diagrams M = f(n) for operation with the SINAMICS converter system are described in the motor characteristics, see Chapter "Technical data and characteristics" (Page 219).

Depending on the motor variant, the S1 characteristic (continuous operation) is available from standstill to rated point with maximum possible thermal torque, or passes through the constant-torque range. The power increases in proportion to speed depending on the available torque.

This is then followed by a constant-power range where the field is weakened (field-weakening range). The field-weakening range is limited by the voltage limit.

For induction motors, in addition to the S1 characteristic, the S6 characteristics are also shown, see Chapter "Technical data and characteristics" (Page 219).

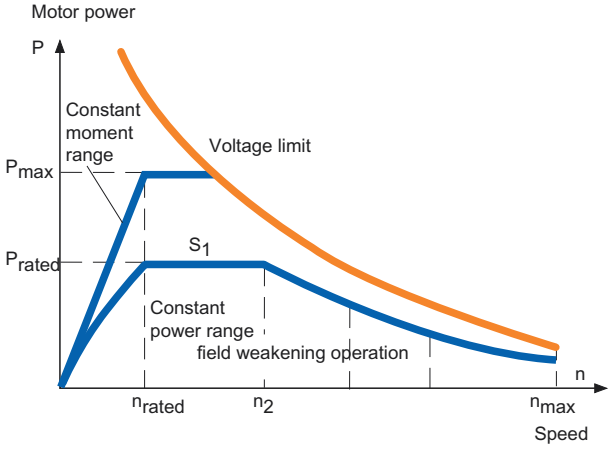


Figure 6-4 Typical speed/power diagram for 1PH8 asynchronous motors

In order that safe, reliable operation is guaranteed even when the line supply voltage fluctuates and the motor parameters vary, a safety margin of at least 10% should always be maintained to the voltage limit at every operating point depending on the type of supply voltage of the Motor Module (inverter) and Infeed Module.

Note

For the configuring of main spindle applications for machine tools, the characteristics for the supply voltage "ALM 400 V" include up to two additional ancillary rated points with which extended field-weakening operation can be configured. In this case, the range of constant power starts at the ancillary rated point and ends at the associated point n_2. The rest of the characteristic is the same as the S1 characteristic in the diagram.

Asynchronous motors have a high overload capacity in the constant power range. The theoretical curve of the maximum permissible overload capacity is shown as a limit in the characteristic diagrams and corresponds to value P_{max}.

6.2.4 Selecting synchronous motors

Characteristic curves for synchronous motors

The S1 characteristic (continuous operation) up to rated point for synchronous motors is similar to the S1 characteristic for asynchronous motors. The S1 characteristic represents the thermally maximum possible continuous torque that can be produced. The S1 power increases with the speed depending on the available torque up to approximately the rated speed.

This is followed by an area with reduced power characterized by increasing iron and friction losses, as well as the increase of negative field voltage with increasing speed due to the constant field of the synchronous rotor.

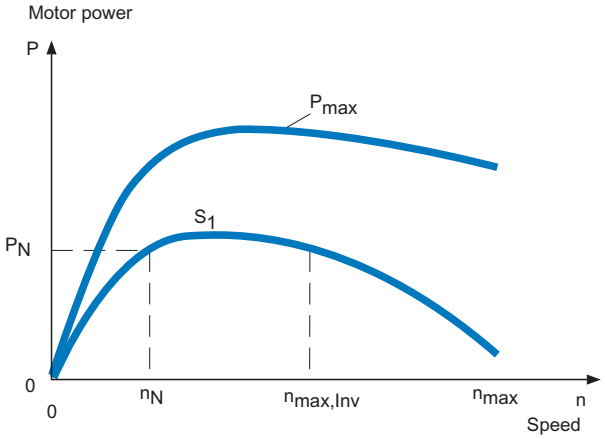


Figure 6-5 Typical speed/power diagram for 1PH8 three-phase synchronous motors

Note

Like those for induction motors, the data sheets for the supply voltage "ALM 400V" include additional ancillary rated points for the configuring of main spindle applications for machine tools. These allow an extended speed range to be configured.

The theoretical curve of the maximum permissible overload capacity is shown as a limit in the characteristic diagrams and corresponds to value P_{max}.

Note

Voltage limitation

A SINAMICS Voltage Protection Module (VPM) is required for operation at speeds of $n_{max,Inv}$ and above. Voltage Protection Modules are available for rated currents up to 200 A.

For further information, please refer to the SINAMICS S120 configuration manuals.

6.2.5 Selecting synchronous-reluctance motors

Characteristics for synchronous-reluctance motors

For synchronous-reluctance motors, the S1 characteristic (uninterrupted duty) has a response similar to that for synchronous motors. The S1 characteristic represents the thermally maximum possible continuous torque that can be produced.

As a result of the very low rotor losses, in the medium speed range, synchronous-reluctance motors have a higher thermal utilization and when compared to induction motors, have a better efficiency class. When configuring, one of two versions can be selected:

- Efficiency (IE3 to IE5)
- Performance (IE2 to IE4)

As a result of the rotor design, a synchronous-reluctance motor has a restricted field-weakening range, and when compared to an induction motor, has a lower maximum mechanical speed.

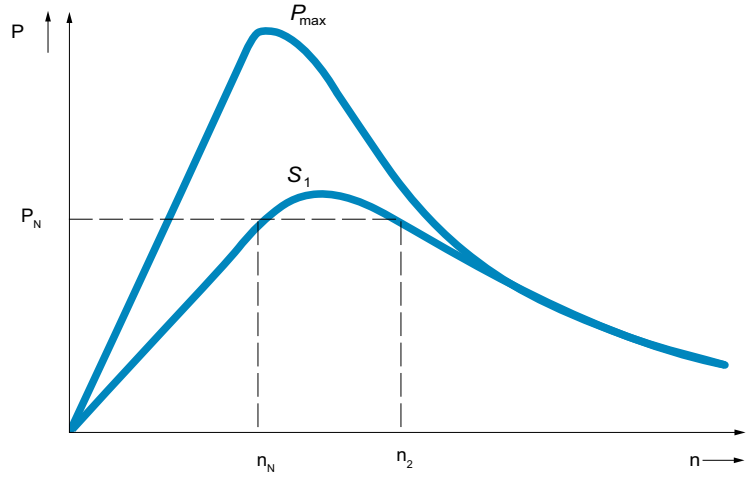


Figure 6-6 Typical speed-power diagram for 1PH8 synchronous-reluctance motors

Note

When configuring the system, the poorer power factor when compared to induction motors must be taken into account. This results in a higher reactive and/or apparent power at the motor terminals, and as a consequence, the converter must be able to provide a somewhat higher current.

6.3 Different rated points for induction motors

All 1PH8 induction motors can be configured based on a total of 4 characteristics and therefore also 4 rated operating points. The rated points are also stamped on the motor nameplate. For correct configuration, the line voltage and the line infeed are relevant for choosing the characteristics and rated points.

Table 6-2 Definition of the characteristics and rated points:

Characteristics order	Converter system	Line voltage	Supply infeed	Remarks
1	SINAMICS	3 AC 400 V	Smart/Basic Line Module (SLM/BLM)	Infeed with uncontrolled Smart/Basic-Mode (converter output voltages up to 380 V)
2	SINAMICS	3 AC 400 V	Active Line Module (ALM)	Infeed with controlled active mode (converter output voltages up to 425 V)
3	SINAMICS	3 AC 480 V	Smart/Basic Line Module (SLM/BLM)	Infeed with uncontrolled Smart/Basic-Mode (converter output voltages up to 460 V)
4	SINAMICS	3 AC 480 V	Active Line Module (ALM)	Infeed with controlled Active Mode (converter output voltages up to 500 V)

Note

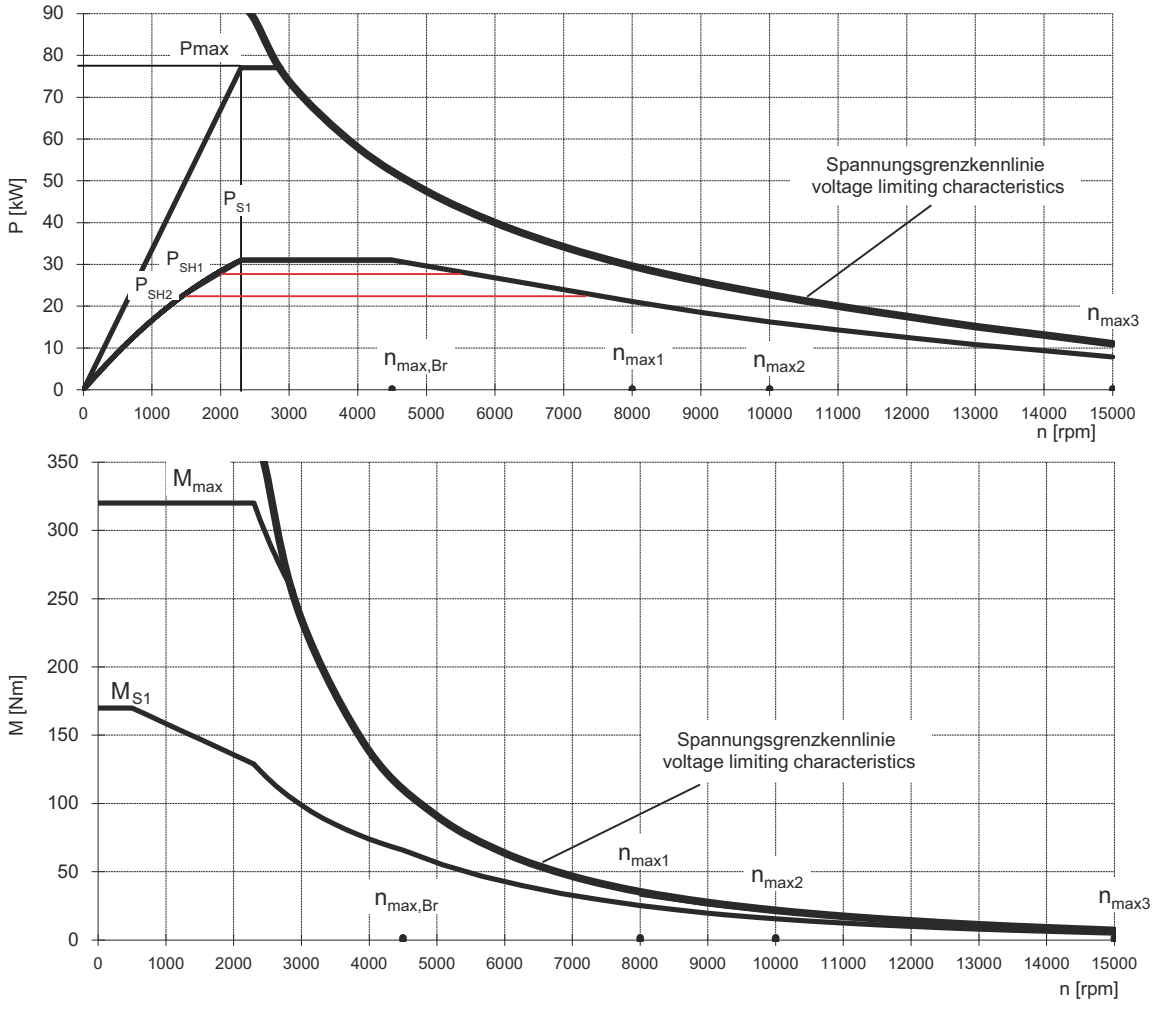
For water-cooled induction motors with shaft heights 180, 225 and 280, the characteristic order "4" is not shown. As a consequence, these motors do not have a fourth rated operating point for "ALM 480 V" on the motor rating plate. When configuring the "ALM 480 V" line infeed, use the data of the characteristic order "3".

Within the characteristic for SINAMICS, 3 AC 400 V, ALM (2nd order, see table), 2 (sometimes also 3) different rated speeds are listed. The rated speeds that are additional to the first rated speed stated are termed ancillary rated points and enable configuration for extended field weakening operation. This type of configuration is often used for main-spindle applications

on machine tools. It is especially important when migrating from old products, such as 1PH4, 1PH7, 1PM4/6 and 1PL6.

Table 6-3 SINAMICS, 3 AC 400 V, Active Line Module, (ALM), 1PH8135-□□G2□

n_{rated} r/min	P_{rated} W	M_{rated} Nm	I_{rated} A	n_{max1} r/min	n_{max2} r/min	n_{max3} r/min	$n_{max, Br}$ r/min	n_2 r/min	M_{max} Nm	I_{max} A	M_0 Nm	I_0 A
2300	31.0	129	61	8000	10,000	15,000	4500	4500	320	148	170	73
2000 1)	29.0	138	64					5250				
1500 1)	23.1	147	63					7300				



1) Ancillary rated point that permits configuration for extended field-weakening operation (e.g. main-spindle application for machine tools). In this case, the range of constant power starts at the ancillary rated point and ends at the associated point n2. The rest of the characteristic is the same as the S1 characteristic in the diagram.

The ancillary rated points have the following advantages for configuration:

- Direct comparability of the power and torque at a rated speed with the old products such as 1PH4, 1PH7, 1PM4/6, and 1PL6. (For the old products, lower rated speeds than for 1PH8 are usually specified.)
- Configuration for an extended field-weakening operation.

Note

For the motor data for SINAMICS, only the rated point is stored. The ancillary rated points cannot be entered; they are only required for better configuration.

Example of migration from 1PH7 to 1PH8:

Motor 1PH7226-__F	Rated operating point for SINAMICS, 3 AC 400 V, ALM	130 kW, 1500 r/min, 828 Nm
Motor 1PH8226-1_F	Rated operating point for SINAMICS, 3 AC 400 V, ALM	135 kW, 1750 r/min, 737 Nm
	Auxiliary rated operating point for SINAMICS, 3 AC 400 V, ALM	130 kW, 1500 r/min, 828 Nm (comparable to 1PH7226-__F)

6.4 Configuration for SINAMICS G

Configuration conditions for 1PH8 induction motors

The 1PH8 induction motors can also be configured for operation on SINAMICS G120, G130, and G150 if certain configuration conditions are met:

- SINAMICS G120 with Power Module PM240-4 (Blocksize) and Control Unit CU240E-2 with firmware release ≥ 4.5 or CU250, vector control (encoderless)
- SINAMICS G130/G150 and Control Unit CU320-2 with firmware version ≥ 4.5, vector control (encoderless or with incremental encoder HTL)
- System restrictions:
- 1PH8 SH 80 to SH 160 Pulse frequency ≥ 4 kHz
- 1PH8 SH 180 to SH 280 Pulse frequency ≥ 2 kHz
- Maximum permissible output frequency for PM240-2: 240 Hz (means n_max = 7000 r/min)
- System classification - characteristics:
  Only the characteristics of 1PH8 can be used for the non-regulated infeed.

Characteristics order	Converter system	Line voltage	Supply infeed	Remarks
1	SINAMICS	400 V 3 AC	Smart/Basic Line Module (SLM/BLM)	Infeed with Smart/Basic Mode non-regulated (converter output voltages up to 380 V)
3	SINAMICS	480 V 3 AC	Smart/Basic Line Module (SLM/BLM)	Infeed with Smart/Basic Mode non-regulated (converter output voltages up to 460 V)

Configuration conditions for 1PH8 synchronous-reluctance motors

1PH8 synchronous-reluctance motors can also be configured for operation on SINAMICS G120, G130 and G150 if certain configuration conditions are met:

- Power Module PM240-4 (Blocksize)
- Control Unit CU240E-2 from firmware V4.7 SP13 HF2

The system classification was shown using specific characteristics, see Chapter "Technical data and characteristics" (Page 219).

6.5 Configuration for 1PH808 Premium Performance

1PH8 motors in the "Premium Performance" variant have been developed specially for spindle drives for "drilling & tapping centers" and are characterized by higher performance data, such as:

- High maximum speeds (24,000 r/min)
- Low intrinsic moment of inertia
- High overload capability

Due to the higher performance data, 1PH8 motors have been harmonized to operate with the SINAMICS S120 Motor Module Booksize, Booksize Combi and the new Booksize Combi Module to facilitate a better configuration.

In the characteristics in Chapter "Technical data and characteristics", in addition to the rated operating point and the necessary pulse frequency, the maximum torques, maximum currents and maximum powers permissible for the specific Motor Module are specified. In this way, different overload requirements can be simply configured. Typical intermittent duties S6-10%, S6-25% and S6-40% for "Drilling & Tapping Center" are also specified in the characteristics.

Table 6-4 Explanation of the symbols in the characteristic curves

Abbreviation	Unit	Description
n_N	r/min	Rated speed
P_N	kW	Rated power
M_N	Nm	Rated torque
I_N	A	Rated current
n_2	r/min	Maximum operating speed in field-weakening range (limits range of constant power)
n_{max}	r/min	Maximum permissible speed for the "Premium Performance" version
I_{max1}	A	Maximum permissible short-time current at M_{max1} for Motor Module Booksize
I_{max2}	A	Maximum permissible short-time current at M_{max2} for Motor Module Booksize Combi
I_{max3}	A	Maximum permissible short-time current at M_{max3} for Motor Module Booksize Combi (upgrade)

M_{max1}	Nm	Maximum permissible short-time torque for Motor Module Booksize
M_{max2}	Nm	Maximum permissible short-time torque for Motor Module Booksize Combi
M_{max3}	Nm	Maximum permissible short-time torque for Motor Module Booksize Combi (upgrade)
P_{max1}	Nm	Maximum permissible short-time power for Motor Module Booksize
P_{max2}	Nm	Maximum permissible short-time power for Motor Module Booksize Combi
P_{max3}	Nm	Maximum permissible short-time power for Motor Module Booksize Combi (upgrade)
f_{cycle}	kHz	Rated pulse frequency

Note

Parameters must be adapted when commissioning

Motors with the "Premium Performance" bearing version are presently not plug & play components. Even after automatically commissioning the motors with DRIVE-CLiQ, the commissioning engineer must adapt the appropriate parameters.

Example: Motors with V and W winding versions (10th position of the Article No.) require an 8 kHz pulse frequency. Presently, this value is not automatically set. Further, for these motors, the current controller must be adapted. These parameters are currently not saved in the DRIVE-CLiQ interface data and must be modified manually by the commissioning engineer. These motors may only be operated with a fast current controller (p1810.11=yes) when connected to the SINAMICS S120 drive system.

Request the commissioning specifications from Technical Support to obtain a precise commissioning procedure (see Chapter "Instructions").

Technical data and characteristics

7

The data sheets and characteristics for the various motor frame sizes are available in SIOS.

Induction motors (https://support.industry.siemens.com/cs/ww/en/view/109808406)

Synchronous motors (https://support.industry.siemens.com/cs/ww/en/view/109808407)

Reluctance motors (https://support.industry.siemens.com/cs/ww/en/view/109808408)

Preparing for use

8

Transportation

Note

Transportation conditions

Comply with the local national regulations for the transportation of motors.

Note

Observing the notes

Observe the information on the original packaging and in the operating instructions when transporting and setting down the motor.

NOTICE
Bearing damage during transport If the customer has already mounted parts, for example coupling, belt pulley, etc., the bearing can be damaged during transport. • In this case, make sure that the customer uses a rotor locking device.

Storage

Note

Storage

If possible, store the motor in its original packaging.

NOTICE
Frost damage to water-cooled motors Water-cooled motors can be damaged by frost • Remove the liquid coolant before storage and blow out the cooling ducts with compressed air.

Preserve the free shaft ends, sealing elements, and flange surfaces with a protective coating.

NOTICE
Seizure damage to bearings If the motors are stored incorrectly, bearing seizure damage can occur, e.g. brineling, as a result of vibration. • Comply with the storage conditions.

Storage conditions

Please observe the warning instructions on the packaging and labels.

Store the motor in a dry, dust-free, and vibration-free indoor storage facility.

Adhere to the following values:

- $v_{rms} < 0.2$ mm/s
- Max. temperatures: -15 °C to 55 °C
- Mean relative humidity < 60 %

Note

Replacing roller bearings

- Even if the motor was stored for more than two 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.

Note

Observing the notes

Observe the information in the operating instructions when storing the motor.

Electrical connection

9

9.1 Permissible line system configurations

In combination with the drive system, the motors are generally approved for operation on TN and TT systems with **grounded neutral** and on IT systems.

In operation on IT systems, the occurrence of a first fault between an active part and ground must be signaled by a monitoring device. In accordance with IEC 60364-4-41 it is recommended that the first fault should be eliminated as quickly as practically possible.

In systems with a **grounded external conductor**, an isolating transformer with grounded neutral (secondary side) must be connected between the line supply and the drive system to protect the motor insulation from excessive stress. The majority of TT systems have a grounded external conductor, so in this case an isolating transformer must be used.

9.2 Circuit diagram of the motor

You will find information on the circuit and on connecting the motor winding and the auxiliary equipment (e. g. temperature sensor, anti-condensation heating, etc.) in the circuit diagram. The circuit diagram is in the terminal box for the cable connection.

9.3 System integration

9.3.1 SINAMICS drive I/O

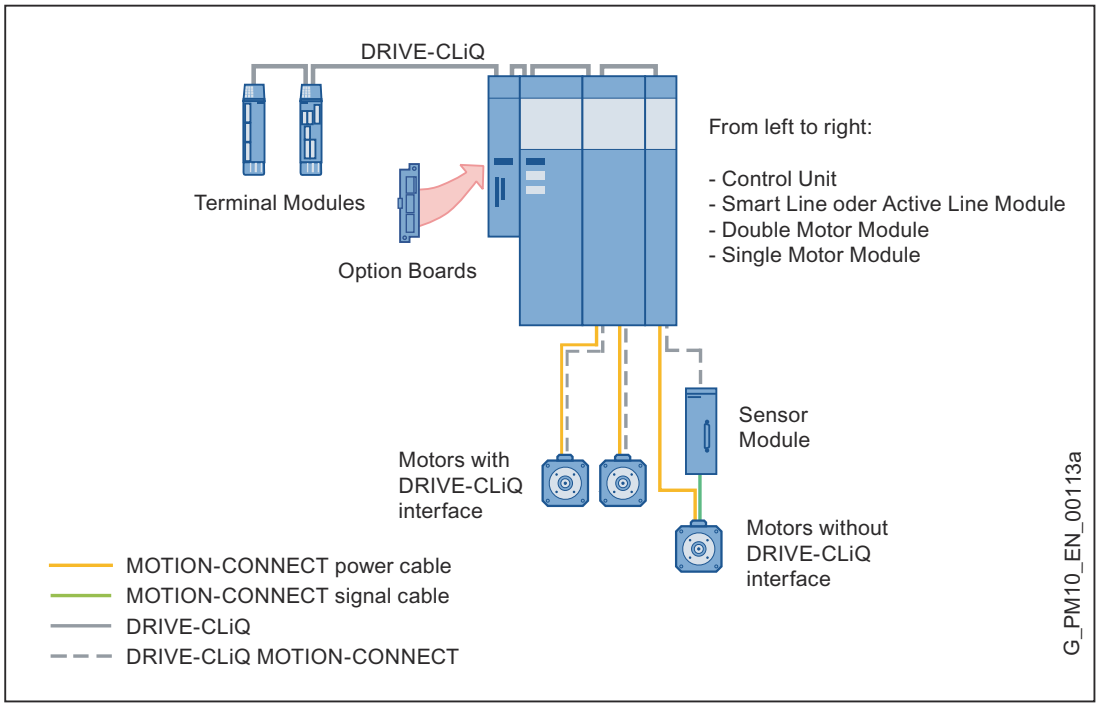


Figure 9-1 SINAMICS S120 system overview

9.3.2 Connecting-up information

Comply with the rating plate data (type plate) and circuit diagram in the terminal box. Use sufficiently dimensioned connection cables.

Note

System compatibility for connection

System compatibility is only guaranteed if shielded power cables are used and the shield is electrically connected through a large surface area to the metal motor terminal box (using metal EMC cable glands) or using a power connector.

Incorporate the shields in the protective grounding concept. Connect open-circuit conductors, conductors that are not used or electrical cables that can be touched to protective ground. If the brake feeder cables in the SIEMENS cable accessories are not used, then connect the brake conductor cores and shields to the cabinet ground. Open-circuit cables result in capacitive charges.

Use EMC cable glands for fixed cable entries. The cable glands are screwed into the threaded holes of the terminal box.

Close and seal any unused threads using a metal screw plug.

Note

Connection with aluminum conductors

Aluminum conductors can also be used for motors with higher powers and currents (e.g. shaft height 280). If you are using aluminum conductors, comply with the following additional points:

- Use only cable lugs that are suitable for connecting aluminum conductors.
- Immediately before inserting the aluminum conductor, remove the oxide layer from the contact areas on the conductor and/or the mating piece, by brushing or filing.
- Then grease the contact areas immediately using neutral Vaseline in order to avoid re-oxidation.

Note

Terminal boxes with aluminum connecting bars

For terminal boxes with aluminum connecting bars (type 1XB7), copper (Cu) cables with copper (Cu) cable lugs can also be connected.

Internal equipotential bonding

The potential equalization between the grounding terminal in the terminal box enclosure and the motor enclosure is established via the terminal box fixing screws. The contact locations underneath the screw/bolt heads are bare and are protected against corrosion.

The standard terminal box cover fixing screws provide adequate equipotential bonding between the terminal box cover and terminal box enclosure.

Note

Higher number of grounding terminals in the terminal box for shaft height 280 (option Q00)

For large transmission powers, symmetrical power cables with a grounding conductor split into 3 are used in some cases. To be able to connect this high number of grounding conductors in the terminal box, with option Q00, for a shaft height 280, a grounding bar with a higher number of terminals can also be mounted, see Chapter "Increased number of grounding terminals in the terminal box (Page 200)".

Shaft height SH	Terminal box Type	Quantity Connecting terminals (Grounding) Standard	Quantity Terminals (grounding) Option Q00
280	1XB7712-P...	4 x M16	12 x M6

Motor and connecting cables

- For the motor cables, use twisted or three-core cables with additional ground conductor. Strip the insulation from the ends of the conductors so that the remaining insulation extends up to the cable lug or terminal.
- Arrange the connecting cables loosely in the terminal box so that the protective conductor has excess length and the insulation of the cable cores cannot be damaged. Ensure that the connecting cables are strain relieved.
- Take special care that the required air clearances are actually maintained:
  - Up to shaft height 160, as a minimum 4.5 mm
  - From shaft height 180, as a minimum 10 mm

Checking/testing after connecting up

- The inside of the terminal box must be clean and free of any cable pieces.
- All of the terminal screws must be tight.
- The minimum air clearances must be strictly maintained.
- The cable entries must be reliably sealed.

- Unused cable entries must be closed and the screw plugs must be screwed tight.
- All the sealing surfaces must be in a perfect condition.

Connecting the ground conductor

The ground conductor cross-section must be in full conformance with the installation regulations, e.g. acc. to IEC/EN 60204-1.

For shaft height 225 and shaft height 280, also connect the grounding conductor to the motor end shield. There is a clamping lug ① for the ground conductor at the designated connection point. This is suitable for connecting multi-conductor cables with cable lugs or ribbon cables with the appropriate conductor terminations.

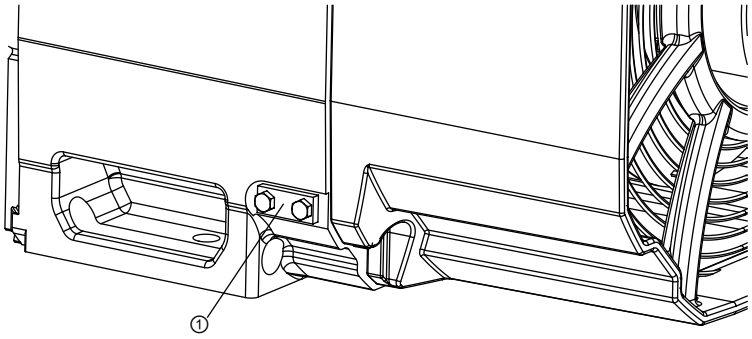


Figure 9-2 Terminal lug for grounding conductor (shaft heights 225 and 280)

When connecting up, ensure that

- the connecting surface is bare and is protected against corrosion using a suitable substance, e.g. acid-free Vaseline
- the flat and spring washers are located under the screw head
- the minimum necessary screw-in depth and the tightening torque for the clamping screw must be maintained

Table 9-1 Screw-in depth and tightening torque

Screw	Penetration depth:	Tightening torque
M8 x 30	> 8 mm	20 Nm

9.3.3 Routing cables in a damp environment

Note

Routing cables in humid/moist environments

If the motor is mounted in a humid environment, the power and signal cables must be routed as shown in the following figure.

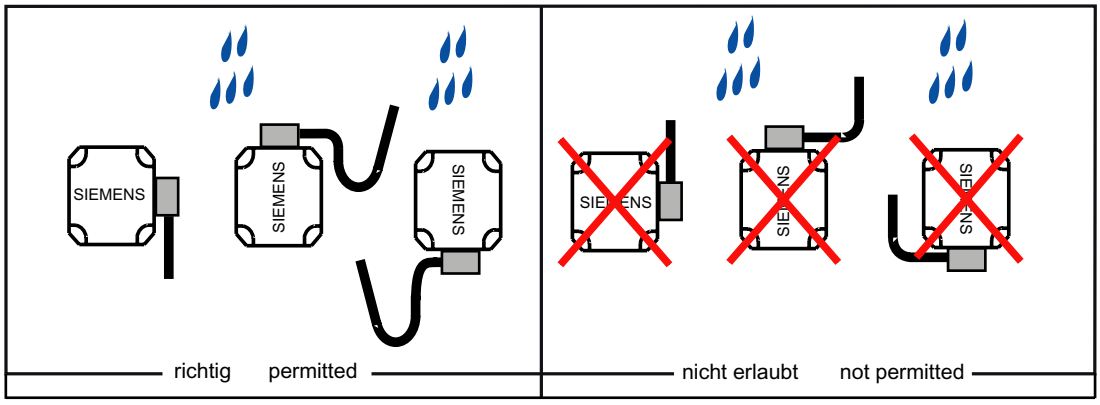


Figure 9-3 Principle of cable routing in a wet/moist environment

9.3.4 Power connection



WARNING

Thermally damaged connecting cables

If connection cables have a conductor cross section that is too small for the application, the connection cables can be thermally damaged. This can result in personal injury and damage to property due to electric shock and fire hazard.

- Carefully observe the current which the motor draws for your particular application! Adequately dimension the connecting cables according to IEC 60204-1 or IEC 60364-5-52.

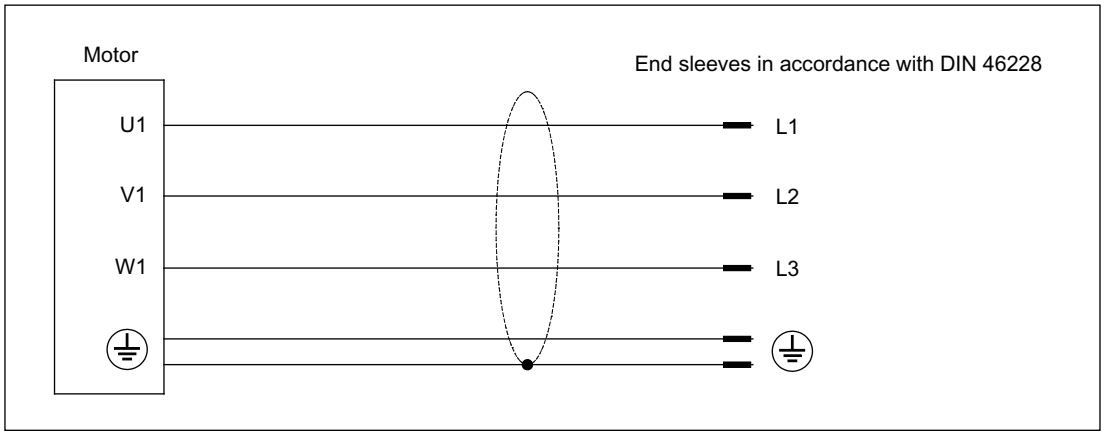


Figure 9-4 Power cable

Terminal box connection

The type designation of the mounted terminal box as well as the details on the power connection for the line supply cables can be taken from the following table. A circuit diagram to connect the motor winding is provided in the terminal box when the motors are shipped.

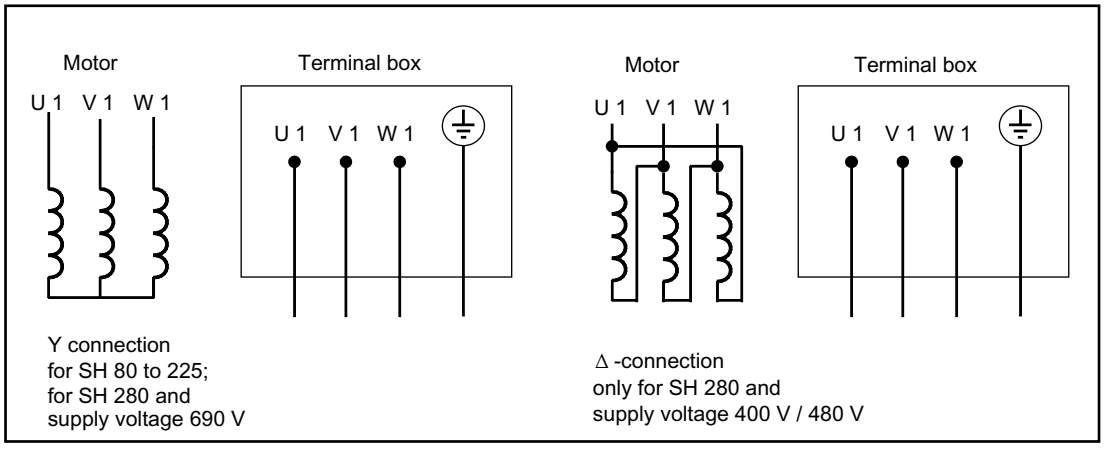


Figure 9-5 Circuit diagram

Note

Connecting temperature sensors and PTC thermistors

The spare temperature sensor (option A25 for shaft heights 80 to 160, standard from shaft height 180 and higher) and the PTC thermistor circuit for alarm/trip (option A12) are connected to a signal terminal block in the terminal box.

Star/delta connection in the terminal box (SH80 to SH160)

The star/delta connection can be implemented using an external contactor circuit or as permanent setting in the terminal box.

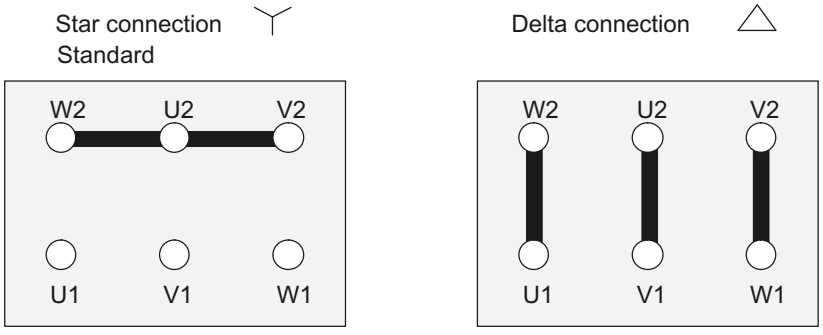


Figure 9-6 Fixed star/delta connection in the terminal box

Current-carrying capacity for power and signal cables

The current carrying capacity of PVC/PUR-insulated copper cables is specified for routing types B1, B2, C and E under continuous operating conditions in the table with reference to an ambient air temperature of 40 °C. For other ambient temperatures, the values must be corrected by the factors from the table of derating factors.

Table 9-2 Cable cross section and current-carrying capacity

Cross section	**Current-carrying capacity rms; AC 50/60 Hz or DC for routing type**			
mm²	**B1** **A**	**B2** **A**	**C** **A**	**E** **A**
Electronics (according to EN 60204-1)				
0.20	-	4.3	4.4	4.4
0.50	-	7.5	7.5	7.8
0.75	-	9	9.5	10
Power (according to EN 60204-1)				
0.75	8.6	8.5	9.8	10.4
1.00	10.3	10.1	11.7	12.4
1.50	13.5	13.1	15.2	16.1
2.50	18.3	17.4	21	22
4	24	23	28	30
6	31	30	36	37
10	44	40	50	52
16	59	54	66	70
25	77	70	84	88
35	96	86	104	110
50	117	103	125	133
70	149	130	160	171
95	180	165	194	207
120	208	179	225	240
Power (according to IEC 60364-5-52)				
150	239[1)]	206[1)]	259[1)]	276[1)]
185	274[1)]	235[1)]	296[1)]	315[1)]
> 185	Values must be taken from the standard			

[1)] Extrapolated values

Table 9-3 Derating factors for power and signal cables

Ambient air temperature **°C**	**Derating factor according to EN 60204-1, Table D1**
30	1.15
35	1.08
40	1.00
45	0.91

Ambient air temperature °C	Derating factor according to EN 60204-1, Table D1
50	0.82
55	0.71
60	0.58

Assignment, terminal boxes and max. cross-sections

Table 9-4 Terminal box data

Terminal box type	Shaft height	Cable entry (power)	Cable entry (external signals)	Outer cable diameter, max. mm [2)]	Number of main terminals	Max. cross-section per terminal mm²	Max. current per terminal A [3)]
gk803	SH80	1 x M25 x 1.5	1 x M16 x 1.5 [1)]	20	Phases: 3 x M5 Grounding: 2 x M5	1 x 10	52
gk806	SH80	1 x M25 x 1.5	1 x M16 x 1.5 [1)]	20	Phases: 6 x M5 Grounding: 2 x M5	1 x 10	52
gk813	SH100	1 x M32 x 1.5	1 x M16 x 1.5 [1)]	24.2	Phases: 3 x M5 Grounding: 2 x M5	1 x 16	70
gk823	SH100	1 x M32 x 1.5	1 x M16 x 1.5 [1)]	24.2	Phases: 3 x M5 Grounding: 2 x M5	1 x 16	70
gk826	SH100	1 x M32 x 1.5	1 x M16 x 1.5 [1)]	24.2	Phases: 6 x M5 Grounding: 2 x M5	1 x 10	52
gk833	SH132	1 x M40 x 1.5	1 x M16 x 1.5 [1)]	32	Phases: 3 x M6 Grounding: 2 x M6	1 x 35	110
gk843	SH132	1 x M50 x 1.5	1 x M16 x 1.5 [1)]	38	Phases: 3 x M6 Grounding: 2 x M6	1 x 50	133
gk846	SH132	1 x M50 x 1.5	1 x M16 x 1.5 [1)]	38	Phases: 6 x M6 Grounding: 2 x M6	1 x 25	88
gk863	SH160	1 x M50 x 1.5	1 x M16 x 1.5 [1)]	38	Phases: 3 x M6 Grounding: 2 x M6	1 x 50	133
gk873	SH160	1 x M63 x 1.5	1 x M16 x 1.5 [1)]	42.6	Phases: 3 x M6 Grounding: 2 x M6	1 x 50	133
gk874	SH160	1 x M63 x 1.5	1 x M16 x 1.5 [1)]	42.6	Phases: 3 x M10 Grounding: 2 x M6	2 x 70	240
1XB7322-P05	SH180 to SH280	2 x M50 x 1.5	1 x M16 x 1.5 [4)]	38	Phases: 3 x M12 Grounding: 4 X M6e	2 x 50	210
1XB7422-P06	SH180 to SH280	2 x M63 x 1.5	1 x M16 x 1.5 [4)]	53	Phases: 3 x M12 Grounding: 4 x M8	2 x 70	270

Terminal box type	Shaft height	Cable entry (power)	Cable entry (external signals)	Outer cable diameter, max. mm [2)]	Number of main terminals	Max. cross-section per terminal mm²	Max. current per terminal A [3)]
1XB7700-P02	SH225 and SH280	3 x M75 x 1.5	1 x M16 x 1.5 [4)]	68	Phases: 3 x 2 x M12 Grounding: 3 x clamping plate	3 x 150	700
1XB7712-P03	SH225 and SH280	4 x M75 x 1.5	1 x M16 x 1.5 [4)]	68	Phases: 3 x 4 x M16 Grounding: 4 x M16	4 x 185	1150

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

2) Depending on the version of metric cable gland (based on the MOTION-CONNECT cable type and cable glands from HUGRO or from AGRO)

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

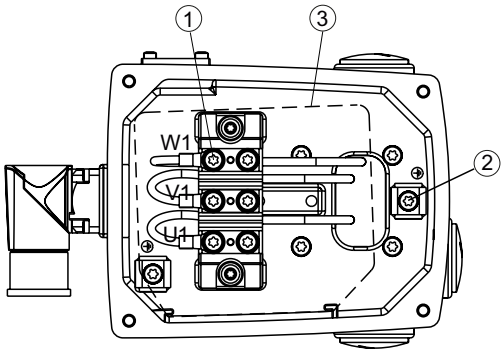
4) M16 x 1.5 thread arranged opposite to the signal connection (lateral to the cable entry plate); thread only for option A12 and encoder version A (without encoder)

Note

Terminal box type 1XB7700-P02

For cable entry, 3 cable glands can only be fit in if cable glands from AGRO or HUGRO are used. Cable glands from Pflitsch or Lapp, for example, are larger and it is not possible to fit 3 of them into the available space.

Terminal box design

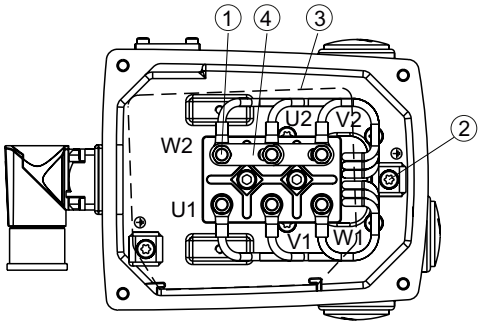


① Terminal screw M5

② Grounding screw M5

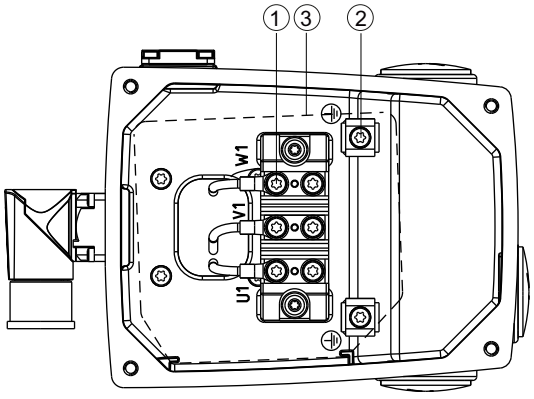
③ Insulation strips

Figure 9-7 Terminal box gk803, 3-pole (SH 80)



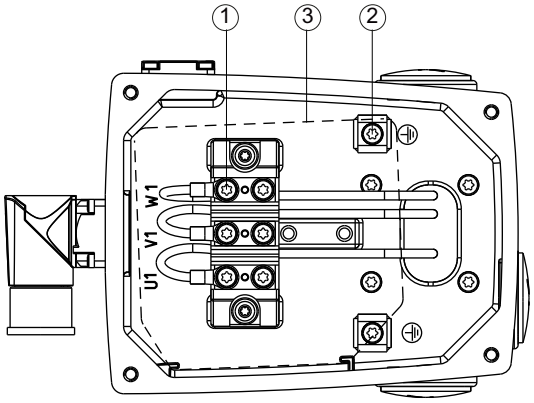
① M5 connecting studs
② Grounding screw M5
③ Insulation strips
④ Jumper

Figure 9-8 Terminal box gk806, 6-pole (SH 80) (can be changed over between star and delta)



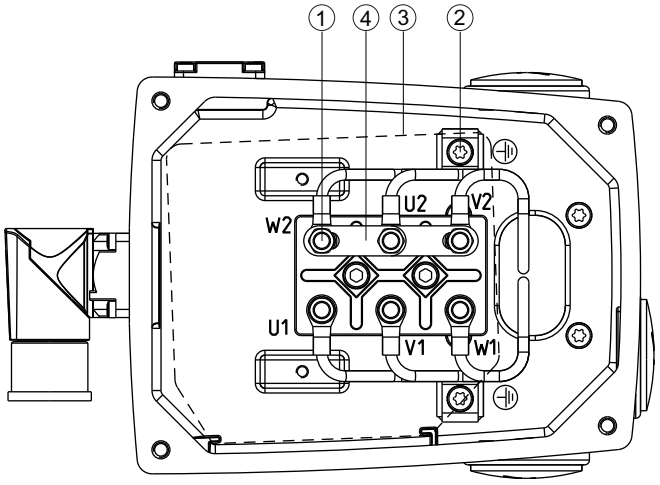
① Terminal screw M5
② Grounding screw M5
③ Insulation strips

Figure 9-9 Terminal box gk813, 3-pole (SH 100)



① Terminal screw M5
② Grounding screw M5
③ Insulation strips

Figure 9-10 Terminal box gk823, 3-pole (SH 100)



① Terminal screw M5
② Grounding screw M5
③ Insulation strips
④ Jumper

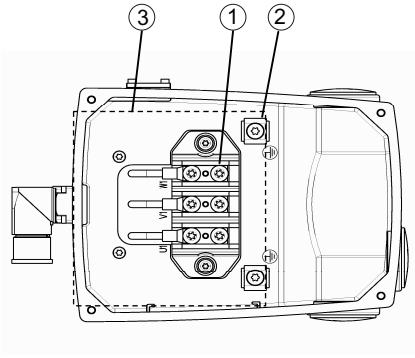
Figure 9-11 Terminal box gk826, 6-pole (SH 100) (can be changed over between star and delta)

Note

Star/delta connection

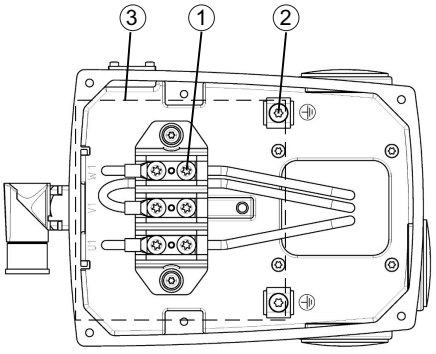
A star/delta connection is implemented using an external contactor circuit or as a fixed configuration in terminal box gk806 for SH 80 and in terminal box gk826 for SH 100.

Standard configuration: Star connection via jumpers



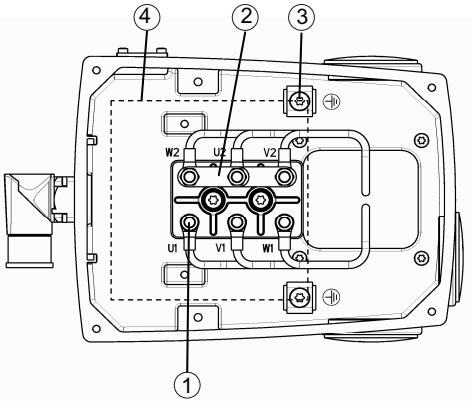
① Terminal screw M6
② M6 grounding screw
③ Insulation strips

Figure 9-12 Terminal box gk833 (SH 132) and gk863 (SH 160), 3-pole



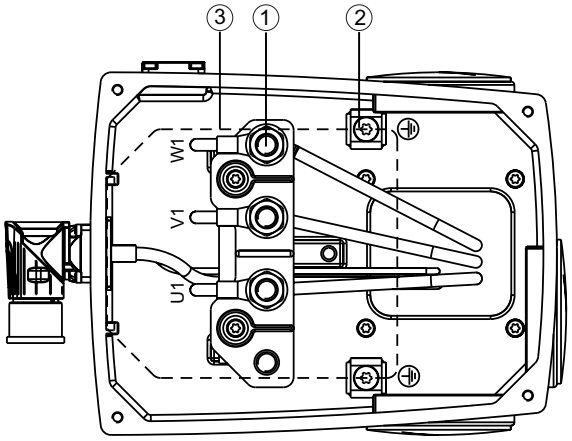
① Terminal screw M6
② M6 grounding screw
③ Insulation strips

Figure 9-13 Terminal box gk843 (SH 132) and gk873 (SH 160), 3-pole



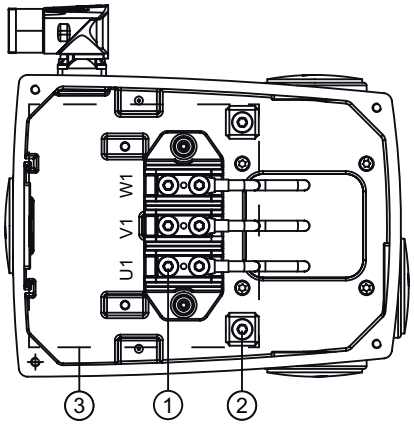
① Terminal stud M6
② Jumper
③ M6 grounding screw
④ Insulation strips

Figure 9-14 Terminal box gk846 (SH 132) and gk876 (SH 160), 6-pole (can be changed over between star and delta)



① Terminal screw M10
② M6 grounding screw
③ Insulation strips

Figure 9-15 Terminal box gk874 (SH 132 and SH 160), 3-pole (only for synchronous motors and synchronous-reluctance motors)



① Connection screw M5 for SH80/100
Connection screw M6 for SH132/160
② Grounding screw M5 for SH80/100
Grounding screw M6 for SH132/160
③ Insulation strips

Figure 9-16 Terminal boxes gk803 (SH 80), gk823 (SH 100), gk843 (SH 132), gk873 (SH 160), 3-pole, cable entry DE (drive end)

Note

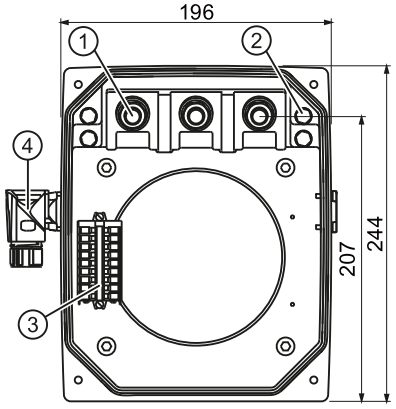
Cable exit direction DE

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

Note

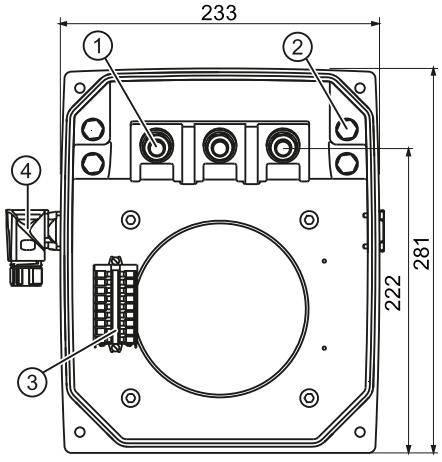
The internal motor cables are mounted on the NDE side on the 3-pole terminal board.

Terminal box gk874 is not possible.



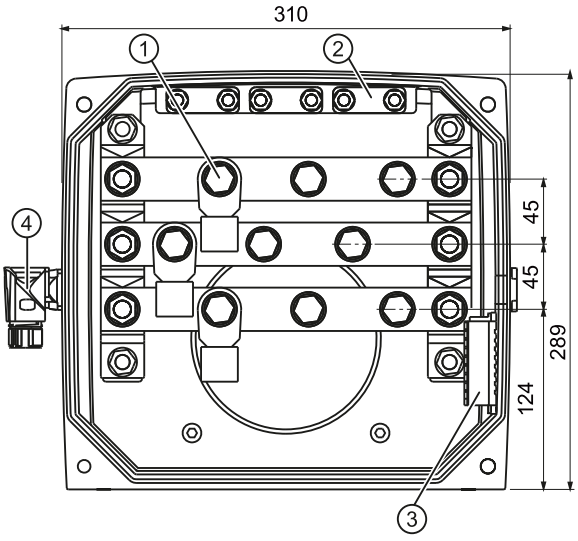
① Main terminal
② Ground terminal
③ Signal connection terminal
④ Signal connection

Figure 9-17 1XB7322-P05 terminal box (SH 180 to SH 280)



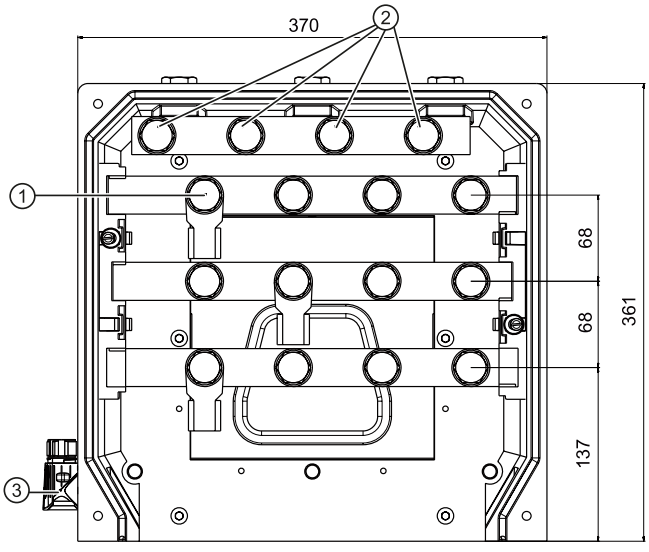
① Main terminal
② Ground terminal
③ Signal connection terminal
④ Signal connection

Figure 9-18 1XB7422-P06 terminal box (SH 180 to SH 280)



① Main terminal
② Ground terminal
③ Signal connection terminal
④ Signal connection

Figure 9-19 1XB7700-P02 terminal box (SH 225 and SH 280)



① Main terminal
② Ground terminal
③ Signal connection terminal

Figure 9-20 1XB7712-P03 terminal box (SH 225 and SH 280)

Note

Signal connection for special orders

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

For the device version without speed encoder, there is an M16 x 1.5 connection thread.

Power connector connection

- Use connector size 1.5.
- Assign the connector as shown in the "Power connector 1.5" diagram. Connect the protective conductor.

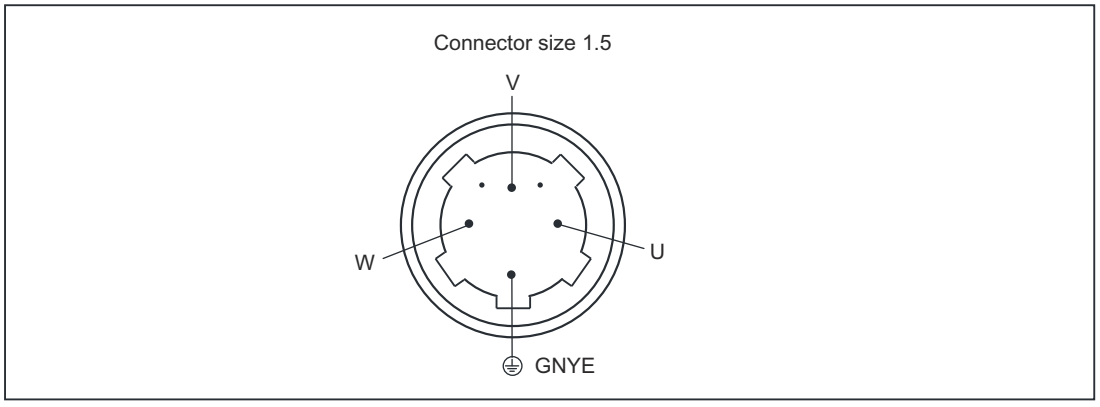


Figure 9-21 Power connector, size 1.5 (view of connector pins)

Connector	Rotation range	Maximum torque
Connector size 1.5	270°	20 Nm

Note

Rotating the connectors

- The permissible rotation range must not be exceeded.
- In order to guarantee the degree of protection, max. 10 revolutions are permissible.
- Connectors should be rotated using the matching mating connector located on the connector thread. Only rotate the Sensor Module by hand. The use of pipe wrenches, hammers, or similar is not permitted.

- Use connector size 3.
- Assign the connector as shown in the "Power connector 3" diagram. Connect the protective conductor.

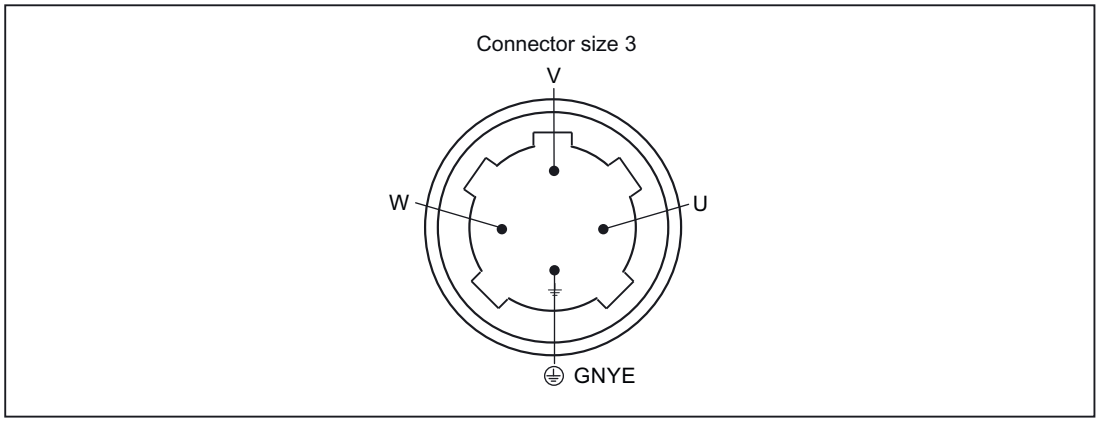


Figure 9-22 Power connector, size 3 (looking onto the connector pins)

Star/delta connection via an external contactor circuit

When induction motors (SH 80 to SH 160) are used, it is possible to select one of the following operating modes:

- Star connection
- Delta connection

Circuit to implement star-delta switchover

For induction motors, all six connection leads of the three winding phases are fed out to be able to select the various operating modes.

The changeover is carried out outside the spindle using switching devices and equipment that are not included with the motor spindle (i.e. these devices are not included in the scope of delivery).

Note

Star/delta connection

When changing over the circuit configuration (star-delta), the appropriate data set for the closed-loop motor control must also be changed-over.

A changeover may only be made when the spindle is in a no-load condition and with the power module pulses inhibited.

For information about the circuit to implement the star-delta changeover, refer to the following diagram and SINAMICS S120 Function Manual (FH1).

Using the star connection

The star connection offers some advantages at low speeds. The maximum torque in the star connection is approximately twice as high as in the delta connection. However, due to the higher reactive power requirement of the star connection, the available torque in the uppermost speed range is significantly restricted. This means that the star connection should only be activated when machining which requires a **high torque in the lower speed range.** An example of such a machining operation is roughing.

Using the delta connection

Although the delta connection provides, in the lower speed range, a lower maximum torque than the star connection, the torque remains available up to high speeds. This means that the delta connection should be activated for **all machining operations which are carried out in the medium and high speed ranges**.

Connection diagram for Y/D changeover

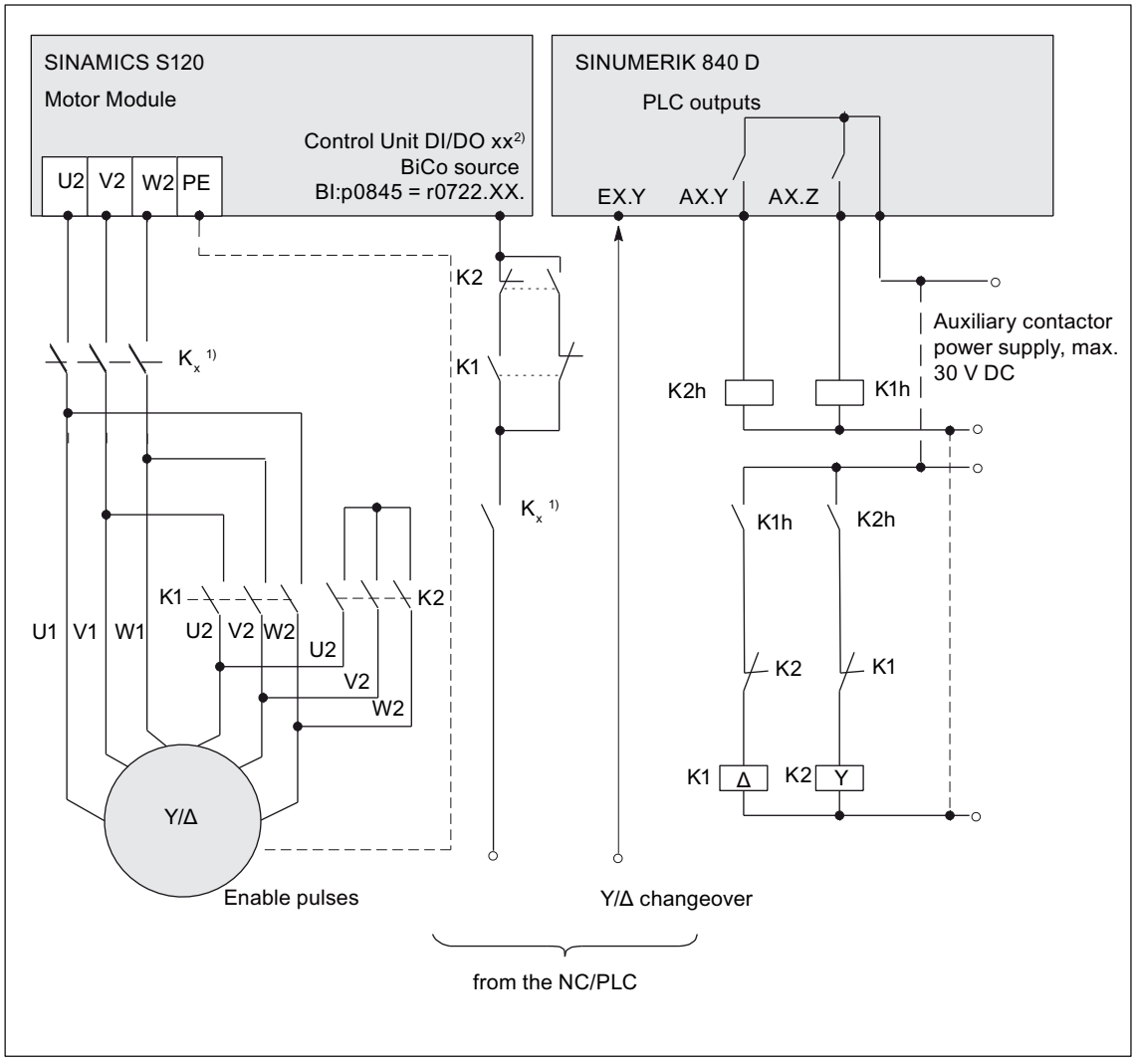


Figure 9-23 Connection diagram for Y/D changeover with SINAMICS

1) Safe operating stop cannot be guaranteed by simply opening K1 and K2. Therefore, for safety reasons there should be electrical isolation provided by contactor K_x. This contactor may only be switched-in the no-current condition, i.e. the pulse enable must be withdrawn 40 ms before the contactor is opened (de-energized).

2) Terminal X3 of the voltage limiting module VPM should be wired to a digital input of the Control Unit on which the assigned 1PH8 motor spindle is also controlled. For the case that several VPMs are used, each terminal must be wired to a separate digital input of the relevant Control Unit.
If an armature short-circuit occurs (terminal X3 has opened), the pulses of the relevant axis must be inhibited. To achieve this, the digital input used is interconnected to the control bit OFF2 (pulse inhibit) via p0845 = r0722.XX.
Further information can be found in the SINAMICS S120 Function Manual.

9.3.5 External fan

Table 9-5 Connected loads for external fans

Shaft height SH	**Fan motor: Maximum current consumption A**			**Air flow direction**
Forced ventilation	**230 V 1 AC/50 Hz (±10 %)**	**230 V 1 AC/60 Hz (±10 %)**	**265 V 1 AC/60 Hz (±10 %)**	
80	0.33	0.25	0.32	NDE --> DE
	0.20	0.16	0.19	DE --> NDE
Forced ventilation	**3-ph. 400 VAC / 50 Hz (±10 %)**	**400 V 3 AC/60 Hz (±10 %)**	**480 V 3 AC/60 Hz (±10 %)**	
100	0.08	0.07	0.11	NDE --> DE
	0.10	0.08	0.11	DE --> NDE
132	0.11	0.13	0.13	NDE --> DE
	0.10	0.12	0.12	DE --> NDE
160	0.16	0.21	0.21	NDE --> DE
	0.16	0.21	0.21	DE --> NDE
Forced ventilation (EC fan) Standard	**1-ph. 200 ... 277 VAC / 50 Hz, 60 Hz (±10 %)**			
180	1.1 ... 1.3			NDE --> DE DE --> NDE
225	2.0 ... 2.3			NDE --> DE DE --> NDE
Forced ventilation (EC fan) Option: L76	**3 AC 380 V ... 480 V (-5 %/+10 %) 50 Hz, 60 Hz (±10 %)**			
180	0.44 ... 0.5			NDE --> DE DE --> NDE
225	0.75 ... 0.9			NDE --> DE DE --> NDE
Forced ventilation (EC fan) Standard	**3 AC 380 V ... 480 V (-5 %/+10 %) 50 Hz, 60 Hz (±10 %)**			
280	0.75 ... 0.9			NDE --> DE DE --> NDE

Note

For EC fans, for shaft height 180 and shaft height 280, as a result of the electronic input circuitry, the current drawn can briefly reach four times the specified current.

Recommended connection

Connect the separately driven fan via the terminal box of the separately driven fan or optionally via a power connector. Implement operation of the fans via the motor circuit breaker. A simple conductor protection is sufficient for the EC fans.

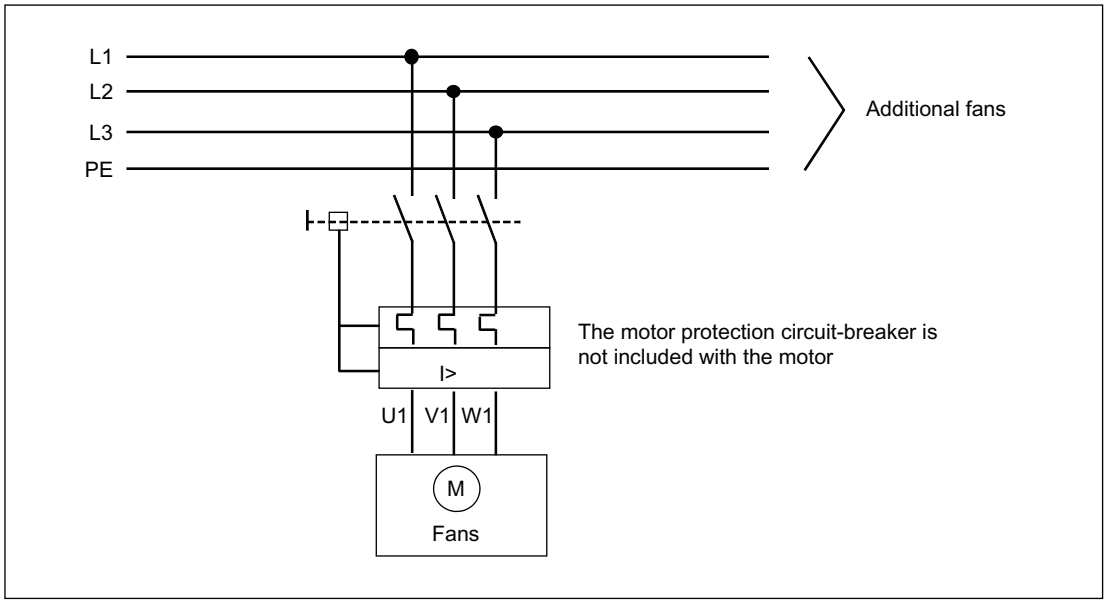


Figure 9-24 Recommended connection

Note

Single-phase fan connection

If you use a 3-pole circuit breaker for a 1-phase fan connection for shaft height 80, then you must connect the 3 current paths in series (see the diagram).

If only one current path would be used, many circuit breakers would trip too early because they often also monitor balanced load or voltage on the 3 line conductors. You must determine whether this circuit is permissible with electronic motor circuit breakers on a case-by-case basis from the product data sheets of the specific manufacturer.

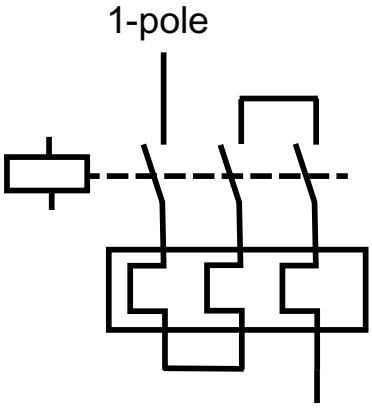


Figure 9-25 Single-phase connection

Connection via the terminal box

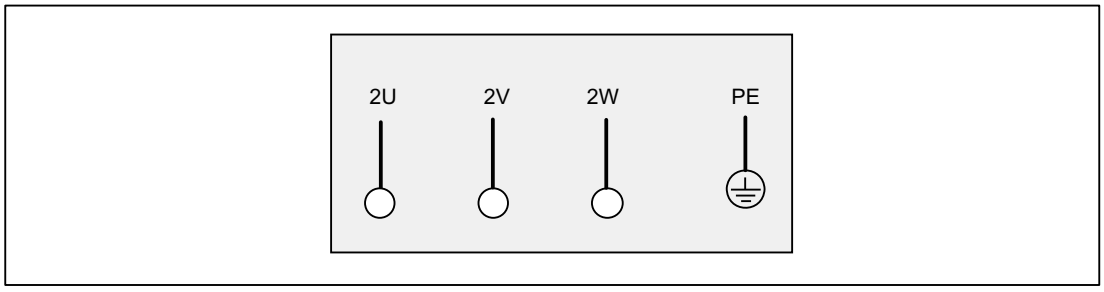


Figure 9-26 Connecting the separately driven fan terminal box, shaft height 100 up to shaft height 160

Connection via the power connector

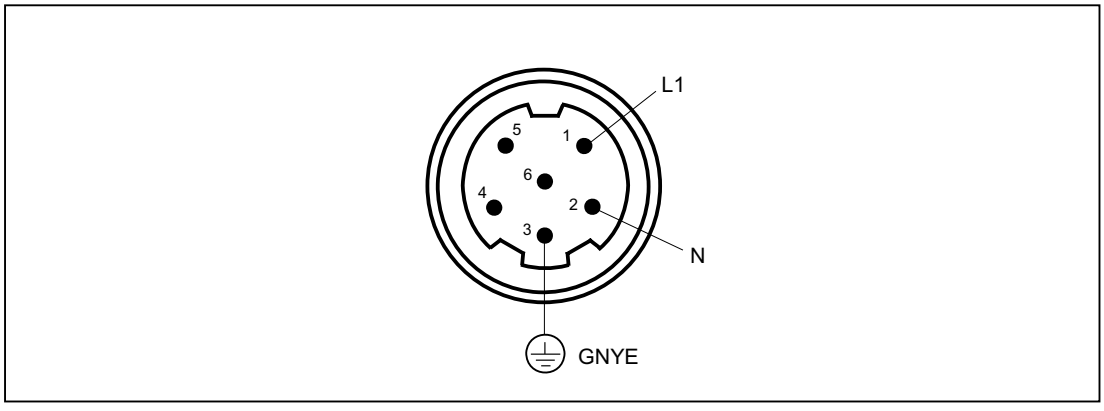


Figure 9-27 Connection, separately driven fan, shaft height 80

Note

For 1PH8 motors, shaft height 80, always switch on the separately driven fan via a power connector, even if the motor power connection is established via a terminal box.

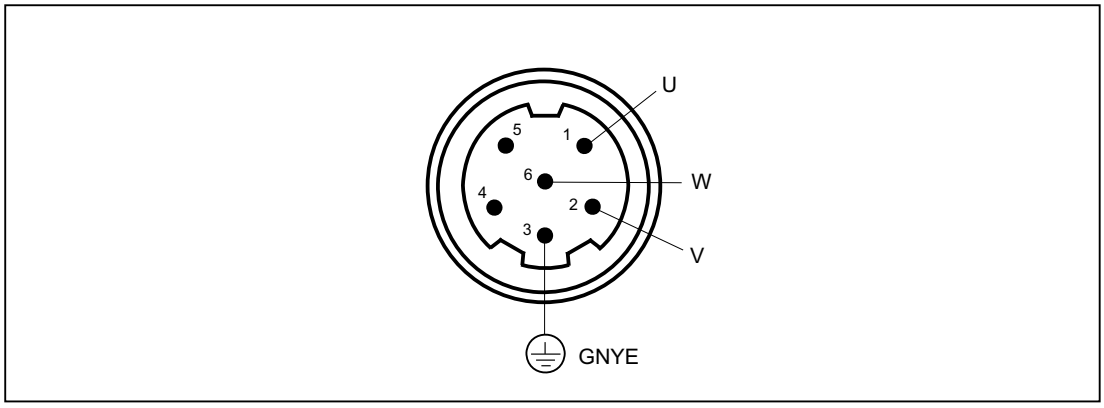


Figure 9-28 Connecting the separately driven fan, shaft height 100 up to shaft height 132

Note

Rotating the connectors

- Do not exceed the permissible rotation range.
- In order to guarantee the degree of protection, max. 10 revolutions are permissible.
- When turning, only use the mating connector that matches the connector thread. Only rotate Sensor Modules by hand. Do not use any tools such as pipe wrench, hammer or similar tool.

Connector	Rotation range	Maximum rotation torque
Connector size 1.0	270°	12 Nm

Note

Scope of delivery

The mating connector is not included in the scope of delivery.

Article number mating connector size 1 (with full thread) 6FX2003-0LU00

Note

Prefabricated cables

Order pre-assembled cables with the following Article No.:
6FX□002-5CG01-□□□0

EC external fan for shaft heights 180 to 280

EC external fans are installed in forced ventilated motors of the 1PH8 series. These are especially designed fan units for this motor series, with a permanently set operating speed.

EC external fans contain high-efficiency electronically commutated motors with permanent magnets. They are speed-controlled by an integrated controller.
The EC external fans meet the general requirements of EN 61800-2 for variable-speed electrical drives and are designed for single-quadrant operation.

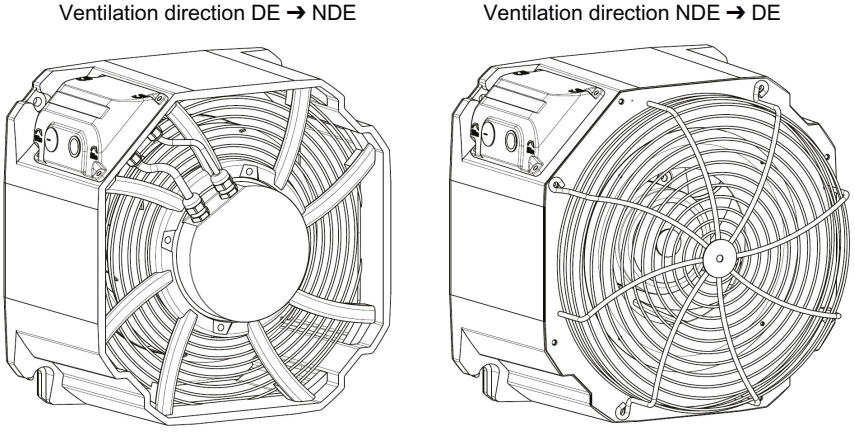


Figure 9-29 EC separately driven fans with air flow direction DE → NDE and air flow direction NDE → DE, shaft height 180 and shaft height 225

External fans with filter unit (option G14)

For the version with air flow direction NDE → DE, you can optionally add a filter unit (option G14). The filter corresponds to DIN EN 779 of filter class G3.

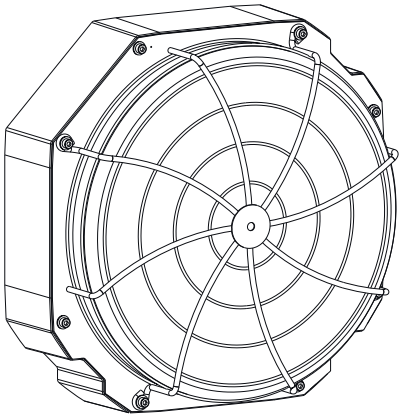


Figure 9-30 EC separately driven fans with air flow direction NDE → DE and filter unit, shaft height 180 and shaft height 225

Connecting a separately driven fan

Connect the separately driven fan in the separately driven fan terminal box. You can rotate the separately driven fan; for shaft heights 180 and 225, through 90° and for shaft height 280, through 180°.

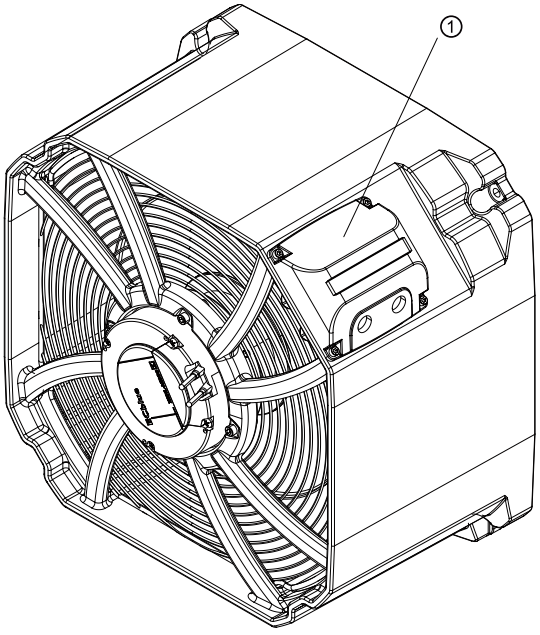


Figure 9-31 Separately driven fan terminal box ① (schematic representation shaft height 180)

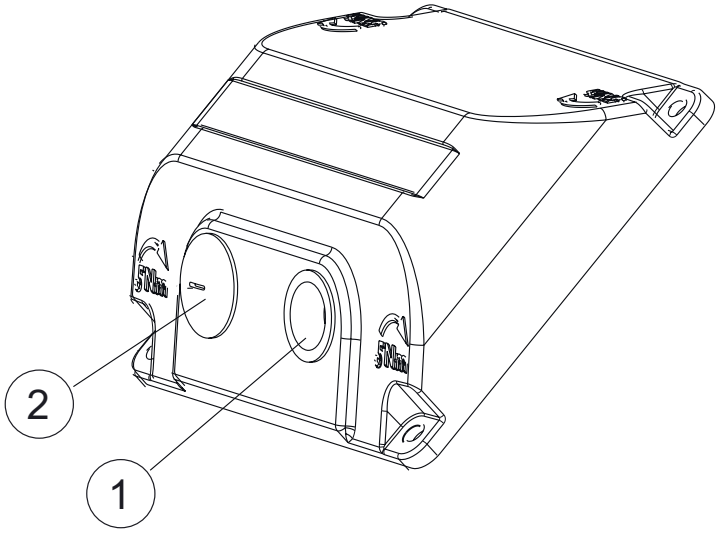
⚠ WARNING

Short-circuit due to standing water, shaft height 180 and shaft height 225

If you rotate the separately driven fan through 90°, it is not permissible that the cable outlet faces upward. Water that accumulates at the cable glands can result in a short circuit.

- Rotate the terminal box cover of the separately driven fan through 180°.

Connection at the terminal box



1 M20 cable entry for line power connection

2 M20 cable entry for control (optional)

Figure 9-32 Cover of the terminal box, shaft height 180 and shaft height 225

In the delivery condition, the two cable entries are sealed.

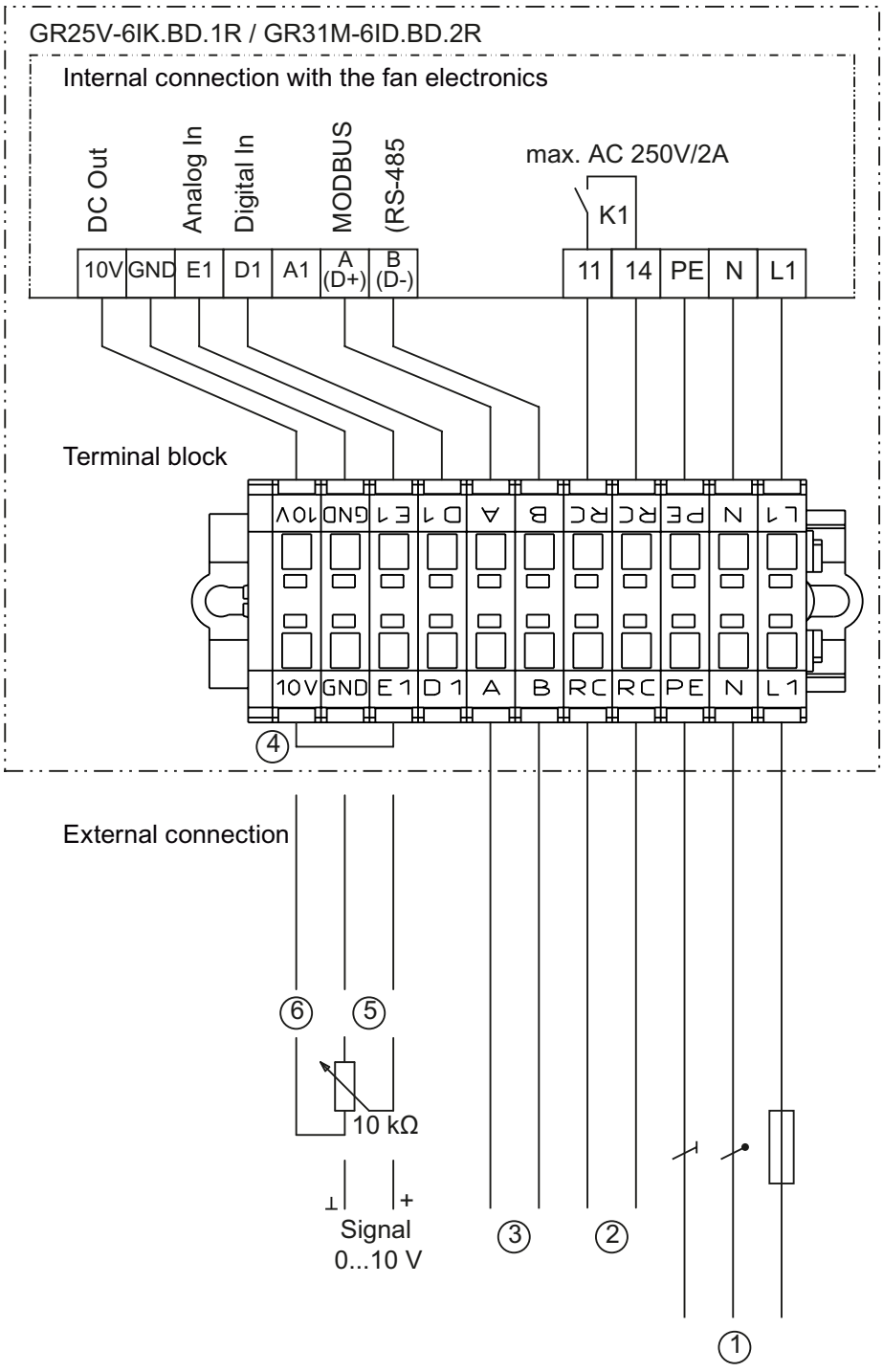
- Cable entry ① is intended for the line supply connection, and is therefore only sealed with a plug.
- Cable entry ② is intended for the optional control connection and is fitted with a screw plug.

Note

Cable gland

The cable glands are not included in the scope of supply. Select suitable cable glands to connect the cable. The general connection instructions must be observed. Ensure that there is permanent leak tightness between the cable gland and the terminal box and cable.

Wiring diagram



1 Line voltage (see Chapter "Terminal box connection")
2 Relay output (K1) for alarm
3 MODBUS (RS-485) interface (only accessible for Siemens Service)
4 Factory-inserted jumper between 10 V and E1 for 100 % operating speed
5 Input for speed setting via 0...10 V signal or potentiometer (Ri > 100 kΩ)

6 10 V DC power supply (I_{max} 50 mA)

Note

Terminal block

The terminal block is led out with spring-loaded terminals. A cable cross-section of 0.08 up to 1.5 mm^2 can be connected to the terminals. A cable cross-section of 1.5 mm^2 is recommended.

Note

Relay output (K1)

An external fault message can be output via the isolated contact of the integrated relay. During operation, the relay picks up, i.e. connections "11" and "14" are jumpered. If a fault occurs, the relay drops out (contact load, max. 250 V AC 2 A).

Note

Factory-inserted jumper between 10 V and E1

When delivered, a jumper is inserted between the "10 V" power supply and analog input "E1." 100 % of the speed is achieved during operation in this way.
After the line voltage has been switched on and after a run up time of approx. 20 seconds, the fan is operated at a constant 100 % speed (rated speed).

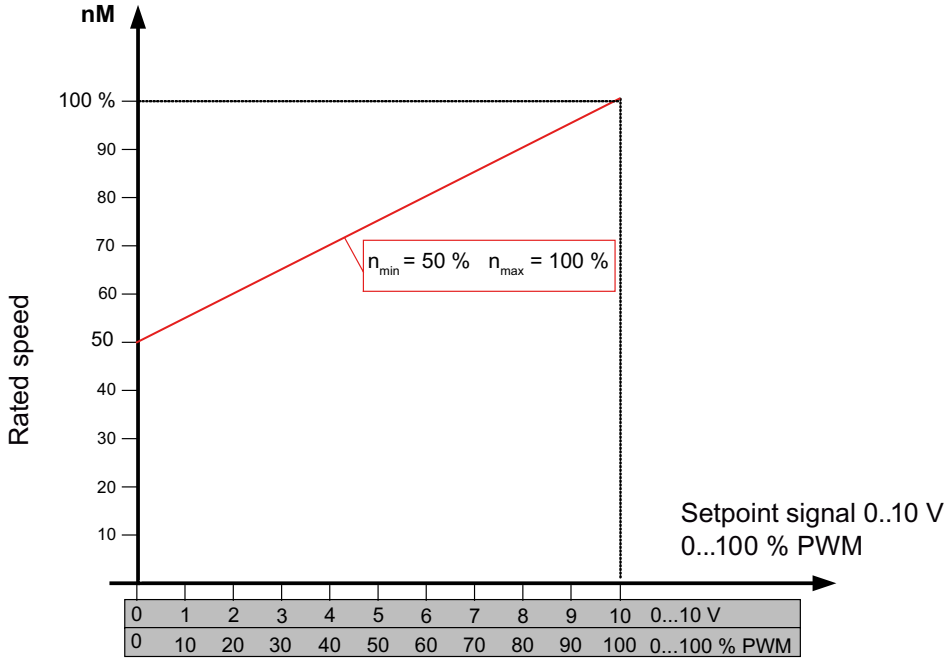
Note

Speed control via setting signal

Adjust the cooling depending on the duty cycle and the utilization level of the 1PH8 motor. Remove the jumper inserted in the factory between "10 V" and "E1". The fan speed can be set in the range 50 ...100 % using a setpoint signal (0...10 V).

Contact Siemens Technical Support for additional information and support.

Diagram of control via an external setting signal



NOTICE
Removing the factory-mounted jumper The 1PH8 motor can overheat if the external EC fan is operated at low fan speeds as a result of the setpoint signal it receives. • Monitor the motor using the integrated temperature sensors. • Integrate the temperature monitoring into the interlocking circuit. **If the company operating the plant or system removes the jumper (which was inserted in the factory), that company becomes responsible for the functional safety of the drive, especially if the safety instructions are not complied with.**

Line connection: Fuse protection

The EC external fans have integrated overload protection, making an external motor protection device (e.g. motor circuit breaker) unnecessary. A simple conductor protection is sufficient.

Simple conductor protection with a fuse or MCB:

Fuse		MCB	Conductor cross section	Conductor cross section
VDE	UL	VDE	mm^2	*AWG
16 A	15 A	C16A	1.5	16

(* AWG = American Wire Gauge)

Residual-current protective device

Only RCDs that are sensitive to universal current (type B or B+) are permissible. Personal protection is not possible if the device is operated with RCDs, as is also the case for converters.

When the power supply of the device is switched on, charging current pulses can occur due to the capacitors. In the integrated EMC filter, this can cause the RCDs to trip instantaneously. We recommend residual-current operated circuit breakers with a tripping threshold of 300 mA and delayed tripping (super-resistant, characteristic K).

Use in IT systems



⚠ WARNING

Risk of electric current

In an IT system, the neutral point of the voltage supply is not grounded. If a short-circuit occurs between a phase (e.g. "L1") and the protective conductor "PE", then the protective conductor is at phase potential.

Under no circumstances may a voltage higher than the specified line voltage of the device be applied between the line connection and the protective conductor "PE".

1-phase EC separately driven fans can be used on an IT line system. On 3-phase IT line systems, follow the bullet points for use During a ground fault of an unused line phase, the potential relative to "PE" must not be higher than the specified line voltage of the device (at neither of the two supply connections).

To ensure fault-free operation on the IT line system, connect the "GND" potential of the control connections to the protective conductor potential.

The following consequences of this connection must be observed for the control connections (except for relay contacts):

1. Only connect using cables that are suitable for the line voltage and environment.
2. Only connect via suitable buffer stages.

9.3.6 Signal connection

DRIVE-CLiQ is the preferred method for connecting the encoder systems to SINAMICS.

Motors with a DRIVE-CLiQ interface can be ordered for this purpose. Motors with a DRIVE-CLiQ interface can be directly connected to the associated motor module via the available MOTION-CONNECT DRIVE-CLiQ cables. The MOTION-CONNECT DRIVE-CLiQ cable is connected to the motor in degree of protection IP67. The DRIVE-CLiQ interface supplies power to the motor encoder via the integrated 24 VDC supply and transfers the motor encoder and temperature signals and the electronic type plate data, e.g. a unique

identification number, rating data (voltage, current, torque) to the control unit. The MOTION-CONNECT DRIVE-CLiQ cable is used universally for connecting the various encoder types. These motors simplify commissioning and diagnostics, as the motor and encoder type are identified automatically.

Encoder connection on motors with DRIVE-CLiQ

Motors with DRIVE-CLiQ interfaces can be directly connected to the corresponding Motor Module via the available MOTION-CONNECT DRIVE-CLiQ cables. This data is transferred directly to the Control Unit.

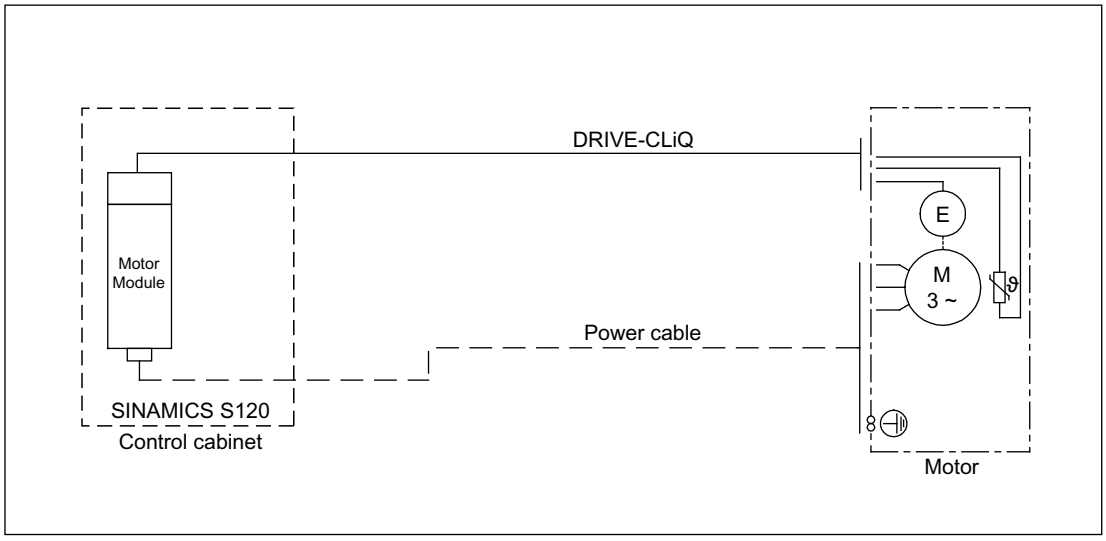


Figure 9-33 Encoder connection on motors with DRIVE-CLiQ

Cables on motors with DRIVE-CLiQ

With DRIVE-CLiQ, the same cable is used for all encoder types. Only pre-assembled cables from Siemens (MOTION-CONNECT) may be used.

Table 9-6 Pre-assembled cable

6FX	**□**	**002**	**-**	**□DC□□**	**-**	**□□□**	**0**
	↓					↓↓↓	
	↓					Length	
	5 MOTION-CONNECT®500					max. cable length 100 m	
	8 MOTION-CONNECT®800					max. cable length 50 m	

For other technical data and length code, refer to Catalog, Chapter "MOTION-CONNECT connection system"

Encoder connection on motors without DRIVE-CLiQ

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.

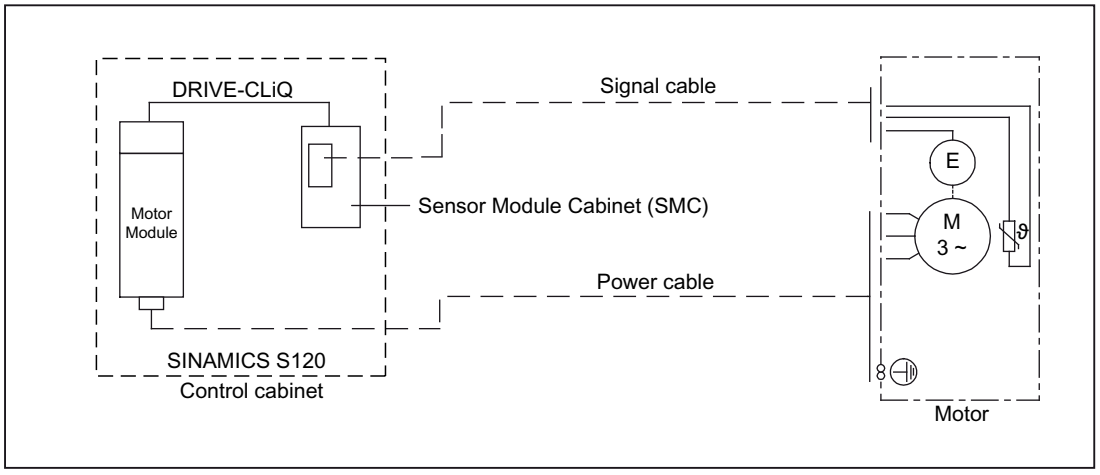


Figure 9-34 Encoder connection on motors without DRIVE-CLiQ

Cables on motors without DRIVE-CLiQ

Prefabricated cables from Siemens (MOTION-CONNECT) must be used. These offer many advantages over self-assembled cables in terms of operational reliability, quality and availability.

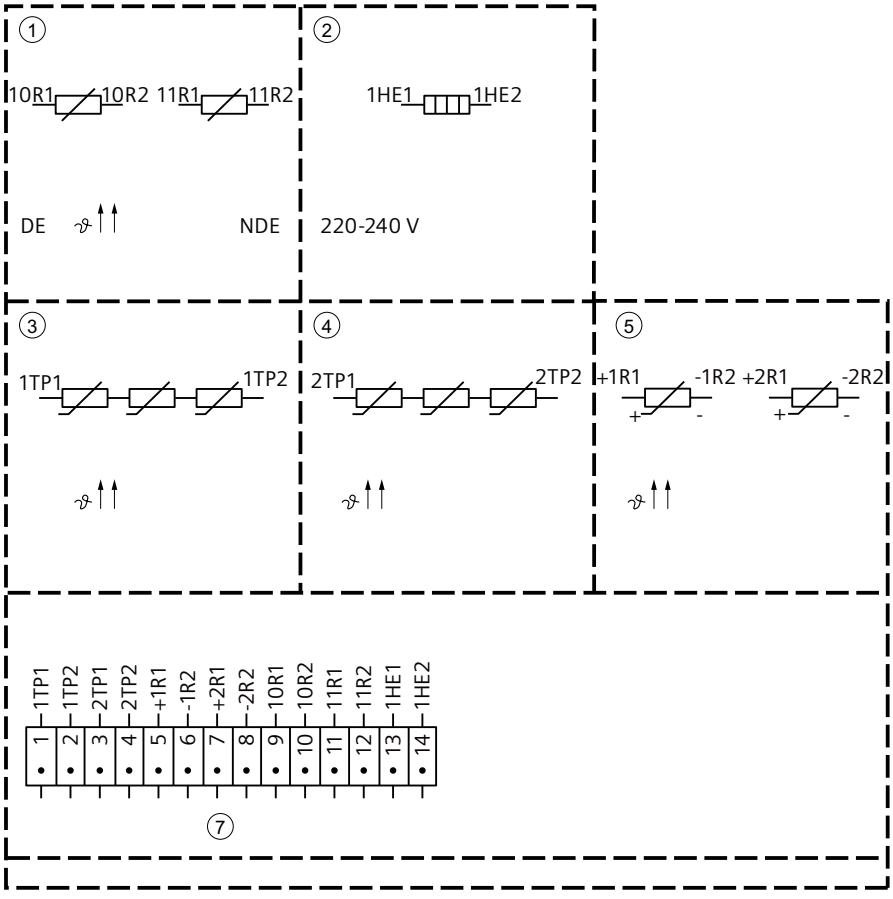
For technical data and length code, see Catalog, Chapter "MOTION-CONNECT connection system".

Maximum assignment of signal terminal strips in the terminal box

The following signals can be connected to the signal terminal strip:

- Temperature sensor (+1R1; -1R2): For an additional reserve temperature sensor, +1R1 and -1R2 are connected to the signal terminal strip and (for motors with encoder) also wired to the signal connector.
- Reserve-temperature sensor (+2R1, -2R2):
  - Shaft height 80-160: Option A25
  - Shaft height 180-280: Standard
- Additional PTC thermistor circuit for alarm and trip (1TP1, 1TP2, 2TP1, 2TP2): Option A12

- Pt100 resistance thermometer to monitor rolling bearings (10R1, 10R2, 11R1, 11R2): Shaft height 180-280: Option A72
- Connection of the anti-condensation heating (1HE1, 1HE2): Shaft height 180-280: Option K45



① Bearing thermometers
② Anti-condensation heating
③ Alarm winding PTC thermistor
④ Shutdown winding PTC thermistor
⑤ Pt1000 winding temperature sensor
⑥ Terminal strip

Figure 9-35 Assignment_signal terminal strip_terminal box

Dimension drawings

10

10.1 SIEMENS Product Configurator

The SIEMENS Product Configurator supports you when configuring your drive.

You will find the following quickly and easily in the SIEMENS Product Configurator

- Technical data
- Characteristics
- dimension drawings
- 2D/3D CAD data

The SIEMENS Product Configurator supports you when creating system documentation regarding project-specific information.

Note

The 3D model in the SIEMENS Product Configurator is a simplified representation that does not show every detail.

You can find further information on the Internet at SIEMENS Product Configurator (www.siemens.com/SPC):

Recency of dimensional drawings

Note

Changing motor dimensions

Siemens reserves the right to change the dimensions of the motors as part of mechanical design improvements without prior notice. This means that dimensional drawings can become out of date.

You can request free of charge current dimension drawings from Technical Support or your local sales partner.

Appendix

A

A.1 Description of terms

Rated torque M_N

The rated torque is the torque that is mechanically available at the shaft and can be thermally provided corresponding to the specified operating mode (duty type) according to IEC 60034-1.

Rated speed n_N

This is the speed for which the rated power and the rated torque are defined corresponding to the specified operating mode (duty type) according to IEC 60034-1.

Rated voltage V_N

Voltage between two motor phases for which the rating data (P_N, n_N, etc.) is defined. The rated voltage definition takes into account magnetic (iron saturation) and thermal factors.

Rated current I_N

This is the current (rms phase value) that flows at the rated speed and rated torque and can be thermally provided according to the specified operating mode (duty type) according to IEC 60034-1.

Rated frequency f_N

Frequency required to obtain the performance ratings (P_N, n_N, etc.).

Rated power P_N

The rated power is the power that is mechanically available at the shaft and can be thermally provided corresponding to the specified operating mode (duty type) according to IEC 60034-1.

Speed for field weakening with constant power n_2

Maximum achievable speed at rated power corresponding to the specified operating mode (duty type) according to IEC 60034-1.

No-load current I_μ

This is the current (rms phase current) that is required in order to operate the motor under no-load conditions at rated speed without load torque. The no-load current defines the motor magnetization in the base speed range (low speed at the start of field weakening).

Maximum speed n_{max}

The maximum permissible speed n_{max} is determined by mechanical factors. The maximum speed n_{max} must not be exceeded.

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.

If $n_{S1} < n_{max}$, the motor must not be operated at n_{max} continuously. Unless a different duty cycle (duty cycle duration 10 minutes) is specified, the speed must be reduced as stated below:

t_1: 1 min---n_1= 0 r/min; t_2: 6 min---n_2= 2/3 n_{max}; t_3: 3 min---n_3= n_{max}

Maximum torque M_{max}

Torque which is briefly available for dynamic operations (e.g. when accelerating).

Max. current I_{max}

This is the current (rms phase value) produced at rated speed (n_{rated}) and maximum torque (M_{max}).

S1 duty (continuous operation)

Operation with a constant load, the duration of which is sufficient that the motor goes into a thermal steady-state condition.

S6 duty (intermittent operation)

Operation which comprises a sequence of identical duty cycles; each of these duty cycles comprises a time with constant motor load and a no-load time. Unless otherwise specified, the load period refers to a duty cycle of 10 min.

for example,

S6-40 % = 4 min load operation, 6 min no-load operation
S6-60 % = 6 min load operation, 4 min no-load operation

Thermal time constant T_{th}

The thermal time constant defines the temperature rise of the motor winding when the motor load is suddenly increased (step increase) up to the permissible S1 torque. The motor has reached 63% of its S1 final temperature after T_{th}.

A.2 Environmental compatibility

Environmental compatibility

- Environmental aspects during development
  When selecting supplier parts, environmental compatibility was an essential criteria.
  Special emphasis was placed on reducing the envelope dimensions, weight and variety of metal and plastic parts.
  Effects that impair paint-wetting can be excluded (PWIS test)
- Environmental aspects during production
  Supplier parts and the products are predominantly transported in re-usable packing.
  Hazardous materials do not have to be transported.
  The packing materials themselves essentially comprises paperboard that is in compliance with the Packaging Directive 94/62/EC.
  Energy consumption during production was optimized.
  Production has low emission levels.
- Environmental aspects for disposal
  Motors must be disposed of carefully taking into account domestic and local regulations in the normal recycling process or by returning to the manufacturer.
  The following must be taken into account when disposing of the motor:
  Oil according to the regulations for disposing of old oil (e.g. gearbox oil when a gearbox is mounted)
  Not mixed with solvents, cold cleaning agents or remains of paint
  Components that are to be recycled should be separated into:
  - Electronics scrap (e.g. encoder electronics, sensor modules)
  - Scrap iron
  - Aluminum
  - Non-ferrous metal (worm gears, motor windings)

More information

Siemens:
www.siemens.com/simotics

Industry Online Support (service and support):
www.siemens.com/online-support

Industry Mall:
www.siemens.com/industrymall

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