Planning Guide 05/2003 Edition

simodrive & masterdrive

AC Servomotors
1FK6
SIMODRIVE 611/Masterdrive MC

SIEMENS

SIEMENS

SIMODRIVE 611
MASTERDRIVES MC

AC Servomotors
1FK6

Planning Guide

05.2003 Edition

SIMODRIVE® Documentation

Printing history

Brief details of this edition and previous editions are listed below.

The status of each edition is shown by the code in the ”Remarks” column.

Status code in the ”Remarks” column:

A . . . . . New documentation
B . . . . . Unrevised reprint with new Order No.
C . . . . . Revised edition with new status

If factual changes have been made on the page since the last edition, this is indicated by a new edition coding in the header on that page.

Edition	Order No. for 1FK6	Remark
05.03	6SN1197-0AD05-0BP0	**A**

This Manual is included in the documentation available on CD-ROM **(DOCONCD)**

Edition	Order No.	Remark
09.03	6FC5 298–7CA00–0BG3	**C**

For more information refer to the Internet under:
http://www.ad.siemens.de/sinumerik

This publication was produced with Interleaf V 7

Other functions not described in this documentation might be executable in the control. This does not, however, represent an obligation to supply such functions with a new control or when servicing.

We have checked that the contents of this document correspond to the hardware and software described. Nonetheless, differences might exist and therefore we cannot guarantee that they are completely identical. The information contained in this document is reviewed regularly and any necessary changes will be included in the next edition. We welcome suggestions for improvement.

Subject to change without prior notice.

Order No.6SN1197-0AD05-0BP0
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Siemens–Aktiengesellschaft

Foreword

Information on SIMODRIVE documentation

This document is part of the Technical Customer Documentation which has been developed for the SIMODRIVE system. All of the documents are available individually. You can obtain the complete list of documentation encompassing all Advertising Brochures, Catalogs, Overviews, Short Descriptions, Operating Instructions and Technical Descriptions with Order No., ordering address and price from your local Siemens office.

For reasons of transparency, this document does not include detailed information about all of the product types. Further, it cannot take into account every conceivable installation, operation or service/maintenance situation.

We would also like to point–out that the contents of this document are neither part of nor modify any prior or existing agreement, commitment or contractual relationship. The sales contract contains the entire obligation of Siemens. The warranty contained in the contract between the parties is the sole warranty of Siemens. Any statements contained herein neither create new warranties nor modify the existing warranty.

Structure of the documentation for 1FK and 1FT motors

The complete Planning Guide for 1FK and 1FT motors can be ordered as hard copy.

Table Foreword-1 Planning Guide with General Section and 1FK and 1FT motors

Title	Order No. (MLFB)	Language
Drehstrom-Servomotoren 1FK und 1FT	6SN1197–0AC20–0**A**P0	German
1FK and 1FT AC Servomotors	6SN1197–0AC20–0**B**P0	English

The General Section and the individual motor series are also available separately.

Table Foreword-2 Planning Guide, individual sections

Title	Order No. (MLFB)	Language
AC Servomotors, General Section	6SN1197–0AD07–0AP0	German
AC Servomotors, 1FK7 Motor Section	6SN1197–0AD06–0AP0	German
AC Servomotors, 1FK6 Motor Section	6SN1197–0AD05–0AP0	German
AC Servomotors, 1FT6 Motor Section	6SN1197–0AD02–0AP0	German
AC Servomotors, 1FT5 Motor Section	6SN1197–0AD01–0AP0	German

Hotline

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Fax: +49 (180) 5050–223
eMail: adsupport@siemens.com

If you have any questions regarding the documentation (suggestions, corrections), then please send a fax to the following number:
+49 (9131) 98–2176

Fax form: Refer to the feedback sheet at the end of the document

Definition of qualified personnel

For the purpose of this document and warning information on the product itself, ”Qualified personnel” are those who are familiar with the installation, mounting, start–up and operation of the equipment and are appropriately qualified and trained for the function which they perform.

- Trained and authorized to energize/de–energize, circuits and equipment in accordance with established safety procedures.
- Trained in the proper care and use of protective equipment in accordance with established safety procedures.
- Trained in rendering first aid.

Explanation of the symbols

The following danger and warning concept is used in this document:

Danger

This symbol is always used if death, severe or substantial property **will** result if proper precautions are not taken.

Warning

This symbol is always used if death, severe or substantial property **can** result if proper precautions are not taken.

Caution

This symbol is always used if minor personal injury or material damage **can** result if proper precautions are not taken.

Caution

The warning note (without a warning triangle) means that material damage **can** occur if proper precautions are not taken.

Notice

This warning note indicates that an undesirable result or an undesirable status **can** occur if the appropriate information is not observed.

Note

In the sense of this document there is a possible advantage/benefit if the note text is observed.

Danger and warning information

Danger

- It is not permissible to commission the equipment until it has been clearly identified that the machine, in which the described components are to be installed, is in full compliance with the specifications in Directive 98/37/EC.
- Only appropriately qualified personnel may commission SIMODRIVE units and AC motors.
- This personnel must take into account the technical customer documentation belonging to the product and be knowledgeable and observe the specified information and instructions on the hazards and warnings.
- When electrical equipment and motors are operated, then the associated electrical circuits are at hazardous voltage levels.
- When the machine or system is operated, hazardous axis movements can occur.
- All of the work carried–out in the electrical machine or system must be carried–out with it in a no–voltage condition.
- SIMODRIVE drive units are designed for operation on low–ohmic, grounded line supplies (TN line supplies).

Warning

- The successful and safe operation of this equipment and motors is dependent on proper transport, storage, installation and mounting as well as careful operator control, service and maintenance.
- For special versions of the drive units and motors, information and data in the catalogs and quotations additionally apply.
- In addition to the information and instructions on hazards and warnings in the technical customer documentation supplied, the applicable national, local and machine/system-specific regulations and requirements must be carefully taken into consideration.

Caution

- The motors can have surface temperatures of over +80° C.
- This is the reason that it is not permissible that temperature–sensitive parts and components – e.g. cables or electrical components – are in contact with the motor or fastened to the motor.
- When connecting and routing connecting cables, the following must be carefully observed:
  - they may not be damaged
  - they may not be strained, and
  - they may not be able to be touched by rotating components**.**

Caution

- SIMODRIVE drive units with AC motors are subject to a voltage test, in compliance with EN 50178 as part of a routine test. While the electrical equipment of industrial machines is being subject to a voltage test in compliance with EN 60204-1, Section 19.4, all of the SIMODRIVE equipment connections must be disconnected/withdrawn in order to avoid damaging the SIMODRIVE equipment.
- Motors should be connected–up according to the circuit diagram supplied. It is not permissible to directly connect the motors to the three–phase line supply. Motors will be destroyed if they are connected directly to the three–phase line supply.

Note

- SIMODRIVE equipment with AC motors fulfill, in the operational state and in dry operating areas, the Low–Voltage Directive 73/23/EEC.
- SIMODRIVE equipment with AC motors fulfill, in the configurations which are specified in the associated AC Declaration of the Conformity, the EMC Directive 89/336/EEC.

ESDS information and instructions

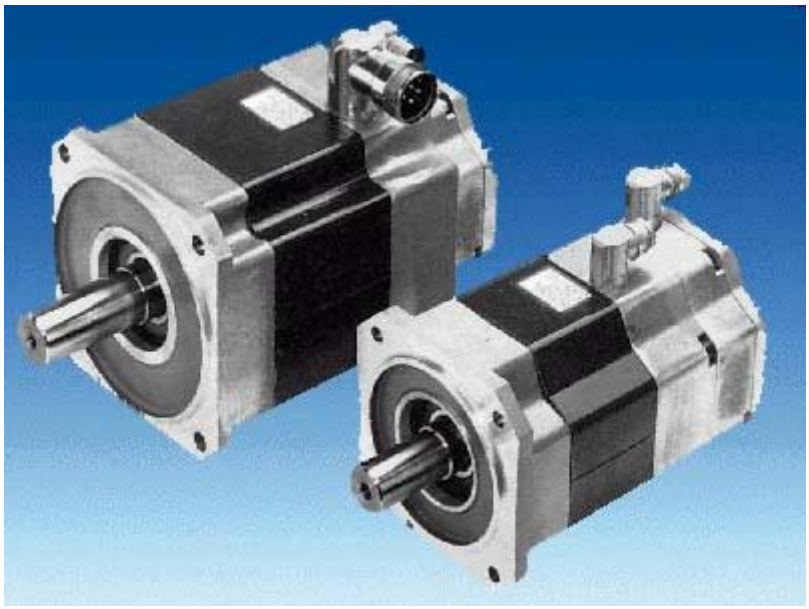
Caution

Electro**S**tatic **D**ischarge **S**ensitive devices (ESDS) are individual components, integrated circuits or boards which can be damaged by electrostatic fields or electrostatic discharge.

Handling ESDS boards:

- The human body, working area and packaging should be well grounded when handling ESDS components!
- Electronic components may only be touched by people in ESDS areas with conductive flooring if
  - they are grounded through an ESDS wrist strap
  - they are wearing ESDS shoes or ESDS shoe grounding strips.
- Electronic boards should only be touched when absolutely necessary.
- Electronic boards may not come into contact with synthetic materials and clothing manufactured out of man–made fibers.
- Electronic boards may only be placed down on conductive surfaces (table with ESDS surface, conductive ESDS foam rubber, ESDS packing bag, ESDS transport containers).
- Electronic boards may not be brought close to data terminals, monitors or television sets (minimum clearance to screen > 10 cm).
- Measuring work may only be carried out on the electronic boards if
  - the measuring device is grounded (e.g. via the protective conductor) or
  - for floating measuring equipment, the probe is briefly discharged before making measurements (e.g. a bare control housing is touched).

1FK6 Table of Contents



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Motor Description

1

1.1 Features

Applications

The 1FK6 series was essentially developed for applications on robots, gantries, loading axes, auxiliary axes, high–bay racking equipment, handling systems, rotary cycle machines, machine tools and woodworking.

The 1FK6 series is also suitable as feed motor for standard requirements.

A reliable drive system is created when 1FK6 motors are used in conjunction with Siemens drive converters.

Features

Depending on the shaft height, the 1FK6 series has standstill torques from 1.1 to 36 Nm at rated speeds from 3000 or 6000 RPM. The motors have a high overload capacity over the complete speed control range.

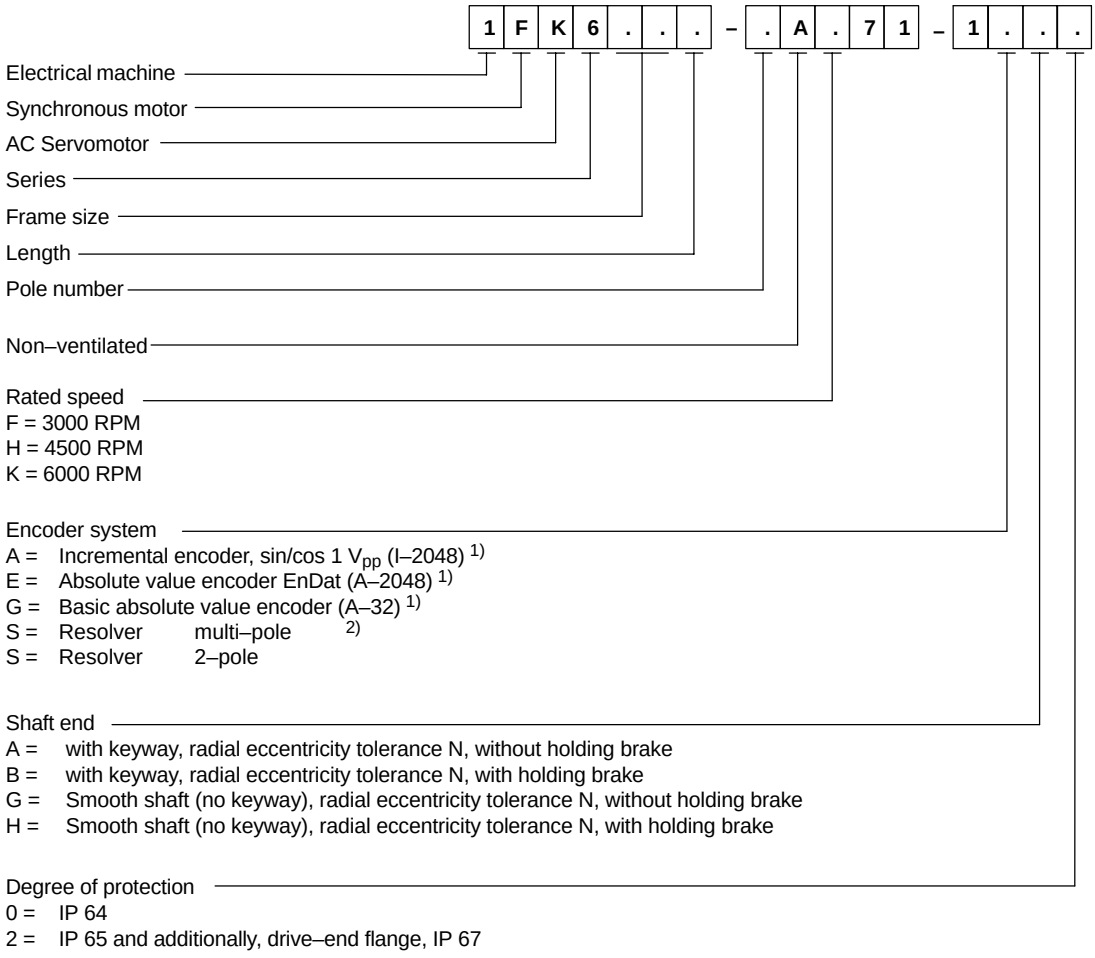
1.2 Order designation

Structure of the order designation

The order designation comprises a combination of digits and letters. It is sub–divided into three hyphenated blocks.

The motor is defined in the 1st block. Additional features are described in the 2nd and 3rd blocks.

Explanation of order designation



1) Not for shaft height 36
2) The encoder pole number corresponds to that of the motor

1.3 Technical data, 1FK6 motor

Table 1-1 Features,1FK6

Technical features	Version
Motor type	Permanent–magnet synchronous motor; AC servomotor
Type of construction (acc. to EN 60034-7; IEC 60034-7)	IM B5 (IM V1, IM V3)
Degree of protection (acc. to EN 60034-5; IEC 60034-5)	IP 64, (option, refer to 1-2)
Cooling (acc. to EN 60034-6; IEC 60034-6)	Non–ventilated
Thermal motor protection (acc. to IEC and EN 60034-11)	KTY84 temperature sensor in the stator winding
Shaft end (acc. to DIN 748-3; IEC 60072-1)	Cylindrical; without keyway and without key tolerance field k6, (option, refer to Table 1-2)
Radial eccentricity, concentricity and axial eccentricity (acc. to DIN 42955; IEC 60072-1)	Tolerance N (normal)
Vibration severity (acc. to EN 60034-14; IEC 60034-14)	Stage N (normal)
Bearings	Roller bearings with permanent grease lubrication (lubrication over the bearing lifetime)
Sound pressure level, max. (acc. to EN 21680)	1FK603: 55 dB (A) 1FK604: 55 dB (A) 1FK606: 65 dB (A) 1FK608: 70 dB (A) 1FK610: 70 dB (A)
Stator winding insulation (acc. to EN 60034-1; IEC 60034-1)	Temperature rise class F for a winding temperature rise of ΔT = 100 K for an ambient temperature of 40 °C. For ambient temperatures > 40 °C, the power must be reduced (de–rated) (refer to the documentation ”General Section”).
Installation altitude above sea level (acc. to IEC and EN 60034–1)	≤ 1000 m above sea level, otherwise power de–rating 2000 m factor 0.94 2500 m factor 0.9 (refer to the documentation ”General Section”)
Magnetic materials	Rare earth materials
Electrical connection	Connector, which can be rotated for power and encoder signals
Speed encoder, integrated	Optical encoder: • Incremental encoder, sin/cos 1 V_{pp} (I–2048) • Basic absolute value encoder (A–32) 1) • Absolute value encoder, (A–2048, not for 1FK6032) 1) • Resolver, two–pole/multi–pole For more detailed information, refer to Chapter 3.2
Rating plate	A rating plate is supplied loose for each motor

1) When using an absolute encoder, the rated torque is reduced by 10% (refer to Table 1-3 Technical data)

1.4 Technical information, options

Table 1-2 Options

Technical features	Version
Degree of protection (acc. to EN 60034-5; IEC 60034-5)	IP 65, in addition, IP67 for the drive end flange
Integrated/mounted components	• Fail–safe holding brake; Supply voltage 24V ± 10% (acc. to DIN 0580 7/79) • Planetary gearbox (prerequisite: smooth shaft – no keyway)
Shaft end (acc. to EN and IEC 60034–14)	Cylindrical; with keyway and key; Tolerance field k6 (half key balancing)
Paint finish	Anthracite (similar to RAL 7016) –Z option X09

1.5 Technical data

100 K values are specified in the table.

Table 1-3 Technical data, 1FK6

n_N [RPM]	M_0 [Nm]	M_N [Nm]	M_N 4) [Nm]	Motor type 1FK6–	Motor current I_0 3) [A]	Rated drive converter current 3) [A]	Connector size	Cross–section 1) [mm²]	Cable type 6FX□002– 5)
6000	1.1	0.8	– 6)	032–6AK71	1.7	3	1	4 x 1.5	5□A01–1□□0
6000	1.6	0.8	0.72	040–6AK71	2.8	3	1	4 x 1.5	5□A01–1□□0
3000	3.2	2.6	2.3	042–6AF71	2.8	3	1	4 x 1.5	5□A01–1□□0
3000	6.0	4.0	3.6	060–6AF71	4.3	5	1	4 x 1.5	5□A01–1□□0
3000	11.0	6.0	5.4	063–6AF71	7.9	9	1	4 x 1.5	5□A01–1□□0
3000	8.0	6.8	6.1	080–6AF71	5.8	9	1	4 x 1.5	5□A01–1□□0
3000	16.0	10.5	9.5	083–6AF71	10.4	18	1	4 x 1.5	5□A01–1□□0
3000	18.0	12.0	10.8	100–6AF71	12.2	18	1	4 x 1.5	5□A01–1□□0
3000	27.0	15.5	14.0	101–6AF71	17.5	18	1.5	4 x 2.5	5□A31–1□□0
3000	36.0	16.5	14.9	103–6AF71	23.5	28	1.5	4 x 4	5□A41–1□□0

without brake cable:	without overall shield	A	
	with overall shield	C	
with brake cable:	without overall shield	B	
	with overall shield	D	
Lengths 2) (examples)	5 m		AF
	10 m		BA
	15 m		BF
	18 m		BJ
	25 m		CF

Cables are not included with the motors – they must be separately ordered.

1) Dimensioned for I_{rms} (100 K); ambient temperature 40 °C; PVC–insulated cable; brake connection 2 x 1.5 mm²
2) Cables are supplied by the meter; length code, refer to documentation ”General Section”
3) The specified values are RMS values
4) With absolute value encoder (due to the max. encoder temperature)
5) 8 = MOTION–CONNECT 800, 5 = MOTION–CONNECT 500; Technical data, refer to Catalog NC Z
6) It is not possible to mount/install absolute value encoders

1.6 Armature short–circuit braking

The function description of the armature short–circuit braking is described in the documentation ”General Section”.

Dimensioning the braking resistors for optimum short–circuit braking

An optimum braking time is achieved by dimensioning the braking resistors.
The braking torques which are obtained are listed in the following table. The data applies for braking from the rated speed. If a drive is braked from another speed, then the braking time **cannot** be linearly calculated. However, longer braking times cannot occur.

The resistor rating must be coordinated with the particular I^2t load capacity, refer to the documentation ”General Section”.

Table 1-4 Resistor braking for 1FK6

Motor type	**External brake resistor** R_{opt} [Ω]	**Average braking torque** $M_{br\ rms}$ [Nm]		**Max. braking torque** $M_{br\ max}$ [Nm]	**RMS braking current** $I_{br\ rms}$ [A]	
		without external braking resistor	**with** external braking resistor		**without** external braking resistor	**with** external braking resistor
1FK6032-6AK71	6.6	1.6	1.8	2.3	6.1	5.6
1FK6040-6AK71	3.8	2.0	2.5	3.1	9.6	8.8
1FK6042-6AF71	2.7	4.8	5.2	6.5	9.9	9.3
1FK6060-6AF71	3.6	6.5	8.0	9.9	12.7	11.6
1FK6063-6AF71	2.2	10.8	15.9	19.8	26.0	23.3
1FK6080-6AF71	3.4	7.1	10.4	12.9	16.7	15.1
1FK6083-6AF71	2.3	11.8	21.2	26.0	31.0	28.0
1FK6100-8AF71	1.8	14.1	25.0	31.0	38.0	35.0
1FK6101-8AF71	1.3	18.7	38.0	47.0	56.0	50.0
1FK6103-8AF71	1.0	23.3	52.0	65.0	77.0	69.0

1.7 Electrical connections

Warning

The motors are not designed to be connected directly to the line supply.

Connection assignment, power connector and signal connector at the motor

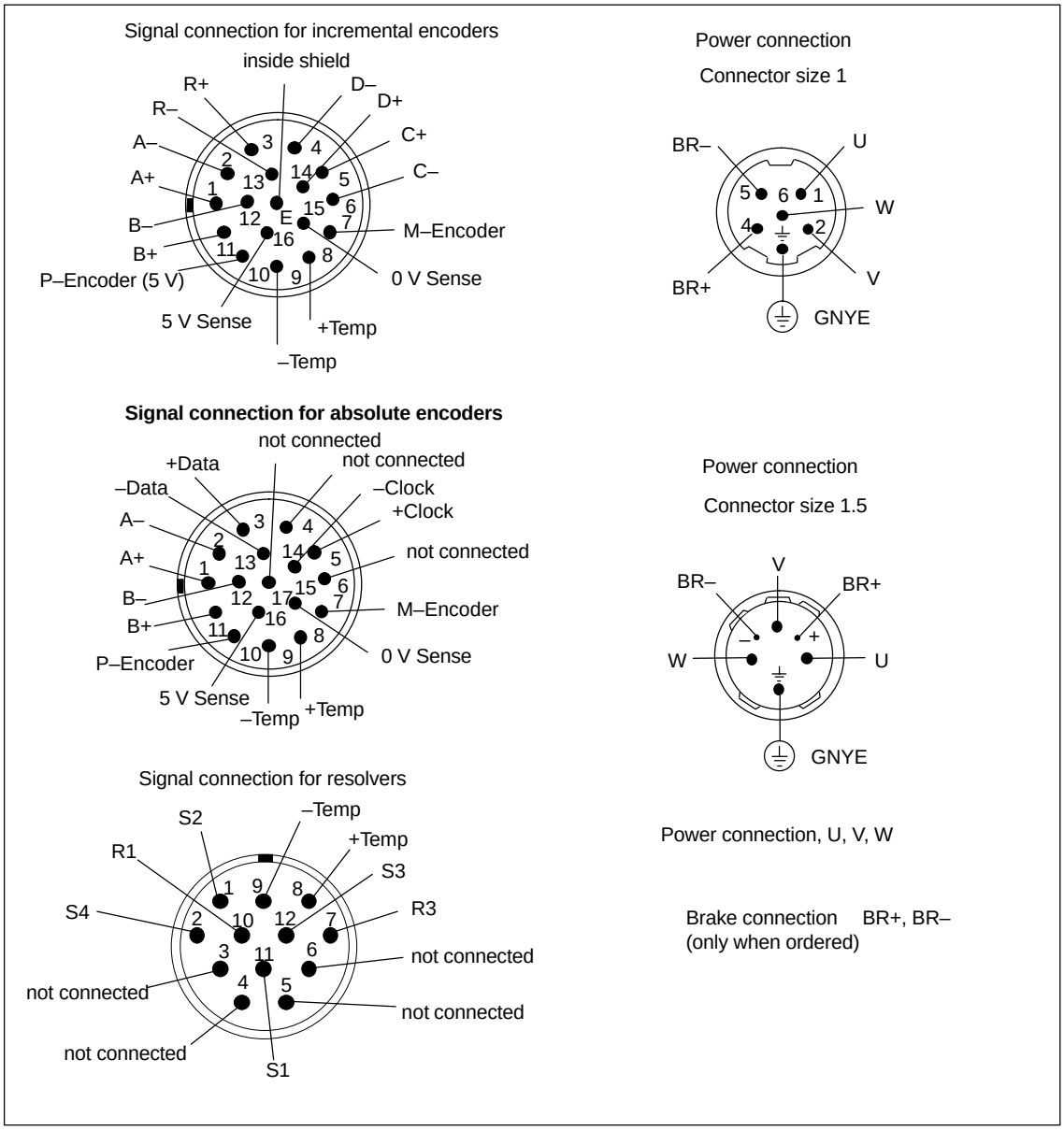


Fig. 1-1 Connection assignment: Power, brake, encoder and temperature sensor

Power and signal connectors can be rotated

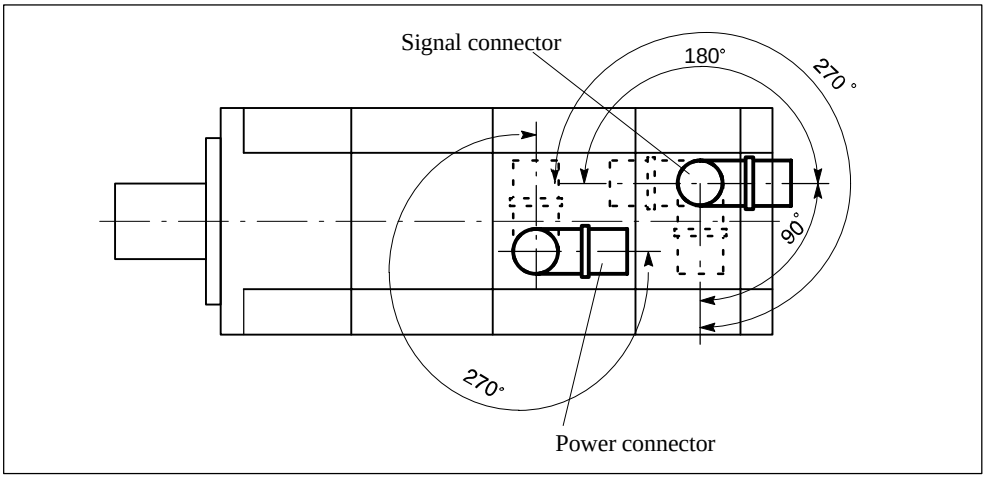


Fig. 1-2 Connectors can be rotated

- **Direction of rotation:**
  - When supplied: Power and signal connector, NDE
  - Power connector: 270°, clockwise
  - Signal connector: Shaft heights 36 to 80: 180°, counter–clockwise
    90°, clockwise
    Shaft height 100: 90°, counter–clockwise
    90°, clockwise
- **Torques when rotating:**
  - Power connector: Size 1: M_{max} = 8 Nm
    Size 1.5: M_{max} = 15 Nm
  - Signal connector: M_{max} = 8 Nm

  Connectors should be rotated using the matching mating connector located on the connector thread.

Note

- It is not permissible that the specified rotation range is exceeded.
- In order to guarantee the degree of protection, max. 10 revolutions are permissible.
- Do not exceed max. torques when rotating.
- Connecting cables must be secured against tension and bending.
- The motor connectors must then be secured so that they cannot rotate.
- It is not permissible to subject the connector to continuous force.

1.8 Drive–out coupling

For the ordering address, refer to the documentation ”General Section” or the Internet www.ktr.com

Table 1-5 Assignment of the drive–out couplings to the motors

Shaft height	Rotex GS Type	Torques which can be transferred with an 80 or 92 Sh–A–GS pinion	
		T_{KN} [Nm]	T_{Kmax} [Nm]
36	14	7.5	15
48	19/24	10	20
63	24/28	35	70
80	28/38	95	190
100	38/45	190	380

It may be necessary to use other pinions (e.g. Shore hardness 80 SH–A). This must be optimally harmonized together with the mounted mechanical system.

Warning

The accelerating torque may not exceed the clamping torque of the coupling!

Notice

Under no circumstances can we guarantee the quality and correctness of third–party products. Please carefully observe the detailed text in the Foreword.

■

Space for your notes

Technical Data and Characteristics

2

Note

- DC link voltages > 600 V occur when the motors are fed from drive converters connected to 480 V line supplies. The following restrictions apply:
  - Shaft heights 36, 48, 63 and 80 may only be utilized to ΔT = 60 K.
  - Shaft height 100 may still be utilized to ΔT = 100 K
- For a description of the shift of the voltage limiting characteristics, refer to the documentation ”General Section”.
- The specified thermal S3 limiting characteristics are referred to ΔT = 100 K for a 1 min. duty cycle.

2.1 Speed–torque diagrams

Table 2-1 1FK6032 Standard

1FK6032				
Technical data	Code	Units	–6AK71	
Engineering data				
Rated speed	n_N	RPM	6000	
Pole number	2p		6	
Rated torque (100K)	$M_{N\ (100\ K)}$	Nm	0.8	
Rated current	I_N	A	1.5	
Standstill torque (60K)	$M_{0\ (60\ K)}$	Nm	0.9	
Standstill torque (100K)	$M_{0\ (100\ K)}$	Nm	1.1	
Standstill current (60K)	$I_{0\ (60\ K)}$	A	1.4	
Standstill current (100K)	$I_{0\ (100\ K)}$)	A	1.7	
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	0.75	
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	0.68	
Optimum operating point				
Optimum speed	n_{opt}	RPM	6000	
Optimum power	P_{opt}	kW	0.5	
Limiting data				
Max. permissible speed (mech.)	n_{max}	RPM	12000	
Maximum torque	M_{max}	Nm	4.5	
Max. current	I_{max}	A	7.3	
Physical constants				
Torque constant	k_T	Nm/A	0.67	
Voltage constant	k_E	V/1000 RPM	44	
Winding resistance at 20°C	$R_{ph.}$	Ohm	5.7	
Rotating field inductance	L_D	mH	13	
Electrical time constant	T_{el}	ms	2.3	
Shaft torsional stiffness	c_t	Nm/rad	6270	
Mechanical time constant	T_{mech}	ms	2.6	
Thermal time constant	T_{th}	min	25	
Weight (with brake)	m	kg	3.0	
Weight (without brake)	m	kg	2.9	

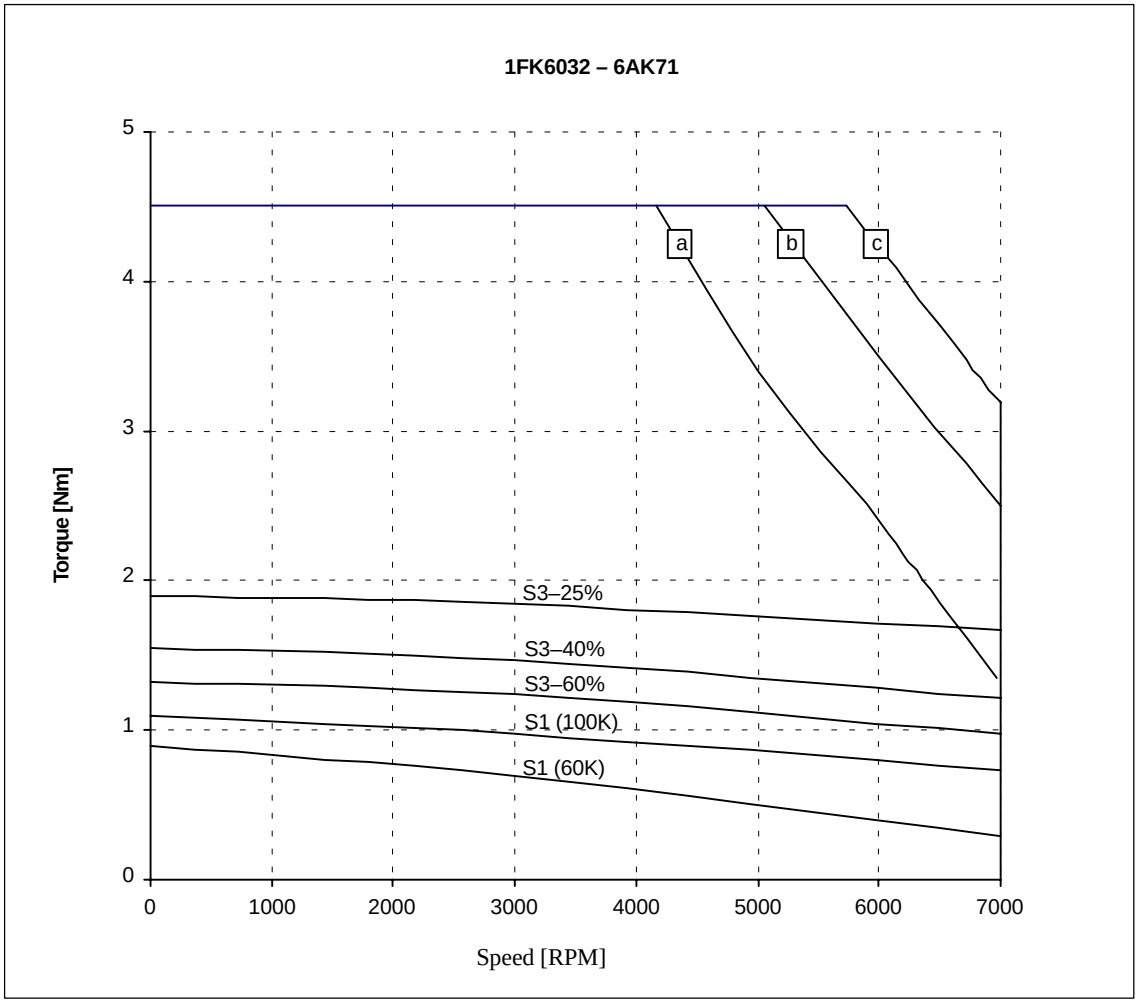


Fig. 2-1 Speed–torque diagram 1FK6032 Standard

[a] MASTERDRIVES MC, $V_{DC\ link}$=540V (DC), V_{mot}=340V_{rms}
[b] SIMODRIVE 611 (UI), $V_{DC\ link}$=540V (DC) and MASTERDRIVES MC (AFE), $V_{DC\ link}$=600V (DC), V_{mot}=380V_{rms}
[c] SIMODRIVE 611 (IR), $V_{DC\ link}$=600V (DC), V_{mot}=425V_{rms}

Table 2-2 1FK6040 Standard

1FK6040				
Technical data	Code	Units	–6AK71	
Engineering data				
Rated speed	n_N	RPM	6000	
Pole number	2p		6	
Rated torque (100K)	$M_{N\ (100\ K)}$	Nm	0.8	
Rated current	I_N	A	1.75	
Standstill torque (60K)	$M_{0\ (60\ K)}$	Nm	1.3	
Standstill torque (100K)	$M_{0\ (100\ K)}$	Nm	1.6	
Standstill current (60K)	$I_{0\ (60\ K)}$	A	2.2	
Standstill current (100K)	$I_{0\ (100\ K)}$	A	2.8	
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	2.10	
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	1.84	
Optimum operating point				
Optimum speed	n_{opt}	RPM	6000	
Optimum power	P_{opt}	kW	0.5	
Limiting data				
Max. permissible speed (mech.)	n_{max}	RPM	8500	
Maximum torque	M_{max}	Nm	5.1	
Max. current	I_{max}	A	9.0	
Physical constants				
Torque constant	k_T	Nm/A	0.57	
Voltage constant	k_E	V/1000 RPM	37.5	
Winding resistance at 20°C	$R_{ph.}$	Ohm	2.75	
Rotating field inductance	L_D	mH	7.0	
Electrical time constant	T_{el}	ms	2.5	
Shaft torsional stiffness	c_t	Nm/rad	18100	
Mechanical time constant	T_{mech}	ms	4.7	
Thermal time constant	T_{th}	min	25	
Weight (with brake)	m	kg	4.1	
Weight (without brake)	m	kg	3.7	

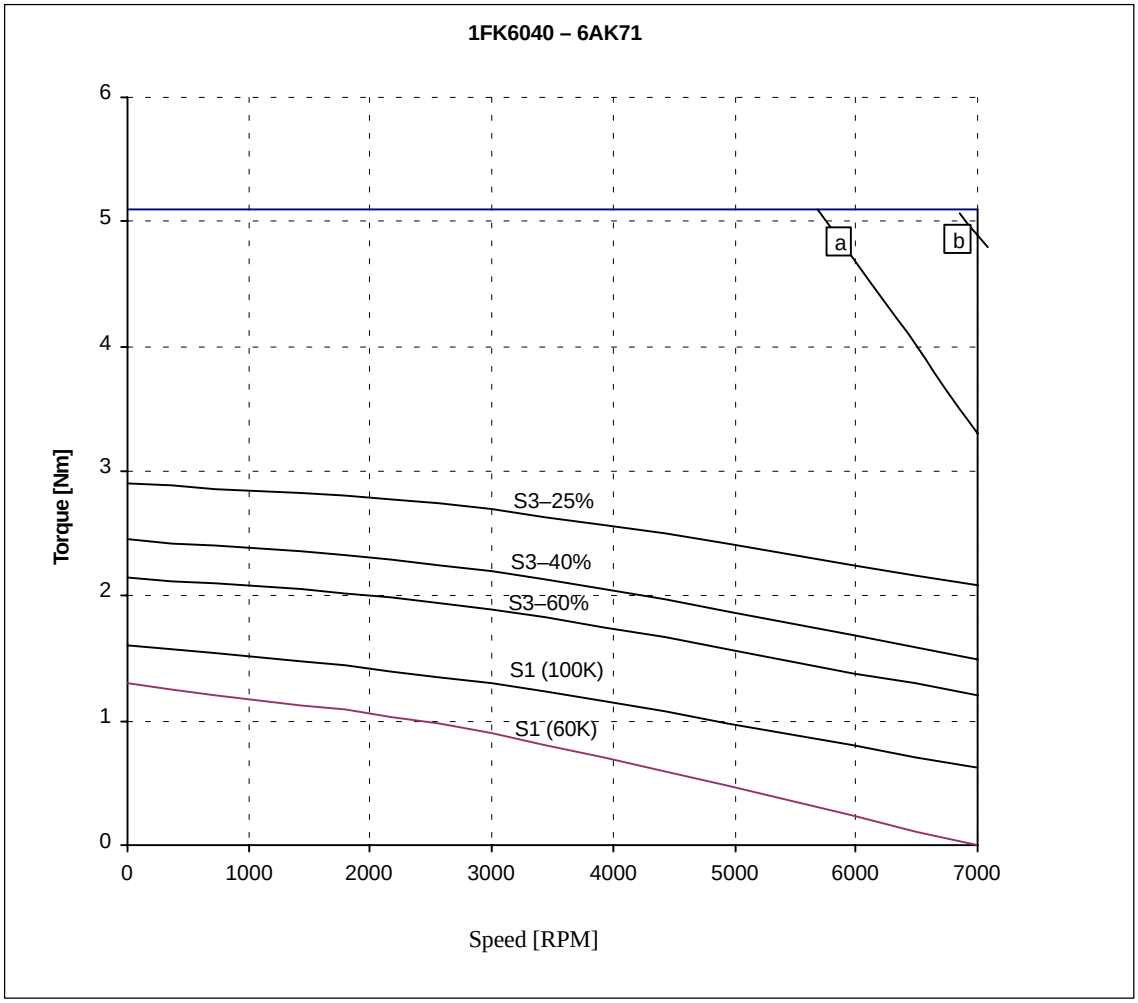


Fig. 2-2 Speed–torque diagram 1FK6040 Standard

[a] MASTERDRIVES MC, $V_{DC\ link}$=540V (DC), V_{mot}=340V_{rms}
[b] SIMODRIVE 611 (UI), $V_{DC\ link}$=540V (DC) and MASTERDRIVES MC (AFE), $V_{DC\ link}$=600V (DC), V_{mot}=380V_{rms}
[c] SIMODRIVE 611 (IR), $V_{DC\ link}$=600V (DC), V_{mot}=425V_{rms}

Table 2-3 1FK6042 Standard

1FK6042				
Technical data	Code	Units	–6AF71	
Engineering data				
Rated speed	n_N	RPM	3000	
Pole number	2p		6	
Rated torque (100K)	$M_{N\ (100\ K)}$	Nm	2.6	
Rated current	I_N	A	2.4	
Standstill torque (60K)	$M_{0\ (60\ K)}$	Nm	2.65	
Standstill torque (100K)	$M_{0\ (100\ K)}$	Nm	3.2	
Standstill current (60K)	$I_{0\ (60\ K)}$	A	2.2	
Standstill current (100K)	$I_{0\ (100\ K)}$	A	2.8	
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	3.52	
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	3.30	
Optimum operating point				
Optimum speed	n_{opt}	RPM	3000	
Optimum power	P_{opt}	kW	0.82	
Limiting data				
Max. permissible speed (mech.)	n_{max}	RPM	8500	
Maximum torque	M_{max}	Nm	10.6	
Max. current	I_{max}	A	9.5	
Physical constants				
Torque constant	k_T	Nm/A	1.15	
Voltage constant	k_E	V/1000 RPM	76	
Winding resistance at 20°C	$R_{ph.}$	Ohm	3.65	
Rotating field inductance	L_D	mH	13.5	
Electrical time constant	T_{el}	ms	3.7	
Shaft torsional stiffness	c_t	Nm/rad	14700	
Mechanical time constant	T_{mech}	ms	2.7	
Thermal time constant	T_{th}	min	35	
Weight (with brake)	m	kg	5.4	
Weight (without brake)	m	kg	5.0	

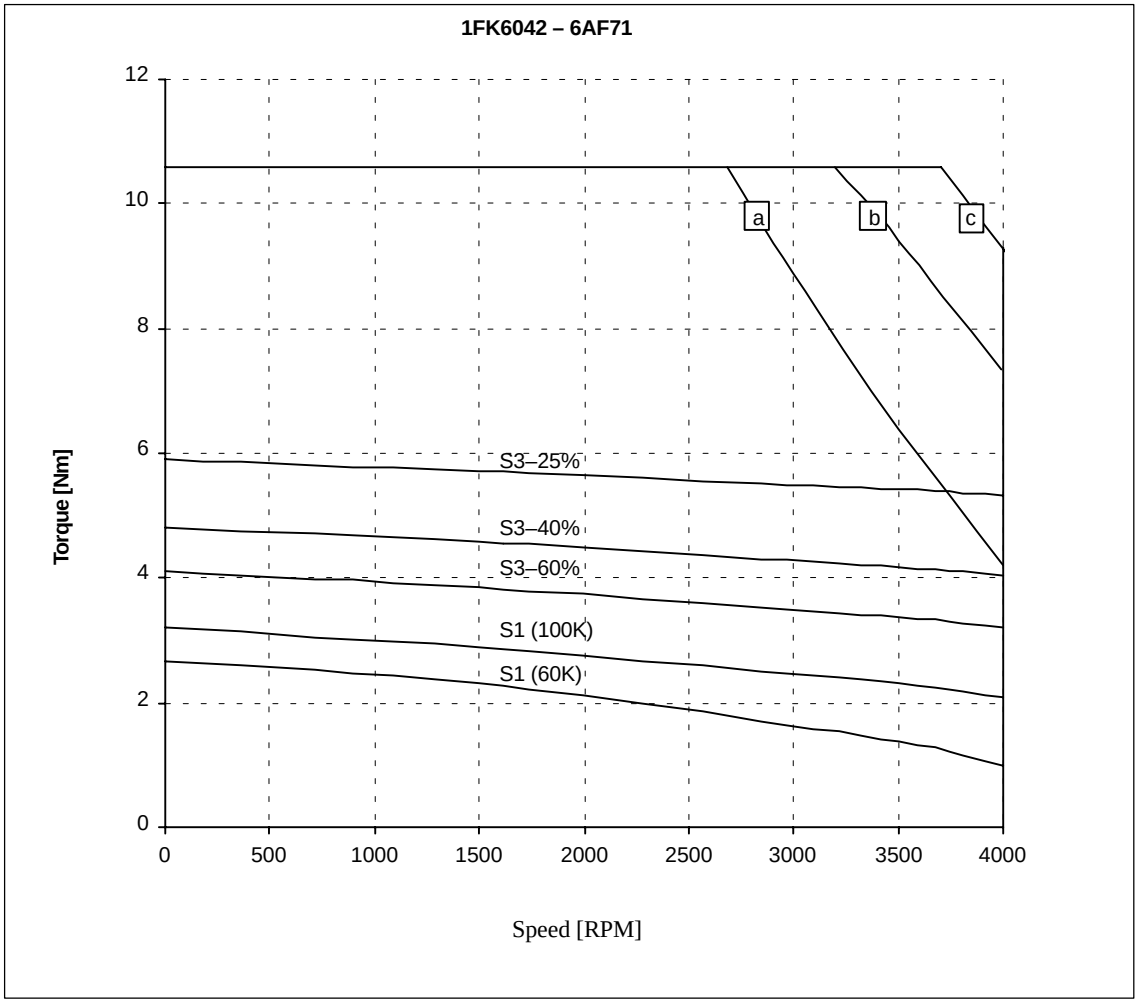


Fig. 2-3 Speed–torque diagram 1FK6042 Standard

[a] MASTERDRIVES MC, $V_{DC\ link}$=540V (DC), V_{mot}=340V_{rms}
[b] SIMODRIVE 611 (UI), $V_{DC\ link}$=540V (DC) and MASTERDRIVES MC (AFE), $V_{DC\ link}$=600V (DC), V_{mot}=380V_{rms}
[c] SIMODRIVE 611 (IR), $V_{DC\ link}$=600V (DC), V_{mot}=425V_{rms}

Table 2-4 1FK6060 Standard

1FK6060				
Technical data	Code	Units	–6AF71	
Engineering data				
Rated speed	n_N	RPM	3000	
Pole number	2p		6	
Rated torque (100K)	$M_{N\ (100\ K)}$	Nm	4.0	
Rated current	I_N	A	3.1	
Standstill torque (60K)	$M_{0\ (60\ K)}$	Nm	5.0	
Standstill torque (100K)	$M_{0\ (100\ K)}$	Nm	6.0	
Standstill current (60K)	$I_{0\ (60\ K)}$	A	3.5	
Standstill current (100K)	$I_{0\ (100\ K)}$	A	4.3	
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	9.50	
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	8.60	
Optimum operating point				
Optimum speed	n_{opt}	RPM	3000	
Optimum power	P_{opt}	kW	1.26	
Limiting data				
Max. permissible speed (mech.)	n_{max}	RPM	6600	
Maximum torque	M_{max}	Nm	17.7	
Max. current	I_{max}	A	14	
Physical constants				
Torque constant	k_T	Nm/A	1.39	
Voltage constant	k_E	V/1000 RPM	92	
Winding resistance at 20°C	$R_{ph.}$	Ohm	2.5	
Rotating field inductance	L_D	mH	13.0	
Electrical time constant	T_{el}	ms	5.2	
Shaft torsional stiffness	c_t	Nm/rad	39600	
Mechanical time constant	T_{mech}	ms	3.3	
Thermal time constant	T_{th}	min	30	
Weight (with brake)	m	kg	9.6	
Weight (without brake)	m	kg	9.0	

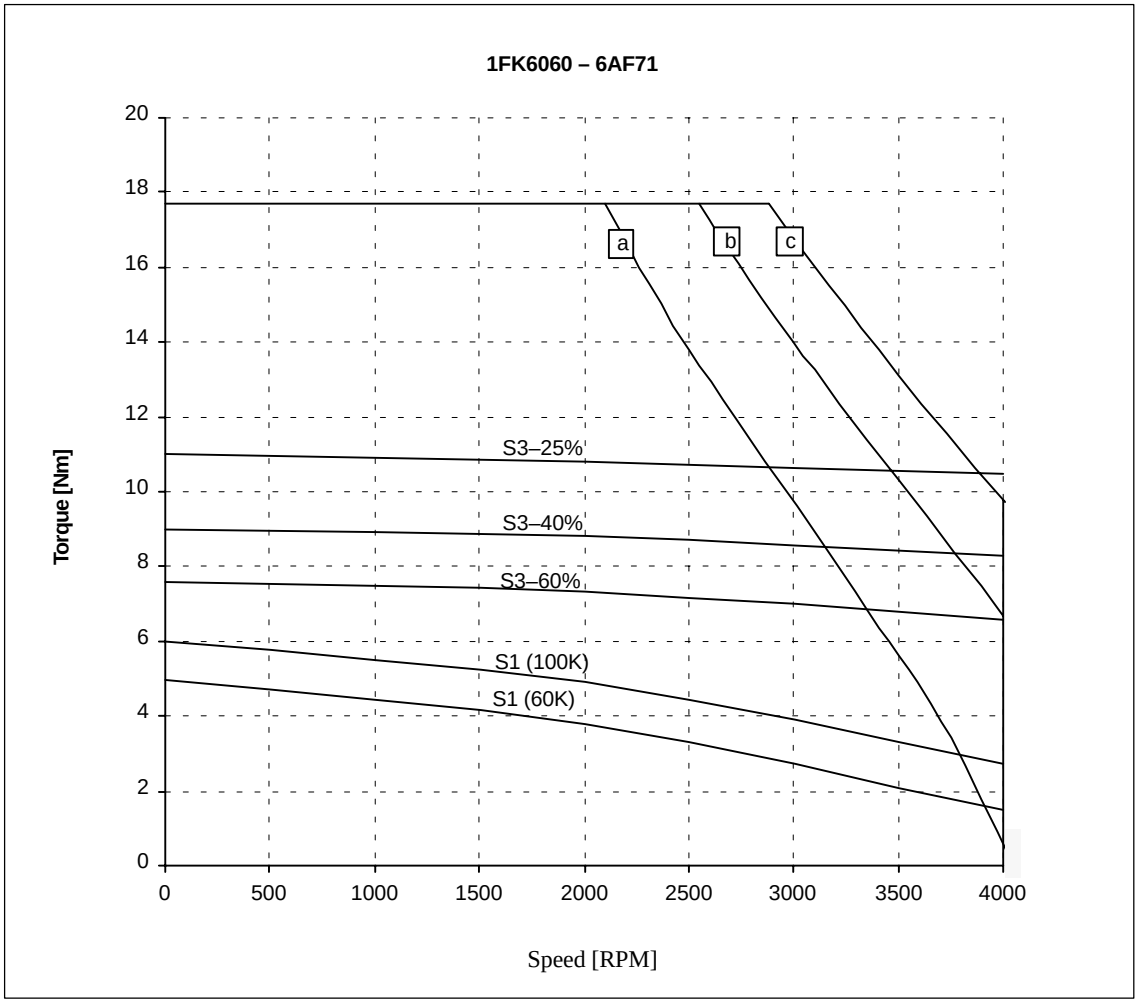


Fig. 2-4 Speed–torque diagram 1FK6060 Standard

[a] MASTERDRIVES MC, $V_{DC\ link}$=540V (DC), V_{mot}=340V_{rms}
[b] SIMODRIVE 611 (UI), $V_{DC\ link}$=540V (DC) and MASTERDRIVES MC (AFE), $V_{DC\ link}$=600V (DC), V_{mot}=380V_{rms}
[c] SIMODRIVE 611 (IR), $V_{DC\ link}$=600V (DC), V_{mot}=425V_{rms}

Table 2-5 1FK6063 Standard

1FK6063				
Technical data	Code	Units	–6AF71	
Engineering data				
Rated speed	n_N	RPM	3000	
Pole number	2p		6	
Rated torque (100K)	$M_{N\ (100\ K)}$	Nm	6.0	
Rated current	I_N	A	4.7	
Standstill torque (60K)	$M_{0\ (60\ K)}$	Nm	9.1	
Standstill torque (100K)	$M_{0\ (100\ K)}$	Nm	11.0	
Standstill current (60K)	$I_{0\ (60\ K)}$	A	6.3	
Standstill current (100K)	$I_{0\ (100\ K)}$	A	7.9	
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	17.0	
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	16.1	
Optimum operating point				
Optimum speed	n_{opt}	RPM	3000	
Optimum power	P_{opt}	kW	1.89	
Limiting data				
Max. permissible speed (mech.)	n_{max}	RPM	6600	
Maximum torque	M_{max}	Nm	36	
Max. current	I_{max}	A	28	
Physical constants				
Torque constant	k_T	Nm/A	1.39	
Voltage constant	k_E	V/1000 RPM	92	
Winding resistance at 20°C	$R_{ph.}$	Ohm	0.83	
Rotating field inductance	L_D	mH	6.5	
Electrical time constant	T_{el}	ms	7.8	
Shaft torsional stiffness	c_t	Nm/rad	32900	
Mechanical time constant	T_{mech}	ms	2.1	
Thermal time constant	T_{th}	min	35	
Weight (with brake)	m	kg	13.8	
Weight (without brake)	m	kg	13.2	

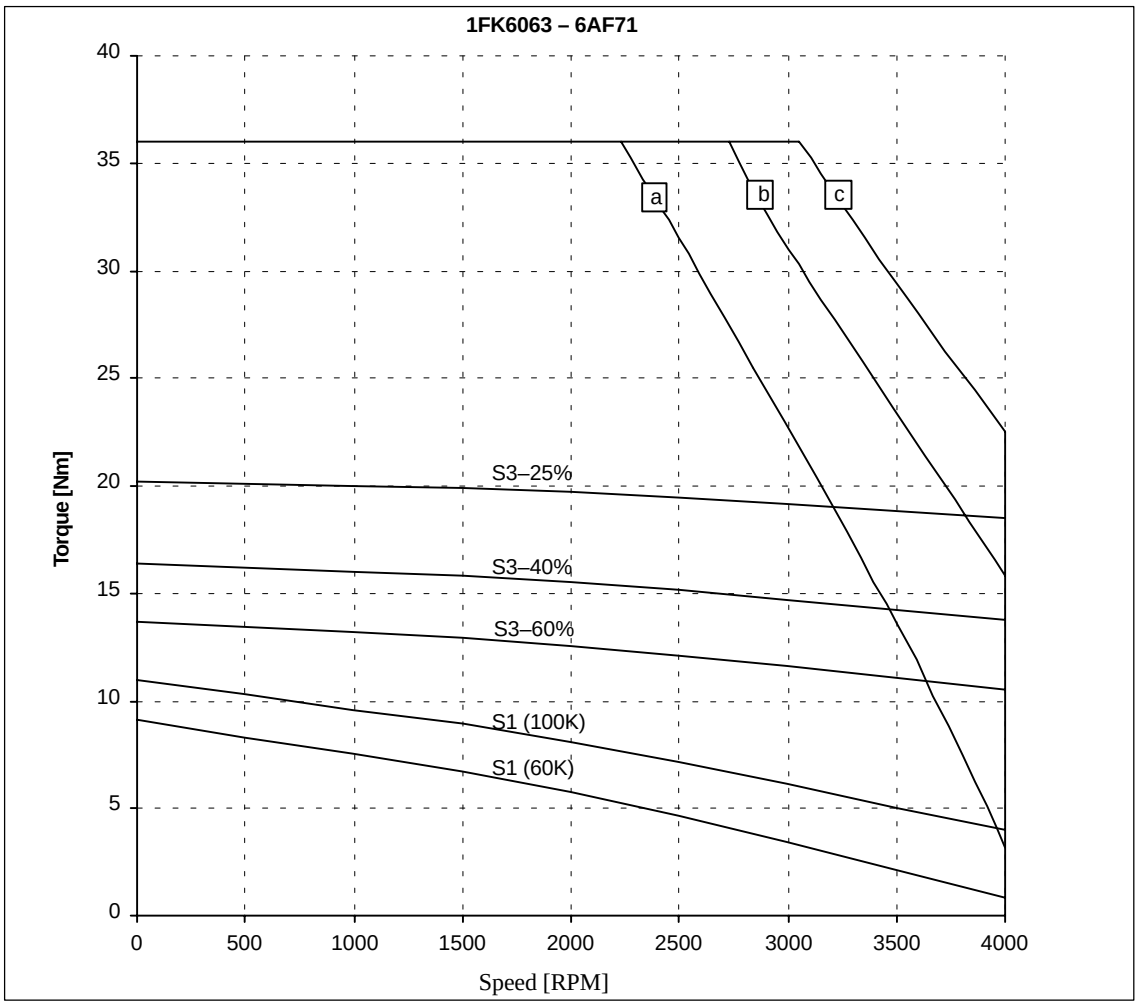


Fig. 2-5 Speed–torque diagram 1FK6063 Standard

[a] MASTERDRIVES MC, $V_{DC\ link}$=540V (DC), V_{mot}=340V_{rms}
[b] SIMODRIVE 611 (UI), $V_{DC\ link}$=540V (DC) and MASTERDRIVES MC (AFE), $V_{DC\ link}$=600V (DC), V_{mot}=380V_{rms}
[c] SIMODRIVE 611 (IR), $V_{DC\ link}$=600V (DC), V_{mot}=425V_{rms}

Table 2-6 1FK6080 Standard

1FK6080				
Technical data	Code	Units	–6AF71	
Engineering data				
Rated speed	n_N	RPM	3000	
Pole number	2p		6	
Rated torque (100K)	$M_{N\ (100\ K)}$	Nm	6.8	
Rated current	I_N	A	5.2	
Standstill torque (60K)	$M_{0\ (60\ K)}$	Nm	6.6	
Standstill torque (100K)	$M_{0\ (100\ K)}$	Nm	8.0	
Standstill current (60K)	$I_{0\ (60\ K)}$	A	4.6	
Standstill current (100K)	$I_{0\ (100\ K)}$)	A	5.8	
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	18.0	
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	15.0	
Optimum operating point				
Optimum speed	n_{opt}	RPM	3000	
Optimum power	P_{opt}	kW	2.14	
Limiting data				
Max. permissible speed (mech.)	n_{max}	RPM	5600	
Maximum torque	M_{max}	Nm	25	
Max. current	I_{max}	A	19	
Physical constants				
Torque constant	k_T	Nm/A	1.39	
Voltage constant	k_E	V/1000 RPM	92	
Winding resistance at 20°C	$R_{ph.}$	Ohm	1.3	
Rotating field inductance	L_D	mH	10	
Electrical time constant	T_{el}	ms	7.7	
Shaft torsional stiffness	c_t	Nm/rad	119000	
Mechanical time constant	T_{mech}	ms	3.0	
Thermal time constant	T_{th}	min	30	
Weight (with brake)	m	kg	13.7	
Weight (without brake)	m	kg	12.5	

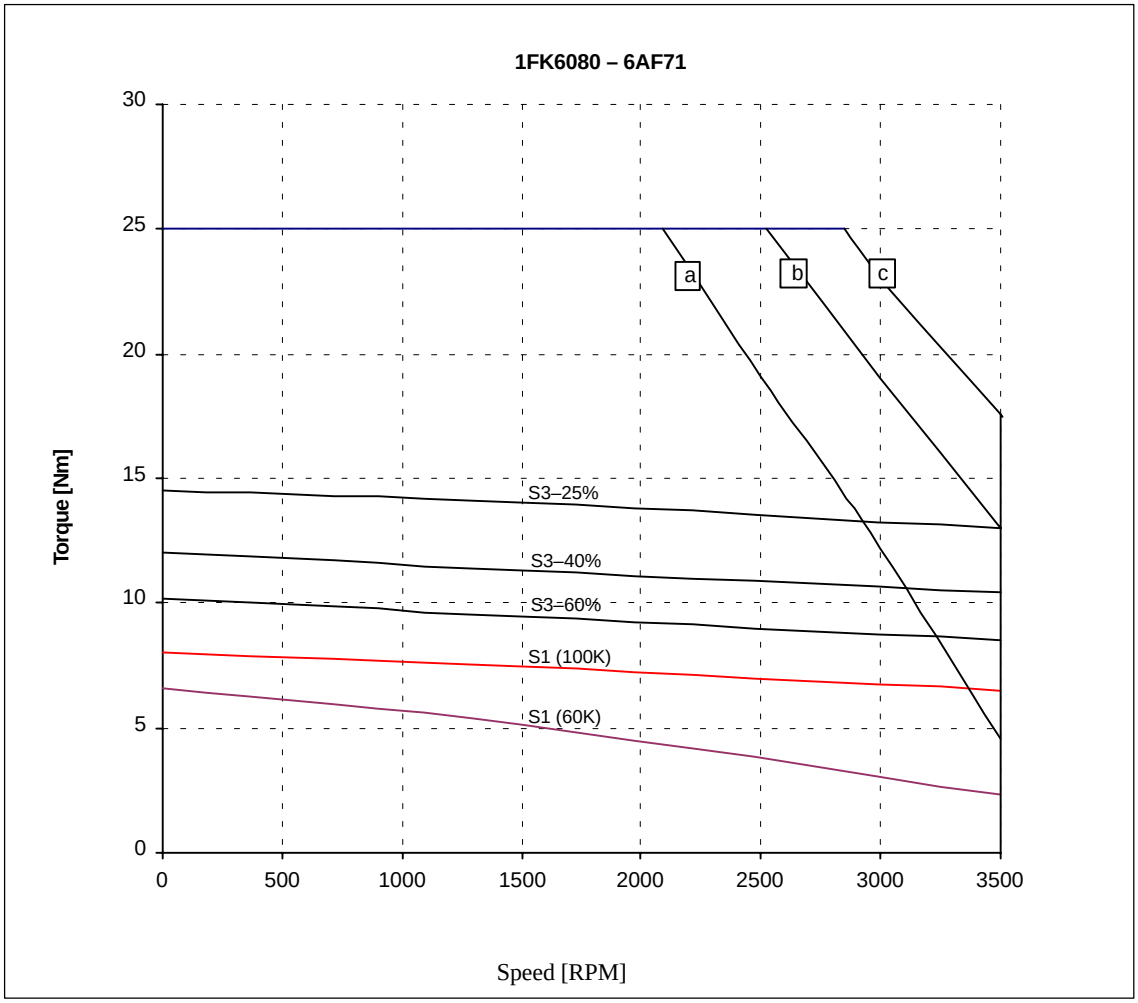


Fig. 2-6 Speed–torque diagram 1FK6080 Standard

[a] MASTERDRIVES MC, $V_{DC\ link}$=540V (DC), V_{mot}=340V_{rms}
[b] SIMODRIVE 611 (UI), $V_{DC\ link}$=540V (DC) and MASTERDRIVES MC (AFE), $V_{DC\ link}$=600V (DC), V_{mot}=380V_{rms}
[c] SIMODRIVE 611 (IR), $V_{DC\ link}$=600V (DC), V_{mot}=425V_{rms}

Table 2-7 1FK6083 Standard

1FK6083				
Technical data	Code	Units	–6AF71	
Engineering data				
Rated speed	n_N	RPM	3000	
Pole number	2p		6	
Rated torque (100K)	$M_{N\ (100\ K)}$	Nm	10.5	
Rated current	I_N	A	7.7	
Standstill torque (60K)	$M_{0\ (60\ K)}$	Nm	13.3	
Standstill torque (100K)	$M_{0\ (100\ K)}$	Nm	16	
Standstill current (60K)	$I_{0\ (60\ K)}$	A	8.3	
Standstill current (100K)	$I_{0\ (100\ K)}$	A	10.4	
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	30.3	
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	27.3	
Optimum operating point				
Optimum speed	n_{opt}	RPM	3000	
Optimum power	P_{opt}	kW	3.3	
Limiting data				
Max. permissible speed (mech.)	n_{max}	RPM	5600	
Maximum torque	M_{max}	Nm	50	
Max. current	I_{max}	A	36	
Physical constants				
Torque constant	k_T	Nm/A	1.54	
Voltage constant	k_E	V/1000 RPM	102	
Winding resistance at 20°C	$R_{ph.}$	Ohm	0.54	
Rotating field inductance	L_D	mH	6.0	
Electrical time constant	T_{el}	ms	11.1	
Shaft torsional stiffness	c_t	Nm/rad	100000	
Mechanical time constant	T_{mech}	ms	1.9	
Thermal time constant	T_{th}	min	35	
Weight (with brake)	m	kg	18.2	
Weight (without brake)	m	kg	17.0	

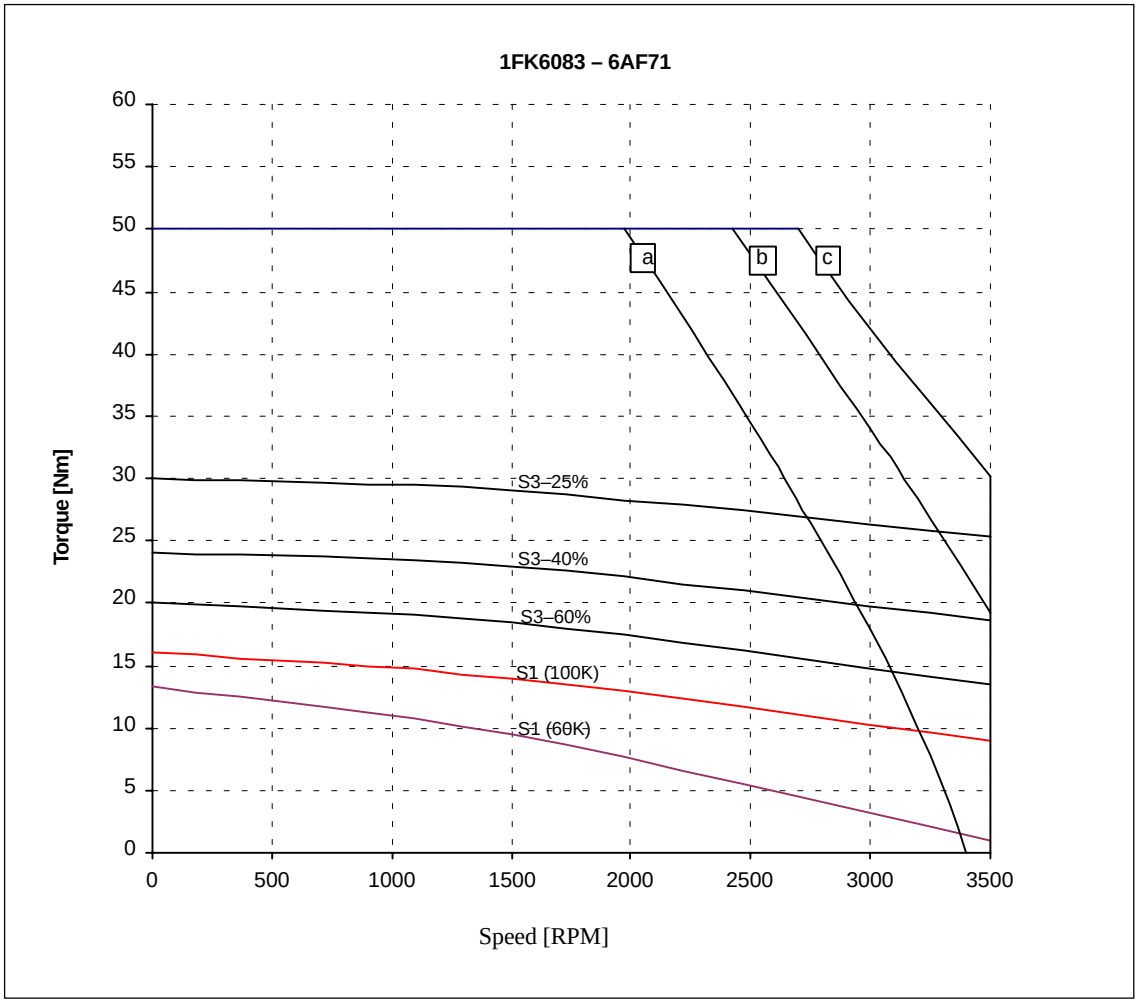


Fig. 2-7 Speed–torque diagram 1FK6083 Standard

[a] MASTERDRIVES MC, $V_{DC\ link}$=540V (DC), V_{mot}=340V_{rms}
[b] SIMODRIVE 611 (UI), $V_{DC\ link}$=540V (DC) and MASTERDRIVES MC (AFE), $V_{DC\ link}$=600V (DC), V_{mot}=380V_{rms}
[c] SIMODRIVE 611 (IR), $V_{DC\ link}$=600V (DC), V_{mot}=425V_{rms}

Table 2-8 1FK6100 Standard

1FK6100				
Technical data	Code	Units	–8AF71	
Engineering data				
Rated speed	n_N	RPM	3000	
Pole number	2p		8	
Rated torque (100K)	$M_{N\ (100\ K)}$	Nm	12.0	
Rated current	I_N	A	8.4	
Standstill torque (60K)	$M_{0\ (60\ K)}$	Nm	15	
Standstill torque (100K)	$M_{0\ (100\ K)}$	Nm	18	
Standstill current (60K)	$I_{0\ (60\ K)}$	A	9.8	
Standstill current (100K)	$I_{0\ (100\ K)}$	A	12.2	
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	63.2	
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	55.3	
Optimum operating point				
Optimum speed	n_{opt}	RPM	3000	
Optimum power	P_{opt}	kW	3.77	
Limiting data				
Max. permissible speed (mech.)	n_{max}	RPM	4300	
Maximum torque	M_{max}	Nm	55	
Max. current	I_{max}	A	42	
Physical constants				
Torque constant	k_T	Nm/A	1.48	
Voltage constant	k_E	V/1000 RPM	98	
Winding resistance at 20°C	$R_{ph.}$	Ohm	0.42	
Rotating field inductance	L_D	mH	3.5	
Electrical time constant	T_{el}	ms	8.3	
Shaft torsional stiffness	c_t	Nm/rad	176000	
Mechanical time constant	T_{mech}	ms	3.2	
Thermal time constant	T_{th}	min	35	
Weight (with brake)	m	kg	22.5	
Weight (without brake)	m	kg	21.0	

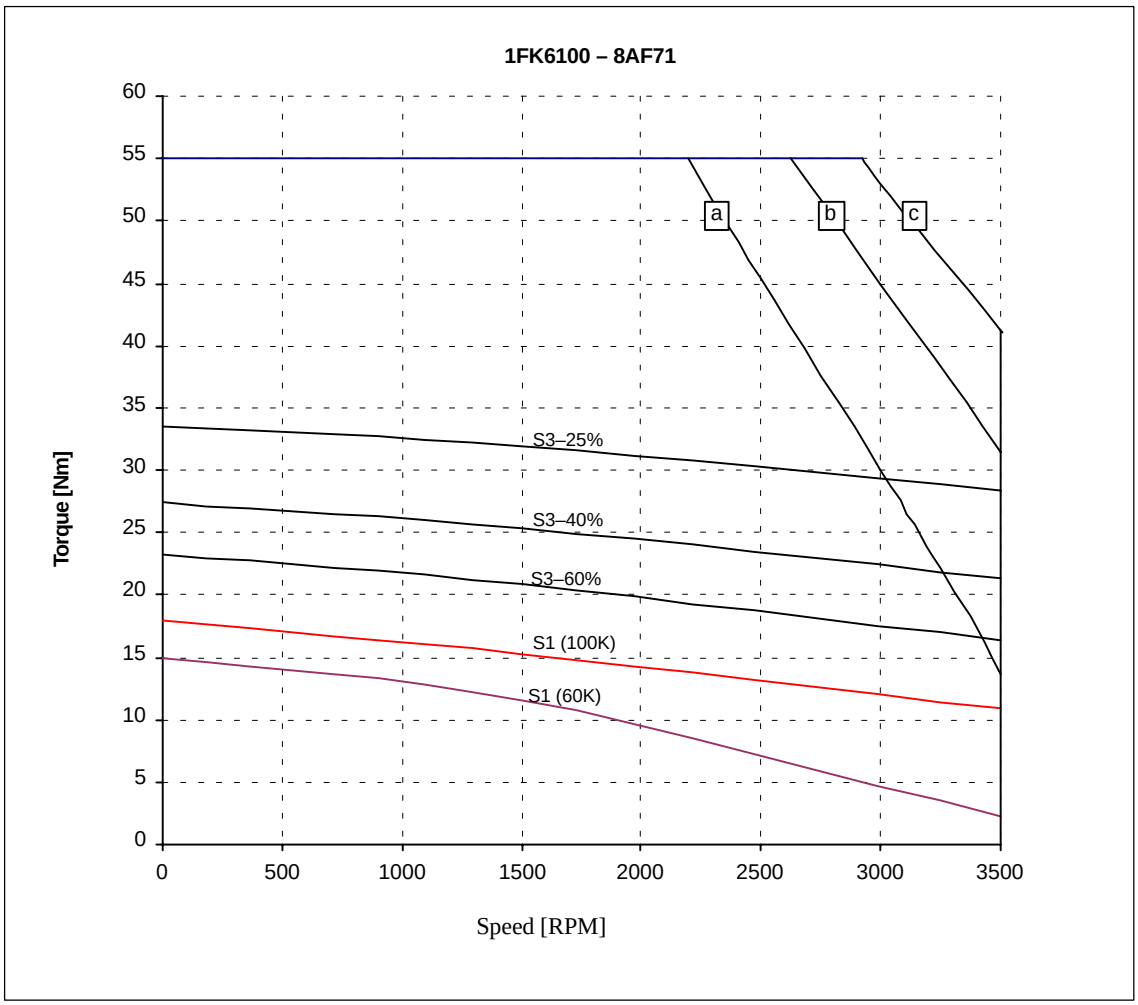


Fig. 2-8 Speed–torque diagram 1FK6100 Standard

[a] MASTERDRIVES MC, $V_{DC\ link}$=540V (DC), V_{mot}=340V_{rms}
[b] SIMODRIVE 611 (UI), $V_{DC\ link}$=540V (DC) and MASTERDRIVES MC (AFE), $V_{DC\ link}$=600V (DC), V_{mot}=380V_{rms}
[c] SIMODRIVE 611 (IR), $V_{DC\ link}$=600V (DC), V_{mot}=425V_{rms}

Table 2-9 1FK6101 Standard

1FK6101				
Technical data	Code	Units	–8AF71	
Engineering data				
Rated speed	n_N	RPM	3000	
Pole number	2p		8	
Rated torque (100K)	$M_{N\ (100\ K)}$	Nm	15.5	
Rated current	I_N	A	10.8	
Standstill torque (60K)	$M_{0\ (60\ K)}$	Nm	22.4	
Standstill torque (100K)	$M_{0\ (100\ K)}$	Nm	27.0	
Standstill current (60K)	$I_{0\ (60\ K)}$	A	14.0	
Standstill current (100K)	$I_{0\ (100\ K)}$	A	17.5	
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	92.8	
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	79.9	
Optimum operating point				
Optimum speed	n_{opt}	RPM	3000	
Optimum power	P_{opt}	kW	4.87	
Limiting data				
Max. permissible speed (mech.)	n_{max}	RPM	4300	
Maximum torque	M_{max}	Nm	80	
Max. current	I_{max}	A	58	
Physical constants				
Torque constant	k_T	Nm/A	1.54	
Voltage constant	k_E	V/1000 RPM	102	
Winding resistance at 20°C	$R_{ph.}$	Ohm	0.24	
Rotating field inductance	L_D	mH	2.5	
Electrical time constant	T_{el}	ms	10.4	
Shaft torsional stiffness	c_t	Nm/rad	159000	
Mechanical time constant	T_{mech}	ms	2.4	
Thermal time constant	T_{th}	min	40	
Weight (with brake)	m	kg	28	
Weight (without brake)	m	kg	26	

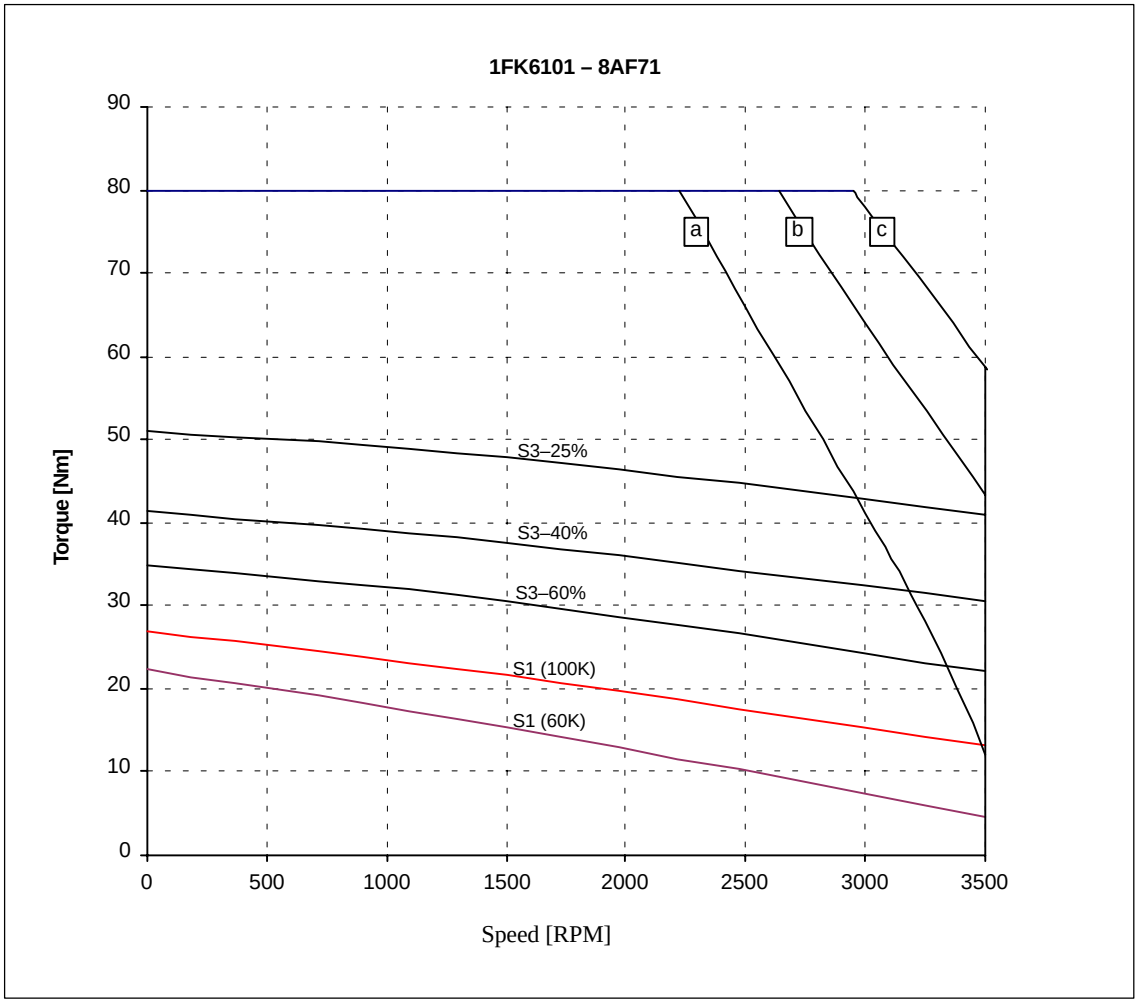


Fig. 2-9 Speed–torque diagram 1FK6101 Standard

[a] MASTERDRIVES MC, $V_{DC\ link}$=540V (DC), V_{mot}=340V_{rms}
[b] SIMODRIVE 611 (UI), $V_{DC\ link}$=540V (DC) and MASTERDRIVES MC (AFE), $V_{DC\ link}$=600V (DC), V_{mot}=380V_{rms}
[c] SIMODRIVE 611 (IR), $V_{DC\ link}$=600V (DC), V_{mot}=425V_{rms}

Table 2-10 1FK6103 Standard

1FK6103				
Technical data	Code	Units	–8AF71	
Engineering data				
Rated speed	n_N	RPM	3000	
Pole number	2p		8	
Rated torque (100K)	$M_{N\ (100\ K)}$	Nm	16.5	
Rated current	I_N	A	11.8	
Standstill torque (60K)	$M_{0\ (60\ K)}$	Nm	30	
Standstill torque (100K)	$M_{0\ (100\ K)}$	Nm	36.0	
Standstill current (60K)	$I_{0\ (60\ K)}$	A	18.9	
Standstill current (100K)	$I_{0\ (100\ K)}$	A	23.5	
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	118	
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	105	
Optimum operating point				
Optimum speed	n_{opt}	RPM	3000	
Optimum power	P_{opt}	kW	5.18	
Limiting data				
Max. permissible speed (mech.)	n_{max}	RPM	4300	
Maximum torque	M_{max}	Nm	107	
Max. current	I_{max}	A	78	
Physical constants				
Torque constant	k_T	Nm/A	1.53	
Voltage constant	k_E	V/1000 RPM	101	
Winding resistance at 20°C	$R_{ph.}$	Ohm	0.15	
Rotating field inductance	L_D	mH	1.8	
Electrical time constant	T_{el}	ms	12.0	
Shaft torsional stiffness	c_t	Nm/rad	144000	
Mechanical time constant	T_{mech}	ms	2.0	
Thermal time constant	T_{th}	min	45	
Weight (with brake)	m	kg	32	
Weight (without brake)	m	kg	30	

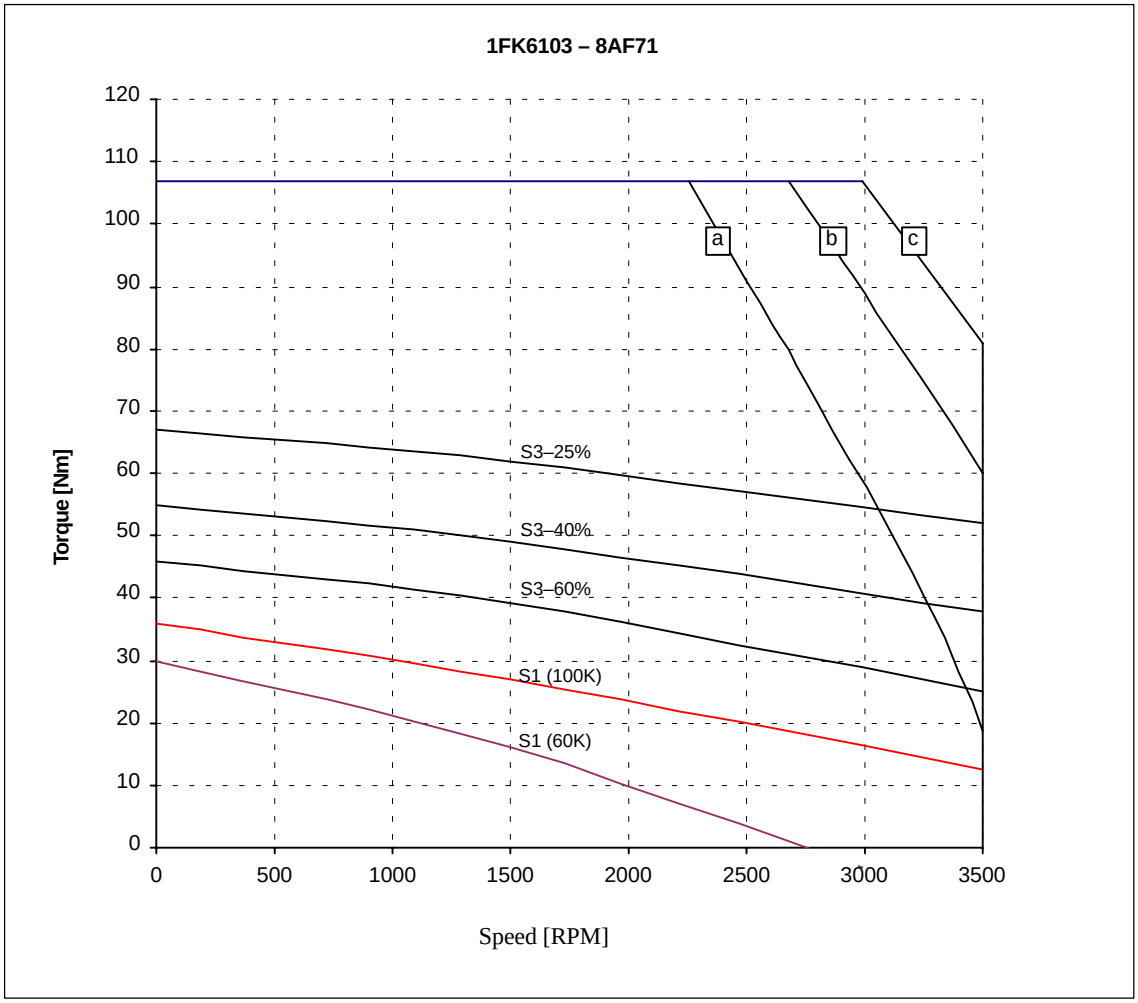


Fig. 2-10 Speed–torque diagram 1FK6103 Standard

[a] MASTERDRIVES MC, $V_{DC\ link}$=540V (DC), V_{mot}=340V_{rms}
[b] SIMODRIVE 611 (UI), $V_{DC\ link}$=540V (DC) and MASTERDRIVES MC (AFE), $V_{DC\ link}$=600V (DC), V_{mot}=380V_{rms}
[c] SIMODRIVE 611 (IR), $V_{DC\ link}$=600V (DC), V_{mot}=425V_{rms}

2.2 Cantilever force diagrams

Cantilever force stressing

Point of application of cantilever forces F_Q at the shaft end

- for average operating speeds
- for a nominal bearing lifetime of 20 000 h

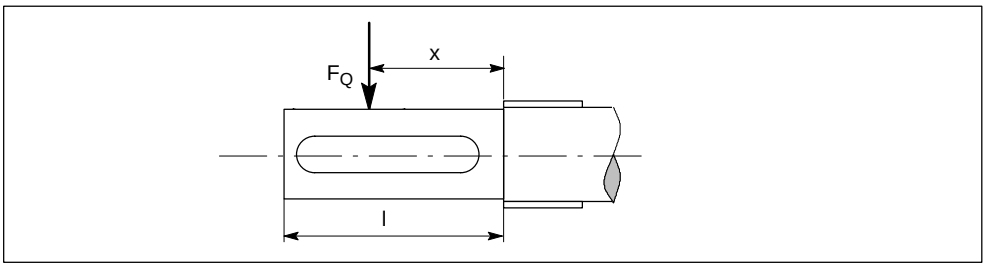


Fig. 2-11 Force application point at the DE shaft end

Dimension x: Distance between the point of application of force F_Q and the shaft shoulder in mm.

Dimension l: Length of the shaft end in mm.

Calculating the pre–tensioned belt force

$F_R = 2 * M_0 * c/d_R$

F_R [N]	Pre–tensioned belt force
M_0 [Nm]	Motor standstill torque
d_R	Effective diameter of the belt pulley
c	Pre–tension factor for the accelerating torque Experience values for toothed belts c = 1.5 to 2.2 Experience values for flat belts c = 2.2 to 3.0

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

$F_R \leq F_{Qper}$

Cantilever force 1FK603□

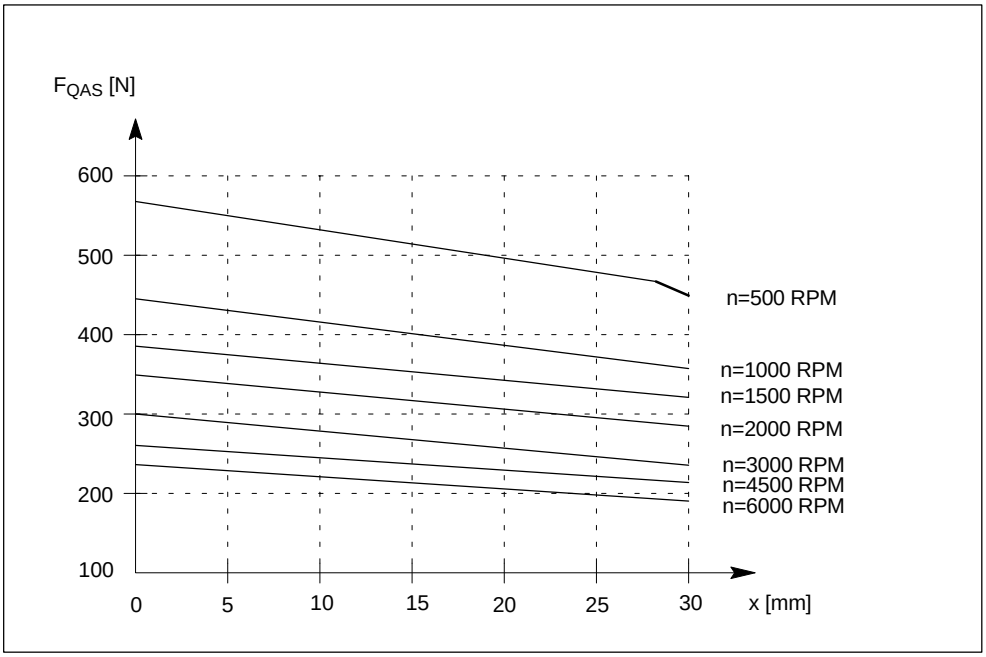


Fig. 2-12 Cantilever force F_Q at a distance x from the shaft shoulder for a nominal bearing lifetime of 20 000 h.

Cantilever force 1FK604□

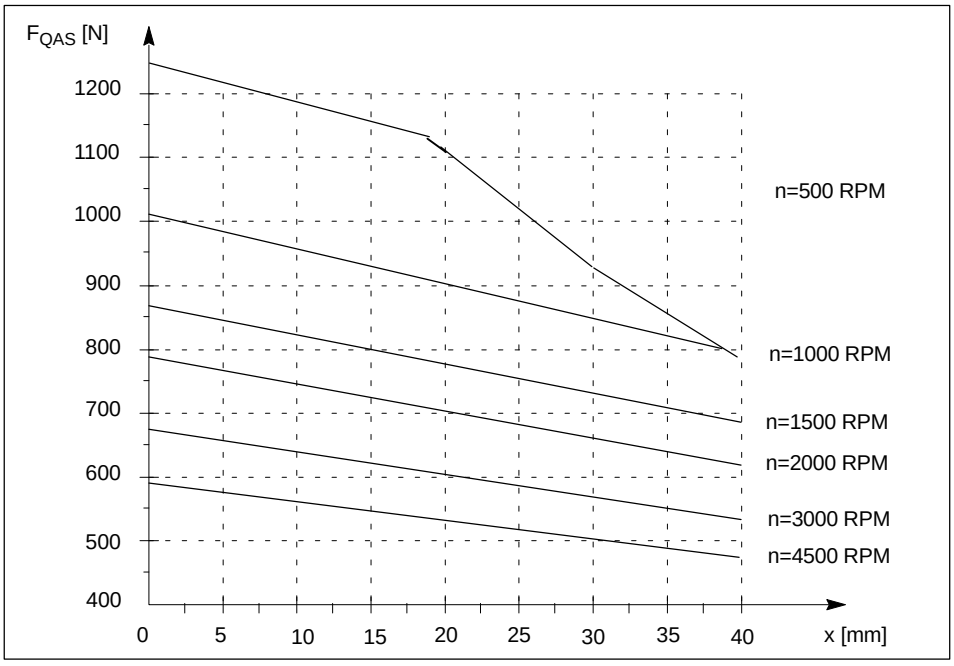


Fig. 2-13 Cantilever force F_Q at a distance x from the shaft shoulder for a nominal bearing lifetime of 20 000 h.

Cantilever force 1FK606□

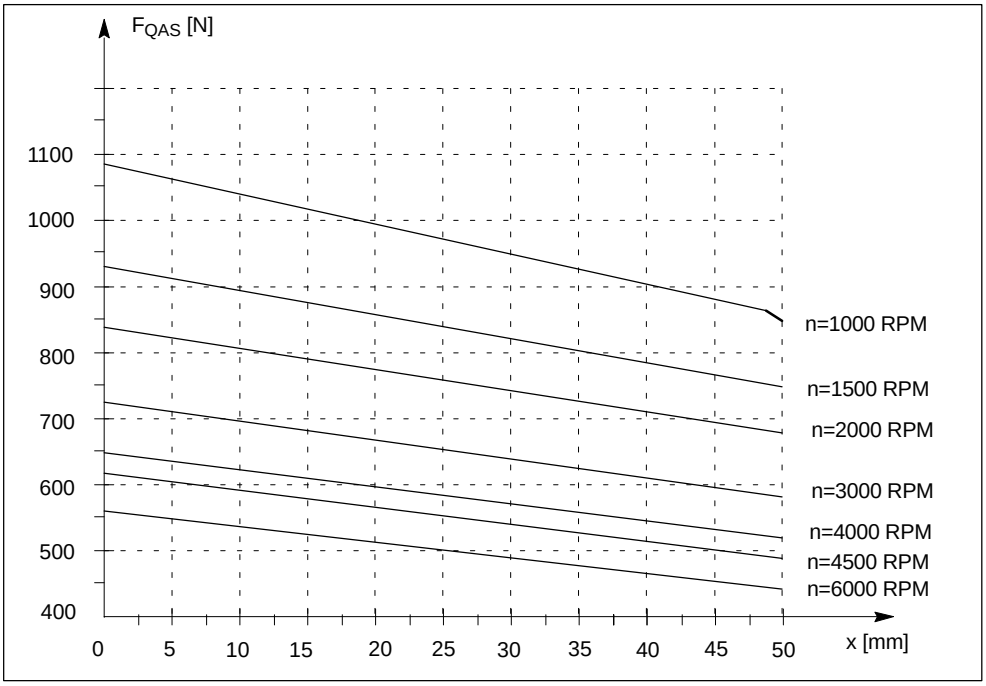


Fig. 2-14 Cantilever force F_Q at a distance x from the shaft shoulder for a nominal bearing lifetime of 20 000 h.

Cantilever force 1FK608□

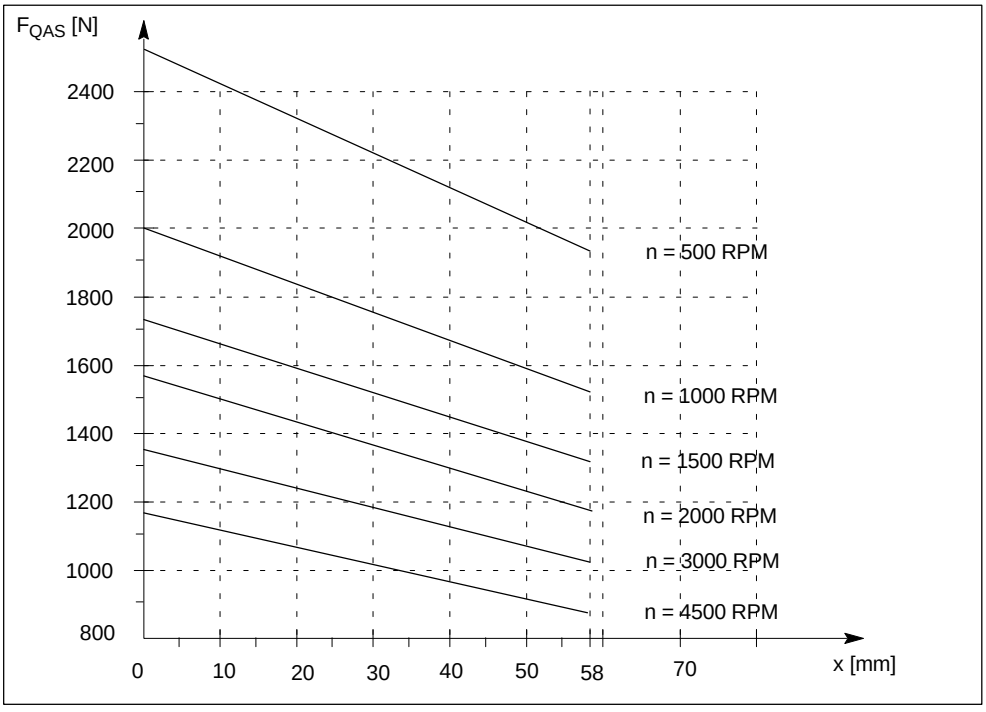


Fig. 2-15 Cantilever force F_Q at a distance x from the shaft shoulder for a nominal bearing lifetime of 20 000 h.

Cantilever force 1FK610□

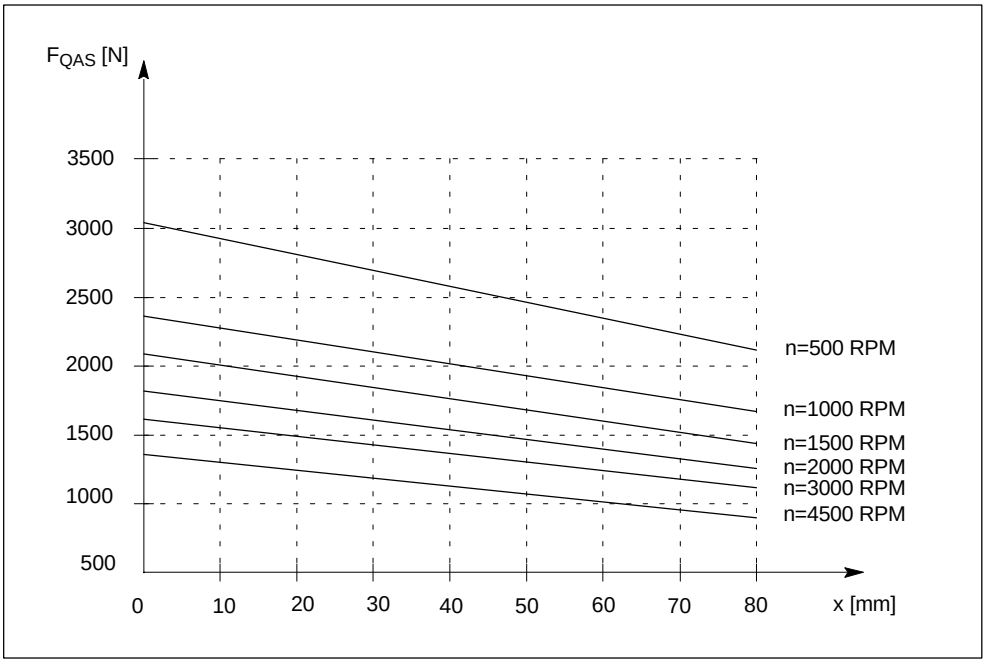


Fig. 2-16 Cantilever force F_Q at a distance x from the shaft shoulder for a nominal bearing lifetime of 20 000 h.

2.3 Axial forces

Axial force stressing

Warning

Axial forces are not permissible for motors with integrated holding brake!

When using, e.g. helical gearwheels as drive element, in addition to the radial force, the motor bearings are also subject to an axial force. For axial forces, the spring–loading of the bearings can be overcome so that the rotary moves corresponding to the axial bearing play present (up to 0.2 mm).

The permissible axial force can be approximately calculated using the following formula:

$$F_A = 0.35 * F_Q$$

Motor Components (Options) 3

3.1 Thermal motor protection

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

Type:	KTY 84 (PTC thermistor)
Resistance when cold (20° C):	approx. 580 Ω
Resistance when hot (100° C):	approx. 1000 Ω
Response temperature	Pre–alarm at 120° C Trip at 155° C ± 5° C
Connection:	via the encoder cable

The change in the resistance of the KTY 84 is proportional to the winding temperature change (refer to Fig. 3-1).

The temperature is sensed and evaluated in the drive converter, whose closed–loop control takes into account the temperature characteristic of the motor resistances.

If a fault condition develops, an appropriate signal is output at the drive converter. When the motor temperature increases, a ”Pre–alarm, motor overtemperature” signal is output which can be externally evaluated. If this signal is not observed, when the motor limiting temperature or the shutdown temperature is exceeded, the drive converter shuts down with the appropriate fault signal.

Warning

If the user carries–out an additional high–voltage test, then the ends of the temperature sensor cables must be short–circuited before the test!

The temperature sensor will be destroyed if the test voltage is connected to only one terminal of the temperature sensor.

The polarity must be carefully observed.

The temperature sensor is designed so that the DIN/EN requirement for ”Protective separation” is fulfilled.

Caution

The integrated temperature sensor protects the servomotors against overload conditions:

Shaft heights 36 and 48	to $2 * I_{0\,60\,K}$ and speed <> 0
from shaft height 63	to $4 * I_{0\,60\,K}$ and speed <> 0

Sufficient protection is no longer provided for thermally critical load situations, e.g. a high overload condition at motor standstill. This is the reason that a thermal overload relay – as example – should be provided as additional protection.

If an overload condition of $4 * M_0$ lasts for longer than 4s, then additional motor protection must also be provided.

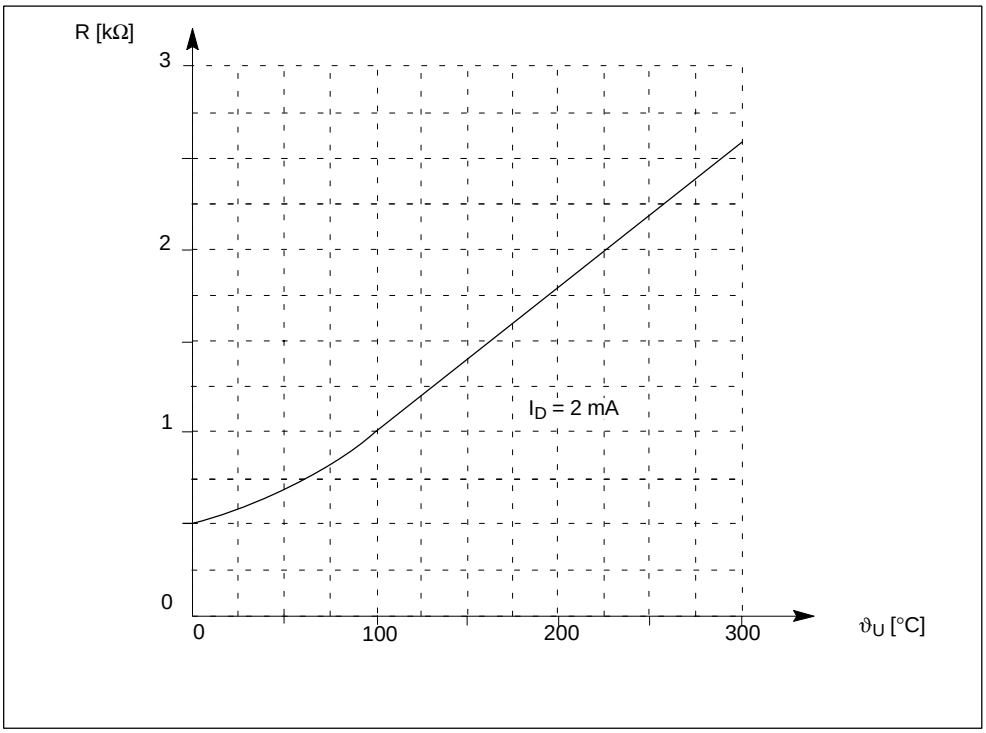


Fig. 3-1 Resistance characteristic of the KTY 84 as a function of the temperature

3.2 Encoders

Table 3-1 Overview of the encoders used

Motor types	Increm. enc. sin/cos 1 Vpp (I–2048)	Abs. value enc. EnDat (A–2048)	Basic absolute value encoder (A–32)	Resolver 2-pole or multi–pole
Order No. 14th position	A	E	G	S, T
1FK6 03□				X
1FK6 04□	X	X	X	X
1FK6 06□	X	X	X	X
1FK6 08□	X	X	X	X
1FK6 10□	X	X	X	X

Notice

When an encoder is replaced, the position of the encoder system with respect to the motor EMF must be adjusted. Only qualified personnel should replace an encoder.

3.2.1 Incremental encoders

Function:

- Angular measuring system for commutation
- Speed actual value sensing
- Indirect increm. meas. system for the pos. control loop
- One zero pulse (reference mark) per revolution

Table 3-2 Technical data, incremental encoder sin/cos $1V_{pp}$

Features	**Incremental encoders sin/cos 1Vpp**	**Incremental encoders sin/cos 1Vpp (low shaft height)**
Mech. limiting speed	15,000 RPM	12,000 RPM
Operating voltage	5V ± 5%	5V ± 5%
Current drain	max. 150 mA	max. 200 mA
Resolution, incremental	2048	2048
Incremental signals	1 Vpp	1 Vpp
Accuracy	± 40”	± 80”
C–D track (rotor position)	Available	Available

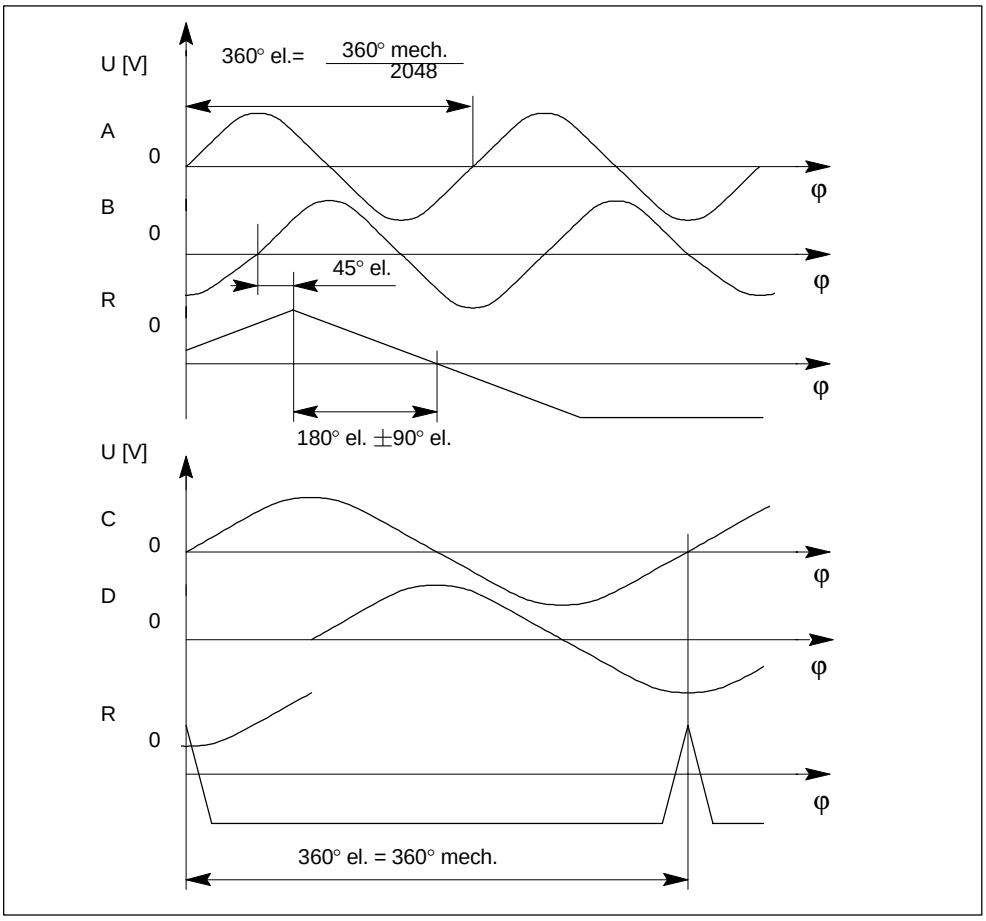
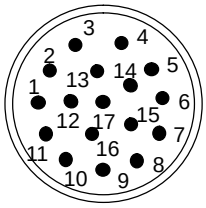


Fig. 3-2 Signal sequence and assignment for a positive direction of rotation (clockwise rotation when viewing the drive end)

Connection assignment for 17-pin flange–mounted socket with plug contacts

PIN No.	Signal
1	A+
2	A–
3	R+
4	D–
5	C+
6	C–
7	M–Encoder
8	+Temp
9	–Temp
10	P–Encoder
11	B+
12	B–
13	R–
14	D+
15	0 V Sense
16	5 V Sense
17	not connected



When viewing the connector side (pins)

Connectors and cables

Mating connector: 6FX2003–0CE17 (socket)

Pre–assembled cable: 6FX□002–2CA31–□□□0

Length 2)

5 = MOTION–CONNECT® 500 1)
8 = MOTION–CONNECT® 800 1)

Cable length: max. 50 m

1) Technical data of the MOTION-CONNECT series, refer to Catalog NC Z
2) Length code, refer to Catalog NC Z

3.2.2 Absolute value encoders

Function:

- Angular measuring system to impress the current
- Speed actual value sensing
- Indirect measuring system for the position control loop

Table 3-3 Technical data, absolute value encoder

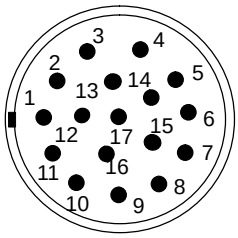
Features	Absolute value encoder EnDat (A–2048)	Absolute value encoder EnDat (A–512)	Basic absolute value encoder (A–32)
Mech. limiting speed	12000 RPM	12000 RPM	12000 RPM
Operating voltage	5V ± 5%	5V ± 5%	5V ± 5%
Current drain	max. 300 mA	max. 300 mA	max. 300 mA
Resolution, incremental (periods per revolution)	2048	512	32
Resolution, absolute (coded revolutions)	4096	4096	4096
Incremental signals	1 Vpp	1 Vpp	1 Vpp
Serial absolute position interface	EnDat	EnDat	EnDat
Accuracy	± 40”	± 80”	± 400”

Note

As a result of the reduced maximum operating temperature of absolute value encoders with respect to incremental encoders, the thermally permissible motor torque is reduced (refer to the technical data of the motors)!

Connection assignment for 17–pin flange–mounted socket with pin contacts

PIN No.	Signal
1	A+
2	A–
3	+Data
4	not connected
5	+Clock
6	not connected
7	M–Encoder
8	+Temp
9	–Temp
10	P–Encoder
11	B+
12	B–
13	+Data
14	–Clock
15	0 V Sense
16	5 V Sense
17	not connected



When viewing the plug–in side (pins)

Connectors and cables

Mating connector: 6FX2003–0CE17 (socket)

Pre–assembled cable: 6FX□002–2EQ10□□□0

Length 2)

5 = MOTION–CONNECT® 500 1)
8 = MOTION–CONNECT® 800 1)

Cable length: max. 50 m

1) Technical data of the MOTION-CONNECT series, refer to Catalog NC Z
2) Length code, refer to Catalog NC Z

3.2.3 Resolvers

Function:

- Speed actual value sensing
- Rotor position encoder for inverter control
- Indirect increm. meas. system for the pos. control loop

Note

The limiting frequency of the drive converter must be carefully observed.

- SIMODRIVE 611U: Limiting frequency 432 Hz (before SW 4.1: 375 Hz)
- SIMODRIVE 611A: only possible for 2–pole resolvers

Table 3-4 Technical data, resolvers

Features	**Values**
Mech. limiting speed	15,000 RPM
Excitation voltage Excitation frequency Current drain	5 V (rms) up to 13 V (rms) 4 kHz to 10 kHz < 80 mA (rms)
Angular accuracy (bandwidth) 2-pole multi–pole	 < 14’ < 4’
Pole number Ratio	2, 4, 6 or 8 1) 0.5

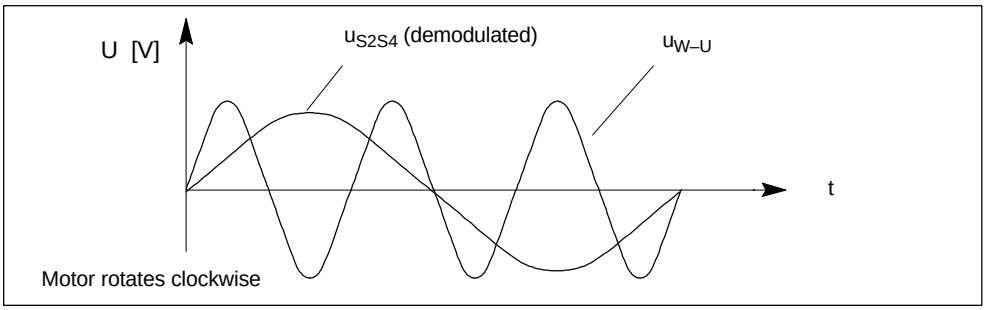
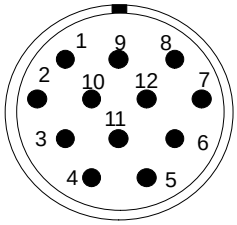


Fig. 3-3 Signal sequence and assignment for a positive direction of rotation (clockwise direction rotation when viewing the drive end)

1) Pole number is the same as the motor pole number

Connection assignment for 12–pin flange–mounted socket with pin contacts

PIN No.	Signal
1	S2
2	S4
3	not connected
4	not connected
5	not connected
6	not connected
7	R3
8	+Temp
9	–Temp
10	R1
11	S1
12	S3



When viewing the plug–in side (pins)

Connectors and cables

Mating connector: 6FX2003–0CE12 (socket)

Pre–assembled cable: 6FX□002–2CF02–□□□0

Length 2)

5 = MOTION–CONNECT® 500 1)
8 = MOTION–CONNECT® 800 1)

Cable length: max. 50 m

1) Technical data of the MOTION-CONNECT series, refer to Catalog NC Z
2) Length code, refer to Catalog NC Z

3.3 Holding brake

For a description of the function, refer to the documentation ”General Section”.

Table 3-5 Technical data of the holding brakes used for 1FK6 motors

Motor type	Brake type	Holding torque M_4 [Nm]	DC current [A]	Opening time with varistor [ms]	Closing time with varistor [ms]	Highest switching work [J]
1FK6032	EBD 0.13BS	1.1	0.4	30	10	13
1FK604□	EBD 0.3B	3.0	0.6	35	10	68
1FK606□	EBD 0.8B	9.0	0.7	55	15	318
1FK608□	EBD 1.4BF	18	0.9	100	30	535
1FK6100	EBD 2BY	20	0.9	100	50	1135
1FK6101 1FK6103	EBD 3.8B	36	0.9	180	25	1233

Principle braking characteristics

The holding torque M_4 [Nm] corresponds to the transmitted torque taking into account the max. solenoid temperature, fluctuations in the friction and the spread of characteristic data for the holding brakes.

3.4 Gearboxes

Planetary gearboxes (alpha company, LP series) – selection table for 1FK6 motors

Table 3-6 Technical data of the planetary gearboxes which can be used for 1FK6 motors

Servo-motor non-ventilated Type	Planetary gearbox 1-stage torsional play ≤12 arcmin Type	Gearbox-weight approx.	Available gearbox ratios		Max. perm. input speed [1]	Max. perm. output torque [1]		Max. perm. drive out shaft load [2]	Moment of inertia gearbox
		[kg]	i = 5	i = 10	n_{G1} [RPM]	M_{G2} at i = 5 [Nm]	M_{G2} at i = 10 [Nm]	F_r [N]	J_G at i = 5/10 [10^{-4} kgm^2]
1FK603□	LP070–M01	1.9	X	X	6000	32	29	1450	0.28
1FK604□	LP090–M01	4.1	X	X	6000	80	72	2400	1.77
1FK606□	LP120–M01	9	X	X	4800	200	180	4600	5.42
1FK608□	LP155–M01	17.5	X	X	4000	400	320	7500	25.73
1FK6100									
1FK6101									
1FK6103									
Code Gearbox shaft with keyway			**V40**	**V42**					

Continuous duty S1

At the rated speed and rated torque, continuous duty is permissible. It is not permissible that a gearbox temperature of 90° C is exceeded.

Table 3-7 Continuous duty S1

Planetary gearbox 1–stage torsional play ≤12 arcmin	Rated speed n_{N1} [RPM]	Max. perm. output torque M_{N2} [Nm] [1]	
Type		**i = 5**	**i = 10**
LP070–M01	3700	16	15
LP090–M01	3400	40	35
LP120–M01	2600	100	90
LP155–M01	2000	290	170

The gearboxes can be mounted in any position.
The gearboxes have degree of protection IP 64.
Gearbox versions are available without keyway.

1) Values for positioning duty S5
(intermittent duty influenced by starting and electrical braking)
2) Referred to the center of the drive out shaft at 100 RPM

Dimensions with gearbox, 1FK6 standard, shaft heights 36 to 80

Standard 1FK6 motor with planetary gearbox (alpha company, series LP).

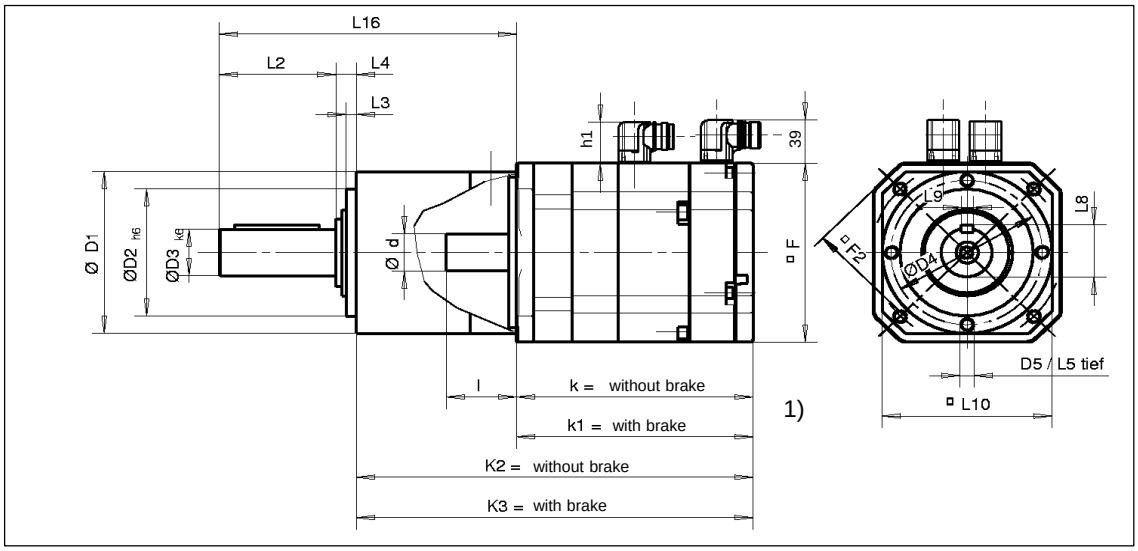


Fig. 3-4 Dimensions, standard 1FK6 motor, shaft height 36 to shaft height 80, with planetary gearbox

Dimensions with gearbox, standard 1FK6, only shaft height 100, series 1FK6100–103

Standard 1FK6 motor with planetary gearbox (alpha company, series LP).

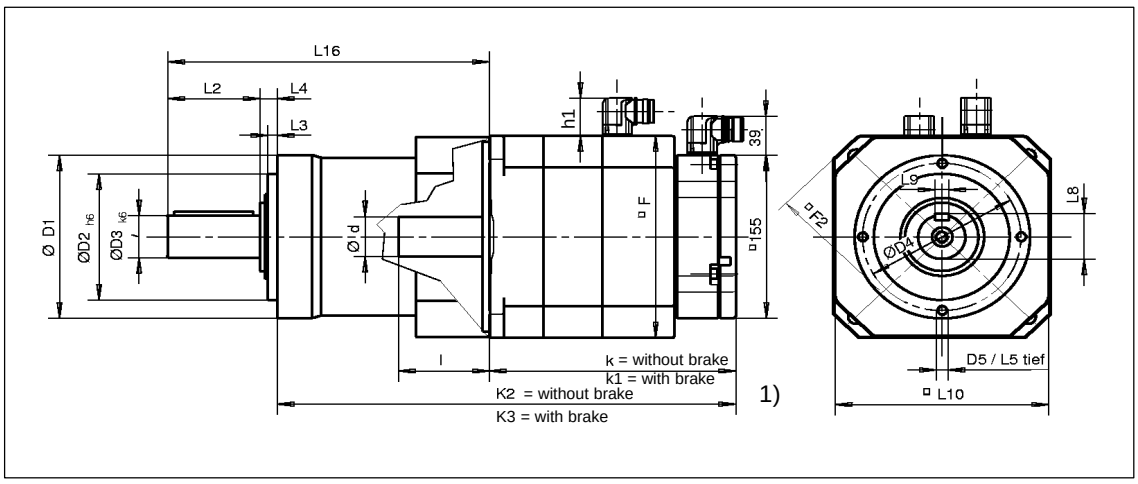


Fig. 3-5 Dimensions, standard 1FK6, series 1FK610□ , shaft height 100, with planetary gearbox

Table 3-8 Dimensions, standard 1FK6 motor, shaft heights 36 to 100, with planetary gearbox (dimension drawing for 1FK603□ to 1FK608□ refer to Fig. 3-4, Dimension drawing for 1FK6100...103 refer to Fig. 3-5)

Servomotor, standard version			Planetary gearbox 1-stage													without brake		with brake	
Type	Dim.		Type	Dimensions															
	h1	□F		∅D1	∅D2	∅D3	∅D4	D5	L16	L2	L3	L4	L5	L8	L9	L10	K2 2)	K2 3)	K3 2)	K3 3)
1FK6032	42	72	LP070–M01	70	52	16	62	M5	126	28	5	8	10	18	5	70	269	—	269	—
1FK6040 1FK6042	42	96	LP090–M01	90	68	22	80	M6	158	36	5	10	12	25	6	90	272 304	316 348	272 304	316 348
1FK6060 1FK6063	42	126	LP120–M01	120	90	32	108	M8	210	58	6	12	16	35	10	120	340 390	378 428	340 390	378 428
1FK6080 1FK6083	42	155	LP155–M01	155	120	40	140	M10	265	82	8	15	20	43	12	150	363 401	410 448	363 401	410 448
1FK6100	42	192	LP155–M01	155	120	40	140	M10	265	82	8	15	20	43	12	192	386	433	386	433
1FK6101 1FK6103	57																412 438	459 485	412 438	459 485

1) Dimensions for k and k1, refer to Chapter 4, Dimension drawings
2) with resolver
3) with encoder

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Dimension Drawings

4

Note

Siemens AG reserves the right to change the dimensions of motors without prior notice as part of ongoing improvements to the mechanical design. Dimensions drawings can go out–of–date.

Up–to–date dimension drawings can be requested at no charge from your local SIEMENS sales department.

1FK6 standard series

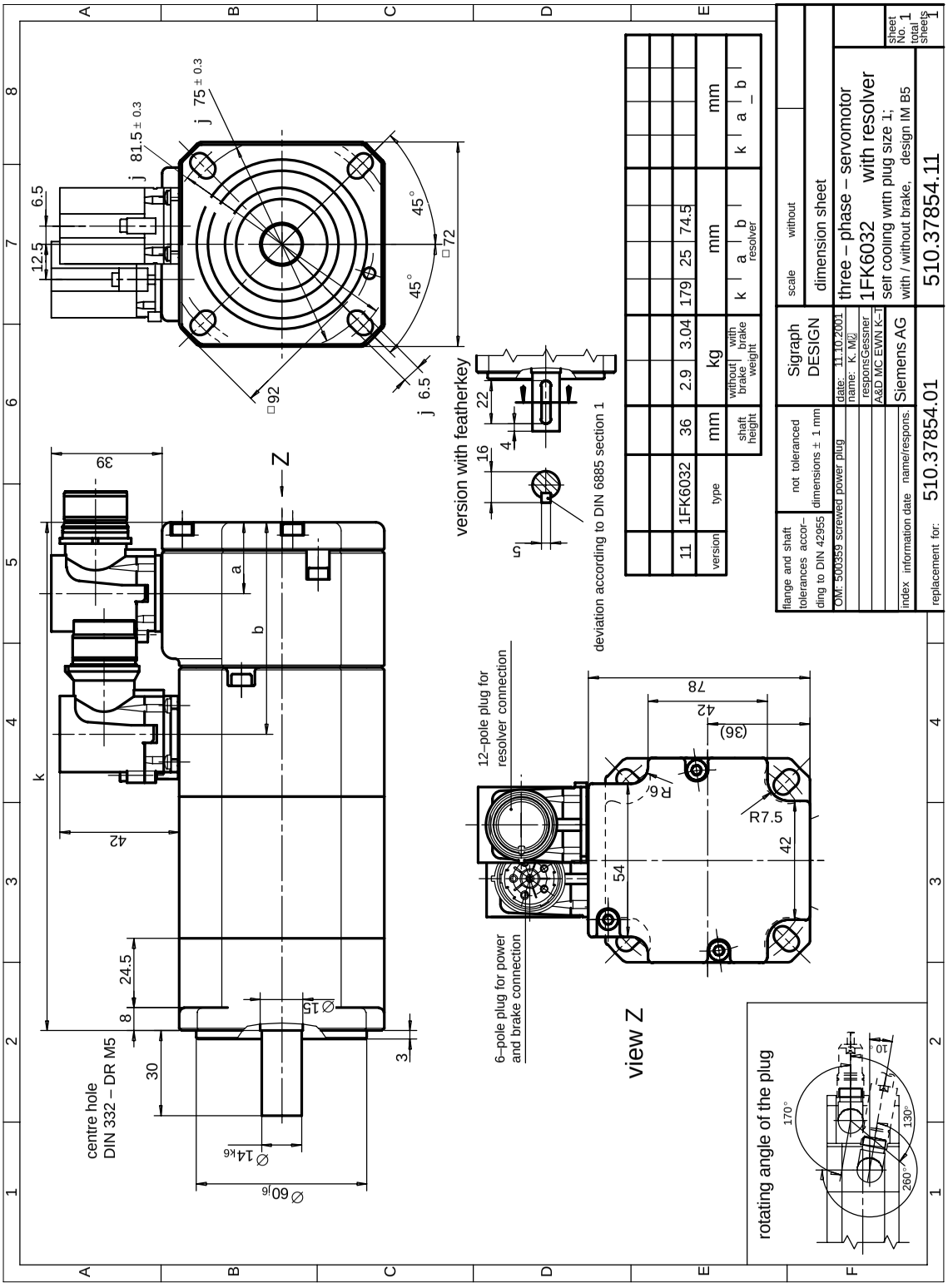

Fig. 4-1 1FK6032 standard, non–ventilated with angled connector, Size 1

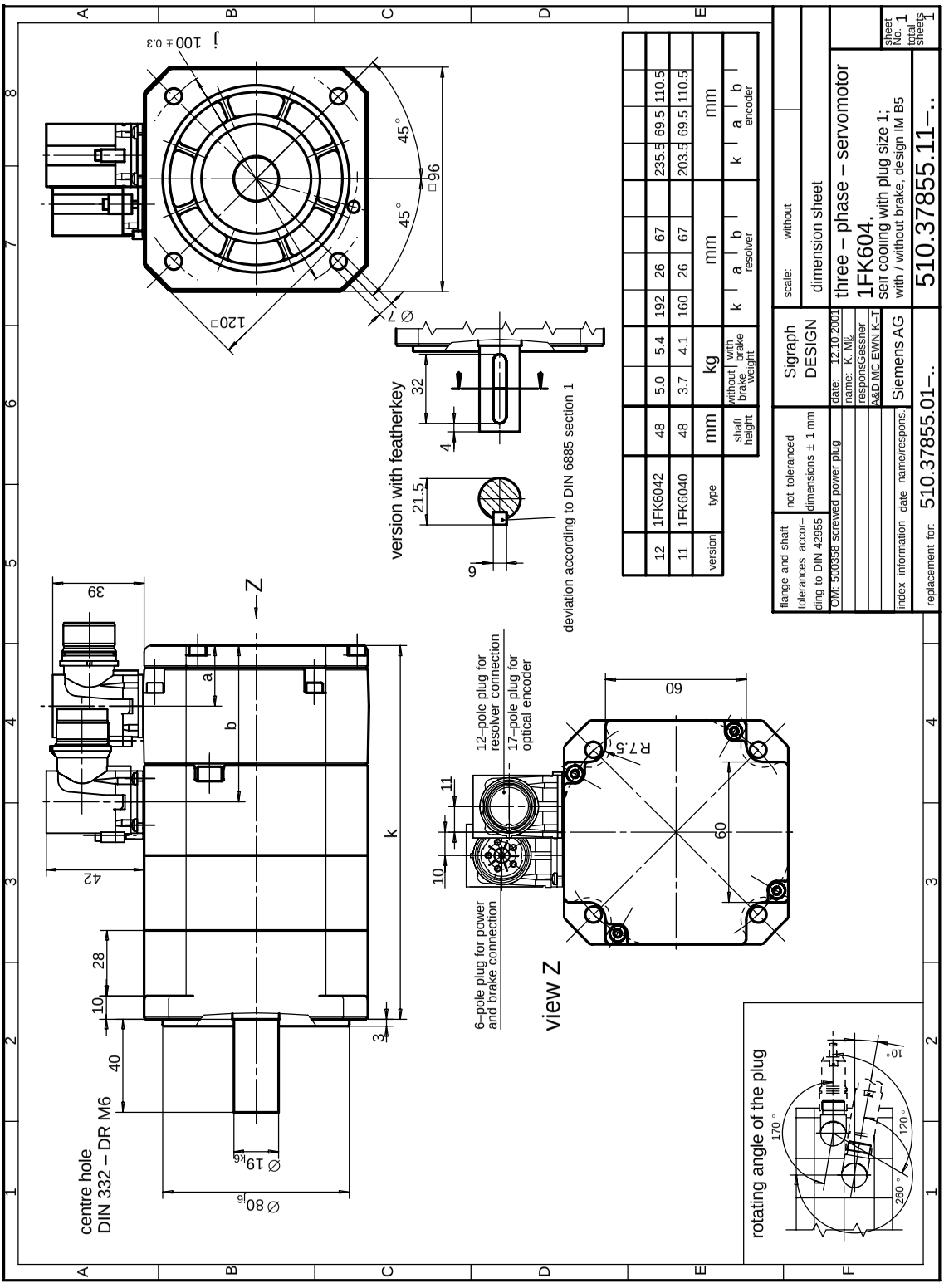

Fig. 4-2 1FK604□ standard, non–ventilated with angled connector, Size 1

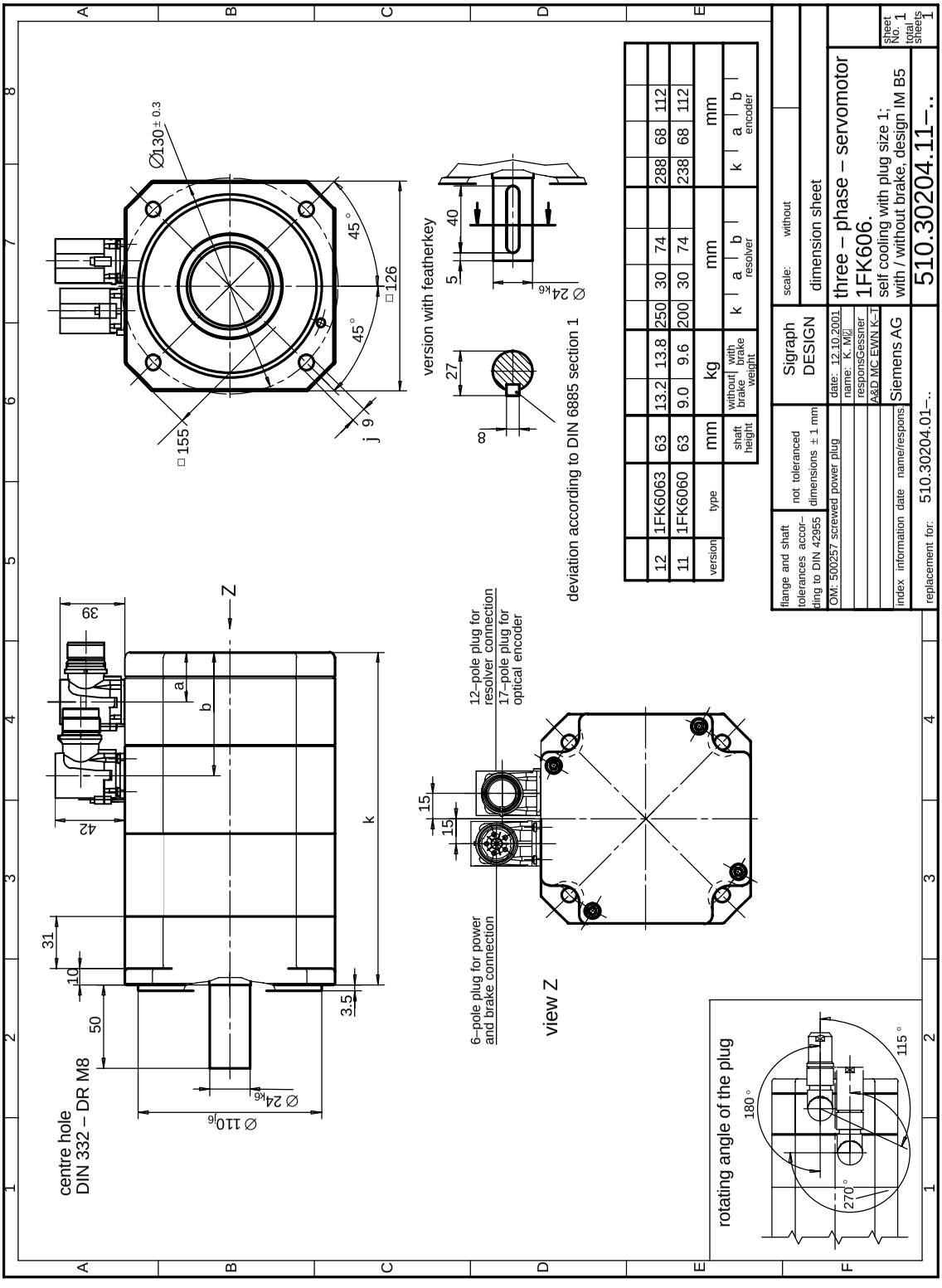

Fig. 4-3 1FK606□ standard, non–ventilated with angled connector, Size 1

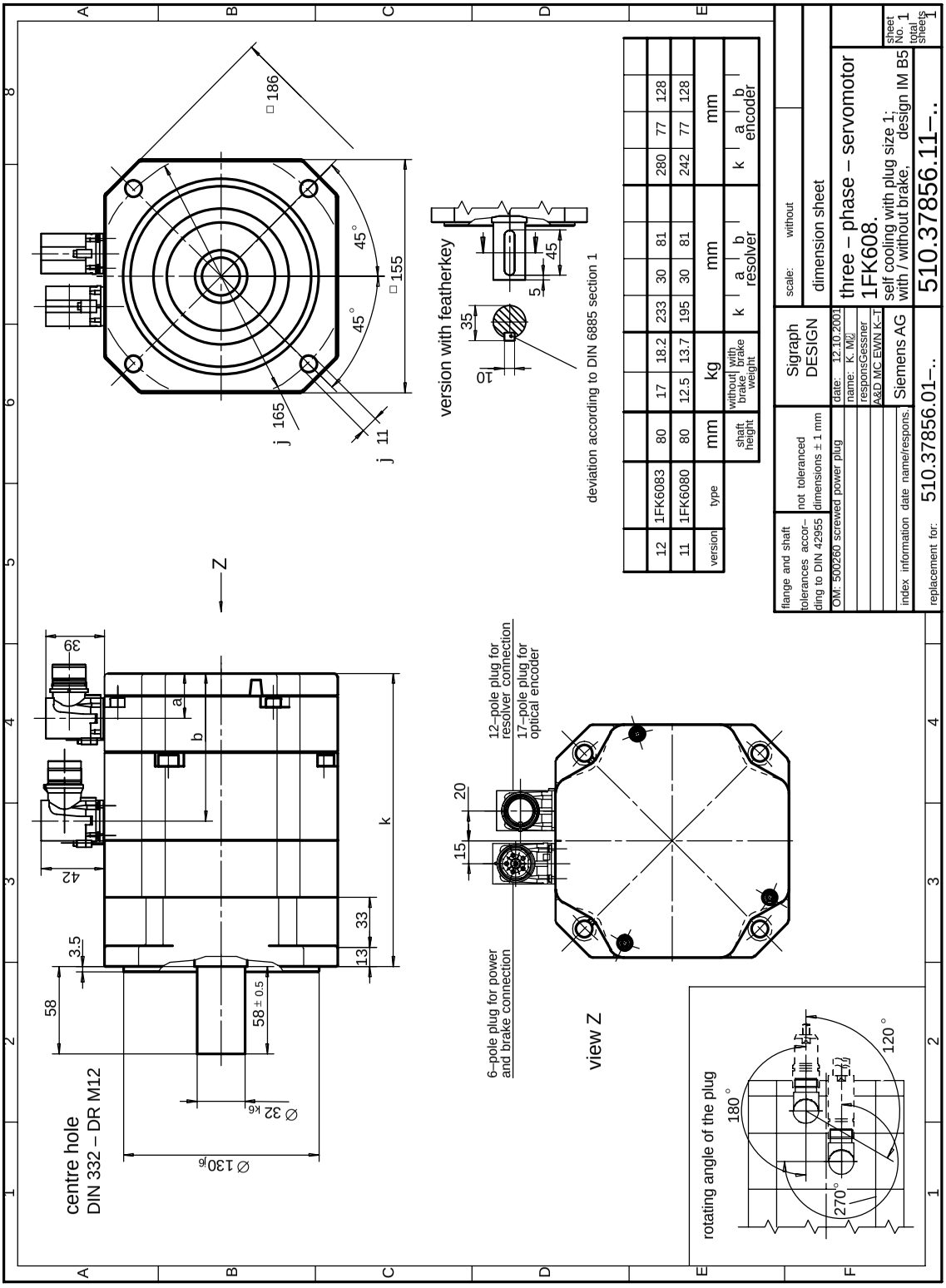

Fig. 4-4 1FK608□ standard, non–ventilated with connector, Size 1

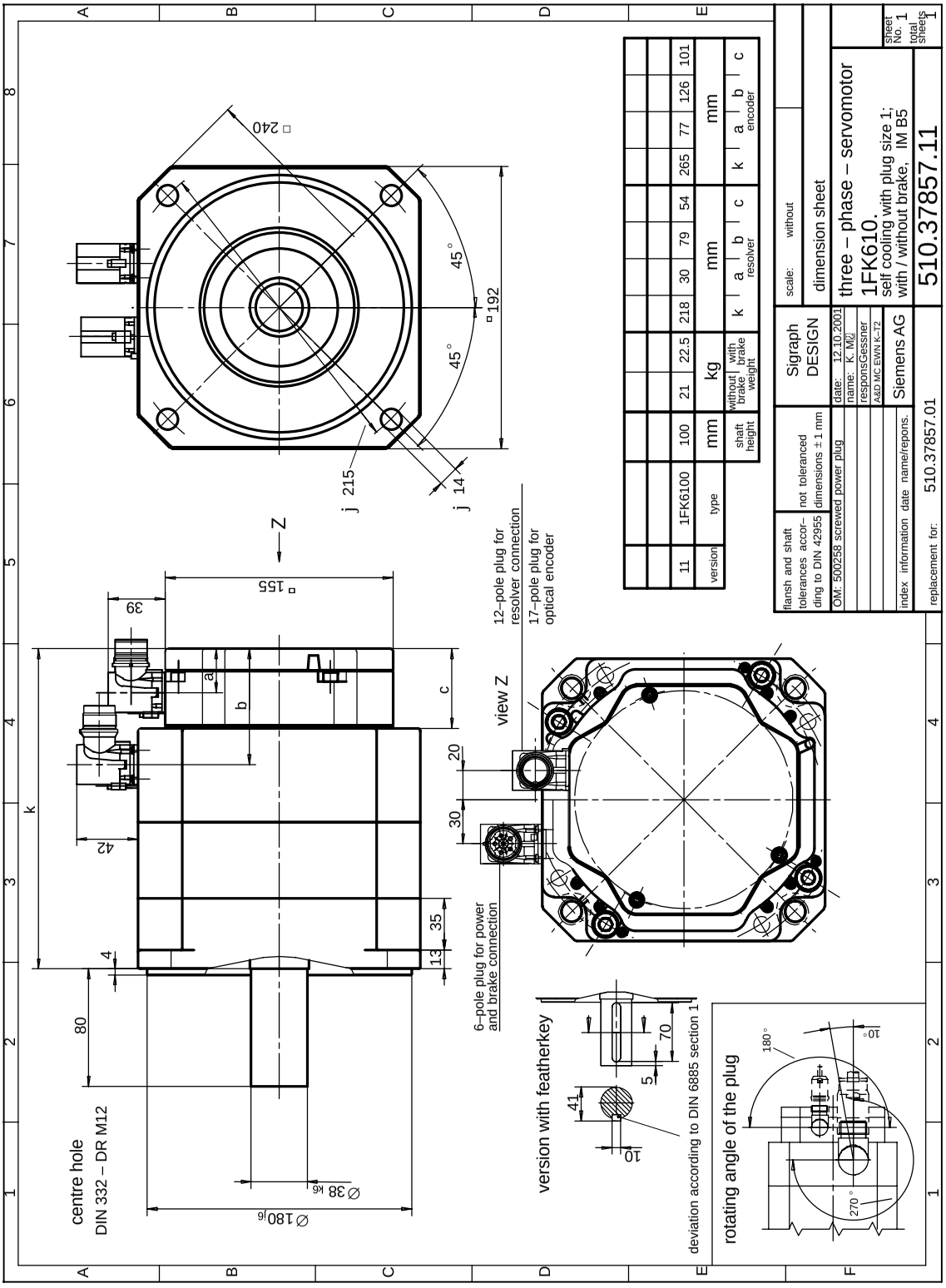

Fig. 4-5 1FK610□ standard, non–ventilated with connector, Size 1

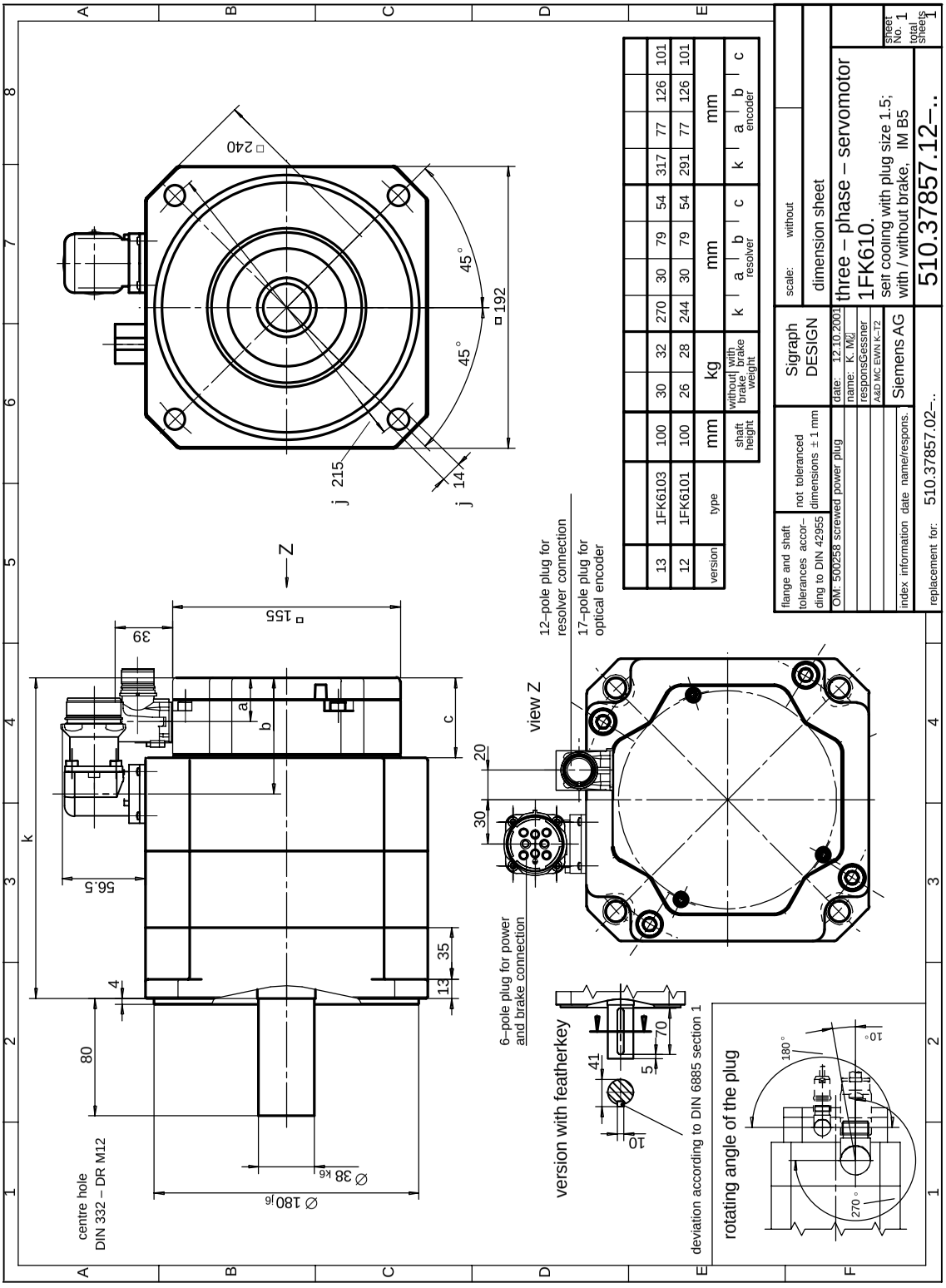

Fig. 4-6 1FK610□ standard, non–ventilated with connector size 1.5

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References

General Documentation

/BU/ **Catalog NC 60**

Automation Systems for Machine Tools
Order No.: E86060–K4460–A101–A9
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Operating Instructions 1FK7

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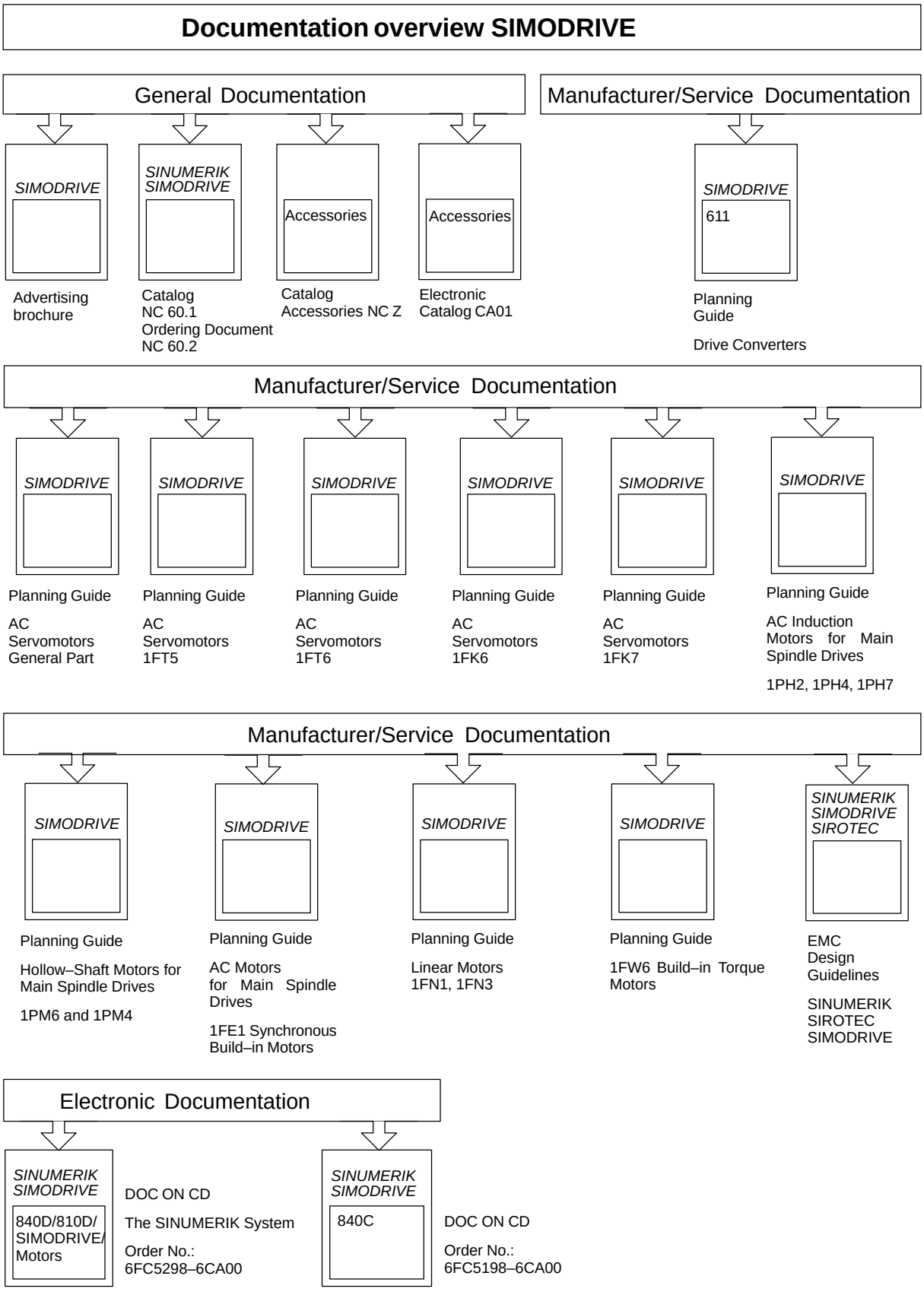

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