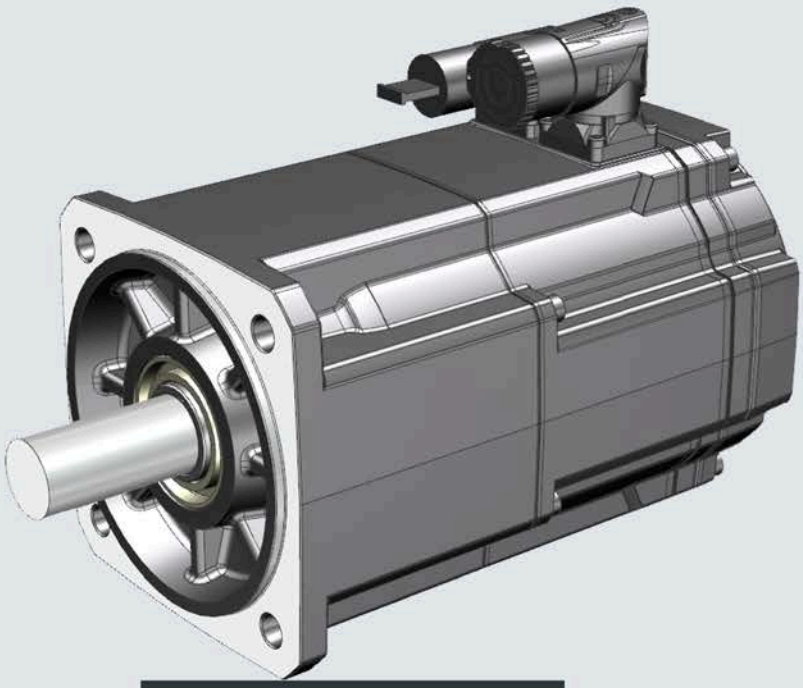
SIEMENS



Configuration Manual

SIMOTICS

SIMOTICS S-1FK2 synchronous motors

For SINAMICS S120

Edition 12/2019

www.siemens.com

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SIMOTICS

Drive technology
1FK2 synchronous motors for SINAMICS S120

Configuration Manual

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Legal information

Warning notice system

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

⚠DANGER

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

⚠WARNING

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

⚠CAUTION

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

NOTICE

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

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

Qualified Personnel

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

Proper use of Siemens products

Note the following:

⚠WARNING

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

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

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GERMANY

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Introduction

Additional documents

For configuring, you can refer to Catalog NC 82 (https://support.industry.siemens.com/cs/ww/en/view/109746977) as print version or online.

Target group

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

Benefits

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

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

Utilization phase

Planning and configuration phase

More information

Information on the following topics is available at:

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

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

If you have any questions regarding the technical documentation (e.g. suggestions, corrections), please send an e-mail to the following address:

E-mail (mailto:docu.motioncontrol@siemens.com)

My support

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

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

Note

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

Later, you can log on with your login data.

Training

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

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

Technical Support

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

Technical support (https://support.industry.siemens.com)

Internet address for products

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

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Information regarding third-party products

Note

Recommendation relating to third-party products

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

You can use equivalent products from other manufacturers.

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

Compliance with the General Data Protection Regulation

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

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

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Fundamental safety instructions

1

1.1 General safety instructions



⚠ WARNING

Electric shock and danger to life due to other energy sources

Touching live components can result in death or severe injury.

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

Generally, the following six steps apply when establishing safety:

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

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



⚠ WARNING

Electric shock due to connection to an unsuitable power supply

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

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



WARNING

Electric shock due to damaged motors or devices

Improper handling of motors or devices can damage them.

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

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



WARNING

Electric shock due to unconnected cable shield

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

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



WARNING

Electric shock if there is no ground connection

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

- Ground the device in compliance with the applicable regulations.



WARNING

Arcing when a plug connection is opened during operation

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

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

NOTICE

Property damage due to loose power connections

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

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

WARNING

Unexpected movement of machines caused by radio devices or mobile phones

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

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

WARNING

Unrecognized dangers due to missing or illegible warning labels

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

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

WARNING

Unexpected movement of machines caused by inactive safety functions

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

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

Note

Important safety notices for Safety Integrated functions

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

WARNING

Active implant malfunctions due to electromagnetic fields

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

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

WARNING

Active implant malfunctions due to permanent-magnet fields

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

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

WARNING

Injury caused by moving or ejected parts

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

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

WARNING

Fire due to inadequate cooling

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

- Comply with the specified cooling requirements for the motor.

⚠ WARNING

Fire due to incorrect operation of the motor

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

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



⚠ CAUTION

Burn injuries caused by hot surfaces

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

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

Measures when maintenance is required:

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

1.2 Equipment damage due to electric fields or electrostatic discharge

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



NOTICE

Equipment damage due to electric fields or electrostatic discharge

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

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

1.3 Industrial security

Note

Industrial security

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

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

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

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

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

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

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

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

Further information is provided on the Internet:

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

⚠ WARNING

Unsafe operating states resulting from software manipulation

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

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

1.4 Residual risks of power drive systems

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

1. Unintentional movements of driven machine or system components during commissioning, operation, maintenance, and repairs caused by, for example,
   - Hardware and/or software errors in the sensors, control system, actuators, and cables and connections
   - Response times of the control system and of the drive
   - Operation and/or environmental conditions outside the specification
   - Condensation/conductive contamination
   - Parameterization, programming, cabling, and installation errors
   - Use of wireless devices/mobile phones in the immediate vicinity of electronic components
   - External influences/damage
   - X-ray, ionizing radiation and cosmic radiation
2. Unusually high temperatures, including open flames, as well as emissions of light, noise, particles, gases, etc., can occur inside and outside the components under fault conditions caused by, for example:
   - Component failure
   - Software errors
   - Operation and/or environmental conditions outside the specification
   - External influences/damage

3. Hazardous shock voltages caused by, for example:
   - Component failure
   - Influence during electrostatic charging
   - Induction of voltages in moving motors
   - Operation and/or environmental conditions outside the specification
   - Condensation/conductive contamination
   - External influences/damage
4. Electrical, magnetic and electromagnetic fields generated in operation that can pose a risk to people with a pacemaker, implants or metal replacement joints, etc., if they are too close
5. Release of environmental pollutants or emissions as a result of improper operation of the system and/or failure to dispose of components safely and correctly
6. Influence of network-connected communication systems, e.g. ripple-control transmitters or data communication via the network

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

Description of the motors

2

2.1 Highlights and benefits

Overview

The SIMOTICS S-1FK2 servo motors are compact and highly dynamic synchronous motors for a wide range of uses in an industrial environment. They are characterized by high power density, degree of protection and overload capability.

The motors are designed for operation without external cooling and the heat is dissipated through the motor surface.

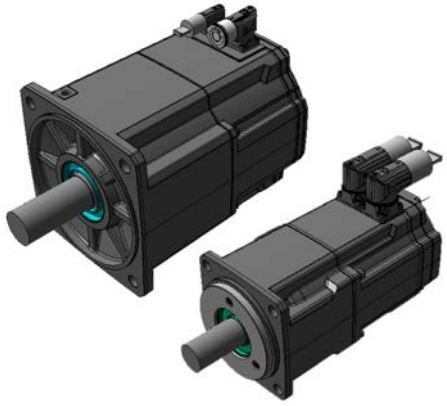


Figure 2-1 1FK2

Advantages

SIMOTICS S-1FK2 High Dynamic motors

- Highest dynamic response through low inertia for highly dynamic applications with low moved masses

SIMOTICS S-1FK2 Compact motors

- Precise, stable control with medium to high masses to be moved with medium moment of inertia
- Very compact design

SIMOTICS S-1FK2 High Inertia motors

- Version with high moment of inertia for robust control with high and variable load inertias

2.2 Motors used for the intended purpose

⚠ WARNING

Motors not used for the intended purpose

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

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

⚠ WARNING

Malfunctions of active implants due to magnetic and electrical fields

Electric motors endanger people with active implants, for example heart pacemakers, who come close to the motors.

- If you are affected, stay a minimum distance of 300 mm from the motors (tripping threshold for static magnetic fields of 0.5 mT according to Directive 2013/35/EU).

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 1FK2 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 23)".

The 1FK2 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 operating instructions is part of correct usage.

Observe the details on the rating plate.

Typical applications

The 1FK2 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

2.3 Technical features and ambient conditions

2.3.1 Directives and standards

Standards that are complied with

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

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

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

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

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

Relevant directives

The following directives are relevant for SIMOTICS motors.

European Low-Voltage Directive

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

European Machinery Directive

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

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

European EMC Directive

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

European RoHS Directive

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

European Directive on Waste Electrical and Electronic Equipment (WEEE)

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

Eurasian conformity

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

China Compulsory Certification

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

CCC negative certification:

CCC product certification (https://support.industry.siemens.com/cs/ww/en/view/93012735)

China RoHS

SIMOTICS motors comply with the China RoHS.

You can find additional information at:

China RoHS (https://support.industry.siemens.com/cs/ww/en/view/109772626)

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/ww/en/ps/13347/cert)

2.3.2 Address of CE-authorized manufacturer

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

Siemens AG

Digital Industries

Motion Control

Industriestraße 1

DE-97615 Bad Neustadt a. d. Saale

Germany

2.3.3 Technical features

Property	Version
Type of motor	Permanent-magnet synchronous motor
Degree of protection according to EN 60034-5 (IEC 60034-5)	IP64, optionally IP65
Cooling according to EN 60034-6	Natural cooling (IC410)
Type of construction according to EN 60034-7 (IEC 60034-7)	IM B5 (IM V1, IM V3)
Shaft extension according to DIN 748-3 (IEC 60072-1)	Plain shaft or with feather key (half key balancing)
Shaft and flange accuracy according to DIN 42955 (IEC 60072–1)	Tolerance N (normal), for radial eccentricity of the shaft extension, concentricity of centering edge, and axial eccentricity of the mounting flange to the axis of the shaft extension
Vibration severity grade according to EN 60034-14 (IEC 60034-14)	Grade A is maintained up to rated speed
Insulation of the stator winding according to EN 60034-1 (IEC 60034-1)	1FK2❑03: Temperature class 130 (B) for a winding temperature of ΔT = 80 K at an ambient temperature of +40 °C 1FK2❑04 ... 1FK2❑10: Temperature class 155 (F) for a winding temperature of ΔT = 100 K at an ambient temperature of +40 °C
Sound pressure level L_{pA} (1 m) according to DIN EN ISO 1680, max. tolerance + 3 dB (A)	1FK2❑03, 1FK2❑04: 55 dB (A); 1FK2❑05, 1FK2❑06: 65 dB (A); 1FK2❑08, 1FK2❑10: 70 dB (A)
Encoder systems, built-in with DRIVE-CLiQ interface	• AS22DQC absolute encoder, singleturn, 22 bit • AM22DQC absolute encoder 22 bit + 12 bit multiturn
Holding brake	Optionally installed, 24 V DC
Connection	Connectors for power and signals, rotatable
Paint finish	Anthracite, similar to RAL7016

2.3.4 Torque overview

1FK2 High Dynamic 3 AC 380 ... 480 V

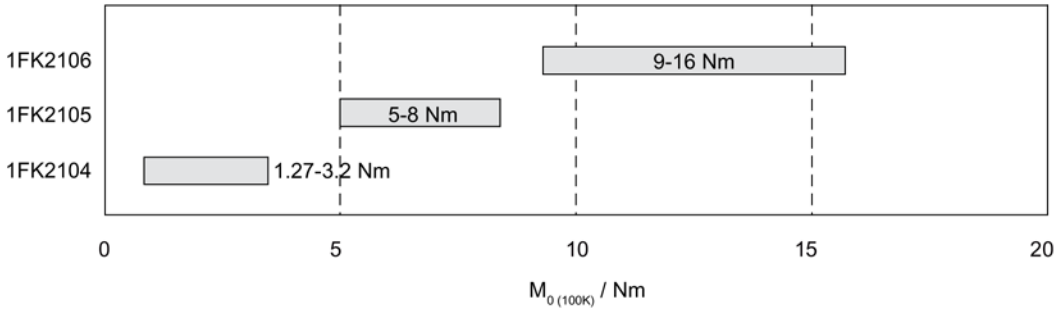


Figure 2-2 Static torques 1FK210❑

1FK2 Compact 3 AC 380 ... 480 V

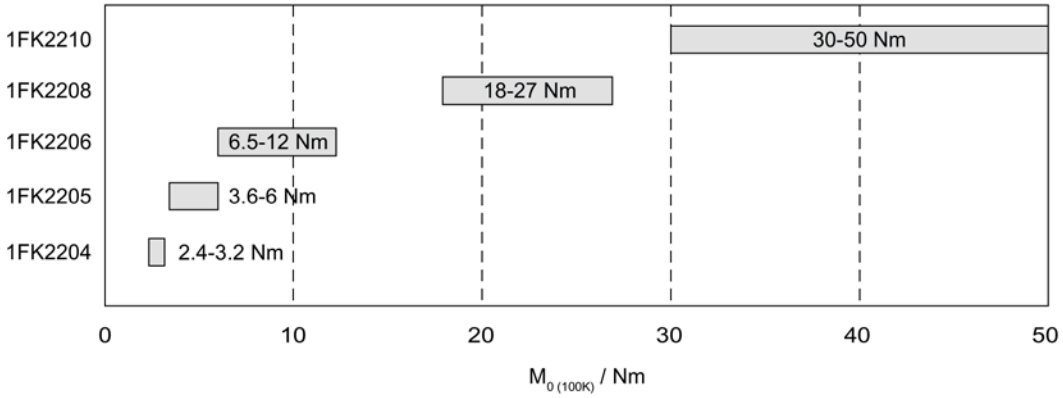


Figure 2-3 Static torques 1FK22❑❑

1FK2 High Inertia 3 AC 380 ... 480 V

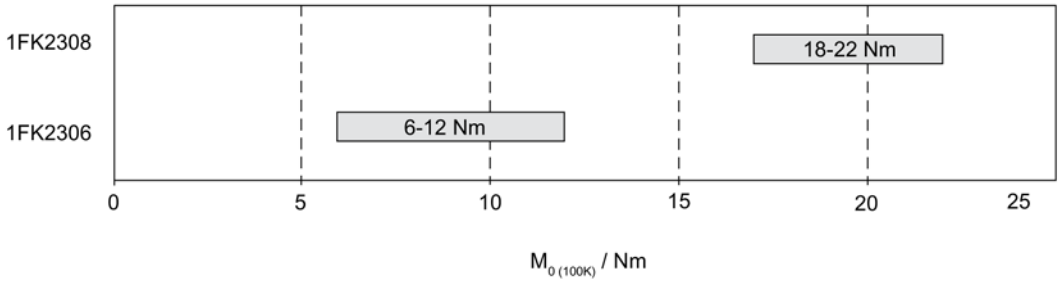


Figure 2-4 Static torques 1FK23❑❑

2.3.5 Environmental conditions

You can classify the environmental conditions for stationary use at weather-protected locations according to the standard DIN EN 60721-3-3.

With the exception of environmental influences "Low air temperature", "Low air pressure", and "Condensation", the motor complies with climate class 3K4.

Table 2- 1 Permissible environmental conditions for the motor 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 degree of protection
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

The motor is not suitable for operation in the following environmental conditions:

- In salt-laden or aggressive atmospheres
- Outdoors
- In a vacuum
- In hazardous areas with a danger of explosion

You will find additional data on the environmental conditions, such as for transport and storage of the motor, in Chapter "Preparation for use (Page 99)".

2.4 Selection based on the article number

The article number describes the motor with the following structure.

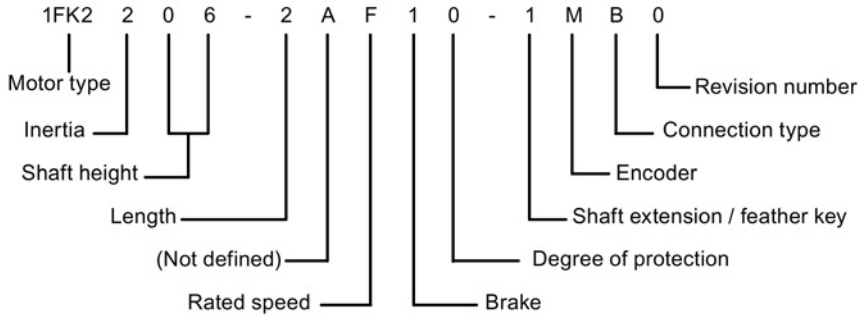


Figure 2-5 Article number structure for 1FK2

You can find possible combinations in the relevant catalog.

Please note that not every theoretical combination is possible.

Description		Position of the article number																
		1	2	3	4	5	6	7	-	8	9	10	11	12	-	13	14	15	16
SIMOTICS S-1FK2 synchronous servomotors		**1**	**F**	**K**	**2**														
Inertia		High Dynamic				1													
		Compact				2													
		High Inertia				3													
Shaft height		SH 30					0	3											
		SH 40					0	4											
		SH 48 CT SH 52 HD					0	5											
		SH 63					0	6											
		SH 80					0	8											
		SH 100					1	0											
Overall length		0 ... 8							-	❑									
(Not defined)											A								
Rated speed	1500 rpm @ 400 V											B							
	2000 rpm @ 400 V											C							
	3000 rpm @ 400 V											F							
	6000 rpm @ 400 V											K							
Holding brake	None												0						
	With												1						
Degree of protection	IP64													0					
	IP65 with radial shaft seal ring, without spring													1					
Shaft geometry	Plain shaft (without keyway)															0			
	Shaft with feather key															1			
	Plain shaft, alternative shaft extension (11 mm x 23 mm), for 1FK2❑03 only						0	3						0		2			
	Plain shaft, alternative shaft extension (14 mm x 30 mm), for 1FK2❑04 only						0	4						0		2			
Encoder	Absolute encoder, singleturn, 22 bit (encoder AS22DQC)																S		
	Absolute encoder, multiturn, 22 bit + 12 bit (encoder AM22DQC)																M		
Connection type	2CC (two-wire technology) for S120																	B	
Revision number	Start																		0

2.5 Rating plate data

The rating plate contains the article number and the technical data of the motor.

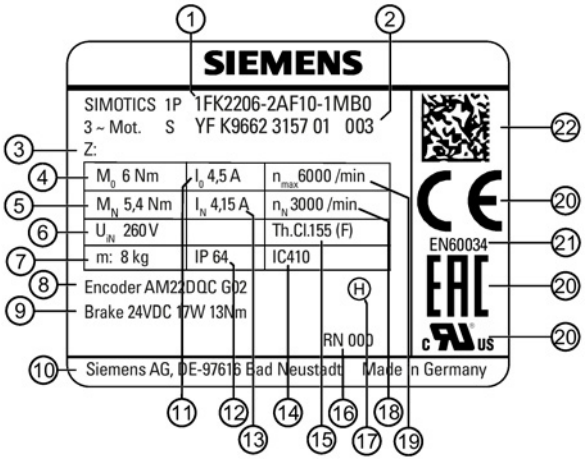


Figure 2-6 1FK2 rating plate

1	Article number	12	Degree of protection
2	ID No., serial number	13	Rated current I_N / A
3	Additional options specified as a supplement to the article number	14	Cooling mode according to EN 60034-6
4	Static torque M_0 / Nm	15	Thermal class of the insulation system
5	Rated torque M_N / Nm	16	Revision
6	Induced voltage at rated speed U_{IN} / V	17	Type of balancing (only for motors with feather key)
7	Motor weight m / kg	18	Rated speed n_N / rpm
8	Marking of encoder type	19	Maximum speed n_{max} / rpm
9	Data of the holding brake	20	Certifications
10	Manufacturer's address	21	Standard for all rotating electrical machines
11	Stall current I_0 / A	22	Data matrix code

Mechanical properties

3

3.1 Cooling

The 1FK2 is a non-ventilated motor.

To ensure sufficient heat dissipation when installed, the motor requires a minimum clearance of 100 mm from adjacent components on three sides.

- Maintain theses clearances irrespective of the following mounting variants.

Non-thermally insulated mounting

Some of the motor power loss is dissipated through the flange when the motor is connected to the mounting surface.

- Observe the following mounting conditions for the specified motor data:

Shaft height	Steel plate, width x height x thickness (in mm)
1FK2❑03	250 x 250 x 6
1FK2❑04	
1FK2❑05	300 x 300 x 12
1FK2❑06	450 x 370 x 30
1FK2❑08	
1FK2❑10	

The data in the table refers to an ambient temperature of 40 °C and an installation altitude up to 1000 m above sea level.

If the environmental conditions are different, derating may be required. You can find information on this in the section "Derating factors (Page 97)".

For larger mounting surfaces, the heat dissipation conditions improve.

Thermally insulated mounting without additional mounted components

For self-cooled motors, you must reduce the S1-characteristic curve as follows:

Reduce the motor static torque by a range of 20% to 30%.

Reduce the torque at 3000 rpm by a range of 40% to 50%.

Thermal motor protection

The converter monitors the motor temperature based on a thermal motor model and issues the alarm "Motor overtemperature" before the maximum temperature is reached. When the motor exceeds the maximum temperature, the converter switches off the motor with the error message "Motor overtemperature".

When the ambient temperature exceeds 40 °C, set the ambient temperature on the converter.

- To do this, select parameter p0613 at the converter.

Parameter r0034 indicates the thermal load of the motor as a percentage. The reading of parameter r0034 depends on the ambient temperature defined via parameter p0613.

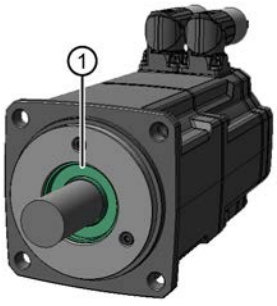
For more details about parameter p0613, see "SINAMICS S120 List Manual".

3.2 Degree of protection

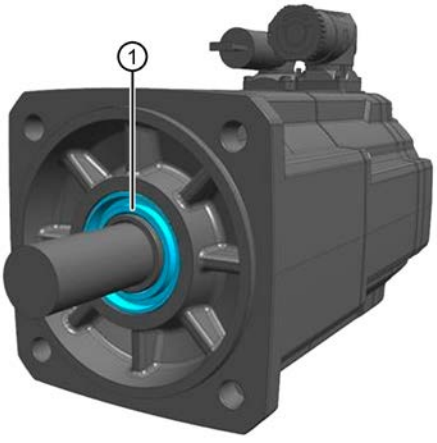
1FK2 motors can be delivered with degree of protection IP64 or IP65.

The degree of protection is stated on the rating plate.

The motors with degree of protection IP65 have a radial shaft sealing.



1FK2❑03 ... 1FK2❑04



1FK2❑05 ... 1FK2❑10

① Radial shaft sealing ring

The radial shaft sealing ring shortens the usable shaft extension on the 1FK2❑03 and 1FK2❑04.

Note

It is permissible that the radial shaft sealing ring runs dry.

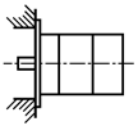
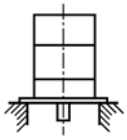
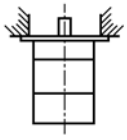
With degree of protection IP65, it is not permissible for liquid to collect in the flange.

The service life of the radial shaft sealing ring is approximately 25000 operating hours.

For additional information, see Chapter "Shaft extension (Page 29)".

3.3 Types of construction

Table 3- 1 Designation of types of construction (acc. to IEC 60034-7)

Designation	Representation	Description
IM B5		Standard
IM V1		The motors can be used in types of construction IM V1 and IM V3 without having to order anything special. Note: When configuring the IM V3 type of construction, attention must be paid to the permissible axial forces (force due to the weight of the drive elements) and especially to the necessary degree of protection.
IM V3		

3.4 Bearing versions

The 1FK2 motors have deep-groove ball bearings with life grease lubrication

3.5 Shaft extension

The motors are supplied with cylindrical shaft extensions. Optionally, a shaft extension with a keyway and feather key can be supplied.

For the 1FK2❑03 and 1FK2❑04 with degree of protection IP65, the radial shaft seal ring shortens the useful shaft extension.

Motor	Shaft dimensions Diameter × length in mm	Shaft dimensions with IP65 Diameter × length in mm	Feather key Width × height × length in mm	Centering thread
1FK2❑03	14 (h6) × 30	14 (h6) × 21.5	5 × 5 × 16	M5
	11 (k6) × 23 [1]	-	-	M4
1FK2❑04	19 (k6) × 40	19 (k6) × 32	6 × 6 × 22	M6
	14 (k6) × 30 [1]	-	-	M5
1FK2❑05	19 (k6) × 40		6 × 6 × 32	M6
1FK2❑06	24 (k6) × 50		8 × 7 × 40	M8
1FK2❑08	32 (k6) × 58		10 × 8 × 45	M12
1FK2❑10	38 (k6) × 80		10 × 8 × 70	M12

[1] The optional shaft extension 11 (k6) mm × 23 mm and 14 (k6) mm × 30 mm can only be supplied without a keyway and without a shaft sealing ring (IP65).

3.6 Radial and axial forces

3.6.1 Axial forces

When using, for example, helical toothed wheels as drive element, in addition to the radial force, there is also an axial force on the motor bearings.

The following axial forces on the shaft extension are permitted.

Motor	Static axial forces in N
1FK2❑03	75
1FK2❑04	100
1FK2❑05	120
1FK2❑06	200
1FK2❑08	300
1FK2210	450

The specified axial forces are determined by the spring loading and therefore also apply to motors with holding brake.

Note

Applications with an angular toothed pinion directly on the motor shaft are not permitted in case the permissible axial forces are exceeded.

3.6.2 Radial forces

As a result of the bearing arrangement, 1FK2 is designed for aligned forces. Forces such as these occur for belt drives, for example.

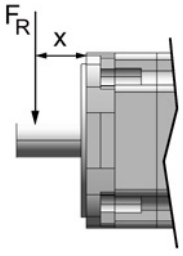
All radial forces always refer to aligned forces.

NOTICE

Motor damage caused by circulating forces

Circulating forces can cause bearing motion, and therefore damage the motor.

- Circulating forces are not permissible.



F_R Point of application of the radial force at the shaft extension

x Distance between where the radial force is applied and the flange in mm

Figure 3-1 Force application point at the DE (A side)

The following diagrams indicate the maximum permissible radial force for the corresponding motor shaft height. It depends on the force application point and the average speed. It is given for a nominal bearing service life (L10h) of 25000 h.

Radial force diagram 1FK2x03

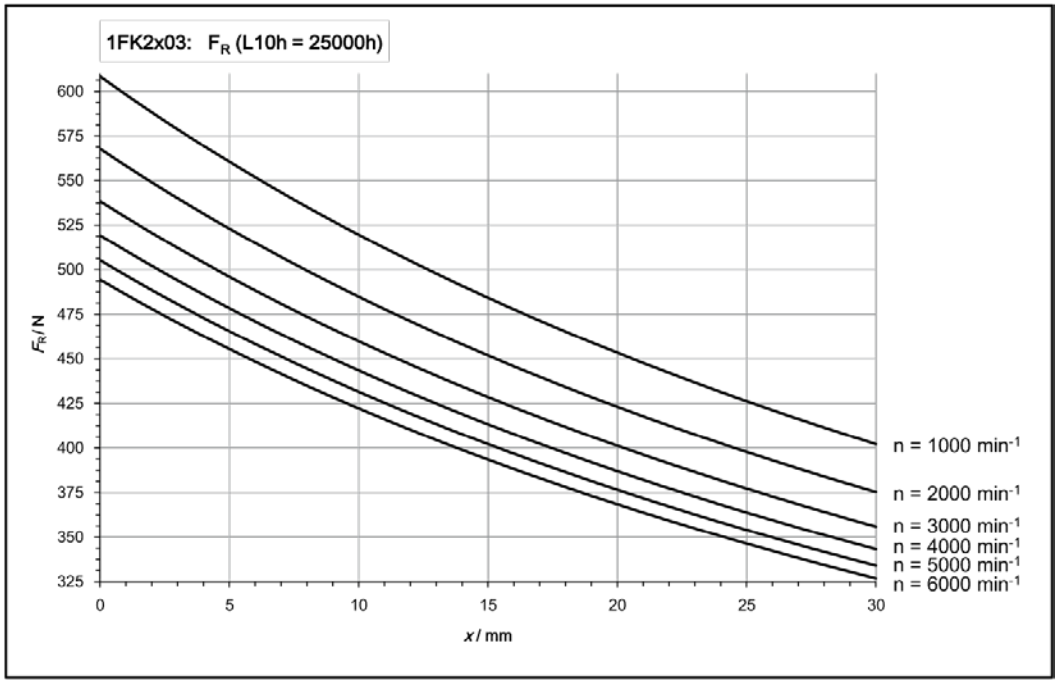


Figure 3-2 Maximum permissible radial force F_R at a distance x from the flange for a nominal bearing lifetime of 25000 h

Radial force diagram 1FK2x04

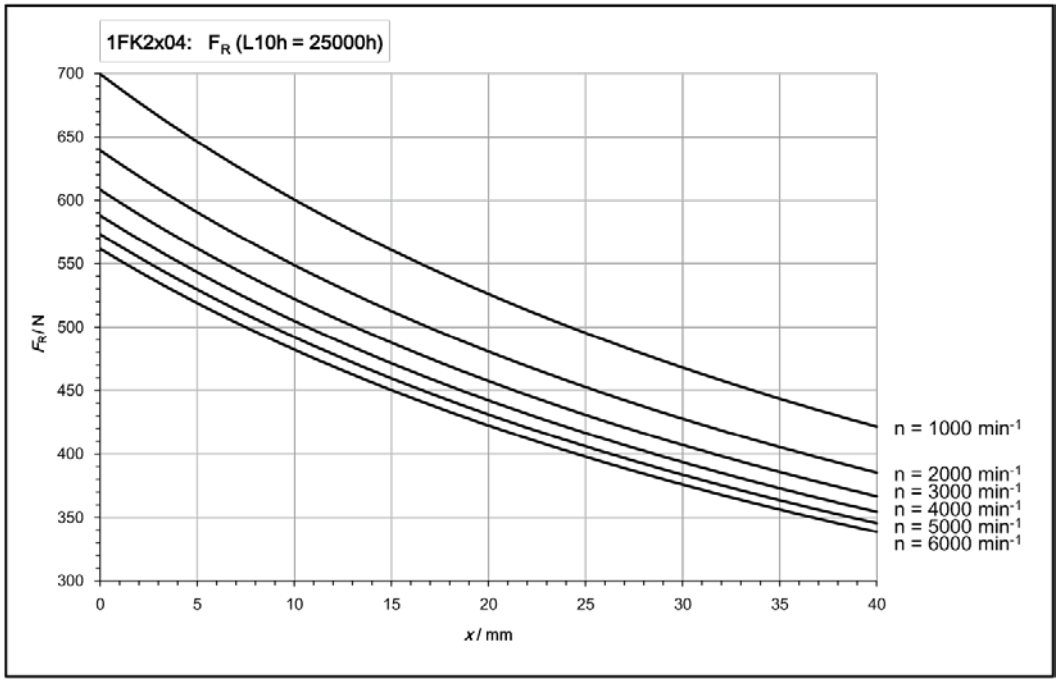


Figure 3-3 Maximum permissible radial force F_R at a distance x from the flange for a nominal bearing lifetime of 25000 h

Radial force diagram 1FK2105

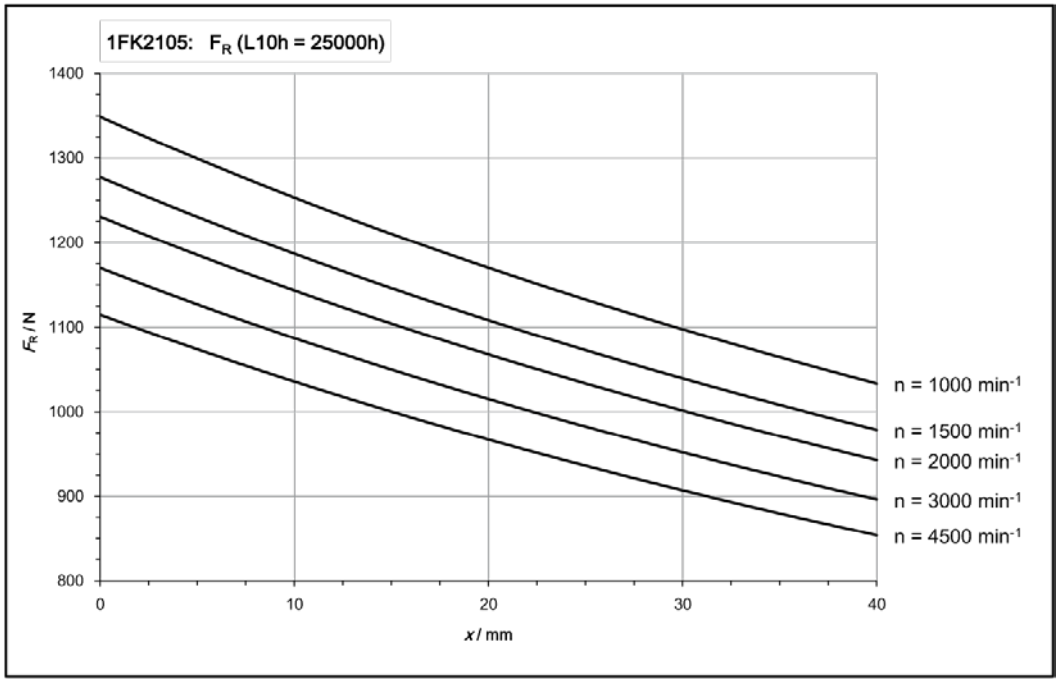


Figure 3-4 Maximum permissible radial force F_R at a distance x from the flange for a nominal bearing lifetime of 25000 h

Radial force diagram 1FK2205

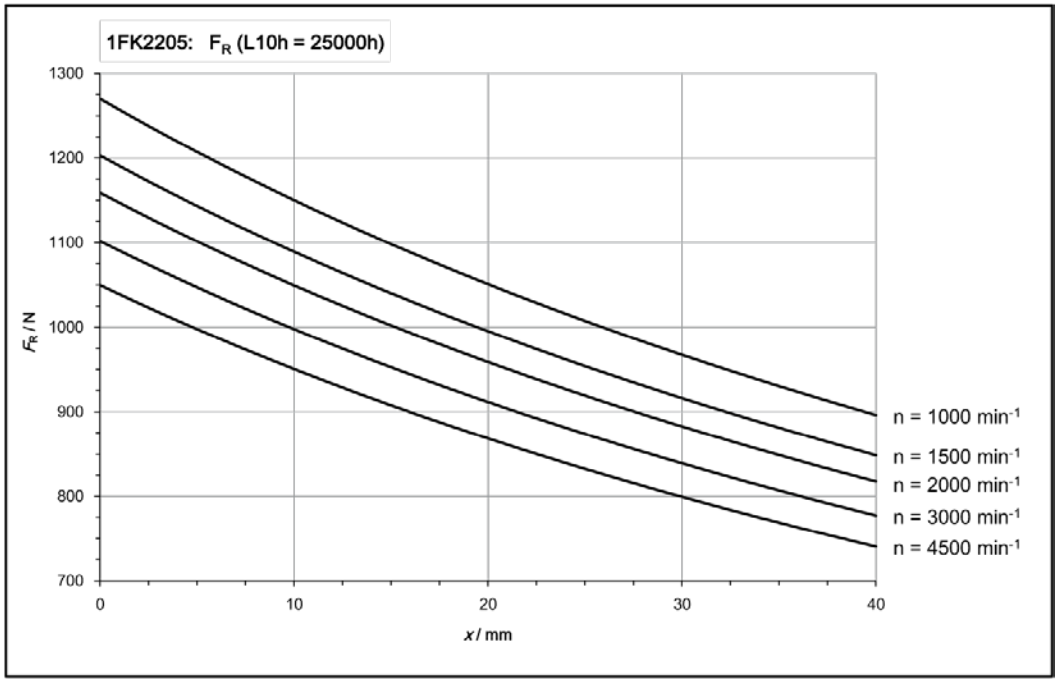


Figure 3-5 Maximum permissible radial force F_R at a distance x from the flange for a nominal bearing lifetime of 25000 h

Radial force diagram 1FK2x06

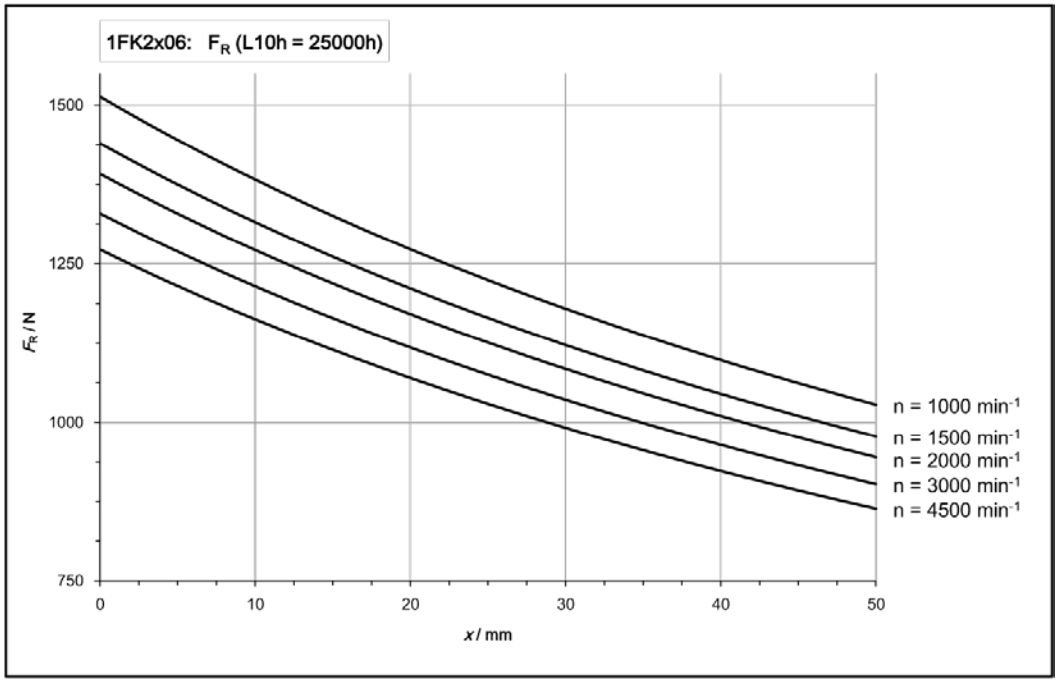


Figure 3-6 Maximum permissible radial force F_R at a distance x from the flange for a nominal bearing lifetime of 25000 h

Radial force diagram 1FK2x08

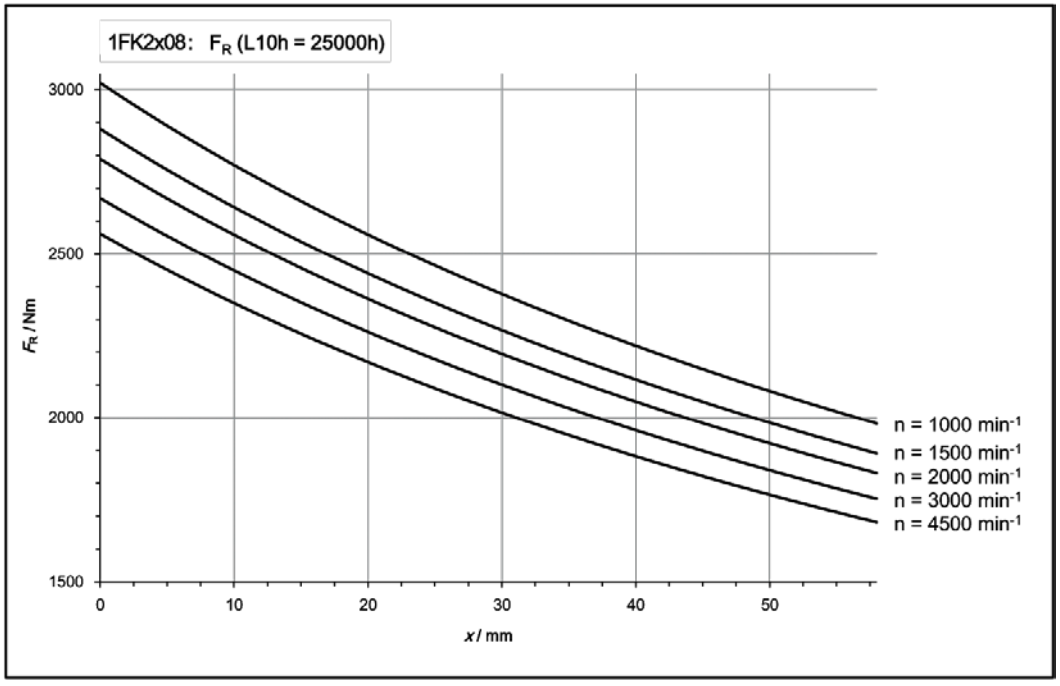


Figure 3-7 Maximum permissible radial force F_R at a distance x from the flange for a nominal bearing lifetime of 25000 h

Radial force diagram 1FK2210

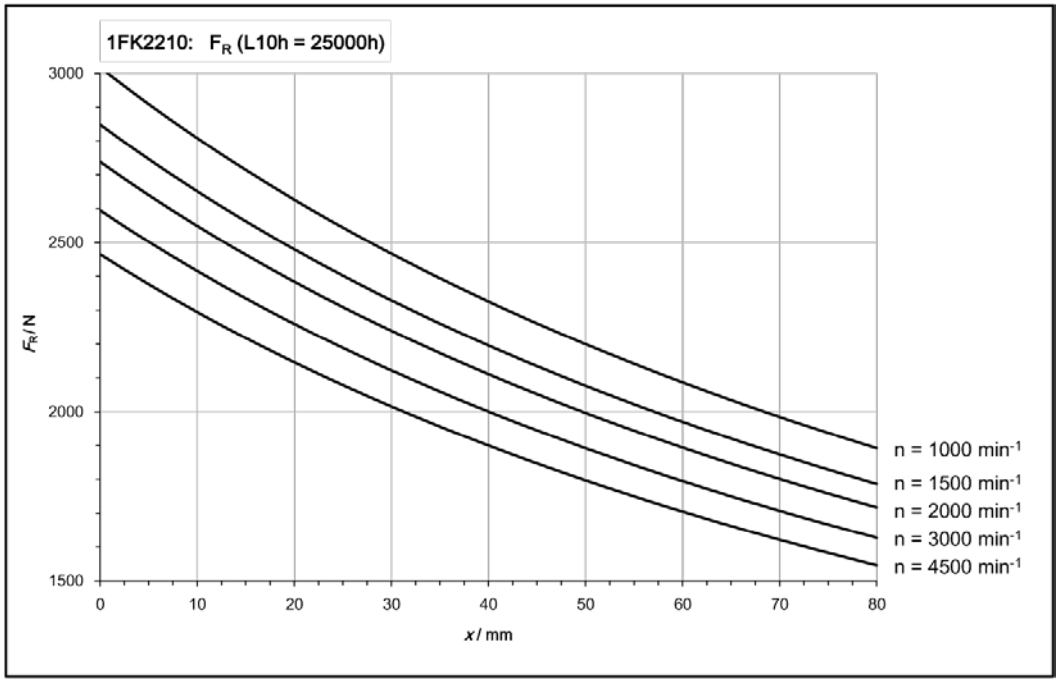


Figure 3-8 Maximum permissible radial force F_R at a distance x from the flange for a nominal bearing lifetime of 25000 h

3.6.3 Sample calculation of the belt pre-tension

Note

Carefully comply with the guidelines provided by the belt manufacturer

- Carefully comply with the guidelines provided by the belt manufacture when configuring the motor for radial forces at the shaft extension.
- Adjust the belt tension using the appropriate measuring instruments.

$F_V = 2 \cdot M_0 \cdot c / d_R$ $F_V \leq F_{R, perm}$

Table 3- 2 Explanation of the formula abbreviations

Formula abbreviations	Unit	Description
F_V	N	Belt pre-tension
M_0	Nm	Motor static torque
c	——	Pre-tensioning factor; this factor is an empirical value provided by the belt manufacturer. It can be assumed as follows: for toothed belts: c = 1.5 to 2.2 for flat belts c = 2.2 to 3.0
d_R	m	Effective diameter of the belt pulley
$F_{R, perm}$	N	Permissible radial force

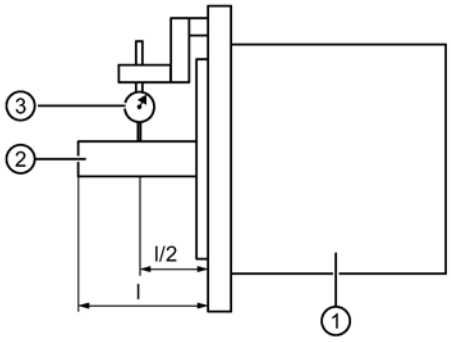
When using other configurations, you must take into account the actual forces generated from the torque being transferred.

3.7 Radial eccentricity, concentricity and axial eccentricity

The shaft and flange accuracies for the 1FK2 motors are implemented to DIN 42955 (IEC 60072-1) as standard (Normal class).

Table 3- 3 Radial eccentricity tolerance of the shaft to the frame axis (referred to cylindrical shaft extension)

Motor	Standard (Normal class)
1FK2❑03	0.035 mm
1FK2❑04	0.04 mm
1FK2❑05	
1FK2❑06	
1FK2❑08	0.05 mm
1FK2❑10	

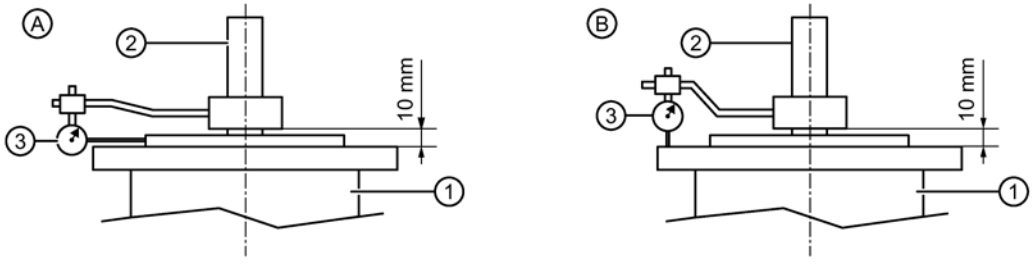


① Motor
② Motor shaft
③ Dial gauge

Figure 3-9 Checking the radial eccentricity

Table 3- 4 Concentricity and axial eccentricity tolerance of the flange surface to the shaft axis (referred to the centering diameter of the mounting flange)

Motor	Standard (Normal class)
1FK2❑03	0.08 mm
1FK2❑04	
1FK2❑05	
1FK2❑06	0.1 mm
1FK2❑08	
1FK2❑10	



A Check for concentricity
B Check for axial eccentricity

① Motor
② Motor shaft
③ Dial gauge

Figure 3-10 Checking the concentricity and axial eccentricity

3.8 Balancing

The motors are balanced according to EN 60034-14.

Motors with feather key in the shaft are half-key balanced.

A mass equalization for the protruding half key must be taken into account for the output elements.

3.9 Vibrational behavior

Vibration severity grade

Motors with a keyway are balanced with a half feather 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 conditions at the installation location can influence the system vibration response and increase the vibration values on the motor.

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

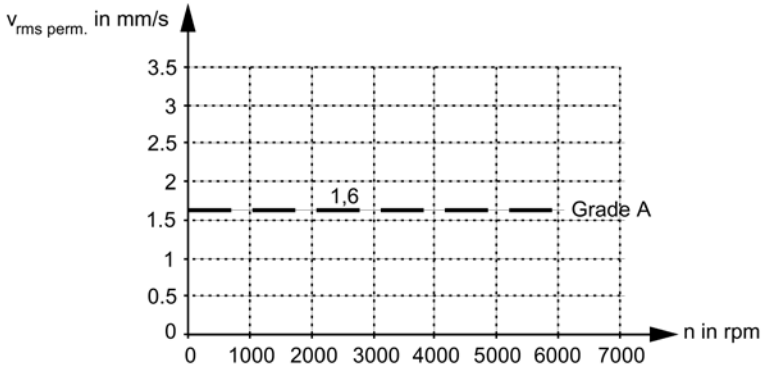


Figure 3-11 Vibration severity grades

Vibration response

Comply with the vibration values in the following table to ensure perfect functioning of the motor and a long service life.

Table 3- 5 Vibration values

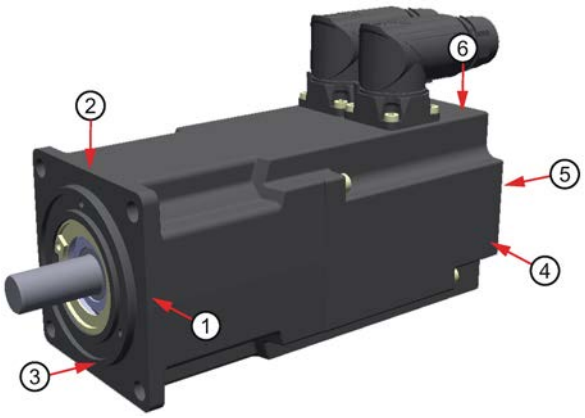
Motor	Vibration velocity V_{rms} to ISO 10816	Vibration acceleration a_{peak} axial	Vibration acceleration a_{peak} radial
1FK21❑	Max. 4.5 mm/s	50 m/s²	50 m/s²
1FK22❑			
1FK23❑		25 m/s²	

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

Select the measuring locations according to ISO 10816-1, Section 3.2.

The vibration acceleration is evaluated in the frequency range from 10 Hz to 2000 Hz. The maximum peak in the measurement time range is considered.

The vibration values must not exceed the specified limits at any measuring location.



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

Figure 3-12 Measuring points for vibration values

3.10 Noise emission

When operated in the speed range 0 to rated speed, 1FK2 motors can reach the following measuring surface sound pressure level L_p:

Table 3- 6 Sound pressure level

Cooling method	Motor	Measuring surface sound pressure level L_p
Naturally cooled	1FK2❑03 1FK2❑04	55 dB(A) + 3 dB tolerance
	1FK2❑05 1FK2❑06	65 dB(A) + 3 dB tolerance
	1FK2❑08 1FK2❑10	70 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.

3.11 Bearing change interval

Motor bearings are wearing parts. Their lifetime depends on various parameters including rotation speed, load cycle, temperature, etc.

At medium loads, the motor bearings last approximately 25000 h.

The procedure for replacing the motor bearing depends on the size of the motor.

For 1FK2❑03 ... 1FK2❑05 motors, it is not possible to replace the motor bearings. Replace these motors in their entirety.

Replacement of the motor bearings is only intended as from 1FK2❑06.

Especially favorable ambient conditions, such as low average speed, low radial force (transverse force) and vibration load can prolong the interval until motor replacement.

Note

Premature bearing and motor replacement

Harsh operating conditions, e.g. continuous operation at n_{max}, high vibration/shock loads, frequent reversing duty reduce the bearing or motor replacement interval by up to 50%.

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

Contact your personal Siemens contact if you require this service.

3.12 Service and inspection intervals

Maintenance measures, inspection/maintenance times intervals

The maintenance intervals depend on the operating conditions.

NOTICE
Damage to the motor due to improper maintenance Improper maintenance can cause damage to the motor. • Service and maintenance must only be performed by qualified personnel. • Use original Siemens parts only.

Table 3- 7 Maintenance measures after operating times or intervals

Operating times and intervals	Measure
When required	Monitor and check the motor for unusual noise, vibrations, and changes.
When required or after 25000 hours of operation	Check the radial shaft sealing ring and replace it when it's worn out.
When required or after 25000 hours of operation	For motors 1FK2❑03 ... 1FK2❑05: Replace the motor if needed. For motors 1FK2❑06 ... 1FK2❑10: Check the motor bearings and replace them if needed.

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

Consult your Siemens representative if you require this service.

Motor components and options

4

4.1 Encoder

Motors with DRIVE-CLiQ interface are designed to operate with the SINAMICS converter system.

Signal transmission to the converter is performed digitally.

The motors 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.

You will find further information in the relevant SINAMICS manual.

NOTICE
Damage to electrostatic sensitive devices The contacts of the DRIVE-CLiQ interface have direct contact with components that can be destroyed by electrostatic discharge (ESDS). • Avoid touching the terminals directly with hands or tools. They may be electrostatically charged and damage components.

The encoders are suitable for the Extended Safety Functions.

Table 4- 1 The 1FK2 can be supplied with the following encoders:

	Absolute encoder, singleturn, 22 bit	Absolute encoder 22 bit +12 bit multiturn
Encoder designation	**AS22DQ**	**AM22DQ**
Description	Absolute encoder 22 bit single-turn	Absolute encoder 22 bit + 12 bit multiturn
Identifier at the 14th digit of the article number	S	M
Operating voltage	24 V	24 V
Maximum current consumption	70 mA	70 mA
Resolution	4,194,304 = 22 bit	4,194,304 = 22 bit
Absolute position	Yes, one revolution	Yes, 4096 revolutions (12 bit)
Angular error	± 100 "	± 100 "

4.2 Brake

4.2.1 Type of holding brake

The type of holding brake installed depends on the size of the motor.

Type of the holding brake	Spring-loaded brake	Permanent-magnet brake
installed in the motors	1FK2❑03 ... 1FK2❑04	1FK2❑05 ... 1FK2❑10
Method of operation	The spring exerts a tensile 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 spring and the brake opens without any residual torque. The spring-loaded brake has a torsional backlash less than 1°.	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.

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 holding brake.

- Avoid impermissible forces on the shaft extension. Detailed information is provided in Chapter "Axial forces (Page 30)".

- 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. When the motor is at a standstill, the holding brake is designed for at least 5 million switching cycles.
- A limited number of EMERGENCY STOP operations is permissible.

⚠ WARNING

Unpredictable movements of the machine or system because of inadequate braking performance

If you use the holding brake incorrectly, e.g. as an operating brake or you ignore the permissible operating energy of the brake, then the brake will be subject to excessive and impermissible wear. As a consequence, there may be no braking effect at all. Unintentional movements of the machine or system can result in death or serious injury.

- Observe the permissible operating energy and EMERGENCY STOP properties.
- Operate the motor only in conjunction with an intact brake.
- Avoid repeated brief acceleration of the motor against a holding brake that is still closed.

- Do not exceed the maximum operating energy per emergency braking.

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.

- The rated voltage of the holding brake is 24 V DC ± 10%. Voltages outside this tolerance range can cause disturbances.

Note

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

4.2.2 Technical specifications

The following table contains technical specifications of the holding brakes:

Note

The following specifications apply to control with 24 V DC.

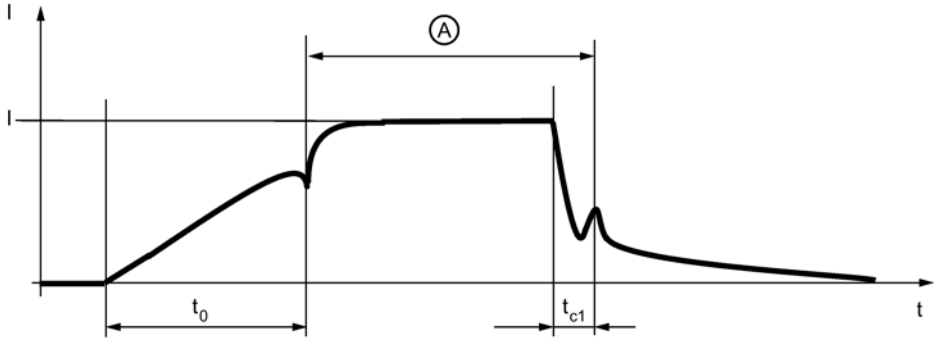
Motor	Holding torque at 120 °C	Dyn. braking torque	Rated current	Opening time [1]	Closing time [1]	Maximum permissible single operating energy [2]	Total operating energy (service life)
	M_4 / Nm	M_{dyn} / Nm	I_n / A	t_{o1} / ms	t_{c1} / ms	W_{max} / J	W_{total} / kJ
For spring-loaded brake							
1FK2❑03	1.3	1.3	0.4	90	20	62	5
1FK2❑04	3.3	3.3	0.5	110	30	270	35
For permanent-magnet brake							
1FK2❑05	8	5	0.6	90	25	570	284
1FK2❑06	13	6.5	0.7	100	50	1550	774
1FK2❑08-3	19	12	0.8	100	40	2000	1800
1FK2❑08-4 1FK2❑08-5	32	17	0.9	200	60	4800	2400
1FK2❑10-3	32	17	0.9	200	60	6500	2400
1FK2❑10-4 1FK2❑10-5	55	26	1.0	220	60	8700	3800

[1] Valid for direct connection to S120 and internal switching. For external brake switching, a varistor has to be used.

[2] Maximum three EMERGENCY STOP operations in sequence, maximum 25% of all the emergency stops as high energy stop with W_{max}.

Note

If the brake is switched in two stages (two clicks), the first switching point is decisive for opening and the second for closing.



I Current
t Time
t_0 Opening time
t_{c1} Closing time
A Brake opened

Figure 4-1 Time-related terminology for braking operation

Holding torque M_4

The holding torque M_4 is the highest permissible torque for the closed brake in steady-state operation without slip (holding function when motor is at standstill). The data applies for the state at operating temperature (120 °C).

Dynamic braking torque M_{1m}

The dynamic braking torque M_{1m} is the smallest mean dynamic braking torque that can occur for an EMERGENCY STOP.

Opening time and closing time

The delay times that occur when switching the brake.

Maximum permissible single switching energy

The maximum permissible single switching energy of an individual EMERGENCY STOP operation.

After an EMERGENCY STOP with the maximum single operating energy, allow a cooling time of at least 3 minutes before you operate the motor again.

Maximum EMERGENCY STOP speed

Maximum permitted speed for a safe EMERGENCY STOP procedure.

Total operating energy (service life)

The total switching energy is the sum of the single switching energy (switching energy for each EMERGENCY STOP procedure). If the total operating energy is exceeded, brakes can no longer be guaranteed to function correctly.

- Refurbish the motor.

Formula for calculating the operating energy per braking operation

$W_{BR} = (J_{Mot\ Br} + J_{load}) \bullet n_{mot}^2 / 182.4$

W_{Br} / J	Operating energy per braking operation
n_{Mot} / min^{-1}	Speed at which the brake is engaged
$J_{Mot\ Br}$ / kgm^2	Rotor moment of inertia of the motor with brake
J_{load} / kgm^2	Load moment of inertia of the mounting part on the motor with brake (kgm^2)
182.4	Constant for calculating the circular frequency and SI units

You can find the corresponding data in Chapter "Technical data and characteristics (Page 61)".

Configuration

5

5.1 Configuring software

5.1.1 SIZER configuration tool

Overview

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

SIZER supports the following configuration steps:

- Configuring the power supply
- Designing the motor and gearbox, including calculation of mechanical transmission elements
- Configuring the drive components
- Compiling the required accessories
- Selection of the line-side and motor-side power options

The configuration process produces the following results:

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

You can find additional information that you can download in the Internet at SIZER (https://support.industry.siemens.com/cs/document/54992004/sizer-for-siemens-drives?dti=0&pnid=13434&lc=en-WW).

5.1.2 Startdrive commissioning tool

The SINAMICS Startdrive is a tool for configuring, commissioning, and diagnosing the SINAMICS family of drives and is integrated into the TIA Portal. It has been optimized with regard to user friendliness and consistent use of the TIA Portal benefits of a common working environment for PLC, HMI, and drives.

The SINAMICS Startdrive commissioning tool is available free on the Internet at Startdrive (https://w3.siemens.com/mcms/mc-solutions/en/engineering-software/startdrive/Pages/startdrive.aspx).

Startdrive can also be ordered directly as a DVD:

Table 5- 1 Article number for Startdrive

Commissioning tool	Article number of the DVD
Startdrive Basic V15.1 Update 1 German, English, Spanish, French, Italian, and Chinese (simplified)	6SL3072-4FA02-0XA0
Startdrive Advanced V15.1 Update 1 German, English, Spanish, French, Italian, and Chinese (simplified)	6SL3072-4FA02-0XA5

5.2 Configuring procedure

Motion control

Drives are optimized for motion control applications. They execute linear or rotary movements within a defined movement cycle. All movements should be optimized in terms of time.

As a result, drives must meet the following requirements:

- High dynamic response, i.e. short rise times
- Capable of overload, i.e. a high reserve for accelerating
- Wide control range, i.e. high resolution for precise positioning

The following table "Configuring procedure" is valid for synchronous and induction motors.

General configuring procedure

The function description of the machine provides the basis for configuration. The components are selected according to physical interdependencies and the selection process is usually carried out in the following sequence of steps:

Table 5- 2 Configuring sequence

Step	Description of the configuring activity	
1.	Clarify the drive type	Refer to the next chapter
2.	Define the boundary conditions and incorporate them into the automation system	
3.	Define the load case, calculate the maximum load torque and determine the motor	
4.	Define the converter required	Refer to catalog
5.	Repeat steps 3 and 4 for additional axes	
6.	Determine line-side power options (main switch, fuses, line filters, etc.)	
7.	Define other system components (e.g. braking resistors)	
8.	Calculate the current demand of the components for the 24 V DC power supply - and specify the power supplies (SITOP devices, Control Supply Modules)	
9.	Determine the connection system components	
10.	Configure the drive line-up components	
11.	Calculate the required cable cross sections for power supply and motor connections	
12.	Inclusion of mandatory installation clearances	

5.2.1 Clarify the drive type

Select the motor on the basis of the required torque (load torque), which is defined by the application, e.g. traveling drives, hoisting drives, test stands, centrifuges, paper and rolling mill drives, feed drives or main spindle drives.

Gearboxes to convert motion or to adapt the motor speed and motor torque to the load conditions must also be taken into account when selecting the motor.

You must know the following mechanical data in order to determine the torque to be supplied by the motor:

- The load torque specified by the application
- Masses to be moved
- Diameter of the drive wheel
- Leadscrew pitch, gear ratios
- Frictional resistance data
- Mechanical efficiency
- Traversing distances
- Maximum velocity
- Maximum acceleration and maximum deceleration
- Cycle time

5.2.2 Define the boundary conditions and incorporate them into the automation system

Take the following into account during the configuration:

- The line system configuration when using specific motor types and/or line filters
- Rated values of the motor
- The ambient temperatures and the installation altitude of the motors and drive components
- Heat dissipation from the motors

Other conditions apply when integrating the drives into an automation environment such as SIMATIC or SIMOTION.

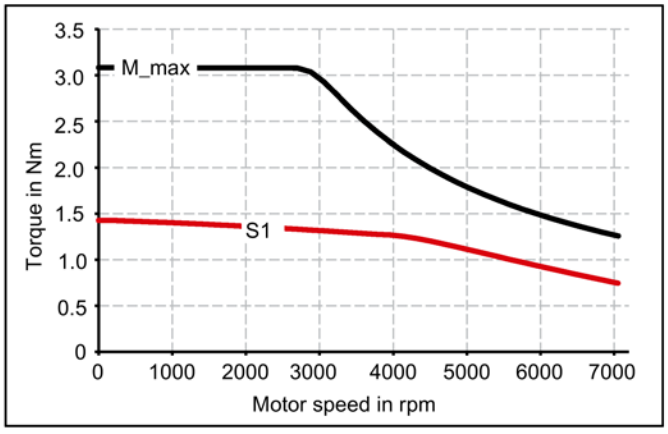
For motion control and technology functions (e.g. positioning), as well as for synchronous operation functions, the corresponding automation system, e.g. SIMATIC S7-1500 or SIMOTION D is used.

5.2.3 Define the load case, calculate the maximum load torque and determine the motor

The motors are defined bases on the motor type-specific limiting characteristic curves.

The limiting characteristic curves describe the torque or power curve over the speed.

The limiting characteristic curves take the limits of the motor into account on the basis of the DC link voltage. The DC link voltage is dependent on the line voltage.



M_max Curve of the maximum torque

S1 S1 characteristic

Figure 5-1 Limit characteristics for synchronous motors

Procedure

1. Determine the load which is specified by the application.

   Use different characteristics for the different loads.
   The following operating scenarios have been defined:

   – Duty cycle with constant ON duration

   – Free duty cycle

2. Determine the characteristic torque and speed operating points of the motor for the defined load.

3. Calculate the acceleration torque of the motor.
   Add the load torque and the acceleration torque to obtain the maximum required torque.

4. Verify the maximum motor torque with the limiting characteristic curves of the motors.

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

   – Adherence to the dynamic limits
     All speed-torque points of the load event must lie below the relevant limiting characteristic curve.

   – Adherence to the thermal limits
     At average motor speed, the effective motor torque must be below the S1 characteristic (continuous operation) during the load.

You have specified a motor.
❒

Duty cycles with constant ON duration

For duty cycles with constant ON duration, there are specific requirements for the torque characteristic curve as a function of the speed, for example:

M = constant, M ~ n^2, M ~ n or P = constant.

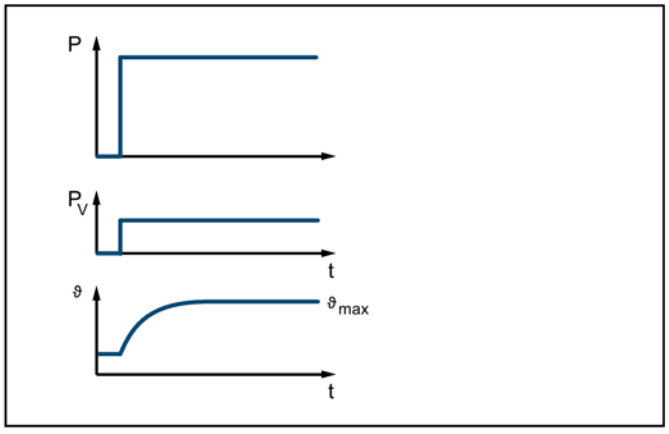


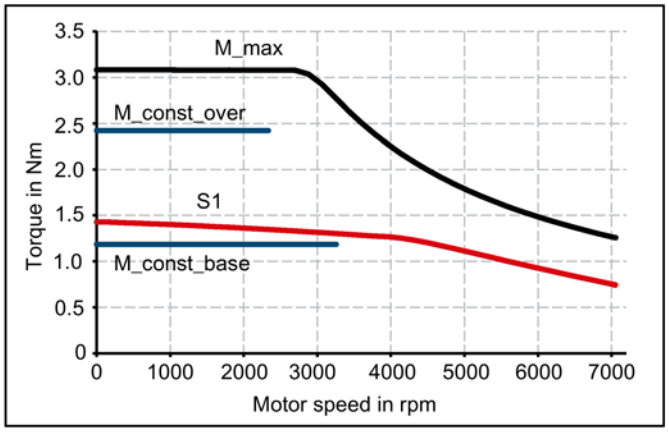
Figure 5-2 S1 duty (continuous operation)

The drives with this load cycle typically operate at a stationary operating point.

Procedure

1. Configure a base load for the stationary operating point. The base load torque must lie below the S1 characteristic.
2. In the event of transient overloads (e.g. during acceleration), configure an overload. Calculate the overload current in relation to the required overload torque. The overload torque must lie below the M_max characteristic.

   In summary, the motor is configured as follows:



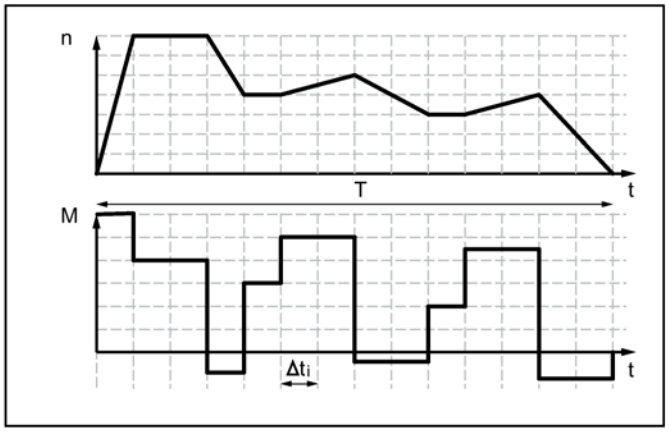
M_max	Curve of the maximum torque	M_const_over	Curve of the overload torque
S1	S1 characteristic	M_const_base	Curve of the base load torque

Figure 5-3 Motor selection for a duty cycle with constant switch-on duration

3. Select a motor that satisfies the requirements of S1 duty.
   ❒

Free duty cycle

A free duty cycle defines the curve of the motor speed and the torque over time.



n	Speed	T	Cycle time
M	Torque	Δt_i	Time interval
t	Time		

Figure 5-4 Example of free duty cycle

Procedure

Determine the required motor torque as follows:

1. Define a load torque for each time slice. Also take the average load moment of inertia and motor moment of inertia into account for acceleration operations. If required, take a frictional torque into account that opposes the direction of motion.
2. With mounted gearbox:
   Determine the load torque and the acceleration torque that must be supplied by the motor. Take the gear ratio and gear efficiency into account.

Note

A higher gear ratio increases positioning accuracy in terms of encoder resolution. For any given encoder resolution, as the gear ratio increases, so does the resolution of the machine position to be detected.

The following formulas can be used for duty cycles outside the field weakening range.

For the motor torque in a time slice Δt_i the following applies:

$$M_{Mot,\,i} = \left(J_M + J_G\right) \cdot \frac{2\pi}{60} \cdot \frac{\Delta n_{Last,\,i}}{\Delta t_i} \cdot i + \left(J_{Last} \cdot \frac{2\pi}{60} \cdot \frac{\Delta n_{Last,\,i}}{\Delta t_i} + M_{Last,\,i} + M_R\right) \cdot \frac{1}{i \cdot \eta_G}$$

The motor speed is:

$$n_{Mot,\,i} = n_{Last,\,i} \cdot i$$

The effective torque is obtained as follows:

$$M_{Mot,\,eff} = \sqrt{\frac{\sum M_{Mot,\,i}^2 \cdot \Delta t_i}{T}}$$

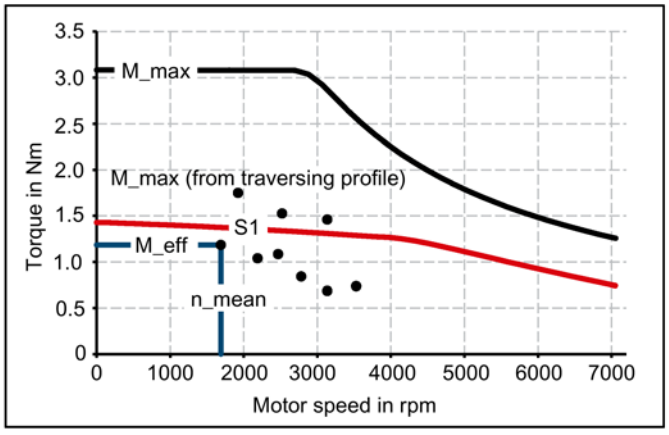
The average motor speed is calculated as follows:

$$n_{Mot,\,mittel} = \frac{\sum \frac{n_{Mot,\,i,\,A} + n_{Mot,\,i,\,E}}{2} \cdot \Delta t_i}{T}$$

J_M	Motor moment of inertia
J_G	Gearbox moment of inertia
J_{load}	Load moment of inertia
n_{load}	Load speed
i	Gear ratio
η_G	Gearbox efficiency
M_{load}	Load torque
M_R	Frictional torque
T	Cycle time
A; E	Initial value, final value in time slice Δt_i
t_e	ON duration
Δt_i	Time interval

The effective torque M_{eff} must lie below the S1 characteristic.

The maximum torque M_{max} is produced during the acceleration operation. M_{max} must lie below the voltage limiting characteristic curve. In summary, the motor is configured as follows:



M_max	Curve of the maximum torque	S1	S1 characteristic = M_0
M_eff	Effective torque	•	Points from the traversing profile
n_mean	Mean speed		

Figure 5-5 Motor selection for duty cycle

You have defined the characteristic motor values corresponding to the duty cycle.
❒

Defining the motor

By varying, you can find the motor that satisfies the conditions of the operating mode (duty cycle).

- Determine the motor current at base load. The calculation depends on the type of motor (synchronous motor or induction motor) and the operating mode (duty cycle) used.

  Note

  When configuring according to duty cycle with constant ON duration with overload, the overload current is calculated in relation to the required overload torque.

- Comply with the thermal limits of the motor.
- Configure the other properties of the motor through the available motor options.

5.3 Output coupling

NOTICE
Motor damage caused by rotating forces Output couplings, especially stiff metal bellows-type couplings can exercise rotating forces on the shaft. These forces can result in bearing motion and in turn damage the motor. • Rotating forces are not permissible.

To achieve optimum output characteristics, we recommend ROTEX® GS couplings from the KTR company.

The advantages of ROTEX® GS couplings are as follows:

- 2 to 4x torsional stiffness of a belt gearbox
- No teeth meshing (when compared to a belt gearbox)
- Low moment of inertia
- Good closed-loop control response

KTR can provide support when selecting the coupling, see http://www.ktr.com

5.4 Braking resistor (armature short-circuit braking)

5.4.1 Description of function braking resistor

The motor cannot be electrically braked if, for converters

- The permissible DC link voltage values are exceeded
- The electronics fails

Then, the motor that is coasting down can only be braked using an armature short circuit.

You can switch the armature short-circuit braking internally via the Motor Module or externally using a contactor circuit with braking resistors.

Armature short-circuit braking must be initiated at the latest by the limit switch in the traversing range of the feed axis.

NOTICE
Damage to the drive at the end of the traversing range
To avoid mechanical damage, mount mechanical stops at the end of the absolute traversing range.

NOTICE
Destruction of the converter as the armature short-circuit contactor incorrectly switches
Incorrect switching of the armature short-circuiting contactor can erode the contactor contacts and destroy the converter. • Program the converter so that pulses are first canceled and this is actually implemented before an armature short-circuit contactor is closed or opened.

In servo motors with an integrated holding brake, you can produce additional braking torque with the holding brake.

Note

The holding brake is not a working brake to brake a spinning motor. A limited number of EMERGENCY STOP operations is permissible.

Additional information is provided in Chapter " Brake (Page 42)".

Note

Braking under normal operating conditions must always be performed via the setpoint input.

For further information, see the configuration manual of the converter.

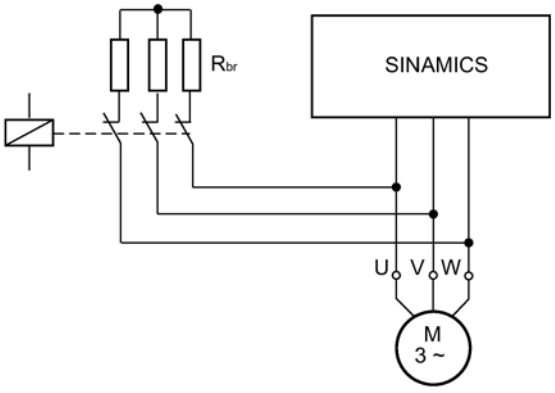


Figure 5-6 Circuit (schematic) with braking resistors

5.4.2 Dimensioning of the construction of braking resistors

Rating

NOTICE
Destruction of the braking resistors Braking from the rated speed is not permitted any more frequently than every 2 minutes; otherwise the resistors will be destroyed. • Maintain a time interval of at least 2 minutes or longer between braking operations. • When required, specify other braking cycles when ordering.

You can dimension the braking resistor so that a surface temperature of 300 °C can occur briefly (max. 500 ms).

The external moment of inertia and the intrinsic motor moment of inertia are decisive when dimensioning the braking resistors.

When ordering the braking resistors, determine the kinetic energy involved.

Kinetic energy	$W = (\omega^2 \cdot J) / 2$	W / Ws = kinetic energy J / kgm² = moment of inertia
Angular velocity	$\omega = (2 \cdot \pi / 60) \cdot n$	ω / 1/s = angular velocity n / rpm = speed

Coordinate the braking resistor ratings to the I^2t load capability.

Calculating the braking time

The values for calculation are provided in Chapter "Data sheets and characteristics (Page 71)".

Braking time	$t_B = J_{Tot} \cdot n / 9.55 \cdot M_{Br}$	t_B / s = braking time
		n / rpm = operating speed
		M_{Br} / Nm = average braking torque
Moment of inertia	$J_{Tot} = J_{Mot} + J_{Ext}$	J_{Tot} / kgm² = moment of inertia
		J_{Mot} / kgm² = motor moment of inertia
		J_{Ext} / kgm² = external moment of inertia

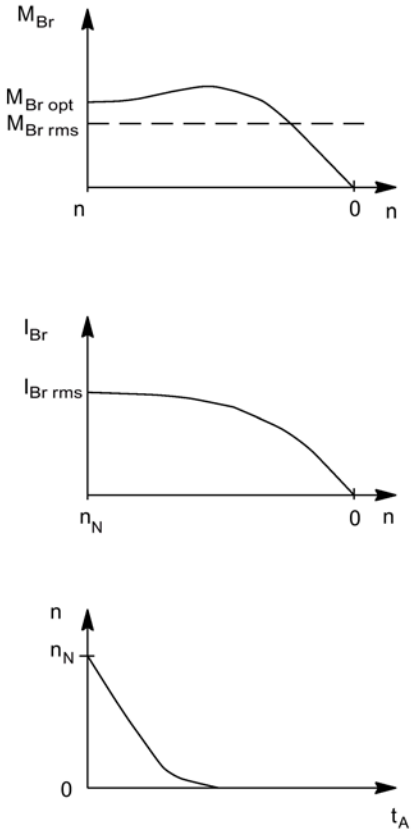
Note

In determining the run-on distance, consider the friction of the mechanical transmission elements (included in the calculation as an allowance in M_B) and the switching delay times of the contactors.

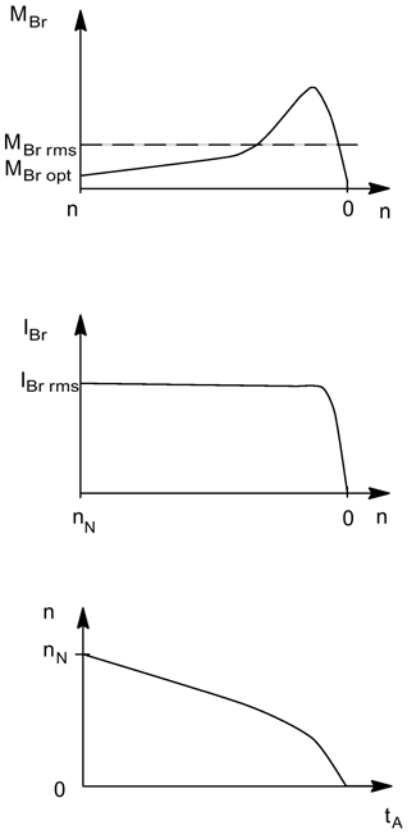
To avoid mechanical damage to the drive, mount mechanical stops at the end of the absolute traversing range of the machine axes.

Armature short-circuit braking

with external braking resistor



without external braking resistor



M_{Br} = braking torque
$M_{Br\ rms}$ = average braking torque
$M_{Br\ opt}$ = optimum braking torque
I_{Br} = braking current
$I_{Br\ rms}$ = rms braking current
t_R = run-out time
n = speed
n_N = rated speed

5.4.3 Dimensioning of braking resistors

The correct dimensioning ensures an optimum braking time. The braking torques obtained are also listed in the tables. The data applies to braking operations from the rated speed and moment of inertia $J_{Ext} = J_{Mot}$.

If the motor brakes from another speed, then the braking time cannot be linearly reduced. In this case, calculate the braking time according to the formula in the section "Dimensioning of the construction of braking resistors (Page 57)".

If the speed at the start of braking is less than the rated speed, the braking times will be shorter or remain the same.

The data in the following tables is calculated for rated values according to the data sheet. The variance during production as well as iron saturation have not been taken into account here. Higher currents and torques than those calculated can occur as a result of the saturation.

WARNING

Risk of fire caused by continuous overload

If the external braking resistor is continuously overloaded, for example as the result of a defective braking chopper, this can cause an explosion or fire - resulting in death or severe injury and/or could cause the housing to melt.

- Use only braking resistors that are intrinsically safe.

Table 5- 3 Dynamic braking for 1FK2

Motor variant	Braking resistor, external R_{opt} / Ω	Average braking torque		Maximum braking torque $M_{br\,max}$ / Nm	rms braking current	
		Without external braking resistor $M_{br\,rms}$ / Nm	With external braking resistor $M_{br\,rms}$ (R_{opt}) / Nm		Without external braking resistor $I_{br\,rms}$ / A	With external braking resistor $I_{br\,rms}$ (R_{opt}) / A
1FK2104-4AF	21	0.75	1.1	1.35	2.2	2
1FK2104-5AF	12.5	1.35	2.3	2.9	4.3	3.9
1FK2104-6AF	8.5	1.75	3.1	3.8	6	5.5
1FK2105-4AF	6.5	1.7	4	5	8.5	7.5
1FK2105-6AF	5	2.7	6.5	8	12	11
1FK2106-3AF	3.4	2.6	6.5	8.5	15	13.5
1FK2106-4AF	3.1	3.2	9	11	18.5	16.5
1FK2106-6AF	2.2	4.7	13.5	16.5	26	24
1FK2204-5AF	6	2.4	3.3	4.1	7	6
1FK2204-6AF	4.6	3.1	4.4	5.5	9.5	8.5
1FK2205-2AF	3.8	5	6.5	8	11	10
1FK2205-4AF	2.6	8	10.5	13	18	16.5
1FK2206-2AF	6.5	2.6	5.4	6.8	9.6	8.6
1FK2206-4AF	3.85	5.9	12.8	15.9	19.3	17.3
1FK2208-3AC	4	7.4	16.5	20.5	17.6	15.7
1FK2208-4AC	2.3	9.7	22.5	28	27	24.5
1FK2208-5AC	1.74	12.3	28.5	35.5	35.5	31.5
1FK2210-3AB	4.5	12.2	30.5	38	19.7	17.7
1FK2210-3AC	1.99	10.2	30.5	38	35	31
1FK2210-4AB	3.1	15.9	41.5	52	28	25
1FK2210-4AC	2.6	13.1	41.5	51	35.5	32
1FK2210-5AC	1.43	16.7	53	66	54	48.5
1FK2306-2AC	9.8	3.3	5.5	6.9	6.1	5.5
1FK2306-4AC	7	7.4	12.9	16.1	11.2	10.1
1FK2308-3AB	4.8	9.5	17.6	22	13.9	12.5
1FK2308-4AB	3.9	12.6	23.5	29.5	18	16.2

Note

Braking resistor with temperature monitoring

Use only a braking resistor with temperature monitoring.

Technical data and characteristics

6

6.1 Explanations

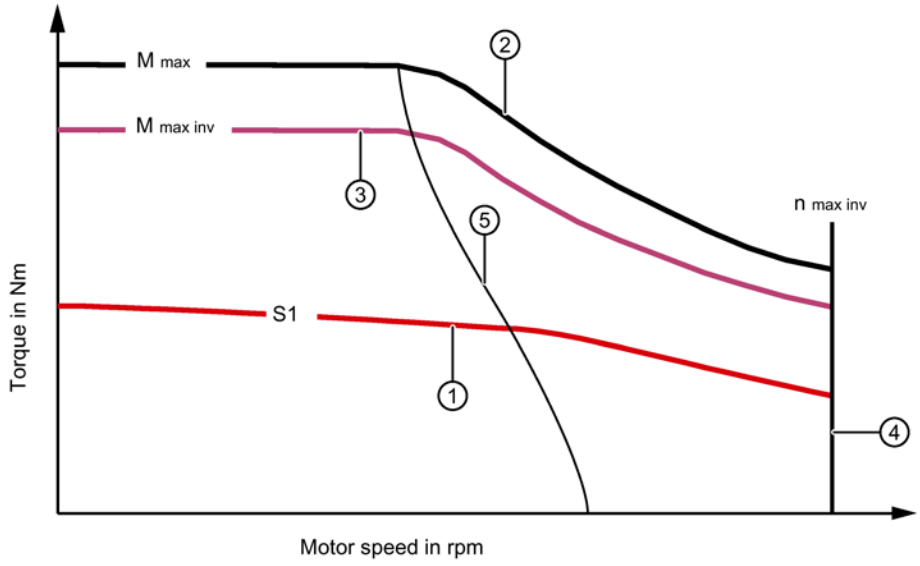
Permissible operating range

The permissible motor operating range is thermally, mechanically and electromagnetically limited. The data provided in the motor data and characteristics are applicable for an ambient temperature of 40 °C.

The losses in the motor (current-dependent losses, iron losses, friction losses) cause the motor temperature to increase.

To maintain the temperature limits, the permissible S1 torque – starting from static torque M_0 – decreases as the speed increases.

Motor characteristics



① S1 characteristic
② M_{max} characteristic
③ $M_{max\ inv}$ characteristic
④ $n_{max\ inv}$ line
⑤ Voltage limit characteristic curve

Figure 6-1 Torque characteristic

S1 characteristic

The S1 characteristic ① shows the limits of the permissible temperature range for continuous operation according to the specified temperature class of the motor.

The average value of the output torque must lie below the S1 characteristic.

You can find additional information in Chapter "Configuration (Page 47)".

NOTICE
Motor damage due to overheating Continuous operation in the area above the S1 characteristic results in motor overheating and subsequent damage. • Operate the motor within the values of the S1 characteristic.

M_{max} characteristic

The M_{max} characteristic ② defines the operating range for transient overloads.

$M_{max\ inv}$ characteristic

The $M_{max\ inv}$ characteristic ③ limits the possible overload range in combination with a specific maximum converter current. The $M_{max\ inv}$ characteristic takes field weakening into consideration.

$n_{max\ inv}$ line

The mechanical variables of the motor and the properties of the converter limit the speed range of the motor. The $n_{max\ inv}$ line ④ limits the maximum permitted speed of the motor in a drive system with SINAMICS S120.

NOTICE
Damage to the converter due to excessively high speeds A motor speed higher than $n_{max\ inv}$ can result in a voltage being induced in the winding that exceeds the maximum permissible voltage at the converter. This induced voltage can destroy the converter. • Operate the motor at speeds below $n_{max\ inv}$.

Voltage limit characteristic curve

Field weakening starts from the voltage limit characteristic ⑤.

As the speed increases, an increasing percentage of the current is used for field weakening, and therefore no longer generates a torque. This is the reason that the M_{max} characteristic and the S1 characteristic have a steep downward gradient in the field weakening range.

Converter output voltages

Every speed-torque diagram includes different characteristics for different converter output voltages.

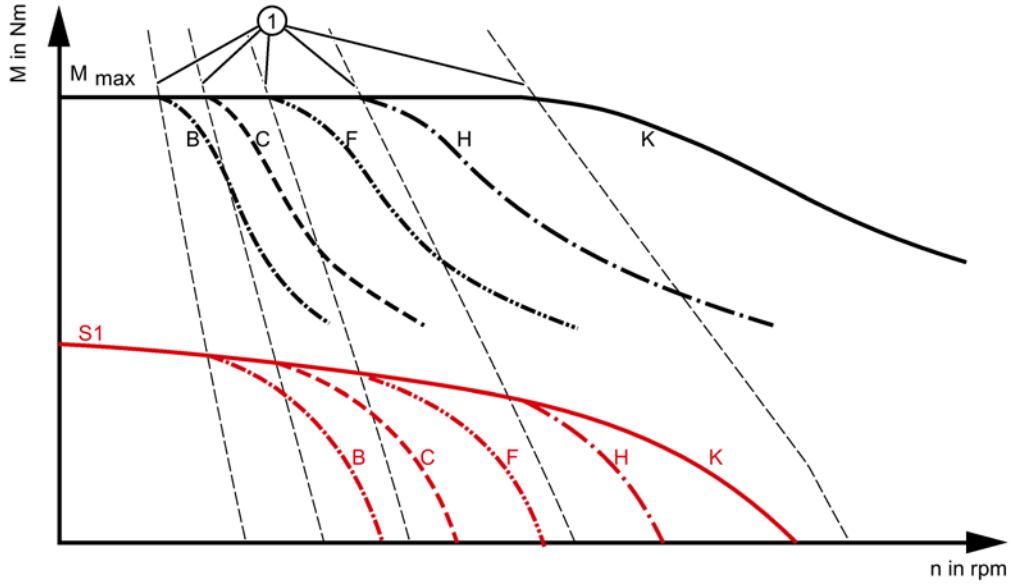
Drive system	Infeed module	Line voltage	DC link voltage	Output voltage
		U_{line}	$U_{DC\ LINK}$	U_{mot}
SINAMICS S120 3 AC 380 V to 480 V	ALM ALM BLM/SLM BLM/SLM	400 V 480 V 400 V 480 V	600 V 720 V 540 V 650 V	425 V 510 V 380 V 460 V

Winding versions

Several winding versions (armature circuits) for different rated speeds n_N are possible within a motor frame size.

Table 6- 1 Code letter, winding version

Rated speed n_N in rpm	Winding version (10th position of the Article number)
1500	B
2000	C
3000	F
4500	H
6000	K



① Voltage limit characteristics

Figure 6-2 Speed-torque diagram

The winding version of a motor defines the position of the natural voltage limit characteristic ①, and therefore defines the operating range limit.

Motors with a higher code letter for the winding permit a wider speed range in the S1 and overload operation. However, these motors require a higher current for the same torque.

The preferred choice is the motor with the lowest code letter for the winding, which still addresses the speed requirements for the application.

This is how you optimize the output current required, and therefore the converter size (rating).

Recommended Motor Module

For every motor, Chapter "Motor overview/Motor Module assignment/power cables (Page 64)" recommends a Motor Module corresponding to its stall (starting) current.

The maximum torque that can be temporarily achieved using this Motor Module is listed in the tables of this manual as $M_{max\ inv}$.

- When configuring intermittent or overload operation, check whether a larger Motor Module is required to provide the necessary peak current.

Tolerance data

The characteristic data listed in the data sheets are subject to a certain amount of scatter. The following tolerances apply to the characteristic data:

Motor list data		Typ. value	Max. value
Current values	I_0, I_N, I_{max}	± 3 %	± 7.5 %
Torque values	M_0, M_N, M_{max}	± 3 %	± 7.5 %
Moment of inertia	J_{Mot}	± 2 %	± 10 %

The torque-speed characteristics specified in the following chapter relate to the nominal values at operating temperature.

6.2 Motor overview/Motor Module assignment/power cables

On the following pages, you can find the suitable SINAMICS Motor Modules and MOTION-CONNECT power cables for the 1FK2.

SINAMICS Motor Module S120 Booksize, DC link voltage 510 V DC to 720 V DC, line voltage 3 AC 380 V to 480 V

Example of an article number for a SINAMICS Motor Module

The following table describes the options that can be selected for the SINAMICS Motor Module.

Description	Position in the article number																
	1	2	3	4	5	6	7	-	8	9	10	11	12	-	13	14	15	16
SINAMICS Motor Modules S120 Booksize (example)	6	S	L	3	1	2	0	-										
	Single Motor Module								1									
	Double Motor Module								2									
										T	E	2	1	-	0	A	D	
											Version release							❑

SINAMICS S120 Booksize, DC link voltages 510 V DC to 720 V DC, line voltages 3 AC 380 V to 480 V

You can find the suitable SINAMICS Motor Modules in the following tables.

Motor data			Combination with Motor Module SINAMICS S120 Booksize C/D type		
Article number	Moment of inertia J_{Mot} / kg cm²	Static / max. torque M_0 / M_{max} / Nm	Static / max. torque in combination with S120 Booksize C/D type $M_{0\,Inv}$ / $M_{max\,Inv}$ / Nm	Article number for S120 Booksize C/D type 6SL3120-…	Rated / max. current for S120 Booksize C/D type I_N / $I_{max\,Inv}$ / A
1FK2 High Dynamic					
1FK2104-4AF	0.35	1.27 / 3.75	1.27 / 3.75	...-❑TE13-0AD❑	3 / 9
1FK2104-5AF	0.56	2.4 / 7.5	2.4 / 7.5	...-❑TE13-0AD❑	3 / 9
1FK2104-6AF	0.76	3.2 / 10	3.2 / 8.6	...-❑TE13-0AD❑	3 / 9
			3.2 / 10	...-❑TE15-0AD❑	5 / 15
1FK2105-4AF	1.7	5 / 15	5 / 13	...-❑TE15-0AD❑	5 / 15
			5 / 15	...-❑TE21-0AD❑	9 / 27
1FK2105-6AF	2.7	8 / 24	6 / 16.5	...-❑TE15-0AD❑	5 / 15
			8 / 24	...-❑TE21-0AD❑	9 / 27
1FK2106-3AF	4.6	9 / 25	8.8 / 21	...-❑TE21-8AC❑	9 / 27
			9 / 24.5	...-❑TE21-8AC❑	18 / 36
			9 / 24.5	...-❑TE21-8AD❑	18 / 54
1FK2106-4AF	6	12 / 32.5	10 / 25.5	...-❑TE21-8AC❑	9 / 27
			12 / 31	...-❑TE21-8AD❑	18 / 36
			12 / 32.5	...-❑TE21-8AD❑	18 / 54
1FK2106-6AF	8.7	16 / 42	16 / 35.5	...-❑TE21-8AC❑	18 / 36
			16 / 42	...-❑TE21-8AD❑	18 / 54
1FK2 Compact					
1FK2204-5AF	1.2	2.4 / 7.1	2.4 / 7.1	...-❑TE13-0AD❑	3 / 9
1FK2204-6AF	1.6	3.2 / 9.5	3.2 / 8.8	...-❑TE13-0AD❑	3 / 9
			3.2 / 9.5	...-❑TE15-0AD❑	5 / 15
1FK2205-2AF	3.2	3.6 / 10.8	3.6 / 10	...-❑TE13-0AD❑	3 / 9
			3.6 / 10.8	...-❑TE15-0AD❑	5 / 15
1FK2205-4AF	5.1	6 / 18	3.8 / 11	...-❑TE13-0AD❑	3 / 9
			6 / 17.9	...-❑TE15-0AD❑	5 / 15
			6 / 18	...-❑TE21-0AD❑	9 / 27
1FK2206-2AF	7.8	6.5 / 18	3.9 / 11	...-❑TE13-0AD❑	3 / 9
			6.5 / 16	...-❑TE15-0AD❑	5 / 15
			6.5 / 18	...-❑TE21-0AD❑	9 / 27
1FK2206-4AF	15	12 / 36	7.6 / 21	...-❑TE15-0AD❑	5 / 15
			12 / 34	...-❑TE21-0AD❑	9 / 27
			12 / 36	...-❑TE21-8AC❑	18 / 36
1FK2208-3AC	30	18 / 51	11 / 30	...-❑TE15-0AD❑	5 / 15
			18 / 48	...-❑TE21-0AD❑	9 / 27
			18 / 51	...-❑TE21-8AC❑	18 / 36

Motor data			Combination with Motor Module SINAMICS S120 Booksize C/D type		
Article number	Moment of inertia J_{Mot} / kg cm²	Static / max. torque M_0 / M_{max} / Nm	Static / max. torque in combination with S120 Booksize C/D type $M_{0\ Inv}$ / $M_{max\ Inv}$ / Nm	Article number for S120 Booksize C/D type 6SL3120-…	Rated / max. current for S120 Booksize C/D type I_N / $I_{max\ Inv}$ / A
1FK2208-4AC	39	22 / 66	17 / 46	...-❑TE21-0AD❑	9 / 27
			22 / 58	...-❑TE21-8AC❑	18 / 36
			22 / 66	...-❑TE21-8AD❑	18 / 54
1FK2208-5AC	48	27 / 80	17 / 47	...-❑TE21-0AD❑	9 / 27
			27 / 60	...-❑TE21-8AC❑	18 / 36
			27 / 80	...-❑TE21-8AD❑	18 / 54
1FK2210-3AB	89	30 / 90	18 / 50	...-❑TE15-0AD❑	5 / 15
			30 / 81	...-❑TE21-0AD❑	9 / 27
			30 / 90	...-❑TE21-8AC❑	18 / 36
1FK2210-3AC	89	30 / 90	18 / 51	...-❑TE21-0AD❑	9 / 27
			30 / 65	...-❑TE21-8AC❑	18 / 36
			30 / 89	...-❑TE21-8AD❑	18 / 54
1FK2210-4AB	120	40 / 120	31 / 83	...-❑TE21-0AD❑	9 / 27
			40 / 105	...-❑TE21-8AC❑	18 / 36
			40 / 120	...-❑TE21-8AD❑	18 / 54
1FK2210-4AC	120	40 / 120	24 / 68	...-❑TE21-0AD❑	9 / 27
			40 / 87	...-❑TE21-8AC❑	18 / 36
			40 / 118	...-❑TE21-8AD❑	18 / 54
1FK2210-5AC	150	50 / 150	40 / 76	...-❑TE21-8AC❑	18 / 36
			40 / 108	...-❑TE21-8AD❑	18 / 54
			50 / 136	...-1TE22-4AD❑	24 / 72
			50 / 112	...-1TE23-0AC❑	30 / 56
			50 / 150	...-1TE23-0AD❑	30 / 90
1FK2 High Inertia					
1FK2306-2AC	12	6 / 18	6 / 16	...-❑TE13-0AD❑	3 / 9
			6 / 18	...-❑TE15-0AD❑	5 / 15
1FK2306-4AC	30	12 / 38	8 / 22.5	...-❑TE13-0AD❑	3 / 9
			12 / 34	...-❑TE15-0AD❑	5 / 15
			12 / 38	...-❑TE21-0AD❑	9 / 27
1FK2308-3AB	60	18 / 51	15 / 40	...-❑TE15-0AD❑	5 / 15
			18 / 51	...-❑TE21-0AD❑	9 / 27
1FK2308-4AB	69	22 / 66	15 / 43	...-❑TE15-0AD❑	5 / 15
			22 / 66	...-❑TE21-0AD❑	9 / 27

Motor data			Combination with Motor Module SINAMICS S120 Booksize Compact		
Article number	Moment of inertia J_{Mot} / kg cm²	Static / max. torque M_0 / M_{max} / Nm	Static / max. torque in combination with S120 Booksize Compact $M_{0\,Inv}$ / $M_{max\,Inv}$ / Nm	Article number for S120 Booksize Compact 6SL3420-…	Rated / max. current for S120 Booksize Compact I_N / $I_{max\,Inv}$ / A
1FK2 High Dynamic					
1FK2104-4AF	0.35	1.27 / 3.75	1.27 / 3.75	...-2TE11-7AA❑	1.7 / 5.1
			1.27 / 3.75	...-❑TE13-0AA❑	3 / 9
1FK2104-5AF	0.56	2.4 / 7.5	2.4 / 7.5	...-❑TE13-0AA❑	3 / 9
1FK2104-6AF	0.76	3.2 / 10	3.2 / 8.6	...-❑TE13-0AA❑	3 / 9
			3.2 / 10	...-❑TE15-0AA❑	5 / 15
1FK2105-4AF	1.7	5 / 15	5 / 13	...-❑TE15-0AA❑	5 / 15
			5 / 15	...-1TE21-0AA❑	9 / 27
1FK2105-6AF	2.7	8 / 24	6 / 16.5	...-❑TE15-0AA❑	5 / 15
			8 / 24	...-1TE21-0AA❑	9 / 27
1FK2106-3AF	4.6	9 / 24.5	8.8 / 21	...-1TE21-8AA❑	9 / 27
			9 / 24.5	...-1TE21-8AA❑	18 / 54
1FK2106-4AF	6	12 / 32.5	10 / 25.5	...-1TE21-8AA❑	9 / 27
			12 / 32.5	...-1TE21-8AA❑	18 / 54
1FK2106-6AF	8.7	16 / 42	16 / 42	...-1TE21-8AA❑	18 / 54
1FK2 Compact					
1FK2204-5AF	1.2	2.4 / 7.1	2.4 / 7.1	...-❑TE13-0AA❑	3 / 9
1FK2204-6AF	1.6	3.2 / 9.5	3.2 / 8.7	...-❑TE13-0AA❑	3 / 9
			3.2 / 9.5	...-❑TE15-0AA❑	5 / 15
1FK2205-2AF	3.2	3.6 / 10.8	3.6 / 10	...-❑TE13-0AA❑	3 / 9
			3.6 / 10.8	...-❑TE15-0AA❑	5 / 15
1FK2205-4AF	5.1	6 / 18	3.8 / 11	...-❑TE13-0AA❑	3 / 9
			6 / 17.9	...-❑TE15-0AA❑	5 / 15
			6 / 18	...-1TE21-0AA❑	9 / 27
1FK2206-2AF	7.8	6.5 / 18	3.9 / 11	...-❑TE13-0AA❑	3 / 9
			6.5 / 16	...-❑TE15-0AA❑	5 / 15
			6.5 / 18	...-1TE21-0AA❑	9 / 27
1FK2206-4AF	15	12 / 36	7.6 / 21	...-❑TE15-0AA❑	5 / 15
			12 / 34	...-1TE21-0AA❑	9 / 27
			12 / 36	...-1TE21-8AA❑	18 / 54
1FK2208-3AC	30	18 / 51	11 / 30	...-❑TE15-0AA❑	5 / 15
			18 / 48	...-1TE21-0AA❑	9 / 27
			18 / 51	...-1TE21-8AA❑	18 / 54
1FK2208-4AC	39	22 / 66	17 / 46	...-1TE21-0AA❑	9 / 27
			22 / 66	...-1TE21-8AA❑	18 / 54
1FK2208-5AC	48	27 / 80	17 / 47	...-1TE21-0AA❑	9 / 27
			27 / 80	...-1TE21-8AA❑	18 / 54

Motor data			Combination with Motor Module SINAMICS S120 Booksize Compact		
Article number	Moment of inertia J_{Mot} / kg cm²	Static / max. torque M_0 / M_{max} / Nm	Static / max. torque in combination with S120 Booksize Compact $M_{0\ Inv}$ / $M_{max\ Inv}$ / Nm	Article number for S120 Booksize Compact 6SL3420-…	Rated / max. current for S120 Booksize Compact I_N / $I_{max\ Inv}$ / A
1FK2210-3AB	89	30 / 90	18 / 50	...-❑TE15-0AA❑	5 / 15
			30 / 81	...-1TE21-0AA❑	9 / 27
			30 / 90	...-1TE21-8AA❑	18 / 54
1FK2210-3AC	89	30 / 90	18 / 51	...-1TE21-0AA❑	9 / 27
			30 / 89	...-1TE21-8AA❑	18 / 54
1FK2210-4AB	120	40 / 120	31 / 83	...-1TE21-0AA❑	9 / 27
			40 / 120	...-1TE21-8AA❑	18 / 54
1FK2210-4AC	120	40 / 120	24 / 68	...-1TE21-0AA❑	9 / 27
			40 / 118	...-1TE21-8AA❑	18 / 54
1FK2210-5AC	150	50 / 150	40 / 108	...-1TE21-8AA❑	18 / 54
1FK2 High Inertia					
1FK2306-2AC	12	6 / 18	6 / 16	...-❑TE13-0AA❑	3 / 9
			6 / 18	...-❑TE15-0AA❑	5 / 15
1FK2306-4AC	30	12 / 38	8 / 22.5	...-❑TE13-0AA❑	3 / 9
			12 / 34	...-❑TE15-0AA❑	5 / 15
			12 / 38	...-1TE21-0AA❑	9 / 27
1FK2308-3AB	60	18 / 51	15 / 40	...-❑TE15-0AA❑	5 / 15
			18 / 51	...-1TE21-0AA❑	9 / 27
1FK2308-4AB	69	22 / 66	15 / 43	...-❑TE15-0AA❑	5 / 15
			22 / 66	...-1TE21-0AA❑	9 / 27

SINAMICS S120 Combi Power Module, DC link voltage 510 V DC to 720 V DC, line voltage 3 AC 380 V to 480 V

You can find the suitable SINAMICS Power Modules in the following table.

Motor data			Combination with Power Modules SINAMICS S120 Combi			
Article number	Moment of inertia J_{Mot} / kg cm²	Static / max. torque M_0 / M_{max} / Nm	Static / max. torque in combination with S120 Combi $M_{0\ Inv}$ / $M_{max\ Inv}$ / Nm			
			I_N = 9 A $I_{max\ Inv}$ = 18 A	I_N = 9 A $I_{max\ Inv}$ = 27 A	I_N = 12 A $I_{max\ Inv}$ = 24 A	I_N = 12 A $I_{max\ Inv}$ = 36 A
1FK2 High Dynamic						
1FK2104-4AF	0.35	1.27 / 3.75	1.27 / 3.75	1.27 / 3.75	1.27 / 3.75	1.27 / 3.75
1FK2104-5AF	0.56	2.4 / 7.5	2.4 / 7.5	2.4 / 7.5	2.4 / 7.5	2.4 / 7.5
1FK2104-6AF	0.76	3.2 / 10	3.2 / 10	3.2 / 10	3.2 / 10	3.2 / 10
1FK2105-4AF	1.7	5 / 15	5 / 15	5 / 15	5 / 15	5 / 15
1FK2105-6AF	2.7	8 / 24	8 / 19.2	8 / 24	8 / 24	8 / 24
1FK2106-3AF	4.6	9 / 26	8.8 / 16	8.8 / 21	9 / 19.5	9 / 24.5
1FK2106-4AF	6	12 / 36	9.4 / 19	9.4 / 25.5	12 / 23.5	12 / 31
1FK2106-6AF	8.7	16 / 46	9.6 / 20	9.6 / 28	13 / 25.5	13 / 36

Motor data			Combination with Power Modules SINAMICS S120 Combi			
Article number	Moment of inertia J_{Mot} / kg cm²	Static / max. torque M_0 / M_{max} / Nm	Static / max. torque in combination with S120 Combi $M_{0\ Inv}$ / $M_{max\ Inv}$ / Nm			
			I_N = 9 A $I_{max\ Inv}$ = 18 A	I_N = 9 A $I_{max\ Inv}$ = 27 A	I_N = 12 A $I_{max\ Inv}$ = 24 A	I_N = 12 A $I_{max\ Inv}$ = 36 A
1FK2 Compact						
1FK2204-5AF	1.2	2.4 / 7.1	2.4 / 7.1	2.4 / 7.1	2.4 / 7.1	2.4 / 7.1
1FK2204-6AF	1.6	3.2 / 9.5	3.2 / 9.5	3.2 / 9.5	3.2 / 9.5	3.2 / 9.5
1FK2205-2AF	3.2	3.6 / 10.8	3.6 / 10.8	3.6 / 10.8	3.6 / 10.8	3.6 / 10.8
1FK2205-4AF	5.1	6 / 18	6 / 18	6 / 18	6 / 18	6 / 18
1FK2206-2AF	7.8	6.5 / 18	6.5 / 18	6.5 / 18	6.5 / 18	6.5 / 18
1FK2206-4AF	15	12 / 36	12 / 24	12 / 34	12 / 31	12 / 36
1FK2208-3AC	30	18 / 51	18 / 35	18 / 48	18 / 44	18 / 51
1FK2208-4AC	39	22 / 66	17 / 32	17 / 46	22 / 42	22 / 58
1FK2208-5AC	48	27 / 80	17 / 32	17 / 47	22 / 42	22 / 60
1FK2210-3AB	89	30 / 90	30 / 59	30 / 81	30 / 74	30 / 90
1FK2210-3AC	89	30 / 90	18 / 35	18 / 51	24 / 46	24 / 65
1FK2210-4AB	120	40 / 120	31 / 59	31 / 83	40 / 75	40 / 105
1FK2210-4AC	120	40 / 120	24 / 47	24 / 68	32 / 61	32 / 86
1FK2210-5AC	150	50 / 150	20 / 40	20 / 59	27 / 53	27 / 77
1FK2 High Inertia						
1FK2306-2AC	12	6 / 18	6 / 18	6 / 18	6 / 18	6 / 18
1FK2306-4AC	30	12 / 38	12 / 38	12 / 38	12 / 38	12 / 38
1FK2308-3AB	60	18 / 51	18 / 46	18 / 51	18 / 51	18 / 51
1FK2308-4AB	69	22 / 66	22 / 50	22 / 66	22 / 64	22 / 66

MOTION-CONNECT power cables for 1FK2

Example of an article number for a MOTION-CONNECT power cable

Description	Position in the article number																
	1	2	3	4	5	6	7	-	8	9	10	11	12	-	13	14	15	16
MOTION-CONNECT power cable (example)	6	F	X															
MOTION-CONNECT 500				5														
MOTION-CONNECT 800 PLUS				8														
					0	0	2	-	5									
	Without brake cables									C								
	With brake cables									D								
											N	0	6	-				
									Length codes						❑	❑	❑	❑

MOTION-CONNECT power cable between the motor and the SINAMICS S120 Motor Module/Power Module

You can find the suitable MOTION-CONNECT power cable in the following table.

Motor variant	Applicable Motor Module/ Power Module	Power cable												
		Plug connector size/ cable cross-section	SPEED-CONNECT connector						Fully threaded connector					
1FK2❑03 1FK2❑04 1FK2❑05	Booksize Compact	M17 / 4 x 1.5	6FX	❑	002-5	D	N30-	....	6FX	❑	002-5	D	A30-	....
	Booksize		6FX	❑	002-5	❑	N27-	....	6FX	❑	002-5	D	S27-	....
	Combi		6FX	5	002-5	D	F07-	....						
1FK2❑06 1FK2❑08 1FK2❑10-3 1FK2❑10-4	Booksize Compact	M23 / 4 x 1.5	6FX	❑	002-5	❑	G10 -	....	6FX	❑	002-5	❑	G01 -	....
	Booksize		6FX	❑	002-5	❑	N06-	....	6FX	❑	002-5	❑	S06-	....
	Combi		6FX	❑	002-5	❑	F10-	....						
1FK2❑10-5	Booksize	M40 / 4 x 4	6FX	❑	002-5	❑	N46	....	6FX	❑	002-5	❑	S46	....
MOTION-CONNECT 500				5						5				
MOTION-CONNECT 800 PLUS				8						8				
Cable without brake cores						C						C		
Cable with brake cores (can also be used for motors without brake)						D						D		
Length code								....						....

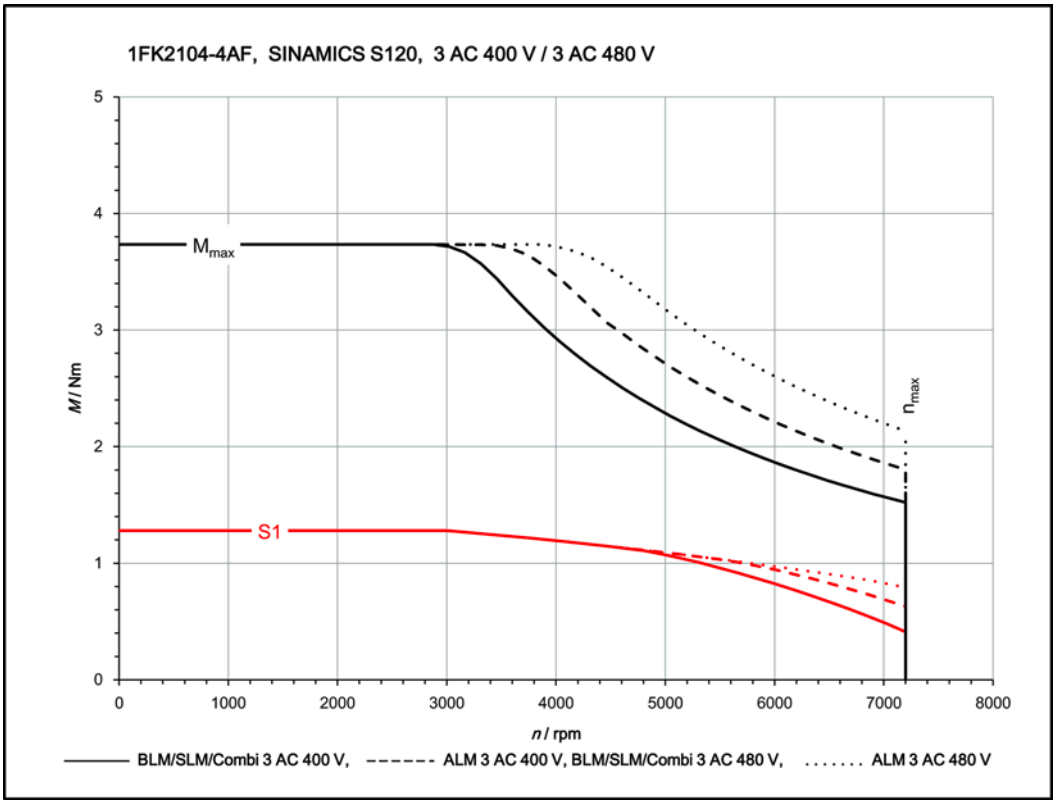
Additional information on the length code is available in Chapter "MOTION-CONNECT connection systems" of Catalog NC 82 (https://support.industry.siemens.com/cs/ww/en/view/109746977).

6.3 Data sheets and characteristics

6.3.1 High Dynamic

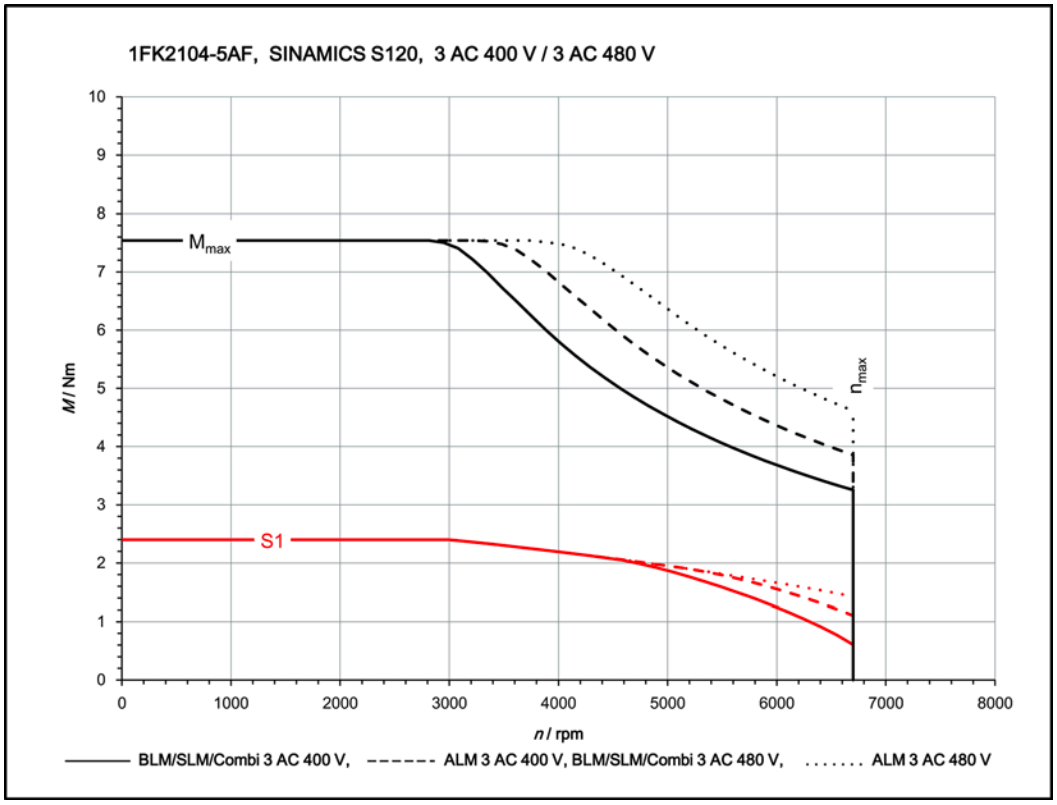
6.3.1.1 1FK2104-4AF

Three-phase servo motor 1FK2104-4AF			
Technical specifications in S120 system	**Symbol**	**Unit**	**Value**
Static torque	M_0	Nm	1.27
Stall current	I_0	A	1.19
Maximum permissible speed (at converter)	$n_{max\ Inv}$	rpm	7200
Maximum torque	M_{max}	Nm	3.75
Maximum current	I_{max}	A	4.2
Thermal time constant	T_{th}	min	33
Moment of inertia	J_{Mot}	kg cm²	0.35
Moment of inertia (with brake)	$J_{Mot\ Br}$	kg cm²	0.43
Weight	m_{Mot}	kg	2.05
Weight (with brake)	$m_{Mot\ Br}$	kg	2.9
Rated data with S120, 3 AC 400 V / 3 AC 480 V			
Rated speed	n_N	rpm	3000
Rated torque	M_N	Nm	1.27
Rated current	I_N	A	1.19
Rated power	P_N	kW	0.4



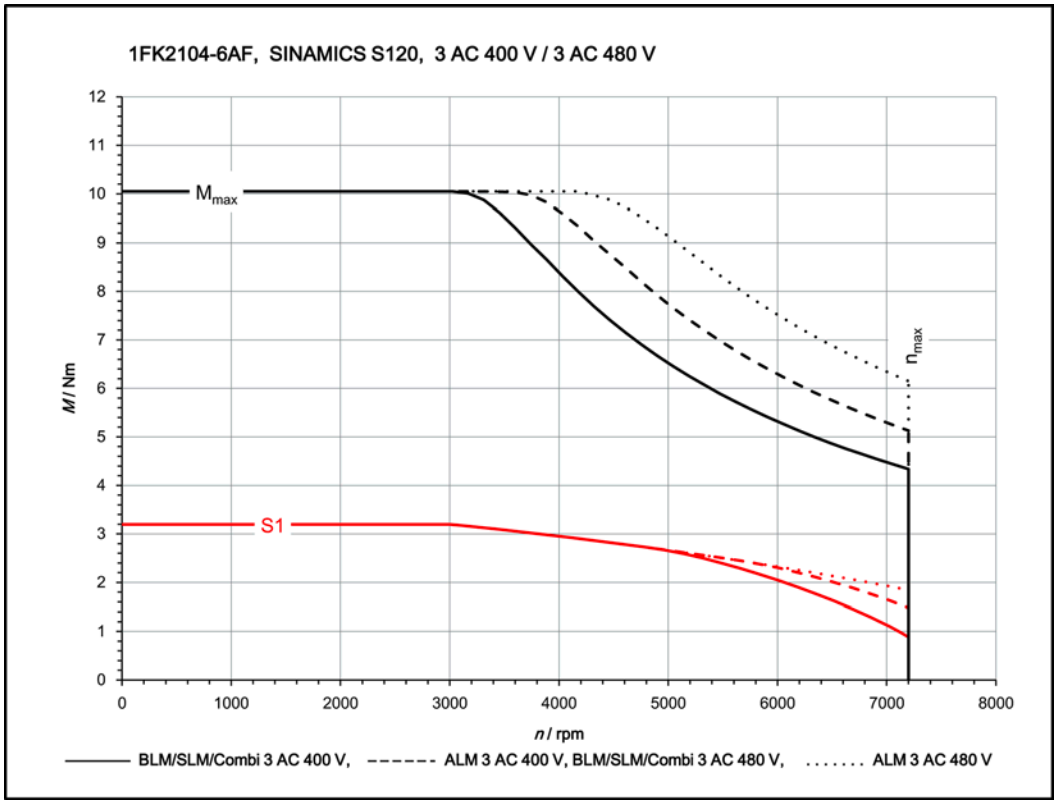
6.3.1.2 1FK2104-5AF

Three-phase servo motor 1FK2104-5AF			
Technical specifications in S120 system	**Symbol**	**Unit**	**Value**
Static torque	M_0	Nm	2.4
Stall current	I_0	A	2.1
Maximum permissible speed (at converter)	$n_{max\ Inv}$	rpm	6700
Maximum torque	M_{max}	Nm	7.5
Maximum current	I_{max}	A	7.6
Thermal time constant	T_{th}	min	35
Moment of inertia	J_{Mot}	kg cm²	0.56
Moment of inertia (with brake)	$J_{Mot\ Br}$	kg cm²	0.65
Weight	m_{Mot}	kg	2.85
Weight (with brake)	$m_{Mot\ Br}$	kg	3.7
Rated data with S120, 3 AC 400 V / 3 AC 480 V			
Rated speed	n_N	rpm	3000
Rated torque	M_N	Nm	2.4
Rated current	I_N	A	2.1
Rated power	P_N	kW	0.75



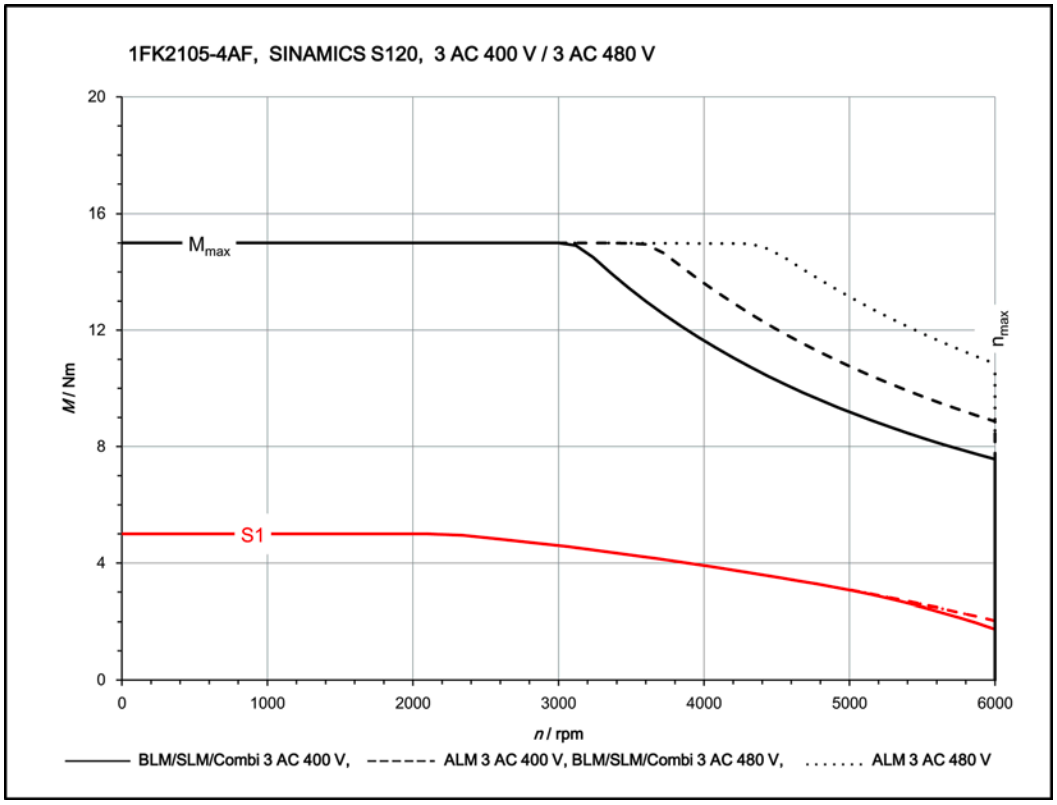
6.3.1.3 1FK2104-6AF

Three-phase servo motor 1FK2104-6AF			
Technical specifications in S120 system	**Symbol**	**Unit**	**Value**
Static torque	M_0	Nm	3.2
Stall current	I_0	A	3
Maximum permissible speed (at converter)	$n_{max\ Inv}$	rpm	7200
Maximum torque	M_{max}	Nm	10
Maximum current	I_{max}	A	10.9
Thermal time constant	T_{th}	min	38
Moment of inertia	J_{Mot}	kg cm²	0.76
Moment of inertia (with brake)	$J_{Mot\ Br}$	kg cm²	0.84
Weight	m_{Mot}	kg	3.4
Weight (with brake)	$m_{Mot\ Br}$	kg	4.25
Rated data with S120, 3 AC 400 V / 3 AC 480 V			
Rated speed	n_N	rpm	3000
Rated torque	M_N	Nm	3.2
Rated current	I_N	A	3
Rated power	P_N	kW	1



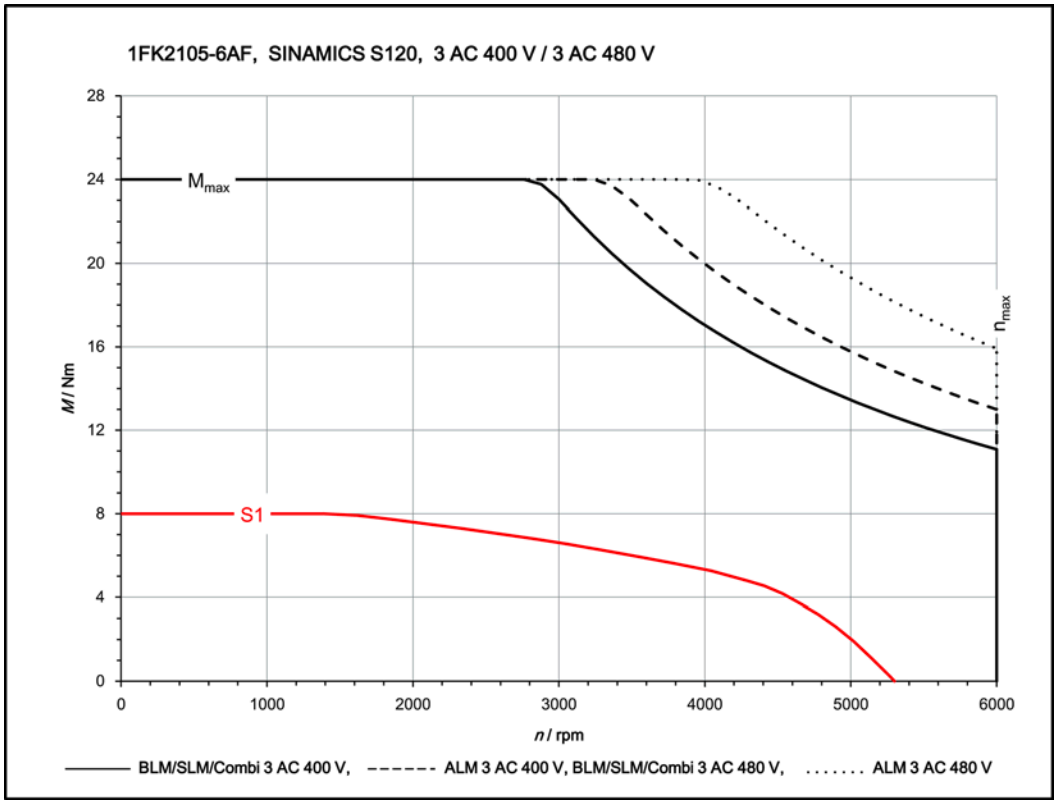
6.3.1.4 1FK2105-4AF

Three-phase servo motor 1FK2105-4AF			
Technical specifications in S120 system	**Symbol**	**Unit**	**Value**
Static torque	M_0	Nm	5
Stall current	I_0	A	4.65
Maximum permissible speed (at converter)	$n_{max\ Inv}$	rpm	6000
Maximum torque	M_{max}	Nm	15
Maximum current	I_{max}	A	18
Thermal time constant	T_{th}	min	34
Moment of inertia	J_{Mot}	kg cm²	1.71
Moment of inertia (with brake)	$J_{Mot\ Br}$	kg cm²	2.55
Weight	m_{Mot}	kg	5.6
Weight (with brake)	$m_{Mot\ Br}$	kg	6.6
Rated data with S120, 3 AC 400 V / 3 AC 480 V			
Rated speed	n_N	rpm	3000
Rated torque	M_N	Nm	4.6
Rated current	I_N	A	4.35
Rated power	P_N	kW	1.45



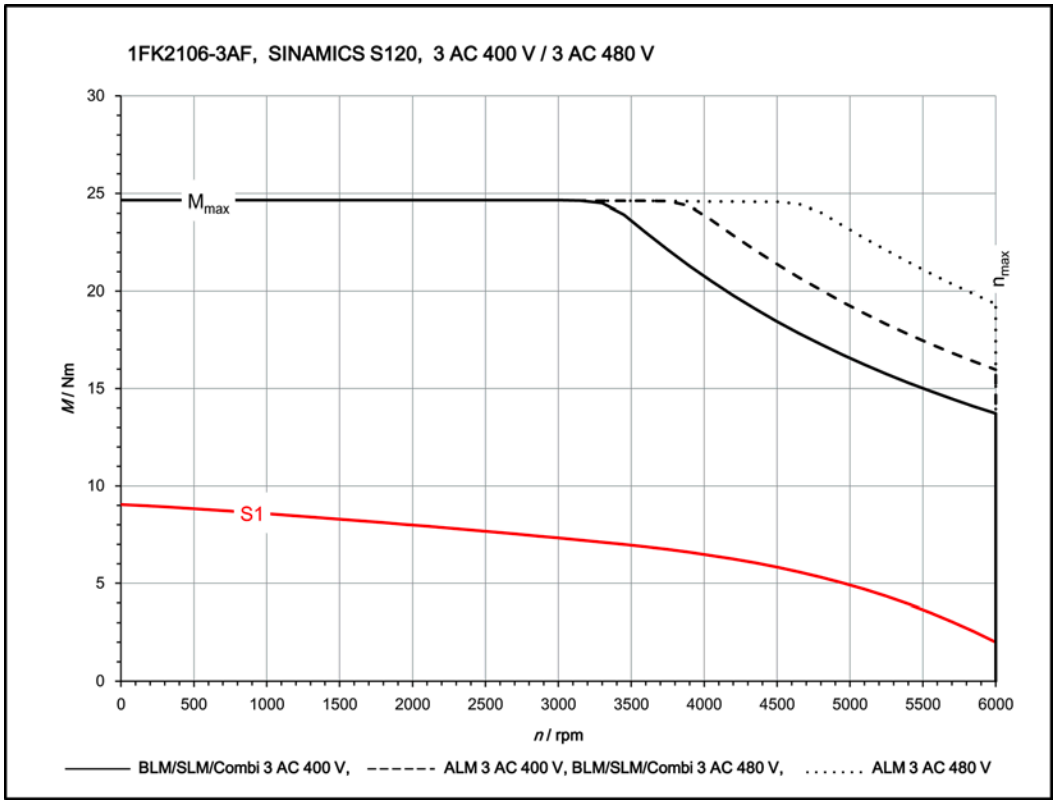
6.3.1.5 1FK2105-6AF

Three-phase servo motor 1FK2105-6AF			
Technical specifications in S120 system	**Symbol**	**Unit**	**Value**
Static torque	M_0	Nm	8
Stall current	I_0	A	6.7
Maximum permissible speed (at converter)	$n_{max\ Inv}$	rpm	6000
Maximum torque	M_{max}	Nm	24
Maximum current	I_{max}	A	24
Thermal time constant	T_{th}	min	40
Moment of inertia	J_{Mot}	kg cm²	2.65
Moment of inertia (with brake)	$J_{Mot\ Br}$	kg cm²	3.5
Weight	m_{Mot}	kg	7.7
Weight (with brake)	$m_{Mot\ Br}$	kg	8.7
Rated data with S120, 3 AC 400 V / 3 AC 480 V			
Rated speed	n_N	rpm	3000
Rated torque	M_N	Nm	6.6
Rated current	I_N	A	5.6
Rated power	P_N	kW	2.1



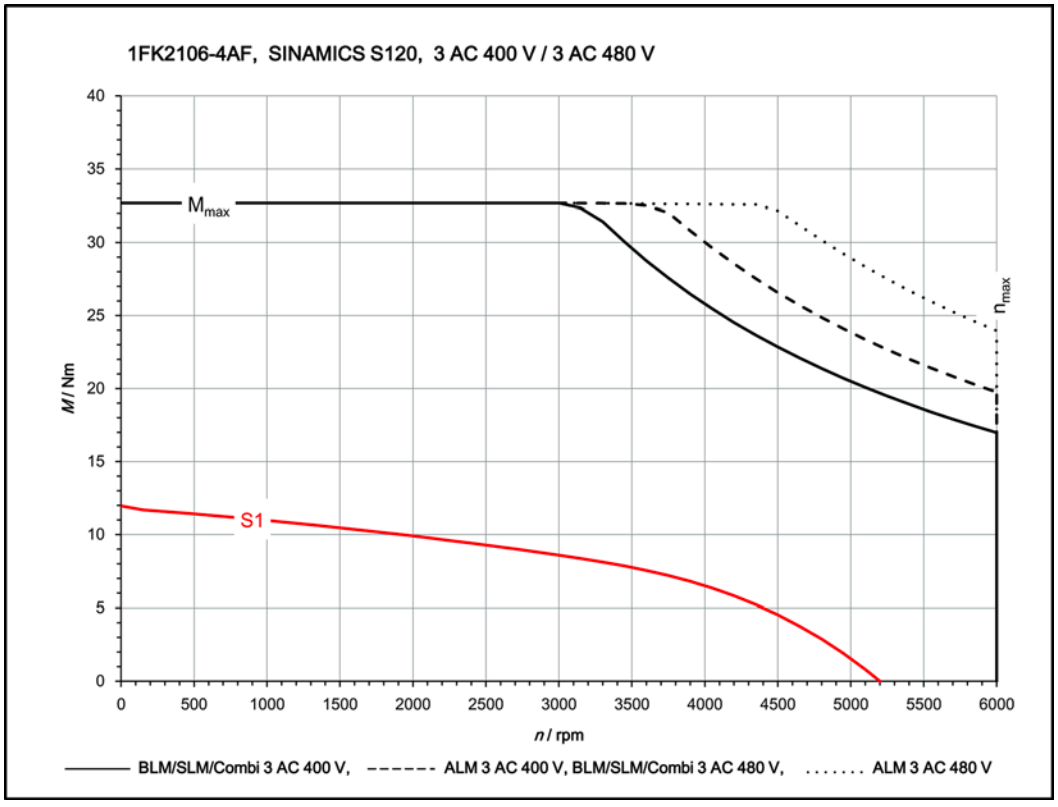
6.3.1.6 1FK2106-3AF

Three-phase servo motor 1FK2106-3AF			
Technical specifications in S120 system	**Symbol**	**Unit**	**Value**
Static torque	M_0	Nm	9
Stall current	I_0	A	9.2
Maximum permissible speed (at converter)	$n_{max\ Inv}$	rpm	6000
Maximum torque	M_{max}	Nm	24.5
Maximum current	I_{max}	A	36
Thermal time constant	T_{th}	min	30
Moment of inertia	J_{Mot}	kg cm²	4.6
Moment of inertia (with brake)	$J_{Mot\ Br}$	kg cm²	6.3
Weight	m_{Mot}	kg	7.4
Weight (with brake)	$m_{Mot\ Br}$	kg	9
Rated data with S120, 3 AC 400 V / 3 AC 480 V			
Rated speed	n_N	rpm	3000
Rated torque	M_N	Nm	7.3
Rated current	I_N	A	7.9
Rated power	P_N	kW	2.3



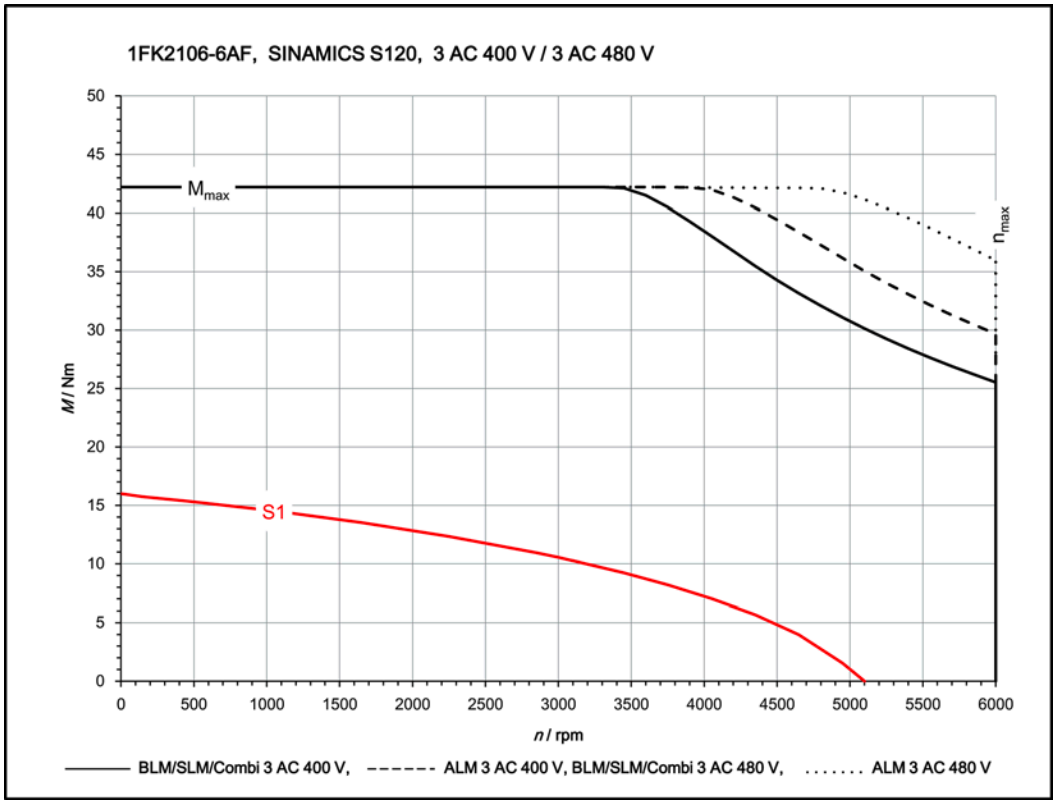
6.3.1.7 1FK2106-4AF

Three-phase servo motor 1FK2106-4AF			
Technical specifications in S120 system	**Symbol**	**Unit**	**Value**
Static torque	M_0	Nm	12
Stall current	I_0	A	10.7
Maximum permissible speed (at converter)	$n_{max\ Inv}$	rpm	6000
Maximum torque	M_{max}	Nm	32.5
Maximum current	I_{max}	A	40
Thermal time constant	T_{th}	min	34
Moment of inertia	J_{Mot}	kg cm²	6
Moment of inertia (with brake)	$J_{Mot\ Br}$	kg cm²	7.6
Weight	m_{Mot}	kg	9
Weight (with brake)	$m_{Mot\ Br}$	kg	10.6
Rated data with S120, 3 AC 400 V / 3 AC 480 V			
Rated speed	n_N	rpm	3000
Rated torque	M_N	Nm	8.6
Rated current	I_N	A	8.1
Rated power	P_N	kW	2.7



6.3.1.8 1FK2106-6AF

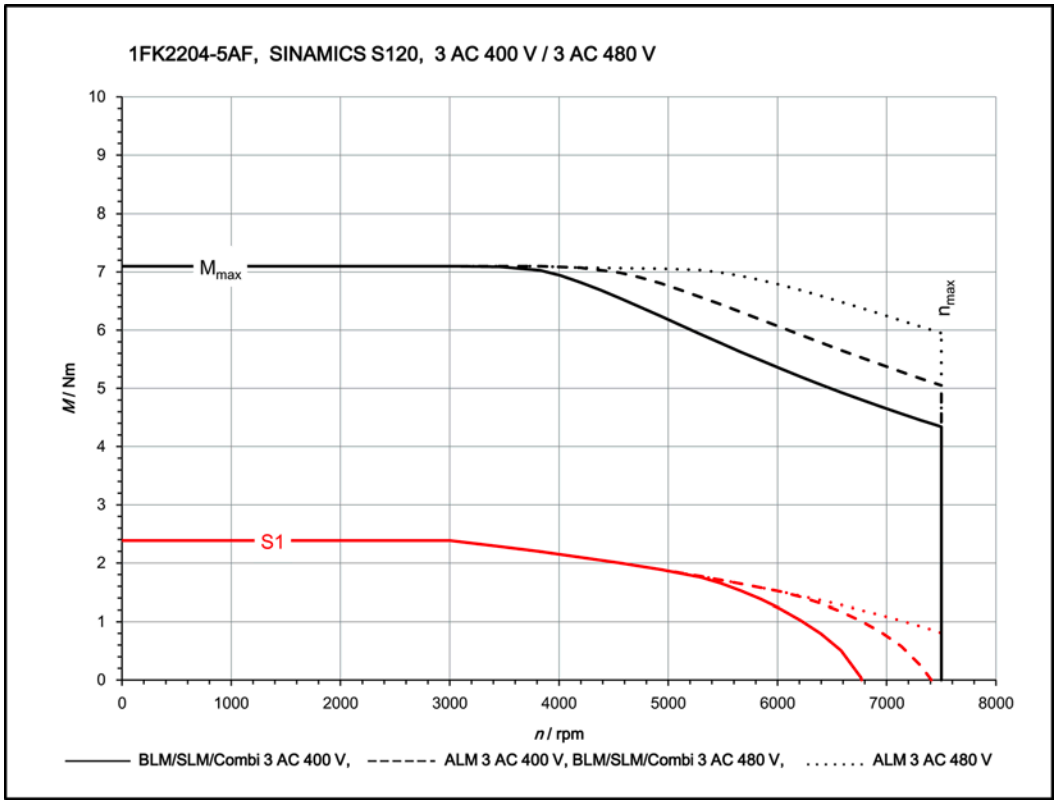
Three-phase servo motor 1FK2106-6AF			
Technical specifications in S120 system	**Symbol**	**Unit**	**Value**
Static torque	M_0	Nm	16
Stall current	I_0	A	14.3
Maximum permissible speed (at converter)	$n_{max\ Inv}$	rpm	6000
Maximum torque	M_{max}	Nm	42
Maximum current	I_{max}	A	44
Thermal time constant	T_{th}	min	50
Moment of inertia	J_{Mot}	kg cm²	8.7
Moment of inertia (with brake)	$J_{Mot\ Br}$	kg cm²	10.4
Weight	m_{Mot}	kg	11.8
Weight (with brake)	$m_{Mot\ Br}$	kg	13.4
Rated data with S120, 3 AC 400 V / 3 AC 480 V			
Rated speed	n_N	rpm	3000
Rated torque	M_N	Nm	10.6
Rated current	I_N	A	9.7
Rated power	P_N	kW	3.3



6.3.2 Compact

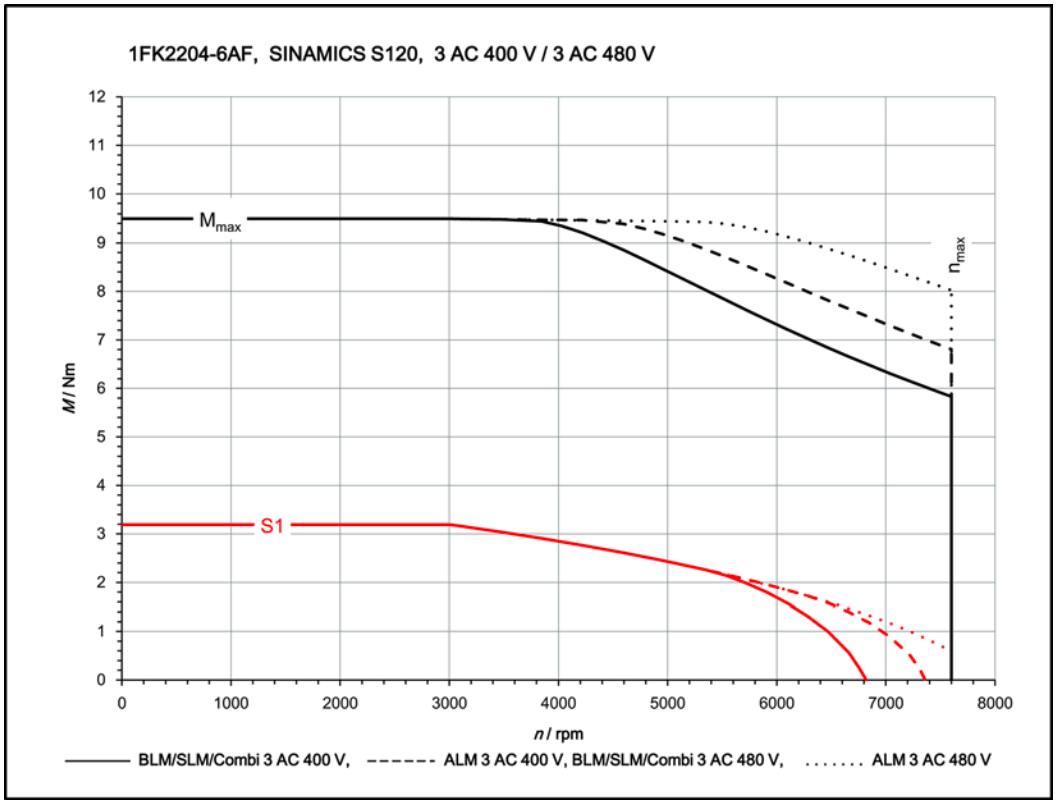
6.3.2.1 1FK2204-5AF

Three-phase servo motor 1FK2204-5AF			
Technical specifications in S120 system	**Symbol**	**Unit**	**Value**
Static torque	M_0	Nm	2.4
Stall current	I_0	A	2.25
Maximum permissible speed (at converter)	$n_{max\ Inv}$	rpm	7500
Maximum torque	M_{max}	Nm	7.1
Maximum current	I_{max}	A	7.1
Thermal time constant	T_{th}	min	29
Moment of inertia	J_{Mot}	kg cm²	1.23
Moment of inertia (with brake)	$J_{Mot\ Br}$	kg cm²	1.31
Weight	m_{Mot}	kg	2.9
Weight (with brake)	$m_{Mot\ Br}$	kg	3.75
Rated data with S120, 3 AC 400 V / 3 AC 480 V			
Rated speed	n_N	rpm	3000
Rated torque	M_N	Nm	2.4
Rated current	I_N	A	2.25
Rated power	P_N	kW	0.75



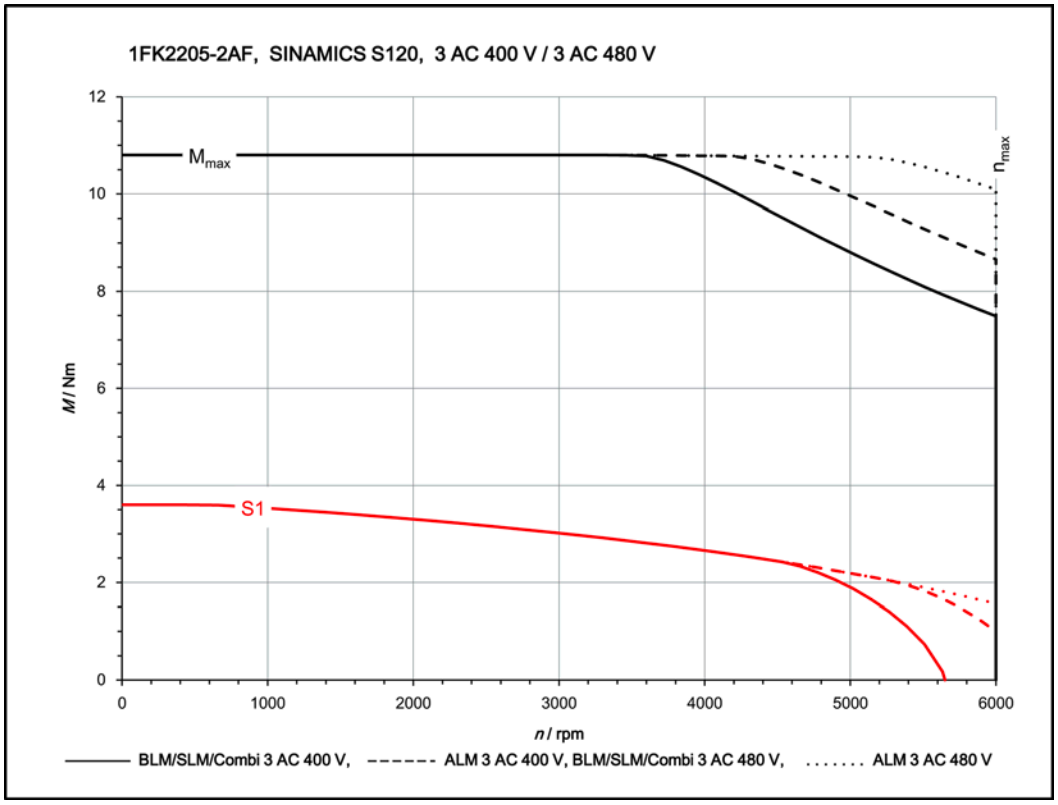
6.3.2.2 1FK2204-6AF

Three-phase servo motor 1FK2204-6AF			
Technical specifications in S120 system	**Symbol**	**Unit**	**Value**
Static torque	M_0	Nm	3.2
Stall current	I_0	A	3
Maximum permissible speed (at converter)	$n_{max\ Inv}$	rpm	7600
Maximum torque	M_{max}	Nm	9.5
Maximum current	I_{max}	A	9.9
Thermal time constant	T_{th}	min	35
Moment of inertia	J_{Mot}	kg cm²	1.61
Moment of inertia (with brake)	$J_{Mot\ Br}$	kg cm²	1.69
Weight	m_{Mot}	kg	3.5
Weight (with brake)	$m_{Mot\ Br}$	kg	4.35
Rated data with S120, 3 AC 400 V / 3 AC 480 V			
Rated speed	n_N	rpm	3000
Rated torque	M_N	Nm	3.2
Rated current	I_N	A	3
Rated power	P_N	kW	1



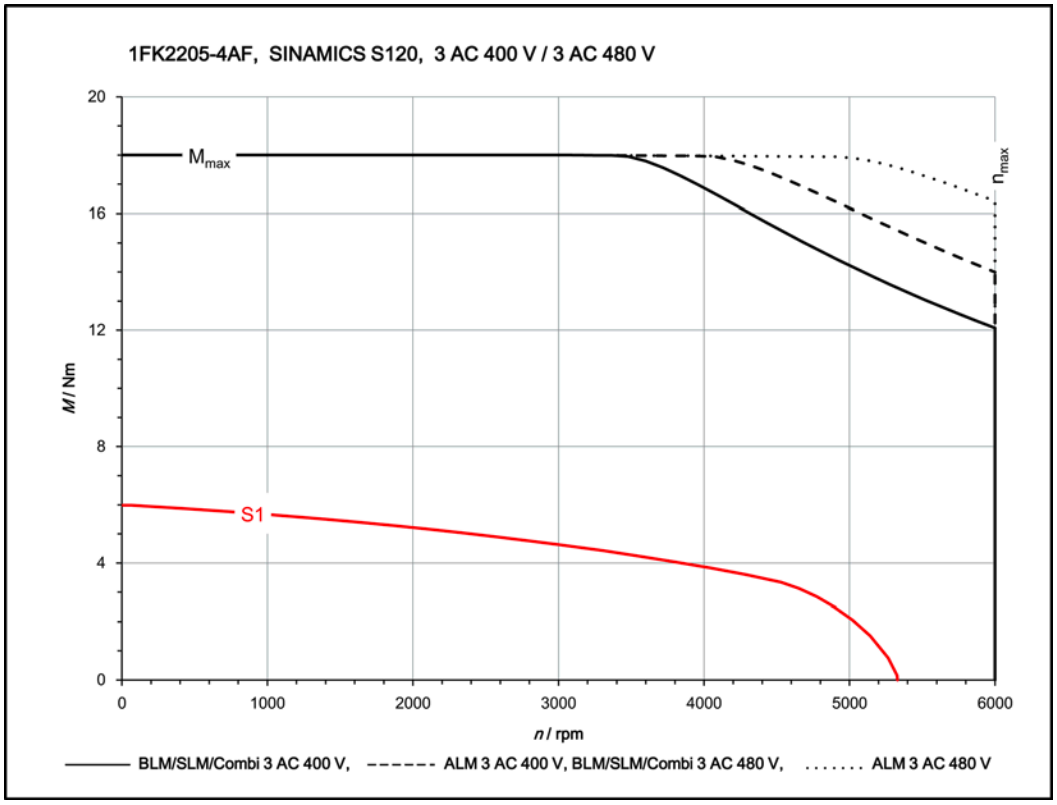
6.3.2.3 1FK2205-2AF

Three-phase servo motor 1FK2205-2AF			
Technical specifications in S120 system	**Symbol**	**Unit**	**Value**
Static torque	M_0	Nm	3.6
Stall current	I_0	A	2.9
Maximum permissible speed (at converter)	$n_{max\ Inv}$	rpm	6000
Maximum torque	M_{max}	Nm	10.8
Maximum current	I_{max}	A	9.5
Thermal time constant	T_{th}	min	22
Moment of inertia	J_{Mot}	kg cm²	3.15
Moment of inertia (with brake)	$J_{Mot\ Br}$	kg cm²	4.05
Weight	m_{Mot}	kg	3.75
Weight (with brake)	$m_{Mot\ Br}$	kg	4.75
Rated data with S120, 3 AC 400 V / 3 AC 480 V			
Rated speed	n_N	rpm	3000
Rated torque	M_N	Nm	3
Rated current	I_N	A	2.5
Rated power	P_N	kW	0.94



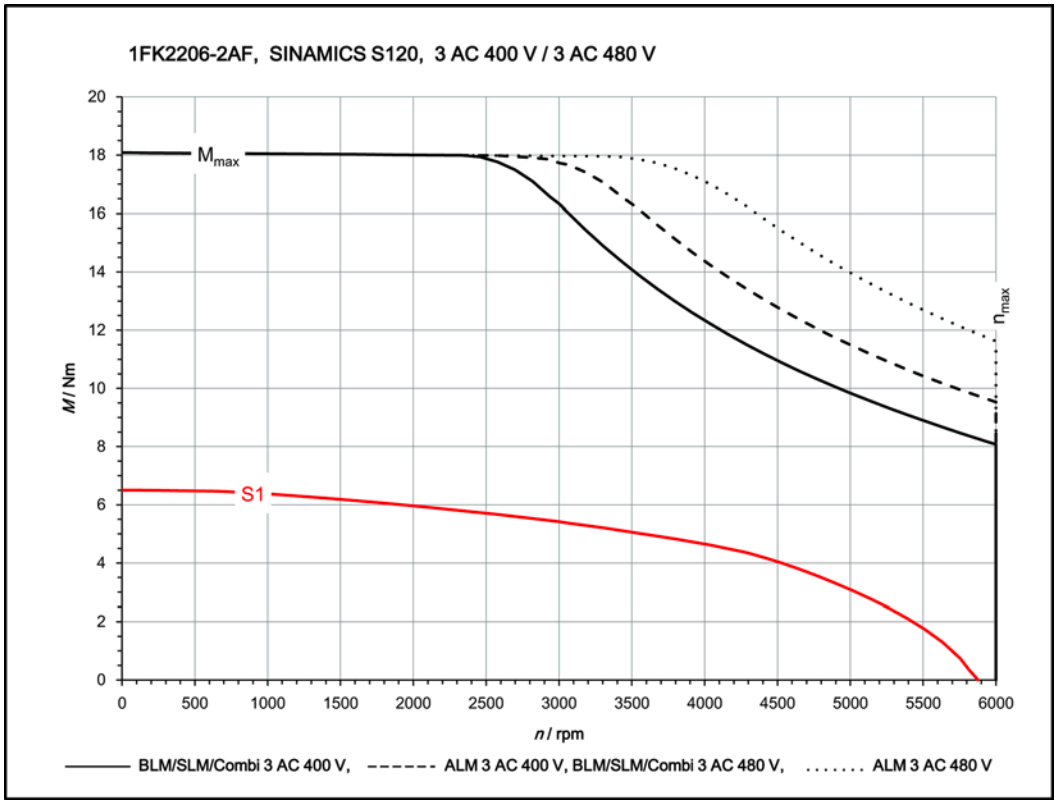
6.3.2.4 1FK2205-4AF

Three-phase servo motor 1FK2205-4AF			
Technical specifications in S120 system	**Symbol**	**Unit**	**Value**
Static torque	M_0	Nm	6
Stall current	I_0	A	4.7
Maximum permissible speed (at converter)	$n_{max\ Inv}$	rpm	6000
Maximum torque	M_{max}	Nm	18
Maximum current	I_{max}	A	15.1
Thermal time constant	T_{th}	min	31
Moment of inertia	J_{Mot}	kg cm²	5.1
Moment of inertia (with brake)	$J_{Mot\ Br}$	kg cm²	6
Weight	m_{Mot}	kg	5.2
Weight (with brake)	$m_{Mot\ Br}$	kg	6.2
Rated data with S120, 3 AC 400 V / 3 AC 480 V			
Rated speed	n_N	rpm	3000
Rated torque	M_N	Nm	4.6
Rated current	I_N	A	3.75
Rated power	P_N	kW	1.45



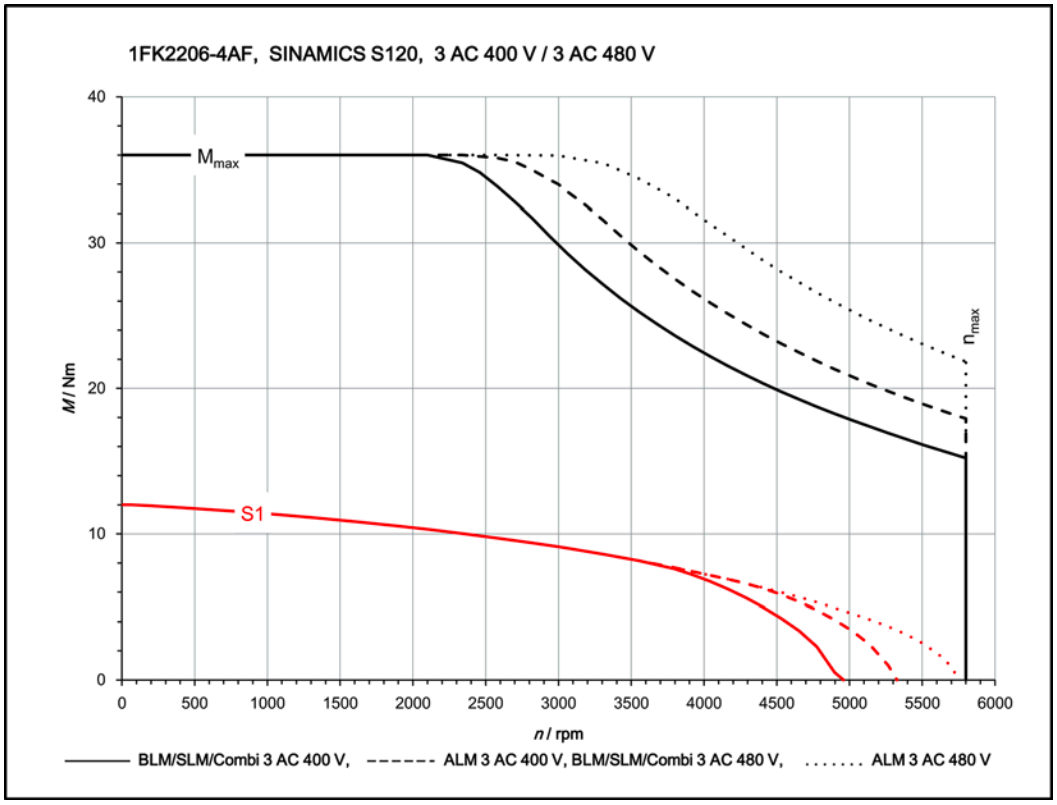
6.3.2.5 1FK2206-2AF

Three-phase servo motor 1FK2206-2AF			
Technical specifications in S120 system	**Symbol**	**Unit**	**Value**
Static torque	M_0	Nm	6.5
Stall current	I_0	A	5
Maximum permissible speed (at converter)	$n_{max\ Inv}$	rpm	6000
Maximum torque	M_{max}	Nm	18
Maximum current	I_{max}	A	17.8
Thermal time constant	T_{th}	min	22
Moment of inertia	J_{Mot}	kg cm²	7.8
Moment of inertia (with brake)	$J_{Mot\ Br}$	kg cm²	9.4
Weight	m_{Mot}	kg	6.3
Weight (with brake)	$m_{Mot\ Br}$	kg	7.9
Rated data with S120, 3 AC 400 V / 3 AC 480 V			
Rated speed	n_N	rpm	3000
Rated torque	M_N	Nm	5.4
Rated current	I_N	A	4.35
Rated power	P_N	kW	1.71



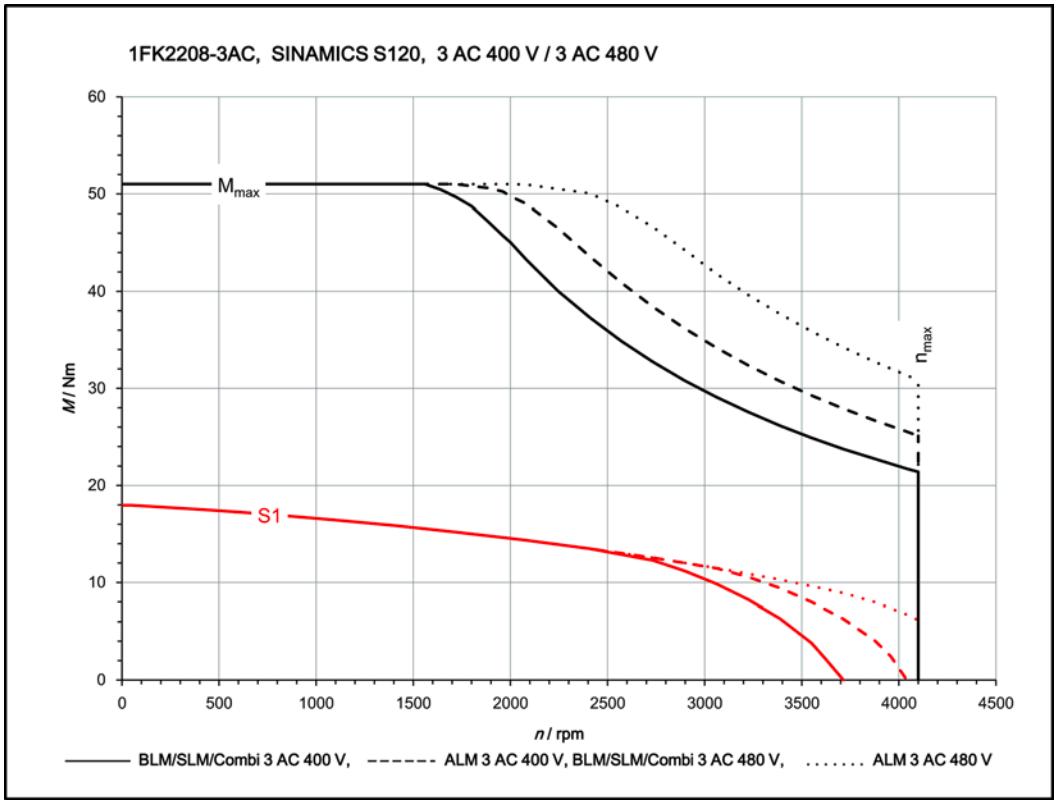
6.3.2.6 1FK2206-4AF

Three-phase servo motor 1FK2206-4AF			
Technical specifications in S120 system	**Symbol**	**Unit**	**Value**
Static torque	M_0	Nm	12
Stall current	I_0	A	7.9
Maximum permissible speed (at converter)	$n_{max\ Inv}$	rpm	5800
Maximum torque	M_{max}	Nm	36
Maximum current	I_{max}	A	29.5
Thermal time constant	T_{th}	min	24
Moment of inertia	J_{Mot}	kg cm²	15.1
Moment of inertia (with brake)	$J_{Mot\ Br}$	kg cm²	16.8
Weight	m_{Mot}	kg	8.9
Weight (with brake)	$m_{Mot\ Br}$	kg	10.6
Rated data with S120, 3 AC 400 V/3 AC 480 V			
Rated speed	n_N	rpm	3000
Rated torque	M_N	Nm	9.1
Rated current	I_N	A	6.2
Rated power	P_N	kW	2.85



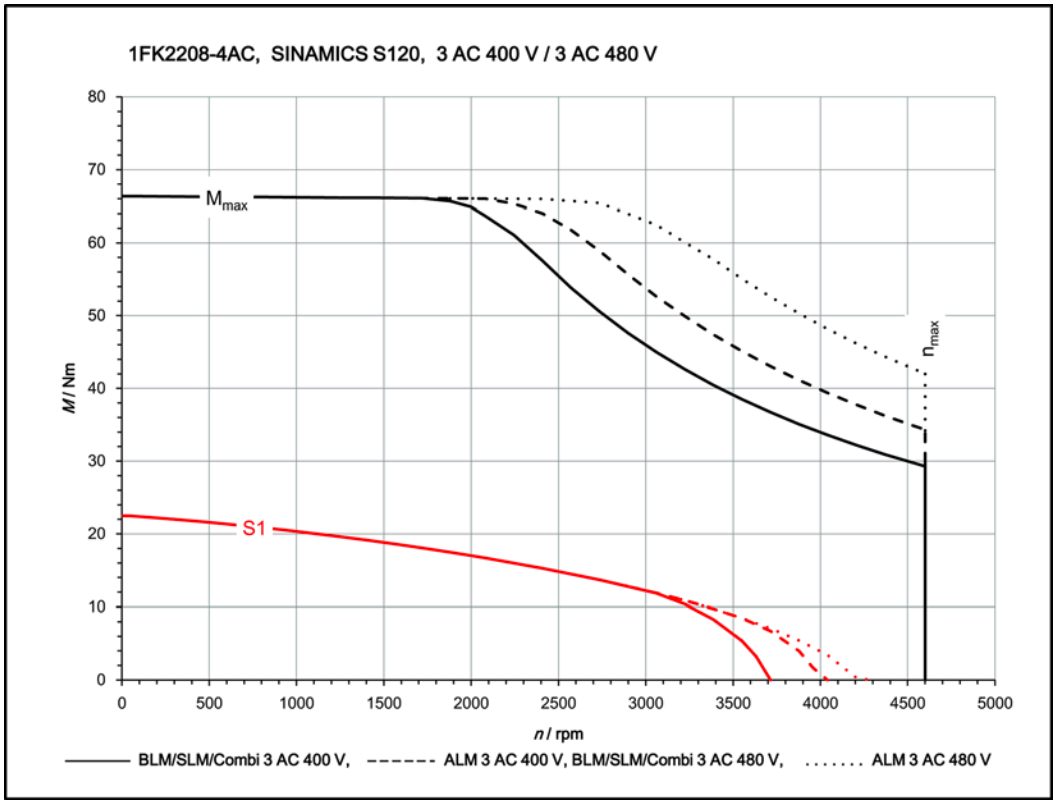
6.3.2.7 1FK2208-3AC

Three-phase servo motor 1FK2208-3AC			
Technical specifications in S120 system	**Symbol**	**Unit**	**Value**
Static torque	M_0	Nm	18
Stall current	I_0	A	8.4
Maximum permissible speed (at converter)	$n_{max\ Inv}$	rpm	4100
Maximum torque	M_{max}	Nm	51
Maximum current	I_{max}	A	29.5
Thermal time constant	T_{th}	min	26
Moment of inertia	J_{Mot}	kg cm²	29.6
Moment of inertia (with brake)	$J_{Mot\ Br}$	kg cm²	33
Weight	m_{Mot}	kg	12.6
Weight (with brake)	$m_{Mot\ Br}$	kg	14.6
Rated data with S120, 3 AC 400 V / 3 AC 480 V			
Rated speed	n_N	rpm	2000
Rated torque	M_N	Nm	14.5
Rated current	I_N	A	7
Rated power	P_N	kW	3.05



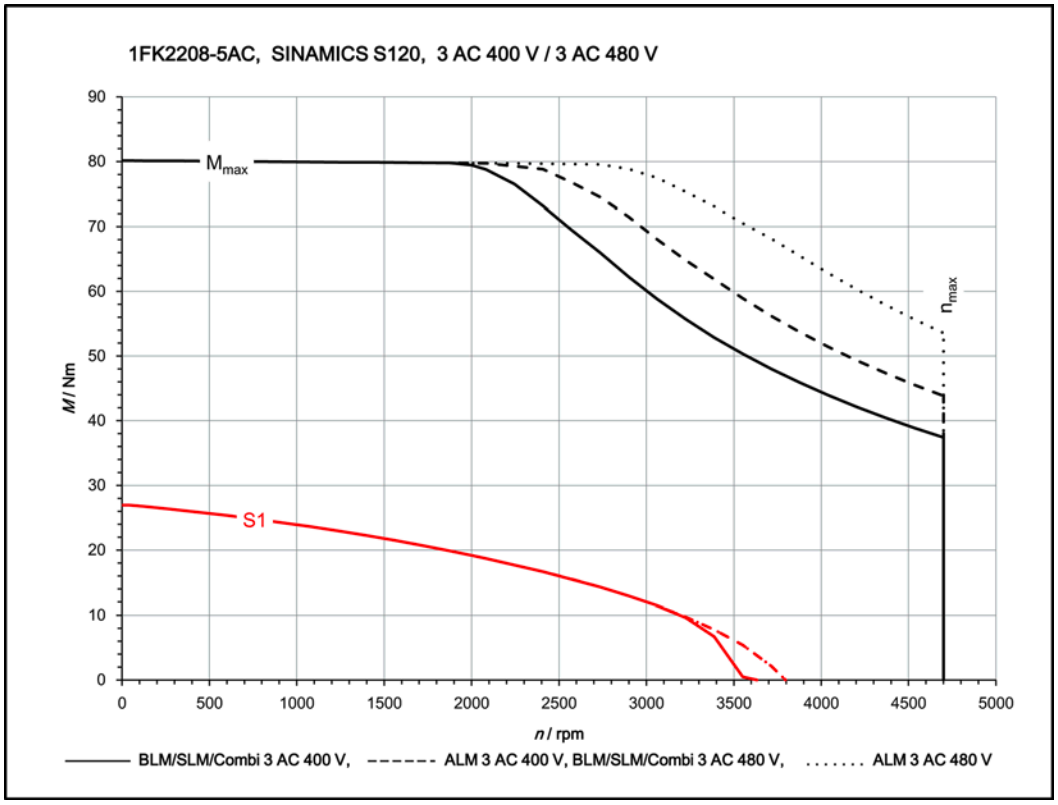
6.3.2.8 1FK2208-4AC

Three-phase servo motor 1FK2208-4AC			
Technical specifications in S120 system	**Symbol**	**Unit**	**Value**
Static torque	M_0	Nm	22
Stall current	I_0	A	11.7
Maximum permissible speed (at converter)	$n_{max\ Inv}$	rpm	4600
Maximum torque	M_{max}	Nm	66
Maximum current	I_{max}	A	43.5
Thermal time constant	T_{th}	min	28
Moment of inertia	J_{Mot}	kg cm²	38.8
Moment of inertia (with brake)	$J_{Mot\ Br}$	kg cm²	44.4
Weight	m_{Mot}	kg	14.6
Weight (with brake)	$m_{Mot\ Br}$	kg	17.3
Rated data with S120, 3 AC 400 V / 3 AC 480 V			
Rated speed	n_N	rpm	2000
Rated torque	M_N	Nm	17
Rated current	I_N	A	9.3
Rated power	P_N	kW	3.55



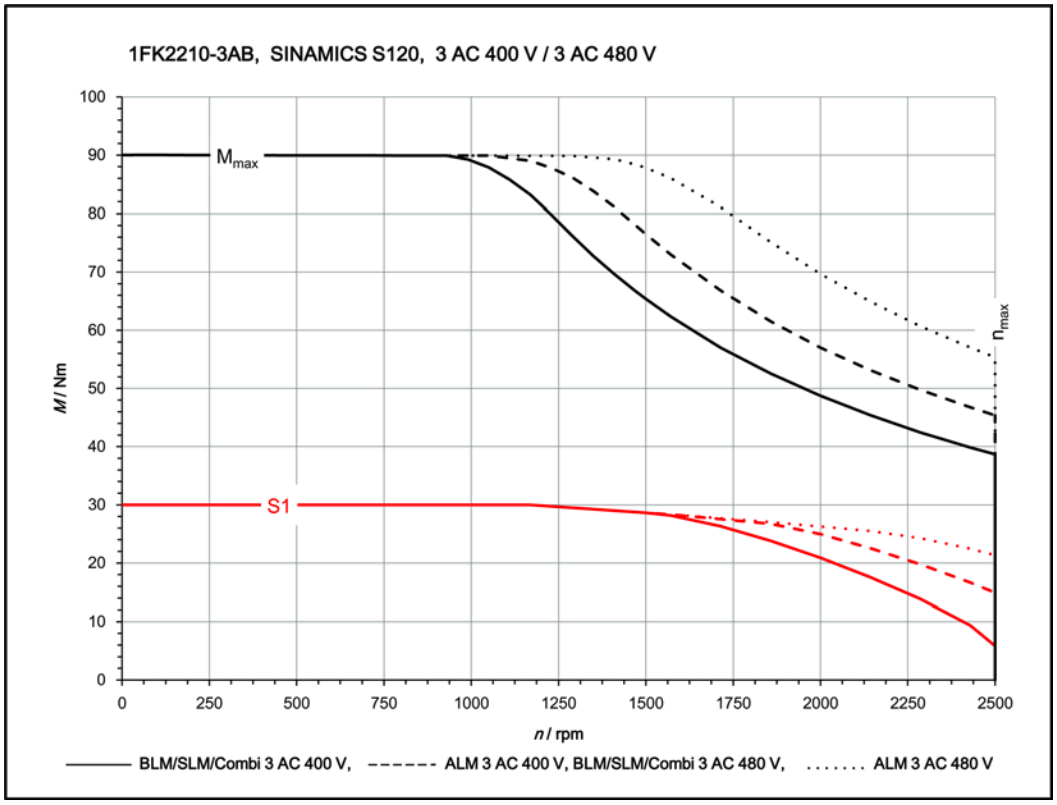
6.3.2.9 1FK2208-5AC

Three-phase servo motor 1FK2208-5AC			
Technical specifications in S120 system	**Symbol**	**Unit**	**Value**
Static torque	M_0	Nm	27
Stall current	I_0	A	14.6
Maximum permissible speed (at converter)	$n_{max\ Inv}$	rpm	4700
Maximum torque	M_{max}	Nm	80
Maximum current	I_{max}	A	51.5
Thermal time constant	T_{th}	min	30
Moment of inertia	J_{Mot}	kg cm²	48.1
Moment of inertia (with brake)	$J_{Mot\ Br}$	kg cm²	53.6
Weight	m_{Mot}	kg	16.6
Weight (with brake)	$m_{Mot\ Br}$	kg	19.3
Rated data with S120, 3 AC 400 V / 3 AC 480 V			
Rated speed	n_N	rpm	2000
Rated torque	M_N	Nm	19.1
Rated current	I_N	A	10.8
Rated power	P_N	kW	4



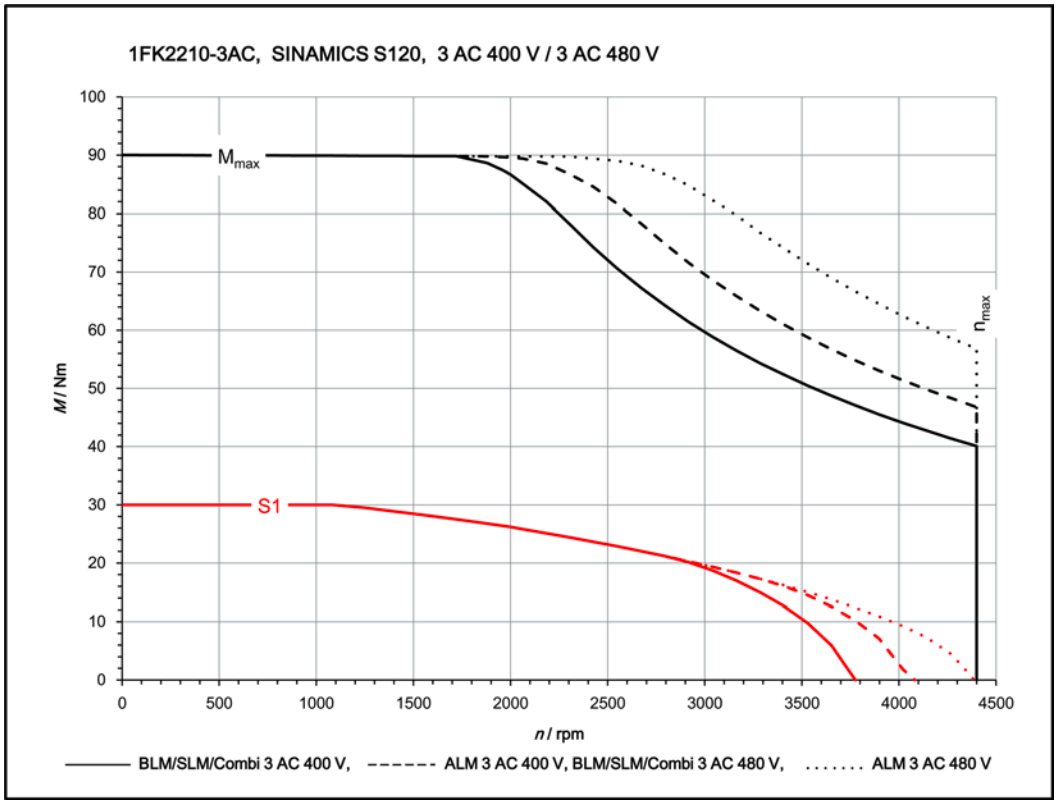
6.3.2.10 1FK2210-3AB

Three-phase servo motor 1FK2210-3AB			
Technical specifications in S120 system	**Symbol**	**Unit**	**Value**
Static torque	M_0	Nm	30
Stall current	I_0	A	8.5
Maximum permissible speed (at converter)	$n_{max\ Inv}$	rpm	2500
Maximum torque	M_{max}	Nm	90
Maximum current	I_{max}	A	31.5
Thermal time constant	T_{th}	min	33
Moment of inertia	J_{Mot}	kg cm²	88.8
Moment of inertia (with brake)	$J_{Mot\ Br}$	kg cm²	94.8
Weight	m_{Mot}	kg	22
Weight (with brake)	$m_{Mot\ Br}$	kg	25
Rated data with S120, 3 AC 400 V / 3 AC 480 V			
Rated speed	n_N	rpm	1500
Rated torque	M_N	Nm	28.5
Rated current	I_N	A	8.3
Rated power	P_N	kW	4.5



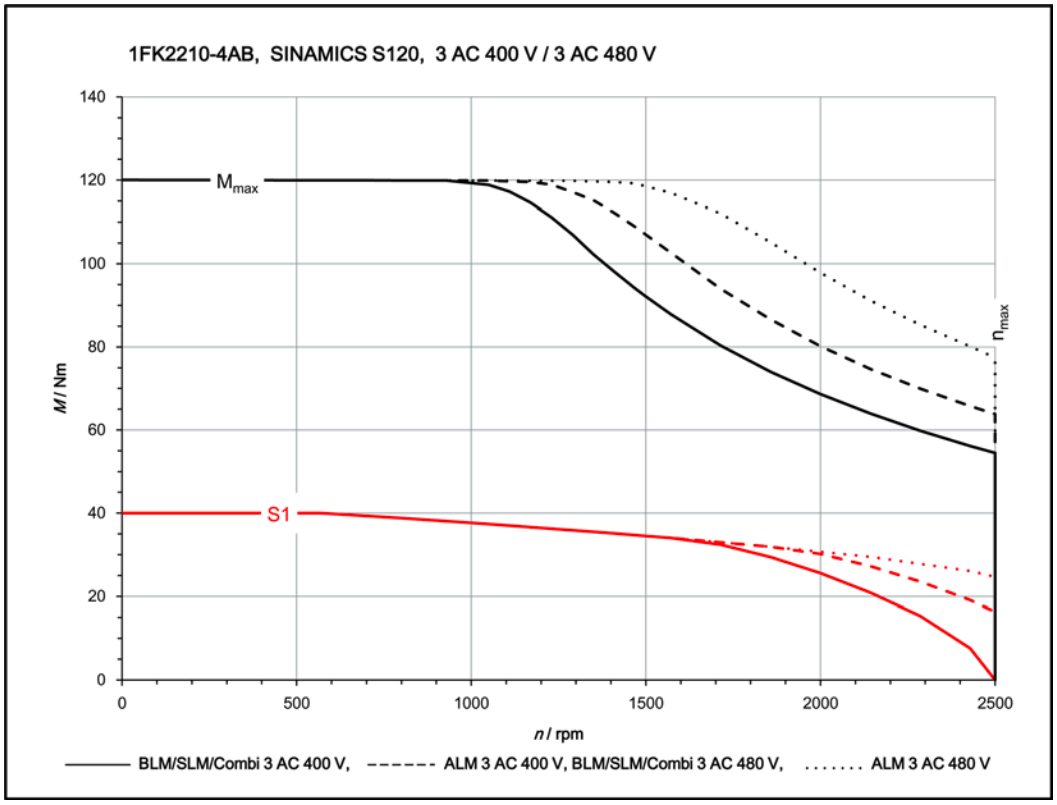
6.3.2.11 1FK2210-3AC

Three-phase servo motor 1FK2210-3AC			
Technical specifications in S120 system	**Symbol**	**Unit**	**Value**
Static torque	M_0	Nm	30
Stall current	I_0	A	15
Maximum permissible speed (at converter)	$n_{max\ Inv}$	rpm	4400
Maximum torque	M_{max}	Nm	90
Maximum current	I_{max}	A	55
Thermal time constant	T_{th}	min	33
Moment of inertia	J_{Mot}	kg cm²	88.8
Moment of inertia (with brake)	$J_{Mot\ Br}$	kg cm²	94.8
Weight	m_{Mot}	kg	22
Weight (with brake)	$m_{Mot\ Br}$	kg	25
Rated data with S120, 3 AC 400 V / 3 AC 480 V			
Rated speed	n_N	rpm	2000
Rated torque	M_N	Nm	26
Rated current	I_N	A	13.5
Rated power	P_N	kW	5.5



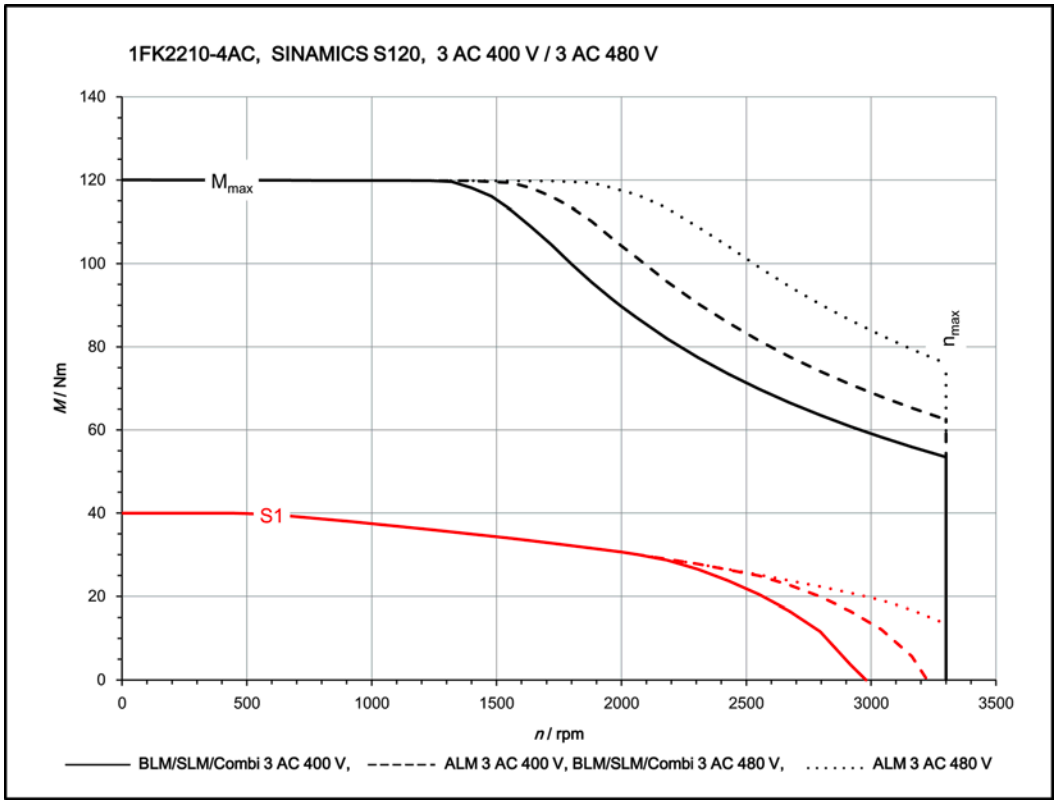
6.3.2.12 1FK2210-4AB

Three-phase servo motor 1FK2210-4AB			
Technical specifications in S120 system	**Symbol**	**Unit**	**Value**
Static torque	M_0	Nm	40
Stall current	I_0	A	11.8
Maximum permissible speed (at converter)	$n_{max\ Inv}$	rpm	2500
Maximum torque	M_{max}	Nm	120
Maximum current	I_{max}	A	43.5
Thermal time constant	T_{th}	min	35
Moment of inertia	J_{Mot}	kg cm²	117
Moment of inertia (with brake)	$J_{Mot\ Br}$	kg cm²	133
Weight	m_{Mot}	kg	27
Weight (with brake)	$m_{Mot\ Br}$	kg	31
Rated data with S120, 3 AC 400 V / 3 AC 480 V			
Rated speed	n_N	rpm	1500
Rated torque	M_N	Nm	34.5
Rated current	I_N	A	10.4
Rated power	P_N	kW	5.4



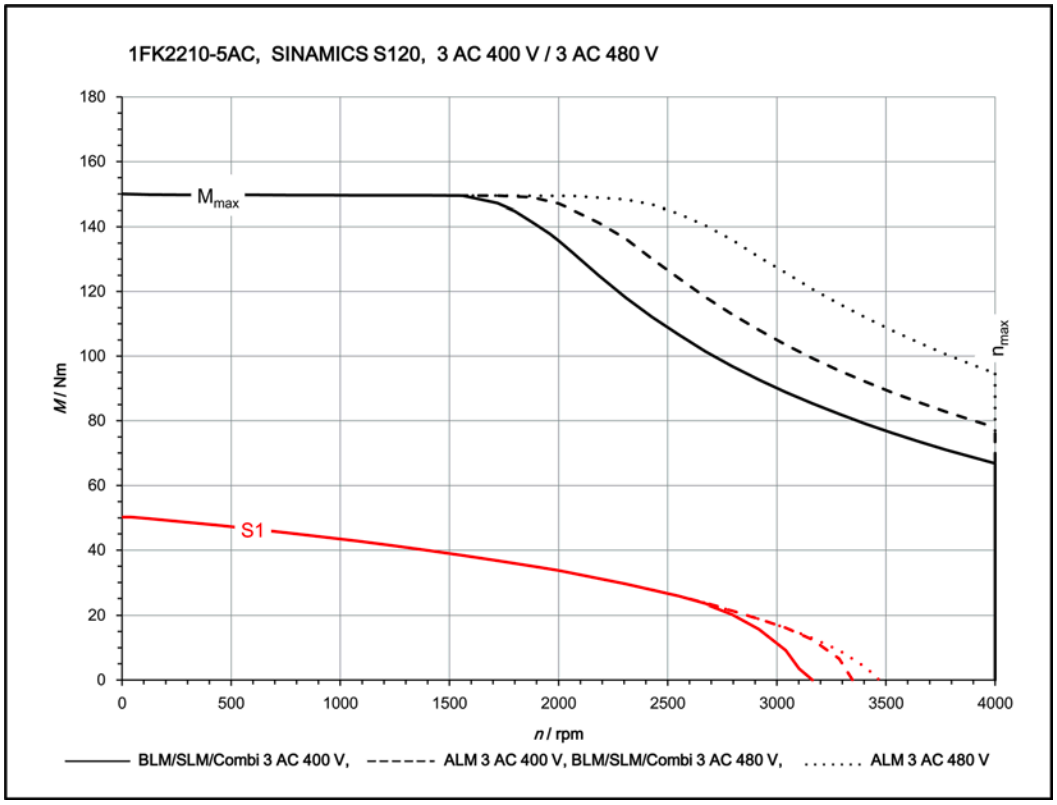
6.3.2.13 1FK2210-4AC

Three-phase servo motor 1FK2210-4AC			
Technical specifications in S120 system	**Symbol**	**Unit**	**Value**
Static torque	M_0	Nm	40
Stall current	I_0	A	15
Maximum permissible speed (at converter)	$n_{max\ Inv}$	rpm	3300
Maximum torque	M_{max}	Nm	120
Maximum current	I_{max}	A	55
Thermal time constant	T_{th}	min	35
Moment of inertia	J_{Mot}	kg cm²	117
Moment of inertia (with brake)	$J_{Mot\ Br}$	kg cm²	133
Weight	m_{Mot}	kg	27
Weight (with brake)	$m_{Mot\ Br}$	kg	31
Rated data with S120, 3 AC 400 V / 3 AC 480 V			
Rated speed	n_N	rpm	2000
Rated torque	M_N	Nm	30.5
Rated current	I_N	A	11.8
Rated power	P_N	kW	6.4



6.3.2.14 1FK2210-5AC

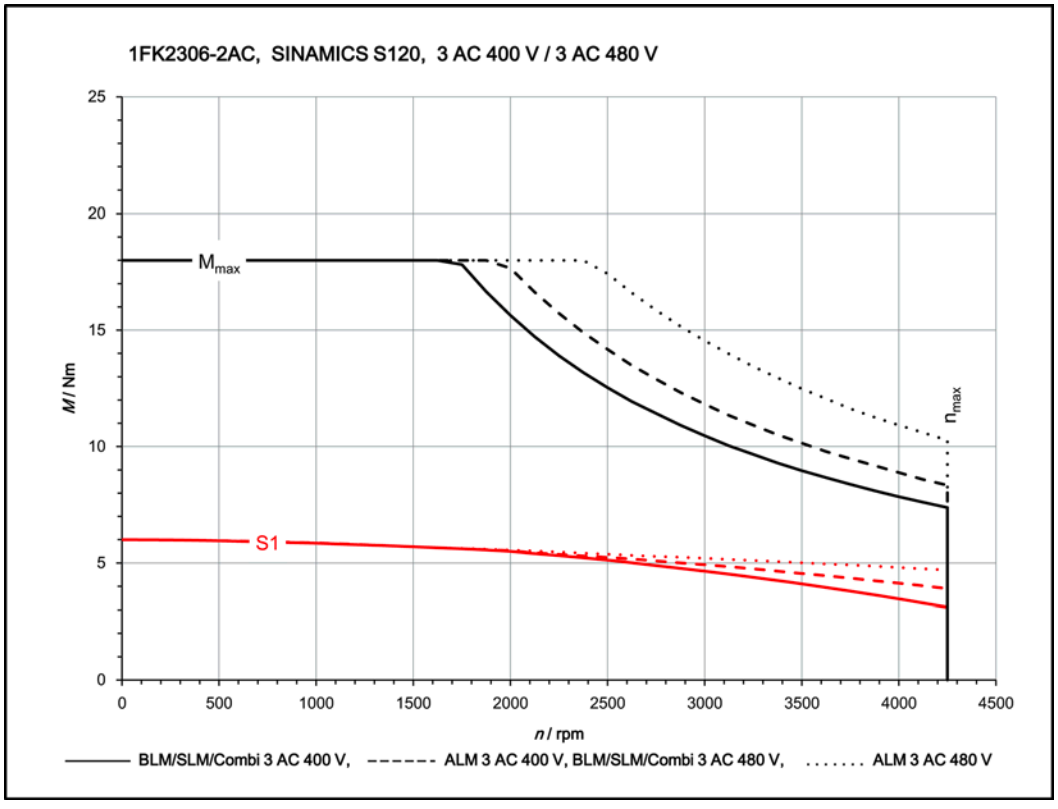
Three-phase servo motor 1FK2210-5AC			
Technical specifications in S120 system	**Symbol**	**Unit**	**Value**
Static torque	M_0	Nm	50
Stall current	I_0	A	22.5
Maximum permissible speed (at converter)	$n_{max\ Inv}$	rpm	4000
Maximum torque	M_{max}	Nm	150
Maximum current	I_{max}	A	83
Thermal time constant	T_{th}	min	37
Moment of inertia	J_{Mot}	kg cm²	145
Moment of inertia (with brake)	$J_{Mot\ Br}$	kg cm²	161
Weight	m_{Mot}	kg	32
Weight (with brake)	$m_{Mot\ Br}$	kg	36
Rated data with S120, 3 AC 400 V / 3 AC 480 V			
Rated speed	n_N	rpm	2000
Rated torque	M_N	Nm	33.5
Rated current	I_N	A	15.8
Rated power	P_N	kW	7.1



6.3.3 High Inertia

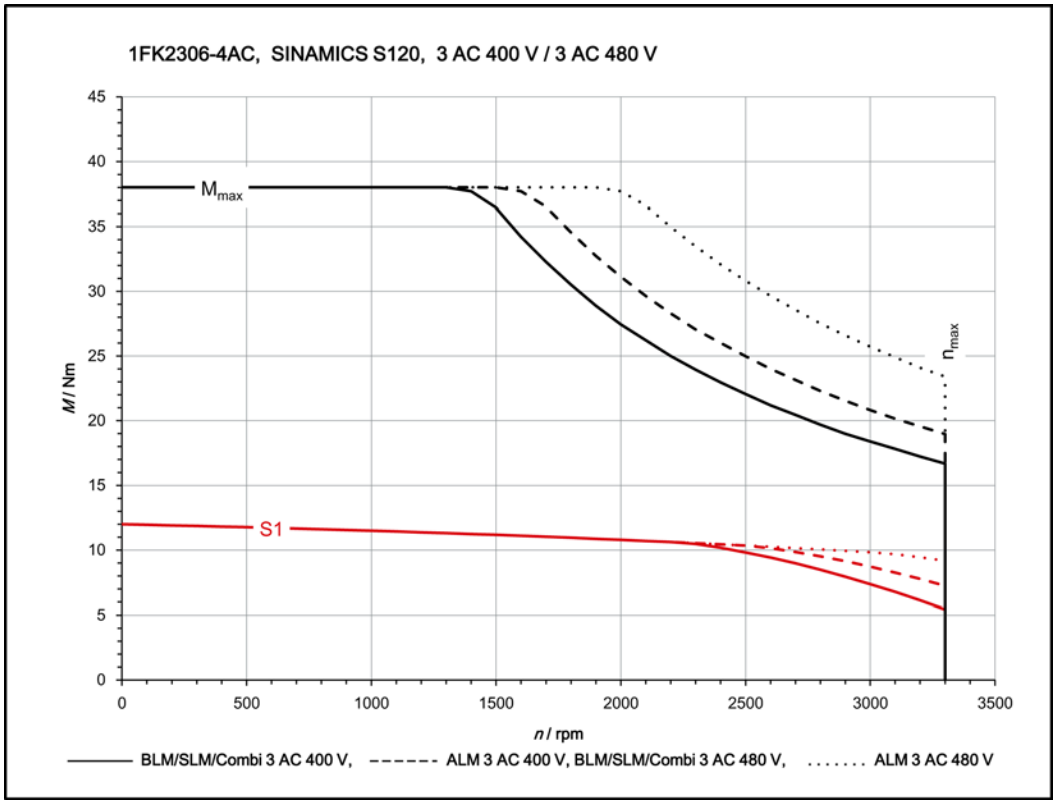
6.3.3.1 1FK2306-2AC

Three-phase servo motor 1FK2306-2AC			
Technical specifications in S120 system	**Symbol**	**Unit**	**Value**
Static torque	M_0	Nm	6
Stall current	I_0	A	2.8
Maximum permissible speed (at converter)	$n_{max\ Inv}$	rpm	4250
Maximum torque	M_{max}	Nm	18
Maximum current	I_{max}	A	10.3
Thermal time constant	T_{th}	min	24
Moment of inertia	J_{Mot}	kg cm²	12.3
Moment of inertia (with brake)	$J_{Mot\ Br}$	kg cm²	13.4
Weight	m_{Mot}	kg	7.6
Weight (with brake)	$m_{Mot\ Br}$	kg	9.0
Rated data with S120, 3 AC 400 V / 3 AC 480 V			
Rated speed	n_N	rpm	2000
Rated torque	M_N	Nm	5.5
Rated current	I_N	A	2.8
Rated power	P_N	kW	1.15



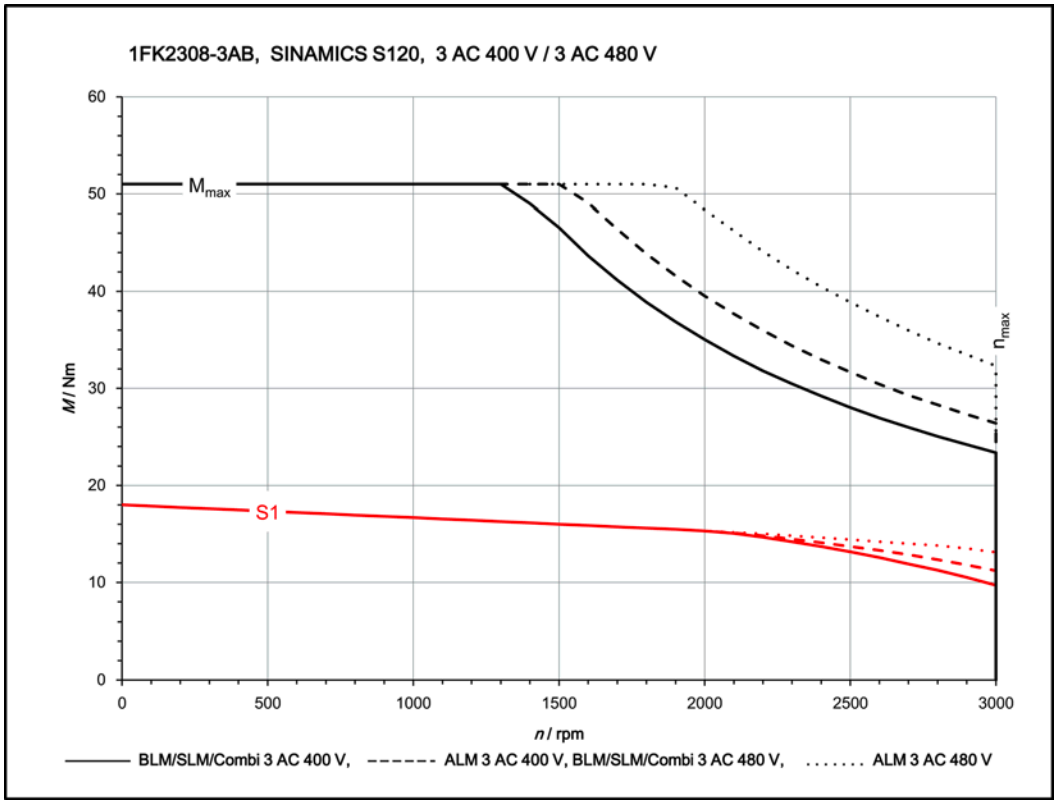
6.3.3.2 1FK2306-4AC

Three-phase servo motor 1FK2306-4AC			
Technical specifications in S120 system	**Symbol**	**Unit**	**Value**
Static torque	M_0	Nm	12
Stall current	I_0	A	4.5
Maximum permissible speed (at converter)	$n_{max\ Inv}$	rpm	3300
Maximum torque	M_{max}	Nm	38
Maximum current	I_{max}	A	17
Thermal time constant	T_{th}	min	32
Moment of inertia	J_{Mot}	kg cm²	29.8
Moment of inertia (with brake)	$J_{Mot\ Br}$	kg cm²	30.8
Weight	m_{Mot}	kg	11.4
Weight (with brake)	$m_{Mot\ Br}$	kg	12.8
Rated data with S120, 3 AC 400 V / 3 AC 480 V			
Rated speed	n_N	rpm	2000
Rated torque	M_N	Nm	10.5
Rated current	I_N	A	4.1
Rated power	P_N	kW	2.2



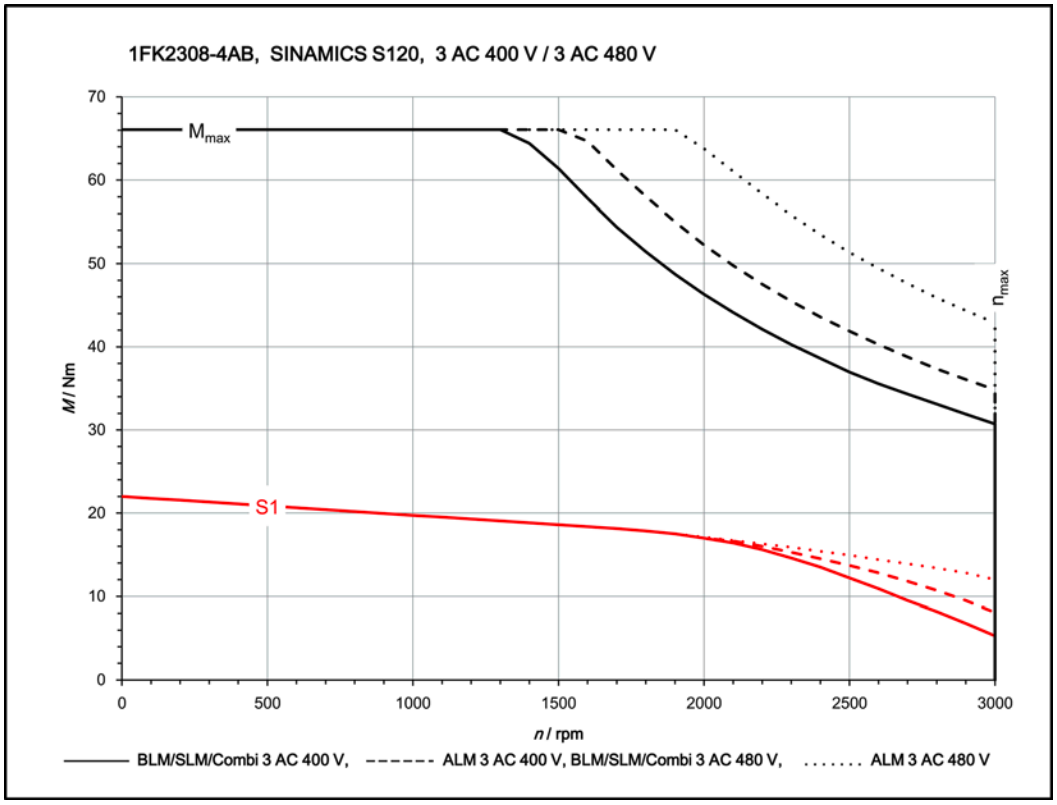
6.3.3.3 1FK2308-3AB

Three-phase servo motor 1FK2308-3AB			
Technical specifications in S120 system	**Symbol**	**Unit**	**Value**
Static torque	M_0	Nm	18
Stall current	I_0	A	6.2
Maximum permissible speed (at converter)	$n_{max\ Inv}$	rpm	3000
Maximum torque	M_{max}	Nm	51
Maximum current	I_{max}	A	20.5
Thermal time constant	T_{th}	min	36
Moment of inertia	J_{Mot}	kg cm²	60.1
Moment of inertia (with brake)	$J_{Mot\ Br}$	kg cm²	62.8
Weight	m_{Mot}	kg	16.2
Weight (with brake)	$m_{Mot\ Br}$	kg	18
Rated data with S120, 3 AC 400 V / 3 AC 480 V			
Rated speed	n_N	rpm	1500
Rated torque	M_N	Nm	16
Rated current	I_N	A	5.7
Rated power	P_N	kW	2.5



6.3.3.4 1FK2308-4AB

Three-phase servo motor 1FK2308-4AB			
Technical specifications in S120 system	**Symbol**	**Unit**	**Value**
Static torque	M_0	Nm	22
Stall current	I_0	A	7.1
Maximum permissible speed (at converter)	$n_{max\ Inv}$	rpm	3000
Maximum torque	M_{max}	Nm	66
Maximum current	I_{max}	A	25
Thermal time constant	T_{th}	min	42
Moment of inertia	J_{Mot}	kg cm²	69.1
Moment of inertia (with brake)	$J_{Mot\ Br}$	kg cm²	74.4
Weight	m_{Mot}	kg	18.5
Weight (with brake)	$m_{Mot\ Br}$	kg	20.5
Rated data with S120, 3 AC 400 V / 3 AC 480 V			
Rated speed	n_N	rpm	1500
Rated torque	M_N	Nm	18.6
Rated current	I_N	A	6.4
Rated power	P_N	kW	2.9



6.4 Derating factors

The specified characteristic curves in Chapter "Data sheets and characteristics (Page 71)" are based on ambient temperature of 40 °C and an installation altitude of 1000 m above sea level.

With ambient temperatures > 40 °C or installation altitudes > 1000 m above sea level, the permissible S1-characteristic must be reduced in speed and torque:

Table 6- 2 Derating of speed and torque depending on the installation altitude and ambient temperature

Installation altitude above sea level in m	Ambient temperature in °C			
	30	40	45	50
1000	1.08	1.00	0.96	0.91
2000	1.02	0.93	0.89	0.84

Calculate the derating factor for ambient temperatures that are not shown here and installation altitudes below the maximum values by interpolating. For example: 40 °C at 1500 m above sea level = derating factor 0.965.

Calculate the reduced S1 line as follows:

$M_{S1\ red}(n) = x_d \bullet M_{S1}(n / x_d)$

$M_{S1\ red}$ reduced motor torque for S1 operation at required altitude and ambient temperature

M_{S1} motor torque for S1 operation at ambient temperature of 40 °C and 1000 m above sea level (see Chapter "Datasheets and characteristics" in Configuration Manual)

n motor speed

x_d derating factor from the table above

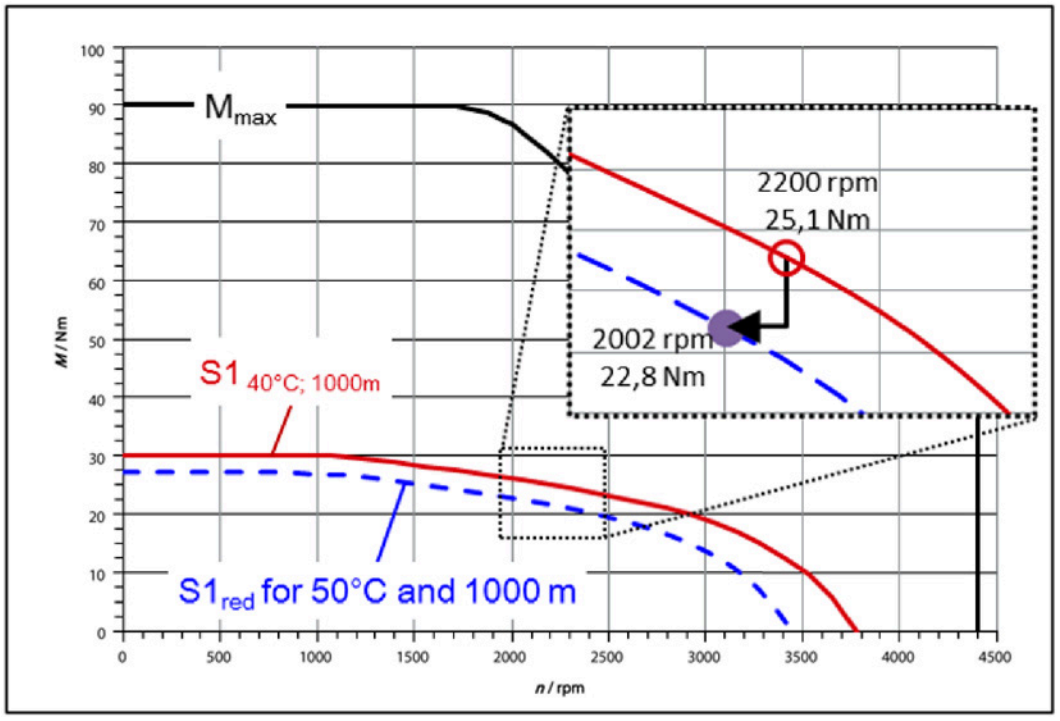


Figure 6-3 Example for derating at ambient temperature of 50 °C and installation altitude of 1000 m with derating factor 0.91

Preparation for use

7

7.1 Transporting

Note

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

Precondition

- Use suitable load suspension devices when transporting and installing the motor.
- Do not lift the motor by the connector.
- Transport the motor carefully.

Procedure

Lifting and transporting with lifting slings

You can lift and transport the motor using lifting 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.

- 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 with lifting slings".

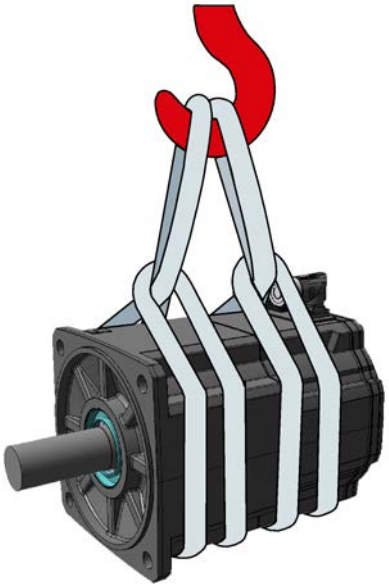


Figure 7-1 Lifting and transporting with lifting slings (example diagram)

Lifting and transporting the motor with eyebolts

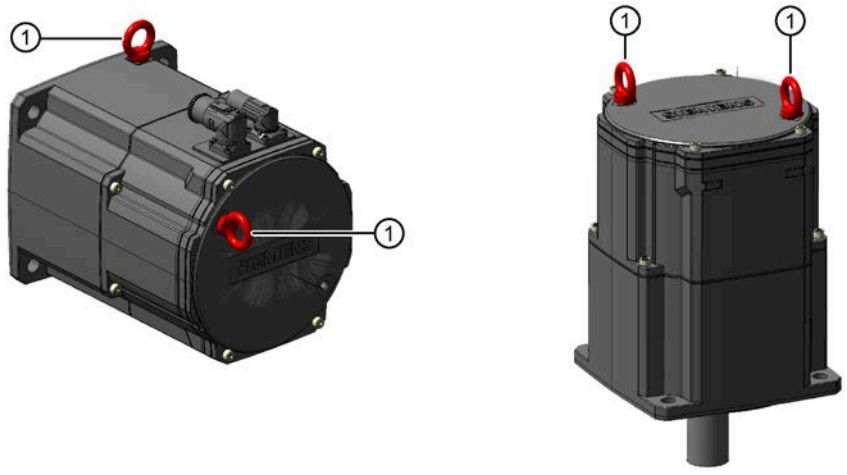
For the 1FK2□10 motors, you can use eyebolts and a lifting beam for lifting and transporting.

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.

- 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.



① Lifting eyes	

1FK2

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).

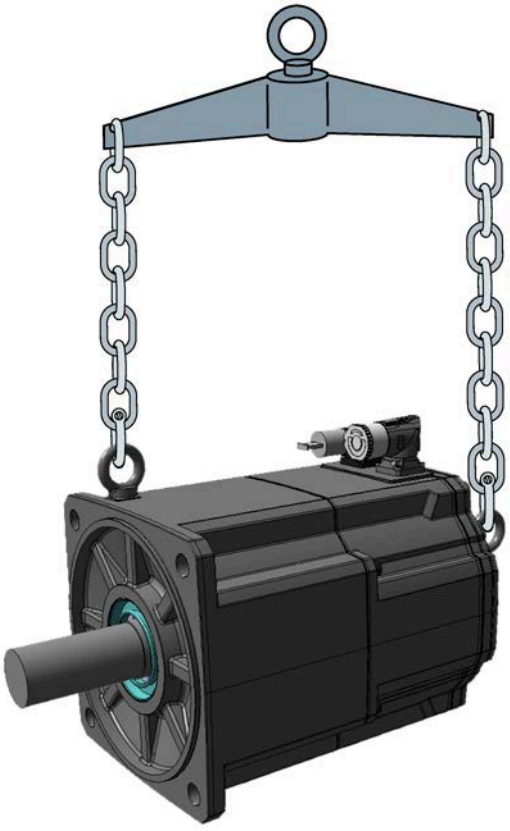


Figure 7-2 Transporting the motor with a beam (example)

3. Set the motor down on a hard, level surface.

⚠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.

4. Secure the motor against unintentional movements.

You have transported the motor to the target position.

❒

7.2 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, for example, brinelling, as a result of vibration.

- Comply with the storage conditions.

Storage conditions

- 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.

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

Table 7- 1 Environmental conditions for long-term storage in the product packaging according to Class 1K3 to EN 60721-3-1 - with the exception of influencing environmental variables "Air temperature", "Highest relative humidity" and "Condensation"

Climatic ambient conditions	-15 °C to +55 °C
Highest relative humidity	< 60%, condensation not permissible
Mechanical ambient conditions	vibration-free storage room V_{rms} < 0.2 mm/s
Protection against chemical substances	Protected in accordance with Class 1C2
Biological ambient conditions	Suitable in accordance with Class 1B2
Duration	• Six months for the conditions listed above. • Special preservation measures are required for storage period of six months up to two years.

Check the correct state of the motor every six months.

- Check the motor for any damage.
- 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.

Electrical connection

8

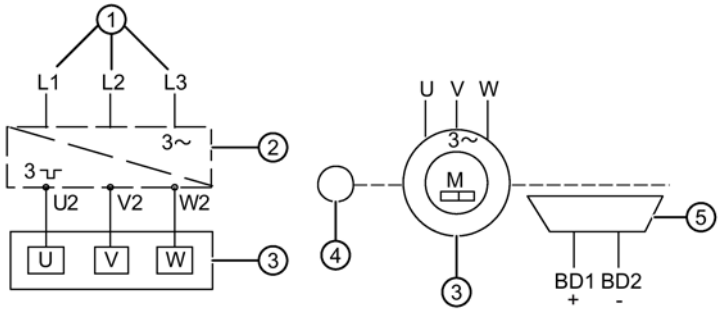
8.1 Permissible line system types

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

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

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

8.2 Circuit diagram of the motor



① Feeder cable
② Power Module
③ Motor
④ Encoder
⑤ Brake

Figure 8-1 Circuit diagram

8.3 System integration

8.3.1 Connection notes

8.3.1.1 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. • 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. • 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.

- The manufacturer of the plant/machine is responsible for the ensuring that the installation is performed correctly.
- Observe the data on the rating plate and the circuit diagrams.
- Adapt the connecting cables to the type of use and the voltages and currents that occur.
- Use prefabricated cables from SIEMENS (not in the scope of delivery). These cables reduce installation costs and increase operational reliability (see the Product Information).
- Make sure that the inside of the connector is clean and free of cable cuttings and moisture.
- 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.

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 8- 1 Cable cross-section and current-carrying capacity

Cross-section in mm²	Current-carrying capacity rms; AC 50/60 Hz or DC for routing type		
	B1 in A	B2 in A	C in 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

Table 8- 2 Derating factors for power and signal cables

Ambient air temperature in °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

8.3.1.2 Rotating the connector on the motor

You can rotate power connectors and signal connectors within a limited range of angles.

Use a suitable socket connector to rotate the angle plug.

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

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.

Rotatability of the power connector and signal connector

Table 8- 3 Rotation range of the power connector ①

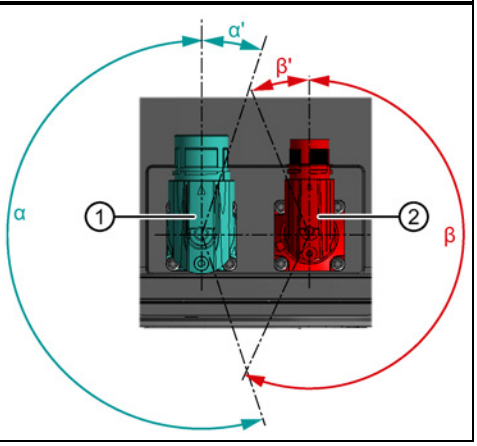
Motor	Connector size of the power connector ①	Angle α	Angle α'	Drawing
1FK2❑03	M17	205	29	
1FK2❑04		205	25	
1FK2❑05		228	35	
1FK2❑06	M23	222	40	
1FK2❑08		222	46	
1FK2❑10		222	55	
	M40	228	48	

Table 8- 4 Rotation range of the signal connector ②

Motor	Connector size of the signal connect-or ②	Angle β	Angle β'	Drawing
1FK2❑03	M17	209	25	See table "Rotation range of the power connector"
1FK2❑04		205	25	
1FK2❑05		215	48	
1FK2❑06		215	41	
1FK2❑08		215	46	
1FK2❑10		215	57	
		210	48	

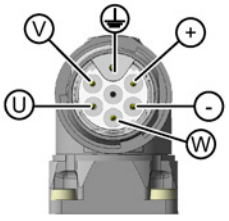
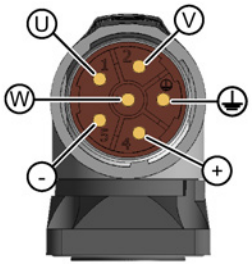
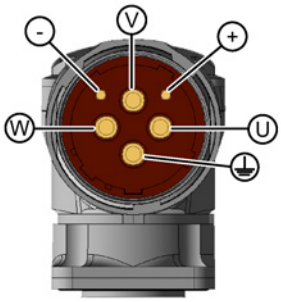
Table 8- 5 Maximum rotating torque for the connectors

Connectors	Max. torque when rotating
Connector M17	8 Nm
Connector M23	12 Nm
Connector M40	20 Nm

8.3.2 Power connection

Designs of the power connectors

The 1FK2 is equipped with the following power connectors depending on the size and power rating.

Round connector M17	Round connector M23	Round connector M40
		
Brake connection 24 V: "+" = BD1+; "-" = BD2-		

The power connectors can be rotated within a certain range.

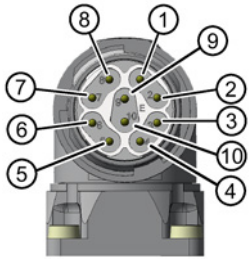
More precise information about the equipping of the motors and the angles of rotation is provided in Chapter "Rotating the connector on the motor (Page 107)".

8.3.3 Signal connection

Design of the signal connector

The signal connector of the 1FK2 is an M17 round connector.

The connector pin assignment is as follows.

M17 signal connector, with DRIVE-CLiQ		
	1	TX-P
	2	TX-N
	3	-
	4	-
	5	RX-P
	6	RX-N
	7	-
	8	-
	9	24 V
	10	0 V

The signal connectors can be rotated within a certain range.

More precise information on the angle of rotation is available in Chapter "Rotating the connector on the motor (Page 107)"

8.3.4 Connecting to a converter

8.3.4.1 Selecting and connecting the cables

- Use prefabricated MOTION-CONNECT cables from SIEMENS or shielded connecting cables.
- The prefabricated MOTION-CONNECT cables reduce installation costs and increase the operational reliability

Note

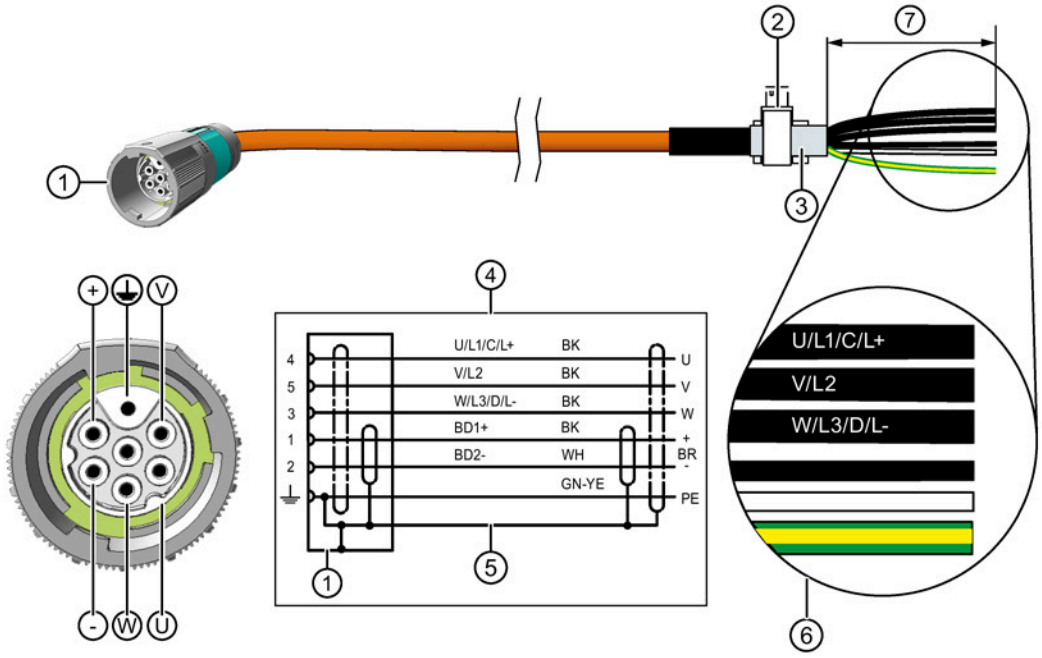
The cable shielding, made up of as many strands as possible, must have a high electrical conductivity. Braided shields made of copper or aluminum are well suited.

When connecting, comply with the following:

- Connect the shield to the converter.
- Keep the unshielded cable ends as short as possible.
- To ensure good discharging of high-frequency currents, provide contacting over a large surface area.

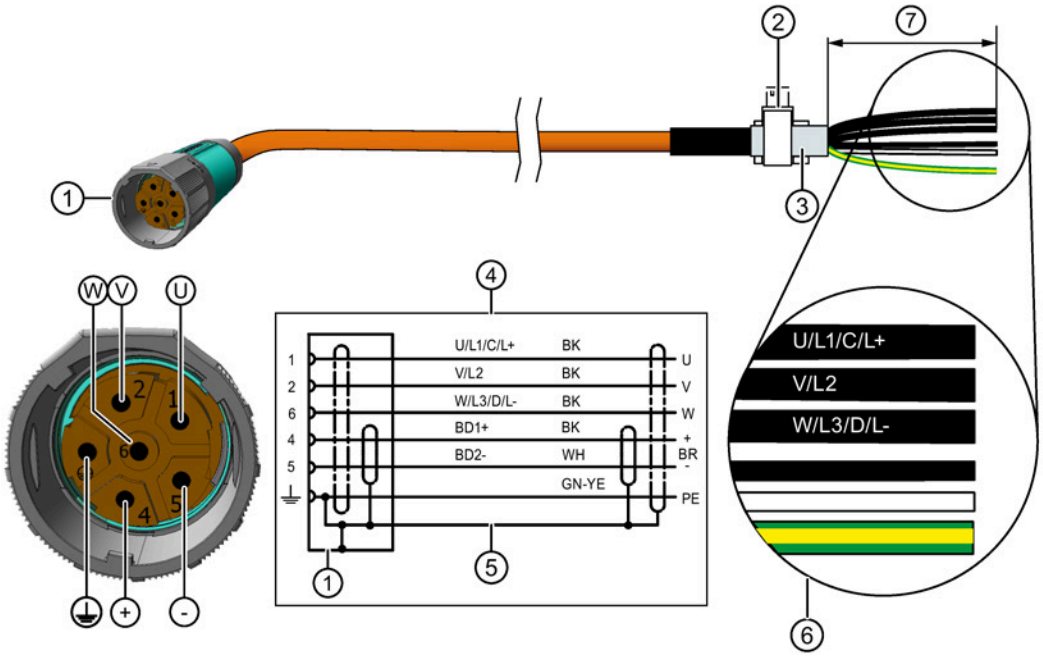
Connection diagram for connection of the 1FK2 motor to the S120 Power Module and Motor Module Booksize and Compact with a MOTION-CONNECT cable

For connector size M17



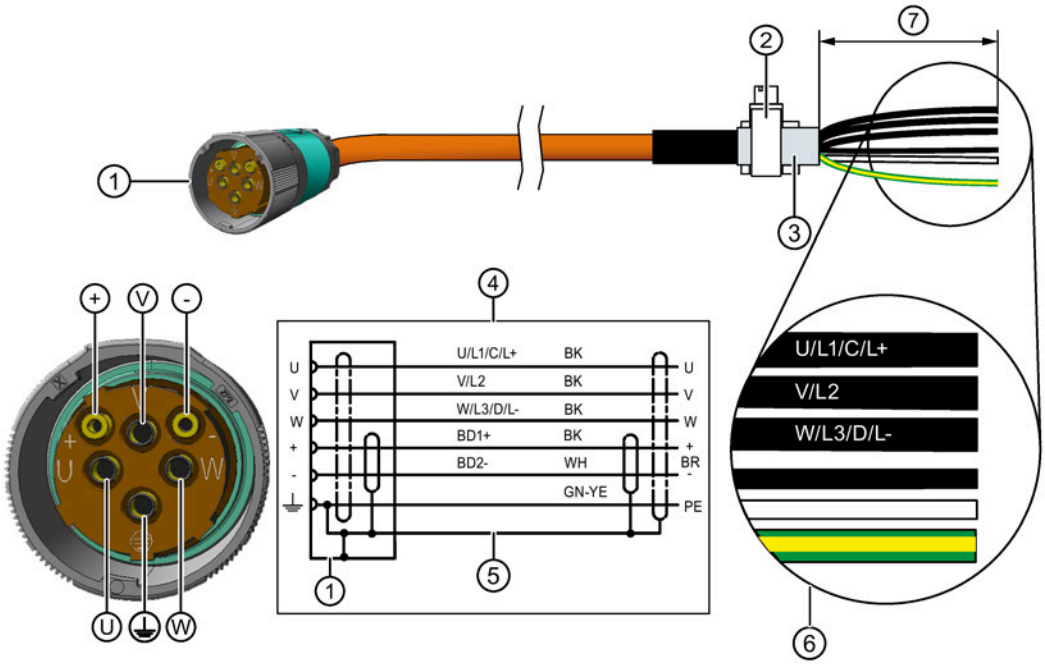
① SPEED-CONNECT connector, size M17
② Terminal for the cable shield
③ Cable shield
④ Connection diagram
U; V; W = power cables, 1.5 mm^2, each cable with separate shielding
BD1+ and BD2- = brake cable without lettering, 1.5 mm^2, shielded together
PE = protective conductor
⑤ Cable shield
⑥ Conductor designations
⑦ Recommended length of the cable ends: 105 mm

For connector size M23



① SPEED-CONNECT connector, size M23
② Terminal for the cable shield
③ Cable shield
④ Connection diagram
U; V; W = power cables, 1.5 mm^2, each cable with separate shielding
BD1+ and BD2- = brake cable without lettering, 1.5 mm^2, shielded together
PE = protective conductor
⑤ Cable shield
⑥ Conductor designations
⑦ Recommended length of the cable ends: 105 mm

For connector size M40



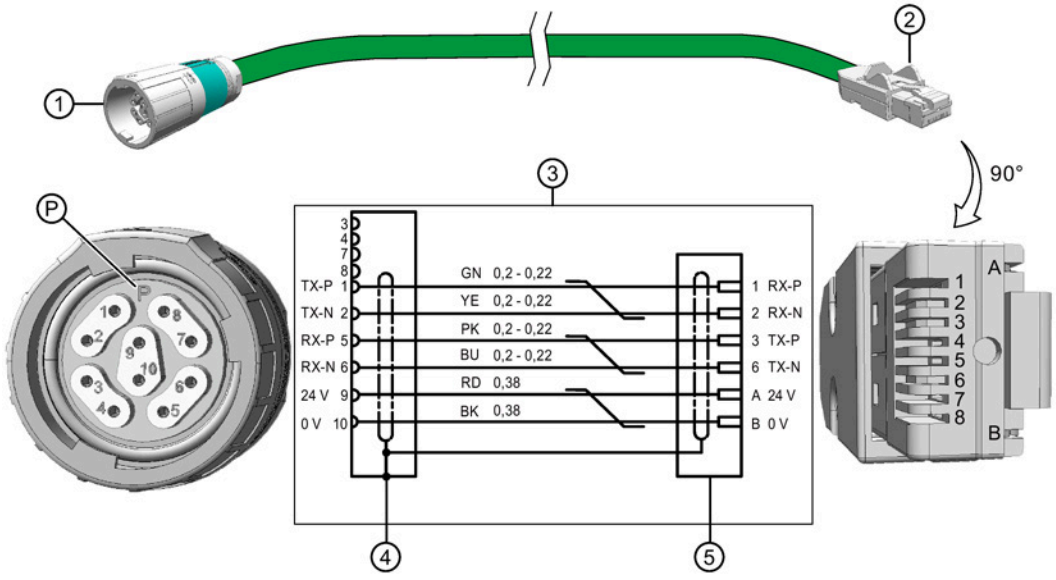
① SPEED-CONNECT connector, size M40
② Terminal for the cable shield
③ Cable shield
④ Connection diagram
U; V; W = power cables, 1.5 mm^2, each cable with separate shielding
BD1+ and BD2- = brake cable without lettering, 1.5 mm^2, shielded together
PE = protective conductor
⑤ Cable shield
⑥ Conductor designations
⑦ Recommended length of the cable ends: 105 mm

Lock the round connector properly on the motor

Information on locking is provided in Chapter "Handling the quick-action locking (Page 114)".

Connection diagram for connection of the signal line for motor 1FK2 on the S120

The connection is made on a signal line with connector M17, 10-pin and RJ45 connector



① M17 round connector, 10-pin
② RJ45/IP20 connector
③ Connection diagram
④ Pin assignment of M17 round connector, 10-pin
⑤ Pin assignment of the RJ45 connector
P 0° coded

Lock the round connector properly on the motor.

Information on locking is provided in Chapter "Handling the quick-action locking (Page 114)".

8.3.4.2 Handling the quick-action locking

The motors are equipped with SPEED-CONNECT connectors.

You can also connect quick-connection cables with SPEED-CONNECT to motor connectors as conventional cables with screw locks (fully threaded).

Note

We recommend cables with SPEED-CONNECT because they are easier to use.

Precondition

- You have mounted the motor correctly.

Procedure

Establishing a SPEED-CONNECT connection

Note

- Only tighten the connector by hand.
- Do not use any wrenches or similar tools.

1. Ensure that the union nut of the SPEED-CONNECT connector is rotated to the end stop in the direction of the "open" arrow.
2. Align the SPEED-CONNECT connector so that the triangles on the top of the connectors are opposite one another.



3. Push the power connector onto the motor connecting socket as far as it will go.
4. Turn the union nut by hand in the direction of "close" through at least 45° (position A) or up to the end stop (position B)



A Minimum locking

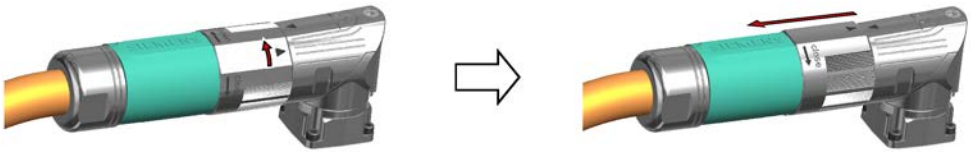
B Maximum locking up to the end stop

Note

A secure connection is only guaranteed from position A onward.

You have established a secure connection.
❒

Releasing a SPEED-CONNECT connection



1. Turn the union nut of the SPEED-CONNECT connector in the direction of "open" to the end stop. The triangles on the top of the connectors must be opposite one another.
2. Withdraw the connector.

Note

Pull out the connector at the connector itself, and do not pull on the cable.

You have disconnected the SPEED-CONNECT connection.
❒

8.3.4.3 Routing cables in a damp environment

Cable routing

Note

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

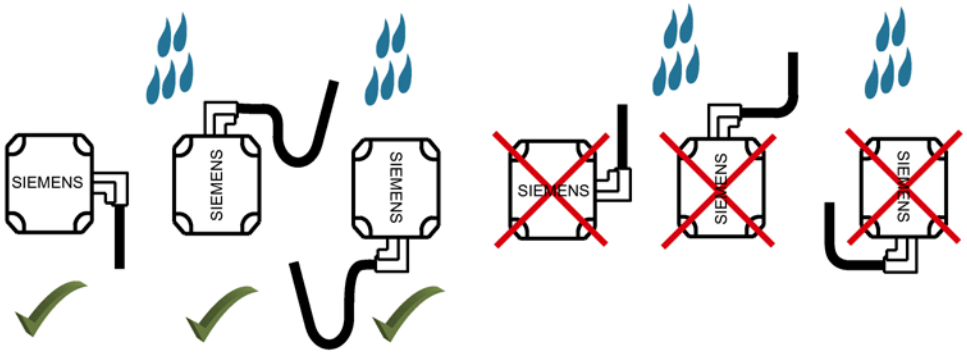


Figure 8-2 Routing cables in a damp environment

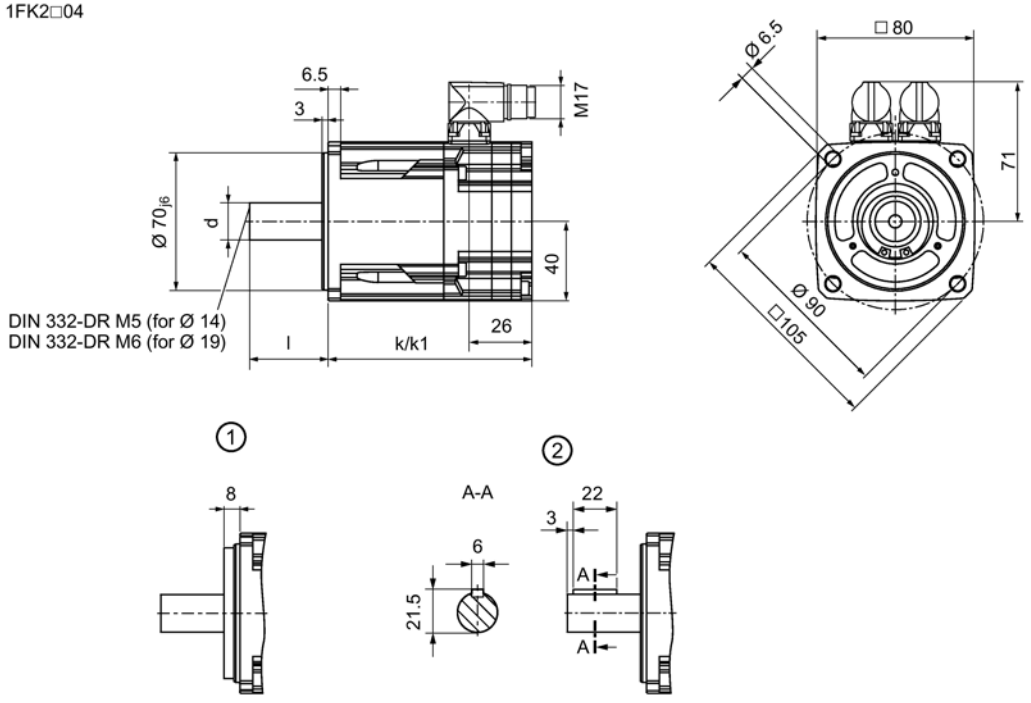
Assembly drawings/dimension sheets

9

9.1 Dimension drawing 1FK2, shaft height 40

All dimensions are in mm.

1FK2□04



① Option with shaft sealing ring (IP65)

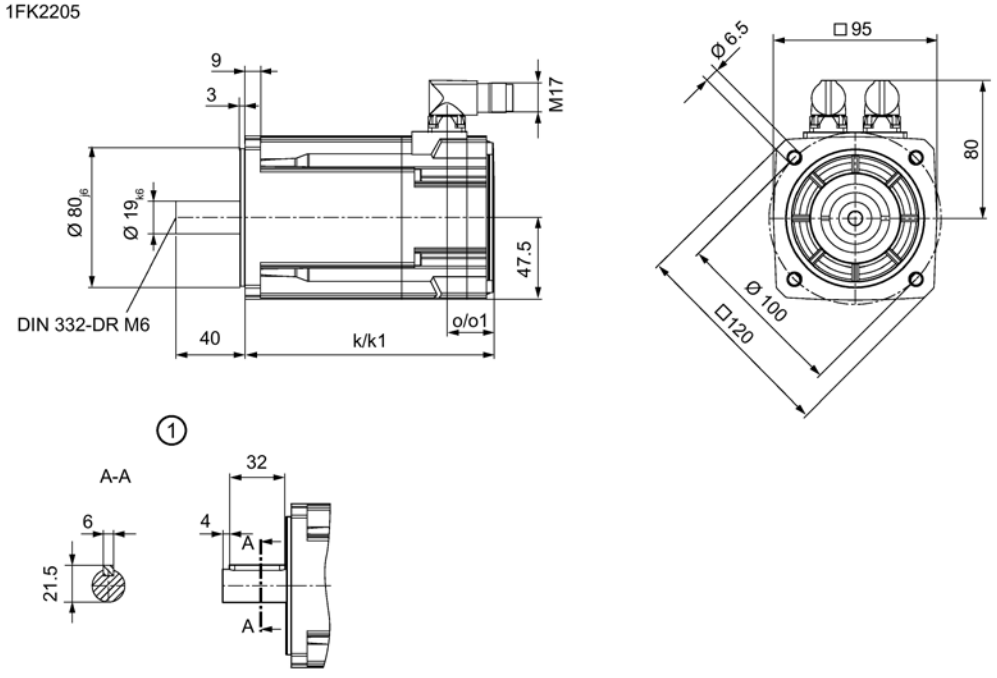
② Option shaft with feather key

SIMOTICS S-1FK2 Shaft height 40		Motor length		Shaft extension			
		Without brake	With brake	Shaft ∅19 x 40		Shaft ∅14 x 30 (for IP64 and plain shaft)	
	DIN	k	k1	d	l	d	l
	IEC	LB	LB1	D	L	D	L
1FK2104-4		98	142	19 (k6)	40	14 (k6)	30
1FK2❑04-5		126	170				
1FK2❑04-6		144	188				

9.2 Dimension drawing 1FK2, shaft height 48

All dimensions are in mm.

1FK2205



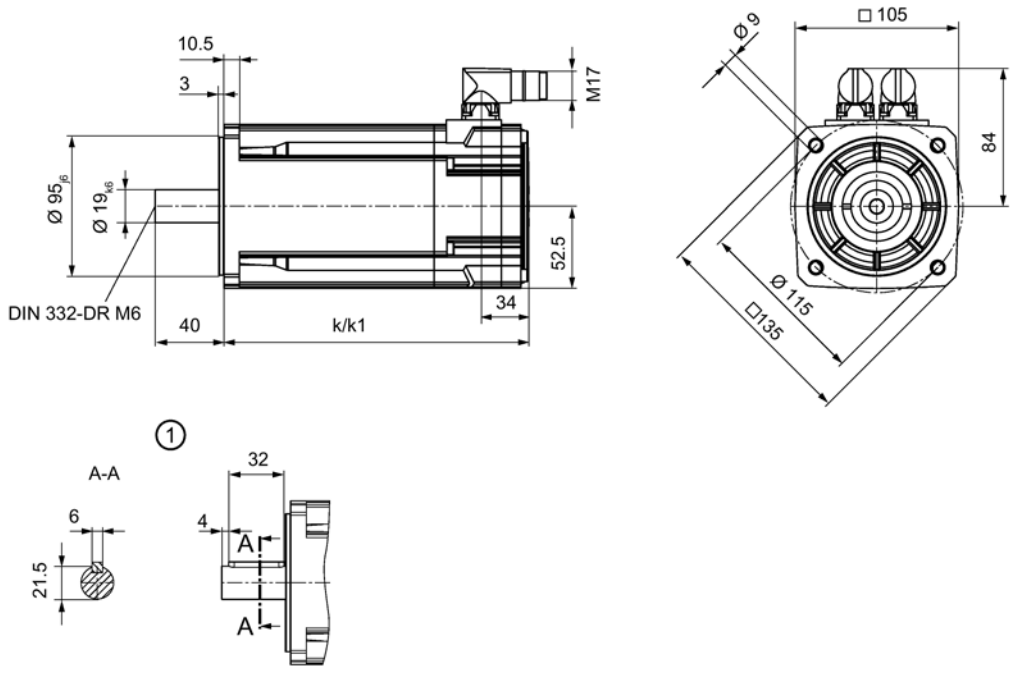
① Option shaft with feather key

SIMOTICS S-1FK2 Shaft height 48		Motor length			
		Without brake		With brake	
	DIN	k	o	k1	o1
	IEC	LB	-	LB1	-
1FK2205-2		145		188	
1FK2205-4		177	28	220	34

9.3 Dimension drawing 1FK2, shaft height 52

All dimensions are in mm.

1FK2105

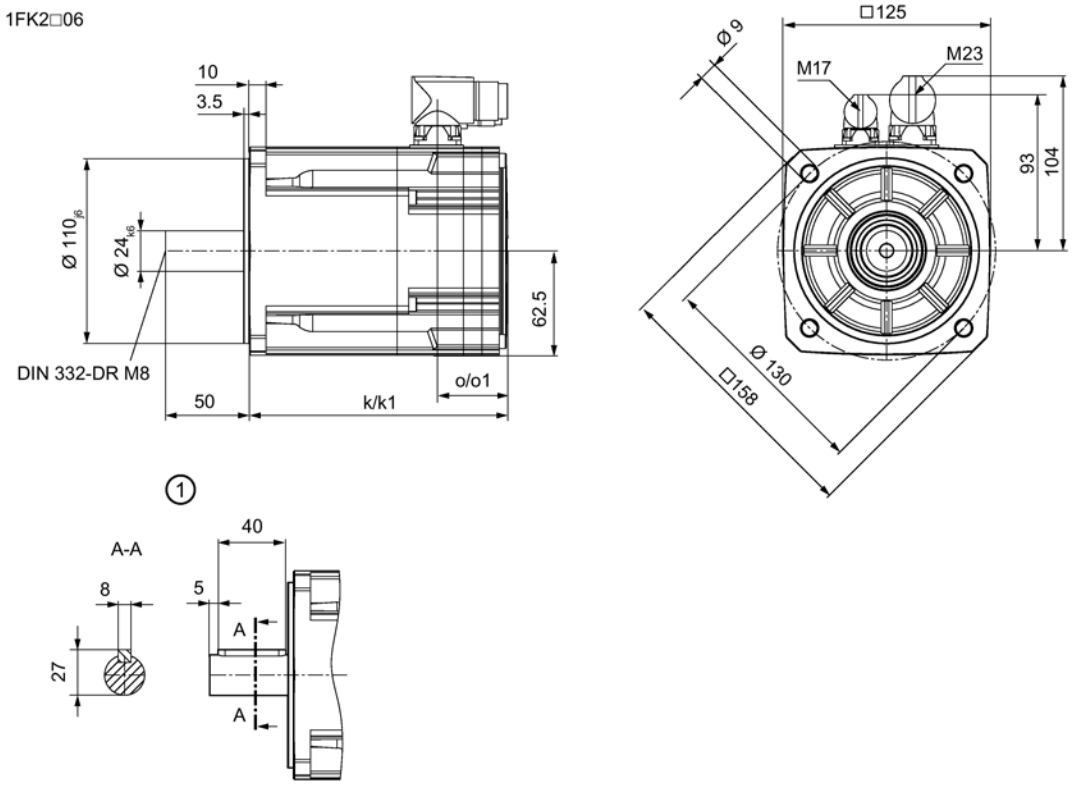


① Option shaft with feather key

SIMOTICS S-1FK2 Shaft height 52		Motor length	
		Without brake	With brake
	DIN	k	k1
	IEC	LB	LB1
1FK2105-4		173	200
1FK2105-6		215	242

9.4 Dimension drawing 1FK2, shaft height 63

All dimensions are in mm.



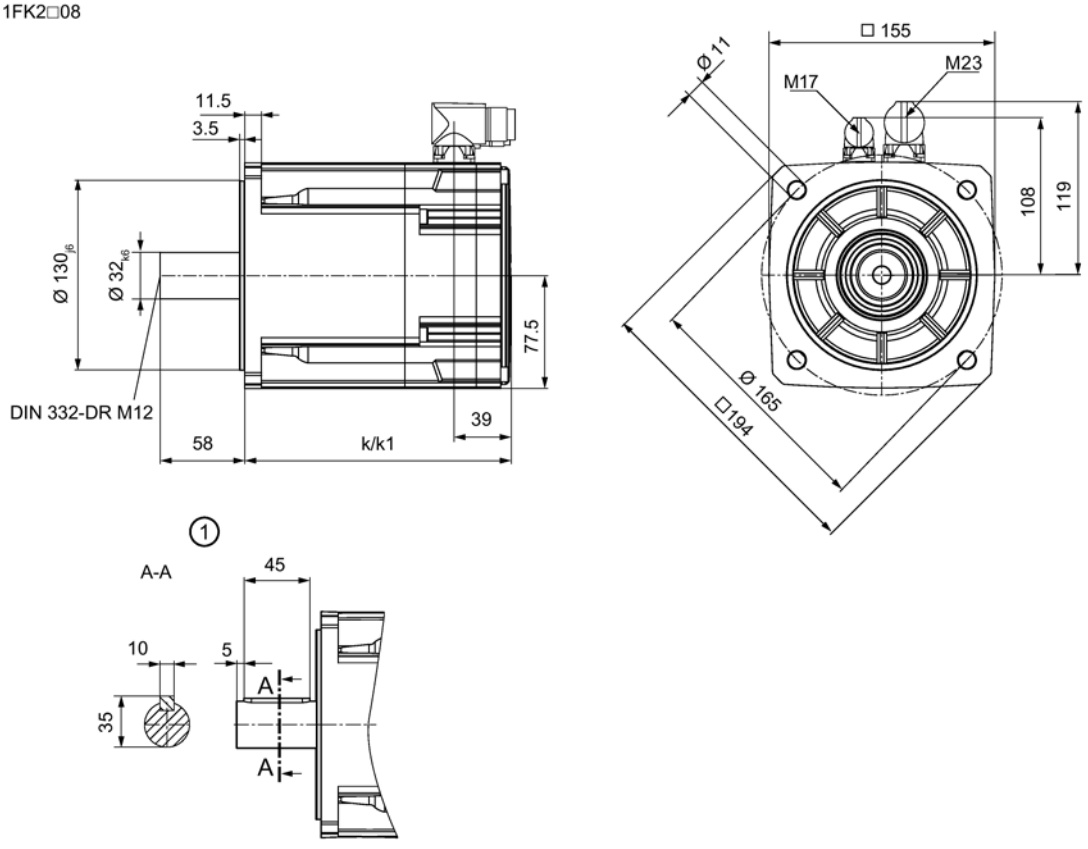
① Option shaft with feather key

SIMOTICS S-1FK2 Shaft height 63		Motor length			
		Without brake		With brake	
	DIN	k	o	k1	o1
	IEC	LB	-	LB1	-
1FK2106-3		174	41	225	53
1FK2106-4		193		244	
1FK2106-6		232		283	
1FK2206-2		154		205	
1FK2206-4		193		244	
1FK2306-2		205	53	242	
1FK2306-4		244		281	

9.5 Dimension drawing 1FK2, shaft height 80

All dimensions are in mm.

1FK2□08



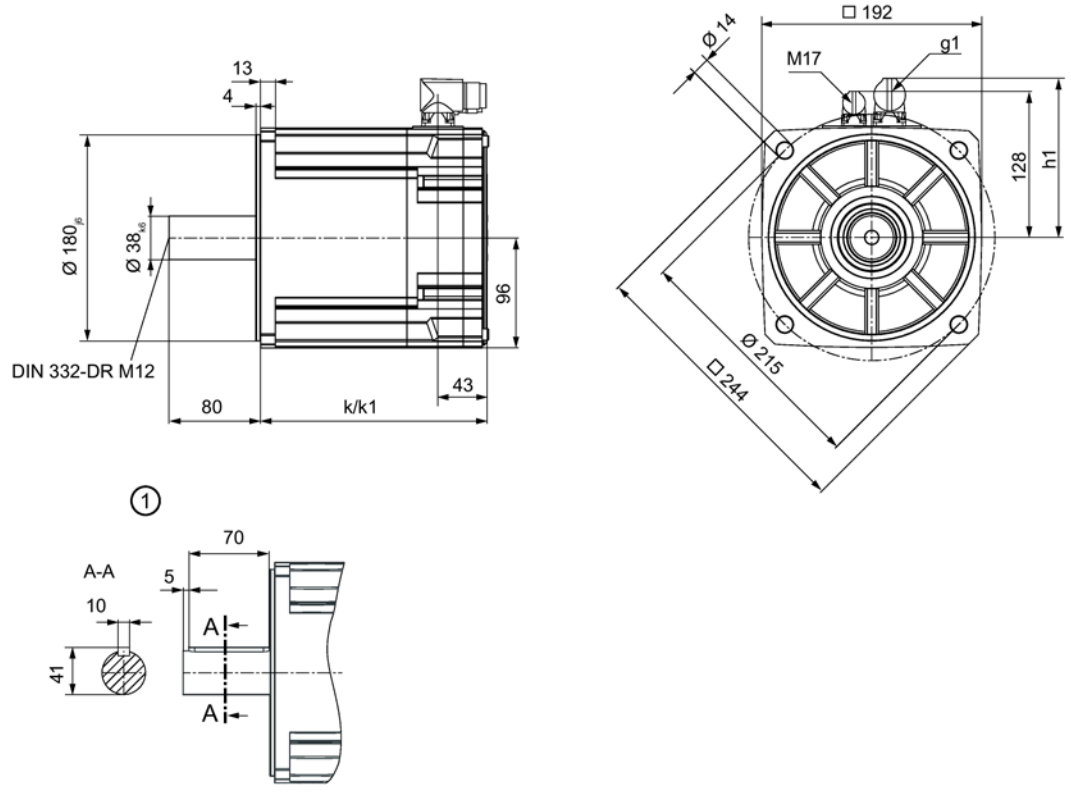
① Option shaft with feather key

SIMOTICS S-1FK2 Shaft height 80		Motor length	
		Without brake	With brake
	DIN	k	k1
	IEC	LB	LB1
1FK2208-3		183	236
1FK2208-4		203	256
1FK2208-5		223	276
1FK2308-3		236	270
1FK2308-4		256	290

9.6 Dimension drawing 1FK2, shaft height 100

All dimensions are in mm.

1FK2210



① Option shaft with feather key

SIMOTICS S-1FK2 Shaft height 100		Motor length		Power connector	
		Without brake	With brake	Size	Height
	DIN	k	k1	g1	h1
	IEC	LB	LB1	-	-
1FK2210-3		198	257	M23	139
1FK2210-4		223	282		
1FK2210-5		248	307	M40	159

DT CONFIGURATOR

In the DT CONFIGURATOR - you can simply and quickly find

- dimension drawings
- 2D/3D CAD data

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

Note

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

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

Recency of dimension drawings

Note

Changing motor dimensions

Siemens AG reserves the right to change the dimensions of the motors as part of mechanical design improvements without prior notice. This means that dimension drawings can become out of date.

Glossary

10

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

Maximum torque M_{max}

Torque that is generated at the maximum permissible current. The maximum torque is briefly available for high-speed operations (dynamic response to quickly changing loads).

The maximum torque is limited by the closed-loop control parameters.

Maximum current I_{max}

This current limit is only determined by the magnetic circuit. Even if this is briefly exceeded, it can result in an irreversible de-magnetization of the magnetic material. Specification of the RMS value of a sinusoidal current.

Maximum speed n_{max}

The maximum mechanically permissible operating speed n_{max} is the lesser of the maximum mechanically permissible speed and the maximum permissible speed at the converter.

Maximum permissible speed (at converter) $n_{max\ Inv}$

The maximum permissible operating speed for operation at a converter is $n_{max\ Inv}$ (e.g. limited by withstand voltage, maximum frequency).

NDE

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

Static torque M_0

Thermal torque limit when the motor is at a standstill corresponding to the motor thermal class. M_0 is always ≥ the rated torque M_N.

Stall current I_0

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

Thermal time constant T_{th}

Defines the increase in the motor frame temperature when the motor load is suddenly increased (step function) to the permissible S1 torque. The motor has reached 63% of its final temperature after T_{th}.

Moment of inertia J_{Mot}

Moment of inertia of rotating motor parts. J_{Mot} = without brake, $J_{Mot\ Br}$ = with brake.

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