

SIEMENS

Operating Instructions

SIMOTICS

S-1FK7 2nd generation synchronous motors

For SINAMICS S120

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SIEMENS

SIMOTICS

Drive technology 1FK7 G2 synchronous motors

Operating Instructions

Introduction

Fundamental safety instructions

1

Description of the motors

2

Preparing for use

3

Mounting

4

Connecting

5

Commissioning

6

Operation

7

Faults and their rectification

8

Maintenance

9

Decommissioning and disposal

10

Technical data

11

Appendix

A




Glossary

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

Keeping the documentation safe

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

Target group and benefits

Target group

These Operating Instructions are intended for installation engineers, commissioners, machine operators, and service and maintenance personnel.

Utilization phase

Planning and configuration phase, implementation phase, setup and commissioning phase, application phase, maintenance and service phase

About these Operating Instructions

These Operating Instructions apply to the SIMOTICS S-1FK7 servomotor, 2nd generation, called "1FK7" later.

The Operating Instructions provide information about the components that enable the target group to install, set up, test, commission, operate, and troubleshoot the products and systems correctly and safely.

These Operating Instructions explain how to handle the 1FK7 from delivery to disposal.

You find additional information in the Configuration Manual for the 1FK7.

Before you start using the motor, you must read these Operating Instructions to ensure safe, problem-free operation and to maximize the service life.

Siemens strives continually to improve the quality of information provided in these Operating Instructions.

- If you find any mistakes or would like to offer suggestions about how this document could be improved, contact the Siemens Service Center.
- Always follow the safety instructions and notices in this Product Information.

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

Text features

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

Operating instructions

Operating instructions with the specified sequence are designated using the following symbols:



The arrow indicates the start of the operating instructions.

The individual handling steps are numbered.

1. Execute the operating instructions in the specified sequence.



The square indicates the end of the operating instruction.

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

- Execute the operating instructions.

Enumerations

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

Notes

Notes are shown as follows:

Note

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

More information

Information on the following topics is available under the link:

- 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>)

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

docu.motioncontrol@siemens.com

My support

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

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

Note

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

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>)

Internet address for products

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

Websites of third parties

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Table of contents

	Introduction	5
1	Fundamental safety instructions	13
1.1	General safety instructions	13
1.2	Handling electrostatic sensitive devices (ESD)	18
1.3	Industrial security	19
1.4	Residual risks of power drive systems.....	20
2	Description of the motors	21
2.1	Use for the intended purpose	21
2.2	Technical features and environmental conditions	22
2.2.1	Directives and standards	22
2.2.2	Technical features.....	24
2.2.3	Environmental conditions.....	26
2.2.4	Degree of protection	27
2.2.5	Noise emission.....	27
2.3	Derating factors.....	28
2.4	Structure of the article number	29
2.5	Rating plate data.....	31
2.6	Mounting and options.....	33
2.6.1	Safety symbols on the motor	33
2.6.2	Bearing version	33
2.6.3	Thermal motor protection.....	33
2.6.4	Encoder.....	35
2.6.4.1	Overview of the encoders that can be deployed	36
2.6.4.2	Technical data of the incremental encoders for 1FK7 motors	37
2.6.4.3	Technical data of the absolute encoders for 1FK7 motors	39
2.6.4.4	Resolvers	40
2.6.5	Cooling.....	42
2.6.5.1	Natural cooling	42
2.6.5.2	Forced ventilation.....	42
2.6.6	Holding brake	43
2.6.6.1	Type of holding brake	43
2.6.6.2	Properties.....	43
2.6.7	Options.....	44
3	Preparing for use	47
3.1	Shipping and packaging	47
3.2	Transportation and storage.....	49
3.2.1	Transport.....	49
3.2.2	Storage	52


4	Mounting.....	55
4.1	Safety instructions.....	55
4.2	Checklists prior to mounting.....	57
4.3	Mounting instructions.....	58
4.4	Mounting conditions.....	59
4.4.1	Natural cooling.....	59
4.4.2	Forced ventilation.....	61
4.5	Mounting the drive elements.....	62
4.6	Vibration response.....	63
5	Connecting.....	65
5.1	Safety instructions.....	65
5.2	Permissible line systems.....	66
5.3	Motor circuit diagram.....	66
5.4	System integration.....	67
5.4.1	Connection notes.....	67
5.4.1.1	Motor connection.....	67
5.4.1.2	Rotating the connector at the motor.....	69
5.4.1.3	Routing cables in a damp environment.....	73
5.4.1.4	Connection notes for motors with M03 and M39.....	73
5.4.2	Connecting to a converter.....	78
5.4.3	Connecting the forced ventilation.....	80
5.4.4	Connecting the holding brake.....	81
5.4.5	Line connection.....	83
5.4.6	Signal connection.....	85
5.4.6.1	Motors with DRIVE-CLiQ interface.....	85
5.4.6.2	Connecting the RJ45 DRIVE-CLiQ connector.....	86
5.4.6.3	Motors without a DRIVE-CLiQ interface.....	90
5.4.6.4	Signal connector version.....	91
5.4.6.5	Connecting the signal line on a motor with forced ventilation.....	92
6	Commissioning.....	95
6.1	Safety instructions.....	95
6.2	Checklists for commissioning.....	98
6.3	Commissioning procedure.....	100
6.4	Switching on and switching off.....	101
7	Operation.....	103
7.1	Safety instructions.....	103
7.2	Switching on and switching off.....	104
7.3	During operation.....	104
7.4	Stoppages.....	106
8	Faults and their rectification.....	109

9	Maintenance	111
9.1	Safety instructions.....	111
9.2	Inspection and maintenance.....	114
9.2.1	Maintenance and inspection intervals.....	114
9.2.2	Cleaning.....	115
9.2.3	Bearing replacement interval.....	115
9.3	Repair	116
10	Decommissioning and disposal	117
10.1	Safety instructions.....	117
10.2	Decommissioning.....	120
10.2.1	Removing the motor.....	120
10.2.2	Dismantling the motor.....	120
10.3	Disposal	120
11	Technical data	123
11.1	Technical data.....	123
A	Appendix.....	125
A.1	Certificate for the "PS Premium" painting system from ECOLAB.....	125
A.2	ECOLAB cleaning recommendation	128
B	Glossary	129
	Index.....	131


Fundamental safety instructions

1.1 General safety instructions



 DANGER	
<p>Danger to life due to live parts and other energy sources</p> <p>Death or serious injury can result when live parts are touched.</p> <ul style="list-style-type: none"> • Only work on electrical devices when you are qualified for this job. • Always observe the country-specific safety rules. <p>Generally, six steps apply when establishing safety:</p> <ol style="list-style-type: none"> 1. Prepare for shutdown and notify all those who will be affected by the procedure. 2. Disconnect the machine from the supply. <ul style="list-style-type: none"> – Switch off the machine. – Wait until the discharge time specified on the warning labels has elapsed. – Check that it really is in a no-voltage condition, from phase conductor to phase conductor and phase conductor to protective conductor. – Check whether the existing auxiliary supply circuits are de-energized. – Ensure that the motors cannot move. 3. Identify all other dangerous energy sources, e.g. compressed air, hydraulic systems, or water. 4. Isolate or neutralize all hazardous energy sources by closing switches, grounding or short-circuiting or closing valves, for example. 5. Secure the energy sources against switching on again. 6. Ensure that the correct machine is completely interlocked. <p>After you have completed the work, restore the operational readiness in the inverse sequence.</p>	



 WARNING	
<p>Danger to life through a hazardous voltage when connecting an unsuitable power supply</p> <p>Touching live components can result in death or severe injury.</p> <ul style="list-style-type: none"> • 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

Danger to life when live parts are touched on damaged motors/devices

Improper handling of motors/devices can damage them.

For damaged motors/devices, hazardous voltages can be present at the enclosure or at exposed components.

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



! WARNING

Danger to life through electric shock due to unconnected cable shields

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

Danger to life due to electric shock when not grounded

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

Danger to life due to electric shock when opening plug connections in operation

When opening plug connections in operation, arcs can result in severe injury or death.

- Only open plug connections when the equipment is in a no-voltage state, unless it has been explicitly stated that they can be opened in operation.

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

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

- Tighten all power connections with the specified tightening torques, e.g. line supply connection, motor connection, DC link connections.
- Check all power connections at regular intervals. This applies in particular after transport.

 **WARNING****Danger to life through unexpected movement of machines when using mobile wireless devices or mobile phones**

Using mobile wireless devices or mobile phones with a transmit power $> 1\text{ W}$ closer than approx. 2 m to the components may cause the devices to malfunction, influence the functional safety of machines therefore putting people at risk or causing material damage.

- Switch the wireless devices or mobile phones off in the immediate vicinity of the components.

 **WARNING****Danger of an accident occurring due to missing or illegible warning labels**

Missing or illegible warning labels can result in accidents involving death or serious injury.

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

 **WARNING**

Danger to life when safety functions are inactive

Safety functions that are inactive or that have not been adjusted accordingly can cause operational faults on machines that could lead to 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**

Danger to life from 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**

Danger to life from 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**Risk of injury caused by moving parts or parts that are flung out**

Touching moving motor parts or drive output elements and loose motor parts that are flung out (e.g. feather keys) in operation 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**Danger to life due to fire if overheating occurs because of insufficient cooling**

Inadequate cooling can cause overheating 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 coolant requirements for the motor.

⚠ WARNING**Danger to life due to fire as a result of overheating caused by incorrect operation**

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**Risk of injury due to touching 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 Handling electrostatic sensitive devices (ESD)

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



NOTICE

Damage through 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. Siemens products and solutions only represent one component of such a concept.

The customer is responsible for preventing unauthorized access to its plants, systems, machines and networks. Systems, machines and components should only be connected to the enterprise network or the internet if and to the extent necessary and with appropriate security measures (e.g. use of firewalls and network segmentation) in place.

Additionally, Siemens' guidance on appropriate security measures should be taken into account. For more information about industrial security, please visit:

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

Siemens' products and solutions undergo continuous development to make them more secure. Siemens strongly recommends to apply product updates as soon as available and to always use the latest product versions. Use of product versions that are no longer supported, and failure to apply 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 (<http://www.siemens.com/industrialsecurity>).

WARNING

Danger to life as a result of unsafe operating states resulting from software manipulation

Software manipulations (e.g. viruses, trojans, malware 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.

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 of the motors

2.1 Use for the intended purpose

 WARNING
<p>Danger to life and material damage when incorrectly used</p> <p>If you do not use the motors correctly, there is a risk of death, severe injury and/or material damage.</p> <ul style="list-style-type: none"> • 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
<p>Danger to life caused by magnetic and electrical fields for carriers of active implants</p> <p>Electric motors endanger people with active implants, for example heart pacemakers, who come close to the motors.</p> <ul style="list-style-type: none"> • If you are an affected person, maintain a minimum distance of 300 mm from the 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.

The 1FK7 motor is intended for industrial or commercial plants.

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

For more detailed information, refer to Chapter "Environmental conditions (Page 26)".

The 1FK7 motor is certified only for operation through a converter.

Any other use of the motor is considered to be incorrect use.

Compliance with all specifications in the Configuration Manual is part of correct usage.

Observe the details on the rating plate.

Typical applications

The 1FK7 synchronous motors have the following typical application areas:

- Machine tools (e.g. auxiliary axes, feed drives)
- Robots and handling systems
- Packaging, plastics and textile machines
- Wood, glass, ceramics and stone working machines

2.2 Technical features and environmental conditions

2.2.1 Directives and standards

Standards that are complied with

SIMOTICS S, SIMOTICS M, SIMOTICS L, SIMOTICS T, SIMOTICS A motors - subsequently called the "SIMOTICS motor series" - comply with the following 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 IEC / EN 60034:

Feature	Standard
Degree of protection	IEC / EN 60034-5
Cooling ¹⁾	IEC / EN 60034-6
Type of construction	IEC / EN 60034-7
Connection designations	IEC / EN 60034-8
Noise levels ¹⁾	IEC / EN 60034-9
Temperature monitoring	IEC / EN 60034-11
Vibration severity levels ¹⁾	IEC / 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 area of validity covered by the Machinery Directive.

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

European EMC Directive

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

Eurasian conformity

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

**China Compulsory Certification**

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



CCC product certification

(<https://support.industry.siemens.com/cs/products?search=CCC&ctp=Certificate&o=DefaultRankingDesc&pnid=13347&lc=de-WW // XmlEditor.InternalXmlClipboard:65c36f4c-2e8c-d8c9-ae3f-9d6074d36b88>)

Underwriters Laboratories

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

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

**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/products?ctp=Certificate&pnid=13347&lc=de-WW // XmlEditor.InternalXmlClipboard:8c9b08a9-3f1f-5513-8cf9-8dce082595ac>)

2.2.2 Technical features

Table 2- 1 Technical features

Type of motor	Permanent-magnet synchronous motor
Magnet material	Rare-earth magnetic material
Cooling	Natural cooling, forced ventilation
Insulation of the stator winding according to EN 60034-1 (IEC 60034-1)	Temperature class 155 (F) for a winding temperature of $\Delta T = 100$ K at an ambient temperature of $+40^\circ$ C
Operating range	-15° to $+40^\circ$ C, derating at higher temperatures
Installation altitude (according to EN 60034-1 and IEC 60034-1)	≤ 1000 m above sea level, otherwise power derating
Type of construction according to EN 60034-7 (IEC 60034-7)	IM B5 (IM V1, IM V3)
Degree of protection according to EN 60034-5 (IEC 60034-5)	IP64; optional IP65 or IP65 + IP67 at the shaft gland
Temperature monitoring	Temperature sensor in the stator winding
Paint finish	Anthracite (RAL 7016)
Shaft extension according to DIN 748-3 (IEC 60072-1)	Plain shaft, optional shaft with fitted key and keyway (half-key balancing)
Radial eccentricity, concentricity, and axial eccentricity according to DIN 42955 (IEC 60072-1) ¹⁾	Tolerance N (normal)
Vibration severity grade according to EN 60034-14 (IEC 60034-14)	Grade A is maintained up to rated speed
Sound pressure level L_{pA} (1 m) according to DIN EN ISO 1680, max. tolerance + 3 dB(A)	Natural cooling: <ul style="list-style-type: none"> • 1FK703□ to 1FK704□: 55 dB(A) • 1FK706□: 65 dB(A) • 1FK708□ to 1FK710□: 70 dB(A) Forced ventilation: <ul style="list-style-type: none"> • 1FK708□: 73 dB(A)
Built-in encoder systems for motors without DRIVE-CLiQ interface	<ul style="list-style-type: none"> • IC2048S/R incremental encoder, sin/cos 1 Vpp, 2048 S/R²⁾ with C and D tracks for SH 36 to SH 100 • AM2048S/R absolute encoder 2048 S/R²⁾, 4096 revolutions Multiturn, with EnDat interface for SH 36 to SH 100 • Resolver, multipole (number of pole pairs corresponds to number of pole pairs of the motor) • 2-pole resolver

Type of motor	Permanent-magnet synchronous motor
Integrated encoder systems for motors with DRIVE-CLiQ interface	<ul style="list-style-type: none"> • AS24DQI absolute encoder singleturn 24-bit, for SH 36 to SH 100 • AM24DQI absolute encoder 24-bit + 12-bit multi-turn, for SH 36 to SH 100 • AS20DQI absolute encoder singleturn 20-bit, for SH 36 to SH 100 • AM20DQI absolute encoder 20-bit + 12-bit multi-turn, for SH 36 to SH 100 • IC22DQ incremental encoder 22-bit for SH 36 to SH 100 • AM16DQ absolute encoder 16-bit + 12-bit multi-turn, for SH 48 to SH 100 • AM20DQ absolute encoder 20-bit + 12-bit multi-turn, for SH 63 to SH 100 • AM22DQI absolute encoder 22-bit + 12-bit multi-turn, for SH 36 to SH 100 • R15DQ resolver 15-bit • R14DQ resolver 14-bit
Connection	Connectors for signals and power, can be rotated
Holding brake	Optional integrated holding brake (free of backlash, 24 V)

1) Radial eccentricity of the shaft extension, concentricity of centering edge, and axial eccentricity of the mounting flange to the axis of the shaft extension.

2) S/R = Signals/Revolution

2.2.3 Environmental conditions

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

With the exception of "Condensation" and "Low air pressure" environmental parameters, you can assign SIMOTICS S servomotors to climatic class 3K4. Condensation is not permissible.

The following temperature ranges apply for natural-cooled and forced-ventilation motors.

Table 2- 2 Environmental conditions are based on climate class 3K4

Environmental parameter	Unit	Value
a) Low air temperature	°C	- 15
b) High air temperature	°C	+ 40
c) Low relative humidity	%	5
d) High relative humidity	%	95
e) Low absolute humidity	g/m ³	1
f) High absolute humidity	g/m ³	29
g) Rate of temperature change ¹⁾	°C/min	0.5
h) Low air pressure ⁴⁾	kPa	89
i) High air pressure ²⁾	kPa	106
j) Solar radiation	W/m ²	700
k) Thermal radiation	-	-
l) Air movement ³⁾	m/s	1.0
m) Condensation	-	Not permissible
n) Wind-driven precipitation (rain, snow, hail, etc.)	-	-
o) Water (other than rain)	-	See protection class
p) Formation of ice	-	-

1) Averaged over a period of 5 min

2) Conditions in mines are not considered.

3) A cooling system based on natural convection can be disturbed by unforeseen air movements.

4) The limit value of 89 kPa covers applications at altitudes up to 1000 m.

Note

Installation instructions

SIMOTICS S motors are not suitable for operation

- In salt-laden or aggressive atmospheres
- Outdoors

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

2.2.4 Degree of protection

1FK7 motors are available with IP64 or IP65 degree of protection. The degree of protection of the motor is specified on the rating plate.

2.2.5 Noise emission

When operated in the speed range 0 to rated speed, 1FK7 motors can reach the following measuring-surface sound pressure level $L_p(A)$:

Table 2- 3 Sound pressure level

Cooling method	Shaft height	Measuring-surface sound pressure level $L_p(A)$
Naturally cooled	1FK703 to 1FK704	55 dB(A) + 3 dB tolerance
	1FK706	65 dB(A) + 3 dB tolerance
	1FK708 to 1FK710	70 dB(A) + 3 dB tolerance
Forced-ventilated	1FK708	73 dB(A) + 3 dB tolerance

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

2.3 Derating factors

Under conditions other than those specified above (ambient temperature > 40° C or installation altitude > 1000 m above sea level), the permissible torques/powers are shown in the following table.

Ambient temperatures and installation altitudes are rounded off to 5° C or 500 m respectively.

Table 2- 4 Power de-rating depending on the installation altitude and the ambient temperature

Installation altitude above sea level [m]	Ambient temperature in °C					
	30	35	40	45	50	55
1000	1.05	1.02	1.00	0.97	0.95	0.92
1500	1.02	1.00	0.97	0.95	0.92	0.89
2000	1.00	0.97	0.95	0.92	0.89	0.87
2500	0.97	0.95	0.92	0.89	0.87	0.84
3000	0.95	0.92	0.89	0.87	0.84	0.81
3500	0.92	0.89	0.87	0.84	0.81	0.77
4000	0.89	0.87	0.84	0.81	0.77	0.74

The factors refer to the static torque M_0 . You shift the S1 characteristic curve in parallel.

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

Table 2- 5 Factors for reducing the maximum DC-link voltage

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

As the DC-link voltage is reduced, the converter output voltage also decreases. This reduces the operating range in the M-n diagram.

The M-n diagrams are contained in the associated Configuration Manual.

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

2.4 Structure of the article number

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

Possible combinations are contained in Catalog D 21.4

(<https://intranet.for.siemens.com/org/i-dt-mc/en/motion-control/support/marketing-materials/catalogs/d-21-4-sinamics-s120-simotics/Pages/d-21-4.aspx#>).

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					
SIMOTICS M-1FK7 synchronous servomotors		1	F	K	7																					
Frame size / shaft height		SH 36			0	3																				
		SH 48			0	4																				
		SH 63			0	6																				
		SH 80			0	8																				
		SH 100			1	0																				
Overall length							0																			
							1																			
							2																			
							3																			
							4																			
							5																			
							6																			
Feature	Compact									2																
	High Inertia									3																
	High Dynamic									4																
Cooling	Natural cooling									A																
										B																
										C																
	Forced ventilation									S																
Rated speeds	(3 AC 380 V ... 480 V)			2,000 rpm						C																
				3,000 rpm						F																
				4,500 rpm						H																
				6,000 rpm						K																
DC-link voltage	270 V ... 330 V										2															
	510 V ... 720 V										7															
Type of construction	IM B5 with KTY84-130 or Pt1000 temperature sensors (see Chapter 2.6.3)											1														
	IM B5 with Pt1000 temperature sensor											4														
Connector outlet direction		Connector sizes 1 and 1.5, rotatable connector													1											
Encoder	With DRIVE-CLiQ	AS24DQI															B									
		AM24DQI															C									
		IC22DQ															D									

Description		Position of the article number																			
		1	2	3	4	5	6	7	-	8	9	10	11	12	-	13	14	15	16	-	Z
		AM22DQ														F					
		AM16DQ														K					
		AM20DQ														L					
		R14DQ resolver														P					
		AS20DQI														Q					
		AM20DQI														R					
		R15DQ resolver														U					
	without DRIVE-CLiQ	IC2048S/R														A					
		AM2048S/R														E					
		Resolver, multi-pole														S					
Resolver, 2-pin														D							
Shaft extension	Fitted key and keyway			Shaft and flange accuracy				Tolerance N			Holding brake		None		A						
								Tolerance N					With		B						
	Plain shaft							Tolerance N					None		G						
								Tolerance N					With		H						
Vibration severity grade	Grade A			Degree of protection				IP64											0		
								IP65											1		
								IP65 with IP67 DE-flange											2		
Options ¹⁾	Mounting of SP+ planetary gearbox														J□□						
	Mounting of planetary gearbox LP+														V□□						
	Version for potentially explosive atmospheres Zone 2														M03						
	Version for potentially explosive atmospheres Zone 22														M39						
	Alternative shaft geometry														N05						
	Version for increased chemical resistance														N16						
	Reinforced brake														N24						
	Metal rating plate instead of adhesive label														Q31						
	Factory certificate														B02						
	Customer data on the rating plate														Y84						
	Special paint finish for the "Worldwide" climate group														K23						
	Special paint finish for "Worldwide" climate group, primed and other paint finish														K23+X						
	Primed (unpainted)														K24						
	Paint finish			jet black, matt				RAL 9005			X01										
				cream				RAL 9001			X02										
				reseda green				RAL 6011			X03										
				pebble grey				RAL 7032			X04										
sky blue				RAL 5015			X05														
light ivory				RAL 1015			X06														
white aluminum				RAL 9006			X08														
pearl dark grey				RAL 9023			X27														

1) More detailed information can be found at Configuration Manual (<https://support.industry.siemens.com/cs/document/55379345?lc=de-WW&pnid=13349&dl=en>)

2.5 Rating plate data

The rating plate contains the technical data applicable to the delivered motor. A second rating plate provided loosely with the motor should be used for documentation purposes.

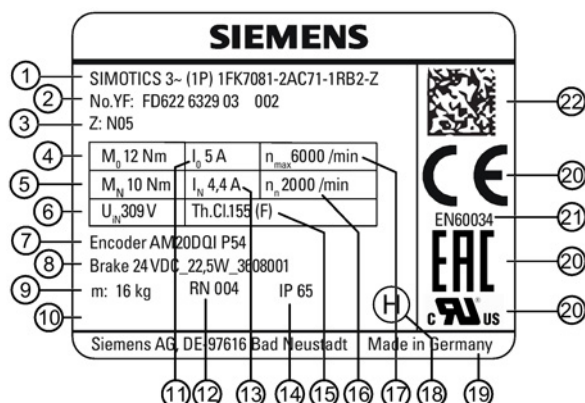


Figure 2-1 1FK7 G2 rating plate content

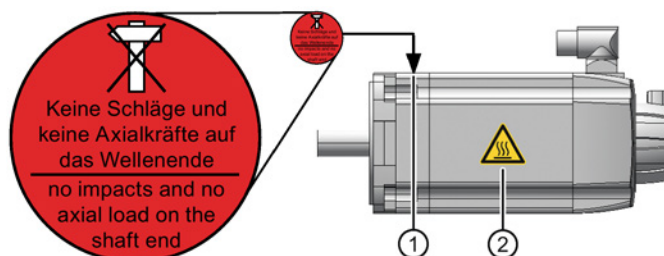
Table 2- 6 Description of the rating plate data

Position	Description / technical data
1	Motor type: Synchronous motors; motor type / order number
2	ID No., serial number
3	Display of Z option
4	Static torque M_0 [Nm]
5	Rated torque M_N [Nm]
6	Induced voltage at rated speed U_{IN} [V]
7	Code, encoder type
8	Holding brake data: Typical voltage, power consumption
9	Motor mass m [kg]
10	Space for customer information
11	Stall current I_0 [A]
12	Motor version
13	Rated current I_N [A]
14	Degree of protection
15	Temperature class
16	Rated speed n_{rated} [rpm]
17	Maximum speed n_{max} [rpm]
18	Symbol for anti-condensation heating
19	Production address
20	Certifications
21	Standard for all rotating electrical machines
22	2D code

2.6 Mounting and options

2.6.1 Safety symbols on the motor

The following warning and information labels are attached to the motor.



- 1 "No impacts or axial forces on the shaft extension" warning sign.
- 2 "Hot surfaces" warning sign. The warning sign is on one side of the housing.

2.6.2 Bearing version

The 1FK7 motors are equipped with permanently lubricated deep-groove ball bearings. The location bearing is at the DE.

2.6.3 Thermal motor protection

A temperature-dependent resistor is integrated as temperature sensor to monitor the motor temperature.

- Starting in 2017, 1FK7 motors with integrated DRIVE-CLiQ interface are generally changed to the Pt1000. The marking is made with the revision number of the motors. The order number does not need to be changed.
- Motors without integrated DRIVE-CLiQ interface are converted with changed order number to the new Pt1000 temperature sensor. In conjunction with the following encoders without DRIVE-CLiQ, the 12th position of the order number must be changed accordingly.

1FK7 2nd generation motors without DRIVE-CLiQ interface:	Old order number with KTY 84	New order number with Pt1000
IC2048 S/R incremental encoder	1FK7000-00001-0A00	1FK7000-00004-0A00
AM2048 S/R absolute encoder	1FK7000-00001-0E00	1FK7000-00004-0E00
AM32 S/R absolute encoder	1FK7000-00001-0G00	1FK7000-00004-0G00
Multi-pole resolver	1FK7000-00001-0S00	1FK7000-00004-0S00
2-pole resolver	1FK7000-00001-0T00	1FK7000-00004-0T00

Table 2- 7 Features and technical data

Type	KTY 84-130	Pt1000
Resistance when cold (20° C)	Approx. 580 Ω	Approx. 1090 Ω
Resistance when hot (100° C)	Approx. 1000 Ω	Approx. 1390 Ω
Connection	Via signal cable	via signal cable
Response temperature	Prewarning < 150° C Alarm/trip at max. 170° C ±5° C	Prewarning < 150° C Alarm/trip at max. 170° C ±5° C

The following figure shows the resistance characteristic as a function of the temperature for KTY 84-130 and Pt1000 temperature sensors.

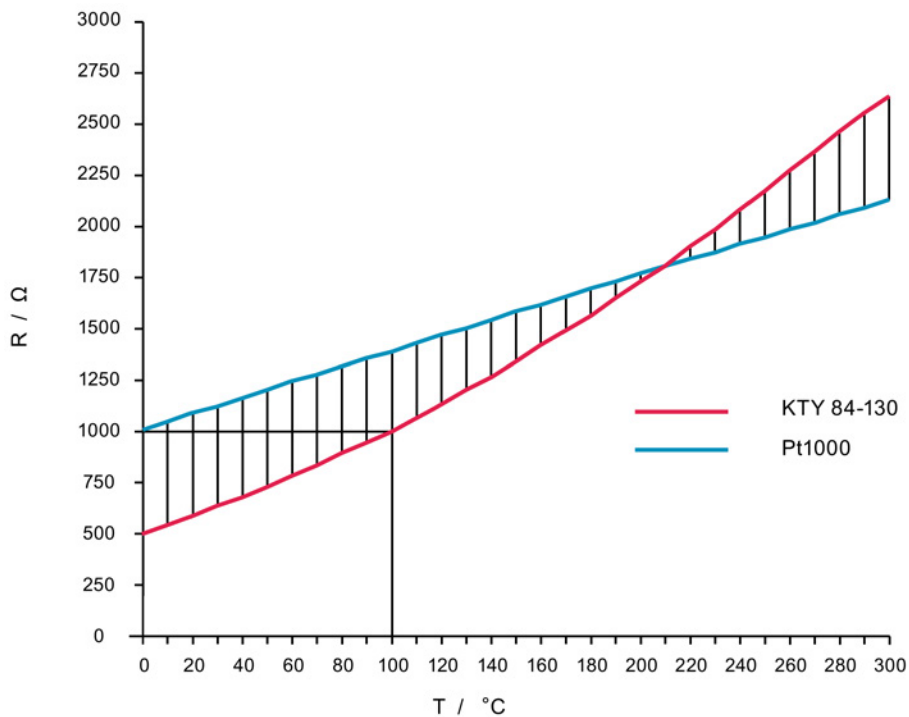


Figure 2-2 Comparison of KTY 84-130 and Pt1000 temperature sensors

The winding temperature is evaluated in the converter. When a fault occurs, an appropriate message is output at the converter. When the motor temperature increases, a message "Alarm motor overtemperature" is output. The message can be evaluated externally.

If this message is ignored, the converter shuts down with the appropriate fault message after a preset time period or when the motor limiting temperature or the shutdown temperature is exceeded.

The integrated temperature sensor protects the synchronous motors only to a certain extent against overloads:

1FK703 to 1FK704: up to $2 \cdot I_{0(60K)}$ and speed $\neq 0$

1FK706 to 1FK710: up to $4 \cdot I_{0(60K)}$ and speed $\neq 0$

NOTICE

Destruction of the motor for a thermal critical load

For load applications that are critical from a thermal perspective, e.g. overload when the motor is stationary or an overload of M_{max} longer than 4 s, adequate protection is no longer available.

- Activate the "Thermal motor model i^2t monitoring" function in the converter.

The temperature sensor is part of a SELV circuit, which can be destroyed if high voltage is applied. The temperature sensor is designed so that the DIN/EN requirement for "protective separation" is fulfilled.

2.6.4 Encoder

Encoder systems with DRIVE-CLiQ interface

Motors with a DRIVE-CLiQ encoder interface are provided for the SINAMICS S110/S120 converter system. Signal transmission to the converter is performed digitally. They have an electronic rating plate that simplifies commissioning and diagnostics. The motor and encoder system are automatically identified and all motor parameters are automatically set, see SINAMICS Equipment Manual.

NOTICE

Damage to components that are sensitive to electrostatic discharge

The contacts of the DRIVE-CLiQ interface have direct contact to components that can be damaged/destroyed by electrostatic discharge (ESDs).

- Do not touch the connections directly even with tools. They could be charged electrostatically.

Encoder systems without a DRIVE-CLiQ interface

For motors without an integrated DRIVE-CLiQ interface, the analog encoder signal is first converted to a digital signal in the drive system. For these motors, the encoder signals for SINAMICS S110 / S120 must be transferred via Sensor Modules.

NOTICE

Damage to components that are sensitive to electrostatic discharge

The contacts of the connector plug have direct contact to components that can be damaged/destroyed by electrostatic discharge (ESDs).

- Do not touch the connections directly even with tools that could be electrostatically charged.

2.6.4.1 Overview of the encoders that can be deployed

Encoders with DRIVE-CLIQ interface: For SINAMICS drive systems			
	Incremental encoder or singleturn encoder	Multiturn absolute encoder	
High resolution, suitable for Safety Integrated Extended Functions			
Encoder designation	AS24DQI	AM24DQI	
Identification in the article number	B	C	
Resolution	16,777,216 = 24 bits	16,777,216 = 24 bits	
Absolute position	Yes, one revolution	Yes, 4096 revolutions (12 bits)	
Max. angular error	± 40"	± 40"	
Average resolution, suitable for Safety Integrated Extended Functions			
Encoder designation	AS20DQI	AM20DQI	
Identification in the article number	Q	R	
Resolution	1,048,576 = 20 bits	1,048,576 = 20 bits	
Absolute position	Yes, one revolution	Yes, 4096 revolutions (12 bits)	
Max. angular error	± 120"	± 120"	
Encoder designation	IC22DQ	AM20DQ	AM22DQ
Identification in the article number	D	L	F
Resolution	4,194,304 =22 bits	1,048,576 = 20 bits	4,194,304 =22 bits
Absolute position	No	Yes, 4096 revolutions (12 bits)	Yes, 4096 revolutions (12 bits)
Max. angular error	± 40"	± 120"	± 40"
Simple resolution, not suitable for Safety Integrated Extended Functions			
Encoder designation	R15DQ resolver R14DQ resolver		AM16DQ
Identification in the article number	U, P		K
Resolution	32,768 = 15 bits or 16,384 = 14 bits		65,536 = 16 bits
Absolute position	only for R14DQ: 1 revolution		Yes, 4096 revolutions (12 bits)
Max. angular error	±240" to ±840" depending on the type and motor		± 280"

Encoder without DRIVE-CLiQ interface: EnDat 2.1 or Sin/Cos 1Vpp or resolver		
	Incremental encoder or singleturn encoder	Multiturn absolute encoder
Suitable for Safety Integrated Extended Functions		
Encoder designation	IC2048S/R	AM2048S/R
Identification in the article number	A	E
Resolution	2048 Sin/Cos 1Vpp	2048 Sin/Cos 1Vpp
Absolute position	No	Yes, 4096 revolutions
Max. angular error	± 40"	± 40"
Simple resolution, not suitable for Safety Integrated Extended Functions		
Encoder designation	R2P resolver RMP resolver	
Identification in the article number	T, S	
Resolution	32,768 = 15 bits or 16,384 = 14 bits	
Absolute position	only for R2P: 1 revolution	
Max. angular error	240" to 840" depending on the type and motor	

2.6.4.2 Technical data of the incremental encoders for 1FK7 motors

Description

This encoder senses relative movements and does not supply absolute position information. In combination with an evaluation logic, a zero point can be determined using the integrated reference mark, which can be used to calculate the absolute position.

The encoder outputs sine and cosine signals. These signals can be interpolated using evaluation logic (usually 2048x) and the direction of rotation can be determined. In the version with a DRIVE-CLiQ interface, this evaluation logic is already integrated in the encoder.

Function and technical data

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

Table 2- 8 Technical data for incremental encoders

Encoders	Code	Operating voltage	Max. current drain	A-B track: Resolution incremental (sin/cos periods per revolution)	C-D track: Rotor/commutation position (sin/cos periods per revolution)	Angular error
without DRIVE-CLiQ interface						
1FK703 to 1FK710: Incremental encoder sin/cos 1 Vpp, 2048 S/R with C and D tracks	IC2048S/R	5 V ±5%	140 mA	2048 S/R (1 Vpp)	1 S/R (1 Vpp)	±40"
with DRIVE-CLiQ interface						
1FK703 to 1FK710: Incremental encoder 22-bit (4,194,304 resolution, 2048 S/R encoder-internal) + 11-bit commutation position	IC22DQ	24 V	180 mA	4,194,304 (=22 bits)	2048 (=11 bits)	±40"

Mech. speed limit for all incremental encoders: 12000 rpm

Note: The "Singleturn absolute value encoders" are other encoders which can be used as incremental encoders in the SINAMICS drive system.

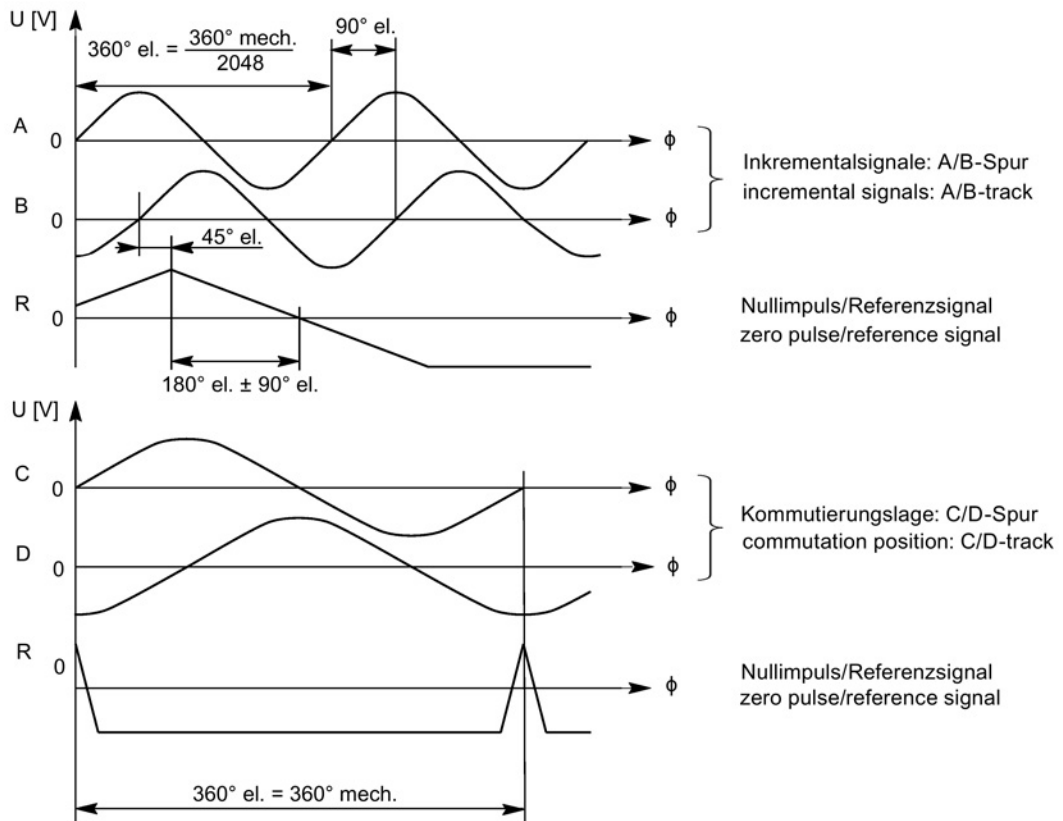


Figure 2-3 Signal sequence and assignment for encoder IC2048S/R without DRIVE-CLiQ interface for a positive direction of rotation

For encoder connection, pin assignment, and cables, refer to the section titled "Connection system".

2.6.4.3 Technical data of the absolute encoders for 1FK7 motors

Description, multiturn absolute encoder

This encoder outputs an absolute angular position between 0° and 360° in the specified resolution. An internal measuring gearbox enables it to differentiate between 4096 rotations. So with a ball screw, for example, the absolute position of the slide can be determined over a long distance.

Description, absolute value singleturn

This encoder outputs an absolute angular position between 0° and 360° in the specified resolution. In contrast to the multiturn absolute value encoder, it has no measuring gearbox and can therefore only supply the position value within one revolution. It does not have a traversing range.

Function and technical data

- Angular measuring system for commutation
- Speed actual value sensing
- Indirect measuring system for absolute position determination within a revolution
- Indirect measuring system for determining the absolute position within a traversing range of 4096 revolutions
- For multiturn encoders: Indirect measuring system for absolute position determination within a traversing range
- Indirect incremental measuring system for position control loop

Table 2- 9 Technical data, absolute value encoder without DRIVE-CLiQ interface

Designation	Code	Operating voltage	Max. current drain	Absolute resolution (single-turn)	Traversing-range (multiturn)	A-B track: Resolution incremental (sin/cos periods per revolution)	Angular error
Serial absolute position interface: EnDat 2.1							
Absolute value encoder 2048 S/R, (4096 revolutions, multiturn, with EnDat interface)	AM2048S/R	5 V ±5%	200 mA	8192 (=13 bits)	4096 (=12 bits)	2048 S/R (1 Vpp)	±40"
Absolute value encoder 16 S/R, (4096 revolutions, multiturn, with EnDat interface)	AM16S/R	5 V ±5%	210 mA	8192 (=13 bits)	4096 (=12 bits)	16 S/R (1 Vpp)	±480"

Table 2- 10 Technical data, absolute value encoder with DRIVE-CLiQ interface

Designation	Code	Operating voltage	Max. current drain	Absolute resolution (singleturn)	Traversing-range (multiturn)	Angle error
Serial absolute position interface: DRIVE-CLiQ						
Absolute encoder, single-turn, 24-bit	AS24DQI	24 V	110 mA	16,777,216 (= 24 bits)	-	±40"
Absolute encoder 24-bit + 12-bit multiturn	AM24DQI	24 V	110 mA	16,777,216 (= 24 bits)	4096 (=12 bits)	±40"
Absolute encoder, single-turn, 20-bit	AS20DQI	24 V	110 mA	1,048,576 (=20 bits)	-	±120"
Absolute encoder 20-bit + 12-bit multiturn	AM20DQI	24 V	110 mA	1,048,576 (=20 bits)	4096 (=12 bits)	±120"
Absolute encoder 22-bit + 12-bit multiturn	AM22DQ	24 V	210 mA	4,194,304 (=22 bits)	4096 (=12 bits)	±40"
Absolute encoder 20-bit + 12-bit multiturn	AM20DQ	24 V	210 mA	1,048,576 (=20 bits)	4096 (=12 bits)	±120"
Absolute value encoder 16-bit + 12-bit multiturn	AM16DQ	24 V	210 mA	65,536 (=16 bits)	4096 (=12 bits)	±280"

Mech. speed limit for all absolute value encoders: 12000 rpm

Signal sequence and assignment of the A/B track; refer to figure "Incremental encoders".

2.6.4.4 Resolvers

Description

The number of sine and cosine periods per revolution corresponds to the number of pole pairs of the resolver. In the case of a 2-pole resolver, the evaluation electronics may output an additional zero pulse per encoder revolution. This zero pulse ensures a unique assignment of the position information in relation to an encoder revolution. A 2-pole resolver can therefore be used as a singleturn encoder. 2-pole resolvers can be used for motors with any number of pole pairs. With multi-pole resolvers, the pole pair numbers of the motor and the resolver are always identical. The resolution is correspondingly higher than for 2-pole resolvers.

Function and technical data

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

Table 2- 11 Technical data, resolver without DRIVE-CLiQ interface

Designation	Short designation	Excitation voltage rms, excitation frequency	Angle error
2-pole resolver	Resolver p=1	2 ... 8 V, 5 ... 10 kHz	840"
6-pole resolver	Resolver p=3	2 ... 8 V, 5 ... 10 kHz	420"
8-pole resolver	Resolver p=4	2 ... 8 V, 5 ... 10 kHz	240"
Calculation of the output signals		Gear ratio $\dot{U} = 0.5 \pm 5\%$ $U_{\text{sin track}} = \dot{U} \times U_{\text{excitation}} \times \sin \alpha$ $U_{\text{cosine track}} = \dot{U} \times U_{\text{excitation}} \times \cos \alpha$ $\alpha = \arctan (U_{\text{sin track}} / U_{\text{cosine track}})$	

Table 2- 12 Technical data, resolver with DRIVE-CLiQ interface

Designation	Short designation	Supply voltage	Resolution	Angle error
Resolver 15-bit resolution 32768, internal, multi- pole	R15DQ	24 V	32,768 (=15 bits)	for 6-pole and 8-pole 240"
Resolver 14-bit resolution 16384, internal, 2-pole	R14DQ	24 V	16,384 (=14 bits)	840"

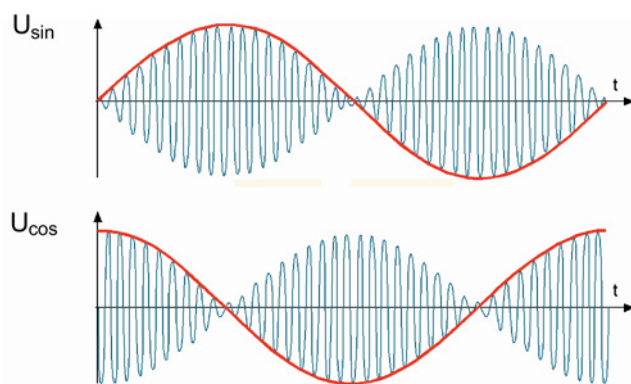


Figure 2-4 Output signals, resolver

2.6.5 Cooling

2.6.5.1 Natural cooling

On naturally cooled motors, the heat loss is dissipated through thermal conduction, radiation and natural convection.

Some of the heat loss is dissipated through the mounting surface of the motor. From large motors, heat is dissipated via the base frame (steel plate).

The motor ratings apply in an ambient temperature of 40° C (104° F). If the ambient temperature exceeds 40° C (104° F), you must adjust the torque and power of the motor accordingly, see Chapter "Derating factors (Page 28)".

2.6.5.2 Forced ventilation

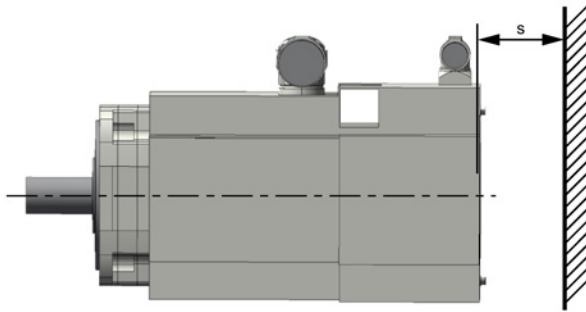
This cooling method is achieved using a separate ventilation unit with a fan that is driven independently of the motor.

Operate the fan only with normal ambient air.

The direction of air flow is from the non-drive end (NDE) to the drive end (DE).

Deposits of contaminated air can impair the heat dissipation of the motor or block the cooling duct and overheat the motor.

Maintain the minimum clearance between the air intake and discharge openings and adjacent components (see the "Minimum clearance" diagram).



s A minimum clearance of 30 mm applies for SH 80

Figure 2-5 Minimum clearance s

2.6.6 Holding brake

2.6.6.1 Type of holding brake

The holding brake is implemented as a permanent-magnet brake.

The magnetic field of the permanent magnets exerts a pulling force on the brake armature disk. This means that in the no-current condition, the brake is closed and the motor shaft is held.


When 24 V DC rated voltage is applied to the brake, the current-carrying coil produces an opposing field. This neutralizes the force of the permanent magnets and the brake opens without any residual torque.

The permanent magnet brake has a torsionally stiff connection to the motor rotor. Therefore the brake has no play.

NOTICE
Damage to the motor due to axial forces on the shaft extension
Axial forces on the shaft extension can damage motors with an integrated permanent-magnet holding brake.
<ul style="list-style-type: none">• Avoid axial forces on the shaft extension.

2.6.6.2 Properties

- The holding brake is used to clamp the motor shaft when the motor is at a standstill. The holding brake is **not** a working brake for braking the rotating motor.

 WARNING
Danger to life caused by unintended movements of the machine or installation
If you ignore the permissible number of braking operations, the braking effectiveness of the holding brake can be irreversibly reduced. This can cause unintended movements of the machine or installation resulting in death or serious injury.
<ul style="list-style-type: none">• Observe the permissible number of braking operations.• Operate the motor only in conjunction with an intact brake.

- Restricted Emergency Stop operation is permissible. You can perform up to 2000 braking operations with three times the rotor moment of inertia as an external moment of inertia from a speed of 3000 rpm, without the brake being subject to an inadmissible amount of wear.

- Do not exceed the maximum operating energy per emergency braking.
- The rated voltage of the holding brake is 24 VDC +/- 10%. Voltages outside this tolerance range can cause faults.

NOTICE

Premature wear of the motor holding brake when operated outside its permissible voltage range

Operating the motor holding brake outside its permissible voltage range at the motor connection will damage the brake.

- Ensure that the motor holding brake is only operated within its permissible voltage range.

NOTICE

Faulty brake function due to inadmissible wear

Inadmissible wear means that the braking function can no longer be guaranteed.

- Comply with the emergency stop features stated above.
- Avoid repeated brief acceleration of the motor against a holding brake that is still closed. Consider the operating times of the brakes and the relays in the drive control and enable.

Note

Subsequent conversion of motors with or without a holding brake is not possible.

The technical data for the holding brake is contained in the Configuration Manual of the motor.

2.6.7 Options

The descriptions of the options are contained in the associated Configuration Manual (<https://support.industry.siemens.com/cs/document/55379345?lc=de-WW&pnid=13349&dl=en>) of the motor





Preparing for use

3.1 Shipping and packaging

The drive systems are put together on an individual basis.

Please pay attention to the handling notes on the packaging in which the motor is delivered.

Table 3- 1 Handling notes and their meaning

Symbol	Meaning	Symbol	Meaning
	Fragile (ISO 7000, No. 0621)		Keep dry (ISO 7000, No. 0626)
	Top (ISO 7000, No. 0623)		Do not stack (ISO 7000, No. 2402)

Checking the delivery for completeness

- Upon receipt of the delivery, check immediately whether the items delivered match the accompanying documents.

Note

Siemens will not accept any claims for missing or incorrect items submitted at a later date.

- Report any visible transportation damage to the delivery company immediately.
- Report any visible defects or missing items to the competent Siemens office immediately.

The delivery includes a second rating plate (type plate). The second rating plate can be used to post the motor data additionally in the vicinity of the motor.

The additional rating plate (type plate) is

- in the terminal box for motors with terminal boxes
- in the safety data sheet for motors with power connectors.

The supplementary sheets with the safety instructions are part of the scope of supply.

Note

Keep the sheets with the safety instructions in an accessible location at all times.

3.2 Transportation and storage

3.2.1 Transport


Note

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

- Use suitable load suspension devices when transporting and installing the motor.
- Transport the motor carefully.

Lifting and transporting the motor using slings up to SH 80

Up a shaft height of 80 mm, you can lift and transport the motor with slings.

 WARNING
Incorrectly dimensioned or incorrectly used lifting slings
If lifting slings are incorrectly dimensioned or incorrectly used, the motor can fall and cause death, severe injury and/or damage to property.
<ul style="list-style-type: none">• Only use lifting slings that are suitable for the weight of the motor.• Attach the lifting slings as shown in the figure "Lifting and transporting the motor using slings".

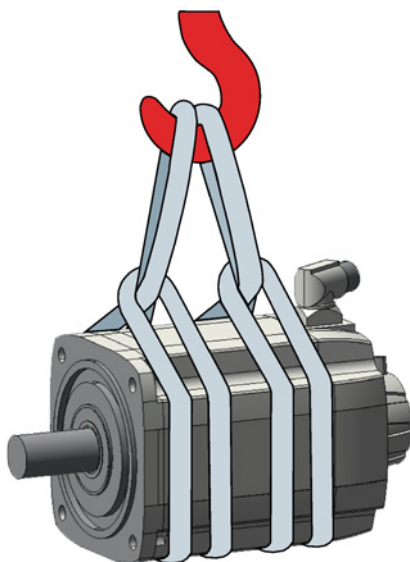

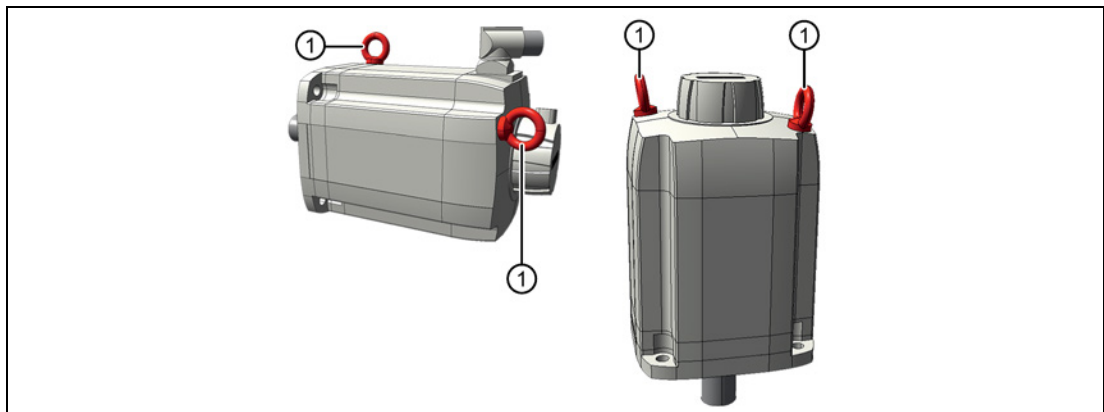


Figure 3-1 Transporting with slings

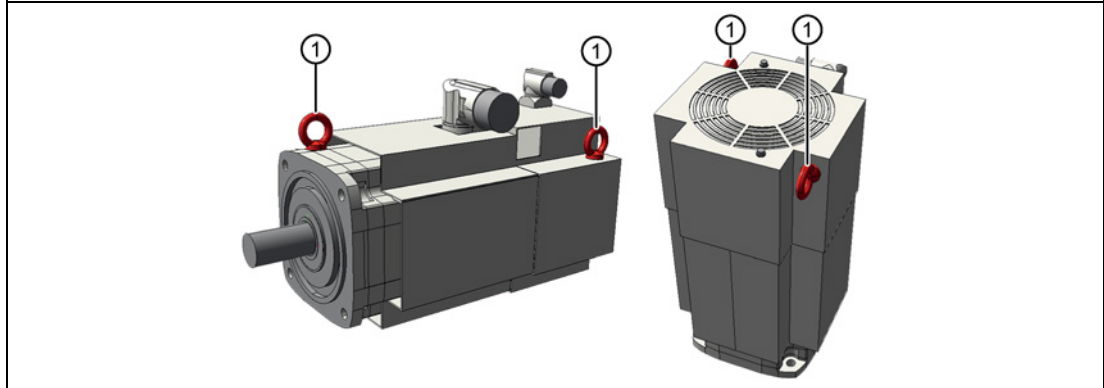
Lifting and transporting with lifting eyes as of SH 80

For motors as of a shaft height of 80 mm, use lifting eyes and a beam to lift and transport the motor.

 WARNING
Incorrect or unused lifting points
Due to incorrect or unused lifting points, the motor can fall and cause death, severe injury and/or damage to property.
<ul style="list-style-type: none">• Only lift and transport larger motors using the eyebolts screwed on to the end shields.• Completely screw in the eyebolts and tighten by hand (approx. 8 Nm).• Do not use bent or damaged eyebolts.• Only use eyebolts with laminated fiber washers.• Loads applied transversely to the plane of the eyebolts are not permitted.

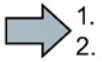


1FK7 with natural cooling (shaft height 80 - 100)



1FK7 with forced ventilation

1 lifting eye



Procedure

1. Screw the lifting eyes (eyebolts) in at appropriate locations for the orientation of the motor during transportation.
2. Hook the beam into the lifting eyes (eyebolts).

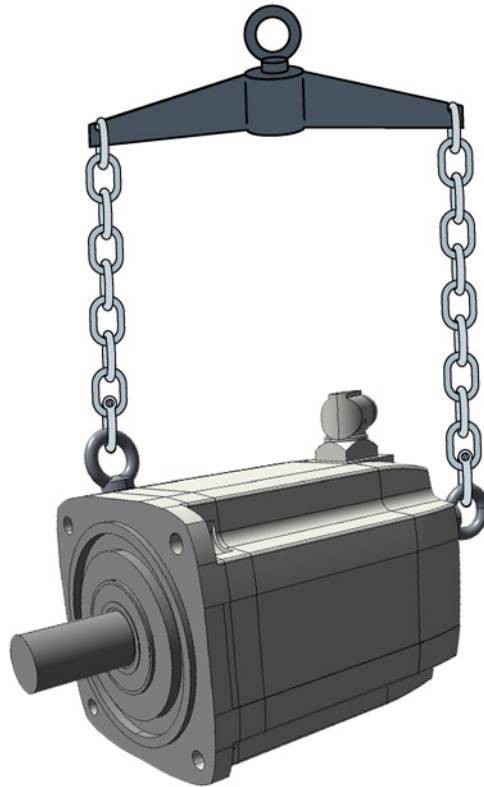


Figure 3-2 Transportation with beam



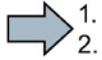
Setting down the motor

WARNING

Danger of severe injury due to unintentional movements of the motor

If the motor is not secured after being set down, unintentional movements of the motor can cause serious injury.

- After the motor has been set down, secure it in position.
- Do not release the lifting devices until the motor has been secured in position.



Procedure

1. Set the motor down on a hard, level surface.
2. Secure the motor against unintentional movements.



3.2.2 Storage

Note

If possible, store the motor in its original packaging.

Preserve the free shaft extensions, sealing elements, and flange surfaces with a protective coating.

NOTICE

Seizure damage to bearings

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

- Comply with the storage conditions.

Storage conditions

Please observe the warning instructions on the packaging and labels.

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

Adhere to the following values:

- $v_{rms} < 0.2$ mm/s
- Max. temperatures: -15° C to 55° C
- Mean relative humidity < 75%

Long-term storage

Note

Storage time up to two years

The storage time affects the properties of the roller bearing grease.

- Store the motor for up to two years at -15° C to 55° C.
-

Note

In the case of storage in transit over six months, special arrangements must be made for preservation.

- Contact Technical Support.
-

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

- The motor must be protected against extreme weather conditions.
- The facility air must be free of corrosive gases.
- The facility must be free of vibrations ($v_{\text{eff}} < 0.2$ mm/s)
- According to EN 60034-1, the temperature must be -15°C to 55°C .
- The relative humidity of the air must be lower than 60%.

Check the correct state of the motor 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.
- Record the preservation work so that all preservation coating can be removed prior to the commissioning.

Condensation

The following ambient conditions encourage the formation of condensation:


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


Avoid these ambient conditions.


Use a dehydrating agent in the packaging.

Mounting

4.1 Safety instructions

 WARNING
Danger to life as a result of incorrect transport and/or lifting of the motor Incorrectly transporting and/or lifting the motor can result in death, severe injury, and/or damage to property. For instance, the motor can fall. <ul style="list-style-type: none">• Lifting devices, ground conveyors, and load suspension equipment must comply with requirements.• The maximum capacity of the lifting equipment and the load suspension device must correspond to the weight of the motor (see the rating plate).• Do not attach any additional loads to the lifting equipment.• To hoist the motor, use suitable cable-guidance or spreading equipment, particularly if the motor is equipped with built-on assemblies.• The motor must not be lifted or transported by means of the power connector or signal connector.• Do not stand in the slewing range of hoisting gear or under suspended loads.

 WARNING
Danger to life from permanent magnet fields Even when switched off, electric motors with permanent magnets pose a potential risk for persons with heart pacemakers or implants if they are close to inverters/motors. <ul style="list-style-type: none">• If you have a heart pacemaker or implant, keep a minimum distance of 20 cm.• 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 transporting by air.

 WARNING
Danger to life due to freely rotating parts Contact with rotating parts can cause death or severe injury. <ul style="list-style-type: none">• Do not touch any rotating parts.• Mount a cover cap or protective shroud over freely rotating parts.

 **WARNING**

Danger to life due to unpredictable movements of the system

The system can perform unpredictable movements under load that can cause death or severe injury.

- De-energize the system before starting work.
- Disconnect all loads from the system.
- Secure the system against accidental reclosure.

NOTICE

Damage to shaft sealing rings caused by solvent

If shaft sealing rings come into contact with solvents when preservation coating is removed, the shaft sealing rings can be damaged.

- Avoid contact between solvents and shaft sealing rings.

NOTICE

Thermal damage to temperature-sensitive parts

Some parts of the electrical motor enclosure can reach temperatures that exceed 100 °C. If temperature-sensitive parts, for instance electric cables or electronic components, come into contact with hot surfaces then these parts can be damaged.

- Ensure that no temperature-sensitive parts come into contact with hot surfaces.

4.2 Checklists prior to mounting

Note

Required checks

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

Assemble the motor as described in the following chapters of the operating instructions.

Thoroughly familiarize yourself with the safety instructions and observe the checklists below before starting any work.

Table 4- 1 Checklist (1) - general checks

Check	OK
Are all of the necessary components of the configured drive line-up available, correctly dimensioned, installed and connected?	
Are the environmental conditions in the permissible range?	

Table 4- 2 Checklist (2) - checks regarding the mechanical system

Check	OK
Is the motor free of visible damage?	
Have the mounting surfaces (e.g. flange, shaft) on the customer machine and on the motor been cleaned?	
Are the mounting surfaces free of corrosion?	
Do the mounting dimensions (e.g. shaft diameter, shaft length, true run) on the customer machine meet the specification?	

4.3 Mounting instructions

NOTICE
Damage to the motor due to runout on the shaft extension
Runout and thrust on the shaft extension of the motor can damage the motor.
<ul style="list-style-type: none"> Mount the motor without runout and thrust on the shaft extension.

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

- Observe the data on the rating plate, as well as the warning and information plates on the motor.
- Check the permissible ambient conditions (e.g. temperature, installation altitude) at the installation location.
Their use is prohibited in hazardous zones.
- Thoroughly clean the shaft extension of corrosion protection. Use commercially available solvents.
- Ensure sufficient dissipation of heat. See Chapter "Mounting conditions (Page 59)"
- If the motor is installed vertically with the end of the shaft facing up, ensure that no liquid can enter the upper bearing.
- If fluid media come into contact with the DE flange, a special flange seal is required.

The motor is sealed via the machined flat contact surface of the centering edge on the DE flange, e.g. with an O ring. The sealing is on the circumference. Sealing at the flange contact surface of the motor is not envisaged.

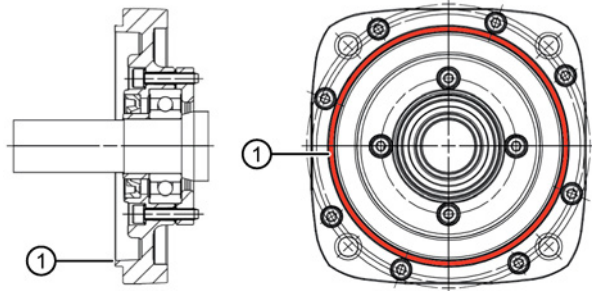


Figure 4-1 Position of the sealing surface on the face of the centering edge

- Ensure that the flange is in even contact with the mounting surface.
- Use hexagon socket head cap screws with a property class of at least 8.8.
- When tightening the fastening bolts avoid any uneven stressing.
- Observe the tightening torques of the fastening bolts of the motor flange. See the "Tightening torques for fastening bolts" table.
- After installation, remove the lifting eyes or tighten them.

Tightening torques for fastening bolts

The general tolerance for the tightening torque is 10%. The tightening torque is based on a friction coefficient of $\mu = 0.14$.

Motor	Screw DIN 7984	Washer ISO 7092 [mm]	Tightening torque for screws (not for electrical connections)
1FK703□	M6	6 (d2 = 11)	8 Nm
1FK704□	M6	6 (d2 = 11)	8 Nm
1FK706□	M8	8 (d2 = 15)	20 Nm
1FK708□	M10	10 (d2 = 18)	35 Nm
1FK710□	M12	12 (d2 = 20)	60 Nm

Tightening torques for fastening bolts

The mounting tools to be used are a torque wrench or pneumatic or impact power screwdriver with automatic switch-off.

4.4 Mounting conditions

4.4.1 Natural cooling

Note the specifications on thermally non-insulated mounting and on thermally insulated mounting.

Note

To ensure enough heat is dissipated, a minimum clearance to adjacent components of 100 mm must be kept free on three side surfaces.

- Mount the motor in such a way that sufficient clearance is provided for heat dissipation.

The motor ratings apply in an ambient temperature of 40° C (104° F). If the ambient temperature exceeds 40° C (104° F), you must adjust the torque and power of the motor accordingly.

- Adjust the torque or the power of the motor at the converter based on the table in Chapter "Derating factors (Page 28)."
Follow the Operating Instructions of the converter.

Non-thermally insulated mounting

Observe the following mounting conditions for the specified motor data:

Table 4- 3 Non-thermally insulated mounting conditions

Shaft height	Steel plate, width x height x thickness [mm]	Mounting surface[m ²]
1FK703□ to 1FK704□	120 x 100 x 40	0.012
1FK706□ to 1FK710□	450 x 370 x 30	0.17

For larger mounting surfaces, the heat dissipation conditions improve.

Thermally insulated mounting without additional mounted components

For non-ventilated motors, the motor torque must be reduced by between 5% and 10%. Configure the motor using the $M_{0(60K)}$ values. As the speed increases, the reduction factor rises, see figure "Effect of the mounting conditions on the S1 characteristic curve".

Thermally insulated mounting with additional mounted components

- Holding brake (integrated in the motor):
No additional torque reduction required
- Gearboxes:
The torque must be reduced. See figure "Effect of the mounting conditions on the S1 characteristic curve"

Effect of thermally insulated/non-insulated mounting without and with gearbox

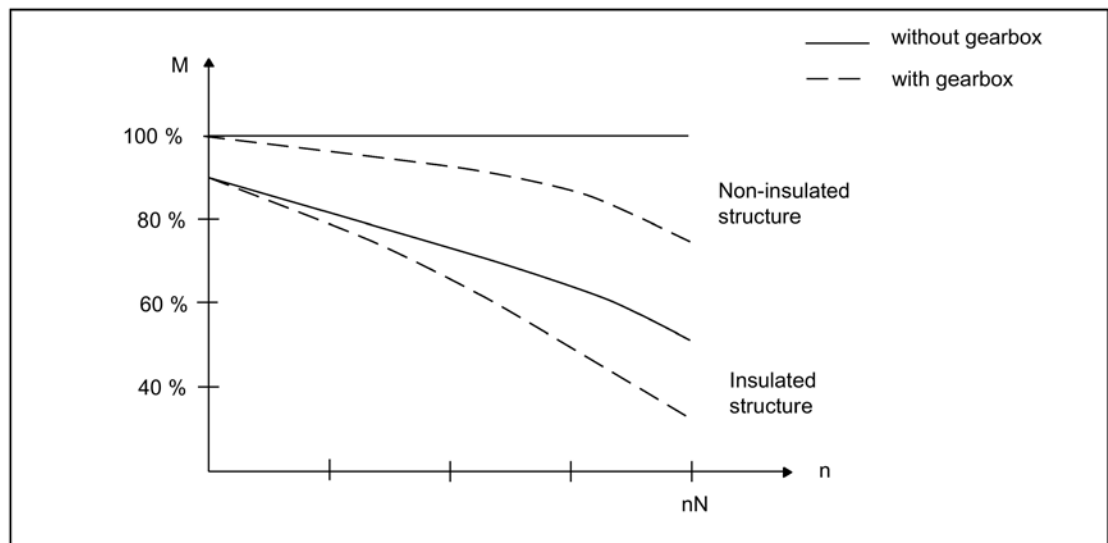


Figure 4-2 Effect of the mounting conditions on the S1 characteristic curve

4.4.2 Forced ventilation

This cooling method is achieved using a separate ventilation unit with a fan that is driven independently of the motor.

 **WARNING**

Explosion hazard

Operating the fan in an environment with inflammable, chemically corrosive, electrically conductive, or explosive dust or gases can cause explosions and result in death or serious injury.

- Operate the motor with forced ventilation only in an environment that is free of inflammable, chemically corrosive, electrically conductive, or explosive dust or gases.

 **WARNING**

Danger to life due to objects being sucked in.

For example, hair, neckties, loose objects can be sucked into the air intake and cause death or serious injury.

- Take measures to prevent objects from being sucked in, e.g.
 - Wear a head covering or hair net,
 - Remove any neckties or similar,
 - Keep the air intake area free.

Note

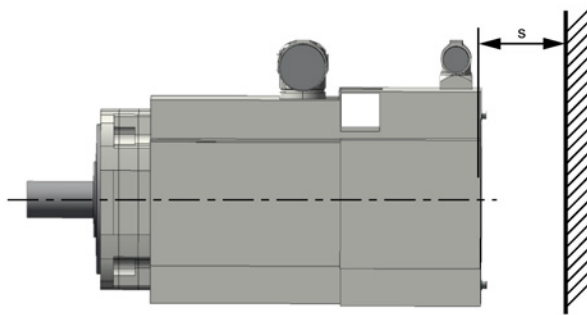
Ensure that the motor is only operated when the external fan is running.

Operate the fan only with normal ambient air.

The direction of air flow is from the non-drive end (NDE) to the drive end (DE).

Deposits of contaminated air can impair the heat dissipation of the motor or block the cooling duct and overheat the motor.

- Position the motor so that the cooling air can freely flow in and out.
- Make sure that no heated discharged air is drawn in.
- Maintain the minimum clearance between the air intake and discharge openings and adjacent components (see the "Minimum clearance" figure).
- To remove the fan cover and connect the signal connector when the motor is installed, maintain a minimum clearance of 125 mm.



s A minimum clearance of 30 mm applies for SH 80

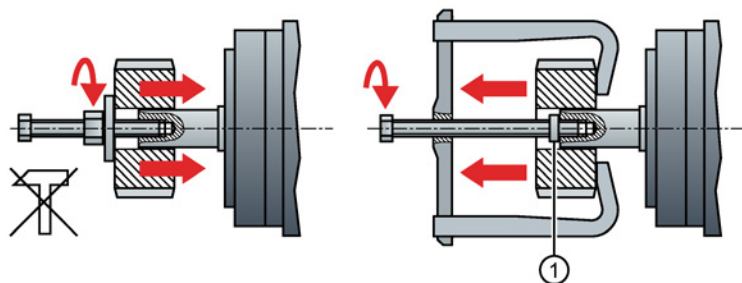
Figure 4-3 Minimum clearance s

4.5 Mounting the drive elements

NOTICE
Damage to the motor due to runout on the shaft extension
Runout and thrust on the shaft extension of the motor can damage the motor.
<ul style="list-style-type: none">• Mount the motor without runout and thrust on the shaft extension.

Mount or remove the power output elements (e.g. couplings, gear wheels, belt pulleys) using suitable devices only (see figure).

- Use the threaded hole in the shaft extension.
- If required, heat up the output elements.
- When removing the output elements, use an intermediate disk to protect the centering in the shaft extension.
- If necessary, completely balance the motor together with the output elements according to ISO1940.



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

Figure 4-4 Mounting and removing output elements

4.6 Vibration response

Vibration severity grade

Motors with a keyway are balanced with a half fitted key by the manufacturer. The vibration response of the system at the location of use is influenced by output elements, any built-on parts, the alignment, the installation, and external vibrations. This can change the vibration values of the motor.

The motors conform to vibration severity grade A according to EN 60034-14 (IEC 60034-14).

The specified values refer only to the motor. The installation-dependent system vibration behavior can increase these values at the motor.

The vibration severity grade is maintained up to the rated speed (n_N).

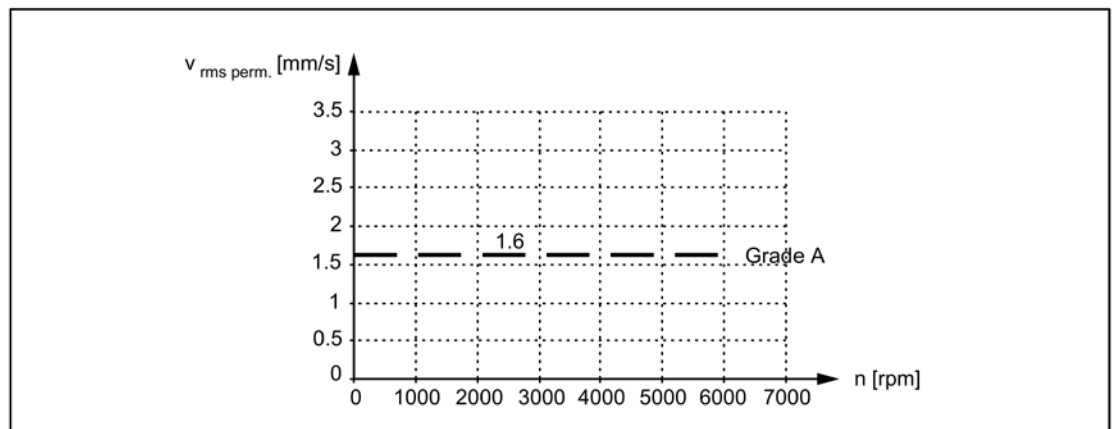


Figure 4-5 Vibration severity grades

Vibration response

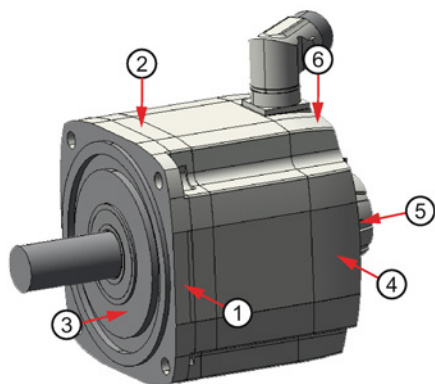
For perfect function and to comply with the motor specification (in particular, the bearing service life) the vibration values specified in the following table must be observed.

Table 4- 4 Vibration values

Vibration speed v_{rms} according to ISO 10816	max. 4.5 mm/s
Vibration acceleration a_{peak} axial ¹⁾	25 m/s ²
Vibration acceleration a_{peak} radial ¹⁾	50 m/s ²

1) For motors with separately driven fans, the limit value for axial and radial vibration acceleration is limited to 10 m/s².

Select the measuring locations according to ISO 10816-1, Section 3.2. The vibration values must not exceed the specified limits at any measuring location.



- | | | | |
|---|----------------------|---|-----------------------|
| 1 | End shield DE radial | 4 | End shield NDE radial |
| 2 | End shield DE radial | 5 | End shield NDE axial |
| 3 | End shield DE axial | 6 | End shield NDE radial |

Figure 4-6 Measuring points for vibration values

The vibration acceleration is evaluated in the frequency band from 10 to 2000 Hz. Whereby, the maximum peak value in the time range is considered.

To evaluate the vibration velocity, the measuring equipment must fulfill the requirements of ISO 2954.

5.1 Safety instructions



! DANGER

Danger to life due to live parts and other energy sources

Death or serious injury can result when live parts are touched.

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

Generally, six steps apply when establishing safety:

1. Prepare for shutdown and notify all those who will be affected by the procedure.
2. Disconnect the machine from the supply.
 - Switch off the machine.
 - Wait until the discharge time specified on the warning labels has elapsed.
 - Check that it really is in a no-voltage condition, from phase conductor to phase conductor and phase conductor to protective conductor.
 - Check whether the existing auxiliary supply circuits are de-energized.
 - Ensure that the motors cannot move.
3. Identify all other dangerous energy sources, e.g. compressed air, hydraulic systems, or water.
4. Isolate or neutralize all hazardous energy sources by closing switches, grounding or short-circuiting or closing valves, for example.
5. Secure the energy sources against switching on again.
6. Ensure that the correct machine is completely interlocked.

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

⚠ WARNING

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

Connecting a motor to an inadequately grounded line supply can result in death, severe injury and damage to the motor if a fault occurs.

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

5.2 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.

5.3 Motor circuit diagram

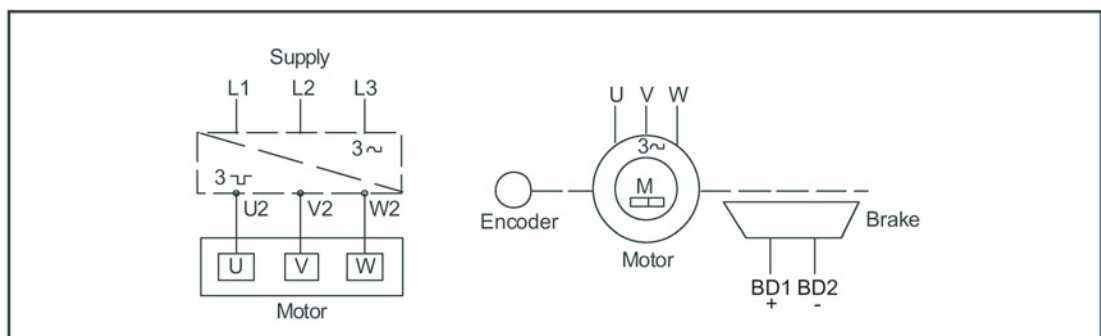


Figure 5-1 Circuit diagram

5.4 System integration

5.4.1 Connection notes

5.4.1.1 Motor connection

NOTICE
Destruction of the motor if it is directly connected to the three-phase line supply The motor will be destroyed if it is directly connected to the three-phase line supply. <ul style="list-style-type: none">• Only operate the motors with the appropriately configured converters.

NOTICE
Damage to electronic components as a result of electrostatic discharge Electrostatically sensitive devices (ESD) can be damaged or destroyed by electrostatic discharge. <ul style="list-style-type: none">• Observe the ESD protection measures.• Only grounded personnel with grounded tools may touch the component connections.• Heed the EMC information provided by the manufacturer of the converter.

- Use prefabricated cables from SIEMENS (not in the scope of delivery). These cables reduce installation costs and increase operational reliability (see the Product Information).
- The manufacturer of the plant/machine is responsible for ensuring that installation is performed correctly.
- Observe the data on the rating plate and the circuit diagrams.
- Adapt the connection cables to the type of use and the voltages and currents that occur.
- When fed from a converter, high-frequency current and voltage oscillations in the motor feeder cables can cause electromagnetic interference. Therefore, use shielded power cables.
- Make sure that the inside of the connector is clean and free of cable cuttings and moisture.
- Avoid protruding wire ends.
- Check that the degree of protection is complied with at the seals and sealing surfaces of the connectors.
- Secure connecting cables against torsion, tensile and compressive strain, and protect them against kinking. It is not permissible to subject the connector to continuous force.
- Insert the coding groove of the plug-in connection into the socket until flush and tighten the screw cap by hand in as far as it will go.

Current-carrying capacity for power and signal cables

The current-carrying capacity of PVC/PUR-insulated copper cables is specified for routing types B1, B2 and C under continuous operating conditions in the table with reference to an ambient air temperature of 40° C. For other ambient temperatures, the values must be corrected by the factors from the "Derating factors" table.

Table 5- 1 Cable cross-section and current-carrying capacity

Cross-section [mm ²]	Current-carrying capacity rms; AC 50/60 Hz or DC for routing type		
	B1 [A]	B2 [A]	C [A]
Electronics (according to EN 60204-1)			
0.20	-	4.3	4.4
0.50	-	7.5	7.5
0.75	-	9	9.5
Power (according to EN 60204-1)			
0.75	8.6	8.5	9.8
1.00	10.3	10.1	11.7
1.50	13.5	13.1	15.2
2.50	18.3	17.4	21
4	24	23	28
6	31	30	36
10	44	40	50
16	59	54	66
25	77	70	84
35	96	86	104
50	117	103	125

Table 5- 2 Derating factors for power and signal cables

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

5.4.1.2 Rotating the connector at the motor

Power connectors and signal connectors can be rotated to a different angle to a limited extent.

Use a suitable socket connector to rotate the angle plug.

Unscrew and open the socket connector completely to avoid damaging the pin contacts.

On encoders with an integrated Sensor Module (DQI), the cable outlet toward the top is fixed and cannot be changed. The M17 encoder connector for option N16 can be rotated.

Note

Rotating the connectors

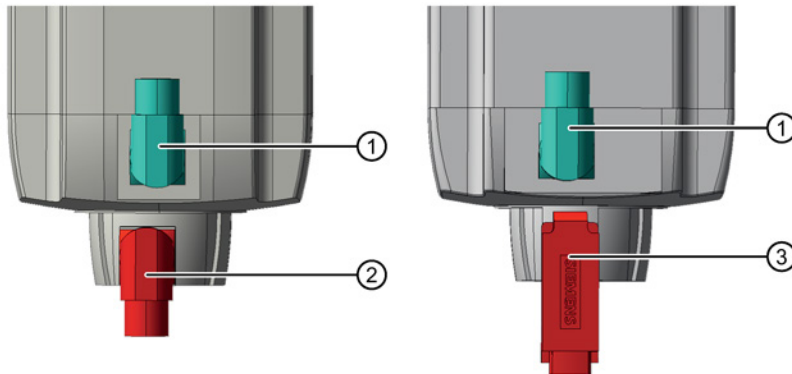
- Do not exceed the permissible range of rotation.
- To ensure the degree of protection, do not rotate more than 10 times.
- Rotate the connector using a mating connector that matches the connector thread. Only rotate Sensor Modules by hand. Use of tools is not permissible.

Twistability of the power connector for motors with DRIVE-CLiQ interface 1FK7□□□-□□□□□-□X□□; X = B, C, Q, R

Table 5- 3 Rotation range of the power connector

Motor	Angle α	Angle β	Connector size	Drawing
1FK703	122°	208°	1	
1FK704 1FK706 1FK708 1FK710	135°	195°	1	
1FK708 1FK710	195°	140°	1.5	

Twistability of the connectors for motors without a DRIVE-CLiQ interface and for motors with DRIVE-CLiQ interface via Sensor Modules
1FK7□□□-□□□□□-□X□□; X = A, D, E, F, G, K, L



- 1 Power connector, size 1 or 1.5
- 2 Signal connector without DRIVE-CLiQ
- 3 Signal connector with DRIVE-CLiQ and Sensor Module (SMI)

Table 5- 4 Rotation range of the power connector ①

Motor	Connector size	Angle α	Angle β	Drawing
1FK703	1	122°	158°	
1FK704 1FK706 1FK708	1	135°	140°	
1FK710	1	135°	195°	
1FK708 1FK710	1.5	195°	140°	

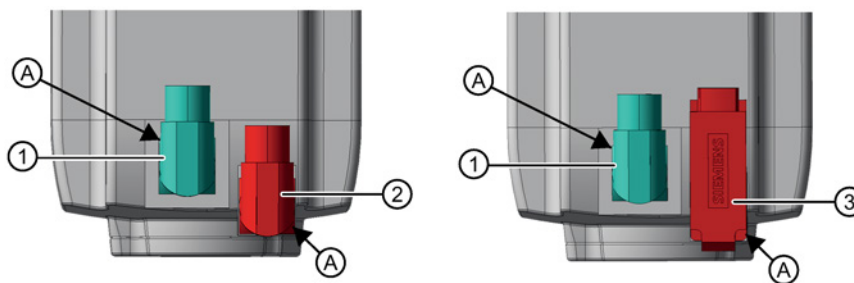
Table 5- 5 Rotation range of the signal connector ②

Motor	Signal connector without DRIVE-CLiQ ②		Drawing
	Angle α'	Angle β'	
1FK703	160°	135°	
1FK704	145°	130°	
1FK706	150°	135°	
1FK708 1FK710	105°	105°	

Table 5- 6 Rotation range of the signal connector ③

Motor	Signal connector with DRIVE-CLiQ via Sensor Modules (SMI) ③		Drawing
	Angle α'	Angle β'	
1FK703	160°	130°	
1FK704	145°	140°	
1FK706	140°	145°	
1FK708	105°	100°	
1FK710			

Twistability of the connectors for motors with Resolver
1FK7□□□-□□□□□-□X□□; X = S, T, U, P



- 1 Power connector, size 1 and 1.5
- 2 Signal connector M23
- 3 Signal connector with SMI
- A Output cam on the connector foot to limit the twistability

Figure 5-2 Twistability of the resolver variants

Table 5- 7 Rotation range of the power connector ① and the M23 signal connector ②

Motor	Power connector, size 1 and 1.5 ①			M23 signal connector ②		Drawing
	Connector size	Angle α	Angle β	Angle α'	Angle β'	
1FK703	1	170°	70°	250°	20°	
1FK704		190°	80°	255°	5°	
1FK706		185°	90°	255°	10°	
1FK708		205°	75°	260°	25°	
1FK708	1.5	190°	70°	245°	15°	
1FK710	1	205°	85°	265°	30°	
1FK710	1.5	195°	80°	260°	25°	

Table 5- 8 Rotation range of the power connector ① and the signal connector with SMI ③

Motor	Power connector, size 1 and 1.5 ①			Signal connector with SMI ③		Drawing
	Connector size	Angle α	Angle β	Angle α'	Angle β'	
1FK703	1	200°	70°	240°	5°	
1FK704		175°	80°	255°	5°	
1FK706		185°	85°	255°	5°	
1FK708		205°	75°	255°	5°	
1FK708	1.5	190°	70°	235°	5°	
1FK710	1	205°	85°	265°	5°	
1FK710	1.5	195°	80°	255°	5°	

Table 5- 9 Maximum rotating torque for the connectors

Connectors	Max. torque when rotating
Power connector, size 1	12 Nm
Power connector, size 1.5	20 Nm
Signal connector (without DRIVE-CLiQ)	12 Nm
Signal connector (with DRIVE-CLiQ)	8 Nm

5.4.1.3 Routing cables in a damp environment

Note

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

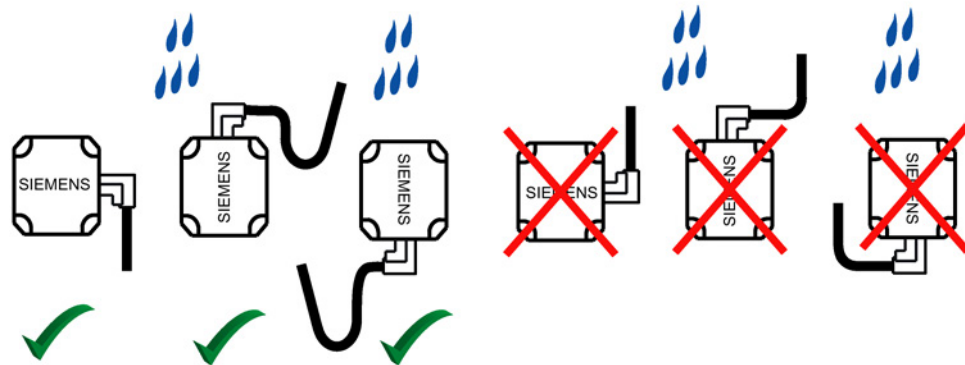


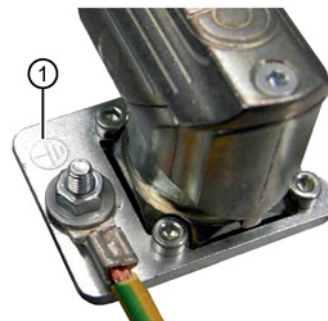
Figure 5-3 Routing cables in a damp environment

5.4.1.4 Connection notes for motors with M03 and M39

For deployment of the motor in the hazardous zones, you must secure the connection of the motor additionally.

Note**Limited twistability of the angle plug**

The use of the grounding clip and/or the disassembly protection sleeves limits the twistability of the angle plug.

Additional grounding

1 Grounding clip (included in the scope of supply)

Note

Ensure a good conductive connection.

Connect the ground connection to the supplied grounding clip.

Install the disassembly protection sleeves for the power and signal connectors

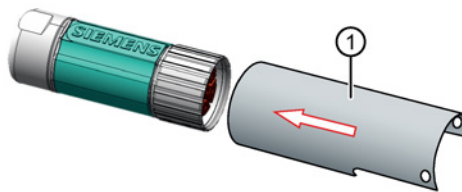
To prevent autonomous and inadvertent loosening of the cable connection, and to ensure an adequate grounding, install disassembly protection sleeves.

Procedure



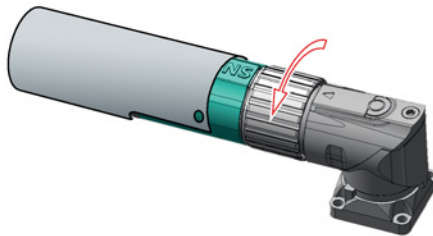
- 1.
- 2.

- 1. Before connecting, push the disassembly protection sleeves over the connectors.



1 Disassembly protection sleeve

- 2. Establish the connector connection.



- 3. Push the disassembly protection sleeve over the connector connection.

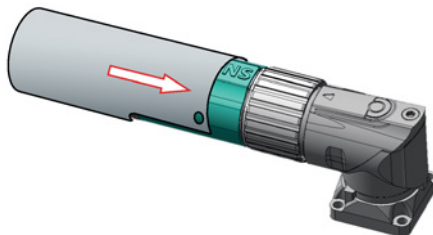
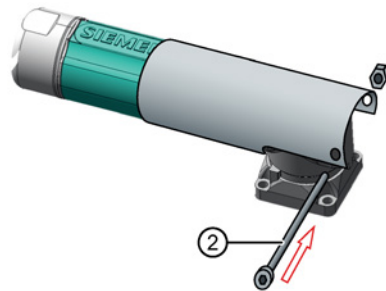


Figure 5-4 Disassembly protection for explosion protection 2

4. After you have pushed the disassembly protection sleeve completely over the connector connection, insert the supplied screw through the drill holes in the disassembly protection sleeve.

Note

Depending on the version, the disassembly protection sleeves can have two drill holes. Select the drill hole nearest the connector.

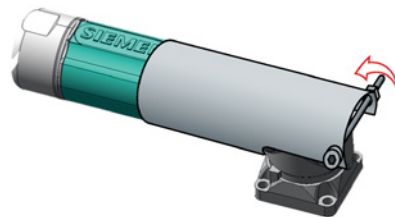


- 2 Cylinder head screw
for connector size 1: M4 x 35, strength class 8.8
for connector size 1.5: M5 x 60, strength class 8.8

5. Tighten the screwed connection until a friction-locking connection results.

Note

To achieve adequate grounding, a metallic contact must be made between the disassembly protection sleeve and the connector or mating connector.



You have installed the disassembly protection sleeve.

Instead of the angle plug, the DRIVE-CLiQ connection of the encoder can also be an RJ45Plus connector.

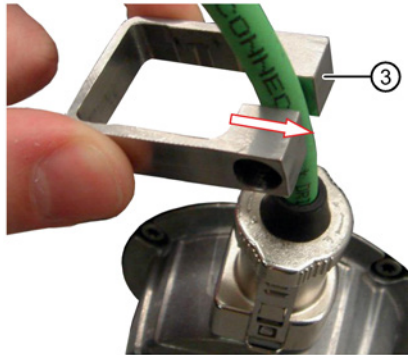
The following procedure describes the securing of an RJ45Plus connection.

Securing an RJ45Plus connection



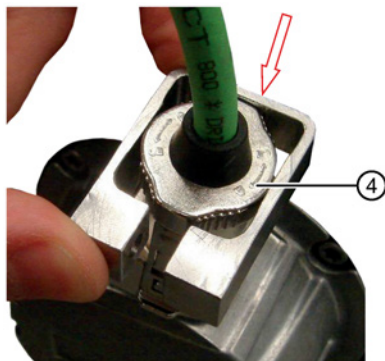
Procedure

1. Mount and lock the RJ45Plus connector
2. Push the loosening protection over the signal connector.



3 Loosening protection

3. Turn the loosening protection over the connector. Push the loosening protection further over the connector locking as shown in the following figure.

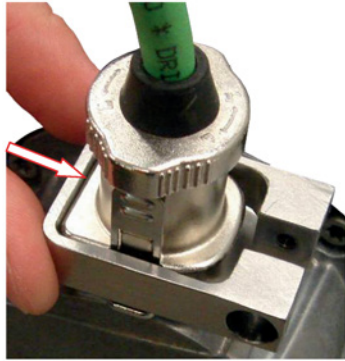


4 Latching the connector

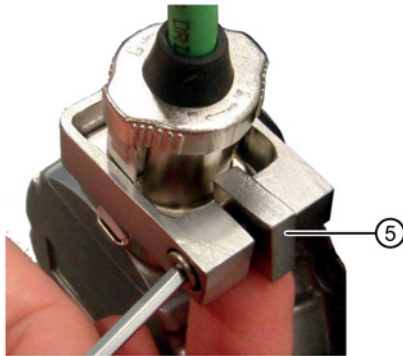
4. Push the loosening protection further down, while turning the loosening protection through 90°.

NOTICE
Unintentional unlatching of the RJ45Plus connector
By turning the loosening protection, the RJ45Plus connector can be unlatched unintentionally.
<ul style="list-style-type: none">• Ensure when turning the loosening protection that the RJ45Plus connector has not unlatched.

Position the connector as shown in the following figure.



5. Insert the supplied screw through the loosening protection and the supplied spacer. Tighten the screw slightly.

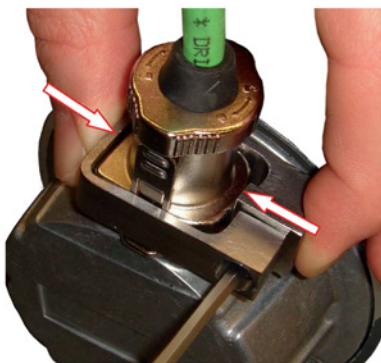


5 Supplied spacer

6. Position the spacer and the loosening protection correctly, and tighten the screw.

Note

The loosening protection and the spacer must be placed tightly on the connector.
The spacer must be securely clamped.



You have secured the RJ45Plus connector against being loosened unintentionally.

5.4.2 Connecting to a converter

Selecting and connecting the cables

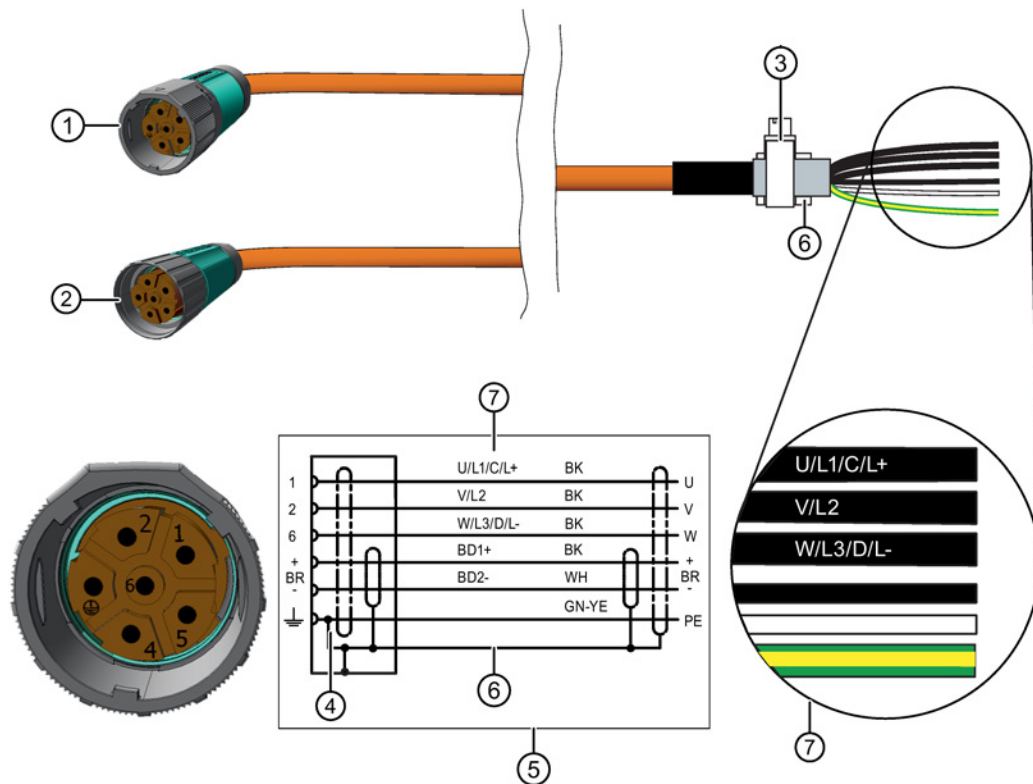
- To connect the motor to a converter, use MOTION-CONNECT cables or shielded connecting cables.

Note

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

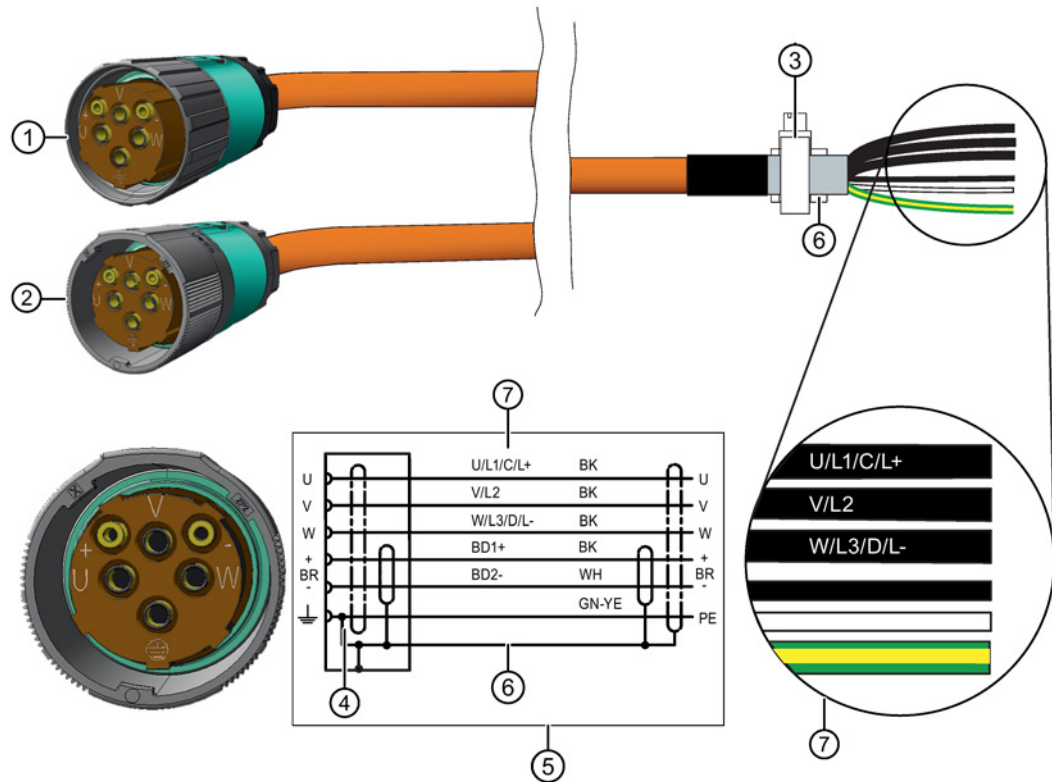
Connection scheme for the motor to the S120 Power Module and Motor Module Booksize and Compact with a MOTION CONNECT cable

For connector size 1



- 1 Connector, size 1
- 2 SPEED CONNECT connector, size 1
- 3 Terminal for the cable shield
- 4 Pin assignment
- 5 Circuit diagram
- 6 Cable shield
- 7 Conductor designation:
 U, V, W = power cables, 1.5 mm², each cable separately shielded
 BD1+ and BD2- = brake cable without lettering, 1.5 mm², shared shield
 PE = protective conductor

For connector size 1.5



- 1 Connector, size 1.5
- 2 SPEED CONNECT connector, size 1.5
- 3 Terminal for the cable shield
- 4 Pin assignment
- 5 Circuit diagram
- 6 Cable shield
- 7 Conductor designation:
 U; V; W = power cables, each cable separately shielded
 BD1+ and BD2- = brake cable without lettering, 1.5 mm², shared shield
 PE = protective conductor

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

5.4.3 Connecting the forced ventilation

The fan connection is a size 1 power connector.

Table 5- 10 Connection data for external fans for 1FK7

Shaft height	Max. current consumption at	
	230 V / 50 Hz (±10 %) [A]	230 V / 60 Hz (±10 %) [A]
80	0.40 A	0.45 A

Note the following information regarding connections:

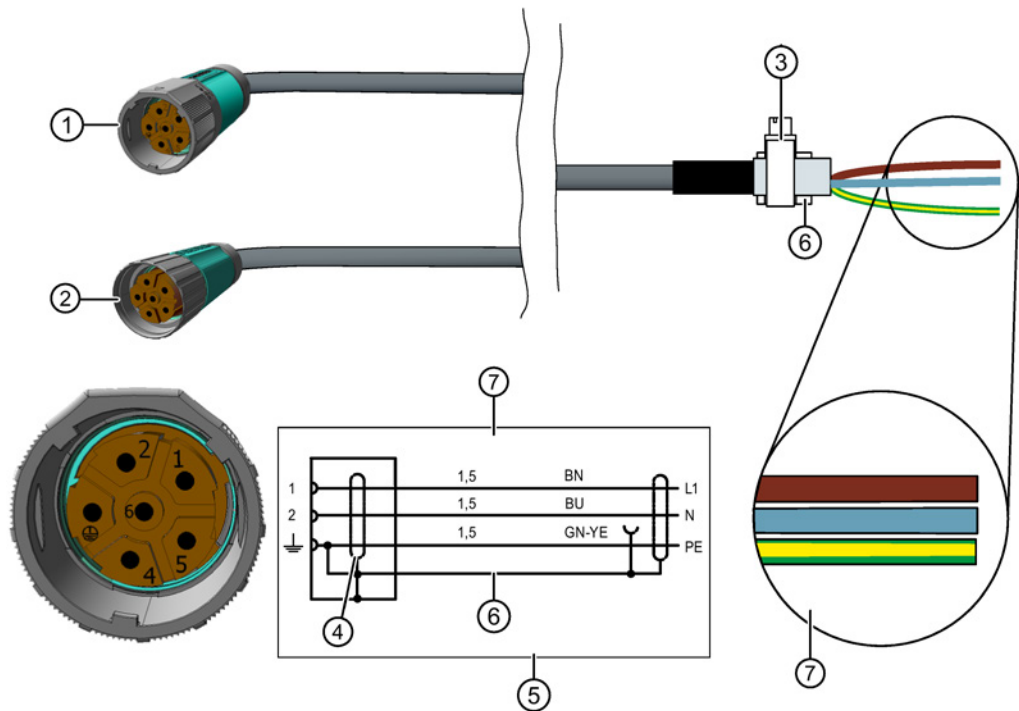
- Only use cables that comply with the relevant installation regulations regarding voltage, current, insulation material, and load-carrying capacity.
- Before connecting the device, make sure that the line voltage matches the device voltage.
- Check whether the data on the fan rating plate matches the connection data.
- Connection cables must not be subjected to excessive tensile stress.

NOTICE

Damage to the fan when inappropriately operated

The fan can be destroyed if inappropriately operated.

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



- 1 Connection plug size 1 (with full thread)
- 2 SPEED CONNECT connection plug size 1
- 3 Terminal for the cable shield
- 4 Pin assignment
- 5 Circuit diagram
- 6 Cable shield
- 7 Conductor designation:
L1, N = power cable, 1.5 mm²
PE = protective conductor

Figure 5-5 1-phase connection of external fan

Table 5- 11 Order numbers

	Order number (article number)
Connector size 1 with full thread	6FX2003-0LU00
Connector size 1 with SPEED-CONNECT	6FX2003-0LU30
Prefabricated cable with full thread	6FX5001-5CG10-□□□□ ¹⁾
Prefabricated cable with SPEED-CONNECT	6FX5002-5CG10-□□□□ ¹⁾ 6FX8002-5CG10-□□□□ ¹⁾

¹⁾ The last 4 positions are the length code. Additional information is contained in Catalog D 21.4 (2017), page 12/7 ff.

Link to the catalogD 21.4 (<https://intranet.for.siemens.com/org/i-dt-mc/en/motion-control/support/marketing-materials/catalogs/d-21-4-sinamics-s120-simotics/Pages/d-21-4.aspx#>)

5.4.4 Connecting the holding brake

Direct connection

The holding brake in the motor is intended for direct connection to the SINAMICS converter using the MOTION CONNECT power cable with an integrated brake connection cable. See Chapter "Connecting to a converter (Page 78)"

Connection to external power supply

The holding brake can be operated via an external power supply.

The external power supply can be a PELV (PELV = Protective Extra Low Voltage) supply:

- if safe electrical isolation from the motor winding is guaranteed for the brake cable in the motor and
- if the power cable has a reinforced insulation.

Note

The relay K1, located between coil and contact, must also have reinforced insulation to protect the internal logic voltage.

If you control the holding brake via an external power supply, you must protect the holding brake from voltage peaks with a protective circuit. See figure "Suggested circuit for the external power supply"

The protective circuit also ensures the specified switching times. See table "Technical data for the the holding brake used" in the associated Configuration Manual.

To ensure reliable opening of the motor holding brake, it requires a 24 V ± 10% voltage supply at the motor connection.

It must be taken into account that voltage dips can occur along the supply cable.

- Use a Control Supply Module (CSM) or a regulated DC power supply, whose setpoint is set to 26 V.
- Use supply cables with a minimum cross-section of 1.5 mm² and a maximum length of 100 m.

If the maximum voltage of 24 VDC +10% is exceeded, the brake can re-close.

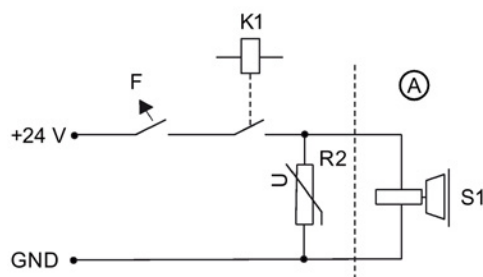
You can calculate the voltage drop ΔV for copper cables approximately as follows:

$$\Delta U [V] = 0.042 \times (l/q) \times I_{brake}$$

l = Cable length [m]
 q = Brake core cross-section [mm²]
 I_{brake} = Direct current of the brake [A]

Note

Integrate a protective circuit into the incoming cable. In this way, you avoid switching overvoltages and possible influence of the installation environment. See the figure below



- A Motor
- K1 Contactor
- F Circuit-breaker
- S1 Holding brake
- R2 Varistors

Figure 5-6 Suggested circuit for the external power supply with protective circuit

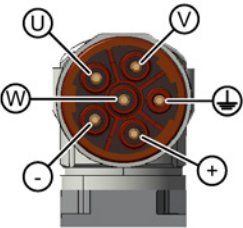
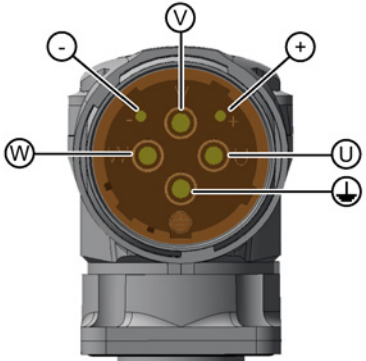
Table 5- 12 Example: Electrical components for the suggested circuit

Electrical component	Examples		
F	3RV10 circuit-breaker with current paths connected in series (if required with mounted auxiliary contact 3RV1901 to provide a feedback signal for the drive).	or	Miniature circuit-breaker 5SX21 (if required with mounted auxiliary contact to provide a feedback signal for the drive).
K1	Auxiliary contactor 3RH11	or	Contactors 3RT10
R2	Varistor SIOVS14K30 (EPCOS)		

5.4.5 Line connection

Connector types

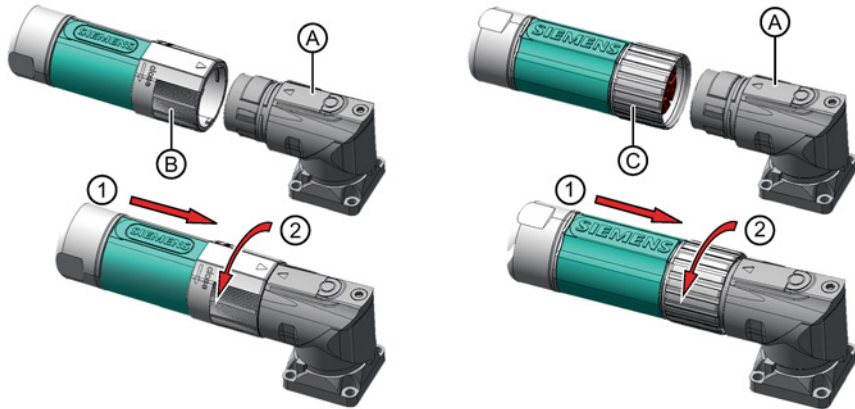
Table 5- 13 Line connection

Connector size 1	Connector size 1.5
	
+ = BD1+; - = BD2-	

The motors can be connected via a quick-release lock (SPEED-CONNECT).

The motor connectors are designed in such a way that both the quick-release lock cables with SPEED-CONNECT and the conventional cables with screw-type connection can be used.

Handling plug-in connections



- A Motor connector, suitable for SPEED-CONNECT and screw lock
- B Connector with SPEED-CONNECT
- C Connector with screw lock
- 1 Connect together
- 2 Lock or tighten by hand

See also

Connection notes for motors with M03 and M39 (Page 73)

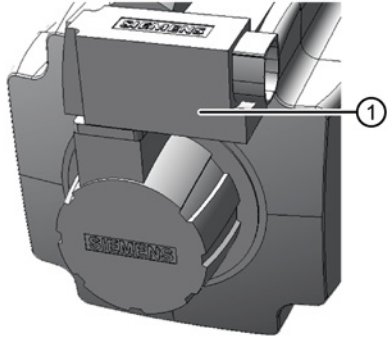
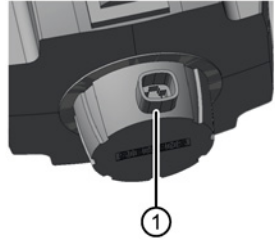
5.4.6 Signal connection

5.4.6.1 Motors with DRIVE-CLiQ interface

Motors designed for SINAMICS drive systems have an integrated encoder and temperature evaluation system as well as an electronic rating plate.

The motors are connected to the converter system via a DRIVE-CLiQ interface.

The following variants are possible for the DRIVE-CLiQ connection:

10-pin RJ45plus socket (SMI)	10-pin RJ45plus socket (DQI)
	
1 SMI with 10-pin RJ45plus socket	1 10-pin RJ45plus socket

The DRIVE-CLiQ interface supplies the motor encoder with power via the integrated 24 VDC power supply. The DRIVE-CLiQ interface transfers the motor encoder and temperature signals and the electronic rating plate data, e.g. a unique identification number, rating data (voltage, current, torque) to the Control Unit.

Motors with a DRIVE-CLiQ interface are connected to the associated Motor Module with a MOTION-CONNECT cable, see Chapter "Connecting the RJ45 DRIVE-CLiQ connector (Page 86)".

NOTICE

Damage to electronic components as a result of electrostatic discharge

The Sensor Module has direct contact with electrostatic sensitive devices that can be damaged or destroyed by electrostatic discharge (ESD).

- Ensure the ESD protection measures are taken (see Handling electrostatic sensitive devices (ESD) (Page 18)).
- Only grounded personnel with grounded tools may touch the component connections.
- Heed the EMC information provided by the manufacturer of the converter.

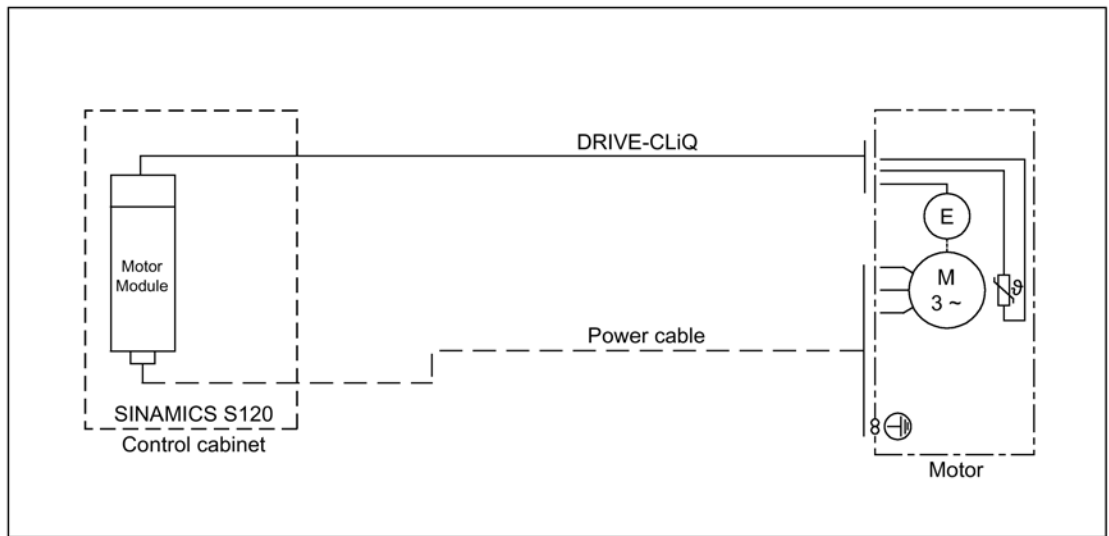
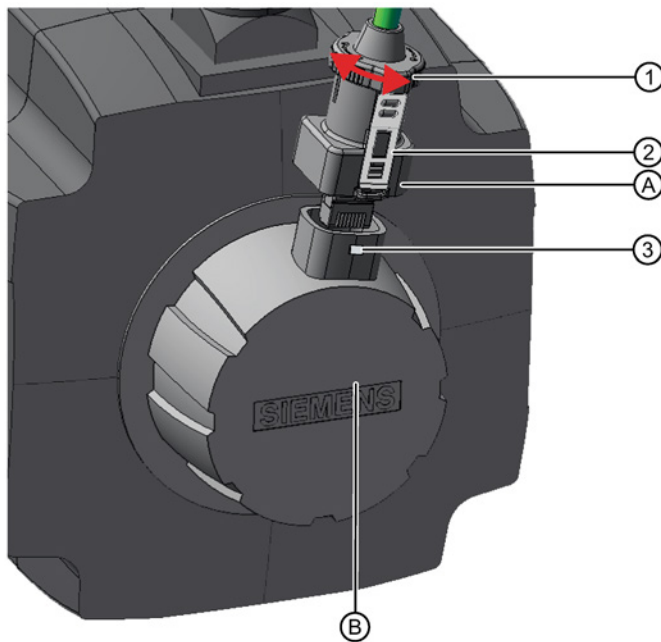


Figure 5-7 Encoder interface with DRIVE-CLiQ

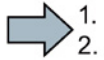
5.4.6.2 Connecting the RJ45 DRIVE-CLiQ connector

The DRIVE-CLiQ connection method with the RJ45 connector has the following components:



- A DRIVE-CLiQ connector with RJ45Plus
- B DRIVE-CLiQ socket with RJ45plus
- 1 Rotatable locking ring
- 2 Tabs (2, opposite each other)
- 3 Latches (2, opposite each other)

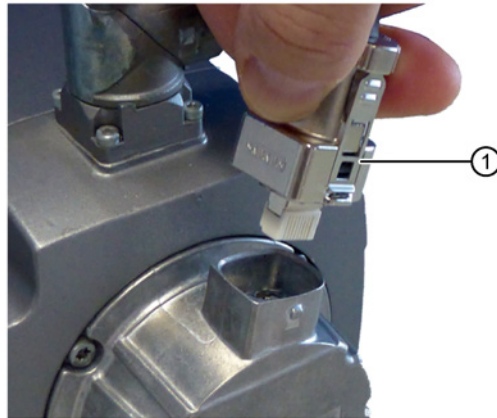
Insertion



1. Check whether the locking ring of the connector is in the "locked" position. If not, turn the locking ring clockwise into the "locked" position.

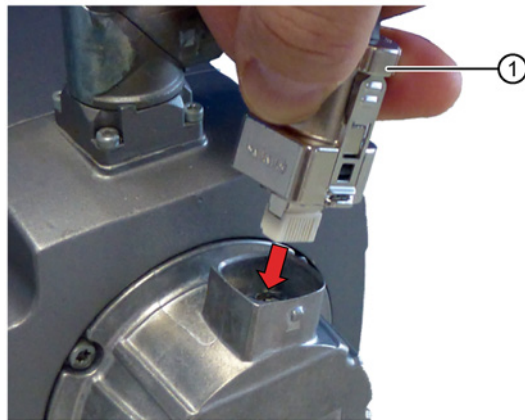
Note

In the "locked" position, the tabs are flush against the connector.



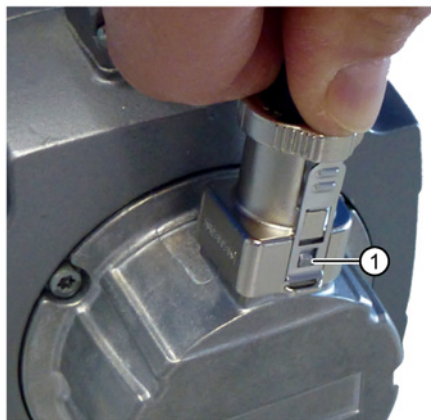
- 1 Locking ring in the "locked" position

2. Insert the connector into the RJ45 socket of the Sensor Module.



- 1 The locking ring remains in the "locked" position.

3. Check that the two tabs are engaged in both latches on the socket and that the connector cannot be pulled out.



1 Both tabs must engage in both latches.



The correct DRIVE-CLiQ connection is made when

- the locking ring is in the "locked" position,
- both tabs are engaged in both latches.

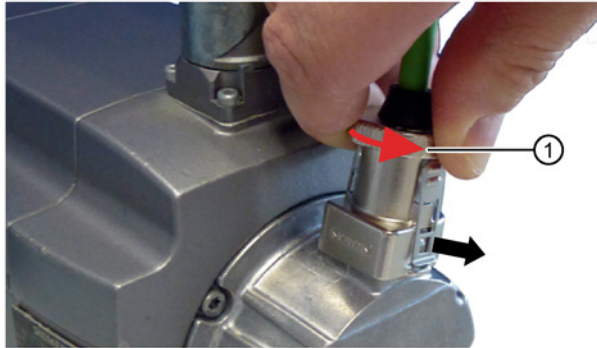


You have made a DRIVE-CLiQ connection.

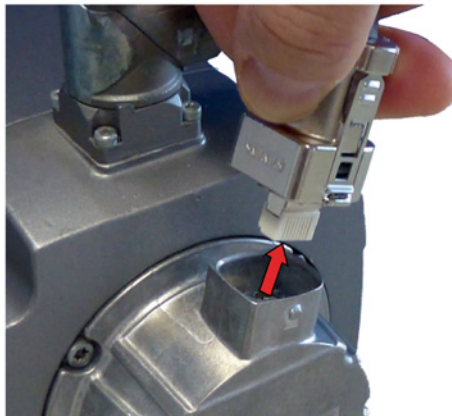
Removal

- ➔ 1.
- 2.

1. Turn the locking ring of the connector counterclockwise into the "unlocked" position.



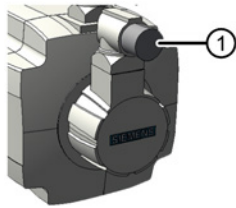
- 1 Turn the locking ring counterclockwise.
→ Both tabs are pressed away by the latches.
2. Check that the two tabs are disengaged from the latches.
3. Pull the connector out of the RJ45 socket of the Sensor Module.



You have released the DRIVE-CLiQ connection.

5.4.6.3 Motors without a DRIVE-CLiQ interface

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



1 Signal connector

Figure 5-8 Motor with a signal connector

Motors without DRIVE-CLiQ require a Sensor Module Cabinet (SMC) for operation with a SINAMICS S120 drive system. The motor is connected to the SMC via a signal cable. The SMC is connected to the motor via a MOTION-CONNECT cable.

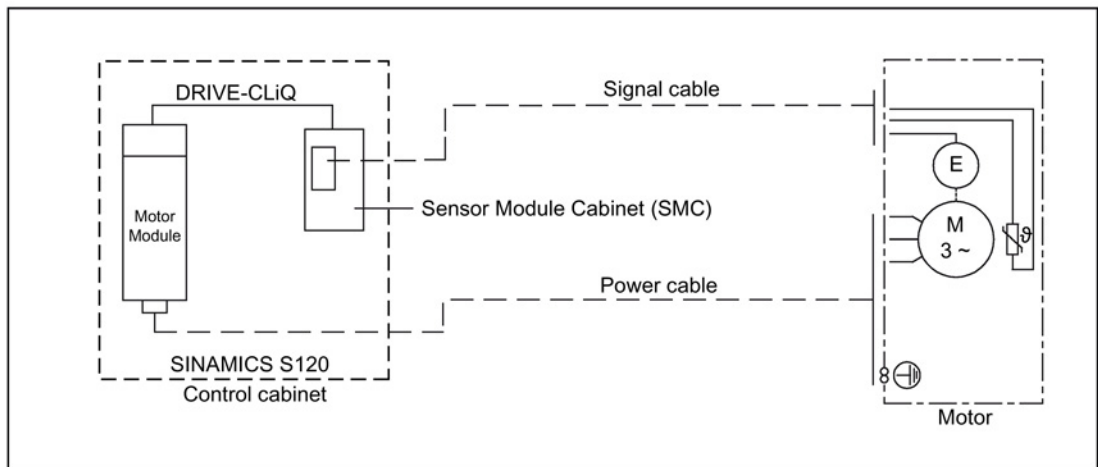

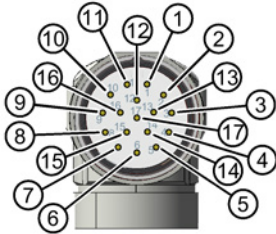


Figure 5-9 Encoder interface without DRIVE-CLiQ

5.4.6.4 Signal connector version

Signal connector versions without DRIVE-CLiQ

Pin assignment, 12-pin signal connector	Pin assignment, 17-pin signal connector	
		
Resolvers	Incremental encoder sin/cos 1Vpp	Absolute encoder
1 = S2	1 = A	1 = A
2 = S4	2 = A*	2 = A*
3 = not connected	3 = R	3 = data
4 = not connected	4 = D*	4 = not connected
5 = not connected	5 = C	5 = clock
6 = not connected*	6 = C*	6 = not connected
7 = R2	7 = M encoder	7 = M encoder
8 = +1R1	8 = +1R1	8 = +1R1
9 = -1R2	9 = -1R2	9 = -1R2
10 = R1	10 = P encoder	10 = P encoder
11 = S1	11 = B	11 = B
12 = S3	12 = B*	12 = B*
	13 = R*	13 = data*
	14 = D	14 = clock*
	15 = M sense	15 = M sense
	16 = P sense	16 = P sense
	17 = not connected	17 = not connected

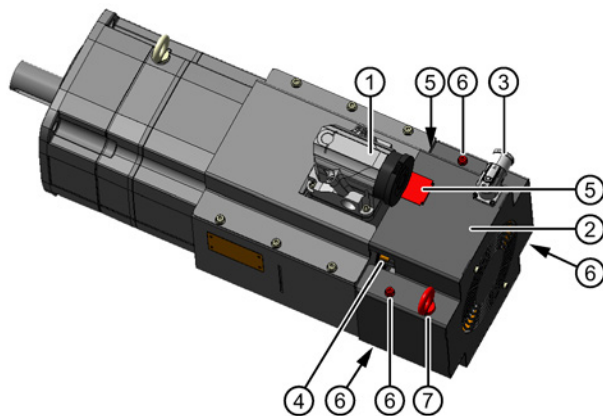
5.4.6.5 Connecting the signal line on a motor with forced ventilation

Connecting the signal cable on a motor with forced ventilation up to shaft height 100

Note the following information regarding connections:

- Use only cables that comply with the installation regulations.
- Signal lines must not be subjected to excessive tensile stress.

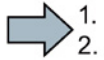
⚠ CAUTION
Danger of injury caused by the unintentional starting of the fan
If the fan starts in the dismantled state, it can cause injuries.
<ul style="list-style-type: none">• Disconnect the fan from the line supply before you dismantle it.



- 1 Motor power connector, e.g. size 3
- 2 Fan cover
- 3 Connection plug of the fan
- 4 Signal connector on the encoder
- 5 Sealing caps of the cable gland
- 6 4 hexagon socket-head screws with washer for fastening the fan cover
- 7 Lifting eyebolt

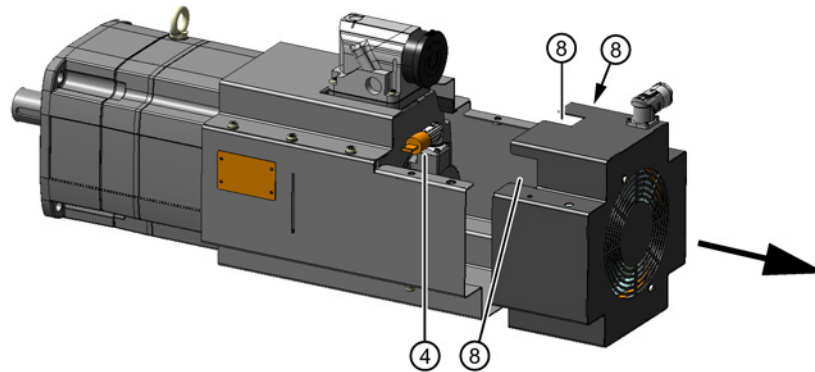
Figure 5-10 Forced ventilation parts

Procedure



- 1.
- 2.

1. Remove the 4 screws (6) of the fan cover (2) and the lifting eyes (7).



- 4 Signal connector on the encoder
- 8 3 cable glands on the fan cover

2. Remove the fan cover (2).
3. Align the signal connector (4), at 90° to the motor axis left or right.
4. Connect the signal connector (4).
5. Close the superfluous cable glands (8) with the sealing caps (5).
6. Mount the fan cover (2) with the screws (6) (tightening torque 9 Nm). Secure all screw connections against autonomous loosening, e.g. with Loctite 243. Reattach any lifting eyes.


To remove the fan cover and connect the signal connector when the motor is installed, you require a minimum clearance of 125 mm.





You have connected the signal cable.


Commissioning


6.1 Safety instructions


 WARNING
Danger to life as a result of hazardous voltages when connected to inadequately grounded line supplies
Connecting a motor to an inadequately grounded line supply can result in death, severe injury and damage to the motor if a fault occurs.
<ul style="list-style-type: none">• Connect motors, as part of the drive system, to TN and TT line supplies with a grounded neutral point or to IT line supplies.• Ensure that the SINAMICS devices and motors are compatible with the residual current device according to EN 61800-5-1 before you connect the devices and motors to the line supply using residual current devices (RCDs).• For line supplies with grounded line conductor, e.g. TT line supplies, use an isolating transformer with grounded neutral point (on the secondary side) between the line supply and the drive system, so that the motor insulation is not overstressed.• When connected to IT line supplies, a monitoring device must signal the first fault between an active part and ground. Eliminate this fault immediately.

 WARNING
Danger to life due to high touch voltages for brake cables
For motor cables with integrated brake cable, when the motor is operated, the motor can charge the brake cable up to hazardous voltage levels. Coming into contact with the conductors or the shield of the brake cable can result in death or serious injury.
<ul style="list-style-type: none">• Use motor cables with separate, shielded brake cables and connect the shield of the brake cable at both ends.

 WARNING
Danger to life caused by dangerous voltage while testing the insulation resistance During the measurement and immediately afterward, high voltages can be present at the terminals that can cause death or severe injury as result of an electric shock. Contact with live parts causes electric shocks. <ul style="list-style-type: none">• Work on power installations must only be performed by qualified personnel.• Before measuring the insulation resistance, read the manual for the insulation resistance meter you are going to use.• Never touch the terminals when making measurements or immediately after the measurement.• Check the connected supply feeder cables to ensure that the line supply voltage cannot be connected.

 WARNING
Danger to life due to unintentional starting of the drive unit Unintentional starting of the drive unit can cause death or severe injury. <ul style="list-style-type: none">• Make sure that the drive unit cannot be started accidentally.• Post a warning notice to this effect at the point where the switch is located.

 WARNING
Danger to life caused by machine movement and loose objects Machine movement and loose objects that can fall out or be ejected can cause death or severe injury. <ul style="list-style-type: none">• Ensure that the machine has been completely installed and all of the setting work completed.• Ensure that nobody is at risk when the machine is switched on.• Before switching on, check that there are no loose objects in or on the motor that can fall or be flung off.• Before switching on, check that all safety guard covers are installed and all safety equipment functions correctly.

 CAUTION
Burns as a result of touching hot surfaces In operation, the motor enclosure can reach high temperatures, which can cause burns if touched. <ul style="list-style-type: none">• Do not touch any hot surfaces.• Allow the motor to cool down before starting any work.• Use the appropriate personnel protective equipment, e.g. gloves.

NOTICE

Thermal damage to temperature-sensitive parts

Some parts of the frame of electric motors can reach temperatures that exceed 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.

NOTICE

Motor damage when the maximum speed is exceeded

The maximum speed n_{\max} is the highest permissible operating speed. The maximum speed is specified on the rating plate.

Impermissible speeds can cause damage to the motor.

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

NOTICE

Motor damage caused by uneven running or abnormal noise

The motor can be damaged by improper handling during transport, storage or installation. If a damaged motor is operated, this can damage the winding or bearings and could even destroy the system.

- In case of uneven running or abnormal noise, switch off the motor.
- Identify the cause.

NOTICE

Premature wear of the motor holding brake when operated outside its permissible voltage range

Operating the motor holding brake outside its permissible voltage range at the motor connection will damage the brake.

- Ensure that the motor holding brake is only operated within its permissible voltage range.

6.2 Checklists for commissioning

Note

Required checks

The lists below do not purport to be complete. It may be necessary to perform additional checks and tests appropriate for the situation specific to the particular installation site.

Before commissioning the system, check that it is properly installed and connected.

Commission the drive system according to the Operating Instructions of the converter or inverter being used.

Checklists for commissioning 1FK7 motors

Thoroughly familiarize yourself with the safety instructions and observe the checklists below before starting any work.

Table 6- 1 Checklist (1) - general checks

Check	OK
Are all of the necessary components of the configured drive line-up available, correctly dimensioned, installed and connected?	
Are the manufacturer's documentation for the system components (e.g. drive system, encoder, brake, cooling system) and the "SIMOTICS S-1FK7 servo motors" Configuration Manual available?	
If the 1FK7 motor is operated on the SINAMICS S120 drive system: Is the following, current SINAMICS documentation available? <ul style="list-style-type: none"> • SINAMICS S120 Commissioning Manual • Getting Started S120 • S120 Function Manual • S120/150 List Manual 	
If the 1FK7 motor is operated on the SINAMICS S120 drive system: Was the Chapter "Checklists for commissioning SINAMICS S" in the SINAMICS S120 Commissioning Manual carefully observed?	
Is the motor type to be commissioned known? (e.g. 1FK7 _ _ _ _ - _ _ _ _ _ - _ _ _ _)	
Are the environmental conditions in the permissible range?	

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

Check	OK
Have all touch protection measures for moving and live parts been fitted and are they functional?	
Has the motor been correctly mounted and aligned?	
Can you rotate the rotor without it touching the stator?	
Have all fastening screws, fastening elements, and electrical connections been tightened with the prescribed torques and properly attached?	
Do the operating conditions correspond to the data specified on the rating plate?	
Do the output elements have the correct setting conditions according to type? Examples: <ul style="list-style-type: none"> • Have the couplings been aligned and balanced? • Has the belt drive tension been correctly adjusted? • Have the gear tooth flank and gear tooth tip play as well as radial play been correctly adjusted for geared outputs? 	

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

Check	OK
Has the motor been connected so that it rotates in the specified direction?	
Have the minimum insulation resistance values been maintained?	
Have the grounding and equipotential bonding connections been correctly established?	
Is the specified limit speed n_{max} maintained during the operation on the converter?	

Table 6- 4 Checklist (4) - Monitoring equipment checks

Check	OK
Has it been ensured that speeds higher than the maximum speed n_{max} cannot be reached?	
Have all supplementary motor monitoring devices been correctly connected and are they working properly?	

Table 6- 5 Checklist (5) - Cooling system checks

Check	OK
<p>Natural cooling Have you adjusted the torque or the power of the motor at the converter based on the table in Chapter "Derating factors (Page 28)"? Follow the Operating Instructions of the converter.</p>	
<p>Forced ventilation Have you checked all safety-related and functionally relevant details? Examples:</p> <ul style="list-style-type: none"> • Have you compared the data of the external cooling unit with the connection data? Connect the external cooling unit only if the supply data does not result in an overload condition. • Has the forced ventilation unit, including accessories, been correctly installed, e.g. fitting of the protective conductor? • Are the mechanical installation and electrical installation of the safety-related components correct? This includes the installation of the motor circuit-breaker and the fitting of protective grilles, for example. • Are the cable entry glands correctly fitted and tight? • Are the fan air intake and the area around the fan blades free of foreign bodies? • Is the fan rotation direction correct? An arrow is stamped on the fan rating plate. This arrow indicates the correct direction of rotation of the fan. An arrow is also marked on the fan blades. When the fan starts, you can check the direction of rotation using the arrows. The fan is functioning correctly if the direction of rotation of the blades matches the direction of the arrow on the fan rating plate. 	
Can the motor only be switched on when the fan is running?	

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

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

6.3 Commissioning procedure

Procedure



1. • Ensure that the frequency converter is correctly parameterized.
2. • Commission the motor with an appropriate commissioning tool, e.g. "Drive ES" or "STARTER".
- Follow the steps of the commissioning tool.



You have commissioned the motor.

Switching off

- Switch off the motor at the frequency converter.

6.4 Switching on and switching off

Note**EMERGENCY OFF**

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

The motor is switched on and off using the frequency converter.

- For more information on this topic, see the chapter in the Operating Instructions for the converter.

Before switching on

- Ensure that the frequency converter is correctly parameterized.
- Check whether sufficient heat is dissipated from the motor.



1.
2.

Switching on

1. Switch on the motor at the frequency converter.
2. Observe any uneven running and abnormal noise of the motor.
3. Check the function of the safety equipment.
4. Check whether the motor reaches the required parameters





You have switched on the motor.


Switching off

- Switch off the motor at the frequency converter.

7.1 Safety instructions

 WARNING
Do not remove covers when the motor is running Rotating or live parts are dangerous. Death, serious injury, or material damage can result if the required covers are removed. All covers that prevent personnel from coming into contact with active or rotating parts, ensure compliance with the required degree of protection, or ensure proper air guidance and, in turn, effective cooling must not be opened/removed during operation.

 WARNING
Faults in operation Deviations from normal operation (e.g. increased power consumption, temperature, or vibration levels, unusual noises or smells, tripping of monitoring equipment, etc.) indicate that the machine is not functioning properly. This can cause faults that can result in eventual or immediate death, severe personal injury, or material damage. Immediately inform the maintenance personnel. If in doubt, shut down the motor immediately, taking into account the plant-specific safety regulations.

 CAUTION
Danger of burns The temperature of certain parts of the motor can exceed 100 °C. Physical contact can cause serious burns. Check the temperature of the parts before touching them and take appropriate protective measures if necessary.

7.2 Switching on and switching off

Note

EMERGENCY OFF

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

The motor is switched on and off using the frequency converter.

- For more information on this topic, see the chapter in the Operating Instructions for the converter.

Before switching on

- Ensure that the frequency converter is correctly parameterized.
- Check whether sufficient heat is dissipated from the motor.



1.
2.

Switching on

1. Switch on the motor at the frequency converter.
2. Observe any uneven running and abnormal noise of the motor.
3. Check the function of the safety equipment.
4. Check whether the motor reaches the required parameters



You have switched on the motor.

Switching off

- Switch off the motor at the frequency converter.

7.3 During operation

While the motor is operating, ensure that the specified parameters are maintained.

Make sure that:

- The power consumption is in the specified range
- Cooling is ensured
 - With forced ventilation: Check that the heat can dissipate freely
- There is no abnormal motor noise
- The motor does not overheat
- If available, the sealing air intake functions

Note

Observe the maintenance intervals

Service the motor at the prescribed maintenance intervals. (see Chapter "Maintenance and inspection intervals (Page 114)")

7.4 Stoppages

Measures for stationary motors that are ready for operation

- Operate the motor regularly, at least once a month, in the event of longer non-operational periods.

NOTICE
Damage due to improper storage
The motor can be damaged if it is not stored properly.
<ul style="list-style-type: none">• If the motor is out of service for extended periods of time, apply suitable anti-corrosion, preservation, and drying measures.

- For longer non-operational periods carefully read the notes in Chapter "Storage (Page 52) ".
- When recommissioning after long non-operational periods, perform the checks and measures listed in Chapter, " Commissioning (Page 95) ".
- Observe Chapter "Switching on and switching off (Page 101)" before switching on to recommission the system.

Faults and their rectification

⚠ WARNING
Danger to life for operation without functioning protective devices
Operation without functioning protective devices can cause death or severe injury.
<ul style="list-style-type: none"> Operate the motor, even in test operation, only with functioning protective devices.

NOTICE
Damage to the motor caused by faults
Faults can cause damage to the motor.
<ul style="list-style-type: none"> Correct the cause of the fault as specified in the remedial measures. Repair any damage to the machine/motor.

Note
On occurrence of electrical faults, observe the notes in the frequency converter documentation.

- If there are deviations from normal operation or if faults occur, initially proceed according to the following list.
- In this regard, observe the relevant chapters in the documentation associated with the components of the complete drive system.

Table 8- 1 Possible faults

Fault	Fault cause (see "Fault causes and remedial measures" key table)															
Motor does not start	A	B														
Motor starts slowly	A		C		F											
Humming sound when starting			C		F											
Humming sound in operation	A		C		F											
High temperature rise under no-load operation				D				I								
High temperature rise under load	A		C					I								
High temperature rise of individual winding sections					F											
Uneven running									J	K						
Grinding sound, running noise											L					
Radial vibrations												M	N	O	P	R
Axial vibrations														O	Q	R

Table 8- 2 "Fault causes and remedial measures" key table

No.	Cause of fault	Remedial measures
A	Overload	Reduce load
B	Interruption of a phase in the supply cable / motor winding	Check the frequency converter and supply cables, measure the winding resistances and insulation resistances, repair after consultation with manufacturer
C	Interrupted phase in the feeder cable after switching on	Check the frequency converter and supply cables/check the winding resistances
D	Converter output voltage too high, frequency too low	Check the settings on the frequency converter, perform automatic motor identification
F	Winding short-circuit or phase short-circuit in stator winding	Measure the winding resistances and insulation resistances, repair after consultation with manufacturer
I	Heat dissipation impeded by deposits	Clean the surface of the drives and ensure that the cooling air can flow in and out unimpeded
	Cooling air inlet/outlet is blocked by foreign bodies	Remove the block and ensure that the cooling air can flow in and out unimpeded
	Fan motor does not start	Check the fan motor to ensure that it is functioning correctly
J	Insufficient shielding for motor and/or encoder cable	Check the shielding and grounding
K	Excessive drive controller gain	Adjust the controller
L	Rotating parts are grinding	Determine cause and adjust parts
	Foreign bodies inside the motor	Send to manufacturer for repair
	Bearing damage	Send to manufacturer for repair
M	Rotor not balanced	Decouple rotor and rebalance
N	Rotor out of true, shaft bent	Consult the manufacturer
O	Poor alignment	Align motor set, check coupling
P	Coupled machine not balanced	Re-balance coupled machine
Q	Shocks from coupled machine	Check coupled machine
R	Fault originating from the gear unit	Adjust/repair gear unit

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

9.1 Safety instructions

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

WARNING

Danger to life when live parts are touched

Death or serious injury can result when live parts are touched.

- Only work on electrical equipment if you are appropriately qualified.
- Always comply with the local national safety regulations when working on electrical equipment.

Generally, six steps apply when establishing safety:

1. Prepare for shutdown and notify all those who will be affected by the procedure.
2. Disconnect the machine from the power supply.
 - Switch off the machine.
 - Wait until the discharge time specified on the warning labels has elapsed.
 - Check that it really de-energized, from phase to phase and phase to protective conductor.
 - Check that every auxiliary circuit is de-energized.
 - Ensure that the motors cannot move.
3. Secure SIMOTICS S motors against unintentional movements that generate a voltage at the terminals.
4. Identify all other dangerous energy sources, e.g. compressed air, hydraulic systems or water.
5. Isolate or neutralize all hazardous energy sources, for example by closing switches, grounding or short-circuiting, or closing valves.
6. Take measures to prevent reconnection of the energy sources.
7. Make sure that the machine is completely locked ... and that you have the right machine.

After you have completed the work, restore operational readiness by performing the above steps in the reverse order.

 **WARNING**

Danger to life due to slipping on leaked oil

Leaked oil can result in slipping or falling and cause death or severe injury.

- Prevent oil from leaking
- Absorb leaked oil immediately with a binding agent for oil or similar.
- Rough up the hazardous location.
- Mark the hazardous location.

 **WARNING**

Danger to life due to unintentional starting of the drive unit

Unintentional starting of the drive unit can cause death or severe injury.

- Make sure that the drive unit cannot be started accidentally.
- Post a warning notice to this effect at the point where the switch is located.

 **CAUTION**

Burning hazard caused by hot surfaces

Some parts of the frame of electrical machines can reach temperatures in excess of 100°C. Touching components when the machine is in operation can cause burns.

- Do not touch frame parts while the machine is in operation or immediately after machine operation.
- Allow frame parts to cool off before starting any work.

 **CAUTION**

Danger of scalding from the hot oil exiting the unit

Exiting hot oil can cause burns.

- Before starting any work, wait until the oil has cooled down to below 30° C.

 **CAUTION**

Chemical burns and irritations caused by chemical cleaning agents

Chemical cleaning agents can be caustic or emit dangerous fumes. If these come into contact with skin or if you inhale the fumes, this can cause injuries (e.g. chemical burns on the skin or respiratory passages, or skin irritation).

- During cleaning, make sure that appropriate methods of extracting fumes are in place and that you wear the appropriate protective gear (e.g. gloves, goggles, face masks).
- If using chemical cleaning agents, observe the instructions and any warnings provided in the relevant safety data sheet. Chemical cleaning agents must be suitable for use with the machine's components, particularly where plastic components are concerned.

⚠ CAUTION**Injuries caused by stirred-up foreign bodies and dust when working with compressed air**

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

- When cleaning using compressed air, make sure you use suitable extraction equipment and wear protective equipment (safety goggles, protective suit, etc.).

⚠ WARNING**Danger to life when lifting and transporting**

Incorrect lifting and transport operations, devices and equipment that are unsuitable or damaged can result in death, severe injury and/or damage to property.

- Lifting devices, ground conveyors, and load suspension equipment must comply with requirements.
- The maximum capacity of the lifting equipment and the load suspension device must correspond to the weight of the motor (see the rating plate).
- Do not attach any additional loads to the lifting equipment.
- To hoist the motor, use suitable cable-guidance or spreading equipment, particularly if the motor is equipped with built-on assemblies.
- The motor must not be lifted or transported by means of the power connector or signal connector.
- Do not stand in the slewing range of hoisting gear or under suspended loads.

⚠ WARNING**Danger to life through incorrect or unused lifting points**

Due to incorrect or unused lifting points, the motor can fall and cause death, severe injury and/or damage to property.

- Lift and transport large motors using the eyebolts screwed on to the end shields.
- Completely screw in the eyebolts and tighten by hand (approx. 8 Nm).
- Do not use bent or damaged eyebolts.
- Only use eyebolts with laminated fiber washers.
- Loads applied transversely to the plane of the eyebolts are not permitted.

⚠ WARNING**Danger of injury due to suspended loads**

While being transported, the motor can cause injury by moving.

- Only use perfectly functioning hoisting and load suspension equipment dimensioned to carry the motor load.
- Do not stand under suspended loads or in their slewing range.
- When placing down the motor, ensure that it cannot roll.

9.2 Inspection and maintenance

9.2.1 Maintenance and inspection intervals

General

Carry out maintenance work, inspections and revisions at regular intervals in order to be able to identify faults at an early stage and remove them.

Note

Inspection if there are faults or unusual conditions

Unusual conditions or faults that represent overstressing of the motor, e.g. overload or short-circuit, can result in consequential damage to the machine.

Immediately perform an inspection when faults or exceptional conditions occur.

Maintenance measures, inspection/maintenance times intervals

The maintenance intervals depend on the operating conditions.

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

Maintenance and repair of the motor can be performed by Siemens Service Centers throughout the world.


Contact your personal Siemens contact if you require this service.


NOTICE
Improper maintenance
Service and maintenance must only be performed by properly authorized qualified personnel.
Only use original SIEMENS parts.

Table 9- 1 Maintenance measures after operating times or intervals

Operating times and intervals	Measure
Operation	
Daily; if possible, more frequently during operation.	Monitor and check the motor for unusual noise, vibrations, and changes.
After approx. 10,000 operating hours, at the latest after two years	If oil-lubricated, replace the radial shaft seal rings
As required, or after 25,000 operating hours	Replace the motor bearings

9.2.2 Cleaning

 WARNING
Danger to life when cleaning due to failure to observe the protection class
When cleaning, especially with high-pressure cleaning equipment, water can enter energized parts and cause an electric shock.
<ul style="list-style-type: none">• Clean the motor in a manner appropriate for its protection class.• Avoid pressurized water on connectors, terminal boxes, and other live parts.

 CAUTION
Chemical burns and irritations caused by chemical cleaning agents
Chemical cleaning agents can be caustic or emit dangerous fumes. If these come into contact with skin or if you inhale the fumes, this can cause injuries, e.g. chemical burns on the skin or respiratory passages, or skin irritation.
<ul style="list-style-type: none">• During cleaning, make sure that appropriate methods of extracting fumes are in place and that you wear the appropriate protective gear (e.g. gloves, goggles, face masks).• If using chemical cleaning agents, observe the instructions and any warnings provided in the relevant safety data sheet. Chemical cleaning agents must be suitable for use with the machine's components, particularly where plastic components are concerned.

Clean the motor of dust and dirt as required. In this way, you ensure adequate heat dissipation.

9.2.3 Bearing replacement interval

The bearings are subject to wear and must be replaced after a defined number of operating hours.

For average load levels, the bearings must be replaced after approx. 25,000 hours.

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

Note

Harsh operating conditions

If the motor is subject to harsh operating conditions (e.g. continuous operation at n_{max} , high vibration/shock loads, frequent reversing duty etc.), the bearing replacement intervals t_{LW} can decrease by up to 50%.

9.3 Repair

The Siemens Service Center Bad Neustadt and other regional service sites throughout the world can handle or organize the maintenance/repair of the motors.

Contact your regional Siemens contact if you require this service.

Note regarding encoder replacement

You can replace a defective encoder.

The procedure for replacing an encoder is described in Service manual replacing an encoder (<https://support.industry.siemens.com/cs/document/99457853/encoder-replacement-in-1fk7-g2-and-1ft7?dti=0&dl=en&pnid=13308&lc=de-WW>).

Decommissioning and disposal

10.1 Safety instructions

Removing the motor from the machine

 **WARNING**

Danger to life when live parts are touched

Death or serious injury can result when live parts are touched.

- Only work on electrical equipment if you are appropriately qualified.
- Always comply with the local national safety regulations when working on electrical equipment.

Generally, six steps apply when establishing safety:

1. Prepare for shutdown and notify all those who will be affected by the procedure.
2. Disconnect the machine from the power supply.
 - Switch off the machine.
 - Wait until the discharge time specified on the warning labels has elapsed.
 - Check that it really de-energized, from phase to phase and phase to protective conductor.
 - Check that every auxiliary circuit is de-energized.
 - Ensure that the motors cannot move.
3. Secure SIMOTICS S motors against unintentional movements that generate a voltage at the terminals.
4. Identify all other dangerous energy sources, e.g. compressed air, hydraulic systems or water.
5. Isolate or neutralize all hazardous energy sources, for example by closing switches, grounding or short-circuiting, or closing valves.
6. Take measures to prevent reconnection of the energy sources.
7. Make sure that the machine is completely locked ... and that you have the right machine.

After you have completed the work, restore operational readiness by performing the above steps in the reverse order.

 **WARNING**

Danger to life due to slipping on leaked oil

Leaked oil can result in slipping or falling and cause death or severe injury.

- Prevent oil from leaking
- Absorb leaked oil immediately with a binding agent for oil or similar.
- Rough up the hazardous location.
- Mark the hazardous location.

 **CAUTION**

Burning hazard caused by hot surfaces

Some parts of the frame of electrical machines can reach temperatures in excess of 100° C. Touching components when the machine is in operation can cause burns.

- Do not touch frame parts while the machine is in operation or immediately after machine operation.
- Allow frame parts to cool off before starting any work.

 **CAUTION**

Danger of scalding from the hot oil exiting the unit

Exiting hot oil can cause burns.

- Before starting any work, wait until the oil has cooled down to below 30° C.

 **CAUTION**

Chemical burns and irritations caused by chemical cleaning agents

Chemical cleaning agents can be caustic or emit dangerous fumes. If these come into contact with skin or if you inhale the fumes, this can cause injuries, e.g. chemical burns on the skin or respiratory passages, or skin irritation.

- During cleaning, make sure that appropriate methods of extracting fumes are in place and that you wear the appropriate protective gear (e.g. gloves, goggles, face masks).
- If using chemical cleaning agents, observe the instructions and any warnings provided in the relevant safety data sheet. Chemical cleaning agents must be suitable for use with the machine's components, particularly where plastic components are concerned.

 **WARNING**

Danger to life caused by falling machine parts

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

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

 WARNING**Injury as a result of suspended loads**

When being dismantled and transported, the motor can cause injury as a result of its movement.

- Only use perfectly functioning hoisting and load suspension equipment dimensioned to carry the motor load.
- Pay careful attention to possible movement when the motor is released.
- Do not stand under suspended loads or in their slewing range.
- When placing down the motor, ensure that it cannot roll.

 CAUTION**Injuries caused by liquids when draining and environmental pollution**

When draining, liquids can cause injuries, such as burns, chemical burns, irritation. Spilt oil can make floor surfaces slippery and pollute the environment.

- Allow the liquid to cool down.
- Use a sufficiently large collection container.
- Avoid liquids coming into contact with the skin. Wear suitable personnel protection equipment, e.g. protective eyewear, gloves.
- Have materials on hand to soak up leaked liquids and prevent areas from being slippery.

Dismantling the motor

Note

The rotor in a motor containing permanent magnets must only be removed by the manufacturer.

- Contact the Siemens Service Center (<https://support.industry.siemens.com/sc/ww/en/sc/2090>).

10.2 Decommissioning

10.2.1 Removing the motor

The dismantling of the motor must be performed and/or supervised by qualified personnel with appropriate expert knowledge.

Contact a certified waste disposal organization in your vicinity. Clarify what is expected in terms of the quality of disassembling the motor and provision of the components.

Removing the motor from the machine



1. Disconnect all electrical connections.
2. Remove all liquids such as oil, water.
3. Remove all supply lines.
4. Remove the fixing elements from the motor.
5. Transport the motor to a suitable location for storage and dismantling.



10.2.2 Dismantling the motor

Note

The rotor in a motor containing permanent magnets must only be removed by the manufacturer.

Contact the Siemens Service Center.

10.3 Disposal

Protecting the environment and preserving its resources are corporate goals of the highest priority for Siemens. Our worldwide environmental management system according to ISO 14001 ensures compliance with legislation and sets high standards in this regard. Environmentally friendly design, technical safety and health protection are always firm goals, even at the product development stage.

Recommendations for the environmentally friendly disposal of the machine and its components are given in the following chapter.

- Be sure to comply with local disposal regulations.
- Separate the housing parts, shafts and roller bearings of the motor according to their material.
- Dispose of the parts in accordance with the applicable legal regulations.
- Dispose of the packaging material in accordance with the applicable legal regulations.

Components

- Sort the components for recycling according to whether they are:
 - Electronics waste, e.g. encoder electronics
 - Iron to be recycled
 - Aluminum
 - Non-ferrous metal, e.g. motor windings
 - Insulating materials

Process materials and chemicals

- Sort the process materials and chemicals for recycling according to whether they are:
 - Oil
 - Dispose of the spent oil as special waste in accordance with the spent oil ordinance
 - Grease
 - Solvents
 - Cleaner solvent
 - Paint residues
- Do not mix solvents, cleaner solvents and paint residues.

Disposing of permanent magnets

Permanent magnets must be demagnetized prior to disposal. This helps avoid potential hazards caused by permanent magnets during and after disposal. Permanent magnets are heated to demagnetize them.

Permanent magnets can be demagnetized in one of the following ways:

- Have a specialist disposal company thermally treat the motor.
- Hand over the motor to the manufacturer. The manufacturer can then remove and demagnetize the rotor and/or permanent magnets.

Note

Rotors that have been removed but are still magnetized cannot be transported.

Note

Removing the rotor

A magnetized rotor may only be removed by the manufacturer. Contact the Siemens Service Center.

Technical data

11.1 Technical data

The technical data for the motors with the various shaft heights is contained in the "Technical data and characteristic curves" chapter of the Configuration Manual.

A


Appendix

A.1 Certificate for the "PS Premium" painting system from ECOLAB



Figure A-1 Certificate_option_N16_page 1

A.1 Certificate for the "PS Premium" painting system from ECOLAB



The certificate for the coating PS Premium based on:

- documented test procedure for material compatibility
- defined product specification
- a standardized cleaning plan

Test procedure

Soaking test:

- Partly soaked into test mediums

Test time :

- 7 days

Test contents:

- pH-value of solutions: 1,5 – 13,0
- Ingredients:
e.g. caustic, phosphoric acid, peroxyacetic acid,
hydrogen peroxide, sodium hypochlorite, alkyl amine acetate

Evaluation:

- Estimation after appr. 7 days regeneration
- Estimation of degradation of coatings according to DIN EN ISO 4628-1 and estimation of decorative changing (colour and gloss level)
- Key
(+) no changing
(o) minor changing possible, decorative nature only
(-) changing possible by long term use

The coating PS Premium was tested with the following products:

Alkaline and chlorinated alkaline foam cleaning products			
P3-topax 12	3%	40°C	+
P3-topax 19	5%	40°C	o
P3-topax 686	5%	40°C	+

TFC-cleaner			
P3-topactive 200	4%	40°C	+
P3-topactive 500	4%	40°C	+

Acidic foam cleaning products			
P3-topax 56	5%	40°C	+
P3-topax 58	5%	40°C	+

Disinfection products			
P3-topax 990	5%	23°C	o
P3-oxonia active 150	1%	23°C	+

DI-water			
	-	40°C	+

Product specification:

P3-topax 12
Mild alkaline foam cleaning product

P3-topax 19
Alkaline foam cleaning product

P3-topax 686
Chlorinated alkaline foam cleaning product

P3-topax 56
Foam cleaning product based on phosphoric acid

P3-topax 58
Foam cleaning product based on organic acids

P3-topactive 200
Alkaline thin film cleaner

P3-topactive 500
Acidic thin film cleaner

P3-topax 990
Foam disinfection product based on alkyl amine acetate

P3-oxonia active 150
Disinfection product based on peroxyacetic acid and hydrogen peroxide


DI-water
Deionised water

Deutsche Bank AG, Düsseldorf
Konto 2 272 276 BLZ 300 700 10
IBAN: DE38 3007 0010 0227 2276 00
BIC: DEUTDE33
UST-ID-Nr: DE 814914835
Gesellschaft mit beschränkter Haftung Sitz: Düsseldorf
Handelsregister: AG Düsseldorf, HRB 28757
Vorsitzender des Aufsichtsrates: Ralf Ebel
Geschäftsführung: Alfred Stöhr, Ralph Gichtbrock

Ecolab Deutschland GmbH Reisholzer Werftstr. 38-42 D-40589 Düsseldorf

Figure A-2 Certificate_option_N16_page 2

A.2 ECOLAB cleaning recommendation








“Cleaning Recommendation“
 SIEMENS AG, Industry Sector, DT MC MF-M
 Coating PS Premium

Cleaning & Disinfection

EUROPE

<p><u>Application:</u> Foam / TFC Cleaning and disinfection</p> <p><u>Specific application area:</u> Removal of residues of the Food & Beverage Industry</p> <p><u>Cleaning frequency:</u> tbd</p>	<p><u>Typical residues:</u> Organic and inorganic residues</p> <p><u>General information:</u> Coating PS Premium for servomotors</p>
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Cleaning Procedure & Chemicals	%	°C	min.	Notes
<p>Pre-rinse</p>  <p>Water</p>	-	40-50	tbd	Low pressure pre-rinse with water to remove rough residues.
<p>Foam Cleaning /Thin Film Cleaning</p>  <p>P3-topax or P3-topactive</p>	1-5	20-40	10 - 30	Concentration, application time and application temperature depends on foam cleaning product and TFC-product as well. For product application please see also the information from the product data sheet
<p>Intermediate Rinse</p>  <p>Water</p>	-	40-50	tbd	Use water of drinking quality. Low pressure rinse thoroughly with fresh water of drinking quality until all product residues are removed.
<p>Foam Disinfection /Thin Film Disinfection</p>  <p>P3-topax or P3-topactive...</p>	1-3	RT	10-30	Concentration, application time and application temperature depends on foam disinfection product and TFC-product as well. Use biocides safely. Always read the label and product information before use.
<p>Final Rinse</p>  <p>Water</p>	-	40-50	tbd	Use water of drinking quality. Low pressure rinse thoroughly with fresh water of drinking quality until all product residues are removed.

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 For any assistance do not hesitate to contact your responsible Ecolab service.


 **Important additional remarks!**
 Due to the diversity of materials and applications the information given above represents only a non binding guideline and is not intended to supersede the manufacturers specifications, limitations and recommendations. It is compulsory to follow the manufacturers limitations, especially concerning pH and temperature stability of the materials. The cleaning process should be individually optimized.

Figure A-3 ECOLAB cleaning recommendation for option N16

Glossary

Rated torque M_N

Thermally permissible continuous torque in S1 duty at the rated motor speed.

Rated speed n_N

The characteristic speed range for the motor is defined in the speed-torque diagram by the rated speed.

Rated current I_N

RMS motor phase current for generating the particular rated torque. Specification of the RMS value of a sinusoidal current.

DE

Drive end = Drive end of the motor

Torque constant k_T (value for a 100 K average winding temperature rise)

Quotient obtained from the static torque and stall current.

Calculation: $k_T = M_{0, 100\text{ K}} / I_{0, 100\text{ K}}$

The constant applies up to approx. $2 \cdot M_{0, 60\text{ K}}$ in the case of self-cooled motors

Note

This constant is not applicable when configuring the necessary rated and acceleration currents (motor losses!).

The steady-state load and the frictional torques must also be included in the calculation.

Maximum permissible speed (mechanical) n_{max} .

The maximum mechanically permissible speed is $n_{max\ mech}$. It is defined by the centrifugal forces and frictional forces in the bearing.

NDE

Non-drive end = Non-drive end of the motor

Number of poles $2p$

Number of magnetic north and south poles on the rotor. p is the number of pole pairs.

Static torque M_0

Thermal limit torque at motor standstill corresponding to a utilization according to 100 K or 60 K. This can be output for an unlimited time when $n = 0$ rpm. M_0 is always greater than the rated torque M_N .

Stall current I_0

Motor phase current to generate the particular stall torque ($M_0 = k_T \cdot I_0$). Specification of the RMS value of a sinusoidal current.

Winding resistance R_{Str} at 20° C winding temperature

The resistance of a phase at a winding temperature of 20° C is specified. The winding is in a star connection.

Index

B

Bearing change interval, 115

C

Certificates

 EAC, 23

 EC Declaration of Conformity, 23

 UL and cUL, 23

Commissioning, 98

Correct usage, 21, 21

D

Degree of protection, 27

Disposal, 120

DRIVE-CLiQ interface, 35, 85

F

Forced ventilation, 42, 61

H

Holding brake, 43

Hotline, 7

I

Inspection and maintenance, 111

K

KTY, 34

L

Lifting and transporting the motor, 49

M

Maintenance intervals, 114

N

Noise emission, 27

P

Pt1000, 34

R

Rating plate data, 31

S

Siemens Service Center, 7

Sound pressure level, 27

T

Target group, 5

Technical features, 24

Technical Support, 7

Thermal motor protection, 34

Tightening torques, 58

Training, 7

Transportation, 49

V

Vibration response, 63

Vibration severity grade, 63

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Motion Control
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91050 ERLANGEN
Germany

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information about
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