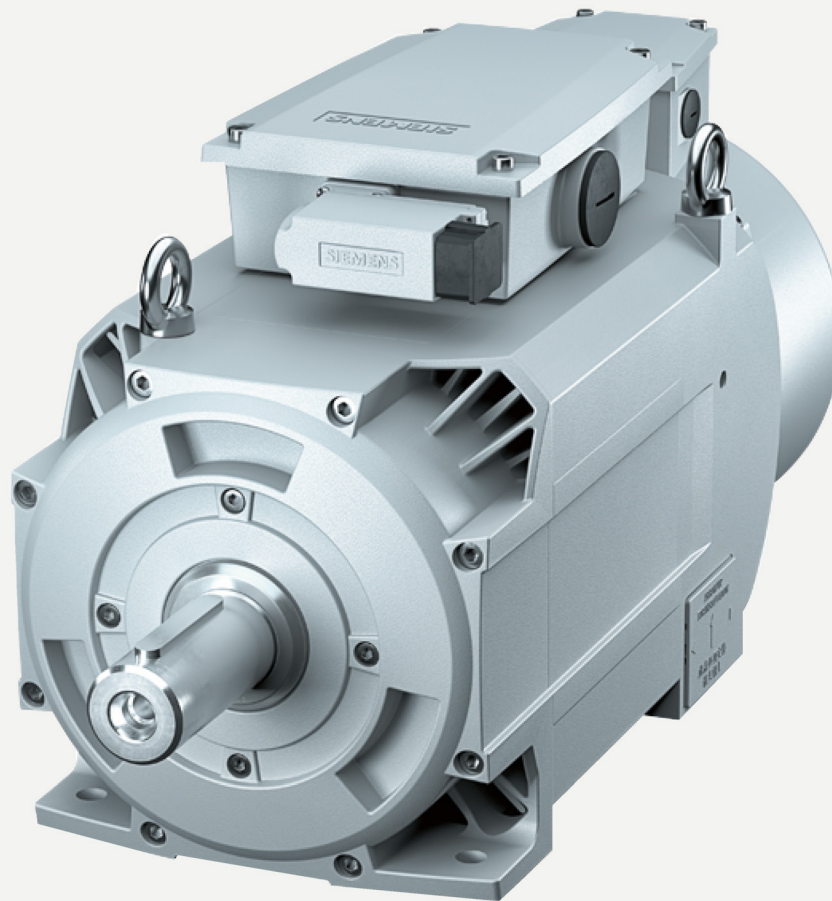




Edition

11/2023

EQUIPMENT MANUAL

SIMOTICS

SIMOTICS M-1PH3 main motors

For SINAMICS S120

SIMOTICS

SIMOTICS M-1PH3 1PH3 main motors

Equipment 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.
--

Trademarks

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Disclaimer of Liability

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

Introduction

Standard version

This documentation only describes the functionality of the standard version. The machine OEM documents any extensions or changes to the motor made by it.

For reasons of clarity, this documentation cannot contain all of the detailed information on all of the product types. Moreover, this documentation cannot take into consideration every possible type of installation, operation, and maintenance.

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

Target group

This documentation addresses the following personnel:

- Project planners and project engineers
- Machine manufacturers
- Commissioning engineers
- Electricians and fitters
- Service technicians and warehouse personnel

Benefits

This documentation enables the target group to apply the rules and guidelines to be observed when configuring and operating products and systems.

This documentation supports you to complete the following tasks:

- Selecting motors and accessories
- Calculating the drive components
- Mounting and connecting motors
- Commissioning motors
- Operating and maintaining motors
- Creating a system or plant configuration

More information

You can find the overview of documentation and links to download documents as well as to use documentation online at:

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

Please send any questions about the technical documentation (e.g. suggestions for improvement, corrections) to the following e-mail address:

docu.motioncontrol@siemens.com

Internet address for products

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

QR code

There is a QR code with ID Link on the product rating plate and on the product packaging. You can recognize the ID Link by the frame with a black frame corner at the bottom right. The ID Link is a globally unique identifier according to IEC 61406-1. You can use the ID Link to get information about your product.



Figure 1 QR code with ID Link

To get product data, manuals, declarations of conformity, certificates and other information about your product, you can scan the QR code by using a standard code scanner or the "Industry Online Support" app.

When using a standard code scanner, you open the scanned ID Link in an Internet browser that is provided on your device.

My support

The following link provides information on how to create your own individual documentation based on Siemens content, and adapt it for your own machine documentation:

My support (<https://support.industry.siemens.com/My/ww/en/>)

Note

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

Later, you can log on with your logon data.

Training

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

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

Technical Support

Country-specific telephone numbers for technical support are provided on the Internet under Contact:

Technical support (<https://support.industry.siemens.com/cs/ww/en/>)

Product maintenance

The components are subject to continuous further development within the scope of product maintenance (improvements to robustness, discontinuations of components, etc).

These further developments are "spare parts-compatible" and do not change the article number.

In the scope of such spare parts-compatible further developments, connector positions are sometimes changed slightly. This does not cause any problems with proper use of the components. Please take this fact into consideration in special installation situations (e.g. allow sufficient clearance for the cable length).

Use of 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.

Compliance with the General Data Protection Regulation

Siemens respects the principles of data protection, in particular the data minimization rules (privacy by design).

For this product, this means:

The product does not process neither store any person-related data, only technical function data (e.g. time stamps). If the user links these data with other data (e.g. shift plans) or if he stores person-related data on the same data medium (e.g. hard disk), thus personalizing these data, he has to ensure compliance with the applicable data protection stipulations.

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Fundamental safety instructions

1.1 General safety instructions



WARNING

Electric shock and danger to life due to other energy sources

Touching live components can result in death or severe injury.

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

Generally, the following steps apply when establishing safety:

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

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



WARNING

Electric shock due to connection to an unsuitable power supply

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

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



WARNING

Electric shock due to damaged motors or devices

Improper handling of motors or devices can damage them.

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

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



WARNING

Electric shock due to unconnected cable shield

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

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



WARNING

Electric shock if there is no ground connection

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

- Ground the device in compliance with the applicable regulations.



WARNING

Arcing when a plug connection is opened during operation

Opening a plug connection when a system is in 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" or a QR code scanner 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.

1.2 Equipment damage due to electric fields or electrostatic discharge

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



NOTICE

Equipment damage due to electric fields or electrostatic discharge

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

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

1.3 Cybersecurity information

Siemens provides products and solutions with industrial cybersecurity 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 cybersecurity 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 cybersecurity measures that may be implemented, please visit

<https://www.siemens.com/global/en/products/automation/topic-areas/industrial-cybersecurity.html>.

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 Cybersecurity RSS Feed under

<https://new.siemens.com/global/en/products/services/cert.html>.

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 state-of-the-art, integrated industrial cybersecurity concept for the installation or machine.
- Make sure that you include all installed products in the integrated industrial cybersecurity concept.
- Protect files stored on exchangeable storage media from malicious software by with suitable protection measures, e.g. virus scanners.
- Carefully check all cybersecurity-related settings once commissioning has been completed.

1.4 Residual risks of power drive systems

When assessing the machine or system-related risk in accordance with the respective local regulations (e.g. EC Machinery Directive), the machine manufacturer or system 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 inside and outside the components, including open flames, as well as emissions of light, noise, particles, gases, etc. due to fault conditions, e.g.:
 - Component failure
 - Software errors
 - Operation and/or environmental conditions outside the specification
 - External influences/damage
 - Short circuits or ground faults in the intermediate DC circuit of the converter
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 and wireless communications systems, e.g. ripple-control transmitters or data communication via the network or mobile radio, WLAN or Bluetooth.
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

2.1 Highlights and benefits

Overview

The SIMOTICS M-1PH3 motors, referred to as 1PH3 motors in the following, is a motor generation developed for universal implementation in plants and machines with motion control applications.

The motors are provided with the following mechanical properties:

- Asynchronous variant
- Forced ventilation
- Shaft heights 100 mm and 132 mm

The 1PH3 motors can be used for the freely selectable performance of both vector control and servo control with the following SINAMICS S120 converter components:

- SINAMICS S120 Motor Modules in booksize format (Smart/Basic Line Module (SLM/BLM))
- SINAMICS S120 Combi Power Modules

Thanks to the flexible interplay between the converter and the motor, it is now even easier to implement the following applications:

- Extreme duty cycle
- Short rise time
- High precision with respect to the speed, torque and positioning

Depending on the control requirements, the appropriate encoder system is available for the motors for sensing the motor speed and indirect position. The encoder system is also available for C-axis operation on machine tools.

Highlights and benefits

- Wide power spectrum with low envelope dimensions
- Wide speed control ranges
- Outstanding performance characteristics
 - Maximum speeds up to 12000 r/min
 - Excellent vibration magnitudes
 - High dynamic response (short ramp-up time)
- Low noise emission
- Simple and flexible connection system
- Commissioning with the electronic naming plate and DRIVE-CLiQ interface

2.2 Use for the intended purpose

WARNING

Danger to life and material damage when incorrectly used

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

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

WARNING

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

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

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

The motors are designed for use in covered areas, such as production areas.

For more information, see Section "General technical data (Page 135)".

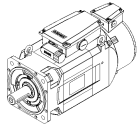
The 1PH3 three-phase motors are used as industrial motors for machine tools and production machines.

Thanks to integrated technology, the 1PH3 motors can be used in a very wide variety of applications in conjunction with the SINAMICS drive system:

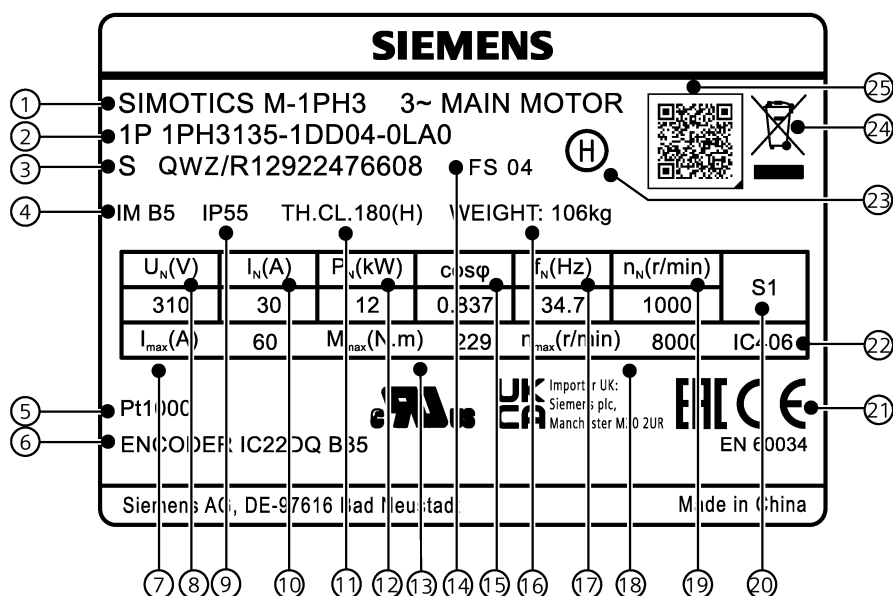
- Compact machine tools
- Complex machining centers and turning machines
- Milling machines with full enclosure
- High-load milling spindles
- Counterspindles or power tools for turning machines
- Main drives in presses and extruders, converting applications
- Rotary axes in the paper and printing industry
- For use in crane systems (power house)
- Flying shears, coilers and winder drives
- Customized machines

2.3 Scope of delivery

2.3.1 Motor package

Component	Shaft height (mm)	Rated power (kW)	Rated speed (r/min)	Article number
SIMOTICS M-1PH3 main motors 	100	3.7	1000	1PH3103-1□D0□-□GA0
		3.7	1500	1PH3101-1□F0□-□LA0
				1PH3101-1□F0□-□KA0
		5.5	1000	1PH3105-1□D0□-□GA0
		5.5	1500	1PH3103-1□F0□-□LA0
				1PH3103-1□F0□-□KA0
		7.5	2000	1PH3105-1□G0□-□LA0
				1PH3105-1□G0□-□KA0
		9	1500	1PH3107-1□F0□-□LA0
				1PH3107-1□F0□-□KA0
				1PH3107-1□F0□-□GA0
		11	2000	1PH3107-1□G0□-□LA0
				1PH3107-1□G0□-□KA0
	132	7.5	1200	1PH3131-1DE0□-□GA0
		9	1200	1PH3132-1DE0□-□GA0
		11	1000	1PH3133-1DD0□-□GA0
		11	1500	1PH3131-1DF0□-□LA0
				1PH3131-1DF0□-□KA0
		12	1000	1PH3135-1DD0□-□LA0
				1PH3135-1DD0□-□KA0
		15	1000	1PH3136-1DD0□-□GA0
		15	1000 (Y) 2000 (Δ)	1PH3136-1DS0□-□GA0
		15	2000	1PH3133-1DG0□-□LA0
				1PH3133-1DG0□-□KA0

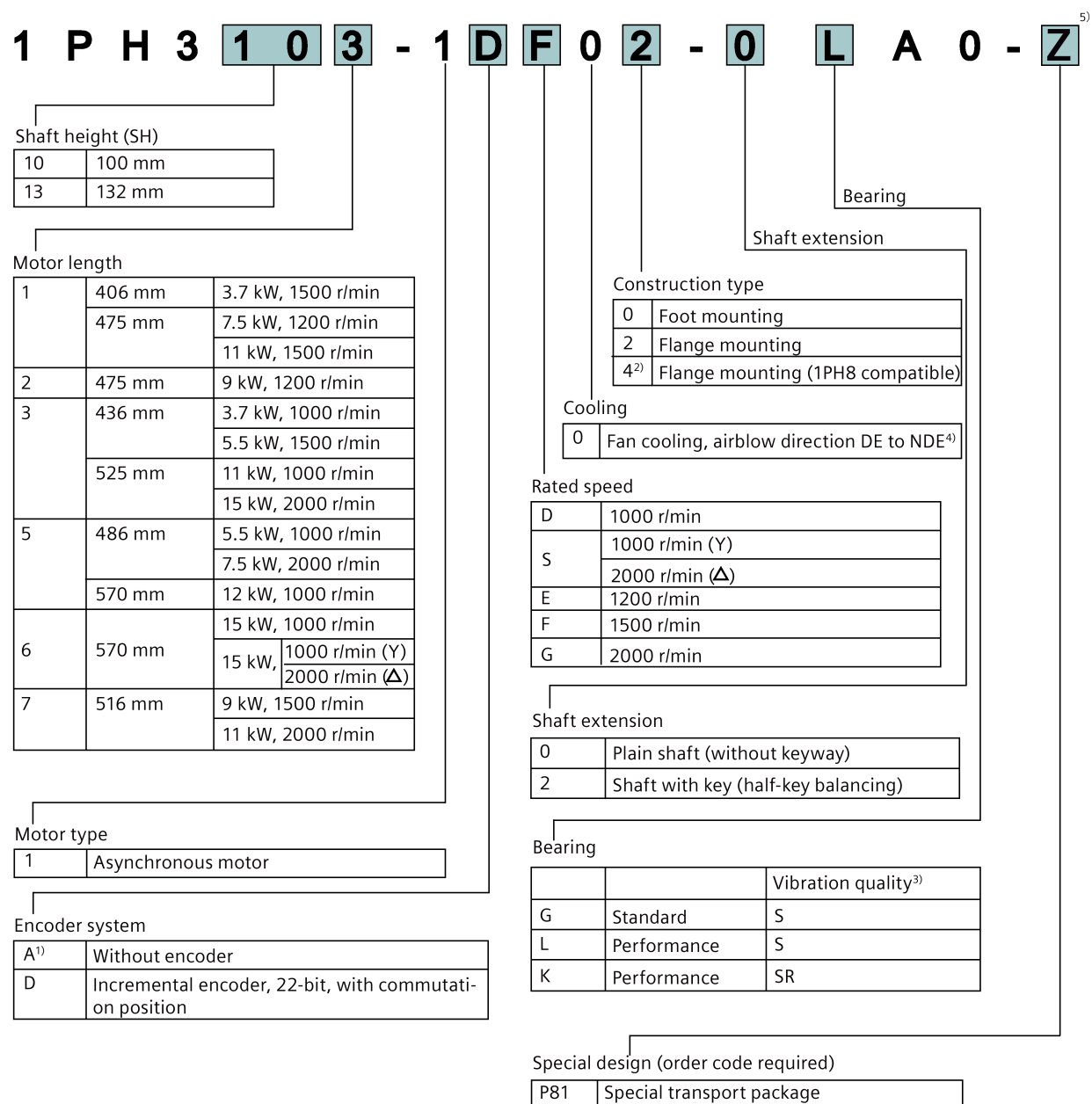
2.3.2 Motor rating plate



- | | |
|---------------------------|---|
| 1 Motor type | 14 Function release/version |
| 2 Article number | 15 Motor power factor |
| 3 Serial number | 16 Weight |
| 4 Mounting orientation | 17 Rated frequency |
| 5 Temperature sensor type | 18 Maximum speed |
| 6 Encoder type | 19 Rated speed |
| 7 Maximum current | 20 Motor operating mode |
| 8 Rated voltage | 21 Certifications |
| 9 Degree of protection | 22 Cooling method |
| 10 Rated current | 23 Shaft extension type (H: shaft with key; blank: plain shaft) |
| 11 Thermal class | 24 Note on disposal |
| 12 Rated power | 25 QR code* |
| 13 Maximum torque | |

* You can scan the QR code on the product rating plate or on the product packaging label by using a standard code scanner or the "Industry Online Support" app to get product data, manuals, declarations of conformity, certificates, and other information about your product.

Article number explanation (example)



¹⁾ For shaft height 100 mm only

²⁾ For shaft height 132 mm only

³⁾ According to Siemens/EN 60034-14 (IEC 60034-14)

⁴⁾ DE = Drive End (motor drive end), NDE = Non-Drive End (motor fan end)

⁵⁾ Depending on the electrical and mechanical configuration, Z options can be appended to the article number suffixes.

2.3.3 Cables

Siemens MOTION-CONNECT power cables

Illustration	Thread (motor side)	Number of cores × cross-section (mm²)	Article number			
Connecting SIMOTICS M-1PH3 motors to SINAMICS S120 Combi Power Modules						
Power cable assemblies						
	M25	4 × 2.5	6FX		002-5CE02-	
	M32	4 × 4	6FX		002-5CE04-	
	M32	4 × 6	6FX	5	002-5CE05-	
Raw cables						
	M25	4 × 2.5	6FX		008-1BB21-	
	M32	4 × 4	6FX		008-1BB31-	
	M32	4 × 6	6FX		008-1BB41-	
	M32	4 × 10	6FX		008-1BB51-	
Connecting SIMOTICS M-1PH3 motors to SINAMICS S120 Motor Modules in booksize format						
Power cable assemblies (for the S120 Motor Modules C/D-Type with the rated output current ≤ 30 A)						
	M25	4 × 2.5	6FX	8	002-5CP17-	
	M32	4 × 4	6FX	8	002-5CP26-	
	M32	4 × 10	6FX	8	002-5CP46-	
Power cable assemblies (for the S120 Motor Modules C-Type with the rated output current = 45 A) ¹⁾						
	M32	4 × 10	6FX	8	002-5CR41-	
Raw cables ²⁾						
	M25	4 × 2.5	6FX		008-1BB21-	
	M32	4 × 4	6FX		008-1BB31-	
	M32	4 × 6	6FX		008-1BB41-	
	M32	4 × 10	6FX		008-1BB51-	
MOTION-CONNECT 500				5		
MOTION-CONNECT 800PLUS				8		

¹⁾ For the Motor Module side connection, the length of the core ends is 300 mm, and five M6 and five M8 cable lugs are also included in the scope of supply of the cables.

²⁾ For the Motor Module side connection, if the rated output current of the connected Motor Modules is ≤ 30 A, order a Siemens terminal block (screw-type terminals: 6SL3162-2MA00-0AC0; spring-loaded terminals: 6SL3162-2MB00-0AC0).

Siemens DRIVE-CLiQ MOTION-CONNECT cables

Cable type	Illustration	Max. length (m)	Article number			
DRIVE-CLiQ cable assemblies		75	6FX	5	002-2DC10-	
		100	6FX	8	002-2DC10-	
MOTION-CONNECT 500				5		
MOTION-CONNECT 800PLUS				8		

Siemens MOTION-CONNECT 800PLUS temperature sensor Pt1000 cable

Cable type	Illustration	Length (m)	Article number
Raw cables		50	6FX8008-1BD00-1FA0

Length code

6 F X - - **2** **G** **C** **2**

Length	Code
0 m	1
100 m	2
200 m	3
500 m	6

Length	Code
0 m	A
10 m	B
20 m	C
30 m	D
40 m	E
50 m	F
60 m	G
70 m	H
80 m	J
90 m	K

Length	Code
0 m	A
1 m	B
2 m	C
3 m	D
4 m	E
5 m	F
6 m	G
7 m	H
8 m	J
9 m	K

Length	Code
0 m	0
0.1 m	1
0.2 m	2
0.3 m	3
0.4 m	4
0.5 m	5
0.6 m	6
0.7 m	7
0.8 m	8

Examples

1.0 m	1AB0
2.3 m	1AC3
36.0 m	1DG0
162.2 m	2GC2

Note

MOTION-CONNECT power cable delivery type

- For power cable assemblies, the maximum delivery length is 299 m.
- For raw cables, the maximum delivery length is 500 m.
 - Cables with a cross-section of 2.5 mm² are available in fixed lengths 50 m, 100 m, 200 m and 500 m.
 - Cables with a cross-section above 2.5 mm² are sold in exact meter lengths.

2.3.4 Device combination

The table below lists the 1PH3 motors and configurable cables. You can select the desired cable according to the motor:

SIMOTICS M-1PH3 motors						Power cable (cross-section, mm ²) ¹⁾				DRIVE- CLiQ MOTION - CONNE CT cable ¹⁾	Tem- pera- ture sensor Pt1000 cable ¹⁾			
Rated power (kW)	Rated cur- rent (A)	Rated speed (r/min)	Shaft height (mm)	Article number		Prefabricated cable		Raw cable						
						Used with SINAMICS S120 Motor Modules in booksize format	Used with SINAMICS S120 Combi Power Mod- ules							
3.7	12.9	1000	100	1PH3103-1	☐	D0 ☐ - ☐ GA0	4 × 2.5	4 × 2.5	4 × 2.5					
3.7	12	1500		1PH3101-1	☐	F0 ☐ - ☐ LA0								
						F0 ☐ - ☐ KA0								
5.5	17.8	1000		1PH3105-1	☐	D0 ☐ - ☐ GA0								
5.5	16.9	1500		1PH3103-1	☐	F0 ☐ - ☐ LA0								
						F0 ☐ - ☐ KA0								
7.5	16.5	2000		1PH3105-1	☐	G0 ☐ - ☐ LA0								
						G0 ☐ - ☐ KA0								
9	24	1500		1PH3107-1	☐	F0 ☐ - ☐ LA0						4 × 4	4 × 4	4 × 4
						F0 ☐ - ☐ KA0								
			F0 ☐ - ☐ GA0											
11	29	2000	1PH3107-1	☐	G0 ☐ - ☐ LA0	4 × 10	4 × 6	4 × 6						
					G0 ☐ - ☐ KA0									
7.5	21.7	1200	132	1PH3131-1	D	E0 ☐ - ☐ GA0	4 × 4	4 × 4	4 × 4					
9	24	1200		1PH3132-1	D	E0 ☐ - ☐ GA0								
11	24	1500		1PH3131-1	D	F0 ☐ - ☐ LA0								
						F0 ☐ - ☐ KA0								
11	29.4	1000		1PH3133-1	D	D0 ☐ - ☐ GA0	4 × 10	4 × 6	4 × 6					
12	30	1000		1PH3135-1	D	D0 ☐ - ☐ LA0			4 × 10					
			D0 ☐ - ☐ KA0											

SIMOTICS M-1PH3 motors						Power cable (cross-section, mm ²) ¹⁾			DRIVE- CLiQ MOTION - CONNE CT cable ¹⁾	Tem- pera- ture sensor Pt1000 cable ¹⁾	
Rated power (kW)	Rated cur- rent (A)	Rated speed (r/min)	Shaft height (mm)	Article number			Prefabricated cable				Raw cable
							Used with SINAMICS S120 Motor Modules in booksize format	Used with SINAMICS S120 Combi Power Mod- ules			
15	30	2000		1PH3133-1	D	G0□- □LA0					
						G0□- □KA0					
15 ²⁾	31	1000 (Y)		1PH3136-1	D	S0□- □GA0					
	31.9	2000 (Δ)									
15 ³⁾	42.8	1000				D0□- □GA0		-			
Without encoder					A		Without encoder				√
Incremental encoder, 22-bit, with commutation position					D		Incremental encoder, 22-bit, with commutation position			√	

¹⁾ For more information about the ordering data of the cables, see Section "Cables (Page 25)".

²⁾ The 1PH3 motors specified in this row can be used for the SINAMICS S120 Combi Power Modules with rated infeed power of 20 kW and rated current of 30 A.

³⁾ The 1PH3 motors specified in this row cannot be used for the SINAMICS S120 Combi Power Modules.

2.4 Derating factors

2.4.1 Overview

Derating for ambient/coolant temperature

Operation: $T = -15\text{ °C}$ to $+40\text{ °C}$ (without derating)

Under conditions other than those specified above (ambient temperature $> 40\text{ °C}$ or installation altitude $> 1000\text{ m}$ above sea level), the permissible torque/power reduction must be considered.

For more information, see Chapter "Cooling (Page 33)".

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 "Motor terminal box (Page 93)").

2.4.2 Reduction of the maximum DC-link voltage

The table below provides factors for reducing the maximum 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 " (reciprocal values from EN 60664-1 Table A.2).

Installation altitude up to [m] above mean sea level	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.

For more information about the torque-speed diagram, see Section "Specific technical data (Page 137)".

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

Mechanical properties

3.1 Directives and standards

Standards that are complied with

The 1PH3 motors comply with the following standards:

- IEC/EN 60034-1: Rotating electrical machines – Dimensioning and operating behavior
- IEC/EN 60204-1: Safety of machinery – Electrical equipment of machines; general requirements
- UL1004-1: Rotating electrical machines – General requirements

Where applicable, the 1PH3 motors are in conformance with the following parts of IEC/EN 60034:

Feature	Standard
Degree of protection	IEC/EN 60034-5
Cooling	IEC/EN 60034-6
Type of construction	IEC/EN 60034-7
Connection designation	IEC/EN 60034-8
Noise level	IEC/EN 60034-9
Temperature monitoring	IEC/EN 60034-11
Vibration severity level	IEC/EN 60034-14

Relevant directives and certifications

The following directives and certifications are relevant for the 1PH3 motors.



European Low-Voltage Directive

The 1PH3 motors comply with the Low-Voltage Directive 2014/35/EU.

European Machinery Directive

The 1PH3 motors do not fall within the area of validity 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

The 1PH3 motors do not fall within the area of validity covered by the EMC Directive. The products are not considered as devices in the sense of the directive.

European RoHS Directive

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

WEEE Directive

The SIMOTICS motor series fulfills the EU Directive 2012/19/EU regarding the take-back and recovery of waste electrical equipment.

Eurasian Conformity

The 1PH3 motors comply with the requirements of the customs union Russia/Belarus/Kazakhstan (EAC).



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 important that you carefully observe the contents of the quotation and that there is a cUL mark on the rating plate!



UKCA certification

The 1PH3 motors comply with the requirements for the market in Great Britain (England, Wales and Scotland).



Quality systems

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

Certificates for the 1PH3 motors can be downloaded from the Internet at the following link:

Certificates for the 1PH3 motors

(<https://support.industry.siemens.com/cs/products?search=1PH3&ctp=Certificate&mfn=ps&o=DefaultRankingDesc&pnid=13347&lc=en-WW>)

China RoHS

SIMOTICS motors comply with the China RoHS.

You can find additional information at:

China RoHS (<https://support.industry.siemens.com/cs/ww/en/view/109772252>)

3.2 Cooling

The 1PH3 motors of both SH100 and SH132 are available with only one cooling method, that is, forced ventilation.

When mounting a motor with forced ventilation, make sure that the following requirements are met:

- The motor is well ventilated, especially for encapsulated installation.
- The warm exhaust air is not drawn in again.
- There is no accumulated dirt in the cooling ducts so that the cooling air can flow in and out without restriction.



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, for example, cables and electronic components.

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

Ambient/coolant temperature

Operation: $T = -15\text{ °C}$ to $+40\text{ °C}$ (without derating)

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

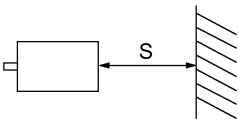
Installation altitude above sea level	Factors for reducing the torque/power according to EN 60034-6		
	40 °C	45 °C	50 °C
1000	1.00	0.96	0.92
1500	0.97	0.93	0.89
2000	0.94	0.90	0.86
2500	0.90	0.86	0.83
3000	0.86	0.82	0.79
3500	0.82	0.79	0.75
4000	0.77	0.74	0.71

Note**Higher ambient temperatures**

For ambient temperatures > 50 °C, contact your local Siemens office.

The 1PH3 motors are not suitable for use in corrosive atmospheres or atmospheres with a high salt content, or in outdoor applications.

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

Shaft height (mm)	Fan mounting	Minimum clearance S (mm)	
100	NDE axial	30	
132		60	

Ventilation data

Shaft height (mm)	Air flow direction	Degree of protection	Air discharge
100	DE → NDE	IP55	Axial
132			

Cleaning the cooling air ducts

On motors with forced ventilation, 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 and oil-free compressed air.

3.3 Degree of protection

Designation of the degree of protection

The degree of protection in accordance with EN 60034-5 (IEC 60034-5) is described with letters "IP" and two digits (for example, IP55).

IP = International Protection

1st code number = protection against ingress of foreign bodies

2nd code number = protection against harmful ingress of water

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

Make sure that you provide 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 the ambient conditions, such as the chemical properties of dusts or cooling media used at the installation site, you can only conditionally evaluate the suitability of the motor for the particular environment (for example, electrically conductive dusts) using the degree of protection.

In these cases, be sure to protect the motor additionally using the appropriate measures.

Note

Liquid and/or oil jet

Liquid and/or oil jet must be prevented from collecting on the motor shaft.

Degree of protection

The only one protection degree for the 1PH3 motors is described in detail in the following table:

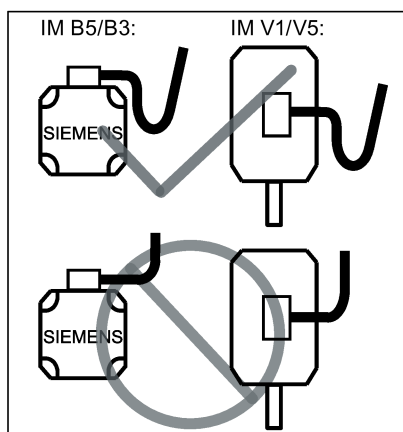
Degree of protection	1st code number		2nd code number
	Touch protection	Protection against ingress of solid foreign bodies	
IP55	Full protection against contact	Protection against damaging dust deposits	Protection against water jets

NOTICE

Damage to the motor due to improper cable routing

Routing cables improperly in humid/moist environments can cause damage to the motor.

- Route the power cables, DRIVE-CLiQ MOTION-CONNECT cables or temperature sensor Pt1000 cables, and fan cables as shown in the figure below, especially in humid/moist environments.

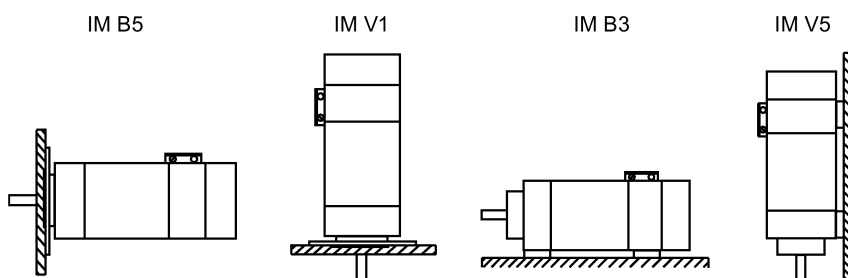


3.4 Construction types

Mounting orientation

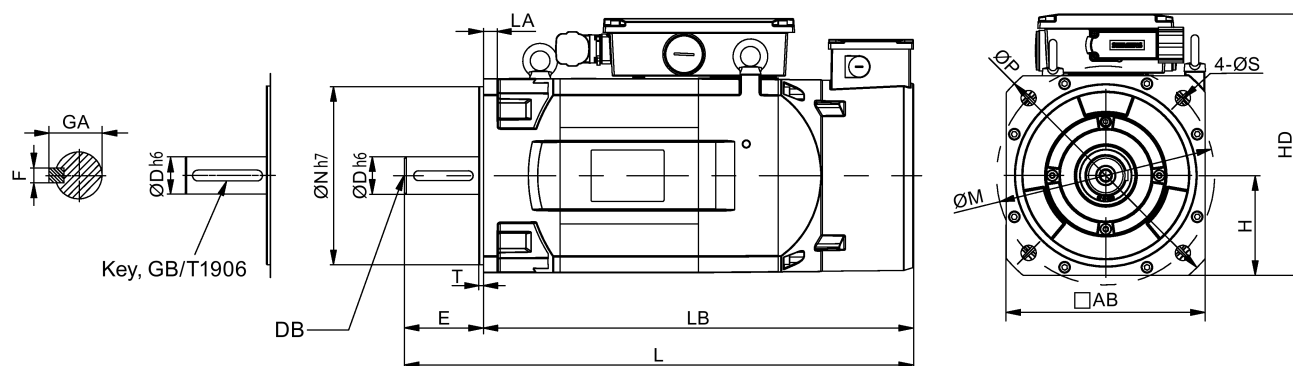
The 1PH3 motors can be mounted in the following types of construction according to EN 60034-7 (IEC 60034-7):

Mounting method	Standard type of construction	Rotated type of construction
Foot mounting	IM B3	IM V5
Flange mounting	IM B5	IM V1



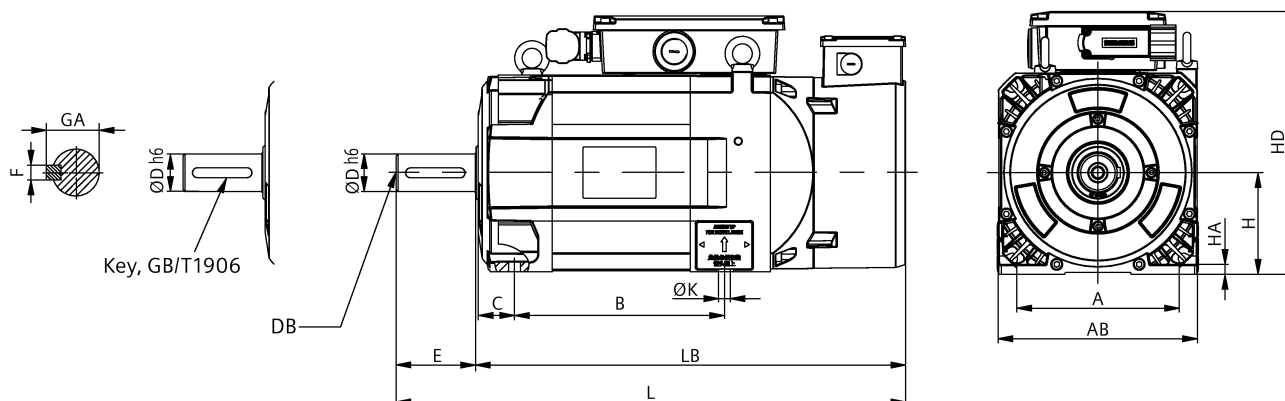
3.5 Motor dimensions

Flange mounting (unit: mm)



Specification	1PH310				1PH313									
	1PH310□-1□□02				1PH313□-1□□02					1PH313□-1□□04				
7th position of the article number	1	3	5	7	1	2	3	5	6	1	2	3	5	6
Shaft height	100				132					132				
F	10				14					14				
GA	41				51.5					51.5				
D	38				48					48				
N	180				230					250				
DB	M12×30				M16×40					M16×40				
E	80				110					110				
T	5				5					5				
LA	15				18					18				
LB	406	436	486	516	475	475	525	570	570	475	475	525	570	570
L	486	516	566	596	585	585	635	680	680	585	585	635	680	680
P	255				310					340				
S	15				15					18				
H	98				132					132				
HD	257				334					334				
AB	196				264					264				
M	215				265					300				

Foot mounting (unit: mm)



Specification	1PH3101	1PH3103	1PH3105	1PH3107	1PH3131	1PH3132	1PH3133	1PH3135	1PH3136
Shaft height	100				132				
F	10				14				
GA	41				51.5				
D	38				48				
DB	M12×30				M16×40				
E	80				110				
C	36.7				40.6				
B	183	213	263	293	252	252	302	347	347
K	12				15				
LB	406	436	486	516	475	475	525	570	570
L	486	516	566	596	585	585	635	680	680
HA	10				15				
H	100				135				
HD	259				337				
A	160				216				
AB	196				264				

For more information about dimension drawings, see Section "Dimension drawings (Page 136)".

3.6 Bearing

3.6.1 Bearing types and bearing versions

The 1PH3 motors support only the deep-groove ball bearing, which is suitable for the following applications:

- Coupling output
- Planetary gearboxes, low radial forces

See the following table for the recommended bearing change intervals based on the bearing versions at the average operating speed:

Shaft height	Bearing version	Average operating speed (r/min)	Recommended bearing change interval (h)
100	Standard	≤ 5000	20000
	Performance	≤ 10500	12000
132	Standard	≤ 4500	20000
	Performance	≤ 8500	12000

Note

Difficult operating conditions in operation at the maximum speed

Under the following difficult operating conditions, the bearing replacement intervals are reduced by up to 50%:

- Large vibrations and shocks
 - Frequent reversing operations
-

3.6.2 Bearing lifetime

The bearing lifetime is limited by the material fatigue (fatigue service life) and/or lubrication failure (grease service life). The fatigue lifetime (statistical bearing lifetime) mainly depends on the mechanical load. For more information on the correlation, see Section "Radial and axial force diagrams (Page 45)". The values are determined according to ISO 281.

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

The grease lifetime can be extended especially by favorable operating conditions, for example, low or average speed, low bearing temperature, and low radial force or vibration load.

The grease lifetime can be reduced for difficult operating conditions and when motors are mounted vertically.

Lifetime lubrication

Note

For 1PH3 motors, only lifetime lubrication but no relubrication is required during the bearing lifetime. In this case, the grease lifetime is harmonized with the bearing lifetime.

Bearing change interval

The recommended bearing change intervals are obtained from the interdependencies mentioned above in the following specific operating conditions:

- Coupling output or belt coupling
- Coolant temperature up to +40 °C
- Complying with the permissible radial and axial forces (For more information, see Section "Radial and axial forces (Page 42)".)
- Complying with the maximum permissible speeds (For more information, see Section "Specific technical data (Page 137)".)
- The bearing change intervals are reduced in the following unfavorable operating conditions:
 - Average speed more than the value specified in the table above
 - Continuous operation at the maximum speed
 - Vibration and shock load
 - Frequent reversing operations

3.7 Shaft extension

The DE shaft extension is cylindrical in accordance with IEC 60072-1.

3.8 Radial and axial forces

3.8.1 Radial force

Make sure that specific radial forces are not exceeded in order to guarantee perfect operation.

For any one of shaft heights 100 and 132, a radial force lower than the minimum radial force is not allowed. This minimum force is indicated in the radial force diagrams that show the radial force F_R as follows:

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

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

For force levels going beyond the upper and lower limits, contact your local Siemens office.

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 extension as a result of radial forces.

- When using mechanical transmission elements, make sure that the maximum limit values specified in the radial force diagrams are not exceeded.

NOTICE

Destruction of bearing seats

The motor bearings are designed for operation with radial forces. Rotating forces from the process or imbalance $> Q 2.5$ can destroy the bearing seats. The 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 higher forces when force/torque boosting elements are used, the flange or feet of the motor can be torn off.

- Make sure that the force/torque boosting elements, for example, gearboxes or brakes, absorb the higher forces. The remedy examples are as follows:
 - Choose the correct type of construction.
 - Mechanically mount the force/torque boosting elements properly.

Note

Complying with the belt manufacturer's guidelines

- When dimensioning the radial forces at the shaft extension, make sure 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 determined approximately via the following formula:

$$F_R = c \times F_U \quad F_U = 2 \times 10^7 \times P / (n \times D)$$

Formula abbreviations	Unit	Description
c	--	Pre-tensioning factor The pre-tensioning factor is an experience value provided by the belt manufacturer. It can be assumed as follows: <ul style="list-style-type: none"> • For V belts: $c = 1.5$ to 2.5 • For 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 the belt pulley

3.8.2 Axial force

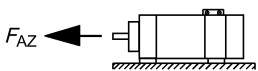
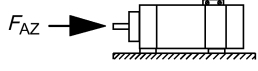
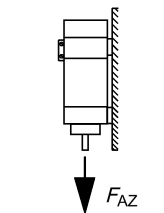
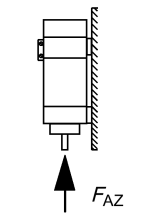
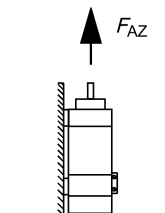
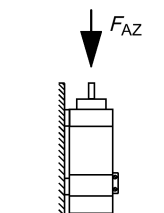
The axial force acting on the locating bearings comprises the following components:

- Axial force in operation
Axial forces acting externally on the motor, for example, gearboxes with helical gearing and machining forces through the tool
- Force due to the spring loading of the bearings
- 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.

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 bearings can be overcome so that the rotor moves in accordance with the axial clearance (up to 0.2 mm). This reduces the service lives of the bearing and encoder and thus must be prevented.

The permissible axial force F_{AZ} in operation depends on the motor mounting position and can be calculated as shown in the table below:

Horizontal arrangement	Shaft extension facing downwards	Shaft extension facing upwards
 $F_{AZ} = F_A - F_C$  $F_{AZ} = F_C$	 $F_{AZ} = F_A - F_L - F_C$  $F_{AZ} = F_L + F_C$	 $F_{AZ} = F_A + F_L - F_C$  $F_{AZ} = F_C - F_L$
F_{AZ}	Permissible axial force in operation	
F_A	Permissible axial force as a function of the average operating speed n_m in each case, ignoring the spring-loading force and the force due to the rotor weight	
F_C	Spring-loading force	
F_L	Force due to the rotor weight	

See the table below for the force due to the rotor weight and spring-loading force:

Motor type	Force due to the rotor weight F_L (N)	Spring-loading force F_C (N) +/- 25%
1PH3101	71	600
1PH3103	95	
1PH3105	125	
1PH3107	145	
1PH3131	224	800
1PH3132	224	
1PH3133	289	
1PH3135	347	
1PH3136	347	

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

The maximum axial force F_A as a function of the radial force is shown in the subsequent force diagrams.

The permissible axial force in the force diagrams is specified without consideration of the force due to the spring loading of the bearings, rotor weight for vertical mounting, and force direction.

Note

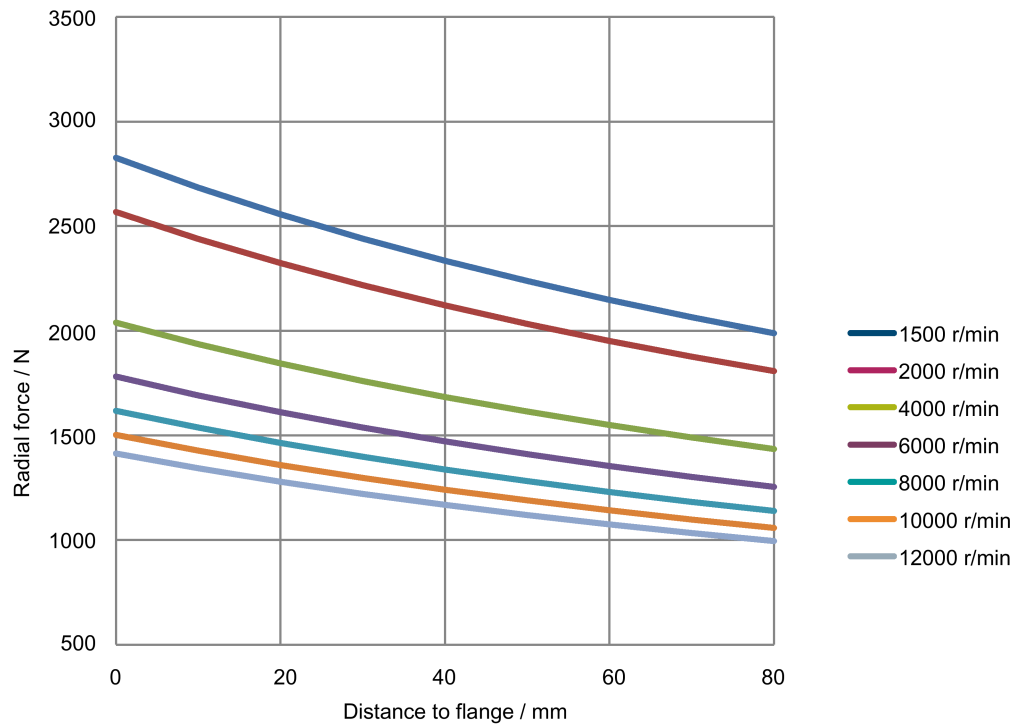
Determining the permissible axial force

The permissible axial force at the shaft extension is dependent on the application (mounting and force direction) and must be calculated.

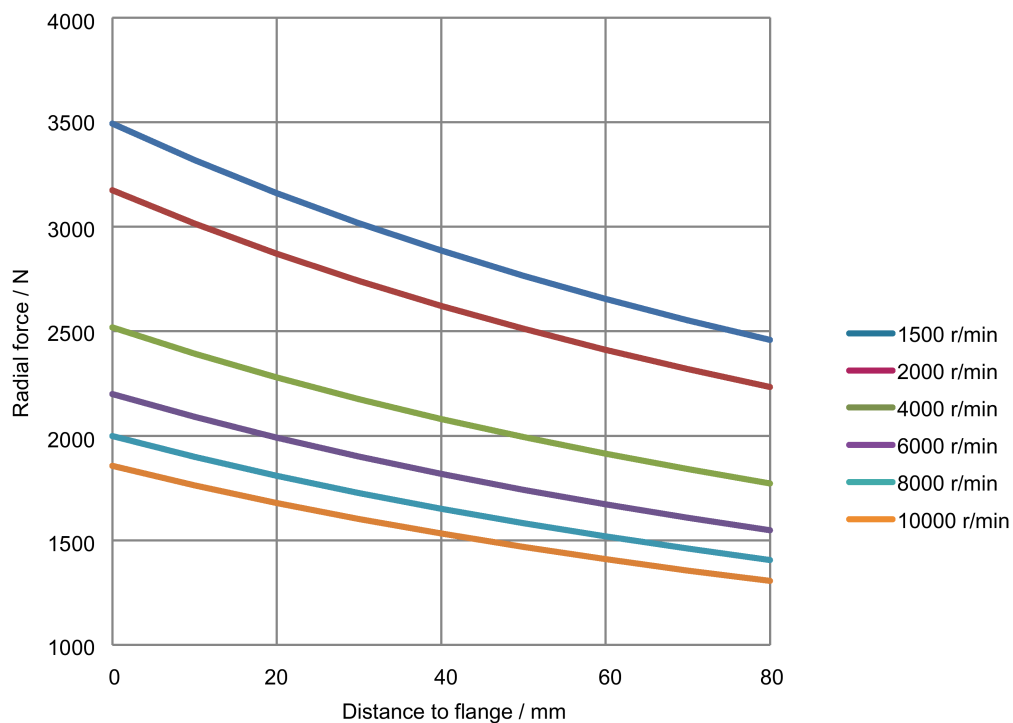
3.8.3 Radial and axial force diagrams

Permissible radial forces

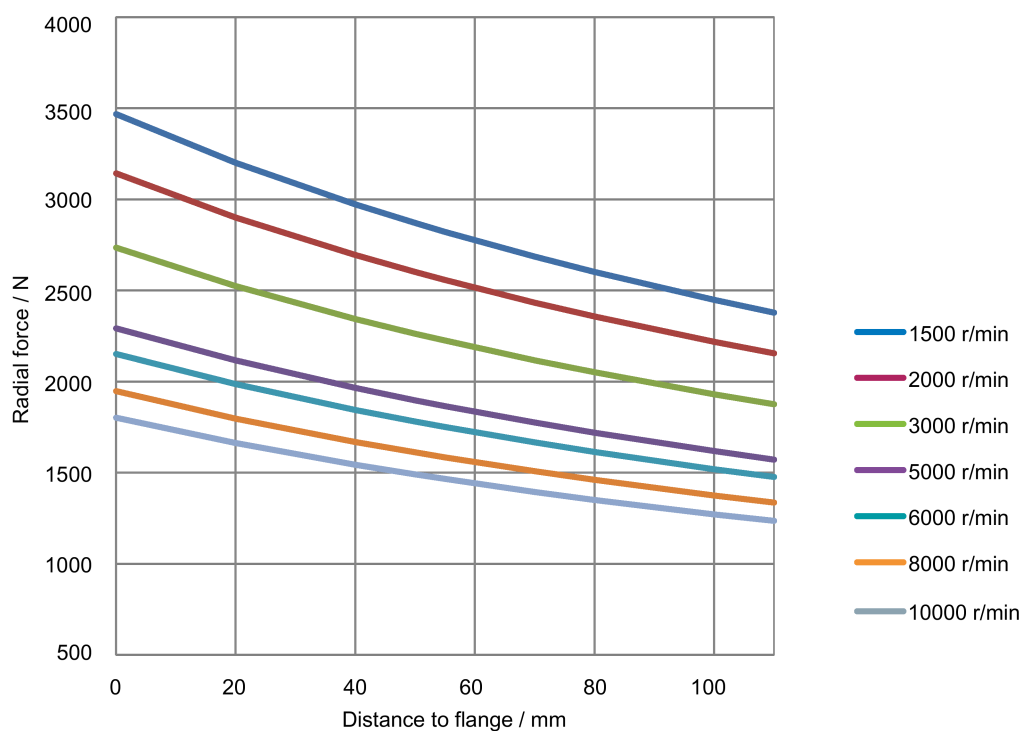
Shaft height 100, performance bearing version, 12000 h bearing lifetime



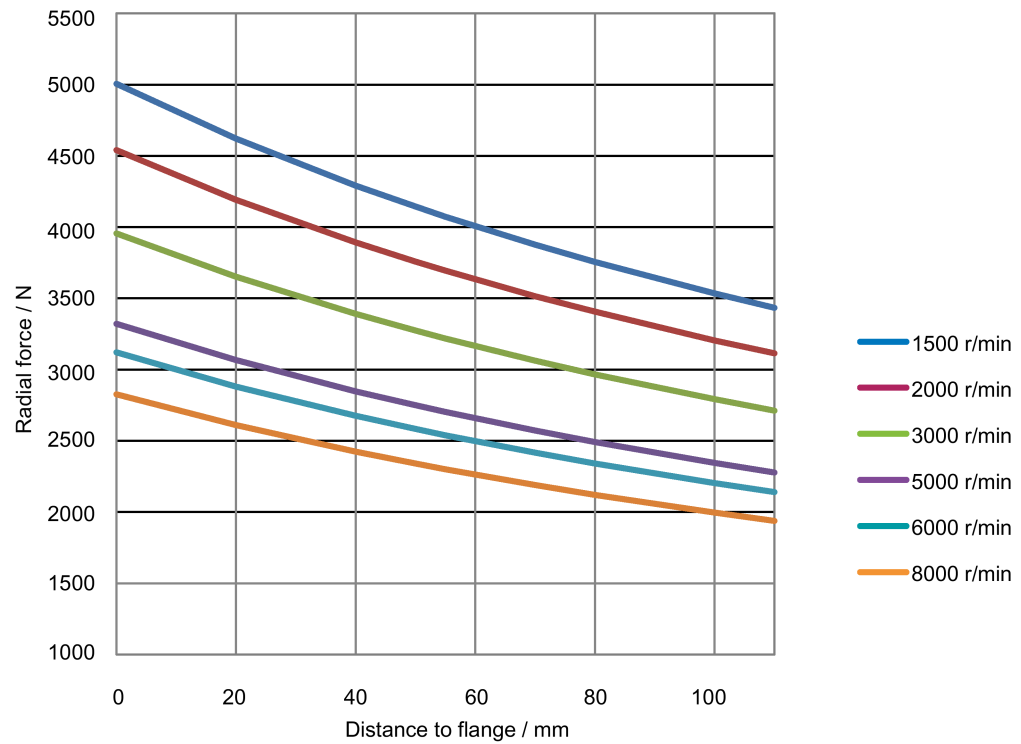
Shaft height 100, standard bearing version, 20000 h bearing lifetime



Shaft height 132, performance bearing version, 12000 h bearing lifetime

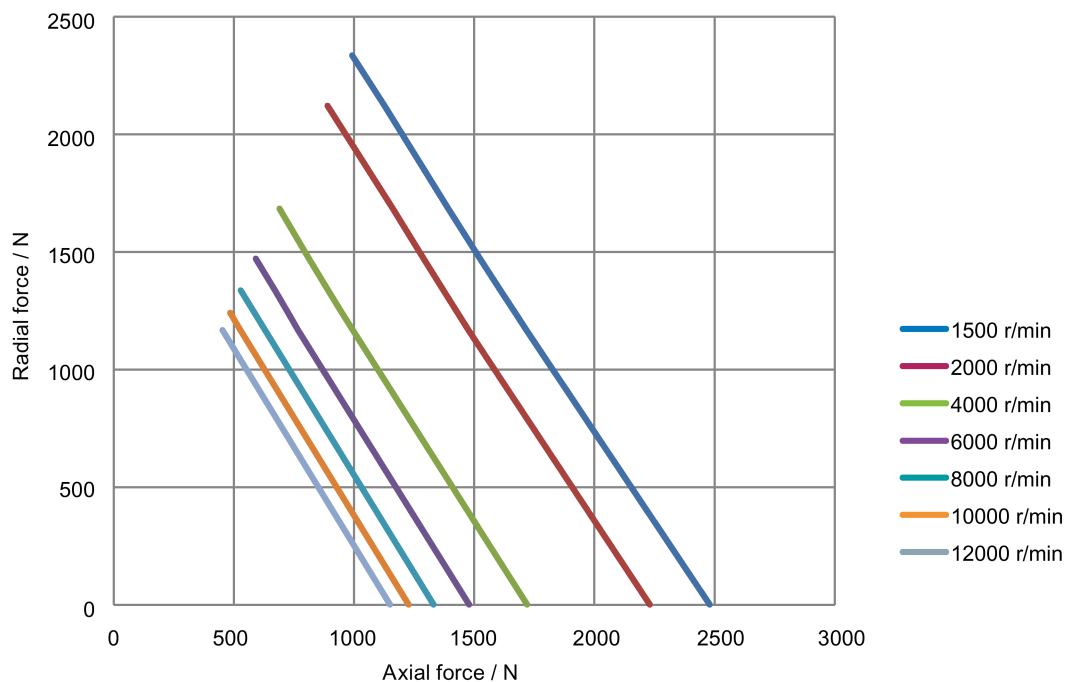


Shaft height 132, standard bearing version, 20000 h bearing lifetime

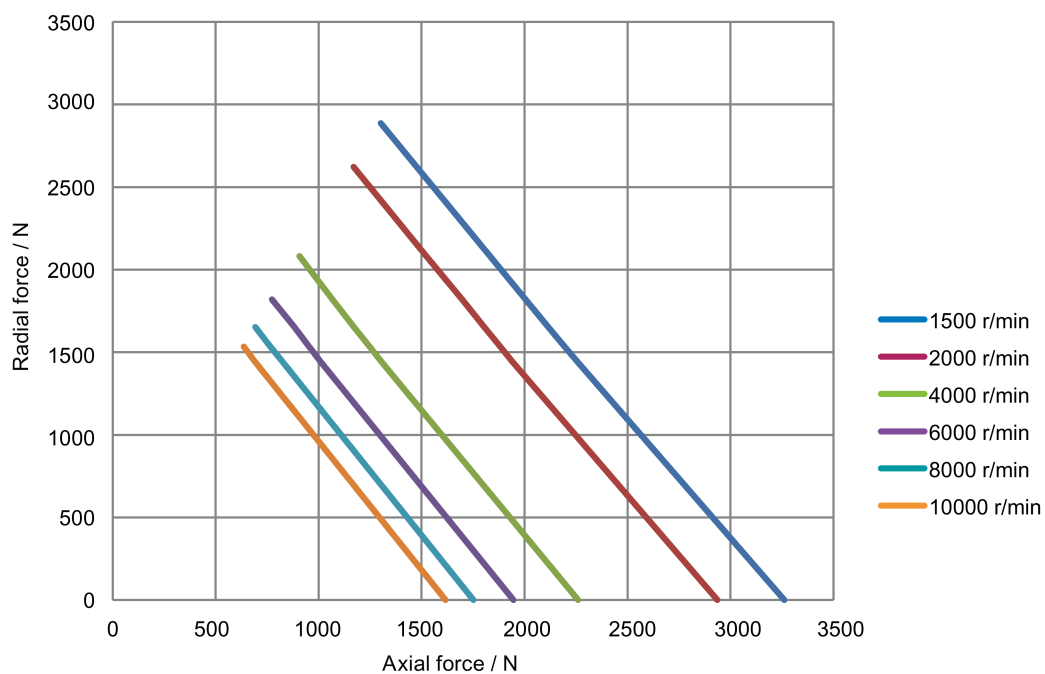


Permissible axial forces

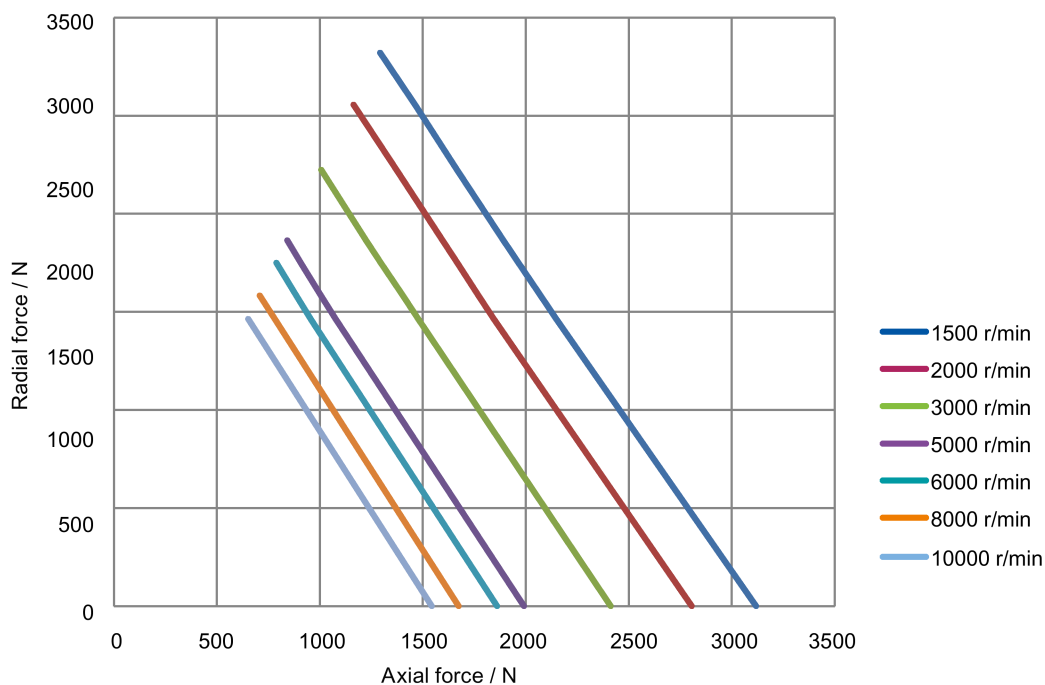
Shaft height 100, performance bearing version, 12000 h bearing lifetime



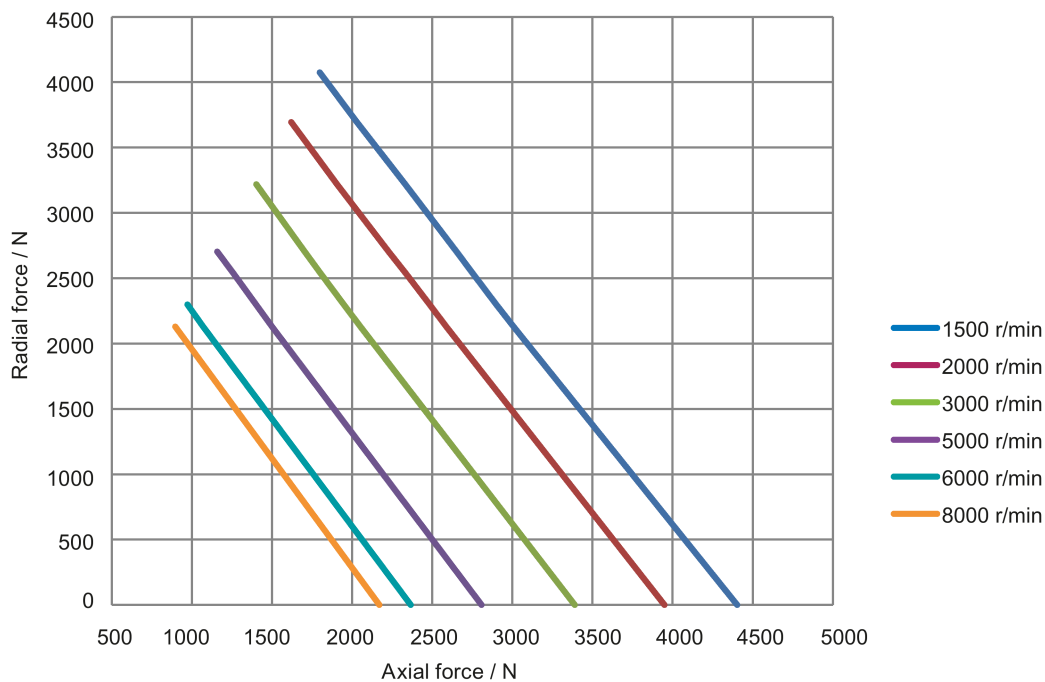
Shaft height 100, standard bearing version, 20000 h bearing lifetime



Shaft height 132, performance bearing version, 12000 h bearing lifetime



Shaft height 132, standard bearing version, 20000 h bearing lifetime



3.9 Radial eccentricity, concentricity and axial eccentricity

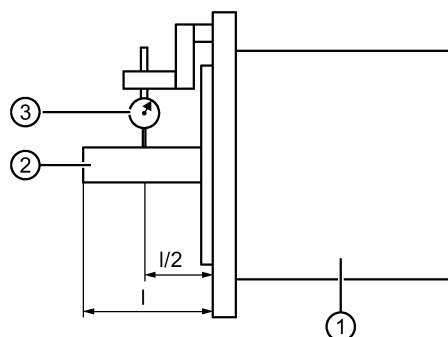
The shaft and flange accuracies are always obtained in accordance with IEC 60072 and DIN 42955-1981 and defined as follows:

- Radial eccentricity tolerance: tolerance of the motor shaft (cylindrical shaft extension) in relation to the frame axis
- Concentricity and axial eccentricity tolerance: tolerance of the motor shaft in relation to the flange surface (centering diameter of the mounting flange)

The table below provides the detailed tolerance values for the 1PH3 motors:

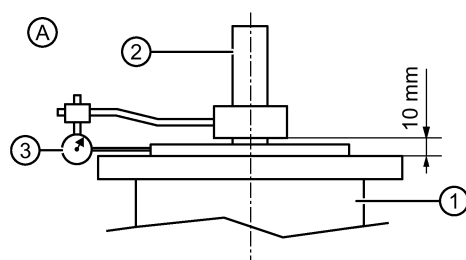
Shaft height (mm)	Mounting method	Radial eccentricity tolerance level R	Concentricity and axial eccentricity tolerance level R
100	Foot mounting	0.025	0.05
132			
100	Flange mounting	0.025	0.05
132			
132	Flange mounting (1PH8 compatible)	0.025	0.063

Checking the radial eccentricity

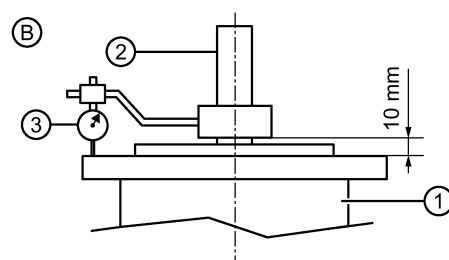


- ① Motor
- ② Motor shaft
- ③ Dial gauge

Checking the concentricity and axial eccentricity



- A Check for concentricity
- B Check for axial eccentricity



- ① Motor
- ② Motor shaft
- ③ Dial gauge

3.10 Balancing

Requirements on the process of balancing mounted components - especially belt pulleys

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

If the motor and the mounted components are separately balanced before they are assembled, the process for balancing the belt pulleys or coupling must be adapted to the motor balancing type.

The 1PH3 motors support the following balancing types:

- Shaft with key: half-key balancing (an "H" is stamped on the shaft face)
- Plain shaft: without keyway

The balancing type is coded in the article number.

Note

Machining the feather key

In the case of a half-key balanced shaft extension or a short output component, remove if necessary the part of the feather key which protrudes out of the output component and beyond the shaft contour. This is urgently recommended in the case of speeds above 1000 r/min and high requirements on the balance quality. To meet the highest requirements on the system dynamic balance quality, you are recommended to use motors with a plain shaft (without keyway).

See the table below for requirements on the balancing process as a function of the motor balancing type:

Balancing equipment/process step	Motor with half-key balancing	Motor with a plain shaft
Auxiliary shaft to balance the mounted components	<ul style="list-style-type: none"> Auxiliary shaft with keyway Keyway with the dimensions same as at the motor shaft extension Auxiliary shaft half-key balanced 	<ul style="list-style-type: none"> Auxiliary shaft without keyway If required, using a tapered auxiliary shaft
	<ul style="list-style-type: none"> Balance quality of the auxiliary shaft $\leq 10\%$ of the required balance quality of the components to be mounted on the motor 	
Attaching the mounted components to the auxiliary shaft for balancing	<ul style="list-style-type: none"> Mounted components attached via a key Design, dimensions, and materials of the key same as at the motor shaft extension 	<ul style="list-style-type: none"> Attaching the mounted components as far as possible without any clearance, for example, using a light press fit on the tapered auxiliary shaft
Positioning the mounted components on the auxiliary shaft	<ul style="list-style-type: none"> Mounted components attached in a position on the auxiliary shaft same as on the actual motor 	<ul style="list-style-type: none"> No special requirements
Balancing the mounted components	<ul style="list-style-type: none"> Two-plane balancing recommended, that is balancing carried out 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, it's recommended 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 components.

3.11 Vibration response

3.11.1 Mounting and mounting instructions

To ensure smooth, vibration-free motor operation, you must mount the motor correctly and precisely by observing the mounting instructions carefully. For more information, see Section "Mounting the motor (Page 70)".

3.11.2 Natural frequency for mounting

The motor is a system that can vibrate at its natural frequency. This natural frequency lies above the specified maximum speed.

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

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

Note

Avoiding natural frequencies during mounting

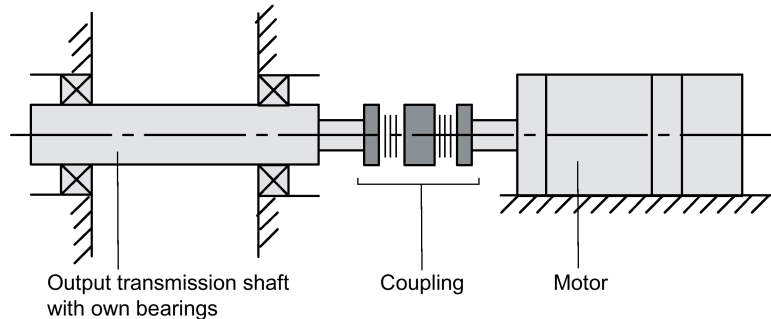
The motor must be carefully mounted on adequately stiff foundations or bedplates. Additional elasticities of the foundations or bedplates can result in resonance effects at the natural frequency and operating speed and therefore result in inadmissibly high vibration values.

The magnitude of the natural frequency occurring when the motor is mounted depends on the following factors:

- Mechanical transmission elements (gearboxes, belts, couplings, pinions, and so on)
- Stiffness of the machine onto 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 driven machine
- Construction type, that is, IM B5, IM B3, IM V5, and IM V1
- Motor weight distribution, that is, length and shaft height

3.11.3 Misalignment

To avoid or minimize misalignment, you are recommended to use a compensating coupling, as shown in the following figure:



You are recommended not to couple the motor directly or rigidly to an output transmission shaft that has its own bearings.

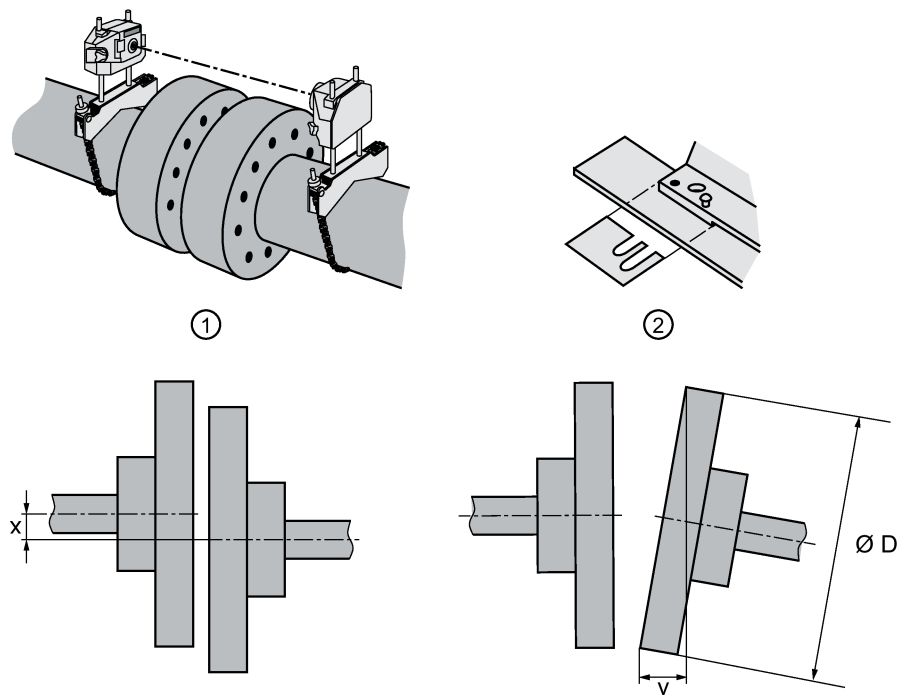
However, if a rigid coupling is absolutely necessary for mechanical design reasons, misalignment deviations must be avoided. In this case, be sure to check the deviations carefully by means of the appropriate measurements.

Vertical and horizontal alignment

To compensate for any radial offset at the coupling and to horizontally adjust the motor with respect to the driven load, perform the following operations:

- Place shims under the motor feet to position the motor vertically and to prevent the stress in the machine. Keep the number of shims as small as possible by using a few thicker shims instead of several thinner ones.
- For horizontal positioning, push the motor sideways on the foundation while remaining the axial position unchanged.
- When positioning the motor, ensure that the axial gaps around the coupling are uniform. In this case, the alignment accuracies of the driven load and coupling must be taken into consideration.

Alignment accuracy



Proceed through the following steps to align the motor:

1. Align the motor with coupling outputs in such a manner that the center lines of the shafts are parallel with no offset. This ensures that no additional force affects the bearings of the shafts during operation.
2. Perform fine adjustments with shims under all the motor feet.

The table below provides permissible deviations during motor aligning:

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

3.11.4 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 limit the critical rotational frequencies of the motor within the lower speed ranges.

When external components are directly mounted onto the motor shaft, you are recommended to balance the overall system precisely in order to minimize/avoid exciting vibration.

Operation in the resonance range must be avoided.

3.11.5 Vibration stressing

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

Under certain circumstances, the rotor may have to be balanced together with the output components.

To ensure normal operation and a long service life, you must not exceed the vibration values according to ISO 10816 at the defined measuring points on the motor.

See the following table for maximum permissible radial vibration values ¹⁾:

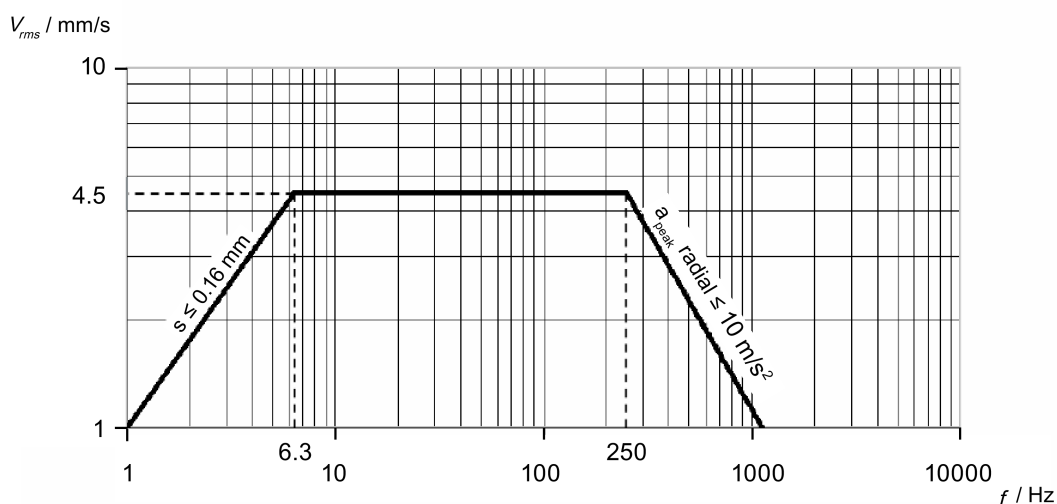
Vibration frequency	Vibration values
< 6.3 Hz	Vibration amplitude $s \leq 0.16$ mm
6.3 Hz to 250 Hz	Vibration velocity $v_{rms} \leq 4.5$ mm/s
> 250 Hz	Vibration acceleration $a_{peak radial} \leq 10$ m/s ²

See the following table for maximum permissible axial vibration values ¹⁾:

Vibration velocity	Vibration acceleration
$v_{rms} = 4.5$ mm/s	$a_{peak axial} = 2.25$ m/s ²

¹⁾ Values in both columns must be considered simultaneously.

The following figure provides the maximum permissible radial vibration velocity including the vibration amplitude and vibration acceleration:



The measuring equipment for measuring the vibration velocity must fulfill the requirements of ISO 2954. The vibration acceleration must be measured as a peak value within the time period based on a frequency band of 10 Hz to 2000 Hz.

If appreciable vibration excitation at a frequency of over 2000 Hz, for example, gear teeth meshing frequency, can be expected, the measurement range must be adapted accordingly. This does not alter the maximum permissible vibration values.

Note

Avoiding continuous operations at natural frequencies

Uninterrupted duty at 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, you are recommended to support flanged-mounted motors at the NDE.

Note

Measuring vibration values according to the relevant directives

Vibration must be analyzed and measured, for example, measuring points, according to ISO 10816-3.

3.12 Vibration severity

The 1PH3 motors are provided with the following vibration qualities in accordance with Siemens/EN 60034-14 (IEC 60034-14):

Vibration quality	14 th position of the article number
S	G, L
SR	K

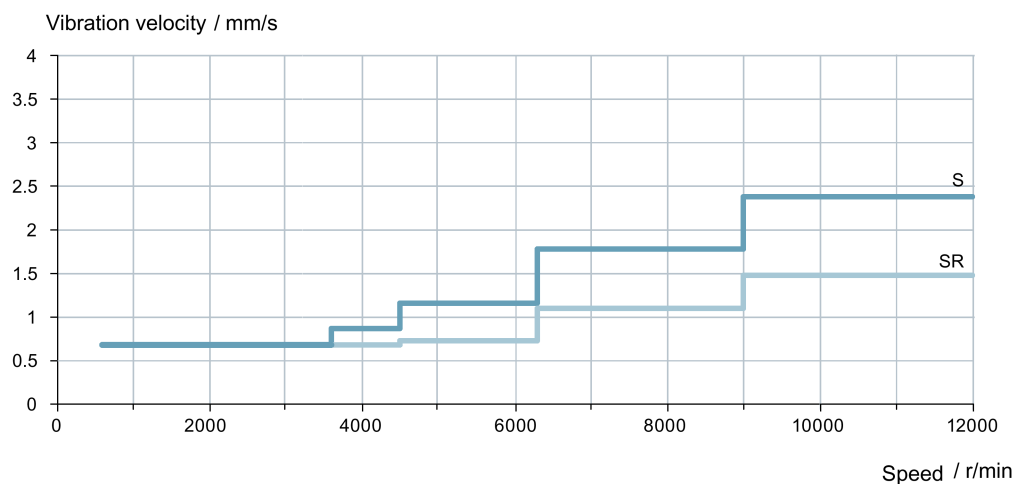
Note

The vibration quality depending on the bearing is encoded in the article number. For more information, see Chapter "Motor rating plate (Page 23)".

The vibration 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 of the motor.

Different applications require different bearings. As a result, a high load capacity for radial forces is not compatible with a high speed and high vibration quality.

The following figure provides vibration severity limit values over various speed ranges:



3.13 Noise emission

The sound pressure level (1 m) of the 1PH3 motors is no higher than 73 dB (A) when the following conditions are satisfied:

- At no-load operation
- At a speed up to the maximum speed
- At a rated pulse frequency of 4 kHz

Preparation for use

4.1 Shipment and packaging

Checking the delivery for completeness

Upon receipt of the delivery, check immediately whether the components delivered are in accordance with the accompanying documents. Siemens will not accept any claims relating to components missing from delivery and which are submitted at a later date.

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

For detailed information about the components included in the package, see Chapter "Scope of delivery (Page 22)".

4.2 Transportation and storage

WARNING

Death, severe injury and/or material damage resulting from lifting and transporting

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

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

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

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

- Only lift the motor by using the lifting eyebolts on the bearing and shields.
- Use all of the lifting eyebolts when transporting.
- Do not attach a lifting eyebolt to the shaft extension.
- Never lift the motor by the encoder system.
- Use a crossbeam if you lift and /or transport the motor by using the eyebolts provided (according to DIN580). Note the following:
 - Completely screw in the eyebolts (lifting eyebolts) and tighten by hand, approx. 8 Nm. Do not overtighten the eyebolts.
 - Do not remove the pressboard washers and do not use deformed or damaged eyebolts.
 - Loads that run transverse to the ring plane are not permitted.
 - If the motor is installed with the shaft extension pointing downwards or upwards, the lifting eyebolts must be changed over. You can find the arrangement of the eyebolts in Chapter "Transporting (Page 62)".

4.2.1 Transporting

Note**Transportation conditions**

Comply with the local national regulations for the transportation of motors.

Note**Observing the notes**

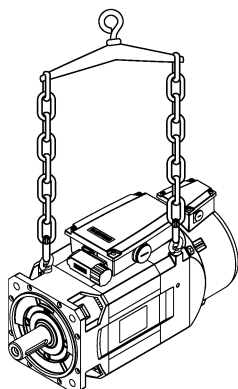
Observe the information on the original packaging and in this documentation when transporting and setting down the motor.

NOTICE**Bearing damage during transport**

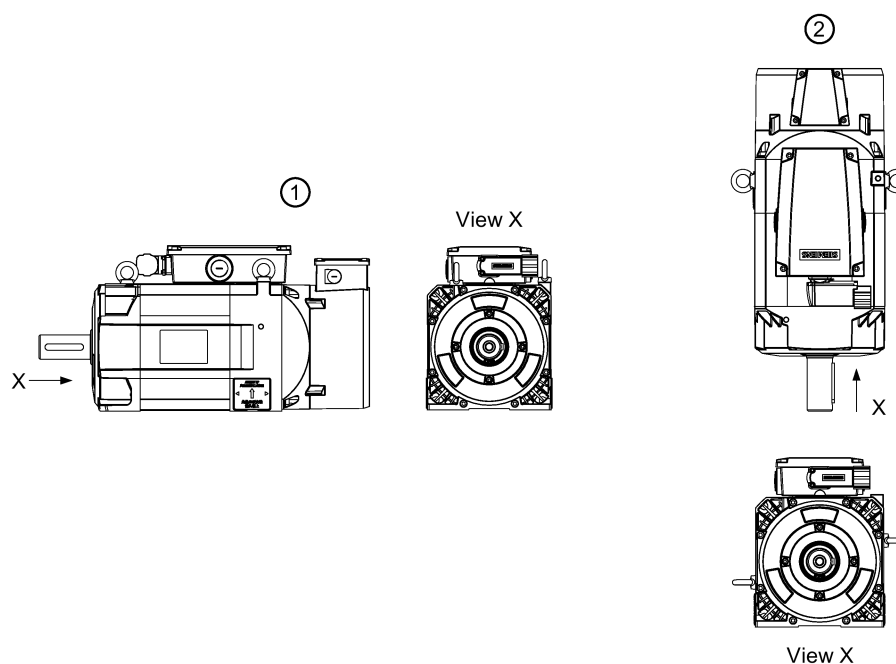
If the customer has already mounted parts, for example coupling, belt pulley and so on, the bearing can be damaged during transport.

- In this case, make sure that the customer uses a rotor locking device.

Lifting and transporting the motor with a crossbeam (example)



Location of the lifting eyebolts on the motor



- ① Horizontal shaft extension (standard)
- ② Shaft extension pointing downwards

Transporting a motor that has already been operated

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

1. Cool down the motor.
2. Remove the connections established by the customer.
3. Always transport and lift the motor with the lifting eyebolts on the bearing end shields.

4.2.2 Storing

The motors can be stored for up to two years in a favorable condition without the specified bearing lifetime being reduced.

Note**Storage**

If possible, store the motor in its original packaging. Take necessary anti-rust measures at the shaft extension regularly.

Note**Replacing roller bearings**

- Even if the motor has been stored for more than two years under favorable conditions, you must replace the bearings.
 - If the motor has been stored under unfavorable conditions, you must replace the bearings after approximate 18 months.
-

NOTICE**Seizure damage to bearings due to the incorrect storage**

If the motors are stored incorrectly, bearing seizure damage can occur, for example, brinelling, as a result of vibrations.

- Observe the instructions for storing the motor.

Short-term storage

To store the motor for less than six months, observe the instructions below:

- Apply a preservation agent to bare or external components for example, shaft extensions, if this has not already been carried out in the factory.
- Store the motor in an area that fulfills the following requirements:
 - Relative humidity: < 60%
 - Temperature: -15 °C to +55 °C
 - Vibration: $V_{rms} < 0.2$ mm/s
 - Well ventilated
 - Dust-free
 - Offers protection against extreme weather conditions
 - No harmful gases in the air of the storage area
- Protect the motor against shocks and humidity.
- Make sure that the motor is covered properly.
- Avoid contact corrosion. Siemens recommends you to rotate the shaft extension manually every three months.

Long-term storage

If you intend to place the motor in storage for longer than six months, you must ensure that the storage area satisfies the following conditions.

Table 4- 1 Environmental conditions for long-term storage in the product packaging according to Class 1K3 to EN 60721-3-1 - with the exception of influencing environmental variables "Air temperature", "Highest relative humidity" and "Condensation"

Climatic ambient conditions	-15 °C to +55 °C
Highest relative humidity	< 60%, condensation not permissible
Mechanical ambient conditions	vibration-free storage room $V_{rms} < 0.2$ mm/s
Protection against chemical substances	Protected in accordance with Class 1C2
Biological ambient conditions	Suitable in accordance with Class 1B2
Duration	<ul style="list-style-type: none">• Six months for the conditions listed above.• Special preservation measures are required for storage period of six months up to two years.

Check the correct state of the motor every six months.

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

Condensation

The following ambient conditions encourage the formation of condensation:

- Large fluctuations of the ambient temperature
- Direct sunshine
- High air humidity during storage

Avoid these ambient conditions.

Use a dehydrating agent in the packaging.

Mounting the motor

Protection against the spread of fire

The device may be operated only in closed housings or in control cabinets with protective covers that are closed, and when all of the protective devices are used. The installation of the device in a metal control cabinet or the protection with another equivalent measure must prevent the spread of fire and emissions outside the control cabinet.

Protection against condensation or electrically conductive contamination

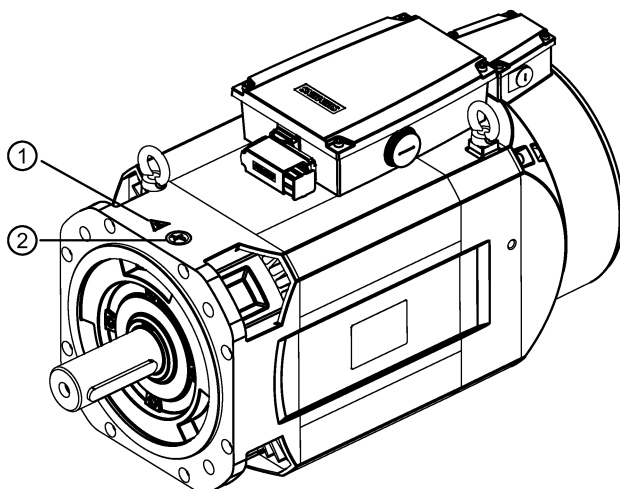
Protect the device, e.g. by installing it in a control cabinet with degree of protection IP54 according to IEC 60529 or NEMA 12. Further measures may be necessary for particularly critical operating conditions.

If condensation or conductive pollution can be excluded at the installation site, a lower degree of control cabinet protection may be permitted.

5.1 Overview

Safety symbols on the motor

The following warning and information labels are attached to the motor in the delivery state. Besides, the motor is supplied with three additional "Hot surface" warning labels.



- ① "Hot surface" warning sign
- ② "No shocks on the shaft extension" warning sign

NOTICE

Thermal damage to temperature-sensitive parts

Some parts of the motor enclosure can reach temperatures that exceed 100 °C. If temperature-sensitive parts, for example, electric cables or electronic components are in contact with hot surfaces, they can be damaged.

- Attach the supplied "Hot surface" warning labels to the hot surfaces and ensure that no temperature-sensitive parts are in contact with hot surfaces.

NOTICE

Damage to the encoder due to shocking

Shocks at the motor shaft extension can cause an encoder damage.

-  Do not exert any shock at the shaft extension.

NOTICE**Damage to the shaft sealing ring due to hitting or pressure**

Hitting or pressure at the shaft sealing ring can cause its movement and damage.

- Do not exert any hitting and pressure via the coupling or hammer at the shaft sealing ring.

Note**Technical data on the motor enclosure**

- Observe the technical data on the rating plate on the motor enclosure.

For more mounting conditions, see Section "Technical data and characteristics (Page 135)".

5.2 Mounting orientation and outline dimensions

5.2.1 Mounting orientation

The SIMOTICS M-1PH3 motors support the following construction types:

- IM B3
- IM V5
- IM B5
- IM V1

For more information, see Section "Construction types (Page 37)".

Minimum clearance between a fan and adjacent components

The minimum clearance S between the air intake/air discharge opening and adjacent components must be maintained. For motor information, see Section "Cooling (Page 33)".

5.2.2 Outline dimensions

For more information about the motor dimensions, see Section "Motor dimensions (Page 38)".

5.3 Mounting the motor

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, it's recommended that the complete unit is dynamically balanced after couplings or belt pulleys have been mounted.
- Use suitable equipment when mounting drive elements. Use the threaded hole at the shaft extension.
- Do not apply any shock or axial pressure to the shaft extension.
- Especially for high-speed motors with flange mounting, ensure 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.
- Place thin sheets (shims) under the motor mounting feet to align the motor and to avoid mechanically stressing the motor. Keep the number of used shims to a minimum.
- In order to securely mount the motor as well as reliably and safely transfer the drive torque, use bolts with property class 8.8 according to ISO 898-1.

Note

Complying with permissible vibration values

All flange-mounted motors must have a stable motor suspension assembly. In a high-speed weakening field, the motors must be supported by the appropriate feet at the bearing end cover (foot/flange type of construction). For more information about vibration severity limit values, see Section "Vibration severity (Page 59)".

Support using feet at the bearing end cover is not required if the following conditions are met:

- For flange-mounted motors, there is a stable motor suspension design.
- The permissible vibration values according to ISO 10816 are kept.

Motors that are mounted, as a result of their type of construction, onto the cabinet wall with the motor feet, must be fixed in place via an adequately dimensioned fit, for example, studs or mounting rails.

When commissioning the motors, make sure that the permissible vibration values according to ISO 10816 are kept.

NOTICE
Damage to the bearing and bearing grease due to liquid at the flange
If liquid accumulates at the flange because of vertical or horizontal mounting, the bearing and bearing grease may be adversely affected.
<ul style="list-style-type: none">• Prevent liquid from accumulating at the flange.

Note

Using the eyebolts

Lift the 1PH3 motors only at the eyebolts.

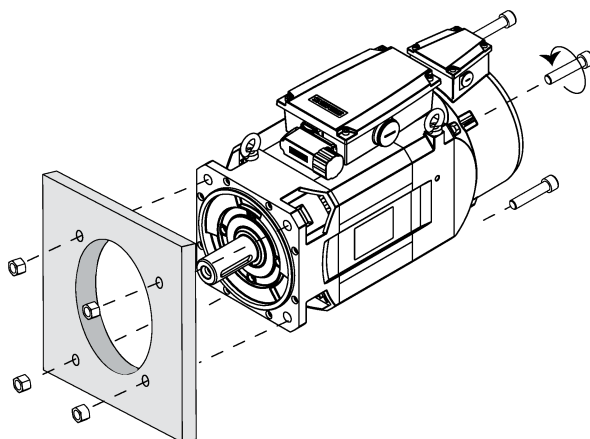
Note

Cooling air

The motor must be mounted in such a way that the cooling air can flow in and out without restriction. For more information, see Section "Cooling (Page 33)".

Flange mounting

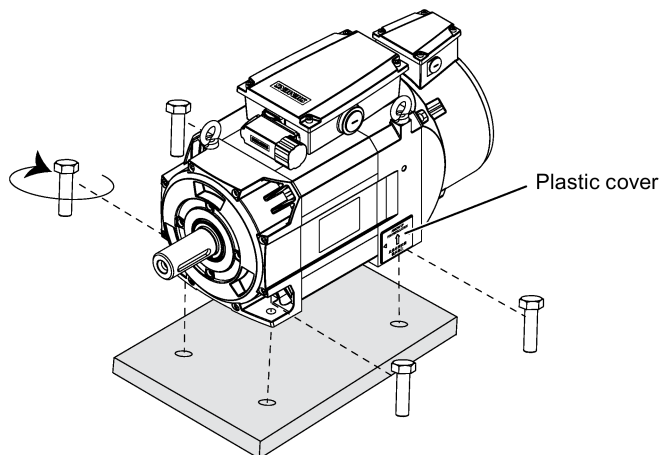
Mount the motor through a mounting steel flange. Note that for shaft height 132 mm motors, there are two kinds of flanges for selection. For more information, see Chapter "Motor dimensions (Page 38)".



Motor variant	Screw	Tightening torque
Flange mounting		
1PH310-1-0002-00A0	4 × M12	84 Nm
1PH313-1-0002-00A0	4 × M12	84 Nm
Flange mounting (1PH8 compatible)		
1PH313-1-0004-00A0	4 × M16	165 Nm

Foot mounting

Remove the plastic cover, fix the motor to the mounting plate with screws, and then reinstall the plastic cover.



Motor variant	Screw	Tightening torque
Foot mounting		
1PH310□-1□□00-□□A0	4 × M10	39 Nm
1PH313□-1□□00-□□A0	4 × M12	84 Nm

5.4 Attaching the output elements

Balancing

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

Shaft with key: half-key balancing (an "H" is stamped on the shaft face)

Attaching the output components

Do as follows when attaching the output components:

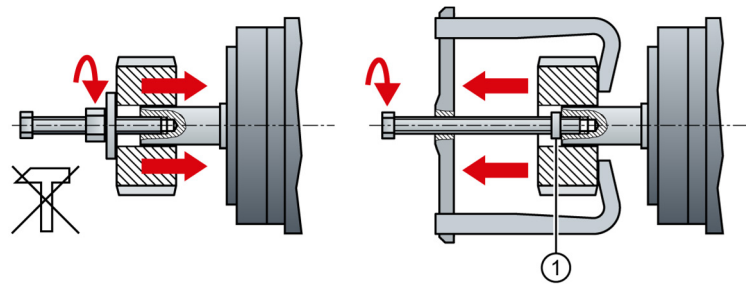
- Make sure that the balancing method of the output components is correct. The output components must be balanced to balance quality grade G2.5 according to ISO 1940. Rotary forces that exceed this are not permissible. Note that rotary forces can also occur with coupling outputs.
- If an output component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

WARNING

Danger to life if rotating output components have no guard

Exposed rotating output components can result in severe injury.

- Cover all exposed output components using an appropriate guard.



- ① Intermediate washer/disk (to protect the centering in the shaft extension)

Motor without output components

WARNING

Danger to life if the feather key is flung out

A feather key in the shaft is only secured during transport to avoid any falling out of the key. An open feather key sitting in the shaft will be flung out in operation. Death or serious injury can result.

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

5.5 Installation as a direct drive for spindles

General procedure

1. Run in the bearings.

The bearings are run in at the factory in order to ensure that the bearing grease is displaced before the motor is shipped. This precaution protects the bearings against damage when the motor is accelerated to the maximum speed. However, it does not ensure optimum distribution of the lubricating film. Experience has shown that the lubricating film is not optimally distributed until the motor has been in operation for a significant period of time, that is, up to 30 hours.

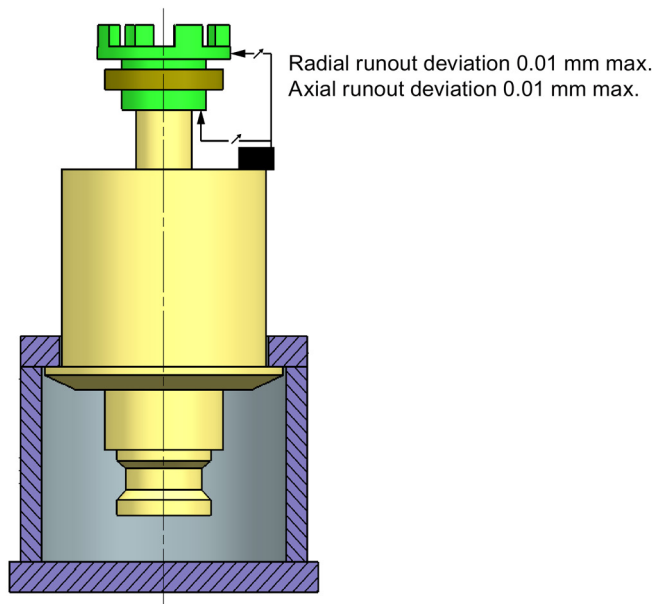
Before installing the motor, run in the bearings. This must be done for the following motors:

- New motors
- Motors that have been in transport for a long time
- Motors that have been in storage for a long time

Bearing noise will occasionally be audible during bearing run-in. The longer the motor is in operation, the quieter the bearings will become until the noise disappears altogether.

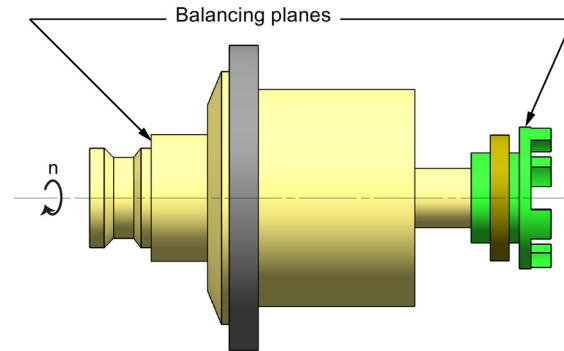
2. Mount the coupling half on the spindle.

The radial/axial runout deviation between the coupling and the spindle axis will determine how smoothly the spindle will run when the coupling half is mounted. Observe the specified tolerances.

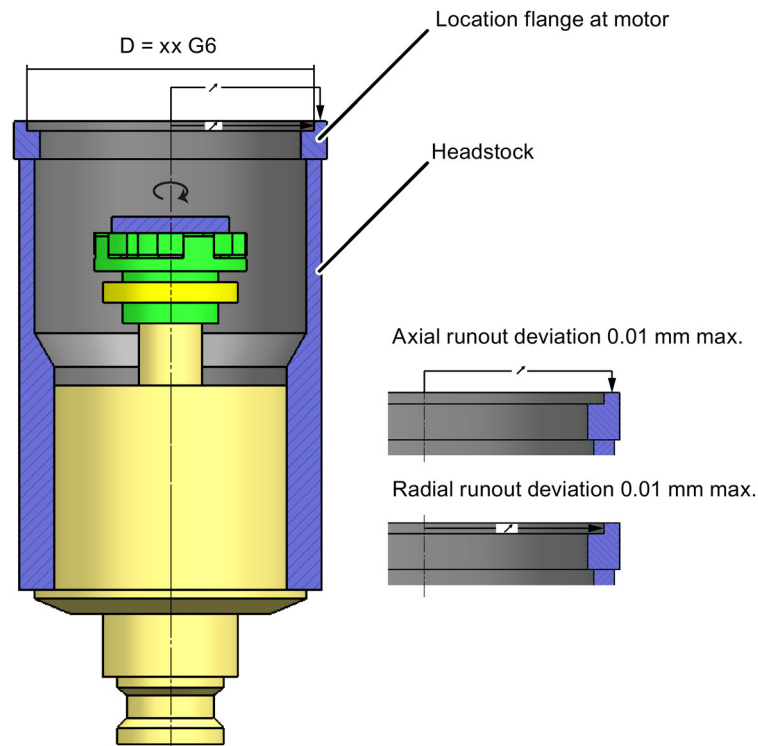


3. Balance the complete assembly (spindle with mounted coupling half).
Balance the complete assembly, that is, spindle with the mounted coupling half, on a suitable fixture.

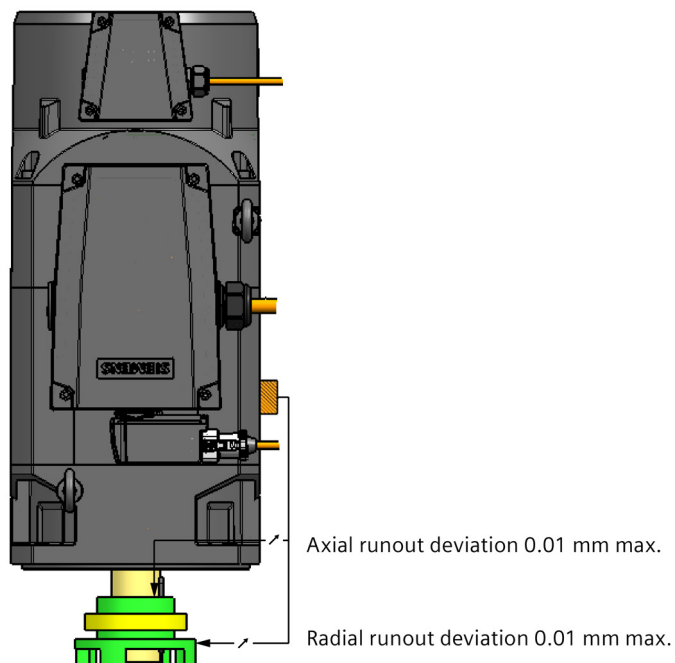
Residual imbalance $u = G1 \text{ g/mm}$



4. Install the spindle in the headstock.
You need to align the location flange for the motor centering shoulder to ensure that the motor shaft and spindle shaft are precisely aligned. Make sure that the radial/axial runout deviation does not exceed 0.01 mm.
For centering the motor, we recommend a G6 fit for the motor location flange.

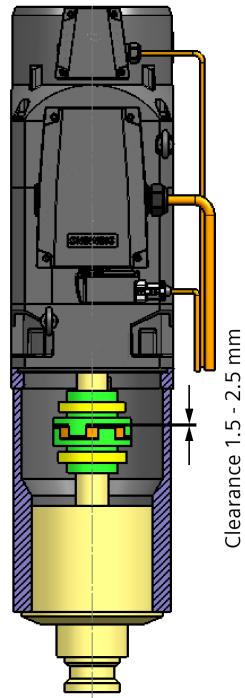


5. Mount the coupling half on the motor shaft.

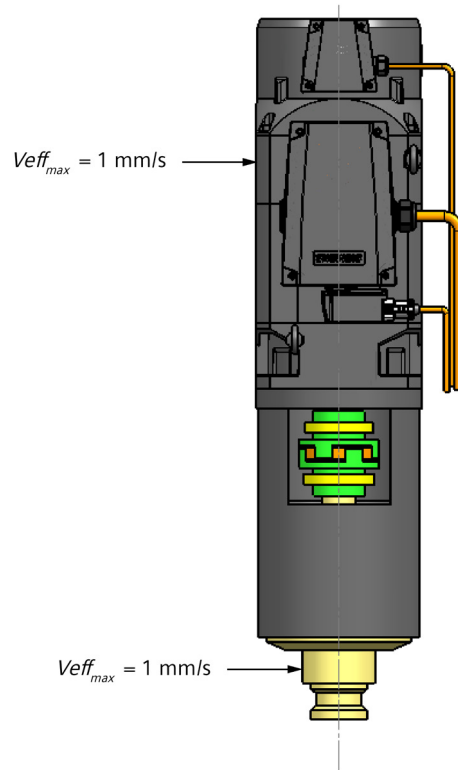


6. Balance complete assembly, that is, motor with the mounted coupling half.
Balance the motor when it is completely assembled with the coupling half. The aim is to achieve the same vibration levels as the motor would exhibit without the coupling half.

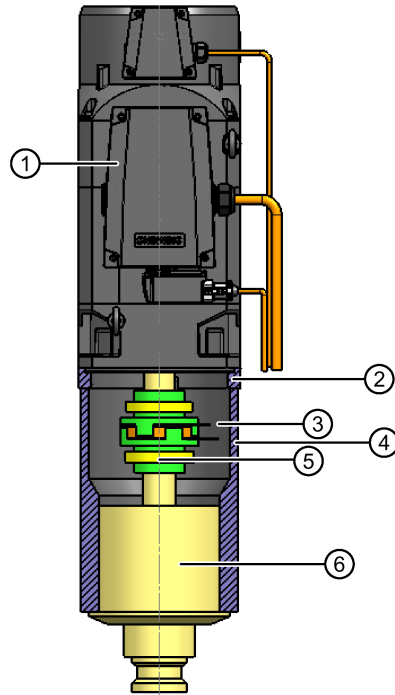
7. Mount the motor on the headstock.
The coupling must exhibit an axial clearance of between 1.5 mm and 2.5 mm in order to prevent constraining forces exerted by the motor/spindle assembly.



8. Check the smooth running performance of the complete drive train.
To ensure satisfactory smooth running and a long bearing service life, the specified vibration velocity values must not be exceeded at any point along the train.



9. Balance the complete drive train.
The complete drive train will need to be balanced if the specified vibration velocity values cannot be achieved.



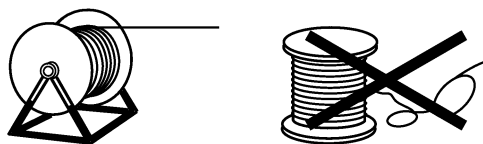
- ① 1PH3 motor
- ② Location flange for the motor
- ③ Coupling reference dimension
- ④ Spindle holder spindle housing
- ⑤ Rotex GS clamping ring hubs (steel)
- ⑥ Spindle

5.6 Notes on laying cables in drag chains

The MOTION-CONNECT cables satisfy requirements for use in drag chains. Observe the following notes when laying these cables in drag chains.

Laying cables

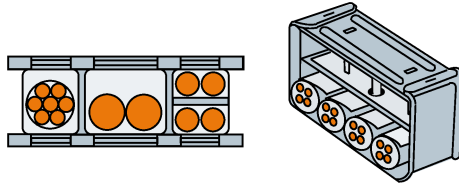
The cables must be removed from the drum without twisting, that is, the cables must be unwound and must never be lifted over the drum flange in loops.



5.6 Notes on laying cables in drag chains

To ensure a long service life of the drag chain and cable, lay cables made of different materials separately with separating webs in the drag chain.

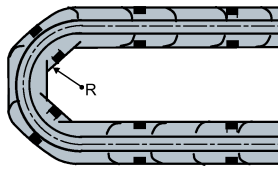
- Fill the webs evenly to ensure that the position of cables does not change during operation.
- Distribute cables as symmetrically as possible according to their weights and dimensions.
- Use webs to separate cables with different outer diameters.
- Keep cables untwisted in the drag chain.



Moving cables

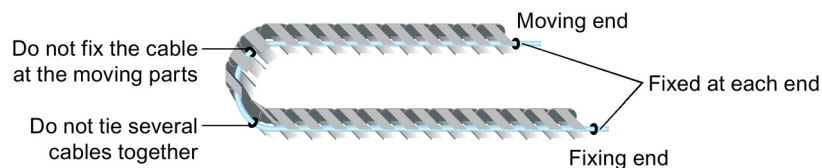
- Cables must be able to move without constraint, especially in the bending radii of the chain.
- Observe the specified minimum bending radii.

R: Bending radius on the drag chains



Fixing cables

- Make sure that cables in the drag chain are unattached and movable.
- Place the cable fixture in a "dead" zone at each end, suitably far away from each end point of the moving parts.



Electrical connection

6.1 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 the first fault between an active part and the ground must be signaled by a monitoring device. In accordance with IEC 60364-4-41, it is recommended that the first fault is eliminated as quickly as 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, and thus in this case an isolating transformer must be used.

6.2 Circuit diagram of the motor

You can find information on the circuit and on connecting the motor winding and auxiliary equipment (for example, the temperature sensor Pt1000 and encoder) in the circuit diagram. The circuit diagram is provided in the motor terminal box for the cable connection.

6.3 Connecting the motor components

6.3.1 Temperature sensor Pt1000

A temperature sensor Pt1000 is integrated in the stator winding to monitor the winding temperature.

The table below provides the technical data of the temperature sensor:

Type	Temperature sensor Pt1000
Resistance on a cold motor (20 °C)	Approximately 1090 Ω
Resistance on a hot motor (100 °C)	Approximately 1390 Ω
Connection	Via the encoder cable
Response temperature	Prewarning temperature: 150 °C ¹⁾ Alarm/trip temperature: 170 °C ± 5 °C

¹⁾ Exception: the prewarning temperature of 1PH3132-1DE□ motors is 160 °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 converter can be externally evaluated.

In the high short-term overload conditions, additional protective measures are required as a result of the thermal coupling time of the temperature sensor.

NOTICE

Destruction of the temperature sensor if the insulation resistance is tested improperly.

If the test voltage is applied to only one of the two temperature sensor terminals, the temperature sensor will be destroyed.

- Short-circuit the conductors of the temperature sensor cable before applying the test voltage.

NOTICE

Destruction of the motor for a thermally critical load

There is no adequate protection for a thermally critical load, for example, a high overload at motor standstill.

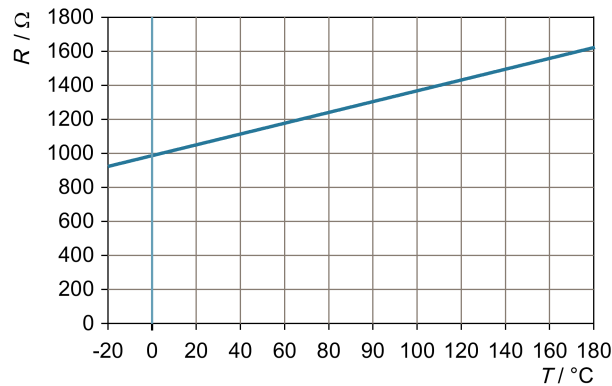
- Take additional protective measures, for example, using an overcurrent relay.
- Activate the thermal motor model i²t monitoring function in the converter.

Note

Connecting the temperature sensor

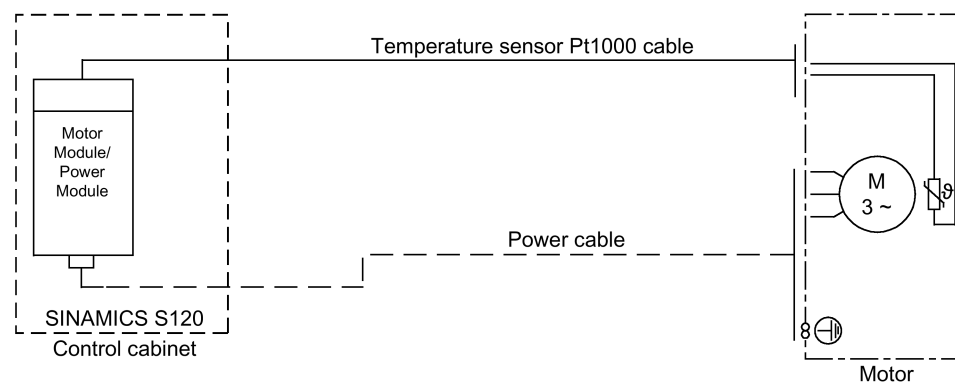
- For motors with an encoder:
The temperature sensor is connected to the encoder connector together with the speed encoder signal. The conductors for the temperature sensor are routed in the same cable together with the encoder conductors.
- For motors without an encoder:
The temperature sensor is connected to a signal terminal block in the motor terminal box. The temperature sensor cable is passed through the threaded hole in the front of the motor terminal box housing.

The following diagram shows the resistance characteristic as a function of the temperature for the temperature sensor Pt1000.



Wiring

Motors without an encoder can be directly connected to the corresponding Motor Module/Power Module via the available MOTION-CONNECT temperature sensor Pt1000 cable. The temperature sensor data is transferred directly to the Control Unit.



6.3.2 Encoder system

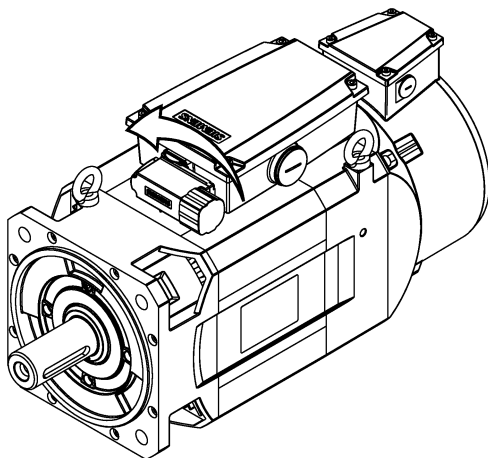
6.3.2.1 Overview

The encoder system of the 1PH3 motors is specified with the corresponding letter in the 9th position of the article number of the motor.

Encoder system	9th position of the article number	Motor variant	
		1PH310	1PH313
Incremental encoder, 22-bit, with commutation position	D	✓	✓
Without encoder	A	✓	-

6.3.2.2 Encoder connection

Motors with an encoder have an internal Sensor Module, which contains an encoder and temperature evaluation system as well as an electronic rating plate. This simplifies commissioning for the SINAMICS S120 drive system, since all the motor parameters are set automatically. The Sensor Module instead of the encoder connector is mounted and equipped with a 10-pin RJ45 socket, that is, DRIVE-CLiQ interface. The pin assignment of the interface is independent of the motor-internal encoder connector. The Sensor Module can be rotated approximately 180 degrees. The typical torsional torque is between 4 Nm and 8 Nm. The Sensor Module can be rotated only by hand. The use of, for example, pipe wrenches or hammers, is not permitted.



⚠ WARNING**Danger to life due to an incorrect Sensor Module**

The Sensor Module contains the motor and encoder-specific data and an electronic rating plate. If you use an incorrect Sensor Module, this can result in death, severe injury, and severe material damage.

- Only use the Sensor Module and the electronic rating plate for the original motor.
- Do not mount the Sensor Module onto other motors.
- Do not replace the Sensor Module by a Sensor Module of another motor.
- Only appropriately trained Siemens service personnel is allowed to replace the Sensor Module.

NOTICE**Damage to components that are sensitive to electrostatic discharge**

The DRIVE-CLiQ interface has a direct contact to components, for example, the encoder system and temperature sensor, that can be damaged/destroyed by electrostatic discharge (ESD). These components that are sensitive to electrostatic discharge (ESD) can be damaged if you touch the connections with your hands or with electrostatically charged tools.

- Carefully observe the information in Section "Equipment damage due to electric fields or electrostatic discharge (Page 16)".

DRIVE-CLiQ interface

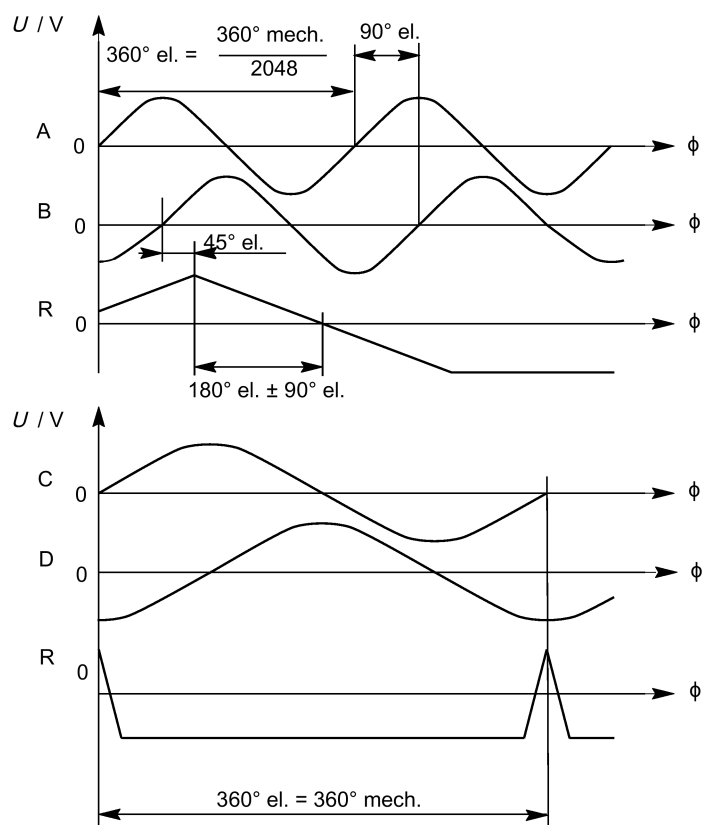
With the DRIVE-CLiQ interface, the encoder system of the 1PH3 motors provides the following functions:

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

Properties	Incremental encoder sin/cos 1 Vpp
Coupling	Integrated in the motor at the NDE
Operating voltage	+5 V $\pm$ 5 %
Current consumption	$\leq$ 150 mA
Incremental resolution (periods per revolution)	2048 S/R
Incremental signals	1 Vpp
Angular error	$\pm 40^\circ$
Maximum permissible speed	With 2048 S/R: 12000 r/min

The figure below provides the signal sequence and assignment of the motor-internal encoder connector for a positive direction of rotation (clockwise direction of rotation when viewed from the drive end).

6.3 Connecting the motor components

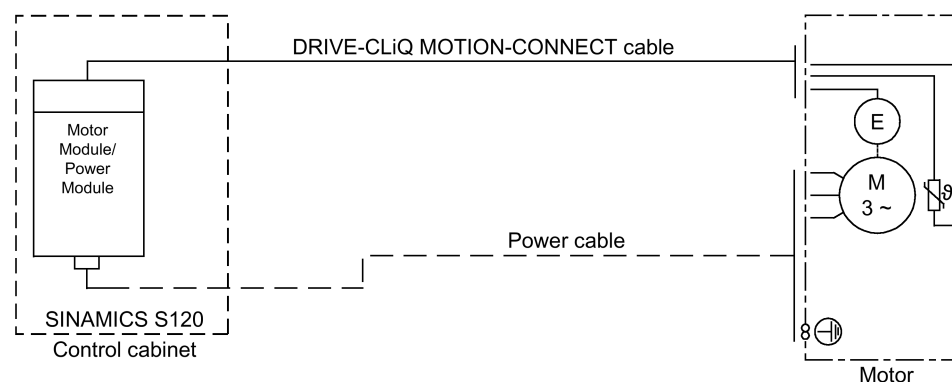


The table below provides the 10-pin RJ45 socket for being connected with the DRIVE-CLiQ MOTION-CONNECT cable.

Pin No.	Signal	Illustration
1	P_24V	
2	RJ_TXP	
3	RJ_TXN	
4	RJ_RXP	
5	Reserved	
6	Reserved	
7	RJ_RXN	
8	Reserved	
9	Reserved	
10	M 0V	

Wiring

Motors with an encoder can be directly connected to the corresponding Motor Module/Power Module via the DRIVE-CLiQ MOTION-CONNECT cable in degree of protection IP65. The encoder data is transferred directly to the Control Unit.



6.3.3 External fan

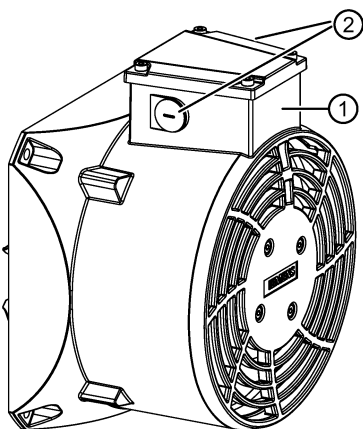
Technical data

Shaft height	Supply voltage	Frequency	Rated current	Rated power
100 mm	3 AC 380 V	50 Hz	0.13 A	45 W
	3 AC 480 V	60 Hz	0.14 A	50 W
132 mm	3 AC 380 V	50 Hz	0.21 A	100 W
	3 AC 480 V	60 Hz	0.24 A	130 W

For more information about the ventilation data and sound pressure level, see Sections "Cooling (Page 33)" and "Noise emission (Page 60)" respectively.

Connection

The external fan is connected in the fan terminal box. Connect the power supply in the fan terminal box, as shown in the figure below.



- ① Terminal box of the external fan
- ② Cable entries for line power connection on both sides of the fan terminal box housing

In the delivery condition, the cable entry is sealed with a plug.

Note**Cable gland**

The general connection instructions for the cable glands must be observed. The continuous sealing of the cable gland toward the terminal box and the cable must be ensured.

NOTICE**Damage to the machine due to a short circuit**

Water that accumulates at the cable glands can result in a short circuit, which can cause consequential damage to the machine.

- Make sure that the cable outlet does not face upward.

NOTICE**Incorrect direction of rotation**

The external fan can be rotated in only one direction. Operation with the wrong direction of rotation can destroy the motor.

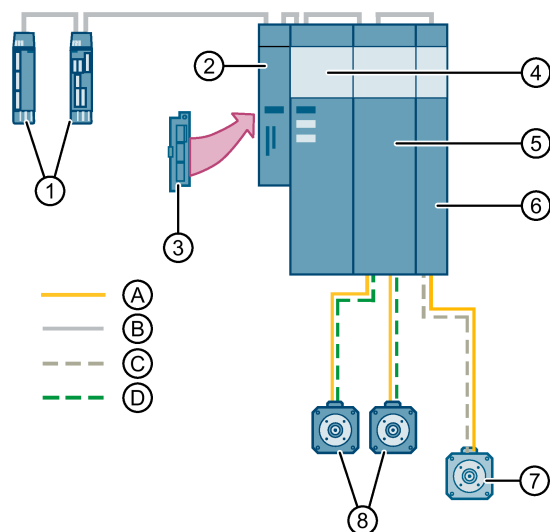
- If necessary, change the direction of rotation by interchanging any two conductors of the three phase conductors (U, V, and W) in the terminal box. You can find the arrow indicating direction of rotation on the fan rating plate.

6.4 System integration

6.4.1 SINAMICS drive I/O

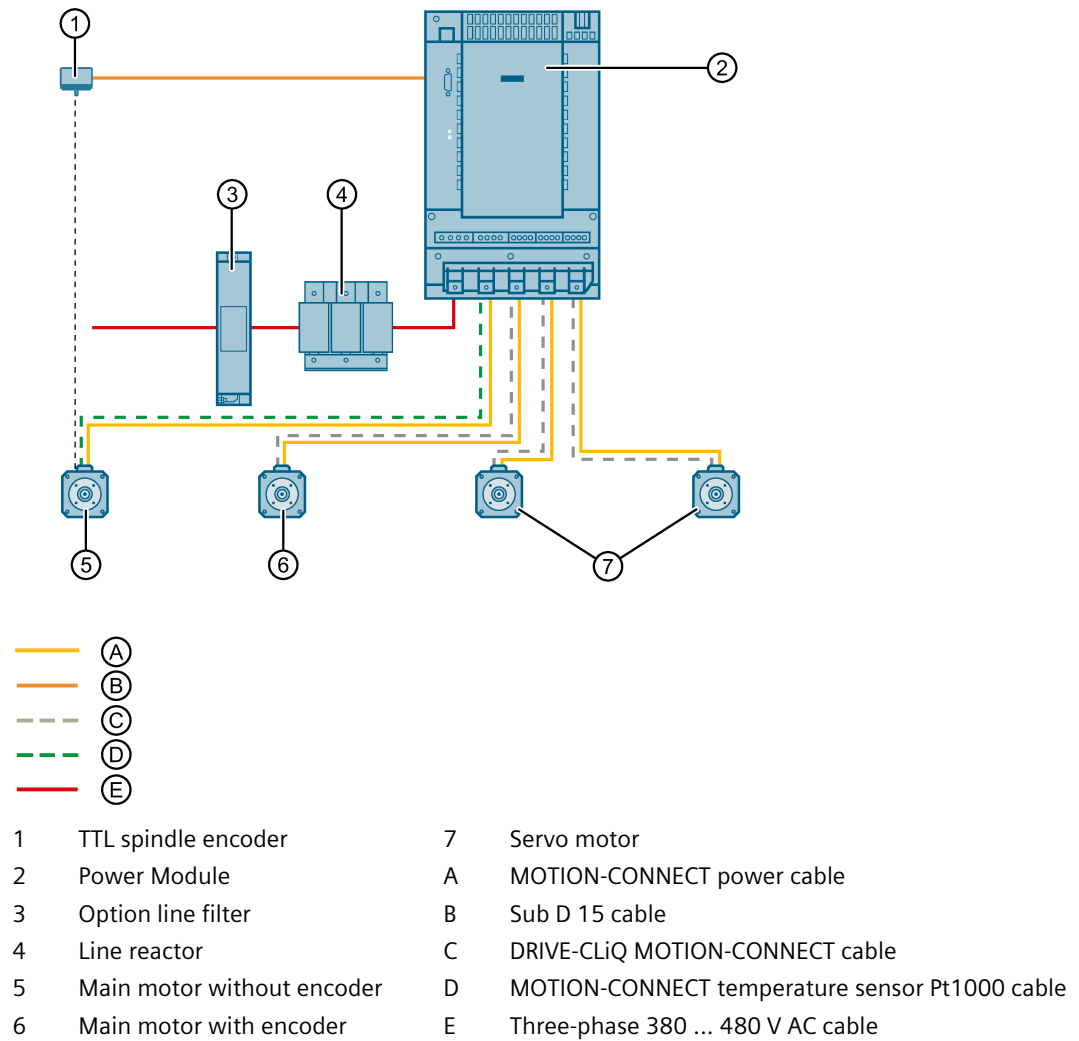
The figures below give the SINAMICS S120 system overview.

SINAMICS S120 Motor Modules in booksize format



- | | | | |
|---|-------------------------------------|---|--|
| 1 | Terminal module | 7 | Main motor with encoder |
| 2 | Control Unit | 8 | Main motor without encoder |
| 3 | Option board | A | MOTION-CONNECT power cable |
| 4 | Smart Line Module/Basic Line Module | B | DRIVE-CLiQ cable |
| 5 | Double Motor Module | C | DRIVE-CLiQ MOTION-CONNECT cable |
| 6 | Single Motor Module | D | MOTION-CONNECT temperature sensor Pt1000 cable |

SINAMICS S120 Combi Power Modules



6.4.2 Connecting-up information

Observe data on the motor rating plate data and circuit diagram in the motor terminal box.
Use sufficiently dimensioned connection cables.

Note

System compatibility for connection

System compatibility is guaranteed only if shielded power cables are used and the shield is conductively bonded over a large area to the metal motor terminal box (with a metal EMC cable gland).

Shields must be incorporated in the protective grounding concept. Protective ground should be connected to conductors that are open-circuit and that are not being used and also electrical cables that can be touched. (Open-circuit cables result in capacitive charges/discharges.)

Use EMC cable glands for fixed cable entries. The cable glands are screwed into the threaded holes on the terminal box.

Openings that are not used must be closed with an appropriate metal cap.

Internal equipotential bonding

The equipotential bonding between the grounding terminal in the terminal box enclosure and the motor housing is established through the terminal box fixing screws. The contact locations underneath the screw/bolt heads are bare and are protected against corrosion.

Equipotential bonding between the terminal box cover and the terminal box enclosure can be provided by the normal fixing screws of the cover.

Selecting and connecting the cables

Observe the following when connecting cables:

- Twisted or three-core cables with an additional ground conductor should be used as power cables. The insulation should be removed from the ends of the conductors so that the remaining insulation extends up to the cable lug or terminal.
- The cables should be freely arranged in the motor terminal box so that the protective conductor has an enough length and the cable conductor insulation cannot be damaged. The cables should be appropriately strain relieved.
- Take special care that a required air clearance of ≥ 4.5 mm is actually maintained.

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 distances must be maintained.
- The cable glands must be reliably sealed.
- Unused cable glands must be closed and the plugs must be tightly screwed in place.
- All of the sealing surfaces must be in a perfect condition.

6.4.3 Routing cables

For more information about how to route cables, see Section "Degree of protection (Page 35)".

6.4.4 Terminal boxes



! 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.

NOTICE

Damage to cables or connectors

- Do not put much stress upon cables or connectors while wiring.

6.4.4.1 Motor terminal box

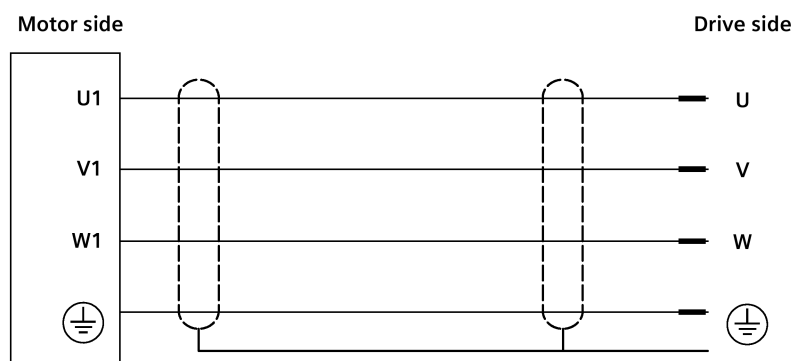


Figure 6-1 Power cable

Terminal box connection

A circuit diagram to connect the motor winding is provided in the terminal box when the motors are shipped.

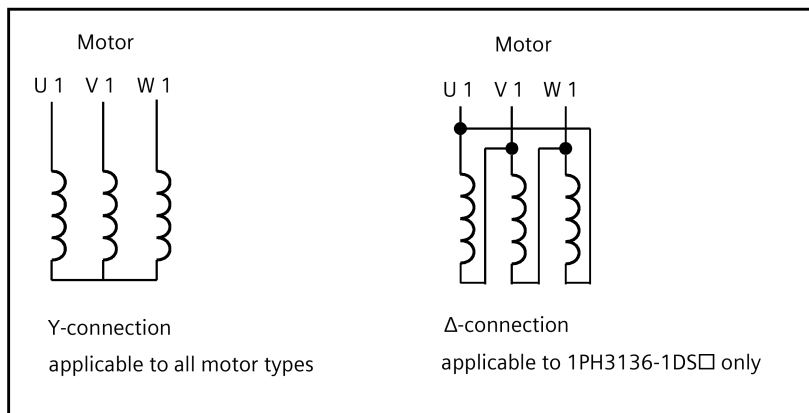


Figure 6-2 Circuit diagram

Star/delta connection in the terminal box (1PH3136-1DS□)

The star/delta connection can be implemented as permanent setting in the terminal box.

Standard configuration: Star connection via jumpers

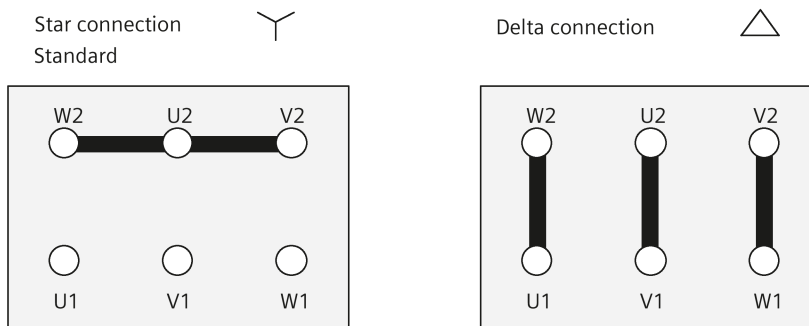


Figure 6-3 Fixed star/delta connection in the terminal box

Note

Star/delta connection

When changing over the circuit configuration (star-delta), the appropriated data set for the closed loop motor control must also be changed-over.

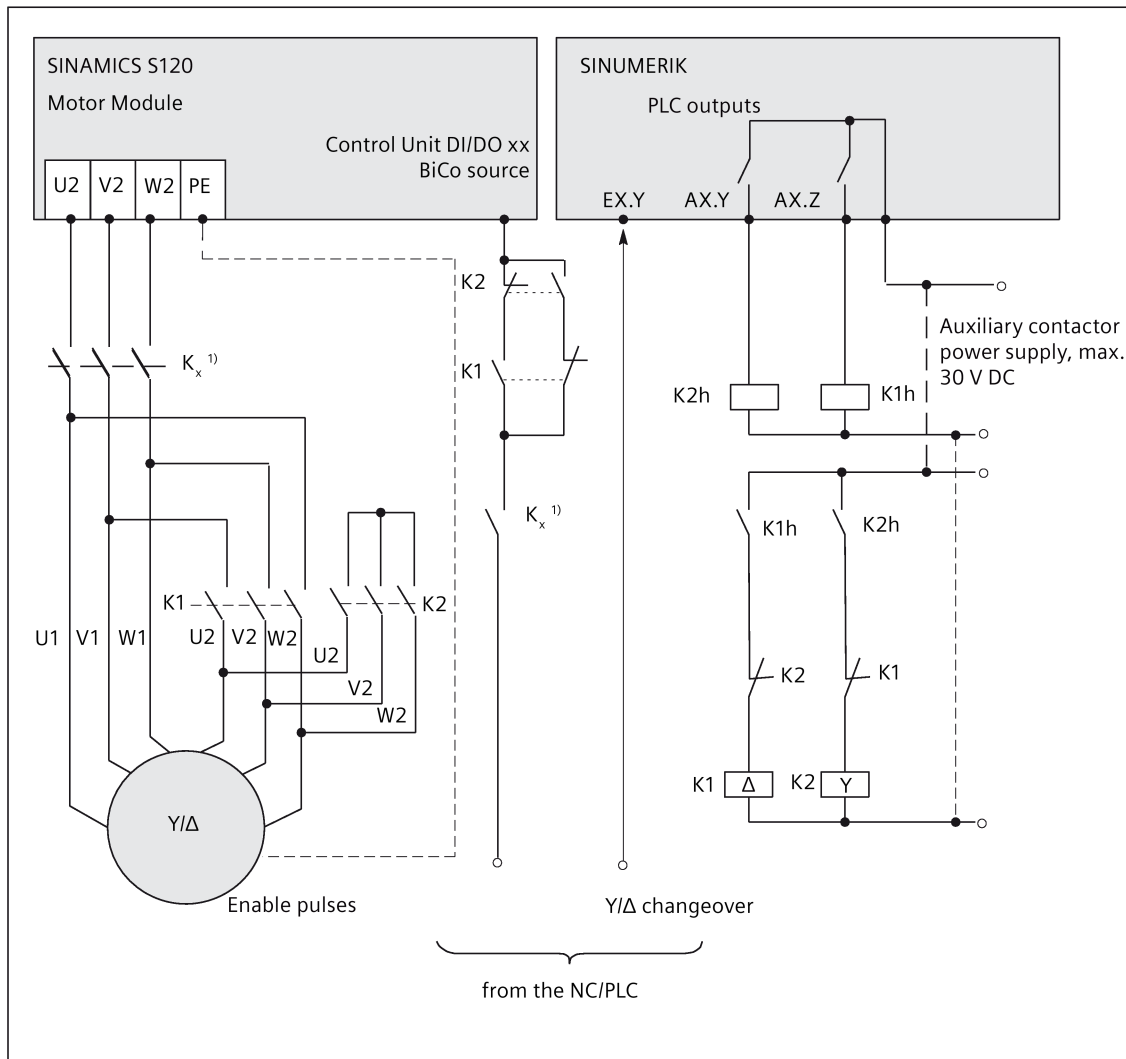
A changeover may only be made when the spindle is in a no-load condition and with the power module pulses inhibited.

Star/delta connection via an external contactor circuit (1PH3136-1DS□)

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).

For information about the circuit to implement the star-delta changeover, refer to the following diagram and SINAMICS S120 Function Manual (FH1).



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 Kx. 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).

Figure 6-4 Connection diagram for Y/Δ changeover with SINAMICS

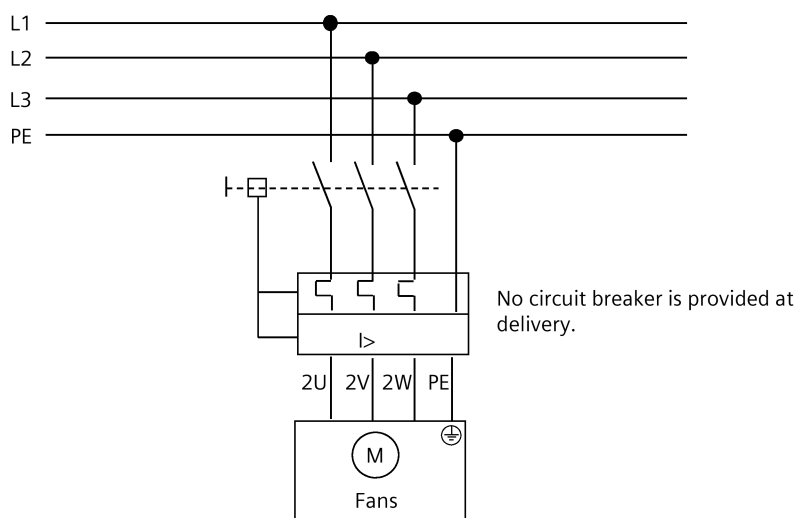
Current-carrying capacity for power cables and DRIVE-CLiQ MOTION-CONNECT cables

See the table below for derating factors for power cables and DRIVE-CLiQ MOTION-CONNECT cables.

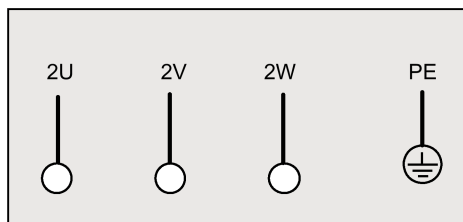
Surrounding air temperature (°C)	Derating factor according to EN 60204-1, Table D1
30	1.15
35	1.08
40	1.00
45	0.91
50	0.82
55	0.71
60	0.58

6.4.4.2 Fan terminal box

Connect the external fan via the fan terminal box. Implement operation of the fan via a circuit breaker.



Terminal box connection

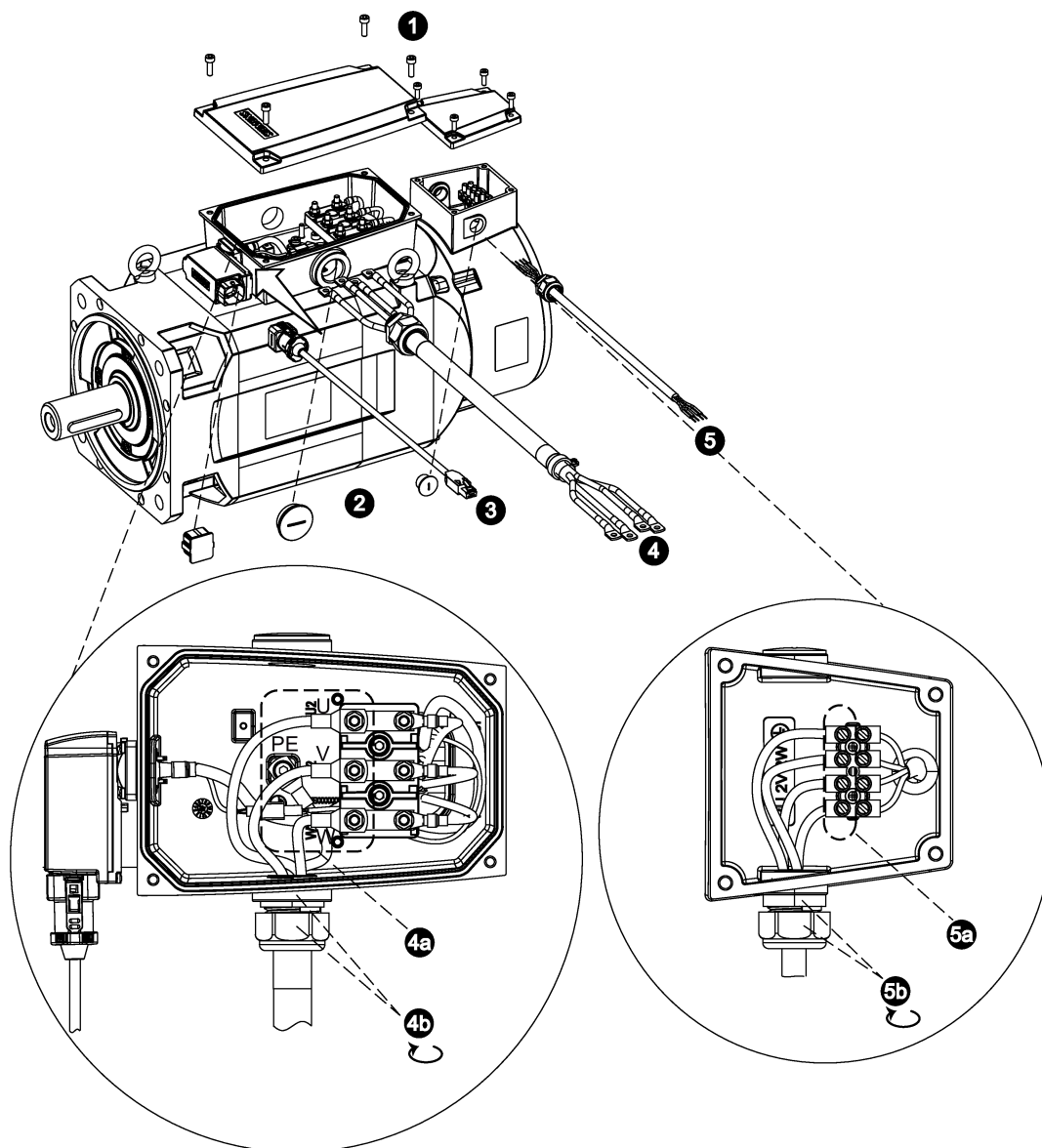


6.4.5 Connecting the terminal boxes

Note

- The recommended sequence for cable connections is as follows: the DRIVE-CLiQ MOTION-CONNECT cable or temperature sensor Pt1000 cable first, the power cable next, and then the fan cable.
- For the power cable and fan cable, there are threaded holes available in both sides of the terminal box housing for you to pass the cables through. You can select to connect the individual cables to the terminal boxes from the threaded holes on the desired side.
- No fan cable is provided at delivery. When connecting your own fan cable, make sure that you connect the fan terminals U, V, and W correspondingly to the line supply terminals L1, L2, and L3 of the machine tool using appropriate cable connectors.
- Tighten the cable glands onto the terminal box housing firmly enough to ensure the specified degree of protection of the motor.

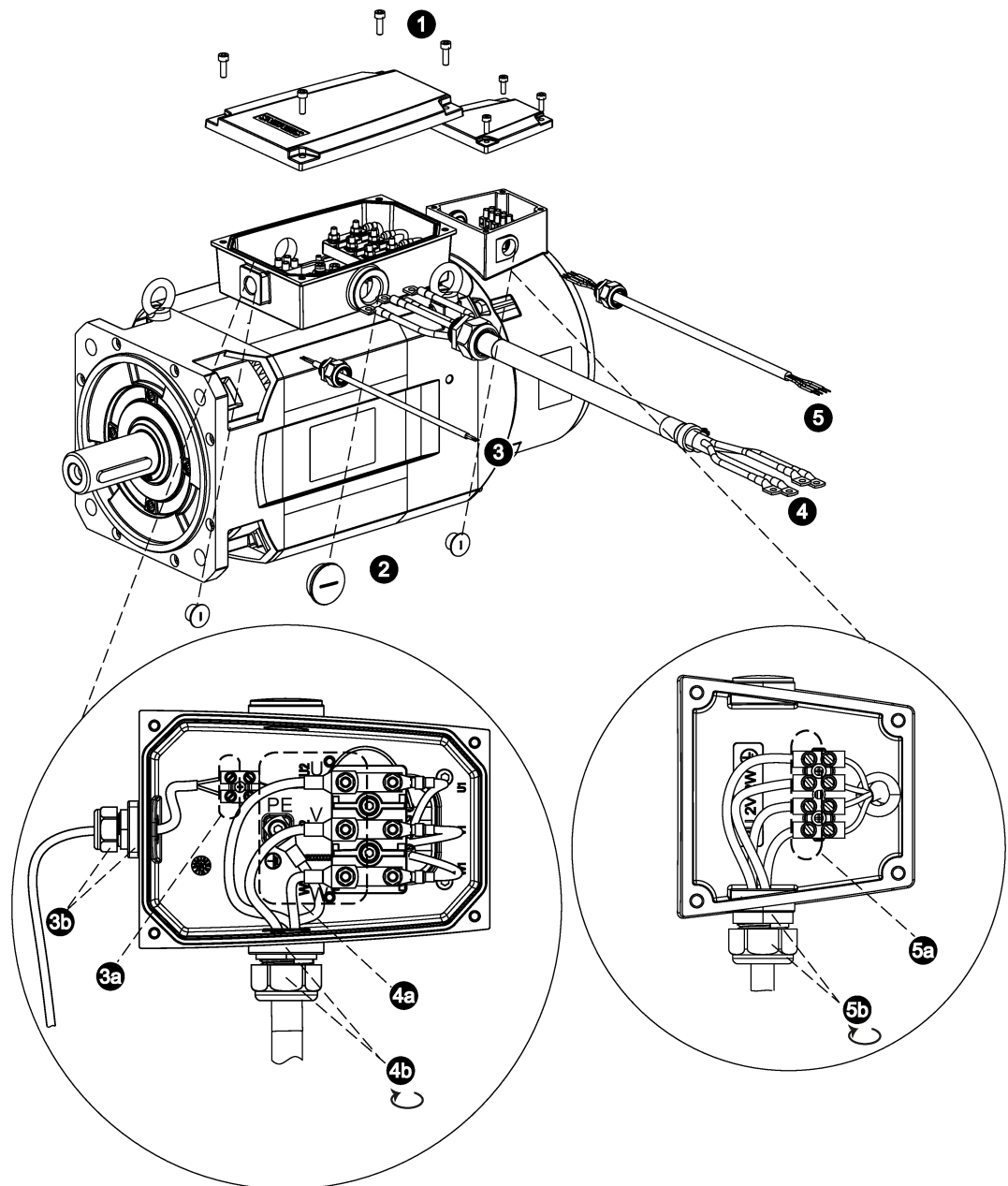
For motors with an encoder



Note

For 1PH3136-1DS□ motor types, the connection in the terminal box can be changed over between star (Y) and delta (Δ).

For motors without an encoder



1. Loosen the screws on the top of both the motor terminal box and the fan terminal box to remove the terminal box covers.
2. Remove the two screw plugs in one side of the two terminal boxes. Then remove the cover of the Sensor Module (for motors with an encoder) or the screw plug in the front of the motor terminal box (for motors without an encoder).
3.
 - For motors with an encoder
Insert the connector of the DRIVE-CLiQ cable into the RJ45 socket on the Sensor Module.
 - For motors without an encoder
Pass the temperature sensor Pt1000 cable (recommended cable outer diameter: 6 mm to 12 mm) through the cable gland, and then through the threaded hole in the front of the motor terminal box housing. Follow the steps below to connect the temperature sensor Pt1000 cable to the motor terminal box:
 - 3a. Loosen the two screws that correspond to the terminals of the signal terminal block. Insert the two terminal lugs at the end of temperature sensor cable conductors into the sockets under the binding posts (irrespective of polarity), and then fasten the cable conductors with the screws.
 - 3b. Tighten the cable gland of the temperature sensor Pt1000 cable onto the threaded hole firmly.
4. Pass the power cable through the cable gland, and then through the threaded hole on the side of the motor terminal box housing. Follow the steps below to connect the power cable to the motor terminal box:
 - 4a. Remove from the terminal box the three binding post nuts that correspond to the power cable terminals U, V, and W. Place the three terminal lugs at the end of the power cable conductors onto the corresponding binding posts, and then fasten the cable conductors with the nuts (3 x M5, max. 4.7 Nm). Remove the grounding screw for power terminal PE. Place the terminal lug of the PE conductor on the grounding screw, and then tighten the screw for the PE terminal (1 x M5, max. 4.7 Nm).
 - 4b. Tighten the cable gland of the power cable onto the threaded hole firmly.
5. Pass your own fan cable (recommended cable outer diameter: 4 mm to 8 mm) through the cable gland, and then through the threaded hole in the fan terminal box housing. Follow the steps below to connect the fan cable to the fan terminal box:
 - 5a. Loosen the four screws that correspond to the fan cable terminals U, V, W and PE. Insert the terminal lugs at the end of fan cable conductors into the corresponding sockets under the binding posts, and then fasten the cable conductors with the screws.
 - 5b. Tighten the cable gland of the fan cable onto the threaded hole firmly.
6. Replace the covers of the terminal boxes, and then tighten the screws respectively for the motor terminal box (4 x M5: max. 4.7 Nm) and the fan terminal box (4 x M4: max. 2.4 Nm).



! WARNING

Electric shock or short circuit due to improper connections

Improper connections have high risks of electric shock and short circuit, which will jeopardize personal safety and equipment.

- The converter must be directly connected with the motor. It is not permissible to connect a capacitor, inductor or filter between them.
- The line supply voltage must be within the allowable range (refer to the converter rating plate). Never connect the line supply cable (for the converter) to the motor terminals U, V, W or connect the motor power cable to the line input terminals L1, L2, L3.
- Never wire up the U, V, W terminals in an interchanged phase sequence.
- If the CE marking for cables is mandatory in some cases, the power cable, line supply cable, and DRIVE-CLiQ MOTION-CONNECT cable used must all be shielded cables.
- For terminal box connection, make sure that the clearances between non-insulated live parts are at least 5.5 mm.
- Route the DRIVE-CLiQ MOTION-CONNECT cable and the power cable separately in different cable conduits. The DRIVE-CLiQ MOTION-CONNECT cable shall be at least 10 cm away from the power cable.
- Cables connected may not come into contact with rotating mechanical parts.



! WARNING

Risk of electric shock and fire from a network with an excessively high impedance

Excessively low short-circuit currents can lead to the protective devices not tripping or tripping too late, and so causing electric shock or a fire.

- In the case of a conductor-conductor or conductor-ground short-circuit, ensure that the short-circuit current at the point where the converter is connected to the line supply at least meets the minimum requirements for the response of the protective device used.
- You must use an additional residual-current device (RCD) if a conductor-ground short circuit does not reach the short-circuit current required for the protective device to respond. The required short-circuit current can be too low, especially for TT systems.



! WARNING

Risk of electric shock and fire from a network with an impedance that is too low

Excessively high short-circuit currents can lead to the protective devices not being able to interrupt these short-circuit currents and being destroyed, and so causing electric shock or a fire.

- Ensure that the uninfluenced short-circuit current at the line terminal of the converter does not exceed the breaking capacity (SCCR or I_{cc}) of the protective device used.

Configuration

7.1 SIZER configuration tool

Overview

The SIZER configuration tool supports you in the technical dimensioning of the hardware and firmware components required for a drive task.

SIZER 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
- Selecting the line-side and motor-side power options

The configuration process results in the following:

- A list of required components (export to Excel)
- Technical specifications of the system
- Characteristic curves
- Comments on system reactions
- Installation information of the drive and drive components
- Energy considerations of the configured drive systems

You can find further information on the Internet at: SIZER
(<https://support.industry.siemens.com/cs/ww/en/view/54992004>)

Configuration tool	Article number of the DVD
SIZER for SIEMENS Drives German/English	6SL3070-0AA00-0AG0

Minimum system requirements

- PG or PC, Pentium™ III min. 800 MHz (recommended > 1 GHz) 512 MB RAM (recommended > 1 GB)
- At least 2 GB free hard disk space
- Additional 100 MB free hard disk space on the Windows system drive
- Monitor resolution, 1024x768 pixels
- Windows 7 (32/64 bit) Professional, Enterprise, Ultimate, Home
- Windows 8.1 (32/64 bit) Professional, Enterprise, Ultimate, Home
- Microsoft Office 2003/2007/2010/2013/2016
- Windows 365
- Microsoft Internet Explorer V8.0
- Microsoft .NET Framework 2.0
- OpenGL 2.1
- Windows 10 Enterprise 64 Bit
- Windows 10 Professional 64 Bit

7.2 Procedure when engineering

7.2.1 SINAMICS configuring procedure

Motion Control

The 1PH3 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, the 1PH3 motors must meet the following requirements:

- High dynamic response, for example, short rise time
- High overload capability, that is, large acceleration margin
- Wide control range, that is, high resolution for precise positioning

General configuring procedure

The function description of the machine provides the basis for configuring 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:

Step	Configuration activity description	Remarks
1.	Clarification of the drive type	For more information, see Section "Specifying the duty cycle (Page 107)".
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 SINAMICS S120 Motor Modules in booksize format/SINAMICS S120 Combi Power Modules	-
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 (for SINAMICS S120 Motor Modules in booksize format only)	
7.	Selection of the line-side options (for example, main switch, fuses, and line filters)	
8.	Specification of the required control performance, selection of the Control Unit, and definition of component cabling (for SINAMICS S120 Motor Modules in booksize format only)	
9.	Definition of other system components (for example, braking resistors)	
10.	Calculation of the current demand of the 24 V DC supply for the components and specification of the power supplies (for example, SITOP devices and Control Supply Modules)	
11.	Selection of the components for the connection system	
12.	Configuration of the drive line-up components	
13.	Calculation of the required cable cross sections for power supply and motor connection	
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, for example, traveling drives, hoisting drives, test stands, centrifuges, paper and rolling mill drives, feed drives, or main spindle drives. Gearboxes used to convert motion or to adapt the motor speed and motor torque according to the load conditions must also be considered.

In addition to the load torque that is determined by the application, the following mechanical data is among those required for the calculation of the torque to be provided by the motor:

- Mass to be moved
- Diameter of the drive wheel
- Leadscrew pitch and gear ratio
- Frictional resistance
- Mechanical efficiency
- Traversing path
- Maximum velocity
- Maximum acceleration and maximum deceleration
- Cycle time

Asynchronous motors can be used to increase maximum speeds in the field-weakening range. Asynchronous motors for higher power ratings are also available.

The following factors are especially important when you configure a drive application:

- The ambient temperature and installation altitude of the motors and drive components.
- Heat dissipation from the motors through forced ventilation

The motor-specific limiting characteristics provide the basis for defining the motors.

These define the speed-power or speed-torque characteristic curves 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 the Line Module.

Other constraints apply when you integrate the drives into an automation environment such as SINUMERIK or SIMOTION.

The motor is selected based on the load that 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 a constant ON period
- Duty cycles with a varying ON period
- Free duty cycle

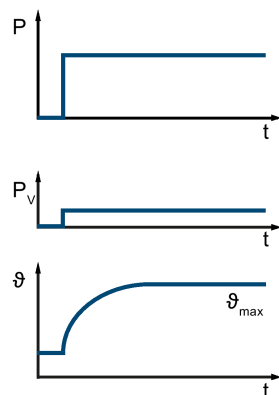
The objective is to identify characteristic torque and speed operating points that can be used as a basis for selecting the motor depending on the load.

7.2.2 Specifying the duty cycle

Duty cycles with a constant ON period

For duty cycles with a constant ON period, there are specific requirements for the torque characteristic curve as a function of the speed, for example, $M = \text{constant}$, $M \sim n^2$, $M \sim n$, or $P = \text{constant}$.

The figure below shows the S1 duty cycle for continuous operation.

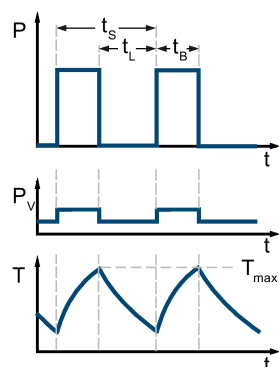


These drives typically operate at a specific operating point and are dimensioned for a base load. The base load torque must lie below the S1 characteristic curve. An overload rating is provided for transient overloads (for example, during acceleration). The overload current must be calculated relative to the required overload torque. The peak torque must lie below the voltage limiting characteristic curve.

Duty cycles with a varying ON period

Besides continuous duty cycles (S1), standard intermittent duty cycles (S6) are defined for duty cycles with a varying ON period. This is a mode of operation consisting of a series of similar cycles, with each one comprising one time period with a constant load and one idle time period. There is no pause.

The figure below shows the S6 duty cycle for continuous duty with an intermittent load.



Designation example:
S6-40%, 11 kW (15 Hp)

Cyclic duration
factor $= \frac{t_s}{t_s + t_L}$, $t_s = 10 \text{ min}$

The following fixed variables (overload factors) are usually applied to the relative ON period:

- S6-40%
- S6-25%
- S6-15%

For more information about the overload factors for the corresponding intermittent duty type (S6) referred to the continuous duty type (S1), see Section "Overload factors for intermittent duty types (S6) (Page 138)".

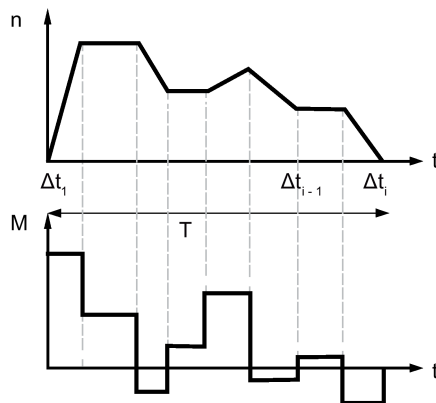
Note

S3 duty cycle

The overload factors for continuous duty with an intermittent load (S6) can also be applied to the S3 intermittent duty type (S3-40%, S3-25%, or S3-15%) for the 1PH3 motors.

Free duty cycle

The figure below shows a load duty cycle that defines the characteristics of the speed and torque of the motor with respect to the time.



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.

If a gearbox has been mounted, 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, the resolution of the machine position to be detected increases.

Note

Duty cycles in the field weakening range

For duty cycles in the field weakening range, the drive system must be configured using the SIZER configuration 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 during acceleration. 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 motor.

The following criteria must be taken into account when you select the motor:

- The dynamic limits must be adhered to, that is, all speed-torque points of a certain load event must lie below the relevant limiting characteristic curve.
- The thermal limits must be adhered to, that is, the effective motor torque at the average motor speed resulting from the duty cycle must lie below the S1 characteristic curve (continuous duty). The effective 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 frequency

The rated pulse frequency of the 1PH3 motors is 4 kHz. Operation of the motors with a rated pulse frequency of less than 4 kHz is not permitted.

7.2.3 Selecting motors

Characteristic curves for asynchronous motors

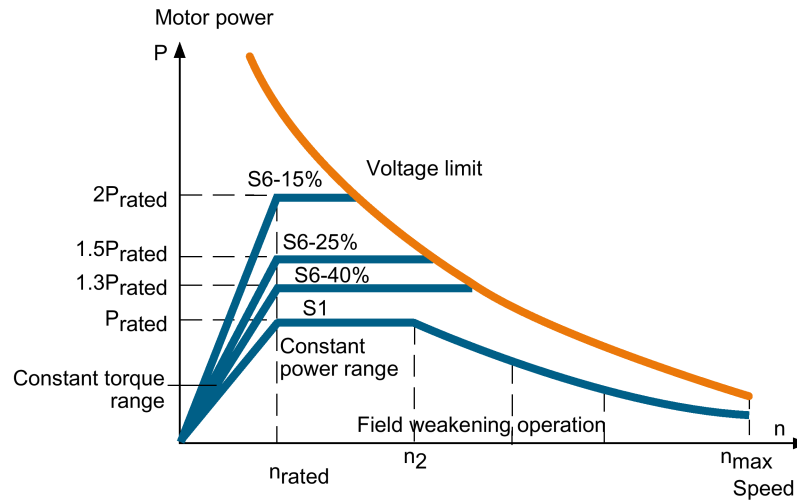
The speed-power diagrams and speed-torque diagrams for operation with the SINAMICS converter system are described in the motor characteristics. For more information, see Section "Characteristics (Page 139)".

Depending on the motor variant, the S1 characteristic (continuous operation) is available from standstill to the rated point with the maximum permissible thermal torque, or passes through the constant-torque range. The power increases in proportion to the 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 the 1PH3 motors, the S3 and S6 characteristics are shown in addition to the S1 characteristic.

The figure below shows the typical speed-power diagram:



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 and Line Module.

The 1PH3 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.

Offset of the voltage limit characteristic

The characteristics in Section "Characteristics (Page 139)" refer to the Smart Line Module (SLM) with a line voltage of 400 V and a converter output voltage of 380 V.

In order to identify the motor limits with a converter output voltage other than 380 V, the plotted voltage limiting characteristic must be shifted accordingly for the new converter output voltage.

Calculating the new voltage limiting characteristic

$$\text{Calculation } P_{\text{new}} = P_{\text{characteristic curve}} \cdot \left(\frac{U_{\text{drive, new}}}{U_{\text{drive}}} \right)^2$$

U_{drive} = drive output voltage
 $U_{\text{drive, new}}$ = new drive output voltage

$$\text{Calculation } n_{\text{new}} = n_{\text{characteristic curve}} \cdot \left(\frac{U_{\text{drive, new}}}{U_{\text{drive}}} \right)^2$$

Example

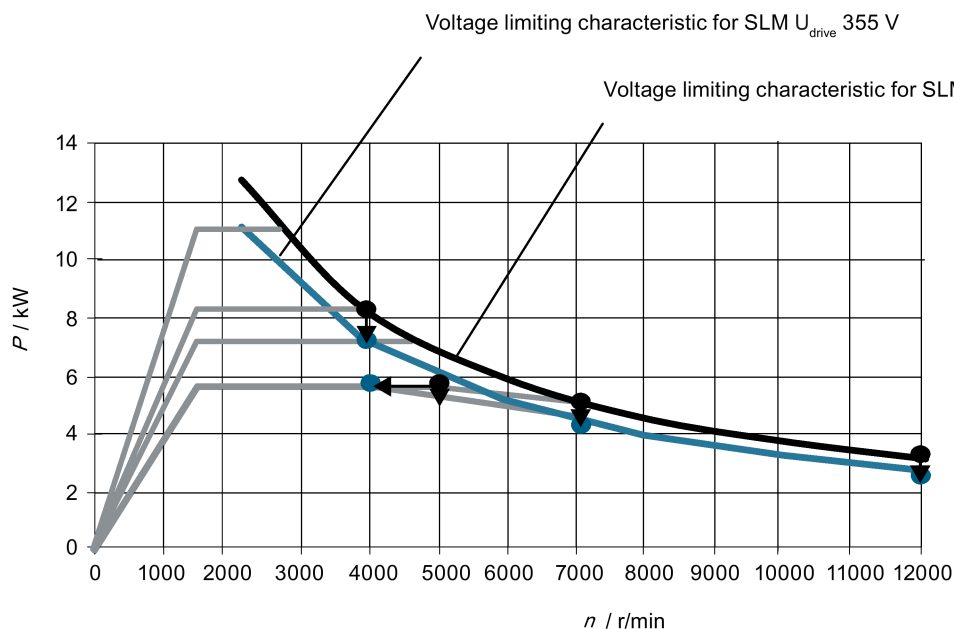
The following takes an SLM with a line voltage of 380 V and a converter output voltage of 355 V for example to show how to calculate the new voltage limiting characteristic for operation.

Voltage limiting characteristic at $U_{\text{drive}} 380 \text{ V}$	New voltage limiting characteristic at $U_{\text{drive}} 355 \text{ V}$
$n = 5500 \text{ r/min}$: $P_{\text{characteristic curve}} = 5.5 \text{ kW}$	$P_{\text{new}} = 5.5 \text{ kW} \cdot \left(\frac{355 \text{ V}}{380 \text{ V}} \right)^2 = 4.8 \text{ kW}$
$n = 12000 \text{ r/min}$: $P_{\text{characteristic curve}} = 3.0 \text{ kW}$	$P_{\text{new}} = 3.0 \text{ kW} \cdot \left(\frac{355 \text{ V}}{380 \text{ V}} \right)^2 = 2.6 \text{ kW}$

The results are the points of intersection in the new voltage limiting characteristic for 355 V.

The new speed up to which power remains constant is:

$$n_{\text{new}} = 5500 \text{ rpm} \cdot \left(\frac{355 \text{ V}}{380 \text{ V}} \right)^2 = 4800 \text{ r/min}$$



Output voltages

For correct configuration, the characteristics are relevant for the line voltage and the line infeed.

Characteristics order	Converter system	Line voltage	Line Module	Remarks
1	SINAMICS	380 V 3 AC	Smart/Basic Line Module (SLM/BLM)	Infeed with a non-regulated SLM/BLM (converter output voltage up to 355 V)
2	SINAMICS	400 V 3 AC	Smart/Basic Line Module (SLM/BLM)	Infeed with a non-regulated SLM/BLM (converter output voltage up to 380 V)
3	SINAMICS	480 V 3 AC	Smart/Basic Line Module (SLM/BLM)	Infeed with a non-regulated SLM/BLM (converter output voltage up to 460 V)

Commissioning

8.1 Safety instructions for commissioning



WARNING

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

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

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

WARNING

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

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

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

WARNING

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

Hair, ties, and articles of clothing drawing into the machine at the air intake can cause severe injury or death.

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



NOTICE

Thermal damage to temperature-sensitive parts

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

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

**NOTICE****Motor damage resulting from the overheating**

Windings and bearings can be destroyed if the motor overheats.

- Only operate motors in conjunction with effective temperature control.

NOTICE**Motor damage when the maximum speed is exceeded**

The maximum speed $n_{\max}$ is the highest permissible operating speed. The maximum speed $n_{\max}$ is stamped on the rating plate. The motor can be damaged if operated at inadmissible speeds.

- Ensure that the maximum permissible speed is not exceeded. To realize this, use a suitable control system or activate the speed monitoring function in the drive.

8.2 Checklists for commissioning

Note

Checks that are required

The following lists do not claim to be complete. It may be necessary to perform additional checks and tests in accordance with the situation specific to the particular installation site.

- Install and connect the motor properly before commissioning the system.
- Commission the drive system corresponding to the operating instructions of converters.
- Familiarize yourself with the safety instructions and observe the following checklists before starting any work.

General checking

Checking items	OK
Are all of the necessary components of the configured drive line-up available, correctly dimensioned, installed and connected?	
Are the manufacturer's documentations for the system components and the SIMOTICS M-1PH3 main motors available?	
If the 1PH3 motors are operating in a SINAMICS S120 drive system, are the following documentation available? <ul style="list-style-type: none"> • SINAMICS S120 Commissioning Manual • SINAMICS S120 Getting Started • SINAMICS S120 Function Manual • SINAMICS S120/S150 List Manual 	
If the 1PH3 motors are operating in a SINAMICS S120 drive system, are the checklists related to the commissioning in the SINAMICS S120 Commissioning Manual carefully observed?	
Do you know the type of the to-be-commissioned motor clearly? 1PH3 ____ - ____ - ____	
Are the environmental conditions in the permissible range?	

Checking the mechanical system

Checking items	OK
Have all touch protection measures for moving and live parts been taken?	
Has the motor been correctly mounted and aligned?	
Can the shaft be rotated smoothly?	
Do the operating conditions correspond to the data specified on the rating plate?	
Are all mounting screws, connecting elements, and electrical connections tight and attached properly?	
Do the output elements have the correct setting conditions according to the type? Examples: <ul style="list-style-type: none"> • Have the couplings been aligned and balanced? • Has the tension of a belt drive been correctly adjusted? • Have the gear tooth flank and gear tooth tip clearance as well as radial clearance been correctly adjusted for geared outputs? 	

Checking the electrical system

Checking items	OK
Has the motor been connected properly so that it can rotate in the specified direction?	
Have the minimum insulation resistance values been maintained?	
Have the grounding and equipotential bonding connections been correctly established?	

Checking monitoring devices

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

Checking the cooling system

Checking items	OK
<p>Have you checked all safety-related and function-relevant details?</p> <p>Examples:</p> <ul style="list-style-type: none"> • Is the electrical installation of the fan, including accessories OK, for example, has the protective conductor been connected? • Are the mechanical installation and electrical installation of the safety-relevant components OK? These include the installation of a circuit breaker and attaching protective guards. • Are the cable entry glands correctly sealed? • Are the fan air intake and the area around the fan blades free of foreign bodies? • Does the minimum clearance S between the air intake/air discharge opening and adjacent components be complied with? • Does the fan have the correct direction of rotation? <p>An arrow is stamped on the fan rating plate. This arrow indicates the correct direction of rotation of the fan. When the fan starts, you can visually check the direction of rotation using the arrow. The fan functions correctly if the direction of rotation matches the direction of the arrow on the fan rating plate.</p>	

Checking roller bearings

Checking items	OK
Are the roller bearings OK?	
For motors that were stored, were the storage conditions and bearing change intervals complied with?	

8.3 Checking the insulation resistance

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



! WARNING

Danger to life through electric shock

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

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

Note the following requirements when you measure the insulation resistance:

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

Limits

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

Stator winding insulation resistance at 25 °C

Measurement voltage	500 V (at least 100 V)
Minimum insulation resistance with new, cleaned, or repaired windings	10 MΩ
Critical specific insulation resistance after a long operating time	0.5 MΩ/kV

Note the following:

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

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

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

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

$$0.6 \text{ kV} \times 0.5 \text{ M}\Omega/\text{kV} = 0.3 \text{ M}\Omega$$

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

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

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

Note**Measured value close to critical value**

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

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

8.4 Switching on and switching off

Note

EMERGENCY OFF

To avoid accidents, be familiar to the EMERGENCY OFF function before you switch on the system.

The motor is switched on and off using the converter. Read about this topic in the converter operating instructions.

Prerequisites

- Ensure that the converter is correctly parameterized.
- Use the appropriate commissioning tools, for example, "STARTER".

Switching on

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

Switching off

1. Switch off the motor by the converter.

After you complete the operation, the motor has been commissioned.

Note**EMERGENCY OFF**

To avoid accidents, be familiar to the EMERGENCY OFF function before you switch on the system.

Switching on **WARNING****Danger to life caused by the machine movement and loose objects**

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

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

The motor is switched on by the converter. Read about this topic in the converter operating instructions.

Operation

While the motor is operational, ensure that the specified parameters are maintained:

- The current drawn is in the specified range.
- Cooling is ensured.
Check that the heat can be dissipated unobstructed.
- There are no abnormal motor noises.
- The motor does not overheat.
- If available, the sealing air intake functions.

NOTICE**Motor damage caused by worn bearings**

Worn bearings cause motor damage.

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

Switching off

The motor is switched off by the converter. Read about this topic in the converter operating instructions.

9.1 Faults

WARNING

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

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

- Only operate the drive system with functioning protective devices.

Note

Damage to the machine caused by faults

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

Note

When faults occur, observe the converter operating instructions.

If changes occur with respect to normal operation or faults, proceed as follows:

- Determine the cause using the "Possible faults" table.
- If you have identified the cause, attempt to resolve the fault using the "Code to causes of faults and remedial measures" table.
- In this regard, observe the relevant chapter in the documentation associated with the components of the complete drive system.

Possible faults

Fault	Cause of fault (see the code table)																	
Motor failing to start	A	B			E													
Motor starting slowly	A		C		E	F												
Rumbling noise when starting			C		E	F												
Rumbling noise in operation	A		C		E	F												
High temperature rise under no load operation				D				I										
High temperature rise under load	A		C					I										
High temperature rise of individual winding sections					E	F												
Uneven running								J	K									
Grinding sound, running noise										L								
Radial vibration											M	N	O	P		R		
Axial vibration													O		Q	R		

Code to causes of faults and remedial measures

Code	Cause of fault	Remedial measures
A	Overload	Reduce load
B	Interrupted phase in the supply cable/motor winding	Check the converter and supply cables/measure the winding resistances and insulation resistances, repair after consultation with manufacturer
C	Interrupted phase in the feeder cable after switching on	Check the converter and supply cables/check the winding resistances
D	Converter output voltage too high, frequency too low	Check the converter settings, perform automatic motor identification
F	Winding short circuit or phase short circuit in stator winding	Measure the winding resistances and insulation resistances, repair after consultation with manufacturer
E	Stator winding incorrectly connected	Check winding connection
I	Heat dissipation obstructed by deposits	Clean the drive surfaces. Ensure that the cooling air can flow in and out unimpeded
	Cooling air inlet/outlet is blocked by foreign bodies	Remove the blockage. Ensure that the cooling air can flow in and out unimpeded
	Fan motor does not start	Check the function of the fan motor
J	Insufficient shielding for motor and/or encoder cable	Check the shielding and grounding
K	Drive controller gain too high	Adjust the controller
L	Rotating parts are grinding	Determine cause and adjust parts concerned
	Foreign bodies in the motor	Send to manufacturer for repair
	Bearing damage	Send to manufacturer for repair
M	Rotor not balanced	Decouple rotor and rebalance
N	Rotor out of true, shaft bent	Consult the manufacturer
O	Poor alignment	Align machine set, check coupling
P	Coupled machine not balanced	Rebalance coupled machine
Q	Mechanical shocks from coupled machine	Inspect coupled machine
R	Uneven gearbox operation	Repair the gearbox

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

9.2 Non-operational periods

NOTICE
Damage due to improper storage
The motor can be damaged if it is not stored properly.
<ul style="list-style-type: none">• If the motor is not operational for longer periods of time, preserve it by using anti-corrosion protection and ensure that it remains dry (for example, appropriate drying agents).

Measures for long non-operational periods:

- If the motor is not operational for extended periods of time, run it at regular intervals (roughly once a month) or spin the rotor by hand.
- When recommissioning after longer non-operational periods of the motor, perform the checks and measures listed in Chapter, "Commissioning (Page 113)".
- Before switching on to commission the drive, carefully read the Section "Switching on" in the Chapter "Switching on and switching off (Page 120)".



CAUTION

Risk of injury through contact with cleaning agents and solvents

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

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

CAUTION

Injuries caused by blown particles

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

- When cleaning the motor with compressed air, ensure there is adequate extraction equipment.
- Use the appropriate personal protection equipment, for example, gloves, protective overall.

10.1 General inspection guidelines

The motor is not disassembled for inspection.

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

We recommend that a Siemens Service Center carries out inspection and maintenance work. The contact data is provided in Section "Technical support" in Chapter "Introduction (Page 3)".

10.2 Maintenance and inspection intervals

General

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

NOTICE

Damage to the machine due to unusual conditions or faults

Unusual conditions or faults of the motor, for example, overload or short circuit can result in consequential damage to the machine.

- Immediately inspect the motor if faults or exceptional conditions occur.

Cleaning

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

Inspection/maintenance intervals, periods, measures

The maintenance intervals depend on the operating conditions.

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

Operating intervals or periods and measures

Operating intervals or periods	Measures
After 500 operating hours, after 6 months at the latest	Initial inspection
Approx. every 8000 operating hours, after 2 years at the latest	General inspection Without radial shaft sealing ring
Approx. every 5000 operating hours, after 2 years at the latest	With radial shaft sealing ring
Note the bearing lifetime (see Section "Bearing lifetime (Page 41)")	Replace the motor if the bearing working time exceeds the lifetime
Depending on the local degree of pollution	Clean the motor and the fan

Note

If the bearing working time exceeds its lifetime, the motor cannot be used any longer. Replace the motor with a new one.

10.3 Initial inspection

Initial inspection

Carry out an initial inspection after one of the following conditions is satisfied:

- Installation
- 500 operating hours, at the latest after 6 months
- Corrective maintenance of the motor

Note

Adapt the inspection to the plant-specific conditions.

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

10.4 General inspection

Note

Adapt the inspection to the plant-specific conditions.

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

Test scope

While the motor is running, check the following items:

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

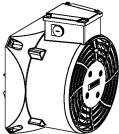
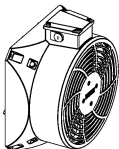
When the motor is at a standstill, check the follows:

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

NOTICE
Machine damage when ignoring abnormalities identified during the inspection Abnormalities identified during inspection that are subsequently ignored can result in machine damage. <ul style="list-style-type: none">• Analyze and remove any abnormalities identified, taking into consideration Chapters "Faults (Page 122)" and "Maintenance (Page 125)".• Contact the Siemens Service Center if you require any support.

10.5 Spare part - External fan

Replacement fans

Motor shaft height	Fan components	
	Illustration	Article number
SH100		1PH3902-0BB00-0AA0
SH132		1PH3902-0BC00-0AA0

For more information about the fan replacement procedure, see Section "Replacing the external fan (Page 130)".

10.6 Replacing the external fan

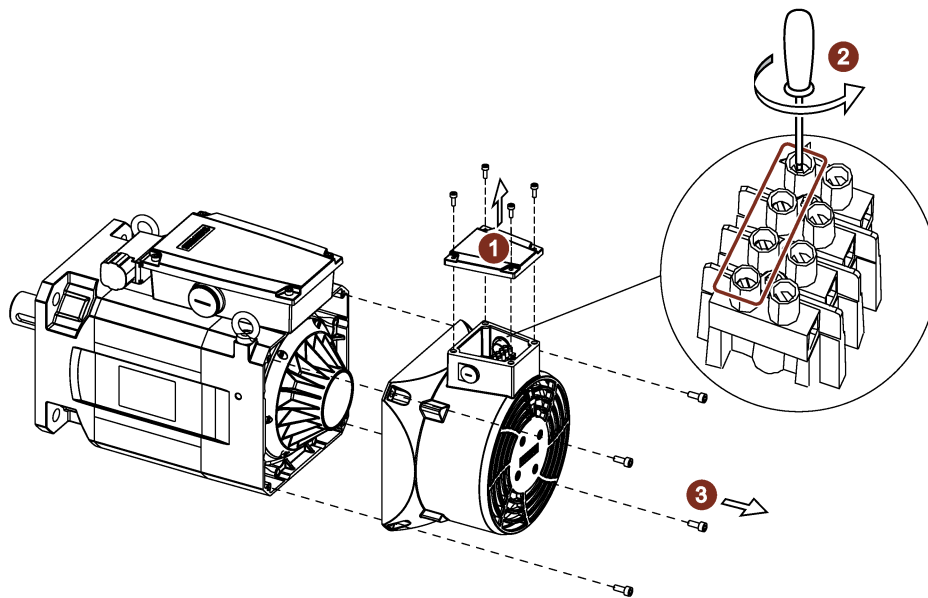
Note

The external fan can be replaced by the customers themselves or by appropriately trained Siemens service personnel.

Before replacing the fan, proceed as follows:

1. Switch off the motor and fan.
2. Disconnect both of them from the power supply by disconnecting all phases.
3. Ensure that they both cannot be accidentally switched on again.
4. Once the voltage has been disconnected on all poles, wait for 5 minutes before touching the device.
5. Allow the motor and fan to cool down.

Proceed through the steps as illustrated below to remove the fan from the motor. To reassemble the fan, proceed in reverse order.



1. Open the terminal box.
2. Disconnect all terminals.
3. Part the four screws and disassemble the fan.

When you complete the replacing, proceed as follows:

1. After replacing, check the insulation resistance.
2. Check that you have re-attached any parts that were removed from replacing.
3. Reconnect the power supply.
4. Switch on the motor and fan again.

10.7 Cleaning the motor and the external fan

When you use the motor, observe the following:

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

Preparing for cleaning

WARNING

Death of severe injury as a result of rotating fan blades

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

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

Before cleaning the fan and motor, proceed as follows:

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

Cleaning



WARNING

Danger to life due to risk of explosion caused by solvents

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

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

**CAUTION****Risk of injury through contact with cleaning agents and solvents**

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

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

NOTICE**Damaged fan blades as a result of excessive force**

Fan blades can be damaged if subject to excessive force.

- Avoid applying excessive force to the fan.

Note

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

Clean the motor and the fan with commercially available cleaning agents.

After cleaning

When you complete the cleaning, proceed as follows:

1. Allow the motor and fan to dry off.
2. After wet cleaning, check the insulation resistance.
3. If used, remove the rotation locks for the fan blades
4. Check that you have removed all cleaning equipment and cleaning agents.
5. Check that you have re-attached any parts that were removed from cleaning.
6. Reconnect the power supply.
7. Switch on the motor and fan again.

Decommissioning and disposal

11.1 Decommissioning

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

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

Observe the notes provided in Chapter "Maintenance (Page 125)". Dismantle the motor using the general motor-typical procedures.



WARNING

Death or severe injury caused by falling machine parts

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

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

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

The encoder electronics must be properly disposed of electronic waste.

11.2 Disposal

Recycling and disposal



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

Components

Sort the components for recycling according to whether they are:

- Electronics waste, for example, sensor electronics
- Iron to be recycled
- Aluminum
- Non-ferrous metal, for example, motor windings
- Insulating materials

Process material and chemicals

Sort the process materials and chemicals for recycling according to whether they are:

- Oil
Dispose of the spent oil as special waste in accordance with the spent oil ordinance.
- Grease
- Solvents
- Cleaner solvent
- Paint residues
Do not mix solvents, cleaner solvents and paint residues.

Insulating materials

Electrical insulation materials are mainly used in the stator. Some supplementary components are made of similar materials and must, therefore, be handled in the same manner.

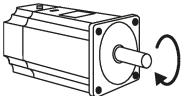
The insulating materials in question are used on the following items of equipment:

- Various insulators which are used in terminals boxes
- Voltage and current transformers
- Power lines
- Instrument wiring
- Surge arrester
- Capacitors

Technical data and characteristics

12.1 SIMOTICS M-1PH3 main motors

12.1.1 General technical data

Parameter	Description		
Type of motor	Asynchronous motor		
Cooling method	Forced ventilation		
Operating temperature	-15 °C to +40 °C (without power derating)		
Relative humidity (operating)	≤ 90%		
Installation altitude	≤ 1000 m (without power derating)		
Noise level	≤ 73 dB		
Thermal class	H		
Vibration severity grade	S/SR according to Siemens/EN 60034-14 (IEC 60034-14)		
Shock resistance	2.25 m/s ² (continuous in the axial direction); 10 m/s ² (continuous in the radial direction)		
Torque ripple		Incremental encoder, 22-bit, with commutation position	Without encoder
	SH100	Under rated load: ≤ 3% Under no load: ≤ 1.5%	-
	SH132	Under rated load: ≤ 2% Under no load: ≤ 1.8%	-
Static bearing lifetime	> 20000 h for the standard bearing version; > 12000 h for the performance bearing version ¹⁾		
Oil seal lifetime	> 20000 h		
Encoder lifetime	> 20000 h		
Motor lifetime	20000 h		
Paint finish	Anthracite 614		
Degree of protection	IP55 (dust-tight and splash-proof during motor operation)		
Tolerance level for shaft and flange accuracies	R		
Type of construction	IM B5, IM B3, IM V1, and IM V5		
Positive rotation	 Clockwise (default setting in SINAMICS S120 drive systems)		
Standards that are complied with	IEC/EN 60204, IEC/EN 60034, and UL1004-1		
Certification	   		

¹⁾ This lifetime is estimated when a motor keeps running at a speed equal to or lower than the average operating speed. Even if the lifetime is not reached, the bearing must be replaced when unusual noises, vibration, or faults are found. For more information about bearing replacement, see Section "Replacing the external fan (Page 130)".

12.1.2 Dimension drawings

DT Configurator

The Drive Technology (DT) Configurator supports you for the following operations:

- Quickly and simply configuring drive components by using the following methods:
 - Using product group preselectors
 - Using targeted navigation through selection menus
 - Entering article numbers directly
- Selecting products starting from the following quick selection elements:
 - Gearboxes
 - Motors
 - Drives
 - Associated options and components
 - Control systems
 - Software licenses
 - Connection systems
- Viewing and downloading the following comprehensive documentation:
 - Technical data sheets
 - Operating instructions
 - Certificates
 - 2D/3D dimension drawings
- Supporting retrofit projects
- Transferring a part list into Industry Mall for online ordering

You can find further information on the Internet at the following link:

DT Configurator (<http://www.siemens.com/dtconfigurator>)

Recency of dimension drawings

Note

Changing motor dimensions

Siemens AG reserves the right to change the dimensions of the motors as part of mechanical design improvements without prior notice. This means that dimension drawings can become out of date. Up-to-date dimension drawings can be requested without any charge from your local SIEMENS office.

12.1.3 Specific technical data

12.1.3.1 Shaft height 100

Article number	1PH310...	1-1□F	3-1□F	3-1□D	5-1□G	5-1□D	7-1□F	7-1□G
Insulation class	H							
Rated power (kW)	3.7	5.5	3.7	7.5	5.5	9	11	
Rated torque (Nm)	24	35	35	36	53	57	53	
Maximum torque (Nm) (speed (r/min))	47 (≤ 1500)	70 (≤ 1500)	71 (≤ 1000)	72 (≤ 2000)	105 (≤ 1000)	115 (≤ 1500)	105 (≤ 2000)	
Rated speed (r/min)	1500	1500	1000	2000	1000	1500	2000	
Maximum speed (r/min)	12000	12000	6000	12000	6000	8000/ 12000	12000	
Rated frequency (Hz)	52.5	53.3	36.9	69.3	36.4	53	69.3	
Rated voltage (phase/phase) (V)	275	280	265	355	275	315	315	
Power factor	0.79	0.826	0.846	0.865	0.835	0.82	0.79	
Rated current (A)	12	16.9	12.9	16.5	17.8	24	29	
Maximum current (A)	24	34	26	33	36	48	58	
Moment of inertia (kgm ²)	0.009	0.0112	0.0112	0.015	0.015	0.018	0.018	
Motor weight (kg)	32	39	39	48	48	53	53	

12.1.3.2 Shaft height 132

Motor type 1PH313...	1-1DF	1-1DE	2-1DE	3-1DG	3-1DD	5-1DD	6-1DD	6-1DS	
								(Y)	(Δ)
Insulation class	H								
Rated power (kW)	11	7.5	9	15	11	12	15	15	15
Rated torque (Nm)	70	60	72	72	105	115	143	143	72
Maximum torque (Nm) (speed (r/min))	140 (≤ 1500)	120 (≤ 1200)	144 (≤ 1200)	144 (≤ 2000)	210 (≤ 1000)	229 (≤ 1000)	287 (≤ 1000)	186 (≤ 1000)	144 (≤ 2000)
Rated speed (r/min)	1500	1200	1200	2000	1000	1000	1000	1000	2000
Maximum speed (r/min)	10000	8000	8000	10000	6000	8000	8000	8000	8000
Rated frequency (Hz)	51.6	41.5	41.7	68.1	35	34.7	35	35.1	67.6
Rated voltage (phase/phase) (V)	355	275	290	370	295	310	278	370	370
Power factor	0.846	0.826	0.844	0.864	0.858	0.837	0.866	0.876	0.806
Rated current (A)	24	21.7	24	30	29.4	30	42.8	31	31.9
Maximum current (A)	48	44	48	60	59	60	86	40	60
Moment of inertia (kgm ²)	0.0547	0.0547	0.0547	0.074	0.074	0.094	0.094	0.094	0.094
Motor weight (kg)	73	73	73	90	90	106	106	106	106

12.1.3.3 Overload factors for intermittent duty types (S6)

The table below specifies the overload factors for intermittent duty types (S6) based on the S1 (continuous operation) characteristics of the relevant motors:

Motor type		Overload factors			
		S6 - 40%	S6 - 25%	S6 - 15%	S6 - 10%
1PH3101-1□F□		1.3	1.5	2	-
1PH3103-1□F□		1.3	1.5	2	-
1PH3105-1□G□		1.3	1.5	2	-
1PH3103-1□D□		1.3	1.5	2	-
1PH3105-1□D□		1.3	1.5	2	-
1PH3107-1□F□		1.3	1.5	2	-
1PH3107-1□G□		1.3	1.5	2	-
1PH3131-1DF□		1.3	1.5	2	-
1PH3133-1DG□		1.3	1.5	2	-
1PH3131-1DE□		1.3	1.5	2	-
1PH3133-1DD□		1.3	1.5	2	-
1PH3132-1DE□		1.3	1.5	2	-
1PH3135-1DD□		1.3	1.5	2	-
1PH3136-1DD□		1.3	1.5	-	2
1PH3136-1DS□	(Y)	1.3	-	-	-
	(Δ)	2	-	-	-

For more information about S1 and S6 characteristics in the typical speed-power diagram, see Section "Selecting motors (Page 109)".

12.1.3.4 Characteristics

Characteristics overview

Note

The characteristics described in this section are generated based on the following drives with a supply voltage of 3-phase 400 V AC:

- SINAMICS S120 Motor Modules in booksize format (SLM/BLM)
- SINAMICS S120 Combi Power Modules

The decreased supply voltage from the drive will cause a decrease of the n_2 speed and voltage limit in the characteristics.

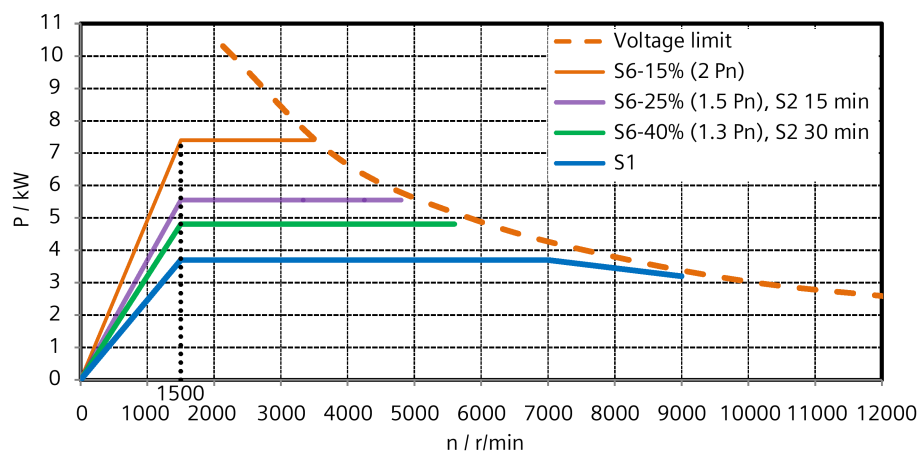
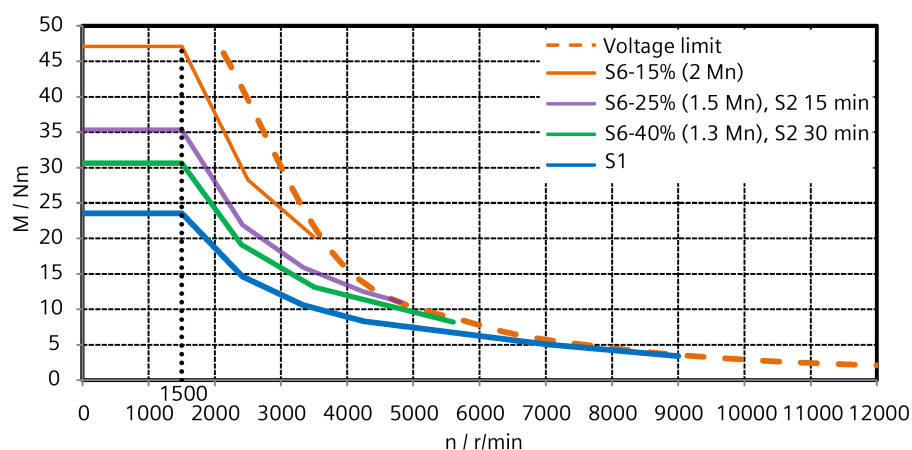
Explanation of technical data abbreviations

Abbrevia- tion	Unit	Description
n_N	r/min	Rated speed
P_N	kW	Rated power
M_N	Nm	Rated torque
I_N	A	Rated current
U_N	V	Rated voltage
f_N	Hz	Rated frequency
n_{max}	r/min	Maximum speed
n_2	r/min	Maximum operating speed in a field-weakening range with the constant power

Shaft height 100

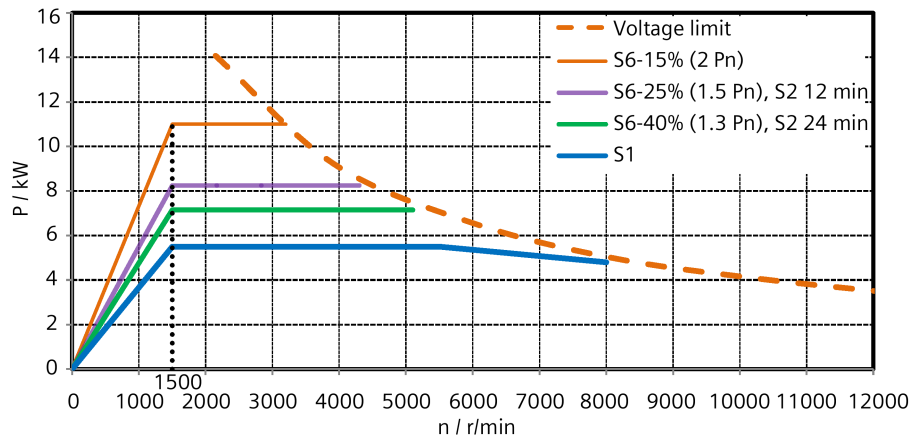
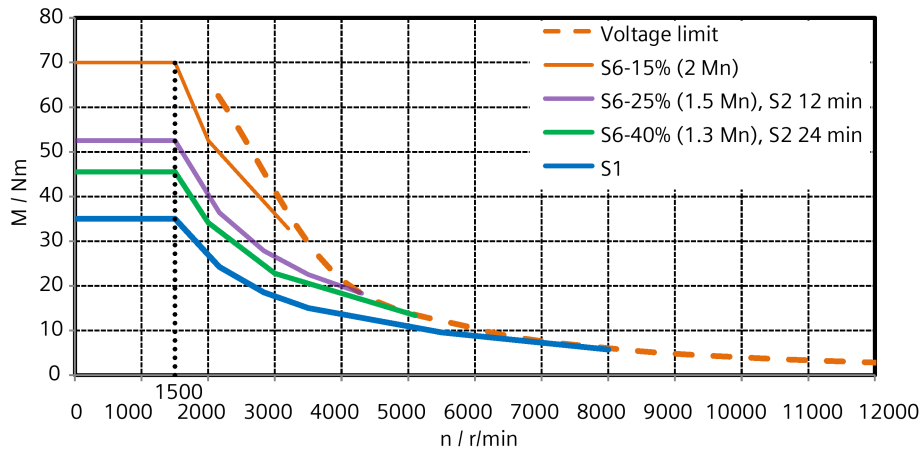
1PH3101-1□F□:

n _N	P _N	M _N	I _N	U _N	f _N	n ₂	n _{max}	P _{S6-40%}	I _{S6-40%}	P _{S6-25%}	I _{S6-25%}	P _{S6-15%}	I _{S6-15%}
[r/min]	[kW]	[Nm]	[A]	[V]	[Hz]	[r/min]	[r/min]	[kW]	[A]	[kW]	[A]	[kW]	[A]
1500	3.7	24	12	275	52.5	7000	12000	4.8	16	5.6	18	7.4	24



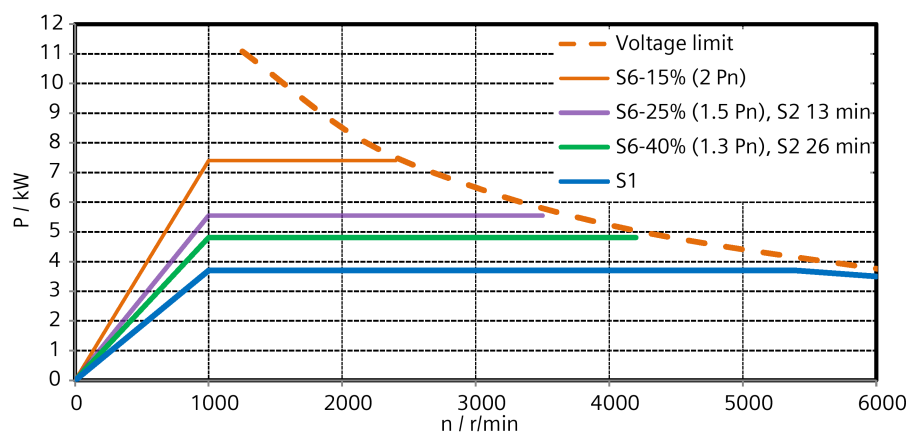
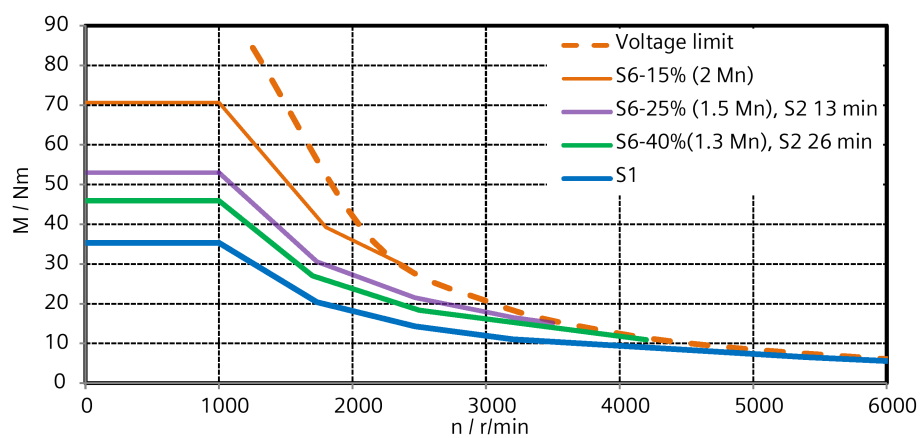
1PH3103-1□F□:

n _N	P _N	M _N	I _N	U _N	f _N	n ₂	n _{max}	P _{s6-40%}	I _{s6-40%}	P _{s6-25%}	I _{s6-25%}	P _{s6-15%}	I _{s6-15%}
[r/min]	[kW]	[Nm]	[A]	[V]	[Hz]	[r/min]	[r/min]	[kW]	[A]	[kW]	[A]	[kW]	[A]
1500	5.5	35	16.9	280	53.3	5500	12000	7.2	22	8.3	25	11	34



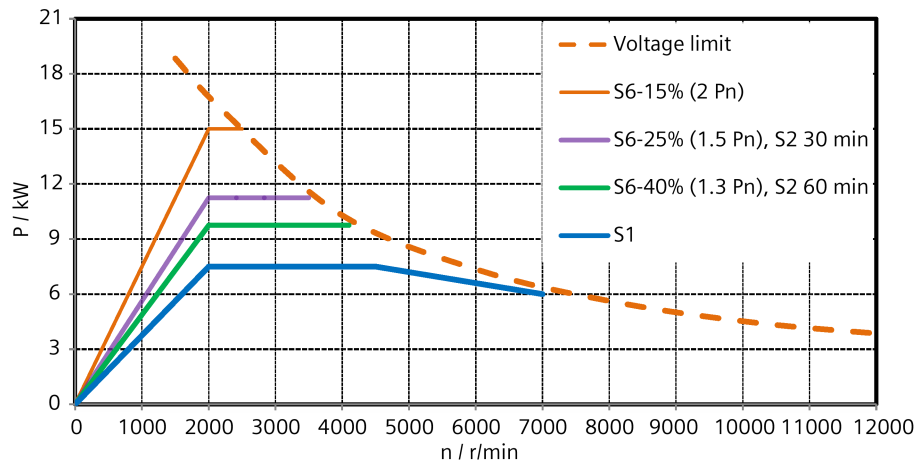
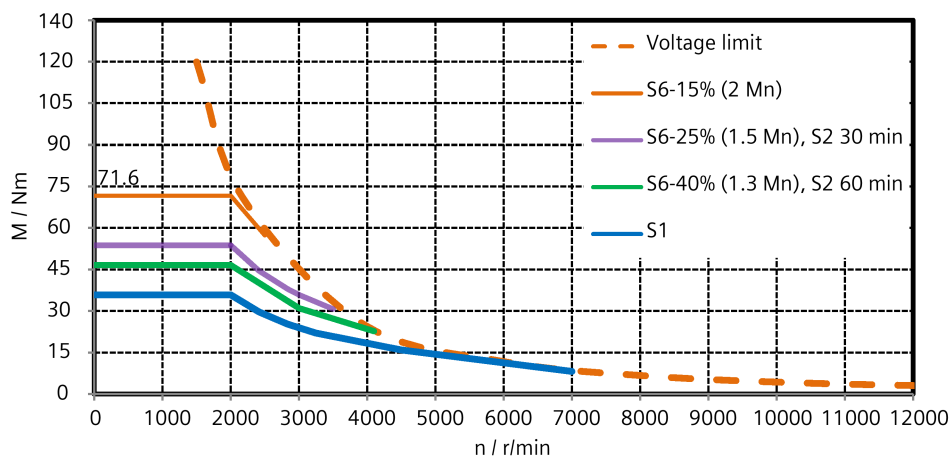
1PH3103-1□D□:

n _N	P _N	M _N	I _N	U _N	f _N	n ₂	n _{max}	P _{S6-40%}	I _{S6-40%}	P _{S6-25%}	I _{S6-25%}	P _{S6-15%}	I _{S6-15%}
[r/min]	[kW]	[Nm]	[A]	[V]	[Hz]	[r/min]	[r/min]	[kW]	[A]	[kW]	[A]	[kW]	[A]
1000	3.7	35	12.9	265	36.9	5400	6000	4.8	17	5.6	19	7.4	26



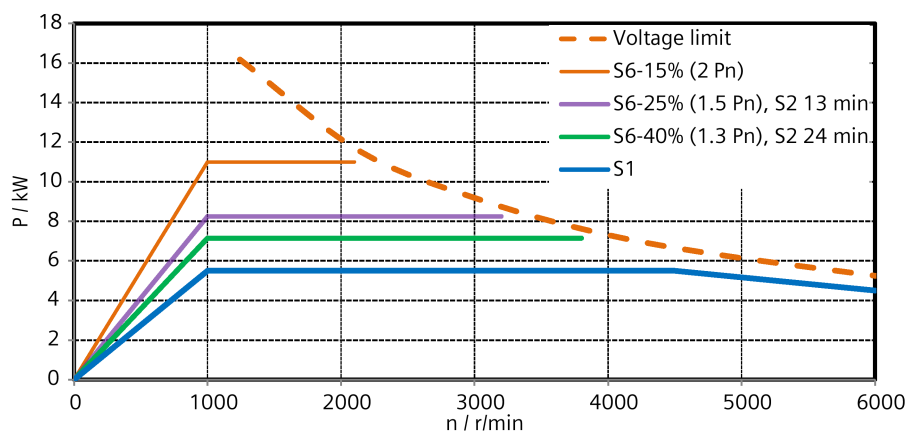
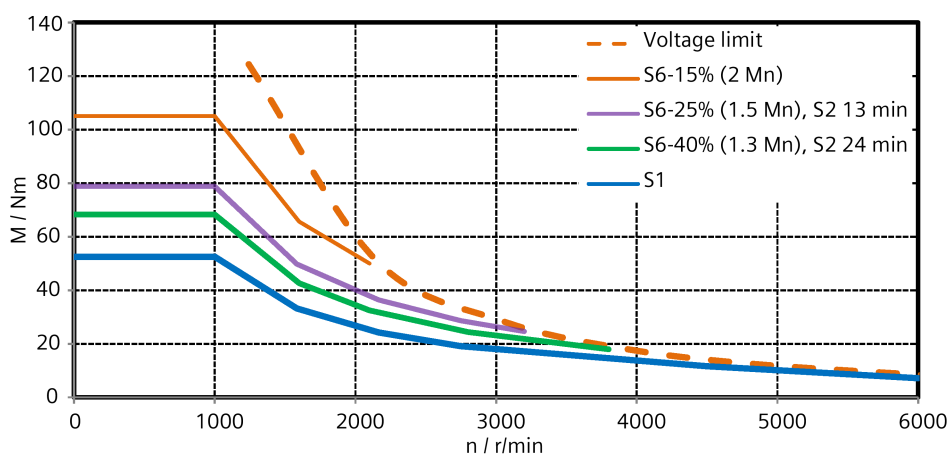
1PH3105-1□G□:

n _N	P _N	M _N	I _N	U _N	f _N	n ₂	n _{max}	P _{s6-40%}	I _{s6-40%}	P _{s6-25%}	I _{s6-25%}	P _{s6-15%}	I _{s6-15%}
[r/min]	[kW]	[Nm]	[A]	[V]	[Hz]	[r/min]	[r/min]	[kW]	[A]	[kW]	[A]	[kW]	[A]
2000	7.5	36	16.5	355	69.3	4500	12000	9.8	21	11.3	25	15	33



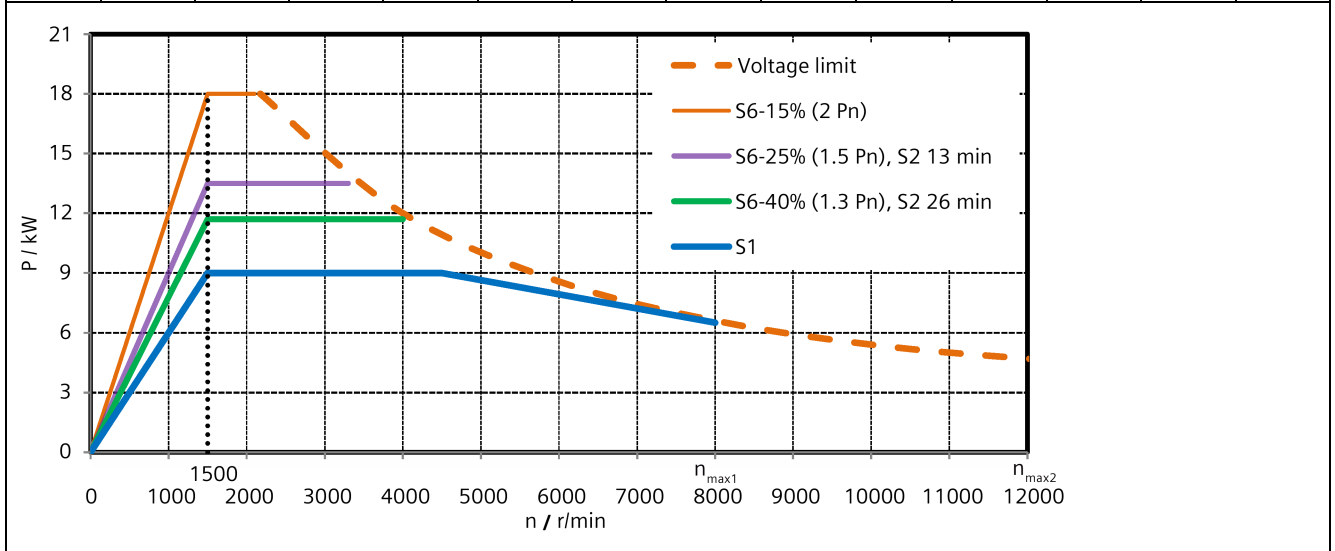
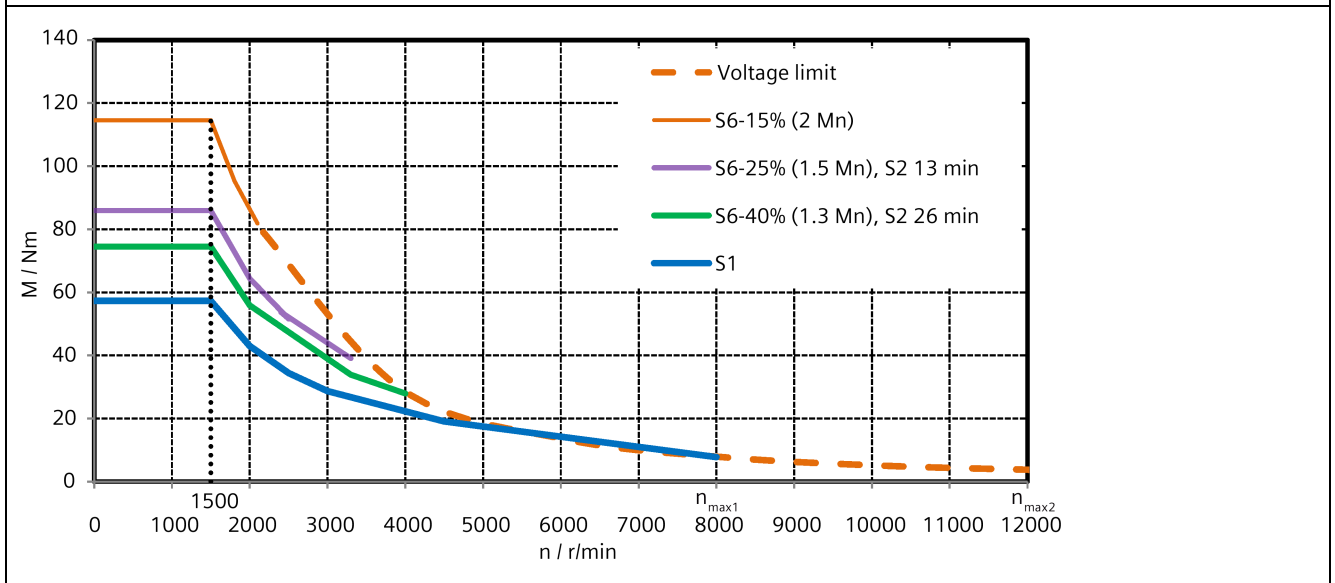
1PH3105-1□D□:

n _N	P _N	M _N	I _N	U _N	f _N	n ₂	n _{max}	P _{S6-40%}	I _{S6-40%}	P _{S6-25%}	I _{S6-25%}	P _{S6-15%}	I _{S6-15%}
[r/min]	[kW]	[Nm]	[A]	[V]	[Hz]	[r/min]	[r/min]	[kW]	[A]	[kW]	[A]	[kW]	[A]
1000	5.5	53	17.8	275	36.4	4500	6000	7.2	23	8.3	27	11	36

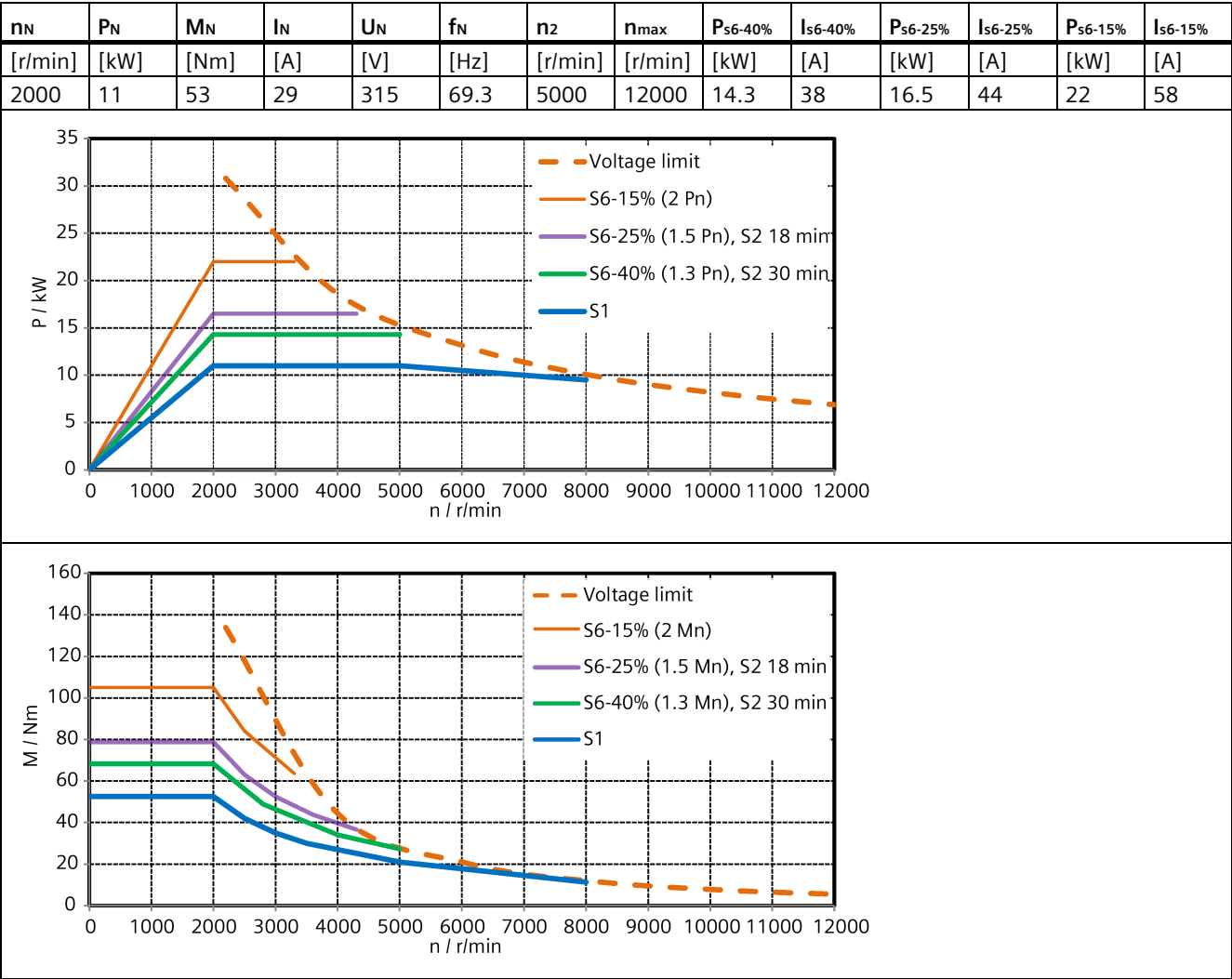


1PH3107-1□F□:

n _N	P _N	M _N	I _N	U _N	f _N	n ₂	n _{max1/2}	P _{s6-40%}	I _{s6-40%}	P _{s6-25%}	I _{s6-25%}	P _{s6-15%}	I _{s6-15%}
[r/min]	[kW]	[Nm]	[A]	[V]	[Hz]	[r/min]	[r/min]	[kW]	[A]	[kW]	[A]	[kW]	[A]
1500	9	57	24	315	53	4500	8000/ 12000	11.7	31	13.5	36	18	48



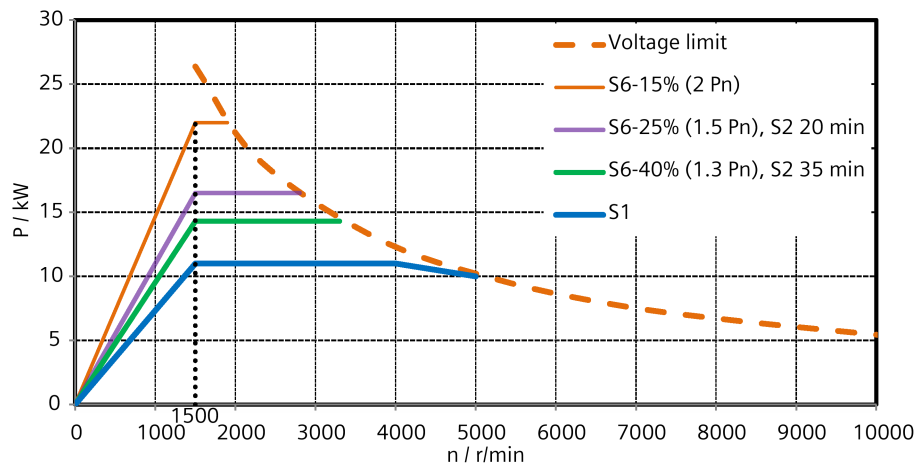
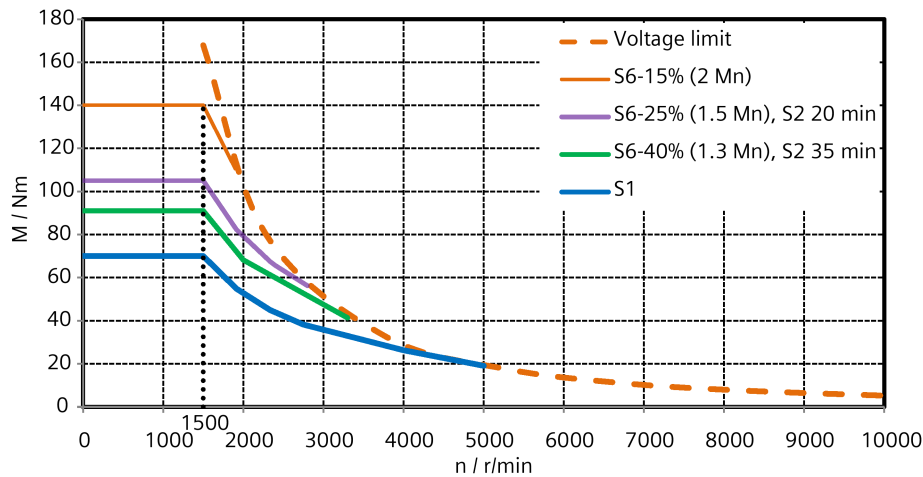
1PH3107-1□G□:



Shaft height 132

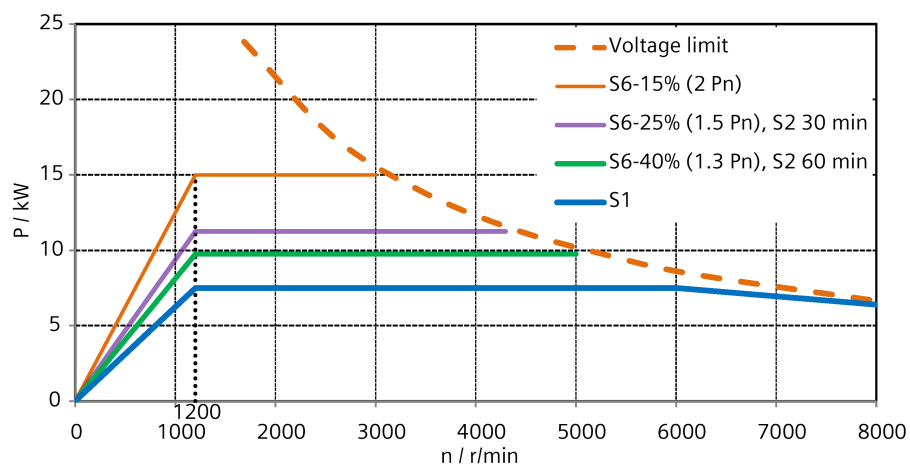
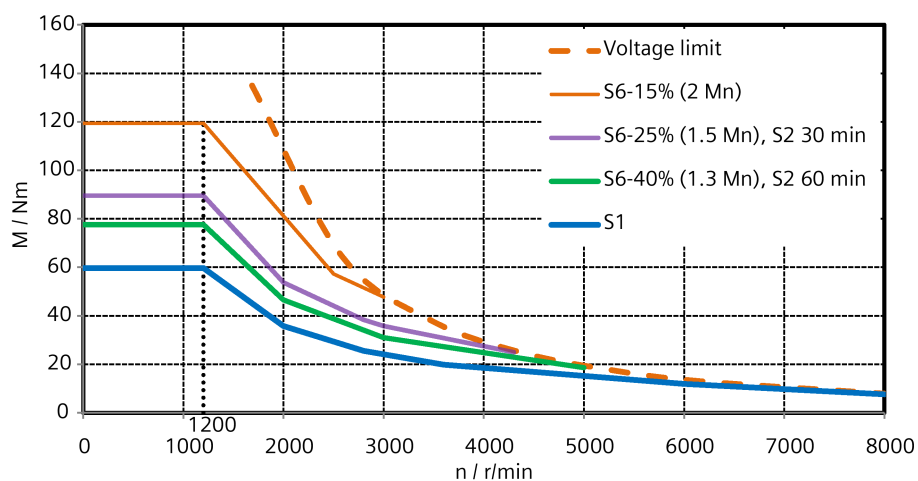
1PH3131-1DF□:

n _N	P _N	M _N	I _N	U _N	f _N	n ₂	n _{max}	P _{s6-40%}	I _{s6-40%}	P _{s6-25%}	I _{s6-25%}	P _{s6-15%}	I _{s6-15%}
[r/min]	[kW]	[Nm]	[A]	[V]	[Hz]	[r/min]	[r/min]	[kW]	[A]	[kW]	[A]	[kW]	[A]
1500	11	70	24	355	51.6	4000	10000	14.3	31	16.5	36	22	48



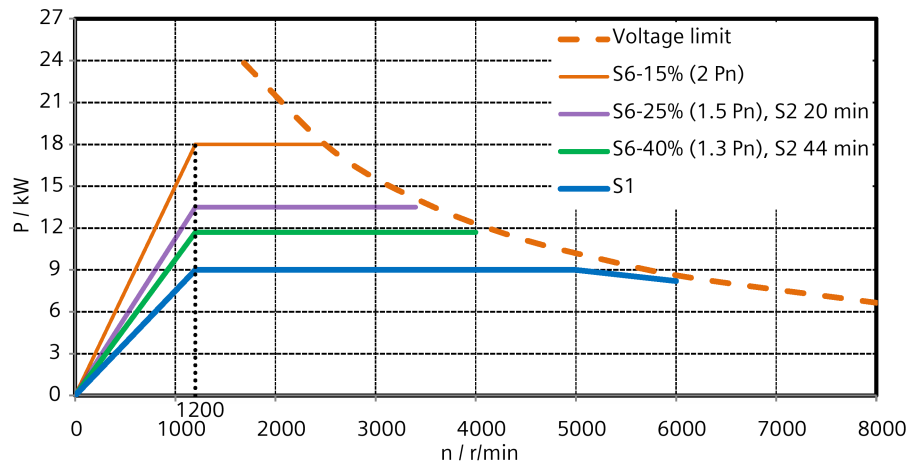
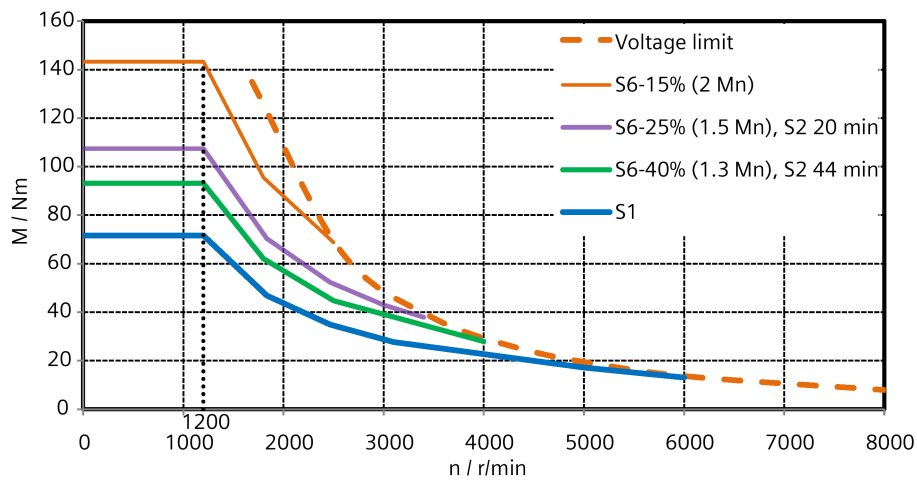
1PH3131-1DE□:

n _N	P _N	M _N	I _N	U _N	f _N	n ₂	n _{max}	P _{s6-40%}	I _{s6-40%}	P _{s6-25%}	I _{s6-25%}	P _{s6-15%}	I _{s6-15%}
[r/min]	[kW]	[Nm]	[A]	[V]	[Hz]	[r/min]	[r/min]	[kW]	[A]	[kW]	[A]	[kW]	[A]
1200	7.5	60	21.7	275	41.5	6000	8000	9.8	28	11.3	33	15	43



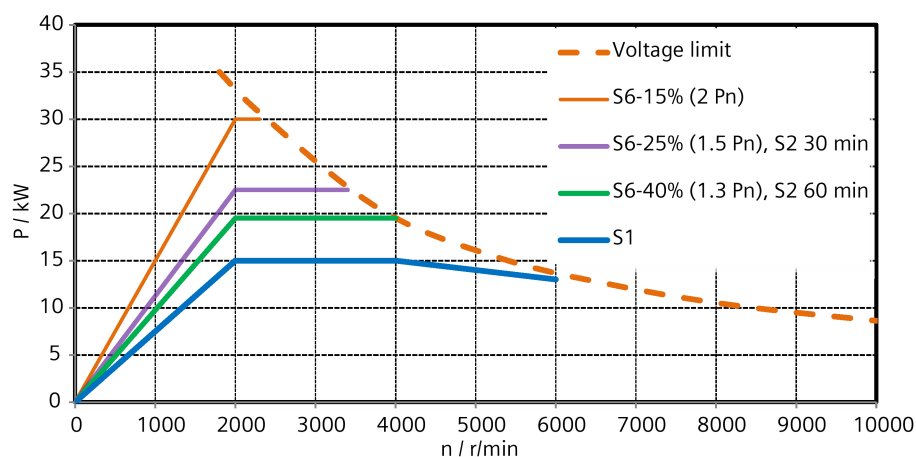
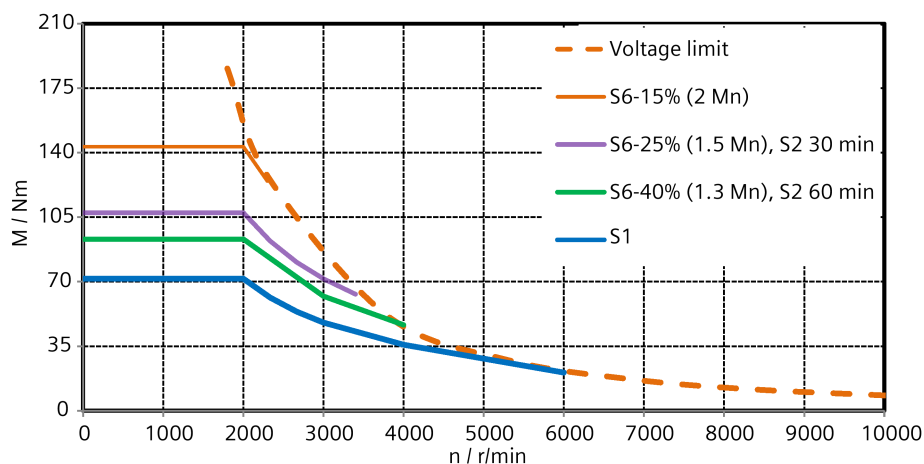
1PH3132-1DE□:

n _N	P _N	M _N	I _N	U _N	f _N	n ₂	n _{max}	P _{s6-40%}	I _{s6-40%}	P _{s6-25%}	I _{s6-25%}	P _{s6-15%}	I _{s6-15%}
[r/min]	[kW]	[Nm]	[A]	[V]	[Hz]	[r/min]	[r/min]	[kW]	[A]	[kW]	[A]	[kW]	[A]
1200	9	72	24	290	41.7	5000	8000	11.7	31	13.5	36	18	48



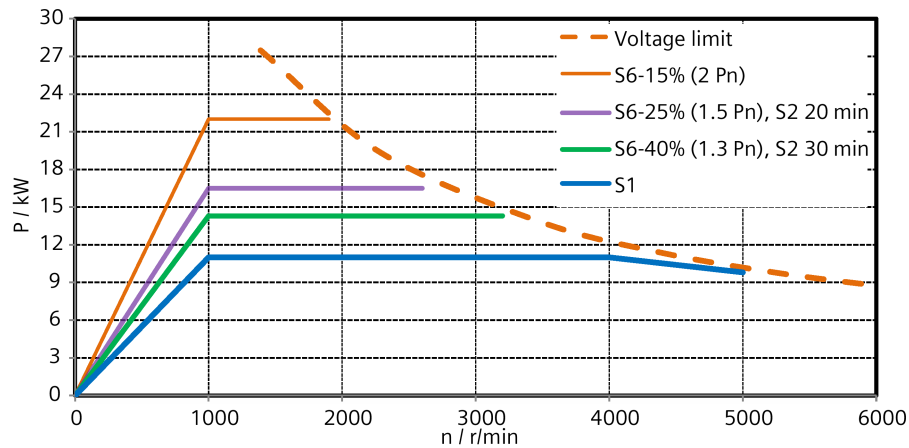
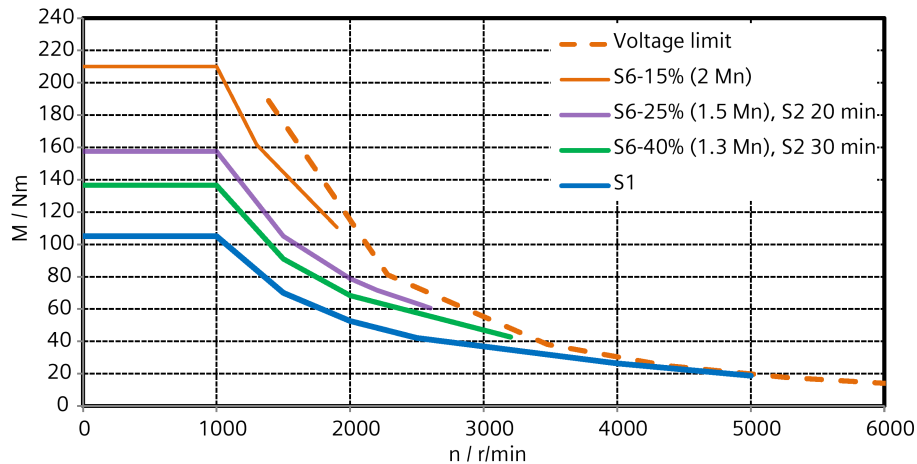
1PH3133-1DG□:

n _N	P _N	M _N	I _N	U _N	f _N	n ₂	n _{max}	P _{s6-40%}	I _{s6-40%}	P _{s6-25%}	I _{s6-25%}	P _{s6-15%}	I _{s6-15%}
[r/min]	[kW]	[Nm]	[A]	[V]	[Hz]	[r/min]	[r/min]	[kW]	[A]	[kW]	[A]	[kW]	[A]
2000	15	72	30	370	68.1	4000	10000	19.5	39	22.5	45	30	60



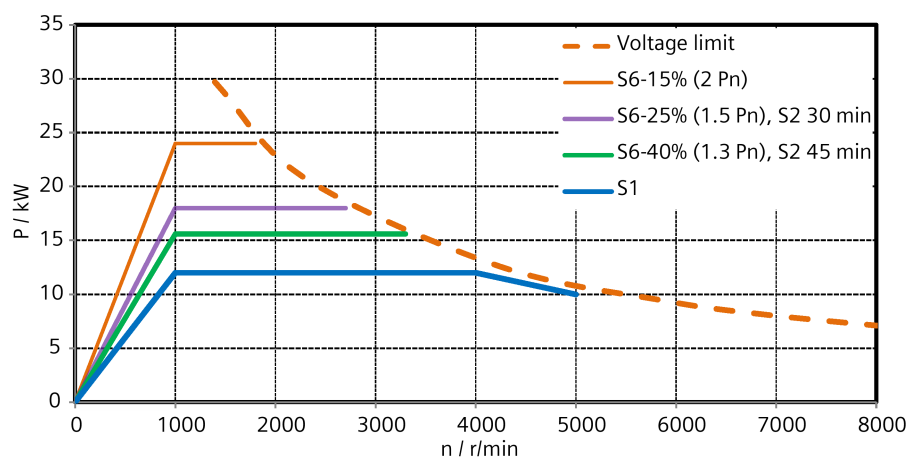
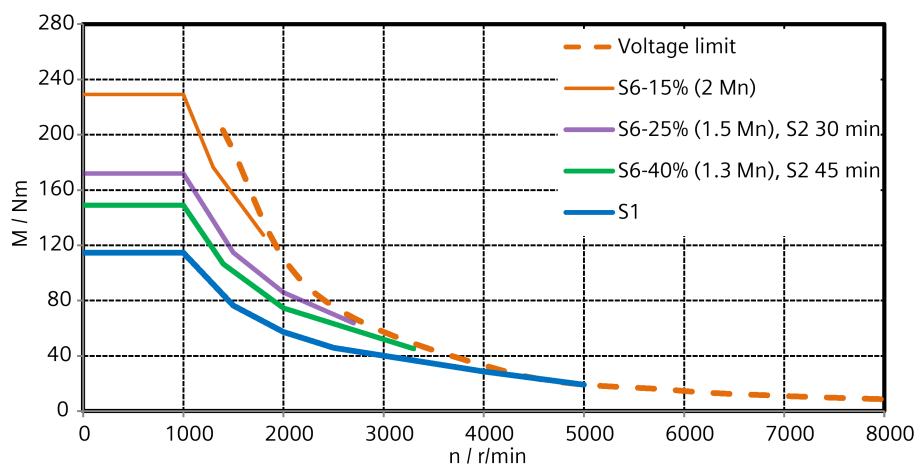
1PH3133-1DD□:

n _N	P _N	M _N	I _N	U _N	f _N	n ₂	n _{max}	P _{s6-40%}	I _{s6-40%}	P _{s6-25%}	I _{s6-25%}	P _{s6-15%}	I _{s6-15%}
[r/min]	[kW]	[Nm]	[A]	[V]	[Hz]	[r/min]	[r/min]	[kW]	[A]	[kW]	[A]	[kW]	[A]
1000	11	105	29.4	295	35	4000	6000	14.3	38	16.5	44	22	59



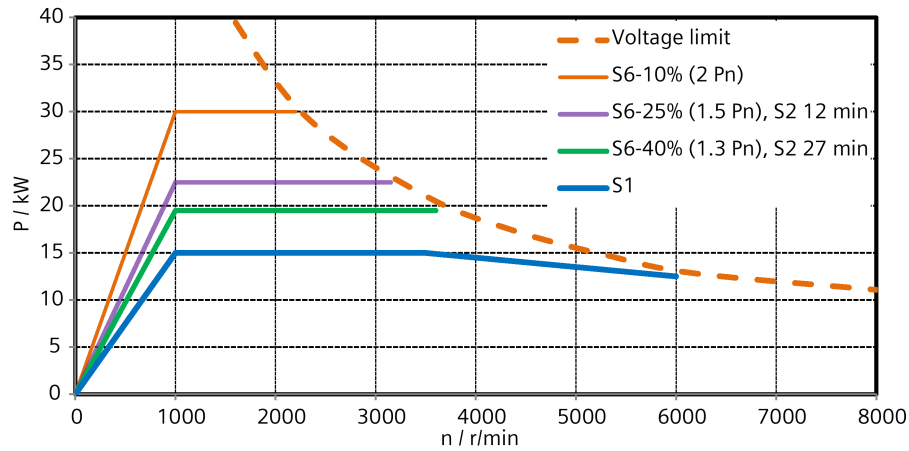
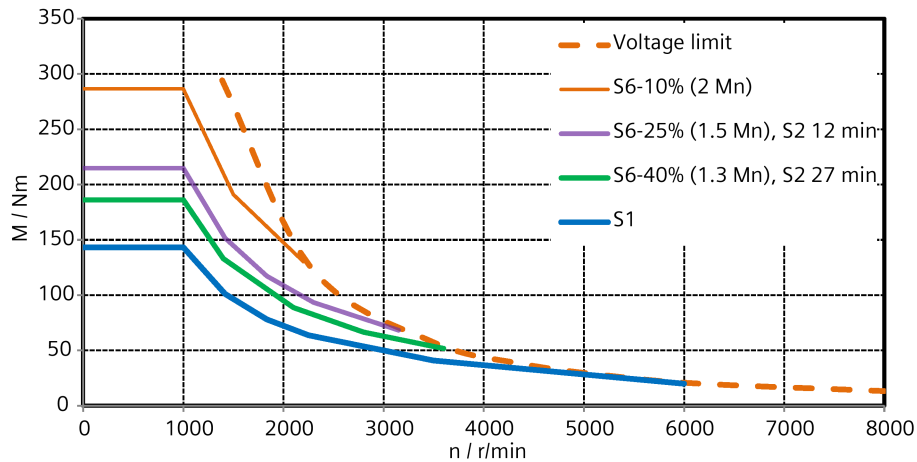
1PH3135-1DD□:

n_N	P_N	M_N	I_N	U_N	f_N	n_2	n_{max}	$P_{S6-40\%}$	$I_{S6-40\%}$	$P_{S6-25\%}$	$I_{S6-25\%}$	$P_{S6-15\%}$	$I_{S6-15\%}$
[r/min]	[kW]	[Nm]	[A]	[V]	[Hz]	[r/min]	[r/min]	[kW]	[A]	[kW]	[A]	[kW]	[A]
1000	12	115	30	310	34.7	4000	8000	15.6	39	18	45	24	60



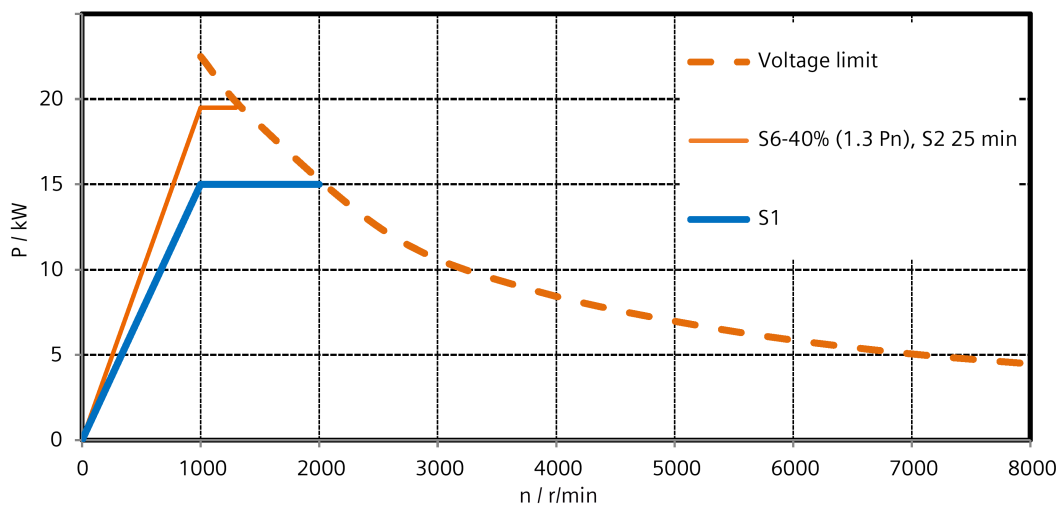
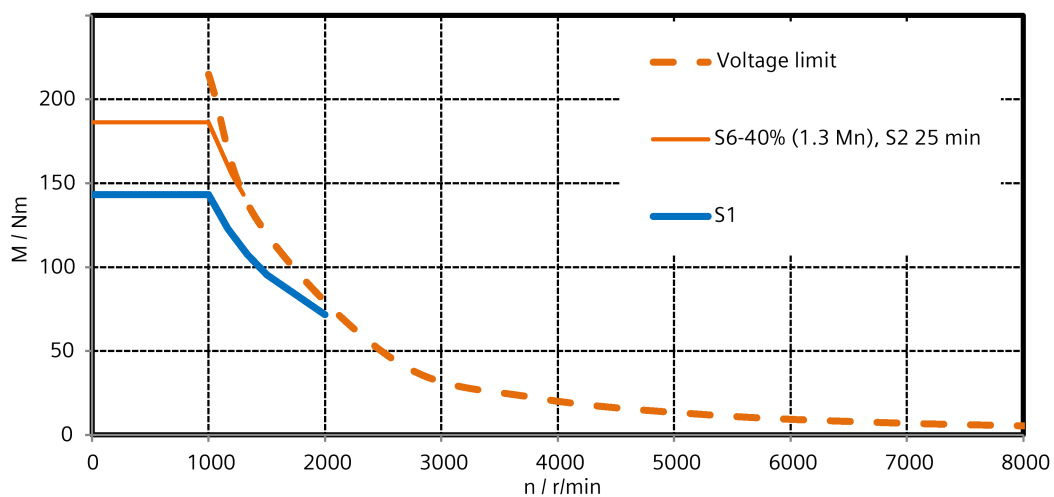
1PH3136-1DD□:

n _N	P _N	M _N	I _N	U _N	f _N	n ₂	n _{max}	P _{s6-40%}	I _{s6-40%}	P _{s6-25%}	I _{s6-25%}	P _{s6-10%}	I _{s6-10%}
[r/min]	[kW]	[Nm]	[A]	[V]	[Hz]	[r/min]	[r/min]	[kW]	[A]	[kW]	[A]	[kW]	[A]
1000	15	143	42.8	278	35	3500	8000	19.5	56	22.5	64	30	86



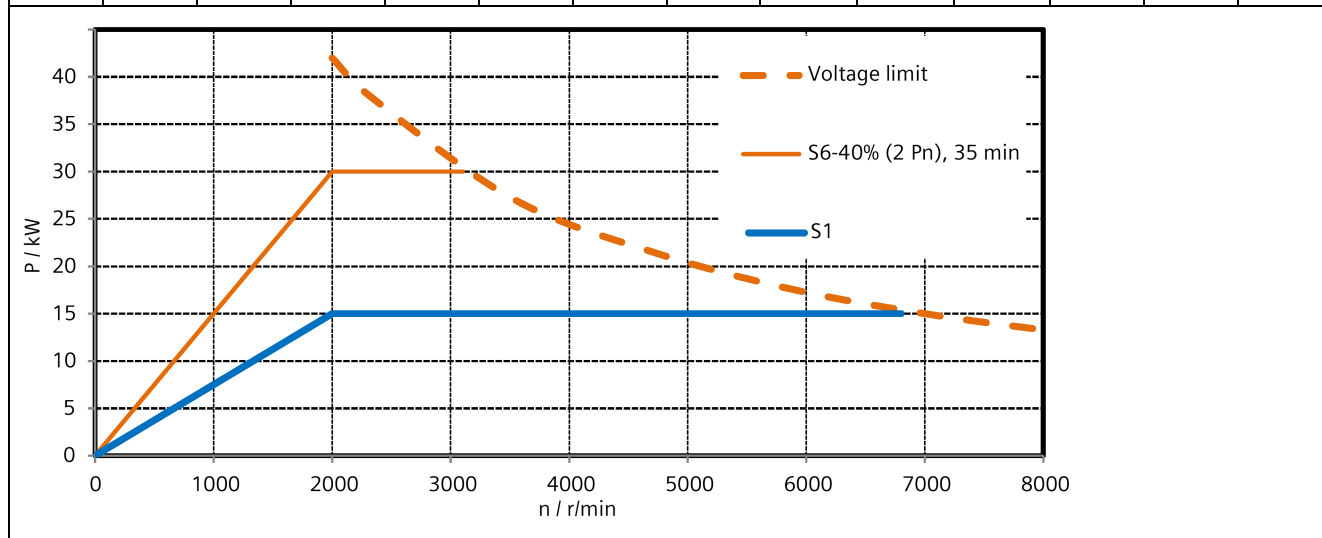
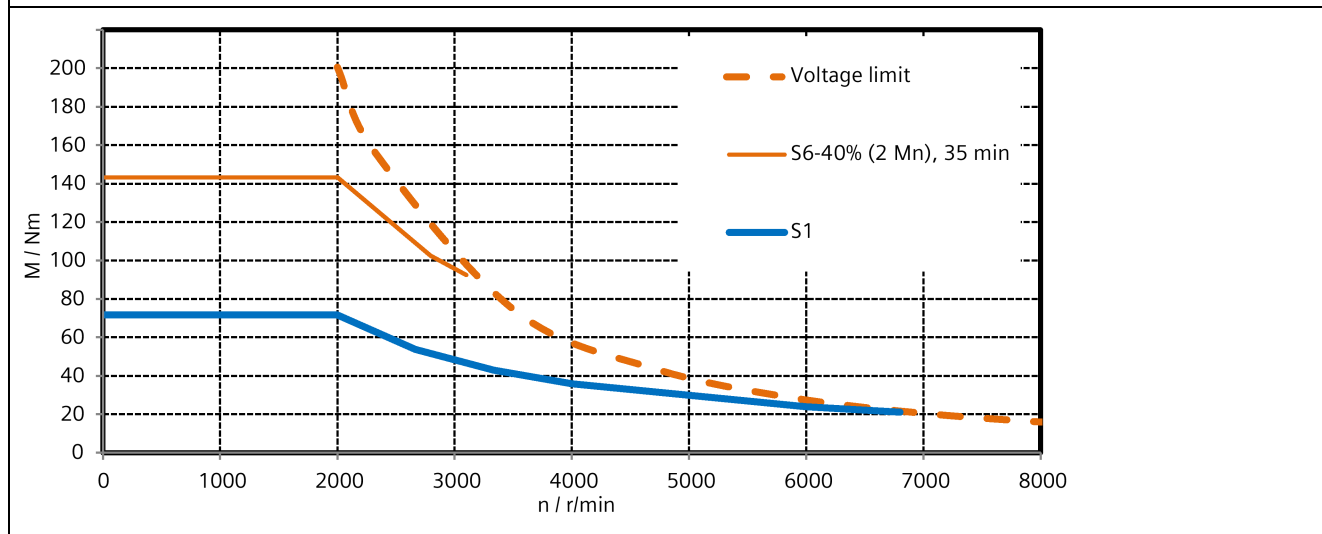
1PH3136-1DS□ (Y-connection):

n _N	P _N	M _N	I _N	U _N	f _N	n ₂	n _{max}	P _{s6-40%}	I _{s6-40%}	P _{s6-25%}	I _{s6-25%}	P _{s6-10%}	I _{s6-10%}
[r/min]	[kW]	[Nm]	[A]	[V]	[Hz]	[r/min]	[r/min]	[kW]	[A]	[kW]	[A]	[kW]	[A]
1000	15	143	31	370	35.1	2000	8000	19.5	40	-	-	-	-



1PH3136-1DS□ (Δ-connection):

n _N	P _N	M _N	I _N	U _N	f _N	n ₂	n _{max}	P _{s6-40%}	I _{s6-40%}	P _{s6-25%}	I _{s6-25%}	P _{s6-10%}	I _{s6-10%}
[r/min]	[kW]	[Nm]	[A]	[V]	[Hz]	[r/min]	[r/min]	[kW]	[A]	[kW]	[A]	[kW]	[A]
2000	15	72	31.9	370	67.6	6800	8000	30	60	-	-	-	-



12.2 MOTION-CONNECT cables

Parameter		Power cable		DRIVE-CLiQ MOTION-CONNECT cable	
		MOTION-CONNECT 500	MOTION-CONNECT 800PLUS	MOTION-CONNECT 500	MOTION-CONNECT 800PLUS
Certificate of suitability	VDE ¹⁾ /RoHS conformity	Yes	Yes	Yes	Yes
	cURus or UR/CSA ²⁾	UL758-CSA-C22.2-N.210.2-M90	UL758-CSA-C22.2-N.210.2-M90	UL STYLE 2502/CSA-N.210.2-M90	UL STYLE 2502/CSA-N.210.2-M90
Rated voltage	Power conductors	600 V/1000 V	600 V/1000 V	30 V	30 V
	Signal conductors	24 V (EN) 1000 V (UL/CSA)	24 V (EN) 1000 V (UL/CSA)		
Test voltage, effective	Power conductors	4 kV	4 kV	500 V	500 V
	Signal conductors	2 kV	2 kV		
Operation temperature on the surface	Fixed installation	-20 °C to +80 °C	-50 °C to +80 °C	-20 °C to +80 °C	-50 °C to +80 °C
	Flexible installation	0 °C to +60 °C	-20 °C to +60 °C	0 °C to +60 °C	-20 °C to +60 °C
Maximum tensile stress	Fixed installation	50 N/mm ²	50 N/mm ²	80 N/mm ²	50 N/mm ²
	Flexible installation	20 N/mm ²	20 N/mm ²	30 N/mm ²	20 N/mm ²
Minimum bending radius	Fixed installation	5 x outer diameter	4 x outer diameter	35 mm	35 mm
	Flexible installation			125 mm	75 mm
Torsional stress		Absolute 30°/m	Absolute 30°/m	Absolute 30°/m	Absolute 30°/m
Bending		100000	10 million	100000	10 million
Traversing velocity		30 m/min	Up to 300 m/min	30 m/min	300 m/min
Acceleration		2 m/s ²	Up to 50 m/s ²	2 m/s ²	Up to 50 m/s ²
Insulation material, including jacket		FCKW/silicone-free	FCKW/halogen/silicone-free IEC 60754-1	FCKW/silicone-free	FCKW/halogen/silicone-free IEC 60754-1
Oil resistance		EN 60811-2-1 (mineral oil only)	EN 60811-2-1	EN 60811-2-1 (mineral oil only)	EN 60811-2-1
Outer jacket		PVC DESINA color orange RAL 2003	PUR, HD22.10 S2 (VDE 0282, Part 10) DESINA color orange RAL 2003	PVC DESINA color green RAL 6018	PUR, HD22.10 S2 (VDE 0282, Part 10) DESINA color green RAL 6018
Flame-retardant		EN 60332-1-1 to 1-3	EN 60332-1-1 to 1-3	EN 60332-1-1 to 1-3	EN 60332-1-1 to 1-3

¹⁾ The respective registration number is printed on the cable jacket.

²⁾ The UR/CSA file number is printed on the cable jacket.

12.3 Address of CE-authorized manufacturer

The CE Declaration of Conformity is held on file available to the competent authorities at the following address:

Siemens AG

Digital Industries

Motion Control

Industriestraße 1

DE-97615 Bad Neustadt a. d. Saale

Germany

Appendix

A.1 Description of terms

Rated torque M_N

This 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 rated torque are defined corresponding to the specified operating mode (duty type) according to IEC 60034-1.

Rated voltage U_N

This is the voltage between two motor phases for which the rating data (P_N , n_N , and so on) is defined. The rated voltage definition takes into account magnetic (iron saturation) and thermal factors.

Rated current I_N

This is the current (effective 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

This is the frequency required for obtaining the performance ratings (P_N , n_N , and so on).

Rated power P_N

This 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

This is the maximum achievable speed at the rated power corresponding to the specified operating mode (duty type) according to IEC 60034-1.

No-load current I_μ

This is the current (effective phase current) that is required for operating the motor under no-load conditions at the 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 $n_{\max}$

This is the speed 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 and is stamped on the rating plate. The motor can be damaged if you operate it at inadmissible speeds.

- Make sure that the maximum permissible speed is not exceeded. Realize this by using a suitable control system or by activating the speed monitoring function in the drive.

Maximum torque $M_{\max}$

This is the torque that is briefly available for dynamic operations, for example, during accelerating.

Maximum current $I_{\max}$

This is the current (effective phase value) that is produced at the rated speed and maximum torque.

S1 duty (continuous operation)

This is the operation with a constant load, the duration of which is sufficient for the motor to go into a thermally steady state.

S6 duty (intermittent operation)

This is the operation that comprises a sequence of identical duty cycles; each of these duty cycles comprises a time period with a constant motor load and a no-load time period. Unless otherwise specified, the constant-load time period refers to a duty cycle of 10 minutes.

Example:

- S6-15% = 1.5 minutes of load operation, 8.5 minutes of no-load operation
- S6-25% = 2.5 minutes of load operation, 7.5 minutes of no-load operation
- S6-40% = 4 minutes of load operation, 6 minutes of no-load operation

A.2 Environmental compatibility

Environmental compatibility

- Environmental compatibility during development
 - When selecting third-party products, environmental compatibility is an essential criterion.
 - Special emphasis is placed on reducing the volume, mass and type variety of metal and plastic parts.
 - Effects of paint-wetting impairment substances (PWIS) need to be excluded via PWIS tests.
- Environmental compatibility during production
 - Third-party products are predominantly transported in re-usable packing. Transport for hazardous materials is not required.
 - The packing materials themselves essentially comprise paperboard containers that are in compliance with the Packaging Directive 94/62/EC.
 - Energy consumption during production needs to be optimized.
 - Production has low emission levels.

- Environmental compatibility for disposal

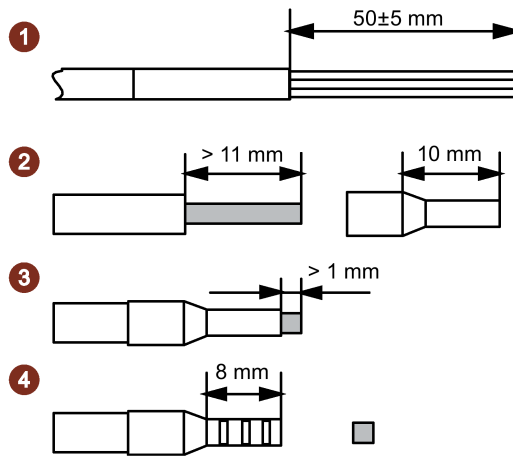
Motors must be disposed in compliance with domestic and local regulations in the normal recycling process or be returned to the manufacturer.

The following must be taken into account when you dispose the motors:

- Disposing oil according to the regulations for disposing old oil (for example, gear oil used when a gearbox is mounted)
- Not mixing solvents, cold cleaning agents, or remains of paint together
- Separating the components that are to be recycled, that is, electronic scraps (encoder electronics or Sensor Module), iron to be recycled, aluminum, and non-ferrous metals (gearwheels or motor windings)

For more information about disposal of the motors, see Section "Disposal (Page 134)".

A.3 Assembling the temperature sensor cable terminals on the motor side



1. Remove the specified length (see illustration) of the outer sheath of the cable.
2. Strip the specified length (see illustration) of the insulation at the end of the wire.
3. Insert the stripped end into the pin-type terminal.
4. Crimp the terminal using a crimping tool, and then cut off the excess part of the wire.

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