

SIEMENS

Configuration Manual

SIMOTICS

M-1FE1 built-in motors

For SINAMICS S120

Edition

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SIMOTICS

Drive technology SIMOTICS M-1FE1 synchronous built-in motors

Configuration Manual

Introduction

Fundamental safety instructions

1

Description

2

Mechanical properties

3

Motor components, characteristics and options

4

Configuration

5

Preparations for use

6

Mounting

7

Electrical connection

8

Technical data and characteristics

9

Dimension drawings

10

Appendix

A

List of abbreviations

B

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

All names identified by ® are registered trademarks of Siemens AG. The remaining trademarks in this publication may be trademarks whose use by third parties for their own purposes could violate the rights of the owner.

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

Documents required_1FE1

Additional documents

When configuring, you require Catalog NC62 (<https://intranet.for.siemens.com/org/i-dt-mc/intraDocs/catalogs/nc622019/NC%2062%20-%202019%20-%20Complete%20Catalog/motion-control-NC62-complete-English-2019.pdf>) as print version or online.

Target group

This documentation addresses project planners and project engineers as well as machine manufacturers and commissioning engineers.

Benefits

The Configuration Manual enables the target group to apply the rules and guidelines to be observed when configuring products and systems.

The Configuration Manual supports you with selecting motors, calculating the drive components, and selecting the required accessories. The Configuration Manual helps the target group to create a system or plant configuration.

Utilization phase

Planning and configuration phase

More information

Information on the following topics is available at:

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

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

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

My support

Information on how to produce individual contents for your own machine documentation based on Siemens contents is available under the link:

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

Note

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

Later, you can log on with your login 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/sc/ww/en/sc/2090>)

Standard scope

This documentation describes the functionality of the standard scope. The machine manufacturer documents the supplements and changes made by the machine manufacturer.

For reasons of clarity, this documentation cannot include all of the detailed information on all of the product types. Further, this documentation cannot take into consideration every conceivable type of installation, operation and service/maintenance.

Keeping the documentation safe

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

Text features

Notes

Notes are shown as follows:

Note

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

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

Instructions for action

Instructions for action are identified using bullet points:

- Execute the instructions for action.

Enumerations

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

Links

Links to additional information are underlined in blue.

When passing over the link, the mouse pointer changes to a hand symbol.

Internet address for products

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

Websites of third parties

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

EC Declarations of Conformity

You can download EC Declarations of Conformity and additional certificates for the SIMOTICS motor series from the Internet at the following link:

Certificates for SIMOTICS motors
(<https://support.industry.siemens.com/cs/products?dtp=Certificate&mfn=ps&pnid=13347&lc=de-WW>)

Table of contents

	Introduction	3
1	Fundamental safety instructions	11
1.1	General safety instructions	11
1.2	Equipment damage due to electric fields or electrostatic discharge	16
1.3	Industrial security.....	17
1.4	Residual risks of power drive systems	19
2	Description	21
2.1	Use for the intended purpose	21
2.2	Features and system preconditions.....	22
2.2.1	Derating factors.....	28
2.2.2	Electromotive force_1FE	29
2.3	Design of the built-in motor	30
2.4	Overview of the motors	31
2.5	Technical features	32
2.5.1	Directives and standards	32
2.5.2	Technical features	34
2.5.2.1	Magnetic forces that occur.....	35
2.5.2.2	Rotor weights and moments of inertia	37
2.6	Rating plate data (type plate)	39
2.7	Selection and ordering data	40
2.8	Structure of the Article No.....	41
3	Mechanical properties.....	45
3.1	Types of construction.....	45
3.2	Degree of protection.....	47
3.3	Permissible motor vibration levels	48
4	Motor components, characteristics and options	51
4.1	Motor components.....	51
4.1.1	Thermal motor protection	51
4.1.1.1	Thermal motor protection with temperature sensors (standard protection)	52
4.1.1.2	Temperature evaluation using the PTC thermistor triplet (full motor protection)	53
4.1.1.3	Temperature evaluation using NTC thermistors (universal protection, option)	54
4.1.1.4	Overview of the temperature sensor connection options	55
4.1.2	Encoder	56
4.1.3	Cooling	58
4.1.3.1	Safety instructions	58
4.1.3.2	Cooling circuit	58

4.1.3.3	Engineering the cooling circuit.....	61
4.1.3.4	Cooling powers to be dissipated (power loss).....	64
4.1.3.5	Coolant.....	68
4.1.4	Commutation angle and pole position identification.....	71
4.1.4.1	Special issues regarding pole position identification for specific motors.....	72
4.2	Options.....	74
4.2.1	Customer data on the rating plate (option Y84).....	75
5	Configuration.....	77
5.1	Procedure when engineering.....	77
5.2	Help when configuring.....	78
5.2.1	SIZER configuration tool.....	78
5.2.2	DT Configurator.....	79
6	Preparations for use.....	81
6.1	Safety instructions for electromagnetic and permanent-magnetic fields.....	81
6.2	Transporting.....	84
6.3	Storage.....	86
7	Mounting.....	89
7.1	Mechanical mounting.....	89
7.1.1	Mounting and removing the rotor (brief form).....	89
7.1.1.1	Tools and resources.....	89
7.1.1.2	Installing the rotor (brief description).....	93
7.1.1.3	Balancing.....	94
7.1.1.4	Removing the rotor (brief description).....	97
7.1.2	Stator assembly with/without cooling jacket.....	98
7.1.2.1	Production equipment, mounting tools and other equipment.....	98
7.1.2.2	Installing the stator (brief description).....	99
7.1.3	Installing the motor spindle.....	100
7.1.3.1	Preparation.....	100
7.1.3.2	Acting magnetic forces.....	101
7.2	Connecting the cooling.....	103
7.2.1	Connecting the water cooling.....	103
7.2.2	Connecting the air cooling.....	103
8	Electrical connection.....	105
8.1	Permissible line systems.....	105
8.2	Circuit diagram of the motor.....	106
8.3	System integration.....	107
8.3.1	Connection notes.....	107
8.3.1.1	Electrical equipment.....	107
8.3.1.2	Connecting cables.....	107
8.3.1.3	Cable cross-sections.....	109
8.3.1.4	Terminal boxes.....	113
8.3.1.5	Recommended grounding.....	113
8.3.1.6	High-voltage test.....	114
8.3.2	Voltage limiting.....	114
8.3.3	Signal connection / motor protection.....	123

8.3.3.1	Connecting the temperature sensors	123
8.3.3.2	Connection assignment of the encoder.....	126
9	Technical data and characteristics	127
9.1	Explanations.....	127
9.2	Technical data	128
9.3	Characteristics.....	132
9.3.1	Data sheets and characteristics.....	132
9.3.2	Calculating the acceleration time from the torque/power characteristic	132
10	Dimension drawings	133
10.1	Reference to the dimension drawings in SIOS.....	133
10.2	DT Configurator.....	134
10.3	CAD CREATOR (title below).....	135
A	Appendix	137
A.1	Technical data and dimensions of the recommended series reactors	137
B	List of abbreviations	143
	Index.....	145

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 six steps apply when establishing safety:

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

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



! WARNING

Electric shock due to connection to an unsuitable power supply

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

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



! WARNING

Electric shock due to damaged motors or devices

Improper handling of motors or devices can damage them.

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

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



! WARNING

Electric shock due to unconnected cable shield

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

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



! WARNING

Electric shock if there is no ground connection

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

- Ground the device in compliance with the applicable regulations.



! WARNING

Arcing when a plug connection is opened during operation

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

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

NOTICE**Property damage due to loose power connections**

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

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

**WARNING****Unexpected movement of machines caused by radio devices or mobile phones**

When radio devices or mobile phones with a transmission power $> 1 \text{ W}$ are used in the immediate vicinity of components, they may cause the equipment to malfunction. Malfunctions may impair the functional safety of machines and can therefore put people in danger or lead to property damage.

- If you come closer than around 2 m to such components, switch off any radios or mobile phones.
- Use the "SIEMENS Industry Online Support app" only on equipment that has already been switched off.

**WARNING****Unrecognized dangers due to missing or illegible warning labels**

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

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

 WARNING

Unexpected movement of machines caused by inactive safety functions

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

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

Note

Important safety notices for Safety Integrated functions

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

 WARNING

Active implant malfunctions due to electromagnetic fields

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

- If you have a heart pacemaker or implant, maintain the minimum distance specified in chapter "Correct usage" from such motors.

 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 you have a heart pacemaker or implant, maintain the minimum distance specified in chapter "Correct usage".
- When transporting or storing permanent-magnet motors always use the original packing materials with the warning labels attached.
- Clearly mark the storage locations with the appropriate warning labels.
- IATA regulations must be observed when transported by air.

! WARNING**Injury caused by moving or ejected parts**

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

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

! WARNING**Fire due to inadequate cooling**

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

- Comply with the specified cooling requirements for the motor.

! WARNING**Fire due to incorrect operation of the motor**

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

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

**! CAUTION****Burn injuries caused by hot surfaces**

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

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

Measures when maintenance is required:

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

1.2 Equipment damage due to electric fields or electrostatic discharge

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



NOTICE

Equipment damage due to electric fields or electrostatic discharge

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

- Only pack, store, transport and send electronic components, modules or devices in their original packaging or in other suitable materials, e.g conductive foam rubber 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 Industrial security

Note

Industrial security

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

In order to protect plants, systems, machines and networks against cyber threats, it is necessary to implement – and continuously maintain – a holistic, state-of-the-art industrial security concept. Products and solutions from Siemens 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. using firewalls and/or network segmentation) are in place.

For additional information on industrial security measures that can be implemented, please visit:

Industrial security (<https://www.siemens.com/industrialsecurity>)

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

To stay informed about product updates, subscribe to the Siemens Industrial Security RSS Feed at:

Industrial security (<https://www.siemens.com/industrialsecurity>)

Further information is provided on the Internet:

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



WARNING

Unsafe operating states resulting from software manipulation

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

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

1.4 Residual risks of power drive systems

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

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

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

Description

2.1 Use for the intended purpose

WARNING

Danger to life and material damage when incorrectly used

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

- Only use the motors for their intended purpose.
- Make sure that the conditions at the location of use comply with all the rating plate data.
- Make sure that the conditions at the location of use comply with the conditions specified in this documentation. When necessary, take into account deviations regarding approvals or country-specific regulations.

WARNING

Danger to life caused by magnetic and electrical fields to persons with active implants

Electric motors represent a danger for people with active implants who come close to the motors.

- If you are an affected person, maintain a minimum separation of 500 mm to motors.

If you wish to use special versions and design variants whose specifications vary from the motors described in this document, then contact your local Siemens office.

If you have any questions regarding the intended usage, please contact your local Siemens office.

Synchronous built-in motors are components for installation in machines and for deployment in industrial or business plants.

Any other application of the motor is considered to be incorrect usage.

The observance of the specifications contained in the Hardware Installation Manual and the Configuration Manual is part of the correct usage.

- Observe the data on the rating plate.

Conditions at the location of use must comply with the specifications on the rating plate.

The 1FE1 is designed for operation in sheltered areas under normal climatic conditions, such as those found on shop floors.

The 1FE1 is not permitted to be operated in hazardous areas.

1FE1 motors are only certified for converter operation.

Applications

The 1FE1 is a three-phase motor for low voltage.

The motor is predominantly used for machine tool main spindle drives.

2.2 Features and system preconditions

The built-in motor is a compact drive solution where the mechanical motor power is transferred directly to the spindle without any mechanical transmission elements.

As the motor is mounted between the spindle bearings, the motor spindle has a high degree of stiffness. For example, this means that C-axis operation for lathes can be implemented using just one drive.

Standard 1FE1 built-in motors are water-cooled, permanent-magnet synchronous motors that are supplied as components.



- 1 Rotor with sleeve (example)
- 2 Stator with cooling jacket for water cooling (standard) (without cooling jacket, on request)
- 3 1FE1 built-in motor installed (shown without any elements on the customer side, e.g. shaft and enclosure)

Figure 2-1 Example of a built-in motor installation

Depending on the motor type, the rotor is equipped with **internal** (IPM) or with **external** (APM) permanent magnets.

Additional information is provided in Chapter "Design of the built-in motor (Page 30)".

A complete, functioning motor is only created once the rotor and stator have been installed in the machine.

Features of the built-in motors

The 4-pole series is especially suitable for high speeds.

The 6 and 8-pulse series are especially suitable for applications demanding high torques and C-axis operation.

The essential features of the 1FE1 include:

- Water-cooled built-in motor with permanent magnet synchronous rotor
- Depending on the frame size, maximum speeds up to 40,000 rpm
- Depending on the frame size, maximum rated torques up to 820 Nm
- Torque is transferred to the spindle without any play through a friction-locked press fit.
- Finish machined and optionally balanced rotor.

Depending on the particular manufacturer version, rotors with sleeve are either prebalanced or not balanced. Rotors with sleeve can be removed from the spindle shaft.

Rotors without sleeve are not balanced. It cannot be guaranteed that they can be removed without causing damage.

Motor spindle design

A motor spindle comprises the following modules:

- Spindle housing
- Spindle shaft with bearings
- Built-in motor
- Cooling system
- Encoder system

The following figure shows the design in detail.

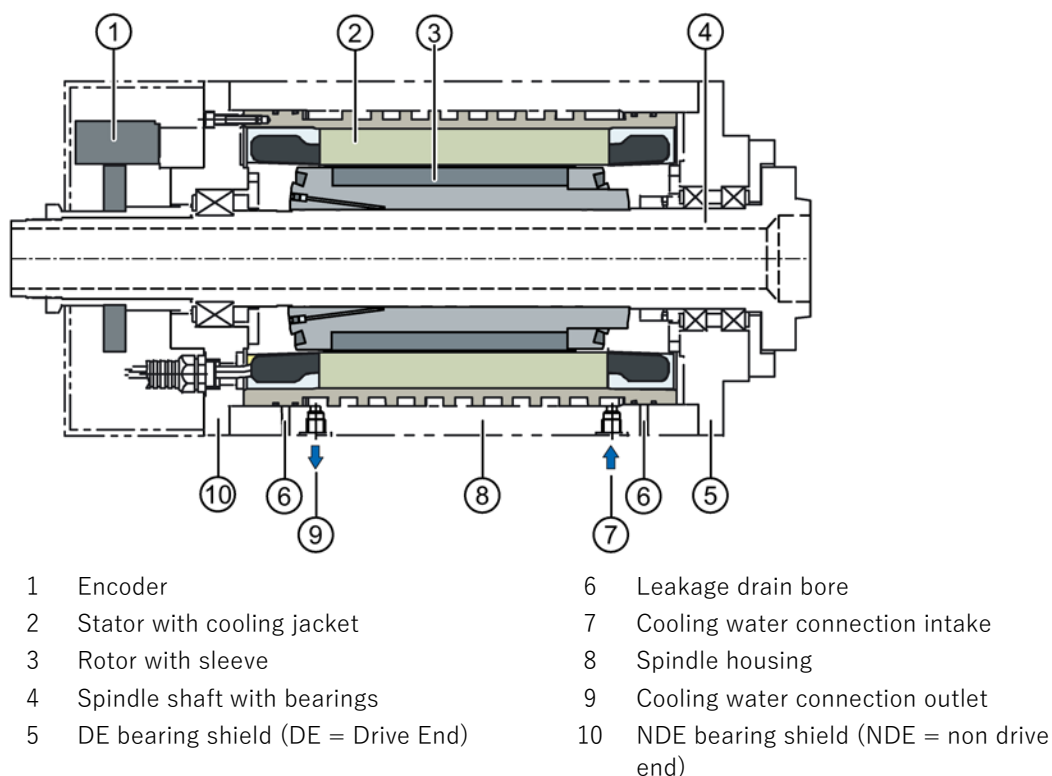


Figure 2-2 Motor spindle design

Note

It is not permissible that the bearing shield protrudes into the motor installation space

Note

The spindle manufacturer is responsible for designing the bearings, lubrication and cooling.

A non-permanent (soft) magnetic shaft material is required to achieve the electrical parameters.

Magnetic attraction

Forces of attraction occur between the rotor and stator in electric motors as a result of the magnetic principle.

The surrounding mechanical structure must absorb these forces.

- The surrounding mechanical structure (spindle shaft, bearings, spindle housing) should be designed to be as stiff as possible so that no vibration can occur.

Precision

The achievable machining precision of the motor spindle is influenced by:

- The stiffness of the system (housing, bearings, spindle)
- The smooth running properties of the motor spindle
- The closed-loop control technology and the encoder resolution

The spindle manufacturer is responsible for the achieved precision.

Static charging

WARNING

Electric shock caused by static charging of the rotor

The rotor can be statically charged at higher speeds depending on the mechanical spindle design as well as the properties of the spindle bearings (e.g. grease and minimum oil lubrication). These could cause you to suffer an electric shock if you touch it.

- If ceramic bearings are used, avoid voltage discharges from the shaft to the sensor housing caused by grounding the motor shaft.

Closed loop control

The determining factors of closed-loop control include:

- the number of encoder signals per spindle revolution
- the precision achieved when mounting and adjusting the encoder system
- the interpolation of encoder signals
- the sampling time of the current and speed controller

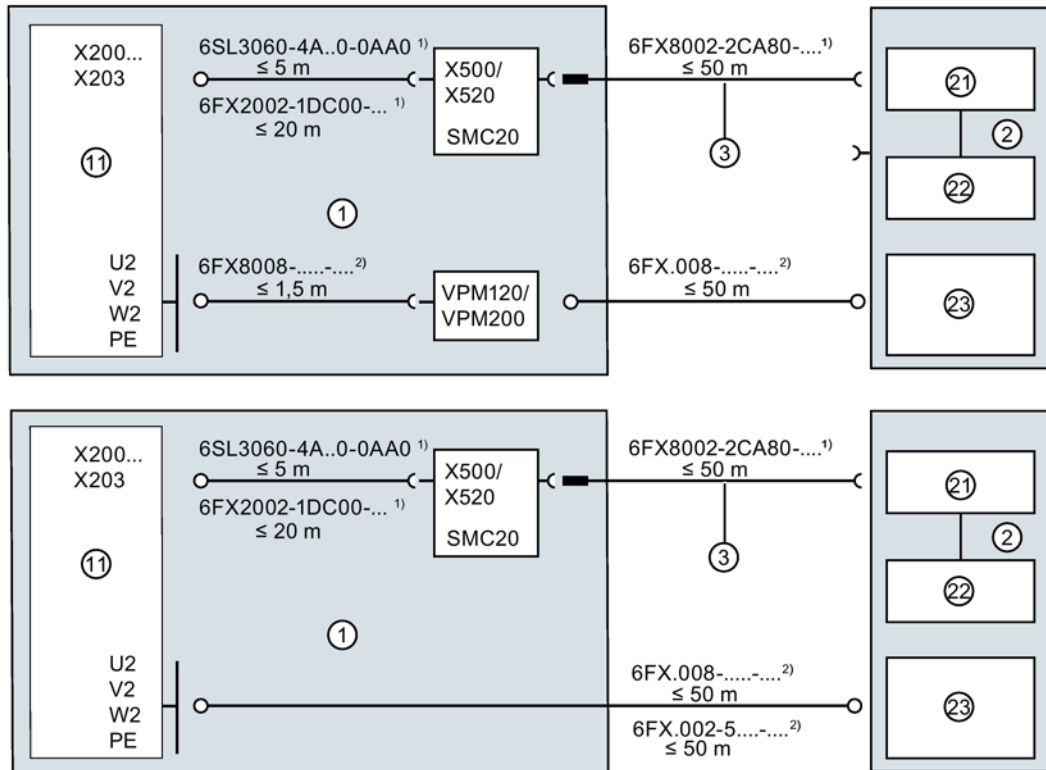
System requirements for the closed-control

Ensure the following requirements:

- Open-loop and closed-loop control modules
 - SINUMERIK 840D sl
 - SINAMICS S120
- Hollow-shaft measuring system

The following diagrams show the possible system integration configurations for the 1FE1.

General rule: Motor with standard protection, integrated into the system via SMC with or without VPM



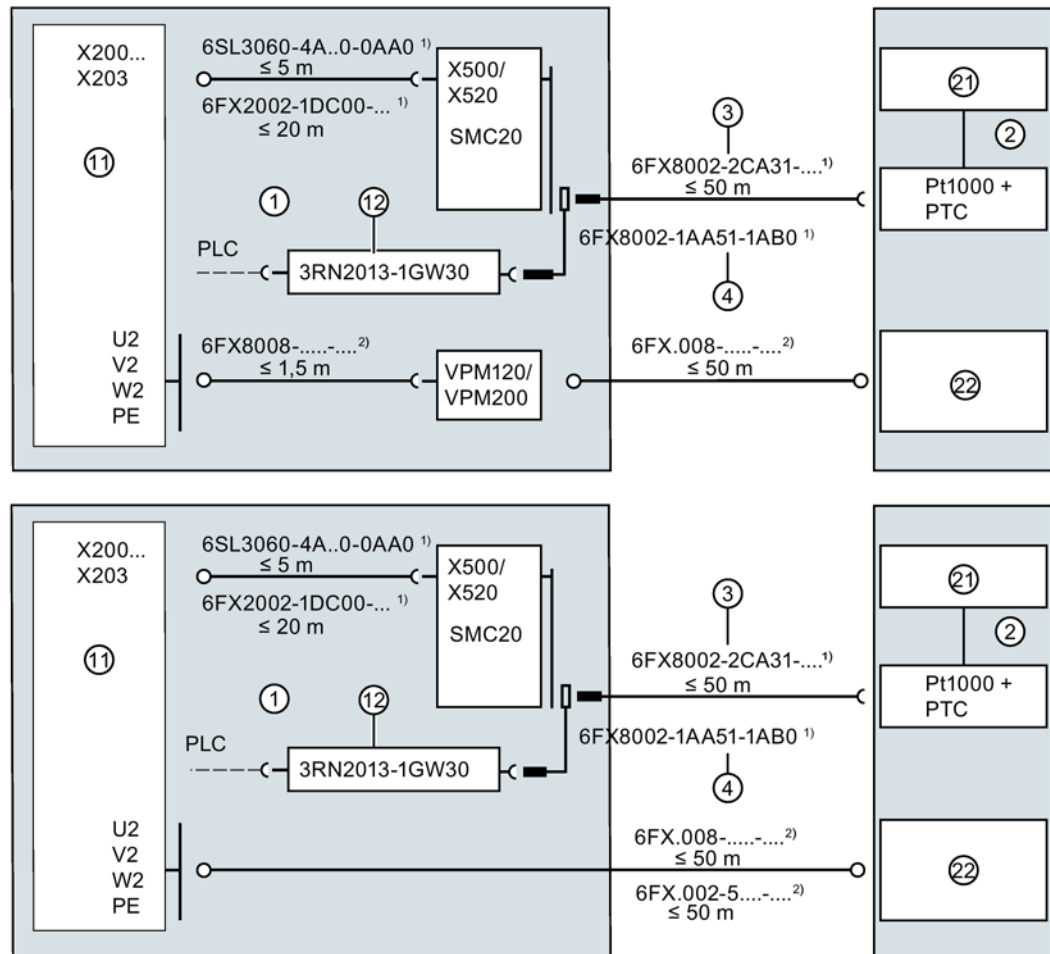
¹⁾ Article numbers for prefabricated MOTION-CONNECT signal cables, M23 connector size

²⁾ Article numbers for prefabricated MOTION-CONNECT power cables

- 1 Electrical cabinet
- 11 SINAMICS S120 Motor Modules, Booksize format, DRIVE CLiQ communication via SMC20
- 2 1FE1 built-in motor
- 21 Incremental encoder sin/cos 1 Vpp or EnDat 2.1 absolute encoder

- 22 Pt1000 temperature sensor
- 23 1FE1 winding, connection via terminal box
- 3 Signal cable for encoder and temperature sensor, 17-pin M23 round connector

Motor with full protection, integrated into the system via SMC20, with or without VPM



¹⁾ Article numbers for prefabricated MOTION-CONNECT signal cables, M23 connector size

²⁾ Article numbers for prefabricated MOTION-CONNECT power cables

- | | |
|---|---|
| 1 Electrical cabinet | 21 Incremental encoder sin/cos 1 Vpp or EnDat 2.1 absolute encoder |
| 11 SINAMICS S120 Motor Modules, Booksize format, DRIVE CLiQ communication via SMC20 | 22 1FE1 winding, connection via terminal box |
| 12 Tripping unit | 3 Signal cable for encoder and temperature sensor, 17-pin M23 round connector |
| 2 1FE1 built-in motor | 4 Signal cable for PTC via tripping unit |

2.2.1 Derating factors

Motors whose maximum speeds exceed the following speeds must be operated with a converter frequency of 8 kHz.

- 4-pole: 24000 rpm
- 6-pole: 16000 rpm
- 8-pole: 12000 rpm

Observe an appropriate Motor Module derating.

The rated motor current is the basis when selecting the Motor Module.

Note

The maximum speed can be increased under certain conditions. Contact your local Siemens office.

You can configure the Motor Modules using the SIZER engineering tool.

- To achieve optimum operation, for the subsequently listed motors, set the following data that deviates from the standard.

Motor article number	Converter pulse frequency f_T in kHz	Current controller cycle time in μs
1FE1042-6WN10 ¹⁾	8	125
1FE1052-4HD10	8	62.5
1FE1053-4HH11		
¹⁾ Also for operation at maximum speeds < 16000 rpm		

2.2.2 Electromotive force_1FE

Operation with a Voltage Protection Module

Note

Electromotive force > 820 V

Depending on the amplitude of the induced phase-to-phase voltage at maximum speed (synchronous generated voltage > 820 V), a Voltage Protection Module (VPM) may be required; see Chapter "Voltage limiting".

Operation with a series reactor

A series reactor with the appropriate inductance is required for the following 1FE1 versions to ensure safe and reliable operation:

1FE1052-4HD..	$L_{\text{series}} = 0.23 \text{ mH}$
1FE1052-4HG..	$L_{\text{series}} = 0.23 \text{ mH}$
1FE1053-4HH..	$L_{\text{series}} = 0.32 \text{ mH}$

We recommend that reactors from the mdexx company (www.mdex.com) are used with the following order designation:

0.23 mH	TEU3031-0UA00-0A
0.32 mH	TEU2731-1UA00-0A

Technical data and dimension drawings for the series reactors are provided in the Appendix under Technical data and dimensions of the recommended series reactors (Page 137).

The drive system setting data, as well as the electrical power data, are only applicable in conjunction with these reactors.

Note

The specified data cannot be guaranteed when using other reactors.

CAUTION

Burn injuries due to hot surfaces

The surfaces of series reactors can reach temperatures of > 100 ° C.

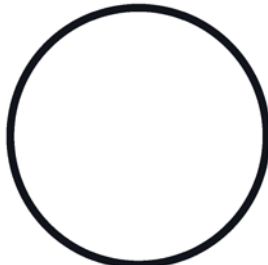
- Do not touch hot series reactors with your bare hands.
- Carefully ensure that temperature-sensitive components are an adequate distance away from hot surfaces.

2.3 Design of the built-in motor

Motor parts

Note

Special versions and construction variants may differ in the scope of delivery with respect to certain technical aspects.

Rotor			
with internal permanent magnets (IPM)		with composite fiber banding and external permanent magnets (APM)	
without sleeve	with sleeve	without sleeve	with sleeve
			
Stator			
with cooling jacket		without cooling jacket (available only on special motor request)	
			
Also included in the scope of delivery			
4 O-ring seals		2 type plates	
			

2.4 Overview of the motors

The following 1FE1 motor types are available:

1FE1 with IPM rotor (rotor with internal permanent magnets)	1FE1 with APM rotor (rotor with external permanent magnets)
1FE105□-4W	1FE105□-4H
1FE107□-4W	1FE110□-4
1FE108□-4□	1FE112□-4
1FE109□-4W	1FE104□-6
1FE105□-6W	1FE114□-8
1FE106□-6W	
1FE108□-6W	
1FE109□-6W	
1FE111□-6W	

Motor types

2.5 Technical features

2.5.1 Directives and standards

Standards that are complied with

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

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

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

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

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

Relevant directives

The following directives are relevant for SIMOTICS motors.

European Low-Voltage Directive



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

European Machinery Directive

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

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

European EMC Directive

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

European RoHS Directive

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

European Directive on Waste Electrical and Electronic Equipment (WEEE)

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

Eurasian conformity

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

**China Compulsory Certification**

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

CCC negative certification:

CCC product certification

(<https://support.industry.siemens.com/cs/products?search=CCC&ctp=Certificate&mfnc=ps&o=DefaultRankingDesc&pnid=13347&lc>)

**China RoHS**

SIMOTICS motors comply with the China RoHS.

You can find additional information at:

China RoHS (<https://support.industry.siemens.com/cs/ww/de/view/109738656/en>)

Underwriters Laboratories

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

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

**Quality systems**

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

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

Certificates for SIMOTICS motors

(<https://support.industry.siemens.com/cs/ww/de/ps/13347/cert>)

2.5.2 Technical features

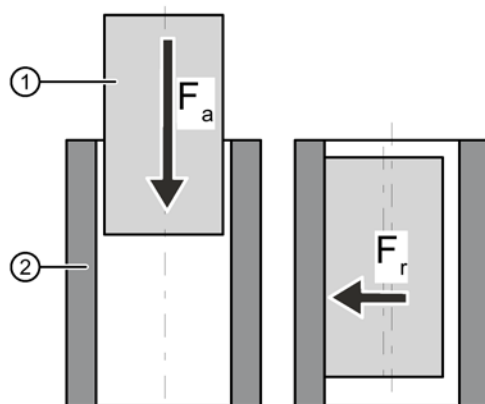
Type of motor	Synchronous motor with permanent-magnet excited rotor (4, 6 or 8-pole)
Type of construction	Individual components (IM 5110 acc. to IEC 60034-7) Stator, rotor
Degree of protection	IP00 (acc. to DIN IEC 60034, Part 5): Stator, rotor
Cooling	Water cooling with $T_{H2O} = 25^\circ \text{C}$ (coolant intake temperature) according to EN 60034-1
Standard protection - temperature monitoring	2 x Pt1000 temperature sensors in the stator winding (of which, 1 x is a reserve)
Full protection (optional)	In addition to the standard protection 1 x PTC thermistor triplet (3 sensors in series) Can be evaluated, e.g. using a thermal motor protection unit: Order No.: 3RN2013-1GW30
Universal protection (optional)	Full protection + NTC PT3-51-F + NTC K227
Winding insulation	Temperature class 155 (F) acc. to EN 60034 permits an average winding temperature rise of 105 K. The power data is valid for a cooling water temperature of $+5^\circ \text{C}$ - 25°C .
Balance quality of the rotor (acc. to ISO 1940-1)	• Rotor with sleeve: Depending on the particular version, pre-balanced, balance quality G 2.5 reference speed 3600 rpm or non-balanced for complete balancing after mounting and installation • Rotor without sleeve: Not pre-balanced
Motor voltage (terminal voltage)	regulated: Maximum 3 AC 430 V_{rms} Non-regulated: Maximum 3 AC 460 V_{rms}
Supply voltage of the SINAMICS S120 drive system	ALM 400 V $\rightarrow V_{DC \text{ link}} \leq 600 \text{ V}$ SLM 400 V $\rightarrow V_{DC \text{ link}} \leq 600 \text{ V}$ SLM 480 V $\rightarrow V_{DC \text{ link}} \leq 650 \text{ V}$ Note: For ALM 480 V infeed, a change must be made to "Smart Mode operation".
Type of connection	Individual supply cables U1, V1, W1; length 0.5 m, 1.5 m or 3.5 m
Torque ripple 1FE1 ... -6W 1FE1 ... -8W 1FE1 ... -4W	$\leq 1\%$ at 20 rpm and $M_N/2$ referred to the rated torque $\leq 1\%$ at 20 rpm and $M_N/2$ referred to the rated torque $\leq 2\%$ at 20 rpm and $M_N/2$ referred to the rated torque

Note

Technical data is system data, and applicable only in conjunction with the specified system components (1FE1 built-in motor, SINAMICS S120 drive system, VPM, etc.).

2.5.2.1 Magnetic forces that occur

For the motor, the following magnetic forces of attraction act.



- ① Spindle shaft with rotor core
- ② Stator core with spindle housing
- F_a Axial attractive force
- F_r Radial attractive force

Figure 2-3 Attractive_forces_motor_spindle

Magnetic forces of attraction

Motor type	Axial forces of attraction F_a / N	Radial forces of attraction F_r / N
IPM rotors		
1FE1051-4W	189	290
1FE1052-4W		580
1FE1053-4W		870
1FE1072-4W	260	700
1FE1073-4W		1050
1FE1074-4W		1400
1FE1075-4W		1750
1FE1082-4W	300	850
1FE1083-4W		1275
1FE1084-4W		1700
1FE1085-4W		2125
1FE1092-4W	180	1000
1FE1093-4W		1500
1FE1094-4W		2000
1FE1095-4W		2500
1FE1096-4W	180	3000
1FE1051-6W		200
1FE1052-6W		400
1FE1054-6W		800

Motor type	Axial forces of attraction F_a / N	Radial forces of attraction F_r / N
1FE1061-6W	250	250
1FE1062-6W		500
1FE1064-6W		1000
1FE1082-6W	350	700
1FE1083-6W		1050
1FE1084-6W		1400
1FE1091-6W	360	350
1FE1092-6W		700
1FE1093-6W		1050
1FE1113-6W	450	1300
1FE1114-6W		1700
1FE1115-6W		2200
1FE1116-6W		2600
APM rotors		
1FE1051-4H	200	150
1FE1052-4H		300
1FE1053-4H		450
1FE1103-4W	250	750
1FE1104-4W		1000
1FE1105-4W		1250
1FE1106-4W		1500
1FE1124-4W	350	1800
1FE1125-4W		2300
1FE1126-4W		2800
1FE1041-6W	180	200
1FE1042-6W		400
1FE1143-8W	700	1800
1FE1144-8W		2400
1FE1145-8W		3000
1FE1147-8W		4200

2.5.2.2 Rotor weights and moments of inertia

Motor article number	Order code Rotor	Stator weight in kg	Rotor weight in kg	Rotor moment of inertia in kg * m ²
6-pole built-in motors				
1FE1041-6W□□□□-□BA□	-	2.50	0.35	0.00019
1FE1042-6W□□□□-□BA□	-	4.00	0.60	0.00033
1FE1051-6W□□□□-□BA□	-	4.00	1.20	0.00106
1FE1051-6W□□□□-□BC□	-	4.00	1.90	0.00152
1FE1052-6W□□□□-□BA□	-	6.00	2.20	0.00195
1FE1052-6W□□□□-□BC□	-	6.00	3.10	0.00248
1FE1054-6W□□□□-□BA□	-	10.00	4.30	0.00380
1FE1061-6W□□□□-□BA□	-	4.00	1.10	0.00141
1FE1061-6W□□□□-□BB□	-	4.00	2.10	0.00242
1FE1062-6W□□□□-□BB□	-	6.50	2.20	0.00283
1FE1064-6W□□□□-□BA□	-	11.50	4.30	0.00553
1FE1082-6W□□□□-□BA□	-	12.00	3.60	0.01048
1FE1082-6W□□□□-□BB□	-	12.00	7.70	0.01841
1FE1082-6W□□□□-□BN□	T34	12.00	7.70	0.01841
1FE1082-6W□□□□-□BC□	-	12.00	6.80	0.01710
1FE1082-6W□□□□-□BN□	T37	12.00	6.80	0.01710
1FE1082-6W□□□□-□BD□	-	12.00	6.10	0.01604
1FE1083-6W□□□□-□BA□	-	17.00	5.70	0.01659
1FE1083-6W□□□□-□BB□	-	17.00	10.60	0.02535
1FE1084-6W□□□□-□BA□	-	22.00	7.10	0.02067
1FE1084-6W□□□□-□BB□	-	22.00	13.60	0.03959
1FE1084-6W□□□□-□BC□	-	22.00	12.20	0.03068
1FE1091-6W□□□□-□BA□	-	14.00	2.60	0.00814
1FE1091-6W□□□□-□BB□	-	14.00	5.40	0.01423
1FE1091-6W□□□□-□BC□	-	14.00	4.50	0.01293
1FE1092-6W□□□□-□BA□	-	21.00	5.00	0.01566
1FE1092-6W□□□□-□BB□	-	21.00	9.10	0.02398
1FE1092-6W□□□□-□BC□	-	21.00	7.50	0.02155
1FE1092-6W□□□□-□BN□ ¹⁾	T37	21.00	8.30	0.02289
1FE1093-6W□□□□-□BA□	-	28.00	7.40	0.02317
1FE1093-6W□□□□-□BB□	-	28.00	12.70	0.03346
1FE1093-6W□□□□-□BC□	-	28.00	10.50	0.03017
1FE1093-6W□□□□-□BN□ ¹⁾	T06	28.00	10.50	0.03017
1FE1113-6W□□□□-□BA□	-	43.00	9.70	0.04765
1FE1113-6W□□□□-□BD□	-	43.00	19.80	0.07747
1FE1113-6W□□□□-□BE□	-	43.00	14.50	0.06512
1FE1114-6W□□□□-□BA□	-	54.00	12.70	0.06239
1FE1114-6W□□□□-□BB□	-	54.00	24.90	0.09843
1FE1114-6W□□□□-□BC□	-	54.00	19.60	0.08650
1FE1114-6W□□□□-□BN□ ¹⁾	T46	54.00	22.40	0.09342
1FE1114-6W□□□□-□BN□ ¹⁾	T49	54.00	20.80	0.08971
1FE1114-6W□□□□-□BN□ ¹⁾	T52	54.00	18.60	0.08353
1FE1114-6W□□□□-□BN□ ¹⁾	T55	54.00	17.90	0.08279

2.5 Technical features

Motor article number	Order code Rotor	Stator weight in kg	Rotor weight in kg	Rotor moment of inertia in kg * m ²
1FE1115-6W□□□-□BC□	-	65.00	23.80	0.10503
1FE1116-6W□□□-□BA□	-	73.00	18.90	0.09285
1FE1116-6W□□□-□BB□	-	73.00	35.80	0.14152
1FE1116-6W□□□-□BC□	-	73.00	28.20	0.12445
8-pole built-in motors				
1FE1143-8W□□□-□BA□		68.00	10.40	0.08627
1FE1144-8W□□□-□BA□	-	82.00	14.50	0.11447
1FE1144-8W□□□-□BC□	-	82.00	24.00	0.18349
1FE1145-8W□□□-□BC□	-	96.00	28.30	0.21636
1FE1145-8W□□□-□BD□	-	96.00	34.00	0.24759
1FE1145-8W□□□-□BE□	-	96.00	41.50	0.28115
1FE1147-8W□□□-□BC□	-	124.00	37.70	0.28823
1FE1147-8W□□□-□BD□	-	124.00	45.20	0.32915
4-pole built-in motors				
1FE1051-4W□□□-□BA□	-	4.50	0.70	0.00057
1FE1051-4H□□□-□BA□	-	4.50	0.60	0.00045
1FE1052-4W□□□-□BA□	-	7.00	1.35	0.00110
1FE1052-4H□□□-□BA□	-	7.00	1.15	0.00087
1FE1053-4W□□□-□BA□	-	9.50	2.00	0.00163
1FE1053-4H□□□-□BA□	-	9.50	1.70	0.00128
1FE1072-4W□□□-□BA□	-	12.50	2.20	0.00287
1FE1073-4W□□□-□BA□	-	16.00	3.30	0.00430
1FE1074-4W□□□-□BA□	-	19.50	4.40	0.00573
1FE1075-4W□□□-□BA□	-	23.00	5.50	0.00741
1FE1082-4W□□□-□BA□	-	15.00	3.10	0.00559
1FE1083-4W□□□-□BA□	-	20.00	4.70	0.00847
1FE1084-4W□□□-□BA□	-	25.00	6.20	0.01118
1FE1085-4W□□□-□BA□	-	30.00	7.70	0.01388
1FE1092-4W□□□-□BR□	-	26.00	3.80	0.00916
1FE1093-4W□□□-□BA□	-	33.00	7.50	0.01694
1FE1093-4W□□□-□BR□	-	33.00	5.60	0.01350
1FE1094-4W□□□-□BA□	-	40.50	9.60	0.02168
1FE1094-4W□□□-□BR□	-	40.50	7.50	0.01808
1FE1095-4W□□□-□BA□	-	48.00	11.70	0.02642
1FE1095-4W□□□-□BR□	-	48.00	9.30	0.02242
1FE1096-4W□□□-□BA□	-	55.50	13.90	0.03139
1FE1096-4W□□□-□BR□	-	55.50	11.20	0.02700
1FE1103-4W□□□-□BA□	-	35.00	5.30	0.01589
1FE1104-4W□□□-□BA□	-	43.00	7.00	0.02098
1FE1105-4W□□□-□BA□	-	52.00	8.70	0.02608
1FE1106-4W□□□-□BA□	-	60.00	10.50	0.03147
1FE1124-4W□□□-□BA□	-	58.00	12.10	0.05112
1FE1125-4W□□□-□BA□	-	69.50	15.00	0.06337
1FE1126-4W□□□-□BA□	-	81.00	18.00	0.07604

1) As an alternative, Z is also valid for N.

2.6 Rating plate data (type plate)

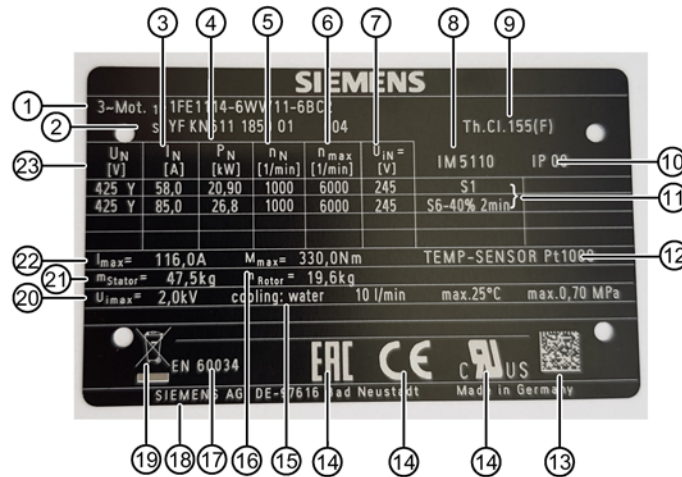


Figure 2-4 1FE1 rating plate (example)

Note

All data applies only in conjunction with the associated rotor.

Position	Description / technical data
1	Motor type: Synchronous motors; motor type / order number
2	Ident. No., serial number
3	Rated current I_N / A
4	Rated power P_N / kW
5	Rated speed n_N / rpm
6	Maximum speed n_{max} / rpm
7	Induced voltage at the rated speed U_{IN} / V
8	Type of construction
9	Temperature class
10	Degree of protection
11	Technical data for S1 and S6 40% 2 minutes
12	ID, temperature sensor
13	2D code contains the motor data
14	Certifications
15	Data regarding water cooling
16	Maximum torque M_{max} / Nm
17	Product standard
18	Production address
19	Marking, compliance with WEEE

Position	Description / technical data
20	Maximum induced voltage U_{Imax} / V
21	Weight of stator m_{stator} / kg and rotor m_{rotor} / kg
22	Maximum current I_{max} / A
23	Rated voltage U_{N} / V

2.7 Selection and ordering data

The required Motor Modules are selected according to the peak and continuous currents that occur in the load cycle.

If more than one motor is operated in parallel on one drive system, the total (summed) values of the peak and continuous currents must be taken into account.

Use the SIZER (<https://support.industry.siemens.com/cs/document/54992004/sizer-for-siemens-drives?dti=0&pnid=13434&lc=en-WW>) engineering tool to select the appropriate Motor Module.

NOTICE

Damage to the insulation on synchronous built-in motors on regulated infeed units

Where synchronous built-in motors are used together with regulated (closed-loop controlled) infeed units (e.g. Active Line Modules), electrical oscillations can occur with respect to ground potential. These oscillations result in increased voltage loads (stress).

Factors that influence these system oscillations include, for example:

- cable lengths
- size of the Motor Module
- number of axes
- motor size
- winding design
- Avoid increased voltage loads or damage to the main insulation of the motor by using an Active Interface Module in Active Line Mode of the motor.

Using smaller Motor Modules

Note

For several motor types, smaller Motor Modules with $I_n < I_{n \text{ motor}}$ can restrict the speed range that can be used, even in partial load operation.

Therefore, please contact your local Siemens office.

2.8 Structure of the Article No.

The article number comprises a combination of digits and letters. It is divided into 3 hyphenated blocks.

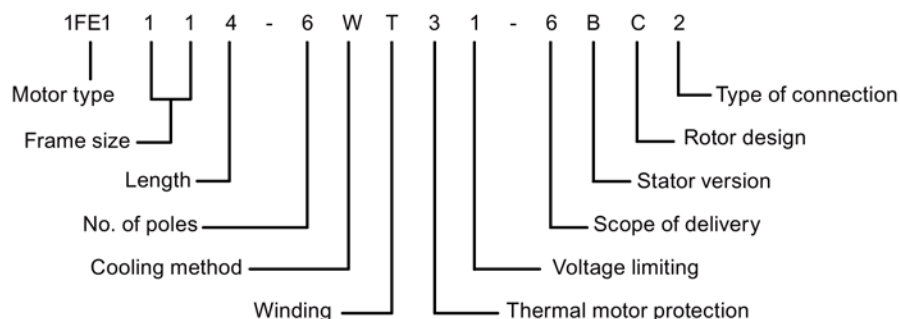


Figure 2-5 Structure of the article number_1FE1

Possible combinations are provided in Catalog NC 62

(<https://intranet.for.siemens.com/org/i-dt-mc/de/motion-control/support/infomaterial/kataloge/nc-62-sinumerik-840d-sl/Seiten/NC-62-SINUMERIK-840.aspx>) and in the DT CONFIGURATOR (<http://siemens.de/dt-konfigurator>).

Please note that not every theoretical combination is available.

Description	Position of the article number																			
	1	2	3	4	5	6	7	-	8	9	10	11	12	-	13	14	15	16	-	Z
Synchronous built-in motors SIMOTICS M-1FE1	1	F	E	1																
Frame size					0	4														
					0	5														
					0	6														
					0	7														
					0	8														
					0	9														
					1	0														
					1	1														
					1	2														
					1	4														
Length							1													
							2													
							3													
							4													
							5													
							6													
							7													
No. of poles	4-pole							4												
	6-pole							6												

Description		Position of the article number																			
		1	2	3	4	5	6	7	-	8	9	10	11	12	-	13	14	15	16	-	Z
	8-pole									8											
Cooling	Water cooling										W										
Winding version	e.g. C, D, E, ...											□									
	Special winding ²⁾											B									
Thermal motor protection¹⁾	Cast winding with standard protection (2 temperature sensors)												1								
	Cast winding with full protection (standard protection + PTC thermistor triplet)												3								
	Cast winding with universal protection (full protection + NTC-PT3-51F + NTC K227)												5								
Voltage limiting	Operation without Voltage Protection Module (VPM)													0							
	Operation with VPM													1							
Scope of delivery	Spare part: Only rotor ("W" at the 15th position of the Article No.)															3					
	Stator and rotor; 2 Pt1000 temperature sensors															6					
	Spare part: Stator only (W in rotor version); 2 Pt1000 temperature sensors															7					
Stator version	Stator with standard cooling jacket ¹⁾																B				
	Stator with special cooling jacket ²⁾ , Z option: V□□																N				
	Order only rotor (if 13th position of the article number = "3")																W				
Rotor version (with different bore versions)	Without rotor sleeve, d _i * - see Table " Dimensions of the built-in motors (https://support.industry.siemens.com/cs/ww/de/view/109771183)" (https://support.industry.siemens.com/cs/ww/de/view/109771183)																	A			
	With rotor sleeve, d _i * - see Table " Dimensions of the built-in motors (https://support.industry.siemens.com/cs/ww/de/view/109771183)" (only for 1FE1061/1FE108/1FE109)																	B			
	With rotor sleeve, d _i ** - see Table " Dimensions of the built-in motors (https://support.industry.siemens.com/cs/ww/de/view/109771183)" (only for 1FE1051/1FE1052/1FE108/1FE109)																	C			
	With rotor sleeve, d _i ** - see Table " Dimensions of the built-in motors" (only for 1FE1082)																	D			
	Customized rotor version with Z option Txx																	N			
	Order only stator (if 13th position of the article number = "7")																	W			
Type of connection	Free cable ends, length 1.5 m																				
	Free cable ends, length 0.5 m																				
	Free cable ends, length 3.5 m available as option																		8	X35 ³⁾	
																			8	X36 ³⁾	

¹⁾ Temperature sensors: see the scope of delivery

²⁾ Only available on request; please contact your local Siemens office

³⁾ Additional descriptive option according to "Z" at the 16th position of the article number

Mechanical properties

3.1 Types of construction

IPM rotors are rotors with **internally located** permanent magnets.

APM rotors are rotors with **externally located** permanent magnets.

Table 3- 1 Assignment of the types of construction to the built-in motors

Motor type	IPM rotors		APM rotors	
	without sleeve	with sleeve	without sleeve	with sleeve
6-pole built-in motors				
1FE104□-6	–	–	X	–
1FE105□-6	X	X	–	–
1FE106□-6	X	X	–	–
1FE108□-6	X	X	–	–
1FE109□-6	X	X	–	–
1FE111□-6	X	X	–	–
8-pole built-in motors				
1FE1143-8	–	–	X	–
1FE1144-8	–	–	X	X
1FE1145-8	–	–	X	X
1FE1147-8	–	–	X	X
4-pole built-in motors				
1FE105□-4W	X	–	–	–
1FE105□-4H	–	–	X	–
1FE107□-4	X	–	–	–
1FE108□-4	X	–	–	–
1FE109□-4	X	X	–	–
1FE110□-4	–	–	X	–
1FE112□-4	–	–	X	–

Design

The rotors of built-in motors are finish machined and mounted directly onto the motor spindle shaft without requiring any subsequent machining.

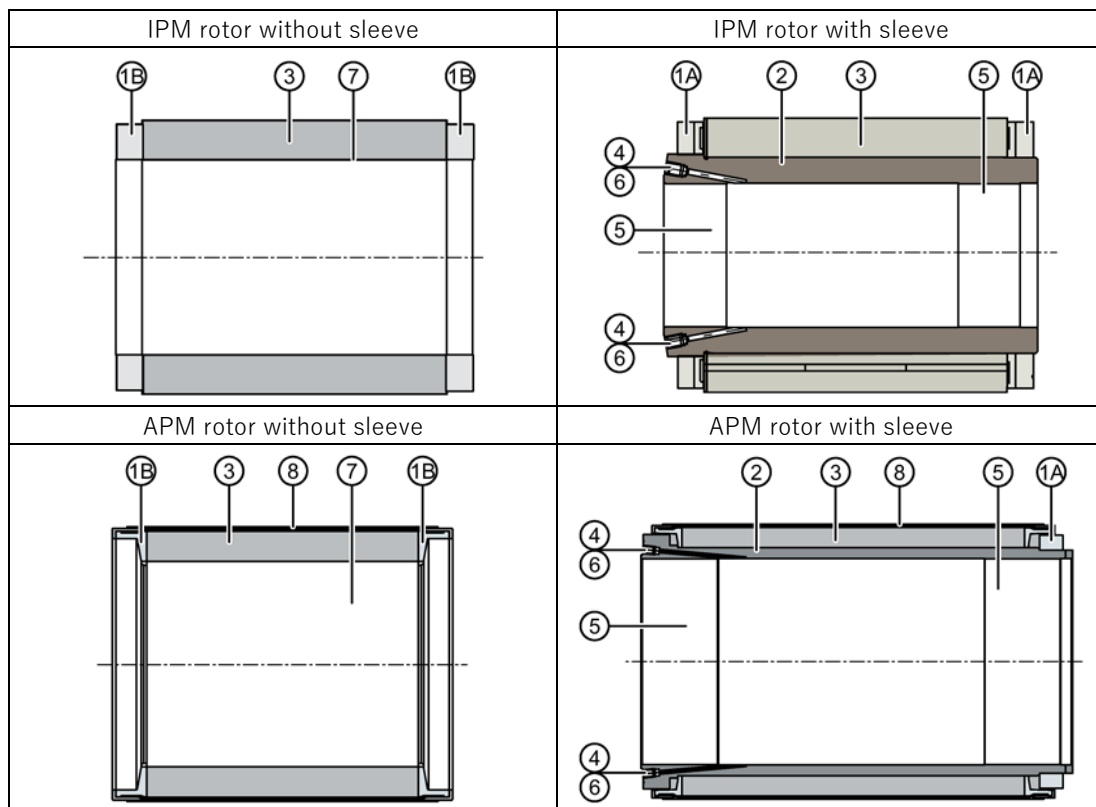


Table 3- 2 Description of the code numbers from the diagrams above

Code number	Description	Code number	Description
1A	Balancing disk	4/6	Pressurized oil connection with grub screw
1B	Locking plate	5	Step interference fit
2	Sleeve	7	Cylindrical interference fit
3	Rotor core	8	Composite fiber

Rotor sleeves

Note

Built-in motors without rotor sleeve:

The force is transmitted without any play through a friction-locked connection. Larger shaft diameter diameters are achieved due to the fact that there is no rotor sleeve. Generally, it is not possible to release the group (rotor and stator) using the version without sleeve.

Built-in motors with rotor sleeve:

The rotor is located on an inner sleeve with a step interference fit. The press fit can be released using pressurized oil without this influencing the joint surfaces.

The spindle manufacturer mounts the rotor on the spindle using a thermal shrinking procedure.

NOTICE

Damage to the rotor permanent magnets due to excessively high temperatures

For IPM rotors, if the temperature exceeds 150 ° C (140 ° C for APM rotors), then the permanent magnets in the rotor will be irreversibly demagnetized.

- Prevent the rotor from being heated up to above 150 ° C for IPM rotors (140 ° C for APM rotors) by checking the rotor temperature using a temperature-reactive dye or a temperature measuring device.
- Inductive heating of the rotor is not permissible.

To ensure torque transmission without any play, in the area of the interference fit, the spindle must be machined with the specified dimensions and tolerances. Additional information is provided in the dimension drawing in Chapter "Dimension drawings (Page 133)".

3.2 Degree of protection

Note

Selecting the degree of protection

The spindle manufacturer is responsible for selecting the degree of protection, its implementation and its verification regarding suitability.

- Protect the motor components against moisture, foreign bodies and contact.

When delivered, the stator and the rotor have degree of protection IP00 in accordance with EN 60034-5.

The spindle manufacturer defines the final degree of protection as a result of the mechanical design of the spindle housing.

Recommended degree of protection: at least IP54

3.3 Permissible motor vibration levels

System vibrations caused by output elements and mounting conditions at the installation location can affect the vibration values on the motor.

Observe the maximum vibration values on the specified measuring points of the motor.

Table 3- 3 Maximum permitted radial vibration values

Vibration frequency	Vibration values
< 6.3 Hz	Vibration displacement $s \leq 0.16 \text{ mm}$
6.3 - 250 Hz	Vibration velocity $v_{\text{rms}} \leq 4.5 \text{ mm/s}$
> 250 Hz	Vibration acceleration $a \leq 10 \text{ m/s}^2$

Table 3- 4 Maximum permitted axial vibration values

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

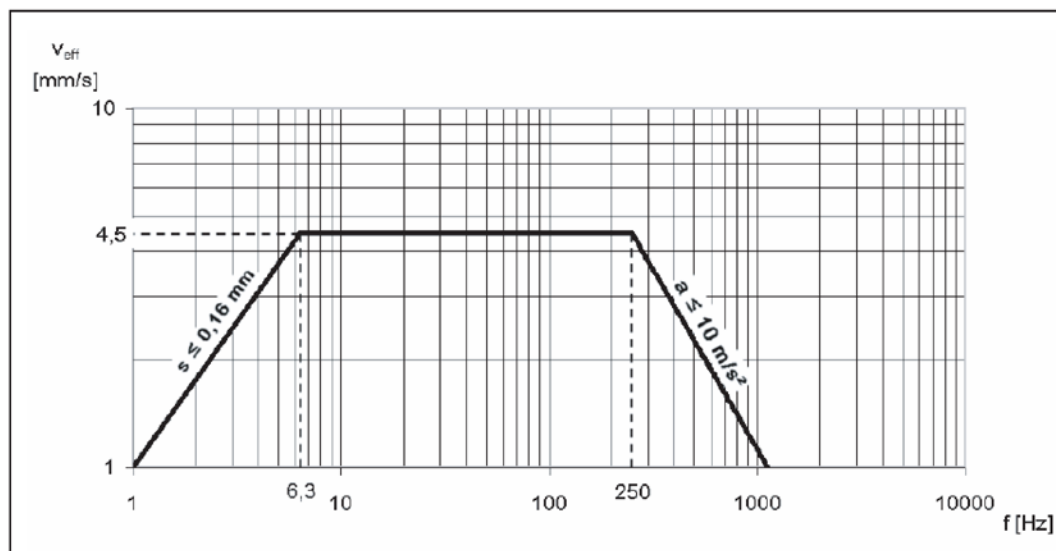


Figure 3-1 Maximum permissible vibration velocity taking into account the vibration displacement and vibration acceleration

Measure the vibration velocity using appropriate measuring equipment.

The vibration acceleration must be evaluated in a frequency band of 10 ... 2000 Hz.

Note

If vibration excitation levels > 2000 Hz (e.g. gear teeth meshing frequencies) can be expected, the measurement range must be adapted accordingly.

The permitted maximum values remain unchanged.

Motor components, characteristics and options

4.1 Motor components

4.1.1 Thermal motor protection

The stator winding can be supplied with the following motor protection to sense (measure) and monitor the motor temperature:

Standard protection:	Temperature sensors (2 x Pt1000); 2x2 conductors in a protective sleeve; protective sleeve diameter 3 mm; conductor cross-section 0.22/0.14 mm ²
Full protection (option):	Temperature sensors + PTC thermistor triplet (3 sensors in series) (2 x Pt1000 + 1 x PTC180 C) in addition to standard protection: 1x2 conductors in a protective sleeve; protective sleeve diameter 3 mm; conductor cross-section 0.22/0.14 mm ²
Universal protection (option):	Temperature sensors + PTC thermistor triplet + NTC thermistor (2 x Pt1000 + 1 x PTC180 C + NTC PT3-51F + NTC K227/33k/A1; in addition to full protection: 2x2 conductors in a protective sleeve; protective sleeve diameter 3 mm; conductor cross-section 0.22/0.14 mm ²

Note

If water-cooled synchronous built-in motors are operated for longer than one minute in standstill with the standstill torque, a phase can be thermally loaded overproportionately.

- Reduce the permanent standstill torque by up to 20 %.
 - Protect the winding thermally with a thermistor triplet (PTC) with an external trip unit or with an I²t monitoring of the drive system.
-

NOTICE

Thermal damage to temperature-sensitive parts

Some parts of the electric motor enclosure can reach temperatures > 100 ° C. If temperature-sensitive parts, e.g. electric cables or electronic components, come into contact with hot surfaces, these parts could be damaged.

- Ensure that no temperature-sensitive parts are in contact with hot surfaces.

4.1.1.1 Thermal motor protection with temperature sensors (standard protection)

The stator laminated core has 2 Pt1000 temperature sensors to monitor the winding temperature; one of these is a reserve.

Note

When the motor is operated at its rated power, the winding temperature can reach approx. 150 ° C.

The winding has thermal class 155 (F) and is dimensioned for this operating state.

The type of temperature sensor installed is stamped on the rating plate.

The temperature sensor protects the motor from overload when operational.

The temperature sensor detects the motor temperature. The drive system evaluates the motor temperature. An external tripping unit is not required. The PTC thermistor function is monitored.

1. Pre-alarm temperature (default setting for the 1FE1)

If the pre-alarm temperature of 150 ° C is exceeded, the drive system issues an appropriate alarm signal. This alarm signal must be evaluated externally. The alarm signal is cleared when the motor temperature decreases to below the pre-alarm temperature.

If the pre-alarm temperature is exceeded for longer than 240 seconds (standard setting) or longer than the parameterized time, then an alarm signal is issued and the drive is shut down.

A detailed description is provided in the SINAMICS S120/S150 List Manual.

SINAMICS S120_150 List Manual

(<https://support.industry.siemens.com/cs/products?search=Listenhandbuch&ctp=Mannual&mfn=ps&o=DefaultRankingDesc&pnid=13204&lc=de-WW>)

2. Motor temperature limit (standard setting for the 1FE1)

If the motor temperature limit of 160 ° C $\pm$ 5 ° C is exceeded, the drive system is shut down and it issues an appropriate fault signal.

Table 4- 1 Features and technical data

Type	Pt1000
Resistance when cold (20 ° C)	Approx. 1090 Ω
Resistance when hot (100 ° C)	Approx. 1390 Ω
Connection	Via signal cable
Response temperature (standard setting for SINAMICS S120)	Pre-alarm at 150 ° C Trip/shutdown at 160 ° C $\pm$ 5 ° C

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

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

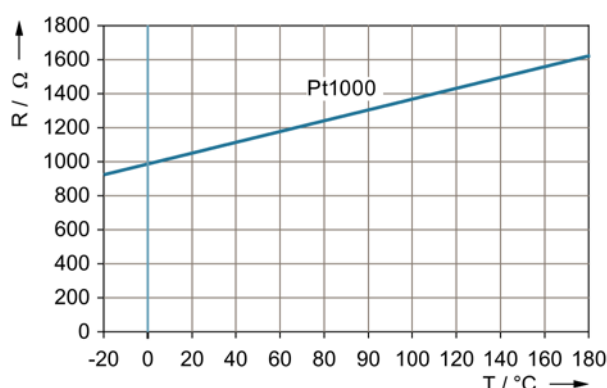


Figure 4-1 Pt1000 characteristic

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

Note

Temperature evaluation using only a Pt1000 does not guarantee full motor protection.

NOTICE

Destruction of the motor for a thermal critical load

A thermally critical load, e.g. high overload when the motor is stationary, can destroy the motor.

- Employ additional protective measures, e.g. an overcurrent relay.

4.1.1.2 Temperature evaluation using the PTC thermistor triplet (full motor protection)

For special applications (e.g. when a load is applied with the motor stationary or for extremely low speeds), the temperature of all of the three motor phases must be additionally monitored using a PTC thermistor triplet.

Note

If water-cooled synchronous built-in motors are operated for longer than one minute in standstill with the standstill torque, a phase can be thermally loaded overproportionately.

- Reduce the permanent standstill torque by up to 20 %.
 - Protect the winding thermally with a thermistor triplet (PTC) with an external tripping unit.
-

The PTC thermistor triplet can be evaluated using an external tripping unit (this is not included in the scope of delivery). This means that the sensor cable is monitored for wire breakage and short-circuit by this unit.

4.1 Motor components

The motor must be de-energized within 1 second when the response temperature is exceeded.

Table 4- 2 Technical data for the PTC thermistor triplet

Designation	Technical data
Type (acc. to DIN 44082–M180)	PTC thermistor triplet
Thermistor resistance (20° C)	$\leq 750 \Omega$
Resistance when hot (180° C)	$\geq 1710 \Omega$
Connection	Via an external trip unit
Cable cross-section/outer diameter	0.14 mm ² /0.9 mm
Response temperature	180° C
Note: PTC thermistors do not have a linear characteristic curve and are, therefore, not suitable for determining the instantaneous temperature.	

Note

PTC thermistors are ESD components
Carefully observe the ESD instructions.

4.1.1.3 Temperature evaluation using NTC thermistors (universal protection, option)

Note

Temperature evaluation using the NTC K227 and NTC PT3-51F thermistors does not guarantee full motor protection. Full motor protection is only ensured when the PTC thermistor triplet is evaluated.

NTC K227 and NTC PT3-51F thermistors are used if the drive system cannot evaluate Pt1000 thermistors.

The NTC thermistors are provided for operating the motor on third-party systems.

The NTC thermistor should be connected in accordance with the configuration and operating instructions of the third-party system.

The drive system senses and evaluates the motor temperature using the sensor signal (refer to the drive system documentation).

Table 4- 3 Technical data, NTC K227 and NTC PT3-51F

Designation	Technical data	
	NTC K227	NTC PT3-51F
PTC thermistor resistance (25 ° C)	Approx. 32.8 kΩ	Approx. 49.1 kΩ
Resistance when hot (100 ° C)	Approx. 1800 Ω	Approx. 3300 Ω
Conductor cross-section	0.14 mm ²	0.14 mm ²
Outer diameter	0.8 mm	0.8 mm

Temperature characteristic

NTC thermistor K227/33k/A1

Thermistor NTC PT3-51F

Note

NTC thermistors are ESD components
Carefully observe the ESD instructions.

4.1.1.4 Overview of the temperature sensor connection options

You can connect the Pt1000 and PTC as follows:

- PTC via thermistor motor protection 3RN2013-1GW30, Pt1000 connected to SMC20
- PTC via thermistor motor protection 3RN2013-1GW30, Pt1000 connected to SME20

- PTC via thermistor motor protection 3RN2013-1GW30, Pt1000 directly connected to the drive system
- PTC and Pt1000 connected to SME120

More detailed information on this topic is provided in Chapter "Connecting the temperature sensors (Page 123)".

4.1.2 Encoder

Function

The encoder system has the following functions:

- Actual speed value encoder for the speed control
- Position encoder for closed-loop position control

The rotor position is determined when switching on using the "pole position identification" software function, see Chapter Commutation angle and pole position identification (Page 71).

Encoder systems that can be used

- Gearwheel encoder or a
- Comparable hollow shaft encoder system with sinusoidal voltage signals 1 Vpp.

Note

The encoder system is not included in the scope of supply.

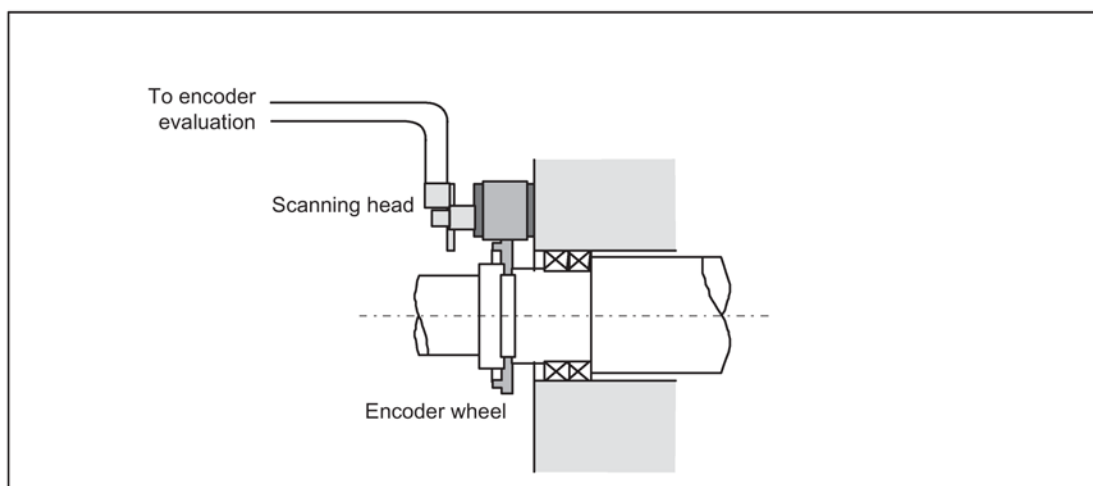


Figure 4-2 Encoder mounting schematic

Measuring systems from different manufacturers can be used.

Recommended encoder systems

Note

The recommended encoder systems are third-party products with fundamental suitability.

The user must check and ensure the necessary compatibility of the encoder systems for the associated applications.

Siemens cannot guarantee the properties/features of third-party products.

Contact the specified manufacturer directly for technical information or questions regarding orders.

We recommend encoder systems from

- Lenord and Bauer, type GEL 244□; www.lenord.de
- Johannes Heidenhain, type ERM 2□□; www.heidenhain.de

Encoderless operation

Together with the appropriate experts, carefully check whether your application is suitable for operation without an encoder.

To do this, contact your local Siemens office.

4.1.3 Cooling

4.1.3.1 Safety instructions

WARNING
--

Electric shock caused by a short-circuit to frame in a fault situation

The spindle housing must be electrically connected to the cooling jacket.

In the case of a fault situation, a lethal voltage can be present at the spindle housing that causes death or severe injuries as the result of an electric shock.

- | |
|---|
| <ul style="list-style-type: none">• Ground the complete motor spindle in accordance with the regulations. |
|---|

WARNING
--

Electric shock due to high leakage current currents
--

High leakage electric shock can cause death or injuries as result of an electric shock.

- | |
|---|
| <ul style="list-style-type: none">• Satisfy the requirements placed on protective conductors in accordance with EN 61800-5-1. |
|---|

NOTICE

Material damage due to the effect of electrochemical series
--

When using different conductive materials, material damage can occur as a result of the electrochemical series.

- | |
|---|
| <ul style="list-style-type: none">• Do not use any zinc in the cooling circuit.• Use brass, stainless steel or plastic for pipes and fittings. |
|---|

4.1.3.2 Cooling circuit

Note

The electrochemical processes that take place in a cooling system must be minimized by choosing the right materials.

- Avoid mixed installations (i.e. a combination of different materials, such as copper, brass, iron, or halogenated plastic (PVC hoses and seals)).
-

Cool the built-in motor using a semi-open or closed cooling circuit.

Table 4- 4 Description of the cooling circuits

Definition	Description
Closed cooling circuit	The pressure equalization tank is closed and possesses an overpressure valve. Oxygen cannot enter the cooling circuit. The coolant is only routed through the motors and converters as well as through the components required to dissipate heat.
Semi-open cooling circuit	Contrary to closed cooling circuits, oxygen can enter the coolant through the pressure equalization tank.

Equipotential bonding

 WARNING
Electric shock as a result of incorrectly routing the cooling water pipes If electrically conductive cooling water pipes come into contact with live parts, this can cause an electric shock leading to death or severe injury. • Ensure adequate insulation. • Securely fasten the pipes.

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

Materials used in the motor cooling circuit

- Match the materials in the cooling circuit to the materials in the motor.

Table 4- 5 Materials used in the motor cooling circuit

Cooling jacket design	Material
Cooling jacket	Steel or aluminum (see the dimension drawing)
O rings	FKM (ISO 1629)

Materials and components in the cooling circuit

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

Table 4- 6 Materials and components of a cooling circuit

Material	Used as	Description
Zinc	Pipes, valves and fittings	Use is not permitted.
Brass	Pipes, valves and fittings	Can be used in closed circuits with inhibitor.
Copper	Pipes, valves and fittings	Can be used only in closed circuits with inhibitors in which the heat sink and copper component are separated (e.g. connection hose on units).
Standard steel (e.g. P235 TR1, P235 TR2)	Pipes	Permissible in closed circuits and semi-open circuits with inhibitors or Antifrogen N, check for oxide formation, inspection window recommended.
Cast steel, cast iron	Pipes, motors	Closed circuit and use of strainers and flushback filters. Fe separator for stainless heat sink.
High-alloy steel, Group 1 (V2A)	Pipes, valves and fittings	Can be used for drinking or municipal water with a chloride content up to < 250 ppm, suitable according to definition in Chapter "Coolant definition".
High-alloy steel, Group 2 (V4A)	Pipes, valves and fittings	Can be used for drinking or municipal water with a chloride content up to < 500 ppm, suitable according to definition in Chapter "Coolant definition".
ABS (AcrylonitrileButadieneStyrene)	Pipes, valves and fittings	Suitable according to the definition in Chapter "Coolant definition". Suitable for mixing with inhibitor and/or biocide as well as Antifrogen N.
Installation comprising different materials (mixed installation)	Pipes, valves and fittings	Use is not permitted.
PVC	Pipes, valves, fittings and hoses	Use is not permitted.
Hoses		The use of hoses should be reduced to a minimum (connecting equipment) and must not be used as the main supply line for the complete system. Recommendation: EPDM hoses with an electrical resistance > 10 ⁹ Ω (e.g. Semperflex FKD supplied from Semperit or DEMITTEL; from PE/EPD, supplied from Telle).
Gaskets	Pipes, valves and fittings	The use of FKM, AFM34, EPDM is recommended.
Hose connections	Transition Pipe - hose	Secure with clips conforming to DIN 2817, available e.g. from the Telle company.

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

- Construct a closed cooling circuit with the cooling unit using stainless steel technology. The cooling circuit dissipates the heat via a water-water heat exchanger.
- For all other components, such as cooling circuit pipes and fittings manufactured of ABS, use stainless steel or general construction steel.

Cooling system manufacturers

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

Note

Other manufacturers

You can also use equivalent products from other manufacturers.

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

4.1.3.3 Engineering the cooling circuit

Note

Observing the maximum permitted pressure

The maximum permitted pressure in the cooling circuit is 0.7 MPa (7 bar).

If a pump is deployed that produces a higher pressure, the produced pressure must be limited by the plant with suitable measures (safety valve $p \leq 0.7$ MPa, pressure control) to the maximum permitted pressure.

- Specify the working pressure depending on the flow conditions in the supply and return of the cooling circuit.
Select the smallest possible pressure difference between the supply and return so that pumps with a flat characteristic curve can be used.
- Set the required coolant flow rate per time unit according to the technical data of the equipment and motors.

Note

Install a backflush filter in the cooling circuit to prevent blockage and corrosion so that any deposited material is flushed out.

Pressure drop in the motor

Observe the nominal coolant flows specified in the following table to ensure that the motor is adequately cooled.

Table 4- 7 Approximate pressure drop at the nominal coolant flow rate

Motor type	Volume flow in l/min	Pressure drop in MPa
1FE104□ to 1FE109□	8	0.03
1FE110□ to 1FE112□	10	0.03 ... 0.12
1FE114□	12	0.03 ... 0.07

Pressure equalization

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

Reactor elements are installed at the coolant outlet of the motor or the relevant components.

Preventing cavitation

NOTICE

Motor damage caused by cavitation and abrasion

An excessive pressure drop at the motor can cause motor damage as the result of cavitation and/or abrasion.

- Operate the motor so that the pressure drop across the motor in continuous operation does not exceed 0.2 MPa.

Connecting motors in series

For the following reasons, connecting motors in series can be recommended only conditionally:

- The required flow rates of the motors must be approximately the same (< a factor of 2)
- An increase in the coolant temperature can result in derating the second or third motor if the maximum coolant inlet temperature is exceeded; see diagram (Influence of the coolant inlet temperature on M_N as a percent"

Coolant inlet temperature

NOTICE

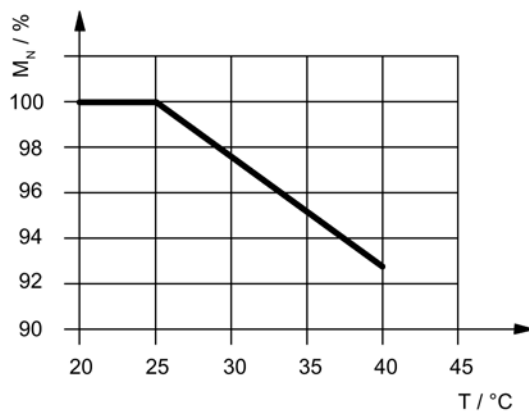
Motor damage caused by condensation formation

Water condensation can cause motor damage.

- Select the coolant inlet temperature so that condensation does not form on the surface of the motor. $T_{\text{cooling}} > T_{\text{ambient}} - 5 \text{ K}$.
- Interrupt the supply of coolant for a longer motor standstill.

The motors are designed for full-load operation at maximum +25 ° C coolant inlet temperature.

Operation up to +40 ° C coolant inlet temperature is possible with derating (reduced power).



M_N Torque reduction referred to M_N as a %

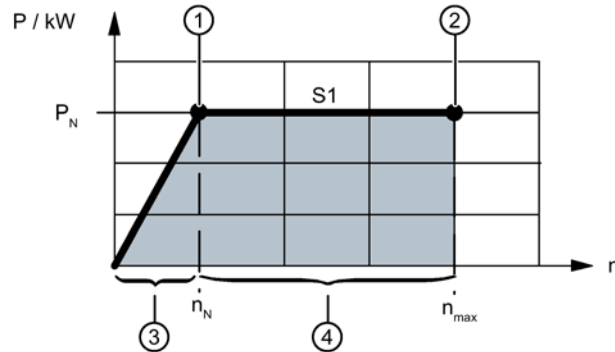
T Coolant inlet temperature in ° C

Figure 4-3 Influence of the coolant inlet temperature on M_N as a percentage

4.1.3.4 Cooling powers to be dissipated (power loss)

You can determine the cooling power to be dissipated based on:

- Reading off the power loss at rated power for $n_{\max}$ or n_N in the table "Cooling powers to be dissipated".
- Using the calculation tool.
The power loss can be calculated within the shaded area of the subsequent diagram for any load state and speed. P and n must lie within the shaded area. The general conditions ③ and ④ must be complied with.



- ① Cooling power to be dissipated at rated speed
- ② Cooling power to be dissipated at maximum speed
- ③ For $n < n_N$, the following applies: $P \leq P_N \times n / n_N$
- ④ For $n_N < n < n_{\max}$, the following applies: $P \leq P_N$

Figure 4-4 Calculating the power loss

You can calculate the power loss using the following program: Tool to calculate the total power loss (<https://support.industry.siemens.com/cs/ww/de/view/109771175>)

The intermediate values of the cooling power can be interpolated linearly in the ratio to the speed.

The cooling power to be dissipated depends on the rated power P_N of the motor. If the motor is operated with reduced power, then the cooling power to be dissipated decreases in an approximately linear relationship.

Table for calculating the cooling powers to be dissipated (power loss)

The values specified in the following table refer to a cooling-medium temperature of 25 ° C and S1 duty.

The cooling powers to be dissipated at maximum speed and at rated speed are listed in the following table. Intermediate values can be linearly estimated proportional to the speed.

Motor article number	P_V in W at n_{max}	P_V in W at n_N
6-pole built-in motors		
1FE1041-6WM□0	1100	900
1FE1041-6WN□0	1000	800
1FE1041-6WU□0	900	800
1FE1042-6WN□0	1400	1400
1FE1042-6WR□0	1400	1400
1FE1042-6WT□0	1500	1400
1FE1051-6WK□0	1500	1400
1FE1051-6WN□0	1500	1300
1FE1052-6WK□0	2800	2500
1FE1052-6WN□0	2400	2200
1FE1052-6WY□0	1800	1700
1FE1054-6WR□0	4200	3600
1FE1054-6WN□0	4200	4200
1FE1061-6WH□0	1600	1300
1FE1061-6WV□0	1200	1000
1FE1061-6WY□0	1200	1000
1FE1062-6WQ□1	2200	1900
1FE1064-6WN□1	4300	2800
1FE1064-6WQ□1	3200	3000
1FE1082-6WP□0	3300	2600
1FE1082-6WQ□1	3300	2500
1FE1082-6WS□0	2500	2300
1FE1082-6WW□1	3300	2200
1FE1082-6WE□1	3000	1900
1FE1083-6WL□0	4500	5000
1FE1083-6WP□0	3300	3000
1FE1084-6WN□1	4900	3800
1FE1084-6WR□1	5500	3800
1FE1084-6WU□1	5000	3800
1FE1084-6WX□1	4000	3300
1FE1091-6WN□0	2000	1500
1FE1091-6WS□0	1800	1300
1FE1092-6WN□0	3000	2500
1FE1092-6WR□1	3000	2300
1FE1093-6WN□0	3600	3400

4.1 Motor components

Motor article number	P_V in W at n_{max}	P_V in W at n_N
1FE1093-6WS□0	3600	3400
1FE1093-6WV□1	4000	3000
1FE1093-6WX□1	3500	2800
1FE1093-6WC□1	3500	2800
1FE1095-6WU□1	5500	3600
1FE1113-6WU□1	4000	2800
1FE1113-6WX□1	3800	2700
1FE1114-6WR□1	4600	4100
1FE1114-6WT□1	4600	4100
1FE1114-6WW□1	4600	4100
1FE1115-6WW□1	5200	4000
1FE1115-6WV□1	6000	4000
1FE1115-6WT□1	5800	4500
1FE1116-6WR□1	6700	5500
1FE1116-6WT□1	6000	5500
1FE1116-6WW□1	5000	5000
1FE1116-6WY□1	5000	5000
8-pole built-in motors		
1FE1143-8WM□1	8500	5200
1FE1143-8WQ□1	6500	4600
1FE1144-8WL□1	8500	6000
1FE1144-8WQ□1	7500	5800
1FE1144-8WT□0	6000	5800
1FE1144-8WT□1	7500	5800
1FE1144-8WV□1	7000	5600
1FE1145-8WN□1	10000	7500
1FE1145-8WQ□1	9500	7200
1FE1145-8WS□1	7500	7000
1FE1145-8WE□1	7500	7000
1FE1147-8WM□1	12000	8500
1FE1147-8WN□1	10000	8500
1FE1147-8WQ□1	10000	8500
1FE1147-8WS□1	8500	8500
4-pole built-in motors		
1FE1051-4HF□1	1800	1300
1FE1051-4HC□0	2000	1500
1FE1051-4WL□1	1400	850
1FE1051-4WN□1	1400	900
1FE1052-4HG□1	3200	2300
1FE1052-4HD□0	3200	3000
1FE1052-4WN□1	2800	1600
1FE1052-4WK□1	2800	1600
1FE1053-4HH□1	3800	3600

Motor article number	P_V in W at $n_{\max}$	P_V in W at n_N
1FE1053-4WJ□1	3800	2200
1FE1053-4WN□1	3800	2200
1FE1072-4WH□1	3200	2000
1FE1072-4WL□1	3200	2200
1FE1072-4WN□1	3200	2200
1FE1072-4WV□1	2200	1700
1FE1073-4WL□1	5000	2700
1FE1073-4WM□1	4500	2700
1FE1073-4WN□1	4500	2700
1FE1073-4WT□1	2800	2400
1FE1074-4WR□1	5000	3500
1FE1074-4WM□1	5000	3500
1FE1074-4WN□1	5000	3500
1FE1074-4WT□1	3800	2500
1FE1074-4WV□1	3600	2800
1FE1075-4WQ□1	4500	2600
1FE1082-4WF□1	3200	2300
1FE1082-4WK□1	3000	2000
1FE1082-4WN□1	2600	2000
1FE1082-4WP□1	2000	2000
1FE1082-4WR□1	2000	2000
1FE1083-4WN□1	3600	2800
1FE1084-4WN□1	4600	3600
1FE1084-4WP□1	5000	3600
1FE1084-4WQ□1	4600	3600
1FE1084-4WT□1	4200	3600
1FE1084-4WV□1	3000	3300
1FE1085-4WN□1	5000	4100
1FE1085-4WQ□1	5000	4100
1FE1085-4WT□1	4000	4000
1FE1092-4WP□1	3300	1900
1FE1092-4WV□1	2000	1700
1FE1093-4WC□1	5300	3500
1FE1093-4WH□1	4500	3100
1FE1093-4WM□1	4500	3500
1FE1093-4WN□1	4000	3100
1FE1094-4WK□1	5300	3700
1FE1094-4WL□1	5300	3700
1FE1094-4WS□1	3500	3500
1FE1094-4WU□1	3000	3000
1FE1095-4WN□1	6500	4500
1FE1096-4WN□1	6500	5000
1FE1096-4WK□1	6500	5000

4.1 Motor components

Motor article number	P_V in W at $n_{\max}$	P_V in W at n_N
1FE1103-4WN□1	4500	3300
1FE1103-4WQ□1	4000	3200
1FE1103-4WT□1	3500	3100
1FE1104-4WN□1	5000	4000
1FE1104-4WL□1	4800	4500
1FE1105-4WN□1	6000	4700
1FE1105-4WQ□1	5200	4600
1FE1105-4WS□1	4800	4200
1FE1106-4WY□1	5000	5000
1FE1106-4WS□1	7000	4800
1FE1106-4WR□1	7500	5000
1FE1106-4WN□1	8000	5500
1FE1124-4WN□1	6000	4500
1FE1124-4WQ□1	6000	4200
1FE1125-4WN□1	7500	5000
1FE1125-4WP□1	7000	4800
1FE1125-4WQ□1	6500	4500
1FE1126-4WN□1	9000	6000
1FE1126-4WP□1	8000	5800
1FE1126-4WQ□1	7000	5500

4.1.3.5 Coolant

Coolant specification

As coolant, use only water that complies with the "water specification for coolant".

Note

If possible, use deionized water with reduced conductivity (5 ... 10 μ S/cm) as the coolant.

Table 4- 8 Coolant water specifications

	Quality of the coolant water for motors with a cooling jacket manufactured out of steel or aluminum
Chloride ions	< 40 ppm, can be achieved by adding deionized water.
Sulfate ions	< 50 ppm
Nitrate ions	< 50 ppm
pH value	For steel: 6 ... 9; for aluminum: 6 ... 8
Electrical conductivity	< 500 μ S/cm
Total hardness	< 170 ppm
Dissolved solids	< 340 ppm
Size of entrained particles	< 100 μ m
Corrosion protection	0.2 to 0.25% inhibitor, Nalco TRAC100 (previously 0GE056)
Anti-freeze protection	When required, 20 - 30% Tyfocor

The values specified for the water as a coolant are the requirements for a closed cooling circuit. Not all of the specified concentrations will occur in the water at the same time. When necessary, contact your water utility for the values.

Note

Inhibitor is not required if a Tyfocor concentration > 20% is ensured.

Derating is not required for antifreeze protection components < 30%.

Measures for frost danger

If there is danger of frost, adopt frost protective measures for complete or preassembled motor spindle units.

- Replenish antifreeze for operation (see Table "Coolant water specifications").

Note

- Avoid mixing different antifreeze products.
- Use and dose the antifreeze according to the manufacturer's specifications.

Manufacturers of chemical additives

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

Information regarding third-party products

Note

Recommendation relating to third-party products

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

You can use equivalent products from other manufacturers.

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

Other coolants (not water-based)

If you use other cooling media (e.g. oil, lubricating coolant), then it may be necessary to reduce the motor power (derating) so that the thermal motor limit is complied with. (Derating)

Note

Oil-water mixtures with more than 10 % oil require derating.

Determine the values of the coolant from the following table:

	Formula symbol	Unit
Density	ρ	kg/m ³
Specific thermal capacitance	c_p	J/(kg•K)
Thermal conductivity	λ	W/(K•m)
Kinematic viscosity	η	m ² /s
Flow rate	V	l/min
Third-party cooling jacket		Cooling jacket geometry is required

Contact your local Siemens office for the power reduction (derating) resulting from the values.

Biocide

Closed cooling circuits with soft water are susceptible to microbes.

- If possible, use chlorinated potable water.

Note

Compatibility of coolant additives

Biocides and Antifrogen N must not be mixed.

- If no chlorinated potable water is available, add, for example Antifrogen N or a biocide, to the potable water.

Antifrogen N acts like a biocide for a minimum concentration > 20%.

- Conduct a water analysis at least annually to determine the type and concentration of microbes.

The following microbes can occur in practice:

- Bacteria that cause the formation of slime
- Corrosive bacteria
- Bacteria that cause deposits of iron

- Add a biocide that counters the determined microbes to the cooling water.

The manufacturer's recommendations must be followed in regard to the dosage and compatibility with any inhibitor used.

Maintenance and service for assembled motor spindles

Check at least once annually

- the filling level,
- for any discoloring and
- the cooling-water specification Information on this is provided in Chapter "Coolant (Page 68)".

4.1.4 Commutation angle and pole position identification

Note

For synchronous spindles, the commutation angle must be determined or entered when the spindle is first commissioned or when the spindle is replaced.

The stator magnetic field must be aligned to the rotor magnetic field for the optimum torque development (synchronized).

This reference is established using a pole position identification routine (PLI) and subsequently passing over the encoder zero mark. The commutation angle offset that is determined is saved to the drive system.

The pole position identification is available in two variants.

	Motion-based pole position identification	Induction-based pole position identification
Precondition	The rotor must be able to freely rotate.	- The rotor can rotate freely or be blocked - The pole position identification requires a minimum current. The rated current (S1 current) of the motor module must be $\geq 50\%$ of the rated motor current.
Accuracy of determining the rotor position.	High, independent of the magnetic properties	Dependent on the magnetic motor characteristics
Effect of series reactors	Using series reactors has no effect on the result.	Using series reactors or motors with low saturation levels is not recommended, as determining the rotor position is not precise enough, or the pole position identification does not provide any result.

4.1.4.1 Special issues regarding pole position identification for specific motors

For high-speed main spindle synchronous motors, the electrical pole position angle is not precise enough when using the inductance-based pole position identification technique.

This applies to the following motors:

- 1FE1 - versions with series reactor on the motor side
- 1FE105□-4H (High Speed 2 series)

For these motors, the inductance-based pole position identification is sufficient for starting. However, they do not achieve their optimum efficiency.

There are 2 alternative strategies when operating the specified motors:

1. Switching over the pole position technique from saturation-based to motion-based.

Prerequisite:

The rotor must be free to rotate when switching on.

If you cannot ensure this, because, for example, in the case of a fault, the spindle is blocked by the tool, then you cannot apply the motion-based pole position identification technique.

2. Determine the angular commutation offset using the motion-based pole position identification technique and operationally start the motor using the saturation-based pole position identification technique.

Prerequisite:

- Encoder has a zero mark. The zero mark is used for fine commutation.
- The motor can rotate freely.

Description:

When commissioning the motor for the first time or when re-commissioning it, the precise commutation angle is determined using motion-based pole position identification.

After you have precisely determined the commutation angle, switch over to saturation-based pole position identification.

The saturation-based pole position identification technique is normally used.

After being switched on, the motor initially starts with the more imprecise commutation angle. When passing the zero mark for the first time, the precise commutation angle, saved in the parameter, is read-in.

Note

When removing the encoder, e.g. when carrying out spindle maintenance work, you must redetermine the commutation angle.

Note

Software prerequisites for both of these strategies

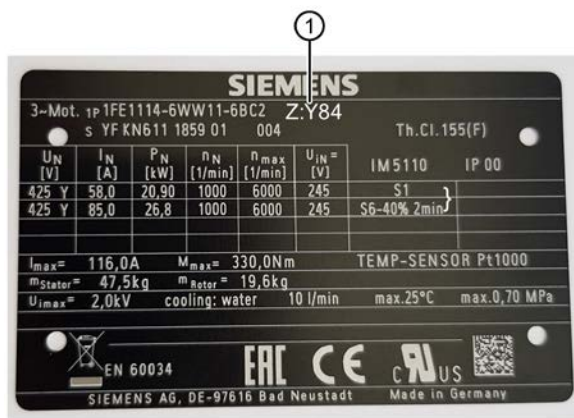
The drive software must support the induction-based and motion-based techniques; from software release 6.x and higher

4.2 Options

The following options are available for the 1FE1.

- Option X35/X36 - 3.5 m cable extension
More detailed information is provided in Chapter "Cable cross-sections (Page 109)".
- Option Y84 - customer data on the rating plate
- On request
 - V09 - fastening thread at both sides of the cooling jacket
 - V80 - without cooling jacket, with cast
 - Special sleeves, special cooling jacket, special windings

You can recognize the selected options on the rating plate by the following digits.



1 "-Z" is the code for an option in the article number

Note

If more than 2 options are ordered, no options will appear on line 2.

When ordering a replacement motor, in this case, enter the motor ID (No.YF).

Additional information is provided in Chapter "Structure of the Article No. (Page 41)".

4.2.1 Customer data on the rating plate (option Y84)

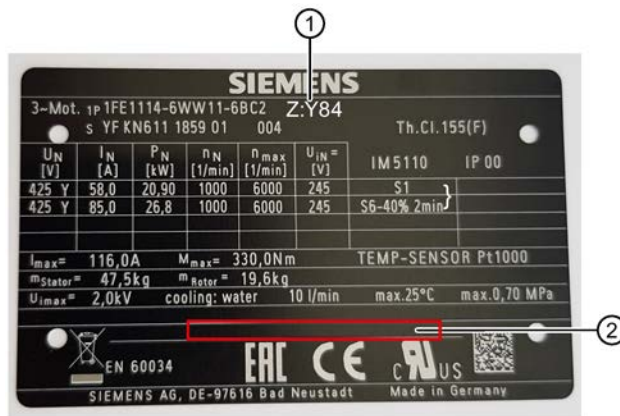
Option Y84 - allows customer's data to be stamped on the motor rating plate. When ordering electronically, when selecting option Y84, you can enter the required text.

Note

The required text may be a maximum of 20 characters long. Additional characters are cut off. Option Y84 does not impact the delivery time.

Option identifier Y84 is not shown as Z option on the rating plate.

Customer data is printed on the rating plate and on the adhesive label showing the type for the product packaging.



- 1 Marking of the Z option Y84
- 2 Customer data, maximum 20 characters

Configuration

5.1 Procedure when engineering

The function description of the machine provides the basis when engineering the drive application.

Prerequisite:

Access to the "SIZER"

(<https://support.industry.siemens.com/cs/document/54992004/sizer-for-siemens-drives?dti=0&lc=de-WW>) engineering tool, or

DT CONFIGURATOR (<http://siemens.de/dt-konfigurator>)

Catalog NC62 (<https://intranet.for.siemens.com/org/i-dt-mc/intraDocs/catalogs/nc622019/NC%2062%20-%202019%20-%20Complete%20Catalog/motion-control-NC62-complete-English-2019.pdf>)

Procedure

1. The type of drive and supply (infeed) are clarified
2. Definition of supplementary conditions and integration into the automation system
3. The load is defined, the max. load torque is calculated, the motor selected
4. The SINAMICS Motor Module is selected
5. Steps 3 and 4 are repeated for additional axes
6. The required DC link power is calculated and the SINAMICS Line Module is selected
7. The line-side options (main switch, fuses, line filters, etc.) are selected
8. Specification of the required control performance and selection of the Control Unit, definition of component cabling
9. Additional system components are defined and selected
10. The current demand of the 24 V DC supply for the components is calculated and the power supplies (SITOP devices, Control Supply Modules) specified
11. The components for the connection system are selected
12. The components of the drive lineup are configured



5.2 Help when configuring

5.2.1 SIZER configuration tool

Overview

The SIZER calculation 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
- Selection of the line-side and motor-side power options

The configuration process produces the following results:

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

You can find additional information that you can download in the Internet at SIZER (<https://support.industry.siemens.com/cs/document/54992004/sizer-for-siemens-drives?dti=0&lc=de-WW>).

5.2.2 DT Configurator

DT CONFIGURATOR

The DT CONFIGURATOR supports you when configuring your drive.

In the DT CONFIGURATOR - you can simply and quickly find

- Technical data
- Characteristics
- dimension drawings
- 2D/3D CAD data

The DT CONFIGURATOR supports you when generating plant/system documentation regarding project-specific information.

Note

The 3D model in the DT CONFIGURATOR is a simplified representation that does not show all of the details.

You can find further information on the Internet at DT CONFIGURATOR (<http://siemens.de/dt-konfigurator>):

Preparations for use

6.1 Safety instructions for electromagnetic and permanent-magnetic fields

Safety measures for electromagnetic and permanent-magnetic fields

- Observe the relevant nationally applicable health and safety regulations.
- Take measures, e.g. using shields, to reduce electromagnetic fields at their source.
- Keep the motor components in their individual packaging until installation.
- Mark the storage location with the warning and prohibition signs from the following tables.
- Avoid being crushed when handling the rotor core.
- Place the unpacked rotor core on a safe non-magnetic surface. Secure the rotor core with non-magnetic devices.
- Avoid contact of the rotor core with ferromagnetic objects.
- Use tools made of non-magnetic materials. Ferromagnetic assembly tools must have low mass.

Attaching warning signs

Any danger areas must be identified by well visible warning and prohibition signs (pictograms) in the immediate vicinity of the danger.

Note

The text for the warning signs should be written in the language of the country of use.

Identification of dangers using warning and prohibition signs:

Table 6- 1 Warning signs according to ISO 7010 and their meaning

Sign	Meaning	Sign	Significance
	Warning - magnetic field (W006)		Warning - hand injuries (W024)
	Warning for electrical voltage (W012)		Warning - hot surface (W017)

Table 6- 2 Prohibition signs according to ISO 7010 and their meaning

Sign	Significance	Sign	Significance
	No access for persons with pacemakers or defibrillator implants (P007)		No access for persons with metal implants (P014)
	No metal objects or watches (P008)		

Note

UN number for permanent magnets

UN number 2807 is allocated to permit magnets as hazardous item.

 WARNING**Components falling as a result of incorrect packing, storage and/or transport**

Risk of death, injury and/or material damage can occur if the devices are packed, stored, or transported incorrectly.

- Always follow the safety instructions for storage and transport.
- Before transporting or lifting machines or machine parts, lock the rotary axes so they cannot accidentally rotate. This is necessary, as the axes are not self locking.
- Always correctly and carefully carry out storage, transport and lifting operations.
- Only use suitable devices and equipment that are in perfect condition.
- Only use lifting devices, transport equipment and suspension equipment that comply with the appropriate regulations.
- IATA regulations must be observed when components are transported by air.
- Mark locations where rotors are stored with warning and prohibit signs according to the tables in Chapter "Supplied pictograms".
- Observe the warning instructions on the packaging.
- Always wear safety shoes and safety gloves.
- When working with permanent magnets, keep the following tools and aids available to free any trapped body parts:
 - A hammer made of non-magnetizable material
 - Two pointed wedges (wedge angle approx. 10° - 15° , minimum height 50 mm) made of non-magnetizable material (e.g. hard wood)
- Take into account the maximum loads that personnel can lift and carry.
- Transport and store built-in motors only in their packed state.
 - Replace any defective packaging. Correct packaging offers protection against sudden forces of attraction that can occur in their immediate vicinity. Further, when correctly packaged you are protected against hazardous motion when storing and moving rotors.
 - Use only undamaged original packaging.

6.2 Transporting

Transport

Note

Observe the country-specific regulations.

The 1FE1 synchronous built-in motors are supplied as motor components in individual or bulk packaging according to the delivery contract.

Note

The standard packaging of 1FE1 motors is suitable for transport by road, rail and sea.

- Please pay attention to the symbols on the packaging in which the motor is delivered.

Symbol	Meaning	Symbol	Meaning
	Fragile (0621)		Keep dry (0626)
	Top (0623)		Stack limitation based on the count (2403)

- Transport the motor carefully and, when possible, in its original packaging.
- Fasten the load suspension device to the provided locations of the packaging or the motor.
- Avoid any jerky and oscillating movements during transport.

Notes regarding air transportation (IATA)

Observe the maximum permissible field strengths in accordance with IATA packaging instructions for the air transport of products that contain permanent magnets.

Note

The magnetic field strengths listed in the table always apply to the values for the constant magnetic field from the IATA packaging instructions 953.

Shipping must be approved, notified or marked for magnetic field strengths above those specified below.

Subject to approval	Shipping a product whose largest determined field strength at 4.6 m distance is larger than 0.418 A/m.	This product may be transported only with approval by the responsible national authorities of the dispatching country and the air transportation company's base country.
Notification and marking approval required	Shipping a product whose largest determined field strength at 2.1 m distance is greater than or equal to 0.418 A/m.	
Notification and marking approval not required	Shipping a product whose largest determined field strength at 2.1 m distance is less than 0.418 A/m.	

Shipping 4-pole 1FE1□□□-4...built-in motors in their original packing requires the appropriate registration and marking.

Shipping 6-pole and 8-pole 1FE1□□□-6..., 1FE1□□□-8... built-in motors in their original packing does not require registration and marking.

6.3 Storage

Transport and store the built-in motors in the original packaging.

Storage

Storage conditions

Store the motor in a dry, dust-free and vibration-free indoor storage facility.

Adhere to the following values:

- $v_{\text{rms}} < 0.2 \text{ mm/s}$
- Permissible ambient temperature: $-15^{\circ} \text{ C} \dots 70^{\circ} \text{ C}$
- Mean relative humidity $< 75 \%$

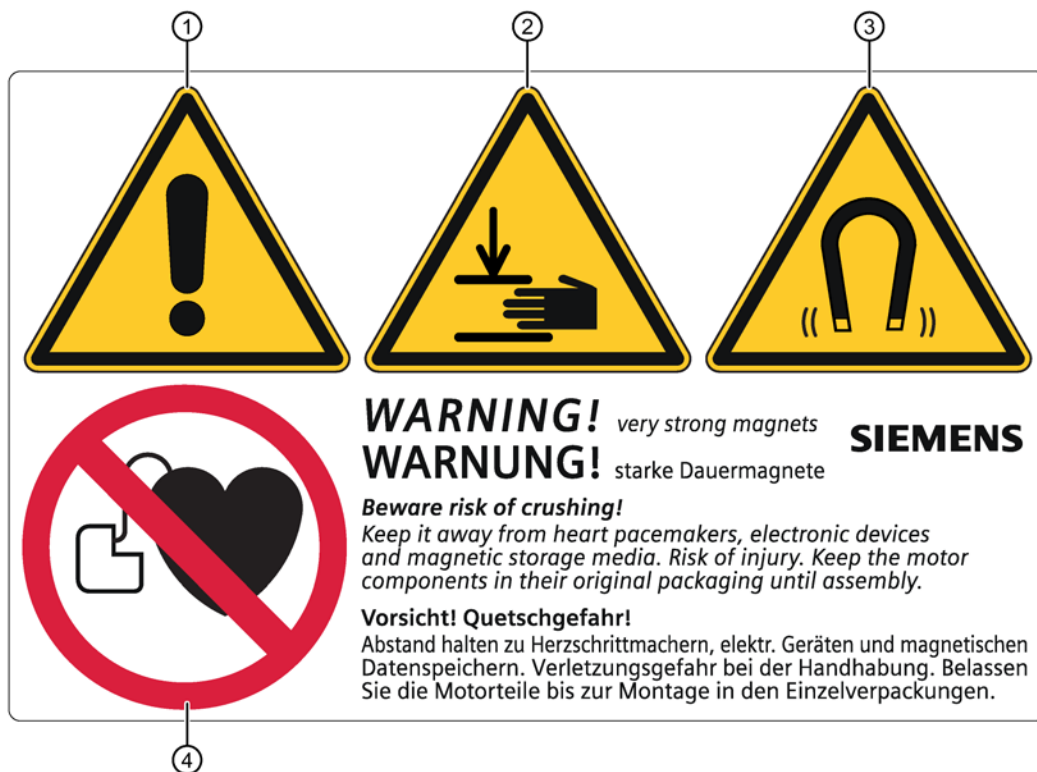
Identification of the storage location

Mark the storage location clearly with warning notices as per the packaging of the built-in motors.

Note

This identification must also be visible after removal of the external packaging.

Warning sign supplied



- 1 Warning regarding a hazardous location
- 2 Warning regarding hand injuries
- 3 Warning regarding a magnetic field
- 4 Access forbidden for persons with pacemakers

Figure 6-1 Warnings on the packaging

Please observe the warning instructions on the packaging and labels.

Long-term storage

If you store the motor for longer than six months, the storage facility must satisfy the following conditions:

- The motor must be protected against extreme weather conditions.
- The facility air must be free from aggressive gases.
- The room must be free of any vibration ($v_{\text{eff}} < 0.2 \text{ mm/s}$)
- According to EN 60034-1, the temperature must be $-15^\circ \text{C} \dots 70^\circ \text{C}$.
- The relative humidity of the air must be less than 60%.

Check the correct state of the machine every six months.

- Check the motor for any damage.
- Perform any necessary maintenance work.
- Check the state of the dehydrating agent and replace when necessary.
- Document the preservation work so that all preservation coating can be removed prior to commissioning.

Condensation

The following ambient conditions encourage the formation of condensation:

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

Avoid these ambient conditions.

Use a dehydrating agent in the packaging.

Mounting

7.1 Mechanical mounting

7.1.1 Mounting and removing the rotor (brief form)

7.1.1.1 Tools and resources

You require the following assembly tools and other resources:

- Occupational safety equipment
 - Face protection shield
 - Protective gloves
 - Closed protective clothing for protection against any oil leaks and high or low surface temperatures
- Fixture for checking the radial runout of the spindle shaft
- Depending on the variant used, you require the following mounting tools and equipment

WARNING

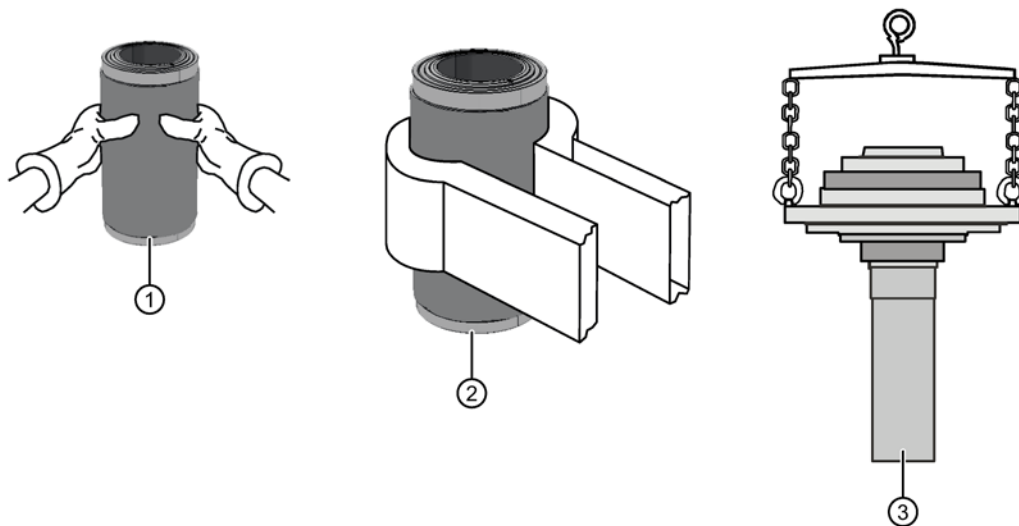
Risk of explosion when using another coolant for the cold process

Liquid oxygen or liquid air can cause explosions and death or severe injuries.

- Use only liquid nitrogen for the cold process.

Joining with the hot process (shrink fit)	Joining with the cold process (stretch fit)	Cold-hot process
• Hot-air oven with temperature monitoring - suitable for temperatures specified in the "Mounting temperatures" table • Oven volume appropriate for the rotor type, placement of the oven in the immediate vicinity of the workplace • Air-conditioned room or cold chamber for tempering the spindle shaft and rotor core	• Dewar vessel with liquid nitrogen N₂ (-195.8 ° C) • For a small workspace: adequate ventilation	• Hot-air oven with temperature monitoring - suitable for temperatures specified in the "Mounting temperatures" table • Oven volume appropriate for the rotor type, placement of the oven in the immediate vicinity of the workplace • Cold chamber for tempering the spindle shaft and rotor core

- Lifting equipment, e.g. gripper, load suspension equipment
 - The carrying capacity of the lifting equipment depends on the weight of the rotor core and/or spindle shaft. Data is stamped on the rating plate.
 - Examples of lifting equipment, preferably with a fixture that allows the load to be quickly lowered



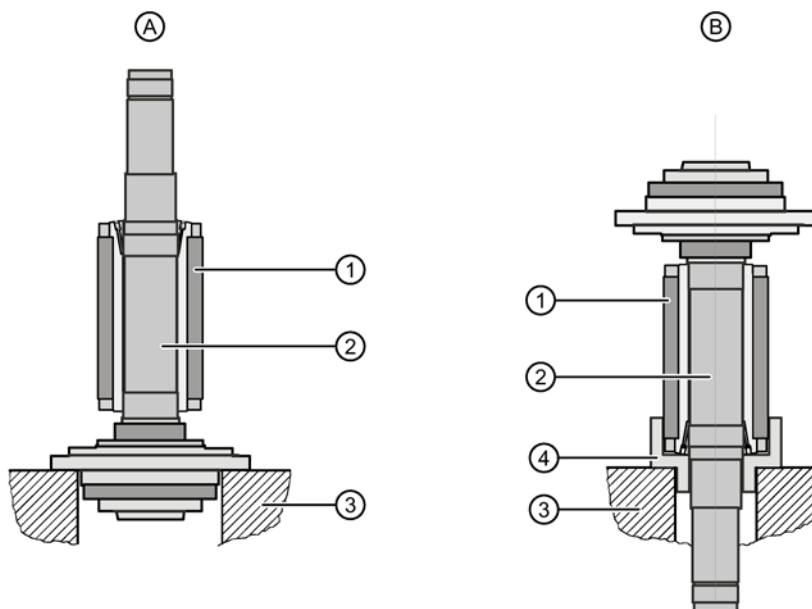
- 1 Rotor with a smaller diameter with gloves
- 2 Rotor with a larger diameter with a gripper tool
- 3 Spindle shaft with lifting eyes and lifting lug

Figure 7-1 Examples for transporting rotor components

● Mounting device depending on the rotor mounting arrangement

You can mount the rotor as follows:

- Version A: The rotor is mounted on the spindle shaft.
- Version B: The spindle shaft is inserted in the rotor.



- ① Rotor core
- ② Spindle shaft
- ③ Stable support with opening
- ④ Mounting fixture (non-magnetic, resistant to heat and cold, thermally insulating)

Figure 7-2 Mounting arrangements for rotor mounting variants

● Suitable oil-pressure hand pump with manometer for relieving stress or dismantling the rotor with sleeve for “oil press fit” device version.

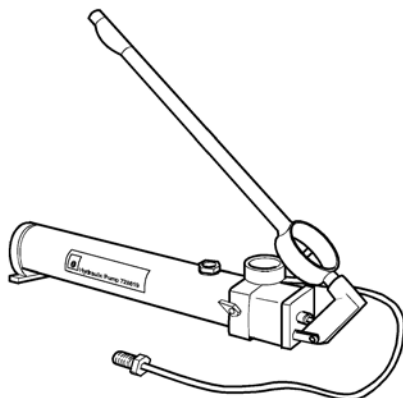
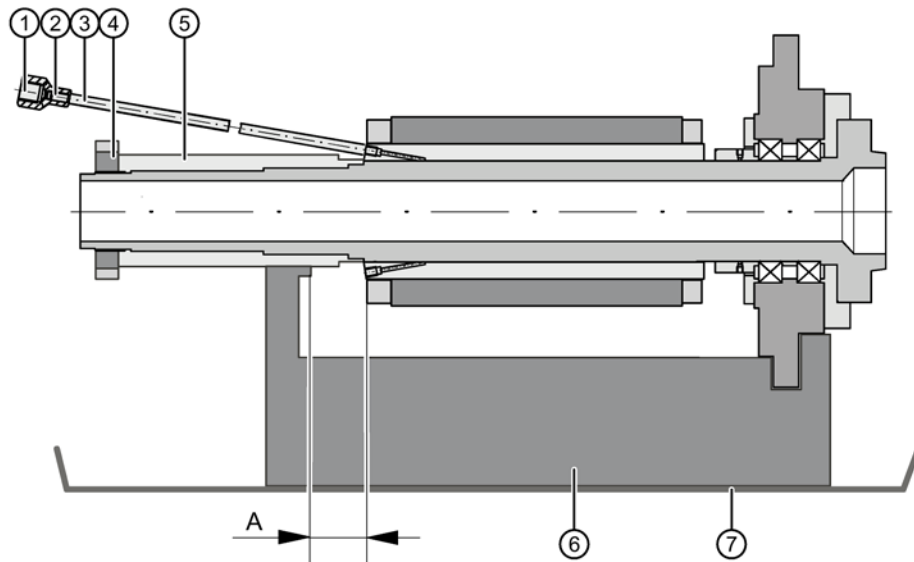


Figure 7-3 Oil pressure hand pump

● Fixture for relieving stress and dismantling



- ① Connection hydraulic hand pump
- ② Connector nipple
- ③ Extension tube
- ④ Slotted nut (only for relieving stress)
- ⑤ Spacer sleeve (only for relieving stress)
- ⑥ Non-magnetic fixture (prism)
- ⑦ Non-magnetic tray
- A Dimension for the axial relative movement for dismantling, 90 mm

Figure 7-4 Fixture for relieving stress and dismantling

● Accessories:

- Connector with nipple (1, 2), e.g. type SKF 1077454
- Extension tube (3), e.g. type SKF1077453
- Non-magnetic fixture (prism, 6)
- Slotted nut (4), spacing sleeve (5)
- Non-magnetic tray (7) for catching oil, e.g. made from aluminum
- Pressure oil for relieving stress, e.g. SKF LHM 300 (viscosity 300 mm²/s at 20° C)
- Pressure oil for dismantling, e.g. SKF LHDF 900 (viscosity 900 mm²/s at 20° C)

● Balancing machine for balancing the rotor (fine or complete balancing)

● Detergent, e.g. Loctite 7061 or Loctite 7063; bolt locking compound, e.g. Loctite 243

7.1.1.2 Installing the rotor (brief description)

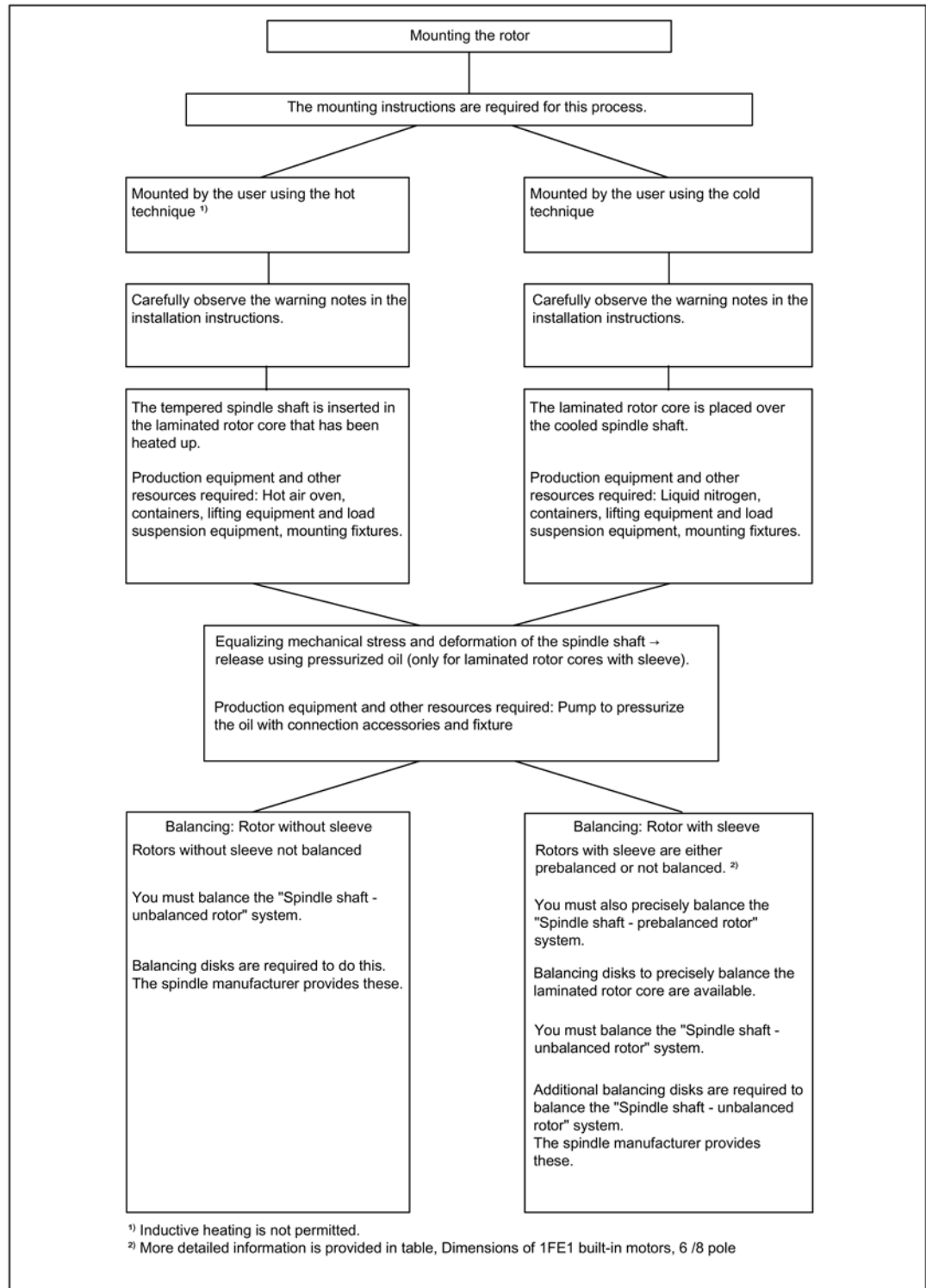


Figure 7-5 Procedure when mounting the rotor

7.1.1.3 Balancing

Rotor core with sleeve

Depending on the variant, laminated rotor cores with sleeve are either supplied pre-balanced or not balanced.

Note

The rotor core must not be modified.

- The pre-balanced rotor cores with sleeve in the delivered state conform with ISO 1940: G 2.5 (reference speed 3600 rpm).
- After mounting, fine balancing of the "spindle shaft - rotor core" system may be necessary.
- The "spindle shaft - not pre-balanced rotor core" system must be balanced. Use the balancing planes, which must be appropriately provided on the spindle axis.
- Drilling holes on the balancing disks of the rotor core ① are permissible only for fine balancing.
- Observe the specifications from the following figure and table when balancing.

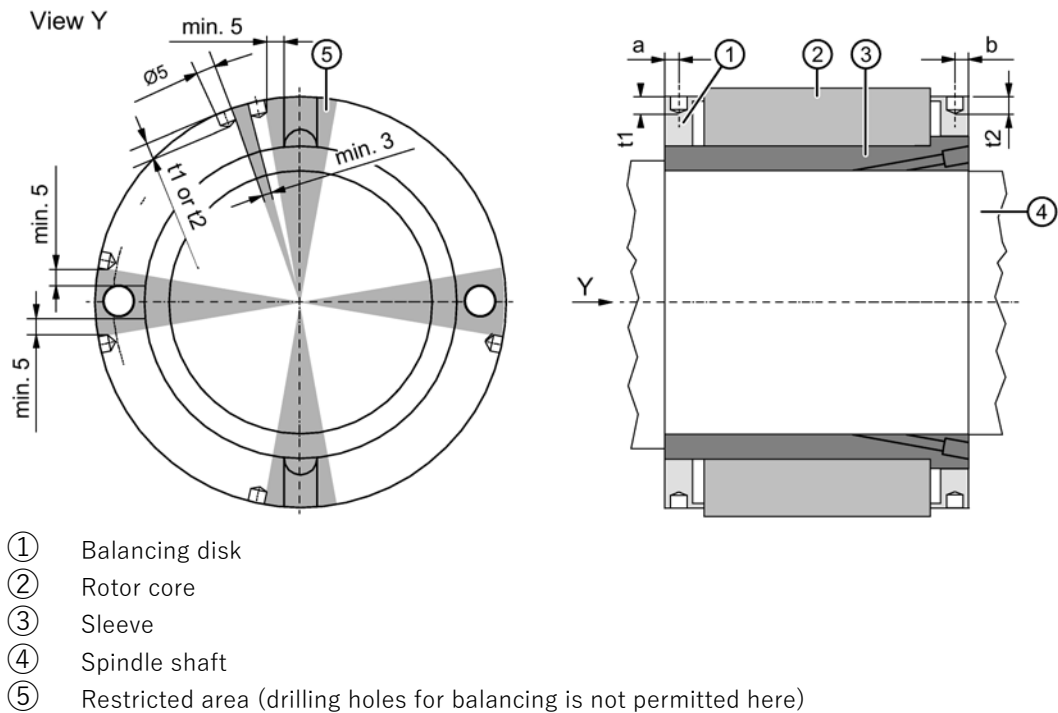
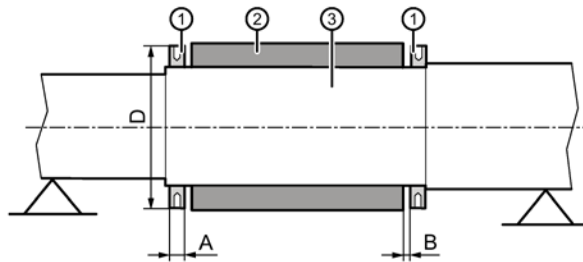


Figure 7-6 Fine balancing a spindle shaft and rotor with sleeve

Motor type	a in mm	t1 in mm	b in mm	t2 in mm
1FE105□-6	4	5	6	3
1FE106□-6				4
1FE108□-6				5
1FE109□-6				5
1FE111□-6				

Rotor core without sleeve

- The rotor core is not prebalanced.
- The "spindle shaft - rotor core without sleeve" system must be balanced, e.g. with balancing disk.
Use the balancing planes, which must be appropriately provided on the spindle axis.



- ① Balancing disk (not included in scope of delivery)
- ② Rotor core
- ③ Spindle shaft

Figure 7-7 Recommended balancing disks for rotors without sleeve; dimensions A, B and D, refer to the following table

Table 7- 1 Dimensions A, B and D for the recommended balancing disks

Motor type	A in mm ¹⁾	B in mm	D in mm
1FE104□-6□□□	The rotor is the end stop for the balancing disk	10	52
1FE105□-6□□□	5 ³⁾	10	70
1FE106□-6□□□	4	10	80
1FE108□-6□□□	4	12	117
1FE109□-6□□□	5 ³⁾	12	125
1FE111□-6□□□	5 ³⁾	12	155
1FE114□-8□□□ ²⁾	The rotor is the end stop for the balancing disk	12	190
1FE1144□-8□□□ ²⁾	22	15	186
1FE105□-4□□□	4	10	63
1FE105□-4H□□	7.5	10	63
1FE107□-4□□□	4	10	80
1FE108□-4□□□	4	10	95

Motor type	A in mm ¹⁾	B in mm	D in mm
1FE109□-4□□□			
rotor d _i = 72 mm	5 ³⁾	12	108
rotor d _i = 80 mm	4	12	108
1FE110□-4□□□	4 ³⁾	12	120
1FE112□-4□□□	4 ³⁾	12	145

¹⁾ Minimum clearance A between the rotor and external balancing disk for magnetic materials. Clearance A is eliminated for non-magnetic materials (refer to the recommendations, dimension drawings).

²⁾ Version only with rotor sleeve, not prebalanced

³⁾ Clearance is provided as a result of the rotor end plates (= aluminum or non-magnetic steel). The balancing disk can be in contact with the rotor end plate.

Mounting dimensions

The mounting dimensions can be taken from the dimension drawings, see Chapter Dimension drawings (Page 133).

A minimum shaft wall thickness is specified in the area of the interference fit. These can be taken from the dimension drawings.

7.1.1.4 Removing the rotor (brief description)

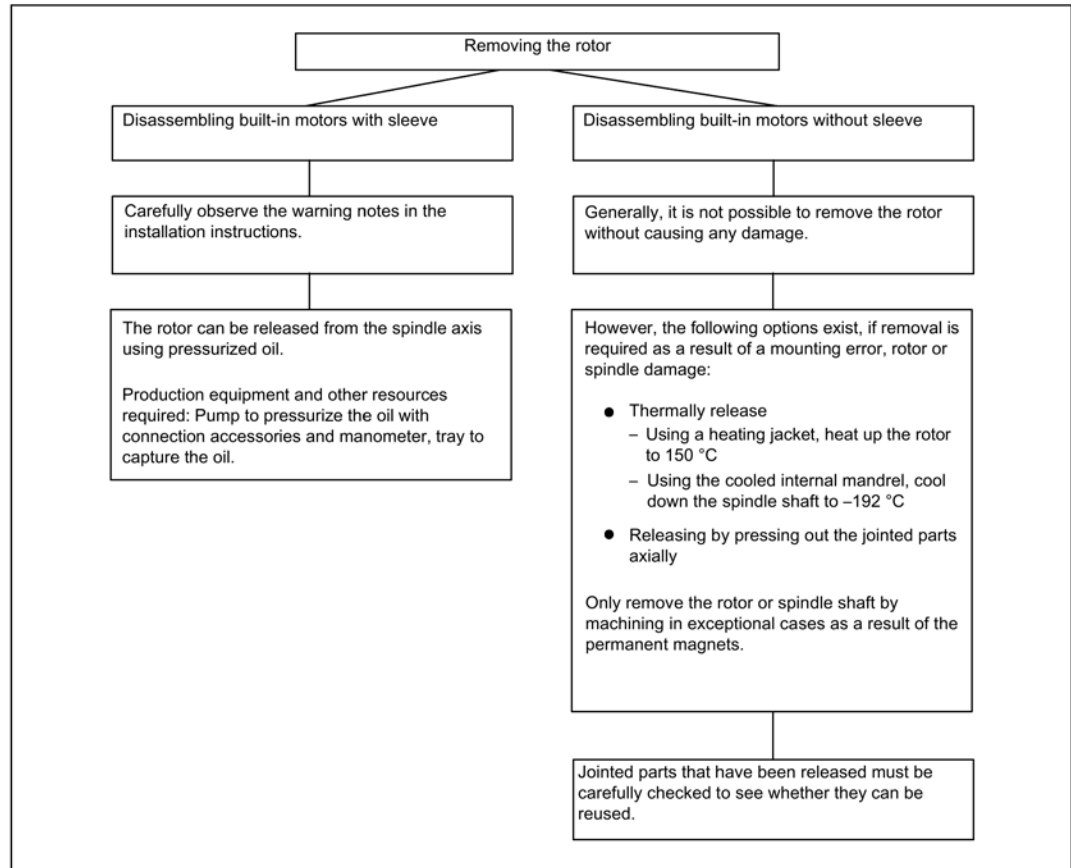
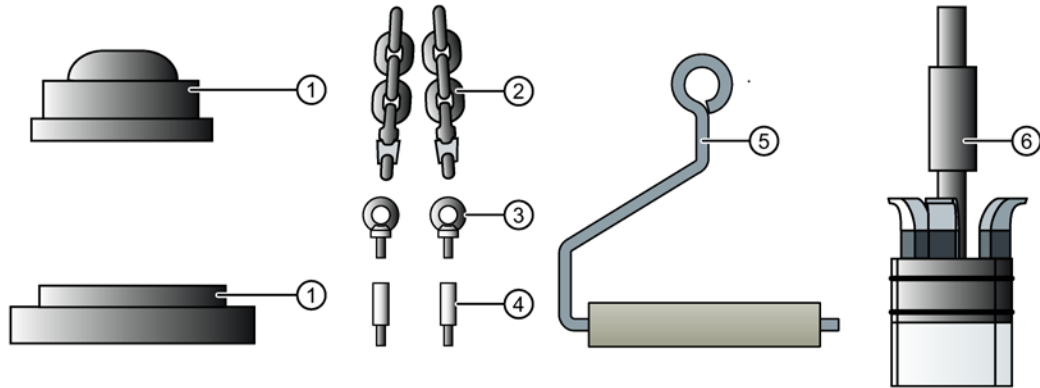


Figure 7-8 Procedure for removing the rotor

7.1.2 Stator assembly with/without cooling jacket

7.1.2.1 Production equipment, mounting tools and other equipment

Provide the following production equipment, mounting tools and other equipment:



- 1 Appropriate axial stops (examples)
- 2 Load suspension equipment (example)
- 3 Eyebolts
- 4 Spacing sleeves
- 5 Plastic-covered support arm for horizontal mounting (example)
- 6 Internal tensioning spindle (example)
- Occupational safety equipment:
 - Face protection shield
 - Protective gloves
 - Closed protective clothing for protection against high surface temperatures
- Hoisting gear with suitable load suspension device for the stator core
- Eyebolts or ring nuts and spacing sleeves
- Axial stop for cooling jacket/stator core without cooling jacket
- Internal tensioning spindle for the laminated stator core
- Plastic-covered support arm (for horizontal mounting)
- Anti-corrosion agent for steel surfaces
- Grease or talcum as lubricants for Viton O-ring seals

For the leak test with liquid:

- Water connection, maximum test pressure 0.7 MPa (7 bar).

For joining by heating the spindle housing (shrink fit):

- Hot-air oven with temperature monitoring
 - Oven volume appropriate for the stator type
 - Placement of the oven in the immediate vicinity of the workplace
- Device for cooling the heated-up cooling jacket.

7.1.2.2 Installing the stator (brief description)

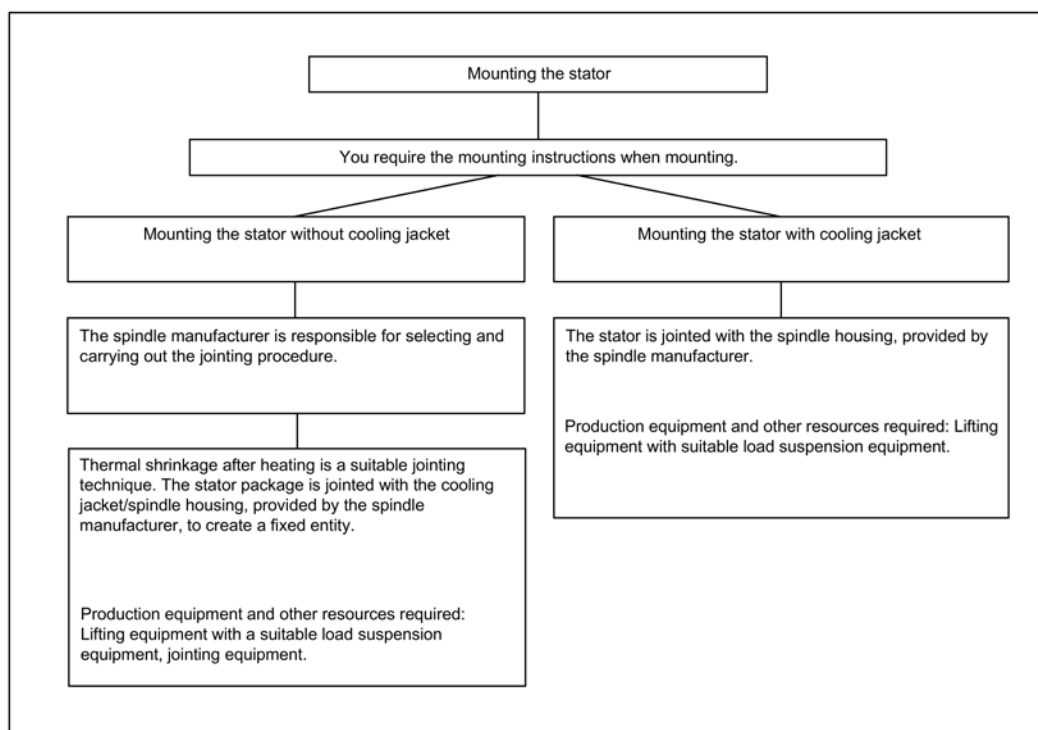


Figure 7-9 Procedure for mounting the stator

7.1.3 Installing the motor spindle

7.1.3.1 Preparation

Stator core with spindle enclosure and spindle shaft with rotor core are assembled to form a complete motor spindle.

NOTICE
Danger of damage to the banding (composite fiber) of the rotor APM rotors have a banding (composite fiber) around the external diameter of the rotor which must not be damaged. • APM rotors must be inserted centrally into the spindle box using an assembly device. • Use the protective foil when mounting.

The rotor is delivered wrapped in protective foil.

You can order the protective foil with Order Number: EWN:6114004001000 through sparepart.nes.mc.aud@siemens.com.

Production equipment and other resources required

Hoisting equipment with suitable load suspension device

Eyebolts

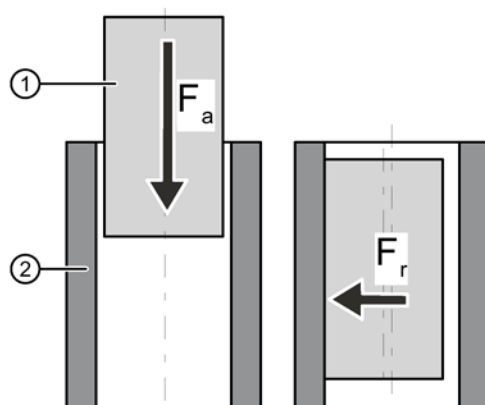
Centering assembly fixture

Protective foil

Personnel protective equipment

7.1.3.2 Acting magnetic forces

The higher magnetic forces present as a result of the permanent magnets in the rotor can draw the spindle into the stator bore.



- ① Spindle shaft with rotor core
- ② Stator core with spindle housing
- F_a Axial attractive force
- F_r Radial attractive force

Figure 7-10 Attractive_forces_motor_spindle

The magnitude of the present magnetic forces is motor-specific.

The present magnetic forces are contained in the table in Chapter "Magnetic forces that occur (Page 35)".

Note

The specified radial forces are the maximum values that occur if the rotor comes into contact with the stator at one side. For an ideally centric rotor (no eccentricity), the resulting radial force is zero.

The radial force between a centric rotor and the rotor in contact with the stator can be linearly converted (calculated air gap, 0.5 mm) depending on the eccentricity.

Depending upon the relative position and the weight of the rotor core, an additional axial mounting force of about 300 N is required.

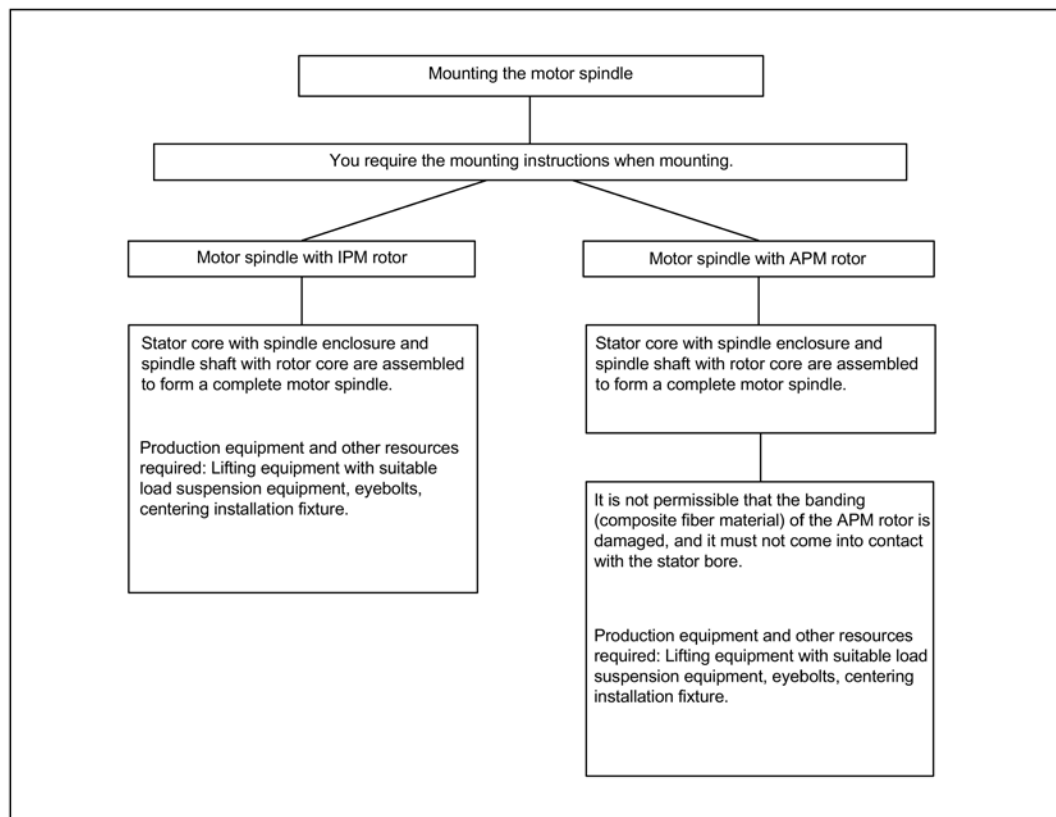


Figure 7-11 Procedure for mounting the motor spindle

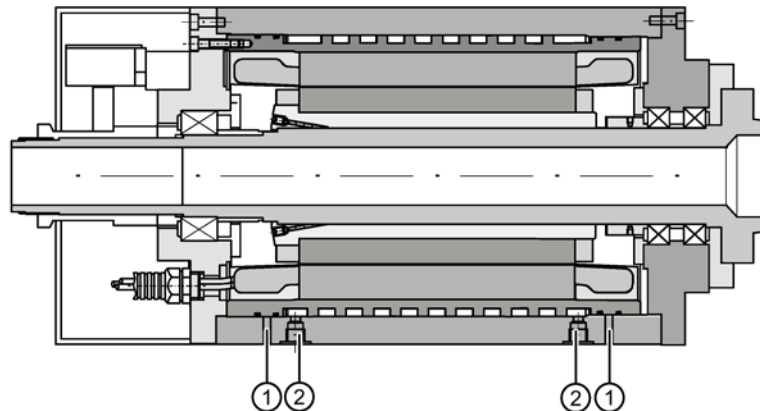
7.2 Connecting the cooling

7.2.1 Connecting the water cooling

Note

Lay the cooling water supply intake and drain outlet connections according to project requirements.

- Ensure that the cooling water complies with the required cooling water specification. See Chapter "Coolant (Page 68)".
- Ensure that cooling water with the required flow volume is available. See rating plate (type plate).
- Carefully ensure that the intake complies with the maximum permissible operating pressure of 0.7 MPa.
- Connect the cooling water pipes for the intake and discharge according to what is specified for the specific project.



- 1 Drain holes
- 2 Connections for the cooling water pipes

- Mount the motor spindle so that the drain holes are free and any condensation can freely drain.

7.2.2 Connecting the air cooling

Air-cooled motors are special versions. Connection is in accordance with the spindle manufacturer's project requirements.

Electrical connection

8.1 Permissible line systems

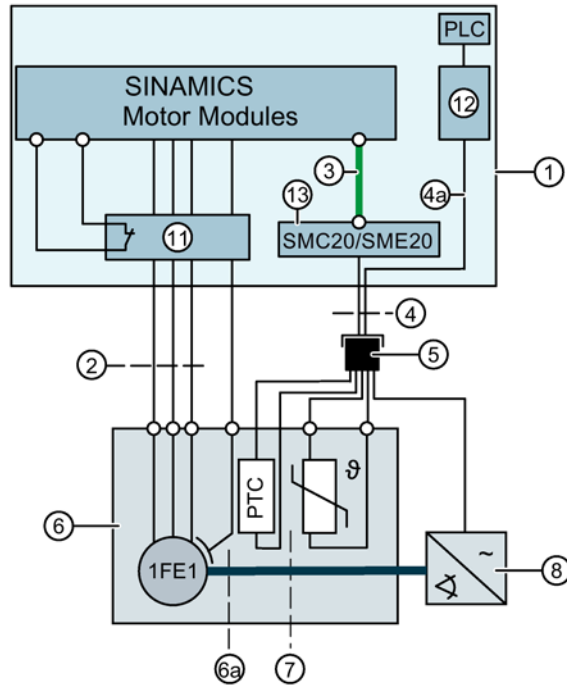
In combination with the drive system, the motors are generally approved for operation on TN and TT systems with **grounded neutral** and on IT systems.

In operation on IT systems, the occurrence of a first fault between an active part and ground must be signaled by a monitoring device. According to IEC 60364-4-41, it is recommended that the first fault is removed as quickly as is practically possible.

In systems with a **grounded external conductor**, an isolating transformer with grounded neutral (secondary side) must be connected between the line supply and the drive system to protect the motor insulation from excessive stress. The majority of TT systems have a grounded external conductor, so in this case an isolating transformer must be used.

8.2 Circuit diagram of the motor

The circuit diagram contains information about wiring and connecting the motor winding. The circuit diagram is provided in the motor packaging.



- 1 Electrical cabinet
- 11 Voltage limiting (VPM), only if the EMF > 820 V
- 12 3RN2013-1GW30 tripping unit
- 13 SMC20/SME20, encoder on the motor side, 6FX2003-0SA12 connector kits, 12-pin
- 2 Power cable
- 3 DRIVE-CLiQ cable 6FX2002-1DC00_□□□, trailable or conditionally trailable
- 4 Signal cable, trailable or only conditionally trailable, Article No. 6FX8002-2CA80-....
- 4a Conductor in the signal cable from the PTC to the 3RN2013-1GW30 tripping unit
- 5 Signal connector, 17 pin, external thread, Article No.: 6FX2003-0SA17-....
- Optional mounting flange for retrofitting, Article No.: 6FX2003-7DX00
- 6 1FE1 built-in motor
- 6a Ground connection
- 7 Temperature sensor (+1 reserve)
- 8 Encoder

Figure 8-1 Circuit diagram for SINAMICS with 1FE1 motor (example)

Note

Connect a rotary encoder according to the project specifications.

8.3 System integration

8.3.1 Connection notes

8.3.1.1 Electrical equipment

The following equipment is provided by the spindle manufacturer:

- Terminal box or connector, version with at least IP54 according to EN 60034
- Protective tubing for the free cable ends from the spindle
- Ground cable with cable lug

8.3.1.2 Connecting cables

In the standard version, the stator core has the following connection cables:

- Power connection marked U1, V1, W1
- 2 cables for the temperature sensor (of which 1x is a reserve), two-conductor, each cable cross-section is 0.22 mm², with color coding, diameter 3 ... 4 mm.

Note

Electrical connection via terminal box or power connector

The power cables of the motor are not suitable as direct electrical interface of the spindle.

The spindle must be electrically connected via a terminal box or power connector.

- Route out the free cable ends from the spindle box in a suitable protective tubing with cable gland to a terminal box provided by the customer.
- Ensure effective strain relief. Comply with the specified bending radii (minimum, 3 to 4x the outer cable diameter).
- To connect the motor to a converter, use MOTION-CONNECT cables or shielded connecting cables from the terminal box or power connector interface.

Note

The maximum length of the connecting cable is 50 m with and without VPM.

- Due to the high voltages, use cables for higher mechanical requirements in combination with a connection socket and VPM.

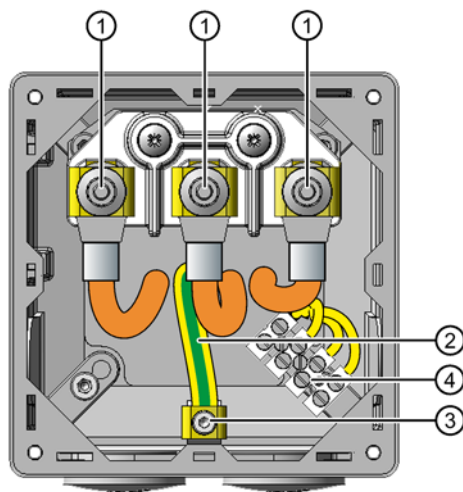
The spindle manufacturer installs the following cable connections:

- Power connection
- Internal protective ground cable (protection from dangerous shock currents)
- Connecting Pt1000 temperature sensors using 2 yellow connecting cables
- Encoder connection

Connecting Pt1000 temperature sensors

Circuit examples for evaluating temperatures are provided in Chapter "Connecting the temperature sensors (Page 123)"

Example for connecting with terminal box



- 1 Power connection U, V, W
- 2 Internal protective conductor
- 3 Connection for internal and external protective conductors
- 4 Connection for temperature sensors; Pt1000 temperature sensors have a yellow color coding.

Figure 8-2 Terminal box (example)

8.3.1.3 Cable cross-sections

Table 6-2 Cable cross-sections (Cu) and outer diameter of the connecting cables

Motor type	L = 0.5 m ¹⁾		L = 1.5 m and 3.5 m ²⁾	
	Cable cross-section per phase in mm ²	Cable outer diameter in mm	Cable cross-section per phase in mm ²	Cable outer diameter in mm
6-pole built-in motors				
1FE1041-6WM□□	2.5 ³⁾	4.4 ³⁾	2.5 ³⁾	4.4 ³⁾
1FE1041-6WU□□	2.5 ³⁾	4.4 ³⁾	2.5 ³⁾	4.4 ³⁾
1FE1042-6WN□□	2.5 ³⁾	4.4 ³⁾	2.5 ³⁾	4.4 ³⁾
1FE1042-6WR□□	2.5 ³⁾	4.4 ³⁾	2.5 ³⁾	4.4 ³⁾
1FE1042-6WT□□	2.5 ³⁾	4.4 ³⁾	2.5 ³⁾	4.4 ³⁾
1FE1051-6WK□□	2.5	4.4	2.5	4.4
1FE1051-6WN□□	2.5	4.4	2.5	4.4
1FE1052-6WK□□	4.0	5.5	4.0	5.5
1FE1052-6WN□□	2.5	4.4	2.5	4.4
1FE1052-6WY□□	2.5	4.4	2.5	4.4
1FE1054-6WN□□	6.0 ³⁾	6.3 ³⁾	6.0 ³⁾	6.3 ³⁾
1FE1054-6WR□□	4.0	5.5	6.0	6.3
1FE1061-6WH□□	2.5	4.4	2.5	4.4
1FE1061-6WV□□	2.5	4.4	2.5	4.4
1FE1061-6WY□□	2.5	4.4	2.5	4.4
1FE1062-6WQ□□	2.5	4.4	2.5	4.4
1FE1064-6WN□□	6.0 ³⁾	6.3 ³⁾	6.0 ³⁾	6.3 ³⁾
1FE1064-6WQ□□	4.0	5.5	6.0	6.3
1FE1082-6WE□□	2.5	4.4	2.5	4.4
1FE1082-6WP□□	10.0	7.9	10.0	7.9
1FE1082-6WQ□□	6.0	6.3	10.0	7.9
1FE1082-6WS□□	4.0	5.5	6.0	6.3
1FE1082-6WW□□	2.5	4.4	2.5	4.4
1FE1083-6WP□□	10.0	7.9	10.0	7.9
1FE1084-6WR□□	6.0	6.3	10.0	7.9
1FE1084-6WU□□	4.0	5.5	6.0	6.3
1FE1084-6WX□□	2.5	4.4	2.5	4.4
1FE1091-6WN□□	2.5	4.4	2.5	4.4
1FE1091-6WS□□	2.5	4.4	2.5	4.4
1FE1092-6WN□□	6.0	6.3	10.0	7.9
1FE1092-6WR□□	4.0	5.5	6.0	6.3
1FE1093-6WN□□	10.0	7.9	16.0	9.0
1FE1093-6WS□□	6.0	6.3	10.0	7.9
1FE1093-6WV□□	4.0	5.5	6.0	6.3
1FE1093-6WX□□	2.5	4.4	2.5	4.4

Motor type	L = 0.5 m ¹⁾		L = 1.5 m and 3.5 m ²⁾	
	Cable cross-section per phase in mm ²	Cable outer diameter in mm	Cable cross-section per phase in mm ²	Cable outer diameter in mm
1FE1113-6WU□□	6.0	6.3	10.0	7.9
1FE1113-6WX□□	4.0	5.5	6.0	6.3
1FE1114-6WR□□	16.0	9.0	25.0	11.0
1FE1114-6WT□□	10.0	7.9	16.0	9.0
1FE1114-6WW□□	6.0	6.3	10.0	7.9
1FE1115-6WT□□	10.0	7.9	16.0	9.0
1FE1115-6WW□□	6.0	6.3	10.0	7.9
1FE1116-6WR□□	16.0	9.0	25.0	11.0
1FE1116-6WT□□	10.0	7.9	16.0	9.0
1FE1116-6WW□□	6.0	6.3	10.0	7.9
1FE1116-6WY□□	4.0	5.5	6.0	6.3

1) According to EN 46200 can only be used in the motor spindle

2) Notes on using cables is provided in VDE 0298, Part 3 and Part 4

3) Teflon cable

Motor type	L = 0.5 m ¹⁾		L = 1.5 m and 3.5 m ²⁾	
	Cable cross-section per phase in mm ²	Cable outer diameter in mm	Cable cross-section per phase in mm ²	Cable outer diameter in mm
8-pole built-in motors				
1FE1143-8WM□1	25.0	11.0	25.0	11.0
1FE1143-8WQ□1	10.0	7.9	16.0	9.0
1FE1144-8WL□1	25.0	11.0	2 * 16	2 * 9
1FE1144-8WQ□1	16.0	9.0	25.0	11.0
1FE1144-8WT□1	16.0	9.0	16.0	9.0
1FE1144-8WV□1	10.0	7.9	10.0	7.9
1FE1145-8WE□1	10.0	7.9	16.0	9.0
1FE1145-8WN□1	2 * 16	2 * 9	2 * 16	2 * 9
1FE1145-8WQ□1	2 * 10	2 * 7.9	2 * 16	2 * 9
1FE1145-8WS□1	25.0	11.0	25.0	11.0
1FE1147-8WM□1	2 * 16	2 * 9	2 * 25	2 * 11
1FE1147-8WN□1	2 * 16	2 * 9	2 * 16	2 * 9
1FE1147-8WQ□1	2 * 10	2 * 7.9	2 * 16	2 * 9
1FE1147-8WS□1	25.0	11.0	25.0	11.0

1) According to EN 46200 can only be used in the motor spindle

2) Notes on using cables is provided in VDE 0298, Part 3 and Part 4

Motor type	L = 0.5 m ¹⁾		L = 1.5 m and 3.5 m ²⁾	
	Cable cross-section per phase in mm ²	Cable outer diameter in mm	Cable cross-section per phase in mm ²	Cable outer diameter in mm
4-pole built-in motors				
1FE1051-4HC□0	2.5	4.4	2.5	4.4
1FE1051-4HF□1	2.5	4.4	2.5	4.4
1FE1051-4WN□1	2.5	4.4	2.5	4.4
1FE1052-4HD□0	6.0	6.3	6.0	6.3
1FE1052-4HG□1	4.0	5.5	6.0 ³⁾	6.3 ³⁾
1FE1052-4WK□1	2.5	4.4	4.0	5.5
1FE1052-4WN□1	2.5	4.4	2.5	4.4
1FE1053-4HH□1	4.0	5.5	6.0	6.3
1FE1053-4WJ□1	4.0	5.5	4.0	5.5
1FE1053-4WN□1	2.5	4.4	2.5	4.4
1FE1072-4WH□1	6.0	6.3	10.0	7.9
1FE1072-4WL□1	4.0	5.5	6.0	6.3
1FE1072-4WN□1	2.5	4.4	4.0	5.5
1FE1072-4WV□1	2.5	4.4	2.5	4.4
1FE1073-4WL□1	10.0 ³⁾	7.9 ³⁾	16.0 ³⁾	9.0 ³⁾
1FE1073-4WN□1	6.0	6.3	10.0	7.9
1FE1073-4WT□1	2.5	4.4	2.5	4.4
1FE1074-4WM□1	16.0 ³⁾	9.0 ³⁾	16.0 ³⁾	9.0 ³⁾
1FE1074-4WN□1	10.0	7.9	16.0	9.0
1FE1074-4WR□1	6.0	6.3	10.0	7.9
1FE1074-4WT□1	6.0	6.3	6.0	6.3
1FE1074-4WV□1	4.0	5.5	6.0	6.3
1FE1075-4WQ□1	6.0	6.3	10.0	7.9
1FE1082-4WF□1	10.0	7.9	16.0	9.0
1FE1082-4WK□1	6.0	6.3	10.0	7.9
1FE1082-4WN□1	4.0	5.5	6.0	6.3
1FE1082-4WP□1	2.5	4.4	2.5	4.4
1FE1082-4WR□1	2.5	4.4	2.5	4.4
1FE1083-4WN□1	10.0	7.9	16.0	9.0
1FE1084-4WN□1	16.0	9.0	25.0	11.0
1FE1084-4WP□1	10.0	7.9	16.0	9.0
1FE1084-4WQ□1	10.0	7.9	16.0	9.0
1FE1084-4WT□1	6.0	6.3	10.0	7.9
1FE1084-4WV□1	4.0	5.5	6.0	6.3
1FE1085-4WN□1	16.0	9.0	25.0	11.0
1FE1085-4WQ□1	10.0	7.9	16.0	9.0
1FE1085-4WT□1	6.0	6.3	10.0	7.9
1FE1092-4WP□1	4.0	5.5	6.0	6.3
1FE1092-4WV□1	2.5	4.4	2.5	4.4

Motor type	L = 0.5 m ¹⁾		L = 1.5 m and 3.5 m ²⁾	
	Cable cross-section per phase in mm ²	Cable outer diameter in mm	Cable cross-section per phase in mm ²	Cable outer diameter in mm
1FE1093-4WH□1	10.0	7.9	16.0	9.0
1FE1093-4WM□1	6.0	6.3	10.0	7.9
1FE1093-4WN□1	6.0	6.3	10.0	7.9
1FE1094-4WK□1	16.0	9.0	25.0	11.0
1FE1094-4WL□1	10.0	7.9	16.0	9.0
1FE1094-4WS□1	6.0	6.3	10.0	7.9
1FE1094-4WU□1	4.0	5.5	6.0	6.3
1FE1095-4WN□1	16.0	9.0	25.0	11.0
1FE1096-4WN□1	16.0	9.0	25.0	11.0
1FE1103-4WN□1	10.0	7.9	16.0	9.0
1FE1103-4WQ□1	10.0	7.9	10.0	7.9
1FE1103-4WT□1	6.0	6.3	10.0	7.9
1FE1104-4WL□1	2 * 10	2 * 7.9	2 * 16	2 * 9
1FE1104-4WN□1	16.0	9.0	25.0	11.0
1FE1105-4WN□1	16.0	9.0	25.0	11.0
1FE1105-4WQ□1	16.0	9.0	16.0	9.0
1FE1105-4WS□1	10.0	7.9	16.0	9.0
1FE1106-4WN□1	2 * 10	2 * 7.9	2 * 16	2 * 9
1FE1106-4WR□1	25.0	11.0	2 * 16	2 * 9
1FE1106-4WS□1	25.0	11.0	25.0	11.0
1FE1106-4WY□1	6.0	6.3	10.0	7.9
1FE1124-4WN□1	25.0	11.0	2 * 16	2 * 9
1FE1124-4WQ□1	25.0	11.0	25.0	11.0
1FE1125-4WN□1	2 * 16	2 * 9	2 * 16	2 * 9
1FE1125-4WP□1	25.0	11.0	2 * 16	2 * 9
1FE1125-4WQ□1	16.0	9.0	25.0	11.0
1FE1126-4WN□1	2 * 16	2 * 9	2 * 16	2 * 9
1FE1126-4WP□1	2 * 16	2 * 9	2 * 16	2 * 9
1FE1126-4WQ□1	25.0	11.0	2 * 16	2 * 9

1) According to EN 46200, can be used only within the motor spindle.

Observe IEC / EN 60364-5-52 and IEC / EN 60204-1.

2) Notes on using cables is provided in VDE 0298, Part 3 and Part 4

3) Teflon cable

8.3.1.4 Terminal boxes

The terminal box is not included in the scope of supply.

Note

The terminal box must have as a minimum, degree of protection IP54 according to DIN IEC 60034-5.

- Install the corresponding seals between the spindle box and terminal box, as well as at the terminal box cover.
-

8.3.1.5 Recommended grounding

Note

A protective conductor / bearing shield must be connected at the spindle box through a good electrical connection.

The spindle housing / bearing shield must be electrically connected to the cooling jacket.

- Use a protective conductor with the required minimum cross-section.
 - Ground so there is a good conductive transition between the protective conductor and spindle box protected against corrosion (e.g. bare contact surfaces with a coating of Vaseline).
-

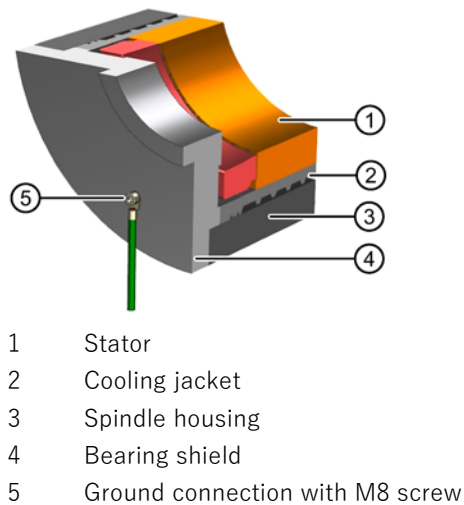


Figure 8-3 Recommended grounding

8.3.1.6 High-voltage test

DANGER

Lethal voltage hazards

A dangerous voltage is present at the motor during a high-voltage test. Death or serious injury can result when live parts are touched.

- Do not touch any live parts.
- Adhere to the fundamental safety instructions.

NOTICE

Destruction of electronic components and damage to the insulation

A high-voltage test on the motor can damage the insulation of the motor and destroy electronic components, e.g. temperature sensors.

- Use maximum 80% of the test voltage in accordance with EN 60034-1.
- Prior to the test, short-circuit the cable ends of the temperature sensors.

Before being shipped, the stators of the built-in motors are subject to a high-voltage test in compliance with EN 60034-1.

However, the Standards Commission recommends that when electrical components (such as built-in motors) are installed, a new high-voltage test according to EN 60034-1 should be performed after the final assembly has been completed.

8.3.2 Voltage limiting

Note

EMF (Electro Motive Force) > 820 V

In a fault situation, a voltage limitation of the DC-link voltage on the converter is required. The voltage limit depends on the maximum EMF (induced phase-to-phase voltage peak > 820 V).

Voltage limiting is required if you operate the motor with a speed $n > n_{\max \text{ inv}}$.

If the power fails (line voltage) at a speed $> n_{\max \text{ inv}}$ of the motor, or the converter pulses are canceled as a result of the power failure, then the synchronous motor feeds a high voltage back into the DC link. The voltage protection detects a DC link voltage that is too high (DC > 820 V) and short-circuits the 3 motor feeder cables. The energy remaining in the motor is converted into heat as a result of the short-circuit and causes the motor to quickly brake.

The VPM (Voltage Protection Module) is used as voltage limiter for SINAMICS S120.

Operation without voltage limiting

NOTICE

Danger of motor damage caused by exceeding the maximum speed

If you operate a motor with an EMF > 820 V without voltage limiting, then you must reduce the maximum permissible speed to $n_{\max \text{ inv}}$.

- Never operate the motor without voltage limitation.
- Do not exceed the maximum permissible speed.

Calculate the maximum permissible speed for operation without voltage limitation using the following equation:

$$n_{\max \text{ inv}} = 820 \text{ V} \cdot 1000 / k_E \cdot \sqrt{2}$$

$n_{\max \text{ inv}}$ / rpm - maximum permissible speed without voltage limiting

k_E / V for 1000 rpm = voltage constant,

The Voltage Protection Module (VPM) is not included in the scope of delivery of 1FE1 built-in motors. You must order the VPM separately. Additional information is provided in Catalog NC62 (<https://intranet.for.siemens.com/org/i-dt-mc/intraDocs/catalogs/nc622019/NC%2062%20-%202019%20-%20Complete%20Catalog/motion-control-NC62-complete-English-2019.pdf>)



WARNING

Electric shock if the permissible EMF is exceeded

The motor can be damaged and cause an electric shock if the electromotive force (EMF) of the motor is exceeded. Electric shock can result in death or serious injury.

- Only use a Voltage Protection Module (VPM) up to a maximum motor EMF of 2 kV.

Integration and system preconditions of the Voltage Protection Modules (VPM)

The VPM is installed between the motor and the drive system. The maximum cable length between the VPM and the drive system is 1.5 m.

Note

No switching elements may be added to the U, V, W connection cables between the drive system, VPM and motor.

Only use shielded motor feeder cables.

System preconditions for using the VPM:

- SINAMICS S120 Booksize (6SL31□□-□□□□□-□□□□□)
- SINUMERIK 840D sl from software release 1.3 and higher

Technical data

Table 8- 1 Technical data VPM

Designation	VPM 120	VPM 200	VPM 200 DYNAMIC
Article number for metric gland	6SN1113-1AA00-1JA1	6SN1113-1AA00-1KA1	6SN1113-1AA00-1KC1
Dimensions H × W × D in mm	300 × 150 × 180	300 × 250 × 190	300 × 250 × 260
Drive system connection (cable cross-section)	U3, V3, W3; M50 (max. 50 mm ²)	U3, V3, W3; 2 × M50 (max. 2 × 50 mm ²)	U3, V3, W3; 2 × M50 (max. 2 × 50 mm ²)
Motor side connection (cable cross-section)	U4, V4, W4; M50 (max. 50 mm ²)	U4, V4, W4; 2 × M50 (max. 2 × 50 mm ²)	U4, V4, W4; 2 × M50 (max. 2 × 50 mm ²)
Cable lug	Crimp-type cable lug M6	Crimp-type cable lug M8	Tubular cable lug M8, 90° angled
Signaling contact 1 × M16 Max. Conductor cross-section	1 × NC contact (floating) 24 V DC ≤ 1.5 mm ²	1 × NC contact (floating) 24 V DC ≤ 1.5 mm ²	1 × NC contact (floating) 24 V DC ≤ 1.5 mm ²
Rated current	≤ 3 AC 120 A _{rms}	≤ 3 AC 200 A _{rms}	≤ 3 AC 200 A _{rms}
Max. permissible short-circuit current	90 A	200 A	200 A
Short-time loading	2 × I _N for approx. 500 ms	3 × I _N for approx. 500 ms	3 × I _N for approx. 500 ms
Connection length, drive system	≤ 1.5 m	≤ 1.5 m	≤ 1.5 m
Connection length, motor side	≤ 50 m	≤ 50 m	≤ 50 m
Power loss · Normal operation · Short-circuit operation with I _N	approx. 0 W approx. 360 W (max. 2 min)	approx. 0 W approx. 1.1 kW (max. 2 min)	approx. 0 W approx. 1.1 kW (max. 2 min)
Tripping voltage	830 V DC +/- 1%	830 V DC +/- 1%	830 V DC +/- 1%
Degree of protection	IP20	IP20	IP20
Ambient temperature	0 ... 50 ° C	0 ... 50 ° C	0 ... 50 ° C
Installation altitude	1000 m above sea level (otherwise power reduction)	1000 m above sea level (otherwise power reduction)	1000 m above sea level (otherwise power reduction)
Vibratory load (in accordance with DIN EN 60721)	Up to 1 g	Up to 1 g	Up to 1 g
Shock load (in accordance with DIN EN 60721)	Up to 10 g	Up to 10 g	Up to 10 g
Max. permissible braking duration	≤ 2 min	≤ 2 min	≤ 2 min
Weight	approx. 6 kg	approx. 11 kg	approx. 13 kg

Capacitance of the drive system with the VPM

To ensure in a fault situation that a defined DC-link voltage is not exceeded and the voltage gain speed is limited, the DC link must have a minimum capacitance.

Minimum capacitance: $C_{\text{DClinkmin}} / \mu\text{F}$

The minimum capacitance of the DC link is calculated using the following formula:

Required variables: $I_{\text{rated motor}} / \text{A}$

Formula: $C_{\text{DClinkmin}} = I_{\text{rated motor}} \times 33.33$

Note

Consider the calculated DC link capacitance when configuring the system.

Maximum permissible braking duration with the VPM

Note

The braking time t_{br} must be $\leq 120 \text{ s}$.

The maximum braking duration for a terminal short-circuit (with VPM) can be approximately calculated as follows:

$$t_{\text{br}} = K \times 10^{-6} \times J_{\text{tot}} \times n^2$$

Braking duration: t_{br} in s

Brake constant: K in $(\text{s min}^2)/(\text{kgm}^2)$

Total moment of inertia: $J_{\text{tot}} = J_{\text{rot}} + J_{\text{external}}$; $J_{\text{tot}} / \text{kgm}^2$

Rotor moment of inertia: J_{rot} in kgm^2

External moment of inertia: J_{external} in kgm^2

Maximum speed: n in rpm

Selecting the VPM and determining the brake constant K

Table 8- 2 Selecting the VPM; brake constant K

Motor type ¹⁾	VPM	Brake constant (K)
6-pole built-in motors		
1FE1062-6WQ11	VPM 120	1.76
1FE1064-6WN11	VPM 120	1
1FE1064-6WQ11	VPM 120	1.1
1FE1082-6WQ11	VPM 120	1.8
1FE1082-6WW11	VPM 120	2
1FE1082-6WE11	VPM 120	2
1FE1084-6WN11	VPM 200 / VPM 200 Dynamik	1.3
1FE1084-6WR11	VPM 120	1.2
1FE1084-6WU11	VPM 120	1.3
1FE1084-6WX11	VPM 120	1.5
1FE1092-6WR11	VPM 120	2.3
1FE1093-6WV11	VPM 120	1
1FE1093-6WX11	VPM 120	1.9
1FE1093-6WC11	VPM 120	2.3
1FE1095-6WU11	VPM 120	1.2
1FE1113-6WU11	VPM 120	2
1FE1113-6WX11	VPM 120	2.2
1FE1114-6WR11	VPM 120	1.1
1FE1114-6WT11	VPM 120	1.1
1FE1114-6WW11	VPM 120	1.1
1FE1115-6WW11	VPM 120	1.6
1FE1115-6WV11	VPM 120	1.5
1FE1115-6WT11	VPM 120	1.4
1FE1116-6WR11	VPM 120	0.9
1FE1116-6WT11	VPM 120	0.9
1FE1116-6WW11	VPM 120	1.9
1FE1116-6WY11	VPM 120	1.7
8-pole built-in motors		
1FE1143-8WM11	VPM 200 / VPM 200 Dynamik	0.8
1FE1143-8WQ11	VPM 120	0.9
1FE1144-8WL11	VPM 200 / VPM 200 Dynamik	0.8
1FE1144-8WQ11	VPM 200 / VPM 200 Dynamik	0.85
1FE1144-8WT11	VPM 120	0.95
1FE1144-8WV11	VPM 120	1
1FE1145-8WN11	VPM 200 / VPM 200 Dynamik	0.6
1FE1145-8WQ11	VPM 200 / VPM 200 Dynamik	0.8
1FE1145-8WS11	VPM 200 / VPM 200 Dynamik	0.9
1FE1145-8WE11	VPM 120	0.8
1FE1147-8WM11	IVP	0.5

Motor type ¹⁾	VPM	Brake constant (K)
1FE1147-8WN11	VPM 200 / VPM 200 Dynamik	0.6
1FE1147-8WQ11	VPM 200 / VPM 200 Dynamik	0.7
1FE1147-8WS11	VPM 200 / VPM 200 Dynamik	0.8
4-pole built-in motors		
1FE1051-4HF11	VPM 120	1.9
1FE1051-4WL11	VPM 120	4.3
1FE1051-4WN11	VPM 120	5.5
1FE1052-4HG11	VPM 120	1.3
1FE1052-4WN11	VPM 120	3.4
1FE1052-4WK11	VPM 120	3.2
1FE1053-4HH11	VPM 120	1
1FE1053-4WJ11	VPM 120	2.1
1FE1053-4WN11	VPM 120	2.5
1FE1072-4WH11	VPM 120	3.3
1FE1072-4WL11	VPM 120	2.7
1FE1072-4WN11	VPM 120	3.6
1FE1072-4WV11	VPM 120	4.1
1FE1073-4WL11	VPM 120	2.1
1FE1073-4WM11	VPM 120	1.9
1FE1073-4WN11	VPM 120	2.6
1FE1073-4WT11	VPM 120	2.8
1FE1074-4WR11	VPM 120	1.9
1FE1074-4WM11	VPM 200 / VPM 200 Dynamik	2.3
1FE1074-4WN11	VPM 120	2.3
1FE1074-4WT11	VPM 120	2
1FE1074-4WV11	VPM 120	2.1
1FE1075-4WQ11	VPM 120	1.9
1FE1082-4WF11	VPM 120	2.8
1FE1082-4WK11	VPM 120	3.1
1FE1082-4WN11	VPM 120	3.6
1FE1082-4WP11	VPM 120	3.7
1FE1082-4WR11	VPM 120	5.3
1FE1083-4WN11	VPM 120	2.7
1FE1084-4WN11	VPM 120	2.2
1FE1084-4WP11	VPM 120	1.8
1FE1084-4WQ11	VPM 120	2.6
1FE1084-4WT11	VPM 120	2.3
1FE1084-4WV11	VPM 120	2.3
1FE1085-4WN11	VPM 120	1.8
1FE1085-4WQ11	VPM 120	2.1
1FE1085-4WT11	VPM 120	2.5
1FE1092-4WP11	VPM 120	3.7
1FE1092-4WV11	VPM 120	5.7

Motor type ¹⁾	VPM	Brake constant (K)
1FE1093-4WC11	VPM 200 / VPM 200 Dynamik	2
1FE1093-4WH11	VPM 120	2.7
1FE1093-4WM11	VPM 120	2.7
1FE1093-4WN11	VPM 120	3
1FE1094-4WK11	VPM 120	2.3
1FE1094-4WL11	VPM 120	2.3
1FE1094-4WS11	VPM 120	3
1FE1094-4WU11	VPM 120	3.5
1FE1095-4WN11	VPM 120	1.9
1FE1096-4WN11	VPM 120	1.9
1FE1096-4WK11	VPM 200 / VPM 200 Dynamik	1.1
1FE1103-4WN11	VPM 120	1.3
1FE1103-4WQ11	VPM 120	1.3
1FE1103-4WT11	VPM 120	1.9
1FE1104-4WN11	VPM 200 / VPM 200 Dynamik	1.1
1FE1104-4WL11	VPM 200 / VPM 200 Dynamik	1.2
1FE1105-4WN11	VPM 200 / VPM 200 Dynamik	0.9
1FE1105-4WQ11	VPM 120	0.9
1FE1105-4WS11	VPM 120	1.7
1FE1106-4WY11	VPM 120	1.7
1FE1106-4WS11	VPM 200 / VPM 200 Dynamik	1.3
1FE1106-4WR11	VPM 200 / VPM 200 Dynamik	1.11
1FE1106-4WN11	VPM 200 / VPM 200 Dynamik	0.9
1FE1124-4WN11	VPM 200 / VPM 200 Dynamik	1.1
1FE1124-4WQ11	VPM 200 / VPM 200 Dynamik	1.1
1FE1125-4WN11	VPM 200 / VPM 200 Dynamik	0.9
1FE1125-4WP11	VPM 200 / VPM 200 Dynamik	1
1FE1125-4WQ11	VPM 200 / VPM 200 Dynamik	1.3
1FE1126-4WN11	VPM 200 / VPM 200 Dynamik	0.8
1FE1126-4WP11	VPM 200 / VPM 200 Dynamik	0.9
1FE1126-4WQ11	VPM 200 / VPM 200 Dynamik	1.1

¹⁾ The table only lists those motors that must be operated with VPM.

Wiring diagram

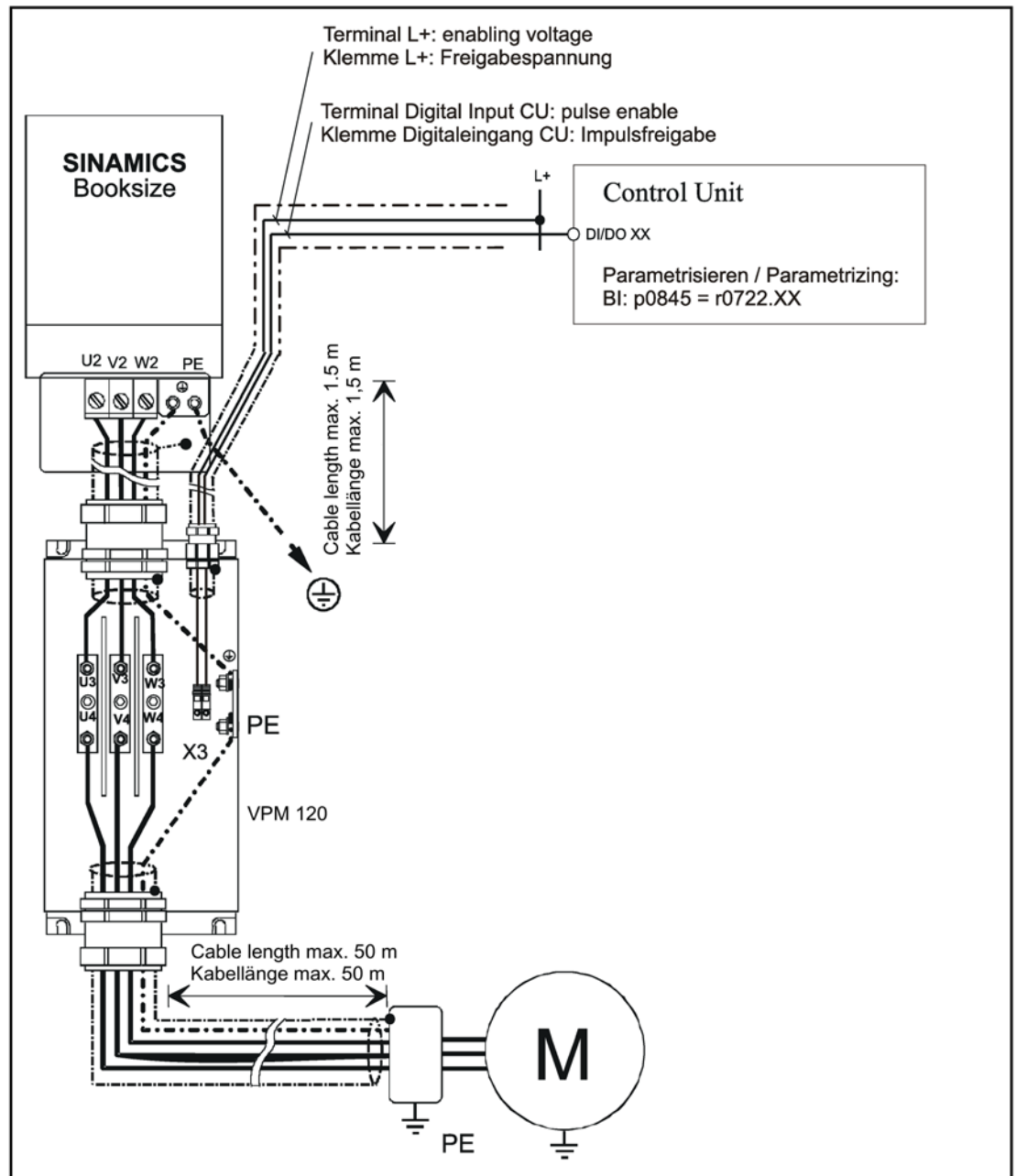


Figure 8-4 Connection diagram VPM 120

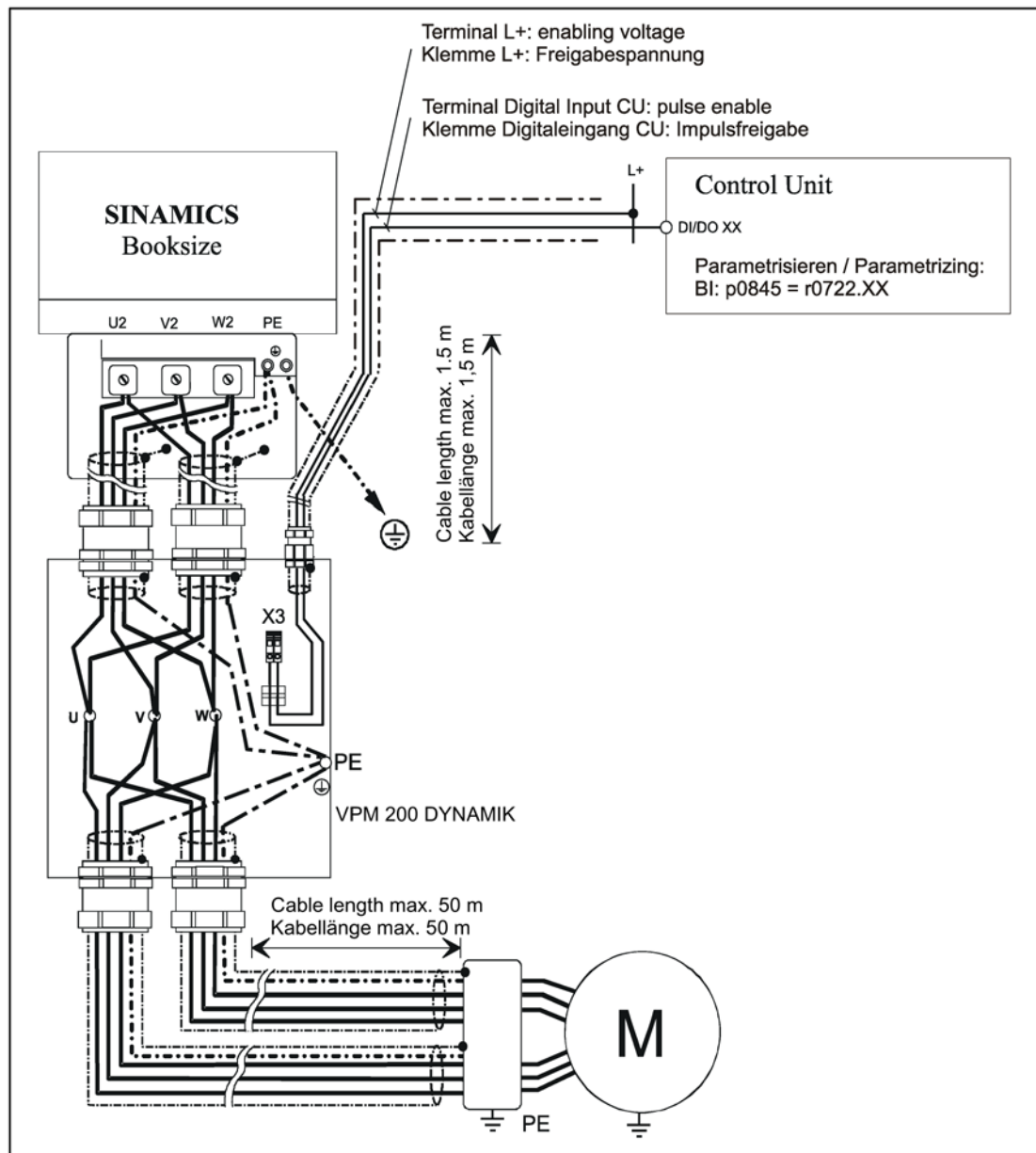


Figure 8-5 Wiring diagram VPM 200/VPM 200 DYNAMIC

8.3.3 Signal connection / motor protection

8.3.3.1 Connecting the temperature sensors

NOTICE
Risk of damage to temperature-sensitive components Some parts of the electrical motor enclosure can reach temperatures that exceed 100 ° C. If temperature-sensitive components, e.g. electric cables or electronic components, come into contact with hot surfaces, these components could be damaged. • Carefully ensure that no temperature-sensitive components are in contact with hot surfaces.

Connecting the Pt1000 temperature sensors

Note

Pt1000 temperature sensors are not ESD components.

Connect the Pt1000 temperature sensor independent of the polarity via two-conductor yellow cables.

You can connect the Pt1000 and PTC as follows:

- Pt1000 via SMC20 or directly at the drive system
- PTC via thermistor motor protection 3RN2013-1GW30 or a comparable device

Connecting the PTC via thermistor motor protection 3RN2013-1GW30, Pt1000 to SMC20

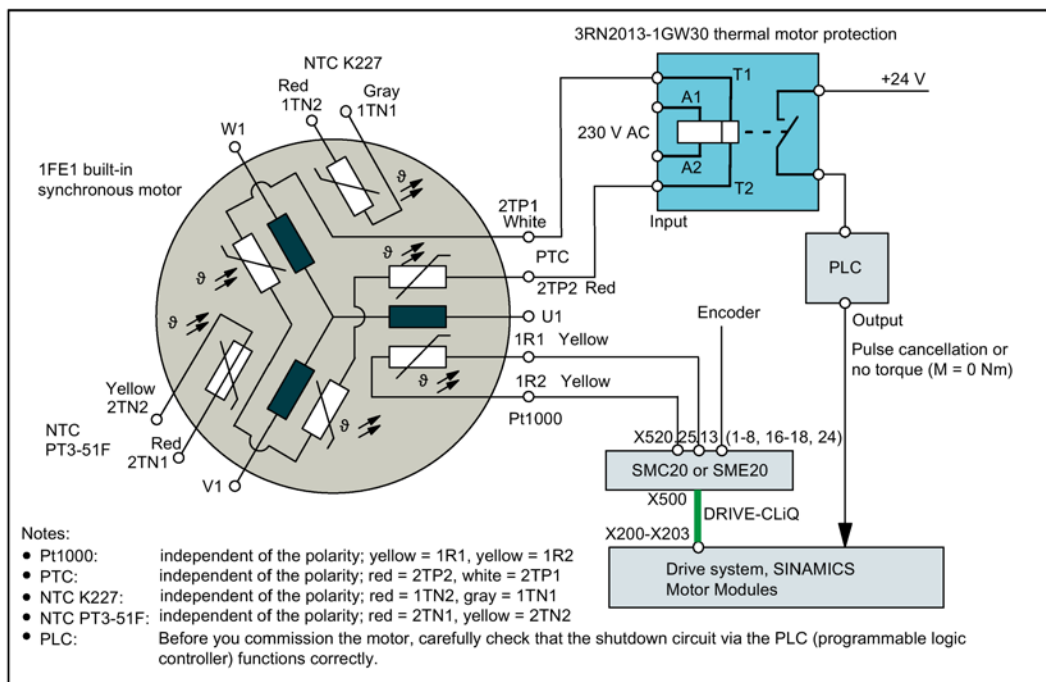


Figure 8-6 Connecting the PTC via thermistor motor protection 3RN2013-1GW30, Pt1000 to SMC20

Note

Additional information about connecting-up and operating the SMC20 is provided in the Equipment Manual for the Control Units and supplementary system components.

Note

Before you commission the motor, carefully check that the shutdown circuit via the PLC (programmable logic controller) functions correctly.

Connecting the PTC via thermistor motor protection 3RN2013-1GW30, Pt1000 directly to the drive system

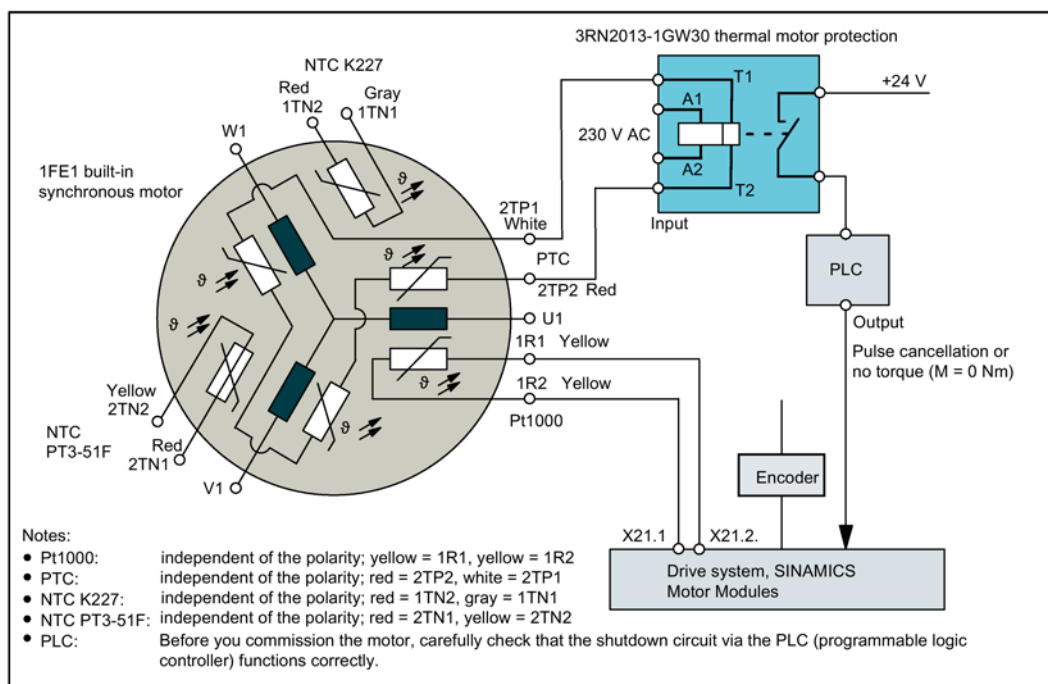
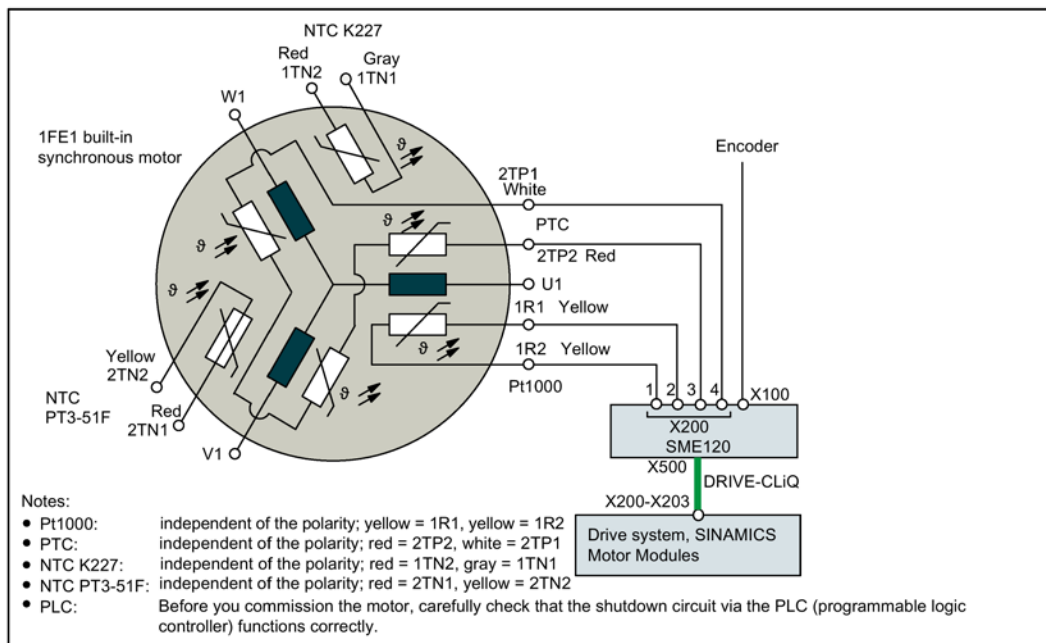


Figure 8-7 Connecting the PTC via thermistor motor protection 3RN2013-1GW30, Pt1000 directly to the drive system

Note

Before you commission the motor, carefully check that the shutdown circuit via the PLC (programmable logic controller) functions correctly.

Connecting the PTC and Pt1000 to SME120



Note SME120

Additional information about connecting-up and operating the SME120 is provided in the Equipment Manual for the Control Units and supplementary system components.

Note

Before you commission the motor, carefully check that the shutdown circuit via the PLC (programmable logic controller) functions correctly.

8.3.3.2 Connection assignment of the encoder

Note

The encoder is not included in the scope of delivery of the motor.
More detailed information is provided in the SINAMICS documentation.

Technical data and characteristics

9.1 Explanations

The values in the following tables and characteristics are valid for motors with water cooling and a cast winding design.

The specified motor power ratings and torques are the values that the rotor of the built-in motor transfers to the spindle. Depending on the mechanical design of the motor spindle, various levels of frictional losses occur (e.g. bearing losses, eddy losses, losses at rotary glands).

The manufacturer of the built-in motors does not know the magnitude of these frictional losses.

To calculate the net power output at the shaft, subtract the total frictional losses from the specified values.

You must continually cool built-in motors independent of the operating mode.

9.2 Technical data

Motor article number	Rated torque M_N / Nm ¹⁾			Rated current I_N / A			Maximum current	Rated speed	Maximum speed
	S1	S6-40 %	S6-25 %	S1	S6-40 %	S6-25 %	$I_{\max}$ / A ₂₎	n_N / rpm	$n_{\max}$ / rpm
6-pole built-in motors									
1FE1041-6WM□0	4.5	6	7	13	17.5	21.5	26	15800	18000
1FE1041-6WN□0	4.5	6	7	12	16.5	20	24	14000	18000
1FE1041-6WU□0	4.5	6	7	8	11	13.5	16	8500	13000
1FE1042-6WN□0	11	14	16	24	32	40	48	12500	18000
1FE1042-6WR□0	11	14	16	19	26	32	38	10000	15000
1FE1042-6WT□0	11	14	16	16	22	27	32	8000	12000
1FE1051-6WK□0	10	12.4	14	20	29	36	40	8000	15000
1FE1051-6WN□0	10	12.6	14	15	22	27	30	6000	12000
1FE1052-6WK□0	18	23	26.7	37	54	68	74	7500	15000
1FE1052-6WN□0	20	25.2	29	30	44	55	60	5500	12000
1FE1052-6WY□0	18	23	26	13.5	20	25	27	3000	6000
1FE1054-6WR□0	42	60	70	40	58	73	80	4600	8500
1FE1054-6WN□0	37	46	52.5	60	88	110	120	6000	12000
1FE1061-6WH□0	13	17	21	21	30	37	42	8500	12000
1FE1061-6WV□0	13	17	21	9	13	16	18	3500	6000
1FE1061-6WY□0	13	17	21	8	11.5	14	16	3000	5000
1FE1062-6WQ□1	23	28	31.5	28.5	36	42	50	5800	12000
1FE1064-6WN□1	56	81	97	56	80	100	112	4300	12000
1FE1064-6WQ□1	56	81	97	43	61	77	86	3400	10000
1FE1082-6WP□0	65	81	95	65	91	112	130	5000	8500
1FE1082-6WQ□1	65	81	95	60	84	103	120	4300	9000
1FE1082-6WS□0	65	81	95	45	62	76	90	3600	6000
1FE1082-6WW□1	65	81	95	30	42	51	60	2200	9000
1FE1082-6WE□1	65	81	95	24	33	40	48	1700	8000
1FE1083-6WL□0	90	127	147	115	164	200	240	6000	9000
1FE1083-6WP□0	97	127	147	66	92	110	132	3500	5500
1FE1084-6WN□1	130	175	200	85	119	146	170	3400	9000
1FE1084-6WR□1	130	175	200	60	84	103	120	2300	9000
1FE1084-6WU□1	130	175	200	45	64	79	90	1700	7000
1FE1084-6WX□1	130	174	200	30	42	52	60	1100	4500
1FE1091-6WN□0	28	36	41	24	35	43	48	3500	7000
1FE1091-6WS□0	30	36	41	15	19	23	30	2000	4000
1FE1092-6WN□0	66	85	98	58	84	103	116	3500	7000
1FE1092-6WR□1	66	85	98	41	58	72	82	3200	7000
1FE1093-6WN□0	100	128	147	83	120	150	166	3500	7000
1FE1093-6WS□0	100	128	148	53	76	94	106	2000	4000

Motor article number	Rated torque $M_N / \text{Nm}^{1)}$			Rated current I_N / A			Maxi- mum current	Rated speed	Maximum speed
	S1	S6-40 %	S6-25 %	S1	S6-40 %	S6-25 %	$I_{\max} / \text{A}$ 2)	n_N / rpm	$n_{\max} / \text{rpm}$
1FE1093-6WV□1	100	128	149	43	60	75	86	1600	7000
1FE1093-6WX□1	98	130	155	30	45	56	60	1460	6300
1FE1093-6WC□1	100	130	155	30	43	53	60	1430	5750
1FE1095-6WU□1	170	225	260	58	83	103	120	1650	7000
1FE1113-6WU□1	150	190	220	60	91	114	124	2100	6500
1FE1113-6WX□1	150	190	220	43	62	78	86	1400	5700
1FE1114-6WR□1	200	256	292	108	159	197	216	2000	6500
1FE1114-6WT□1	200	256	292	84	123	154	168	1400	6500
1FE1114-6WW□1	200	256	292	58	85	106	116	1000	6000
1FE1115-6WW□1	265	340	385	60	87	109	120	1050	4500
1FE1115-6WV□1	265	340	385	71	103	129	142	1400	5300
1FE1115-6WT□1	265	340	385	85	123	154	170	1500	6500
1FE1116-6WR□1	300	384	438	109	160	200	218	1200	6500
1FE1116-6WT□1	300	384	438	84	123	154	168	900	5500
1FE1116-6WW□1	300	384	438	60	87	108	120	700	4000
1FE1116-6WY□1	310	410	460	45	65	80	90	740	3000
8-pole built-in motors									
1FE1143-8WM□1	325	440	500	120	180	225	248	1800	8000
1FE1143-8WQ□1	320	440	500	77	113	141	154	1150	5000
1FE1144-8WL□1	430	610	690	133	193	241	266	1400	6500
1FE1144-8WQ□1	430	610	690	100	146	182	200	1100	4900
1FE1144-8WT□0	430	610	700	85	124	154	170	900	1700
1FE1144-8WT□1	430	610	700	85	124	154	170	900	3800
1FE1144-8WV□1	430	610	700	71	103	128	142	780	3500
1FE1145-8WN□1	585	795	890	200	290	360	400	1700	8000
1FE1145-8WQ□1	585	795	890	158	230	285	316	1300	6000
1FE1145-8WS□1	585	795	890	130	188	235	260	1100	5000
1FE1145-8WE□1	585	795	890	85	128	160	170	780	3500
1FE1147-8WM□1	820	1110	1240	220	320	395	440	1300	6000
1FE1147-8WN□1	820	1110	1240	200	290	360	400	1200	5500
1FE1147-8WQ□1	820	1110	1240	158	230	285	316	950	4200
1FE1147-8WS□1	820	1110	1240	130	190	235	260	750	3500
4-pole built-in motors									
1FE1051-4HF□1	5	7	9	21	29	35	42	19000	40000
1FE1051-4HC□0	5	7	9	25	34.5	42	50	24000	40000
1FE1051-4WL□1	6.5	9	11	13.5	18.5	23	27	10300	30000
1FE1051-4WN□1	6.5	9	11	12	17	21	24	9500	30000
1FE1052-4HG□1 ³⁾	12	15	19	44	59	73	88	19000	40000
1FE1052-4HD□0 ³⁾	12	15	19	57	75	95	114	25000	40000
1FE1052-4WN□1	13	18	22	20	26	33	40	8000	30000

9.2 Technical data

Motor article number	Rated torque $M_N / \text{Nm}^{1)}$			Rated current I_N / A			Maximum current	Rated speed	Maximum speed
	S1	S6-40 %	S6-25 %	S1	S6-40 %	S6-25 %	$I_{\text{max}} / \text{A}$ 2)	n_N / rpm	$n_{\text{max}} / \text{rpm}$
1FE1052-4WK□1	13	17	21	30	39	49	60	12500	30000
1FE1053-4HH□1 ³⁾	18	23	28	46	63	77	92	13500	40000
1FE1053-4WJ□1	20	27	32	36	49	60	72	11000	30000
1FE1053-4WN□1	20	27	32	29	38	47	58	7900	30000
1FE1072-4WH□1	28	40	48	64	96	119	128	9700	24000
1FE1072-4WL□1	28	40	48	45	68	84	90	6800	24000
1FE1072-4WN□1	28	40	48	36	54	67	72	5500	24000
1FE1072-4WV□1	28	40	48	18	26.5	33	38	2500	12600
1FE1073-4WL□1	44	67	75	83	124	154	166	9700	24000
1FE1073-4WM□1	45	64	75	68	100	125	136	7400	24000
1FE1073-4WN□1	42	59	71	65	97	120	130	6800	24000
1FE1073-4WT□1	45	64	75	30	44	55	60	3200	14000
1FE1074-4WR□1	60	85	95	58	85	106	116	4800	20000
1FE1074-4WM□1	60	86	100	97	144	176	194	7700	20000
1FE1074-4WN□1	56	79	95	91	136	168	182	7000	20000
1FE1074-4WT□1	60	85	95	53	77	95	106	4100	18000
1FE1074-4WV□1	60	80	95	45	66	83	90	3800	15500
1FE1075-4WQ□1	75	100	125	51	75	94	105	3000	14000
1FE1082-4WF□1	42	55	63	81	115	142	162	7500	20000
1FE1082-4WK□1	42	55	63	55	78	96	110	5600	20000
1FE1082-4WN□1	42	55	63	42	60	76	84	3500	20000
1FE1082-4WP□1	42	55	63	30	43	52	60	2700	15000
1FE1082-4WR□1	42	55	63	24	34	43	48	2000	11000
1FE1083-4WN□1	63	83	95	77	110	137	154	4200	20000
1FE1084-4WN□1	84	110	127	105	150	187	210	4300	20000
1FE1084-4WP□1	78	110	127	79	120	150	160	4300	20000
1FE1084-4WQ□1	84	110	127	83	119	147	166	3400	18000
1FE1084-4WT□1	84	110	127	60	85	105	120	3000	15000
1FE1084-4WV□1	84	110	127	50	71	88	100	2600	12000
1FE1085-4WN□1	105	138	159	105	150	187	210	3500	18000
1FE1085-4WQ□1	105	140	160	85	120	150	170	3000	16000
1FE1085-4WT□1	105	140	160	60	85	105	120	2200	12000
1FE1092-4WP□1	45	60	73	41	58	72	82	3400	18000
1FE1092-4WV□1	50	64	73	24	35	43	48	2000	10000
1FE1093-4WC□1	72	95	105	130	187	232	270	6500	18000
1FE1093-4WH□1	75	103	113	83	120	148	166	4500	18000
1FE1093-4WM□1	75	103	113	64	92	114	128	3500	18000
1FE1093-4WN□1	75	103	113	60	86	107	120	3300	16000
1FE1094-4WK□1	100	137	151	108	156	192	216	4400	18000
1FE1094-4WL□1	100	137	151	90	130	160	180	3800	18000

Motor article number	Rated torque $M_N / \text{Nm}^{1)}$			Rated current I_N / A			Maximum current	Rated speed	Maximum speed
	S1	S6-40 %	S6-25 %	S1	S6-40 %	S6-25 %	$I_{\max} / \text{A}$ 2)	n_N / rpm	$n_{\max} / \text{rpm}$
1FE1094-4WS□1	100	125	140	60	85	105	120	2500	13000
1FE1094-4WU□1	95	119	133	45	64	79	90	1800	10000
1FE1095-4WN□1	125	171	189	108	156	192	216	3500	18000
1FE1096-4WN□1	150	206	226	120	173	214	240	3300	16000
1FE1096-4WK□1	150	170	190	180	231	276	360	5000	18000
1FE1103-4WN□1	102	142	156	84	127	158	168	3600	16000
1FE1103-4WQ□1	100	130	150	68	98	121	136	3300	15000
1FE1103-4WT□1	100	130	150	53	75	93	106	2500	12000
1FE1104-4WN□1	136	189	208	120	181	226	240	3800	16000
1FE1104-4WL□1	136	175	185	140	200	245	280	5300	16000
1FE1105-4WN□1	170	236	260	120	180	221	240	3000	16000
1FE1105-4WQ□1	170	230	250	95	135	166	190	2600	10000
1FE1105-4WS□1	170	230	250	84	120	148	170	2300	10000
1FE1106-4WY□1	200	270	300	60	85	105	120	1200	6000
1FE1106-4WS□1	200	270	300	120	170	210	240	2700	12500
1FE1106-4WR□1	204	270	300	128	184	227	260	2900	14000
1FE1106-4WN□1	204	283	313	159	240	300	318	3400	16000
1FE1124-4WN□1	200	275	315	135	198	247	270	3000	14000
1FE1124-4WQ□1	200	275	315	110	162	201	220	2500	12000
1FE1125-4WN□1	250	345	390	162	240	295	324	3000	14000
1FE1125-4WP□1	250	345	390	147	215	270	294	2500	12500
1FE1125-4WQ□1	250	345	390	116	169	210	232	2200	10000
1FE1126-4WN□1	300	410	470	200	295	365	400	3000	14000
1FE1126-4WP□1	300	410	470	180	265	330	360	2500	12500
1FE1126-4WQ□1	300	410	470	147	215	270	294	2000	10000

1) Data for $\Delta T = 105 \text{ K}$

2) The maximum current $I_{\max}$ must not be exceeded due to the risk of demagnetization

3) For these built-in motors, a series reactor is required for safe and reliable operation

Note regarding the use of a series reactor:

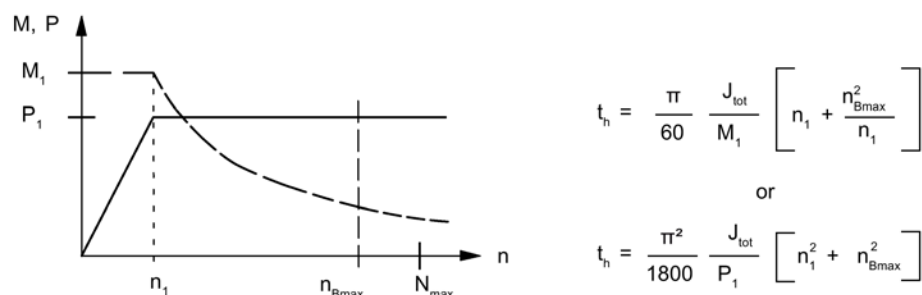
The setting data of the drive system are only valid in conjunction with the specified reactor. The specified data cannot be guaranteed if a third-party reactor is used. If a series reactor is used, a heat source is created and surface temperatures can reach up to approx. 100°C .

9.3 Characteristics

9.3.1 Data sheets and characteristics

The data sheets and characteristics for the various motor frame sizes are available in SIOS under Technical data and characteristics for the SIMOTICS M-1FE1 (<https://support.industry.siemens.com/cs/ww/de/view/109771184>).

9.3.2 Calculating the acceleration time from the torque/power characteristic



$t_{\text{ramp-up}}$	Ramp-up time in s up to the maximum operating speed
J_{tot}	Total moment of inertia of the spindle in kgm^2
n_1	Rated speed in rpm, e.g. for S6 - 25 %
n_{Bmax}	Maximum operating speed in rpm
N_{max}	Maximum speed in rpm
M_1	Acceleration torque in Nm, e.g. for S6 - 25 %
P_1	Acceleration power in W, e.g. for S6 - 25 %

Figure 9-1 Calculating the acceleration time

Note

The equations provide an approximation and serve as estimate. The precondition is a constant power range extending from the rated speed up to the maximum operating speed.

You can calculate the acceleration time using the following program: Tool to calculate the acceleration time

(<https://support.industry.siemens.com/cs/ww/de/view/109771177>)

With the 200/250/257 A Motor Modules, the following motors achieve as maximum duty type S6-40%:

1FE1106-4WN11, 1FE1125-4WN11, 1FE1125-4WP11, 1FE1126-4WN11, 1FE1126-4WP11, 1FE1126-4WQ11;

The acceleration time does not change appreciably as a result.

Dimension drawings

10.1 Reference to the dimension drawings in SIOS

You can find the dimension drawings for 1FE1 under Dimension drawings for the SIMOTICS M-1FE1 (<https://support.industry.siemens.com/cs/ww/de/view/109771183>) in SIOS.

Note

Siemens AG reserves the right to change the motor dimensions as part of design improvements without prior notification.

You can also find the dimension drawings for the required motors in:

CAD CREATOR (<http://www.siemens.com/cadcreator>),

DT CONFIGURATOR (<http://siemens.de/dt-konfigurator>) or

Catalog NC62 (<https://intranet.for.siemens.com/org/i-dt-mc/intraDocs/catalogs/nc622019/NC%2062%20-%202019%20-%20Complete%20Catalog/motion-control-NC62-complete-English-2019.pdf>)

Additional information about 1FE1 built-in motors is provided in the associated Hardware Installation Manual (<https://support.industry.siemens.com/cs/ww/de/view/109745110/88061310347?dl=en>).

10.2 DT Configurator

DT CONFIGURATOR

The DT CONFIGURATOR supports you when configuring your drive.

In the DT CONFIGURATOR - you can simply and quickly find

- Technical data
- Characteristics
- dimension drawings
- 2D/3D CAD data

The DT CONFIGURATOR supports you when generating plant/system documentation regarding project-specific information.

Note

The 3D model in the DT CONFIGURATOR is a simplified representation that does not show all of the details.

You can find further information on the Internet at DT CONFIGURATOR (<http://siemens.de/dt-konfigurator>):

10.3 CAD CREATOR (title below)

CAD CREATOR

In the CAD CREATOR you will find the following quickly and easily:

- Dimension drawings
- 2D/3D CAD data

The CAD CREATOR supports you in the creation of system documentation regarding project-specific information. The data for motors, drives and CNC controls is currently available in the online version.

Note

The 3D model in the CAD CREATOR is a simplified representation that does not display every detail.

You will find further information on the Internet at "CAD CREATOR (<http://www.siemens.com/cadcreator>)".

Motors

- 1FK7, 1FT7, 1FT6 synchronous motors
- 1FE1 built-in synchronous motors
- 1FW3 complete torque motors
- 1FW6 built-in torque motors
- 1FK7, 1FT7, 1FT6 geared motors
- 1PH8 synchronous/induction motors
- 1PH7, 1PH4, 1PL6, 1PM4, 1PM6 induction motors
- 2SP1 motor spindles
- 1FN3 linear motors

SINAMICS S120

- Control Units
- Power Modules (blocksize, chassis)
- Line Modules (booksize, chassis)
- Line-side components
- Motor Modules (booksize, chassis)
- DC link components
- Additional system components
- Load-side power components
- Encoder system connection
- MOTION-CONNECT connection system

SIMOTION

- SIMOTION D
- SIMOTION C

SINUMERIK solution line

- Control systems
- Operator components for CNC controls

Appendix

A.1 Technical data and dimensions of the recommended series reactors

The drive system setting data, as well as the electrical power data, are only applicable in conjunction with these reactors.

Note

The specified data cannot be guaranteed when using other reactors.

Technical data and dimensions TEU2731-1UA00-0A



Datasheet: output choke
Type: TEU2731-1UA00-0A

**Description:**

English

phases:	3
mains voltage 1 Un [V]:	575
Cont. current Ithmax 1 [A] / -frequency 1 [Hz]	61 rated frequency [Hz]: 300
clock frequency (max.) [kHz]:	3
rated current I Ln [A]:	54,9
rated inductance [mH]:	0,317
referenced voltage drop at Ithmax and Un [%]:	12,6
rated ambient temperature / temp. Class:	40 /H
protection IP:	00
type of terminals:	flat-type terminal
standard :	EN 61558-2-20
Losses [W]:	291
Weight [kg]:	28

Connection:

Terminals 1: ---

Terminals 2: ---

Type	Voltage [V]	Terminals	Wiring
PRI1		1U1-1V1-1W1	
		1U2-1V2-1W2	

Dimension drawing / Mounting :

MTZEU001-03-13

(siehe Anlage)

(see enclosure)

Dimension values [mm]:

Figure A-1 DB_TEU2731-1UA00-0A_75



Technical data and dimensions TEU3031-0UA00-0A



Datasheet: output choke
Type: TEU3031-0UA00-0A

**Description:**

English

phases:	3
mains voltage 1 Un [V]:	575
Cont. current Ithmax 1 [A] / -frequency 1 [Hz]	82rated frequency [Hz]:300
clock frequency (max.) [kHz]:	3
rated current I Ln [A]:	73,8
rated inductance [mH]:	0,232
referenced voltage drop at Ithmax and Un [%]:	12
rated ambient temperature / temp. Class:	40 /H
protection IP:	00
type of terminals:	flat-type terminal
standard :	EN 61558-2-20
Losses [W]:	373
Weight [kg]:	42

Connection:

Terminals 1: ---

Terminals 2: ---

Type	Voltage [V]	Terminals	Wiring
PRI1		1U1-1V1-1W1	
		1U2-1V2-1W2	

Dimension drawing / Mounting :

MTZEU001-04-13

(siehe Anlage)

(see enclosure)

Dimension values [mm]:

mdexx GmbH
<http://www.mdexx.com>
 © 2009 mdexx GmbH

TEU3031-0UA00-0A

2 / 4

Dat.: 24.04.2019

Figure A-3 DB_TEU3031-0UA00-0A_75

A.1 Technical data and dimensions of the recommended series reactors

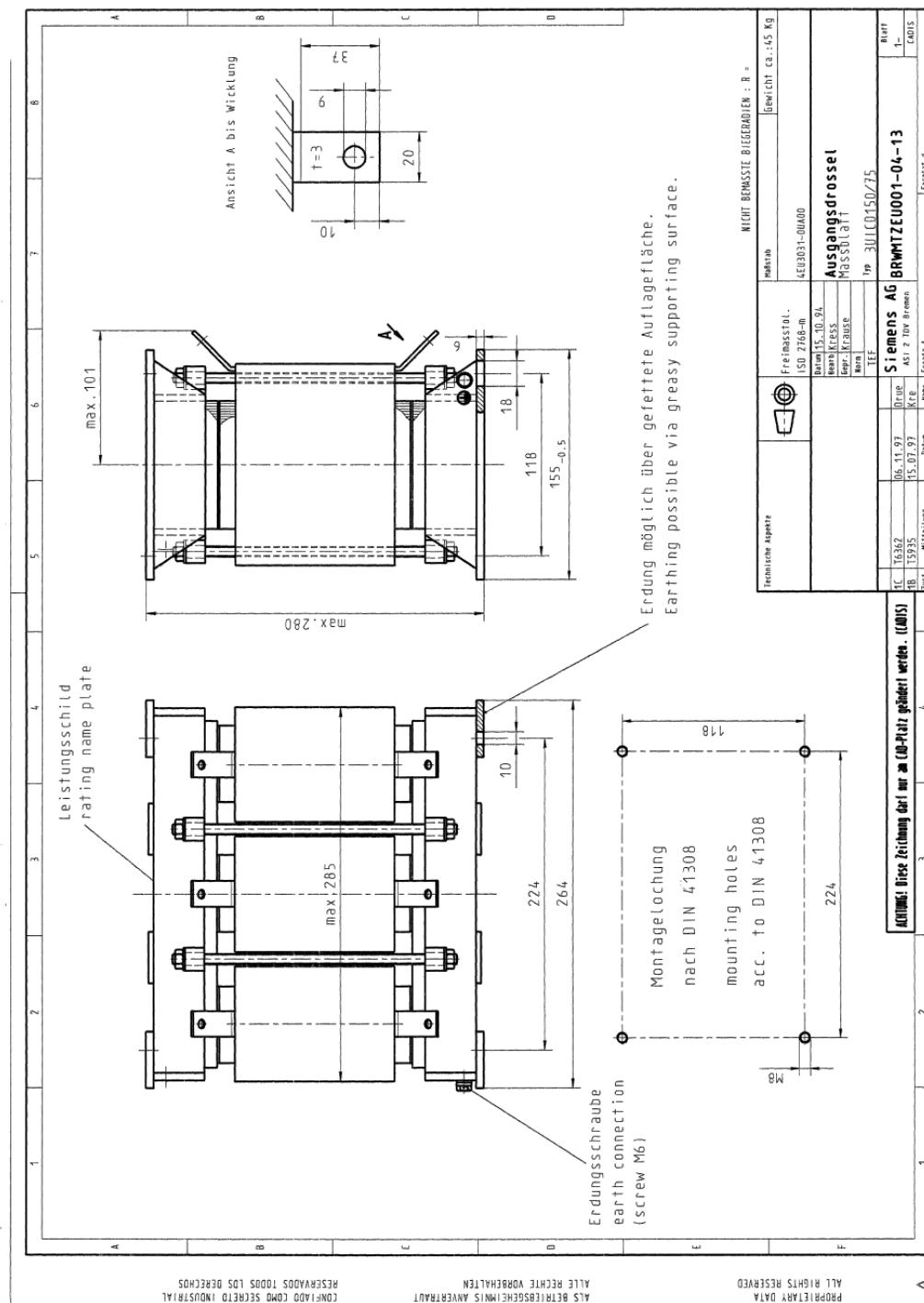


Figure A-4 MTZE001-04-13

List of abbreviations

APM	Rotor with external permanent magnets and banding
BGR	Health and safety at work regulations
BGV	Health and safety at work regulations
CE	Conformité Européenne - compliance with EU directives
DIN	Deutsche Industrie Norm (German Industry Standard)
DRIVE-CLiQ	Drive Component Link with IQ - for installation with SINAMICS components
EGB	Electrostatic Sensitive Devices
EMF	Electromotive force
EMC	Electromagnetic compatibility
EN	European standard
IATA	International Air Transport Association
IPM	Rotor with internal permanent magnets
IEC	International Electrotechnical Commission
IP	International Protection
ISO	International Organization for Standardization
IVP	Internal Voltage Protection
MLFB	Machine-Readable Product Code
NTC	Negative Temperature Coefficient - temperature sensor with negative temperature coefficient
PLC	Programmable Logic Controller
Pt1000	Platinum temperature sensor with rated value of 1000 Ω at 0° C
PTC	Positive Temperature Coefficient - temperature sensor with positive temperature coefficient
SMC	Sensor Module Cabinet
SME	Sensor Module External
PLC	Programmable logic controller
VDE	Association of Electrical Engineering, Electronics and Information Technology (Germany)
VPM	Voltage Protection Module

Index

A

Accessories, 92
APM rotors, 45

C

Calculating the acceleration time
 Formula, 132
Certificates
 EAC, 33
 EC Declaration of Conformity, 33
 UL and cUL, 33
Characteristics, 127
Converter pulse frequency, 28
Coolant
 Other coolant, 70
 Water, (Specification)
Cooling power
 to be dissipated, 64
Cooling water supply, 103
Correct usage, 21

D

Diagrams, 127

E

Encoder system, 56

F

Fine balancing, 94

H

Hotline, 4

I

IATA, 85
IPM rotors, 45

M

Magnetic attraction, 24
Motor spindle, 23, 24
Motor types
 APM rotors, 31
 IPM rotors, 31
Mounting
 Motor spindle, 102
 Rotor, 93
 Stator, 99

N

NTC K227, 54, 55
NTC PT3-51, 55
NTC PT3-51F, 54
NTC thermistor, 54

O

Occupational safety equipment, 89, 98

P

Packaging, 83
Pole position identification
 Special issues for certain motors, 72
Power loss, 64
Power-speed diagrams, 127
Prohibition signs, 82
Pt1000, 52

R

Removing the rotor, 97
RoHS, 33
Rotor mounting, 91
Rotor sleeves, 47

S

Safety instructions
 Packaging, 83

- Storage, 83
- Transport, 83
- Siemens Service Center, 4
- Sleeve, 47
- Speed-torque diagrams, 127
- Storage, 83
- System requirements, 25

T

- Technical Support, 4
- Thermal motor protection, 51, 52
 - NTC thermistor, 54
 - Pt1000, 53
 - PTC thermistor triplet, 53
- Third-party products, 70
- Training, 4
- Transport, 83
- Type of construction, 34

V

- Vibration values, 48
- VPM, 114

W

- Warning signs, 82

Z

- Zero-speed monitoring, 53

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