SIEMENS

SIMODRIVE

Planning Guide 11.2000 Edition

AC Motors for Feed and Main Spindle Drives

Manufacturer/Service Documentation

SIEMENS

SIMODRIVE
AC Motors for Feed and Main Spindle Drives

Planning Guide

Valid for

6SN11 equipment series

11.2000 Edition

SIMODRIVE® documentation

Edition coding

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.	Remarks
04.93	6SN1060–0AC00–0BP0	**A**
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This Manual is also included in the documentation on CD–ROM **(DOCONCD)**

Edition	Order No.	Remarks
10.00	6FC5298–6CA00–0BG0	**C**

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Foreword

This document is part of the documentation developed for SIMODRIVE. All documents are available individually. The documentation list, which includes all advertising Brochures, Catalogs, Overviews, Short Descriptions, User Manuals and Technical Descriptions can be obtained from your local Siemens office with Order No., location and price.

This Manual does not purport to cover all details or variations in equipment, nor to provide for every possible contingency to be met in connection with installation, operation or maintenance. Should further information be desired or should particular problems arise, which are not covered sufficiently for the purchaser's purposes, the matter should be referred to the local Siemens sales office. The contents of this Guide shall not become part of nor modify any prior or existing agreement, commitment or relationship. The sales contract contains the entire obligation of Siemens. Any statements contained herein neither create new warranties nor modify the existing warranty.

Definitions

Qualified personnel

For the purpose of this documentation and product labels, a “qualified person” is someone who is familiar with the installation, mounting, start–up and operation of the equipment and the hazards involved. He or she must have the following qualifications:

- Trained and authorized to energize, de–energize, clear, ground and tag 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

Danger

This symbol indicates that death, severe personal injury or substantial property damage **will** result if proper precautions are not taken.

Warning

This symbol indicates that death, severe personal injury or property damage **can** result if proper precautions are not taken.

Caution

This symbol indicates that minor personal injury or material damage **can** result if proper precautions are not taken.

Caution

This warning notice (without warning triangle) means that a material damage **can** result if the appropriate precautions are not taken.

Notice

This warning notice means that an undesired event or an undesired state **can** result if the appropriate notices are not observed.

!

Important

This symbol appears in the documentation if a particular issue is significant.

Note

For the purpose of this documentation, “Note” indicates information about the product or the respective part of the document which is essential to highlight.

Warning

Operational electrical equipment has parts and components which are at hazardous voltage levels.

Incorrect handling of these units, i.e. not observing the warning information, can therefore lead to death, severe bodily injury or significant material damage.

Only appropriately qualified personnel may commission/start–up this equipment.

This personnel must have in–depth knowledge regarding all of the warning information and service measures according to this Planning Guide.

Perfect, safe and reliable operation of this equipment assumes that it has been professionally transported, stored, mounted and installed as well as careful operator control and service.

Hazardous axis motion can occur when working with the equipment.

Note

When handling cables, observe the following

- they must not be damaged,
- they must not be strained and
- they must not come into contact with rotating components

Note

It is not permissible to connect SIMODRIVE equipment to a supply system with ELCBs (this restriction is permitted acc. to DIN VDE 0160/05.88, Section 6.5). When operational, protection against direct contact is provided in a form to allow the unit to be used in enclosed electrical equipment rooms (DIN VDE 0558 Part 1/07.87, Section 5.4.3.2.4).

In compliance with DIN VDE 0160/05.88, all SIMODRIVE units are subject to a high–voltage test at the time of routine testing. If the electrical equipment of industrial tools is subject to a high–voltage test, all connections must be disconnected so that sensitive electronic components in the SIMODRIVE converter are not damaged (permissible according to DIN VDE 0113/06.93, Part 1, Section 20.4).

Warning

Start–up/commissioning is absolutely prohibited until it has been ensured that the machine in which the components described here are to be installed, fulfills the regulations/specifications of the Directive 89/392/EWG.

Warning

The information and instructions in all of the documentation supplied and any other instructions must always be observed to eliminate hazardous situations and damage.

- For special versions of the machines and equipment, the information in the associated catalogs and quotations applies.
- Further, all of the relevant national, local and plant/system–specific regulations and specifications must be taken into account.
- All work should be undertaken with the system in a no–voltage condition!
- For the feed motors, when the rotor is rotating, a voltage is present at the motor terminals (as a result of the integrated permanent magnets).
- The motor must be connected according to the circuit diagram supplied.
- It is not permissible to directly connect the motor to the three–phase supply as this would destroy the motor.
- Surface temperatures of above 100° C can occur at the motor enclosure surface. No temperature–sensitive parts or components, e.g. cables or electronic components may be in contact with or connected to the motor.

Warning

The holding brake is only designed for a limited number of emergency braking operations. It is not permissible to use it as working brake.

ESDS information

Electro–**s**tatic **d**ischarge **s**ensitive devices

Components which can be destroyed by electrostatic discharge are individual components, integrated circuits, or boards, which when handled, tested or transported, could be destroyed by electrostatic fields or electrostatic discharge. These components are designated as **ESDS** (**E**lectro**S**tatic **D**ischarge **S**ensitive Devices).

Handling ESDS boards:

- The human body, working area and packing should be well grounded when handling ESDS components!
- Electronic boards should only be touched when absolutely necessary.
- Components may only be touched, if
  - you are continuously grounded through an ESDS bracelet,
  - you are wearing ESDS shoes or ESDS shoe grounding strips in conjunction with an ESDS floor surface.
- Boards may only be placed on conductive surfaces (desk with ESDS surface, conductive ESDS foam rubber, ESDS packing bag, ESDS transport containers).
- Boards may not be brought close to data terminals, monitors or television sets (a minimum of 10 cm should be kept between the board and the screen).
- Boards may not be brought into contact with materials which can be charged–up and which are highly insulating.
- Measuring work may only be carried out on the boards, if
  - the measuring equipment 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).

Note

Please refer to the following manuals for technical information on SIMODRIVE 611:

SIMODRIVE 611, Planning Guide
Transistor PWM Inverters for AC Feed Drives and AC Main Spindle Drives
Order No.: 6SN1197–0AA00–0□P□

SIMODRIVE 611 Analog System, Start–Up Instructions
Transistor PWM Inverter for AC Feed Drives and AC Main Spindle Drives
Order No.: 6SN1197–0AA60–0□P□

Note

Start–up software is available for the start–up of main spindle, synchronous and induction motor modules.

Order No. of the start–up software: 6SN1153–2AX10–□AB□5

Order No. of the documentation: 6SN1197–0AA30–0□B□

General Information on AC Servomotors

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Note

Stepping motors can also be used to supplement the feed motor series. The Siemens SIMOSTEP series is described in the Description of Functions (FB) Order No.: 6SN1197–0AA70.

Notes

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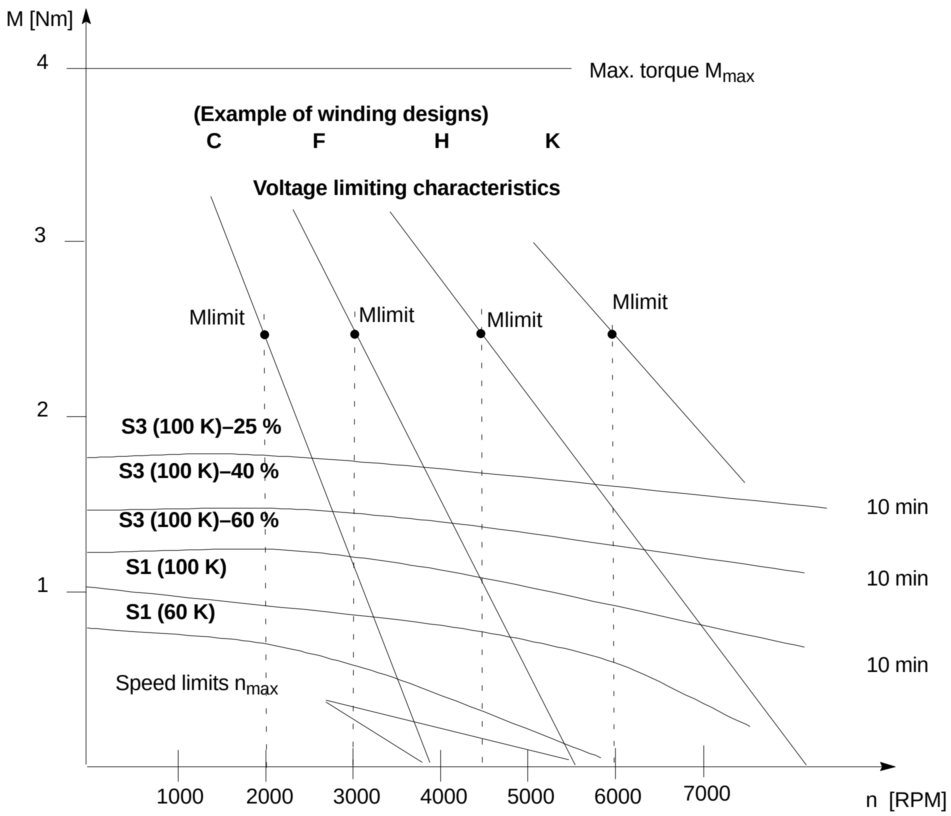
1 Electrical Data

1.1 Definitions

Example of the characteristics



Thermal limiting characteristics for

- Continuous duty
  S1 (100 K) and S1 (60 K),
- Intermittent duty
  S3–60 % (100 K), S3–40 % (100 K)
  S3–25 % (100 K)
  for a 10 min duty cycle

Fig. 1-1 Speed–torque diagram

100 K, 60 K values

100 K or 60 K is the average winding temperature rise

105 K corresponds to a utilization according to temperature rise Class F.

60 K lies within the utilization according to temperature rise Class B. The 60 K utilization should therefore only be used, if

- the enclosure temperature must be below 90 °C for safety reasons,
- or if the shaft temperature rise has a negative impact on the mounted machine

All of the data is valid for a permissible ambient temperature or cooling medium temperature of 40 °C.

Torque characteristics

Several armature circuit designs are possible within any one frame size. The AC servomotors offer a torque characteristic which is constant up to approx. 2000 RPM, above which, depending on the type, it is reduced. A higher overload capability is provided over the complete speed control range.

The following limits are always valid for the servomotor–drive converter module combinations.

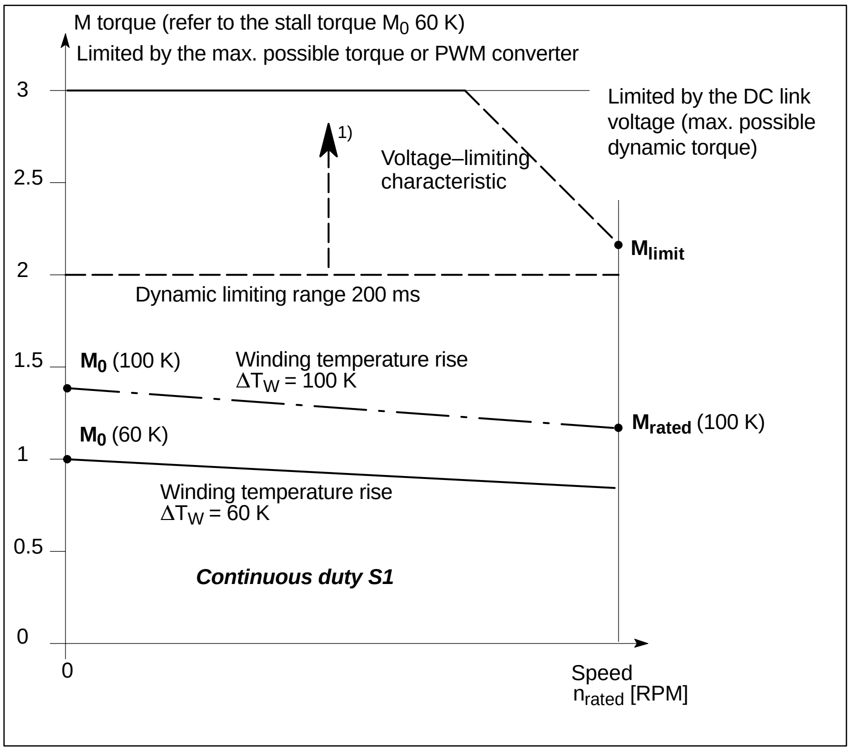


Fig. 1-2 Torque characteristics of AC servomotors

1) Dynamic limiting range 2 * M_0 (60 K) corresponds to a standard drive assignment. Further, the drive converter can be assigned corresponding to the particular drive application. If an additional overload protection is required for the motor, the mechanical limit of the motors is 4 * M_0 (100 K).

Warning

Under fault conditions, the motor can accelerate to n_{max} (acc. to the technical data), and for higher supply or DC link voltages, this speed can be significantly exceeded. Only the dynamic torque, limited by the voltage limiting characteristic, can occur.

Thermal limiting characteristic

Corresponds in the diagrams to the S1 (100 K) characteristic. The arithmetic average may not be exceeded, even in intermittent duty.

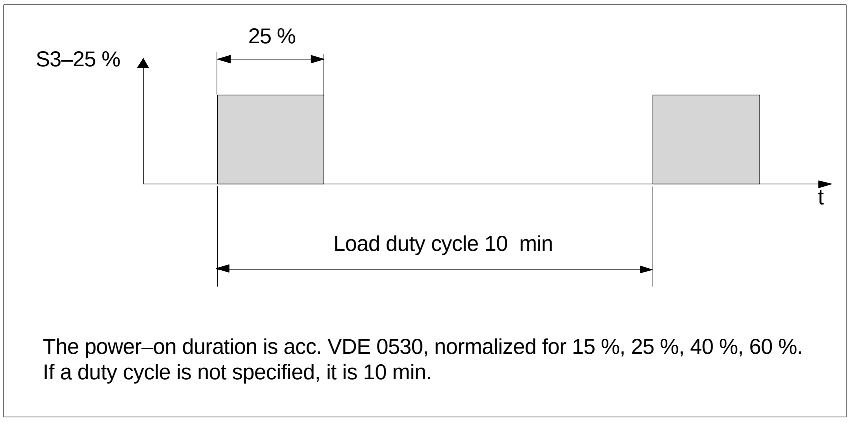


Fig. 1-3 Power–on duration in intermittent duty

Voltage limiting characteristics

The motor EMF increases proportionally with increasing speed. Only the difference between the DC link voltage and the increasing motor EMF is available to impress the current. This limits the magnitude of the current which can be impressed at high speeds

Warning

It is not permissible for the motor to be continuously operated at the voltage limiting characteristic in the range above the S1 characteristic for thermal reasons.

The voltage limiting characteristics of a motor with a rated speed of 6000 RPM lies far above that of the same motor type with 2000 RPM. However, this motor requires a significantly higher current for the same torque. Thus, it is practical to select the rated speed, so that this does not lie too far above the required maximum speed for the particular application. This allows the rating of the drive converter module (current rating) to be minimized.

The voltage limiting characteristics are valid for
1FT5/1FT6/1FK6 for 600 V.

Table 1-1 Code letter, winding version

Rated speed [RPM]	Winding version (10th pos. of the Order No.)
1200	A
1500	B
2000	C
3000	F
4000	G
4500	H
6000	K

Operating drive modules with 1FT5 and 1FT6/1FK6 motors from an uncontrolled infeed

Under certain circumstances, the following restrictions can be expected due to the lower DC link voltage of 490V for the UE module (600V for the U/E module):

– The dynamic drive performance is reduced in the upper speed range

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Shifting the voltage limiting characteristic

In order to be able to identify the motor limits at DC link voltages other than 600 V, the indicated voltage limiting characteristic for the particular armature circuit, must be shifted. A lower DC link voltage is obtained, for example, when operating the motor from uncontrolled supply infeeds. A higher DC link voltage can occur, e.g. if the drive converter is connected to a 480 V supply.

The degree of the actual shift is obtained as follows:

The shift along the X axis (speed), for a DC link voltage of $V_{DC\ link(new)}$, is given by: **$U_{DC\ link(new)}$/600 V for1FT5/6/ 1FK6**

Example:

If a point (P1) of the particular voltage limiting characteristic is at 3000 RPM, the new voltage limiting characteristic for 490 V runs through (P2):

$$\frac{490\ V}{600\ V} = 0.82$$

3000 RPM * 0.82 = 2460 RPM.

The new voltage limiting characteristic must, for n = 2460 RPM, be drawn in parallel to the existing characteristic.

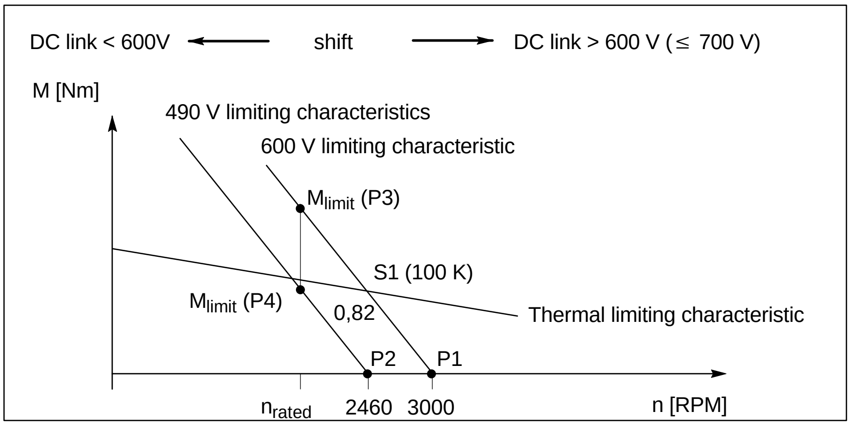

Fig. 1-4 Voltage limiting characteristic shift

The new limiting torque with the new limiting characteristic can be calculated according to the following formula:

1FT5: $$M_{limit(new)} = \frac{V_{DC\ link(new)} - k_E * n_{rated}/1000}{600\ V - k_E * n_{rated}/1000} * M_{limit}$$

1FT6/1FK6: $$M_{limit(new)} = \frac{V_{DC\ link(new)} - \sqrt{2} * k_E * n_{rated}/1000}{600\ V - \sqrt{2} * k_E * n_{rated}/1000} * M_{limit}$$

k_E = Voltage constant from the data sheet
M_{limit} = Limiting torque from the data sheet (P3)
$M_{limit(new)}$ = New limiting torque at n_{rated} (P4)
n_{rated} = Rated speed from the data sheet

Check: P4 must lie on the new limiting characteristic

Stall torque M_0

Thermal limiting torque when the motor is at a standstill, corresponding to the utilization according to 100 K or 60 K. This torque is available at n = 0 for an unlimited time. M_0 is always greater than the rated torque M_{rated}.

Stall current I_0

Motor phase current which is used to generate the particular stall torque.

1FT6 and 1FK6 motors are supplied with sinusoidal currents, 1FT5 motors are supplied with squarewave currents. For 1FT5 motors, the current I_0 corresponds to the peak value.

Rated torque M_{rated}

Thermally permissible continuous torque at the rated motor speed.

Rated current I_{rated}

RMS motor phase current which is required to generate the rated torque.

Rated output P_{rated}

Output which is available at the rated speed and rated torque.

Limiting torque M_{limit}

Maximum torque which is still available at rated speed for acceleration.

Limiting current I_{limit}

Motor phase current which generates the limiting torque.

Maximum current I_{max}

This current limit is determined by the magnetic circuit. The magnetic material could be irreversibly de–magnetized if this current is exceeded, even for a short time.

Mechanical limiting speed n_{max}

The maximum permissible operating speed is n_{max}. It is either defined electrically (voltage limiting characteristic) or mechanically (centrifugal forces, bearing-stressing). The lower value is always specified in the catalog data.

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Maximum torque M_{max}

Torque, which is generated at the maximum permissible current.

The maximum torque is available for fast, dynamic operations.

The maximum torque is limited by the control parameters. The rotor will be de–magnetized if the current is further increased.

Typical M/I characteristic

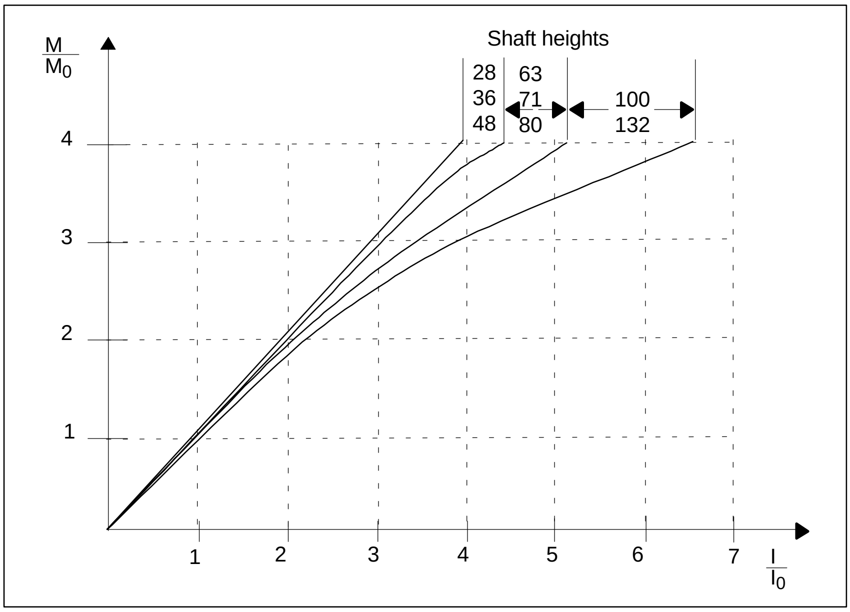

Fig. 1-5 Typical current–torque characteristic for various shaft heights for non–ventilated motors

The individual characteristics of the individual 1FT5/6 and 1FK6 motors are combined to form “typical shaft height ranges”. The lefthand characteristic can be considered as the “best case” and the righthand as “worst case”.

Torque constant k_T

Quotient of the stall torque and stall current. $k_T = M_0/I_0$. The constants are valid up to approx. $2 * M_0$.

!

Important

These constants are not valid (motor losses) when calculatig the necessary rated and accelerating currents.

Further, the steady–state load and the friction torques must be included in the calculation.

Voltage constant k_E

Value of the induced motor voltage at a speed of 1000 RPM. The phase–to–phase motor terminal voltage is specified.

Winding resistance R_{str}

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

Inductance L_D

The three–phase inductance $L_D = 1.5 * L_{ph}$ is specified.

Electrical time constant T_{el}

Quotient of the three–phase inductance and winding resistance. $T_{el} = L_D/R_{ph.}$

Mechanical time constant T_{mech}

The mechanical time constant is obtained from the tangent along a theoretical ramp–function starting at the origin.

1FT5: $T_{mech} = 2 * R_{ph.} * J_{mot}/k_T^2$ [s]
1FT6/1FK6: $T_{mech} = 3 * R_{ph.} * J_{mot}/k_T^2$ [s]

J_{mot} = Moment of inertia of the servomotors [kgm^2]
$R_{ph.}$ = Resistance of a stator winding phase [Ohm]
k_T = Torque constant[Nm/A]

Thermal time constant T_{th}

Defines the temperature increase of the motor housing when the motor load is quickly increased (step increase) to the permissible S1 torque. After T_{th}, the motor has reached 63 % of its final temperature.

Thermal resistance R_{th}

Describes the power dissipation through the motor enclosure at the rated operting point [in W/K]

Brake resistor $R_{a\ opt}$

$R_{a\ opt}$ corresponds to the resistor, externally connected in series to the motor winding for each phase for armature short–circuit braking. If the resistor value is zero, the optimum braking is achieved without using any external resistors, i.e. a direct short–circuit at the terminal.

Braking torque $M_{b\ opt}$

$M_{b\ opt}$ corresponds to the average optimum braking torque which can be achieved by modifying the resistance.

Tolerance data

Data going beyond this lie below the achievable measuring accuracy)

Table 1-2 Tolerance data of the motor list data

Motor list data		Typ. value	Theoretical value
Standstill (stall) current	I_0	± 3 %	± 7.5 %
Max. speed	n_{max}	± 3 %	± 7.5 %
Electrical time constant	T_{el}	± 5 %	± 10 %
Torque constant	k_T	± 3 %	± 7.5 %
Voltage constant	k_T	± 3 %	± 7.5 %
Winding resistance	R_{Str}	± 5 %	± 10 %
Moment of inertia	J_{Mot}	± 2 %	± 10 %

Core types

Core types are a subset of the complete motor spectrum. Core types have shorter delivery times. The various options are restricted. They have a different Order No.

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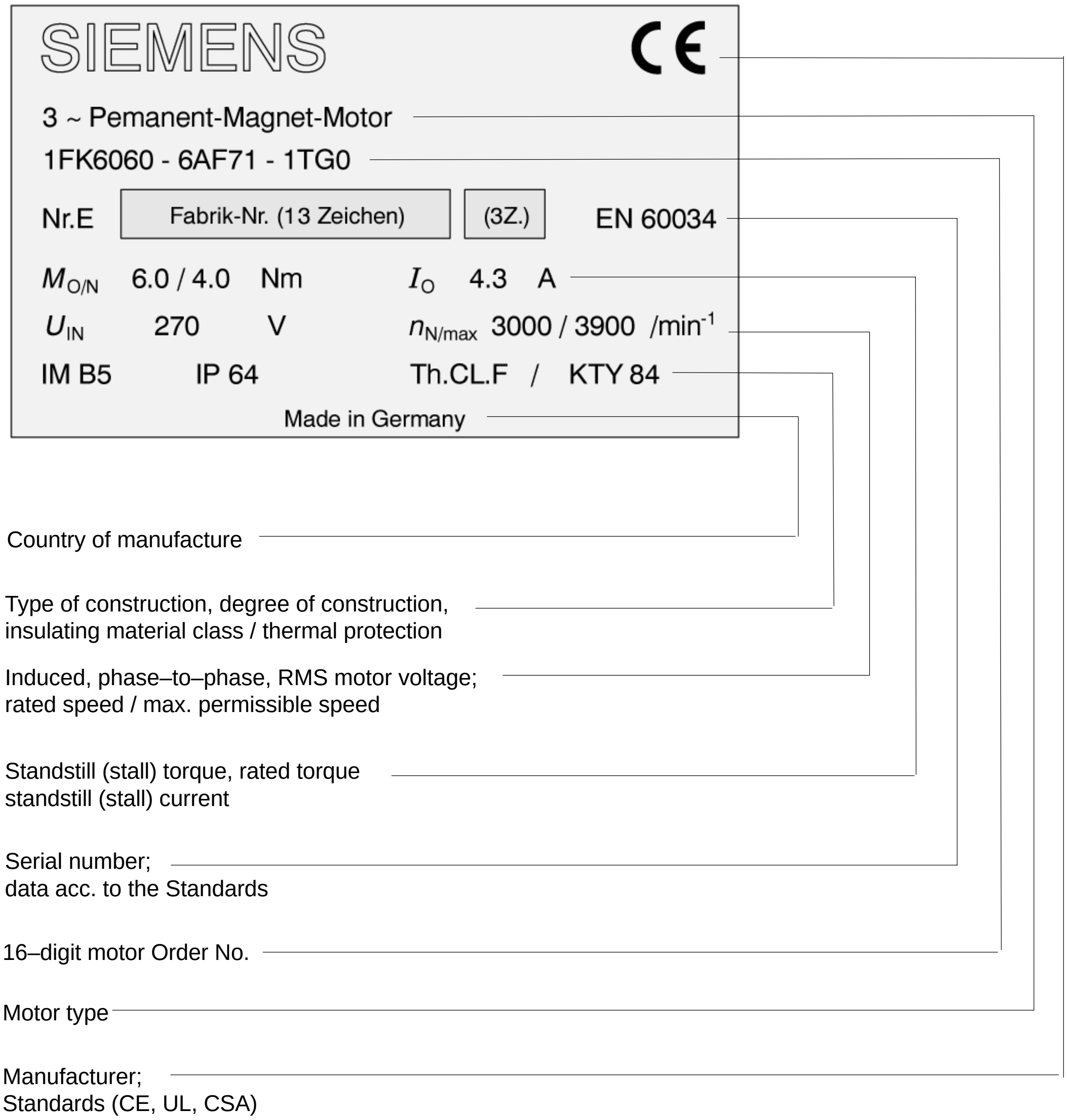
1.2 Rating plate data

Example from the 1FK6 series:



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Notes

Mechanical Data 2

2.1 Definitions

Type of construction (acc. to IEC 34–7)

1FT/1FK motors have type of construction IM B5. They can be mounted corresponding to types of construction IM V1 or IM V3 without having to provide any special information when ordering.

For types of construction IM B14, IM V18 und IM V19, threaded glands are provided in the mounting holes.

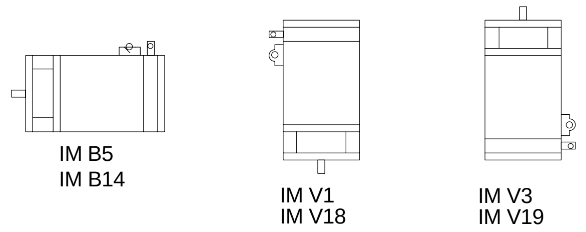


Fig. 2-1 Type of construction

Note

When engineering IM V3 and IM V19 motors, please observe the permissible axial forces (due to the weight of the rotor) and especially the necessary degree of protection. It is important to ensure that there are no liquid remains on the flange.

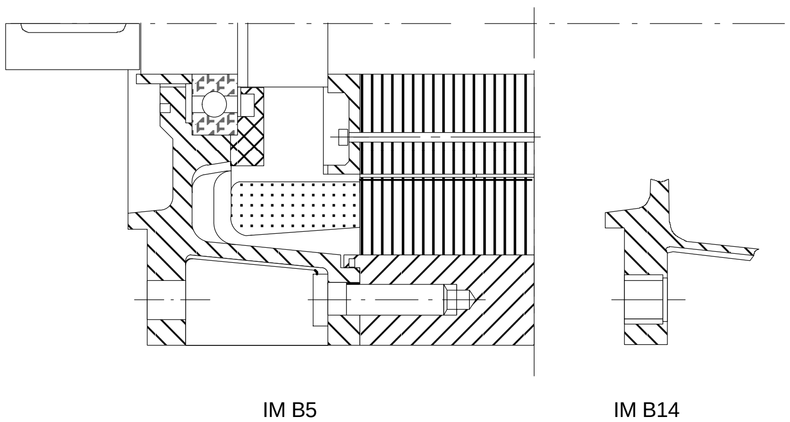


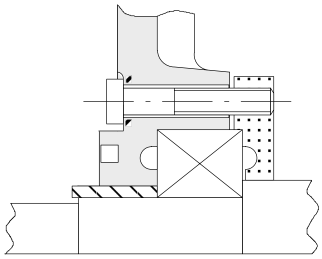
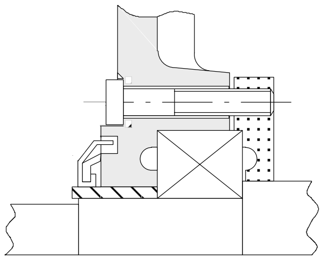
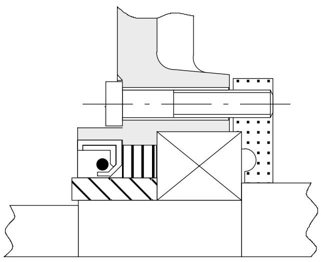
Fig. 2-2 Type of construction IM B5/IM B14 (with threaded gland)

Degree of protection (acc. to EN 60529)

The complete 1FT5/6 motor sealed with O rings.

The motor shaft sealing can be taken from the overview, Table 2-1. All seals use fluoride rubber (FPM).

Table 2-1 Overview, degree of protection acc. to DIN 40050

Degree of protection EN 60529	Shaft sealing type	Application
IP 64	Seal 	In continuous operation, it is only permissible that a slight amount of moisture is present in the area of the shaft end flange
IP 65 (only for 1FT6)	Gamma ring 	The shaft gland is sealed against water spray and cooling–lubricating medium. The gamma ring can operate in the dry state (without any lubricating medium) Lifetime 20,000 h
IP 67* (only for 1FT5 and 1FT6) not for force–ventilated motors *) for 1FK6 DE flange IP67	Radial shaft sealing ring DIN 3760 	In addition, a pre–whetting sealing medium is used for the mechanical interfaces at the housing. For gearbox mounting (for gearboxes which are not sealed) to seal against the ingress of oil. In order to guarantee the correct functioning, the sealing lip must be adequately cooled using gearbox oil. Lifetime 5000 h
IP 68 (not for 1FK6)	Refer to IP 67; Further, for the mechanical interfaces (bolts, bearing cover), a whetting sealing medium is used.	Refer to IP 67

Engineering information when selecting the motor degree of protection

Often, it is not adequate to just protect against water, as generally oil–containing, penetrating and/or agressive cooling–lubricating mediums are used.

The following table will help you to select the required degree of protection. In addition to the theoretical DIN regulations, experience gained in practice has been taken into account. If in doubt, always select the next higher degree of protection.

Table 2-2 Selecting the motor degree of protection

Effects	Liquid/fluid		
	General workshop environment	**Water; General, cooling–lubricating medium (95 % H_2O; 5 % oil); oil**	**Penetrating oil; Petroleum; aggressive cooling–lubricating medium**
Dry	IP 64	–	–
Environment where liquids and fluids are present	–	IP 64[1)]	IP 67
Mist	–	IP 65	IP 67
Spray	–	IP 65	IP 68
Jet	–	IP 67	IP 68
Splash; brief immersion; continuous flooding	–	IP 67	IP 68

IP☐☐ 1st code (0–6): Degree of protection against contact and the ingress of foreign bodies
2nd code (0–8): Degree of protection against the ingress of water (no protection against oil)

Cooling

Operating temperature range: –15 °C to+40 °C.

All of the catalog data refer to an ambient temperature of 40 °C and assume that the equipment is not mounted so that it is thermally insulated. The following de–rating must be applied for ambient temperatures greater than 40 °C
to 45 °C 96%
to 50 °C 92%
to 55 °C 87%
to 60 °C 82%

Non–ventilated (9th position of the Order No.: A)

The power is dissipated by radiation and natural convection, which means that the motor must be suitably mounted to guarantee adequate heat dissipation.

Servomotors can have high surface temperatures
(> 100 °C). When required, provide touch protection

Forced–ventilation (9th position of the Order No.: S)

Available for selected types (refer to Catalog)

- for 1FT5 for shaft heights 71, 100 and 132,
- for 1FT6 for shaft heights 80, 100 and 132
- Forced ventilation is not available for 1FK6

It is not permissible that the hot discharged air is drawn in again.

1) For the version with holding brake and oil as cooling–lubricating medium: IP 67

Water cooling (9th position of the Order No.: W) available for selected types (refer to Catalog).

- for 1FT6 for shaft heights 80 and 100.

Degree of protection

Motors with separately–driven fan fulfill, according to EN 60529, degree of protection IP 54. The IP 65 of IP 67 option cannot be fulfilled if a separately–driven fan is used. The motor shaft–height specific version and a description of the separately–driven fan termination system, is described in the special motor Chapters. The following features regarding non–ventilated motors remain unchanged:

- Encoder system
- Holding brake
- Type of construction, flange dimensions
- Vibration and shock stressing
- Vibration characteristics
- Moments of inertia
- Natural torsional and shaft bending frequencies
- Bearing design

Bearing design

The bearings are sealed on both sides and are permanently lubricated. The bearings are designed for operation at a minimum ambient temperature of –15 °C. The specific versions can be taken from the motor data.

Note

We recommend that the bearings are replaced after approx. 20 000 operating hours, however, at the latest after 5 years.

Shaft end

Table 2-3 Differences in the various cylindrical shaft ends

Characteristics	DIN 748 Shaft end with key (type a)	DIN 748 Shaft end without keyway (type b)
Keyway and key (DIN 6885)	X	
Force–locked	X	
Friction–locked, smooth shaft (e.g. shrink connection, clamping sets etc.)		X
No play		X
Favorable for reversing operation and fast acceleration		X
Standard for motors	1FT5	1FT6 and 1FK6
Optional for motors	1FT6 and 1FK6	1FT5

Dimensions, refer to the dimension drawings in the specific motor Chapters!

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Manual actuation

It is not possible to manually rotate the axis at the non–drive end of the motor. The motor shaft should be manually rotated at the most accessible location (e.g. lead screw).

Radial eccentricity, concentricity and axial eccentricity (acc. to DIN 42955)

Table 2-4 Radial eccentricity of the shaft to the housing axis (referred to the cylindrical shaft ends)

Shaft height	Standard N	Option R
28, 36	0.035 mm	0.018 mm
48 (1FT5)	0.035 mm	0.018 mm
48 (1FT6/1FK6)	0.04 mm	0.021 mm
63	0.04 mm	0.021 mm
71	0.04 mm	0.021 mm
80	0.05 mm	0.025 mm
100	0.05 mm	0.025 mm
132	0.05 mm	0.025 mm

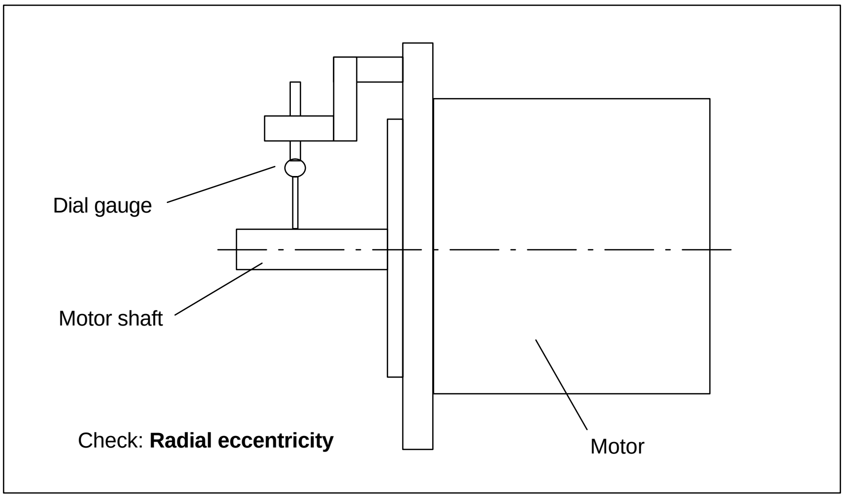

Fig. 2-3 Radial eccentricity check

Table 2-5 Concentricity and axial eccentricity tolerance of the flange surface to the shaft axis (referred to the centering diameter of the mounting flange)

Shaft height	Standard N	Option R
28, 36	0.08 mm	0.04 mm
48	0.08 mm	0.04 mm
63 (1FT5)	0.08 mm	0.04 mm
63 (1FT6/1FK6)	0.1 mm	0.05 mm
71	0.1 mm	0.05 mm
80	0.1 mm	0.05 mm
100	0.1 mm	0.05 mm
132	0.125 mm	0.063 mm

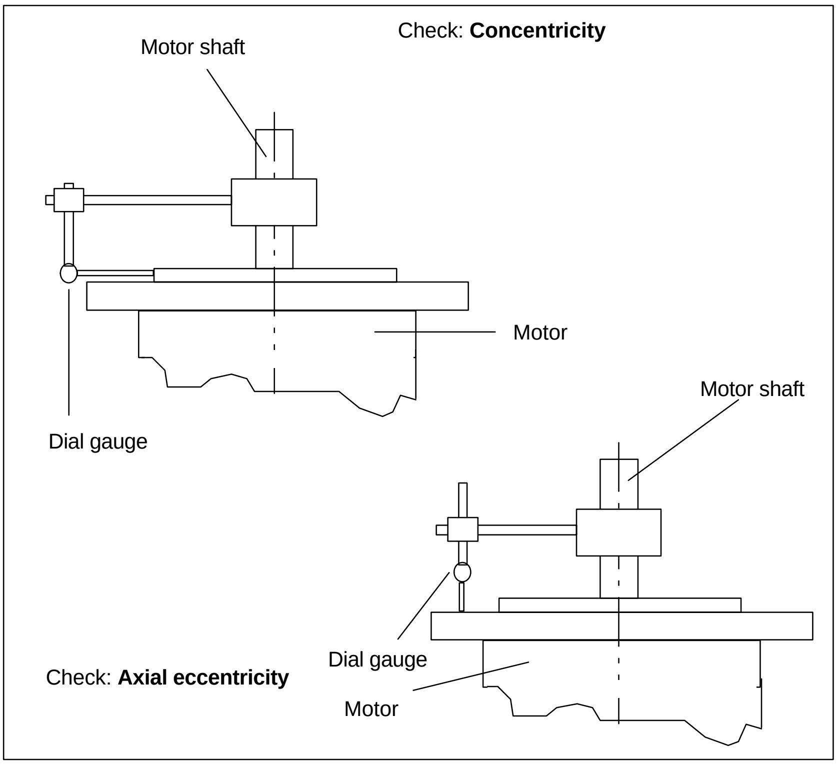

Fig. 2-4 Concentricity and axial eccentricity check

Noise (acc. to DIN 45635)

The sound pressure values are valid when the motor is fed from the SIMODRIVE 611 PWM inverter for non–ventilated and separately–ventilated motors (with the exception of shaft height 132), measured at 1 m.

Table 2-6 Noise

Shaft height	Sound pressure level under no–load conditions dB (A) 0 to 6000 RPM
28, 36	55
48	55
63	65
71	70
80	70
100	70
132	70

Vibration severity (acc. to EN 60034–14, IEC 60034–14)

The specified values refer to the motor alone. The overall system vibration characteristics, as a result of the mounting type, can increase these values at the motor.

The speeds of 1800 RPM and 3600 RPM and the associated limit values are defined according to IEC 34–14. The speeds of 4500 RPM and 6000 RPM and the specified values are defined by the motor manufacturer.

ALS

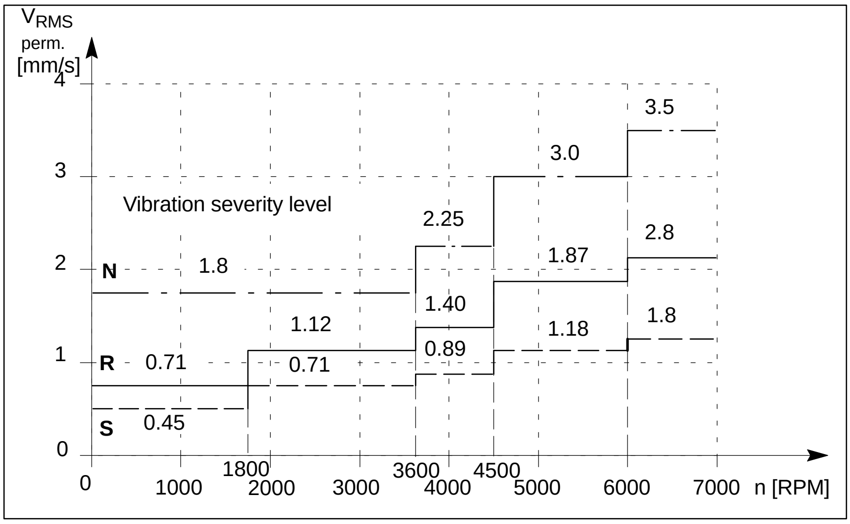

Fig. 2-5 Characteristics of vibration severity level limits for shaft heights 28 to 132

Shock stressing (acc. to DIN 40046. T7)

The maximum briefly permissible radial acceleration levels are specified in the Table 2-7, which do not have a negative impact on the function (when the servomotor is not operational; e.g. during transport):

Table 2-7 Shock stressing

Shaft height	Accleration
28, 36	1000 m/s^2
48	1000 m/s^2
63	500 m/s^2
71	300 m/s^2
80	300 m/s^2
100	200 m/s^2
132	100 m/s^2

Vibration stressing (acc. to EN 60721–3–3)

The maximum permissible limit values are only valid, with full functionality, for motors without brake, or with the brake closed.

10 m/s^2 axial (20 Hz to 2 kHz)
30 m/s^2 radial (20 Hz to 2 kHz)

Balancing (acc. to DIN ISO 8821)

For motors **with** key:

1FT5 motors: Full–key balancing1
FT6/1FK6motors Half–key balancing

Cantilever force stressing

The permissible cantilever forces are shown in the diagrams for the correspon- ding motors

Application point of the cantilever forces at the shaft end

- At average operating speeds
- For nominal bearing lifetimes of 20 000 h

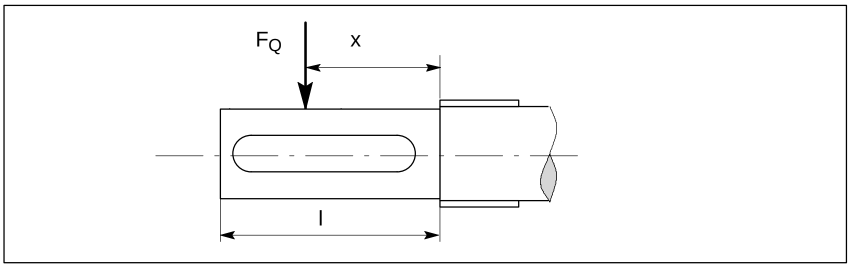

Fig. 2-6 Point of application of cantilever forces at the shaft ends of motors

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

Dimension l: Length of the shaft in mm.

Calculating the belt pre–tension:

$F_R = 2 * M_0 * c/d_R$

F_R [N]	Belt pre–tension force
M_0 [Nm]	Motor stall torque
d_R [m]	Effective diameter of the belt pulley
c	Pre–tensioning 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

For other designs, the actual forces from the torque to be transferred should be considered

$F_R \leq F_{qperm.}$

Axial force stressing

The permissible axial forces are shown in the diagrams for the appropriate motors.

Caution

For motors with integrated holding brake, axial forces are not permitted!

When using, for example, gear wheels with helical teeth as the drive element, in addition to the radial force, the bearing is also subject to an axial force. For axial forces acting towards the motor, the bearing alignment force can be overcome, so that the rotor can move corresponding to the actual bearing axial play (up to 0.2 mm).

The permissible axial force can be approximated using the following formula

$$F_A = 0.35 * F_Q$$

Accurate data can be taken from the diagrams, taking into account the mounting position.

Paint finish

Table 2-8 Paint finish for 1FT5, 1FT6 and 1FK6

1FT5, 1FT6	1FK6
Anthracite (SN30901–614) Two component epoxy resin paint; no special paint finish is required for the tropics.	Primer finish; without final paint finish

2.2 Mounted/integrated components

Effects

When the motor is mounted onto a flange, some of the motor power loss is dissipated through the flange.

- **Mounting design which is not thermally insulated**

  The following mounting conditions are valid for the motor data shown:

Table 2-9 Mounting conditions, non–thermally insulated mounting

Shaft height	Steel plate width x height x thickness	Mounting surface [m^2]
28 to 48	120 x 100 x 40	0.012
63 to 132	450 x 370 x 30	0.17

  The heat dissipation conditions are improved for larger mounting surfaces.

- **Thermally insulated mounting <u>without</u> additional mounting components**

  The motor torque must be reduced by between 5 % and10 %. We recommend that the system is configured using the M_0(60k) values.

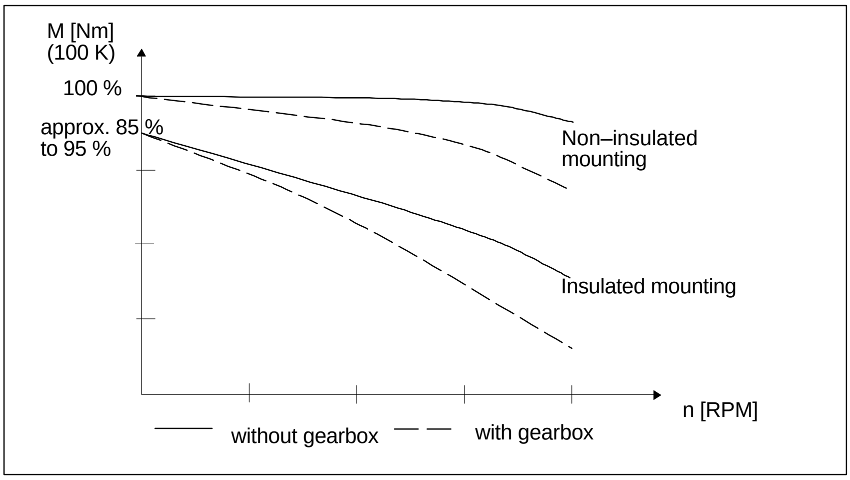

Fig. 2-7 S1 characteristics

- **Thermally insulated mounting <u>with</u> additional mounted components**

  – Holding brake (integrated in the motor)
    Additional torque reduction is not required

  – Gearboxes
    The torque must be reduced (refer to the diagram above)

  Instructions on the rating plate: **“reduce rating with gearing”**

Dimensioning information regarding the required motor size is povided in the following section.

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Gearboxes

We recommend the following motor options:

- Improved radial eccentricity (R) and flange accuracy
- IP 67 (if the gearbox oil is in contact with the motor flange)

Technical data should be taken from the gearbox manufacturer’s catalogs.

Dimensioning the gearbox

1. Selecting the gearbox side

   The following parameters must be taken into account:

   Accelerating torque, continuous torque, number of cycles, cycle type, permissible input speed, mounting position, torsional play, radial and axis forces.

   The motor and gearbox are assigned as follows:

   $M_{max,\ gear} \geq M_{0(100\ K)} * f * i$

$M_{max,\ gear}$	Maximum permissible drive–out torque
$M_{0(100\ K)}$	Motor stall torque
	Ratio
	Supplementary factor

S1 duty:	f = 2	Factor due to gearbox temperature rise
S3 duty:	f = f1 * f2	
	f1 = 2	For the motor accelerating torque
	f2 = 1	for ≤ 1000 switching cycles of the gearbox
	f2 > 1	for > 1000 switching cycles (refer to the gearbox Catalog)

Note

Switching cycles can also be in the form of superimposed vibrations/oscillations!

The supplementary factor (f2) is, in this case, not adequate when dimensioning the gearbox. This can result in gearbox failures.

The complete system must be optimized, so that the superimposed vibration/oscillations are minimized.

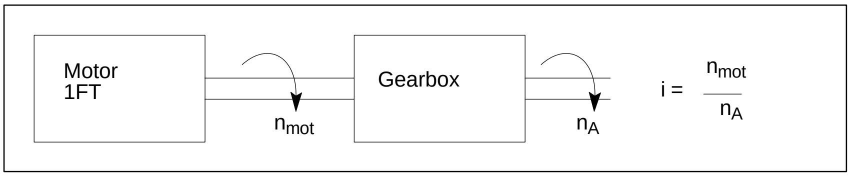


Fig. 2-8 Dimensioning the gearbox

2. Selecting the motor size

The load torque and the required traversing velocity define the gearbox drive–out torque and the drive speed, and therefore also the drive output

The required drive output can be calculated from this data:

$P_{ab}\,[W] = P_{mot} \cdot \eta_G = (\pi/30) \cdot M_{mot}\,[Nm] \cdot n_{mot}\,[RPM] \cdot \eta_G$

The gearbox prevents heat from being dissipated through the motor flange, and the gearbox itself generates heat due to frictional losses.

The torque must be reduced for S1 duty.

- **Dimensioning the motor for S1 duty for non–ventilated motors**

  The required motor torque is calculated as follows:

$$M_{mot} = \sqrt{\left(\frac{M_{ab}}{i * \eta_G} + M_V\right)^2 - M_V^2}$$

$$\text{with } M_V = a * b * \frac{n_{mot}}{60} (1 - \eta_G) * \frac{k_T^2}{R_{ph.}}$$

M_V	calculated “torque loss”
a	π/2 for 1FT5 motors fed with squarewave currents π/3 for 1FT6 motors fed with sinusoidal currents
b	0.5 weighting factor for gearbox losses (no dimensions)
n_{mot}	Motor speed [RPM]
k_T	Torque constant [$\frac{Nm}{A}$]
$R_{ph.}$	Thermal resistance of the motor phase [Ω] = 1.4 $R_{ph.}$ (Catalog data)
M_{out}	Gearbox drive–out torque [Nm]
i	Gearbox ratio (i>1)
η_G	Gearbox efficiency
P_{mot}	Motor output [W]
P_{ab}	Gearbox drive–out power [W]
M_{mot}	Motor torque [Nm]

Typical efficiencies:

Planetary gearbox	η≈0.94	single–stage
Spur gearing	η≈0.95	
Cyclo gearbox	η≈0.92	single–stage
Harmonic drive	η≈0.7	
Worm gear	η≈0.45...0.9	

- **Dimensioning the motor for S3 duty for non–ventilated motors**

  The torque does not have to be reduced.

  $M_{mot} = M_{red.} / (i * \eta_G)$

Planetary gearboxes from alpha

Technical features of planetary gearboxes

- High efficiency (>94%)
- The power is distributed from the central sun wheel to the planetary wheels
- As a result of the symmetrical force distribution, shaft bending does not occur in the planetary wheel set
- Extremely low moment of inertia.
- This means extremely fast motor accelerating times.
- The drive–out bearings are designed for high cantilever and axis stressing using pre–tensioned tapered roller bearings.
- High torsional stiffness and smooth running characteristics
- The gearboxes, which are sealed and filled with oil in the factory, are coupled to the motor shaft through an integrated clamping hub. A smooth motor shaft end is required; the radial eccentricity N, according to DIN 42955 is adequate. The motor flange is adapted using adapter plates.
- Operation is possible in all mounting positions.
- The gearbox out drive is axial to the motor
- Gearbox oil seal to the motor is in the gearbox
- Small dimensions
- Low weight

Motors with mounted planetary gearboxes

The gearboxes, assigned to the individual motors as well as the gearbox ratios which are available for these motor–gearbox combinations, are listed in the selection Table 1. When selecting the gearbox, the maximum permissible input-speed of the gearbox must be taken into consideration (this is the same as the maximum motor speed).

The motor–gearbox combinations, listed in the selection table, are essentially for positioning operation (S5).

If the gearboxes are to be used in continuous operation at high speeds, the gearbox manufacturer must be contacted. The motor–gearbox assignment must be made in accordance with the Planning Guide.
The 1FT5/6 and 1FK6 AC servomotors can be supplied ex–factory (Siemens) complete with flange–coupled planetary gearboxes.

If you have any questions regarding the gearbox, please contact the following company
alpha getriebebau GmbH
Service Gewerbegebiet Harthausen
Rotwiesenstr. 1
D–97999 Igersheim
Telephone: +49 (0) 79 31 – 493 – 900
Telefax: +49 (0) 79 31 – 493 – 200
Mailing address:
Postfach 11 63
D–97997 Igersheim

Drive–out couplings

After investigating various drive–out couplings for servomotors in conjunction with SIMODRIVE drive converters, we have identified, that in many cases, the reasons for vibration problems, lie in the drive–out couplings.

For this reason, we would like to recommend that Rotex couplings, from KTR are used, which can guarantee the optimum drive–out characteristics.

The advantages of Rotex couplings include:

- 200 to 400 percent torsional stiffness of a belt–driven gearbox
- No meshing teeth (with respect to belt gearboxes
- Low moment of inertia
- Optimum control characteristics

The couplings can be mounted without key up to the specified torques which have to be transferred. It should be observed, that the friction locking torques should always be adequately dimensioned, corresponding to the particular motor frame size. Please note, that the accelerating torque must also be transmitted.

Alternatively, a clamping hub with groove or the special version with two clamping screws can be used.

The investigations also involved the vibration characteristics. The couplings, assigned to the motors, permit higher gain factors in the speed control loop, which can possibly result in higher K_V values and more uniform motion.

For ROTEX GS, three different plastic pinion wheels, with varying Shore hardnesses, are available:

	80 Shore A (soft)
alternatively:	92 Shore A
alternatively:	98 Shore A (hard)

The adaptation to existing machine masses and stiffness levels must be determined in conjunction with the mounted mechanical system.

KTR can provide technical information, delivery times and prices.

You can only order the couplings through KTR.

Address:	KTR	
	Kupplungstechnik GmbH	
	Rodder Damm 170;	48432 Rheine
	Postfach 1763;	48407 Rheine
	Tel.:	05971/798–465(426)
	FAX:	–400

The assignment of the drive couplings to the motors is specified in the appropriate motor Chapter.

Holding brake (option)

A holding brake holds the axis, without play, at standstill or in the no–voltage condition (powered–down).

The permanent magnet, single–disk brake operates according to the fail–safe principle, i.e. the brake is closed (applied) when it is not energized.

Note

Axial forces are not permitted for motors equipped with a holding brake!

The holding brake is **not** a working brake!

For emergency stopping or during power failures, approx. 2000 braking operations can be made with the specified maximum switching work (refer to the technical data)

($W=1/2 * J_{tot} * \omega^2$; Jtot in [kgm^2], ω in [1/s], W in [J])

without the brake being subject to excessive wear.

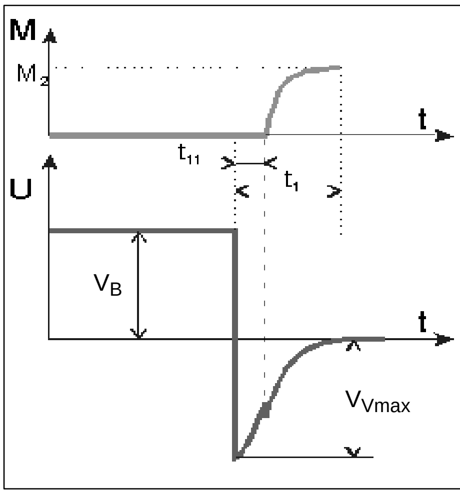
The specified holding torques are only valid at standstill. For slipping brakes, the dynamic braking torques always apply (refer to the technical data).

1FT6 motors with integrated holding brakes are longer.

Supply voltage: 24 V DC ± 10 %

In order to prevent overvoltages when switching–off, and the associated effects on the system environment, the brake feeder cable must be externally provided with a free–wheeling diode or a matching varistor (a varistor is the preferred solution, as the closing time is extended when a free–wheeling diode is used).

The basic voltage characteristic is shown below:



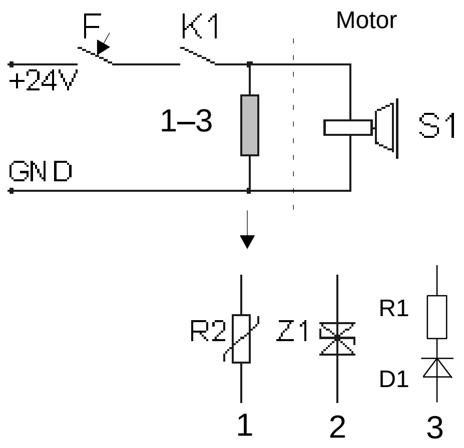
M_2	Rated torque
t_{11}	Response delay
t_1	Closing time
VB	Operating voltage
V_{Vmax}	Max. switch–off voltage

Fig. 2-9 Voltage characteristic when braking

When switching–off, the voltage spike V_{Vmax} can reach several 1000 volt in the millisecond range if the contactor is not dampened. The coil, contacts and electronic components could be destroyed. The switch contacts arc at switch–off. This means that when switching–off, the current must be reduced using contactor damping circuitry, which then also limits the voltages.
Caution: Sensitive electronic components (e.g. logic components) could however be destroyed by the lower switch–off voltage (e.g. 60 volts).

Preventing switch–off voltage spikes

For DC power supplies with a residual ripple <10%, the following diagram shows the possible damping possibilities to prevent damaging switch–off voltage spikes:



F	Fuse (NCB)
K1	Contactor to switch the brake
S1	Holding brake
1–3	Circuit recommendations, refer below
D1	Diode
R1	Resistor
R2	Varistor
Z1	Zener diode

Fig. 2-10 Recommended external power supply for the holding brake

Damping circuit 1 (varistor)

Switch–off voltage spikes are limited by using varistor (a varistor is a resistor with a resistance which depends on the voltage).
It should be ensured that the varistor power limit is not exceeded. The power limit is a function of the coil current, switch–off voltage, switch–off time and number of switching operations per unit time.
For average requirements and a 24V operating voltage, for example, SIOV–S14K30 from Siemens can be used (Order designation Q69–X3022 30V).

Damping circuit 2 (Zena diode)

The properties of the bi–directional Zener diode are approximately the same as those for a varistor. For the same size, a Zena diode has a lower power rating but a more precisely defined characteristic. Generally, a varistor is the preferred damping method.

Damping circuit 3 (resistor and Zena diode)

The times specified in the Technical data apply for this damping circuit.

Technical data for the holding brakes are included in the appropriate motor Chapters.

!

Important

The brake connecting cable is included in the power cable. The insulation between the power and brake cores is designed for the basis insulation in (230 V).

To protect the internal logic voltage (PELV protective low voltage), basis insulation must also be available between the coil and contact of relay K1.

The PELV power supply may not be used for the holding brake (refer to the recommended circuit).

Note

You must always ensure that there is a minimum 24 V DC –10% at the connector on the motor side in order to guarantee that the brake opens correctly. The brake can close again when the maximum 24V DC +10% is exceeded.

The voltage drop along the brake feeder cable must be taken into account. The voltage dropalong copper cables can be approximated as follows:

$$dU=0.042 * (l/q) * I_{Brake}$$

l	=Cable length in m
q	=Brake conductor cross–section in mm^2
I_{Brake}	=Brake DC current in A
dU	=Voltage drop along the brake cable in V

Example: 1FK6101 with EBD brake 3.8B I_{Brake}=0.9A, l=50m, q=1mm^2
dV=0.042*50/1*0.9=1.89
this means, that the voltage on the supply side must be a minimum of 24V*0.9+1.89V=23.5 V.

Defining torques

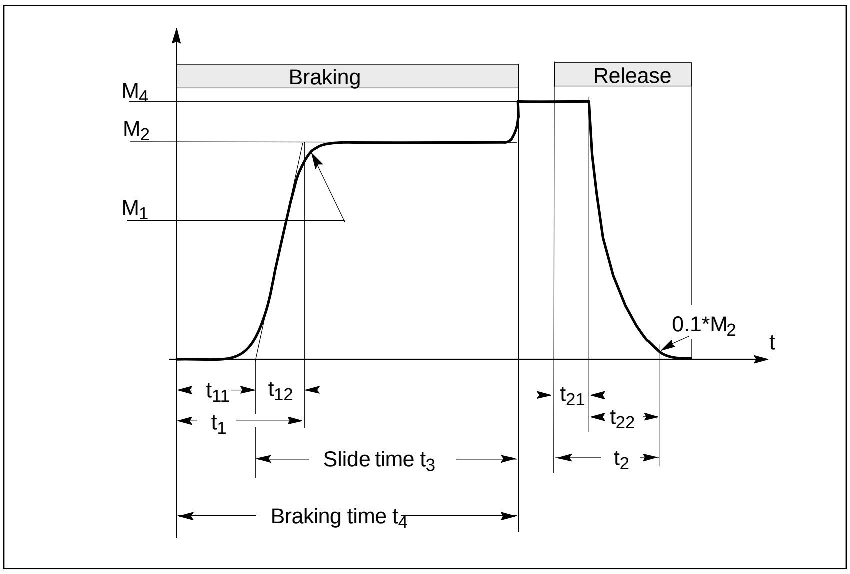


Fig. 2-11 Definiing torques and switching times according to VDE 0580

Torques:

M_1 [Nm] = Switching torque or dynamic torque

M_2 [Nm]= Value from the equivalent characteristic of the experiment standardized in VDE 0580

M_4[Nm]= Torque which can be transferred, taking into account the max. solenoid temperature; friction value fluctuations and spread between various brakes .

Braking:

t_1 ≙ Closing time (at standstill, the following applies: $t_1 \doteq t_4$)

t_{11} ≙ Response delay

t_{12} ≙ Rise time

t_3 ≙ Slip time – this depends on the total moment of inertia J_{tot} of the axis

t_4 ≙ Braking time

Brake release:

Opening times (release time): $t_2 + t_x$ (refer to the technical data) Determined from various trials

t_2 ≙ Separating time

t_{21} ≙ Response delay, when separating

t_{22} ≙ Drop–out time

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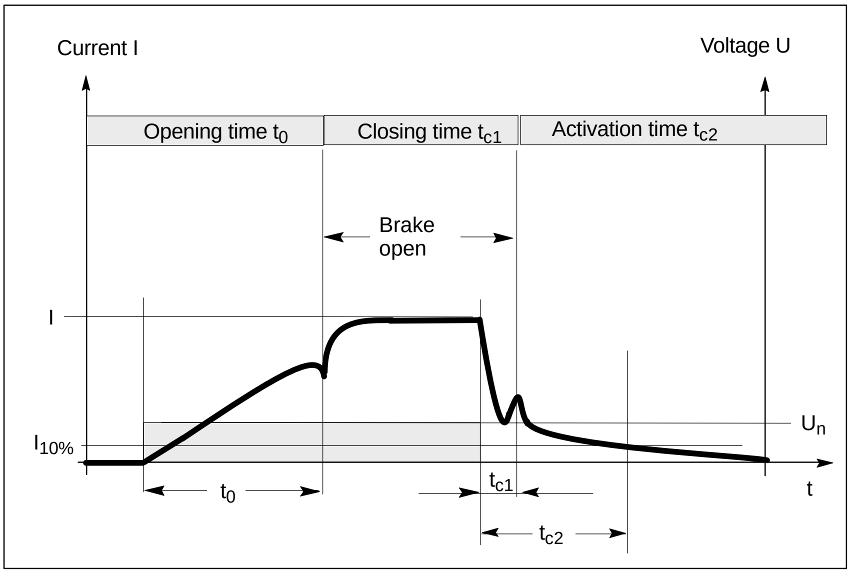

Fig. 2-12 Definitions of times for holding operation (this deviates from DIN VDE 0580)

Measured with damping circuit connected in parallel with the contactor: (damping circuit 3)
Series circuit comprising free–wheeling diode and resistor $R = 5 * R_{Brake}$

■

Notes

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3 Functions – Options

Armature short–circuit braking

Transistor PWM converters can no longer be electronically braked when the DC link voltage exceeds a specific value or if the electronics has failed. If the drive represents a danger when it coasts down, the motor can be braked by short–circuiting the the armature. The armature short–circuit should be made within the traversing range of the feed axis. However, it should be initiated at the latest by the emergency limit switch.

When determining the run–up travel of the feed axis, the friction of the mechanical system and the switching times of the contactors should be taken into account. In order to prevent mechanical damage, mechanical end stops should be provided at the end of the absolute traversing range.

For servomotors with integrated holding brake, the holding brake can be simultaneously de–energized, in order to generate an additional braking force; this braking torque is somewhat delayed.

Caution

The drive converter pulses must always first be cancelled, before an armature short–circuit contactor is closed. This prevents the contactor contacts burning which could destroy the PWM converter.

Warning

The setpoint input must always be used for standard operational braking. For EMERGENCY OFF, terminal 64 at the drive converter should be used to initiate braking.

Brake resistors

The servomotor braking torque can be optimized in regenerative operation using an armature short–circuit with adapted external resistor. The resistors which are required are listed in the motor tables.

The resistors can be ordered from:
Fritzlen GmbH & Co.KG
Gottlieb–Daimler–Str. 61
71711 Murr
Tel.: 07144 / 2724–25

Resistor rating

The resistor ratings can be dimensioned so that a surface temperature of 300° C can briefly occur (max. 500 ms). In order to prevent the resistor from being destroyed, the drive may only be braked from rated speed every two minutes. If you require other braking cycles, then please specify these when ordering. The external moment of inertia and the motor moment of inertia are decisive when dimensioning the resistors.

The kinetic energy must be specified when ordering so that the resistor rating can be determined.

$$W = \frac{1}{2} * J * \omega^2$$

W	in	[Ws]
J	in	[kgm^2]
ω	in	[s^{-1}]

Braking times and braking travel

In order to calculate the maximum braking times and braking travel, the average braking torque, the complete moment of inertia and the rated speed must be known. The braking time is calculated using the following formula:

Braking time:	$t_B = \frac{J_{tot} * n_{rated}}{9{,}55 * M_B}$	J [kgm^2] n_N [RPM] M_B [NM]
Moment of inertia:	$J_{tot} = J_M + J_{ext.}$	t_B [s] s [m]
Braking travel:	$s = \frac{1}{2} V_{max} * t_B$	V_{max} [$\frac{m}{s}$]

!

Important

When calculating the run–on travel, then, for example, the friction (included in M_B as supplementary factor), the mechanical transmission elements and the switching delay times of the contactors must be taken into account. In order to prevent mechanical damage, mechanical end stops must be provided at the end of the absolute traversing range of the machine axes.

AL S

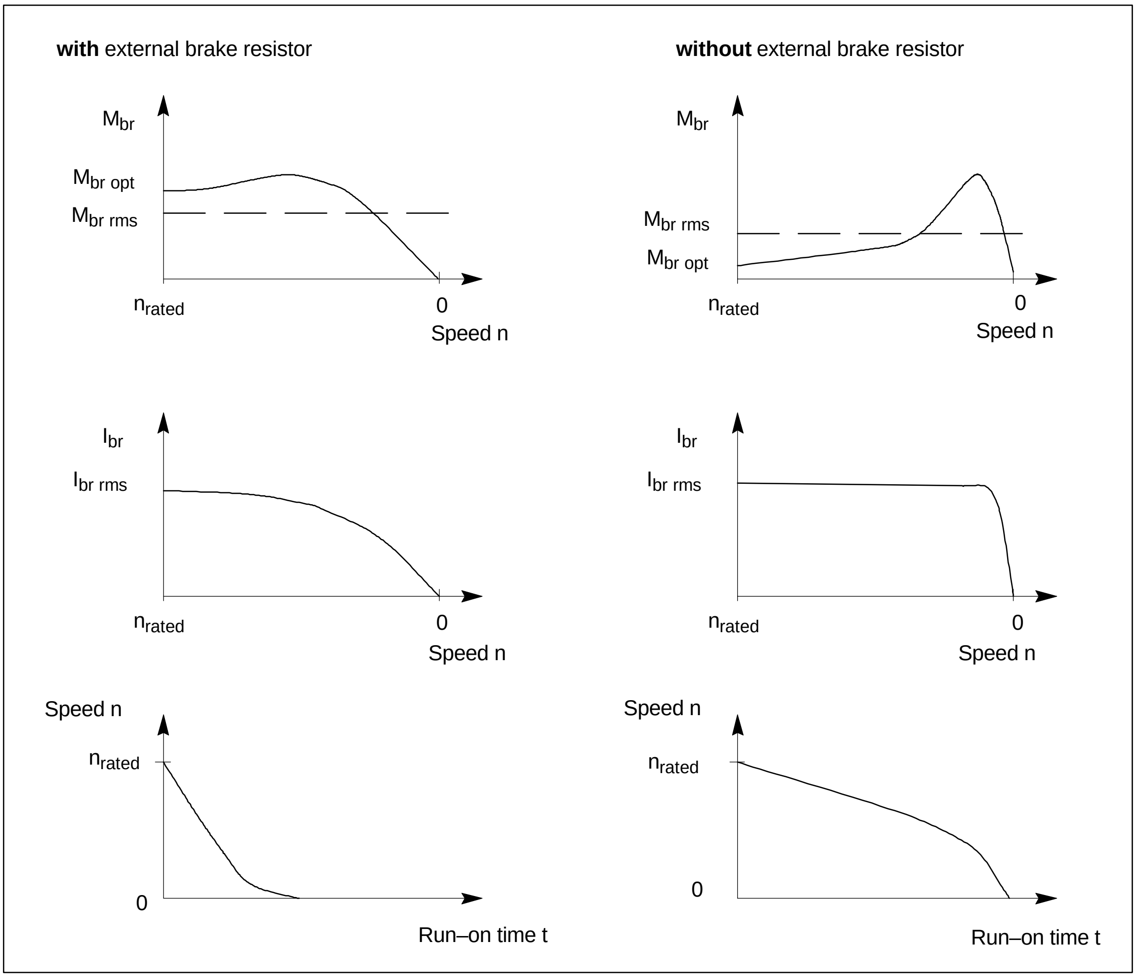

Fig. 3-1 Armature short–circuit braking

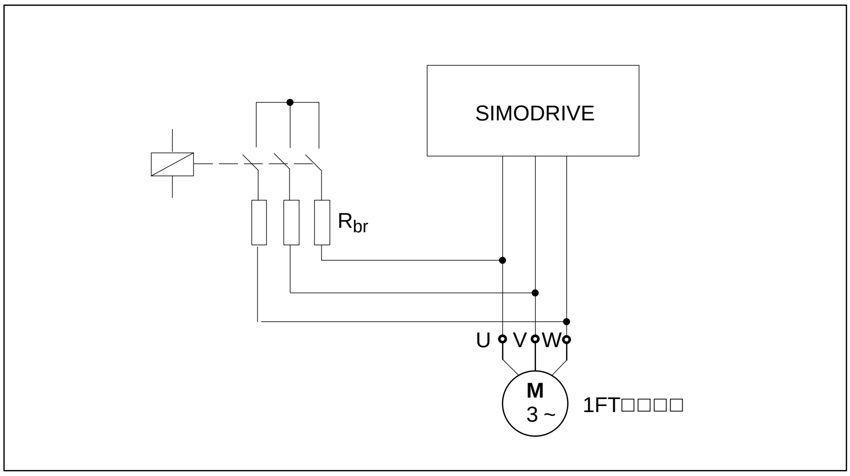

Fig. 3-2 Circuit (principle) for armature short–circuit braking

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Notes

Termination Technology 4

Pre–assembled cables reduce the assembly time and increase the operational reliability.

4.1 Power cables

Caution

Servomotors cannot be directly connected to the line supply and should only be used with the assigned SIMODRIVE 611 transistor PWM converters.

Please observe the rating plate data and adequately dimension the connecting cables (tables are included in the Guide) and ensure that these cables are strain–relieved.

For safety–relevant circuits, it should be checked for every application, whether the internal control devices in the drive converter are adequate to electrically isolate it from the line supply.

When carrying–out any work on the system, it should always be ensured that it is in a no–voltage condition (powered–down)!

Cross–sections

The permissible current load capability acc. to EN 60204–1 for PVC insulated cables with copper conductors for an ambient temperature of 40° C and routing type C (cables and conductors on panels and open cable duct) are listed in Table 4-1.

Table 4-1 Current load capability

Motor current [A] (RMS)	Cross–section for the motor connection [mm^2]	Comments
15,2	1.5	Correction factors regarding the ambient temperature and routing type can be taken from EN 60204–1.
21	2.5	
28	4.0	
36	6.0	
50	10.0	
66	16.0	
84	25.0	
104	35.0	
123	50.0	

RMS current:

1FT5: $I_{rms} = I_0 * \sqrt{2/3}$ (at standstill: $I_{rms} = I_0$!)
1FT6/1FK6: $I_{rms} = I_0$

Shielding

We recommend that all of the power cables are shielded.

!

Important

Shields should be used in the overall protective grounding concept. Open–circuit or unused cores/electrical cables which can be touched, should be connected to protective ground. If the brake feed cables in the SIEMENS cables are not used, then the braking cable conductors and shields must be connected to the cabinet ground (open–circuit cables result in capacitive charging!).

Assignment

The assignment, motor – cable cross–section – power connector is specified in the appropriate motor chapters.

4.2 Signal cables

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Pre–assembled cables offer many advantages over self–assembled cables. In addition to guaranteeing the correct function and the high quality, there are also cost benefits.

In order to eliminate any effect of noise, the signal cables must be routed separately away from the power cables.

Note

The max. cable lengths, specified in the connection overviews, must be observed.

Assignment

The signal cables which are used are described for the appropriate encoders (refer to Chapter GE).

4.3 Cable versions

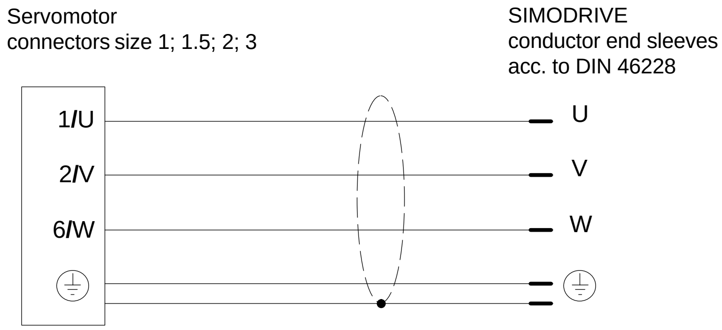
Caution

Observe the current drawn by the motor in your particular application! Adequately dimension the connecting cables corresponding to IEC 60204–1.

Pre–assembled power cables

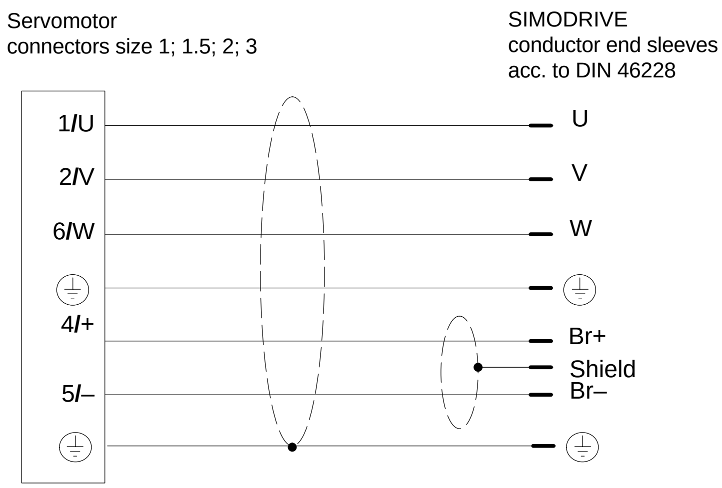
- without brake cables

Order designations: 6FX□002–5CA□□–□□□0 with overall shield
6FX□002–5AA□□–□□□0 without overall shield



- with brake cables

Order designation: 6FX□002–5DA□□–□□□0 with overall shield
6FX□002–5BA□□–□□□0 without overall shield



Note

- Cables are available in various versions.
- Technical data is provided in Catalog NC Z.

Explanation

6FX□002–□□□□□–□□□0

- Length
- Type, cross–section, connector size
- 8 = Motion connect 800 / 5 = Motion connect 500

Length code

Ordering data	Order No.
Cable, pre–assembled	6FX□ 002–□□□□□–□□□0
Length code:	
1 m to 99 m	1
100 m to 199 m	2
200 m to 299 m	3
0 m	A
10 m	B
20 m	C
30 m	D
40 m	E
50 m	F
60 m	G
70 m	H
80 m	J
90 m	K
0 m	A
1 m	B
2 m	C
3 m	D
4 m	E
5 m	F
6 m	G
7 m	H
8 m	J
9 m	K

Examples:

1 m	6FX□ 002–□□□□□–**1AB0**
2 m	6FX□ 002–□□□□□–**1AC0**
5 m	6FX□ 002–□□□□□–**1AF0**
10 m	6FX□ 002–□□□□□–**1BA0**
15 m	6FX□ 002–□□□□□–**1BF0**
18 m	6FX□ 002–□□□□□–**1BJ0**
20 m	6FX□ 002–□□□□□–**1CA0**
25 m	6FX□ 002–□□□□□–**1CF0**
50 m	6FX□ 002–□□□□□–**1FA0**
100 m	6FX□ 002–□□□□□–**2AA0**
150 m	6FX□ 002–□□□□□–**2FA0**

The complete order designations are provided in Catalog NC Z!

Connector assignments

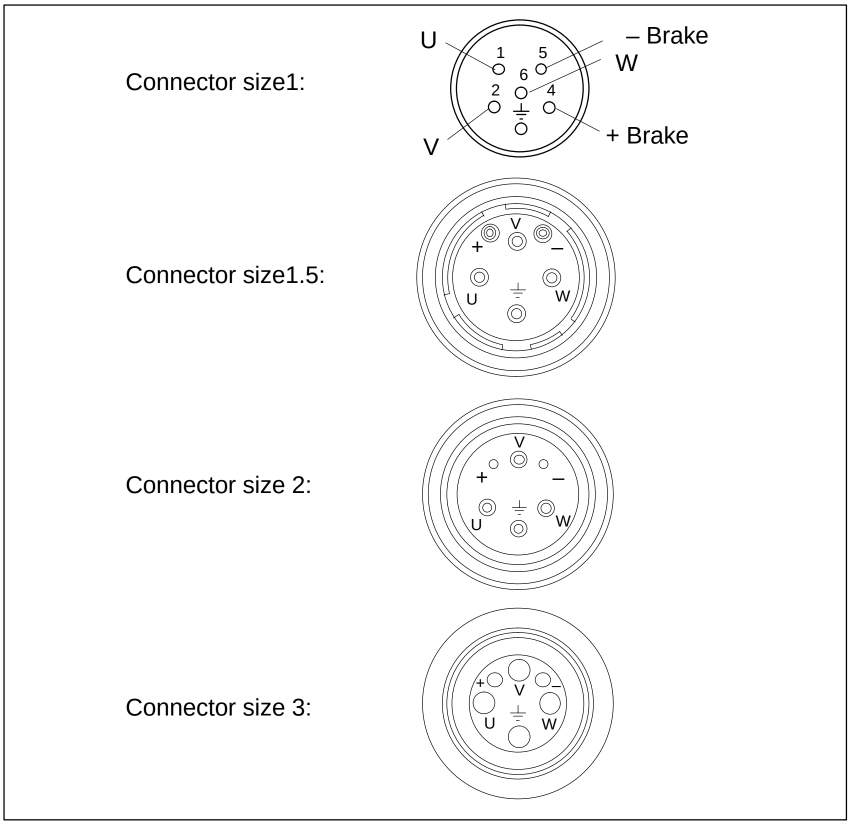


Fig. 4-1 Connector assignments (when viewing the connector side)

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ALS

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Index

General Information on AC Induction Motors

ALA

Notes

Electrical Data

1

ALA

1.1 Definitions

Mechanical limiting speed n_{max}

The maximum permissible speed n_{max} is defined by the mechanical design (bearing design, short–circuit ring of the squirrel–cage rotor etc.). This speed may **never** be exceeded!

The following load duty cycle applies:

30 %	n_{max}
60 %	2/3 n_{max}
10 %	Standstill

Max. continuous speed n_1

The maximum permissible speed which is continuously permitted without any speed duty cycles.

Electical limiting speed n1

The maximum permissible electrical speed n1 is either defined by n_{max} mechanical (refer above) or by the stall limit.

Thermal time constant T_{th}

The thermal time constant defines the temperature increase of the motor winding when the motor load is suddenly (step function) increased to the permissible S1 torque. After T_{th}, the motor reaches 63% of its S1 final temperature

S1 duty (continuous operation)

Operation with a constant load, which is so that the motor reaches its thermal steady state condition.

S6 duty (intermittent duty)

Operation, which includes a sequence of similar load duty cycles which comprises a period where the motor load is constant and a no–load period. If not otherwise specified, the power–on time refers to a 10 min. load duty cycle.

S6 – 40 %: 4 min load
6 min no–load time

Mode of operation of 1PH

Constant torque M_{rated} is available from standstill up to the rated operating point.

The constant power range starts from the rated operating point (refer to the power/speed diagrams).

At higher speeds, i.e. in the constant–power range, the maximum available torque M_{max} at a specific speed n can be approximated according to the following formula:

$$M_{max}\,[Nm] \approx 9.6 * \frac{P_{max}\,[W]}{n\,[RPM]}$$

AC motors have a high overload capability in the constant–power range. For several AC motors, the overload capability in the higest speed range is reduced. The exact data can be taken from the motor characteristics in the appropriate motor Chapters.

The motor field remains constant in the basic speed range up to the rated motor operating point. This is then followed by an additional constant–power range.

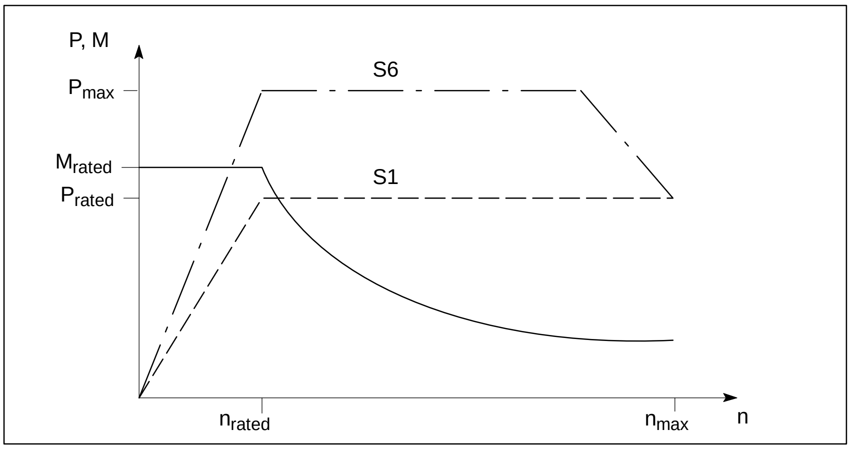


Fig. 1-1 Basic characteristics of power P and torque M as a function of the speed n (duty types according to VDE 0530 Part 1)

Power characteristics

The constant power range, for main spindle drives, with typical machining and a constant cutting power, can be extremely efficiently used and reduces the required drive converter rating.

The following limits and characteristics are, from the basic principle, valid for all main spindle motors –PWM drive converter combinations.

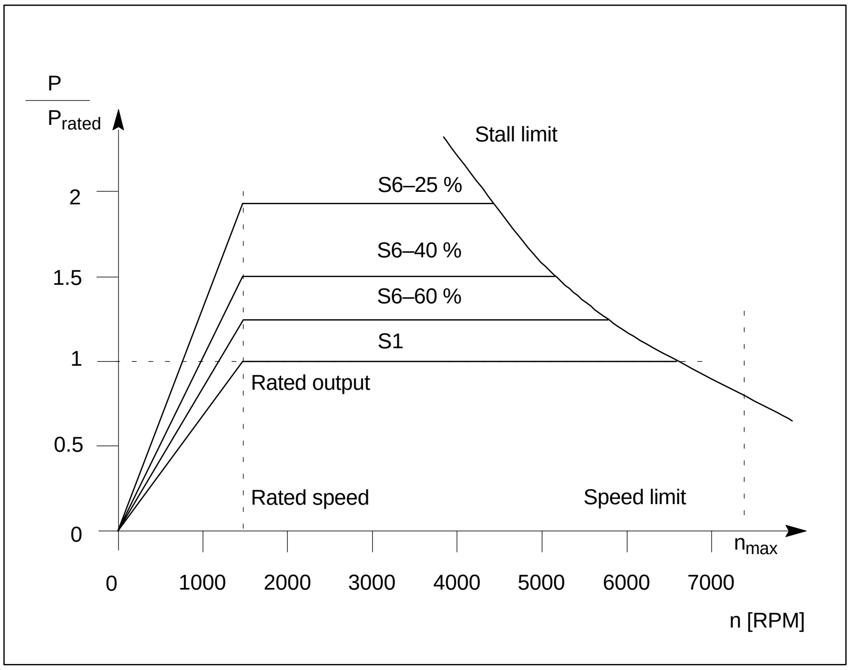


Fig. 1-2 Power characteristics, limiting and characteristics

Motor limits

For induction motors, the speed and power data are limited due to thermal and mechanical[1)] reasons. The maximum current is only limited by the thermal motor winding characteristics.

Thermal limit

Heat losses are stored in the motor and are dissipated to the cooling medium. The actual motor temperature, depends on, among other things, the load duty cycle. It must never exceed the critical motor temperature.

The characteristics for continuous duty S1 and intermittent duty S6–60 %, S6–40 % and S6–25 % define the permissible outputs at an ambient temperature of up to 40 °C. In this case, the winding temperature rise is approx. 105 K.

Mechanical limit

The mechanical limiting speed may not be exceeded. If this speed is exceeded, it can cause damage to the bearings, short–circuit rings, press fits, etc. A monitoring function in the PWM converter ensures that the limiting speed is not exceeded.

Maximum torque M_{max}

Torque, which is briefly available for dynamic operations (e.g. acceleration).

$M_{max} = 2 \cdot M_{rated}$

1) Shaft end stressing; bearing stressing

Drive converter limits

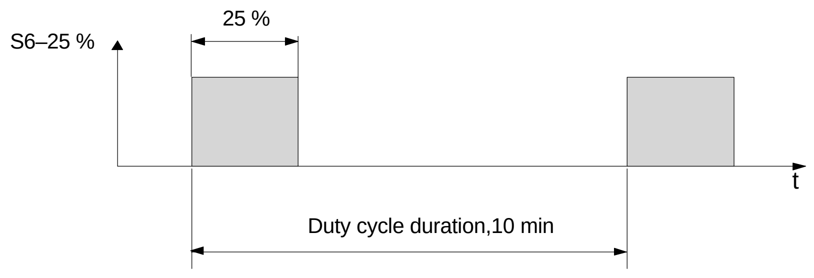
Limiting voltage characteristic (stall limit)

In the upper speed range, the drive converter provides the motor with the maximum output voltage to impress the controlled motor current. In order to guarantee that a specific current is impressed in the motor up to the maximum speed, the current and therefore the maximum available power, must be reduced with increasing speed.

Above this characteristic **(stall limit),** if more power is demanded, the speed dips. The motor or drive converter **will not be damaged**.

Thermal limit

The drive converter output is thermally limited. The short–time output increases if the power–on duration is reduced. The short–time output is defined by the short–time current.



The power–on duration is, acc. to VDE 0530, standardized for 15 %, 25 %, 40 %, 60 %. If a duty cycle is not specified, it is 10 min.

Fig. 1-3 Power–on duration in intermittent operation

Assignment, motor–power module

If the drive converter rated current exceeds the rated motor current, then the motor thermal characteristic (S1) defines the continuous output of the motor–drive converter combination.

In this case, the drive converter is not fully utilized.

In the opposite case, the drive converter rated current defines the available continuous output.

Thus, the motor is not thermally fully utilized.

If load duty cycles apply, then the motor must be selected, so that the RMS current does not exceed the permissible S1 value of the motor.

The following is generally valid:

If a range of two limit values or characteristics is defined, the lower limit defines the range which can be used.

Operation from an uncontrolled infeed

The drive modules can be operated from the uncontrolled and controlled infeed modules of the SIMODRIVE 611 drive converter system. The engineering and power data in the Catalog refer to operation with the controlled infeed/regenerative feedback modules. This data may have to be corrected for operation from uncontrolled infeed modules.

ALA

When operating main spindle and induction motor modules from an uncontrolled infeed (UE module), a lower maximum motor output is available in the upper speed range than when using the infeed/regenerative feedback module (refer to the diagram).

As a result of the lower DC link voltage of 490 V for the UE module, the available continuous output is given by the following:

If $V \quad < 1.5 * V$ then, as continuous output, only

$$P_{continuous} = P_N * \frac{V_{DClink}}{1.5 * V_{N\,motor}}$$ can be used at rated speed.

$V_{DC\,link}$ 490 V for UE modules
$V_{DC\,link}$ 600 V for I/R modules

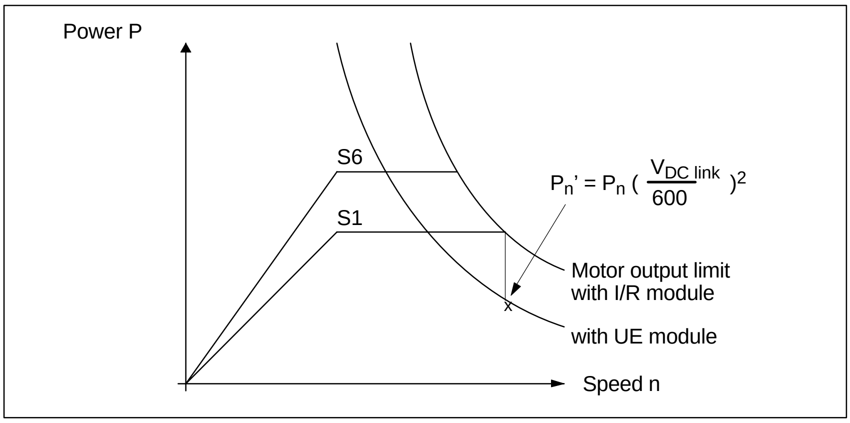


Fig. 1-4 Power–speed diagram, general

For UE modules, it must also be ensured, that regenerative braking energy does not exceed the pulsed resistor rating:

- Infeed module, 5 kW
  200 W continuous output (regenerative feedback power)
  10 kW short–time power for 120 ms once every 10 s load duty cycle without a pre–load condition
- Infeed module, 10 kW
  300 W continuous output (regenerative power)
  25 kW short time power for 120 ms once every 10 s duty cycle without a pre–load condition.

- 28 kW infeed module
  max. 2 x 300 W continuous output
  max. 2 x 25 kW short–time output for 120 ms, once per 10 s duty cycle without pre–load condition
  or
  max. 2 x 1.5 kW continuous output
  max. 2 x 25 kW short–time output for 12 ms, once per 10 s duty cycle without pre–load condition

For higher regenerative powers, a separate pulsed resistor module must be used, or the regenerative power must be reduced by using longer braking times.

Power–speed diagram

Outputs for duty types S1 and S6

The duty types are defined in IEC 60034, Part 1. For duty types S1 and S6, according to IEC 60034, Part 1, a maximum duty cycle of 10 min. is defined, if no other information is specified.

All of the output data specified for AC motors refers to continuous operation and corresponds to duty type S1.

For many applications, duty type S1 is not applicable, e.g. if various load levels apply as a function of time. In these cases, an equivalent sequence can be specified, which represents, as a minimum, the same motor load.

Duty type S6–... can be considered as valid for the particular application.

(S6 = continuous operation with intermittent load).

In order to handle shorter accelerating time and torque surges, a peak current is available for 10 seconds within the 60–second cycle. The power module currents (S1/S6–40%/peak current) are specified in the diagrams.

Core types

Core types are a subset of the total motor range. Core types have shorter delivery times, and in some cases, are available ex–stock. The range of options is limited. They have a different order designation.

1.2 Rating plate data

Rating plate data for shaft heights 100 to 225

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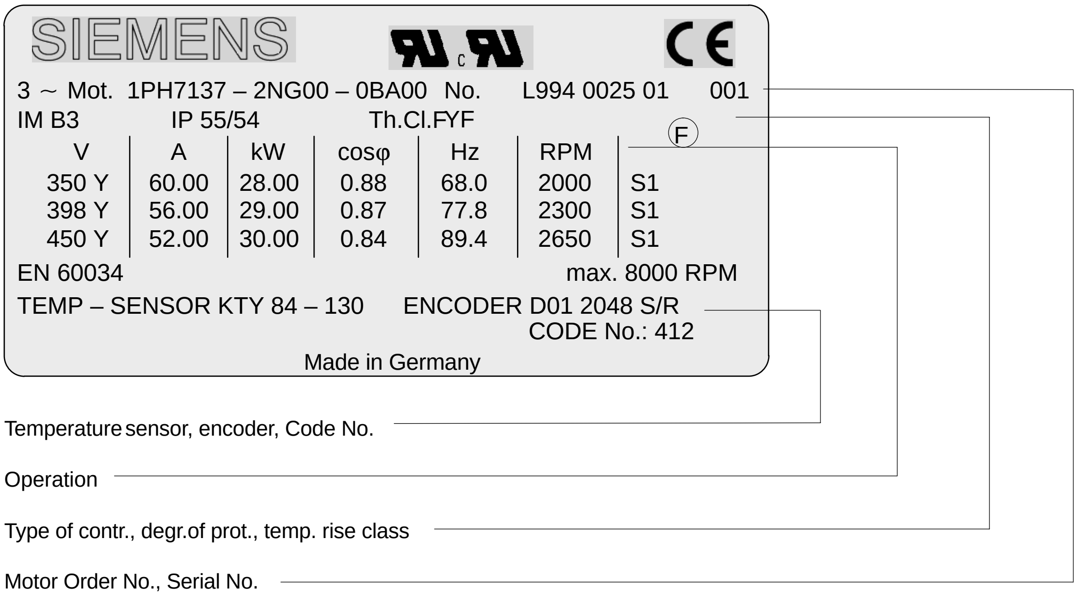
Example:
Shaft height 132



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Notes

Mechanical Data for 1PH4 and 1PH7

2

ALA

2.1 Definitions

Types of construction

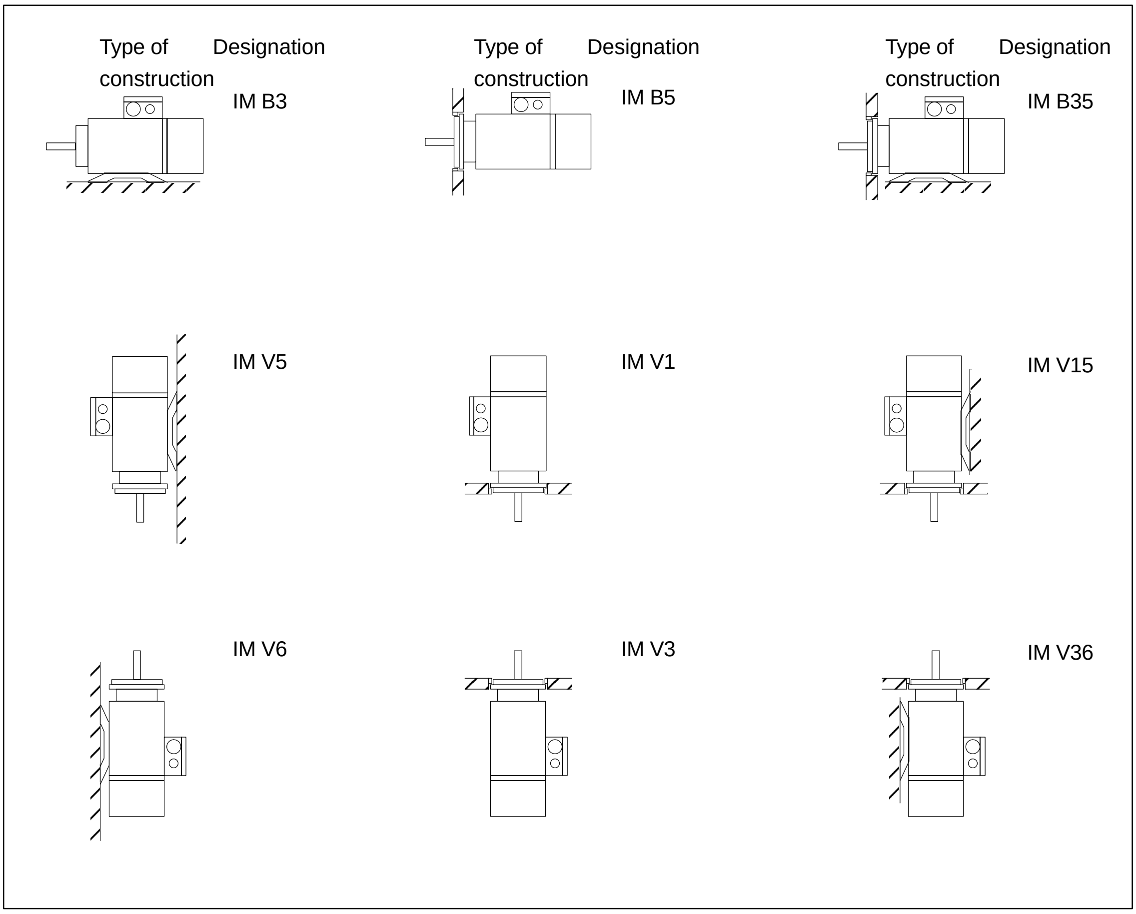

Fig. 2-1 Types of construction

Vibration severity limit values

Generally, a high cantilever force load capability cannot be provided in conjunction with high speed and high vibration quality as the various requirements require different bearing designs.

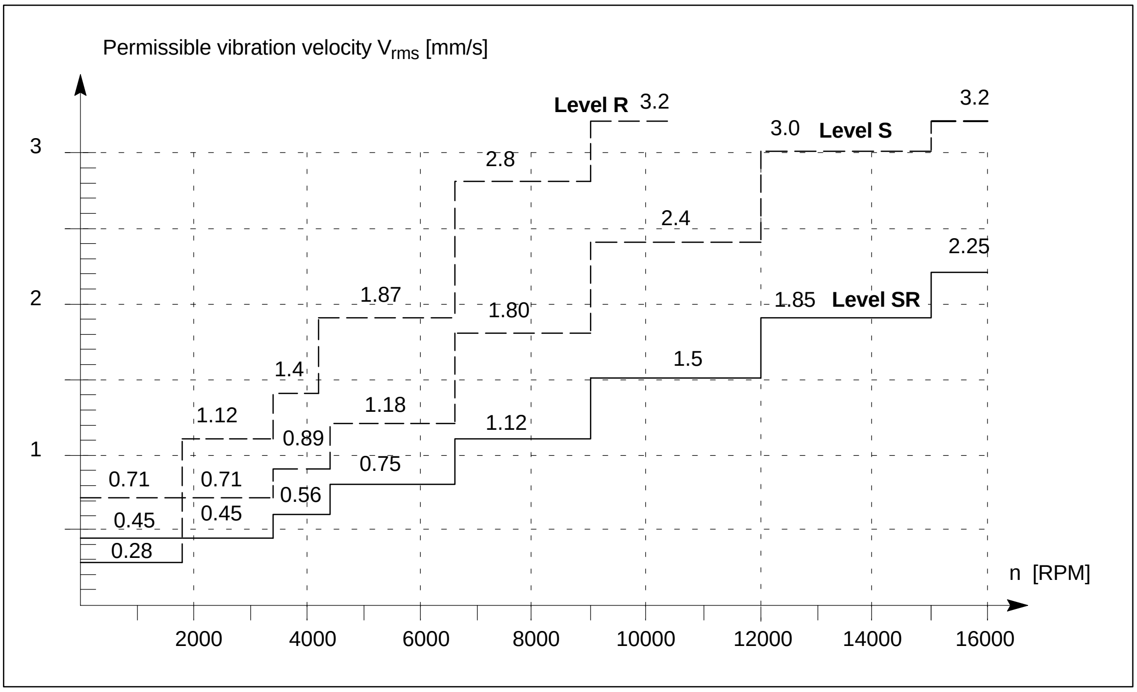

Fig. 2-2 Vibration severity – limit values, AC motors, shaft heights 100 mm to 132 mm

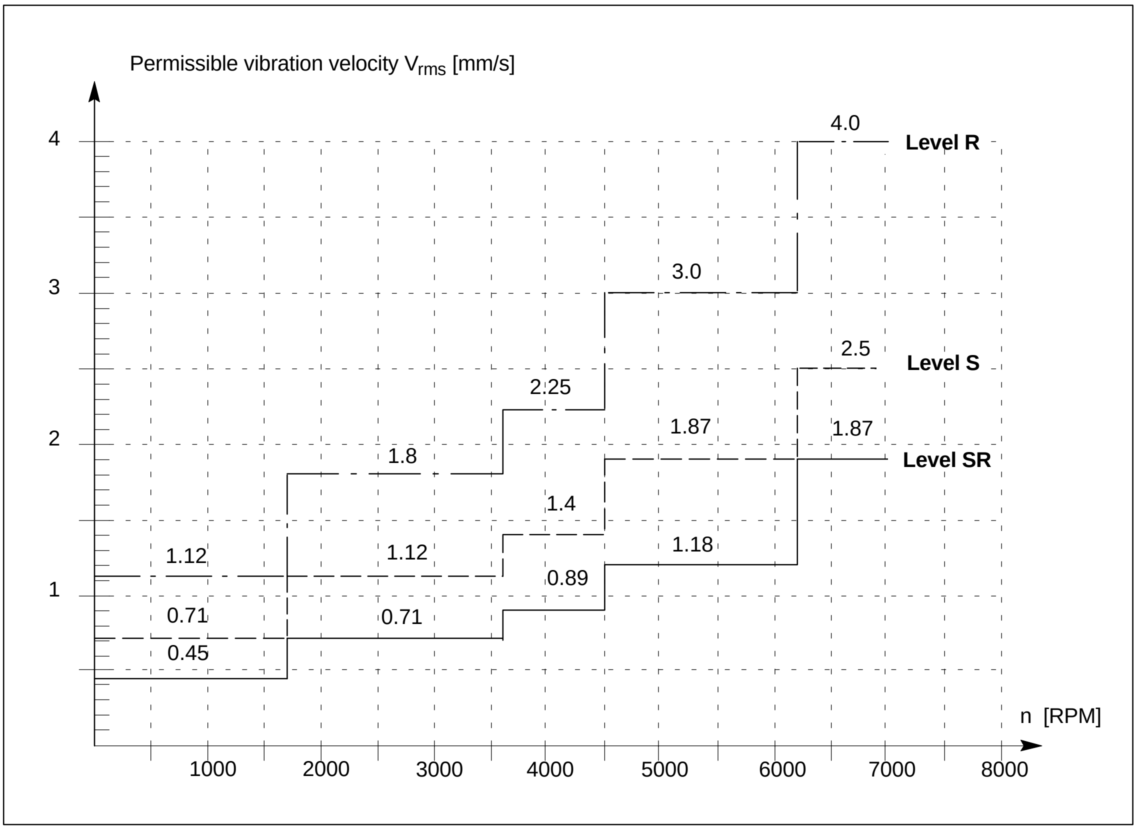

Fig. 2-3 Vibration severity, AC motors, shaft heights 160 mm to 225 mm

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Requirements when balancing mounted components, especially belt pullies

The vibration quality of motors with mounted belt pullies, in addition to the motor balancing quality, is essentially defined by the balancing quality of the mounted part or component.
If the motor and mounted component are separately balanced before assembly, the balancing process for the belt pulley must be adapted to the motor balancing type. For main spindle motors 1PH4 and 1PH7, a differentiation must be made between the following balancing types:

– half–key balancing
– full–key balancing
– smooth shaft end (no key).

For 1PH7 motors, the balancing type is coded in the order designation. Half and full–key balanced motors can be identified by an ”H” (half key) or ”F” (full key) at the face end of the shaft.
The following table describes the balancing requirements as a function of the motor balancing type.
We recommend motors with a smooth shaft (without keyway) if the highest system vibration quality is too be achieved. For full key–balanced motors, we recommend belt pullies with two keyways on opposite sides of the shaft, however, only one key in the shaft end.

Table 2-1 Balancing process

Balancing equipment / process step	Motor half key balancing	Motor full key balancing	Motor with smooth shaft end
Auxiliary shaft to balance the mounted component	–auxiliary shaft with keyway –keyway with the same dimensions as the motor shaft end –auxiliary shaft, half–key balanced	–auxiliary shaft with keyway –keyway design with the exception of the keyway width (same as the motor) can be freely selected –Auxiliary shaft, full–key balanced	–auxiliary shaft without keyway –auxiliary shaft, if required with taper
	–Balance quality of the auxiliary shaft ≤10% of the required balancing quality of the mounted components		
Attach the component to the auxiliary shaft for balancing	–attach with key –key design, dimensions and material the same as the motor shaft end	–attach with key –keyway design, dimensions and materials the same as for full–key balancing of the auxiliary shaft	–attach with the lowest possible play, e.g. slight press fit on the tapered auxiliary shaft
Position of the mounted component on the auxiliary shaft when balancing	–select the position between the mounted components and keyway or the auxiliary shaft as in the mounted condition	–no specific requirements	
Balancing the mounted components	–we recommend a two–plane balancing technique, i.e. balancing in two planes at both sides of the mounted component at right angles to the axis of rotation		

Cantilever force

In order to guarantee perfect, smooth running operation, specific cantilever forces may not be exceeded.

For various shaft heights, a minimum force may not be fallen below. This can be seen from the cantilever force diagrams.

The cantilever force diagrams in the motor Chapters show the cantilever force F_Q

- at various operating speeds
- as a function of the bearing lifetime

The force diagrams and tables are only valid for standard drive shaft ends; for non–standard drive shaft ends, dimensions are defined depending on the particular application, corresponding to the permissible force loads.

Please contact us for forces which go beyond these values.

Caution

- For coupling and belt drives:

  If you use mechanical transmission elements, which subject the shaft end to a cantilever force, then you must ensure that the maximum limit values, specified in the cantilever force diagrams, are not exceeded.

- Only for belt drives (shaft heights 180 and 225):

  For applications with extremely low cantilever force loads, it should be ensured that the motor shaft is subject to the minimum cantilever force specified in the diagrams. If cantilever forces are too low, this can cause the bearings to roll in an undefined fashion, which can result in increased bearing wear.
  For applications with cantilever force loads, which are lower than the specified minimum cantilever forces (e.g. coupling drive), the bearing design used for the belt drive may not be used.
  For these applications, the induction motor must be ordered with a bearing design for a coupling–type drive.

Note

- The precise dimensioning of the cantilever forces at the shaft end must be made in accordance with the belt manufacturer's guidelines.

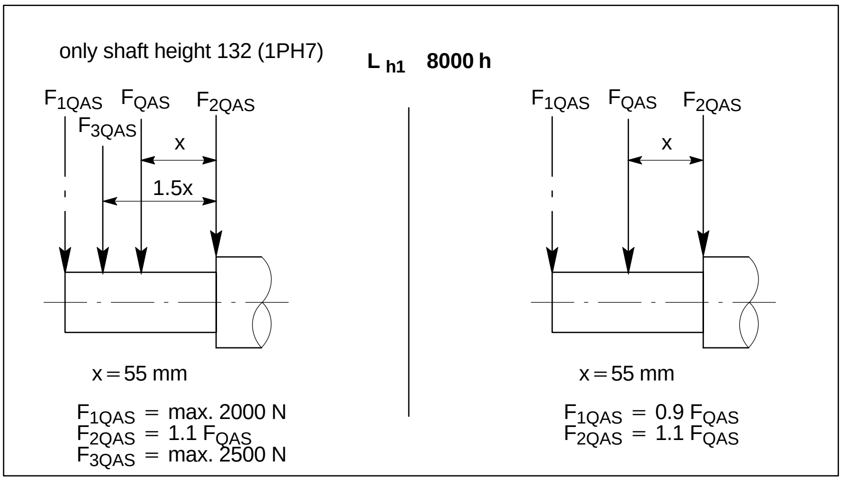

Fig. 2-4 Point of application of cantilever forces at the motor shaft end

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

- Total cantilever force: $F_Q = c * F_U$

  Pre–tensioning factor c is an experience value of the belt manufacturer. It can be assumed as follows:

  – for belts c = 1.5 to 2.5

  – for special plastic belts (flat belts), depending on the load type and belt design c = 2.0 to 2.5

The circumferential force F_U is calculated using the following equation:
$F_U = 2 * 10^7 * P/(n * D)$ in [N]

F_U	[N]	Circumferential force
D	[mm]	Belt pulley diameter
P	[kW]	Motor output
n	[RPM]	Motor speed

- Lifetime (L_h)

Estimated lifetime for revised operating conditions (F_{QAS}; n)

$$L_{h\,tot} = \frac{100}{\frac{q1}{L_{h1}} + \frac{q2}{L_{h2}} + \frac{q3}{L_{h3}}}$$

L_h = from the diagram
q = time for which it is effective with constant conditions [%]

Axial force stressing

The axial force acting on the locating bearing comprises an external axial force (e.g. gearbox with helical teeth, machining forces through the tool), a bearing alignment force and possibly the force due to the weight of the rotor when the motor is mounted vertically. This results in a maximum axial force which is dependent on the direction.

When using, for example, gearwheels with inclined teeth as drive element, in addition to the radial force, the bearing is also subject to an axial force. For axial forces in the direction of the motor, the bearing alignment force can be overcome so that the rotor moves according to the actual bearing axial play present (up to 0.2 mm). The maximum operational axial force F_{AZ} is calculated as a function of the motor mounting position.

The maximum permissible axial force is calculated as follows depending on the mounting position:

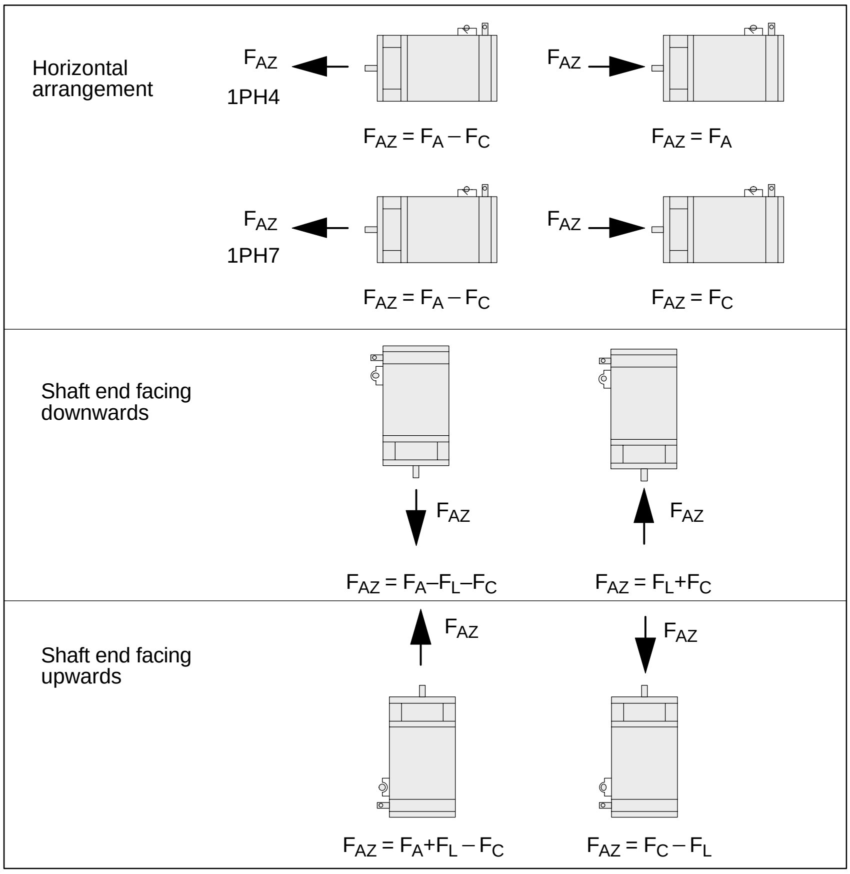


Fig. 2-5 Permissible axial force for 1PH7 motors

F_{AZ} Operational axial force
F_A Permissible axial force as a function of the average speed
F_C Bearing alignment force, refer to the Tables, Pages 1PH4/3–13 and 1PH7/3–48
F_L Force due to the rotor weight, refer to the Tables, Pages 1PH4/3–13 and 1PH7/3–49

2.2 Termination technology

AC motor connection

The type of terminal box used, the number of terminals, cross–sections which can be connected, number of auxiliary terminals and cross–section for the PE connection are specified in the following tables.

Table 2-2 Overview of the termination technology for 1PH4 motors

Motor	No. of main terminals	Max. cross–section	Terminal strip for the temperature sensor	PE connection size/cable lug width
Shaft height100	3xM5	16 mm^2	3 terminals	M4/9 mm
Shaft height 132	3xM5	35 mm^2 with cable lug connection	3 terminals	M5/15 mm
Shaft height160	3xM10	70 mm^2 with cable lug connection	3 terminals	M6/15 mm

Table 2-3 Overview, termination technology for 1PH7

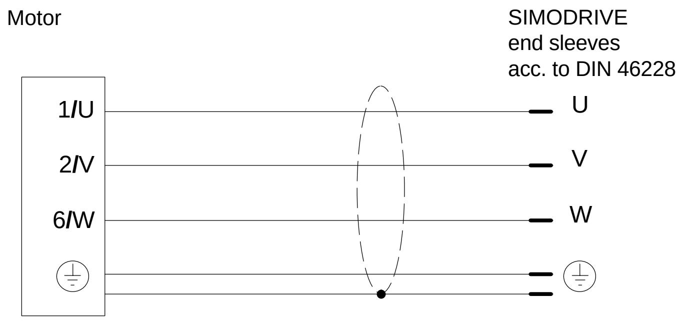
Motor	No. of main terminals	Max. cross–section	Terminal strip for the temperature sensor	PE connection size/cable lug width
Shaft height 100	6xM5	25 mm^2	3 terminals	M5/9 mm
Shaft height 132	6xM6	35 mm^2 with cable lug connection	3 terminals	M6/15 mm
Shaft height 160	6xM6	50 mm^2 with cable lug connection	3 terminals	M6/15 mm
Shaft height 180	3xM12	2 x 50 mm^2 with cable lug connection	4 terminals	Without cable lug, using a terminal clamp[1)]
Shaft height 225	3xM12	2 x 50 mm^2 with cable lug connection	4 terminals	Without cable lug, using a terminal clamp[1)]

Caution

Please observe the motor current for your particular application! Please dimension the connecting cables adequately in compliance with IEC 60204-1.

1) Cable cross–section corresponds to the supply feeder cable cross–section

Power cable



Note

- The cables are available in a UL version, or for higher mechanical requirements.
- The Technical data are included in Catalog NC Z.

Connection information

Note

The system compatibility is only guaranteed when shielded power cables are used.

The shields should be included in the protective grounding concept. Open–circuit or cores/conductors which are not used/cables which can be touched, should be connected to the protective ground. If the brake feeder cables are not used in the SIEMENS accessory cables, then the brake conductors and shields should be connected to the cabinet ground (open–circuit cables/conductors result in capacitive charging!).

Warning

- Before carrying–out any work on the AC motor, ensure that the motor is disconnected and is locked–out so that it cannot be powered–up!
- Observe the rating plate data and the circuit diagram in the terminal box. The connecting cables must be adequately dimensioned.

- The motor cables should be twisted or a three–core cable with additional ground conductor must be used. The insulation must be removed from the cable ends, so that the remaining insulation extends to the cable lug or the terminal.
- The connecting cables must be arranged in the terminal box so that the protective conductor has some excess length and so that the conductor insulation cannot be damaged. The connecting cables must be strain–relieved.
- Ensure that the following minimum air clearances are maintained: Supply voltages up to 500 V: Minimum air clearance 4.5 mm.

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- After connecting–up, it should be checked that
  - the inside of the terminal boxes are clean and free of cable pieces,
  - all of the terminal screws are tight,
  - the minimum air clearances are maintained,
  - the cable glands are reliably sealed,
  - unused cable glands are closed and the caps are tightly screwed–in, and
  - all of the sealing surfaces are correct
- For air–cooled motors, the cooling air paths should be regularly cleaned depending on the level of pollution at the mounting location. They can be cleaned, e.g. using dry, oil–free compressed air. For TEFC motors, it is sufficient if the inside of the motor is cleaned at the normal maintenance/service intervals.

  For water–cooled motors, the cooling conditions (liquid inlet temperature, liquid quantity, cooling power are maintained. The cooling medium may have to be cleaned using a filter before it is fed into the motor cooling circuit.

Press drives

Note

For press drives with acceleration rates > 2g, special measures are required. Please contact your local Siemens office.

Cross –sections

When connecting to the terminal panel, the connecting cables should be dimensioned corresponding to the rated current and the size of the cable lugs should be selected, according to the dimensions of the terminal studs. Table 2-4 specifies the current load capacity according to EN60204–1 for PVC–insulated cables with copper conductors for an ambient temperature of 40°C and routing type C (cables and conductors routed along walls, panels and cable ducts).

Table 2-4 Current load capacity

I_{rms} at+40 °C [A]	Required cross–section [mm^2]	Comments
11.7	1	Correction factors regarding ambient temperature and routing type should be taken from EN60204–1.
15.2	1.5	
21	2.5	
28	4	
36	6	
50	10	
66	16	
84	25	
104	35	
123	50	
155	70	
192	95	
221	120	

Power cables

Table 2-5 Power cables for 1PH motors (sold by the meter)

Core number x cross–section [mm^2]	Power cable (sold by the meter) Order No.
4 x 1.5	6FX□008 - 1□□11 - □□A0
4 x 2.5	6FX□008 - 1□□21 - □□A0
4 x 4	6FX□008 - 1□□31 - □□A0
4 x 6	6FX□008 - 1□□41 - □□A0
4 x 10	6FX□008 - 1□□51 - □□A0
4 x 16	6FX□008 - 1□□61 - □□A0
4 x 25 + 2 x 1.5	6FX□008 - 1BA25 - □□A0
4 x 35 + 2 x 1.5	6FX□008 - 1BA35 - □□A0
4 x 50 + 2 x 1.5	6FX□008 - 1BA50 - □□A0

Draggable **8**
Not draggable **5** (only with overall shield)

w/out brake cable: with overall shield B B

with brake cable: (2 x 1.5) with overall shield B A

Supplied lengths			
	for 25 mm^2 to 50 mm^2	10 m	1 B
	for 1.5 mm^2 to 50 mm^2	50 m	1 F
		100 m	2 A
	for 1.5 mm^2 to 6 mm^2	200 m	3 A
	(on request)	500 m	6 A

The power cables for 1PH motors are selected depending on the rated motor current I_{rated} at +40 °C acc. to Table 2-4.

Signal cable

The signal cable is described in the Chapter Encoders (GE).

Pre–assembled cables offer many advantages over customer–assembled cables. The cable function is guaranteed, and the high quality also results in cost benefits.

In order to avoid the influence of noise (e.g. as a result of EMC), the signal cables must be routed separately away from the power cables.

Note

The maximum cable lengths, specified in the connetion overview, must be observed.

Note

- Performance and standard power and signal cables are available.
- The technical data are provided in Catalog NC Z.

■

Notes

Planning

3

ALA

Selection

A differentiation must be made between three applications when selecting a suitable 1PH motor:

Case 1: The motor essentially operates in continuous operation.

Case 2: The drive is dimensioned according to the periodic load duty cycle.

case 3: A high field–weakening range is required.

Case 1

A motor should be selected, whose S1 output is the same or greater than the required drive output.

Using speed–power diagrams, it should be checked as to whether the output is available over the required speed range. If required, a larger motor must be selected.

Case 2

The drive is dimensioned according to the load duty cycle.

It is assumed that the speeds are below the rated speed during the load duty cycle.

If the torques during the load duty cycle are not known, but only the power, then the power can be converted into a torque using the following equation:

$M = P * 9550/n$, M in Nm, P in kW, n in RPM

The torque, which the motor must provide, comprises the friction torque $M_{Friction}$, the load torque M_{Load} of the driven machine and the accelerating torque M_B:

$M = M_{Friction} + M_{Load} + M_B$

The accelerating torque M_B is calculated as follows:

$$M_B = \frac{\pi}{30} * J_{Motor+load} * \frac{\Delta n}{t_B} = \frac{J_{Motor+load} * \Delta n}{9.55 * t}$$

M_B	Accelerating torque in Nm referred to the motor shaft (on the motor side)
$J_{Motor+load}$	Total moment of inertia in kgm^2 (on the motor side)
Δn	Speed range in RPM
t_B	Accelerating time in s

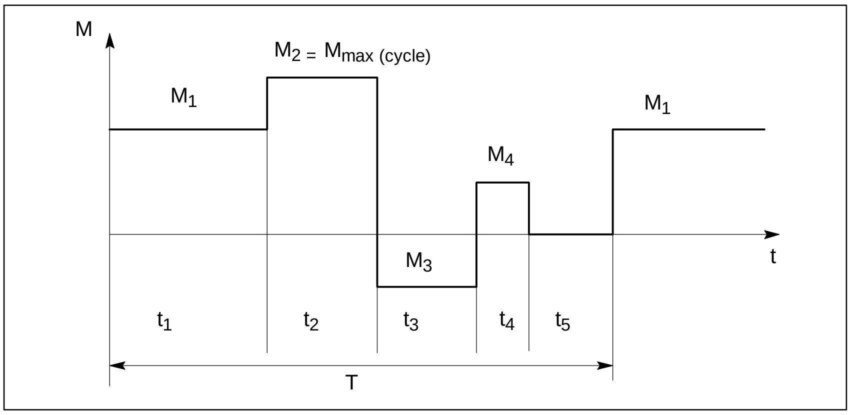

Fig. 3-1 Load duty cycle with 1PH6– motor

The RMS torque M_{rms} must be calculated from the load cycle:

$$M_{rms} = \sqrt{\frac{M_1^2 * t_1 + M_2^2 * t_2 ...}{T}}$$

Motor selection

Depending on the period T and the shaft height–dependent thermal time constant T_{th} of the motor, a differentiation should be made as follows:

- $T/T_{th} \leq 0.1$ (for a period of between 2 and 4 min)

  A motor, with rated torque M_n should be selected:

  $M_n > M_{rms}$ **and** $M_{max\ (cycle)} < 2M_n$

- $0.1 \leq T/T_{th} \leq 0.5$ (for a period of between approx. 3 min and approx 20 min)

  A motor with a rated torque M_n should be selected:

  $$M_n > \frac{M_{rms}}{1.025 - 0.25 * \frac{T}{T_{th}}}$$ **and** $M_{max\ (cycle)} < 2M_n$

- $T/T_{th} > 0.5$ (for a period of approx. 15 min)

  If, for load duty cycles, torques above M_n occur for longer than 0.5 T_{th}, then a motor with a rated torque $M_n > M_{max\ (cycle)}$ should be selected.

Drive converter selection

The currents, required under overload conditions, are specified in the power–speed diagrams (powers for S6–25 %, S6–40 %, S6–60 %). Intermediate values can be interpolated.

Example:

Moment of inertia of the motor+load: J = 0.2 kgm^2, the friction can be neglected.

ALA

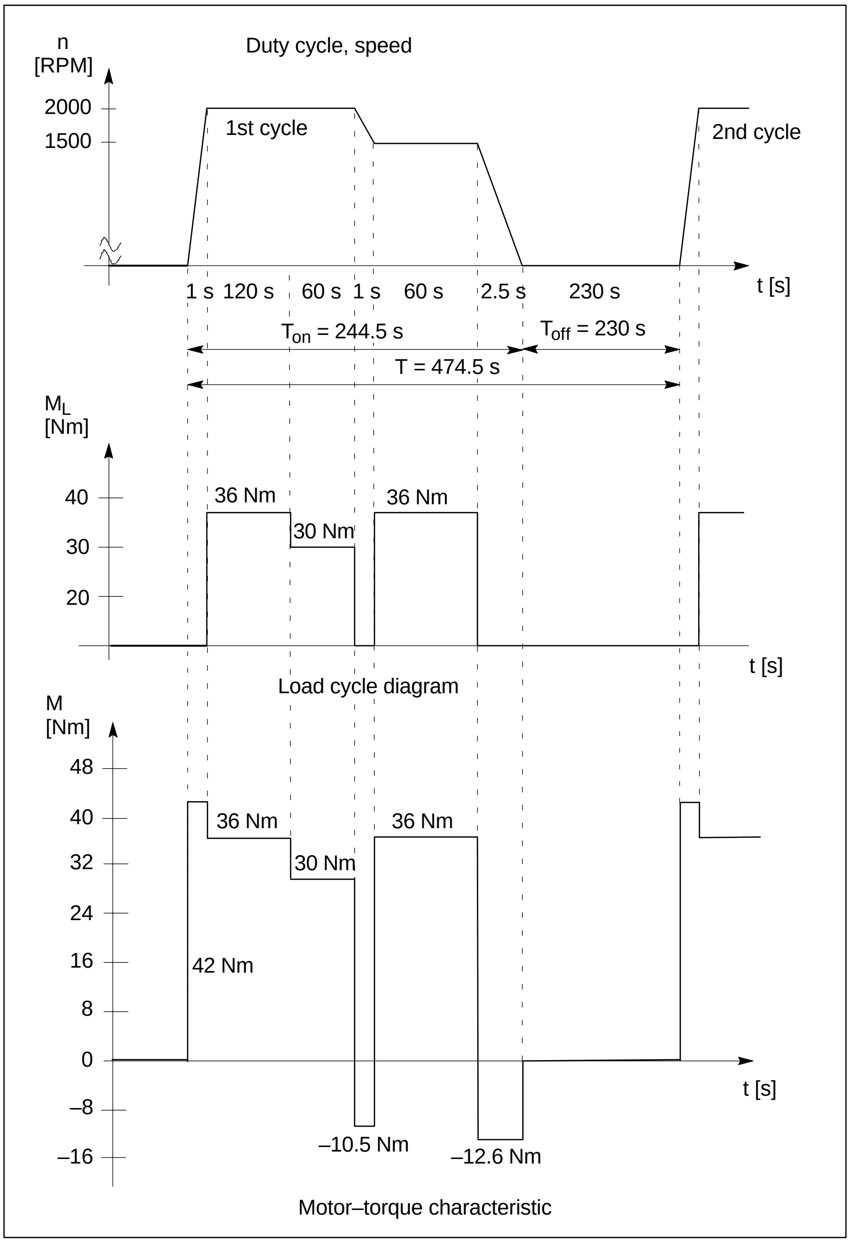

Fig. 3-2 Load duty cycle as example

Calculating the accelerating torques

$$M_B = \frac{J * \Delta n}{9.55 * t_a}$$

Accelerating for 1 s from 0 to 2000 RPM:

$$M_B = \frac{0.2 * 2000}{9.55 * 1} \text{ Nm} = 41.8 \text{ Nm} \approx 42 \text{ Nm}$$

Braking for 1 s from 2000 to 1500 RPM:

$$M_B = \frac{0.2 * (-500)}{9.55 * 1} = -10.5 \text{ Nm}$$

Braking for 2.5 s from 1500 to 0 RPM:

$$M_B = \frac{0.2 * (-1500)}{9.55 * 2.5} = -12.6 \text{ Nm}$$

Maximum torque M_{max}: 42 Nm for 1 s

Calculating the RMS motor torque in the operating cycle (duty cycle)

$$M_{rms} = \sqrt{\frac{M_1^2 * t_1 + M_2^2 * t_2 + ... + M_n^2 * t_n}{T}}$$

$$M_{rms} = \sqrt{\frac{42^2 * 1 + 36^2 * 120 + 30^2 * 60 + (-10.5)^2 1 * 1 + 36^2 * 60 + (-12.6)^2 * 2.5}{474.5}}$$

M_{rms} = 24.7 Nm ≈ 25 Nm

Motor selection:

With the data:	Speed	2000 RPM
	Maximum motor torque M_{max}:	42 Nm
	RMS motor torque:	25 Nm

a motor with n_n = 2000 RPM, $M_n \geq$ 25 Nm
is selected from the torque characteristics.

Drive converter selection

From the power–speed diagram:
The power at rated speed and 42 Nm maximum torque should be entered. The current requirement can be determined from the characteristics.

ALA

Case 3

A field–weakening operation is required

For applications with a field–weakening range greater than that for standard 1PH motors, as listed in the motor chapters, proceed as follows:

Starting from the maximum speed n_{max} and the power required at that speed P_{max}, a motor should be selected, which provides the required output P_{max} at this operating point (n_{max}, P_{max}).

It should then be checked, whether the motor can provide the torque and the output at the required transition speed for the particular application (n_n, P_n).

Example 4:

Power P_{max} = 8 kW at n_{max} = 5250 RPM is required.
The field–weakening range should be 1 : 3.5.

The transition speed, demanded for this particular application, would then be 5250/3.5 RPM = 1500 RPM.

The power–speed diagram shows, as solution, a motor with e.g.
P_n = 9 kW, n_n = 1500 RPM, M_n = 57 Nm.

■

Notes

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ALA

Notes

1FT5 AC Servomotors

1FT5

Notes

Motor Description 1

1.1 Characteristics and technical data

Application

The 1FT5 series was developed for use on a wide range of machine tools. In conjunction with the SIMODRIVE 611 analog drive converter system, the motors, among other things, admirably suited for feed drives on lathes and milling machines, machining centers, for grinding and special–purpose machines, robots, handling equipment and for woodworking.

They can be directly mounted onto feed spindles and gearboxes with toothed wheels or toothed belts.

Warning

The motors are not suitable for direct online operation (they cannot be connected directly to the line supply).

Characteristics

Depending on the shaft height, the 1FT5 series has stall torques from 0.9 to 185 mm at rated speeds from 1200 to 6000 RPM. They have a high overload capability over the complete speed range.

Standards, regulations

The appropriate standards, regulations are directly assigned to the functional requirements.

Technical features

The motors are designed for operation on a 600 V DC link and are impressed with a squarewave current. Together with the analog SIMODRIVE 611, they form a complete drive system.

For DC link voltages which differ from 600V (max. 700V), the voltage limiting characteristic is shifted as described in Chapter ALS/1.1.

Note

If the drive converter is connected to, for example, a 480 V supply, DC link voltages are obtained > 600 V. The following restriction applies: Shaft heights 36, 48, 63, 71 may only be utilized according to the ΔT=60 K limit values.

Table 1-1 Motors, standard version

Technical features	Version
Motor type	Permanent–magnet synchron. 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
Cooling (acc. to EN 60034–6; IEC 60034–6)	Non–ventilated
Thermal motor protection (acc. to IEC and EN 60034–11)	PTC in the stator winding

Table 1-1 Motors, standard version

Technical features	Version
Shaft end (acc. to DIN 748–3; IEC 60072–1)	Cylindrical; with keyway and key; tolerance zone k6
Rating plate	A second rating plate is provided for core types
Radial eccentricity, concentricity and axial eccentricity (acc. to DIN 42955; IEC 60072–1)	Tolerance N (standard)
Vibration severity (acc. to EN 60034–14; IEC 60034–14)	Degree N (standard)
Balancing (acc. to IEC and EN 60034–14)	Full–key balancing
Bearings	Deep–groove ball bearings with permanent lubrication (lifetime lubrication) Bearing lifetime > 20000 h locating bearing at the drive end
Stator winding insulation (acc. to EN 60034–1; IEC 60034–1)	Temperature rise class F for a winding overtemperature of ΔT = 100 K for an ambient temperature of 40 °C.
Installation altitude (acc. to IEC and EN 60034–1)	≤ 1000m above sea level, otherwise de–rating (VDE0530) 2000 m factor 0.94 2500 m factor 0.9
Magnet materials	Rare–earth materials
Electrical connection	Connectors for power and encoder signals • The connector outlet direction can be selected
Encoder system	Integrated analog tachometer • Speed sensing Magnetic sensor or Hall sensors • Sensing the rotor position

Options

Table 1-2 Options

Technical features	Version
Degree of protection (acc. to EN 60034–5; IEC 60034–5)	IP 67, IP 68 (only non–ventilated)
Cooling	Force ventilated
Shaft end (acc. to DIN 748–3; IEC 60072–1)	Cylindrical without key (DIN 6885); tolerance zone k6
Radial eccentricity, concen–tricity and axial eccentricity (DIN 42955; IEC 60072–1)	Tolerance R
Vibration severity (acc. to EN 60034–14; IEC 60034–14)	Degree R
Integrated/mounted comopnents	• Fail–safe holding brake; 24 V ± 10% supply voltage (acc– to DIN 0580 7/79) • Working brake (shaft heights 71, 100, 132) • Integrated pulse encoder (shaft height 63–132) • Mounted pulse encoder • Prepared for encoder mounting • Mounted planetary gearbox

1FT5

Technical data

Core types have a grey background.

100 K values are specified in the table.

Table 1-3 Technical data, 1FT5 motors, continued

Rated speed [RPM]	M_0 [Nm]	M_{rated} [Nm]	Motor type 1FT5–	Motor current I_0 [A]	Rated drive converter current [A]	P_{calc} [kW]	Connector size	Cross–section[1)] [mm²]	Cable type 6FX□[4)]002–
1200	33	31	102–□AA71	12.5	12.5	3.9	2	4x2.5	5□A02–1□□0
	45	40	104–□AA71	17	25	5.0	2	4x2.5	5□A02–1□□0
	55	47	106–0AA71	20.5	25	5.9	2	4x2.5	5□A02–1□□0
	68	55	108–0AA71	25.5	25[1)]	6.9	2	4x2.5	5□A02–1□□0
	75	55	132–0AA71	28	40	6.9	2	4x4	5□A12–1□□0
	90	65	134–0AA71	33.5	40	8.2	2	4x4	5□A12–1□□0
	105	82	136–0AA71	39	40	10.3	2	4x6	5□A22–1□□0
	130	100	138–0AA71	48.5	80	12.6	3	4x16	5□A23–1□□0
	95	85	132–0SA71	35	40	10.7	2	4x6	5□A22–1□□0
	120	115	134–0SA71	45	80	14.5	2	4x10	5□A32–1□□0
	145	135	136–0SA71	54	80	17.0	3	4x16	5□A23–1□□0
	185	170	138–0SA71	69	80	21.4	3	4x16	5□A23–1□□0
2000	2.6	2.4	062–□AC71	1.6	4	0.5	1	4x1.5	5□A01–1□□0
	5.5	4.7	064–□AC71	3.3	4	1.0	1	4x1.5	5□A01–1□□0
	8	6.7	066–□AC71	4.9	7.5	1.4	1	4x1.5	5□A01–1□□0
	12	9.5	072–□AC71	7.3	7.5	2.0	1	4x1.5	5□A01–1□□0
	18	14	074–□AC71	11	12.5	2.9	1	4x1.5	5□A01–1□□0
	22	18.5	076–□AC71	13.5	25	3.9	1	4x1.5	5□A01–1□□0
	33	29	102–□AC71	20.5	25	6.1	2	4x2.5	5□A02–1□□0
	45	35	104–□AC71	27.5	40	7.3	2	4x4	5□A12–1□□0
	55	39	106–□AC71	33	40	8.2	2	4x4	5□A12–1□□0
	68	42.5	108–□AC71	40	40	8.9	2	4x6	5□A22–1□□0
	75	45	132–0AC71	44	80	9.4	3	4x10	5□A13–1□□0
	90	50	134–0AC71	56	80	10.5	3	4x16	5□A23–1□□0
	105	60	136–0AC71	59	80	12.6	3	4x16	5□A23–1□□0
	95	80	132–0SC71	56	80	16.8	3	4x16	5□A23–1□□0
	120	110	134–0SC71	75	80	23.0	3	4x16	5□A23–1□□0
	145	130	136–0SC71	81	80[1)]	27.2	3	4x25	5□A33–1□□0
3000	1	1	042–□AF71	1.1	4	0.3	1	4x1.5	5□A01–1□□0
	2	1.9	044–□AF71	2.1	4	0.6	1	4x1.5	5□A01–1□□0
	3.7	3.4	046–□AF71	3.9	4	1.1	1	4x1.5	5□A01–1□□0
	2.6	2.3	062–□AF71	2.4	4	0.7	1	4x1.5	5□A01–1□□0
	5.5	4.3	064–□AF71	5.0	7.5	1.4	1	4x1.5	5□A01–1□□0
	8	6.1	066–□AF71	7.3	7.5	1.9	1	4x1.5	5□A01–1□□0
	12	8.5	072–□AF71	11	12.5	2.7	1	4x1.5	5□A01–1□□0
	18	12.5	074–□AF71	17	25	3.9	1	4x1.5	5□A01–1□□0
	22	16.5	076–□AF71	20	25	5.2	2	4x2.5	5□A02–1□□0
	33	25	102–□AF71	31	40	7.9	2	4x4	5□A12–1□□0
	45	29	104–0AF71	41.5	40[1)]	9.1	2	4x6	5□A22–1□□0
	55	28	106–0AF71	52	80	8.8	3	4x16	5□A23–1□□0
	68	20	108–0AF71	62.5	80	6.3	3	4x16	5□A23–1□□0
	75	30	132–0AF71	59	80	23.6	3	4x16	5□A23–1□□0
	40	36	102–0SF71	37	40	11.3	2	4x6	5□A22–1□□0
	58	45	104–0SF71	53	80	14.3	3	4x16	5□A23–1□□0
	70	58	106–0SF71	66	80	18.2	3	4x16	5□A23–1□□0
	95	75	132–0SF71	75	80	29.8	3	4x16	5□A23–1□□0

Table 1-3 Technical data, 1FT5 motors, continued

Rated speed [RPM]	M_0 [Nm]	M_{rated} [Nm]	Motor type 1FT5–	Motor current I_0 [A]	Rated drive converter current [A]	P_{calc} [kW]	Connector size	Cross–section[1] [mm²]	Cable type 6FX□[4]002–
4000	2.6	2.2	062–□AG71	3.2	4	0.9	1	4x1.5	5□A01–1□□0
	5.5	3.8	064–□AG71	6.7	7.5	1.6	1	4x1.5	5□A01–1□□0
	8	5.5	066–□AG71	9.6	12.5	2.3	1	4x1.5	5□A01–1□□0
	12	7.5	072–0AG71	14.4	25	3.1	1	4x1.5	5□A01–1□□0
	18	11	074–0AG71	21.5	25	4.6	2	4x2.5	5□A11–1□□0
	22	13	076–0AG71	26.0	25[3]	5.4	2	4x4	5□A12–1□□0
	33	10	102–0AG71	38.5	40	4.2	2	4x6	5□A22–1□□0
	20.5	17	074–0SG71	24.5	25	7.1	2	4x2.5	5□A11–1□□0
	26	21	076–0SG71	31.0	40	8.8	2	4x4	5□A12–1□□0
	40	32	102–0SG71	46.5	40	13.4	3	4x16	5□A23–1□□0
6000	0.9	0.76	034–□AK71	1.6	4	0.5	1	4x1.5	5□A01–1□□0
	1.3	1.0	036–□AK71	2.3	4	0.6	1	4x1.5	5□A01–1□□0
	1.0	0.9	042–□AK71	1.7	4	0.56	1	4x1.5	5□A01–1□□0
	2.0	1.65	044–0AK71	3.4	4	1.0	1	4x1.5	5□A01–1□□0
	3.7	2.7	046–□AK71	6.3	7.5	1.7	1	4x1.5	5□A01–1□□0
	2.6	2.1	062–0AK71	4.6	7.5	1.3	1	4x1.5	5□A01–1□□0
	5.5	3.0	064–0AK71	9.8	12.5	1.9	1	4x1.5	5□A01–1□□0
	8.	4.2	066–0AK71	14.5	25	2.6	1	4x1.5	5□A01–1□□0
	12	5.0	072–0AK71	21.0	25	3.1	2	4x2.5	5□A11–1□□0
	18	7.0	074–0AK71	32.0	40	4.4	2	4x4	5□A12–1□□0
	22	4.0	076–0AK71	39.0	40	2.5	2	4x6	5□A22–1□□0
	20.5	12	074–0SK71	36.0	40	7.5	2	4x6	5□A22–1□□0
	26	15	076–0SK71	46.0	40[1]	9.4	3	4x16	5□A23–1□□0

Motor type □:
1 Core type
0 Not a core type

Cable type □:

w/out 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. Actual value cable, refer to Chapter Encoders (GE).

1) Designed for $I_{0rms} = I_{0[100\ k]} \times \sqrt{2/3}$; ambient temperature 40 °C; PVC–insulated cable; brake connection 2 x 1 mm².
2) Cables can be supplied in incremental lengths of 1 meter; length code, refer to Section AL S/4.3.
3) With the specified power module, the motor cannot be fully utilized to a 100 K winding temperature.
4) 8 = Motion Connect 800; 5 = Motion Connect 500; Technical data, refer to Catalog NC Z

1FT5

Table 1-4 Technical data of 1FT5 motors, continued

Rated speed [**RPM**]	M_0 [**Nm**]	M_{rated} [**Nm**]	**Motor type** **1FT5–**	**Motor current** I_0 [**A**]	**Rated drive converter current** [**A**]	**Pcalc** [**kW**]	**Connector size**	**Cross–section**[1] [mm^2]	**Cable type** **6FX□002–** [3]
Short motors									
2000	3.5	3.1	070–0AC71	3.1	4	0.65	1	4x1.5	5□A01–1□□0
	5.5	5	071–0AC71	5.2	4	1.0	1	4x1.5	5□A01–1□□0
	9.	8	073–0AC71	8.2	7.5	1.7	1	4x1.5	5□A01–1□□0
	13	12	100–0AC71	12.0	12.5	2.5	2	4x2.5	5□A02–1□□0
	19	17	101–0AC71	18.0	12.5	3.6	2	4x2.5	5□A02–1□□0
	25	22.5	103–0AC71	23.0	25	4.7	2	4x2.5	5□A02–1□□0
3000	3.5	3.0	070–0AF71	3.1	4	0.94	1	4x1.5	5□A01–1□□0
	5.5	4.8	071–0AF71	5.2	7.5	1.5	1	4x1.5	5□A01–1□□0
	9	7.2	073–0AF71	8.2	12.5	2.3	1	4x1.5	5□A01–1□□0
	13	11	100–0AF71	12.0	12.5	3.5	2	4x2.5	5□A02–1□□0
	19	15	101–0AF71	18.0	25	4.7	2	4x2.5	5□A02–1□□0
	25	20	103–0AF71	23.0	25	6.3	2	4x2.5	5□A02–1□□0

w/out 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

Calculating the output

$$P_{calc}\,[kW] = \frac{M_{rated} \times n}{9550} \quad \begin{matrix} M\,[Nm] \\ n\,[RPM] \end{matrix}$$

Cables are not included with the motors, they must be separately ordered. Actual value cable, refer to Chapter Encoders (GE).

1) Designed for $I_{0rms} = I_{0[100\,k]} \times \sqrt{2/3}$; ambient temperature 40 °C; PVC–insulated cable; brake connection 2 x 1 mm^2.
2) Cables can be supplied in incremental lengths of 1 meter; length code, refer to Section AL_S/4.3.
3) 8 = Motion Connect 800; 5 = Motion Connect 500; Technical data, refer to Catalog NC Z

1.2 Functions and options

Armature short–circuit braking

Definition, refer to Chapter 3 General information on AC servomotors AL_S.

Brake resistors

The optimum braking time is achieved by appropriately dimensioning the brake resistors. The braking torques which are obtained are also listed in the Tables. The data is valid when braking from the rated speed. If the drive brakes from another speed, the the braking time **cannot** be linearly interpolated. However, the braking times either remain the same or are shorter.

The rating of the resistors must be harmonized with the I^2t load capability, refer to Chapter 3 General information on AC servomotors AL_S.

Table 1-5 Resistor braking for 1FT5, shaft heights 36 and 48

Motor type	Ext. brake resistor R_{opt} [Ω]	Avg. braking torque $M_{br\ rms}$ [Nm]	Max. braking torque $M_{br\ max}$ [Nm]	RMS braking torque $I_{br\ rms}$ [A]
1FT5034–□AK71	–	1.5	1.9	4.1
	4.7	1.5		3.9
1FT5036–□AK71	–	2.3	3.0	6.6
	4.7	2.4		6.2
1FT5042–□AF71	–	1.8	2.3	2.7
1FT5042–□AK71	–	1.7	2.3	4.8
	7.8	1.8		4.5
1FT5044–□AF71	–	3.6	4.5	6.0
	2.8	3.7		5.8
1FT5044–0AK71	–	2.9	4.5	10.0
	5.9	3.6		9.2
1FT5046–□AF71	–	6.9	9.4	12.8
	2.7	7.6		11.9
1FT5046–□AK71	–	4.9	9.1	20.6
	3.4	7.2		18.6

Table 1-6 Resistor braking for 1FT5 motors, shaft height 63

Motor type	Ext. brake resistor R_{opt} [Ω]	Avg. braking torque $M_{br\ rms}$ [Nm]	Max. braking torque $M_{br\ max}$ [Nm]	RMS braking current $I_{br\ rms}$ [A]
1FT5062–□AC71	–	2.5	3.4	2.9
1FT5062–□AF71	–	2.8	3.5	4.1
1FT5062–□AG71	–	1.9	3.4	6.0
	10.0	2.8		5.4
1FT5062–0AK71	–	1.6	3.5	9.1
	6.8	2.8		8.1
1FT5064–□AC71	–	4.9	7.5	6.4
1FT5064–□AF71	–	4.1	7.5	9.7
1FT5064–□AG71	–	3.5	7.6	13.3
	4.7	6.1		11.9
1FT5064–0AK71	–	2.8	7.6	19.6
	3.9	6.1		17.6
1FT5066–□AC71	–	7.0	11.5	9.8
	5.6	9.2		8.9
1FT5066–□AF71	–	5.4	11.3	14.6
	3.9	8.9		13.1
1FT5066–□AG71	–	4.9	11.5	20.1
	3.3	9.2		18.0
1FT5066–0AK71	–	3.7	11.2	28.8
	2.7	9.0		25.8

Table 1-7 Resistor braking for 1FT5 motors, shaft height 71

Motor type	Ext. brake resistor R_{opt} [Ω]	Avg. braking torque $M_{br\ rms}$ [Nm]	Max. braking torque $M_{br\ max}$ [Nm]	RMS braking current $I_{br\ rms}$ [A]
1FT5072–□AC71	–	7.7	12.5	10.8
	4.7	10.0		9.8
1FT5072–□AF71	–	6.5	12.5	16.5
	3.9	10.1		14.7
1FT5072–0AG71	–	5.6	12.6	22.0
	3.3	10.3		19.5
1FT5072–0AK71	–	4.0	12.4	30.5
	2.7	9.8		27.0
1FT5074–□AC71	–	12.3	21.9	19.0
	2.7	17.6		17.0
1FT5074–□AF71	–	10.0	22.0	29.5
	2.2	18.0		26.5
1FT5074–0AG71	–	8.1	21.7	36.5
	3.9	17.0		32.5
1FT5074–0AK71	–	7.0	22.2	59.0
	2.2	18.0		52.5
1FT5076–□AC71	–	16.8	31.4	27.5
	2.2	25.5		24.5
1FT5076–□AF71	–	13.4	31.4	40.5
	1.5	25.0		36.5
1FT5076–0AG71	–	11.5	31.6	54.5
	1.2	25.5		48.5
1FT5076–0AK71	–	8.9	31.6	80.0
	1.0	25.5		71.5

Table 1-8 Resistor braking for 1FT5 motors, shaft height 100

Motor type	Ext. brake resistor R_{opt} [Ω]	Avg. braking torque $M_{br\ rms}$ [Nm]	Max. braking torque $M_{br\ max}$ [Nm]	RMS braking current $I_{br\ rms}$ [A]
1FT5102–□AA71	–	34.0	56.5	29.5
	1.8	45.5		26.5
1FT5102–□AC71	–	25.5	56.4	48.5
	1.2	45.0		43.5
1FT5102–□AF71	–	20.5	56.6	75.5
	0.82	45.5		67.5
1FT5102–0AG71	–	18.0	56.4	94.5
	0.82	45.0		84.5
1FT5104–□AA71	–	49.0	82.0	44.0
	1.2	67.5		39.5
1FT5104–□AC71	–	37.0	82.5	73.0
	0.82	68.0		65.5
1FT5104–0AF71	–	27.5	81.5	105.0
	0.68	66.0		94.0
1FT5106–0AA71	–	59.5	105.0	56.5
	1.0	87.0		51.0
1FT5106–□AC71	–	43.0	104.0	89.0
	0.68	84.0		80.0
1FT5106–0AF71	–	33.0	103.0	136.0
	0.47	82.0		122.0
1FT5108–0AA71	–	73.0	126.0	71.0
	0.82	102.0		64.5
1FT5108–□AC71	–	51.0	123.0	105.0
	0.56	100.0		93.0
1FT5108–0AF71	–	43.0	125.0	167.0
	0.39	101.0		149.0

Table 1-9 Resistor braking for 1FT5 motors, shaft height 132 1)

Motor type	Ext. brake resistor R_{opt} [Ω]	Avg. braking torque $M_{br\ rms}$ [Nm]	Max. braking torque $M_{br\ max}$ [Nm]	RMS braking current $I_{br\ rms}$ [A]
1FT5132–0AA71	–	61.5	123.0	65.0
	1.0	98.5		58.0
1FT5132–0AC71	–	51.0	128.0	114.0
	0.56	101.0		103.0
1FT5132–0AF71	–	35.5	124.0	140.0
	0.56	100.0		125.0
1FT5134–0AA71	–	77.0	160.0	86.5
	0.68	131.0		77.5
1FT5134–0AC71	–	54.5	156.0	137.0
	0.47	124.0		123.0
1FT5136–0AA71	–	94.0	206.0	109.0
	0.56	166.0		98.5
1FT5136–0AC71	–	68.0	204.0	163.0
	0.47	164.0		146.0
1FT5138–0AA71	–	107.0	245.0	130.0
	0.47	197.0		117.0

1) When utilized acc. to M_0 (100 K), a brake resistor must be connected in series, to prevent partial de–magnetization
When utilized acc. to M_0 (60 K), the additional brake resistor is not required.

Table 1-10 Resistor braking for 1FT5 motors, shaft heights 71 and 100 (force–ventilated)

Motor type	Ext. brake resistor R_{opt} [Ω]	Avg. braking torque $M_{br\ rms}$ [Nm]	Max. braking torque $M_{br\ max}$ [Nm]	RMS braking current $I_{br\ rms}$ [A]
1FT5074–0SG71	–	8.1	21.7	36.5
	3.9	17.0		32.5
1FT5074–0SK71	–	7.0	22.2	59.0
	2.2	18.0		52.5
1FT5076–0SG71	–	11.5	31.6	54.5
	1.2	25.5		48.5
1FT5076–0SK71	–	8.9	31.6	80.0
	1.1	25.5		71.5
1FT5102–0SF71	–	20.5	56.6	75.5
	0.82	45.5		67.5
1FT5102–0SG71	–	18.0	56.4	94.5
	0.82	45.0		84.5
1FT5104–0SF71	–	27.5	81.5	105.0
	0.68	66.0		94.0
1FT5106–0SF71	–	33.0	103.0	136.0
	0.47	82.0		122.0

Table 1-11 Resistor braking for 1FT5 motors, shaft height 132 (force ventilated)[1)]

Motor type	Ext. brake resistor R_{opt} [Ω]	Avg. braking torque $M_{br\ rms}$ [Nm]	Max. braking torque $M_{br\ max}$ [Nm]	RMS braking current $I_{br\ rms}$ [A]
1FT5132–0SA71	–	61.5	123.0	65.0
	1.0	98.5		58.0
1FT5132–0SC71	–	51.0	128.0	114.0
	0.56	101.0		103.0
1FT5132–0SF71	–	35.5	124.0	140.0
	0.56	100.0		125.0
1FT5134–0SA71	–	77.0	160.0	86.5
	0.68	131.0		77.5
1FT5134–0SC71	–	54.5	156.0	137.0
	0.47	124.0		123.0
1FT5136–0SA71	–	94.0	206.0	109.0
	0.56	166.0		98.5
1FT5136–0SC71	–	68.0	204.0	163.0
	0.47	164.0		146.0
1FT5138–0SA71	–	107.0	245.0	130.0
	0.47	197.0		117.0

1) When utilized acc. to M_0 (100 K), a brake resistor must be connected in series, to prevent partial de–mnagnetization
When utilized acc. to M_0 (60 K), the additional brake resistor is not required.

Table 1-12 Resistor braking for 1FT5 motors, shaft heights 71 and 100 (short motors)

Motor type	**Ext. brake resistor** R_{opt} [Ω]	**Avg. braking torque** $M_{br\ rms}$ [Nm]	**Max. braking torque** $M_{br\ max}$ [Nm]	**RMS braking current** $I_{br\ rms}$ [A]
1FT5070–0AC71	–	2.8	3.7	3.0
1FT5070–0AF71	–	2.4	3.6	4.4
1FT5071–0AC71	–	4.3	6.3	5.5
1FT5071–0AF71	–	3.8	6.4	8.5
1FT5073–0AC71	–	7.2	11.3	9.7
	4.7	9.1		8.8
1FT5073–0AF71	–	5.9	11.3	14.7
	3.9	9.1		13.3
1FT5100–0AC71	–	10.0	18.1	15.8
	3.3	14.5		14.3
1FT5100–0AF71	–	8.0	18.0	23.8
	2.7	14.5		21.4
1FT5101–0AC71	–	15.0	29.0	26.0
	2.2	24.0		23.5
1FT5101–0AF71	–	11.9	28.7	39.0
	1.5	23.5		34.5
1FT5103–0AC71	–	21.0	42.4	38.0
	1.5	34.0		34.0
1FT5103–0AF71	–	16.0	42.7	56.5
	1.2	34.5		50.5

Holding brake

Function description, refer to Chapter 2.2 General information on AC servomotors AL_S.

The holding brake can be retrofitted. The motor length does not change.

Table 1-13 Technicial data of the holding brakes used with 1FT5 motors

Motor type	Brake type	Holding torques M_4 1) [Nm]		Dyn. torque M_{1m} [Nm]	DC current [A]	Power drain [W]	Opening time t_2 1) [ms]	Closing time 1) [ms]	Moment of inertia [10^{-4} kgm^2]	Highest switching work 2) 4) [J]
		20 °C	120 °C	120 °C						
1FT503□	EBD 0.11B	1.2	1.0	0.75	0.3	7.5	20	10	0.07	24
1FT504□	EBD 0.2B	2.0	1.5	1.3	0.6	13	40	20	0.4	122
1FT506□	EBD 0.8B	12	10	7	0.7	16	55	15	1.1	291
1FT507□	EBD 2B	28	23	13	0.93	22	100	30	7.6	1005
1FT510□	EBD 4B	100	80	43	1.4	32	180	20	32	2150 3)
1FT513□	EBD 8B	200	140	60	1.7	40	260	70	76	9870
Short motors										
1FT507□	EBD 0.4B	6.5	5	3.5	0.8	20	30	15	1.1	148
1FT510□	EBD 2.2B	20	15	13	0.9	22	70	35	9.5	987

M_{1m} = Average dynamic torque, determined from the slip time t_3
M_4 = Torque which can be transmitted, taking into account the max. solenoid temperature, friction value fluctuations and spread due to tolerances between the various units

Torques and switching times are defined according to VDE 0580 refer to Chapter AL_S Fig. 2-11.

1) Standardized acc. to VDE 0580 with resistor and diode
2) Each emergency stop, with n=3000/min
3) Each emergency stop with n=2000/min
4) $W=1/2 * Jtotal * \omega^2$; Jtotal in [$kgm^2$], ω in [1/s], W in [J]

 6SN1197–0AA20

Working brake (option C00)

The working brake operates according to the fail–safe principle, i.e. the brake is closed when in the no–current condition. However, the brake can be released in the no–voltage condition using a manual release lever.

The working brake cannot be ordered in conjunction with integrated or mounted position encoders. Further, the brake can only be mounted onto standard non–ventilated motors (not short motors).

Mounting: Non–drive end
Degree of prot.: IP 54
Supply: 24 V DC via terminal box
Circuit: as for the holding brake
Dimensions: Refer to Section 4

The braking torque can be subsequently reduced using the adjustment ring up to 50%.

Table 1-14 Technical data, working brake (option C00)

Motor type	**Brake type**	**Braking torque M at speed n** [Nm]	[RPM]	**Max. speed** [RPM]	**Highest switching power** [kJ/h]	**Rated power** [W]	**Brake closing time** [ms]	**Moment of inertia** [10^{-4} kgm^2]	**Lifetime, oper-ations** (nom. val.) [MJ]
1FT507□	13A	32	250	4000	460	38	40	5	175
1FT510□	16A	60	250	3500	570	60	85	14	345
1FT513□	19A	130	125	3000	640	75	100	38	440

Gearboxes

When dimensioning gearboxes, refer to Chapter 2.2, General information on AC servomotors.

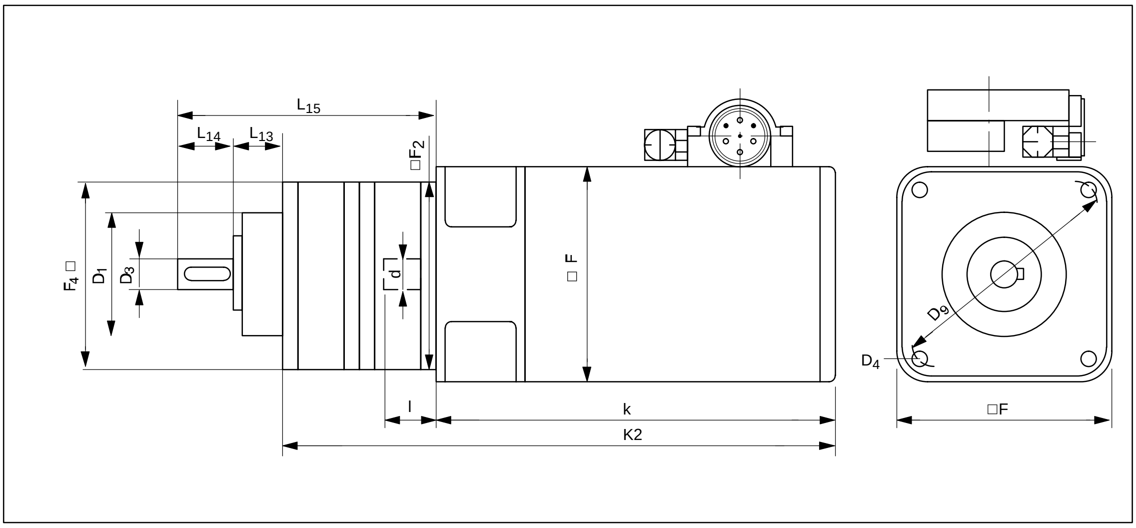


Fig. 1-1 1FT5 motor with planetary gearbox (alpha Company) SPG 1 stage dimensions in [mm]

Table 1-15 1FT5 motor with planetary gearbox (alpha Company) SPG 1 stage

Standard motor					Planetary gearbox, 1 stage									Motor with planetary gearbox	
Type	Dimensions				Type	Dimensions								Dimensions	
	k	l	d	□ F		L_{13}	L_{14}	L_{15}	D_1	D_3	D_4	D_9	□ F_4	K_2	□ F_2
1FT5034	181	23	11	70	SPG 060–M01	20	28	129	60	16	5,5	68	62	262	70
1FT5036	206													287	
1FT5042	165	30	14	92	SPG 075–M01	20	36	156	70	22	6,6	85	76	265	90
1FT5044	190													290	
1FT5046	240													340	
1FT5062	241	40	19	115	SPG 100–M01	30	58	202	90	32	9	120	101	355	100
1FT5064	281													395	
1FT5066	321													435	
1FT5072	273	50	24	142	SPG 140–M01	30	82	257	130	40	11	165	141	418	140
1FT5074	323													468	
1FT5076	373													518	
1FT5102	352	58	32	190	SPG 180–M01	30	82	297	160	55	13	215	182	537	190
1FT5104	402													587	
1FT5106	452													637	
1FT5108	502													687	
1FT5132	429	82	48	260	SPG 210–M01	38	105	339	180	75	17	250	212	625	260
1FT5134	479													675	
1FT5136	529													725	
1FT5138	604													800	

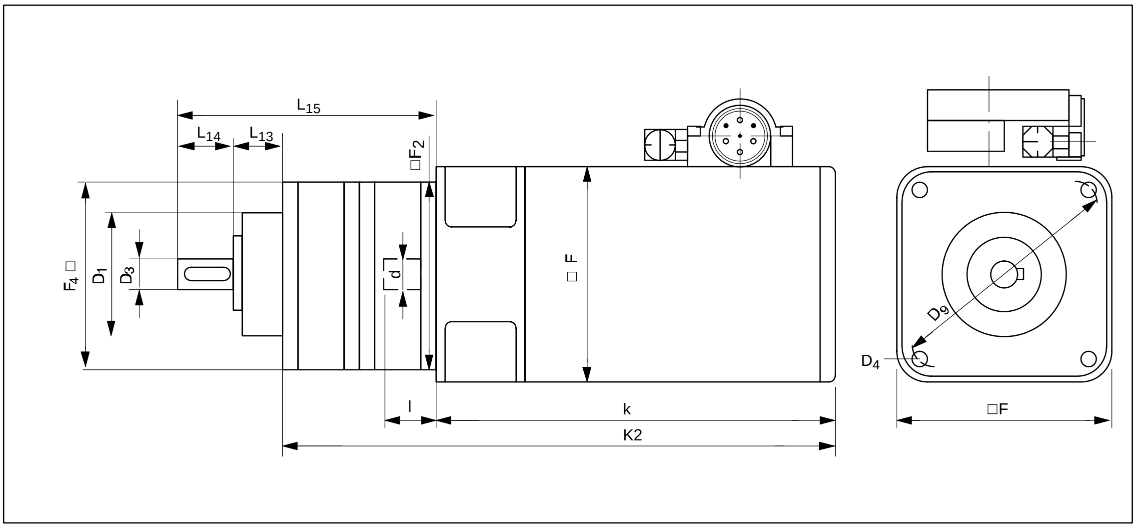


Fig. 1-2 1FT5 motor with planetary gearbox (alpha Company) SPG 2 stage – dimensions in [mm]

Table 1-16 1FT5 motor with planetary gearbox (alpha Company) SPG 2 stage

Stanard motor					**Planetary gearbox, 2 stage**									**Motor with planetary gearbox dimensions**	
Type	**Dimensions**				**Type**	**Dimensions**								**Dimensions**	
	k	**l**	**d**	**□ F**		**L_{13}**	**L_{14}**	**L_{15}**	**D_1**	**D_3**	**D_4**	**D_9**	**□ F_4**	**K**	**□ F_2**
1FT5034	181	23	11	70	SPG 075–M02	20	36	183	70	22	6.6	85	76	308	80
1FT5036	206													333	
1FT5042	165	30	14	92										292	90
1FT5044	190													317	
1FT5042	165	30	14	92	SPG 100–M02	30	58	235	90	32	9	120	101	312	100
1FT5044	190													337	
1FT5046	240													387	
1FT5062	241	40	19	115										388	
1FT5064	281													428	
1FT5064	281	40	19	115	SPG 140–M02	30	82	297	130	40	11	165	141	466	140
1FT5066	321													506	
1FT5072	273	50	24	142										458	
1FT5072	273	50	24	142	SPG 180–M02	30	82	316	160	55	13	215	182	477	140
1FT5074	323													527	
1FT5076	373													577	
1FT5072	273	50	24	142	SPG 210–M02	38	105	359	180	75	17	250	212	489	140
1FT5074	323													539	
1FT5076	373													589	
1FT5102	352	58	32	190										568	190
1FT5076	373	50	24	142	SPG 240–M02	40	130	413	200	85	17	290	240	616	140
1FT5102	352	58	32	190										595	190
1FT5104	402													645	
1FT5106	452													695	
1FT5108	502													745	

Table 1-17 Planetary gearbox, 1 stage (alpha Company, SPG series) – selection table for 1FT5 motors
Ordering info.: **1FT5□□□–0A□71–1–Z** Motor Order No. (standard type) with code **–Z** and
V□□ code for mounting the planetary gearbox assigned to the motor

AC servo-motor, non–ventilated	Planetary gearbox, 1 stage play ≤ 4 arcmin[2)]		Available gearbox ratios *i* =				Max. permissible input speed	Max. permissible output torque	Max. permissible drive shaft load [1)]	Gearbox moment of inertia	
Type	Type	Weight, approx. kg	4	5	7	10	n_{G1} RPM	M_{G2} Nm	F_r N	J_G at *i*=4 10^{-4} kgm^2	J_G at *i*=10 10^{-4} kgm^2
1FT5034	SPG 060–M01	1.5	X	X	X	X	6000	40	2600	0.14	0.12
1FT5036			X	X	X	X		(32)[3)]			
1FT5042	SPG 075–M01	2.8	X	X	X	X	6000	100	3800	0.57	0.4
1FT5044			X	X	X	X		(80)[3)]			
1FT5046			X	X	X	X					
1FT5062	SPG 100–M01	6.2	X	X	X	X	4500	250	6000	2.0	1.3
1FT5064			X	X	X	X		(200)[3)]			
1FT5066			X	X	X	X					
1FT5072	SPG 140–M01	11.5	X	X	X	X	4000	500	9000	5.7	3.5
1FT5074			X	X	X	X		(400)[3)]			
1FT5076			X	X	X	X					
1FT5102	SPG 180–M01	27	X	X	X	X	3500	1100	14000	30.6	17.4
1FT5104			X	X	X	X		(880)[3)]			
1FT5106			X	X	X	X					
1FT5108			X	X	X	X					
1FT5132	SPG 210–M01	45	X	X	X	X	2000	1600	15000	70.0	31.0
1FT5134			X	X	X			(1280)[3)]			
1FT5136			X	X	X						
1FT5138			X	X							
Code											
Gearbox shaft **with** key			**V02**	**V03**	**V05**	**V09**					
Gearbox shaft **without** key			**V22**	**V23**	**V25**	**V29**					

1FT5

1) Nominal values for the maximum permissible drive shaft load at the center of the shaft at a speed of n_{G2}=300 RPM Axial load F_a=0.5 · F_r for SPG 060 to SPG 180; F_a= F_r for SPG 210.

2) For SPG 060 and SPG 075: 6 arcmin

3) Values in brackets (...) for *i*=10

Table 1-18 Planetary gearbox, 2–stage (alpha Company, SPG series) – selection table for 1FT5 motors
Ordering info.: **1FT5□□□–0A□71–1–Z** Motor Order No. (standard type) with codes **–Z** and **V□□** code for mounting the planetary gearbox assigned to the motor

AC servo-motors, non–ventilated	**Planetary gearbox 2 stage** Play ≤ 6 arcmin		**Available gearbox ratios *i* =**					Max. permissible input speed	Max. permissible output torque	Max. permissible drive out shaft load 1)	Moment of inertia, gearbox
Type	Type	Weight approx. kg	16	20	28	40	50	n_{G1} RPM	M_{G2} Nm	F_r N	J_G for i=20 10^{-4} kgm²
1FT5034	SPG 075–M02	3.1	X	X	X	X	X	6000	100	3800	0.47
1FT5036			X	X	X	X	X				
1FT5042			X	X	X	X					0.52
1FT5044			X	X							
1FT5042	SPG 100–M02	7.1					X	4500	250	6000	1.7
1FT5044					X	X	X				
1FT5046			X	X	X	X	X				
1FT5062			X	X	X	X	X				1.8
1FT5064			X	X							
1FT5064	SPG 140–M02	14.5			X	X	X	4000	500	9000	4.4
1FT5066			X	X	X						
1FT5072			X	X							5.1
1FT5072	SPG 180–M02	29			X	X		4000	1100	14000	5.5
1FT5074			X	X	X						
1FT5076			X	X							
1FT5072	SPG 210–M02	51					X	3000	1600	15000	6.25
1FT5074						X	X				
1FT5076					X						
1FT5102			X	X							11.6
1FT5076	SPG 240–M02	61				X	X	3000	3000	22000	19.0
1FT5102					X	X	X				24.2
1FT5104			X	X	X						
1FT5106			X	X	X						
1FT5108			X	X							
Code											
Gearbox shaft **with** key			**V12**	**V13**	**V15**	**V16**	**V17**				
Gearbox shaft **without** key			**V32**	**V33**	**V35**	**V36**	**V37**				

1) Nominal values for the maximum permissible drive shaft load at the shaft center at a speed n_{G2}=300 RPM
Axial load F_a=0.5 · F_r for SPG 075 to SPG 180; F_a= F_r for SPG 210 and SPG 240.

Forced ventilation

The different cooling types – non–ventilated and force ventilated – have already been defined in Chapter 2.1, General information (AL).

Degree of protection: IP 54 (acc. to EN 60529). IP 67 cannot be fulfilled. It is not permissible that the hot discharged air is drawn–in again.

The separately driven fan can be retrofitted, whereby you must taken into account the various measures required. Only authorized workshops may retrofit fans onto motors, shaft height 100.

Due to the higher torques and therefore the higher phase currents, the motors are, in some cases, allocated larger power connectors.

Shaft heights 71, 100 and 132 differ as follows:

- **Shaft heights 100 and 132:** Airflow direction from the drive end to the non drive end.

  The air is drawn–in from the non–drive end through the corners of the extruded enclosure using the mounted radial fan.

  The modified dimensions should be taken from the dimension drawings.

Termination technology:	via terminal box
Supply voltage:	3–ph. 400/460 V AC, 50/60 Hz
Max. current:	0.4 A
Weight of the fan assembly:	Approx. 5.6 kg

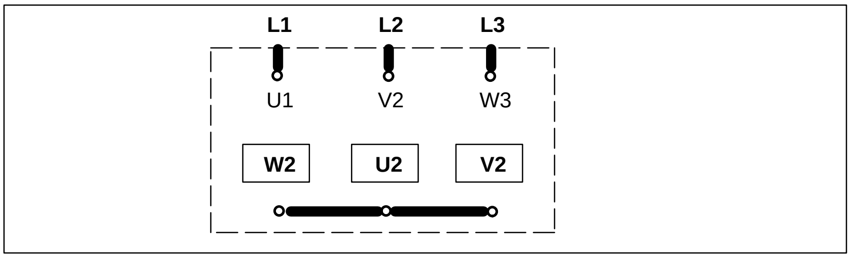


Fig. 1-3 Fan connection, shaft heights 100/132

- **Shaft height 71:** Air flow direction from the non–drive end to the drive end

  The available torque is reduced by approx. 20 % when reversing the air flow direction.

  Mechanical change of the motors over non–ventilated versions:

  – The power connector is 12 mm higher.

  – A sheet steel envelope is placed over the motor enclosure from the non–drive end; the axial fan is installed in this sheet metal envelope. Only some air flows across the motor through the cut–out in the sheet steel at the connectors (3–sided cooling).

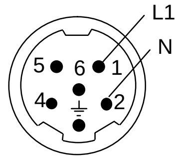
  – The motor dimensions should be taken from the dimension drawings.

Termination technology:	Connector[1),] 6FX2003–0CA10
Supply voltage:	1–ph. 230/260 V AC, 50/60 Hz
Max. current:	0.3 A
Weight of the fan assembly:	approx. 4.8 kg

1) Power connector, size 1

Pin assignment:

Fan connector (shaft height 71)



Mounting

The following minimum clearances to customer–specific mounted components and the air discharged opening must be maintained:

Table 1-19 Minimum clearance to customer–specific components

Shaft height [mm]	Minimum clearance [mm]
71 100 132	20 30 60

Drive out coupling

Technical descriptions and ordering address are provided Chapter 2.2, General information AL_S.

Table 1-20 Allocating the drive out couplings to the motors

Shaft height	Rotex GS Type	Torques which can be transmitted with 98 Sh–A–GS pinion	
		T_{KN} [Nm]	T_{Kmax} [Nm]
63	24/28	60	120
71	28/32	160	320
100	38/45	325	650

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

Warning

The accelerating torque may not exceed the clamping torque!

1FT5

1.3 Interfaces

Circuit diagrams

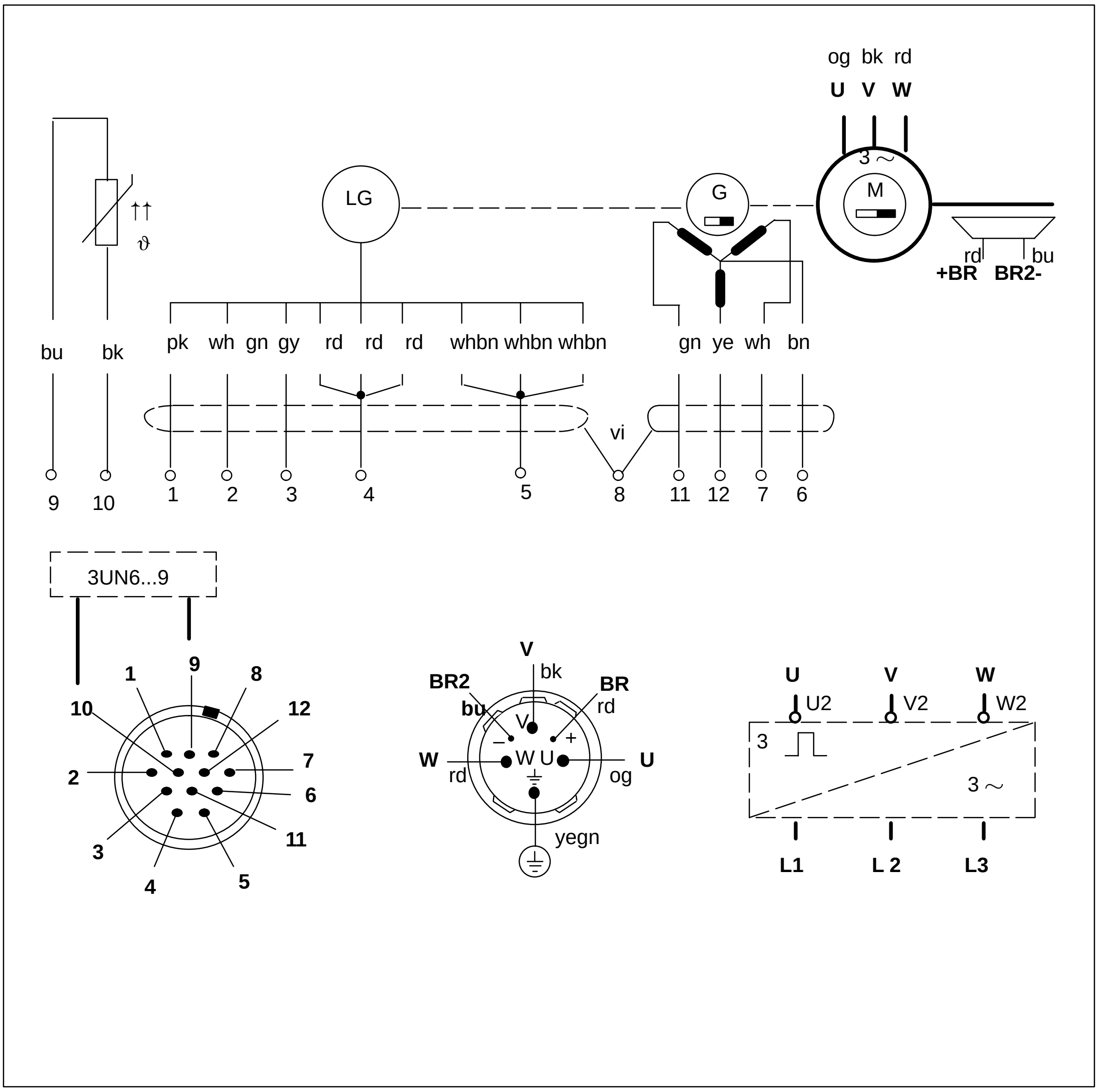


Fig. 1-4 Connection assignment: Power, brake, tachometer, position encoder and PTC thermistor

1.4 Thermal motor protection

Refer to GE Chapter 1

1.5 Encoders

Refer to GE Chapter 1

■

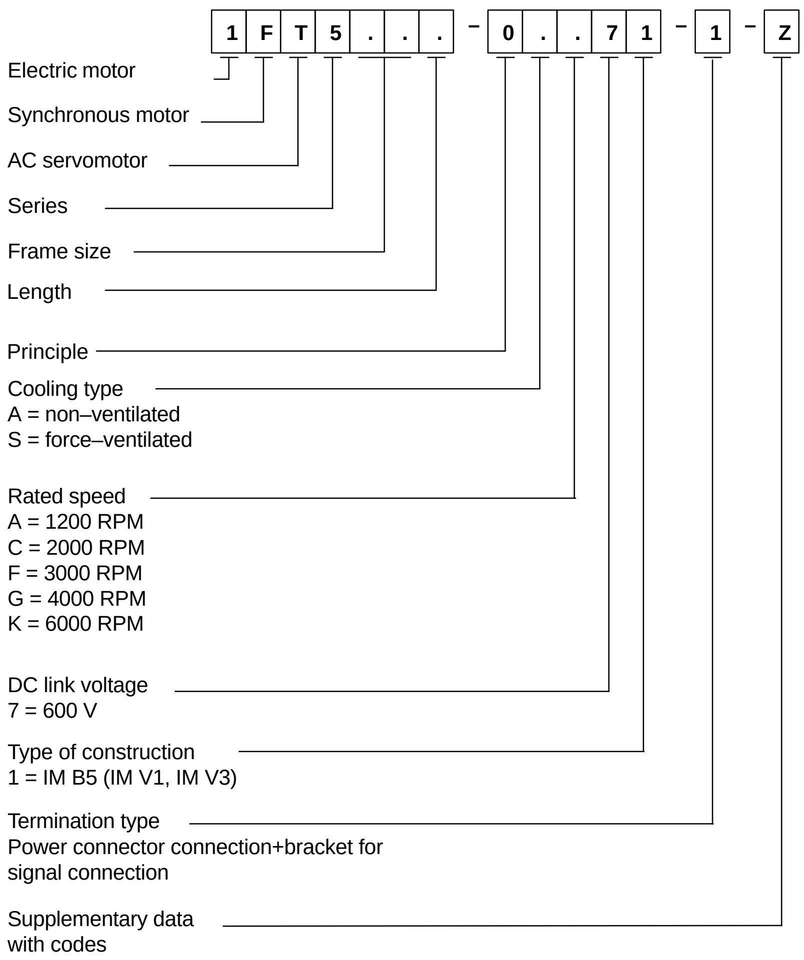
Order Designations 2

1FT5

Order designation (standard)

The order designation consists of a combination of numbers and letters. It is sub–divided into four hyphenated blocks.

The first block comprises seven positions and defines the motor type. Additional design features are coded in the second block. The third and fourth blocks are provided for additional data.



Supplem. data for standard versions and options

Plain text information			Code
Degree of prot. IP 67 (not for force–ventilated motors) 7) IP 68 (not for force–ventilated motors) 7)			**K93** **M24**
Second rating plate (standard for core types)			**K31**
Connector outlet direction 1)	Cable enters from the drive end		**K83** 8)
	Cables enters from the non–drive end		**K84** 8)
rotated through 180° (with respect to the standard)			**K85** 8)
Radial shaft sealing ring acc. to DIN 3760			**K18**
Shaft end: Smooth shaft			**K42**
Vibration severity (ISO 2373) Stage R (reduced)	 600 to 1800 RPM >1800 to 3600 RPM	 ≤ 0.71 mm/s ≤ 1.12 mm/s	**K01**
Shaft and flange accuracy, tolerance R according to DIN 42955			**K04**
Motor with mounted pulse encoder 11) 5000 pulses/revolution 9) 2500 pulses/revolution 9) 2000 pulses/revolution 9) 1000 pulses/revolution 9)			 **H28** **H27** **H26** **H22**
Motor is prepared for mounting a pulse encoder (incremental or absolute) with a synchronous flange 2) 9)			**G51**
Motor with integrated ROD 320 pulse encoder 3) 6) 5000 pulses/revolution 9) 2500 pulses/revolution 9) 2000 pulses/revolution 9) 1250 pulses/revolution 9)			 **H04** **G44** **G42** **H01**
Holding brake (integrated) 10)			**G45**
Motor with mounted planetary gearbox 12)			**V□□**
Working brake; mounted 4)			**C00**
Retrofit set prepared for encoder mounting (G51) with mounting instructions5)			EWN: 519.4033804:1FT5032 to 1FT5036 519.4033803:1FT5042 to 1FT5046 519.4033801:1FT5062 to 1FT5066 519.4033802:1FT5072 to 1FT5108

1) Standard version corresponding to the dimension drawings (Chapter 4)
2) For 1FT503□, 1FT504□ an absolute value encoder can only be mounted on request; not for force ventilated motors
3) For 1FT503□, 1FT504□ not possible; not with forced ventilation
4) For 1FT503□, 1FT504□ and 1FT506□, not possible
5) Only a maximum of 2 per motor version can be supplied ex–factory
6) Limiting frequency: 300 kHz; Motors may only be designed for a winding temperature rise ΔT=60 K. Cannot be combined with a connector outlet direction which is axial on the non drive end.
7) Options mutually exclude each other
8) Options mutually exclude each other
9) Options mutually exclude each other
10) For motors with brakes, axial forces are not permissible in operation
11) Pulse encoder with axial cable outlet
12) Only vibration severity stage H can be guaranteed for the motor and gearbox unit.

1FT5

Order designation, core types

1 F T 5 . . . – 1 A . 7 1 – . . . 0

- Electric motor
- Synchronous motor
- AC servomotor
- Series
- Frame size
- Length
- **Designation, core type**
- Rated speed
  - A = 1200 RPM
  - C = 2000 RPM
  - F = 3000 RPM
  - G = 4000 RPM
  - K = 6000 RPM
- Connector outlet direction
  - 1 = transverse, right } not for shaft heights 36, 48, 63
  - 2 = transverse, left } not for shaft heights 36, 48, 63
  - 3 = axial NDE
  - 4 = axial DE

Encoder system:		
	Integrated tachometer/rotor position encoders	A
	Additionally prepared for encoder mounting [2]	E
	Additional ROD 320 pulse encoder, integrated[1] (only shaft heights 63, 73 and 100; 2500 pulses/rev.)	F

Shaft with key and keyway/without holding brake	A
Shaft with key and keyway/with holding brake	B
Smooth shaft/without holding brake	G
Smooth shaft/with holding brake	H

1) Limiting frequency: 300 kHz; motors may only be dimensioned for a winding temperature ΔT=60 K. Cannot be combined with a connector transition direction, axial NDE.

2) With synchronous flange

Ordering example

When ordering a 1FT5 AC servomotor, for options, it is necessary to specify Order code ”–Z”, and in addition, the short designation. For core types, the last order block is appropriately supplemented.

The following is required:

AC servomotor

- To be connected to a SIMODRIVE 611 drive converter with a 600 V DC link voltage
- Rated speed, 3000 RPM
- Stall torque, 33 Nm at $\Delta T = 100$ K
- Type of construction: IM B5 (IM V1, IM V3)
- Connection type: Power connector for motor/brake, signal connector for the encoder system
- With integrated holding brake
- With mounted ROD 426 pulse encoder (1000 pulses/rev.)

The following should be ordered:	**Order No.:**
1FT5 AC servomotor n_{rated} = 3000 RPM, M_0 = 33 Nm at $\Delta T = 100$ K	**1FT5102–0AF71–1–Z**
Special version:	Codes
• Integrated holding brake	**G45**
• Mounted ROD 426 pulse encoder	**H22**
When ordering, specify the following:	**1FT5102–0AF71–1–Z G45+H22**
Order No., core type:	**1FT5102–1AF71–1EB0** (the same motor, only prepared for encoder mounting)

■

Technical Data and Characteristics 3

3.1 Speed–torque diagrams

1FT5

Note

For converter operation on 480 V supply networks, DC link voltages of > 600 V are obtained. The following restrictions apply:

- Motors, shaft heights 36, 48, 63 and 71 may only be utilized to ΔT = 60 K. Shaft heights 100 and 132 may still be utilized according to ΔT = 100 K.
- The shift of the voltage limiting characteristics is described in Chapter AL S/1.1.
- The specified thermal limiting characteristics are referred to ΔT = 100 K.

3.1.1 Standard motors

Note

The rotor moment of inertia for 1FT5 motors is specified without tachometer.

Table 3-1 Standard motor 1FT5034

1FT5034				
Technical data	**Code**	**Units**	**–□AK71**	
Engineering data				
Rated speed	n_{rated}	RPM	6000	
Rated torque	$M_{rated\ (100\ K)}$	Nm	0.76	
Rated current	I_{rated}	A	1.5	
Stall torque	$M_{0\ (60\ K)}$	Nm	0.7	
Stall torque	$M_{0\ (100\ K)}$	Nm	0.9	
Stall current	$I_{0\ (60\ K)}$	A	1.2	
Stall current	$I_{0\ (100\ K)}$	A	1.6	
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	0.74	
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	0.67	
Limit data				
Max. speed	n_{max}	RPM	9000	
Max. torque	M_{max}	Nm	3.6	
Peak current	I_{max}	A	6.5	
Limiting torque	M_{limit}	Nm	1.4	
Physical constants				
Torque constant	k_T	Nm/A	0.58	
Voltage constant	k_E	V/1000 RPM	70	
Winding resistance	$R_{ph.}$	Ohm	16.3	
Three–phase inductance	L_D	mH	21.8	
Electrical time constant	T_{el}	ms	1.3	
Mechanical time constant	T_{mech}	ms	6.5	
Thermal time constant	T_{th}	min	40	
Weight with brake	m	kg	2.6	
Weight without brake	m	kg	2.4	

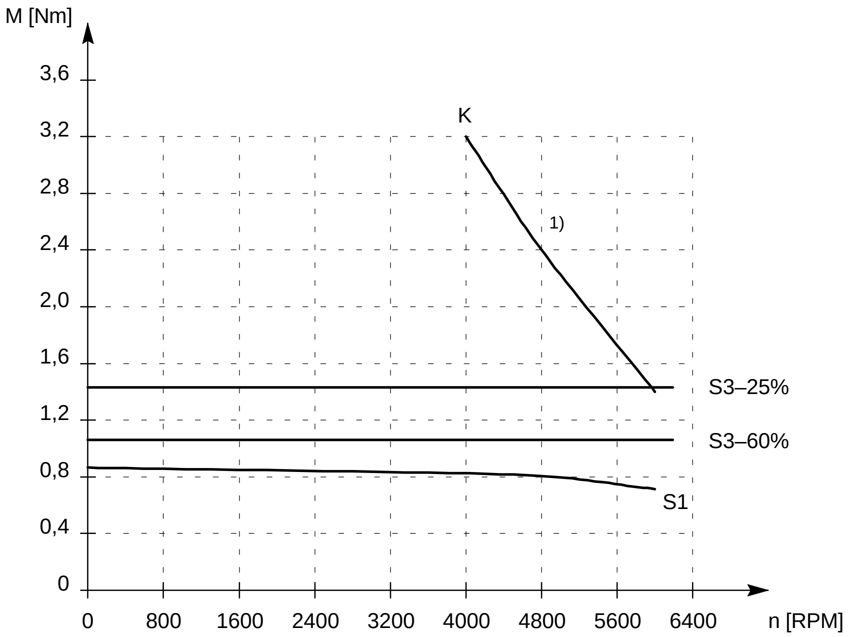


Fig. 3-1 Speed–torque diagram 1FT5034

1) valid for a 600 V DC link voltage

Table 3-2 Standard motor 1FT5036

1FT5036				
Technical data	**Code**	**Units**	**–□AK71**	
Engineering data				
Rated speed	n_{rated}	RPM	6000	
Rated torque	$M_{rated\ (100\ K)}$	Nm	1.0	
Rated current	I_{rated}	A	2.0	
Stall torque	$M_{0\ (60\ K)}$	Nm	1.0	
Stall torque	$M_{0\ (100\ K)}$	Nm	1.3	
Stall current	$I_{0\ (60\ K)}$	A	1.7	
Stall current	$I_{0\ (100\ K)}$	A	2.3	
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	1.03	
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	0.96	
Limit data				
Max. speed	n_{max}	RPM	9000	
Max. torque	M_{max}	Nm	5.2	
Peak current	I_{max}	A	9.5	
Limiting torque	M_{limit}	Nm	2.5	
Physical constants				
Torque constant	k_T	Nm/A	0.58	
Voltage constant	k_E	V/1000 RPM	70	
Winding resistance	$R_{ph.}$	Ohm	8.6	
Three–phase inductance	L_D	mH	13.7	
Electrical time constant	T_{el}	ms	1.5	
Mechanical time constant	T_{mech}	ms	4.9	
Thermal time constant	T_{th}	min	45	
Weight with brake	m	kg	3.3	
Weight without brake	m	kg	3.1	

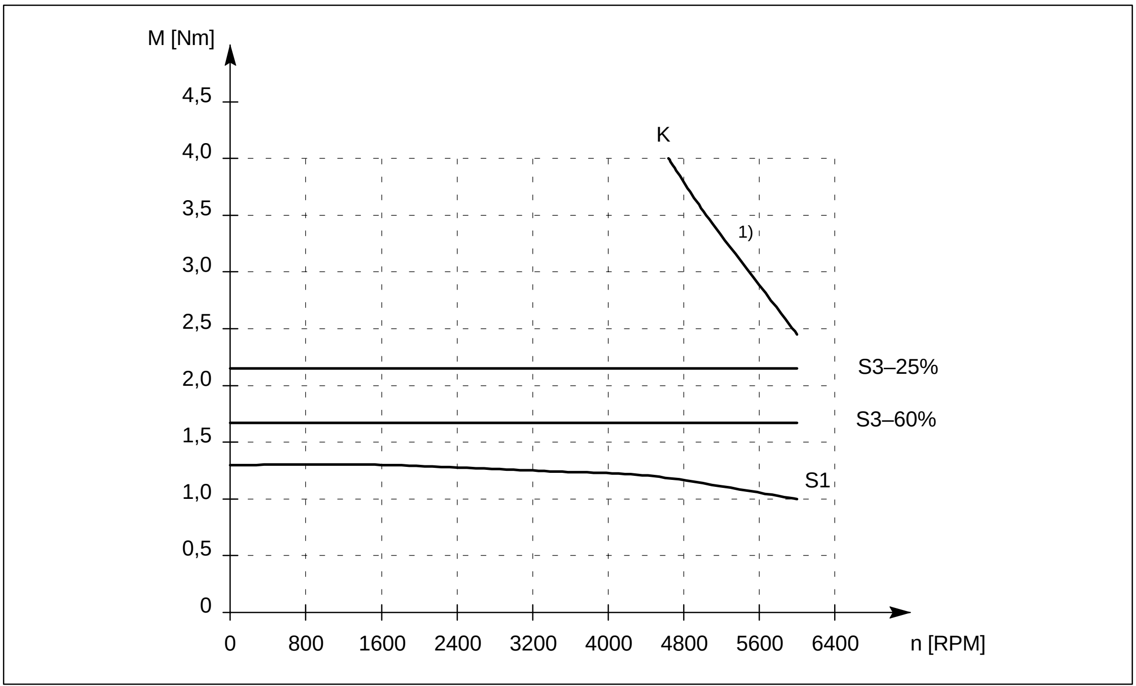


Fig. 3-2 Speed–torque diagram 1FT5036

1) valid for a 600 V DC link voltage

 6SN1197–0AA20

Table 3-3 Standard motor 1FT5042

1FT5042					
Technical data	**Code**	**Units**	**–0AF71**	**–□AK71**	
Engineering data					
Rated speed	n_{rated}	RPM	3000	6000	
Rated torque	$M_{rated\ (100\ K)}$	Nm	1.0	0.9	
Rated current	I_{rated}	A	1.1	1.6	
Stall torque	$M_{0\ (60\ K)}$	Nm	0.75	0.75	
Stall torque	$M_{0\ (100\ K)}$	Nm	1.0	1.0	
Stall current	$I_{0\ (60\ K)}$	A	0.8	1.3	
Stall current	$I_{0\ (100\ K)}$	A	1.1	1.7	
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	2.11	2.11	
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	1.73	1.73	
Limit data					
Max. speed	n_{max}	RPM	5500	8300	
Max. torque	M_{max}	Nm	4.0	4.0	
Peak current	I_{max}	A	4.5	7.0	
Limiting torque	M_{limit}	Nm	2.5	1.9	
Physical constants					
Torque constant	k_T	Nm/A	0.95	0.60	
Voltage constant	k_E	V/1000 RPM	115	75	
Winding resistance	$R_{ph.}$	Ohm	28.2	11.8	
Three–phase inductance	L_D	mH	48.4	20.3	
Electrical time constant	T_{el}	ms	1.7	1.7	
Mechanical time constant	T_{mech}	ms	11.0	11.0	
Thermal time constant	T_{th}	min	40	40	
Weight with brake	m	kg	3.5	3.5	
Weight without brake	m	kg	3.2	3.2	

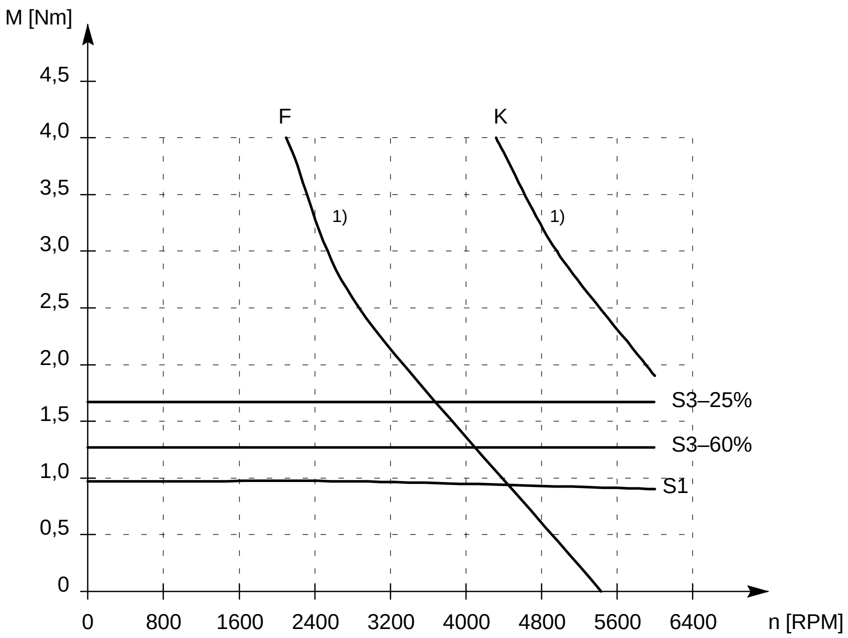


Fig. 3-3 Speed–torque diagram 1FT5042

1) valid for a 600 V DC link voltage

Table 3-4 Standard motor 1FT5044

1FT5044					
Technical data	**Code**	**Units**	**–□AF71**	**–□AK71**	
Engineering data					
Rated speed	n_{rated}	RPM	3000	6000	
Rated torque	$M_{rated\ (100\ K)}$	Nm	1.9	1.65	
Rated current	I_{rated}	A	2.2	3.0	
Stall torque	$M_{0\ (60\ K)}$	Nm	1.5	1.5	
Stall torque	$M_{0\ (100\ K)}$	Nm	2.0	2.0	
Stall current	$I_{0\ (60\ K)}$	A	1.6	2.5	
Stall current	$I_{0\ (100\ K)}$	A	2.1	3.4	
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	3.14	3.14	
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	2.8	2.8	
Limit data					
Max. speed	n_{max}	RPM	5500	8300	
Max. torque	M_{max}	Nm	8.0	8.0	
Peak current	I_{max}	A	8.5	14.0	
Limiting torque	M_{limit}	Nm	5.0	3.6	
Physical constants					
Torque constant	k_T	Nm/A	0.95	0.60	
Voltage constant	k_E	V/1000 RPM	115	72	
Winding resistance	$R_{ph.}$	Ohm	9.0	3.4	
Three–phase inductance	L_D	mH	24.2	9.5	
Electrical time constant	T_{el}	ms	2.8	2.8	
Mechanical time constant	T_{mech}	ms	5.4	5.4	
Thermal time constant	T_{th}	min	45	45	
Weight with brake	m	kg	4.5	4.5	
Weight without brake	m	kg	4.2	4.2	

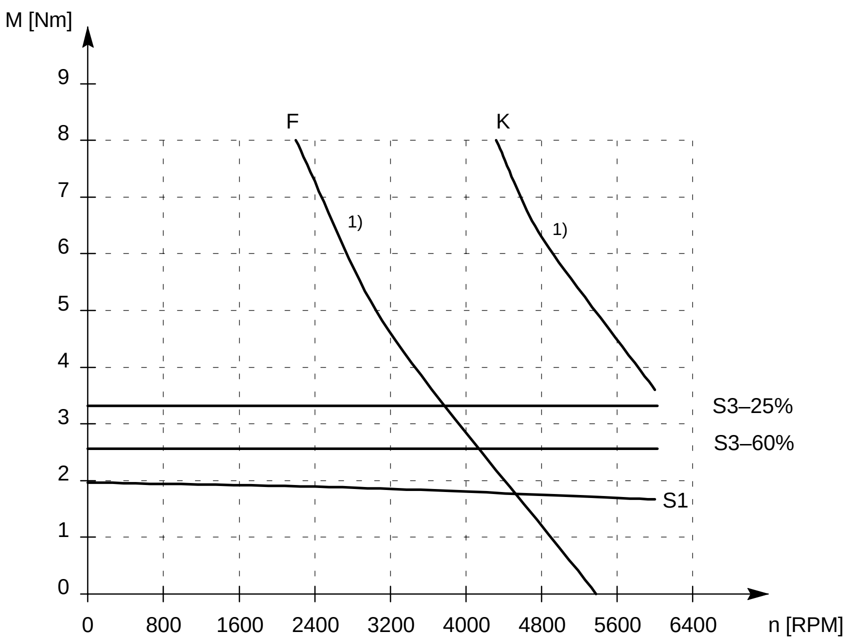


Fig. 3-4 Speed–torque diagram 1FT5044

1) valid for a 600 V DC link voltage

Table 3-5 Standard motor 1FT5046

1FT5046					
Technical data	**Code**	**Units**	**–□AF71**	**–□AK71**	
Engineering data					
Rated speed	n_{rated}	RPM	3000	6000	
Rated torque	$M_{rated\ (100\ K)}$	Nm	3.4	2.7	
Rated current	I_{rated}	A	3.9	5.1	
Stall torque	$M_{0\ (60\ K)}$	Nm	2.8	2.8	
Stall torque	$M_{0\ (100\ K)}$	Nm	3.7	3.7	
Stall current	$I_{0\ (60\ K)}$	A	3.0	4.8	
Stall current	$I_{0\ (100\ K)}$	A	3.9	6.3	
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	5.31	5.31	
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	4.93	4.93	
Limit data					
Max. speed	n_{max}	RPM	5500	8300	
Max. torque	M_{max}	Nm	14.8	14.8	
Peak current	I_{max}	A	16.0	26.0	
Limiting torque	M_{limit}	Nm	8.0	6.0	
Physical constants					
Torque constant	k_T	Nm/A	0.95	0.59	
Voltage constant	k_E	V/1000 RPM	115	71	
Winding resistance	$R_{ph.}$	Ohm	3.1	1.2	
Three–phase inductance	L_D	mH	11.7	4.6	
Electrical time constant	T_{el}	ms	3.8	3.8	
Mechanical time constant	T_{mech}	ms	3.4	3.4	
Thermal time constant	T_{th}	min	50	50	
Weight with brake	m	kg	6.7	6.7	
Weight without brake	m	kg	6.4	6.4	

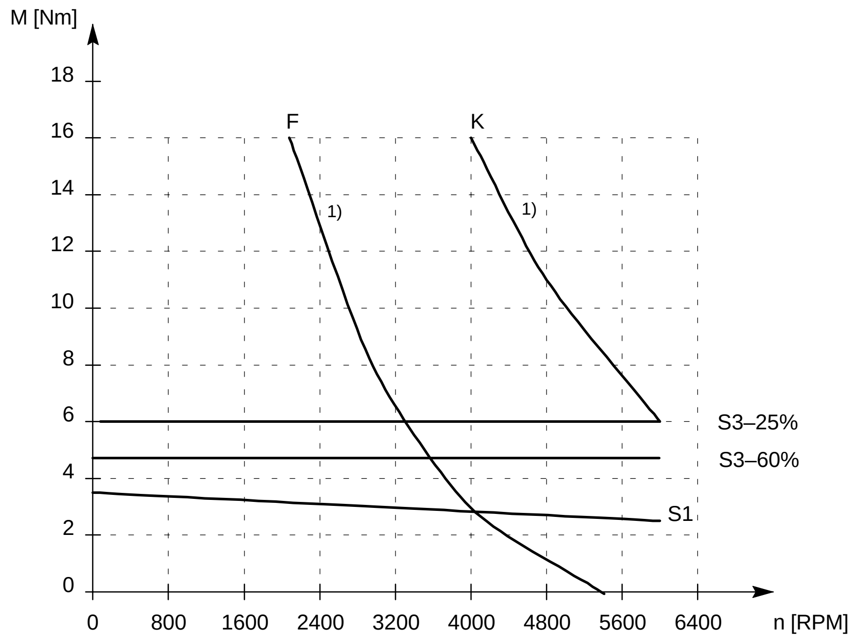


Fig. 3-5 Speed–torque diagram 1FT5046

1) valid for a 600 V DC link voltage

Table 3-6 Standard motor 1FT5062

1FT5062						
Technical data	**Code**	**Units**	**–□AC71**	**–□AF71**	**–□AG71**	**–□AK71**
Engineering data						
Rated speed	n_{rated}	RPM	2000	3000	4000	6000
Rated torque	$M_{rated\ (100\ K)}$	Nm	2.4	2.3	2.2	2.1
Rated current	I_{rated}	A	1.6	2.3	2.9	4.1
Stall torque	$M_{0\ (60\ K)}$	Nm	2.2	2.2	2.2	2.2
Stall torque	$M_{0\ (100\ K)}$	Nm	2.6	2.6	2.6	2.6
Stall current	$I_{0\ (60\ K)}$	A	1.3	2.0	2.7	3.9
Stall current	$I_{0\ (100\ K)}$	A	1.6	2.4	3.2	4.6
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	5.76	5.76	5.76	5.76
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	4.7	4.7	4.7	4.7
Limit data						
Max. speed	n_{max}	RPM	3200	4800	6400	8600
Max. torque	M_{max}	Nm	10.4	10.4	10.4	10.4
Peak current	I_{max}	A	6.6	10.0	13.5	20.0
Limiting torque	M_{limit}	Nm	5.0	5.0	4.9	4.8
Physical constants						
Torque constant	k_T	Nm/A	1.65	1.10	0.82	0.56
Voltage constant	k_E	V/1000 RPM	187	125	93	62
Winding resistance	$R_{ph.}$	Ohm	15.1	7.1	3.8	1.7
Three–phase inductance	L_D	mH	85.3	38.1	21.0	9.3
Electrical time constant	T_{el}	ms	5.6	5.6	5.6	5.6
Mechanical time constant	T_{mech}	ms	6.3	6.3	6.3	6.3
Thermal time constant	T_{th}	min	25	25	25	25
Weight with brake	m	kg	7.5	7.5	7.5	7.5
Weight without brake	m	kg	6.5	6.5	6.5	6.5

1FT5

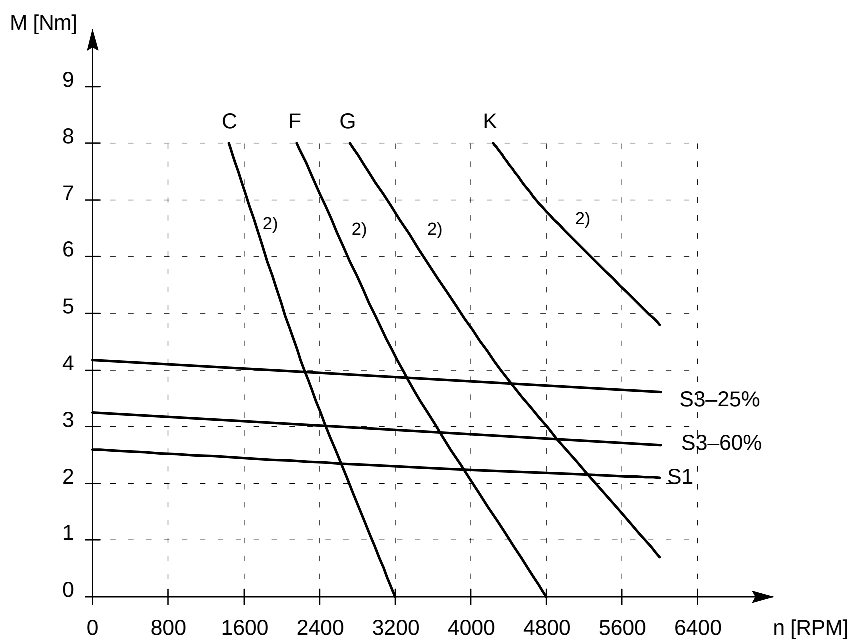


Fig. 3-6 Speed–torque diagram 1FT5062

2) valid for a 600 V DC link voltage

Table 3-7 Standard motor 1FT5064

1FT5064						
Technical data	**Code**	**Units**	**–□AC71**	**–□AF71**	**–□AG71**	**–□AK71**
Engineering data						
Rated speed	n_{rated}	RPM	2000	3000	4000	6000
Rated torque	$M_{rated\ (100\ K)}$	Nm	4.7	4.3	3.8	3.0
Rated current	I_{rated}	A	3.1	4.2	5.1	5.9
Stall torque	$M_{0\ (60\ K)}$	Nm	4.5	4.5	4.5	4.5
Stall torque	$M_{0\ (100\ K)}$	Nm	5.5	5.5	5.5	5.5
Stall current	$I_{0\ (60\ K)}$	A	2.7	4.1	5.5	8.0
Stall current	$I_{0\ (100\ K)}$	A	3.3	5.0	6.7	9.8
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	9.36	9.36	9.36	9.36
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	8.3	8.3	8.3	8.3
Limit data						
Max. speed	n_{max}	RPM	3200	4800	6400	8600
Max. torque	M_{max}	Nm	22	22	22	22
Peak current	I_{max}	A	14.0	20.0	29.0	42.0
Limiting torque	M_{limit}	Nm	10.0	10.0	9.8	9.6
Physical constants						
Torque constant	k_T	Nm/A	1.65	1.10	0.82	0.56
Voltage constant	k_E	V/1000 RPM	187	125	93	63
Winding resistance	$R_{ph.}$	Ohm	5.0	2.2	1.2	0.56
Three–phase inductance	L_D	mH	39.3	17.5	9.5	4.4
Electrical time constant	T_{el}	ms	7.5	7.5	7.5	7.5
Mechanical time constant	T_{mech}	ms	3.0	3.0	3.0	3.0
Thermal time constant	T_{th}	min	30	30	30	30
Weight with brake	m	kg	9.5	9.5	9.5	9.5
Weight without brake	m	kg	8.5	8.5	8.5	8.5

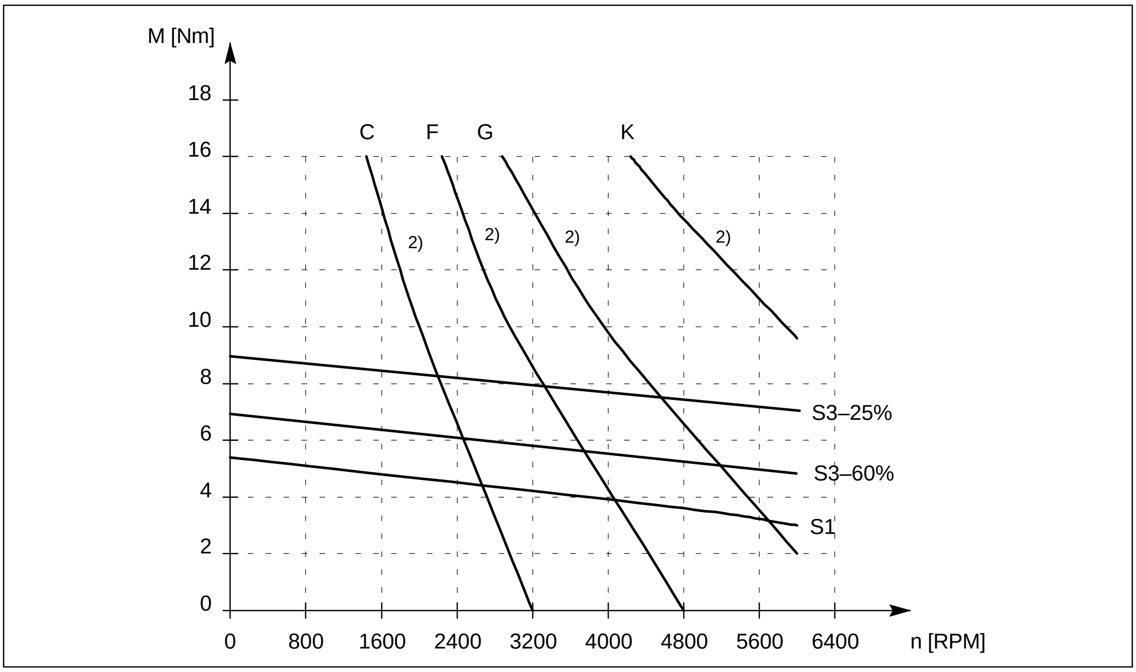


Fig. 3-7 Speed–torque diagram 1FT5064

2) valid for a 600 V DC link voltage

1FT5

Table 3-8 Standard motor 1FT5066

1FT5066						
Technical data	**Code**	**Units**	**–□AC71**	**–□AF71**	**–□AG71**	**–□AK71**
Engineering data						
Rated speed	n_{rated}	RPM	2000	3000	4000	6000
Rated torque	$M_{rated\ (100\ K)}$	Nm	6.7	6.1	5.5	4.2
Rated current	I_{rated}	A	4.4	6.1	7.3	8.3
Stall torque	$M_{0\ (60\ K)}$	Nm	6.5	6.5	6.5	6.5
Stall torque	$M_{0\ (100\ K)}$	Nm	8.0	8.0	8.0	8.0
Stall current	$I_{0\ (60\ K)}$	A	3.9	6.0	7.9	11.6
Stall current	$I_{0\ (100\ K)}$	A	4.9	7.3	9.6	14.5
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	12.86	12.86	12.86	12.86
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	11.8	11.8	11.8	11.8
Limit data						
Max. speed	n_{max}	RPM	3200	4900	6400	8600
Max. torque	M_{max}	Nm	32	32	32	32
Peak current	I_{max}	A	20.0	31.0	41.0	61.0
Limiting torque	M_{limit}	Nm	14.8	14.8	14.8	14.4
Physical constants						
Torque constant	k_T	Nm/A	1.65	1.09	0.82	0.56
Voltage constant	k_E	V/1000 RPM	187	123	93	63
Winding resistance	$R_{ph.}$	Ohm	2.8	1.2	0.68	0.37
Three–phase inductance	L_D	mH	25.6	11.4	6.3	3.4
Electrical time constant	T_{el}	ms	9.2	9.2	9.2	9.2
Mechanical time constant	T_{mech}	ms	2.4	2.4	2.4	2.4
Thermal time constant	T_{th}	min	35	35	35	35
Weight with brake	m	kg	11.5	11.5	11.5	11.5
Weight without brake	m	kg	10.5	10.5	10.5	10.5

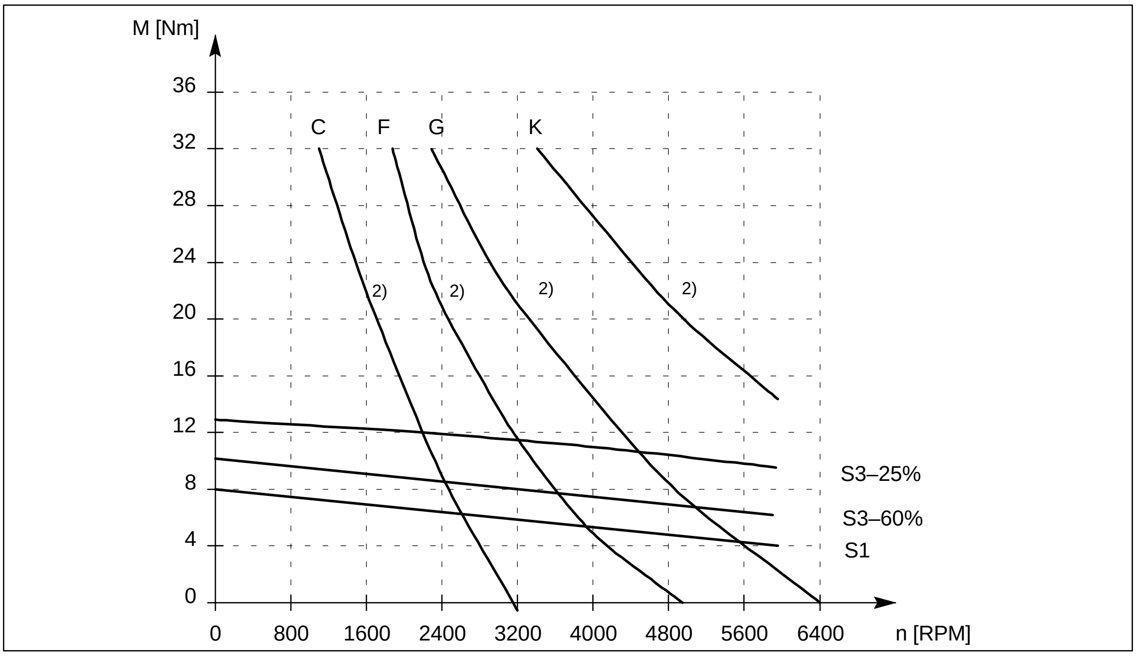


Fig. 3-8 Speed–torque diagram 1FT5066

2) valid for a 600 V DC link voltage

Table 3-9 Standard motor 1FT5072

1FT5072						
Technical data	**Code**	**Units**	**–□AC71**	**–□AF71**	**–□AG71**	**–□AK71**
Engineering data						
Rated speed	n_{rated}	RPM	2000	3000	4000	6000
Rated torque	$M_{rated\ (100\ K)}$	Nm	9.5	8.5	7.5	5.0
Rated current	I_{rated}	A	6.3	8.4	9.8	9.9
Stall torque	$M_{0\ (60\ K)}$	Nm	10.0	10.0	10.0	10.0
Stall torque	$M_{0\ (100\ K)}$	Nm	12.0	12.0	12.0	12.0
Stall current	$I_{0\ (60\ K)}$	A	6.1	9.1	12.0	17.5
Stall current	$I_{0\ (100\ K)}$	A	7.3	11.0	14.5	21.0
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	30.3	30.3	30.3	30.3
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	22.8	22.8	22.8	22.8
Limit data						
Max. speed	n_{max}	RPM	3200	4800	6300	7000
Max. torque	M_{max}	Nm	40	40	40	40
Peak current	I_{max}	A	29.0	43.0	60.0	89.0
Limiting torque	M_{limit}	Nm	15.0	16.0	18.0	16.0
Physical constants						
Torque constant	k_T	Nm/A	1.64	1.10	0.84	0.57
Voltage constant	k_E	V/1000 RPM	186	124	95	65
Winding resistance	$R_{ph.}$	Ohm	2.6	1.2	0.63	0.32
Three–phase inductance	L_D	mH	23.2	10.3	5.7	2.9
Electrical time constant	T_{el}	ms	11	11	11	11
Mechanical time constant	T_{mech}	ms	4.4	4.4	4.4	4.4
Thermal time constant	T_{th}	min	35	35	35	35
Weight with brake	m	kg	15	15	15	15
Weight without brake	m	kg	13.5	13.5	13.5	13.5

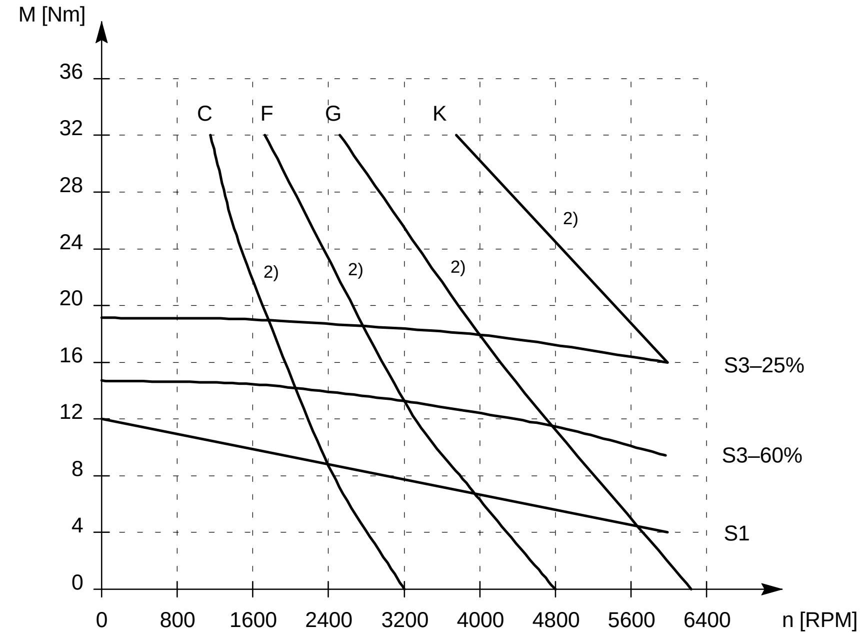


Fig. 3-9 Speed–torque diagram 1FT5072

2) valid for a 600 V DC link voltage

Table 3-10 Standard motor 1FT5074

1FT5074						
Technical data	**Code**	**Units**	**–□AC71**	**–□AF71**	**–□AG71**	**–□AK71**
Engineering data						
Rated speed	n_{rated}	RPM	2000	3000	4000	6000
Rated torque	$M_{rated\ (100\ K)}$	Nm	14.0	12.5	11.0	7.0
Rated current	I_{rated}	A	9.3	13.0	14.0	14.1
Stall torque	$M_{0\ (60\ K)}$	Nm	14.0	14.0	14.0	14.0
Stall torque	$M_{0\ (100\ K)}$	Nm	18.0	18.0	18.0	18.0
Stall current	$I_{0\ (60\ K)}$	A	8.5	13.0	16.5	25.0
Stall current	$I_{0\ (100\ K)}$	A	11.0	17.0	21.5	32.0
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	44.2	44.2	44.2	44.2
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	36.7	36.7	36.7	36.7
Limit data						
Max. speed	n_{max}	RPM	3200	4900	6200	7000
Max. torque	M_{max}	Nm	56	56	56	56
Peak current	I_{max}	A	45.0	67.0	90.0	104.0
Limiting torque	M_{limit}	Nm	24.0	24.5	24.5	22.5
Physical constants						
Torque constant	k_T	Nm/A	1.64	1.08	0.85	0.57
Voltage constant	k_E	V/1000 RPM	186	122	96	65
Winding resistance	$R_{ph.}$	Ohm	1.2	0.52	0.33	0.14
Three–phase inductance	L_D	mH	13.2	5.6	3.6	1.5
Electrical time constant	T_{el}	ms	11	11	11	11
Mechanical time constant	T_{mech}	ms	3.3	3.3	3.3	3.3
Thermal time constant	T_{th}	min	40	40	40	40
Weight with brake	m	kg	18.5	18.5	18.5	18.5
Weight without brake	m	kg	17.2	17.2	17.2	17.2

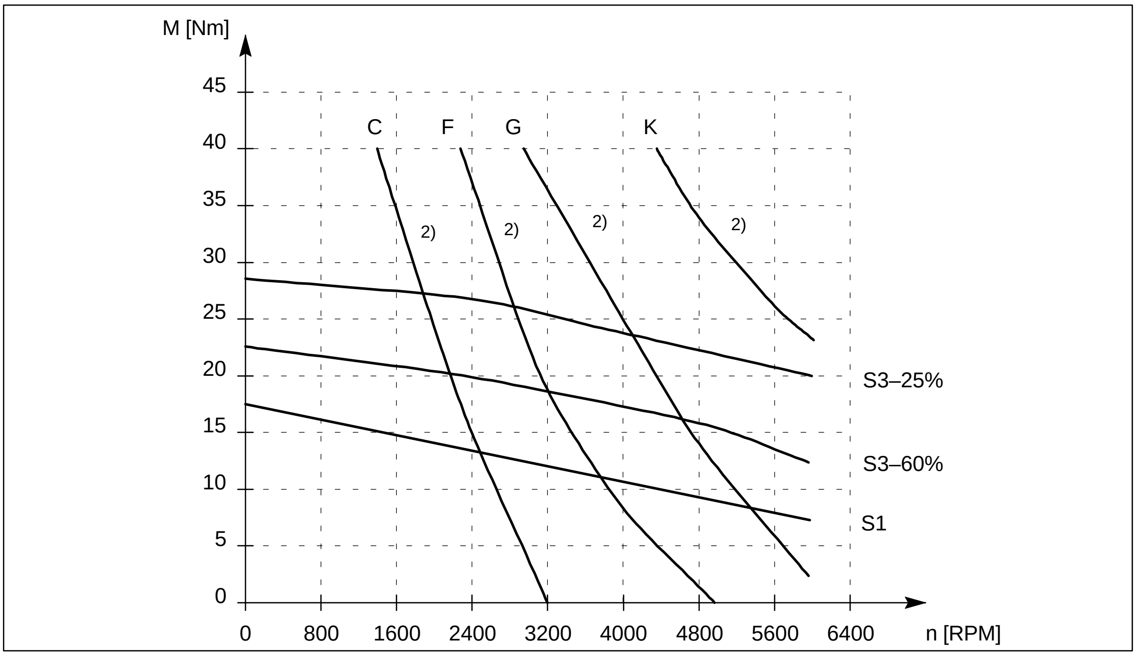


Fig. 3-10 Speed–torque diagram 1FT5074

2) valid for a 600 V DC link voltage

Table 3-11 Standard motor 1FT5076

1FT5076						
Technical data	**Code**	**Units**	**–□AC71**	**–□AF71**	**–□AG71**	**–□AK71**
Engineering data						
Rated speed	n_{rated}	RPM	2000	3000	4000	6000
Rated torque	$M_{rated\ (100\ K)}$	Nm	18.5	16.5	13.0	4.0
Rated current	I_{rated}	A	12.0	16.0	17.0	9.0
Stall torque	$M_{0\ (60\ K)}$	Nm	18.0	18.0	18.0	18.0
Stall torque	$M_{0\ (100\ K)}$	Nm	22.0	22.0	22.0	22.0
Stall current	$I_{0\ (60\ K)}$	A	11.5	16.5	21.5	32.0
Stall current	$I_{0\ (100\ K)}$	A	13.5	20.0	26.0	39.0
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	58.4	58.4	58.4	58.4
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	50.9	50.9	50.9	50.9
Limit data						
Max. speed	n_{max}	RPM	3200	4800	6200	7000
Max. torque	M_{max}	Nm	72	72	72	72
Peak current	I_{max}	A	52.0	78.0	110	163
Limiting torque	M_{limit}	Nm	39.0	38.0	36.0	36.0
Physical constants						
Torque constant	k_T	Nm/A	1.63	1.10	0.85	0.57
Voltage constant	k_E	V/1000 RPM	185	125	96	65
Winding resistance	$R_{ph.}$	Ohm	0.75	0.35	0.20	0.093
Three–phase inductance	L_D	mH	9.1	4.2	2.4	1.1
Electrical time constant	T_{el}	ms	12	12	12	12
Mechanical time constant	T_{mech}	ms	2.8	2.8	2.8	2.8
Thermal time constant	T_{th}	min	45	45	45	45
Weight with brake	m	kg	22.5	22.5	22.5	22.5
Weight without brake	m	kg	21	21	21	21

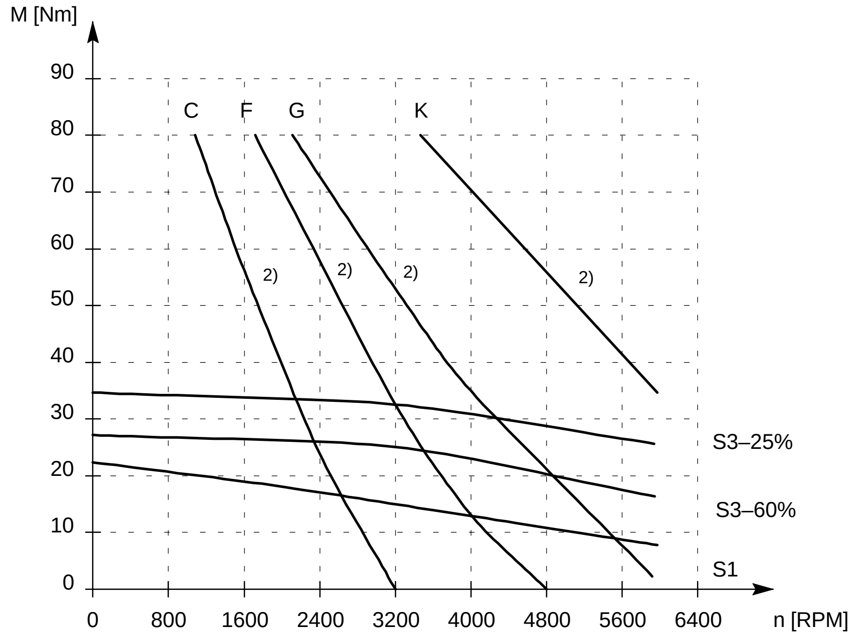


Fig. 3-11 Speed–torque diagram 1FT5076

2) valid for a 600 V DC link voltage

Table 3-12 Standard motor 1FT5102

1FT5102						
Technical data	**Code**	**Units**	**–□AA71**	**–□AC71**	**–□AF71**	**–0AG71**
Engineering data						
Rated speed	n_{rated}	RPM	1200	2000	3000	4000
Rated torque	$M_{rated\ (100\ K)}$	Nm	31.0	29.0	25.0	10.0
Rated current	I_{rated}	A	12.0	19.0	25.0	13.0
Stall torque	$M_{0\ (60\ K)}$	Nm	27.0	27.0	27.0	27.0
Stall torque	$M_{0\ (100\ K)}$	Nm	33.0	33.0	33.0	33.0
Stall current	$I_{0\ (60\ K)}$	A	9.9	16.5	25.0	31.5
Stall current	$I_{0\ (100\ K)}$	A	12.5	20.5	31.0	38.5
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	151	151	151	151
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	136	136	136	136
Limit data						
Max. speed	n_{max}	RPM	1900	3200	4900	6200
Max. torque	M_{max}	Nm	108	108	108	108
Peak current	I_{max}	A	47.0	80.0	120.0	164.0
Limiting torque	M_{limit}	Nm	52.0	57.0	57.0	45.0
Physical constants						
Torque constant	k_T	Nm/A	2.74	1.64	1.08	0.86
Voltage constant	k_E	V/1000 RPM	310	186	122	97
Winding resistance	$R_{ph.}$	Ohm	0.9	0.33	0.14	0.097
Three–phase inductance	L_D	mH	14.2	5.2	2.2	1.4
Electrical time constant	T_{el}	ms	16	16	16	16
Mechanical time constant	T_{mech}	ms	3.3	3.3	3.3	3.3
Thermal time constant	T_{th}	min	45	45	45	45
Weight with brake	m	kg	36	36	36	36
Weight without brake	m	kg	31	31	31	31

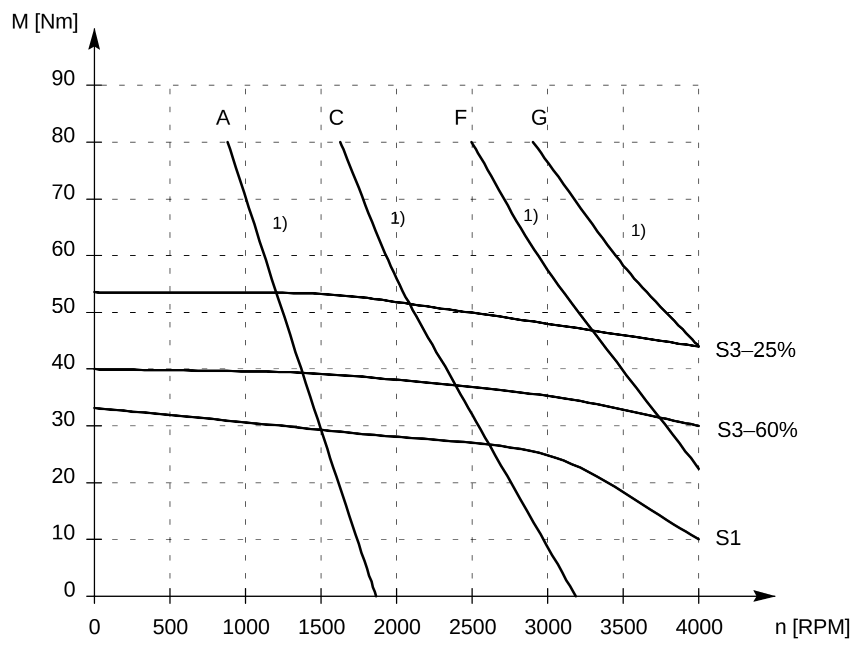


Fig. 3-12 Speed–torque diagram 1FT5102

1) valid for a 600 V DC link voltage

Table 3-13 Standard motor 1FT5104

1FT5104						
Technical data	**Code**	**Units**	**–□AA71**	**–□AC71**	**–0AF71**	
Engineering data						
Rated speed	n_{rated}	RPM	1200	2000	3000	
Rated torque	$M_{rated\ (100\ K)}$	Nm	40.0	35.0	29.0	
Rated current	I_{rated}	A	16.0	23.0	29.0	
Stall torque	$M_{0\ (60\ K)}$	Nm	37.0	37.0	37.0	
Stall torque	$M_{0\ (100\ K)}$	Nm	45.0	45.0	45.0	
Stall current	$I_{0\ (60\ K)}$	A	14.0	22.5	34.0	
Stall current	$I_{0\ (100\ K)}$	A	17.0	27.5	41.5	
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	210	210	210	
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	185	185	185	
Limit data						
Max. speed	n_{max}	RPM	1900	3200	4800	
Max. torque	M_{max}	Nm	148	148	148	
Peak current	I_{max}	A	64.0	110.0	164.0	
Limiting torque	M_{limit}	Nm	80.0	78.0	80.0	
Physical constants						
Torque constant	k_T	Nm/A	2.72	1.66	1.09	
Voltage constant	k_E	V/1000 RPM	308	188	123	
Winding resistance	$R_{ph.}$	Ohm	0.56	0.2	0.095	
Three–phase inductance	L_D	mH	9.5	3.5	1.7	
Electrical time constant	T_{el}	ms	18	18	18	
Mechanical time constant	T_{mech}	ms	2.8	2.8	2.8	
Thermal time constant	T_{th}	min	50	50	50	
Weight with brake	m	kg	43	43	43	
Weight without brake	m	kg	39	39	39	

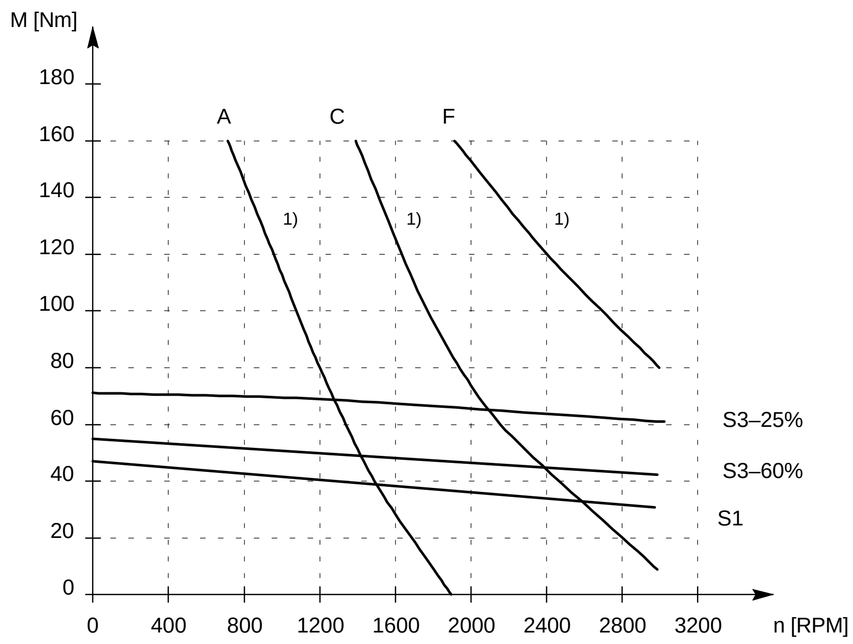


Fig. 3-13 Speed–torque diagram 1FT5104

1) valid for a 600 V DC link voltage

Table 3-14 Standard motor 1FT5106

1FT5106						
Technical data	**Code**	**Units**	**–0AA71**	**–□AC71**	**–0AF71**	
Engineering data						
Rated speed	n_{rated}	RPM	1200	2000	3000	
Rated torque	$M_{rated\ (100\ K)}$	Nm	47.0	39.0	28.0	
Rated current	I_{rated}	A	19.0	25.0	29.0	
Stall torque	$M_{0\ (60\ K)}$	Nm	45.0	45.0	45.0	
Stall torque	$M_{0\ (100\ K)}$	Nm	55.0	55.0	55.0	
Stall current	$I_{0\ (60\ K)}$	A	17.0	26.8	42.5	
Stall current	$I_{0\ (100\ K)}$	A	20.5	33.0	52.0	
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	264	264	264	
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	239	239	239	
Limit data						
Max. speed	n_{max}	RPM	1900	3200	5000	
Max. torque	M_{max}	Nm	180	180	180	
Peak current	I_{max}	A	80.0	130.0	200.0	
Limiting torque	M_{limit}	Nm	90.0	98.0	102.0	
Physical constants						
Torque constant	k_T	Nm/A	2.72	1.68	1.06	
Voltage constant	k_E	V/1000 RPM	308	190	120	
Winding resistance	$R_{ph.}$	Ohm	0.39	0.15	0.066	
Three–phase inductance	L_D	mH	7.4	2.9	1.2	
Electrical time constant	T_{el}	ms	19	19	19	
Mechanical time constant	T_{mech}	ms	2.5	2.5	2.5	
Thermal time constant	T_{th}	min	50	50	50	
Weight with brake	m	kg	49	49	49	
Weight without brake	m	kg	45	45	45	

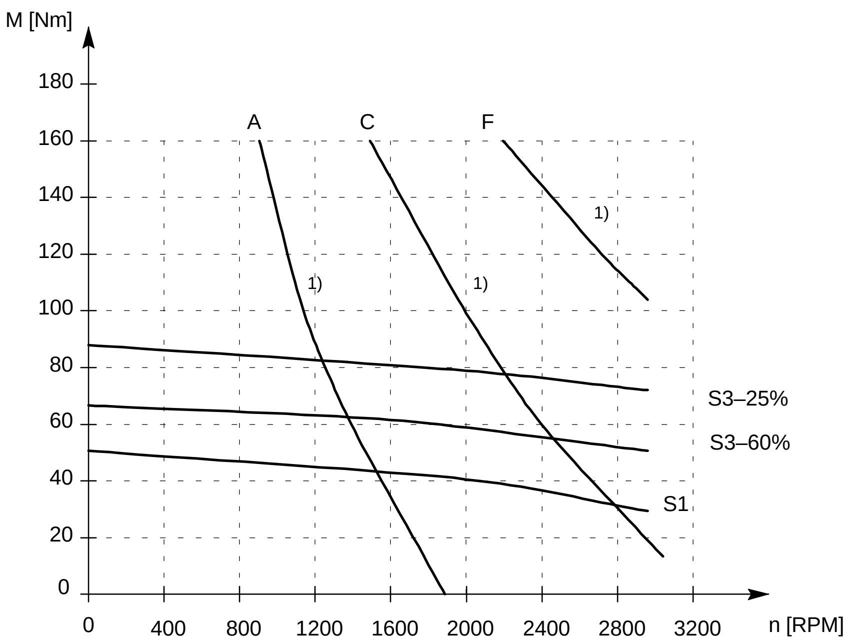


Fig. 3-14 Speed–torque diagram 1FT5106

1) valid for a 600 V DC link voltage

Table 3-15 Standard motor 1FT5108

1FT5108						
Technical data	**Code**	**Units**	**–0AA71**	**–□AC71**	**–0AF71**	
Engineering data						
Rated speed	n_{rated}	RPM	1200	2000	3000	
Rated torque	$M_{rated\ (100\ K)}$	Nm	55.0	42.5	20.0	
Rated current	I_{rated}	A	22.0	27.0	21.0	
Stall torque	$M_{0\ (60\ K)}$	Nm	55.0	55.0	55.0	
Stall torque	$M_{0\ (100\ K)}$	Nm	68.0	68.0	68.0	
Stall current	$I_{0\ (60\ K)}$	A	20.5	32.5	50.5	
Stall current	$I_{0\ (100\ K)}$	A	25.5	40.0	62.5	
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	315	315	315	
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	290	290	290	
Limit data						
Max. speed	n_{max}	RPM	2000	3100	4900	
Max. torque	M_{max}	Nm	220	220	220	
Peak current	I_{max}	A	95.0	164.0	247.0	
Limiting torque	M_{limit}	Nm	120.0	120.0	125.0	
Physical constants						
Torque constant	k_T	Nm/A	2.70	1.70	1.09	
Voltage constant	k_E	V/1000 RPM	306	192	123	
Winding resistance	$R_{ph.}$	Ohm	0.29	0.13	0.054	
Three–phase inductance	L_D	mH	5.8	2.5	1.0	
Electrical time constant	T_{el}	ms	19	19	19	
Mechanical time constant	T_{mech}	ms	2.4	2.4	2.4	
Thermal time constant	T_{th}	min	55	55	55	
Weight with brake	m	kg	55	55	55	
Weight without brake	m	kg	51	51	51	

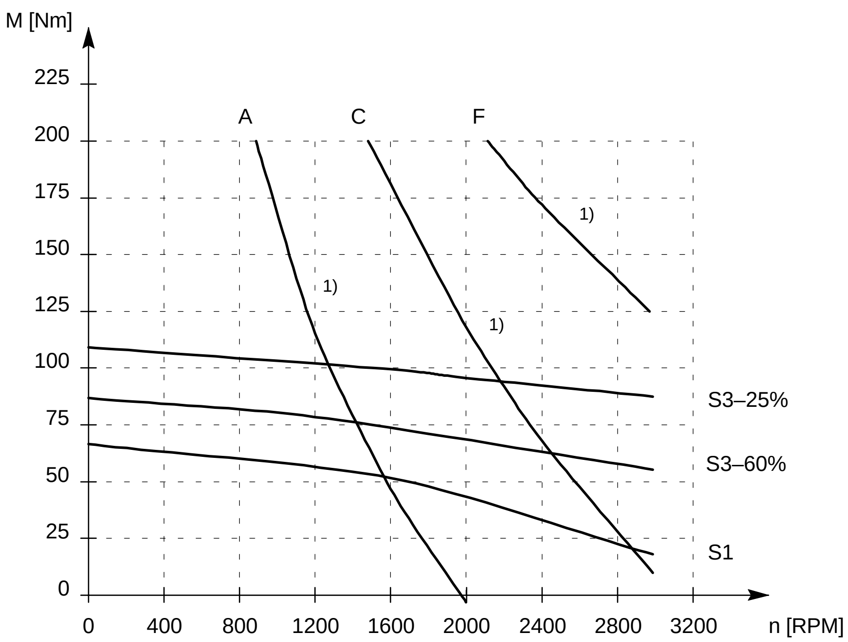


Fig. 3-15 Speed–torque diagram 1FT5108

1) valid for a 600 V DC link voltage

Table 3-16 Standard motor 1FT5132

1FT5132						
Technical data	**Code**	**Units**	**–0AA71**	**–0AC71**	**–0AF71**	
Engineering data						
Rated speed	n_{rated}	RPM	1200	2000	3000	
Rated torque	$M_{rated\ (100\ K)}$	Nm	55.0	45.0	30.0	
Rated current	I_{rated}	A	22.0	29.0	27.0	
Stall torque	$M_{0\ (60\ K)}$	Nm	60.0	60.0	60.0	
Stall torque	$M_{0\ (100\ K)}$	Nm	75.0	75.0	75.0	
Stall current	$I_{0\ (60\ K)}$	A	22.5	35.5	47.5	
Stall current	$I_{0\ (100\ K)}$	A	28.0	44.0	59.0	
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	539	539	539	
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	464	464	464	
Limit data						
Max. speed	n_{max}	RPM	2000	3100	3200	
Max. torque	M_{max}	Nm	240	240	240	
Peak current	I_{max}	A	112.0	186.0	236.0	
Limiting torque	M_{limit}	Nm	129.0	115.0	112.0	
Physical constants						
Torque constant	k_T	Nm/A	2.70	1.71	1.27	
Voltage constant	k_E	V/1000 RPM	306	194	144	
Winding resistance	$R_{ph.}$	Ohm	0.28	0.10	0.062	
Three–phase inductance	L_D	mH	6.4	2.3	1.4	
Electrical time constant	T_{el}	ms	23	23	23	
Mechanical time constant	T_{mech}	ms	3.3	3.3	3.3	
Thermal time constant	T_{th}	min	80	80	80	
Weight with brake	m	kg	82	82	82	
Weight without brake	m	kg	75	75	75	

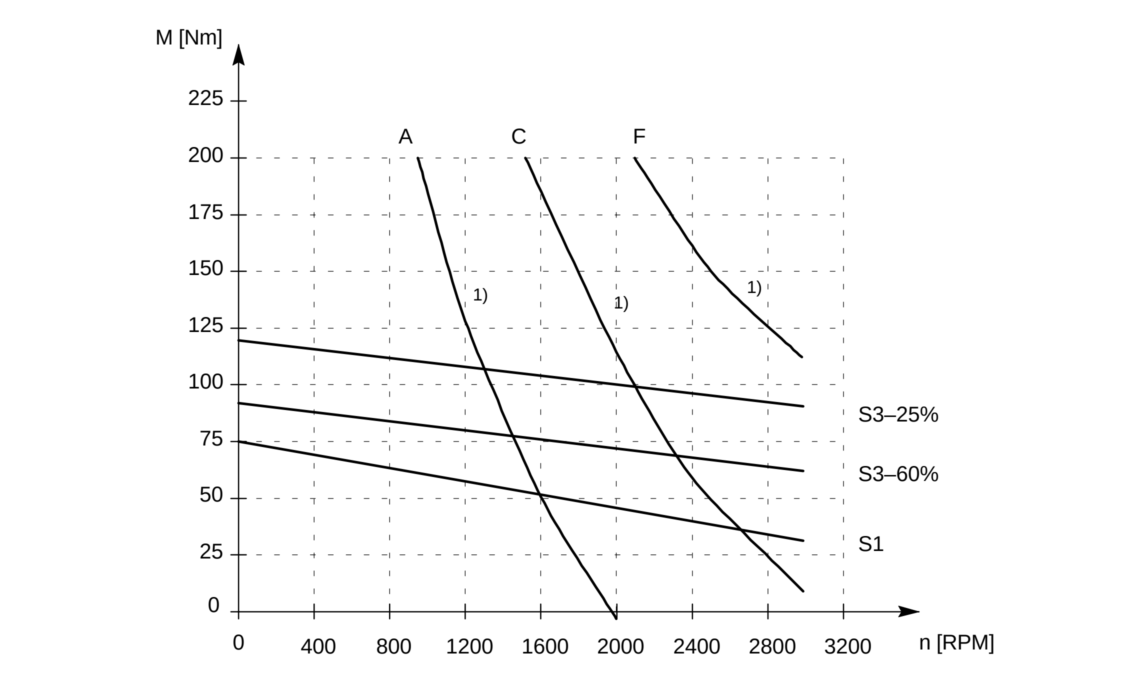


Fig. 3-16 Speed–torque diagram 1FT5132

1) valid for a 600 V DC link voltage

Table 3-17 Standard motor 1FT5134

1FT5134					
Technical data	**Code**	**Units**	**–0AA71**	**–0AC71**	
Engineering data					
Rated speed	n_{rated}	RPM	1200	2000	
Rated torque	$M_{rated\ (100\ K)}$	Nm	65.0	50.0	
Rated current	I_{rated}	A	26.0	34.0	
Stall torque	$M_{0\ (60\ K)}$	Nm	75.0	75.0	
Stall torque	$M_{0\ (100\ K)}$	Nm	90.0	90.0	
Stall current	$I_{0\ (60\ K)}$	A	28.0	47.0	
Stall current	$I_{0\ (100\ K)}$	A	33.5	56.0	
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	665	665	
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	590	590	
Limit data					
Max. speed	n_{max}	RPM	2000	3200	
Max. torque	M_{max}	Nm	300	300	
Peak current	I_{max}	A	134.0	222.0	
Limiting torque	M_{limit}	Nm	164.0	156.0	
Physical constants					
Torque constant	k_T	Nm/A	2.70	1.61	
Voltage constant	k_E	V/1000 RPM	306	182	
Winding resistance	$R_{ph.}$	Ohm	0.19	0.073	
Three–phase inductance	L_D	mH	4.8	1.8	
Electrical time constant	T_{el}	ms	25	25	
Mechanical time constant	T_{mech}	ms	3.1	3.1	
Thermal time constant	T_{th}	min	85	85	
Weight with brake	m	kg	102	102	
Weight without brake	m	kg	95	95	

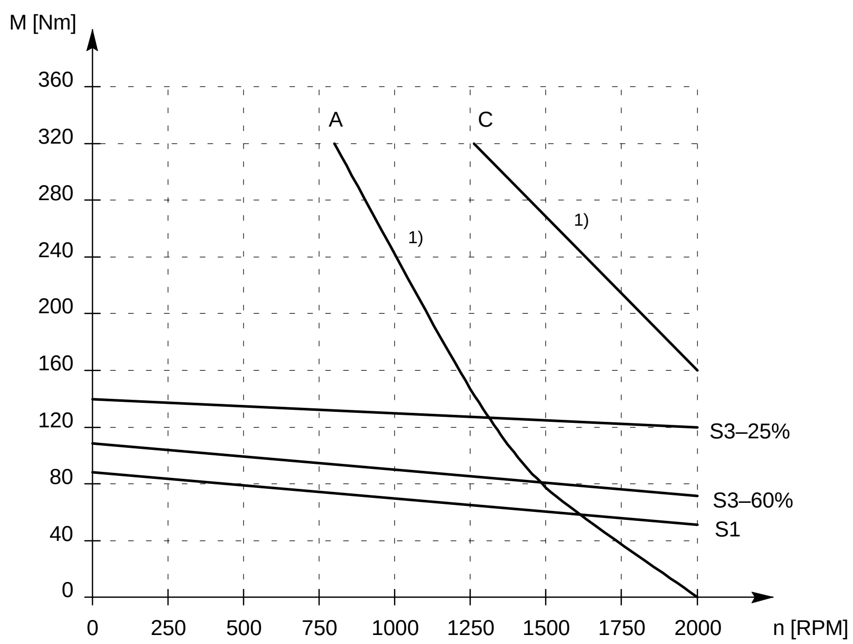


Fig. 3-17 Speed–torque diagram 1FT5134

1) valid for a 600 V DC link voltage

Table 3-18 Standard motor 1FT5136

1FT5136					
Technical data	**Code**	**Units**	**–0AA71**	**–0AC71**	
Engineering data					
Rated speed	n_{rated}	RPM	1200	2000	
Rated torque	$M_{rated\ (100\ K)}$	Nm	82.0	60.0	
Rated current	I_{rated}	A	33.0	37.0	
Stall torque	$M_{0\ (60\ K)}$	Nm	85.0	85.0	
Stall torque	$M_{0\ (100\ K)}$	Nm	105.0	105.0	
Stall current	$I_{0\ (60\ K)}$	A	31.5	47.5	
Stall current	$I_{0\ (100\ K)}$	A	39.0	59.0	
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	791	791	
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	716	716	
Limit data					
Max. speed	n_{max}	RPM	1900	2900	
Max. torque	M_{max}	Nm	340	340	
Peak current	I_{max}	A	156.0	234.0	
Limiting torque	M_{limit}	Nm	180.0	170.0	
Physical constants					
Torque constant	k_T	Nm/A	2.70	1.79	
Voltage constant	k_E	V/1000 RPM	306	203	
Winding resistance	$R_{ph.}$	Ohm	0.14	0.063	
Three–phase inductance	L_D	mH	3.8	1.7	
Electrical time constant	T_{el}	ms	27	27	
Mechanical time constant	T_{mech}	ms	2.8	2.8	
Thermal time constant	T_{th}	min	90	90	
Weight with brake	m	kg	122	122	
Weight without brake	m	kg	115	115	

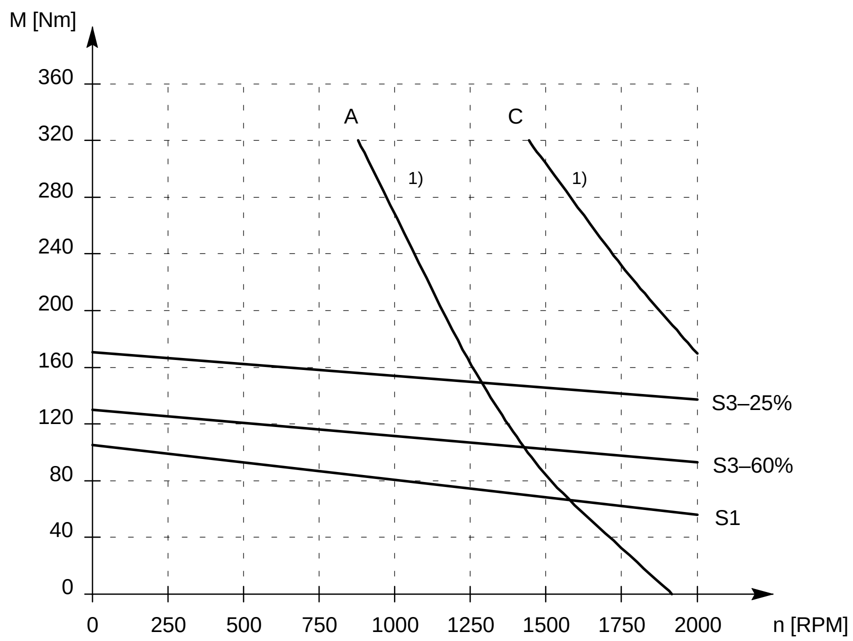


Fig. 3-18 Speed–torque diagram 1FT5136

1) valid for a 600 V DC link voltage

Table 3-19 Standard motor 1FT5138

1FT5138				
Technical data	**Code**	**Units**	**–0AA71**	
Engineering data				
Rated speed	n_{rated}	RPM	1200	
Rated torque	$M_{rated\ (100\ K)}$	Nm	100.0	
Rated current	I_{rated}	A	40.0	
Stall torque	$M_{0\ (60\ K)}$	Nm	105.0	
Stall torque	$M_{0\ (100\ K)}$	Nm	130.0	
Stall current	$I_{0\ (60\ K)}$	A	39.0	
Stall current	$I_{0\ (100\ K)}$	A	48.5	
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	980	
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	905	
Limit data				
Max. speed	n_{max}	RPM	2000	
Max. torque	M_{max}	Nm	420	
Peak current	I_{max}	A	194.0	
Limiting torque	M_{limit}	Nm	220.0	
Physical constants				
Torque constant	k_T	Nm/A	2.70	
Voltage constant	k_E	V/1000 RPM	306	
Winding resistance	$R_{ph.}$	Ohm	0.11	
Three–phase inductance	L_D	mH	3.2	
Electrical time constant	T_{el}	ms	29	
Mechanical time constant	T_{mech}	ms	2.7	
Thermal time constant	T_{th}	min	100	
Weight with brake	m	kg	152	
Weight without brake	m	kg	145	

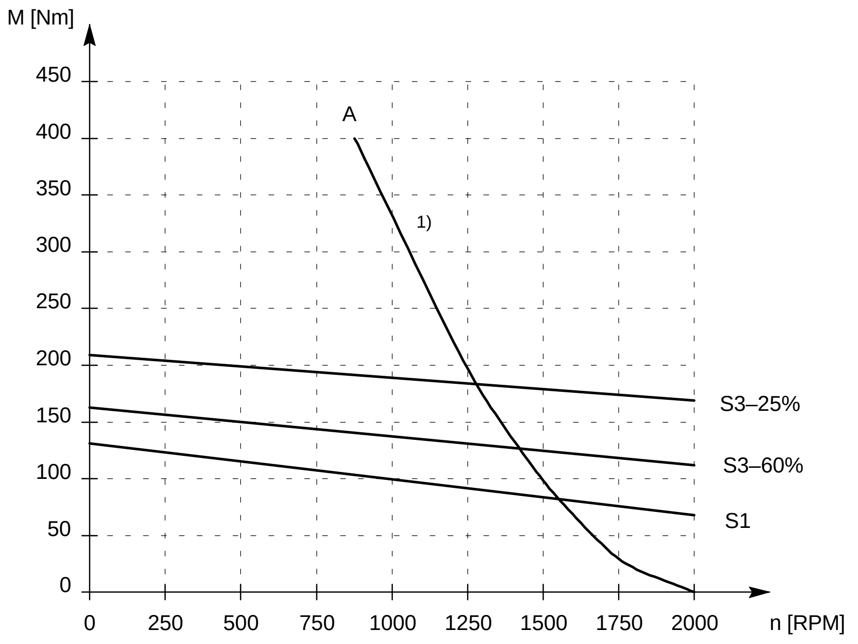


Fig. 3-19 Speed–torque diagram 1FT5138

1) valid for a 600 V DC link voltage

Table 3-20 Standard motor 1FT5074. force–ventilated

1FT5074					
Technical data	**Code**	**Units**	**–0SG71**	**–0SK71**	
Engineering data					
Rated speed	n_{rated}	RPM	4000	6000	
Rated torque	$M_{rated\ (100\ K)}$	Nm	17.0	12.0	
Rated current	I_{rated}	A	22.0	23.0	
Stall torque	$M_{0\ (60\ K)}$	Nm	16.0	16.0	
Stall torque	$M_{0\ (100\ K)}$	Nm	20.5	20.5	
Stall current	$I_{0\ (60\ K)}$	A	19.0	28.0	
Stall current	$I_{0\ (100\ K)}$	A	24.5	36.0	
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	44.2	44.2	
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	36.7	36.7	
Limit data					
Max. speed	n_{max}	RPM	6200	7000	
Max. torque	M_{max}	Nm	56	56	
Peak current	I_{max}	A	90.0	104.0	
Limiting torque	M_{limit}	Nm	24.5	22.5	
Physical constants					
Torque constant	k_T	Nm/A	0.85	0.57	
Voltage constant	k_E	V/1000 RPM	96	65	
Winding resistance	$R_{ph.}$	Ohm	0.33	0.14	
Three–phase inductance	L_D	mH	3.6	1.5	
Electrical time constant	T_{el}	ms	11	11	
Mechanical time constant	T_{mech}	ms	3.0	3.0	
Thermal time constant	T_{th}	min	40	40	
Weight with brake	m	kg	23.5	23.5	
Weight without brake	m	kg	22	22	

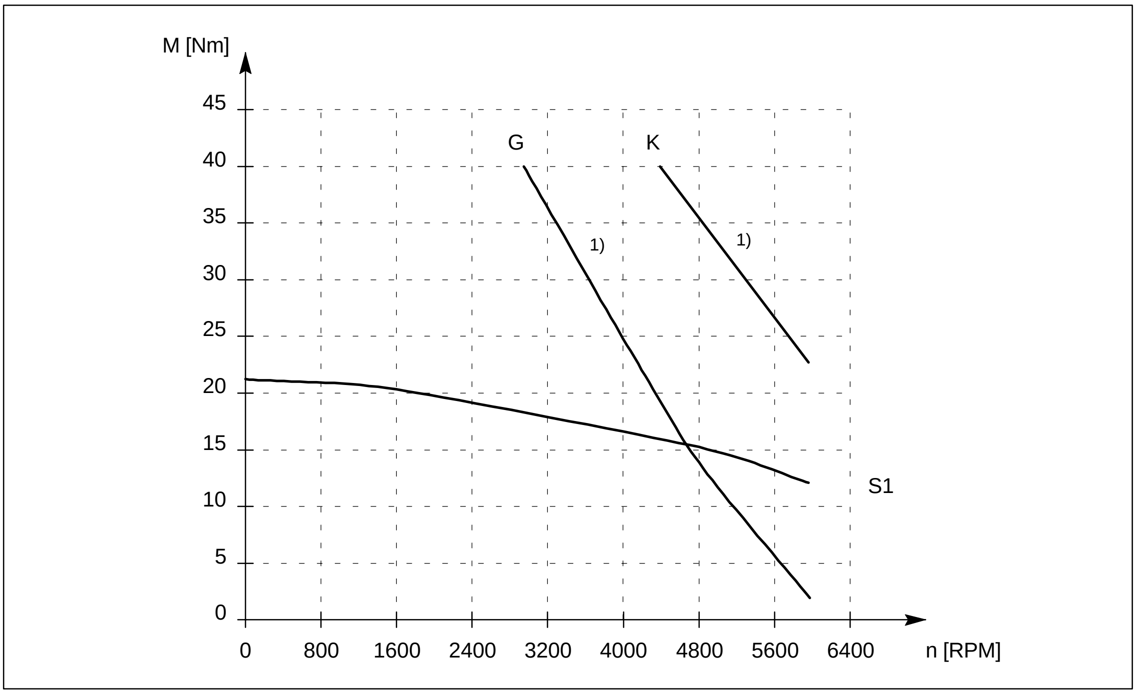


Fig. 3-20 Speed–torque diagram 1FT5074. force–ventilated

1) valid for a 600 V DC link voltage

Table 3-21 Standard motor 1FT5076. force–ventilated

1FT5076					
Technical data	**Code**	**Units**	**–0SG71**	**–0SK71**	
Engineering data					
Rated speed	n_{rated}	RPM	4000	6000	
Rated torque	$M_{rated\ (100\ K)}$	Nm	21.0	15.0	
Rated current	I_{rated}	A	27.0	29.0	
Stall torque	$M_{0\ (60\ K)}$	Nm	20.5	20.5	
Stall torque	$M_{0\ (100\ K)}$	Nm	26.0	26.0	
Stall current	$I_{0\ (60\ K)}$	A	24.5	36.0	
Stall current	$I_{0\ (100\ K)}$	A	31.0	46.0	
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	58.4	58.4	
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	50.9	50.9	
Limit data					
Max. speed	n_{max}	RPM	6200	7000	
Max. torque	M_{max}	Nm	72	72	
Peak current	I_{max}	A	110.0	163.0	
Limiting torque	M_{limit}	Nm	36.0	36.0	
Physical constants					
Torque constant	k_T	Nm/A	0.85	0.57	
Voltage constant	k_E	V/1000 RPM	96	65	
Winding resistance	$R_{ph.}$	Ohm	0.20	0.093	
Three–phase inductance	L_D	mH	2.4	1.1	
Electrical time constant	T_{el}	ms	12	12	
Mechanical time constant	T_{mech}	ms	2.9	2.9	
Thermal time constant	T_{th}	min	45	45	
Weight with brake	m	kg	27.5	27.5	
Weight without brake	m	kg	26	26	

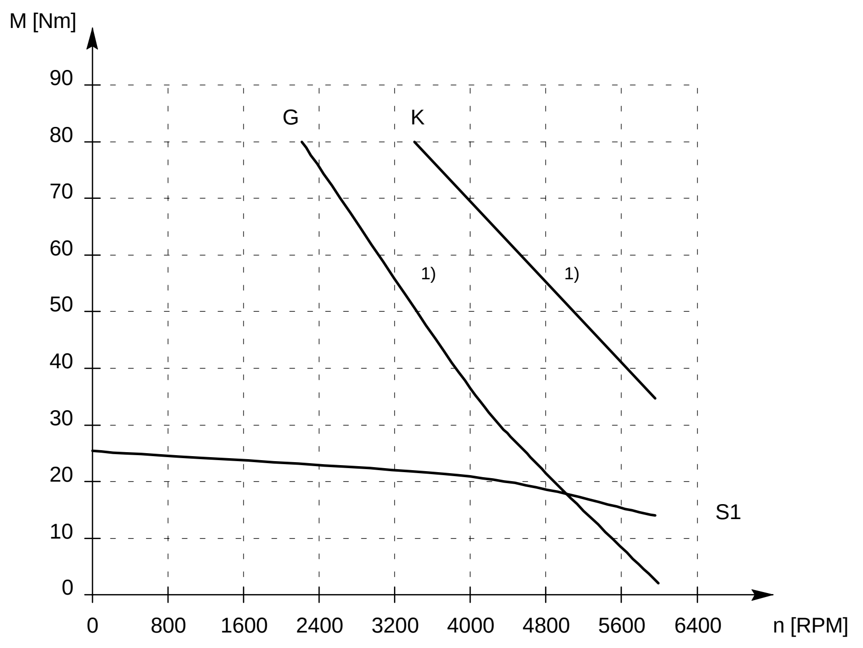


Fig. 3-21 Speed–torque diagram 1FT5076. force–ventilated

1) valid for a 600 V DC link voltage

Table 3-22 Standard motor 1FT5102. force–ventilated

1FT5102					
Technical data	**Code**	**Units**	**–0SF71**	**–0SG71**	
Engineering data					
Rated speed	n_{rated}	RPM	3000	4000	
Rated torque	$M_{rated\ (100\ K)}$	Nm	36.0	32.0	
Rated current	I_{rated}	A	36.0	40.0	
Stall torque	$M_{0\ (60\ K)}$	Nm	34.0	34.0	
Stall torque	$M_{0\ (100\ K)}$	Nm	40.0	40.0	
Stall current	$I_{0\ (60\ K)}$	A	31.5	39.5	
Stall current	$I_{0\ (100\ K)}$	A	37.0	46.5	
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	161	161	
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	136	136	
Limit data					
Max. speed	n_{max}	RPM	4900	6200	
Max. torque	M_{max}	Nm	108	108	
Peak current	I_{max}	A	120.0	164.0	
Limiting torque	M_{limit}	Nm	57.0	45.0	
Physical constants					
Torque constant	k_T	Nm/A	1.08	0.86	
Voltage constant	k_E	V/1000 RPM	122	97	
Winding resistance	$R_{ph.}$	Ohm	0.14	0.097	
Three–phase inductance	L_D	mH	2.2	1.4	
Electrical time constant	T_{el}	ms	16	16	
Mechanical time constant	T_{mech}	ms	3.5	3.5	
Thermal time constant	T_{th}	min	45	45	
Weight with brake	m	kg	39	39	
Weight without brake	m	kg	35	35	

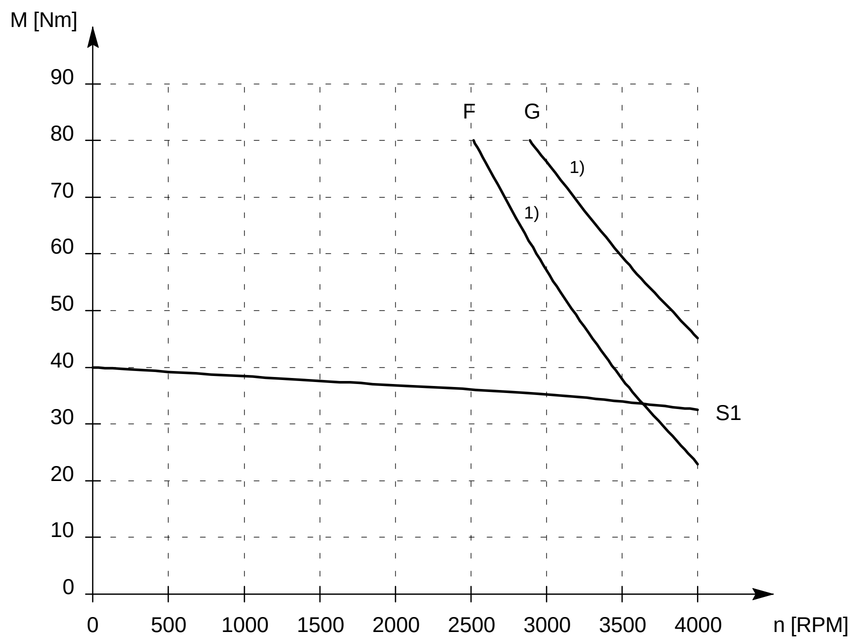


Fig. 3-22 Speed–torque diagram 1FT5102. force–ventilated

1) valid for a 600 V DC link voltage

Table 3-23 Standard motor 1FT5104. force–ventilated

1FT5104				
Technical data	**Code**	**Units**	**–□SF71**	
Engineering data				
Rated speed	n_{rated}	RPM	3000	
Rated torque	$M_{rated\ (100\ K)}$	Nm	45.0	
Rated current	I_{rated}	A	45.0	
Stall torque	$M_{0\ (60\ K)}$	Nm	48.0	
Stall torque	$M_{0\ (100\ K)}$	Nm	58.0	
Stall current	$I_{0\ (60\ K)}$	A	44.0	
Stall current	$I_{0\ (100\ K)}$	A	53.0	
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	210	
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	185	
Limit data				
Max. speed	n_{max}	RPM	4800	
Max. torque	M_{max}	Nm	148	
Peak current	I_{max}	A	164.0	
Limiting torque	M_{limit}	Nm	80.0	
Physical constants				
Torque constant	k_T	Nm/A	1.09	
Voltage constant	k_E	V/1000 RPM	123	
Winding resistance	$R_{ph.}$	Ohm	0.095	
Three–phase inductance	L_D	mH	1.7	
Electrical time constant	T_{el}	ms	18	
Mechanical time constant	T_{mech}	ms	3.0	
Thermal time constant	T_{th}	min	50	
Weight with brake	m	kg	47	
Weight without brake	m	kg	43	

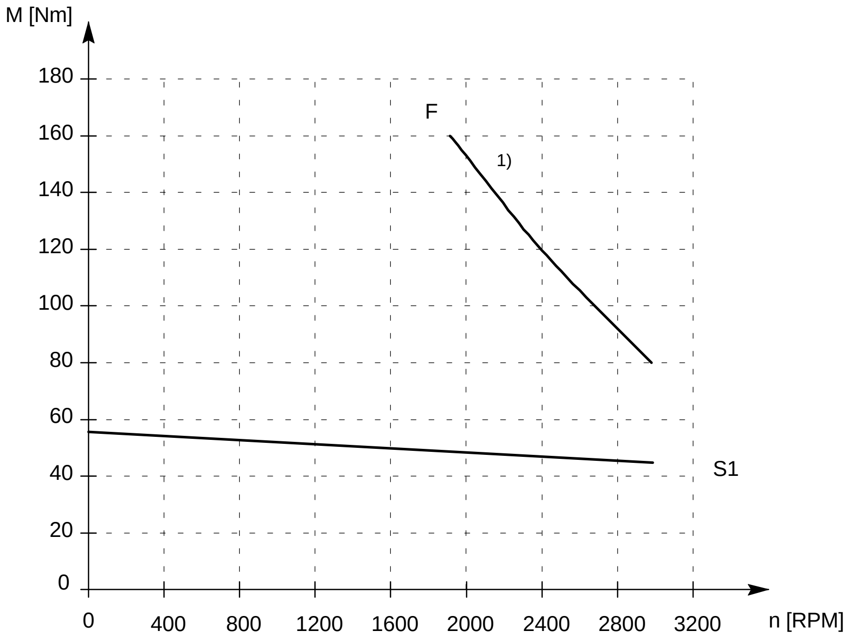


Fig. 3-23 Speed–torque diagram 1FT5104. force–ventilated

1) valid for a 600 V DC link voltage

Table 3-24 Standard motor 1FT5106. force–ventilated

1FT5106				
Technical data	**Code**	**Units**	**–□SF71**	
Engineering data				
Rated speed	n_{rated}	RPM	3000	
Rated torque	$M_{rated\ (100\ K)}$	Nm	58.0	
Rated current	I_{rated}	A	59.0	
Stall torque	$M_{0\ (60\ K)}$	Nm	57.0	
Stall torque	$M_{0\ (100\ K)}$	Nm	70.0	
Stall current	$I_{0\ (60\ K)}$	A	54.0	
Stall current	$I_{0\ (100\ K)}$	A	66.0	
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	264	
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	239	
Limit data				
Max. speed	n_{max}	RPM	5000	
Max. torque	M_{max}	Nm	180	
Peak current	I_{max}	A	200.0	
Limiting torque	M_{limit}	Nm	102.0	
Physical constants				
Torque constant	k_T	Nm/A	1.06	
Voltage constant	k_E	V/1000 RPM	120	
Winding resistance	$R_{ph.}$	Ohm	0.066	
Three–phase inductance	L_D	mH	1.2	
Electrical time constant	T_{el}	ms	19	
Mechanical time constant	T_{mech}	ms	2.8	
Thermal time constant	T_{th}	min	50	
Weight with brake	m	kg	53	
Weight without brake	m	kg	49	

1FT5

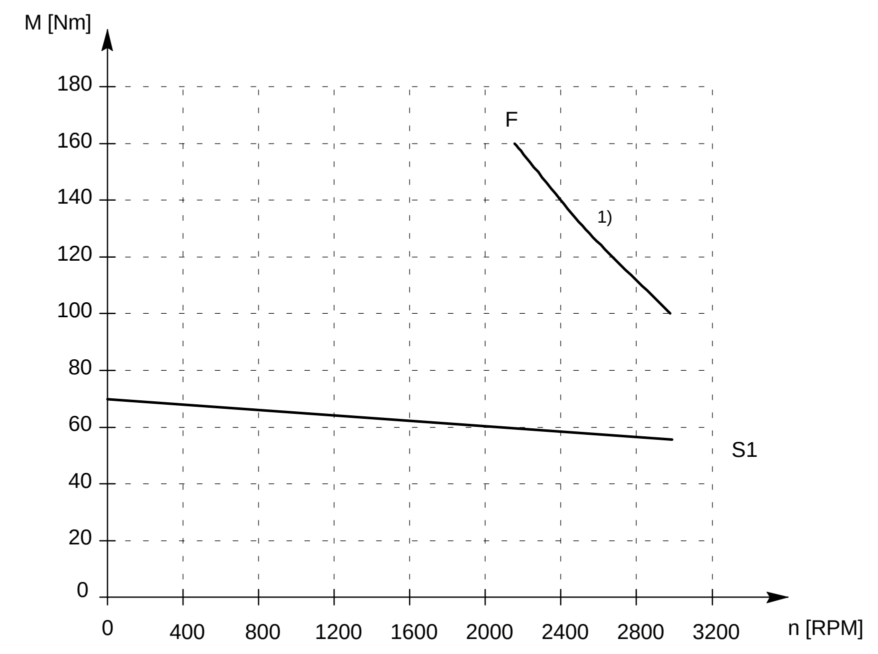


Fig. 3-24 Speed–torque diagram 1FT5106. force–ventilated

1) valid for a 600 V DC link voltage

Table 3-25 Standard motor 1FT5132. force–ventilated

1FT5132						
Technical data	**Code**	**Units**	**–0SA71**	**–0SC71**	**–0SF71**	
Engineering data						
Rated speed	n_{rated}	RPM	1200	2000	3000	
Rated torque	$M_{rated\ (100\ K)}$	Nm	85.0	80.0	75.0	
Rated current	I_{rated}	A	34.0	50.0	64.0	
Stall torque	$M_{0\ (60\ K)}$	Nm	70.0	70.0	70.0	
Stall torque	$M_{0\ (100\ K)}$	Nm	95.0	95.0	95.0	
Stall current	$I_{0\ (60\ K)}$	A	26.0	41.0	55.5	
Stall current	$I_{0\ (100\ K)}$	A	35.0	56.0	75.0	
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	539	539	539	
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	464	464	464	
Limit data						
Max. speed	n_{max}	RPM	1900	3000	3200	
Max. torque	M_{max}	Nm	240	240	240	
Peak current	I_{max}	A	112.0	186.0	236.0	
Limiting torque	M_{limit}	Nm	129.0	115.0	110.0	
Physical constants						
Torque constant	k_T	Nm/A	2.70	1.71	1.27	
Voltage constant	k_E	V/1000 RPM	306	194	144	
Winding resistance	$R_{ph.}$	Ohm	0.28	0.10	0.062	
Three–phase inductance	L_D	mH	6.4	2.3	1.4	
Electrical time constant	T_{el}	ms	23	23	23	
Mechanical time constant	T_{mech}	ms	3.5	3.5	3.5	
Thermal time constant	T_{th}	min	80	80	80	
Weight with brake	m	kg	87	87	87	
Weight without brake	m	kg	80	80	80	

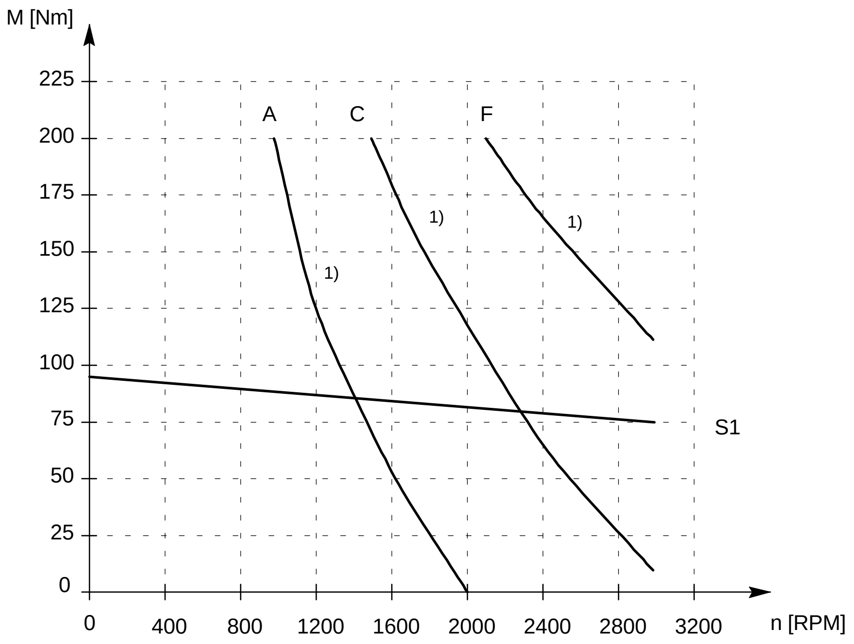


Fig. 3-25 Speed–torque diagram 1FT5132. force–ventilated

1) valid for a 600 V DC link voltage

1FT5

Table 3-26 Standard motor 1FT5134. force–ventilated

1FT5134					
Technical data	**Code**	**Units**	**–0SA71**	**–0SC71**	
Engineering data					
Rated speed	n_{rated}	RPM	1200	2000	
Rated torque	$M_{rated\ (100\ K)}$	Nm	115.0	110.0	
Rated current	I_{rated}	A	46.0	74.0	
Stall torque	$M_{0\ (60\ K)}$	Nm	90.0	90.0	
Stall torque	$M_{0\ (100\ K)}$	Nm	120.0	120.0	
Stall current	$I_{0\ (60\ K)}$	A	34.0	56.0	
Stall current	$I_{0\ (100\ K)}$	A	45.0	75.0	
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	665	665	
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	590	590	
Limit data					
Max. speed	n_{max}	RPM	1900	3200	
Max. torque	M_{max}	Nm	300	300	
Peak current	I_{max}	A	134.0	222.0	
Limiting torque	M_{limit}	Nm	164.0	156.0	
Physical constants					
Torque constant	k_T	Nm/A	2.70	1.61	
Voltage constant	k_E	V/1000 RPM	306	182	
Winding resistance	$R_{ph.}$	Ohm	0.19	0.073	
Three–phase inductance	L_D	mH	4.8	1.8	
Electrical time constant	T_{el}	ms	25	25	
Mechanical time constant	T_{mech}	ms	3.2	3.2	
Thermal time constant	T_{th}	min	85	85	
Weight with brake	m	kg	107	107	
Weight without brake	m	kg	100	100	

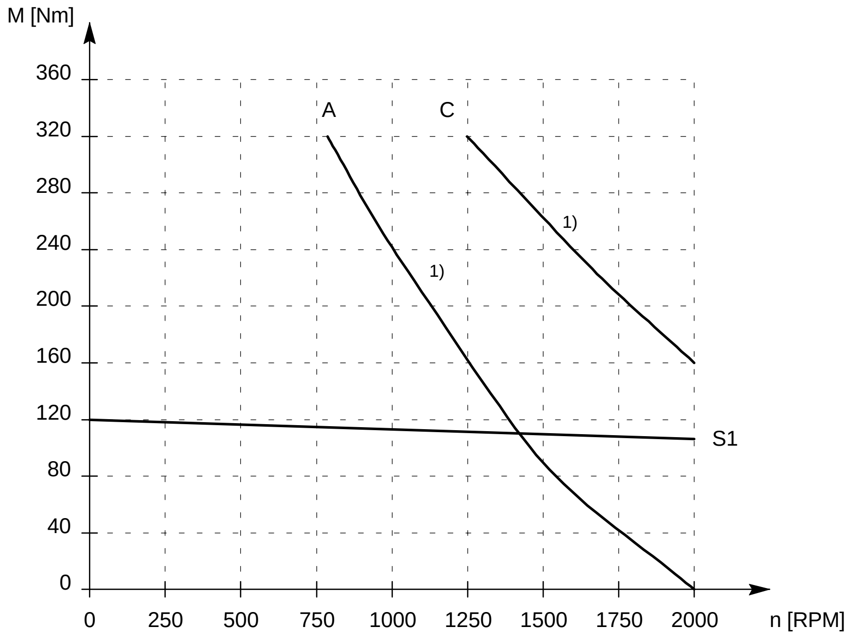


Fig. 3-26 Speed–torque diagram 1FT5134. force–ventilated

1) valid for a 600 V DC link voltage

Table 3-27 Standard motor 1FT5136. force–ventilated

1FT5136					
Technical data	**Code**	**Units**	**–0SA71**	**–0SC71**	
Engineering data					
Rated speed	n_{rated}	RPM	1200	2000	
Rated torque	$M_{rated\ (100\ K)}$	Nm	135.0	130.0	
Rated current	I_{rated}	A	54.0	78.0	
Stall torque	$M_{0\ (60\ K)}$	Nm	110.0	110.0	
Stall torque	$M_{0\ (100\ K)}$	Nm	145.0	145.0	
Stall current	$I_{0\ (60\ K)}$	A	41.0	61.5	
Stall current	$I_{0\ (100\ K)}$	A	54.0	81.0	
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	791	791	
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	716	716	
Limit data					
Max. speed	n_{max}	RPM	1900	2900	
Max. torque	M_{max}	Nm	340	340	
Peak current	I_{max}	A	156.0	234.0	
Limiting torque	M_{limit}	Nm	180.0	170.0	
Physical constants					
Torque constant	k_T	Nm/A	2.70	1.79	
Voltage constant	k_E	V/1000 RPM	306	203	
Winding resistance	$R_{ph.}$	Ohm	0.14	0.063	
Three–phase inductance	L_D	mH	3.8	1.7	
Electrical time constant	T_{el}	ms	27	27	
Mechanical time constant	T_{mech}	ms	2.8	2.8	
Thermal time constant	T_{th}	min	90	90	
Weight with brake	m	kg	127	127	
Weight without brake	m	kg	120	120	

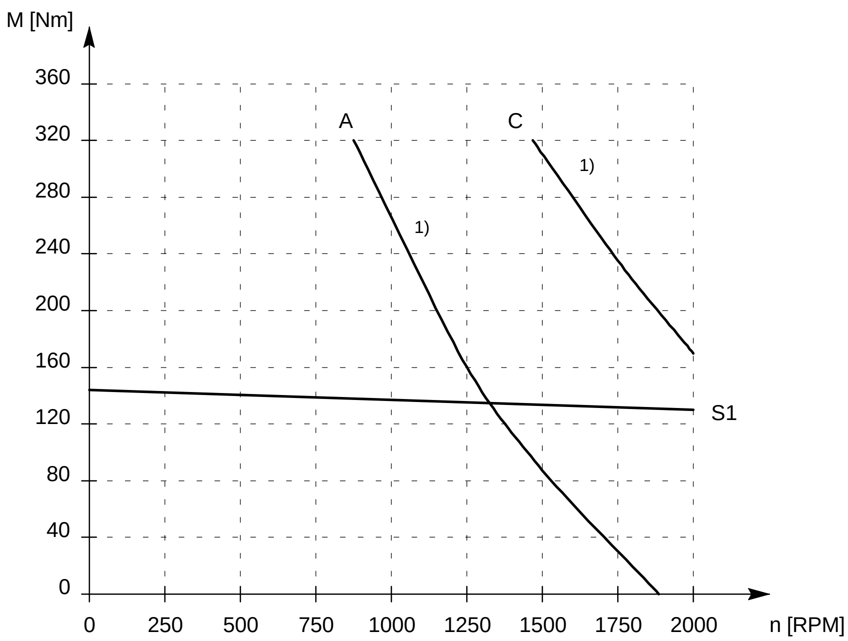


Fig. 3-27 Speed–torque diagram 1FT5136. force–ventilated

1) valid for a 600 V DC link voltage

Table 3-28 Standard motor 1FT5138. force–ventilated

1FT5138				
Technical data	**Code**	**Units**	**–0SA71**	
Engineering data				
Rated speed	n_{rated}	RPM	1200	
Rated torque	$M_{rated\ (100\ K)}$	Nm	170.0	
Rated current	I_{rated}	A	67.0	
Stall torque	$M_{0\ (60\ K)}$	Nm	140.0	
Stall torque	$M_{0\ (100\ K)}$	Nm	185.0	
Stall current	$I_{0\ (60\ K)}$	A	52.0	
Stall current	$I_{0\ (100\ K)}$	A	69.0	
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	980	
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	905	
Limit data				
Max. speed	n_{max}	RPM	1900	
Max. torque	M_{max}	Nm	420	
Peak current	I_{max}	A	194.0	
Limiting torque	M_{limit}	Nm	220.0	
Physical constants				
Torque constant	k_T	Nm/A	2.70	
Voltage constant	k_E	V/1000 RPM	306	
Winding resistance	$R_{ph.}$	Ohm	0.11	
Three–phase inductance	L_D	mH	3.2	
Electrical time constant	T_{el}	ms	29	
Mechanical time constant	T_{mech}	ms	2.7	
Thermal time constant	T_{th}	min	100	
Weight with brake	m	kg	157	
Weight without brake	m	kg	150	

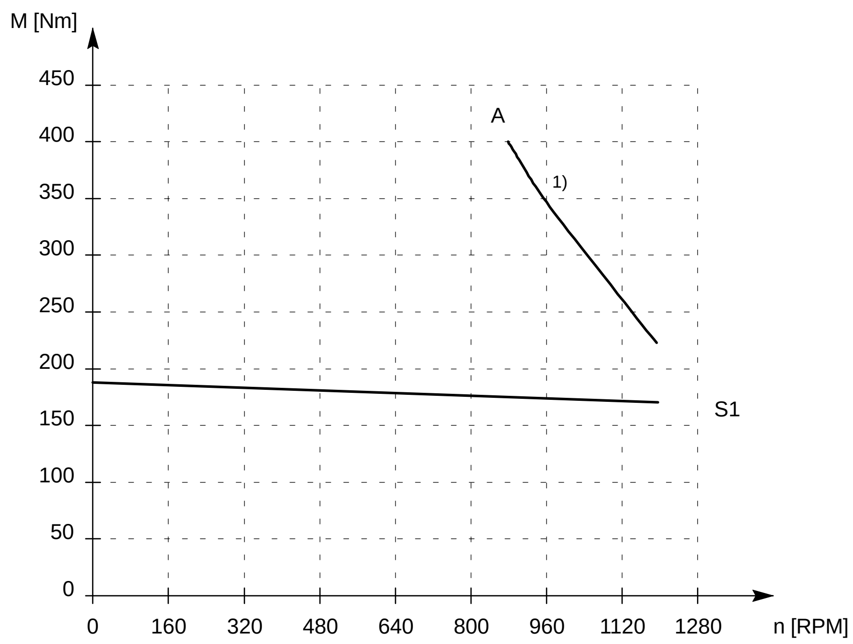


Fig. 3-28 Speed–torque diagram 1FT5138. force–ventilated

1) valid for a 600 V DC link voltage

3.1.2 Short motors

Table 3-29 Short motor 1FT5070

1FT5070					
Technical data	**Code**	**Units**	**–0AC71**	**–0AF71**	
Engineering data					
Rated speed	n_{rated}	RPM	2000	3000	
Rated torque	$M_{rated\ (100\ K)}$	Nm	3.1	3.0	
Rated current	I_{rated}	A	2.0	2.8	
Stall torque	$M_{0\ (60\ K)}$	Nm	3.0	3.0	
Stall torque	$M_{0\ (100\ K)}$	Nm	3.5	3.5	
Stall current	$I_{0\ (60\ K)}$	A	1.8	2.6	
Stall current	$I_{0\ (100\ K)}$	A	2.1	3.1	
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	16.5	16.5	
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	9.0	9.0	
Limit data					
Max. speed	n_{max}	RPM	3000	4600	
Max. torque	M_{max}	Nm	12	12	
Peak current	I_{max}	A	8.0	12.0	
Limiting torque	M_{limit}	Nm	6.0	6.0	
Physical constants					
Torque constant	k_T	Nm/A	1.72	1.15	
Voltage constant	k_E	V/1000 RPM	195	130	
Winding resistance	$R_{ph.}$	Ohm	16.35	7.86	
Three–phase inductance	L_D	mH	85.2	39.1	
Electrical time constant	T_{el}	ms	5.3	5.3	
Mechanical time constant	T_{mech}	ms	10.2	10.2	
Thermal time constant	T_{th}	min	25	25	
Weight with brake	m	kg	9.0	9.0	
Weight without brake	m	kg	7.5	7.5	

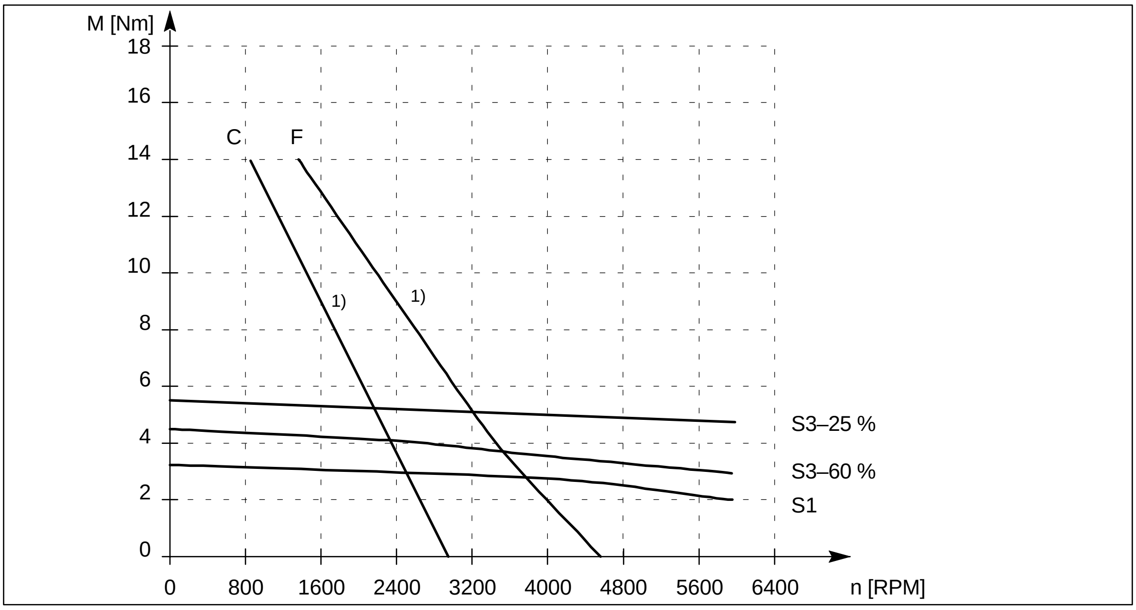


Fig. 3-29 Speed–torque diagram 1FT5070

1) valid for 600 V DC link voltage

1FT5

Table 3-30 Short motor 1FT5071

1FT5071					
Technical data	**Code**	**Units**	**–0AC71**	**–0AF71**	
Engineering data					
Rated speed	n_{rated}	RPM	2000	3000	
Rated torque	$M_{rated\ (100\ K)}$	Nm	5.0	4.8	
Rated current	I_{rated}	A	3.4	5.0	
Stall torque	$M_{0\ (60\ K)}$	Nm	4.5	4.5	
Stall torque	$M_{0\ (100\ K)}$	Nm	5.5	5.5	
Stall current	$I_{0\ (60\ K)}$	A	2.9	4.3	
Stall current	$I_{0\ (100\ K)}$	A	3.5	5.2	
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	20.5	20.5	
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	13	13	
Limit data					
Max. speed	n_{max}	RPM	3300	5000	
Max. torque	M_{max}	Nm	18	18	
Peak current	I_{max}	A	13.0	21.0	
Limiting torque	M_{limit}	Nm	8.0	8.0	
Physical constants					
Torque constant	k_T	Nm/A	1.59	1.06	
Voltage constant	k_E	V/1000 RPM	180	120	
Winding resistance	$R_{ph.}$	Ohm	6.44	2.90	
Three–phase inductance	L_D	mH	43.8	18.9	
Electrical time constant	T_{el}	ms	6.8	6.8	
Mechanical time constant	T_{mech}	ms	6.7	6.7	
Thermal time constant	T_{th}	min	30	30	
Weight with brake	m	kg	10	10	
Weight without brake	m	kg	8.5	8.5	

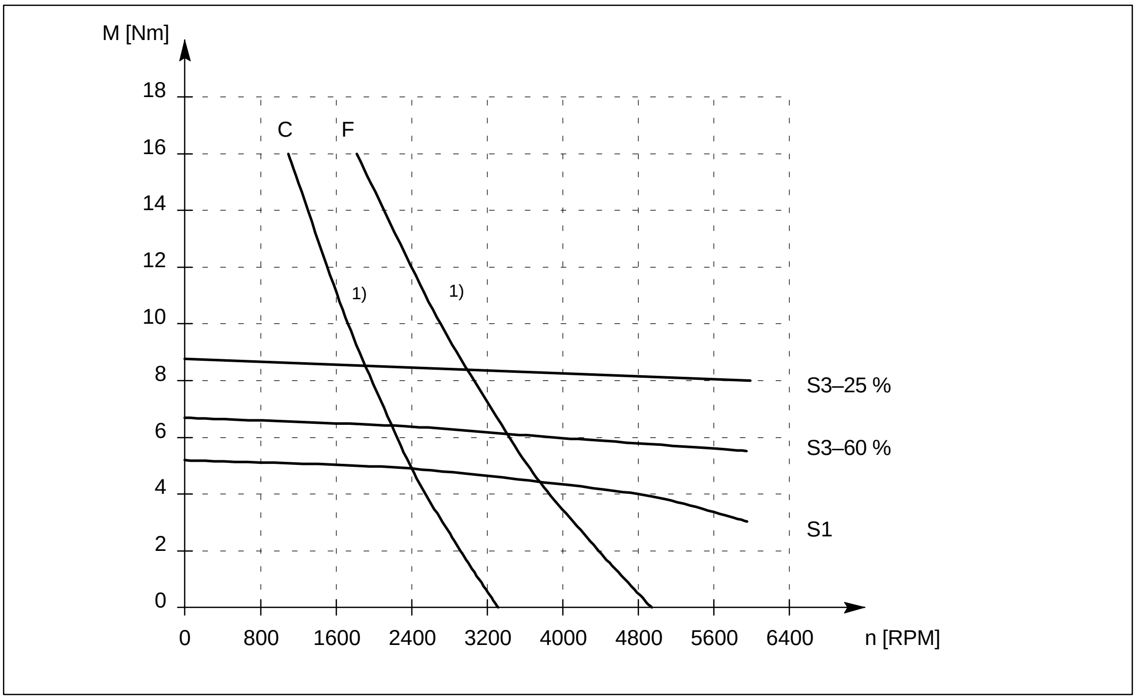


Fig. 3-30 Speed–torque diagram 1FT5071

1) valid for 600 V DC link voltage

Table 3-31 Short motor 1FT5073

1FT5073					
Technical data	**Code**	**Units**	**–0AC71**	**–0AF71**	
Engineering data					
Rated speed	n_{rated}	RPM	2000	3000	
Rated torque	$M_{rated\ (100\ K)}$	Nm	8.0	7.2	
Rated current	I_{rated}	A	5.3	7.2	
Stall torque	$M_{0\ (60\ K)}$	Nm	7.0	7.0	
Stall torque	$M_{0\ (100\ K)}$	Nm	9.0	9.0	
Stall current	$I_{0\ (60\ K)}$	A	4.3	6.4	
Stall current	$I_{0\ (100\ K)}$	A	5.5	8.2	
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	27.5	27.5	
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	20	20	
Limit data					
Max. speed	n_{max}	RPM	3200	4800	
Max. torque	M_{max}	Nm	28	28	
Peak current	I_{max}	A	21.0	32.0	
Limiting torque	M_{limit}	Nm	15.2	15.4	
Physical constants					
Torque constant	k_T	Nm/A	1.64	1.1	
Voltage constant	k_E	V/1000 RPM	186	124	
Winding resistance	$R_{ph.}$	Ohm	3.06	1.35	
Three–phase inductance	L_D	mH	25.7	11.4	
Electrical time constant	T_{el}	ms	8.5	8.5	
Mechanical time constant	T_{mech}	ms	4.5	4.5	
Thermal time constant	T_{th}	min	35	35	
Weight with brake	m	kg	12	12	
Weight without brake	m	kg	10.5	10.5	

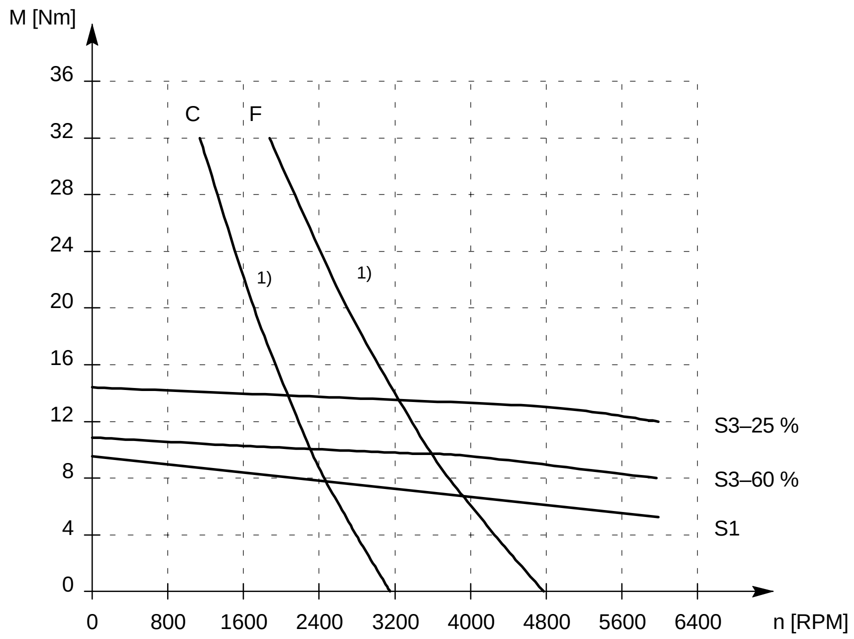


Fig. 3-31 Speed–torque diagram 1FT5073

1) valid for 600 V DC link voltage

Table 3-32 Short motor 1FT5100

1FT5100					
Technical data	**Code**	**Units**	**–0AC71**	**–0AF71**	
Engineering data					
Rated speed	n_{rated}	RPM	2000	3000	
Rated torque	$M_{rated\ (100\ K)}$	Nm	12.0	11.0	
Rated current	I_{rated}	A	7.9	11.0	
Stall torque	$M_{0\ (60\ K)}$	Nm	10.0	10.0	
Stall torque	$M_{0\ (100\ K)}$	Nm	13.0	13.0	
Stall current	$I_{0\ (60\ K)}$	A	6.2	9.2	
Stall current	$I_{0\ (100\ K)}$	A	8.0	12.0	
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	84	84	
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	59	59	
Limit data					
Max. speed	n_{max}	RPM	3200	4800	
Max. torque	M_{max}	Nm	40	40	
Peak current	I_{max}	A	32.0	47.0	
Limiting torque	M_{limit}	Nm	19.5	20.0	
Physical constants					
Torque constant	k_T	Nm/A	1.63	1.09	
Voltage constant	k_E	V/1000 min^{-1}	185	123	
Winding resistance	$R_{ph.}$	Ohm	1.4	0.62	
Three–phase inductance	L_D	mH	15.7	7.0	
Electrical time constant	T_{el}	ms	11	11	
Mechanical time constant	T_{mech}	ms	6.2	6.2	
Thermal time constant	T_{th}	min	35	35	
Weight with brake	m	kg	19.5	19.5	
Weight without brake	m	kg	15.5	15.5	

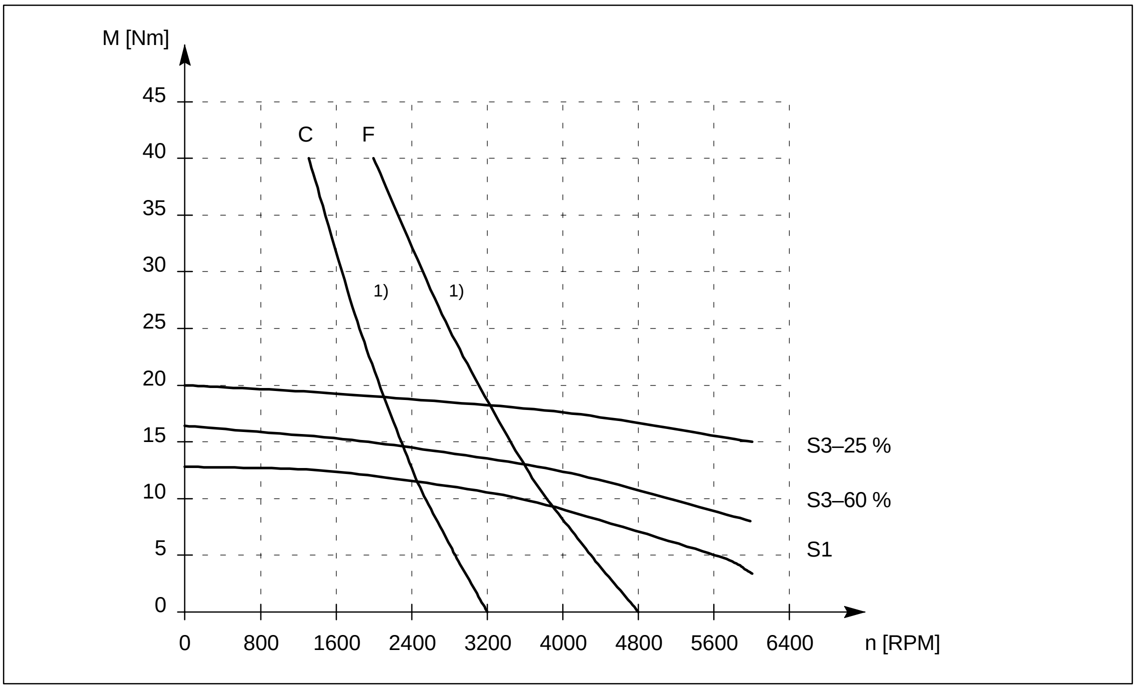


Fig. 3-32 Speed–torque diagram 1FT5100

1) valid for 600 V DC link voltage

Table 3-33 Short motor 1FT5101

1FT5101					
Technical data	**Code**	**Units**	**–0AC71**	**–0AF71**	
Engineering data					
Rated speed	n_{rated}	RPM	2000	3000	
Rated torque	$M_{rated\ (100\ K)}$	Nm	17.0	15.0	
Rated current	I_{rated}	A	11.0	15.0	
Stall torque	$M_{0\ (60\ K)}$	Nm	15.0	15.0	
Stall torque	$M_{0\ (100\ K)}$	Nm	19.0	19.0	
Stall current	$I_{0\ (60\ K)}$	A	9.4	14.5	
Stall current	$I_{0\ (100\ K)}$	A	12.0	18.0	
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	110	110	
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	85	85	
Limit data					
Max. speed	n_{max}	RPM	2700	4200	
Max. torque	M_{max}	Nm	60	60	
Peak current	I_{max}	A	46.0	66.0	
Limiting torque	M_{limit}	Nm	32.0	35.0	
Physical constants					
Torque constant	k_T	Nm/A	1.61	1.06	
Voltage constant	k_E	V/1000 RPM	182	120	
Winding resistance	$R_{ph.}$	Ohm	0.71	0.33	
Three–phase inductance	L_D	mH	9.4	4.2	
Electrical time constant	T_{el}	ms	14	14	
Mechanical time constant	T_{mech}	ms	4.8	4.8	
Thermal time constant	T_{th}	min	40	40	
Weight with brake	m	kg	23	23	
Weight without brake	m	kg	19	19	

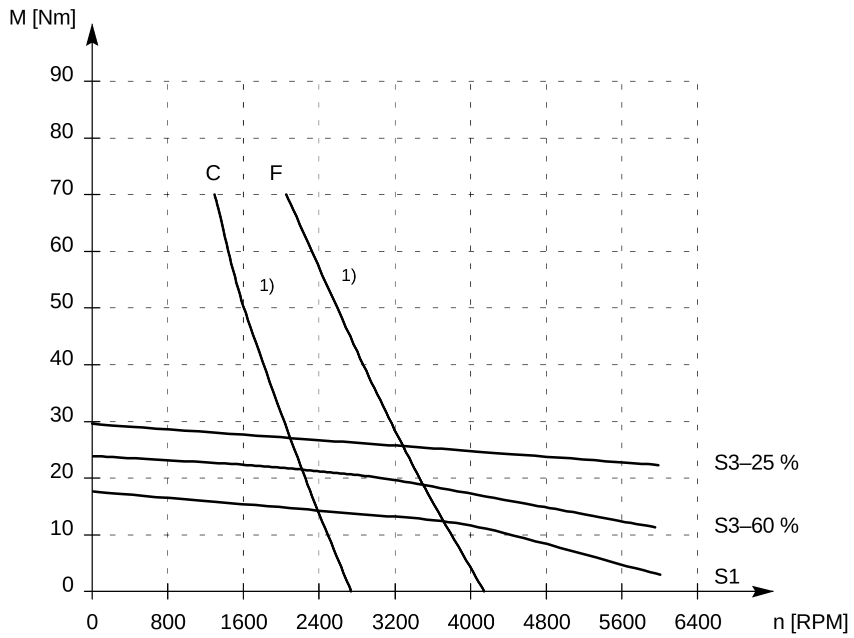


Fig. 3-33 Speed–torque diagram 1FT5101

1) valid for 600 V DC link voltage

Table 3-34 Short motor 1FT5103

1FT5103					
Technical data	**Code**	**Units**	**–0AC71**	**–0AF71**	
Engineering data					
Rated speed	n_{rated}	RPM	2000	3000	
Rated torque	$M_{rated\ (100\ K)}$	Nm	22.5	20.0	
Rated current	I_{rated}	A	15.0	20.0	
Stall torque	$M_{0\ (60\ K)}$	Nm	19.0	19.0	
Stall torque	$M_{0\ (100\ K)}$	Nm	25.0	25.0	
Stall current	$I_{0\ (60\ K)}$	A	12.0	17.5	
Stall current	$I_{0\ (100\ K)}$	A	16.0	23.0	
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	195	195	
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	110	110	
Limit data					
Max. speed	n_{max}	RPM	2700	4200	
Max. torque	M_{max}	Nm	76	76	
Peak current	I_{max}	A	62.0	93.0	
Limiting torque	M_{limit}	Nm	45.0	45.0	
Physical constants					
Torque constant	k_T	Nm/A	1.60	1.10	
Voltage constant	k_E	V/1000 RPM	181	124	
Winding resistance	$R_{ph.}$	Ohm	0.47	0.20	
Three–phase inductance	L_D	mH	6.5	3.0	
Electrical time constant	T_{el}	ms	17	17	
Mechanical time constant	T_{mech}	ms	3.8	3.8	
Thermal time constant	T_{th}	min	45	45	
Weight with brake	m	kg	26	26	
Weight without brake	m	kg	22	22	

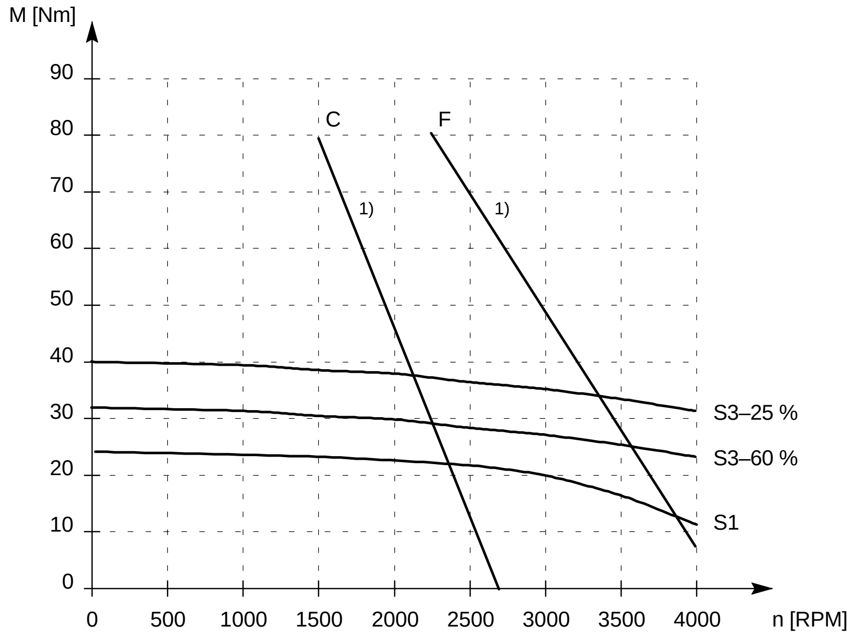


Fig. 3-34 Speed–torque diagram 1FT5103

1) valid for 600 V DC link voltage

 6SN1197–0AA20

3.2 Cantilever/axial force diagrams

Cantilever force

Definition, refer to Chapter 2.1, General information on AC servomotors AL S.

Axial force

$F_{A\ AS}$ is the absolute permissible force without taking into account the bearing alignment forces, the rotor weight, the mounting position as well as the direction of the force.

Caution

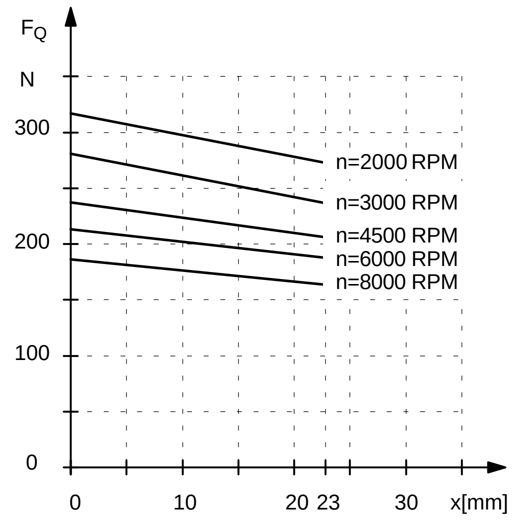
Axial forces are not permissible for motors with integrated holding brake!

For definitions, refer to Chapter 2.1, General information on AC servomotors AL S.

3.2.1 Standard motors

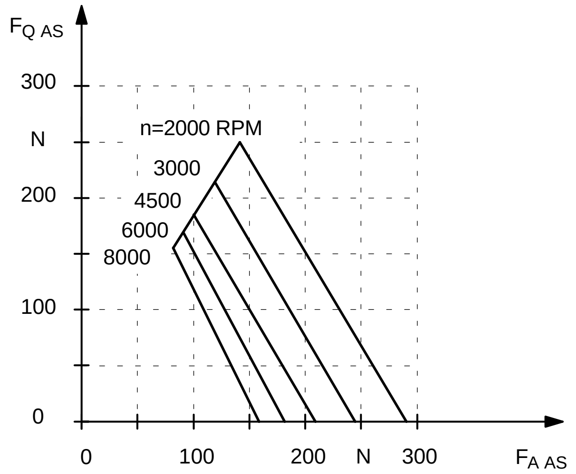
Cantilever force 1FT5034 to 1FT5036

Cantilever force F_Q at distance x from the shaft shoulder for a nominal bearing lifetime of 20 000 hours.



Axial force 1FT5034 to 1FT5036

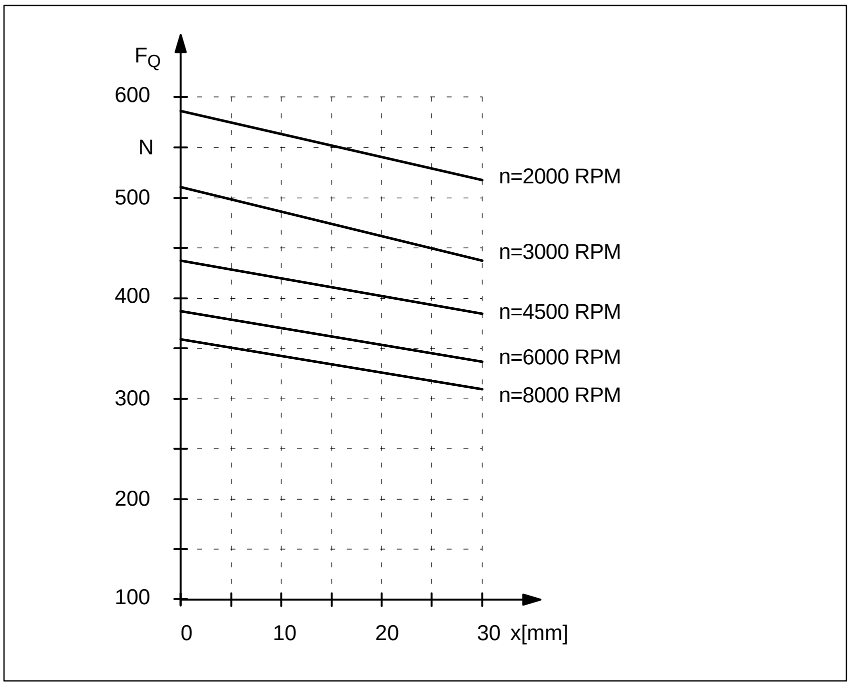
Permissible axial force as a function of the cantilever force.



1FT5

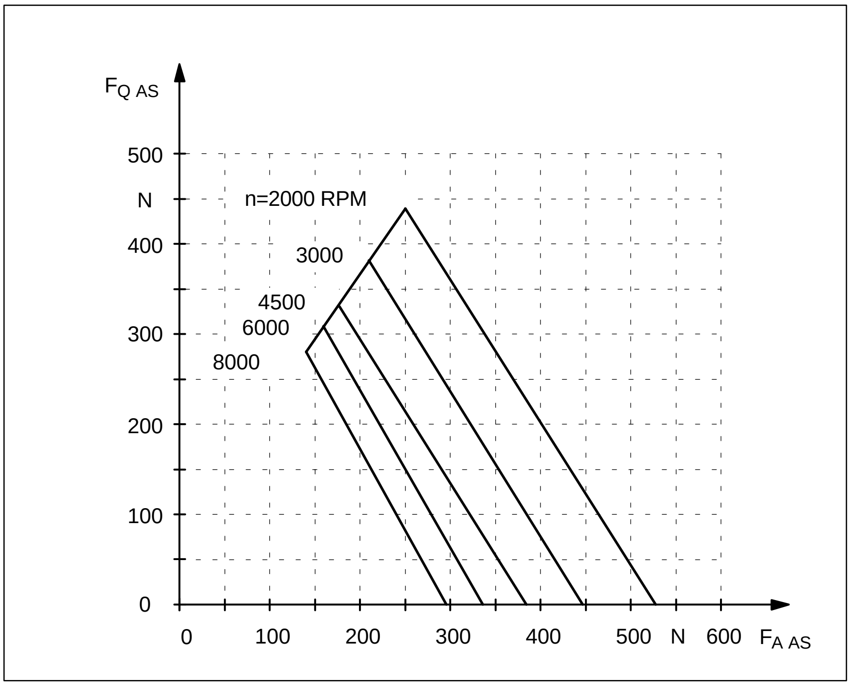
Cantilever force 1FT5042 to 1FT5046

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



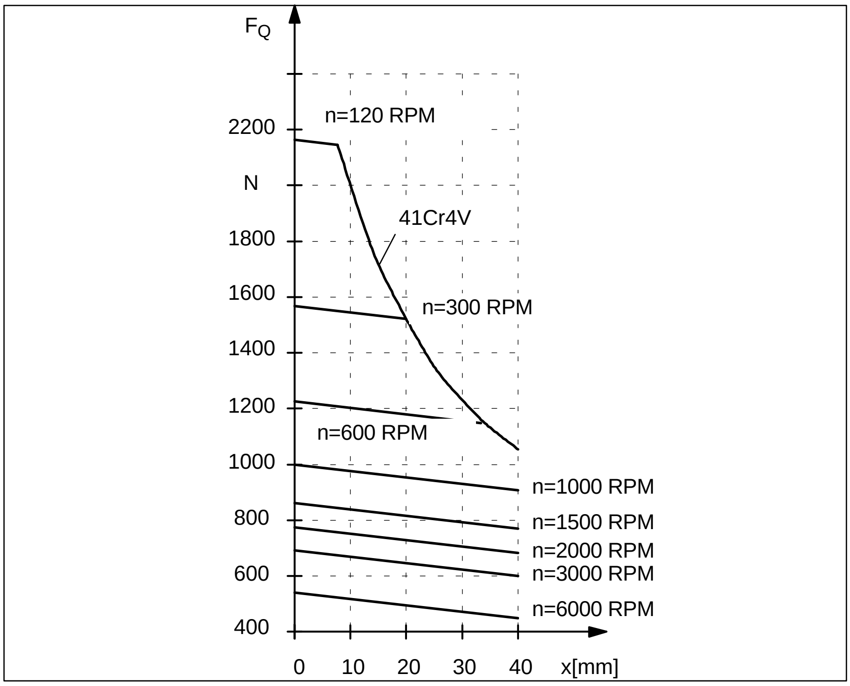
Axial force 1FT5042 to 1FT5046

Permissible axial force as a function of the cantilever force.



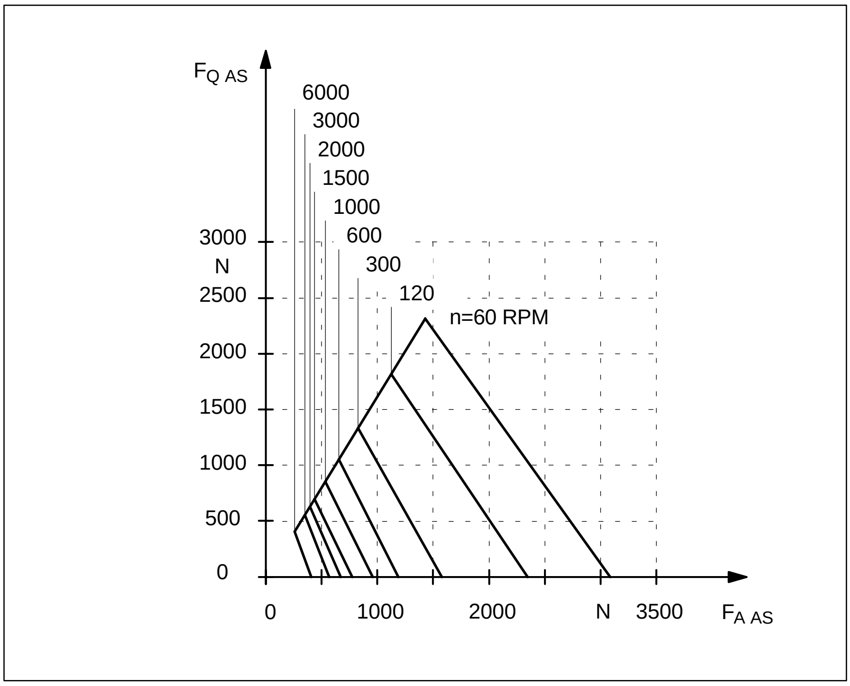
Cantilever force 1FT5062 to 1FT5066

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



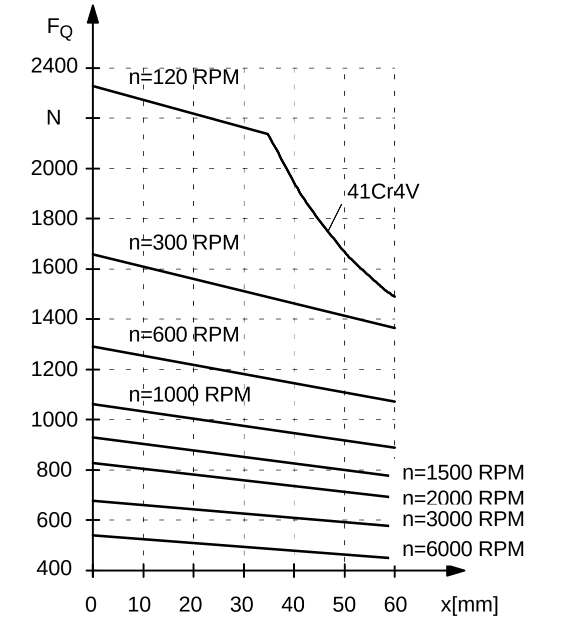
Axial force 1FT5062 to 1FT5066

Permissible axial force as a function of the cantilever force.



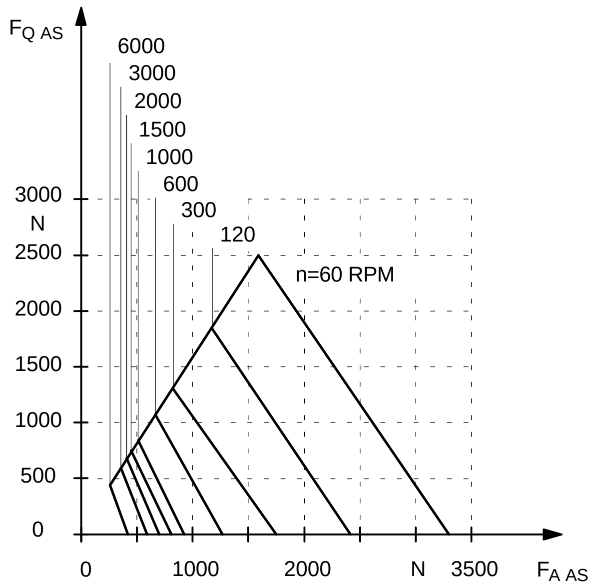
Cantilever force 1FT5072 to 1FT5076

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



Axial force 1FT5072 to 1FT5076

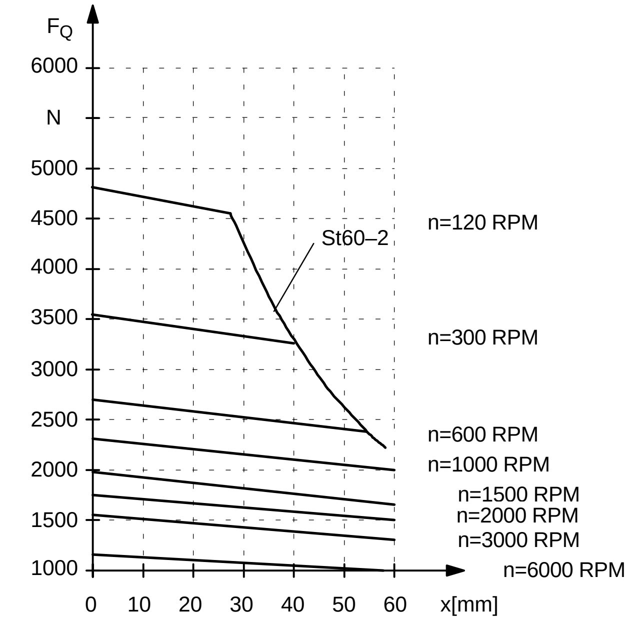
Permissible axial force as a function of the cantilever force.



1FT5

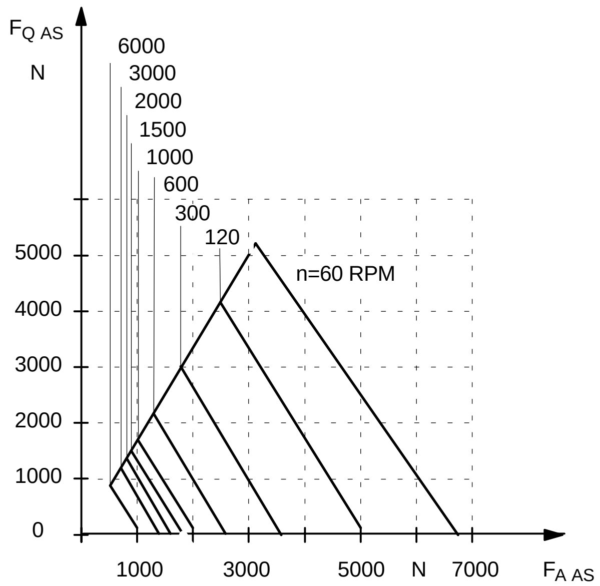
Cantilever force 1FT5102 to 1FT5104

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



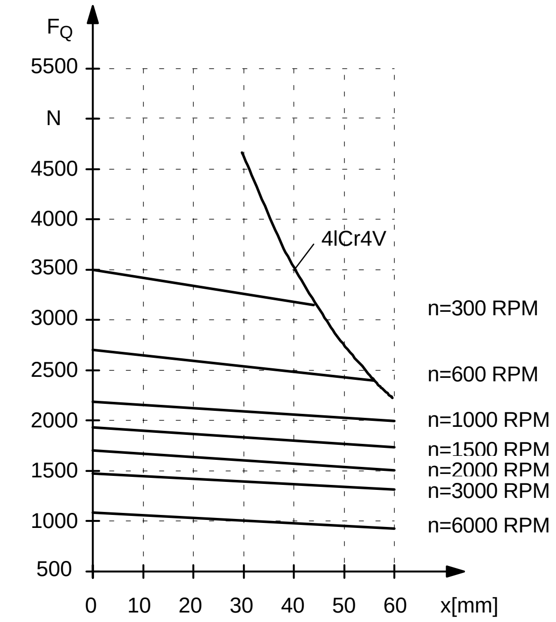
Axial force 1FT5102 to 1FT5104

Permissible axial force as a function of the cantilever force.



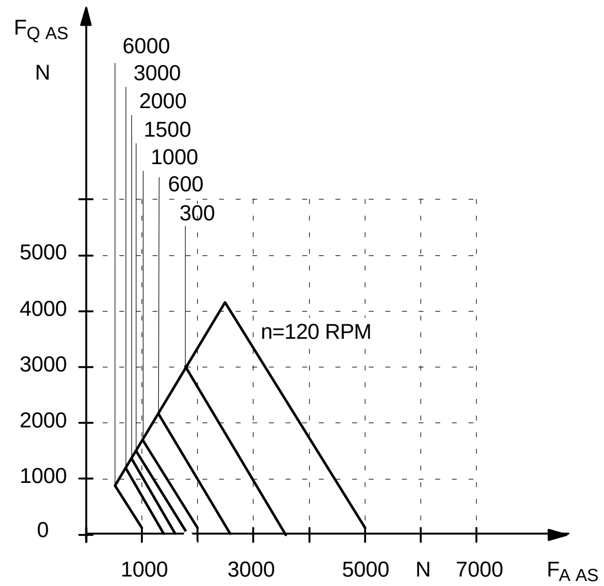
Cantilever force 1FT5106 to 1FT5108

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



Axial force 1FT5106 to 1FT5108

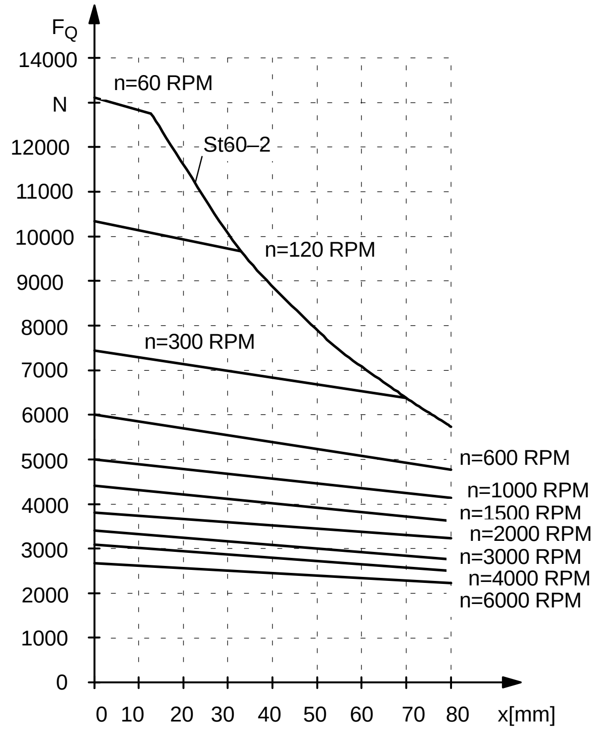
Permissible axial force as a function of the cantilever force.



1FT5

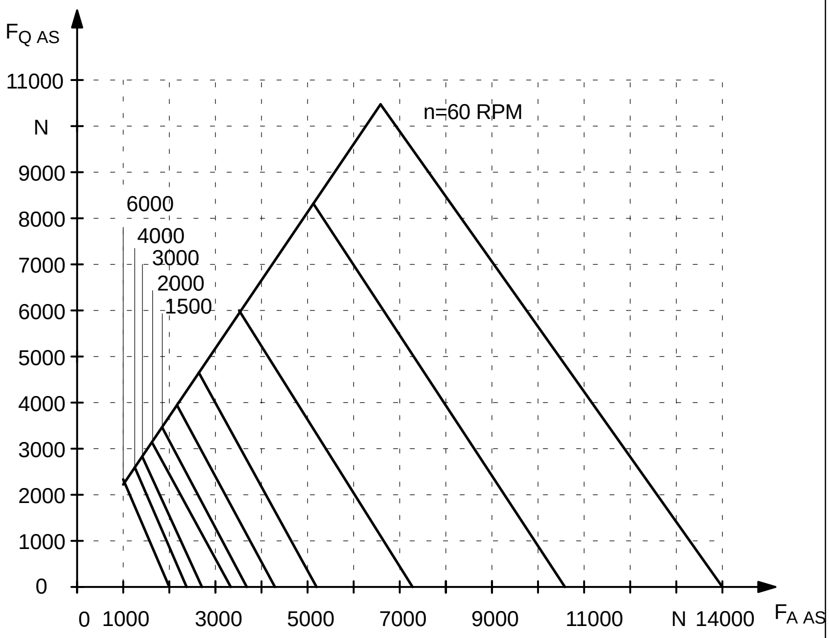
Cantilever force 1FT5132 to 1FT5136

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



Axial force 1FT5132 to 1FT5136

Permissible axial force as a function of the cantilever force.

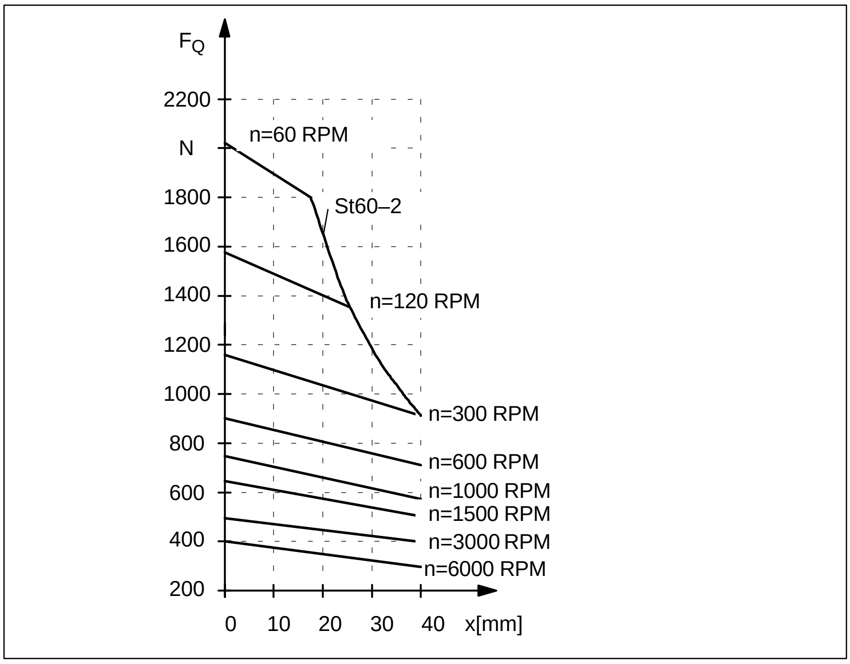


 6SN1197–0AA20

3.2.2 Short motors

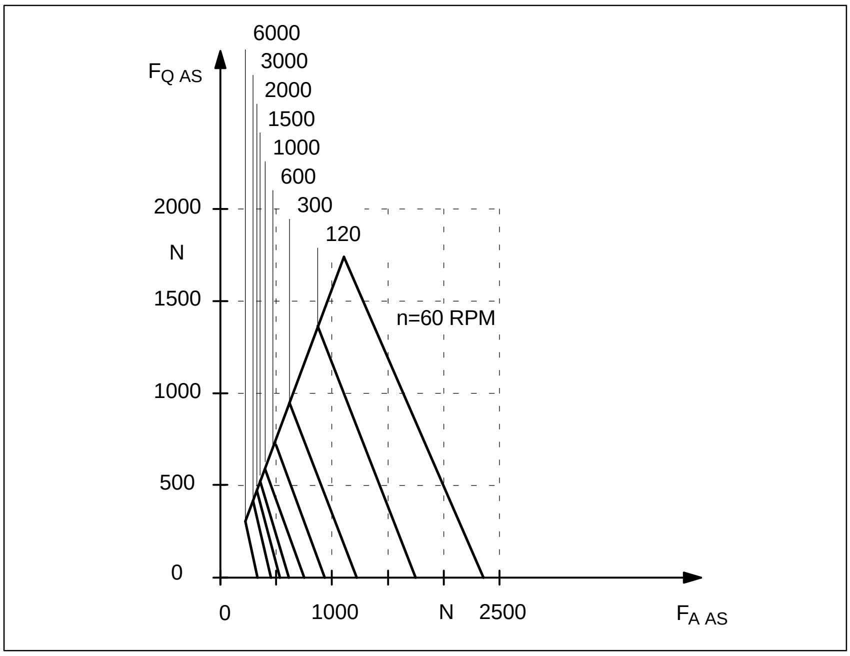
Cantilever force 1FT5070 and 1FT5071

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



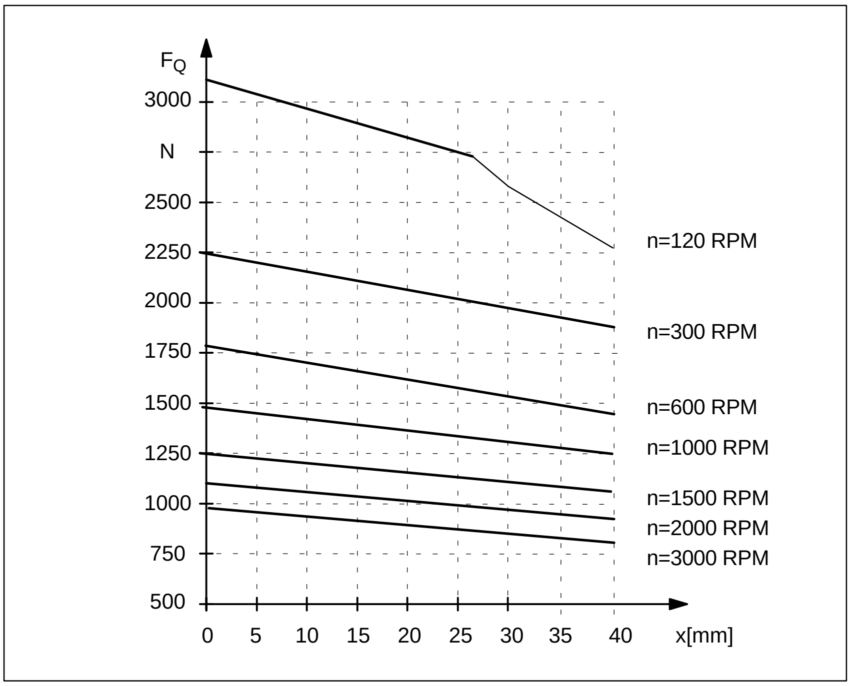
Axial force 1FT5070 and 1FT5071

Permissible axial force as a function of the cantilever force.



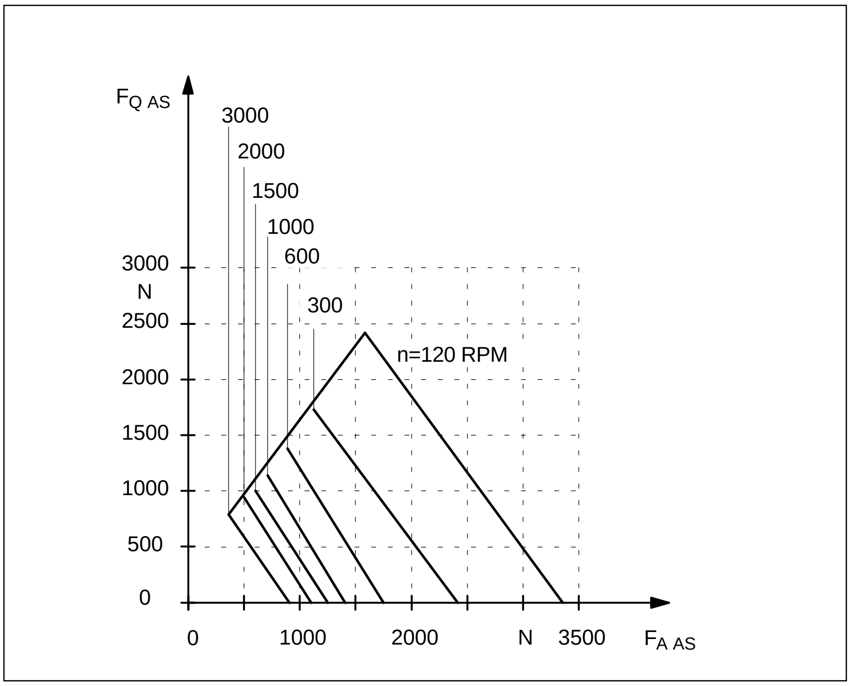
Cantilever force
1FT5100
1FT5101
1FT5103

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



Axial force
1FT5100
1FT5101
1FT5103

Permissible axial force as a function of the cantilever force.



■

Notes

Dimension Drawings 4

Note

Siemens AG reserves the right to change motor dimensions within the scope of design improvements, without prior notice. Dimension drawings can go out of date. Up–to–date dimension drawings can be requested at no charge.

Standard type of construction, basic version

Standard type of construction, optional pulse encoder mounting

Short type of construction, basic version

1FT5

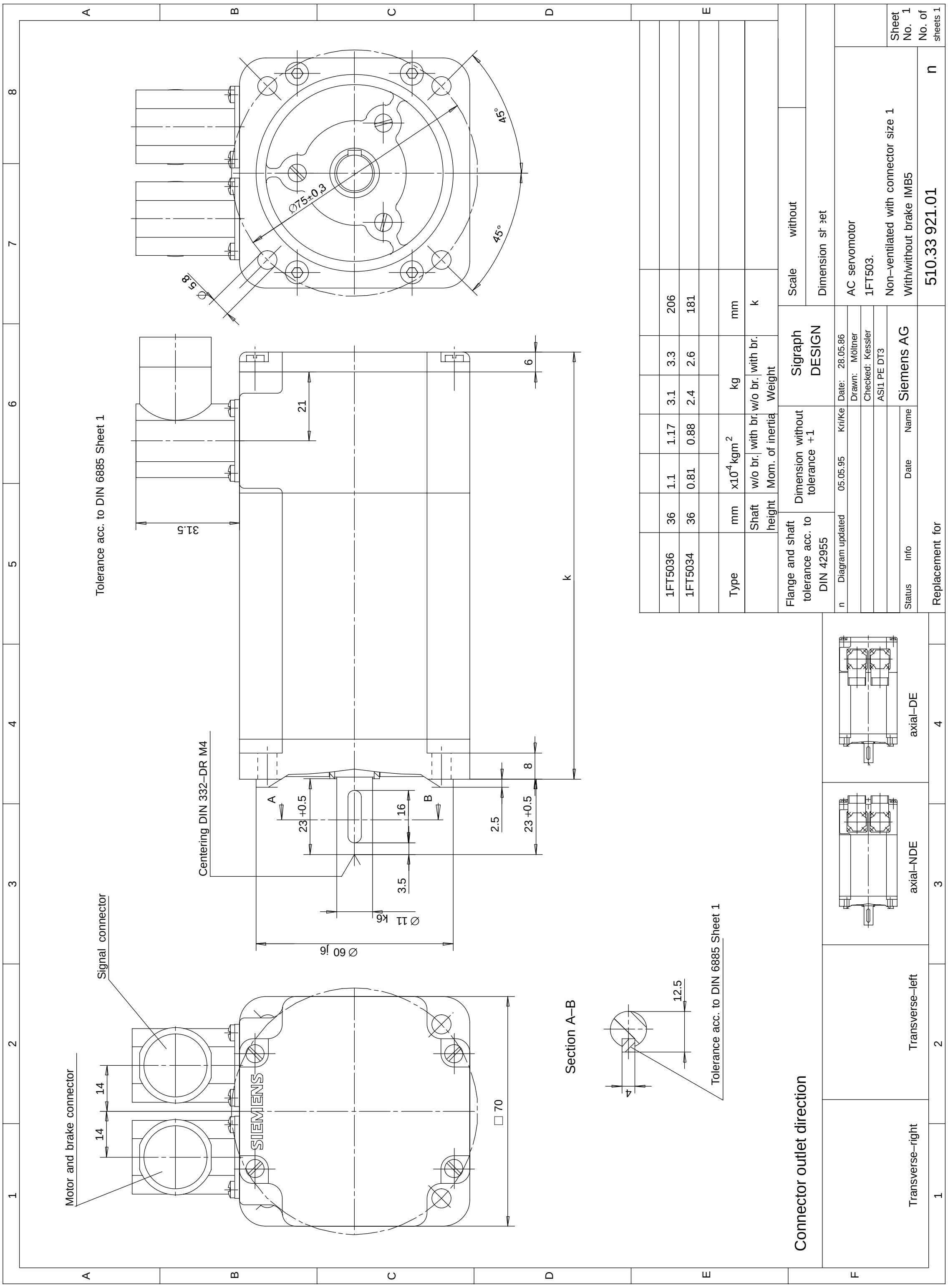
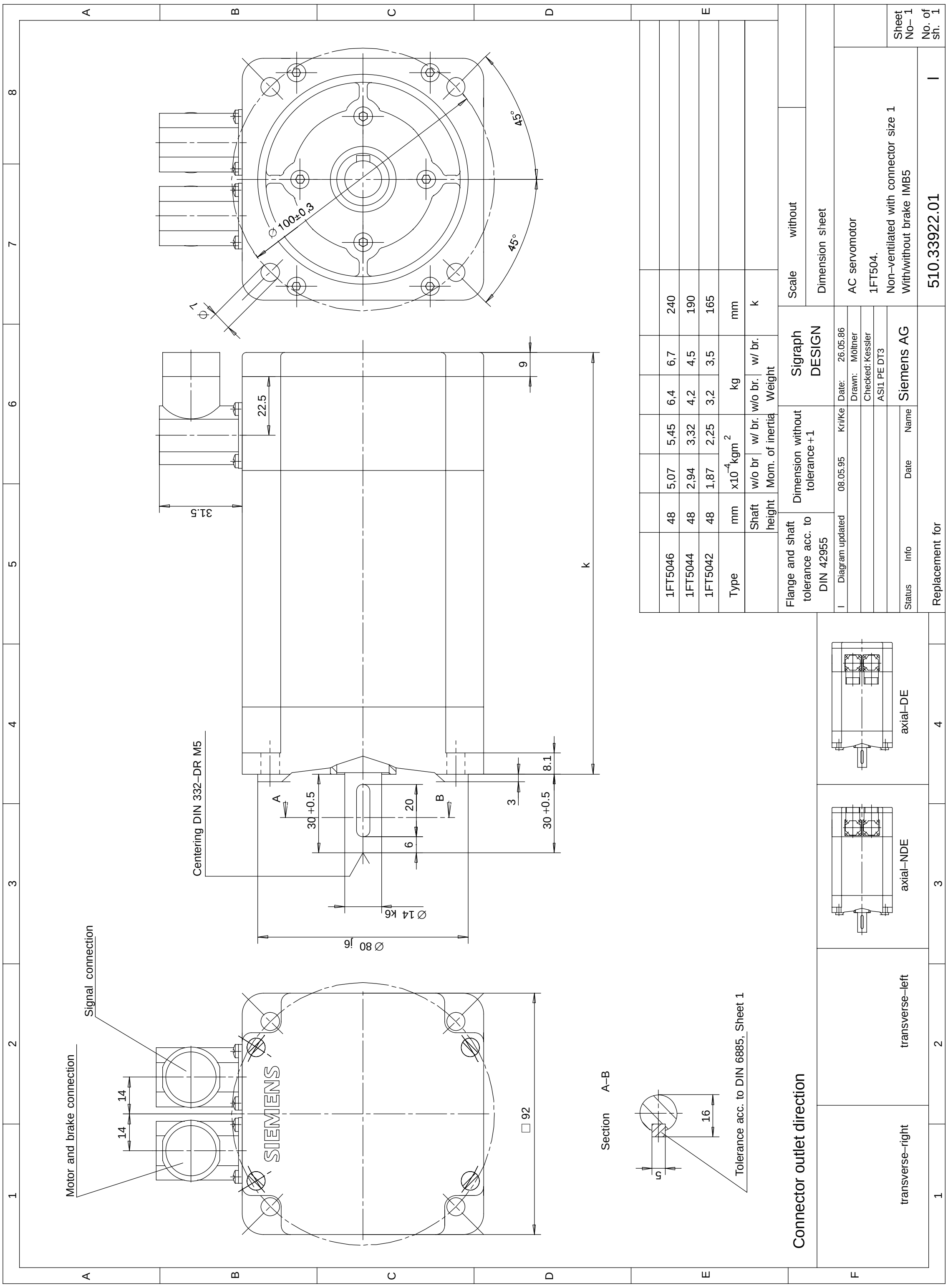
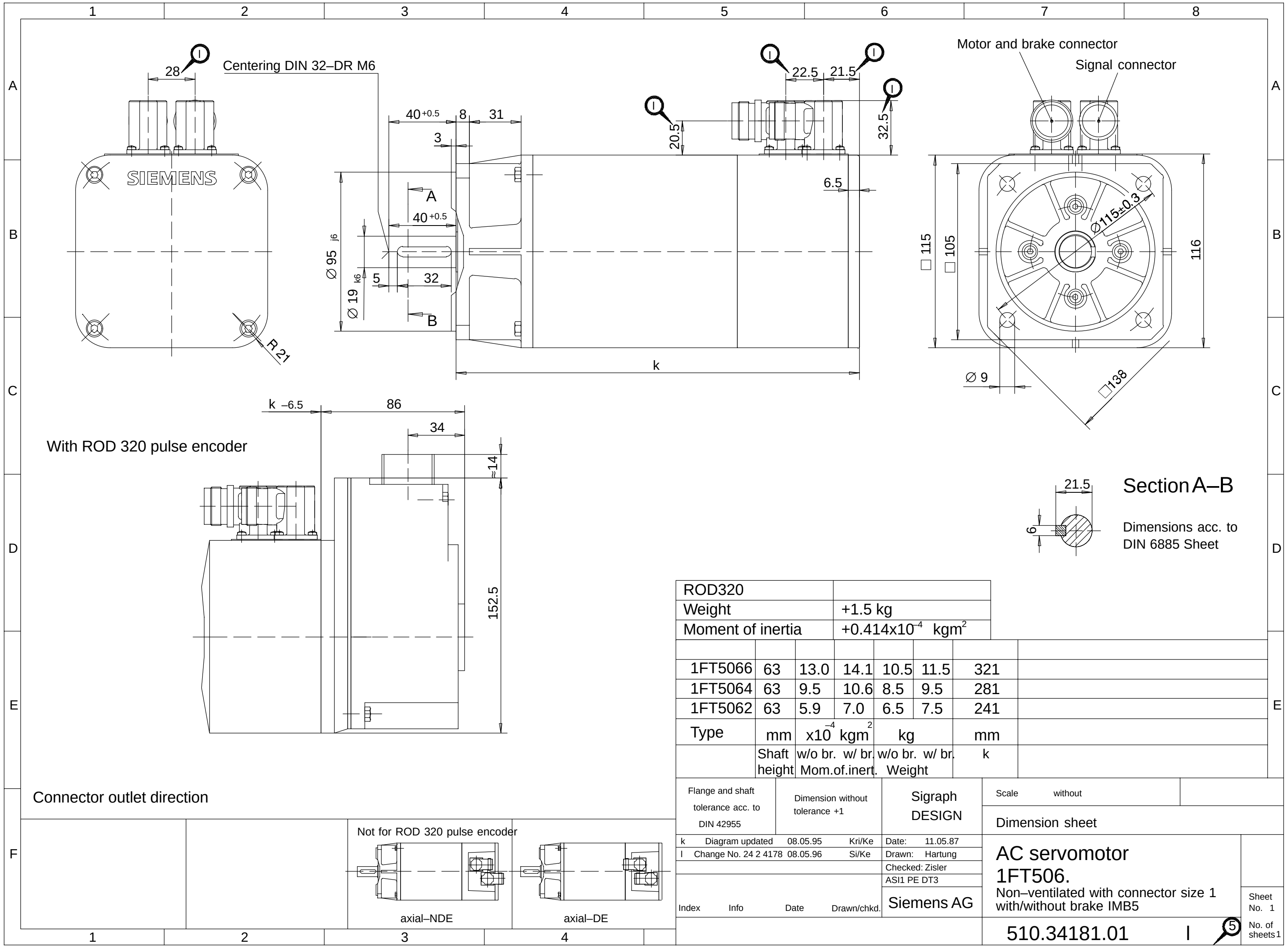


Fig. 4-1 1FT503□ non–ventilated with connector size 1



Type	Shaft height (mm)	Mom. of inertia w/o br ($x10^{-4}$ kgm^2)	Mom. of inertia w/ br ($x10^{-4}$ kgm^2)	Weight w/o br. (kg)	Weight w/ br. (kg)	k (mm)
1FT5046	48	5,07	5,45	6,4	6,7	240
1FT5044	48	2,94	3,32	4,2	4,5	190
1FT5042	48	1,87	2,25	3,2	3,5	165

Fig. 4-2 1FT504□ non–ventilated with connector size 1



ROD320	
Weight	+1.5 kg
Moment of inertia	+0.414x10^{-4} kgm^2

Type	Shaft height (mm)	Mom.of.inert. w/o br. ($x10^{-4}$ kgm^2)	Mom.of.inert. w/ br. ($x10^{-4}$ kgm^2)	Weight w/o br. (kg)	Weight w/ br. (kg)	k (mm)
1FT5066	63	13.0	14.1	10.5	11.5	321
1FT5064	63	9.5	10.6	8.5	9.5	281
1FT5062	63	5.9	7.0	6.5	7.5	241

Fig. 4-3 1FT506□ non–ventilated with connector size 1

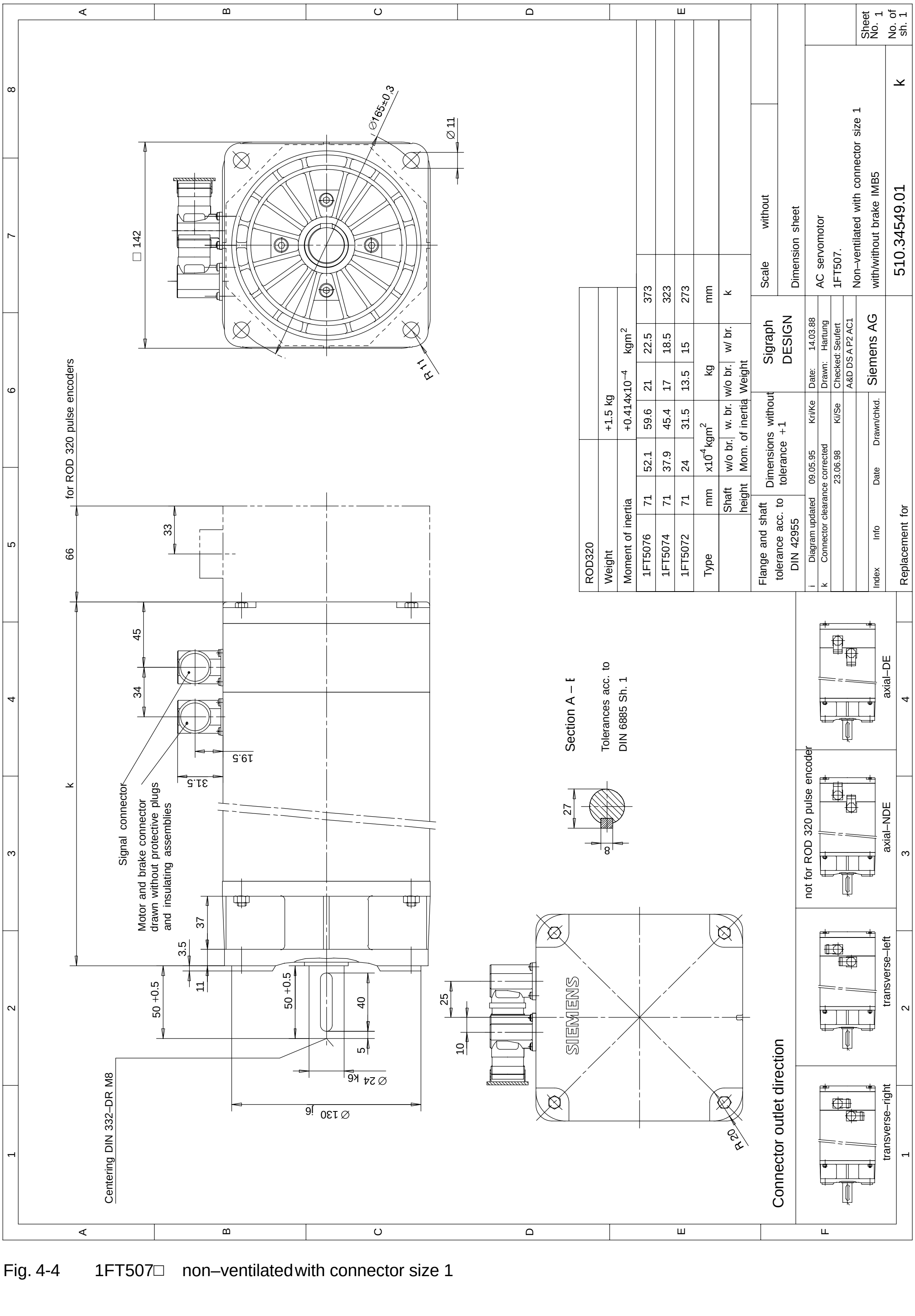


Fig. 4-4 1FT507□ non–ventilated with connector size 1

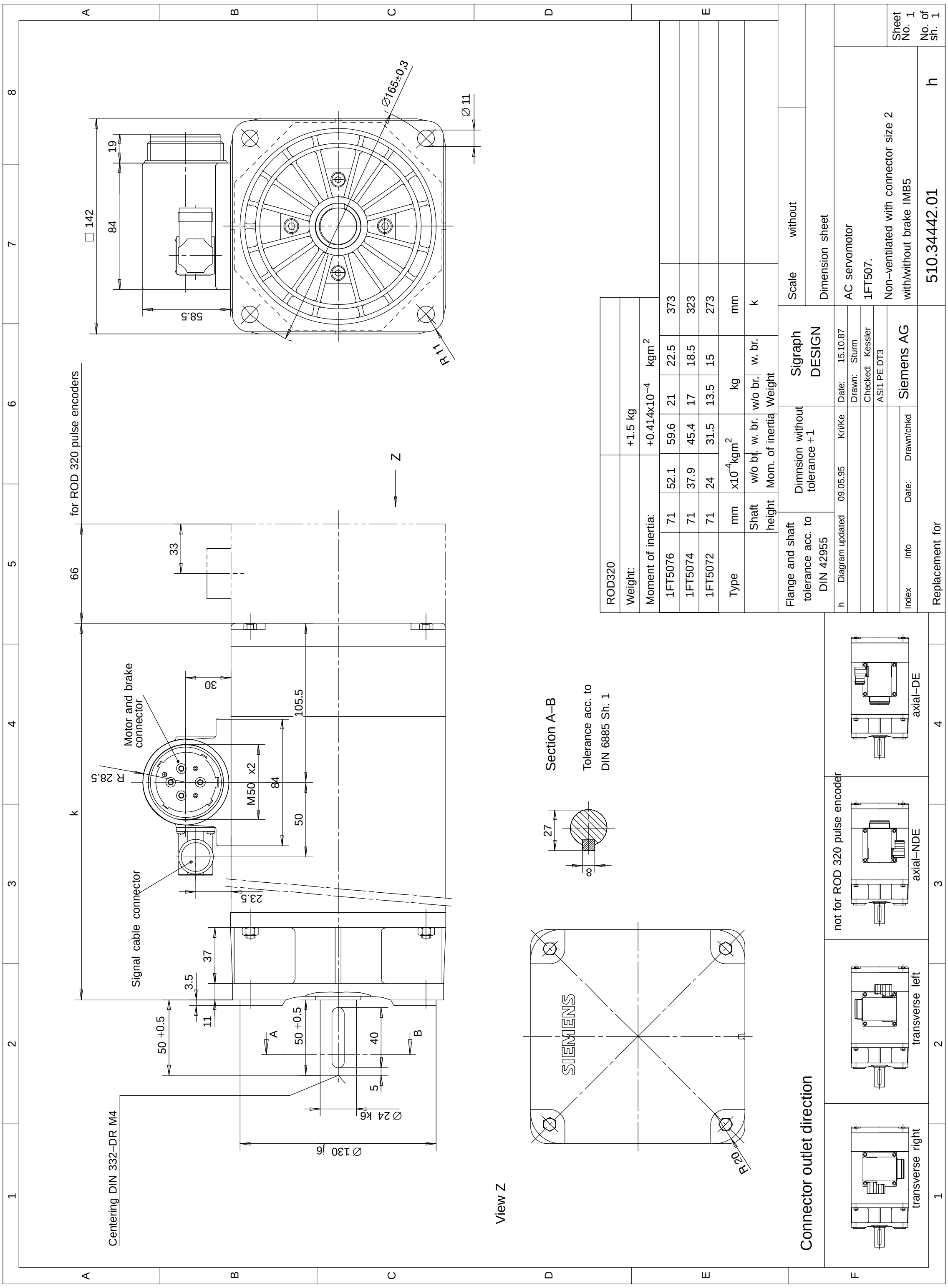


Fig. 4-5 1FT507□ non–ventilated with connector size 2

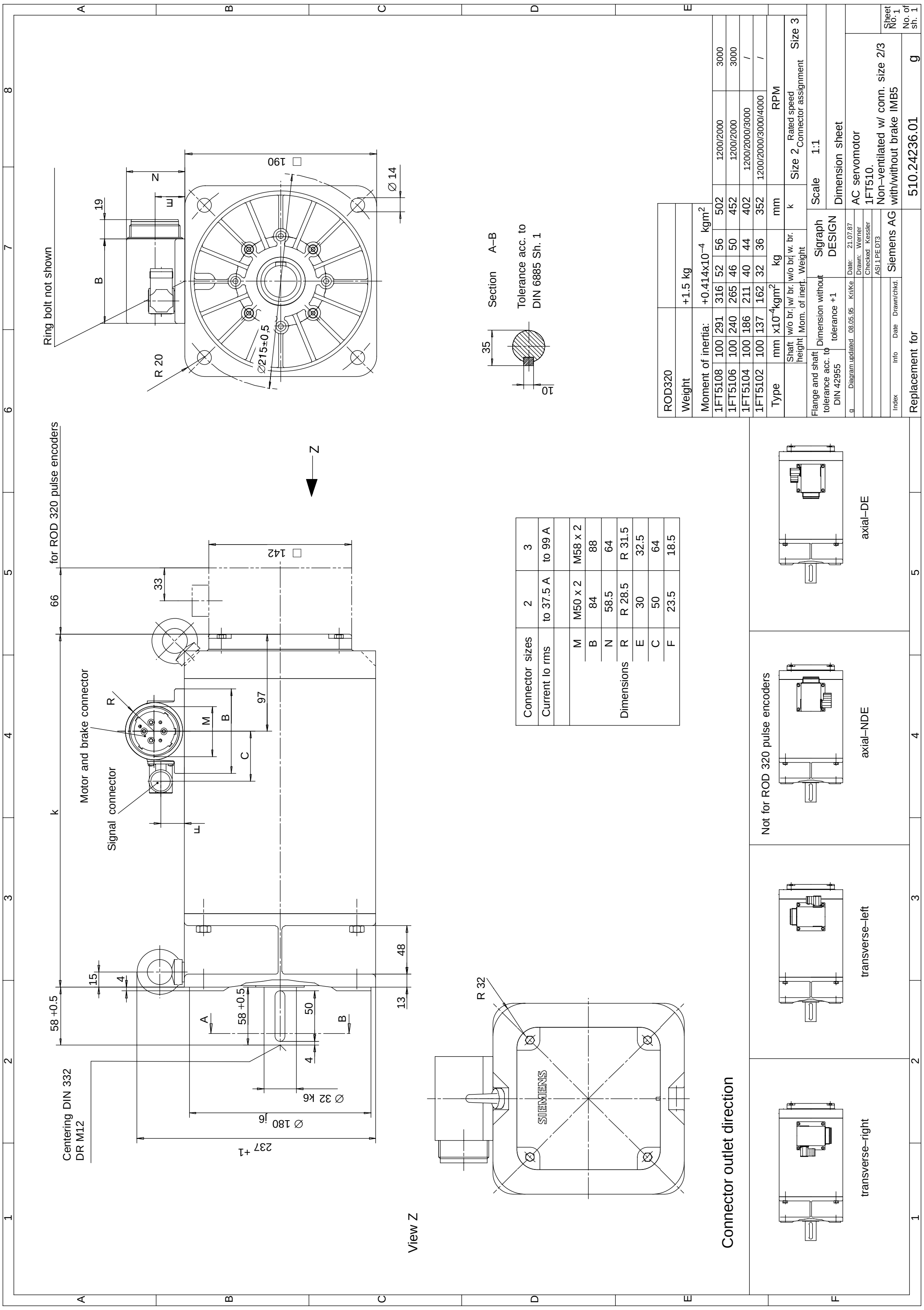


Fig. 4-6 1FT510□ non–ventilated with connector size 2/3

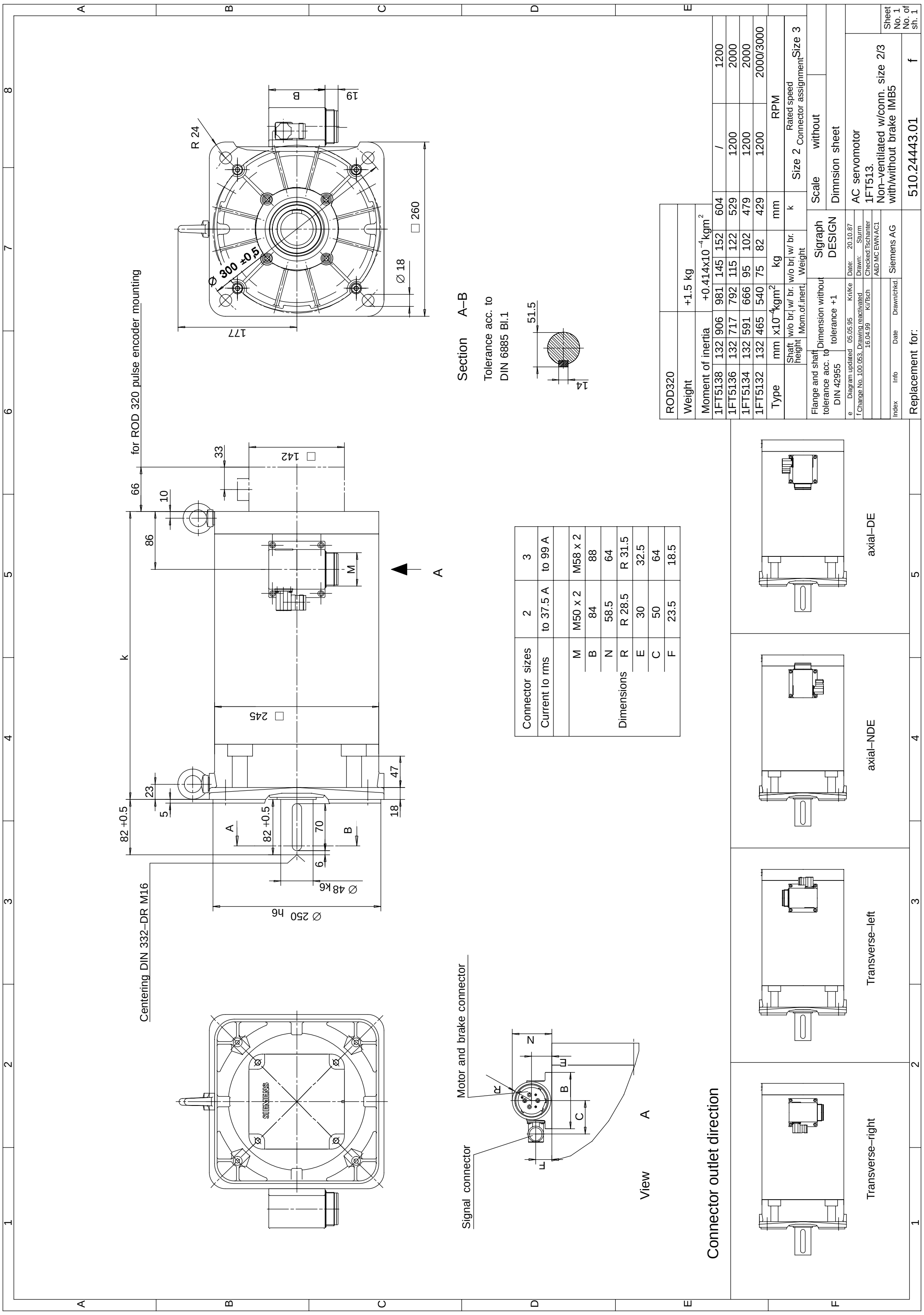


Fig. 4-7 1FT513□ non–ventilated with connector size 2/3

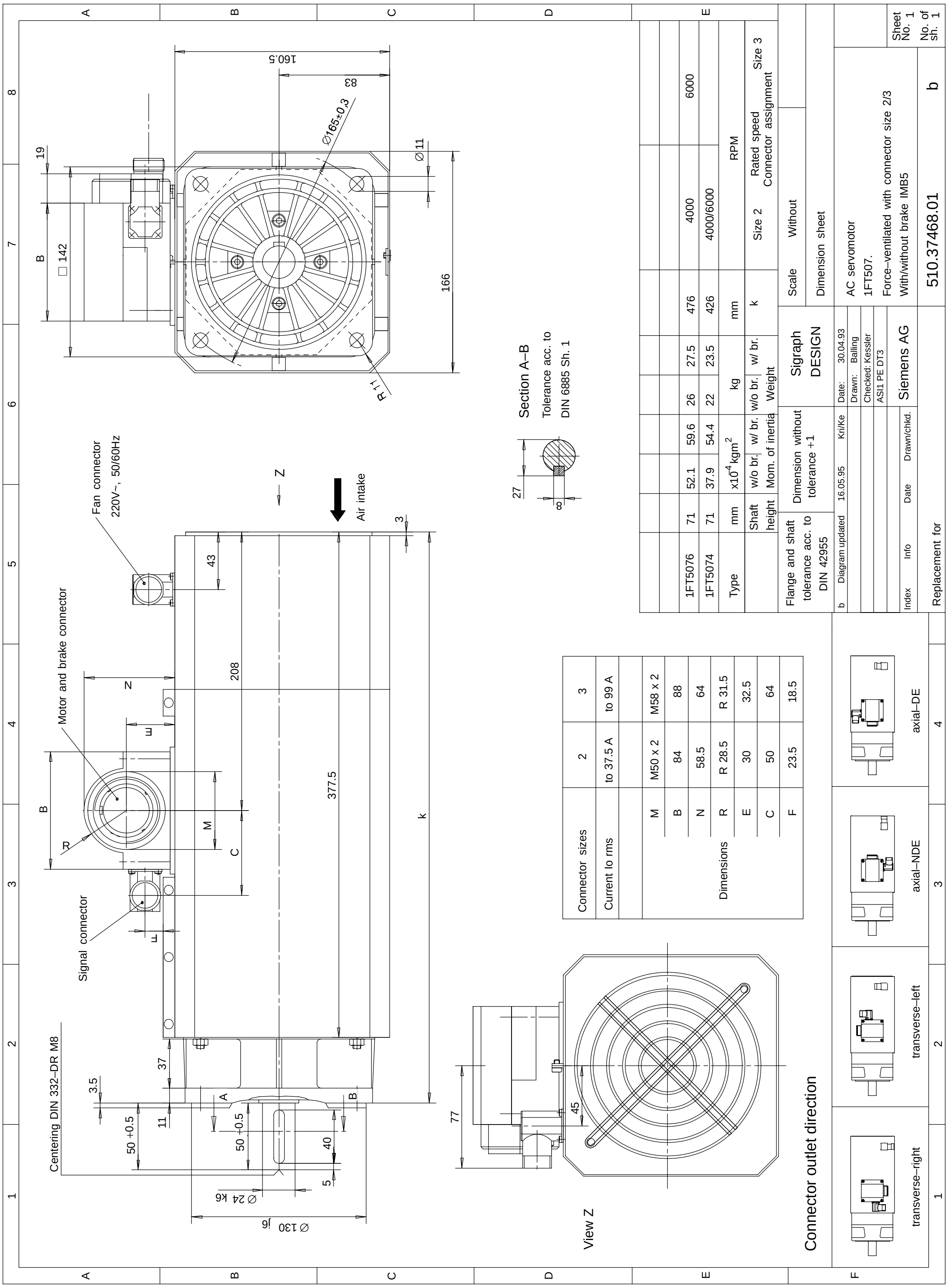


Fig. 4-8 1FT507□ force ventilated with connector size 2/3

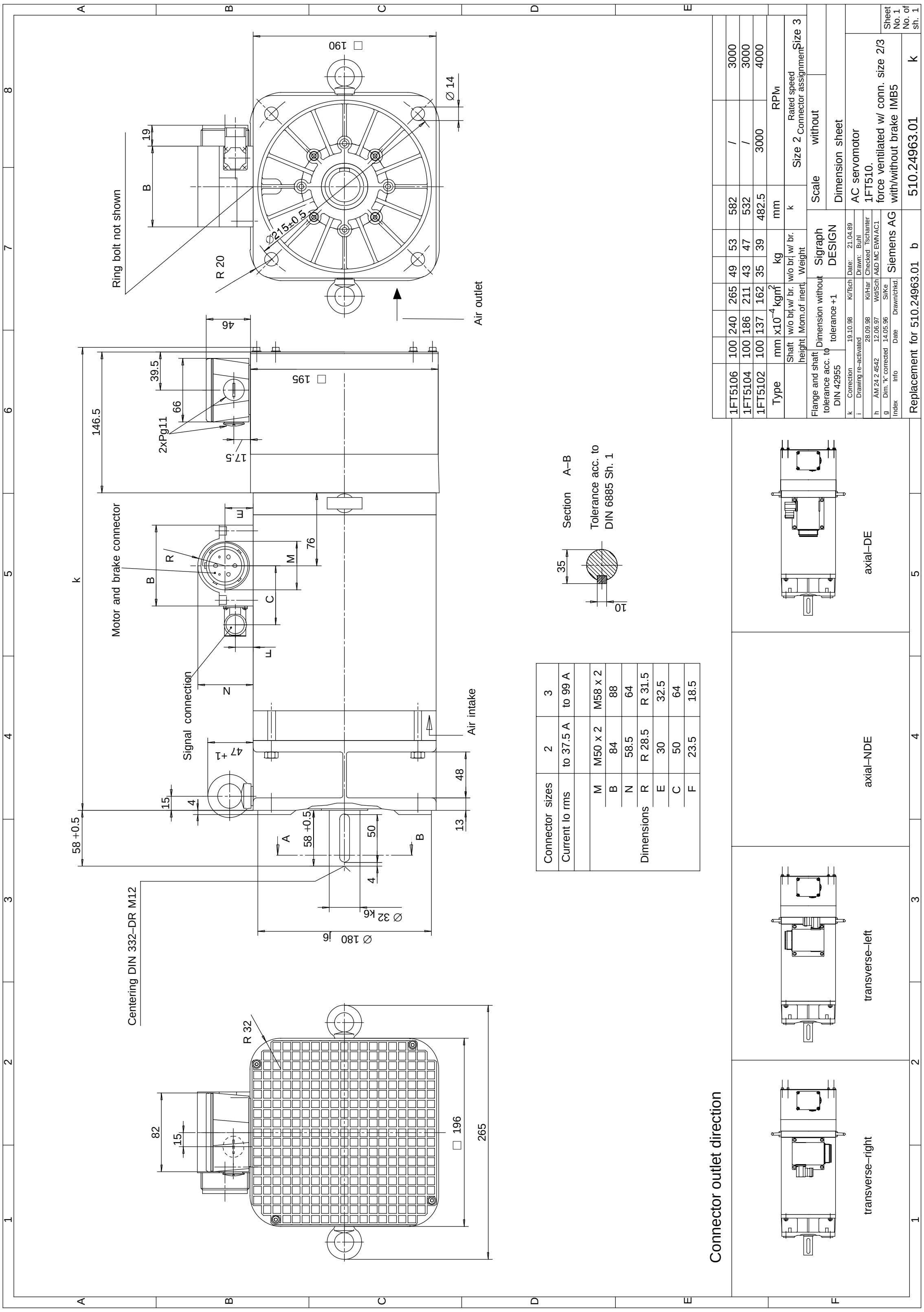


Fig. 4-9 1FT510□ force ventilated with connector size 2/3

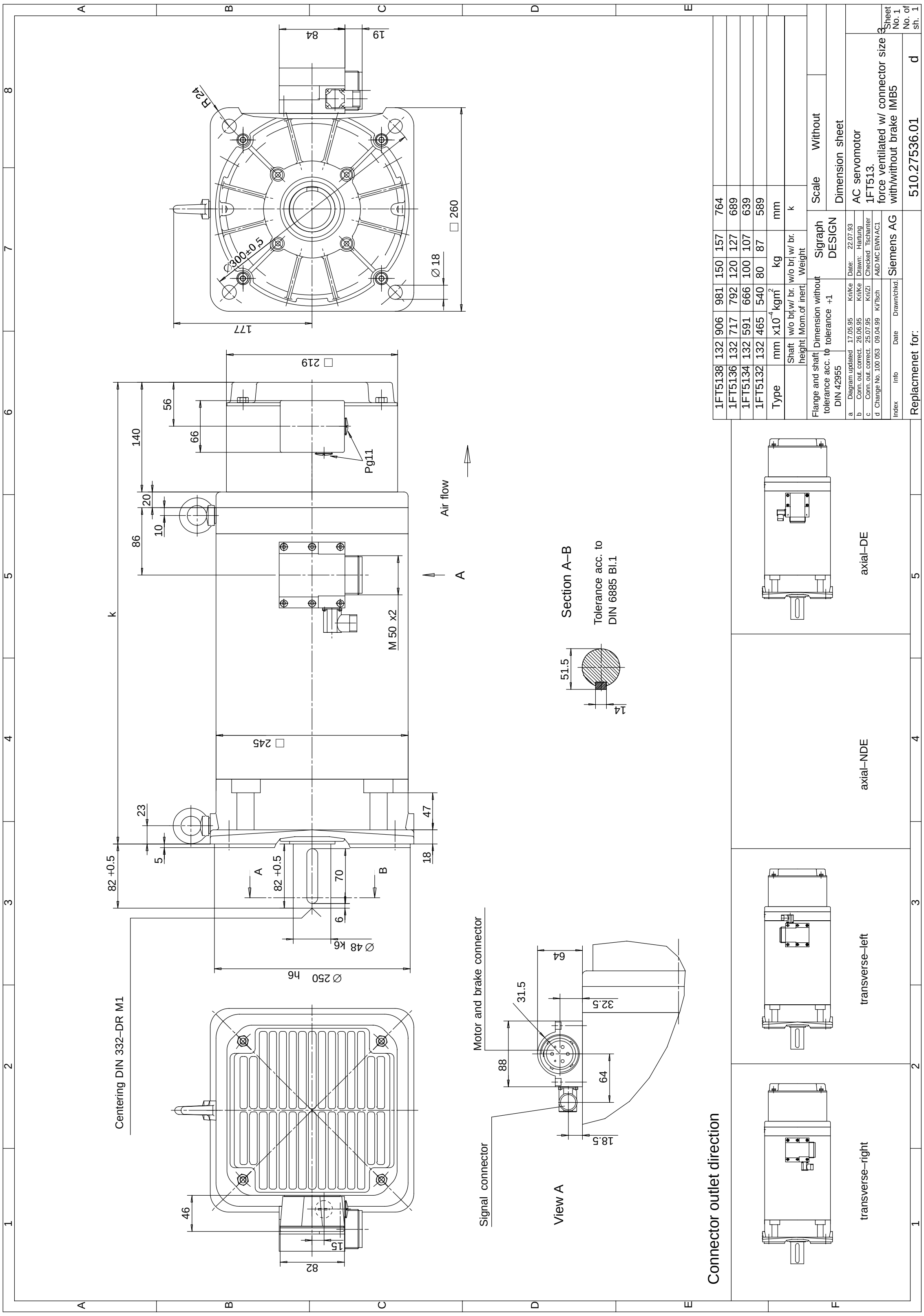


Fig. 4-10 1FT513□ force ventilated with connector size 3

1FT5

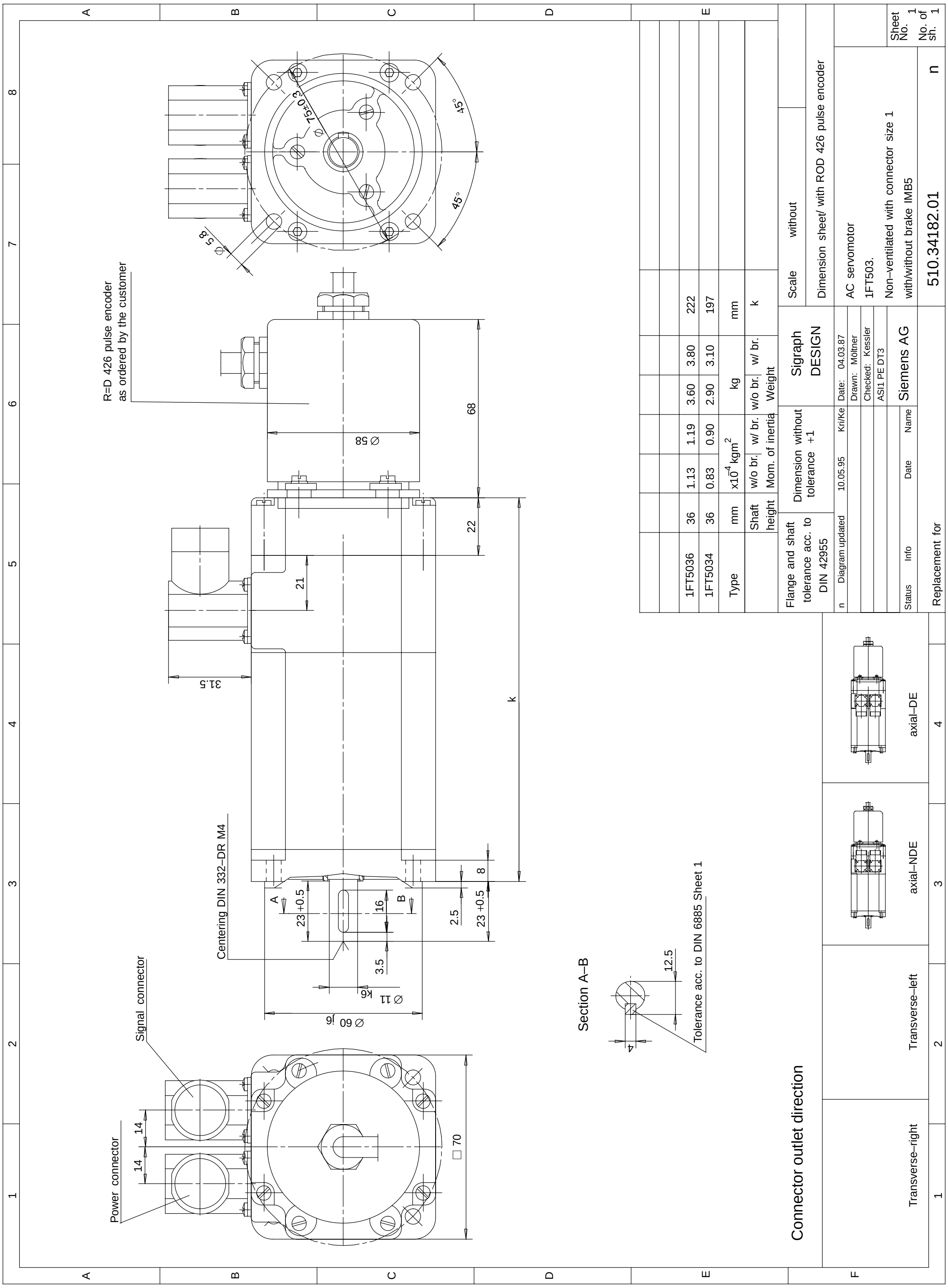
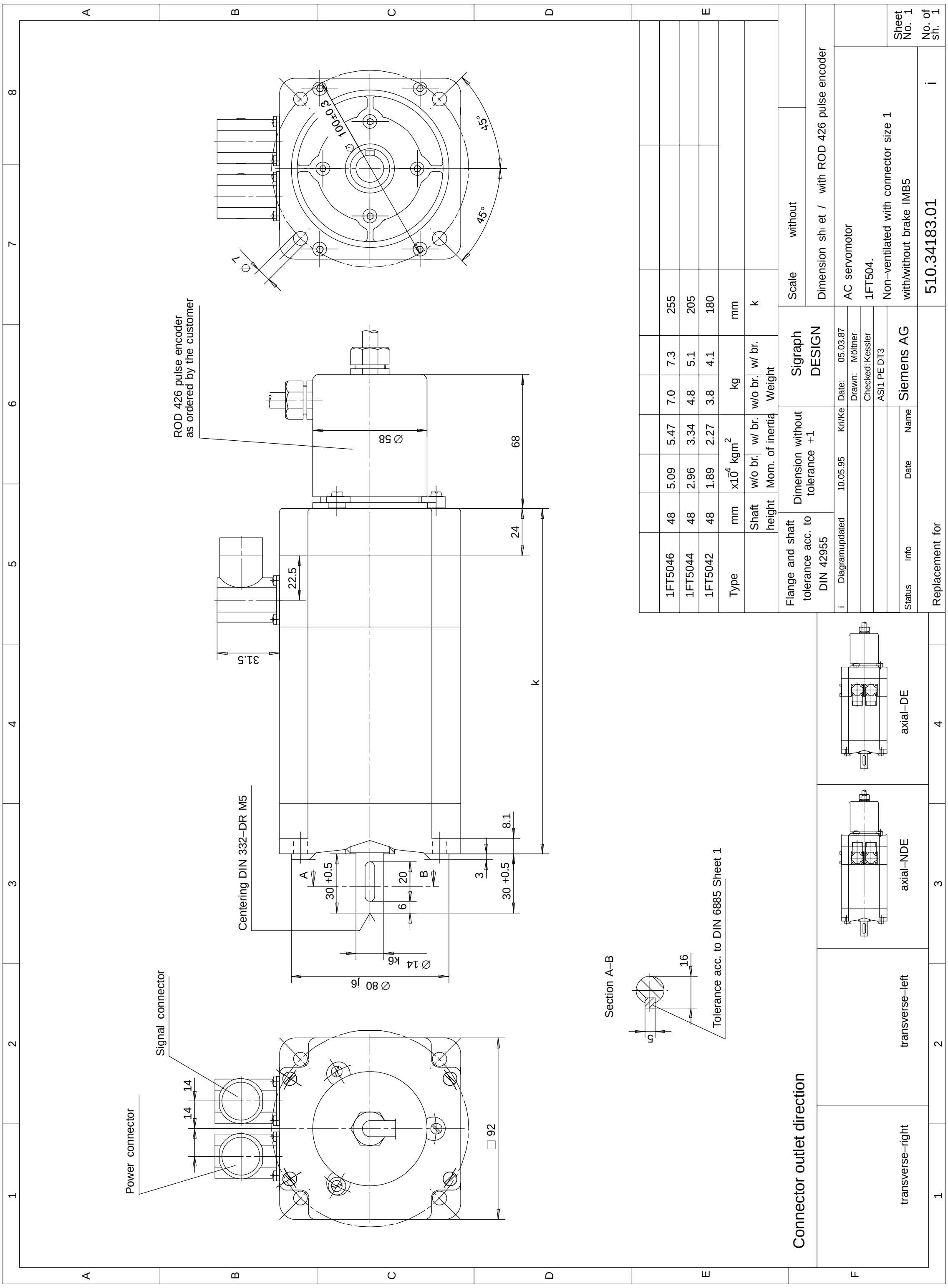


Fig. 4-11 1FT503□ non–ventilated with connector size 1



Type	Shaft height (mm)	Mom. of inertia $x10^{-4}$ kgm^2 w/o br.	Mom. of inertia w/ br.	Weight (kg) w/o br.	Weight w/ br.	k (mm)
1FT5046	48	5.09	5.47	7.0	7.3	255
1FT5044	48	2.96	3.34	4.8	5.1	205
1FT5042	48	1.89	2.27	3.8	4.1	180

Fig. 4-12 1FT504□ non–ventilated with connector size 1

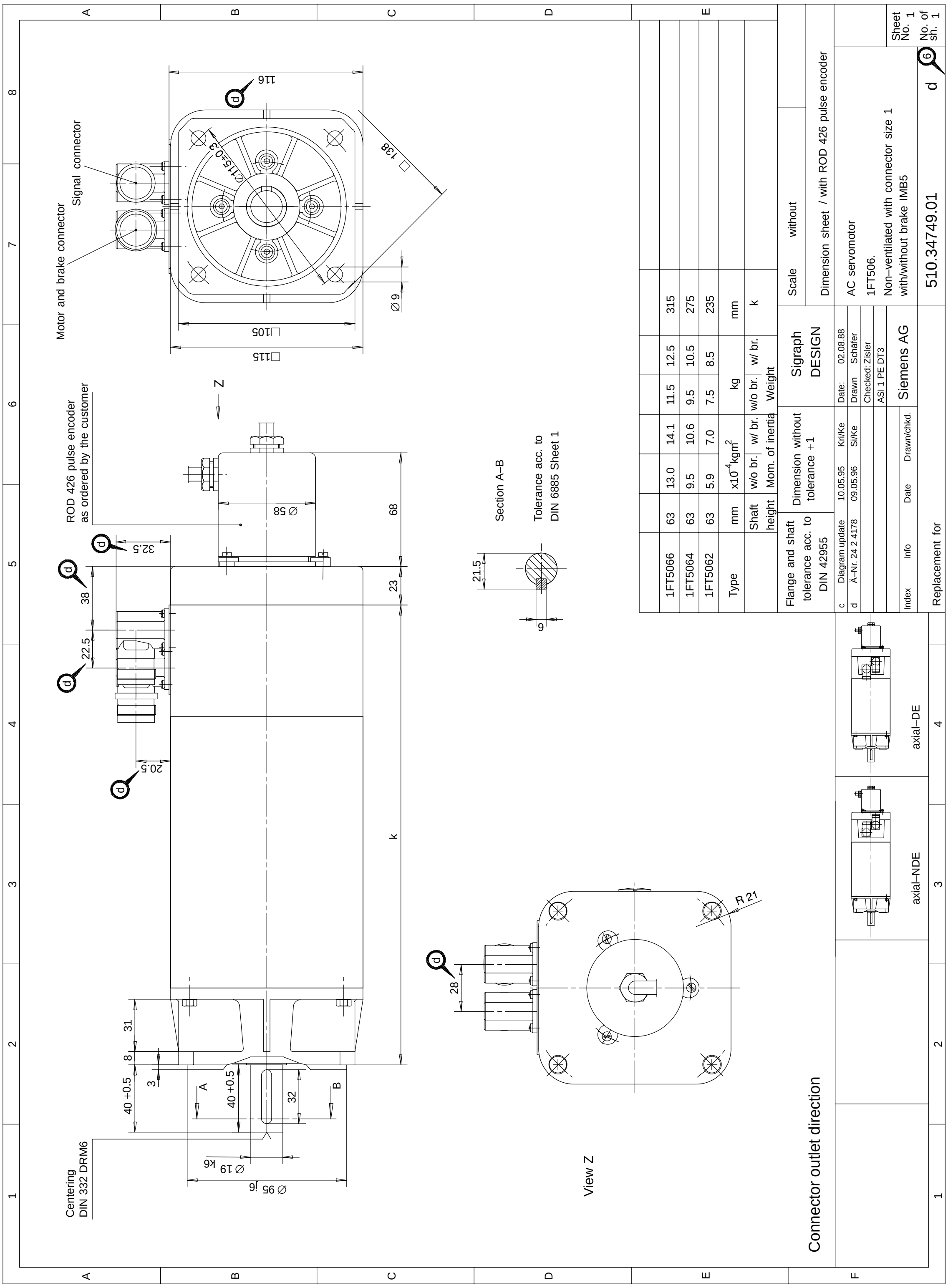


Fig. 4-13 1FT506□ non–ventilated with connector size 1

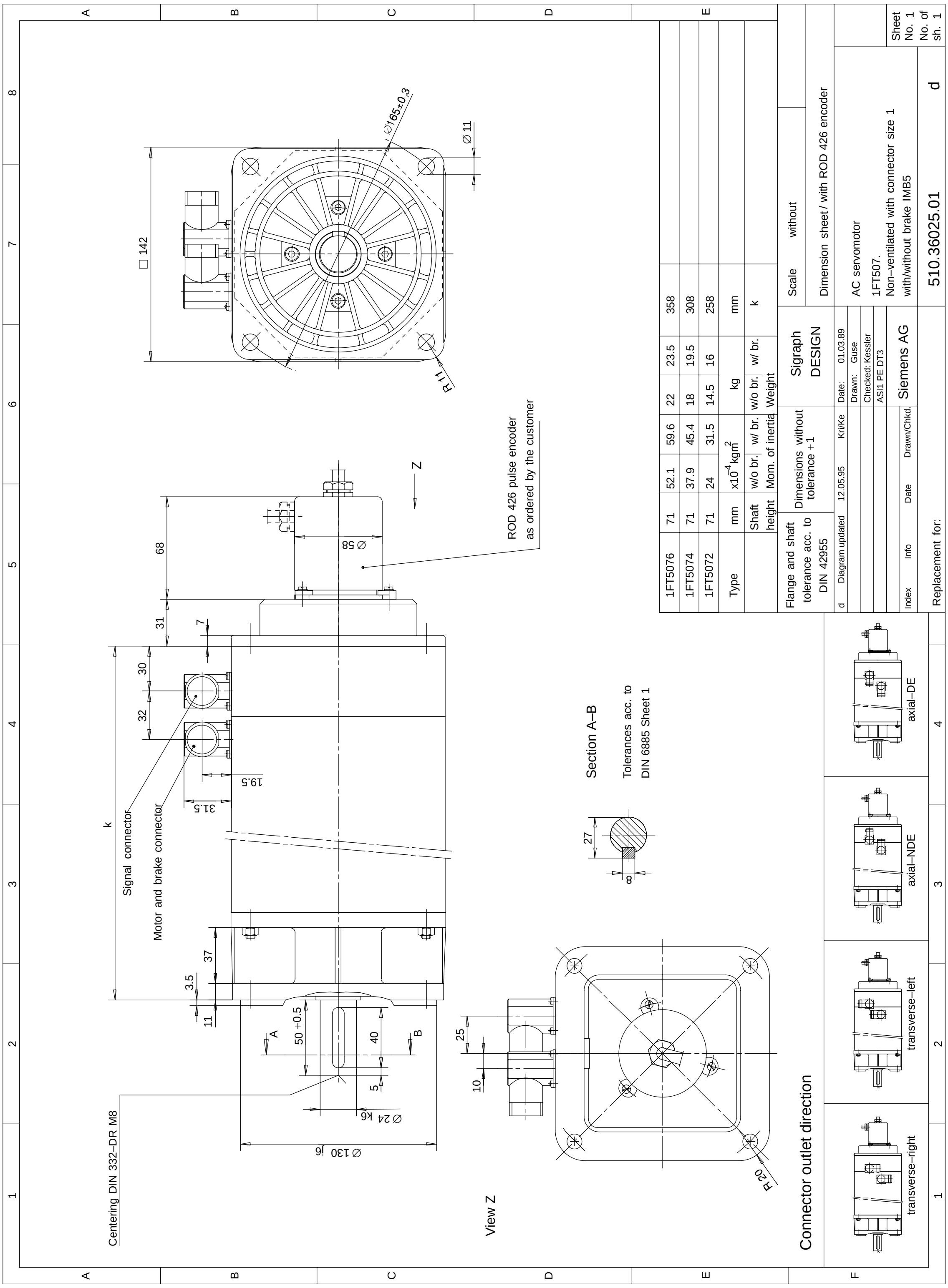


Fig. 4-14 1FT507□ non–ventilated with connector size 1

1FT5

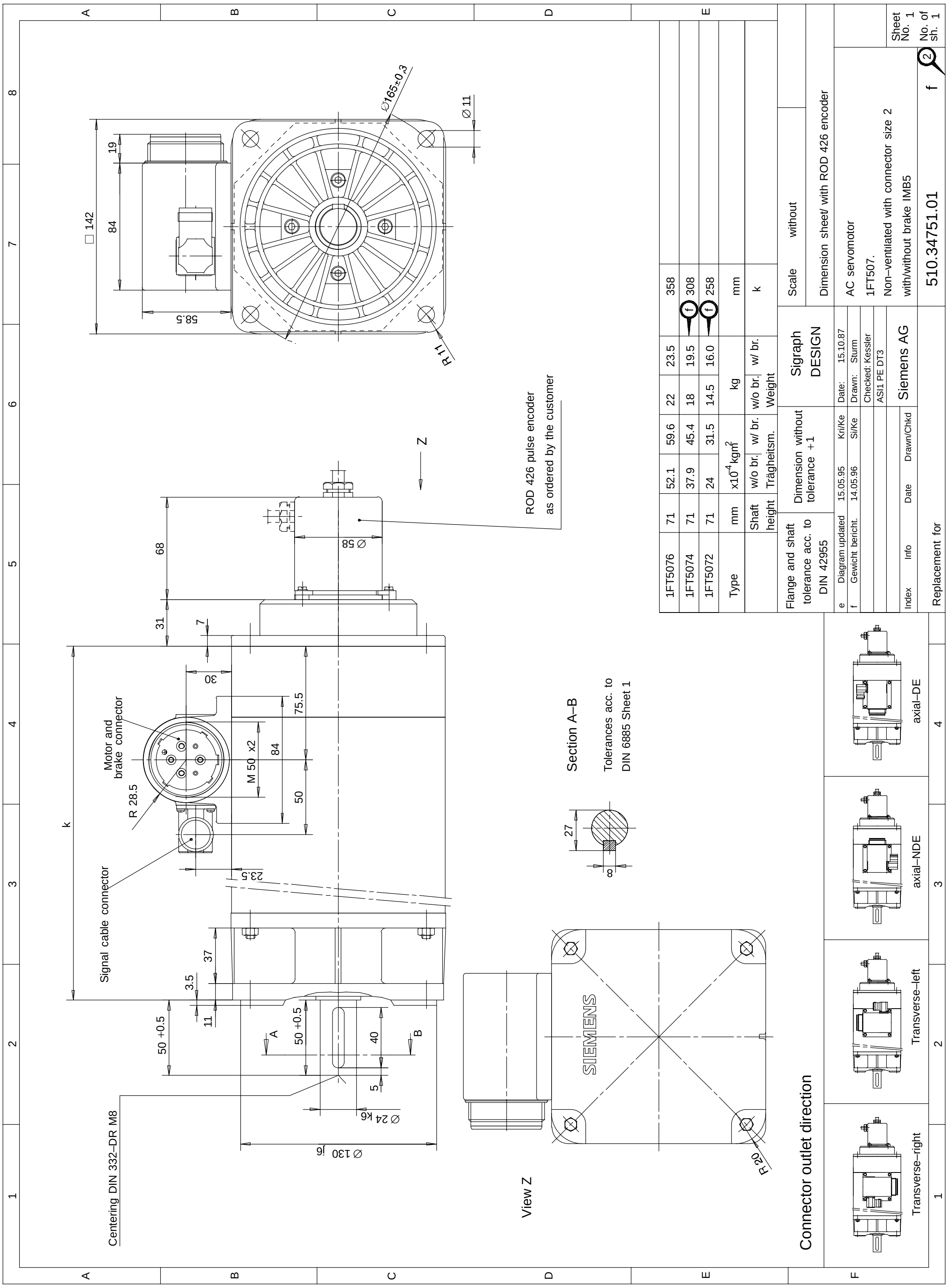


Fig. 4-15 1FT507□ non–ventilated with connector size 2

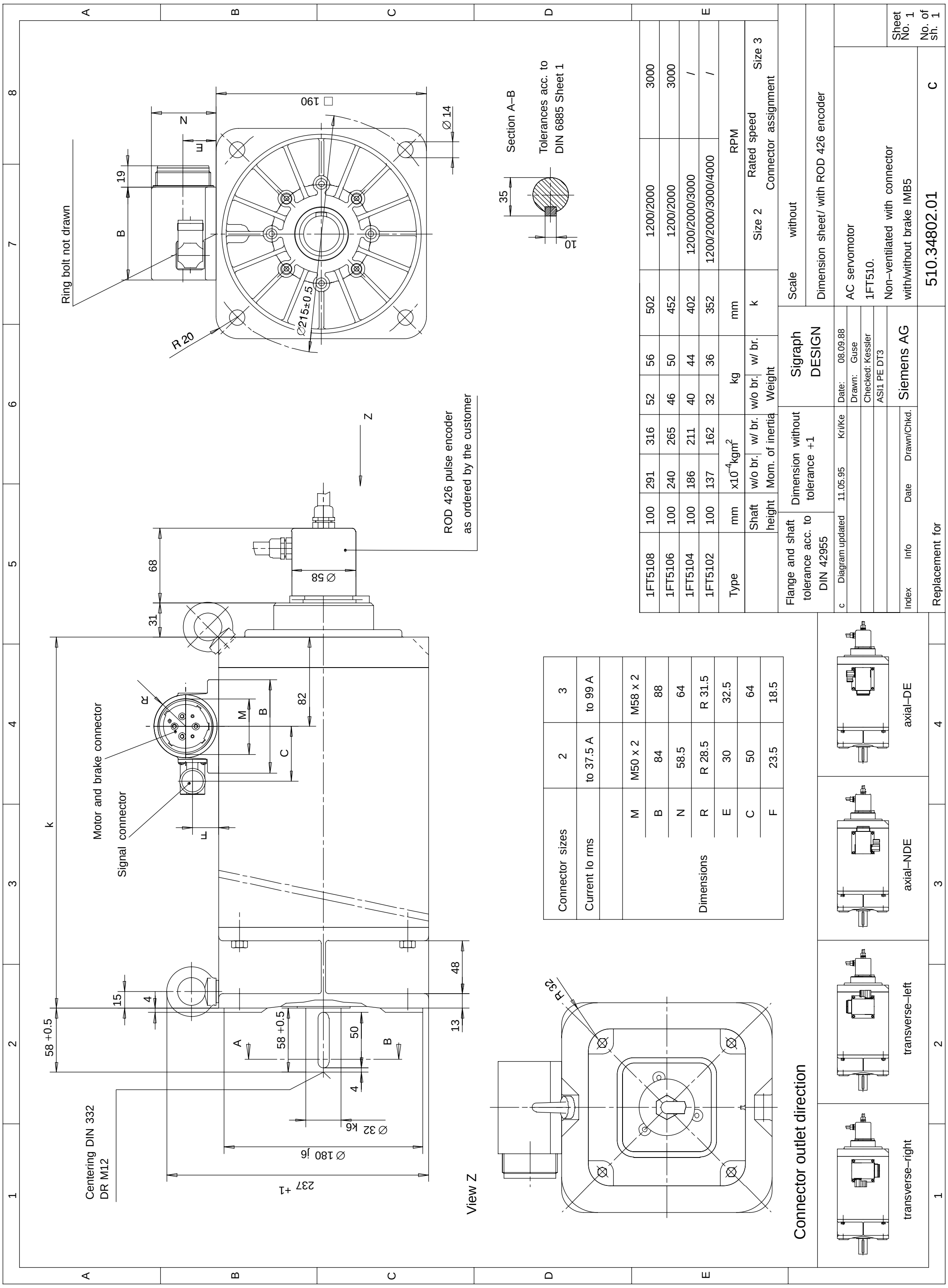
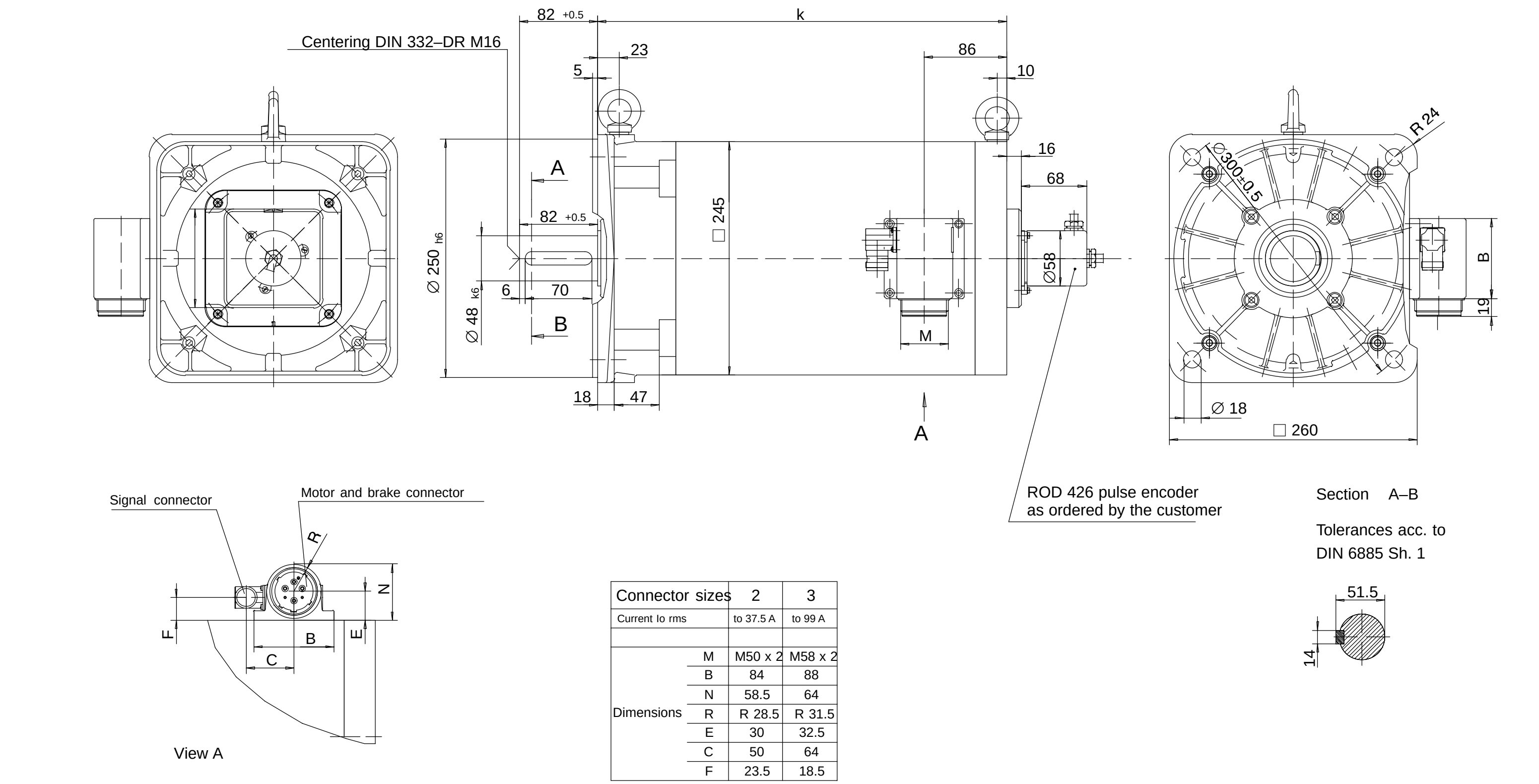
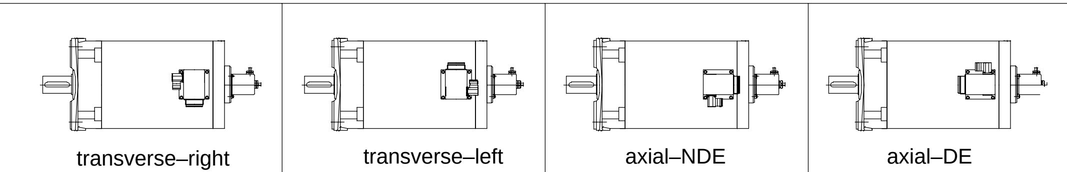


Fig. 4-16 1FT510□ non–ventilated with connector



Connector sizes		2	3
Current Io rms		to 37.5 A	to 99 A
Dimensions	M	M50 x 2	M58 x 2
	B	84	88
	N	58.5	64
	R	R 28.5	R 31.5
	E	30	32.5
	C	50	64
	F	23.5	18.5

Connector outlet direction



Type	Shaft height (mm)	Mom. of inert. w/o br. ($x10^{-4}$ kgm^2)	Mom. of inert. w/ br. ($x10^{-4}$ kgm^2)	Weight w/o br. (kg)	Weight w/ br. (kg)	k (mm)	Connector assignment Rated speed Size 2 (RPM)	Connector assignment Rated speed Size 3 (RPM)
1FT5138	132	906	981	146	153	604	/	1200
1FT5136	132	717	792	116	123	529	1200	1200/2000
1FT5134	132	591	666	96	103	479	1200	2000
1FT5132	132	465	540	76	83	429	1200	2000/3000

Flange and shaft tolerance acc. to DIN 42955	Dimension without tolerance +1	Sigraph DESIGN	Scale Without	
			Dimension sheet with pulse encoder ROD426	
c Diagram updated 10.05.95 Kri/Ke		Date: 01.03.89	AC servomotor 1FT513. Non–ventilated with connector size 2/3 With/without brake IMB5	
d Ä–Nr. 100 053 09.04.99 Ki/Tsch		Drawn: Guse		
		Checked: Tschanter		
		A&D MC EWN AC1		
Index Info Date Drawn/Chkd.		Siemens AG		Sheet No. 1
Replacement for			510.26027.01 d	No. of sh. 1

Fig. 4-17 1FT513□ non–ventilated with connector size 2/3

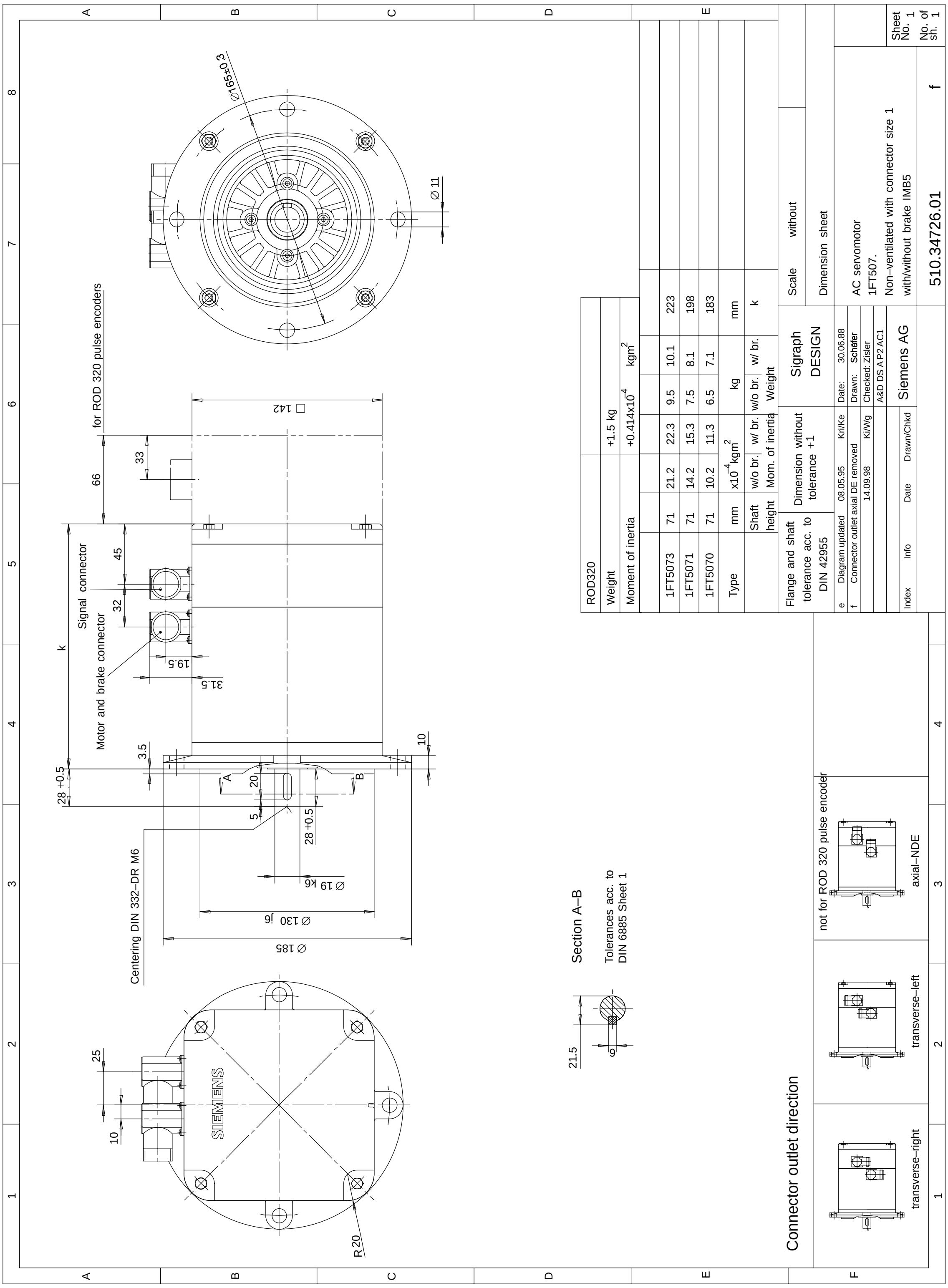


Fig. 4-18 1FT507□ non–ventilated with connector size 1

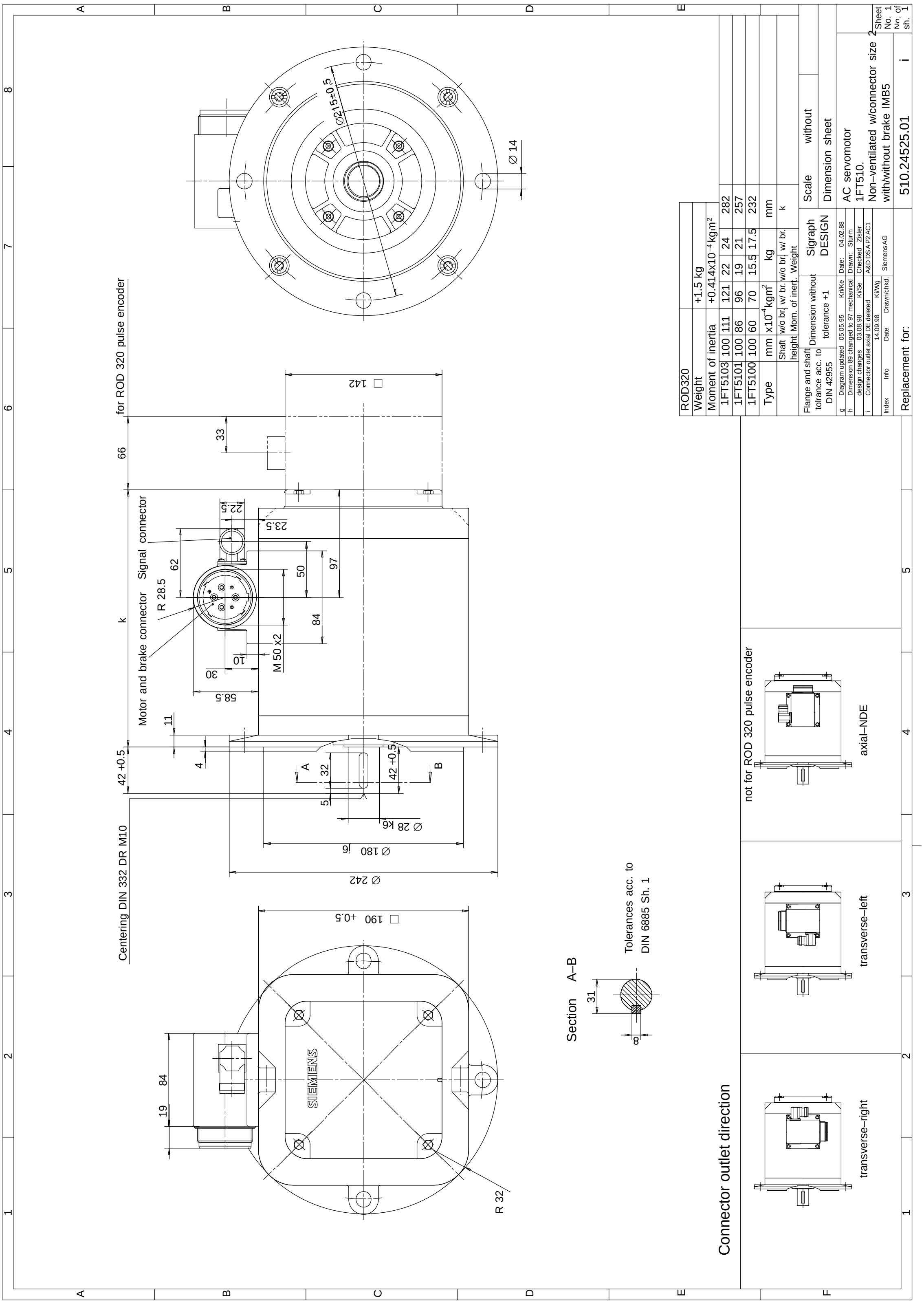


Fig. 4-19 1FT510☐ non–ventilated with connector size 2

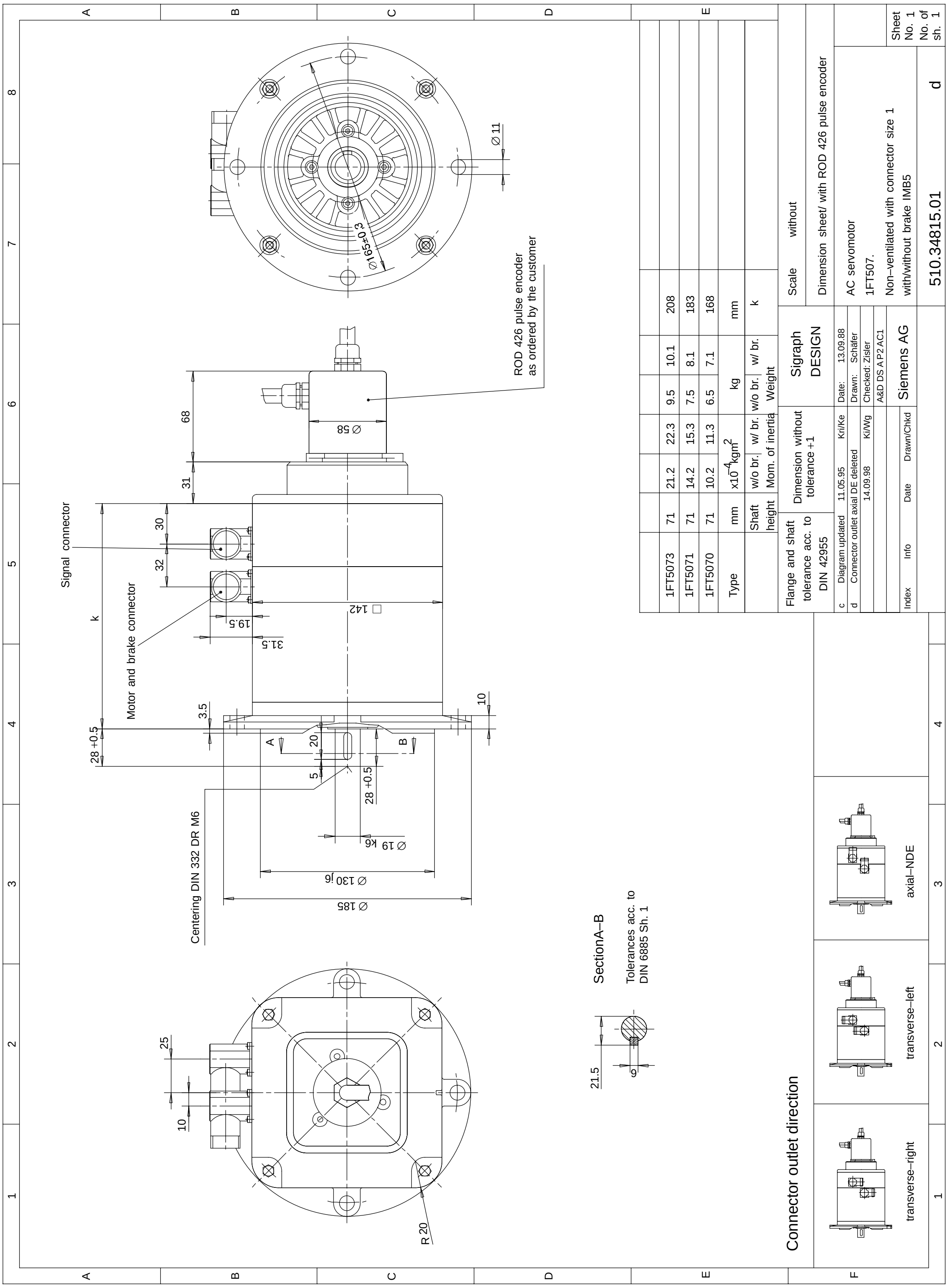


Fig. 4-20 1FT507□ non–ventilated with connector size 1

 6SN1197–0AA20

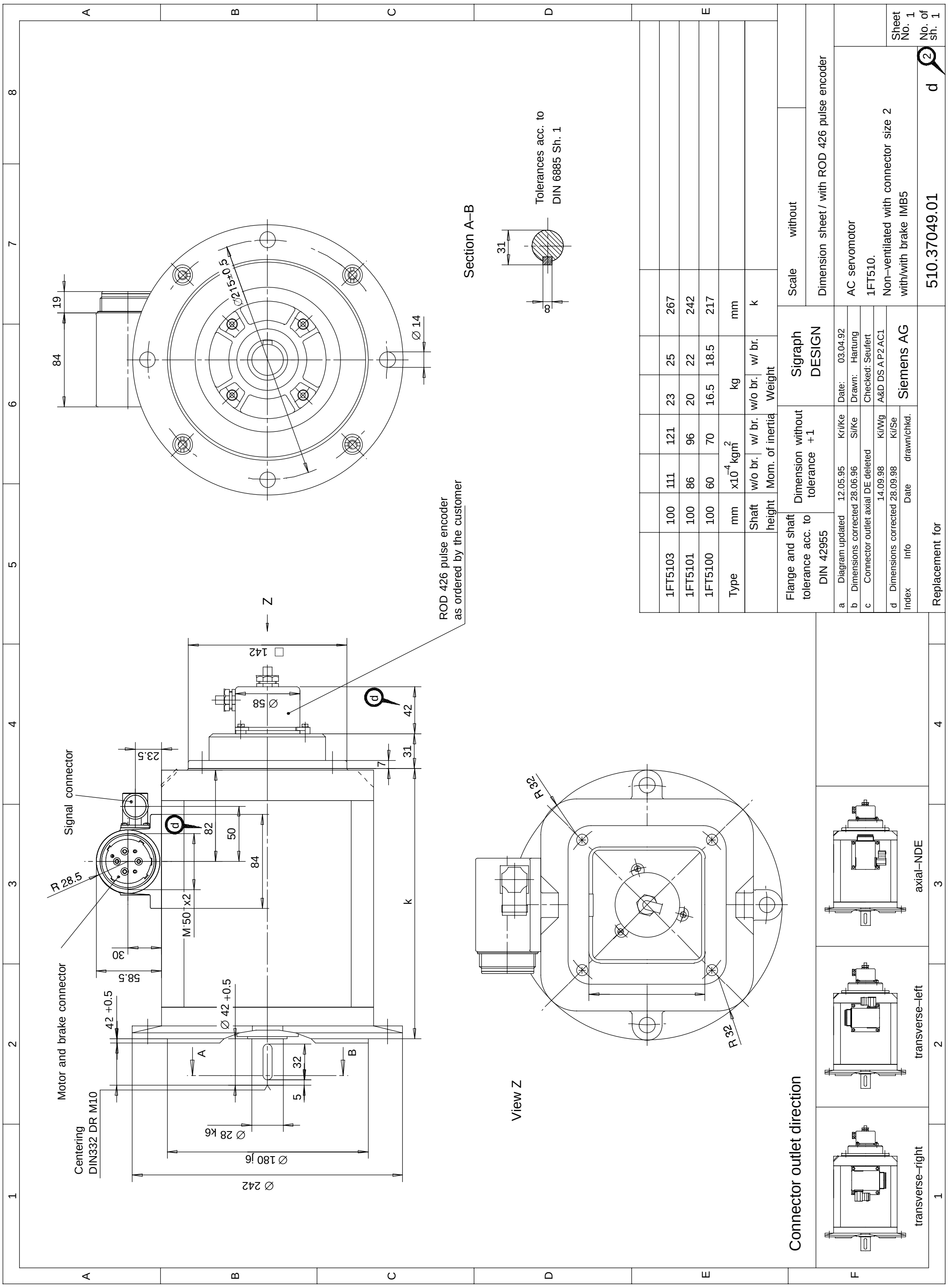


Fig. 4-21 1FT510□ non–ventilated with connector size 2

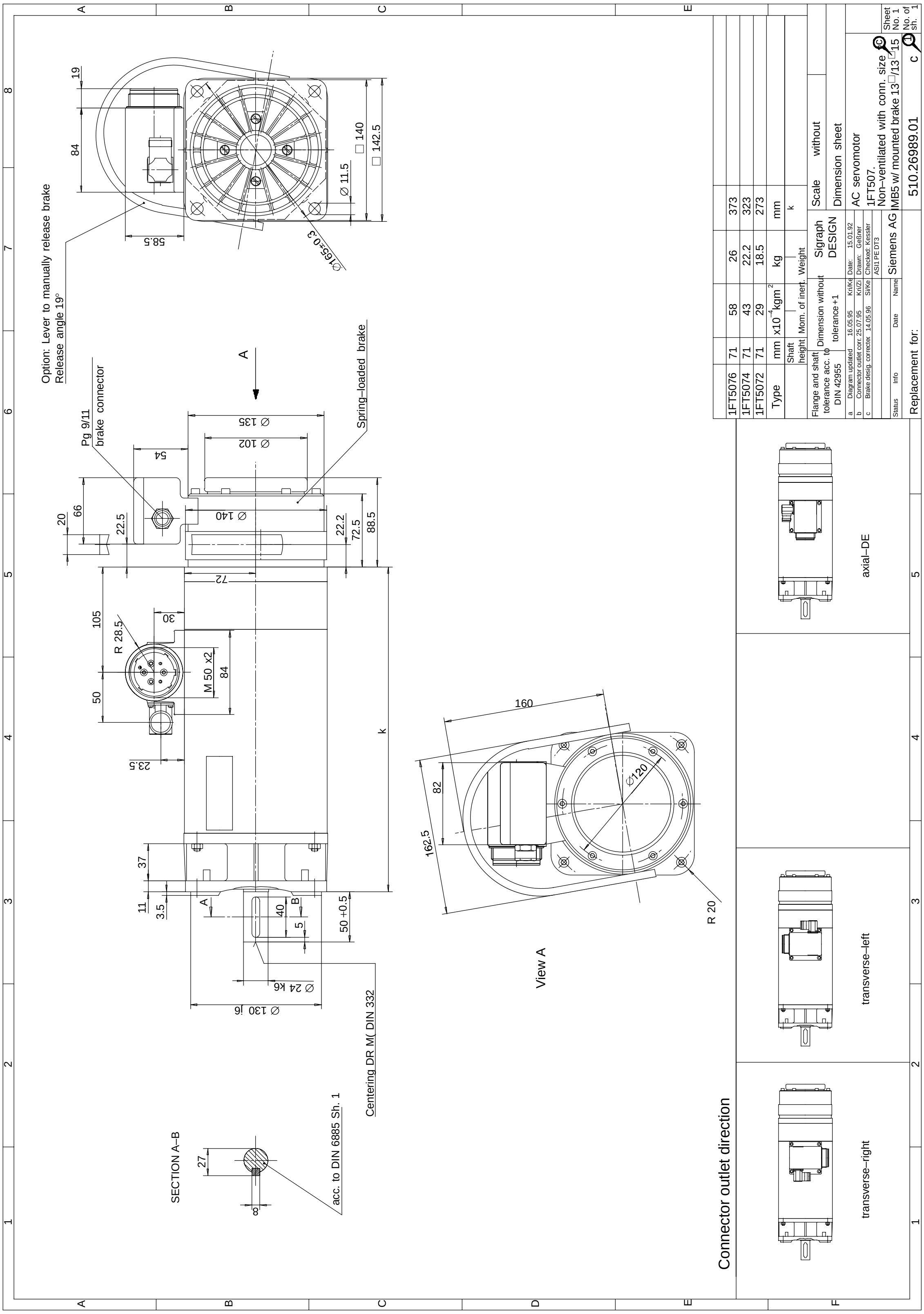


Fig. 4-22 1FT507□ non–ventilated with connector size 2

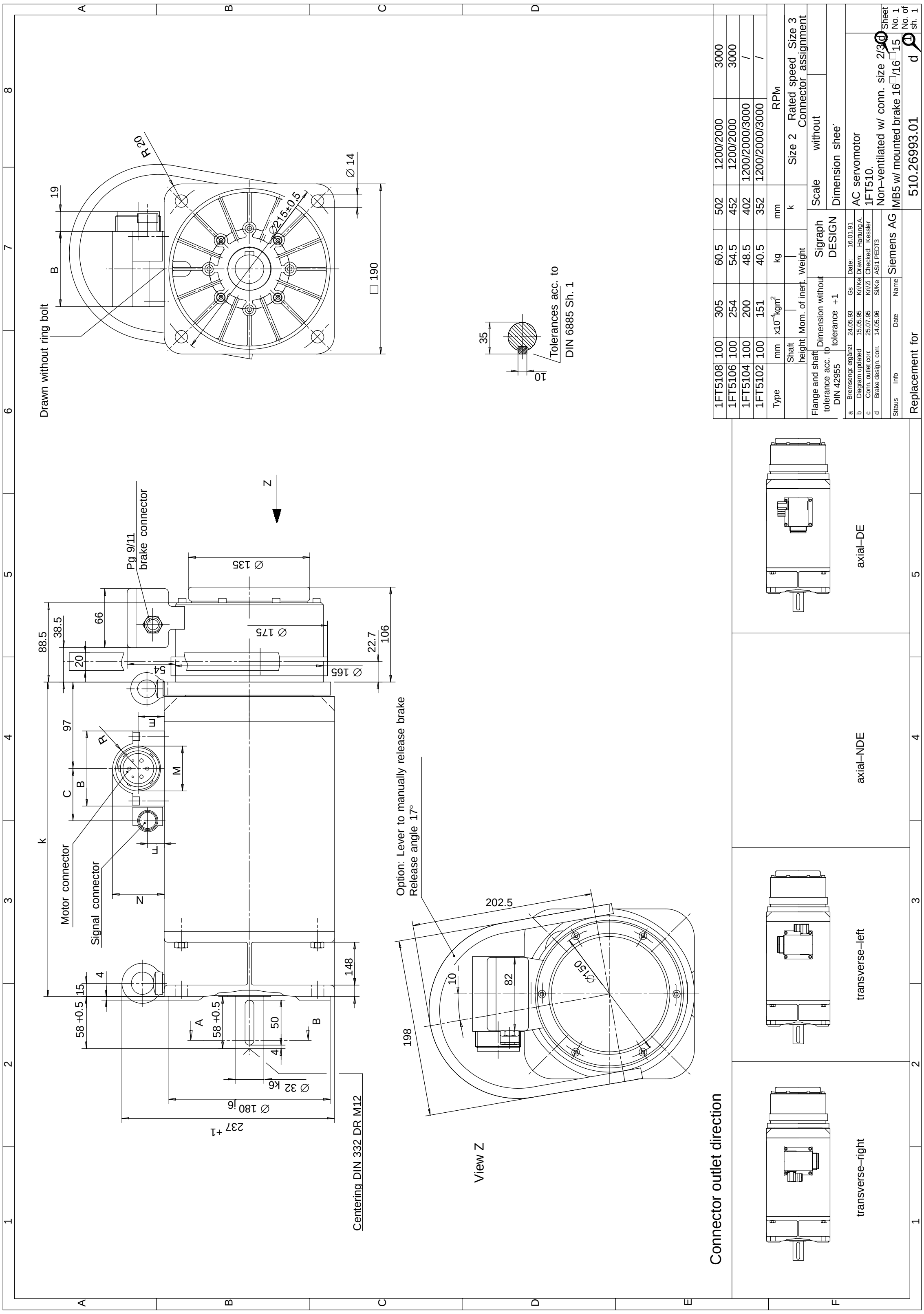


Fig. 4-23 1FT510□ non–ventilated with connector size 2/3

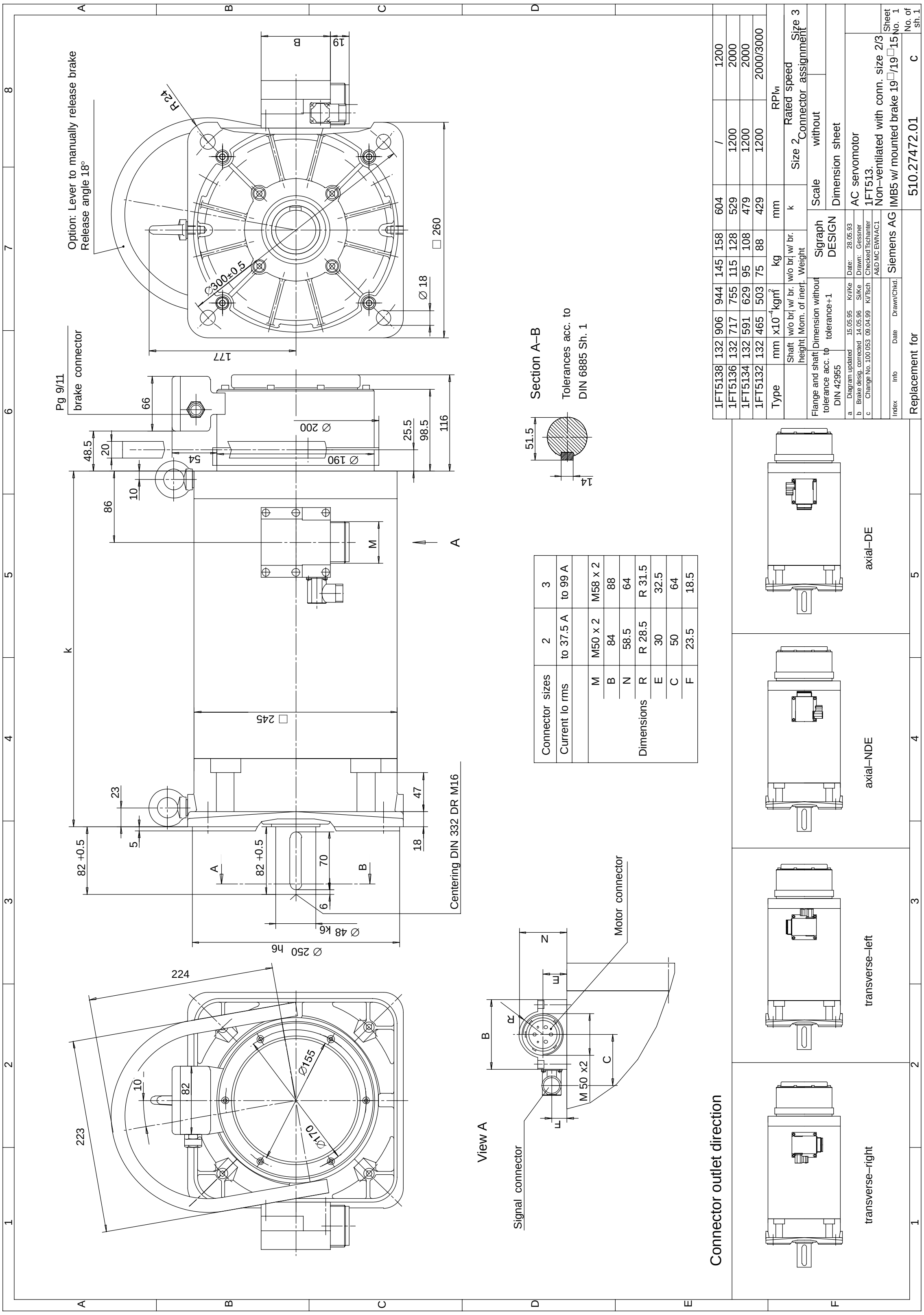


Fig. 4-24 1FT513□ non–ventilated with connector size 2/3

Index

5

Notes

1FT6 AC Servomotors

Notes

Motor Description 1

1.1 Characteristics and technical data

Application

The 1FT6 series was developed for applications on machine tools with the highest demands regarding smooth–running characteristics and surface quality. In conjunction with the SIMODRIVE 611 drive converter system with digital control, the motors are, among other things, admirably suited for feed drives on lathes and milling machines, machining centers, for grinding and special–purpose machines and for woodworking.

They can be directly mounted onto feed spindles and onto gearboxes with gears or toothed belts.

Warning

The motors are not suitable for direct online operation (directly connected to the line supply).

Characteristics

Depending on the shaft height, the 1FT6 series has stall torques from 0.4 to 140 Nm at rated speeds from 1500 to 6000 RPM. They have a high overload capability over the complete speed control range. The motors are optimized for a low torque ripple.

Standards, regulations

The appropriate standards and regulations are directly assigned to the functional requirements.

Technical features

The motors are designed for operation from a 600 V DC link voltage, for sinusoidal impressed currents. Together with the digital SIMODRIVE 611, they form a complete drive system.

For DC link voltages which differ from 600 V (max. 700 V), the voltage limiting characteritic is shifted as described in Chapter AL S/1.1.

Note

When the drive converter is connected, for example, to a 480 V supply, DC link voltages are obtained > 600 V. In this case, the following restriction is valid: Shaft heights 28, 36, 48, 63, 80 may only be utilized according to the ΔT=60 K limit values.

Table 1-1 Motors, standard version

Technical features	Version
Motor type	Permanent–magnet synchronous motors, AC servomotor
Type of construction (acc. to EN60034–7; IEC 60034–7)	IM B5 (IM V1, IM V3)
Degree of protection (acc, to EN60034–5; IEC 60034–5)	IP 64; core types, IP 65

Table 1-1 Motors, standard version

Technical features	Version
Cooling (acc. to EN60034–6; IEC 60034–6)	Non–ventilated
Thermal motor protection (acc. to EN 60034-11; IEC 60034–11)	KTY84 PTC in the stator winding
Shft end (acc. to DIN 748-3; IEC 60072-1)	Cylindrical; without keyway and without key; tolerance zone k6
Rating plate	All motors have a second rating plate supplied with them
Radial eccentricity, concentricity and axial eccentricity (acc. to DIN 42955; IEC 60072–1)	Tolerance N (standard)
Vibration severity (acc. to EN 60034–14; IEC 60034–14)	Level N (standard)
Bearings	Roller bearings with permanent lubrication (lifetime lubrication) Bearing lifetime > 20000 h Shaft height 36/48: locating bearing on the NDE Shaft heights 28, 63 to 132: Locating bearing on the DE
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. Lifetime > 40 000 h
Installation altitude (acc. to EN and IEC 60034–1)	≤ 1000 m above sea level, otherwise de–rating 2000 m factor 0.94 2500 m factor 0.9
Magnetic materials	Rare earth materials
Electrical connection	Connector for the power and encoder signals (the connector outlet connection can be selected)
Encoder system	Integrated encoder • speed sensing • rotor position sensing • indirect position sensing (incrementall)

Options, supplements

Table 1-2 Options

Technical features	Version
Type of construction (acc. to EN60034–7; IEC 60034–7)	IM B14
Degree of protection (acc. to EN60034–5; IEC 60034–5)	IP 65, IP 67, IP 68 (not with separately–driven fan) (shaft height 28, only IP 67)
Cooling (acc. to EN60034–6; IEC 60034–6)	– forced ventilation – water cooling
Shaft end (acc. to EN and IEC 60034–14)	Cylindrical; with keyway and key; tolerance zone k6 half–key balancing acc. to DIN 8821
Radial eccentricity, concentricity and axial eccentricity (acc. to DIN 42955; IEC 60072–1)	Tolerance R (reduced)
Vibration severity (acc. to EN 60034–14; IEC 60034–14)	Level R (not 1FT6 108 8WF7)
Integrated/mounted components	• fail–safe holding brake; 24V ± 10% supply voltage (acc. to DIN 0580 7/79) • mounted planetary gearbox • multi–turn absolute value encoder[1)] • resolver

1) when an absolute encoder is used, the rated torque is reduced (refer to the Table, Technical data)

Technical data

Core types have a grey background.

100 K values are specified in the table

Table 1-3 Technical data – 1FT6 motors

Rated speed [RPM]	M_0 [Nm]	M_{rated} [Nm]	M_{rated} [1] [Nm]	Motor type 1FT6–	Motor current [2] I_0 [A]	Rated drive converter current [2] [A]	P_{calc} [kW]	Connector size	Cross–section [mm²]	Cable type [3] 6FX□002–
1500	27.0	24.5	24.5	102–□AB7□	8.4	9.0	3.8	1.5	4x1.5	5□A21–1□□0
	50.0	41.0	41.0	105–□AB7□	17.2	18.0	6.4	1.5	4x2.5	5□A31–1□□0
	70.0	61.0	61.0	108–□AB7□	22.1	28.0	9.6	1.5	4x4	5□A41–1□□0
	75.0	62.0	62.0	132–□AB7□	23.0	28.0	9.7	1.5	4x4	5□A41–1□□0
	95.0	75.0	75.0	134–□AB7□	29.0	28.0[5]	11.8	1.5	4x6	5□A51–1□□0
	115.0	88.0	88.0	136–□AB7□	34.0	56.0	13.8	1.5	4x10	5□A61–1□□0
	119.0	116.0	116.0	108–□WB7□	41.0	56.0	18.2	3.0	4x10	5□A61–1□□0
2000	4.0	3.7	3.7	061–□AC7□	2.0	3.0	0.8	1.0	4x1.5	5□A01–1□□0
	6.0	5.2	5.2	062–□AC7□	2.7	3.0	1.1	1.0	4x1.5	5□A01–1□□0
	9.5	8.0	8.0	064–□AC7□	4.2	5.0	1.7	1.0	4x1.5	5□A01–1□□0
	8.0	7.5	7.5	081–□AC7□	4.1	5.0	1.6	1.5	4x1.5	5□A21–1□□0
	13.0	11.4	11.4	082–□AC7□	6.9	9.0	2.4	1.5	4x1.5	5□A21–1□□0
	20.0	16.9	16.9	084–□AC7□	9.5	9.0[5]	3.5	1.5	4x1.5	5□A21–1□□0
	27.0	22.5	22.5	086–□AC7□	12.0	18.0	4.7	1.5	4x1.5	5□A21–1□□0
	27.0	23.0	23.0	102–□AC7□	12.4	18.0	4.8	1.5	4x1.5	5□A21–1□□0
	50.0	38.0	38.0	105–□AC7□	22.9	28.0	8.0	1.5	4x4	5□A41–1□□0
	70.0	55.0	55.0	108–□AC7□	29.0	28.0[5]	11.5	1.5	4x6	5□A51–1□□0
	75.0	55.0	55.0	132–□AC7□	31.0	28.0[5]	11.5	1.5	4x6	5□A51–1□□0
	95.0	65.0	65.0	134–□AC7□	39.0	56.0	13.6	1.5	4x10	5□A61–1□□0
	115.0	74.0	74.0	136–□AC7□	43.0	56.0	15.5	3.0	4x16	5□A23–1□□0
	65.0	56.0	56.0	105–□SC7□	32.0	28.0[5]	11.7	1.5	4x6	5□A51–1□□0
	90.0	80.0	80.0	108–□SC7□	41.0	56.0	16.8	3.0	4x16	5□A23–1□□0
	110.0	98.0	98.0	132–□SC7□	51.0	56.0	20.5	3.0	4x16	5□A23–1□□0
	140.0	125.0	125.0	134–□SC7□	62.0	56.0[5]	26.2	3.0	4x16	5□A23–1□□0
	85.0	82.0	82.0	105–□WC7□	58.0	140.0	17.2	3.0	4x16	5□A23–1□□0
	119.0	115.0	115.0	108–□WC7□	54.0	140.0	24.1	3.0	4x16	5□A23–1□□0
3000	2.6	2.15	2.0	041–□AF7□	1.8	3.0	0.7	1.0	4x1.5	5□A01–1□□0
	5.0	4.3	4.1	044–□AF7□	3.0	3.0[5]	1.4	1.0	4x1.5	5□A01–1□□0
	4.0	3.5	3.3	061–□AF7□[6]	2.75	3.0	1.1	1.0	4x1.5	5□A01–1□□0
	6.0	4.7	4.5	062–□AF7□	4.0	5.0	1.5	1.0	4x1.5	5□A01–1□□0
	9.5	7.0	6.7	064–□AF7□	6.1	9.0	2.2	1.0	4x1.5	5□A01–1□□0
	8.0	6.9	6.6	081–□AF7□	6.0	9.0	2.2	1.5	4x1.5	5□A21–1□□0
	13.0	10.3	9.8	082–□AF7□	10.2	18.0	3.2	1.5	4x1.5	5□A21–1□□0
	20.0	14.7	14.0	084–□AF7□	14.0	18.0	4.6	1.5	4x1.5	5□A21–1□□0
	27.0	18.5	17.6	086–□AF7□	17.5	18.0	5.8	1.5	4x2.5	5□A31–1□□0
	27.0	19.5	18.5	102–□AF7□	17.2	18.0	6.1	1.5	4x2.5	5□A31–1□□0
	50.0	31.0	29.0	105–□AF7□	34.0	28.0[5]	9.7	1.5	4x6	5□A51–1□□0
	75.0	36.0	34.2	132–□AF7□	46.0	56.0[1]	11.3	3.0	4x16	5□A23–1□□0
	26.0	22.0	21.0	084–□SF7□	19.3	18.0[5]	6.9	1.5	4x2.5	5□A31–1□□0
	35.0	31.0	29.0	086–□SF7□	26.0	28.0	9.7	1.5	4x4	5□A41–1□□0
	65.0	50.0	48.0	105–□SF7□	45.0	56.0	15.7	3.0	4x16	5□A23–1□□0
	35.0	35.0	33.0	084–□WF7□	26.0	28.0	11.0	1.5	4x4	5□A41–1□□0
	47.0	46.0	44.0	086–□WF7□	35.0	56.0	14.5	1.5	4x10	5□A61–1□□0

Table 1-4 Technical data – 1FT6 motors. continued

Rated speed [RPM]	M_0 [Nm]	M_{rated} [Nm]	M_{rated} 1) [Nm]	Motor type 1FT6–	Motor curr. 2) I_0 [A]	Rated drive converter current 2) [A]	P_{calc} [kW]	Connector size	Cross–section [mm²]	Cable type 3) 6FX□002–
	85.0	78.0	74.0	105–□WF7□	83.0	140.0	26.5	3.0	4x25	5DA33–1□□0
	119.0	109.0	104.0	108–□WF7□	81.0	140.0	34.0	3.0	4x25	5DA33–1□□0
4500	4.0	2.9	2.6	061–□AH7□	4.1	5.0	1.4	1.0	4x1.5	5□A01–1□□0
	6.0	3.6	3.2	062–□AH7□	5.6	9.0	1.7	1.0	4x1.5	5□A01–1□□0
	9.5	4.8	4.3	064–□AH7□	9.1	9.0 5)	2.3	1.0	4x1.5	5□A01–1□□0
	8.0	5.8	5.2	081–□AH7□	9.0	9.0	2.7	1.5	4x1.5	5□A21–1□□0
	13.0 6)	8.5	7.7	082–□AH7□	15.0	18.0	4.0	1.5	4x2.5	5□A31–1□□0
	20.0	10.5	9.5	084–□AH7□	21.6	18.0 5)	4.8	1.5	4x2.5	5□A31–1□□0
	27.0	12.0	10.8	086–□AH7□	25.3	28.0	5.7	1.5	4x4	5□A41–1□□0
	27.0	12.0	10.8	102–□AH7□	24.8	28.0	5.7	1.5	4x4	5□A41–1□□0
	26.0	20.0	18.0	084–□SH7□	28.0	28.0	9.4	1.5	4x4	5□A41–1□□0
	35.0	27.0	24.3	086–□SH7□	39.0	56.0	12.7	3.0	4x16	5□A23–1□□0
	35.0	35.0	32.0	084–8WH7□	38.0	56.0	16.5	1.5	4x10	5□A61–1□□0
	47.0	45.0	41.0	086–8WH7□	53.0	56.0	22.1	3.0	4x16	5DA23–1□□0
6000	0.4		7)	021–□AK7□		3.0	0.25	1.0	4x1.5	5□A01–1□□0
	0.8		7)	024–□AK7□		3.0	0.5	1.0	4x1.5	5□A01–1□□0
	1.0	0.75	0.6	031–□AK7	1.45	3.0	0.5	1.0	4x1.5	5□A01–1□□0
	2.0	1.4	1.2	034–□AK7□	2.6	3.0	0.9	1.0	4x1.5	5□A01–1□□0
	2.6	1.7	1.4	041–□AK7□	3.0	3.0 5)	1.1	1.0	4x1.5	5□A01–1□□0
	5.0	3.0	2.6	044–□AK7□	5.9	9.0	1.9	1.0	4x1.5	5□A01–1□□0
	4.0	2.1	1.8	061–□AK7□	5.0	5.0	1.3	1.0	4x1.5	5□A01–1□□0
	6.0	2.1	1.8	062–□AK7□	7.5	9.0	1.3	1.0	4x1.5	5□A01–1□□0
	9.5	2.1	1.8	064–□AK7□	12.1	18.0	1.3	1.0	4x1.5	5□A01–1□□0
	8.0	4.6	3.9	081–□AK7□	11.1	18.0	2.9	1.5	4x1.5	5□A21–1□□0
	13.0	5.5	4.7	082–□AK7□	18.2	18.0 5)	3.5	1.5	4x4	5□A41–1□□0
	20.0	6.5	5.5	084–□AK7□	25.0	28.0	2.5	1.5	4x4	5□A41–1□□0
6000	26.0	17.0	14.5	084–□SK7□	36.0	56.0	10.7	1.5	4x10	5□A61–1□□0
	35.0	22.0	18.7	086–□SK7□	45.0	56.0	13.7	3.0	4x16	5□A23–1□□0
	35.0	34.0	29.0	084–□WK7□	49.0	56.0	22.0	3.0	4x16	5□A23–1□□0
	47.0	44.0	37.0	086–□WK7□	61.0	140.0	29.2	3.0	4x25	5DA33–1□□0

Motor type code:
1 Core type
4, 6, 8 Pole No.

Cable type code:
without brake cable: without overall shield A
with overall shield C
with brake cable: without overall shield B
with overall shield D

Lengths 4) (examples)
5 m AF
10 m BA
15 m BF
18 m BJ
25 m CF

Power calculation

$$P_{calc}\,[kW] = \frac{M_{rated} \times n}{9550}$$ M [Nm], n [RPM]

Cables are not included in the scope of supply of the motors, they must be separately ordered.
Actual value cables, refer to Chapter, Encoders (GE).

1) with absolute encoder EQN (due to the max. encoder temperature)
2) the specified values are RMS values
3) 8 = Motion Control 800; 5 = Motion Control 500; Technical data, refer to Catalog NC Z
4) cables can be supplied in increments of a meter; for length code, refer to Chapter AL S/4.3
5) with the specified power module, the motor cannot be fully utilized acc. to a 100 K widing temperature.
6) from 30.09.00 this is no longer a core type
7) an absolute value encoder is not possible

1.2 Functions and options

Armature short–circuit braking

Definition, refer to Chapter 3, General information on AC servmotors AL S .

Brake resistors

An optimum braking time is achieved by appropriately dimensioning the brake resistors. The braking torques which are obtained, are also listed in the tables. This data is valid for braking from rated speed. If the drive brakes from another speed, then the braking time **cannot** be linearly interpolated. However, the braking times either remain the same or are shorter.

The resistor ratings must be adapted to the particular I^2t load capability, refer to Chapter 3, General information on AC servomotors AL S.

Table 1-5 Resistor braking for 1FT6 motors, shaft heights 28, 36 and 48

Motor type	Ext. brake resistor R_{opt} [Ω]	Avg. braking torque $M_{br\ rms}$ [Nm]	Max. braking torque $M_{br\ max}$ [Nm]	RMS braking current $I_{br\ rms}$ [A]
1FT6021–6AK71	–	1.2	1.7	6.9
1FT6024–6AK71	–	3.0	4.0	8.8
1FT6031–□AK71	– 4.3	2.1 2.3	2.8	6.9 6.4
1FT6034–□AK71	– 3.7	3.8 4.6	5.7	13.5 12.3
1FT6041–□AF71	– 0.3	6.7 6.8	8.4	10.2 10.1
1FT6041–□AK71	– 2.6	5.8 6.7	8.3	18.1 16.6
1FT6044–□AF71	– 2.0	12.5 13.4	16.6	17.8 16.6
1FT6044–□AK71	– 1.8	9.7 13.5	16.8	37.0 33.0

Table 1-6 Resistor braking for 1FT6 motors, shaft height 63

Motor type	Ext. brake resistor R_{opt} [Ω]	Avg. braking torque $M_{br\ rms}$ [Nm]	Max. braking torque $M_{br\ max}$ [Nm]	RMS braking current $I_{br\ rms}$ [A]
1FT6061–□AC71	–	2.9	4.1	3.8
	9.1	3.3		3.5
1FT6061–□AF71	–	2.5	4.1	5.4
	9.4	3.3		4.9
1FT6061–□AH71	–	2.0	4.1	8.2
	7.3	3.3		7.4
1FT6061–□AK71	–	1.7	4.1	10.0
	7.1	3.3		8.9
1FT6062–□AC71	–	4.3	6.4	5.6
	7.7	5.2		5.2
1FT6062–□AF71	–	3.7	6.5	8.6
	6.4	5.2		7.8
1FT6062–□AH71	–	2.9	6.4	12.1
	5.5	5.2		10.8
1FT6062–□AK71	–	2.4	6.4	16.0
	4.4	5.1		14.3
1FT6064–□AC71	–	6.4	10.6	9.1
	5.8	8.6		8.2
1FT6064–□AF71	–	5.2	10.6	13.1
	4.9	8.5		11.8
1FT6064–□AH71	–	4.1	10.7	19.9
	3.6	8.6		17.8
1FT6064–□AK71	–	3.4	10.7	26.0
	2.9	8.6		23.7

Table 1-7 Resistor braking for 1FT6 motors, shaft height 80

Motor type	Ext. brake resistor R_{opt} [Ω]	Avg. braking torque $M_{br\ rms}$ [Nm]	Max. braking torque $M_{br\ max}$ [Nm]	RMS braking current $I_{br\ rms}$ [A]
1FT6081–□AC71	–	4.4	7.5	7.3
	6.5	6.0		6.6
1FT6081–□AF71	–	3.7	7.6	11.0
	5.1	6.1		9.9
1FT6081–□AH71	–	2.8	7.5	16.4
	3.7	6.0		14.7
1FT6081–□AK71	–	2.4	7.7	20.6
	3.4	6.2		18.5
1FT6082–□AC71	–	6.2	11.7	11.9
	4.2	9.4		10.7
1FT6082–□AF71	–	5.0	11.8	17.7
	3.2	9.5		15.9
1FT6082–□AH71	–	3.7	11.5	26.0
	2.4	9.2		23.0
1FT6082–□AK71	–	3.3	12.1	33.0
	2.2	9.8		29.0

Table 1-7 Resistor braking for 1FT6 motors, shaft height 80

Motor type	Ext. brake resistor R_{opt} [Ω]	Avg. braking torque $M_{br\ rms}$ [Nm]	Max. braking torque $M_{br\ max}$ [Nm]	RMS braking current $I_{br\ rms}$ [A]
1FT6084–□AC71	–	8.9	19.1	17.4
	3.5	15.4		15.6
1FT6084–□AF71	–	7.0	19.2	26.0
	2.6	16.5		23.1
1FT6084–□AH71	–	5.4	19.2	40.0
	1.7	15.4		36.0
1FT6084–□AK71	–	4.4	19.0	46.0
	1.8	15.3		41.0
1FT6086–□AC71	–	12.6	28.0	24.2
	2.7	22.8		21.7
1FT6086–□AF71	–	9.8	28.0	35.0
	2.1	24.7		32.0
1FT6086–□AH71	–	7.5	28.0	51.0
	1.6	22.9		46.0

Table 1-8 Resistor braking for 1FT6 motors, shaft height 100

Motor type	Ext. brake resistor R_{opt} [Ω]	Avg. braking torque $M_{br\ rms}$ [Nm]	Max. braking torque $M_{br\ max}$ [Nm]	RMS braking current $I_{br\ rms}$ [A]
1FT6102–□AB71	–	12.0	28.0	17.5
	3.9	22.6		15.8
1FT6102–□AC71	–	10.0	28.0	24.7
	2.8	22.7		22.1
1FT6102–□AF71	–	7.7	28.0	34.0
	2.3	22.5		31.0
1FT6102–□AH71	–	6.1	29.0	50.0
	1.7	23.0		45.0
1FT6105–□AB71	–	19.1	50.0	31.0
	2.2	40.0		28.0
1FT6105–□AC71	–	16.0	50.0	42.0
	1.7	40.0		38.0
1FT6105–□AF71	–	12.0	49.0	62.0
	1.2	39.0		56.0
1FT6108–□AB71	–	32.0	87.0	53.0
	1.4	70.0		47.0
1FT6108–□AC71	–	26.0	86.0	68.0
	1.2	69.0		61.0

Table 1-9 Resistor braking for 1FT6 motors, shaft height 132

Motor type	**Ext. brake resistor** R_{opt} [Ω]	**Avg. braking torque** $M_{br\ rms}$ [Nm]	**Max. braking torque** $M_{br\ max}$ [Nm]	**RMS braking current** $I_{br\ rms}$ [A]
1FT6132–□AB71	–[1]	27.0	80.0	46.0
	1.7	64.0		41.0
1FT6132–□AC71	–[1]	22.2	81.0	62.0
	1.3	65.0		55.0
1FT6132–□AF71	–[1]	16.7	80.0	92.0
	0.9	64.0		80.0
1FT6134–□AB71	–[1]	40.0	120.0	68.0
	1.2	97.0		61.0
1FT6134–□AC71	–[1]	34.0	122.0	94.0
	0.9	99.0		84.0
1FT6136–□AB71	–[1]	41.0	132.0	77.0
	1.0	106.0		69.0
1FT6136–□AC71	–[1]	34.0	134.0	98.0
	0.9	107.0		88.0

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Table 1-10 Resistor braking for 1FT6 motors, shaft height 80, shaft heights100 and 132 (force–ventilated)

Motor type	**Ext. brake resistor** R_{opt} [Ω]	**Avg. braking torque** $M_{br\ rms}$ [Nm]	**Max. braking torque** $M_{br\ max}$ [Nm]	**RMS braking current** $I_{br\ rms}$ [A]
1FT6084–□SF71	–	6.9	19.2	27.0
	2.3	15.4		24.4
1FT6084–□SH71	–	5.4	19.2	40.0
	1.7	15.4		36.0
1FT6084–□SK71	–	4.3	19.2	52.0
	1.4	15.5		46.0
1FT6086–□SF71	–	10.1	29.0	41.0
	1.6	23.0		37.0
1FT6086–□SH71	–	7.1	28.0	59.0
	1.1	22.1		53.0
1FT6086–□SK71	–	6.0	28.0	70.0
	1.1	22.2		62.0
1FT6105–□SC71	–	15.8	49.0	45.0
	1.5	40.0		40.0
1FT6105–□SF71	–	12.0	49.0	62.0
	1.2	39.0		56.0
1FT6108–□SC71	–	27.0	87.0	76.0
	0.9	70.0		68.0
1FT6132–□SC71	–[1]	23.3	81.0	70.0
	1.1	65.0		62.0
1FT6134–□SC71	–[1]	33.0	120.0	99.0
	0.8	97.0		89.0

1) When utilized acc. to M_0 (100 K), a series brake resistor must be used to prevent partial de–magnetization.
When utilized acc. to M_0 (60 K) this additional brake resistor is not required.

Table 1-11 Resistor braking for 1FT6 motors, shaft height 80 and100 (water cooled)

Motor type	**Ext. brake resistor** R_{opt} [Ω]	**Avg. braking torque** $M_{br\ rms}$ [Nm]	**Max. braking torque** $M_{br\ max}$ [Nm]	**RMS braking current** $I_{br\ rms}$ [A]
1FT6084–□WF71	–	6.9	19.2	27.0
	2.3	15.4		24.4
1FT6084–□WH71	–	5.4	19.2	40.0
	1.7	15.4		36.0
1FT6084–□WK71	–	4.3	19.2	52.0
	1.4	15.5		46.0
1FT6086–□WF71	–	10.1	29.0	41.0
	1.6	23.4		37.0
1FT6086–□WH71	–	7.1	28.0	59.0
	1.1	22.1		53.0
1FT6086–□WK71	–	6.0	28.0	70.0
	1.1	22.2		62.0
1FT6105–□WC71	–	15.8	49.0	62.0
	0.8	39.0		56.0
1FT6105–□WF71	–	12.8	51.0	92.0
	0.6	41.0		83.0
1FT6108–□WB71	–	32.0	87.0	57.0
	1.2	70.0		51.0
1FT6108–□WC71	–	27.0	87.0	76.0
	0.9	70.0		68.0
1FT6108–□WF71	–	21.0	88.0	115.0
	0.6	71.0		103.0

Holding brake

Function description, refer to Chapter 2.2, General informationon AC servomotors (AL S).

The holdinb brake cannot be retrofitted! Motors with holding brake are longer by the space required to integrated the brake (refer to the dimension drawing).

Table 1-12 Technical data for the holding brakes used with 1FT6 motors used

Motor type	Brake type	Holding torques M_4 1) [Nm]		Dyn. torque [Nm]	DC current [A]	Power drain [W]	Opening time [ms]	Closing time 1) [ms]	Mom. of inertia [10^{-4} kgm^2]	Highest switching work 2) 4) [J]
		20 °C	120 °C	120 °C						
1FT602□	EBD 0.11B	1.0	1.2	0.75	0.3	7.5	20	10	0.07	34
1FT603□	EBD 0.15B	2.5	2.0	1.6	0.4	9	30	15	0.12	27
1FT604□	EBD 0.4BA	6.5	5.0	3.5	0.8	18	30	15	1.06	126
1FT606□	EBD 1.5BN	19.0	22.0	10.0	0.7	17	130	20	3.2	321
1FT6081 1FT6082	EBD 1.2B	15.0	12.0	8.0	0.8	21	70	35	3.2	740
1FT6084 1FT6086	EBD 3.5BN	35.0	28.0	17.0	0.9	23	180	35	13.5	1640
1FT610□	EBD 4B	100.0	80.0	43.0	1.4	32	180	20	32	2150 3)
1FT613□	EBD 8B	200.0	140.0	60.0	1.7	40	260	70	76.0	9870

M_{1m} = Average dynamic torque determined by the slip time t_3
M_4 = Torque which can be transmitted, taking into account the max. solenoid temperature, friction value flucturations and spread between the units (production tolerances)

1) standardized according to VDE 0580 with varistor circuit
2) for each emergency stop with n=3000/min
3) for each emergency stop with n=2000/min
4) $W=1/2 * Jtot * \omega^2$ Jtot [kgm^2] ; ω [1/s] ; W [J]

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Gearboxes

For engineering gearboxes, refer to Chapter 2.2, General information on AC servomotors (AL S).

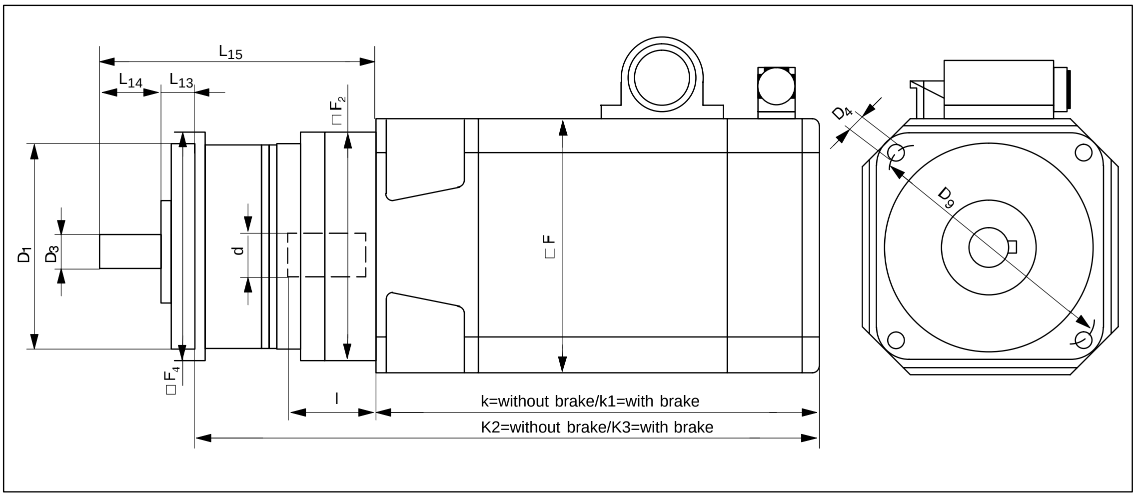


Fig. 1-1 1FT6 motor with planetary gearbox (alpha company) SPG 1–stage, dimensions in [mm]

Table 1-13 1FT6 motor with planetary gearbox (alpha company) 1–stage

Motor, standard version						Planetary gearbox, 1 stage											
Type	Dimensions					Type	Dimensions									Dimen-sions	
	k	k1	l	d	□ F		L_{13}	L_{14}	L_{15}	D_1	D_3	D_4	D_9	□ F4	□ F2	K_2	K_3
1FT6031	220	240	30	14	72	SPG 060–M01	20	28	129	60	16	5.5	68	62	70	301	321
1FT6034	260	280														341	361
1FT6034	260	280	30	14	72	SPG 075–M01	20	36	156	70	22	6.6	85	76	80	360	380
1FT6041	228	263	40	19	96										100	328	363
1FT6044	278	313														378	413
1FT6044	278	313	40	19	96	SPG 100–M01	30	58	202	90	32	9	120	101	100	392	427
1FT6061	228	258	50	24	116										120	342	372
1FT6062	253	283														367	397
1FT6064	303	333														417	447
1FT6081	221	248	58	32	155	SPG 140–M01	30	82	256	130	40	11	165	141	150	366	393
1FT6082	246	273														391	418
1FT6084	296	342														441	487
1FT6086	346	392														491	537
1FT6086	346	392	58	32	155	SPG 180–M01	30	82	297	160	55	13	215	182	180	531	577
1FT6102	295	341	80	38	192										190	480	526
1FT6105	370	416														555	601
1FT6108	470	516														655	701
1FT6105	370	416	80	38	192	SP 210–M01	38	105	335	180	75	17	250	212	190	562	608
1FT6108	470	516														662	708
1FT6132	435	485	82	48	260				339						260	631	681
1FT6134	485	535														681	731
1FT6136	535	585														731	781

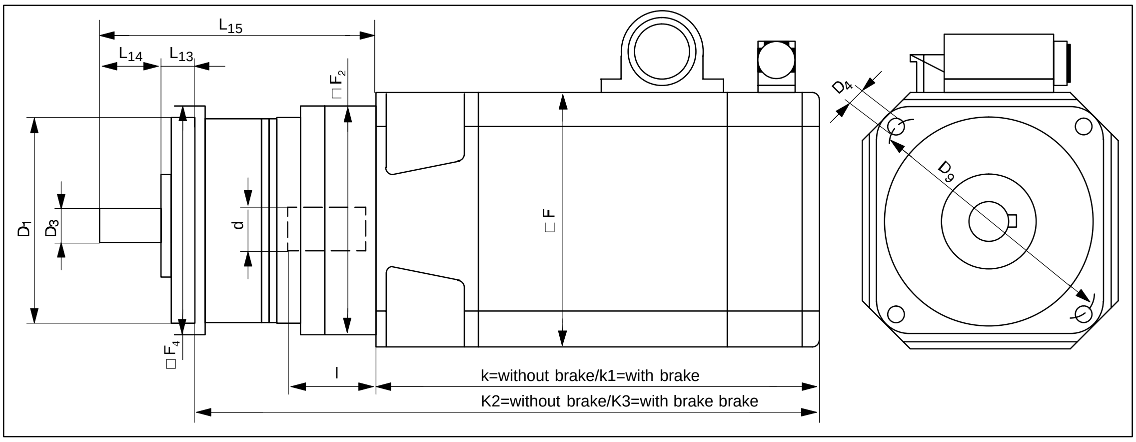


Fig. 1-2 1FT6 motor with planetary gearbox (alpha Company) SPG 2–stage, dimensions in [mm]

1FT6

Table 1-14 1FT6 motor with planetary gearbox (alpha Company) 2–stage

Motor, standard version						Planetary gearbox, 2 stage											
Type	Dimensions					Type	Dimensions									Dimension	
	k	k1	l	d	□ F		L_{13}	L_{14}	L_{15}	D_1	D_3	D_4	D_9	□ F4	□ F2	K_2	K_3
1FT6031	220	240	30	14	72	SPG 075–M02	20	36	183	70	22	6.6	85	76	80	347	367
1FT6034	260	280														387	404
1FT6034	260	280	30	14	72	SPG 100–M02	30	58	235	90	32	9	120	101	80	407	427
1FT6041	228	263	40	19	96										100	375	410
1FT6044	278	313														425	460
1FT6061	228	258	50	24	116										120	375	405
1FT6062	253	283														400	430
1FT6041	228	263	40	19	96	SPG 140–M02	30	82	297	130	40	11	165	141	100	413	448
1FT6044	278	313														463	498
1FT6061	228	258	50	24	116										120	413	443
1FT6062	253	283														438	468
1FT6064	303	333														488	518
1FT6062	253	283	50	24	116	SPG 180–M02	30	82	316	160	55	13	215	182	120	457	487
1FT6064	303	333														507	537
1FT6081	221	248	58	32	155										150	425	452
1FT6082	246	273														450	477
1FT6084	296	342														500	546
1FT6086	346	392														550	596
1FT6082	246	273	58	32	155	SPG 210–M02	38	105	359	180	75	17	250	212	150	462	489
1FT6084	296	342														512	558
1FT6086	346	392														562	608
1FT6102	295	341	80	38	192										180	511	557
1FT6105	370	416														586	632
1FT6084	296	342	58	32	155	SPG 240–M02	40	130	413	200	85	17	290	240	150	539	585
1FT6086	346	392														589	635
1FT6102	295	341	80	38	192										190	538	584
1FT6105	370	416														613	659
1FT6108	470	516														713	759

Table 1-15 Planetary gearbox 1–stage (alpha Company, SPG series) selection table for 1FT6 motors

Ordering info: **1FT6□□□–□A□7□–□□□□–Z** Order No. of the motor (standard type) with Codes **–Z** and
V□□ a code for mounting the planetary gearbox, assigned to the motor

AC servo-motor, non–ventilated	**Planetary gearbox 1–stage** play ≤ 4 arcmin[2)]		**Available gearbox ratios *i* =**				Max. permissible input speed	Max. permissible output torque	Max. permissible drive–out shaft load[1)]	Moment of inertia of the gearbox	
Type	Type	Weight approx. kg	4	5	7	10	n_{G1} RPM	M_{G2} Nm	F_r N	J_G at *i*=4 10^{-4} kgm^2	J_G at *i*=10 10^{-4} kgm^2
1FT6031	SPG 060–M01	1.5	X	X	X	X	6000	40	2600	0.17	0.15
1FT6034			X	X	X			(32)[3)]			
1FT6034	SPG 075–M01	2.8				X	6000	100	3800	0.57	0.4
1FT6041			X	X	X	X		(80)[3)]		0.63	0.46
1FT6044			X	X	X						
1FT6044	SPG 100–M01	6.2				X	4500	250	6000	2.0	1.3
1FT6061			X	X	X	X		(200)[3)]		2.7	2.0
1FT6062			X	X	X	X					
1FT6064			X	X	X	X					
1FT6081	SPG 140–M01	11.5	X	X	X	X	4000	500	9000	8.4	6.2
1FT6082			X	X	X	X		(400)[3)]			
1FT6084			X	X	X	X					
1FT6086			X	X	X						
1FT6086	SPG 180–M01	27				X	3500	1100	14000	30.6	17.4
1FT6102			X	X	X	X		(880)[3)]		31.7	18.5
1FT6105			X	X	X						
1FT6108			X	X	X						
1FT6105	SPG 210–M01	45				X	2000	1600	15000	62.1	28.1
1FT6108						X		(1280)[3)]			
1FT6132			X	X	X					70.0	36.0
1FT6134			X	X	X						
1FT6136			X	X	X						
1FT6132	SPG 240–M01	61				X	2000	3000	22000	131	73.0
1FT6134						X		(2400)[3)]			
1FT6136						X					
Code											
Gearbox shaft **with** keyway			**V02**	**V03**	**V05**	**V09**					
Gearbox shaft **without** keyway			**V22**	**V23**	**V25**	**V29**					

1) Nominal values for the maximum permissible drive shaft load at the shaft center at a speed n_{G2}=300 RPM
Axial load F_a=0.5 · F_r for SPG 060 to SPG 180; F_a= F_r for SPG 210 and SPG 240.

2) For SPG 060 and SPG 075: ≤ 6 arcmin

3) Values in brackets (...) for *i*=10

Table 1-16 Planetary gearbox 2–stage (alpha Company, SPG series) selection tables for 1FT6 motors

Ordering info: **1FT6□□□–□A□7□–□□□□–Z** Order No. of the motor (standard type) with code **–Z** and
V□□ a code for mounting the planetary gearbox assigned to the motor

AC servo-motor, non–ventilted	**Planetary gearbox 2–stage** Play ≤ 6 arcmin[2]		**Available gearbox ratio *i* =**					Max. permissible input speed	Max. permissible output torquet	Max. permissible drive–out shaft load [1]	Moment of inertia of the gearbox
Type	Type	Weight approx. kg	16	20	28	40	50	n_{G1} RPM	M_{G2} Nm	F_r N	J_G at i=20 10^{-4} kgm^2
1FT6031	SPG 075–M02	3.1	X	X	X	X	X	6000	100	3800	0.52
1FT6034			X	X							
1FT6034	SPG 100–M02	7.1			X	X	X	4500	250	6000	1.7
1FT6041			X	X	X	X					1.8
1FT6044			X	X							
1FT6061			X	X	X						2.5
1FT6062			X	X							
1FT6041	SPG 140–M02	14.5					X	4000	500	9000	4.4
1FT6044					X	X	X				
1FT6061						X	X				5.1
1FT6062					X	X					
1FT6064			X	X							
1FT6062	SPG 180–M02	29					X	4000	1100	14000	5.5
1FT6064					X	X	X				
1FT6081			X	X	X	X	X				8.2
1FT6082			X	X	X	X					
1FT6084			X	X							
1FT6086			X	X							
1FT6082	SPG 210–M02	51					X	3000	1600	15000	11.6
1FT6084					X	X					
1FT6086					X						
1FT6102			X	X	X						16.4
1FT6105			X								
1FT6084	SPG 240–M02	61					X	3000	3000	22000	24.2
1FT6086						X	X				
1FT6102						X	X				29.7
1FT6105				X	X						
1FT6108			X	X							
Code											
Gearbox **with** keyway			**V12**	**V13**	**V15**	**V16**	**V17**				
Gearbox shaft **without** keyway			**V32**	**V33**	**V35**	**V36**	**V37**				

1FT6

1) Nominal values for the maximum permissible drive shaft load at the shaft center at a speed n_{G2}=300 RPM
Axial load F_a=0.5 · F_r for SPG 075 to SPG 180; F_a= F_r for SPG 210 and SPG 240.

2) For SPG 060 and SPG 075: ≤ 8 arcmin

Supplementary cooling

The various cooling types have already been defined in Chapter 2.1, General informtion on AC servomotors AL S.

Forced ventilation

Degree of protection: IP 54 (acc. to EN 60529). IP 67 cannot be fulfilled. It is not permissible that the hot air is drawn–in again. The separately–driven fan can be retrofitted, whereby various measures must be observed. In some cases, the motors are assigned larger power connectors due to the higher torques and the associated higher phase currents.

Shaft heights 80, 100 and 132 differ as follows:

- **Shaft height 132:** Air flow direction from the DE to NDE
  The air is drawn–in from the non–drive end (NDE) through the housing corners of the extruded profiles, using a mounting radial fan.

  The modified dimensions should be taken from the dimension drawings.

Termination technology:	terminal box
Supply voltage:	3–ph. 400/460 V AC, 50/60 Hz
Maximum current:	0.4 A
Weight of the fan assembly:	approx. 5.6 kg

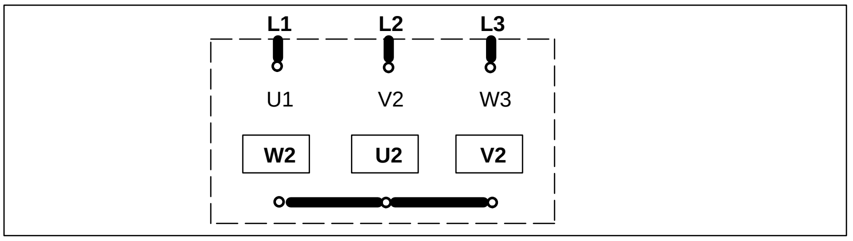
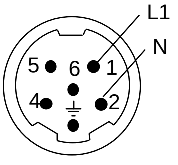


Fig. 1-3 Connecting the fan, shaft height 132

- **Shaft heights 80 and 100:** Air flow direction from the NDE to DE
  The torque yield is reduced by approx. 20% when the air flow direction is reversed. Mech. change of the motors with respect to non–ventilated types:
  - The power connector is 12 mm higher.
  - A sheet steel envelope is inserted over the motor enclosure from the non–drive end; the axial fan is accommodated in this sheet steel envelope. Air only partially flows across the motor there through the cut–out in the sheet steel envelope at the connectors (three–sided ventilation).
  - The motor dimensions should be taken from the dimension drawings.

Termination technology:	Connector[1] (6FX2003–0CA10)
Supply voltage:	1–ph. 230/260 V AC, 50/60 Hz
Maximum current:	0.3 A
Weight of the fan assembly:	approx. 4.8 kg
Pin assignment:	Fan connections (shaft heights 80 and 100)



1) Power connector, Size1

Mounting: The following minimum clearances must be maintained to customer–specific mounted components and the air discharge opening:

Table 1-17 Minimum clearance to customer–specific components

Shaft heights [mm]	Minimum clearance [mm]
80	20
100	30
132	60

Water cooling

Degree of protection IP 64–68

It is not possible to retrofit water cooling. The dimensions should be taken from the dimension sheets.

Motor type 1FT6 108 is only availble with vibration severity grade N.

Cooling water inlet temperature: ≤ 25 °C.

Cooling water connection: G3/8 “

Cooling water flow: 5 l/min (± 0.75 l)

Max. permissible pressure: 2.5 bar

Pressure drop, inlet–outlet (return line): < 0.1 bar

Cooling medium

An anti–corrosion agent (e.g. Tyfocor) should be added to the water.

The following ratio should not be fallen below

water/anti–corrosion agent = 75 %/25 %

When using other cooling mediums (e.g. oil, cooling–lubricating medium) it may be necessary to de–rate the motor, so that the thermal motor limit is not violated.

The following properties of the cooling medium must be known in order to calculate the de–rating:

Specific density ρ [kg/m^3]

Specific thermal capacitance c_p [J/(kg*K)]

The motor does not have to be de–rated for oil–water mixtures with less than 10% oil. The cooling medium must be pre–cleaned or filtered, in order to avoid the cooling circuit from being blocked.

Maximum permissible particle size after filtering 100 μm.

1FT6

Cooling power

Table 1-18 Cooling power, 1FT6 motors

Motor type 1FT6–	Cooling power [W]
–084–8WF7	1500
–084–8WH7	1600
–084–8WK7	1700
–086–8WF7	1800
–086–8WH7	2000
–086–8WK7	2400
–105–8WC7	2000
–105–8WF7	2100
–108–8WB7	1900
–108–8WC7	2100
–108–8WF7	2100

Drive–out coupling

Technical explanations and ordering address, refer to Chapter 3, General information on AC servomotors AL S.

Table 1-19 Assigning the drive–out couplings to the motors

Shaft heights	Rotex GS Type	Torques which can be transmitted 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
132	42/55	265	530

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

Warning

It is not permissible that the accelerating torque exceeds the coupling clamping torque!

1.3 Interfaces

Circuit diagrams

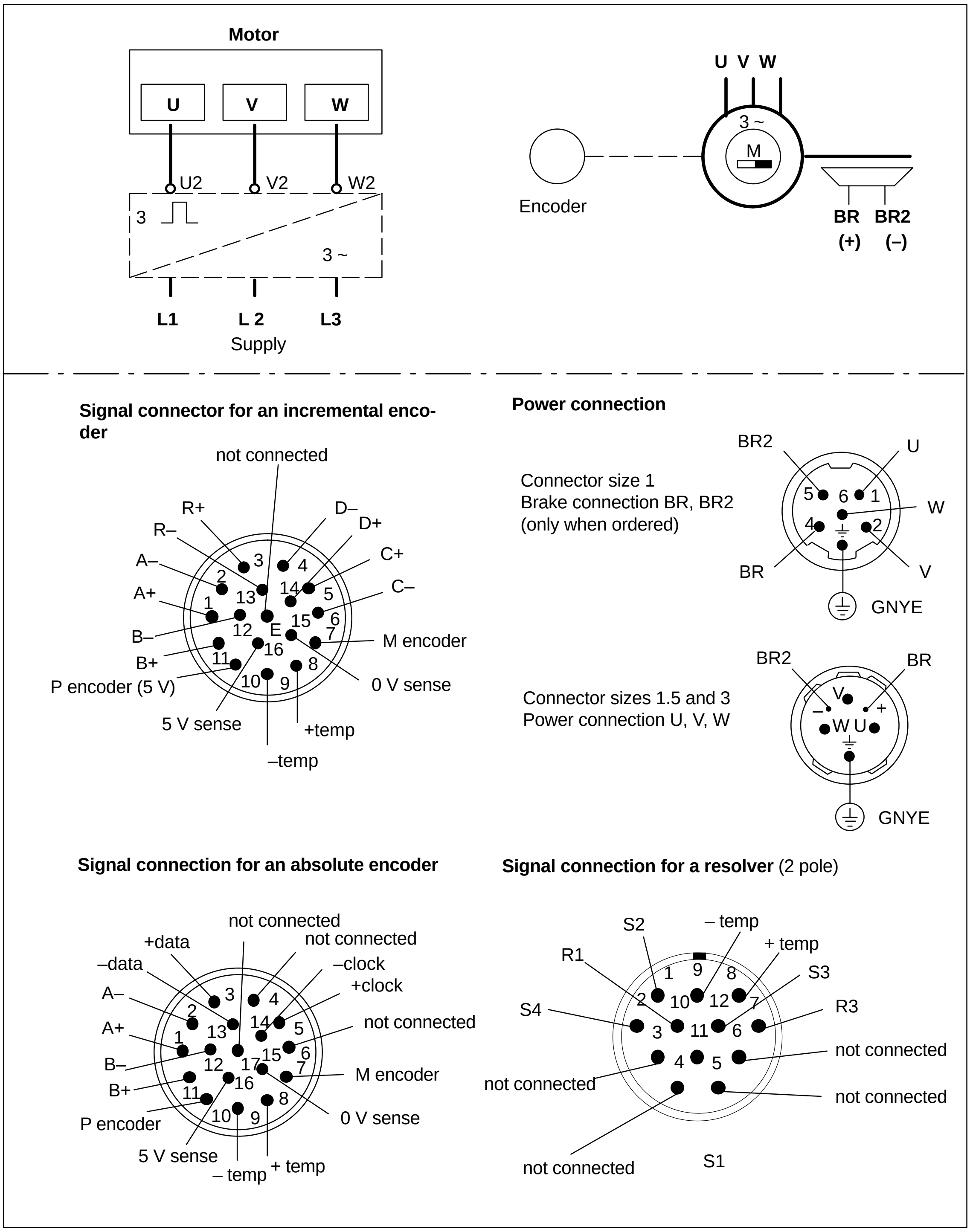


Fig. 1-4 Connector assignment: Power, brake, encoder

1.4 Thermal motor protection

Refer to Chapter 1, Encoders(GE)

1.5 Encoders

Incremental encoders

1 Vpp incremental encoders

Description, refer to Chapter 1.2.1, Encoders (GE).

Absolute value encoders

Multiturn absolute value encoder

Description, refer to Chapter 2, Integrated encoders (GE).

Resolvers

Description, refer to Chapter 1.2.2, Integrated encoders (GE), Page GE/1–17 .

■

Order Designations 2

1FT6

Order designation (standard type)

1 F T 6 . . . – . . . 7 1 – . . . .

- Electric motor
- Synchronous motor
- AC servomotor
- Series
- Frame size
- Length
- Pole No.
- Cooling type
  - A = Non–ventilated
  - S = Force–ventilated with mounted separately driven fan
  - W = Water cooling
- Rated speed
  - B = 1500 RPM
  - C = 2000 RPM
  - F = 3000 RPM
  - H = 4500 RPM
  - K = 6000 RPM
- DC link voltage
  - 7 = 600 V
- Type of construction
  - 1 = IM B5 (standard)
  - 2 = IM B14 1)
- Connector outlet direction
  - 1 = transv., to the right (not for shaft heights 36, 48, 63)
  - 2 = transv., to the left (not for shaft heights 36, 48 63)
  - 3 = axial NDE
  - 4 = axial DE
- Encoders
  - A = Incremental encoder
  - E = Absolute value encoder
  - T = Resolver (2-pole)
  - S = Resolver (multi–pole)

	Shaft end	Radial eccentricity	Holding brake
A =	with key	N	without
B =	with key	N	with
D =	with key	R	without
E =	with key	R	with
G =	without keyway	N	without
H =	without keyway	N	with
K =	without keyway	R	without
L =	without keyway	R	with

	Vibration severity level	Degree of protection
0 =	N	IP 64
1 =	N	IP 65 2)
2 =	N	IP 67 2)
6 =	N	IP 68 2)
3 =	R 3)	IP 64
4 =	R 3)	IP 65 2)
5 =	R 3)	IP 67 2)
7 =	R 3)	IP 68 2)

1) only for shaft heights 63, 80, 100
2) not for motors with forced ventilation
3) not 1FT6 108–8WF7

Order designations, core types

1 F T 6 . . . – 1 A . 7 1 – . . . 0

Electric motor

Synchronous motor

AC servomotor

Series

Frame size

Length

Code, core type

Rated speed
C = 2000 RPM
F = 3000 RPM
K = 6000 RPM

Connector outlet direction
1 = transverse, to the right (not for shaft heights 36, 48, 63)
2 = transverse, to the left (not for shaft heights 36, 48, 63)
3 = axial NDE
4 = axial DE

Optical encoders
A = Incremental encoders
E = Absolute value encoder

G = without holding brake
H = with holding brake

■

Technical Data and Characteristics 3

3.1 Speed–torque diagrams

Note

For drive converter operation on 480 V line supplies, DC link voltages of > 600 V are obtained. The following restrictions apply:

- Motors, shaft heights 28, 36, 48, 63 and 80 may only be utilized acc. to ΔT = 60 K. Shaft heights 100 and 132 can still be utilized according to ΔT = 100 K.
- The shift of the voltage limiting characteristics is described in Chapter ALS/1.1.
- The specified thermal S3 limit characteristics are referred to ΔT = 100 K.
- The voltage limiting characteristic for DC link = 540V corresponds to the limiting characteristic, previously shown in the Planning Guide (Edition 08.98). The new voltage limiting characteristic for DC link = 600 V can only be used in conjunction with the drive function 'L(I) _:Adaption'. This is integrated into the following systems:
  SIMODRIVE 611 Digital from drive firmware 4.4.01
  SIMODRIVE 611 Universal from drive firmware 3.2.2

Table 3-1 Standard motor 1FT6021

1FT6021				
Technical data	**Code**	**Units**	**– AK7**	
Engineering data				
Rated speed	n_{rated}	RPM	6000	
Rated torque	$M_{rated\ (100\ K)}$	Nm	0.3	
Rated current	$I_{rated\ (100\ K)}$	A	1.1	
Stall torque	$M_{0\ (60\ K)}$	Nm	0.33	
Stall torque	$M_{0\ (100\ K)}$	Nm	0.4	
Stall current	$I_{0\ (60\ K)}$	A	1.05	
Stall current	$I_{0\ (100\ K)}$	A	1.25	
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	0.28	
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	0.21	
Limit data				
Max. speed	n_{max}	RPM	12000	
Max. torque	M_{max}	Nm	1.6	
Peak current	I_{max}	A	5	
Limiting torque (600 V)	M_{limit}	Nm	1.55	
Limiting current (600 V)	I_{limit}	A	5	
Physical constants				
Torque constant	k_T	Nm/A	0.32	
Voltage constant (phase–to–phase)	k_E	V/1000 RPM	21	
Winding resistance	$R_{ph.}$	Ohm	7.3	
Three–phase inductance	L_D	mH	4	
Electrical time constant	T_{el}	ms	0.6	
Mechanical time constant	T_{mech}	ms	4.5	
Thermal time constant	T_{th}	min	2	
Thermal resistance	R_{th}	W/K	0.1	
Weight with brake	m	kg	1.4	
Weight without brake	m	kg	1.2	

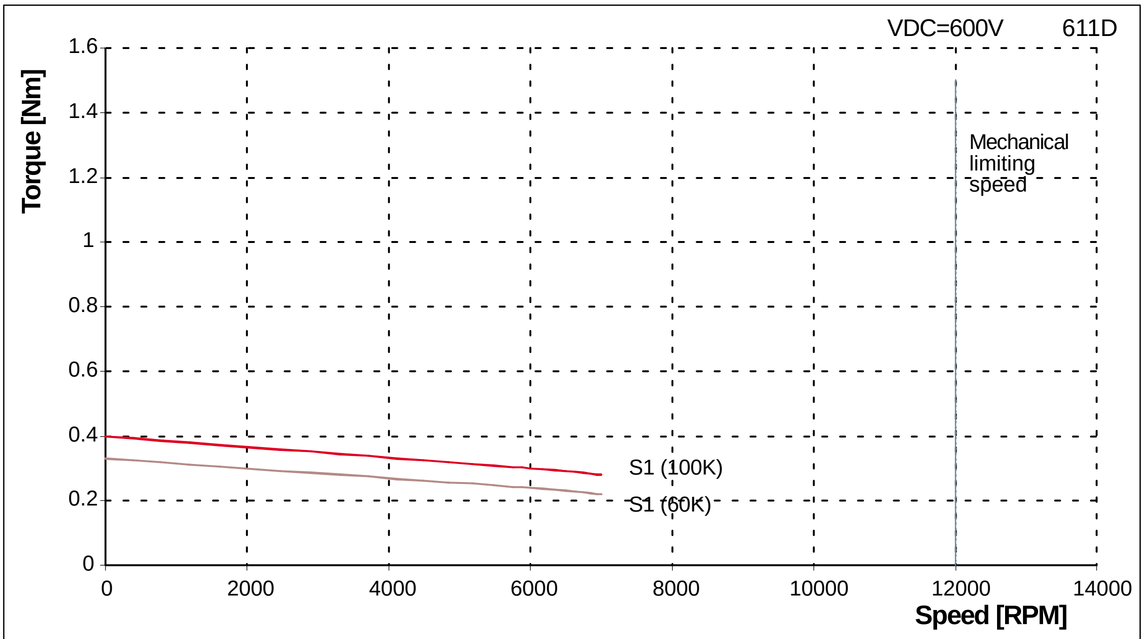


Fig. 3-1 Speed–torque diagram 1FT6021

Table 3-2 Standard motor 1FT6024

1FT6024				
Technical data	**Code**	**Units**		
Engineering data				
Rated speed	n_{rated}	RPM	6000	
Rated torque	$M_{rated\ (100\ K)}$	Nm	0.5	
Rated current	$I_{rated\ (100\ K)}$	A	0.9	
Stall torque	$M_{0\ (60\ K)}$	Nm	0.66	
Stall torque	$M_{0\ (100\ K)}$	Nm	0.8	
Stall current	$I_{0\ (60\ K)}$	A	1.05	
Stall current	$I_{0\ (100\ K)}$	A	1.25	
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	0.41	
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	0.34	
Limit data				
Max. speed	n_{max}	RPM	10000	
Max. torque	M_{max}	Nm	3.2	
Peak current	I_{max}	A	5	
Limiting torque (600 V)	M_{limit}	Nm	3.15	
Limiting current (600 V)	I_{limit}	A	5	
Physical constants				
Torque constant	k_T	Nm/A	0.64	
Voltage constant (phase–to–phase)	k_E	V/1000 RPM	43	
Winding resistance	$R_{ph.}$	Ohm	10.7	
Three–phase inductance	L_D	mH	7	
Electrical time constant	T_{el}	ms	0.7	
Mechanical time constant	T_{mech}	ms	3.2	
Thermal time constant	T_{th}	min	2	
Thermal resistance	R_{th}	W/K	0.1	
Weight with brake	m	kg	2.3	
Weight without brake	m	kg	2.1	

1FT6

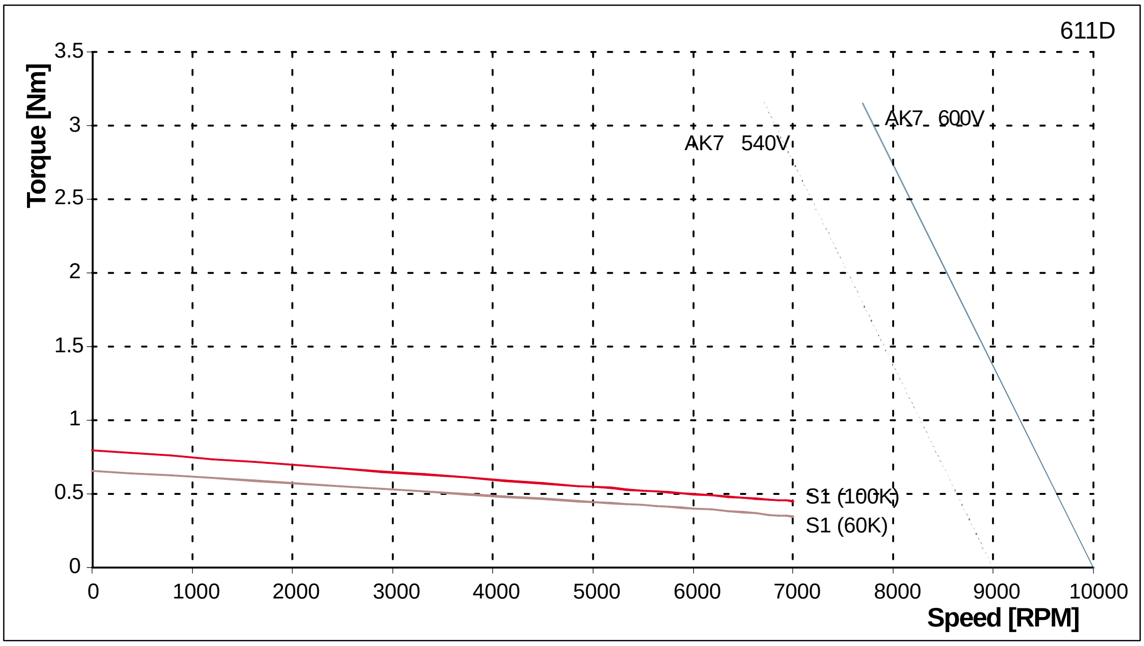


Fig. 3-2 Speed–torque diagram 1FT6024

Table 3-3 Standard motor 1FT6031

1FT6031				
Technical data	**Code**	**Units**	**-□AK7**	
Engineering data				
Rated speed	n_{rated}	RPM	6000	
Rated torque	$M_{rated\ (100\ K)}$	Nm	0.75	
Rated current	$I_{rated\ (100\ K)}$	A	1.2	
Stall torque	$M_{0\ (60\ K)}$	Nm	0.83	
Stall torque	$M_{0\ (100\ K)}$	Nm	1.0	
Stall current	$I_{0\ (60\ K)}$	A	1.2	
Stall current	$I_{0\ (100\ K)}$	A	1.45	
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	0.77	
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	0.65	
Limit data				
Max. speed	n_{max}	RPM	9700	
Max. torque	M_{max}	Nm	4.0	
Peak current	I_{max}	A	5.8	
Limiting torque (600 V)	M_{limit}	Nm	3.5	
Limiting current (600 V)	I_{limit}	A	5.1	
Physical constants				
Torque constant	k_T	Nm/A	0.69	
Voltage constant (phase–to–phase)	k_E	V/1000 RPM	47	
Winding resistance	$R_{ph.}$	Ohm	7.0	
Three–phase inductance	L_D	mH	18.0	
Electrical time constant	T_{el}	ms	2.6	
Mechanical time constant	T_{mech}	ms	2.9	
Thermal time constant	T_{th}	min	2.5	
Thermal resistance	R_{th}	W/K	0.11	
Weight with brake	m	kg	3.5	
Weight without brake	m	kg	3.1	

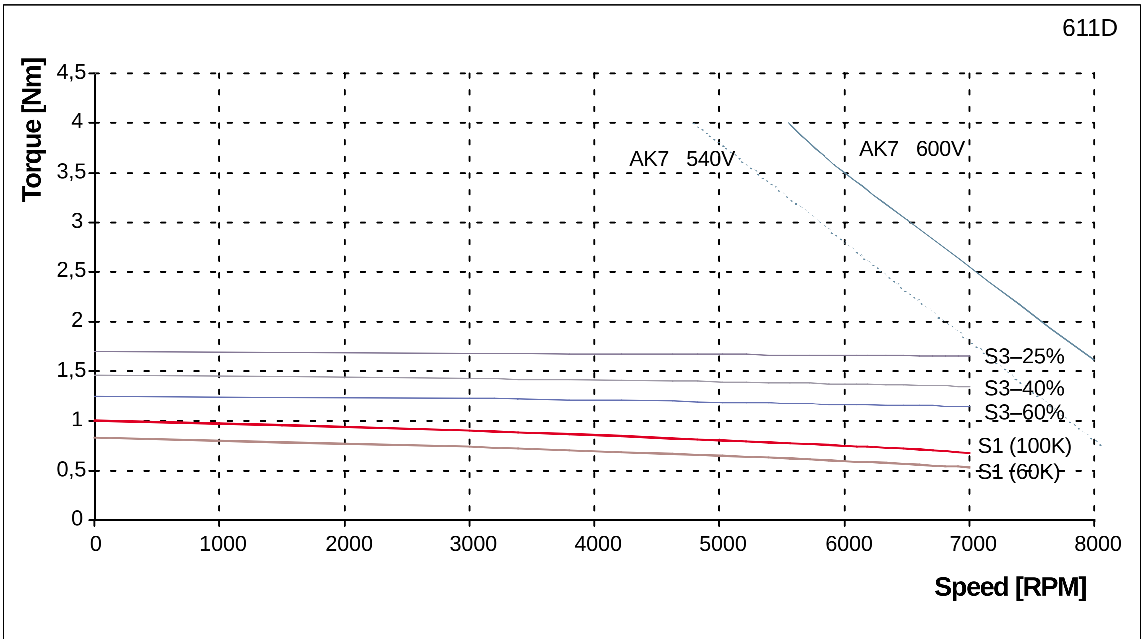


Fig. 3-3 Speed–torque diagram 1FT6031

Table 3-4 Standard motor 1FT6034

1FT6034				
Technical data	**Code**	**Units**	**-□AK7**	
Engineering data				
Rated speed	n_{rated}	RPM	6000	
Rated torque	$M_{rated\ (100\ K)}$	Nm	1.4	
Rated current	$I_{rated\ (100\ K)}$	A	2.1	
Stall torque	$M_{0\ (60\ K)}$	Nm	1.65	
Stall torque	$M_{0\ (100\ K)}$	Nm	2.00	
Stall current	$I_{0\ (60\ K)}$	A	2.15	
Stall current	$I_{0\ (100\ K)}$	A	2.60	
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	1.22	
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	1.1	
Limit data				
Max. speed	n_{max}	RPM	9300	
Max. torque	M_{max}	Nm	7.8	
Peak current	I_{max}	A	10.5	
Limiting torque (600 V)	M_{limit}	Nm	7.7	
Limiting current (600 V)	I_{limit}	A	10.5	
Physical constants				
Torque constant	k_T	Nm/A	0.77	
Voltage constant (phase–to–phase)	k_E	V/1000 RPM	50	
Winding resistance	$R_{ph.}$	Ohm	2.59	
Three–phase inductance	L_D	mH	10	
Electrical time constant	T_{el}	ms	3.9	
Mechanical time constant	T_{mech}	ms	1.4	
Thermal time constant	T_{th}	min	30	
Thermal resistance	R_{th}	W/K	0.20	
Weight with brake	m	kg	4.8	
Weight without brake	m	kg	4.4	

1FT6

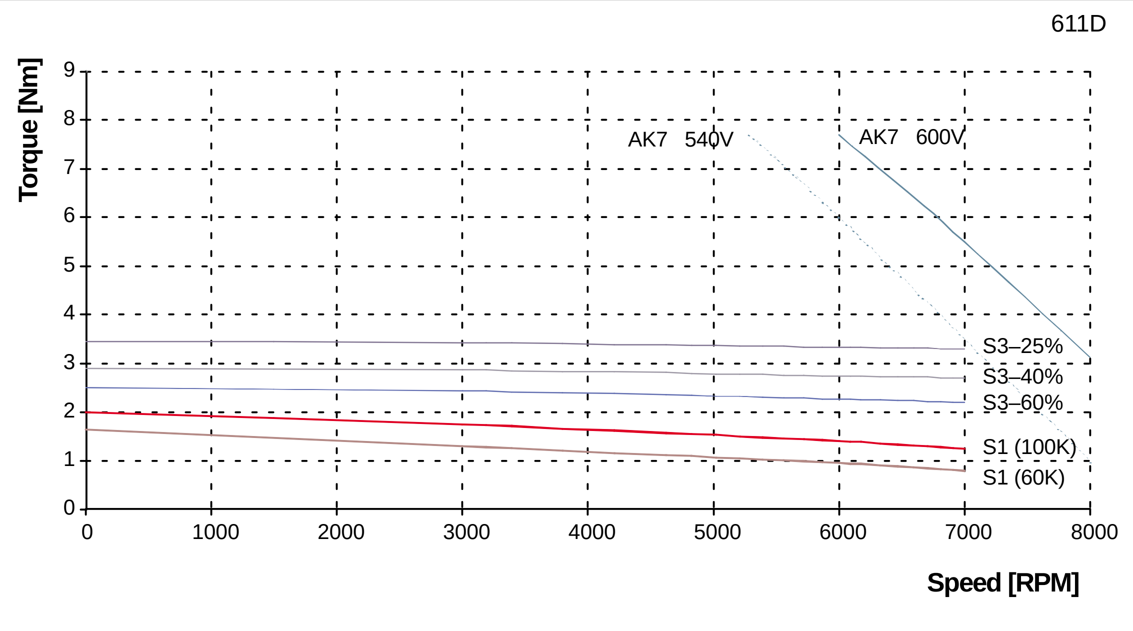


Fig. 3-4 Speed–torque diagram 1FT6034

1FT6041					
Technical data	**Code**	**Units**	**-□AF7**	**-□AK7**	
Engineering data					
Rated speed	n_{rated}	RPM	3000	6000	
Rated torque	$M_{rated\ (100\ K)}$	Nm	2.15	1.70	
Rated current	$I_{rated\ (100\ K)}$	A	1.7	2.4	
Stall torque	$M_{0\ (60\ K)}$	Nm	2.15	2.15	
Stall torque	$M_{0\ (100\ K)}$	Nm	2.60	2.60	
Stall current	$I_{0\ (60\ K)}$	A	1.55	2.60	
Stall current	$I_{0\ (100\ K)}$	A	1.80	3.0	
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	3.96	3.96	
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	2.9	2.9	
Limit data					
Max. speed	n_{max}	RPM	4800	7700	
Max. torque	M_{max}	Nm	10.0	10.0	
Peak current	I_{max}	A	7.7	12.8	
Limiting torque (600 V)	M_{limit}	Nm	9.8	9.3	
Limiting current (600 V)	I_{limit}	A	7.7	11.3	
Physical constants					
Torque constant	k_T	Nm/A	1.44	0.87	
Voltage constant (phase–to–phase)	k_E	V/1000 RPM	90	54	
Winding resistance	$R_{ph.}$	Ohm	6.6	2.38	
Three–phase inductance	L_D	mH	22	8	
Electrical time constant	T_{el}	ms	3.3	3.3	
Mechanical time constant	T_{mech}	ms	2.8	2.8	
Thermal time constant	T_{th}	min	30	30	
Thermal resistance	R_{th}	W/K	0.28	0.28	
Weight with brake	m	kg	7.8	7.8	
Weight without brake	m	kg	6.6	6.6	

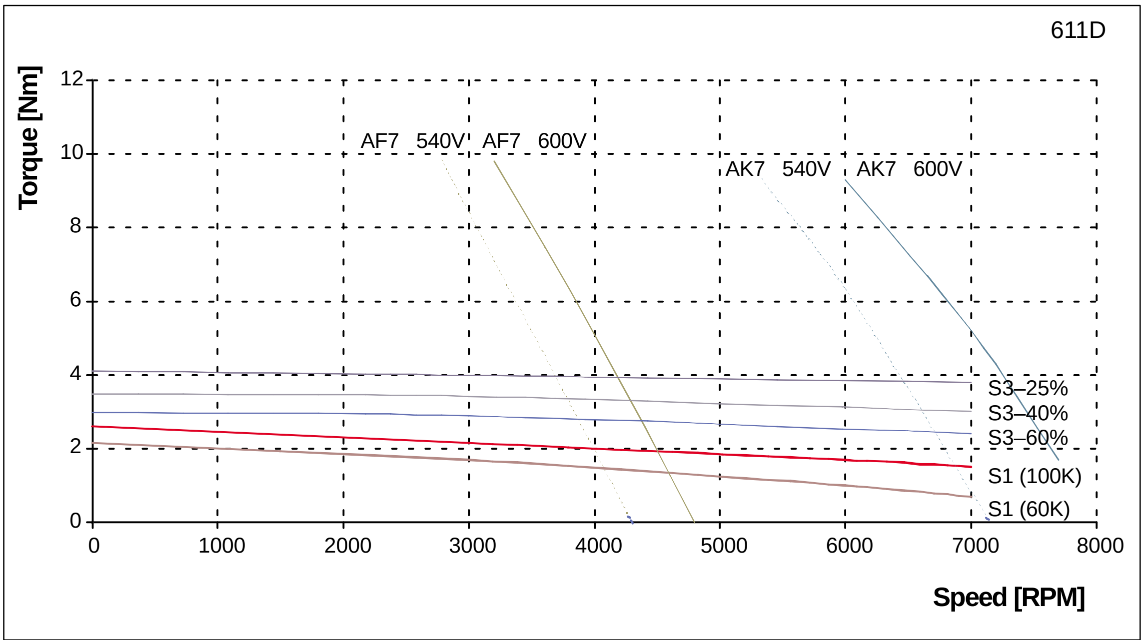


Fig. 3-5 Speed–torque diagram 1FT6041

Table 3-5 Standard motor 1FT6044

1FT6044					
Technical data	**Code**	**Units**	**-□AF7**	**-□AK7**	
Engineering data					
Rated speed	n_{rated}	RPM	3000	6000	
Rated torque	$M_{rated\ (100\ K)}$	Nm	4.30	3.00	
Rated current	$I_{rated\ (100\ K)}$	A	2.9	4.1	
Stall torque	$M_{0\ (60\ K)}$	Nm	4.20	4.20	
Stall torque	$M_{0\ (100\ K)}$	Nm	5.00	5.00	
Stall current	$I_{0\ (60\ K)}$	A	2.50	4.90	
Stall current	$I_{0\ (100\ K)}$	A	3.00	5.90	
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	6.16	6.16	
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	5.1	5.1	
Limit data					
Max. speed	n_{max}	RPM	4050	7700	
Max. torque	M_{max}	Nm	18.0	18.0	
Peak current	I_{max}	A	11.0	22.0	
Limiting torque (600 V)	M_{limit}	Nm	16.7	17.6	
Limiting current (600 V)	I_{limit}	A	10.2	22	
Physical constants					
Torque constant	k_T	Nm/A	1.67	0.85	
Voltage constant (phase–to–phase)	k_E	V/1000 RPM	108	55	
Winding resistance	$R_{ph.}$	Ohm	3.05	0.79	
Three–phase inductance	L_D	mH	16	4.1	
Electrical time constant	T_{el}	ms	5.2	5.2	
Mechanical time constant	T_{mech}	ms	1.7	1.7	
Thermal time constant	T_{th}	min	40	40	
Thermal resistance	R_{th}	W/K	0.18	0.18	
Weight with brake	m	kg	9.5	9.5	
Weight without brake	m	kg	8.3	8.3	

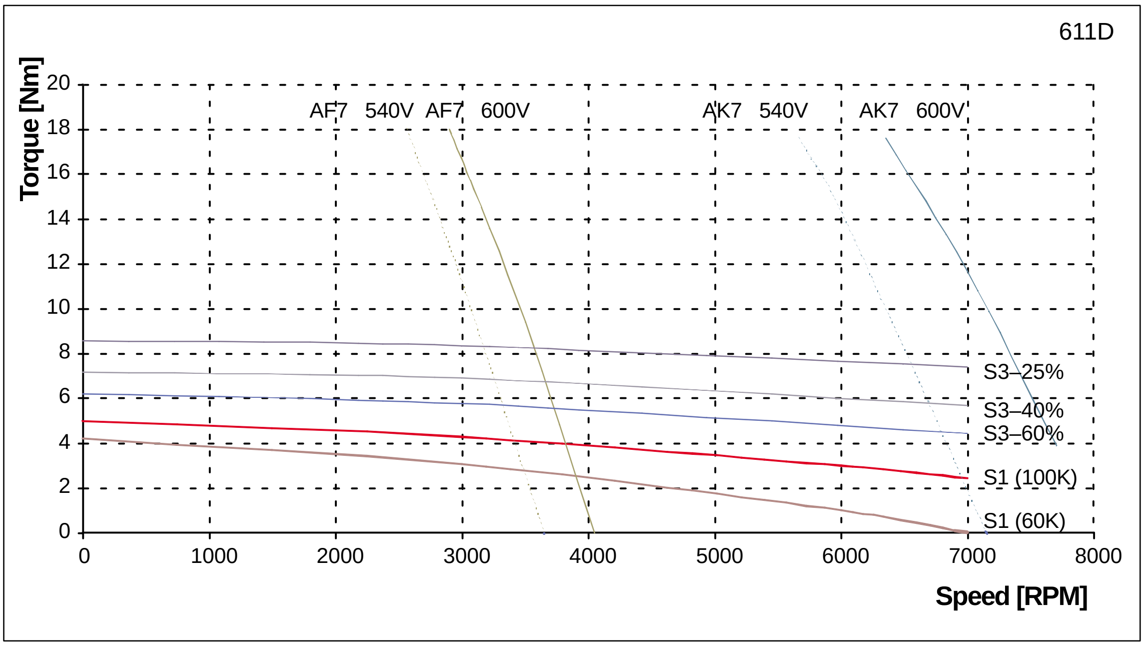


Fig. 3-6 Speed–torque diagram 1FT6044

Table 3-6 Standard motor 1FT6061

1FT6061						
Technical data	**Code**	**Units**	**-□AC7**	**-□AF7**	**-□AH7**	**-□AK7**
Engineering data						
Rated speed	n_{rated}	RPM	2000	3000	4500	6000
Rated torque	$M_{rated\ (100\ K)}$	Nm	3.70	3.50	2.90	2.10
Rated current	$I_{rated\ (100\ K)}$	A	1.9	2.6	3.4	3.1
Stall torque	$M_{0\ (60\ K)}$	Nm	3.3	3.3	3.3	3.3
Stall torque	$M_{0\ (100\ K)}$	Nm	4.0	4.0	4.0	4.0
Stall current	$I_{0\ (60\ K)}$	A	1.60	2.25	3.4	4.10
Stall current	$I_{0\ (100\ K)}$	A	2.00	2.75	4.10	5.00
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	9.2	9.2	9.2	9.2
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	6.0	6.0	6.0	6.0
Limit data						
Max. speed	n_{max}	RPM	3400	4800	7200	8750
Max. torque	M_{max}	Nm	16	16	16	16
Peak current	I_{max}	A	10.0	14.0	21.0	26.0
Limiting torque (600 V)	M_{limit}	Nm	8.9	8.8	9.5	8.3
Limiting current (600 V)	I_{limit}	A	4.5	6.2	10.2	10.8
Physical constants						
Torque constant	k_T	Nm/A	2.0	1.46	0.98	0.80
Voltage constant (phase–to–phase)	k_E	V/1000 RPM	126	90	60	49
Winding resistance	$R_{ph.}$	Ohm	9.4	4.77	2.12	1.43
Three–phase inductance	L_D	mH	59	30	13.3	9.0
Electrical time constant	T_{el}	ms	6.3	6.3	6.3	6.3
Mechanical time constant	T_{mech}	ms	4.0	4.0	4.0	4.0
Thermal time constant	T_{th}	min	27	27	27	27
Thermal resistance	R_{th}	W/K	0.29	0.29	0.29	0.29
Weight with brake	m	kg	9.5	9.5	9.5	9.5
Weight without brake	m	kg	8.0	8.0	8.0	8.0

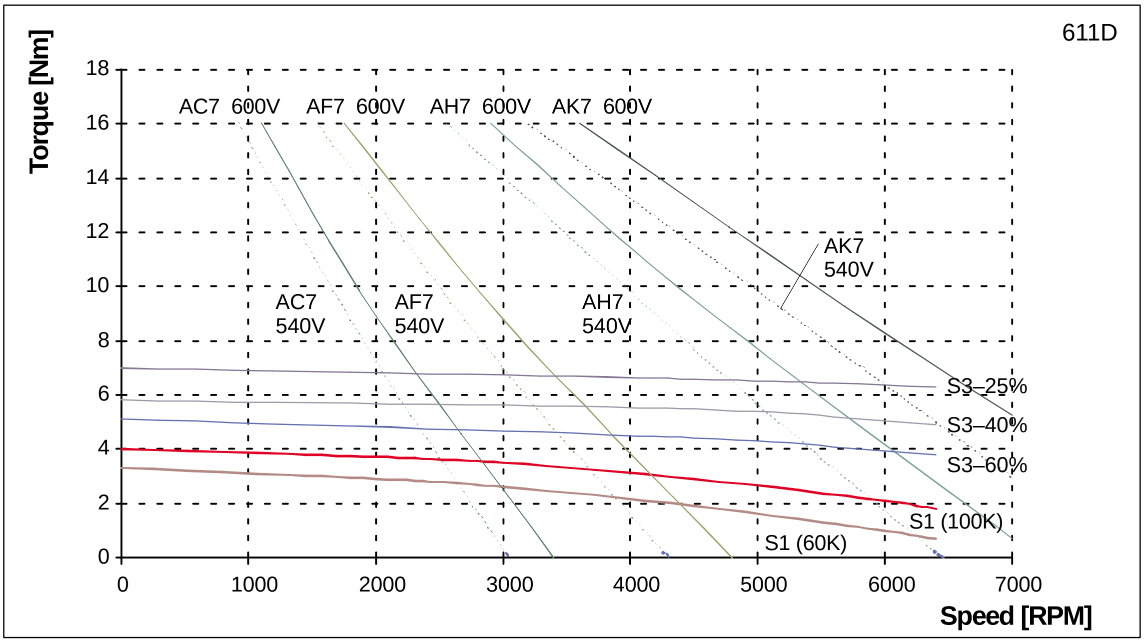


Fig. 3-7 Speed–torque diagram 1FT6061

Table 3-7 Standard motor 1FT6062

1FT6062						
Technical data	**Code**	**Units**	**-□AC7**	**-□AF7**	**-□AH7**	**-□AK7**
Engineering data						
Rated speed	n_{rated}	RPM	2000	3000	4500	6000
Rated torque	$M_{rated\ (100\ K)}$	Nm	5.20	4.70	3.60	2.10
Rated current	$I_{rated\ (100\ K)}$	A	2.6	3.4	3.9	3.2
Stall torque	$M_{0\ (60\ K)}$	Nm	5.00	5.00	5.00	5.00
Stall torque	$M_{0\ (100\ K)}$	Nm	6.00	6.00	6.00	6.00
Stall current	$I_{0\ (60\ K)}$	A	2.30	3.40	4.80	6.30
Stall current	$I_{0\ (100\ K)}$	A	2.7	4.00	5.6	7.50
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	11.7	11.7	11.7	11.7
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	8.5	8.5	8.5	8.5
Limit data						
Max. speed	n_{max}	RPM	3200	4800	6750	9000
Max. torque	M_{max}	Nm	24	24	24	24
Peak current	I_{max}	A	15.0	22.0	31.0	41.0
Limiting torque (600 V)	M_{limit}	Nm	12.8	14.1	13.2	13.6
Limiting current (600 V)	I_{limit}	A	6.0	10.1	13.2	18.2
Physical constants						
Torque constant	k_T	Nm/A	2.22	1.5	1.07	0.8
Voltage constant (phase–to–phase)	k_E	V/1000 RPM	135	90	64	48
Winding resistance	$R_{ph.}$	Ohm	5.8	2.6	1.32	0.74
Three–phase inductance	L_D	mH	43	19	9.7	5.5
Electrical time constant	T_{el}	ms	7.3	7.3	7.3	7.3
Mechanical time constant	T_{mech}	ms	2.9	2.9	2.9	2.9
Thermal time constant	T_{th}	min	30	30	30	30
Thermal resistance	R_{th}	W/K	0.19	0.19	0.19	0.19
Weight with brake	m	kg	11.0	11.0	11.0	11.0
Weight without brake	m	kg	9.5	9.5	9.5	9.5

1FT6

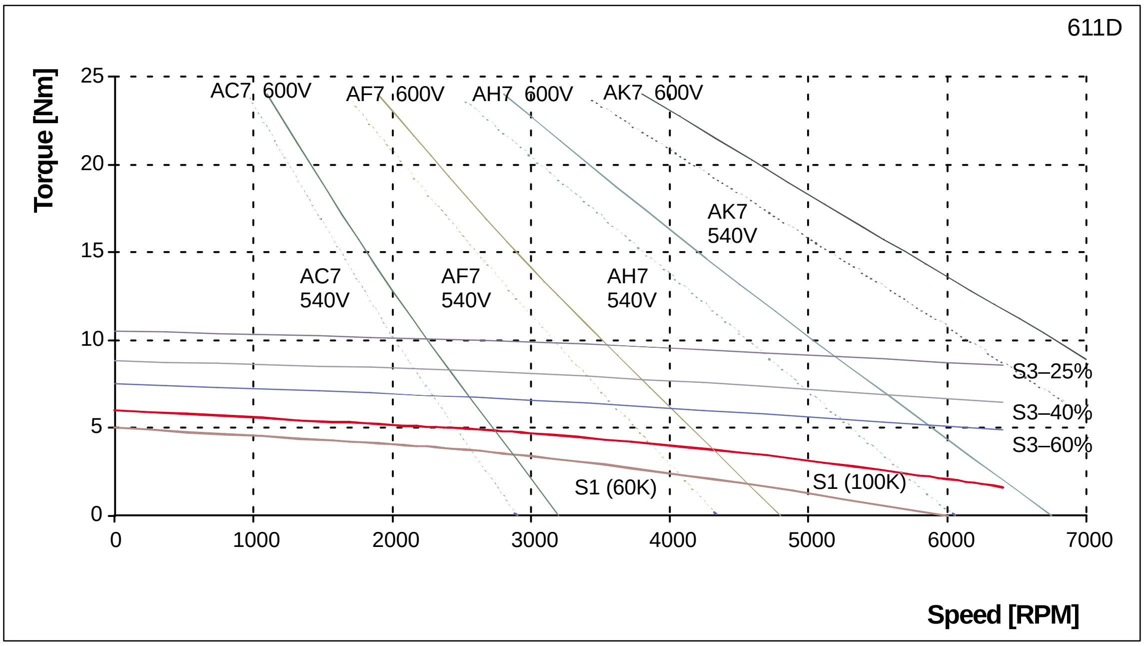


Fig. 3-8 Speed–torque diagram 1FT6062

Table 3-8 Standard motor 1FT6064

1FT6064						
Technical data	**Code**	**Units**	**-□AC7**	**-□AF7**	**-□AH7**	**-□AK7**
Engineering data						
Rated speed	n_{rated}	RPM	2000	3000	4500	6000
Rated torque	$M_{rated\ (100\ K)}$	Nm	8.00	7.00	4.80	2.10
Rated current	$I_{rated\ (100\ K)}$	A	3.8	4.9	5.5	3.5
Stall torque	$M_{0\ (60\ K)}$	Nm	7.90	7.90	7.90	7.90
Stall torque	$M_{0\ (100\ K)}$	Nm	9.50	9.50	9.50	9.50
Stall current	$I_{0\ (60\ K)}$	A	3.50	5.00	7.50	10.0
Stall current	$I_{0\ (100\ K)}$	A	4.20	6.1	9.10	12.1
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	16.2	16.2	16.2	16.2
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	13.0	13.0	13.0	13.0
Limit data						
Max. speed	n_{max}	RPM	3150	4550	6800	9100
Max. torque	M_{max}	Nm	38	38	38	38
Peak current	I_{max}	A	23.0	33.0	49.0	66.0
Limiting torque (600 V)	M_{limit}	Nm	21.5	21.7	22.9	23.4
Limiting current (600 V)	I_{limit}	A	9.9	14.5	23.2	31.8
Physical constants						
Torque constant	k_T	Nm/A	2.26	1.56	1.04	0.79
Voltage constant (phase–to–phase)	k_E	V/1000 RPM	140	97	65	49
Winding resistance	$R_{ph.}$	Ohm	2.95	1.42	0.63	0.35
Three–phase inductance	L_D	mH	28.0	13.5	6.0	3.4
Electrical time constant	T_{el}	ms	9.5	9.5	9.5	9.5
Mechanical time constant	T_{mech}	ms	2.2	2.2	2.2	2.2
Thermal time constant	T_{th}	min	35	35	35	35
Thermal resistance	R_{th}	W/K	0.11	0.11	0.11	0.11
Weight with brake	m	kg	13.0	13.0	13.0	13.0
Weight without brake	m	kg	12.5	12.5	12.5	12.5

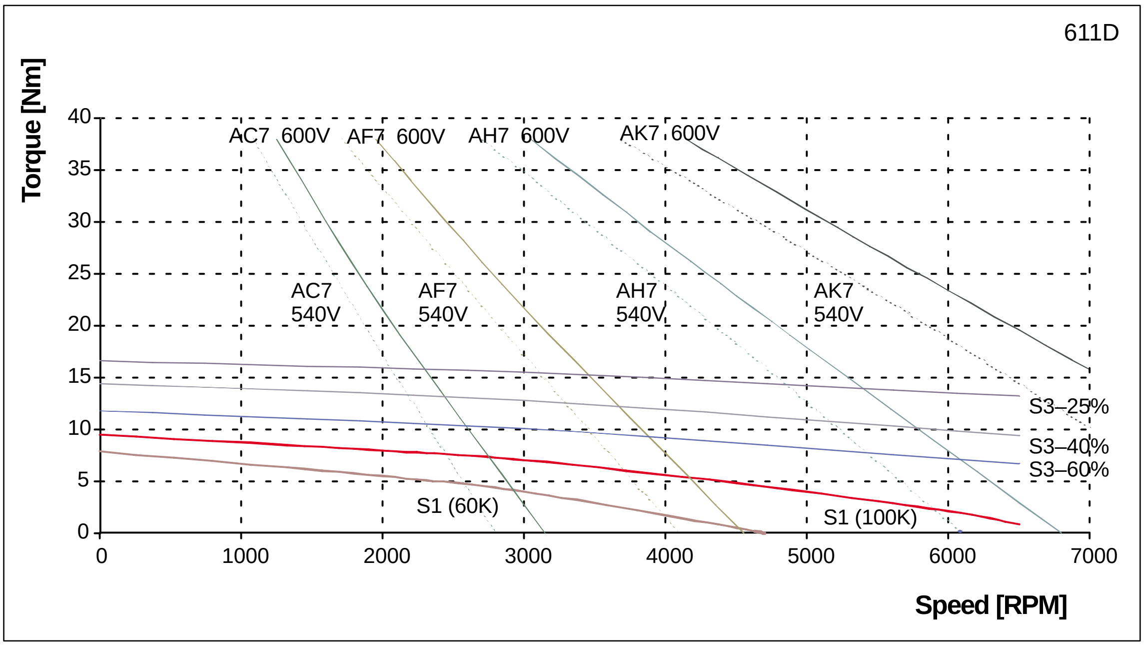


Fig. 3-9 Speed–torque diagram 1FT6064

Table 3-9 Standard motor 1FT6081

1FT6081						
Technical data	**Code**	**Units**	**-□AC7**	**-□AF7**	**-□AH7**	**-□AK7**
Engineering data						
Rated speed	n_{rated}	RPM	2000	3000	4500	6000
Rated torque	$M_{rated\ (100\ K)}$	Nm	7.50	6.90	5.80	4.60
Rated current	$I_{rated\ (100\ K)}$	A	4.1	5.6	7.3	7.7
Stall torque	$M_{0\ (60\ K)}$	Nm	6.60	6.60	6.60	6.60
Stall torque	$M_{0\ (100\ K)}$	Nm	8.00	8.00	8.00	8.00
Stall current	$I_{0\ (60\ K)}$	A	3.30	4.90	7.40	9.1
Stall current	$I_{0\ (100\ K)}$	A	4.10	6.00	9.00	11.1
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	24.2	24.2	24.2	24.2
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	21.0	21.0	21.0	21.0
Limit data						
Max. speed	n_{max}	RPM	3400	5050	7550	7900
Max. torque	M_{max}	Nm	26	26	26	26
Peak current	I_{max}	A	16.5	24.5	37.0	46.0
Limiting torque (600 V)	M_{limit}	Nm	16.7	17.5	18.1	16.3
Limiting current (600 V)	I_{limit}	A	9.0	14.2	22.4	24.7
Physical constants						
Torque constant	k_T	Nm/A	1.95	1.33	0.89	0.72
Voltage constant (phase–to–phase)	k_E	V/1000 RPM	123	83	35	45
Winding resistance	$R_{ph.}$	Ohm	3.11	1.41	0.62	0.41
Three–phase inductance	L_D	mH	23	10.3	4.6	3.0
Electrical time constant	T_{el}	ms	7.3	7.3	7.3	7.3
Mechanical time constant	T_{mech}	ms	5.0	5.0	5.0	5.0
Thermal time constant	T_{th}	min	30	30	30	30
Thermal resistance	R_{th}	W/K	0.22	0.22	0.22	0.22
Weight with brake	m	kg	14.0	14.0	14.0	14.0
Weight without brake	m	kg	12.5	12.5	12.5	12.5

1FT6

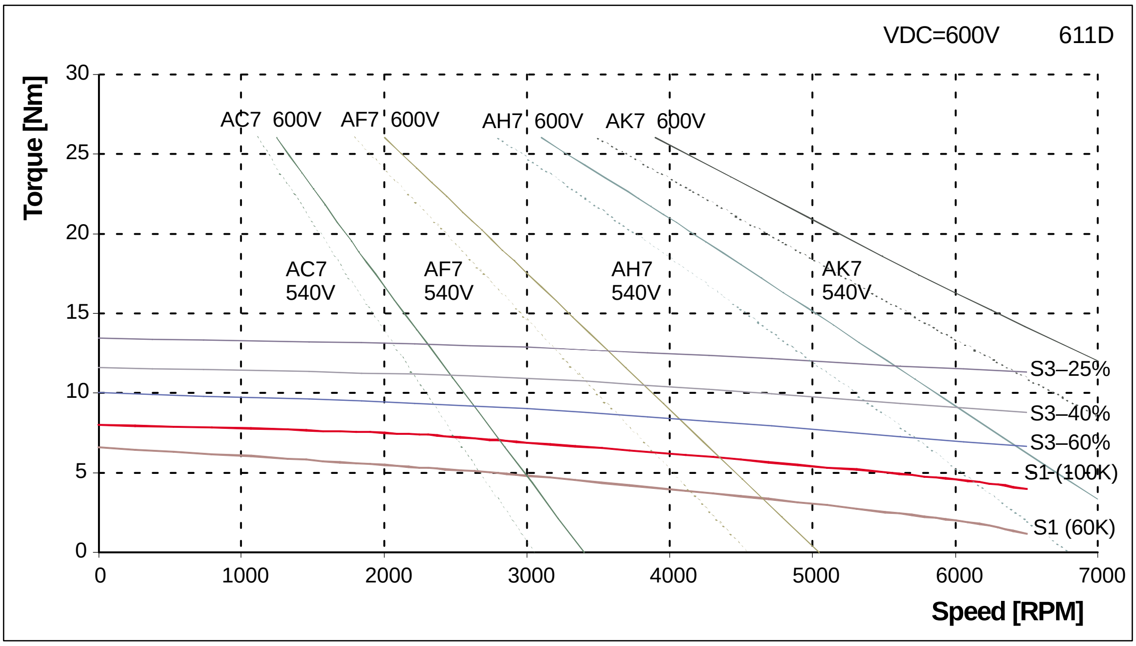


Fig. 3-10 Speed–torque diagram 1FT6081

Table 3-10 Standard motor 1FT6082

1FT6082						
Technical data	**Code**	**Units**	**-□AC7**	**-□AF7**	**-□AH7**	**-□AK7**
Engineering data						
Rated speed	n_{rated}	RPM	2000	3000	4500	6000
Rated torque	$M_{rated\ (100\ K)}$	Nm	11.40	10.30	8.50	5.50
Rated current	$I_{rated\ (100\ K)}$	A	6.6	8.7	11.0	9.1
Stall torque	$M_{0\ (60\ K)}$	Nm	10.80	10.80	10.80	10.80
Stall torque	$M_{0\ (100\ K)}$	Nm	13.00	13.00	13.00	13.00
Stall current	$I_{0\ (60\ K)}$	A	5.50	8.20	12.10	14.6
Stall current	$I_{0\ (100\ K)}$	A	6.90	10.2	15.00	18.20
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	33.2	33.2	33.2	33.2
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	30.0	30.0	30.0	30.0
Limit data						
Max. speed	n_{max}	RPM	3550	5250	7750	7900
Max. torque	M_{max}	Nm	42	42	42	42
Peak current	I_{max}	A	28.0	41.0	60.0	73.0
Limiting torque (600 V)	M_{limit}	Nm	28.0	29.0	29.0	25.0
Limiting current (600 V)	I_{limit}	A	16.3	24.9	37.0	39.0
Physical constants						
Torque constant	k_T	Nm/A	1.88	1.28	0.87	0.71
Voltage constant (phase–to–phase)	k_E	V/1000 RPM	118	80.0	54.0	45.0
Winding resistance	$R_{ph.}$	Ohm	1.48	0.68	0.31	0.21
Three–phase inductance	L_D	mH	13.6	6.2	2.9	1.9
Electrical time constant	T_{el}	ms	9.3	9.3	9.3	9.3
Mechanical time constant	T_{mech}	ms	3.7	3.7	3.7	3.7
Thermal time constant	T_{th}	min	35	35	35	35
Thermal resistance	R_{th}	W/K	0.15	0.15	0.15	0.15
Weight with brake	m	kg	16.5	16.5	16.5	16.5
Weight without brake	m	kg	15.0	15.0	15.0	15.0

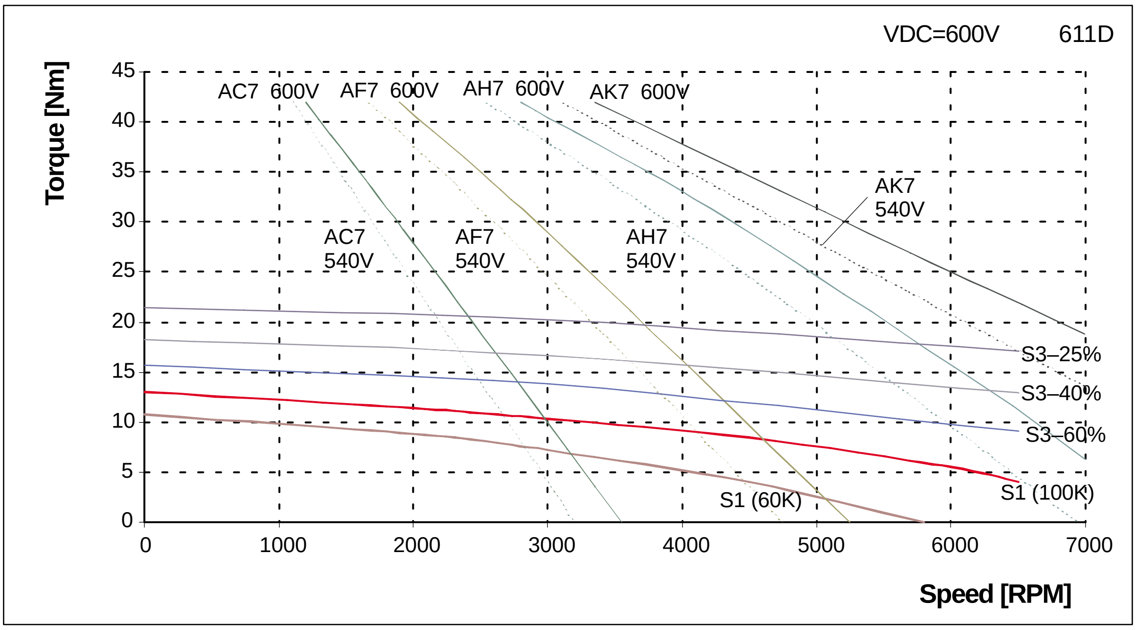


Fig. 3-11 Speed–torque diagram 1FT6082

Table 3-11 Standard motor 1FT6084

1FT6084						
Technical data	**Code**	**Units**	**-□AC7**	**-□AF7**	**-□AH7**	**-□AK7**
Engineering data						
Rated speed	n_{rated}	RPM	2000	3000	4500	6000
Rated torque	$M_{rated\ (100\ K)}$	Nm	16.90	14.70	10.5	6.5
Rated current	$I_{rated\ (100\ K)}$	A	8.3	11.0	12.5	9.2
Stall torque	$M_{0\ (60\ K)}$	Nm	16.60	16.60	16.60	16.60
Stall torque	$M_{0\ (100\ K)}$	Nm	20.00	20.00	20.00	20.00
Stall current	$I_{0\ (60\ K)}$	A	7.70	11.30	17.50	20.20
Stall current	$I_{0\ (100\ K)}$	A	9.50	14.00	21.60	25.00
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	61.5	61.5	61.5	61.5
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	48.0	48.0	48.0	48.0
Limit data						
Max. speed	n_{max}	RPM	3200	4700	7100	7900
Max. torque	M_{max}	Nm	65	65	65	65
Peak current	I_{max}	A	38	56	83	100
Limiting torque (600 V)	M_{limit}	Nm	41	41	45	35
Limiting current (600 V)	I_{limit}	A	20.8	31.0	52.0	47.0
Physical constants						
Torque constant	k_T	Nm/A	2.11	1.43	0.93	0.80
Voltage constant (phase–to–phase)	k_E	V/1000 RPM	132	90	58	50
Winding resistance	$R_{ph.}$	Ohm	0.88	0.41	0.17	0.13
Three–phase inductance	L_D	mH	10.4	4.8	2.0	1.5
Electrical time constant	T_{el}	ms	12.0	12.0	12.0	12.0
Mechanical time constant	T_{mech}	ms	2.9	2.9	2.9	2.9
Thermal time constant	T_{th}	min	42	42	42	42
Thermal resistance	R_{th}	W/K	0.09	0.09	0.09	0.09
Weight with brake	m	kg	24.0	24.0	24.0	24.0
Weight without brake	m	kg	20.5	20.5	20.5	20.5

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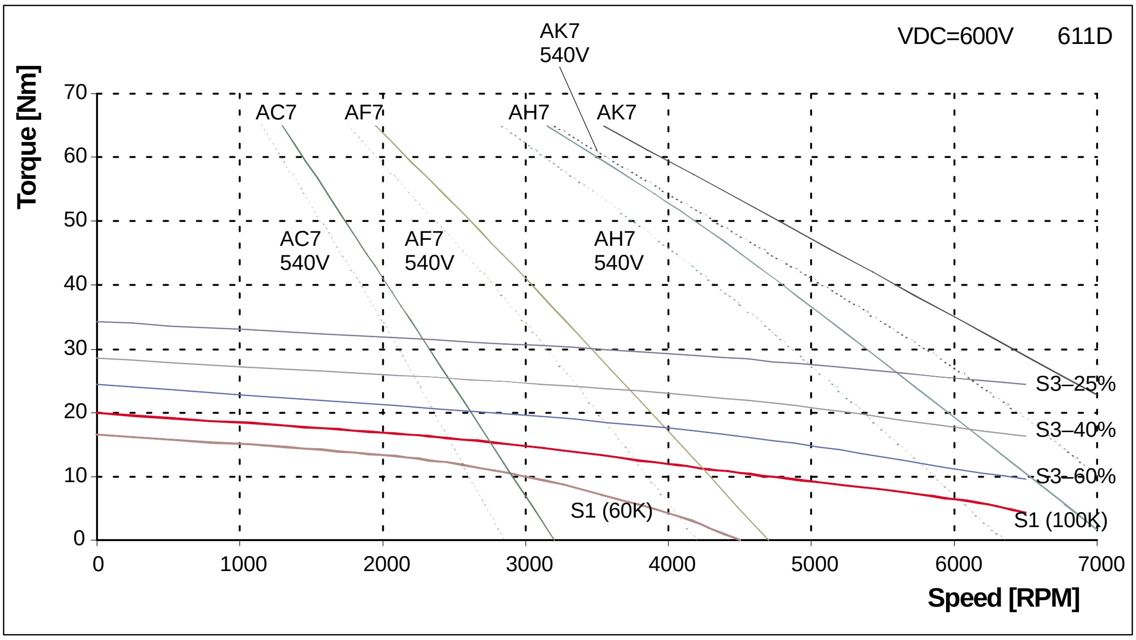

Fig. 3-12 Speed–torque diagram 1FT6084

Table 3-12 Standard motor 1FT6086

1FT6086						
Technical data	**Code**	**Units**	**-□AC7**	**-□AF7**	**-□AH7**	
Engineering data						
Rated speed	n_{rated}	RPM	2000	3000	4500	
Rated torque	$M_{rated\ (100\ K)}$	Nm	22.50	18.50	12.00	
Rated current	$I_{rated\ (100\ K)}$	A	10.9	13.0	12.6	
Stall torque	$M_{0\ (60\ K)}$	Nm	22.40	22.40	22.40	
Stall torque	$M_{0\ (100\ K)}$	Nm	27.00	27.00	27.00	
Stall current	$I_{0\ (60\ K)}$	A	9.70	14.10	20.40	
Stall current	$I_{0\ (100\ K)}$	A	12.00	17.50	25.30	
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	80.0	80.0	80.0	
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	66.5	66.5	66.5	
Limit data						
Max. speed	n_{max}	RPM	3000	4400	6350	
Max. torque	M_{max}	Nm	90	90	90	
Peak current	I_{max}	A	48.0	71.0	102	
Limiting torque (600 V)	M_{limit}	Nm	52	52	49	
Limiting current (600 V)	I_{limit}	A	24.6	36.0	49.0	
Physical constants						
Torque constant	k_T	Nm/A	2.25	1.54	1.07	
Voltage constant (phase–to–phase)	k_E	V/1000 RPM	141	97	67	
Winding resistance	$R_{ph.}$	Ohm	0.63	0.30	0.14	
Three–phase inductance	L_D	mH	8.0	3.8	1.8	
Electrical time constant	T_{el}	ms	13.0	13.0	13.0	
Mechanical time constant	T_{mech}	ms	2.5	2.5	2.5	
Thermal time constant	T_{th}	min	50	50	50	
Thermal resistance	R_{th}	W/K	0.07	0.07	0.07	
Weight with brake	m	kg	29.0	29.0	29.0	
Weight without brake	m	kg	25.5	25.5	25.5	

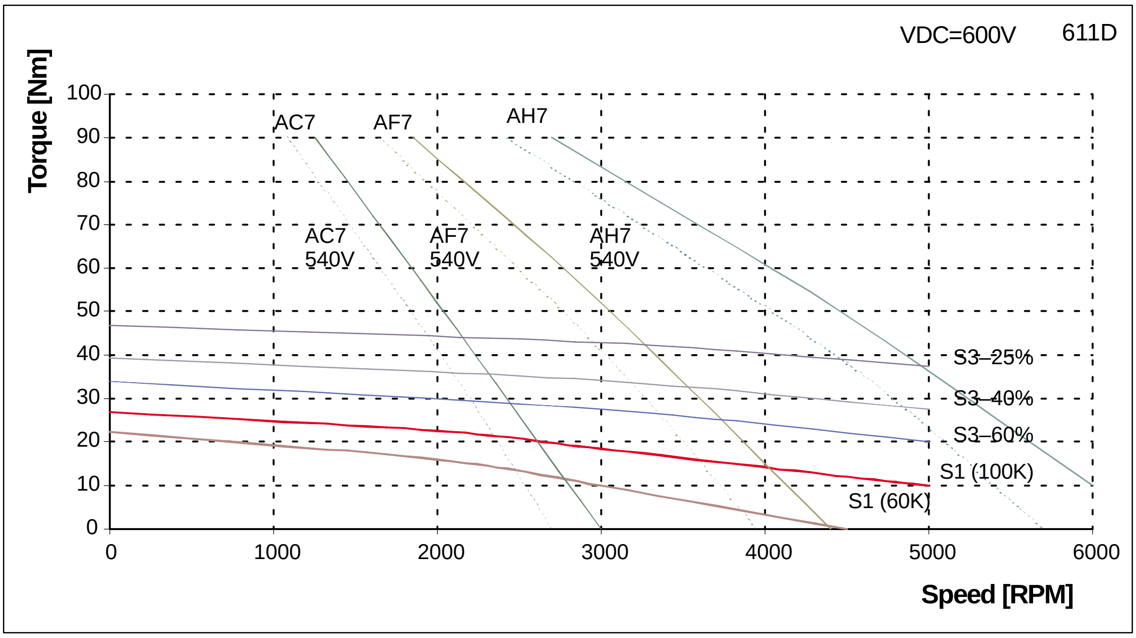

Fig. 3-13 Speed–torque diagram 1FT6086

Table 3-13 Standard motor 1FT6102

1FT6102						
Technical data	**Code**	**Units**	**-□AB7**	**-□AC7**	**-□AF7**	**-□AH7**
Engineering data						
Rated speed	n_{rated}	RPM	1500	2000	3000	4500
Rated torque	$M_{rated\ (100\ K)}$	Nm	24.50	23.00	19.50	12.00
Rated current	$I_{rated\ (100\ K)}$	A	8.4	11.0	13.2	12.0
Stall torque	$M_{0\ (60\ K)}$	Nm	22.40	22.40	22.40	22.40
Stall torque	$M_{0\ (100\ K)}$	Nm	27.00	27.00	27.00	27.00
Stall current	$I_{0\ (60\ K)}$	A	7.30	10.20	14.20	20.50
Stall current	$I_{0\ (100\ K)}$	A	8.40	12.40	17.20	24.80
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	130.8	130.8	130.8	130.8
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	99.0	99.0	99.0	99.0
Limit data						
Max. speed	n_{max}	RPM	2250	3100	4350	5600
Max. torque	M_{max}	Nm	80.0	80.0	80.0	80.0
Peak current	I_{max}	A	42.0	59.0	82.0	118
Limiting torque (600 V)	M_{limit}	Nm	57	64	59	57
Limiting current (600 V)	I_{limit}	A	21.5	35.0	44.0	61.0
Physical constants						
Torque constant	k_T	Nm/A	3.21	2.18	1.57	1.09
Voltage constant (phase–to–phase)	k_E	V/1000 RPM	193	138	99	69
Winding resistance	$R_{ph.}$	Ohm	0.83	0.42	0.22	0.11
Three–phase inductance	L_D	mH	15.1	7.7	4.0	1.90
Electrical time constant	T_{el}	ms	18.0	18.0	18.0	18.0
Mechanical time constant	T_{mech}	ms	2.6	2.6	2.6	2.6
Thermal time constant	T_{th}	min	45	45	45	45
Thermal resistance	R_{th}	W/K	0.12	0.12	0.12	0.12
Weight with brake	m	kg	32.0	32.0	32.0	32.0
Weight without brake	m	kg	27.5	27.5	27.5	27.5

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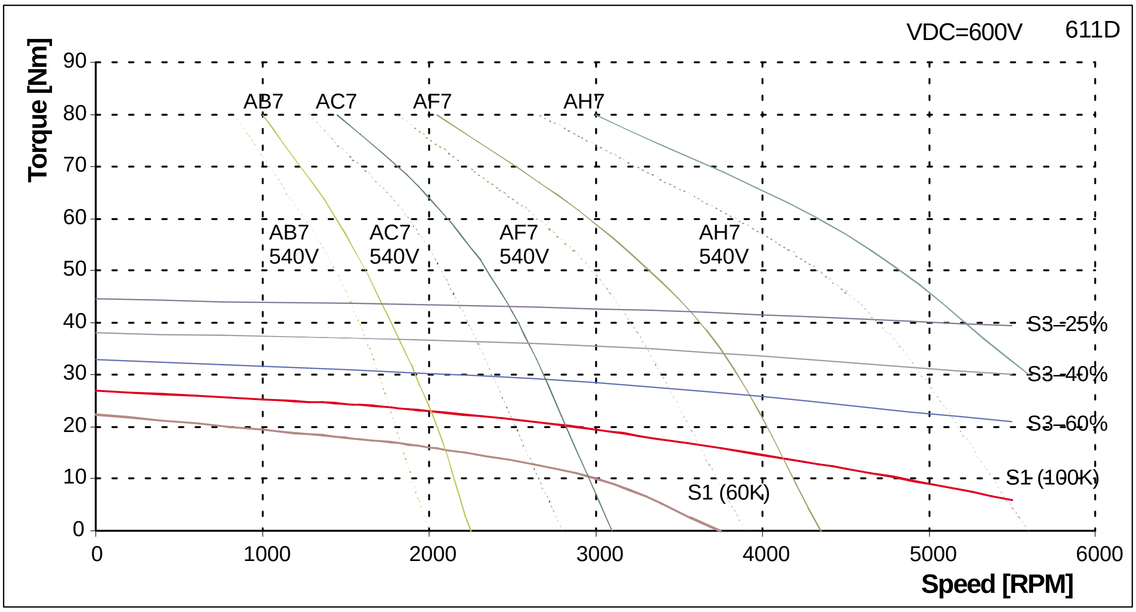

Fig. 3-14 Speed–torque diagram 1FT6102

Table 3-14 Standard motor 1FT6105

1FT6105						
Technical data	**Code**	**Units**	**-□AB7**	**-□AC7**	**-□AF7**	
Engineering data						
Rated speed	n_{rated}	RPM	1500	2000	3000	
Rated torque	$M_{rated\ (100\ K)}$	Nm	41.00	38.00	31.00	
Rated current	$I_{rated\ (100\ K)}$	A	14.5	17.6	22.5	
Stall torque	$M_{0\ (60\ K)}$	Nm	42.00	42.00	42.00	
Stall torque	$M_{0\ (100\ K)}$	Nm	50.00	50.00	50.00	
Stall current	$I_{0\ (60\ K)}$	A	13.80	18.40	28.00	
Stall current	$I_{0\ (100\ K)}$	A	17.20	22.90	34.00	
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	199.8	199.8	199.8	
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	168.0	168.0	168.0	
Limit data						
Max. speed	n_{max}	RPM	2250	3000	4500	
Max. torque	M_{max}	Nm	140	140	140	
Peak current	I_{max}	A	77	103	155	
Limiting torque (600 V)	M_{limit}	Nm	104	107	110	
Limiting current (600 V)	I_{limit}	A	40.0	56.0	88.0	
Physical constants						
Torque constant	k_T	Nm/A	2.91	2.18	1.45	
Voltage constant (phase–to–phase)	k_E	V/1000 RPM	191	143	95	
Winding resistance	$R_{ph.}$	Ohm	0.39	0.22	0.10	
Three–phase inductance	L_D	mH	8.4	4.7	2.1	
Electrical time constant	T_{el}	ms	21.0	21.0	21.0	
Mechanical time constant	T_{mech}	ms	2.3	2.3	2.3	
Thermal time constant	T_{th}	min	50	50	50	
Thermal resistance	R_{th}	W/K	0.07	0.07	0.07	
Weight with brake	m	kg	44.0	44.0	44.0	
Weight without brake	m	kg	39.5	39.5	39.5	

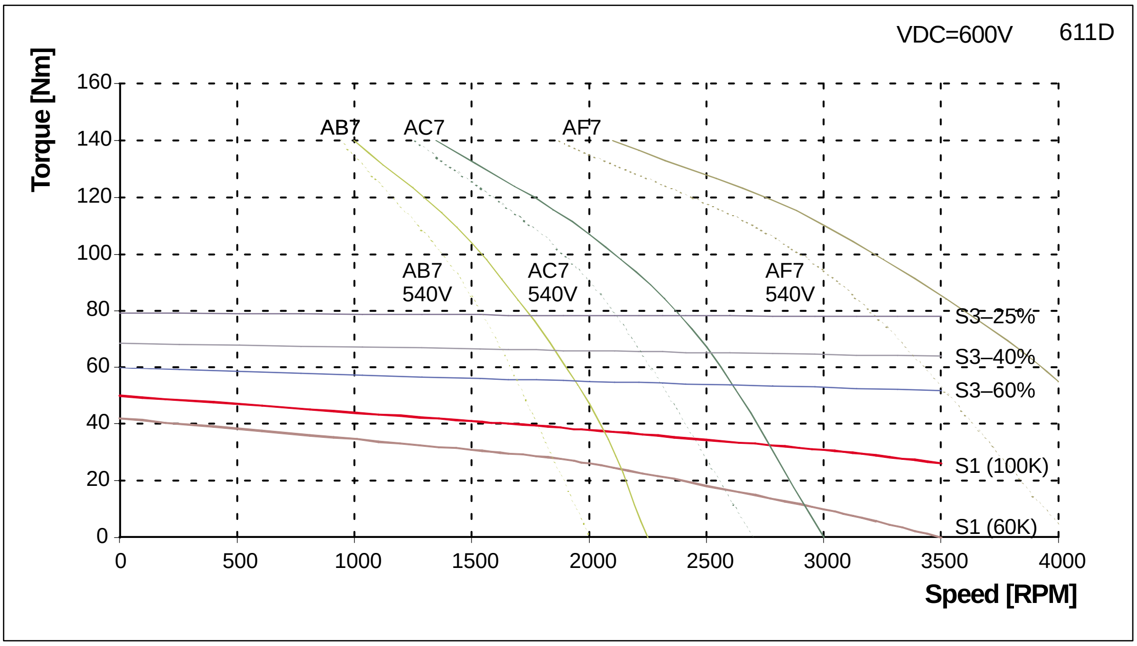

Fig. 3-15 Speed–torque diagram 1FT6105

Table 3-15 Standard motor 1FT6108

1FT6108						
Technical data	**Code**	**Units**	**-□AB7**	**-□AC7**	**-□AF7**	
Engineering data						
Rated speed	n_{rated}	RPM	1500	2000	3000	
Rated torque	$M_{rated\ (100\ K)}$	Nm	61.00	55.00	37	
Rated current	$I_{rated\ (100\ K)}$	A	20.5	24.5	25	
Stall torque	$M_{0\ (60\ K)}$	Nm	58.00	58.00	58	
Stall torque	$M_{0\ (100\ K)}$	Nm	70.00	70.00	70	
Stall current	$I_{0\ (60\ K)}$	A	18.30	24.00	34	
Stall current	$I_{0\ (100\ K)}$	A	21.50	29.00	41	
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	291.8	291.8	291.8	
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	260	260	260	
Limit data						
Max. speed	n_{max}	RPM	2200	2900	4100	
Max. torque	M_{max}	Nm	220	220	220	
Peak current	I_{max}	A	107	139	198	
Limiting torque (600 V)	M_{limit}	Nm	161	160	153	
Limiting current (600 V)	I_{limit}	A	61.0	79.0	106	
Physical constants						
Torque constant	k_T	Nm/A	3.17	2.41	1.71	
Voltage constant (phase–to–phase)	k_E	V/1000 RPM	199	153	107	
Winding resistance	$R_{ph.}$	Ohm	0.22	0.13	0.065	
Three–phase inductance	L_D	mH	5.2	3.1	1.5	
Electrical time constant	T_{el}	ms	24.0	24.0	24	
Mechanical time constant	T_{mech}	ms	1.7	1.7	1.7	
Thermal time constant	T_{th}	min	60	60	60	
Thermal resistance	R_{th}	W/K	0.04	0.04	0.04	
Weight with brake	m	kg	60.0	60.0	60	
Weight without brake	m	kg	55.5	55.5	55.5	

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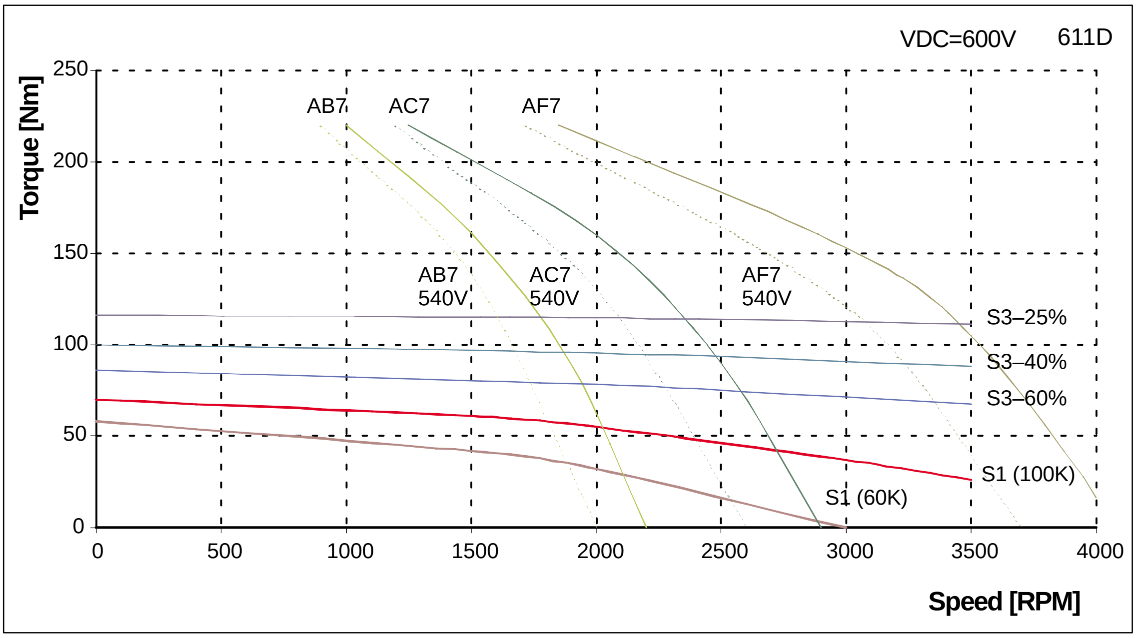

Fig. 3-16 Speed–torque diagram 1FT6108

Table 3-16 Standard motor 1FT6132

1FT6132						
Technical data	**Code**	**Units**	**-□AB7**	**-□AC7**	**-□AF7**	
Engineering data						
Rated speed	n_{rated}	RPM	1500	2000	3000	
Rated torque	$M_{rated\ (100\ K)}$	Nm	62.00	55.00	36.00	
Rated current	$I_{rated\ (100\ K)}$	A	19.0	23.0	23.0	
Stall torque	$M_{0\ (60\ K)}$	Nm	62.00	62.00	62.00	
Stall torque	$M_{0\ (100\ K)}$	Nm	75.00	75.00	75.00	
Stall current	$I_{0\ (60\ K)}$	A	18.50	25.00	37.00	
Stall current	$I_{0\ (100\ K)}$	A	23.00	31.00	46.00	
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	506.0	506.0	506.0	
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	430.0	430.0	430.0	
Limit data						
Max. speed	n_{max}	RPM	2050	2750	3600	
Max. torque	M_{max}	Nm	248	248	248	
Peak current	I_{max}	A	96	128	192	
Limiting torque (600 V)	M_{limit}	Nm	167	173	179	
Limiting current (600 V)	I_{limit}	A	52.0	72.0	113.0	
Physical constants						
Torque constant	k_T	Nm/A	3.26	2.42	1.63	
Voltage constant (phase–to–phase)	k_E	V/1000 RPM	210	158	105	
Winding resistance	$R_{ph.}$	Ohm	0.24	0.13	0.06	
Three–phase inductance	L_D	mH	8.4	4.7	2.1	
Electrical time constant	T_{el}	ms	34.0	34.0	34.0	
Mechanical time constant	T_{mech}	ms	2.9	2.9	2.9	
Thermal time constant	T_{th}	min	80	80	80	
Thermal resistance	R_{th}	W/K	0.03	0.03	0.03	
Weight with brake	m	kg	95.0	95.0	95.0	
Weight without brake	m	kg	85.0	85.0	85.0	

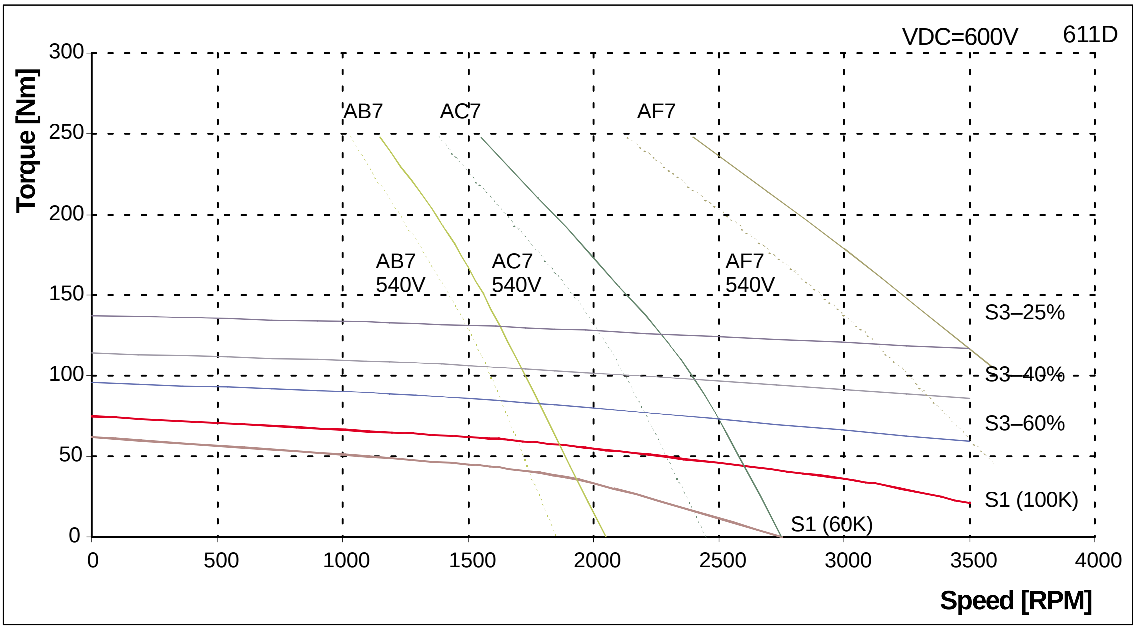

Fig. 3-17 Speed–torque diagram 1FT6132

Table 3-17 Standard motor 1FT6134

1FT6134					
Technical data	**Code**	**Units**	**-□AB7**	**-□AC7**	
Engineering data					
Rated speed	n_{rated}	RPM	1500	2000	
Rated torque	$M_{rated\ (100\ K)}$	Nm	75.00	65.00	
Rated current	$I_{rated\ (100\ K)}$	A	24.0	27.0	
Stall torque	$M_{0\ (60\ K)}$	Nm	79.00	79.00	
Stall torque	$M_{0\ (100\ K)}$	Nm	95.00	95.00	
Stall current	$I_{0\ (60\ K)}$	A	24.00	33.00	
Stall current	$I_{0\ (100\ K)}$	A	29.00	39.00	
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	623	623	
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	547	547	
Limit data					
Max. speed	n_{max}	RPM	2050	2750	
Max. torque	M_{max}	Nm	316	316	
Peak current	I_{max}	A	125	170	
Limiting torque (600 V)	M_{limit}	Nm	210	226	
Limiting current (600 V)	I_{limit}	A	64.0	95.0	
Physical constants					
Torque constant	k_T	Nm/A	3.28	2.44	
Voltage constant (phase–to–phase)	k_E	V/1000 RPM	214	158	
Winding resistance	$R_{ph.}$	Ohm	0.16	0.09	
Three–phase inductance	L_D	mH	5.8	3.1	
Electrical time constant	T_{el}	ms	36	36	
Mechanical time constant	T_{mech}	ms	2.5	2.5	
Thermal time constant	T_{th}	min	85	85	
Thermal resistance	R_{th}	W/K	0.02	0.02	
Weight with brake	m	kg	110.0	110.0	
Weight without brake	m	kg	100.0	100.0	

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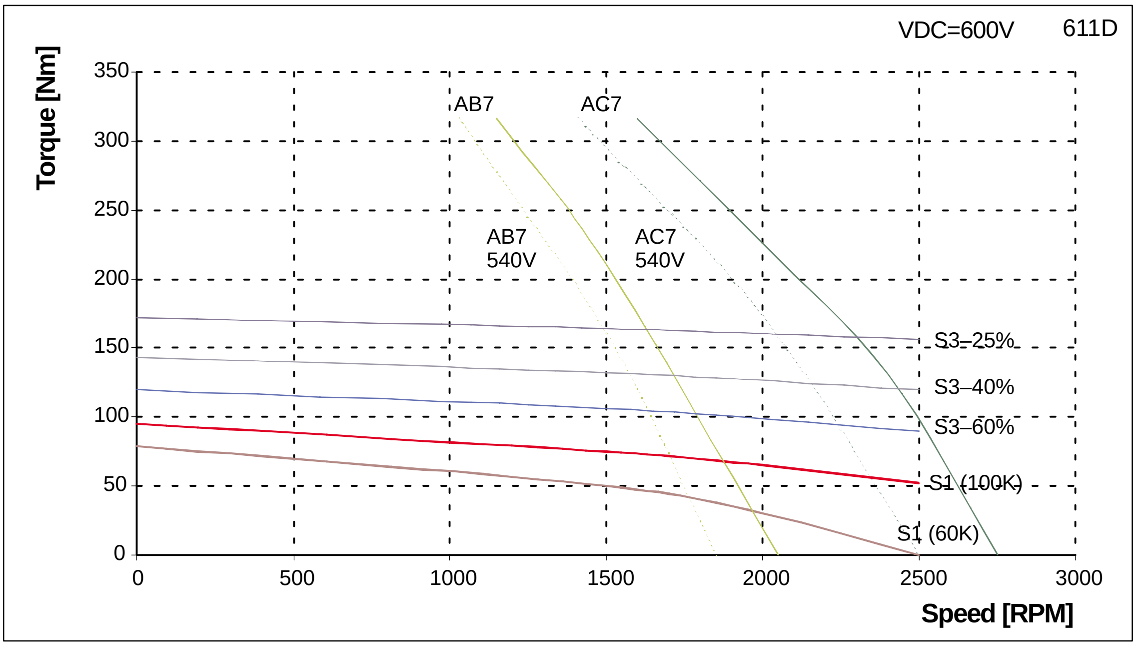

Fig. 3-18 Speed–torque diagram 1FT6134

Table 3-18 Standard motor 1FT6136

1FT6136					
Technical data	**Code**	**Units**	**-□AB7**	**-□AC7**	
Engineering data					
Rated speed	n_{rated}	RPM	1500	2000	
Rated torque	$M_{rated\ (100\ K)}$	Nm	88.00	74.00	
Rated current	$I_{rated\ (100\ K)}$	A	27.0	30.0	
Stall torque	$M_{0\ (60\ K)}$	Nm	95.00	95.00	
Stall torque	$M_{0\ (100\ K)}$	Nm	115.00	115.00	
Stall current	$I_{0\ (60\ K)}$	A	28.00	35.00	
Stall current	$I_{0\ (100\ K)}$	A	34.00	43.00	
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	740	740	
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	664	664	
Limit data					
Max. speed	n_{max}	RPM	2100	2650	
Max. torque	M_{max}	Nm	380	380	
Peak current	I_{max}	A	146	183	
Limiting torque (600 V)	M_{limit}	Nm	281	252	
Limiting current (600 V)	I_{limit}	A	90.0	100.0	
Physical constants					
Torque constant	k_T	Nm/A	3.38	2.67	
Voltage constant (phase–to–phase)	k_E	V/1000 RPM	206	165	
Winding resistance	$R_{ph.}$	Ohm	0.12	0.08	
Three–phase inductance	L_D	mH	4.9	3.1	
Electrical time constant	T_{el}	ms	43	43	
Mechanical time constant	T_{mech}	ms	2.1	2.1	
Thermal time constant	T_{th}	min	90	90	
Thermal resistance	R_{th}	W/K	0.01	0.01	
Weight with brake	m	kg	125.0	125.0	
Weight without brake	m	kg	117.0	117.0	

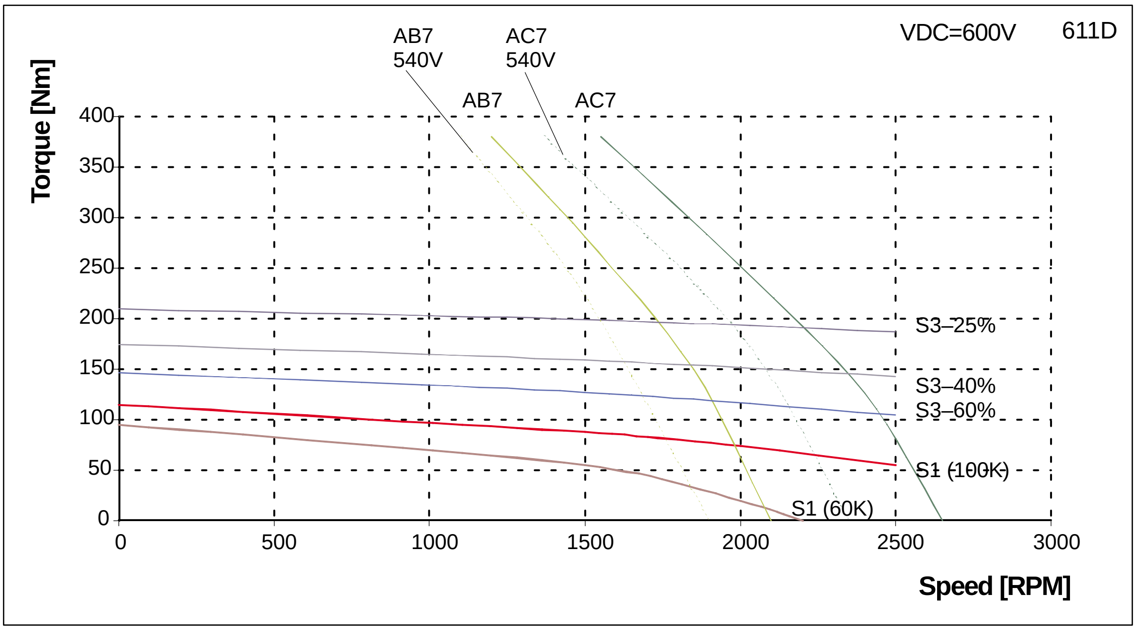

Fig. 3-19 Speed–torque diagram 1FT6136

Table 3-19 Standard motor 1FT6084, force ventilated

1FT6084						
Technical data	**Code**	**Units**	**-□SF7**	**-□SH7**	**-□SK7**	
Engineering data						
Rated speed	n_{rated}	RPM	3000	4500	6000	
Rated torque	$M_{rated\ (100\ K)}$	Nm	22.00	20.00	17.00	
Rated current	$I_{rated\ (100\ K)}$	A	17.0	24.5	25.5	
Stall torque	$M_{0\ (60\ K)}$	Nm	21.60	21.60	21.60	
Stall torque	$M_{0\ (100\ K)}$	Nm	26.00	26.00	26.00	
Stall current	$I_{0\ (60\ K)}$	A	15.60	27.70	29.00	
Stall current	$I_{0\ (100\ K)}$	A	19.30	28.00	36.00	
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	61.5	61.5	61.5	
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	48.0	48.0	48.0	
Limit data						
Max. speed	n_{max}	RPM	4850	7100	7900	
Max. torque	M_{max}	Nm	65	65	65	
Peak current	I_{max}	A	59.0	86.0	112	
Limiting torque (600 V)	M_{limit}	Nm	46	45	43	
Limiting current (600 V)	I_{limit}	A	36.0	52.0	64.0	
Physical constants						
Torque constant	k_T	Nm/A	1.35	0.93	0.71	
Voltage constant (phase–to–phase)	k_E	V/1000 RPM	85	58	45	
Winding resistance	$R_{ph.}$	Ohm	0.36	0.17	0.1	
Three–phase inductance	L_D	mH	4.3	2.0	1.2	
Electrical time constant	T_{el}	ms	12.0	12.0	12.0	
Mechanical time constant	T_{mech}	ms	2.9	2.9	2.9	
Thermal time constant	T_{th}	min	42	42	42	
Thermal resistance	R_{th}	W/K	0.09	0.09	0.09	
Weight with brake	m	kg	28.5	28.5	28.5	
Weight without brake	m	kg	25.0	25.0	25.0	

1FT6

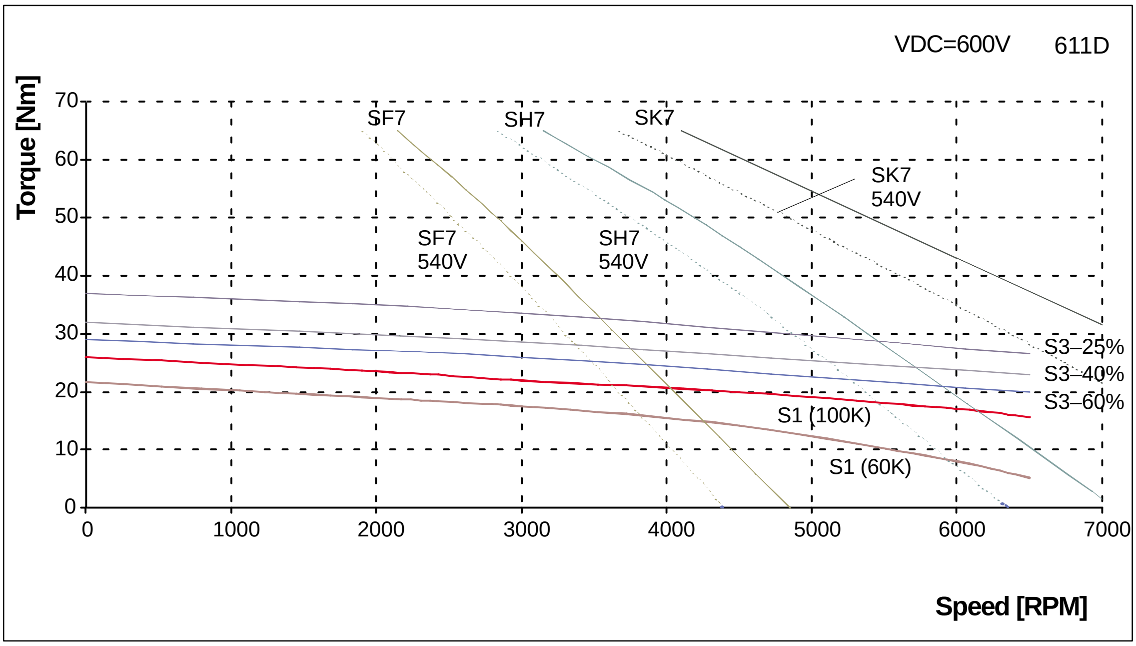

Fig. 3-20 Speed–torque diagram 1FT6084, force ventilated

Table 3-20 Standard motor 1FT6086, force ventilated

1FT6086						
Technical data	**Code**	**Units**	**-□SF7**	**-□SH7**	**-□SK7**	
Engineering data						
Rated speed	n_{rated}	RPM	3000	4500	6000	
Rated torque	$M_{rated\ (100\ K)}$	Nm	31.00	27.00	22.00	
Rated current	$I_{rated\ (100\ K)}$	A	24.5	31.5	29.0	
Stall torque	$M_{0\ (60\ K)}$	Nm	29.00	29.00	29.00	
Stall torque	$M_{0\ (100\ K)}$	Nm	35.00	35.00	35.00	
Stall current	$I_{0\ (60\ K)}$	A	20.70	32.00	37.00	
Stall current	$I_{0\ (100\ K)}$	A	26.00	39.00	45.00	
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	80.0	80.0	80.0	
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	66.5	66.5	66.5	
Limit data						
Max. speed	n_{max}	RPM	4850	7450	7900	
Max. torque	M_{max}	Nm	90	90	90	
Peak current	I_{max}	A	80	122	141	
Limiting torque (600 V)	M_{limit}	Nm	64	67	53	
Limiting current (600 V)	I_{limit}	A	50.0	83.0	73.0	
Physical constants						
Torque constant	k_T	Nm/A	1.34	0.89	0.77	
Voltage constant (phase–to–phase)	k_E	V/1000 RPM	86	56	48	
Winding resistance	$R_{ph.}$	Ohm	0.23	0.10	0.07	
Three–phase inductance	L_D	mH	2.9	1.3	0.95	
Electrical time constant	T_{el}	ms	13.0	13.0	13.0	
Mechanical time constant	T_{mech}	ms	2.5	2.5	2.5	
Thermal time constant	T_{th}	min	50	50	50	
Thermal resistance	R_{th}	W/K	0.07	0.07	0.07	
Weight with brake	m	kg	33.5	33.5	33.5	
Weight without brake	m	kg	30.0	30.0	30.0	

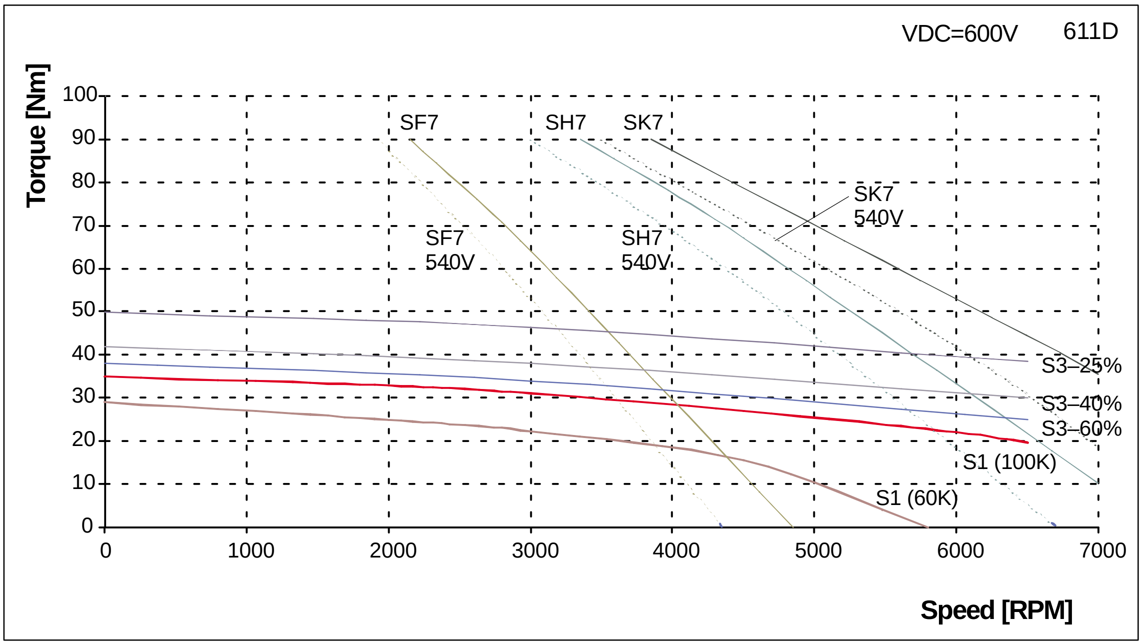

Fig. 3-21 Speed–torque diagram 1FT6086, force ventilated

Table 3-21 Standard motor 1FT6105, force ventilated

1FT6105					
Technical data	**Code**	**Units**	**-□SC7**	**-□SF7**	
Engineering data					
Rated speed	n_{rated}	RPM	2000	3000	
Rated torque	$M_{rated\ (100\ K)}$	Nm	56.00	50.00	
Rated current	$I_{rated\ (100\ K)}$	A	28.0	35.0	
Stall torque	$M_{0\ (60\ K)}$	Nm	54.00	54.00	
Stall torque	$M_{0\ (100\ K)}$	Nm	65.00	65.00	
Stall current	$I_{0\ (60\ K)}$	A	26.00	36.00	
Stall current	$I_{0\ (100\ K)}$	A	32.00	45.00	
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	199.8	199.8	
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	168	168	
Limit data					
Max. speed	n_{max}	RPM	3200	4500	
Max. torque	M_{max}	Nm	140	140	
Peak current	I_{max}	A	110	155	
Limiting torque (600 V)	M_{limit}	Nm	117	110	
Limiting current (600 V)	I_{limit}	A	69.0	88.0	
Physical constants					
Torque constant	k_T	Nm/A	2.03	1.45	
Voltage constant (phase–to–phase)	k_E	V/1000 RPM	133	95	
Winding resistance	$R_{ph.}$	Ohm	0.19	0.10	
Three–phase inductance	L_D	mH	4.1	2.1	
Electrical time constant	T_{el}	ms	21.0	21.0	
Mechanical time constant	T_{mech}	ms	2.3	2.3	
Thermal time constant	T_{th}	min	50	50	
Thermal resistance	R_{th}	W/K	0.07	0.07	
Weight with brake	m	kg	50.0	50.0	
Weight without brake	m	kg	45.5	45.5	

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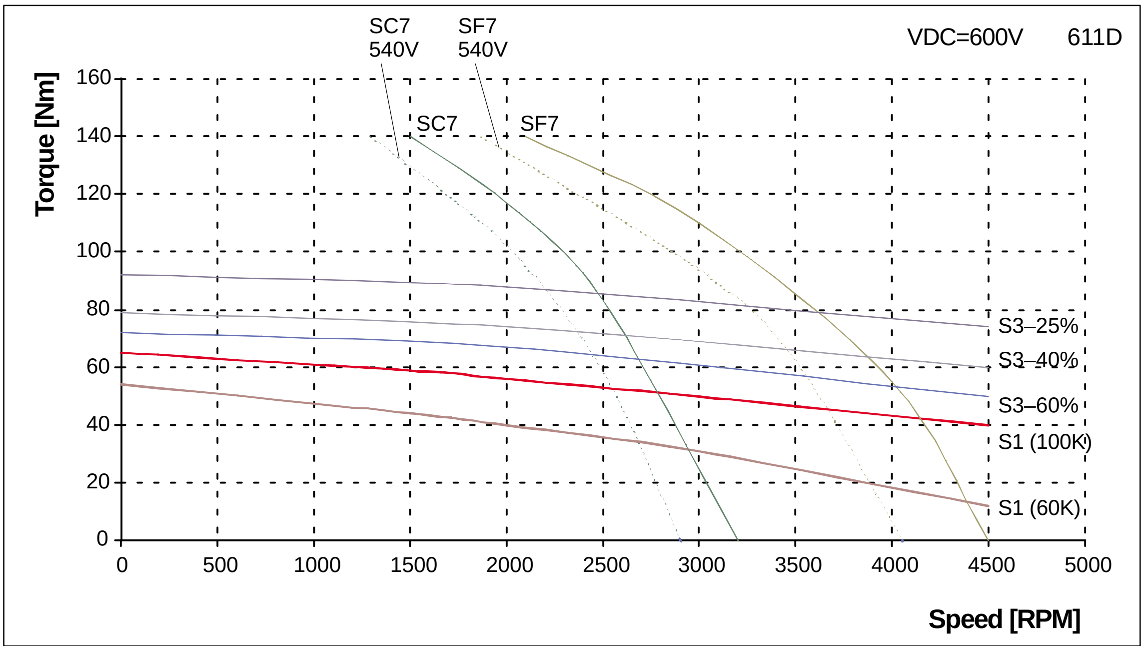


Fig. 3-22 Speed–torque diagram 1FT6105, force ventilated

Table 3-22 Standard motor 1FT6108, force ventilated

1FT6108				
Technical data	**Code**	**Units**	**-□SC7**	
Engineering data				
Rated speed	n_{rated}	RPM	2000	
Rated torque	$M_{rated\ (100\ K)}$	Nm	80	
Rated current	$I_{rated\ (100\ K)}$	A	40	
Stall torque	$M_{0\ (60\ K)}$	Nm	75	
Stall torque	$M_{0\ (100\ K)}$	Nm	90	
Stall current	$I_{0\ (60\ K)}$	A	34	
Stall current	$I_{0\ (100\ K)}$	A	41	
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	291.8	
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	260	
Limit data				
Max. speed	n_{max}	RPM	3200	
Max. torque	M_{max}	Nm	220	
Peak current	I_{max}	A	154	
Limiting torque (600 V)	M_{limit}	Nm	184	
Limiting current (600 V)	I_{limit}	A	66107	
Physical constants				
Torque constant	k_T	Nm/A	2.2	
Voltage constant (phase–to–phase)	k_E	V/1000 RPM	138	
Winding resistance	$R_{ph.}$	Ohm	0.11	
Three–phase inductance	L_D	mH	2.5	
Electrical time constant	T_{el}	ms	24.0	
Mechanical time constant	T_{mech}	ms	1.7	
Thermal time constant	T_{th}	min	60	
Thermal resistance	R_{th}	W/K	0.04	
Weight with brake	m	kg	66	
Weight without brake	m	kg	61.5	

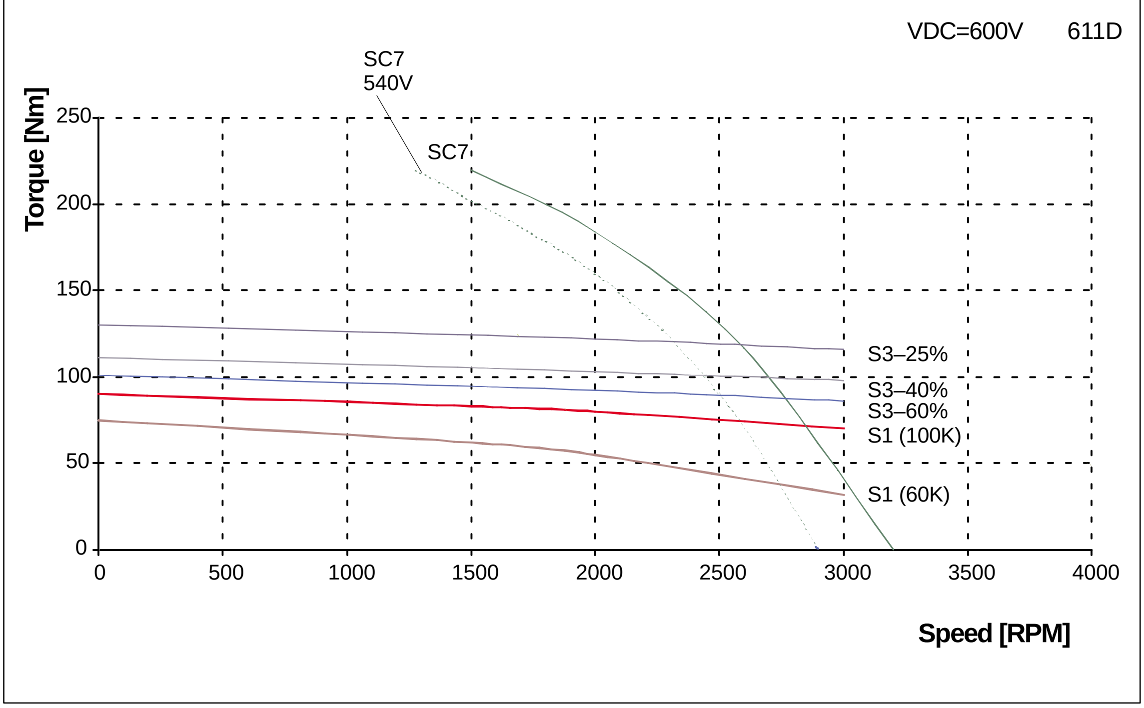


Fig. 3-23 Speed–torque diagram 1FT6108, force ventilated

Table 3-23 Standard motor 1FT6132, force ventilated

1FT6132						
Technical data	**Code**	**Units**	**-□SC7**			
Engineering data						
Rated speed	n_{rated}	RPM	2000			
Rated torque	$M_{rated\ (100\ K)}$	Nm	98			
Rated current	$I_{rated\ (100\ K)}$	A	46			
Stall torque	$M_{0\ (60\ K)}$	Nm	91			
Stall torque	$M_{0\ (100\ K)}$	Nm	110			
Stall current	$I_{0\ (60\ K)}$	A	41			
Stall current	$I_{0\ (100\ K)}$	A	51			
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	506			
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	430			
Limit data						
Max. speed	n_{max}	RPM	3100			
Max. torque	M_{max}	Nm	248			
Peak current	I_{max}	A	144			
Limiting torque (600 V)	M_{limit}	Nm	214			
Limiting current (600 V)	I_{limit}	A	105			
Physical constants						
Torque constant	k_T	Nm/A	2.16			
Voltage constant (phase–to–phase)	k_E	V/1000 RPM	140			
Winding resistance	$R_{ph.}$	Ohm	0.11			
Three–phase inductance	L_D	mH	3.7			
Electrical time constant	T_{el}	ms	37			
Mechanical time constant	T_{mech}	ms	2.9			
Thermal time constant	T_{th}	min	80			
Thermal resistance	R_{th}	W/K	0.03			
Weight with brake	m	kg	101			
Weight without brake	m	kg	91			

1FT6

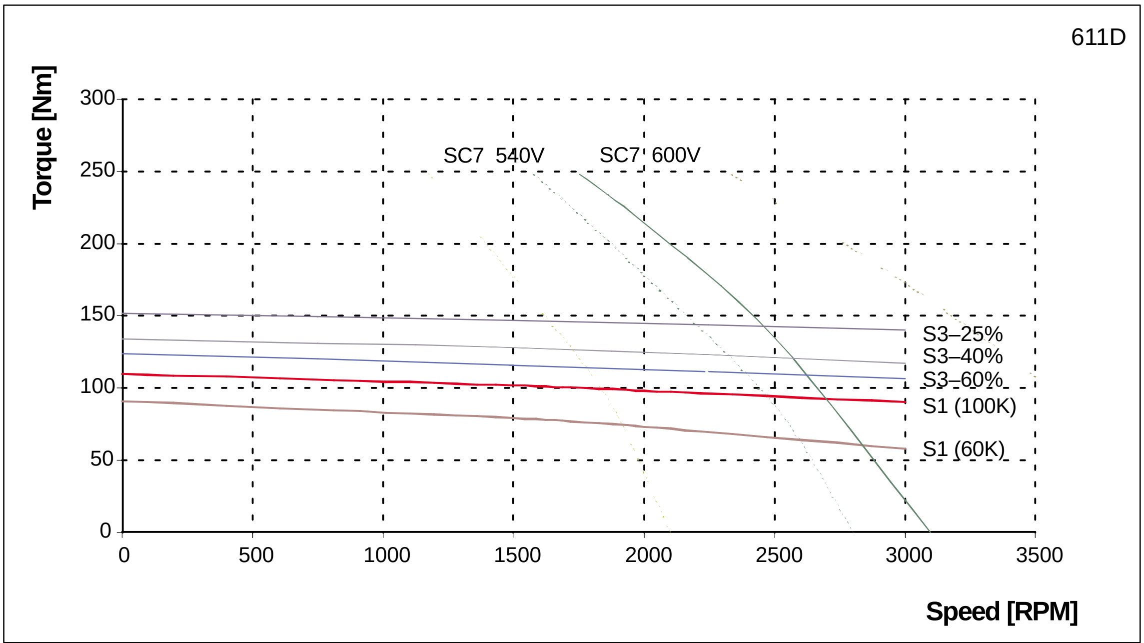


Fig. 3-24 Speed–torque diagram 1FT6132, force ventilated

Table 3-24 Standard motor 1FT6134, force ventilated

1FT6134				
Technical data	**Code**	**Units**	**-□SC7**	
Engineering data				
Rated speed Rated torque Rated current Stall torque Stall torque Stall current Stall current Moment of inertia (with brake) Moment of inertia (without brake)	n_{rated} $M_{rated\ (100\ K)}$ $I_{rated\ (100\ K)}$ $M_{0\ (60\ K)}$ $M_{0\ (100\ K)}$ $I_{0\ (60\ K)}$ $I_{0\ (100\ K)}$ J_{mot} J_{mot}	RPM Nm A Nm Nm A A 10^{-4} kgm^2 10^{-4} kgm^2	2000 125 57 116 140 52 62 623 547	
Limit data				
Max. speed Max. torque Peak current Limiting torque (600 V) Limiting current (600 V)	n_{max} M_{max} I_{max} M_{limit} I_{limit}	RPM Nm A Nm A	2950 316 182 259 121	
Physical constants				
Torque constant Voltage constant (phase–to–phase) Winding resistance Three–phase inductance Electrical time constant Mechanical time constant Thermal time constant Thermal resistance Weight with brake Weight without brake	k_T k_E $R_{ph.}$ L_D T_{el} T_{mech} T_{th} R_{th} m m	Nm/A V/1000 RPM Ohm mH ms ms min W/K kg kg	2.26 146 0.08 2.7 36 2.5 85 0.02 116 106	

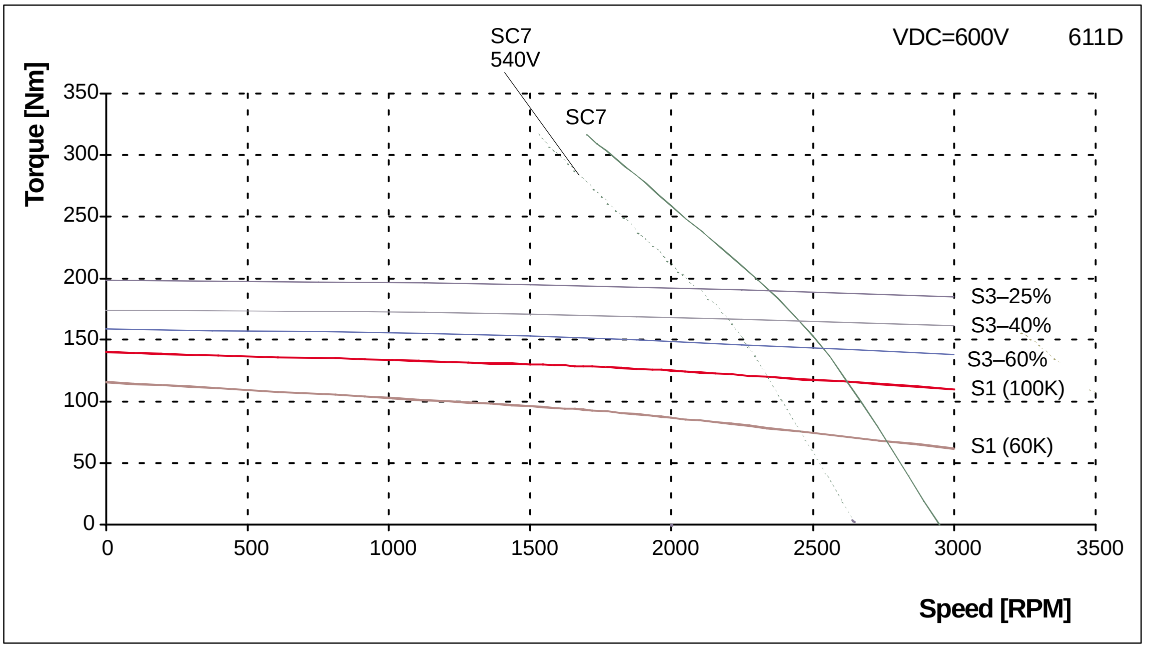


Fig. 3-25 Speed–torque diagram 1FT6134, force ventilated

Table 3-25 Standard motor 1FT6084, water cooled

1FT6084						
Technical data	**Code**	**Units**	**-□WF7**	**-□WH7**	**-□WK7**	
Engineering data						
Rated speed	n_{rated}	RPM	3000	4500	6000	
Rated torque	$M_{rated\ (100\ K)}$	Nm	35	35.0	34	
Rated current	$I_{rated\ (100\ K)}$	A	27	39	51	
Stall torque	$M_{0\ (60\ K)}$	Nm	29	29	29	
Stall torque	$M_{0\ (100\ K)}$	Nm	35	35	35	
Stall current	$I_{0\ (60\ K)}$	A	21	31.0	40.0	
Stall current	$I_{0\ (100\ K)}$	A	26	38.0	49	
Verlustleistung	P_v	W	1500	1600	1700	
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	61.5	61.5	61.5	
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	48	48	48	
Limit data						
Max. speed	n_{max}	RPM	4850	7100	7900	
Max. torque	M_{max}	Nm	65	65	65	
Peak current	I_{max}	A	59	86	112	
Limiting torque (600 V)	M_{limit}	Nm	46	45	43	
Limiting current (600 V)	I_{limit}	A	36	52	64	
Physical constants						
Torque constant	k_T	Nm/A	1.35	0.93	0.71	
Voltage constant (phase–to–phase)	k_E	V/1000 RPM	85	58	45	
Winding resistance	$R_{ph.}$	Ohm	0.36	0.17	0.10	
Three–phase inductance	L_D	mH	4.3	2.0	1.2	
Electrical time constant	T_{el}	ms	12.0	12.0	12.0	
Mechanical time constant	T_{mech}	ms	2.9	2.9	2.9	
Thermal time constant	T_{th}	min	30	30	30	
Thermal resistance	R_{th}	W/K	0.009	0.009	0.009	
Weight with brake	m	kg	24.5	24.5	24.5	
Weight without brake	m	kg	21	21	21	

1FT6

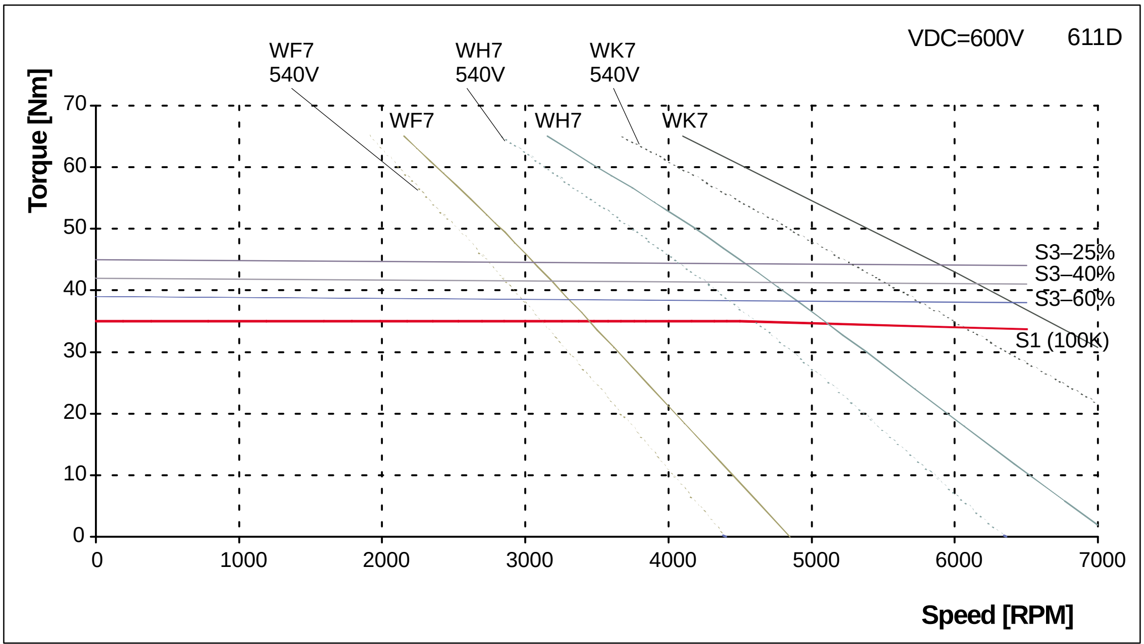


Fig. 3-26 Speed–torque diagram 1FT6084, water cooled

Table 3-26 Standard motor 1FT6086, water cooled

1FT6086						
Technical data	**Code**	**Units**	**-□WF7**	**-□WH7**	**-□WK7**	
Engineering data						
Rated speed	n_{rated}	RPM	3000	4500	6000	
Rated torque	$M_{rated\ (100\ K)}$	Nm	46	45	44	
Rated current	$I_{rated\ (100\ K)}$	A	37	53	58	
Stall torque	$M_{0\ (60\ K)}$	Nm	39	39	39	
Stall torque	$M_{0\ (100\ K)}$	Nm	47	47	47	
Stall current	$I_{0\ (60\ K)}$	A	28	43	49	
Stall current	$I_{0\ (100\ K)}$	A	35.0	53	61	
Power loss	P_v	W	1800	2000	2400	
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	80	80	80	
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	66.5	66.5	66.5	
Limit data						
Max. speed	n_{max}	RPM	4850	7450	7900	
Max. torque	M_{max}	Nm	90	90	90	
Peak current	I_{max}	A	80	122	141	
Limiting torque (600 V)	M_{limit}	Nm	64	67	53	
Limiting current (600 V)	I_{limit}	A	50	83	73	
Physical constants						
Torque constant	k_T	Nm/A	1.34	0.89	0.77	
Voltage constant (phase–to–phase)	k_E	V/1000 RPM	86	56	48	
Winding resistance	$R_{ph.}$	Ohm	0.23	0.098	0.074	
Three–phase inductance	L_D	mH	2.9	1.3	0.95	
Electrical time constant	T_{el}	ms	13.0	13.0	13.0	
Mechanical time constant	T_{mech}	ms	2.5	2.5	2.5	
Thermal time constant	T_{th}	min	35	35	35	
Thermal resistance	R_{th}	W/K	0.007	0.007	0.007	
Weight with brake	m	kg	29.5	29.5	29.5	
Weight without brake	m	kg	26	26	26	

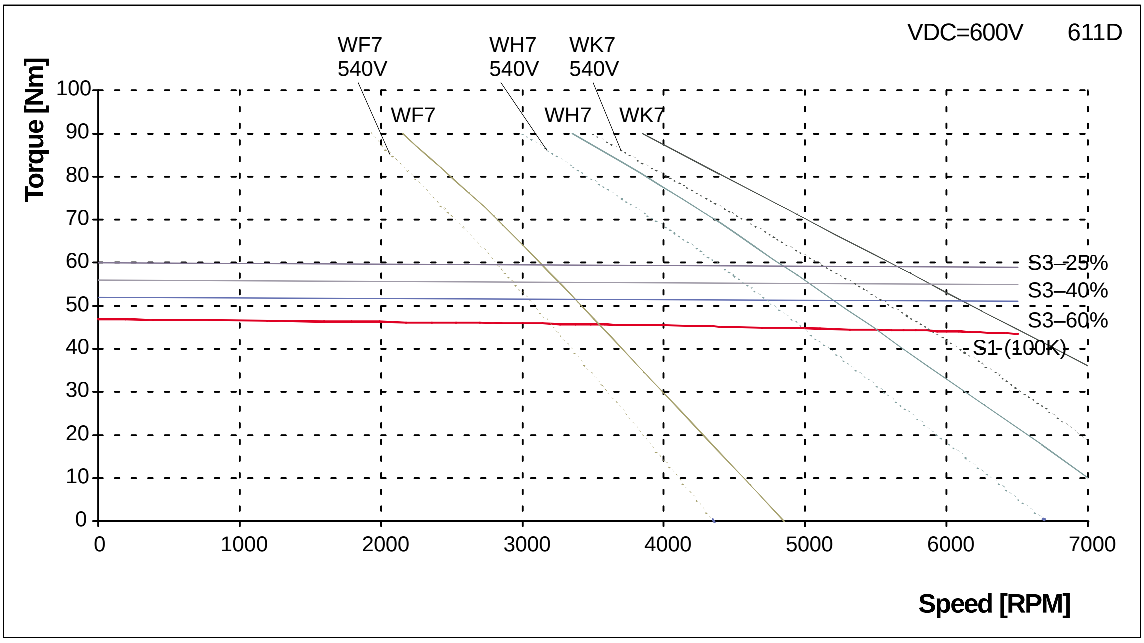


Fig. 3-27 Speed–torque diagram 1FT6086, water cooled

Table 3-27 Standard motor 1FT6105, water cooled

1FT6105					
Technical data	**Code**	**Units**	**-□WC7**	**-□WF7**	
Engineering data					
Rated speed	n_{rated}	RPM	2000	3000	
Rated torque	$M_{rated\ (100\ K)}$	Nm	82	78	
Rated current	$I_{rated\ (100\ K)}$	A	60	82	
Stall torque	$M_{0\ (60\ K)}$	Nm	70	70	
Stall torque	$M_{0\ (100\ K)}$	Nm	85	85	
Stall current	$I_{0\ (60\ K)}$	A	47	67	
Stall current	$I_{0\ (100\ K)}$	A	58	83	
Power loss	P_v	W	2000	2100	
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	199.8	199.8	
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	168	168	
Limit data					
Max. speed	n_{max}	RPM	4500	5600	
Max. torque	M_{max}	Nm	140	140	
Peak current	I_{max}	A	155	221	
Limiting torque (600 V)	M_{limit}	Nm	139	138	
Limiting current (600 V)	I_{limit}	A	163	233	
Physical constants					
Torque constant	k_T	Nm/A	1.45	1.02	
Voltage constant (phase–to–phase)	k_E	V/1000 RPM	95	67	
Winding resistance	$R_{ph.}$	Ohm	0.1	0.05	
Three–phase inductance	L_D	mH	2.1	1	
Electrical time constant	T_{el}	ms	21.0	21.0	
Mechanical time constant	T_{mech}	ms	2.3	2.3	
Thermal time constant	T_{th}	min	35	35	
Thermal resistance	R_{th}	W/K	0.007	0.007	
Weight with brake	m	kg	50	50	
Weight without brake	m	kg	45.5	45.5	

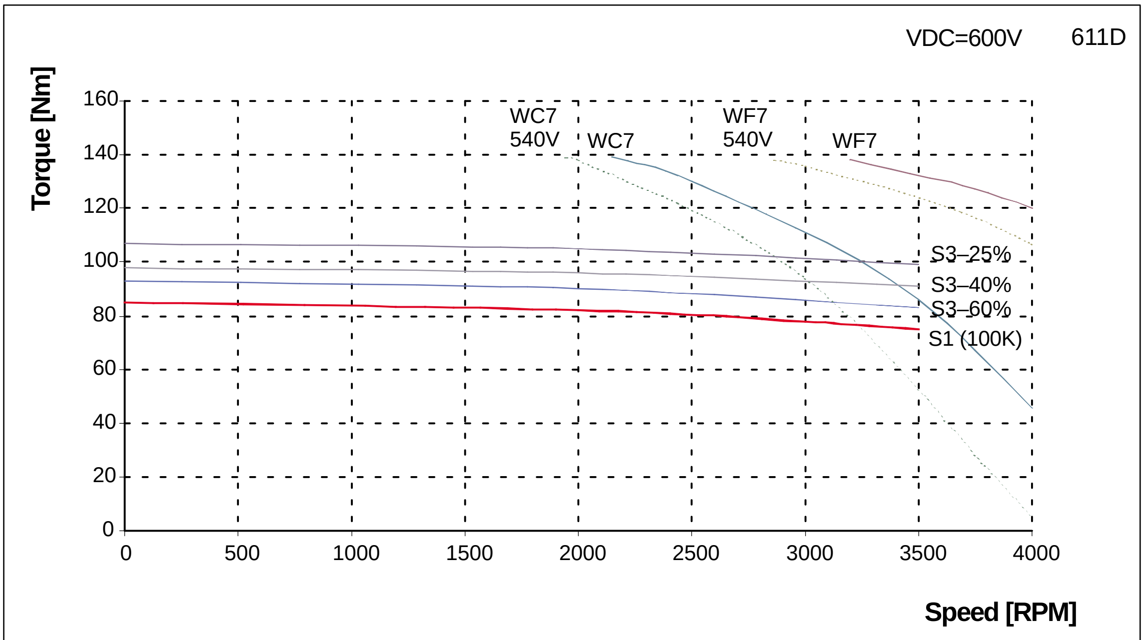


Fig. 3-28 Speed–torque diagram 1FT6105, water cooled

Table 3-28 Standard motor 1FT6108, water cooled

1FT6108						
Technical data	**Code**	**Units**	**-□WB7**	**-□WC7**	**-□WF7**	
Engineering data						
Rated speed	n_{rated}	RPM	1500	2000	3000	
Rated torque	$M_{rated\ (100\ K)}$	Nm	116	115	109	
Rated current	$I_{rated\ (100\ K)}$	A	43	57	81	
Stall torque	$M_{0\ (60\ K)}$	Nm	98	98	98	
Stall torque	$M_{0\ (100\ K)}$	Nm	119	119	119	
Stall current	$I_{0\ (60\ K)}$	A	34	45	67	
Stall current	$I_{0\ (100\ K)}$	A	41	54	81	
Power loss	P_v	W	1900	2100	2300	
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	291.8	291.8	291.8	
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	260	260	260	
Limit data						
Max. speed	n_{max}	RPM	2400	3200	4800	
Max. torque	M_{max}	Nm	220	220	220	
Peak current	I_{max}	A	116	154	231	
Limiting torque (600 V)	M_{limit}	Nm	180	184	187	
Limiting current (600 V)	I_{limit}	A	78	107	167	
Physical constants						
Torque constant	k_T	Nm/A	2.9	2.2	1.46	
Voltage constant (phase–to–phase)	k_E	V/1000 RPM	183	138	92	
Winding resistance	$R_{ph.}$	Ohm	0.19	0.11	0.05	
Three–phase inductance	L_D	mH	4.4	2.5	1.1	
Electrical time constant	T_{el}	ms	24.0	24.0	24.0	
Mechanical time constant	T_{mech}	ms	1.7	1.7	1.7	
Thermal time constant	T_{th}	min	40	40	40	
Thermal resistance	R_{th}	W/K	0.004	0.004	0.004	
Weight with brake	m	kg	66	66	66	
Weight without brake	m	kg	61.5	61.5	61.5	

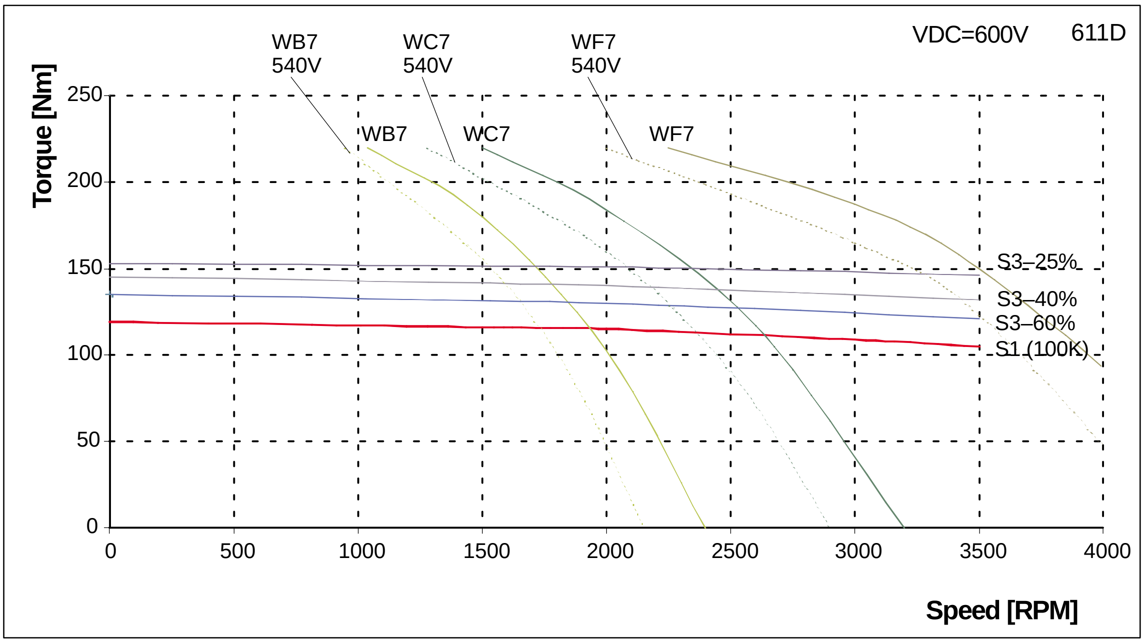


Fig. 3-29 Speed–torque diagram 1FT6108, water cooled

3.2 Cantilever/axial force diagrams

Cantilever force

Definition, refer to Chapter 2.1, General information AC servomotors AL_S.

Axial force

$F_{A\ AS}$ is the absolute permissible force without taking into account the bearing alignment force, the rotor weight, the mounting position as well as the force direction.

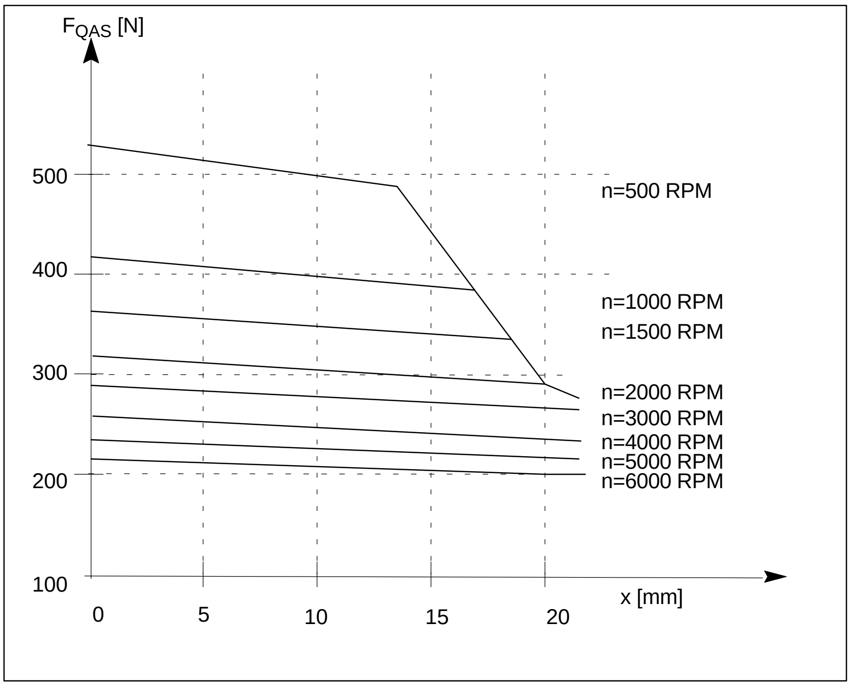
Caution

For motors with integrated holding brake, axial forces are not permitted!

Definition, refer to Section 2.1, General information AC servomotors AL_S.

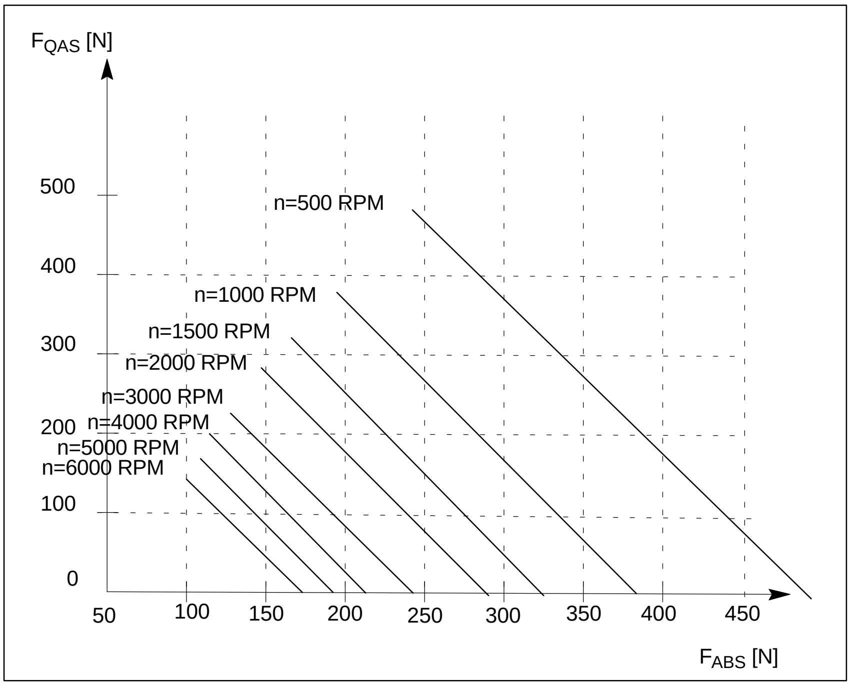
Cantilever force
1FT6024
1FT6028

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



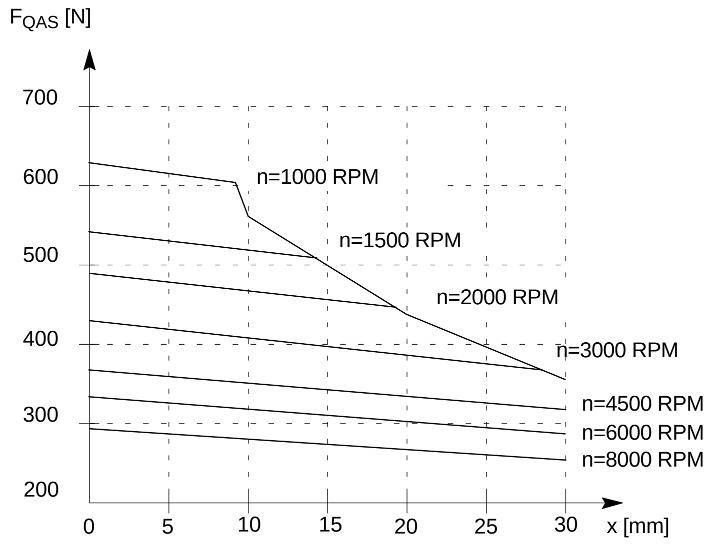
Axial force
1FT6024
1FT6028

Permissible axial force as a function of the cantilever force.



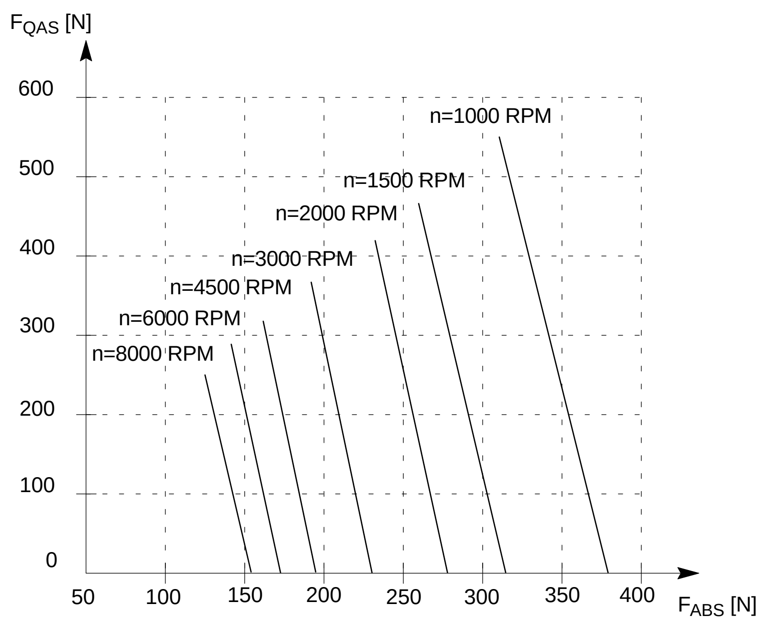
Cantilever force
1FT6031
1FT6034

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



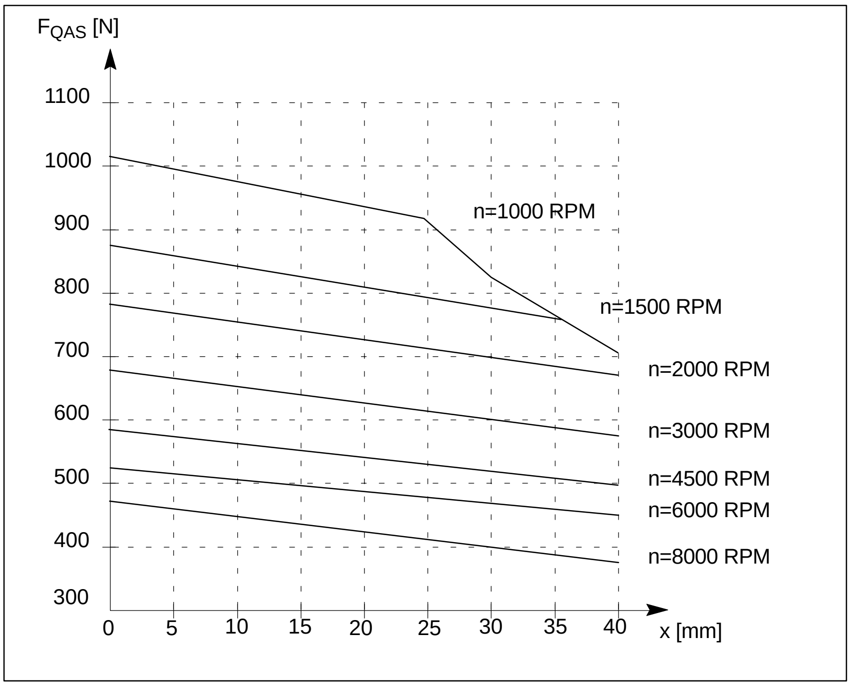
Axial force
1FT6031
1FT6034

Permissible axial force as a function of the cantilever force.



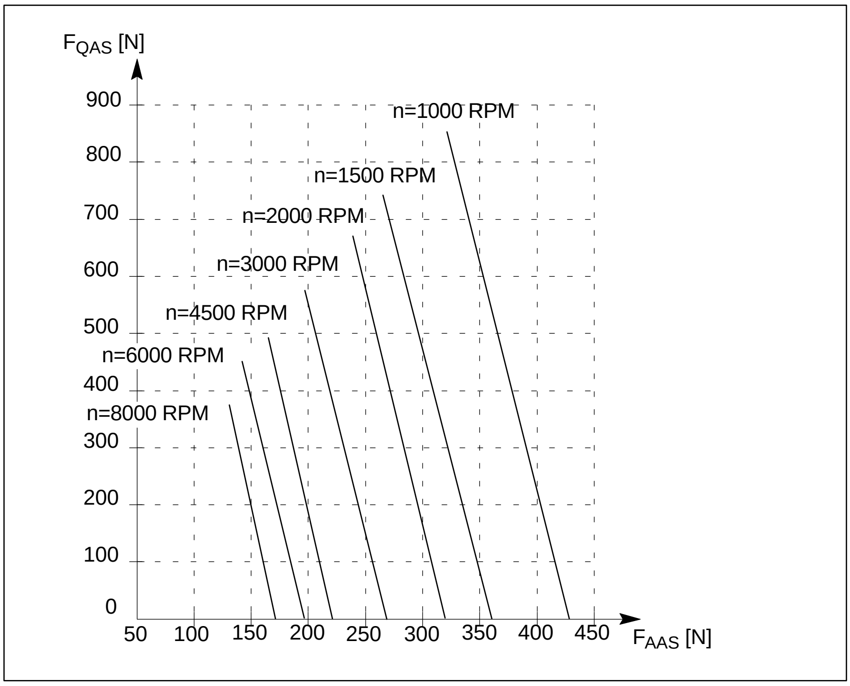
Cantilever force
1FT6041
1FT6044

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



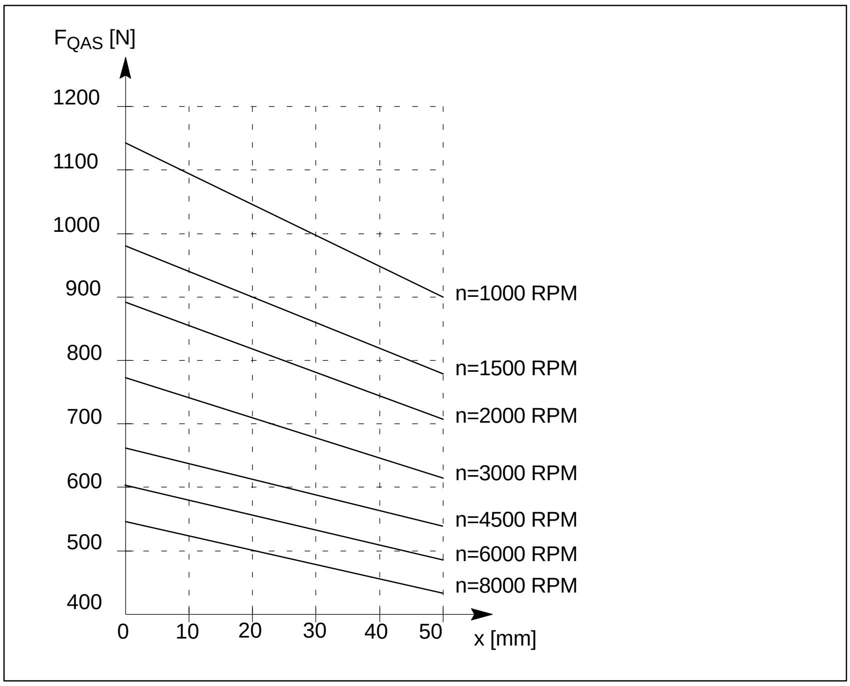
Axial force
1FT6041
1FT6044

Permissible axial force as a function of the cantilever force.



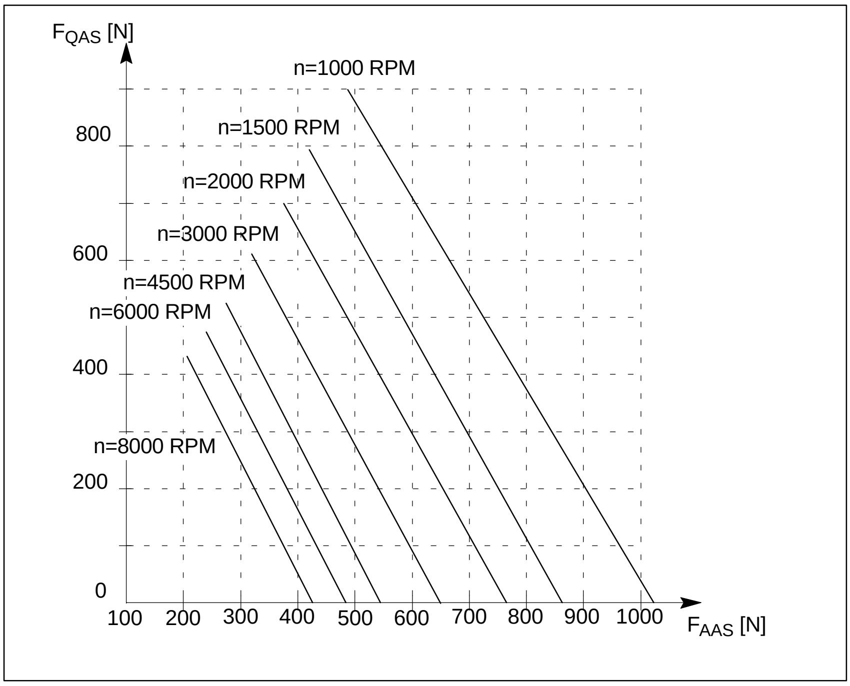
Cantilever force
1FT6061
1FT6062
1FT6064

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



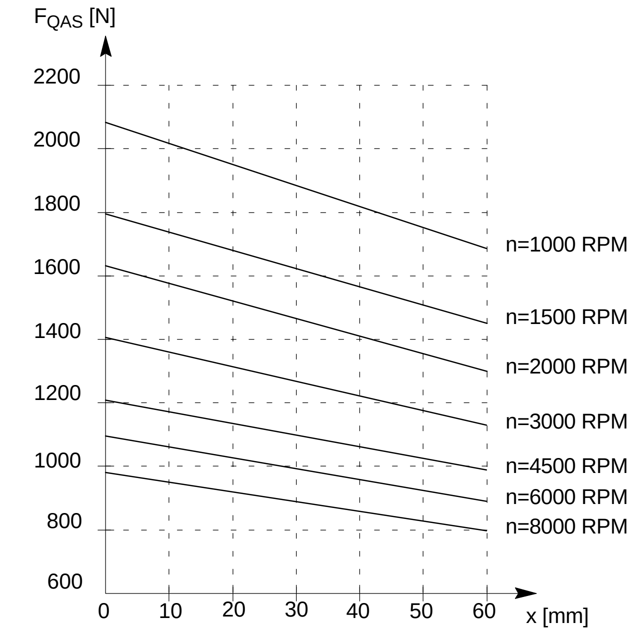
Axial force
1FT6061
1FT6062
1FT6064

Permissible axial force as a function of the cantilever force.



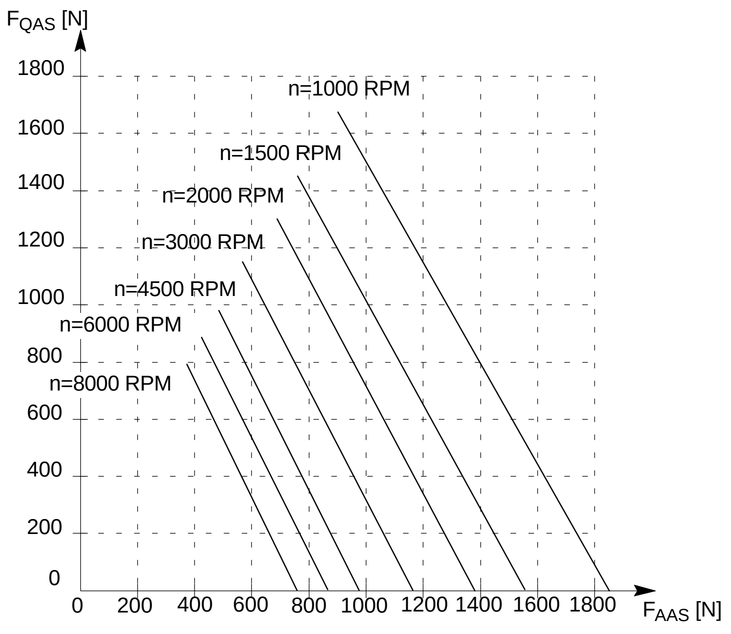
Cantilever force
1FT6081
1FT6082
1FT6084
1FT6086

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



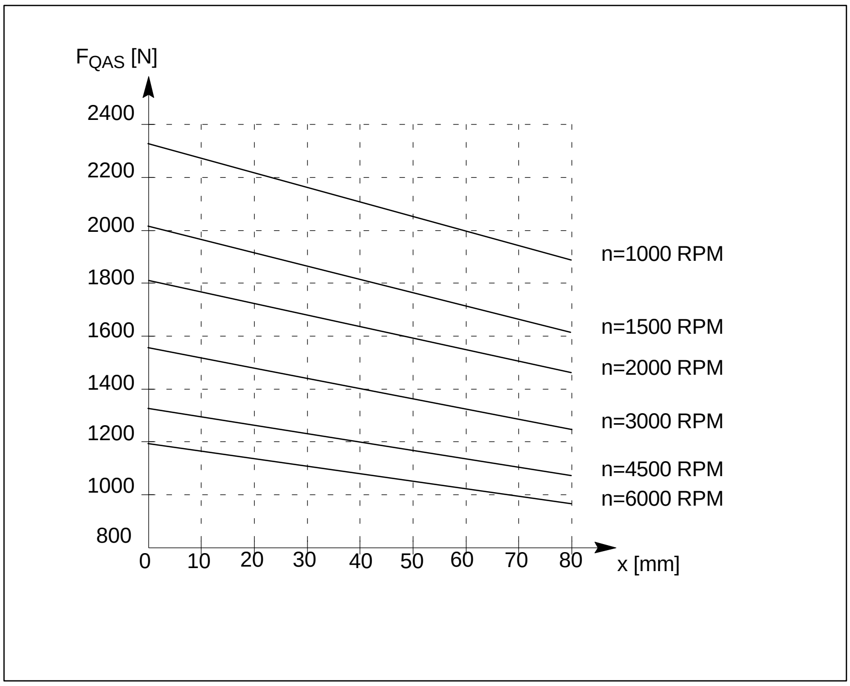
Axial force
1FT6081
1FT6082
1FT6084
1FT6086

Permissible axial force as a function of the cantilever force.



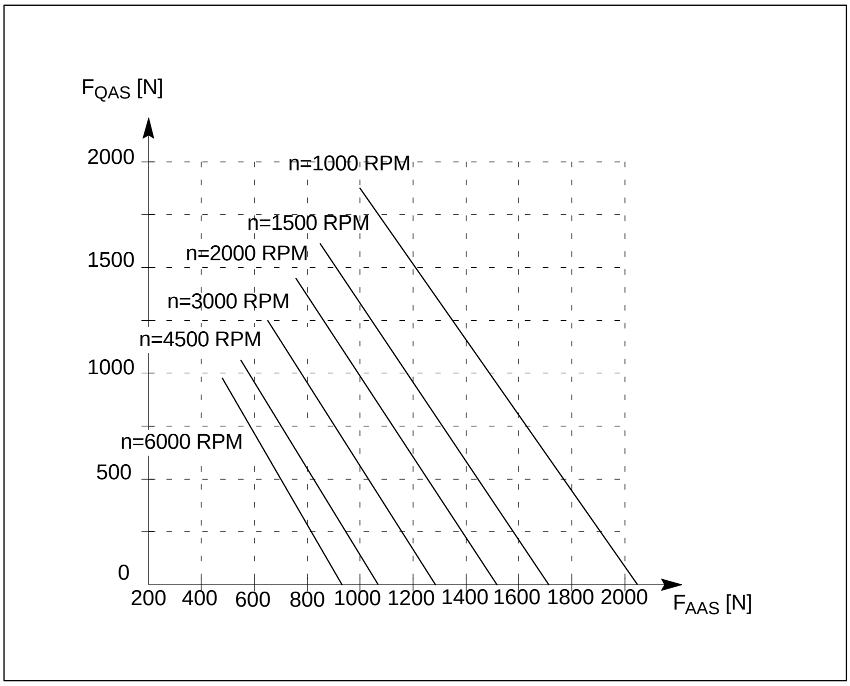
Cantilever force
1FT6102
1FT6105
1FT6108

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



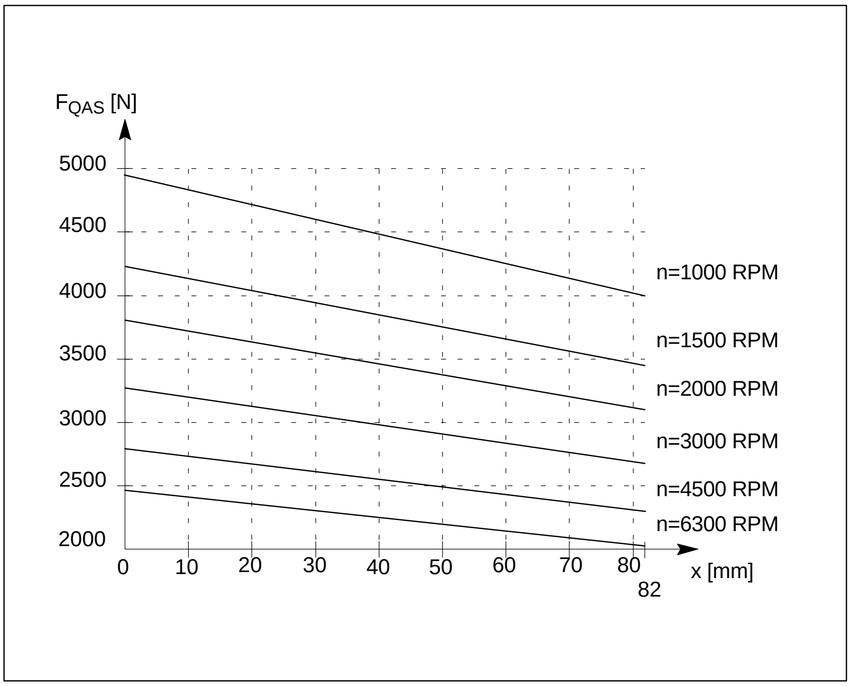
Axial force
1FT6102
1FT6105
1FT6108

Permissible axial force as a function of the cantilever force.



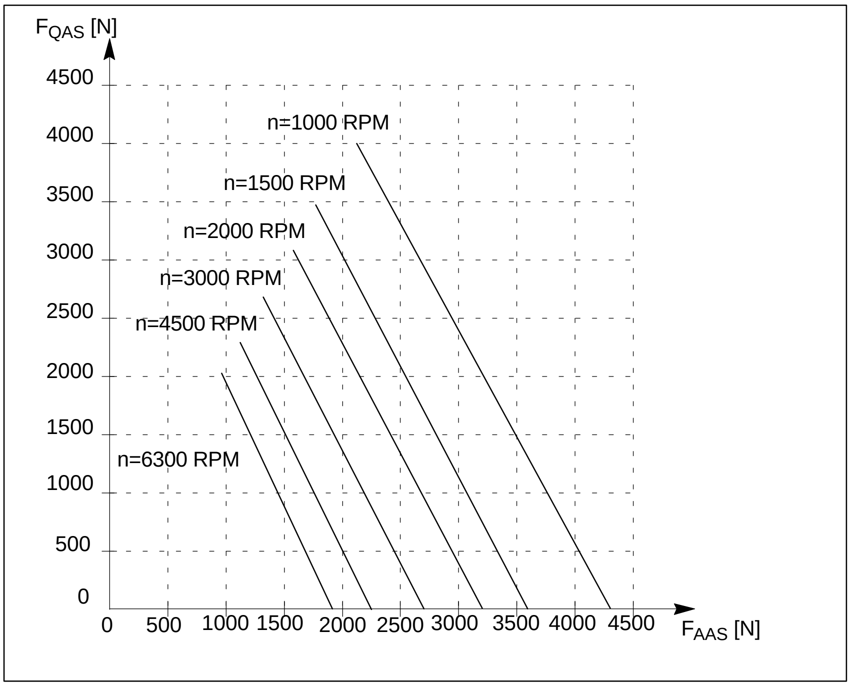
Cantilever force
1FT6132
1FT6134
1FT6136

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



Axial force
1FT6132
1FT6134
1FT6136

Permissible axial force as a function of the cantilever force.



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Dimension Drawings

4

Note

Siemens AG reserves the right to change motor dimensions within the scope of design improvements without prior notice. Dimension drawings can go out of date. Up–to–date dimension drawings can be requested at no charge.

Standard type of construction, non–ventilated

Motor type

Standard type of construction, force–ventilated

Motor type

Standard type of construction, water–cooled

Motor type

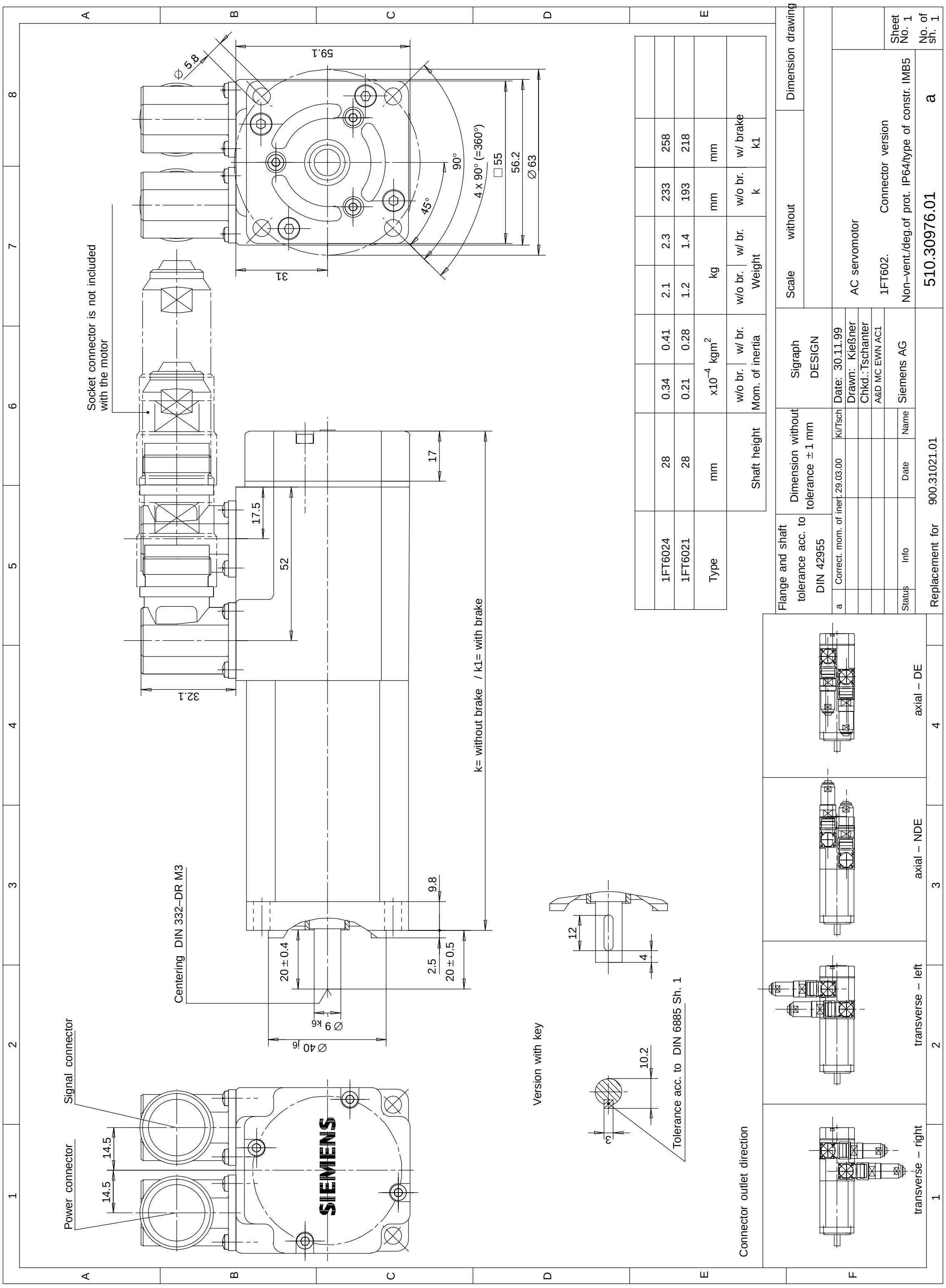


Fig. 4-1 1FT602□ non–ventilated

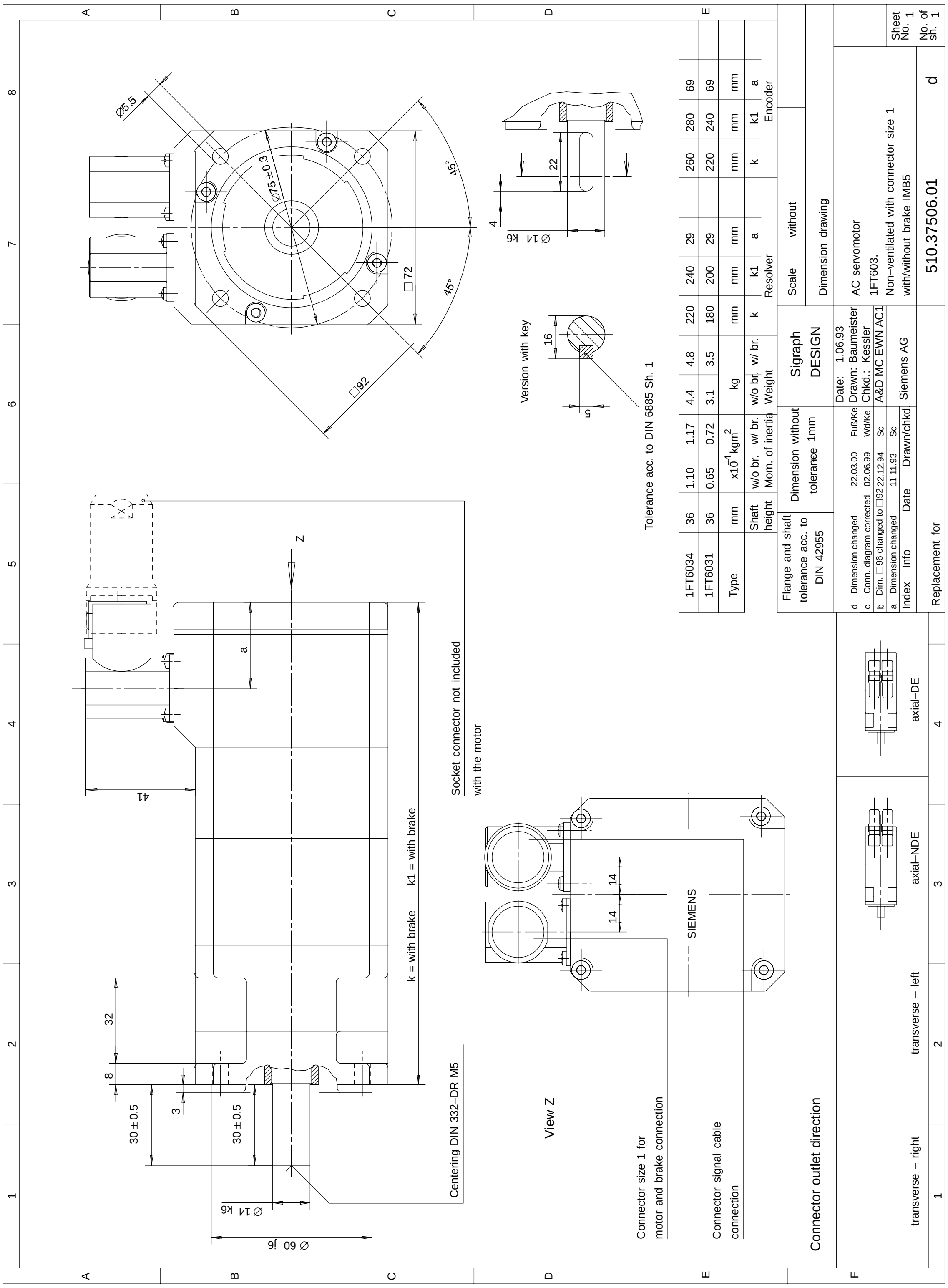


Fig. 4-2 1FT603□ non–ventilated with connector size 1

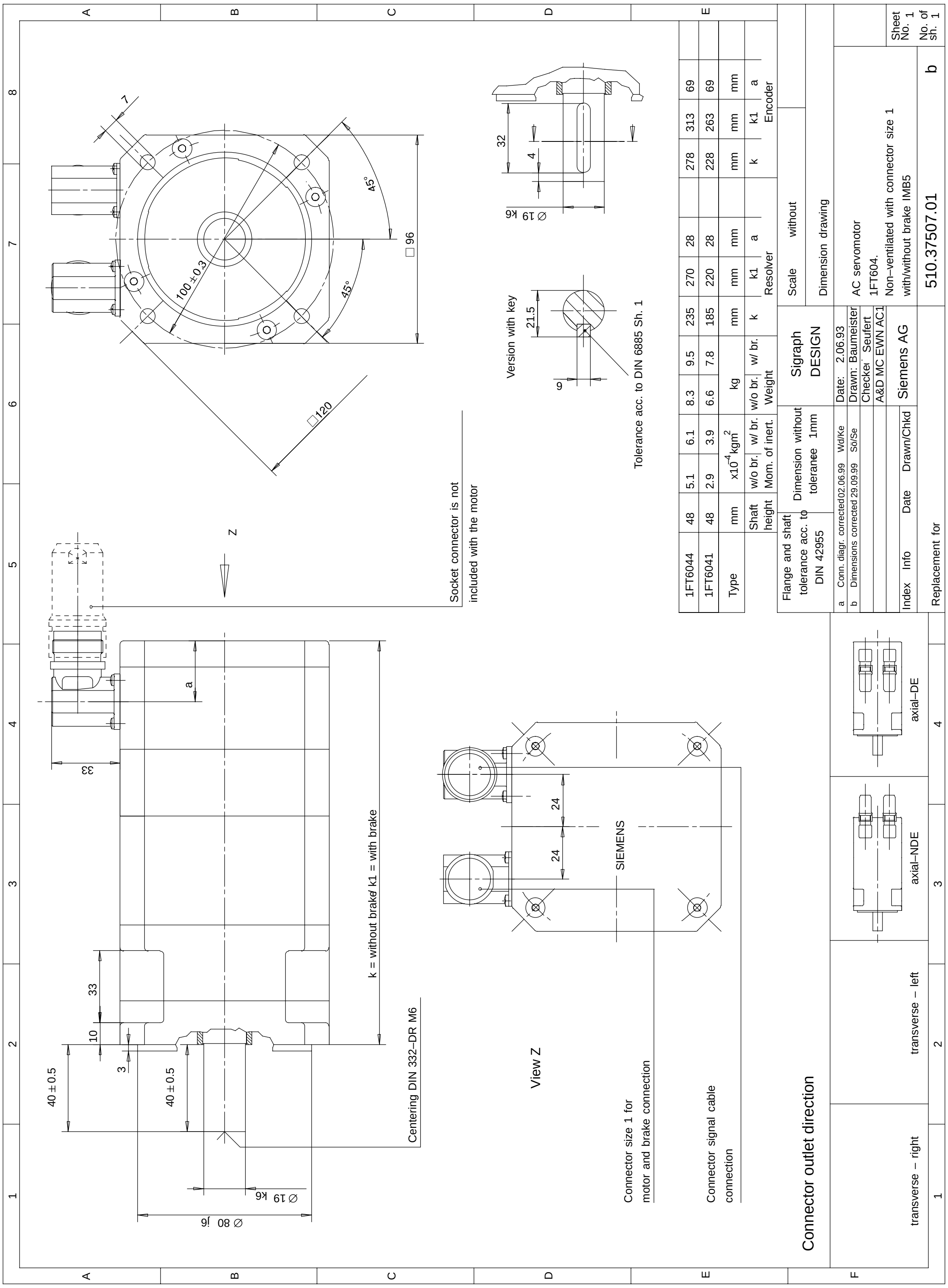


Fig. 4-3 1FT604□ non–ventilated with connector size 1

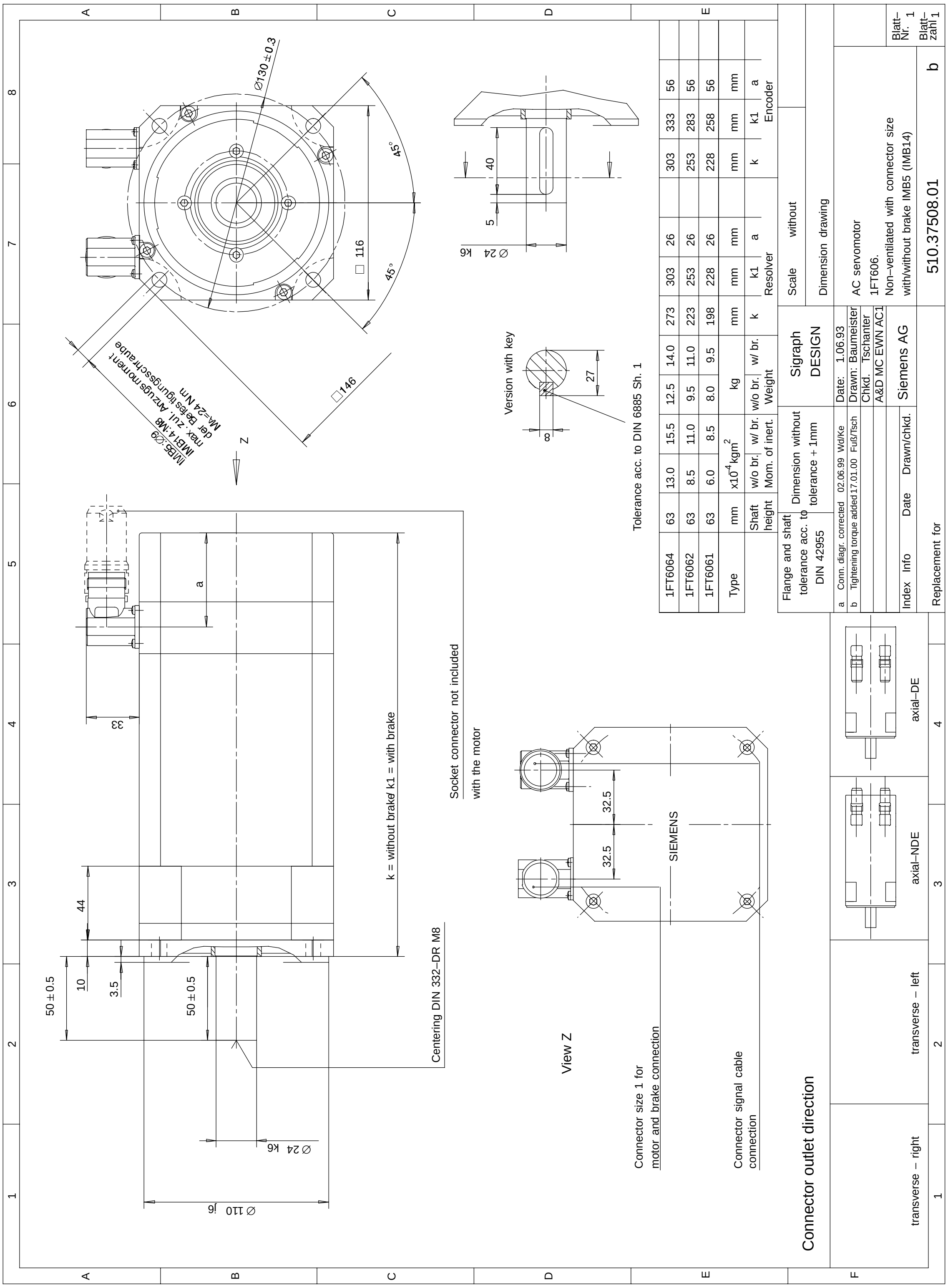


Fig. 4-4 1FT606□ non–ventilated with connector size 1

1FT6

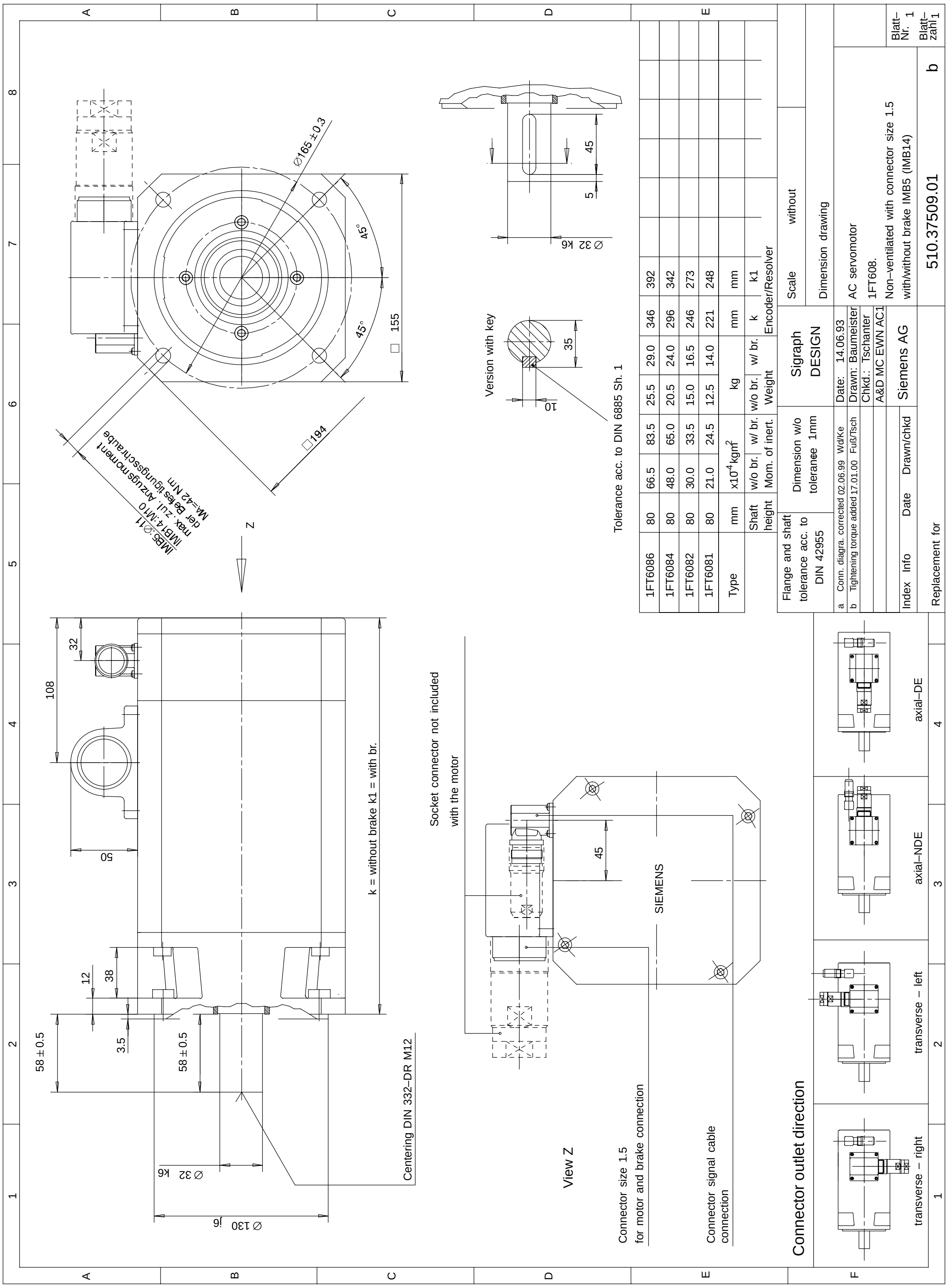


Fig. 4-5 1FT608□ non–ventilated with connector size 1.5

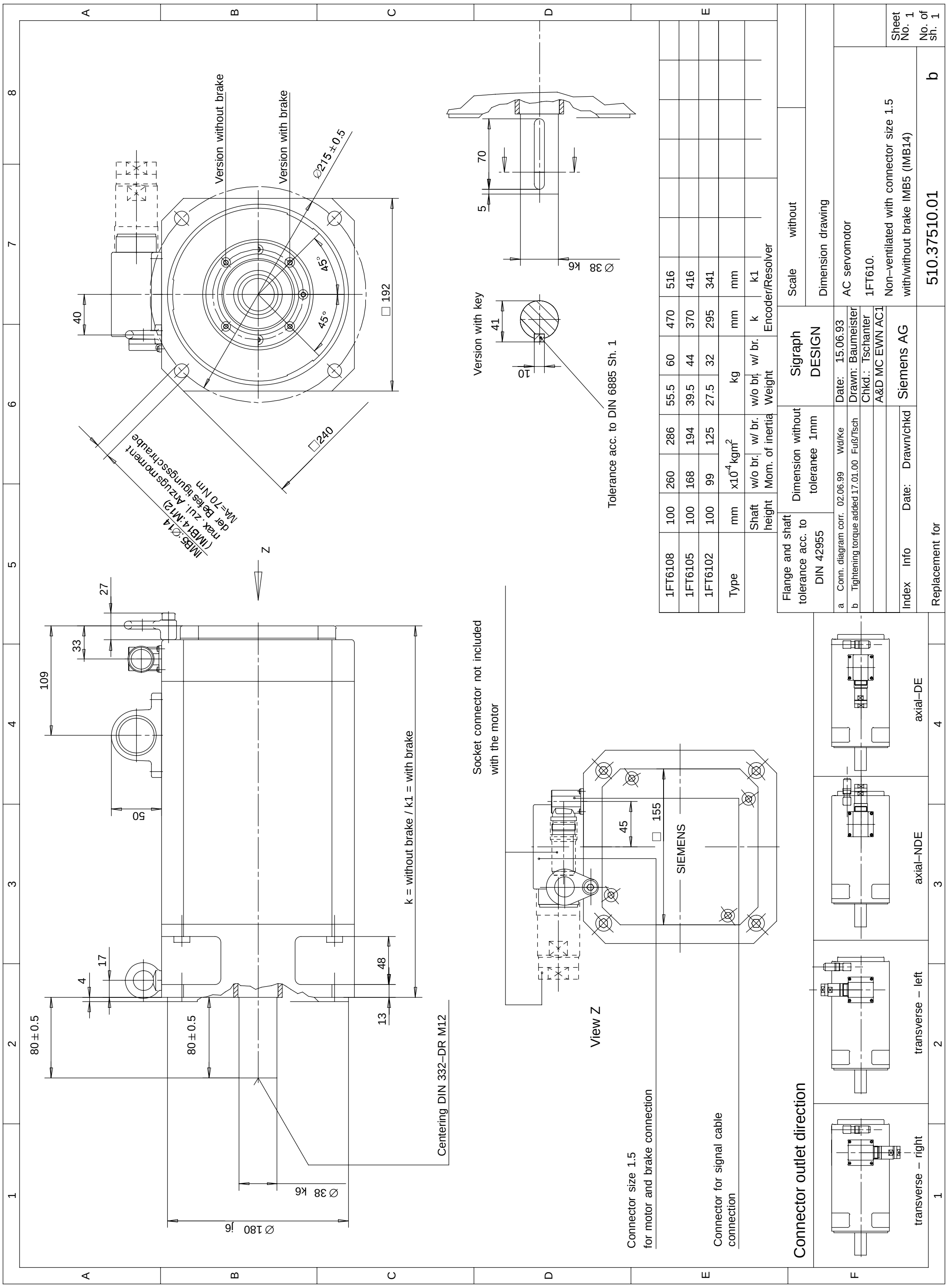
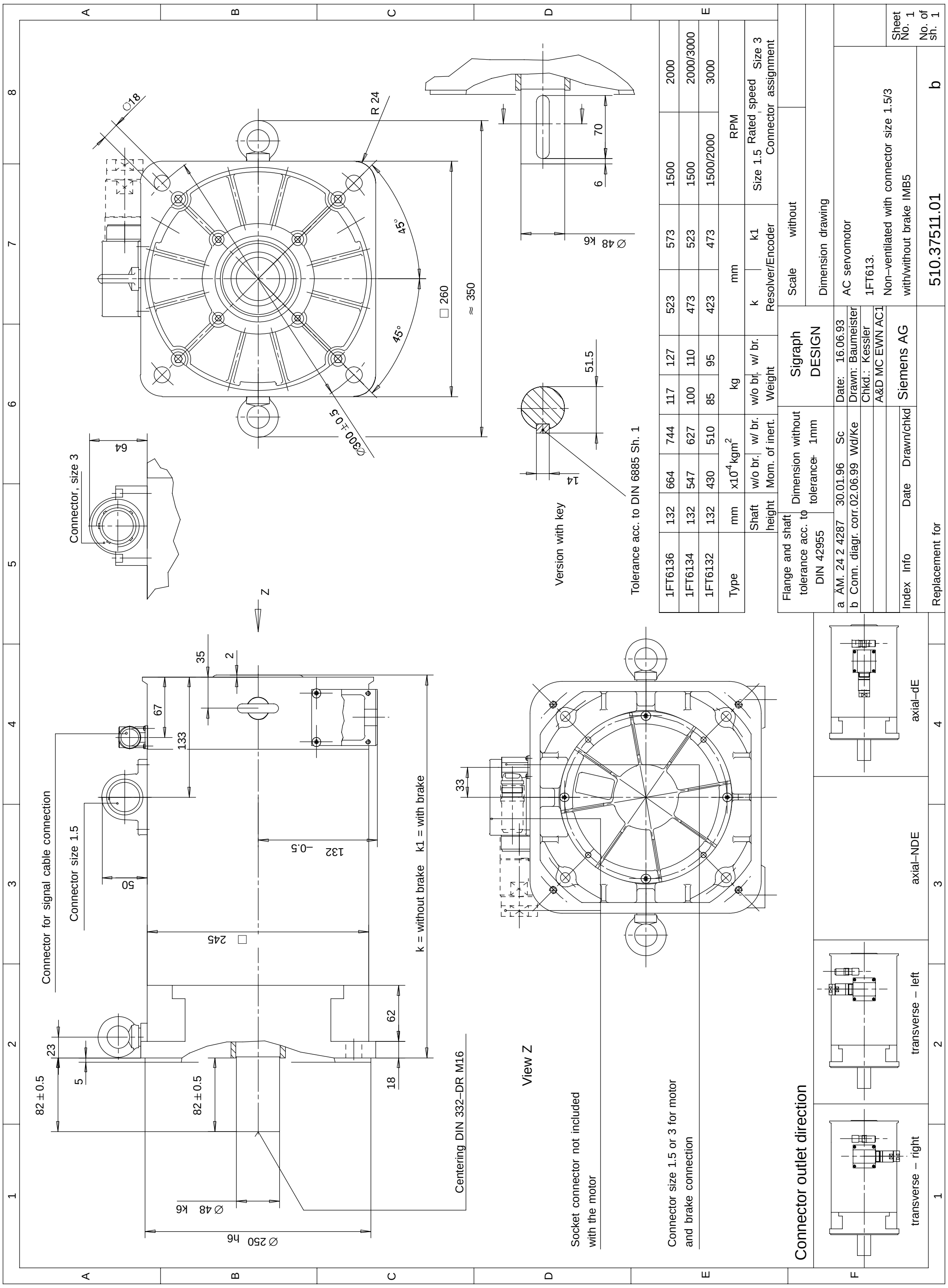


Fig. 4-6 1FT610□ non–ventilated with connector size 1.5

1FT6



Type	Shaft height	Mom. of inert. w/o br.	Mom. of inert. w/ br.	Weight w/o br.	Weight w/ br.	k	k1	Rated speed Size 1.5	Rated speed Size 3
	mm	$x10^{-4}$ kgm²		kg		mm		RPM	
1FT6136	132	664	744	117	127	523	573	1500	2000
1FT6134	132	547	627	100	110	473	523	1500	2000/3000
1FT6132	132	430	510	85	95	423	473	1500/2000	3000

Fig. 4-7 1FT613☐ non–ventilated with connector size 1.5/3

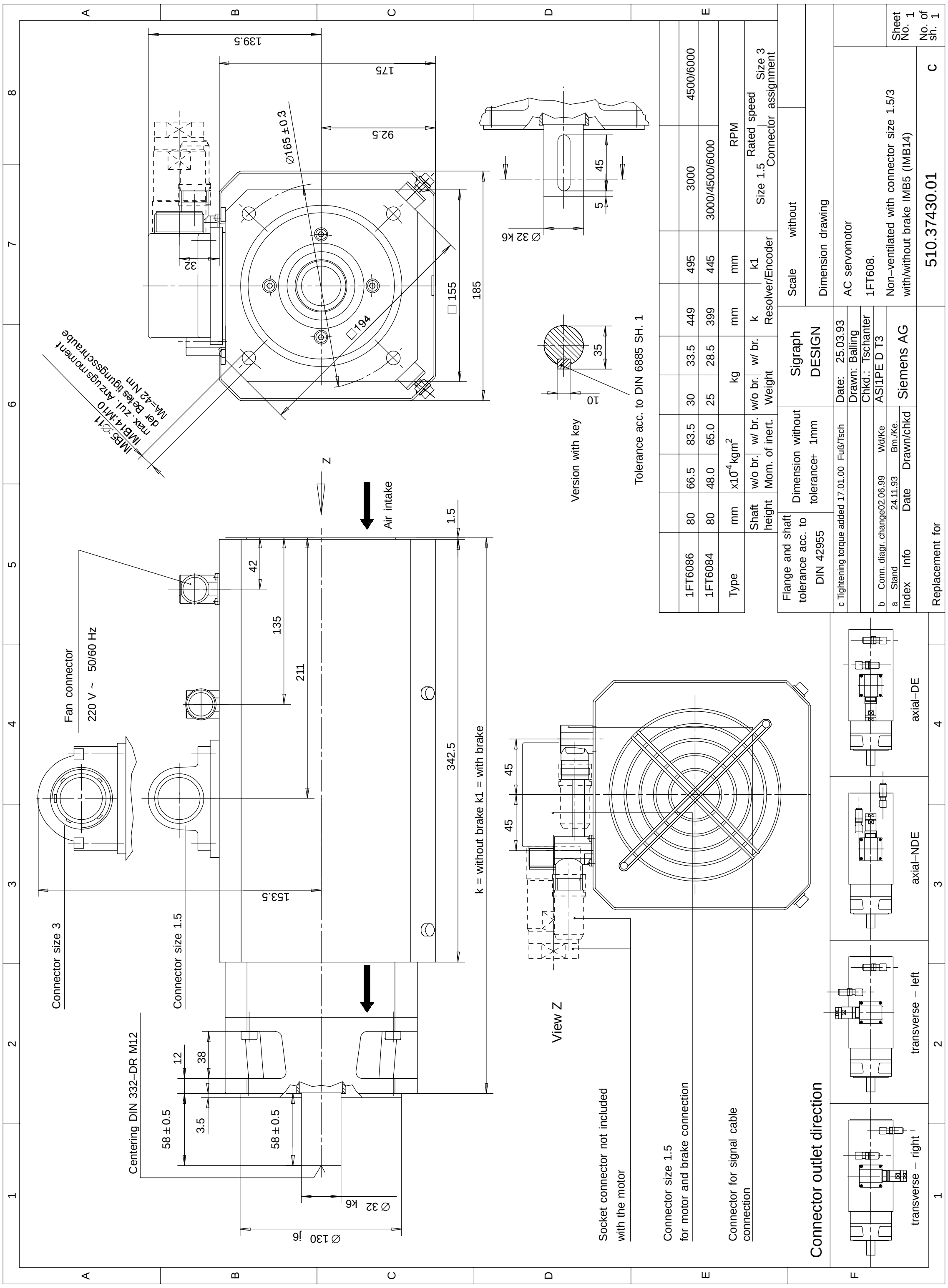


Fig. 4-8 1FT608□ force–ventilated with connector size 1.5/3

1FT6

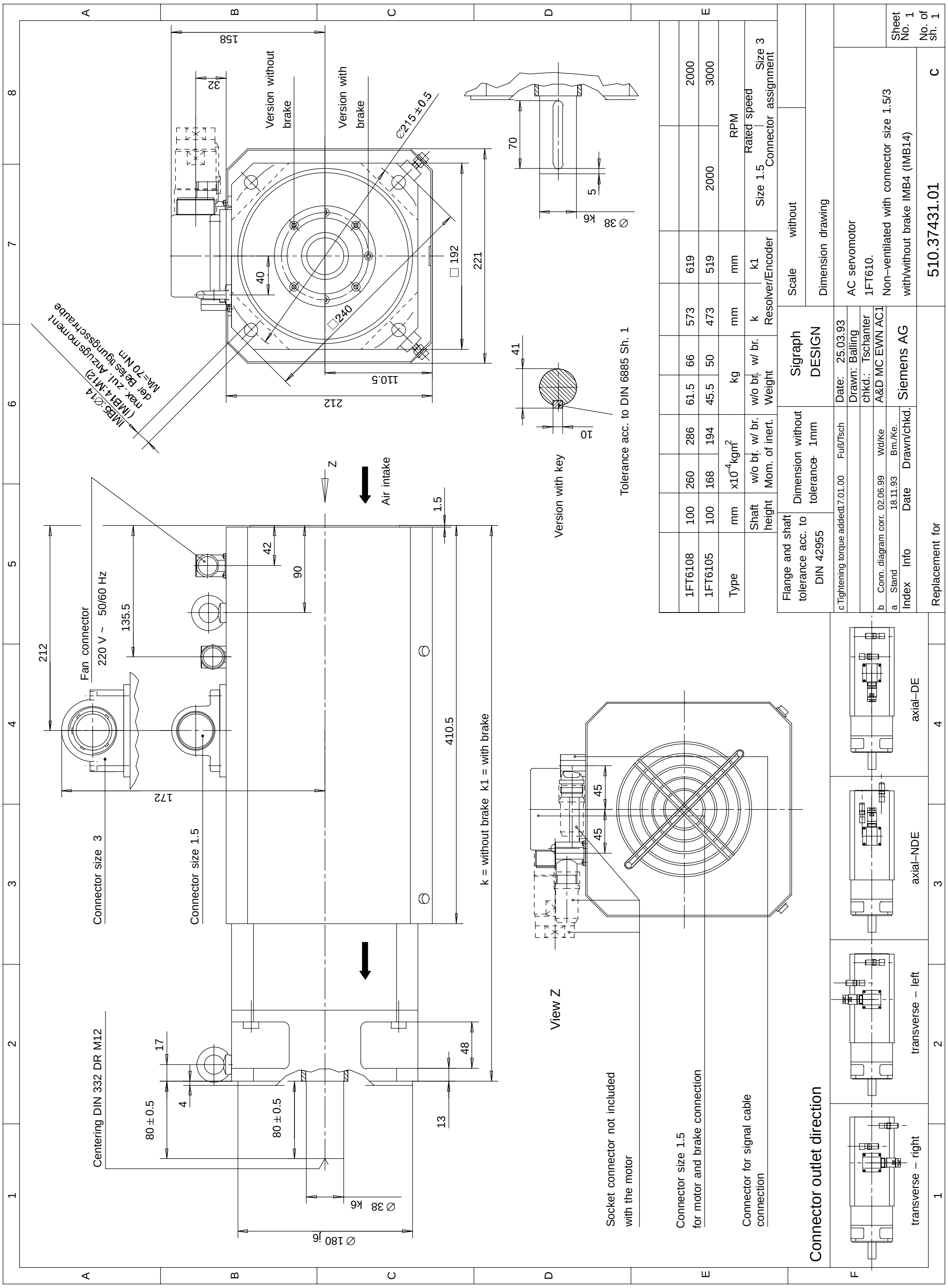


Fig. 4-9 1FT610□ force–ventilated with connector size 1.5/3

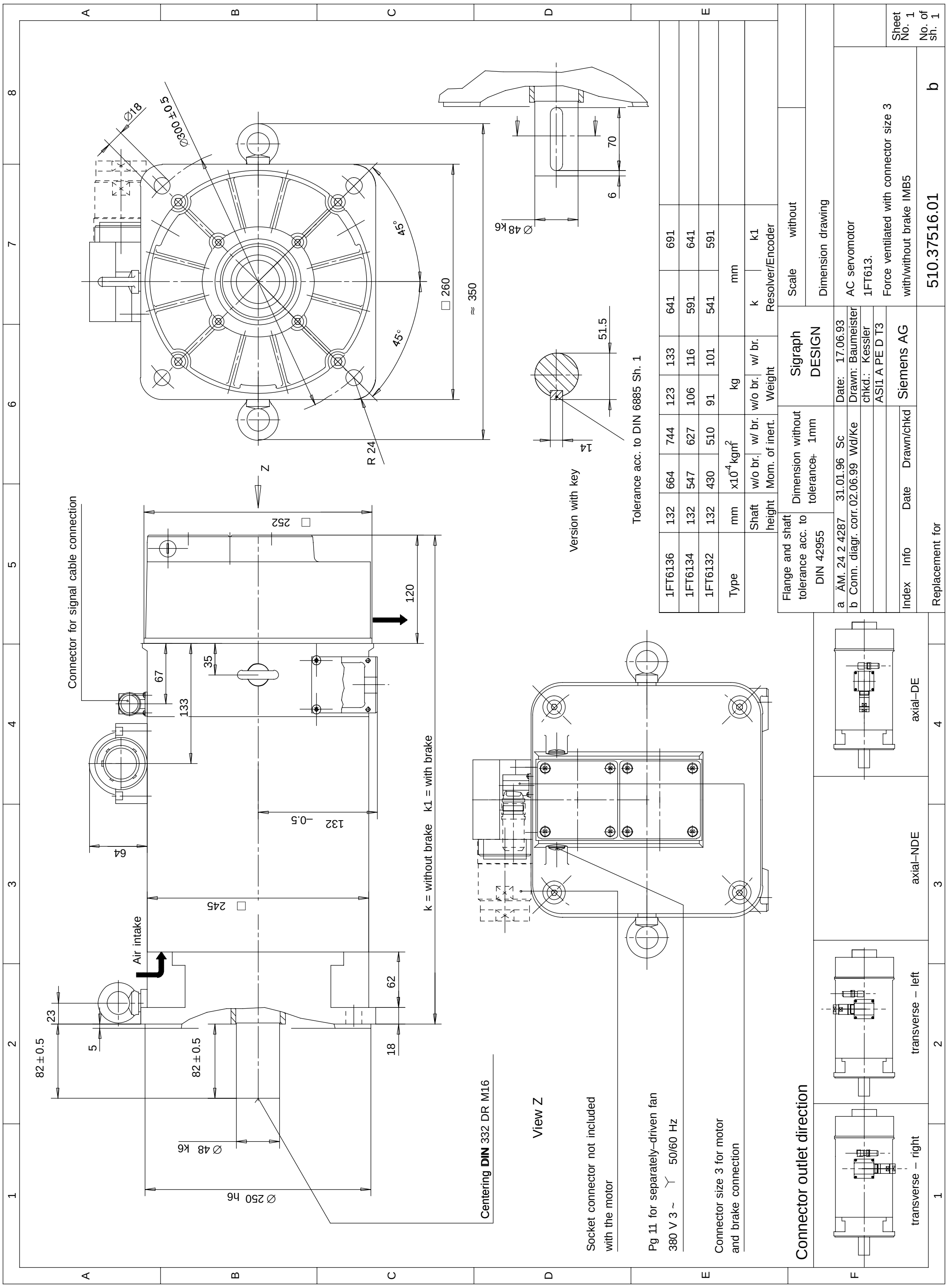


Fig. 4-10 1FT613□ force–ventilated with connector size 3

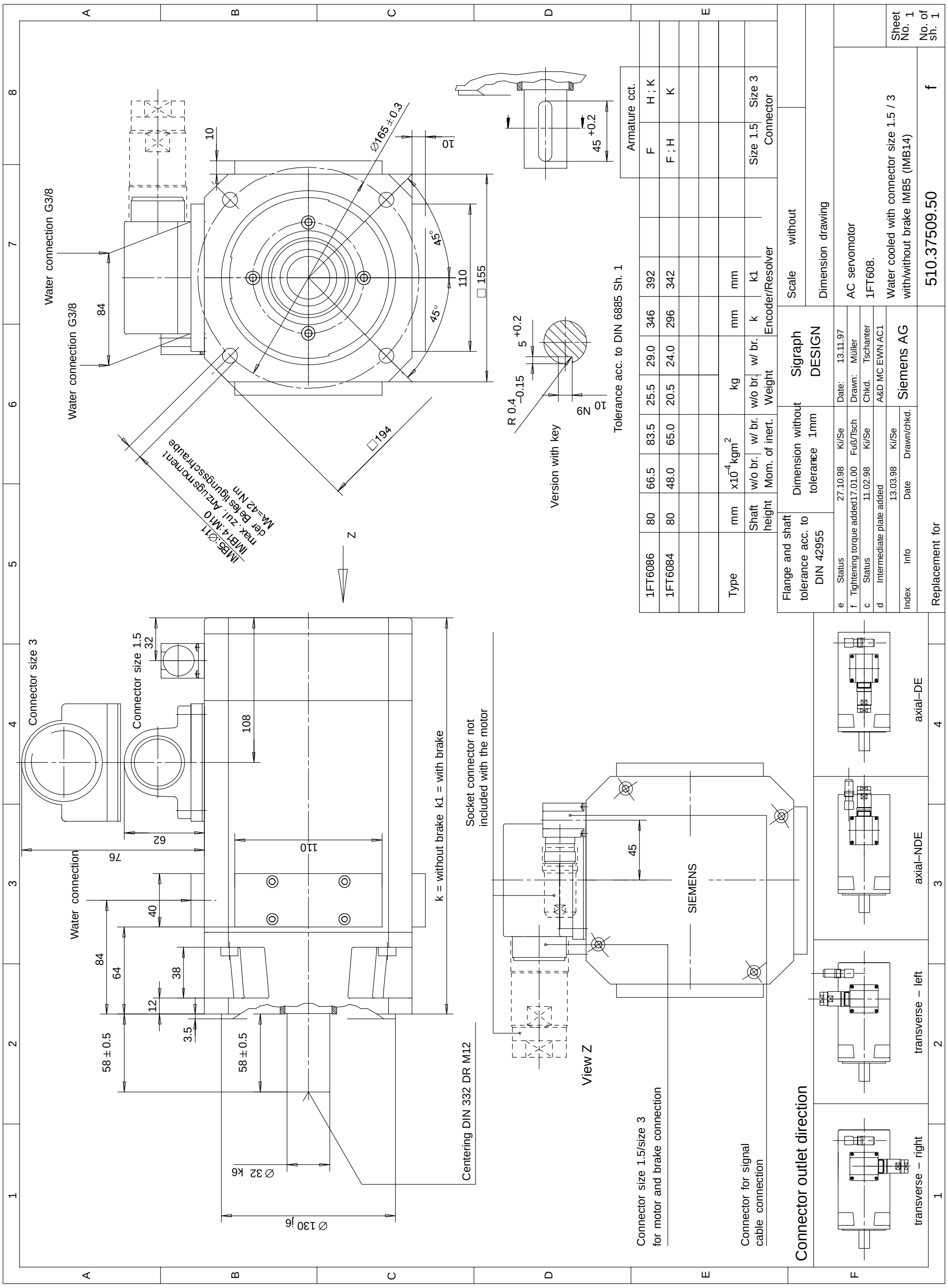


Fig. 4-11 1FT608□ water–cooled with connector size 1.5/3

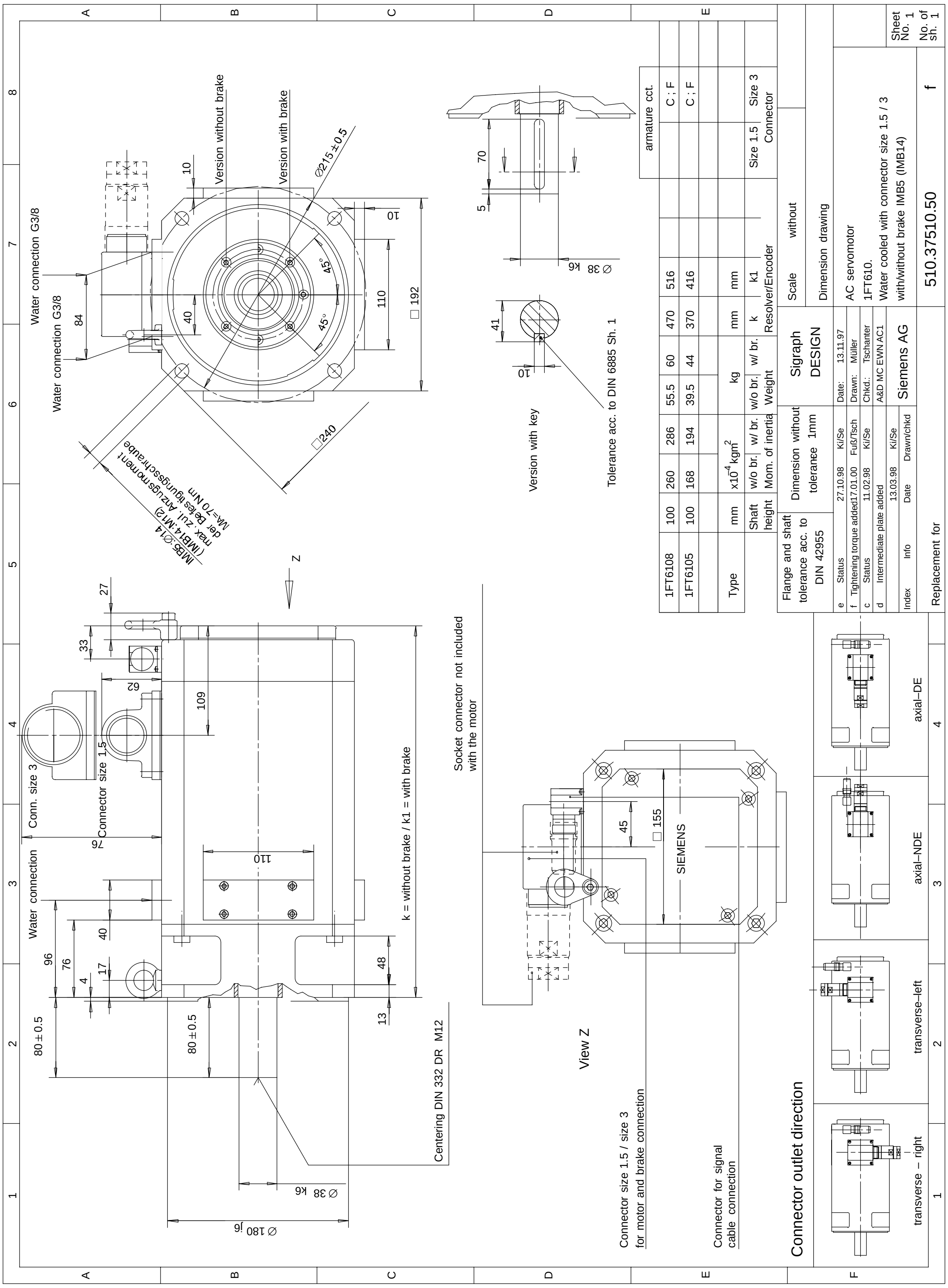


Fig. 4-12 1FT610□ water–cooled with connector size 1.5/3

■

Notes

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Notes

1FK6 AC Servomotors

Notes

Motor Description 1

1.1 Characteristics and technical data

Applications

The 1FK6 series was mainly developed for use on robots, gantries, loading and axes, auxiliary axes, high–bay racking devices, handling systems, rotary cycle machines, standard machine tools and in woodworking. In conjunction with the SIMODRIVE 611 drive converter, a reliable drive system is created.

These motors can be used as feed motor for standard applications.

Warning

The motors are not suitable for direct online operation (directly connected to the line supply).

Characteristics

Depending on the shaft height, the 1FK6 series has stall torques from 1.1 to 36 mm at rated speeds of3000 or 6000 RPM. These motors have a high overload capability over the complete speed control range. They are flange and shaft–compatible to 1FT6 motors.

Standards, regulations

The appropriate Standards and regulations are directly assigned to the function requirements.

Technical features

The motors are designed for operation from a 600 V DC link, for sinusoidally impressed currents. Together with the SIMODRIVE 611, they form a complete drive system.

For DC link voltages which differ from 600 V (max. 700 V), the voltage limiting characteristic is shifted as described in Chapter AL S/1.1.

Note

When, e.g., the drive converter is connected to a 480 V-line supply, DC link voltages are obtained > 600 V. In this case, the following restriction applies: Shaft heights 36, 48, 63, 80 may only be utilized acc. to the ΔT=60 K limit values.

Technical features

Table 1-1 Motors, standard version

Technical features	Versions
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
Cooling (acc. to EN 60034-6; IEC 60034-6)	Non–ventilated
Thermal motor protection (acc. to IEC and EN 60034-11)	KTY84 PTC thermistor in the stator winding
Shaft end (acc. to DIN 748-3; IEC 60072-1)	Cylindrical; without keyway and without key (acc. to DIN 748, Part 3); tolerance zone k6
Radial eccentricity, concentricity and axial eccentricity (acc. to DIN 42955; IEC 60072-1)	Tolerance N
Vibration severity (acc. to EN 60034-14; IEC 60034-14)	Grade N
Bearings	Roller bearings with permanent grease lubrication (lifetime lubrication) Bearing lifetime > 20000 h Locating bearing on the NDE
Winding insulation (acc. to EN 60034-1; IEC 60034-1)	Insulating material class F permits a winding temperature rise of ΔT = 100 K for an ambient temperature of 40 °C lifetime > 40.000 h.
Installation altitude (acc. to IEC and EN 60034–1)	≤ 1000 m above sea level, otherwise de–rating 2000 m factor 0.94 2500 m factor 0.9
Magnetic materials	Rare earth materials
Electrical connection	Connector for power and encoder signals, which can be rotated
Encoder system	Integrated encoder • speed sensing • rotor sensing • indirect position sensing
Rating plate	A rating plate is supplied loose with each motor

Options

Table 1-2 Options

Technical features	Version
Degree of protection (acc. to EN 60034-5; IEC 60034-5)	IP 65, additionally, DE flange IP 67
Integrated/mounted components	• Fail–safe holding brake; supply voltage, 24V ±10% (acc. to DIN 0580 7/79) • Planetary gearbox (prerequisite: shaft without keyway)
Encoder system	• Incremental encoder, 1 Vpp • Simple absolute value encoder • Multi–turn absolute value encoder, (not for 1FK6 032)[1)] • Resolver, multi–pole
Shaft end (acc. to EN and IEC 60034–14)	Cylindrical; with keyway and key; Tolerance zone k6 (half–key balancing, acc. to DIN 8821)

1) The rated torque is reduced when using an absolute encoder (refer to the Table, Technical data)

Technical data

100 K values are specified in the Table.

Rated speed [RPM]	M_0 [Nm]	M_{rated} [Nm]	M_{rated} 4) [Nm]	Motor type 1FK6–	Motor current I_0 3) [A]	Rated drive conv. curr. 3) [A]	P_{calc} [kW]	Con-nector size	Cross–section 1) [mm²]	Cable type 6FX□002– 5)
3000	3.2	2.6	2.3	042–6AF71	2.8	3	0.8	1.0	4 x 1.5	5□A01–1□□0
3000	6.0	4.0	3.6	060–6AF71	4.3	5	1.3	1.0	4 x 1.5	5□A01–1□□0
3000	11.0	6.0	5.4	063–6AF71	7.9	9	1.9	1.0	4 x 1.5	5□A01–1□□0
3000	8.0	6.8	6.1	080–6AF71	5.8	9	2.1	1.0	4 x 1.5	5□A01–1□□0
3000	16.0	10.5	9.5	083–6AF71	10.4	18	3.3	1.0	4 x 1.5	5□A01–1□□0
3000	18.0	12.0	10.8	100–8AF71	12.2	18	3.8	1.0	4 x 1.5	5□A01–1□□0
3000	27.0	15.5	14.0	101–8AF71	17.5	18	4.9	1.5	4 x 2.5	5□A31–1□□0
3000	36.0	16.5	14.9	103–8AF71	23.5	28	5.2	1.5	4 x 4	5□A41–1□□0
6000	1.1	0.8	–6)	032–6AK71	1.7	3	0.5	1.0	4 x 1.5	5□A01–1□□0
6000	1.6	0.8	0.72	040–6AK71	2.8	3	0.5	1.0	4 x 1.5	5□A01–1□□0

without brake cable:	w/out overall shield	A
	with overall shield	C
with brake cable:	w/out overall shield	B
	with overall shield	D

Lengths2) (examples)	5 m	AF
	10 m	BA
	15 m	BF
	18 m	BJ
	25 m	CF

Cables are not included in the scope of supply of the motors, they must be separately ordered, actual value cables, refer to Chapter, Encoders (GE).

Power calculation

$$P_{calc}\,[kW] = \frac{M_{rated} \times n}{9550}$$

M [Nm]
n [RPM]

1) Dimensioned for I_{rms} (100 K); 40 °C ambient temperature; PVC insulated cable; brake connection 2 x 1 mm².
2) Cables are supplied in increments of a meter; length code, refer to Chapter AL S/4.3.
3) The specified values are RMS values
4) With absoltue value encoder (due to the maximum encoder temperature)
5) 8 = Motion Connect 800, 5 = Motion Connect 500; Technical data, refer to Catalog NC Z
6) It is not possible to integrate an absolute value encoder

Technical data 1FK6 HD

For the high–dynamic performance, low–inertia motors, components are used which play a role in enhancing the flexibility and productivity for production machines:

- HIgher accelerating torque with respect to standard motors as a result of the low rotor moment of inertia and the higher torque for the same shaft height
- Low, overall dimensions

100 K values are specified in the table.

Rated speed [**RPM**]	**M_0** [**Nm**]	**M_{rated}** [**Nm**]	**M_{rated}** 4) [**Nm**]	**Motor type** **1FK6–**	**Motor current** I_0 3) [**A**]	**Rated drive conv. current** 3) [**A**]	**P_{calc}** [**kW**]	**Connec tor size**	**Cross–section** 1) [**mm²**]	**Cable type** **6FX□002–** 5)
4500	3.1	2.6	2.3	043–7AH7	4.6	5	1.6	1	4 x 1.5	5□A01–1□□0
3000	4.0	3.5	3.2	044–7AF7	4.4	5	1.5	1	4 x 1.5	5□A01–1□□0
4500	4.0	3.0	2.7	044–7AH7	5.9	9	2.3	1	4 x 1.5	5□A01–1□□0
3000	6.4	5.4	4.9	061–7AF7	6.1	9	2.2	1	4 x 1.5	5□A01–1□□0
4500	6.4	4.3	3.9	061–7AH7	8.6	9	3.3	1	4 x 1.5	5□A01–1□□0
3000	12	8.0	7.2	064–7AF7	11.0	18	4.1	1	4 x 1.5	5□A01–1□□0

1FK6

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

Power calculation

$$P_{calc}\,[kW] = \frac{M_{rated} \times n}{9550} \quad \text{M [Nm]},\ \text{n [RPM]}$$

Cables are not included in the scope of supply of the motors, they must be separately ordered,
actual value cables, refer to Chapter, Geber (GE).

1) Dimensioned for I_{rms} (100 K); 40 °C ambient temperature; PVC insulated cable; brake connection 2 x 1 mm².
2) Cables are supplied in increments of a meter; length code, refer to Chapter AL S/4.3.
3) The specified values are RMS values
4) With absoltue value encoder (due to the maximum encoder temperature)
5) 8 = Motion Connect 800, 5 = Motion Connect 500; Technical data, refer to Catalog NC Z

1.2 Functions and options

Armature short–circuit braking

Definition, refer to Chapter 3, General information on AC servomotors AL S.

Brake resistors

The optimum braking time is achieved by appropriately dimensioning the brake resistors. The braking torques which are obtained, are also listed in the tables. The data is valid for braking from rated speed. If the drive brakes from another speed, then the braking time **cannot** be linearly interpolated. However, the braking times either remain the same or are shorter.

The resistor ratings must be adapted to the particular I^2t load capability, refer to Chapter 3, General information on AC servomotors AL S.

Table 1-3 Resistor braking for 1FK6 shaft heights 36 to 100

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]
1FK6032–6AK71	0 6.6	1.6 1.8	2.3	6.1 5.6
1FK6040–6AK71	0 3.8	2.0 2.5	3.1	9.6 8.8
1FK6042–6AF71	0 2.7	8.0 5.2	6.5	9.9 9.3
1FK6060–6AF71	0 3.6	6.5 8.0	9.9	12.7 11.6
1FK6063–6AF71	0 2.2	10.8 15.9	19.8	26.0 23.3
1FK6080–6AF71	0 3.4	7.1 10.4	12.9	16.7 15.1
1FK6083–6AF71	0 2.3	11.8 21.2	26.0	31.0 28.0
1FK6100–8AF71	0 1.8	14.1 25.0	31.0	38.0 35.0
1FK6101–8AF71	0 1.3	18.7 38.0	47.0	56.0 50.0
1FK6103–8AF71	0 1.0	23.3 52.0	65.0	77.0 69.0
1FK6043–7AH71	0 9.4	0.7 1.7	2.1 2.1	5.5 4.9
1FK6044–7AF71	0 7.9	1.0 2.0	2.5 2.5	5.2 4.7
1FK6044–7AH71	0 7.0	0.8 2.0	2.4 2.4	7.0 6.3
1FK6061–7AF71	0 8.7	0.9 3.0	3.7 3.7	6.4 5.8
1FK6061–7AH71	0 6.4	0.7 3.1	3.8 3.8	9.4 8.4
1FK6064–7AF71	0 4.7	1.6 5.6	7.0 7.0	12.0 10.8

Holding brake

Function description, refer to Chapter 2.2, General information on AC servomotors AL S.

Table 1-4 Technical data of the holding brakes used with 1FK6 motors

Motor type	Brake type	Holding torque M_4 [Nm]		Dyn. torque M_{1m} [Nm]	DC cur-rent	Power drain	Ope-ning time	Closing time	Moment of inertia, brake	Highest swit-ching power 1)2)
		20 °C	120 °C	120 °C	[A]	[W]	[ms]	[ms]	[10^{-4} kgm^2]	[J]
1FK6032	EBD 0.13BS	1.5	1.1	0.8	0.4	9.5	30	10	0.08	13
1FK604□	EBD 0.3B	3.9	3.2	2.1	0.6	13.5	35	10	0.2	68
1FK606□	EBD 0.8B	12	10	7	0.7	15.6	55	15	0.6	318
1FK608□	EBD 1.4BV	22	18	8	0.9	21	150	30	2.6	535
1FK6100	EBD 2 BY	28	20	12	0.9	22.3	100	30	8.6	1135
1FK6101 1FK6103	EBD 3.8B	50	36	17	0.9	22.3	180	25	10.3	1233

1) per emergency stop with n = 3000/min.
2) $\omega = 1/2 \cdot J_{tot} \cdot \omega^2$; J_{tot} [kgm^2]; ω [1/s]; ω [W];

Basic braking characteristics

Refer to Chapter 2, General information on AC servomotors AL S.

M_{1m}	[Nm]	=	Average dynamic torque defined by the slip time t_3
M_4	[Nm]	=	Torque which is transmitted, taking into account the max. solenoid temperature, friction value fluctuations and production tolerances.

Forced ventilation

Not available

Connector outlet direction

The customer can rotate the connector (refer to the dimension drawing)

1FK6

Gearboxes

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

Table 1-5 Technical data of the planetary gearboxes used for 1FK6 motors

Servo-motor non–ventilated Type	**Planetary gearbox** 1 stage play ≤12 arcmin Type	Gearbox weight approx.	**Available gearbox ratios**		Max. permissible input speed 1)	Max. permissible output torque 1)		Max. permissible drive–out shaft load 2)	Moment of inertia, gearbox
		[kg]	**i = 5**	**i = 10**	n_{G1} [RPM]	M_{G2} **for i = 5** [Nm]	M_{G2} **for i = 10** [Nm]	F_r [N]	J_G **for 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			X						
1FK6101 1FK6103			X X						
Code Gearbox shaft <u>with</u> key			**V40**	**V42**					

Continuous duty S1:

Continuous duty is permissible at the rated speed and rated torque. A gearbox temperature of 90 °C may not be exceeded.

Table 1-6 Continuous duty S1

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

The gearboxes are suitable for every mounting position.
The gearbox degree of protection is IP 64.
Gearboxes without key are not available.

1) Values for positioning operation S5
2) Referred to the center of the drive–out shaft, at 100 RPM

Technical data, dimensions (in mm)

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

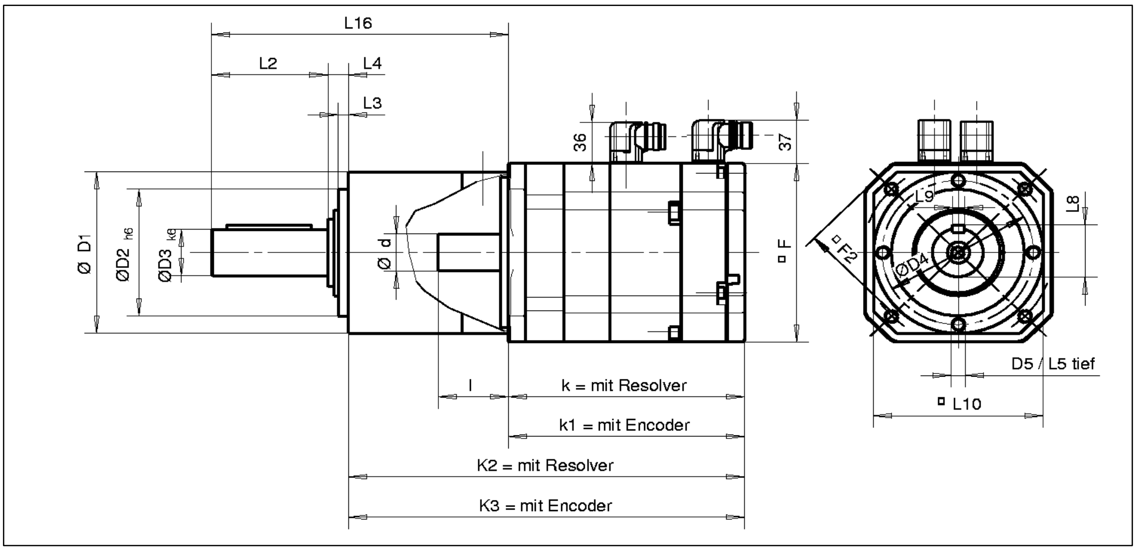


Fig. 1-1 DImensions, 1FK6 motors (shaft heights 36–80) with planetary gearboxes (alpha Company, LP series)

1FK6

Table 1-7 Dimensions, 1FK6 motors (shaft heights 36–80) with planetary gearbox

Servomotor, standard version						**Planetary gearbox** 1 stage															
Type	Dimensions					Type	Dim.														
	k	k1	l	∅d	F		∅D1	∅D2	∅D3	∅D4	D5	L16	L2	L3	L4	L5	L8	L9	L10	K2	K3
1FK6032	179	—	30	14	72	LP070–M01	70	52	16	62	M5	126	28	5	8	10	18	5	70	269	—
1FK6040 1FK6042	160 192	204 238	40	19	96	LP090–M01	90	68	22	80	M6	158	36	5	10	12	24.5	6	90	272 304	316 348
1FK6060 1FK6063	200 250	238 288	50	24	126	LP120–M01	120	90	32	108	M8	210	58	6	12	16	35	10	120	340 390	378 428
1FK6080 1FK6083	195 233	242 280	58	32	155	LP155–M01	155	120	40	140	M10	265	82	8	15	20	43	12	150	363 401	410 448

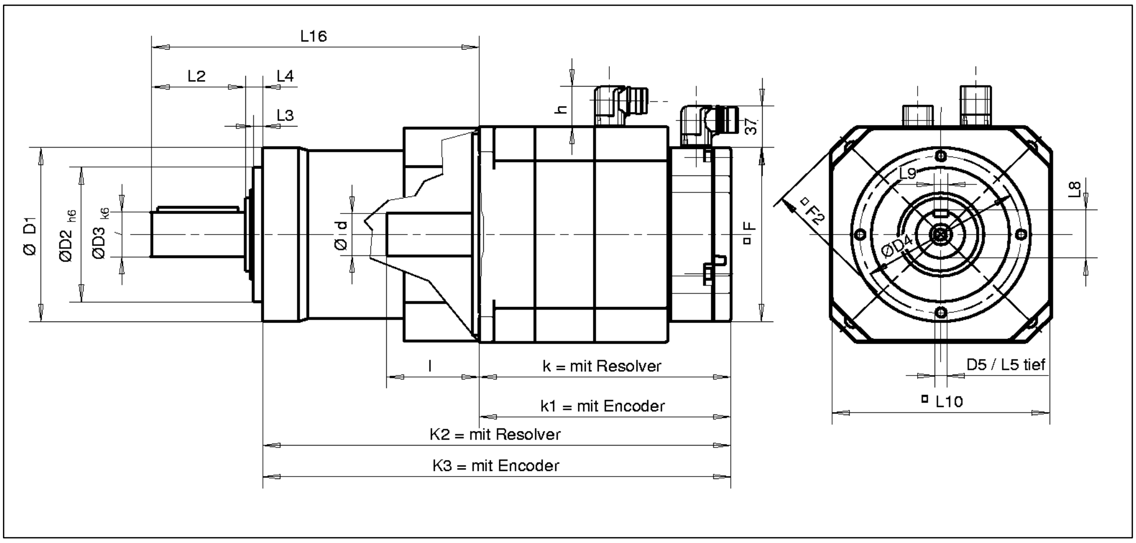


Fig. 1-2 Dimensions, 1FK6 motor (shaft height 100) with planetary gearbox (alpha Company, LP series)

Table 1-8 Dimensions, 1FK6 motors (shaft height 100) with planetary gearbox

Servomotor, standard version						**Planetary gearbox** 1–stage															
Type	Dimensions					Type	Dim.														
	k	k1	l	∅d	h		∅D1	∅D2	∅D3	∅D4	D5	L16	L2	L3	L4	L5	L8	L9	L10	K2	K3
1FK6100	218	265	80	38	36	LP155–M01	155	120	40	140	M10	265	92	8	15	20	43	19	132	386	433
1FK6101 1FK6103	244 270	291 317	80 80	38 38	54 54															412 438	459 485

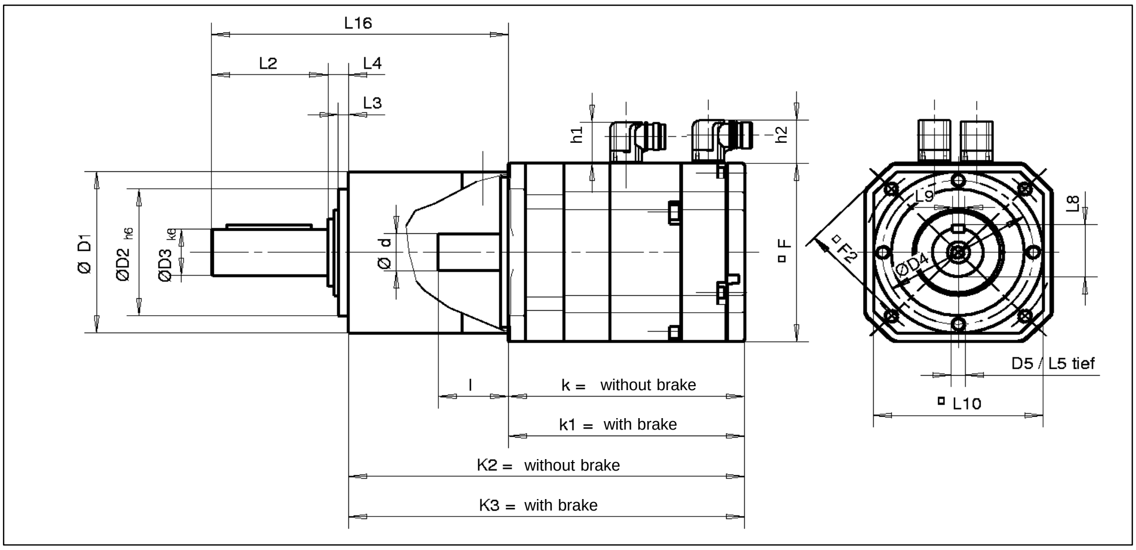


Fig. 1-3 Dimensions, 1FK6 motor, High Dynamic with planetary gearbox, (alpha Company, LP series)

1FK6

Table 1-9 Dimensions, 1FK6 motors, High Dynamic

Servomotor **High Dynamic version**										
Type	Dimensions									
	k with resolver	k with encoder	k with resolver	k with encoder	l	∅d	☐F	☐F2	h1	h2
1FK6043 1FK6044	203 228	248 273	226 251	271 296	40	19	96	120	42	42
1FK6061 1FK6064	196 260	234 298	214 278	252 316	50	24	126	155	42	42

Table 1-10 Dimensions, 1FK6 planetary gearboxes

Planetary gearbox 1 stage																	
Type	Dimensions																
	∅D1	∅D2	∅D3	∅D4	D5	L16	L2	L3	L4	L5	L8	L9	L10	K2 with re- solver	K2 with en- coder	K3 with re- solver	K3 with en- coder
LP090–M01	90	68	22	80	M6	158	36	5	10	12	25	6	90	315 340	360 385	338 363	383 408
LP120–M01	120	90	32	108	M8	210	58	6	12	16	35	10	120	336 400	374 438	354 418	392 456

1.3 Interfaces

Circuit diagrams

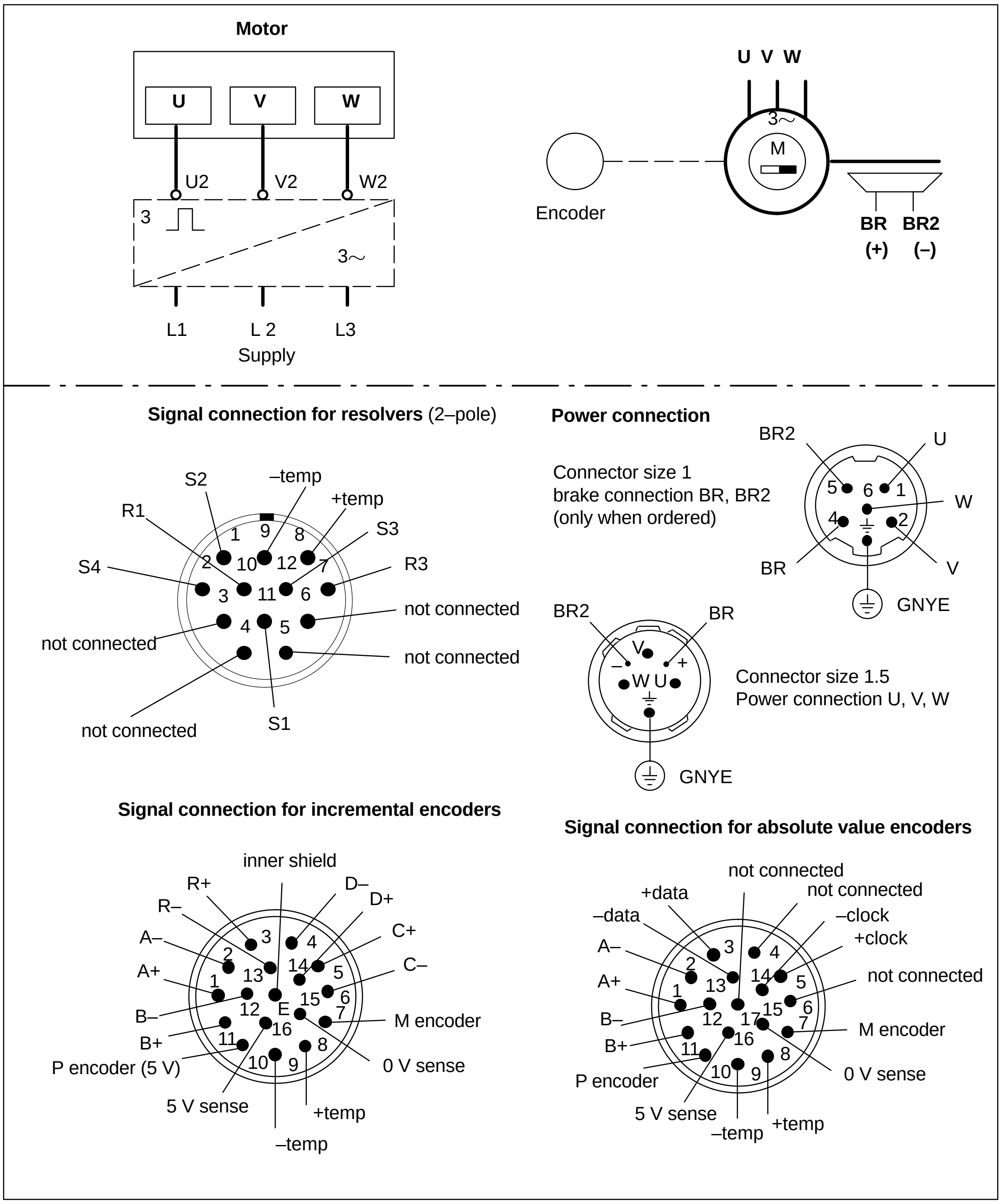


Fig. 1-4 Connector assignment: Power, brake, encoder

Connector can be rotated

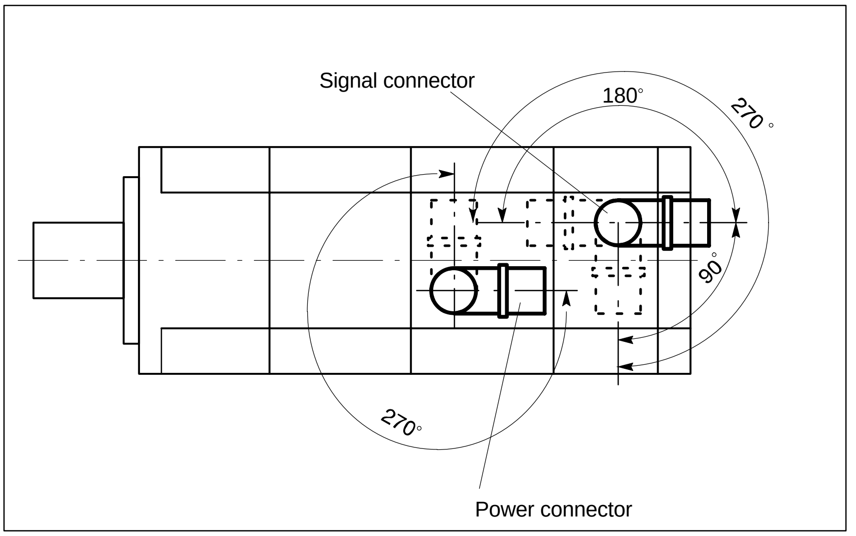


Fig. 1-5 Connector can be rotated

1FK6

- **Rotation direction:**
  - When supplied, power and signal connectors, NDE
  - Power connector: 270° in the clockwise sense
  - Signal connector: Shaft heights 36 80: 180° counter–clockwise
    90° clockwise
    Shaft height 100: 90° counter–clockwise
    90° clockwise

Note

- The permissible range of rotation may not be exceeded.
- A maximum of 5 rotations are permissible in order to ensure that the degree of protection is maintained
- Max. rotating torques may not be exceeded.
- Connecting cables must be secured against stressing and bending
- The motor connectors must be secured so that they cannot rotate after they have been set to the correct position.
- It is not permissible that the connectors are subject to permanent forces

---

- **Rotating torques:**
  - Power connector: Size 1: M_{max} = 8 Nm
    Size 1.5: M_{max} = 15 Nm
  - Signal connector: M_{max} = 8 Nm

  The connector should be rotated by attaching a mating connector onto the connector thread.

1.4 Thermal motor protection

Refer to Section GE, Chapter 1

1.5 Encoders

Optical incremental encoder

Incremental encoder 1 Vpp

Description, refer to Section GE, Chapter 1

Optical multi–turn absolute value encoder

Absolute value encoder
Description, refer to Section GE, Chapter 1

Inductive basic absolute encoder

Inductive encoder system
Description, refer to Section GE, Chapter 1

Resolver (2 pole)

Inductive encoder system
Description, refer to Section GE, Chapter 1

Resolver (multi–pole)

Inductive encoder system
Description, refer to Section GE, Chapter 1

■

Order Designations 2

Order designation

1 F K 6 . . . – . A . 7 1 – 1 . . .

Electric motor

Synchronous motor

AC servomotor

Series

Frame size

Length

Pole No.
7 = High Dynamic (HD)

Non–ventilated

Rated speed
F = 3000 RPM
H= 4500 RPM
K = 6000 RPM

Encoder system

A	Incremental encoder, 1 Vpp		1)
E	Absolute value encoder		1)
G	Basic absolute value encoder		1)
T	Resolver	2–pole	
S	Resolver	Multi–pole	2)

	Shaft end1)	Radial eccentricity	Holding brake
A =	with keyway	N	without
B =	with keyway	N	with
G =	without keyway	N	without
H =	without keyway	N	with

	Degree of protection
0 =	IP 64
2 =	IP 65 and additional DE flange IP67

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

■

1FK6

Notes

Technical Data and Characteristics 3

3.1 Speed–torque diagrams

Note

- For drive converter operation on 480 V line supplies, DC link voltages of > 600 V are obtained.
- Motors, shaft heights 36, 48, 63 and 80 may only be utilized according to ΔT = 60 K. Shaft heights 100 and 132 can still be utilized according to ΔT = 100 K.
- The shift of the voltage limiting characteristics is described in chapter AL_S 1.1.
- The specified thermal S3 limit characteristics are referred to ΔT = 100K.
- The voltage limiting characteristic for DC link = 600 V can only be used in conjunction with the ’L(I)_Adaption’ drive function. This is integrated into the following systemst:
  SIMODRIVE 611 digital from drive firmware 4.4.01
  SIMODRIVE 611 universal from drive firmware 3.3.2

Table 3-1 Standard motor 1FK6032

1FK6032				
Technical data	**Code**	**Units**	**–6AK7**	
Engineering data				
Rated speed	n_{rated}	RPM	6000	
Rated torque	$M_{rated\ (100\ K)}$	Nm	0.8	
Rated current	I_{rated}	A	1.5	
Stall torque	$M_{0\ (60\ K)}$	Nm	0.9	
Stall torque	$M_{0\ (100\ K)}$	Nm	1.1	
Stall current	$I_{0\ (60\ K)}$	A	1.4	
Stall current	$I_{0\ (100\ K)}$	A	1.7	
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	0.71	
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	0.63	
Limit data				
Max. speed	n_{max}	RPM	10600	
Max. torque	M_{max}	Nm	4.5	
Peak current	I_{max}	A	7.3	
Limiting torque	M_{limit}	Nm	4.2	
Limiting current	I_{limit}	A	6.7	
Physical constants				
Torque constant	k_T	Nm/A	0.67	
Voltage constant	k_E	V/1000 RPM	44	
Winding resistance	R_{ph}	Ohm	5.7	
Three–phase inductance	L_D	mH	13	
Electrical time constant	T_{el}	ms	2.3	
Mechanical time constant	T_{mech}	ms	2.4	
Thermal time constant	T_{th}	min	25	
Thermal resistance	R_{th}	W/K	0.1	
Weight with brake	m	kg	3.04	
Weight without brake	m	kg	2.9	

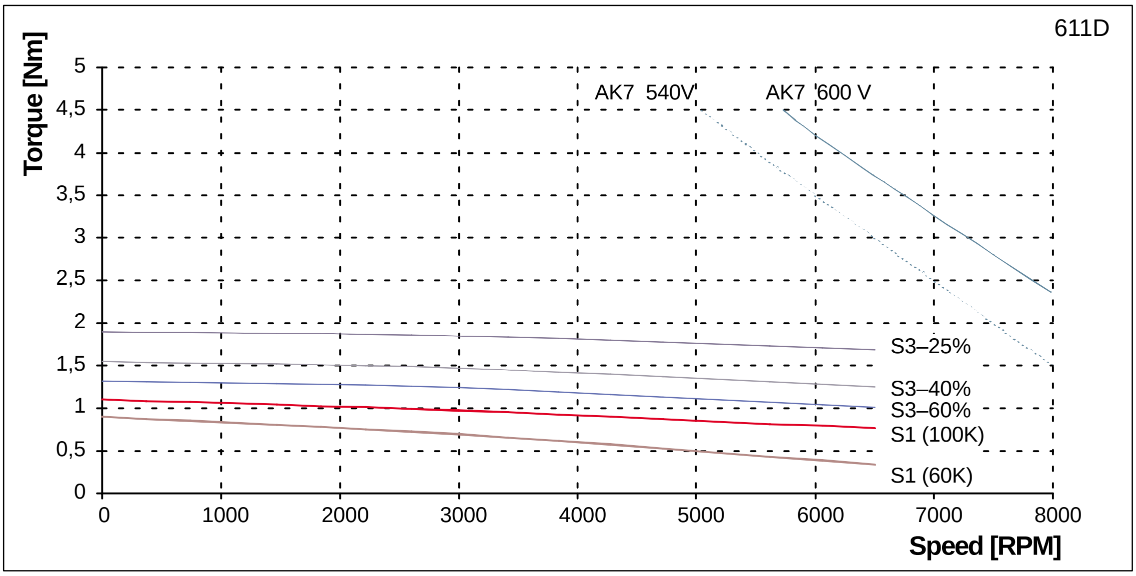


Fig. 3-1 Speed–torque diagram 1FK6032

Table 3-2 Standard motor 1FK6040

1FK6040				
Technical data	**Code**	**Units**	**–6AK7**	
Engineering data				
Rated speed	n_{rated}	RPM	6000	
Rated torque	$M_{rated\ (100\ K)}$	Nm	0.8	
Rated current	I_{rated}	A	1.75	
Stall torque	$M_{0\ (60\ K)}$	Nm	1.3	
Stall torque	$M_{0\ (100\ K)}$	Nm	1.6	
Stall current	$I_{0\ (60\ K)}$	A	2.2	
Stall current	$I_{0\ (100\ K)}$	A	2.8	
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	2.08	
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	1.87	
Limit data				
Max. speed	n_{max}	RPM	8500	
Max. torque	M_{max}	Nm	5.1	
Peak current	I_{max}	A	9.0	
Limiting torque	M_{limit}	Nm	4.9	
Limiting current	I_{limit}	A	8.8	
Physical constants				
Torque constant	k_T	Nm/A	0.57	
Voltage constant	k_E	V/1000 RPM	37.5	
Winding resistance	R_{ph}	Ohm	2.75	
Three–phase inductance	L_D	mH	7.0	
Electrical time constant	T_{el}	ms	2.5	
Mechanical time constant	T_{mech}	ms	4.7	
Thermal time constant	T_{th}	min	25	
Thermal resistance	R_{th}	W/K	0.3	
Weight with brake	m	kg	4.1	
Weight without brake	m	kg	3.7	

1FK6

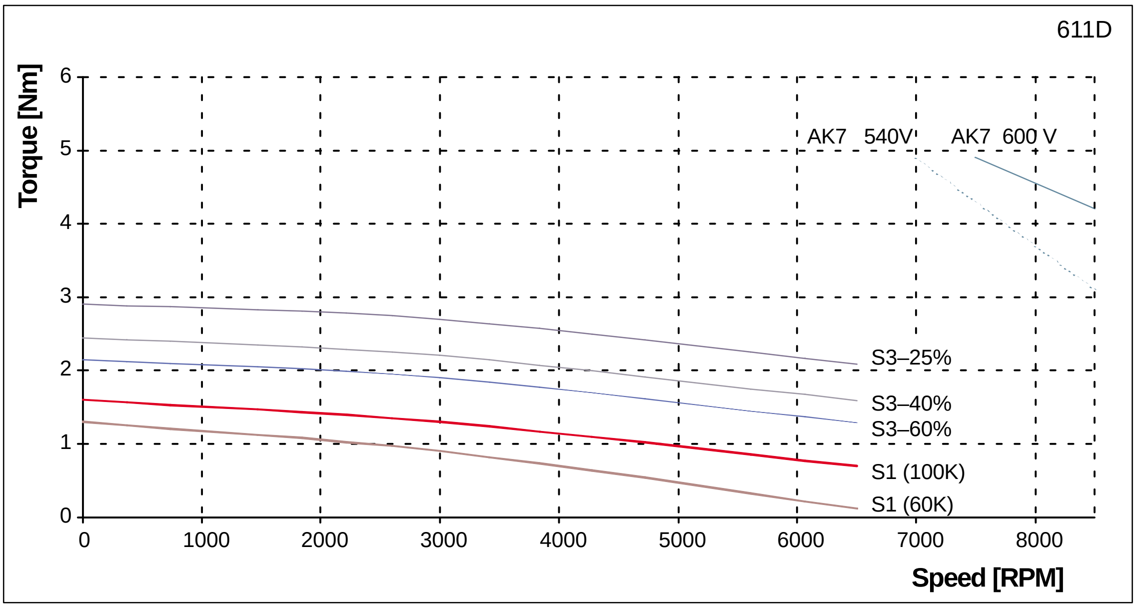


Fig. 3-2 Speed–torque diagram 1FK6040

Table 3-3 Standard motor 1FK6042

1FK6042				
Technical data	**Code**	**Units**	**–6AF7**	
Engineering data				
Rated speed	n_{rated}	RPM	3000	
Rated torque	$M_{rated\ (100\ K)}$	Nm	2.6	
Rated current	I_{rated}	A	2.4	
Stall torque	$M_{0\ (60\ K)}$	Nm	2.65	
Stall torque	$M_{0\ (100\ K)}$	Nm	3.2	
Stall current	$I_{0\ (60\ K)}$	A	2.2	
Stall current	$I_{0\ (100\ K)}$	A	2.8	
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	3.68	
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	3.47	
Limit data				
Max. speed	n_{max}	RPM	6200	
Max. torque	M_{max}	Nm	10.6	
Peak current	I_{max}	A	9.5	
Limiting torque	M_{limit}	Nm	10.3	
Limiting current	I_{limit}	A	9.5	
Physical constants				
Torque constant	k_T	Nm/A	1.15	
Voltage constant	k_E	V/1000 RPM	76	
Winding resistance	R_{ph}	Ohm	3.65	
Three–phase inductance	L_D	mH	13.5	
Electrical time constant	T_{el}	ms	3.7	
Mechanical time constant	T_{mech}	ms	2.9	
Thermal time constant	T_{th}	min	35	
Thermal resistance	R_{th}	W/K	0.2	
Weight with brake	m	kg	5.4	
Weight without brake	m	kg	5	

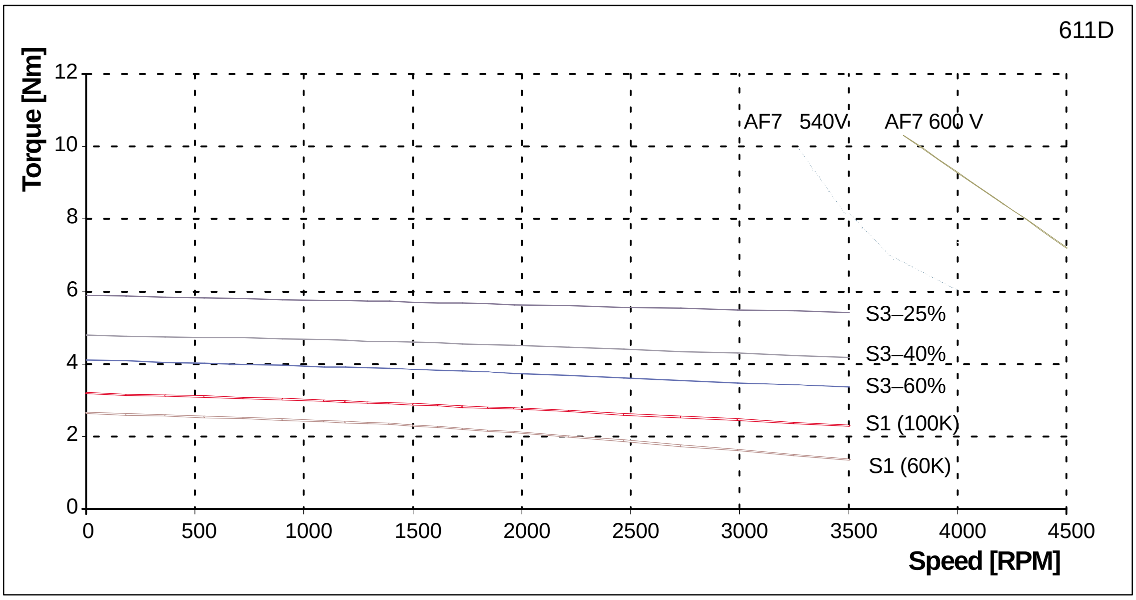


Fig. 3-3 Speed–torque diagram 1FK6042

Table 3-4 Standard motor 1FK6060

1FK6060				
Technical data	**Code**	**Units**	**–6AF7**	
Engineering data				
Rated speed	n_{rated}	RPM	3000	
Rated torque	$M_{rated\ (100\ K)}$	Nm	4.0	
Rated current	I_{rated}	A	3.1	
Stall torque	$M_{0\ (60\ K)}$	Nm	5.0	
Stall torque	$M_{0\ (100\ K)}$	Nm	6.0	
Stall current	$I_{0\ (60\ K)}$	A	3.5	
Stall current	$I_{0\ (100\ K)}$	A	4.3	
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	9.2	
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	8.6	
Limit data				
Max. speed	n_{max}	RPM	5300	
Max. torque	M_{max}	Nm	17.7	
Peak current	I_{max}	A	14	
Limiting torque	M_{limit}	Nm	16.8	
Limiting current	I_{limit}	A	13.5	
Physical constants				
Torque constant	k_T	Nm/A	1.39	
Voltage constant	k_E	V/1000 RPM	92	
Winding resistance	R_{ph}	Ohm	2.5	
Three–phase inductance	L_D	mH	13.0	
Electrical time constant	T_{el}	ms	5.2	
Mechanical time constant	T_{mech}	ms	3.3	
Thermal time constant	T_{th}	min	30	
Thermal resistance	R_{th}	W/K	0.2	
Weight with brake	m	kg	9.6	
Weight without brake	m	kg	9	

1FK6

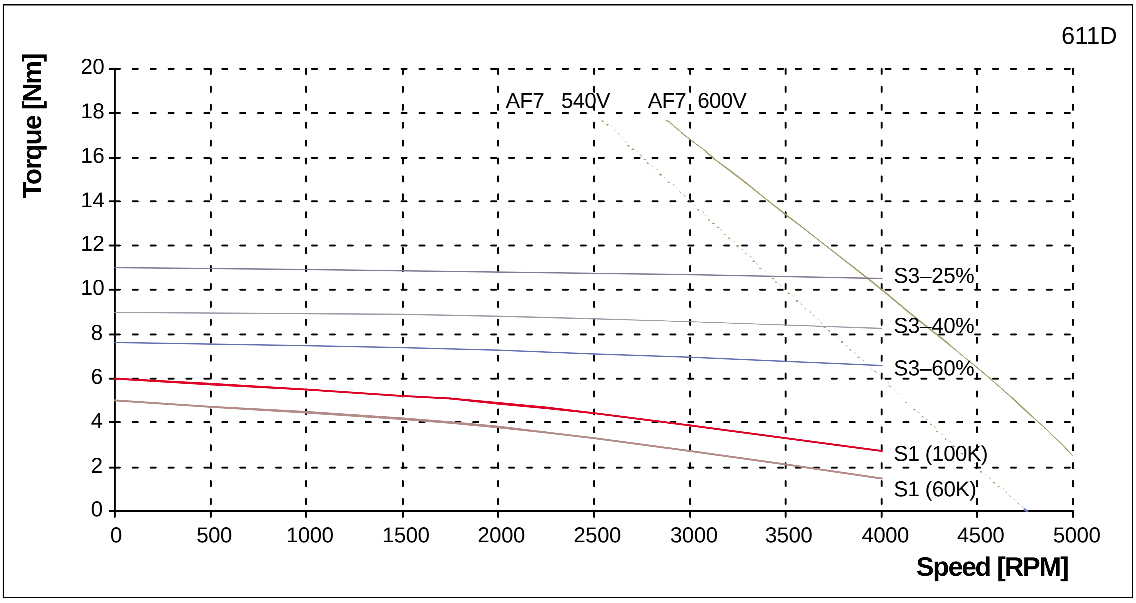


Fig. 3-4 Speed–torque diagram 1FK6060

Table 3-5 Standard motor 1FK6063

1FK6063				
Technical data	**Code**	**Units**	**–6AF7**	
Engineering data				
Rated speed	n_{rated}	RPM	3000	
Rated torque	$M_{rated\ (100\ K)}$	Nm	6.0	
Rated current	I_{rated}	A	4.7	
Stall torque	$M_{0\ (60\ K)}$	Nm	9.1	
Stall torque	$M_{0\ (100\ K)}$	Nm	11.0	
Stall current	$I_{0\ (60\ K)}$	A	6.3	
Stall current	$I_{0\ (100\ K)}$	A	7.9	
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	16.7	
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	16.1	
Limit data				
Max. speed	n_{max}	RPM	5300	
Max. torque	M_{max}	Nm	36	
Peak current	I_{max}	A	28	
Limiting torque	M_{limit}	Nm	35	
Limiting current	I_{limit}	A	28	
Physical constants				
Torque constant	k_T	Nm/A	1.39	
Voltage constant	k_E	V/1000 RPM	92	
Winding resistance	R_{ph}	Ohm	0.83	
Three–phase inductance	L_D	mH	6.5	
Electrical time constant	T_{el}	ms	7.8	
Mechanical time constant	T_{mech}	ms	2.1	
Thermal time constant	T_{th}	min	35	
Thermal resistance	R_{th}	W/K	0.15	
Weight with brake	m	kg	13.8	
Weight without brake	m	kg	13.2	

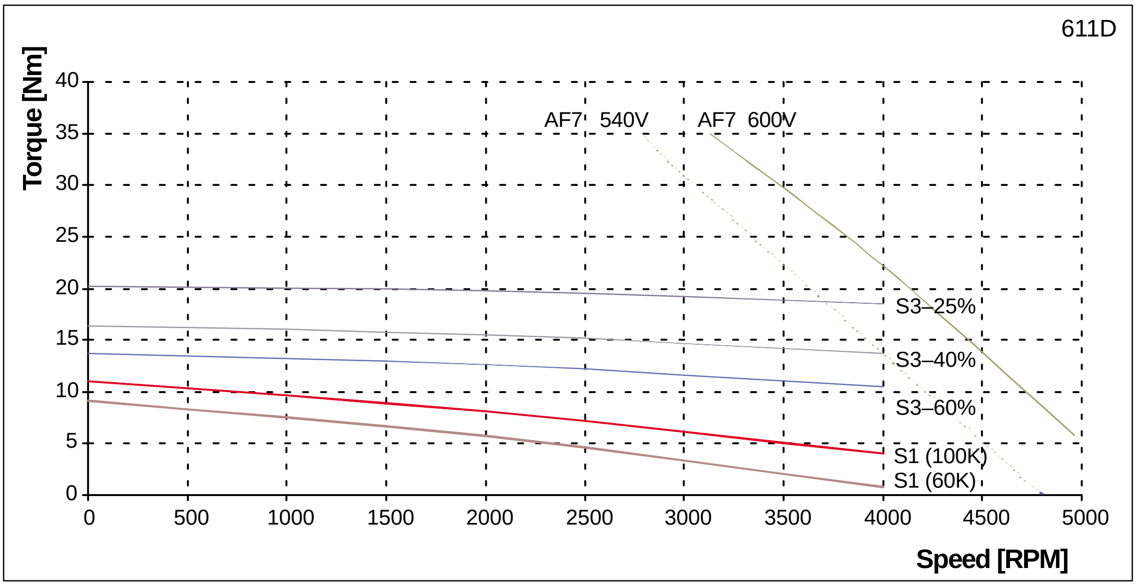


Fig. 3-5 Speed–torque diagram 1FK6063

Table 3-6 Standard motor 1FK6080

1FK6080				
Technical data	**Code**	**Units**	**–6AF7**	
Engineering data				
Rated speed	n_{rated}	RPM	3000	
Rated torque	$M_{rated\ (100\ K)}$	Nm	6.8	
Rated current	I_{rated}	A	5.2	
Stall torque	$M_{0\ (60\ K)}$	Nm	6.6	
Stall torque	$M_{0\ (100\ K)}$	Nm	8.0	
Stall current	$I_{0\ (60\ K)}$	A	4.6	
Stall current	$I_{0\ (100\ K)}$	A	5.8	
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	18.7	
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	16.1	
Limit data				
Max. speed	n_{max}	RPM	4800	
Max. torque	M_{max}	Nm	25	
Peak current	I_{max}	A	19	
Limiting torque	M_{limit}	Nm	23	
Limiting current	I_{limit}	A	18	
Physical constants				
Torque constant	k_T	Nm/A	1.39	
Voltage constant	k_E	V/1000 RPM	92	
Winding resistance	R_{ph}	Ohm	1.3	
Three–phase inductance	L_D	mH	10	
Electrical time constant	T_{el}	ms	7.7	
Mechanical time constant	T_{mech}	ms	3.2	
Thermal time constant	T_{th}	min	30	
Thermal resistance	R_{th}	W/K	0.2	
Weight with brake	m	kg	13.7	
Weight without brake	m	kg	12.5	

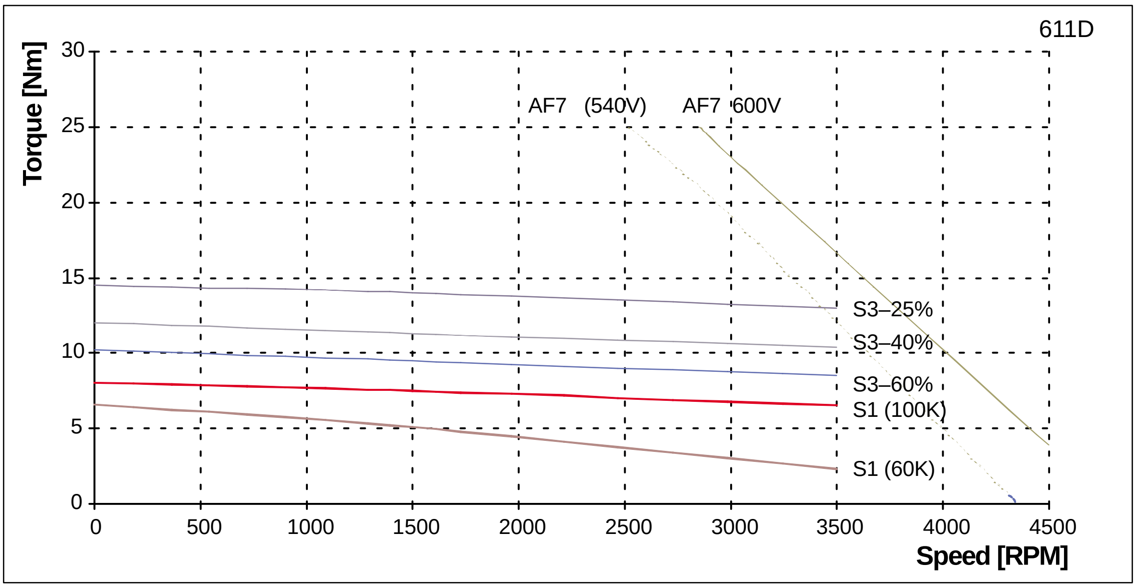


Fig. 3-6 Speed–torque diagram 1FK6080

1FK6

Table 3-7 Standard motor 1FK6083

1FK6083				
Technical data	**Code**	**Units**	**–6AF7**	
Engineering data				
Rated speed Rated torque Rated current Stall torque Stall torque Stall current Stall current Moment of inertia (with brake) Moment of inertia (without brake)	n_{rated} $M_{rated\ (100\ K)}$ I_{rated} $M_{0\ (60\ K)}$ $M_{0\ (100\ K)}$ $I_{0\ (60\ K)}$ $I_{0\ (100\ K)}$ J_{mot} J_{mot}	RPM Nm A Nm Nm A A 10^{-4} kgm^2 10^{-4} kgm^2	3000 10.5 7.7 13.3 16 8.3 10.4 29.7 27.1	
Limit data				
Max. speed Max. torque Peak current Limiting torque Limiting current	n_{max} M_{max} I_{max} M_{limit} I_{limit}	RPM Nm A Nm A	4400 50 36 42 29	
Physical constants				
Torque constant Voltage constant Winding resistance Three–phase inductance Electrical time constant Mechanical time constant Thermal time constant Thermal resistance Weight with brake Weight without brake	k_T k_E R_{ph} L_D T_{el} T_{mech} T_{th} R_{th} m m	Nm/A V/1000 RPM Ohm mH ms ms min W/K kg kg	1.54 102 0.54 6.0 11.1 1.8 35 0.15 18.2 17	

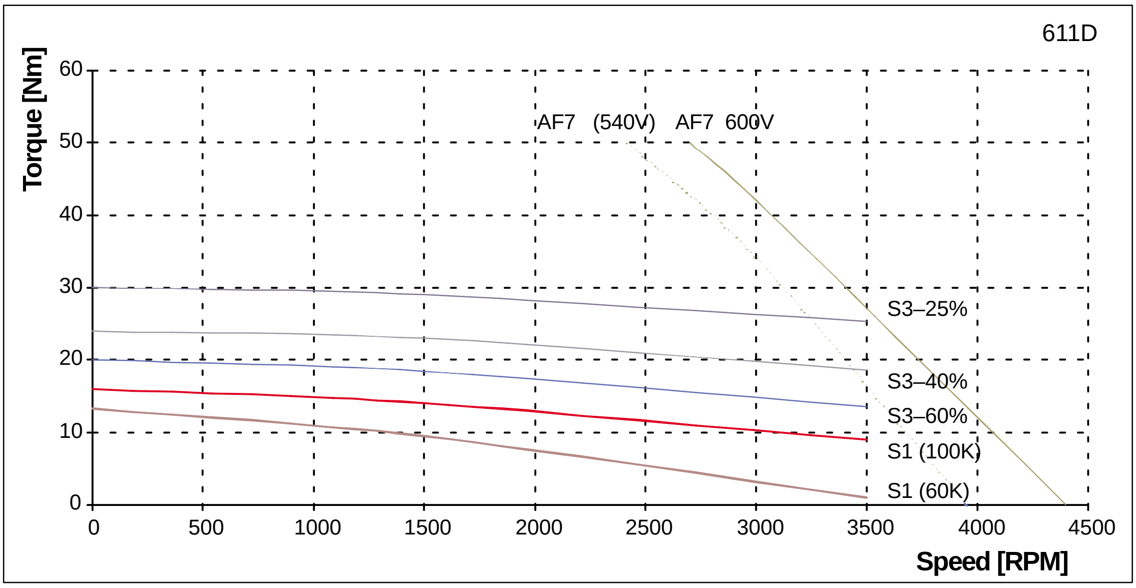


Fig. 3-7 Speed–torque diagram 1FK6083

Table 3-8 Standard motor 1FK6100

1FK6100				
Technical data	**Code**	**Units**	**–8AF7**	
Engineering data				
Rated speed	n_{rated}	RPM	3000	
Rated torque	$M_{rated\ (100\ K)}$	Nm	12.0	
Rated current	I_{rated}	A	8.4	
Stall torque	$M_{0\ (60\ K)}$	Nm	15	
Stall torque	$M_{0\ (100\ K)}$	Nm	18	
Stall current	$I_{0\ (60\ K)}$	A	9.8	
Stall current	$I_{0\ (100\ K)}$	A	12.2	
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	67.5	
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	57.2	
Limit data				
Max. speed	n_{max}	RPM	4300	
Max. torque	M_{max}	Nm	55	
Peak current	I_{max}	A	42	
Limiting torque	M_{limit}	Nm	53	
Limiting current	I_{limit}	A	41	
Physical constants				
Torque constant	k_T	Nm/A	1.48	
Voltage constant	k_E	V/1000 RPM	98	
Winding resistance	R_{ph}	Ohm	0.42	
Three–phase inductance	L_D	mH	3.5	
Electrical time constant	T_{el}	ms	8.3	
Mechanical time constant	T_{mech}	ms	3.3	
Thermal time constant	T_{th}	min	35	
Thermal resistance	R_{th}	W/K	0.12	
Weight with brake	m	kg	22.5	
Weight without brake	m	kg	21	

1FK6

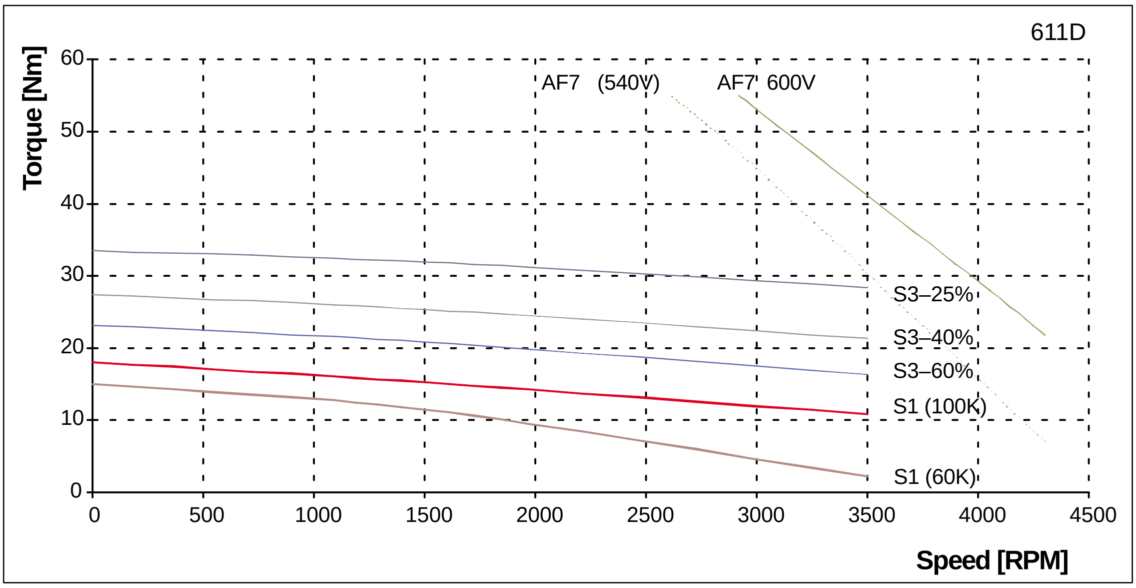


Fig. 3-8 Speed–torque diagram 1FK6100

Table 3-9 Standard motor 1FK6101

1FK6101				
Technical data	**Code**	**Units**	**–8AF7**	
Engineering data				
Rated speed	n_{rated}	RPM	3000	
Rated torque	$M_{rated\ (100\ K)}$	Nm	15.5	
Rated current	I_{rated}	A	10.8	
Stall torque	$M_{0\ (60\ K)}$	Nm	22.4	
Stall torque	$M_{0\ (100\ K)}$	Nm	27.0	
Stall current	$I_{0\ (60\ K)}$	A	14.0	
Stall current	$I_{0\ (100\ K)}$	A	17.5	
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	99.8	
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	89.5	
Limit data				
Max. speed	n_{max}	RPM	4300	
Max. torque	M_{max}	Nm	80	
Peak current	I_{max}	A	58	
Limiting torque	M_{limit}	Nm	78	
Limiting current	I_{limit}	A	57	
Physical constants				
Torque constant	k_T	Nm/A	1.54	
Voltage constant	k_E	V/1000 RPM	102	
Winding resistance	R_{ph}	Ohm	0.24	
Three–phase inductance	L_D	mH	2.5	
Electrical time constant	T_{el}	ms	10.4	
Mechanical time constant	T_{mech}	ms	2.7	
Thermal time constant	T_{th}	min	40	
Thermal resistance	R_{th}	W/K	0.12	
Weight with brake	m	kg	28	
Weight without brake	m	kg	26	

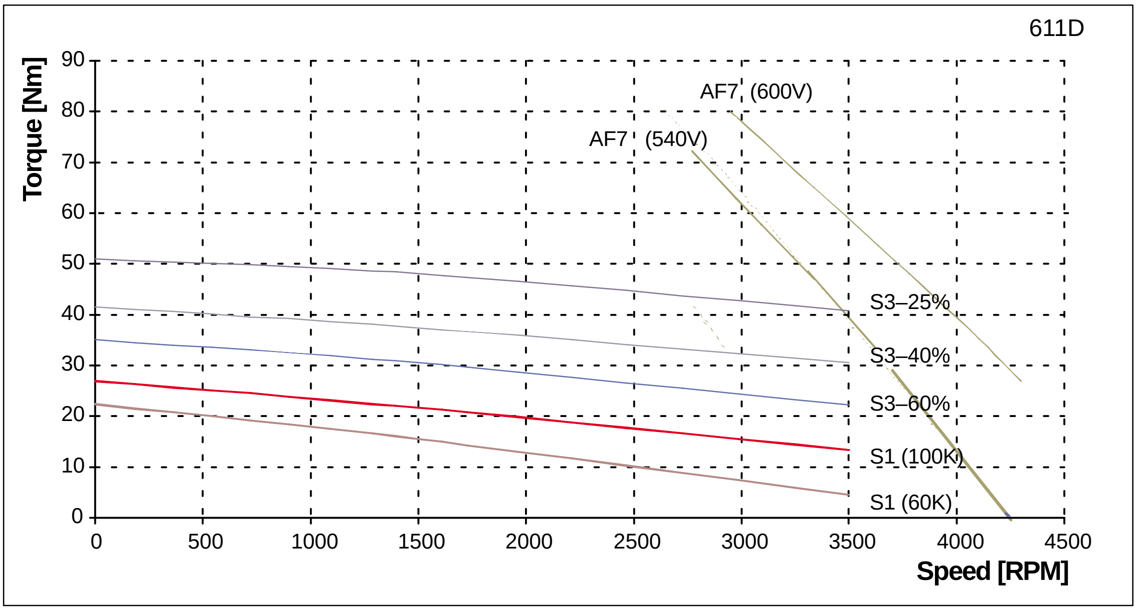


Fig. 3-9 Speed–torque diagram 1FK6101

Table 3-10 Standard motor 1FK6103

1FK6103				
Technical data	**Code**	**Units**	**–8AF7**	
Engineering data				
Rated speed	n_{rated}	RPM	3000	
Rated torque	$M_{rated\ (100\ K)}$	Nm	16.5	
Rated current	I_{rated}	A	11.8	
Stall torque	$M_{0\ (60\ K)}$	Nm	30	
Stall torque	$M_{0\ (100\ K)}$	Nm	36.0	
Stall current	$I_{0\ (60\ K)}$	A	18.9	
Stall current	$I_{0\ (100\ K)}$	A	23.5	
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	131.8	
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	121.5	
Limit data				
Max. speed	n_{max}	RPM	4300	
Max. torque	M_{max}	Nm	107	
Peak current	I_{max}	A	78	
Limiting torque (600 V)	M_{limit}	Nm	105	
Limiting current (600 V)	I_{limit}	A	78	
Physical constants				
Torque constant	k_T	Nm/A	1.53	
Voltage constant	k_E	V/1000 RPM	101	
Winding resistance	R_{ph}	Ohm	0.15	
Three–phase inductance	L_D	mH	1.8	
Electrical time constant	T_{el}	ms	12.0	
Mechanical time constant	T_{mech}	ms	2.3	
Thermal time constant	T_{th}	min	45	
Thermal resistance	R_{th}	W/K	0.07	
Weight with brake	m	kg	32	
Weight without brake	m	kg	30	

1FK6

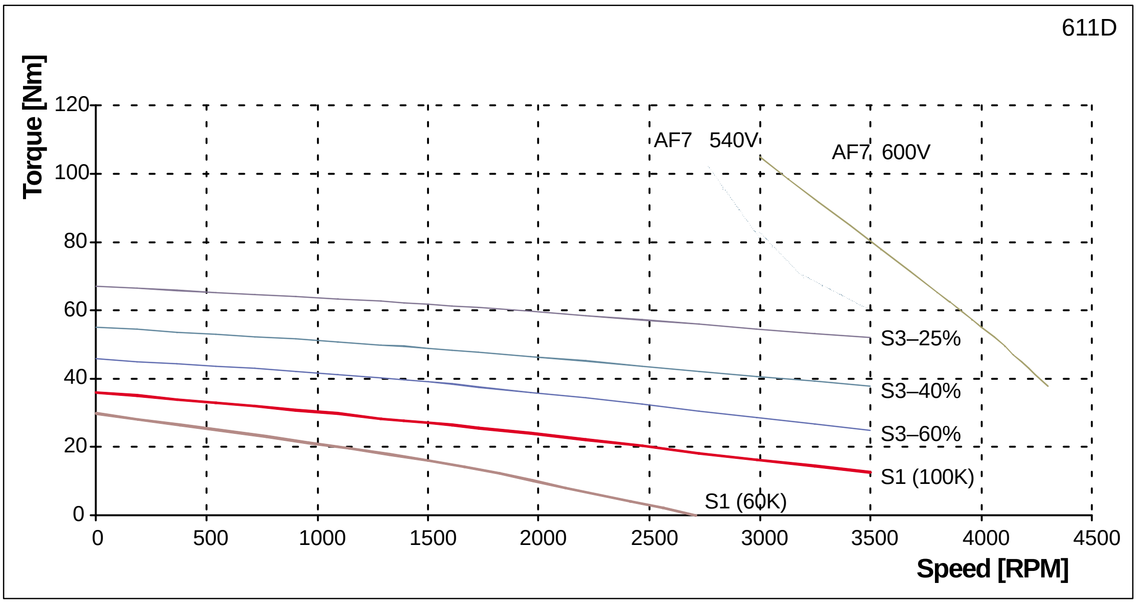


Fig. 3-10 Speed–torque diagram 1FK6103

Table 3-11 Standard motor 1FK6043 HD

1FK6043 HD				
Technical data	**Code**	**Units**	**–7AH7**	
Engineering data				
Rated speed	n_{rated}	RPM	4500	
Rated torque	$M_{rated\ (100\ K)}$	Nm	2.6	
Rated current	I_{rated}	A	4.0	
Stall torque	$M_{0\ (60\ K)}$	Nm	2.5	
Stall torque	$M_{0\ (100\ K)}$	Nm	3.1	
Stall current	$I_{0\ (60\ K)}$	A	3.6	
Stall current	$I_{0\ (100\ K)}$	A	4.5	
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	1.78	
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	1.01	
Limit data				
Max. speed	n_{max}	RPM	8000	
Max. torque	M_{max}	Nm	9.4	
Peak current	I_{max}	A	14.8	
Limiting torque (600 V)	M_{limit}	Nm	6.3	
Limiting current (600 V)	I_{limit}	A	8.4	
Physical constants				
Torque constant	k_T	Nm/A	0.68	
Voltage constant	k_E	V/1000 RPM	45	
Winding resistance	R_{ph}	Ohm	1.2	
Three–phase inductance	L_D	mH	15	
Electrical time constant	T_{el}	ms	12.5	
Mechanical time constant	T_{mech}	ms	1.2	
Thermal time constant	T_{th}	min	35	
Thermal resistance	R_{th}	W/K	0.16	
Weight with brake	m	kg	7.3	
Weight without brake	m	kg	6.7	

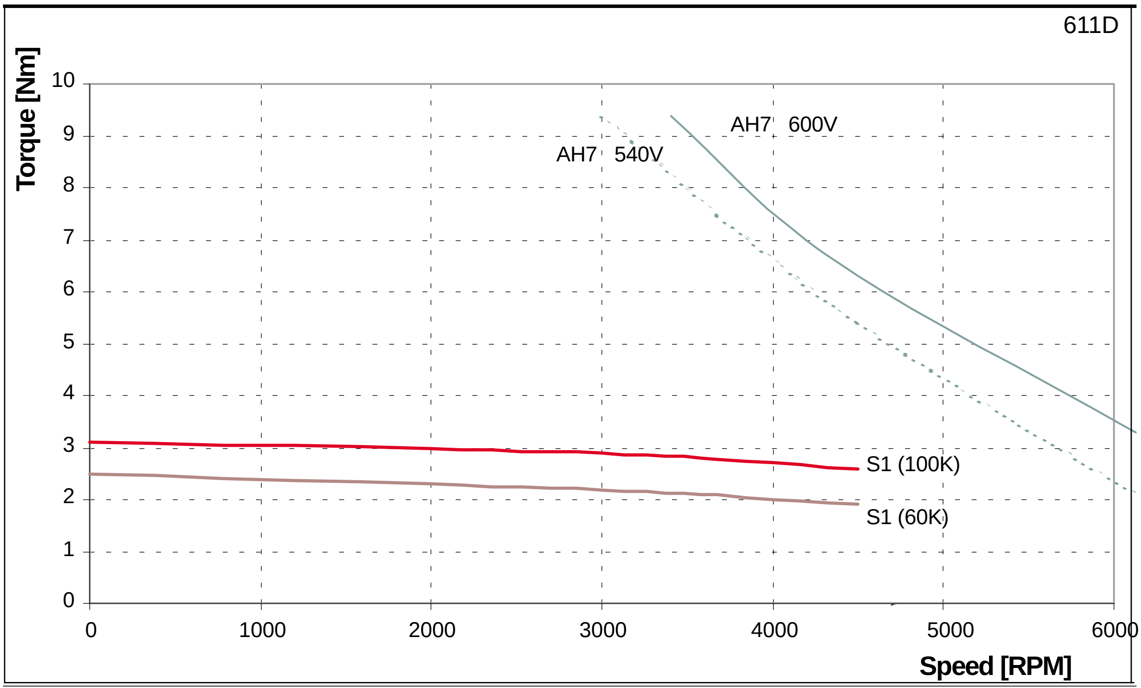


Fig. 3-11 Speed–torque diagram 1FK6043 HD

Table 3-12 Standard motor 1FK6044 HD

1FK6044 HD					
Technical data	**Code**	**Units**	**–7AF7**	**–7AH7**	
Engineering data					
Rated speed	n_{rated}	RPM	3500	4500	
Rated torque	$M_{rated\ (100\ K)}$	Nm	3.5	3.0	
Rated current	I_{rated}	A	4.0	4.9	
Stall torque	$M_{0\ (60\ K)}$	Nm	3	3	
Stall torque	$M_{0\ (100\ K)}$	Nm	4	4	
Stall current	$I_{0\ (60\ K)}$	A	3.4	4.6	
Stall current	$I_{0\ (100\ K)}$	A	4.5	6.3	
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	2.05	2.05	
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	1.28	1.28	
Limit data					
Max. speed	n_{max}	RPM	6500	8000	
Max. torque	M_{max}	Nm	12	12	
Peak current	I_{max}	A	14.8	20	
Limiting torque (600 V)	M_{limit}	Nm	9.5	8.0	
Limiting current (600 V)	I_{limit}	A	11.4	13	
Physical constants					
Torque constant	k_T	Nm/A	0.86	0.69	
Voltage constant	k_E	V/1000 RPM	57	42	
Winding resistance	R_{ph}	Ohm	1.5	0.81	
Three–phase inductance	L_D	mH	20	11	
Electrical time constant	T_{el}	ms	13.3	13.5	
Mechanical time constant	T_{mech}	ms	1.1	1.1	
Thermal time constant	T_{th}	min	4.5	45	
Thermal resistance	R_{th}	W/K	0.1	0.1	
Weight with brake	m	kg	8.6	8.6	
Weight without brake	m	kg	8	8	

1FK6

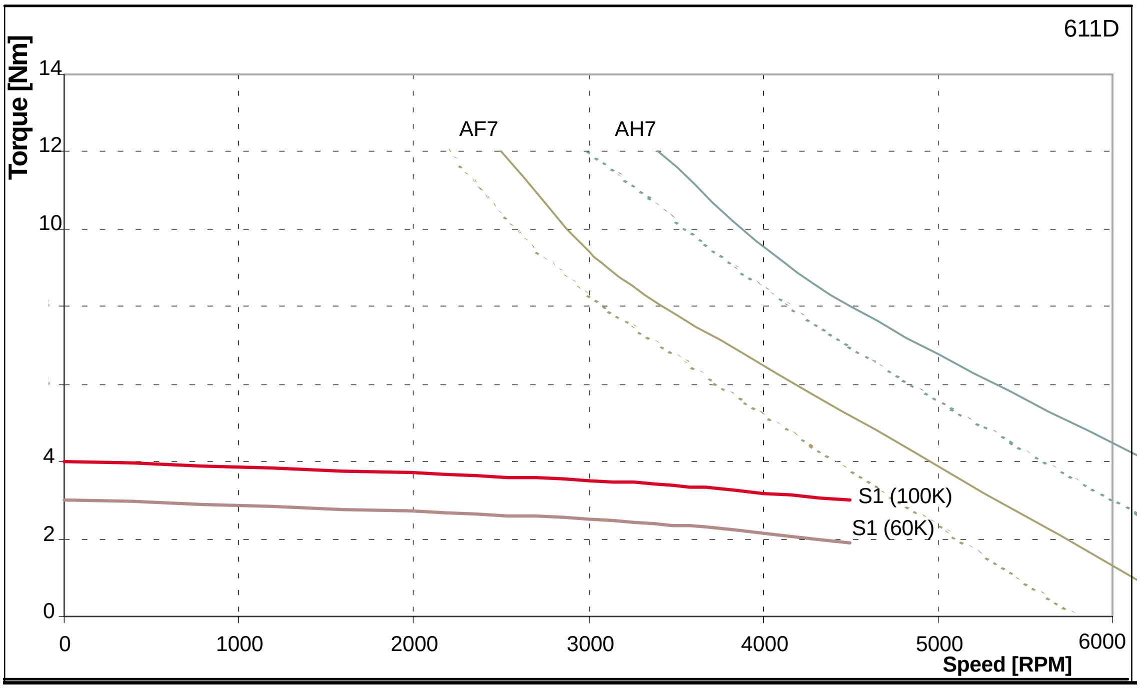


Fig. 3-12 Speed–torque diagram 1FK6044 HD

Table 3-13 Standard motor 1FK6061 HD

1FK6061 HD					
Technical data	**Code**	**Units**	**–7AF71**	**–7AH71**	
Engineering data					
Rated speed	n_{rated}	RPM	3000	4500	
Rated torque	$M_{rated\ (100\ K)}$	Nm	5.4	4.3	
Rated current	I_{rated}	A	5.3	5.9	
Stall torque	$M_{0\ (60\ K)}$	Nm	4.9	4.9	
Stall torque	$M_{0\ (100\ K)}$	Nm	6.4	6.4	
Stall current	$I_{0\ (60\ K)}$	A	4.8	7.0	
Stall current	$I_{0\ (100\ K)}$	A	6.1	8.0	
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	5.6	5.6	
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	3.4	34	
Limit data					
Max. speed	n_{max}	RPM	5500	8000	
Max. torque	M_{max}	Nm	17.9	17.3	
Peak current	I_{max}	A	17.5	25.3	
Limiting torque (600 V)	M_{limit}	Nm	12	11.5	
Limiting current (600 V)	I_{limit}	A	10.8	14.0	
Physical constants					
Torque constant	k_T	Nm/A	1.06	0.74	
Voltage constant	k_E	V/1000 RPM	7.0	49	
Winding resistance	R_{ph}	Ohm	0.74	0.36	
Three–phase inductance	L_D	mH	20	9.6	
Electrical time constant	T_{el}	ms	27	27	
Mechanical time constant	T_{mech}	ms	30	90	
Thermal time constant	T_{th}	min	45	45	
Thermal resistance	R_{th}	W/K	0.11	0.11	
Weight with brake	m	kg	10.8	10.8	
Weight without brake	m	kg	10.1	10.1	

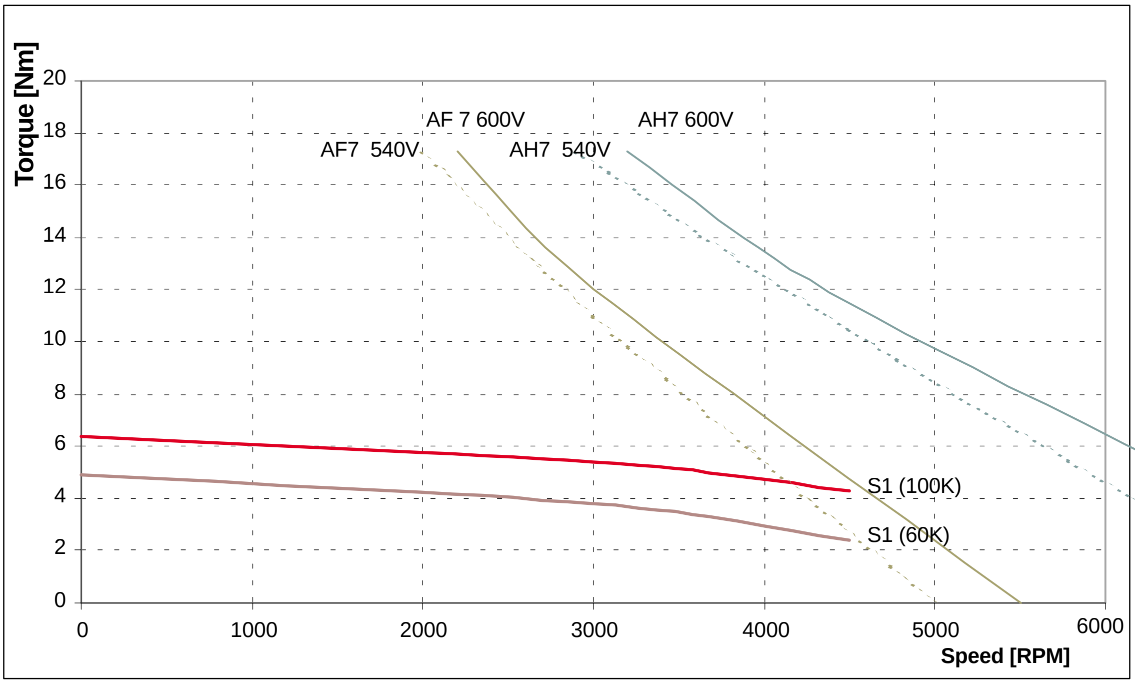


Fig. 3-13 Speed–torque diagram 1FK6061 HD

Table 3-14 Standard motor 1FK6064 HD

1FK6064 HD				
Technical data	**Code**	**Units**	**–7AF7**	
Engineering data				
Rated speed	n_{rated}	RPM	3000	
Rated torque	$M_{rated\ (100\ K)}$	Nm	8.0	
Rated current	I_{rated}	A	7.5	
Stall torque	$M_{0\ (60\ K)}$	Nm	9	
Stall torque	$M_{0\ (100\ K)}$	Nm	12	
Stall current	$I_{0\ (60\ K)}$	A	8.5	
Stall current	$I_{0\ (100\ K)}$	A	11.0	
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	9.72	
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	6.5	
Limit data				
Max. speed	n_{max}	RPM	5500	
Max. torque	M_{max}	Nm	32	
Peak current	I_{max}	A	31	
Limiting torque (600 V)	M_{limit}	Nm	24	
Limiting current (600 V)	I_{limit}	A	22	
Physical constants				
Torque constant	k_T	Nm/A	1.06	
Voltage constant	k_E	V/1000 RPM	70	
Winding resistance	R_{ph}	Ohm	0.95	
Three–phase inductance	L_D	mH	10.7	
Electrical time constant	T_{el}	ms	30.5	
Mechanical time constant	T_{mech}	ms	0.77	
Thermal time constant	T_{th}	min	35	
Thermal resistance	R_{th}	W/K	0.18	
Weight with brake	m	kg	18	
Weight without brake	m	kg	15.3	

1FK6

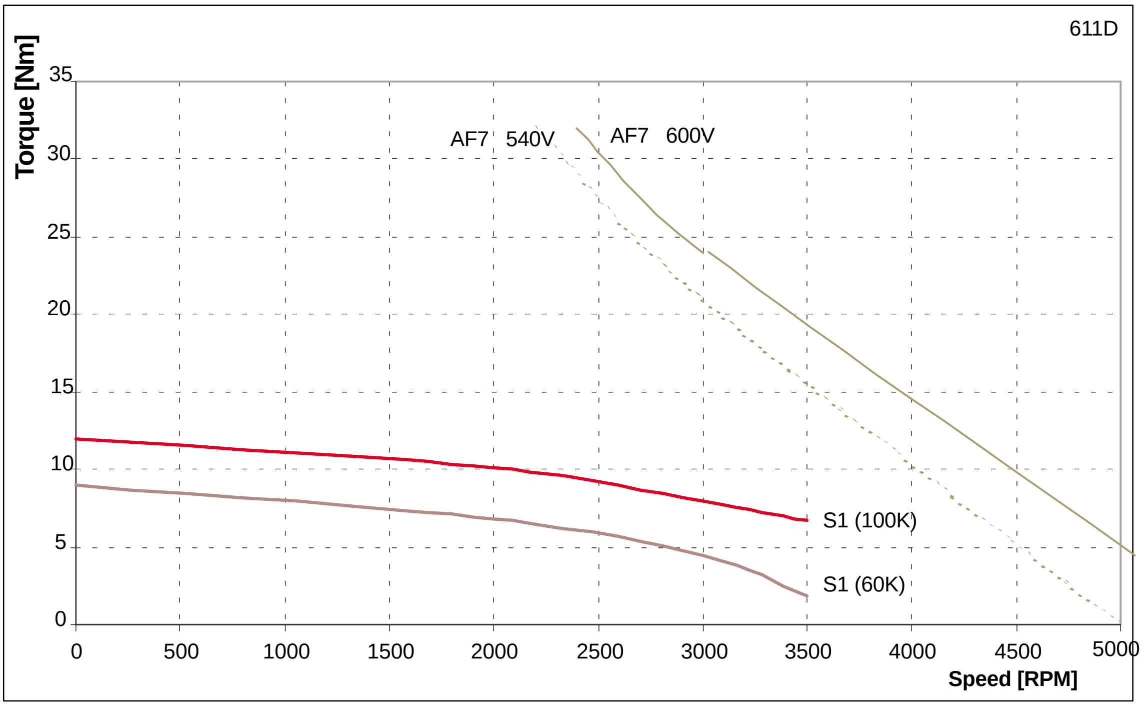


Fig. 3-14 Speed–torque diagram 1FK6064 HD

3.2 Cantilever/axial force diagrams

Cantilever force

Definition, refer to Chapter 2.1, General information on AC servomotors AL S.

Axial force

F_{AZ} is the absolute permissible force without taking into account the bearing alignment force, the rotor weight, the mounting position as well as the force direction.

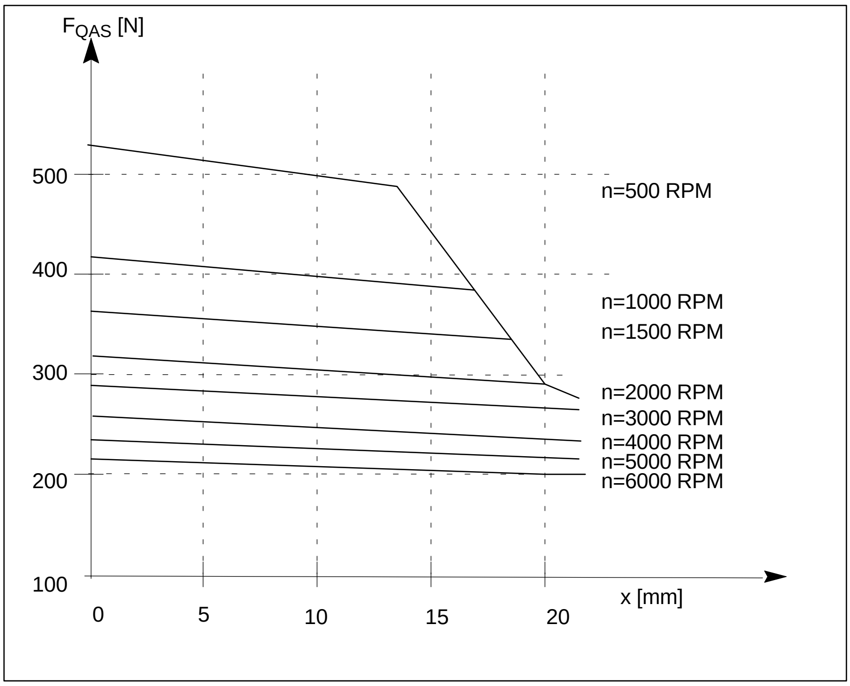
Caution

Motors with integrated holding brake may not be subject to axial forces!

Definitions, refer to Chapter 2.1, General information on AC servomotors AL S.

Cantilever force 1FK602

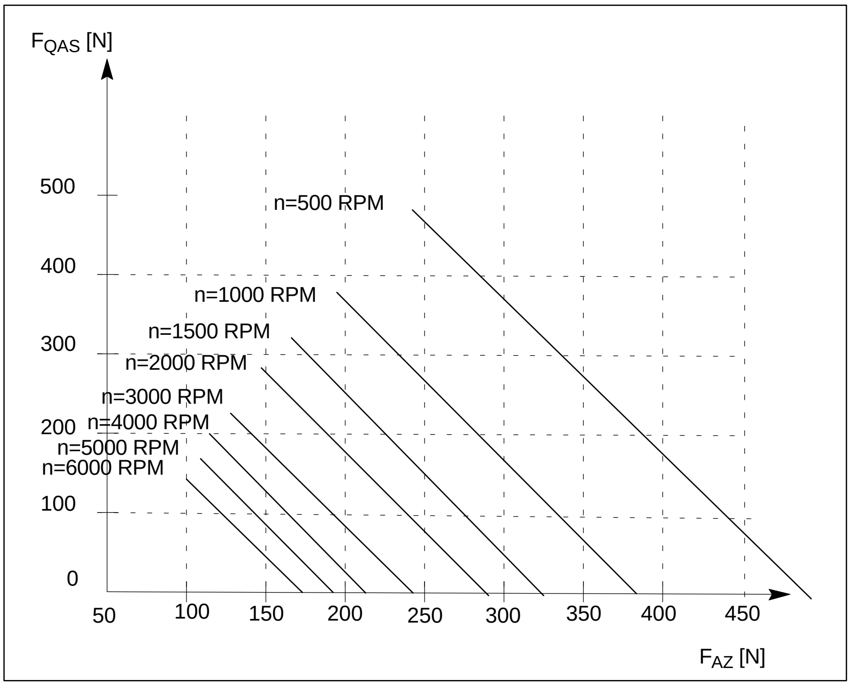
Cantilever force F_Q at a distance x from the shaft shoulder for a nominal bearing lifetime of 20,000 h.



1FK6

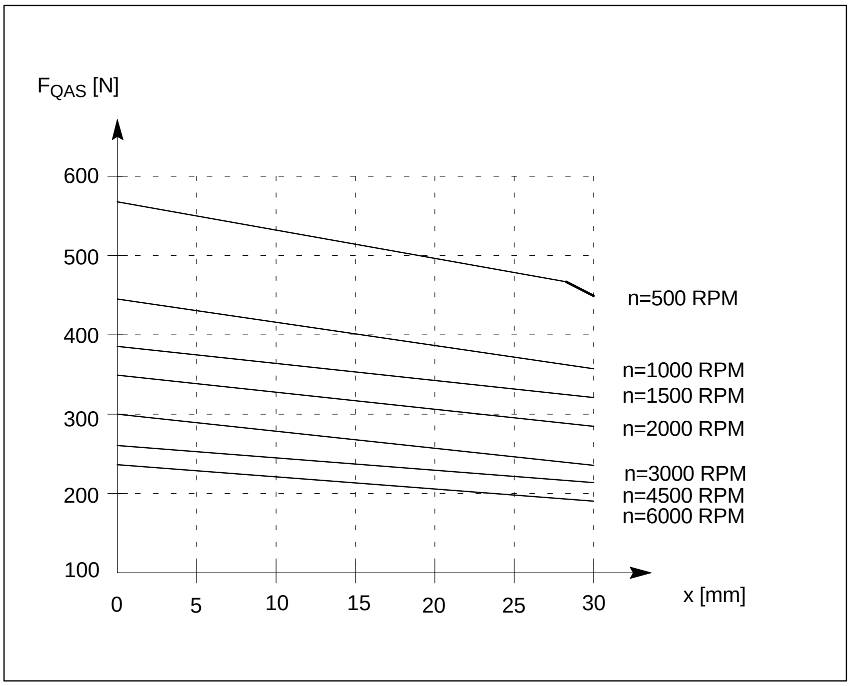
Axial force 1FK602

Permissible axial force as a function of the cantilever force.



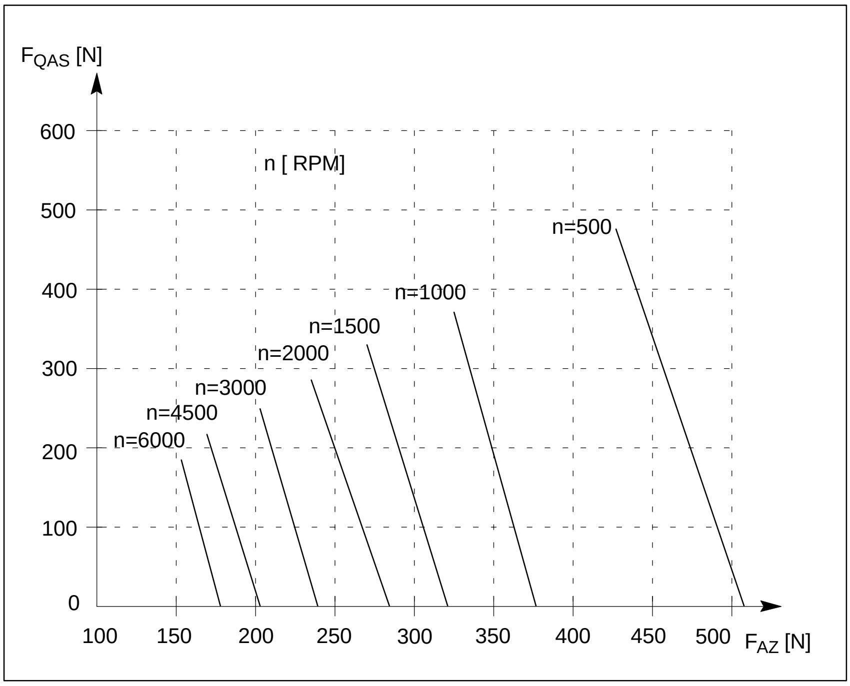
Cantilever force 1FK603

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



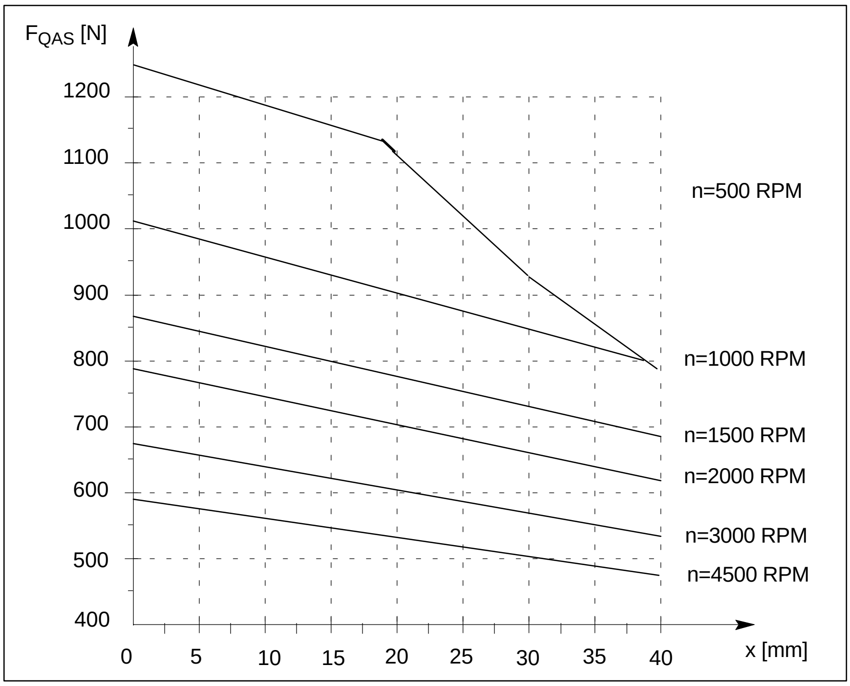
Axial force 1FK603

Permissible axial force as a function of the cantilever force



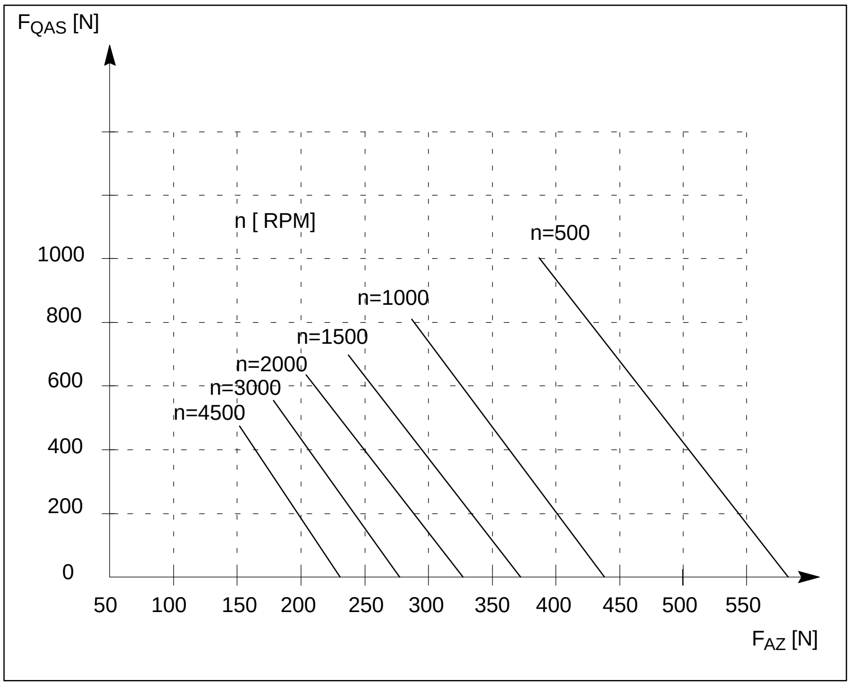
Cantilever force 1FK604

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



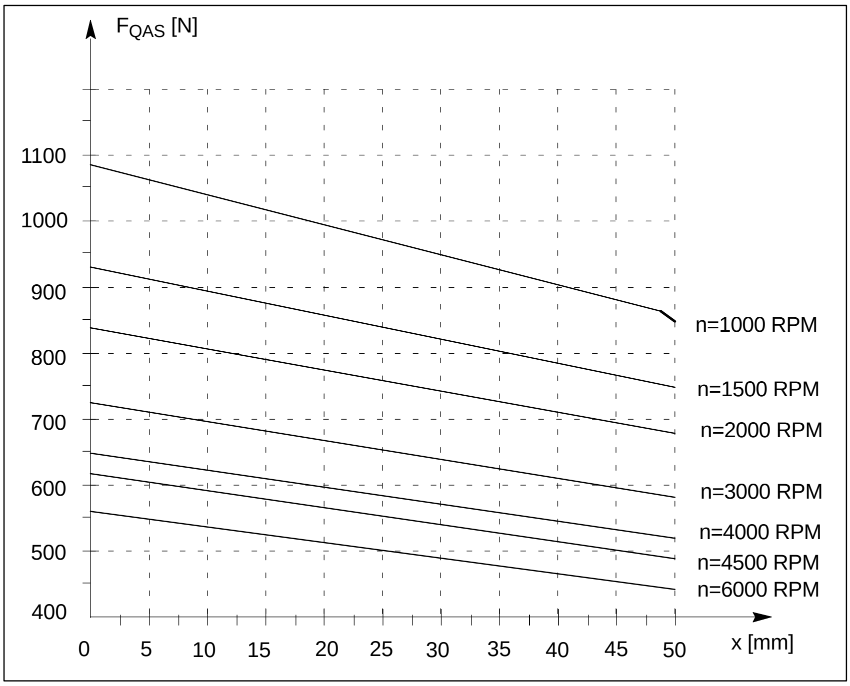
Axial force 1FK604

Permissible axial force as a function of the cantilever force



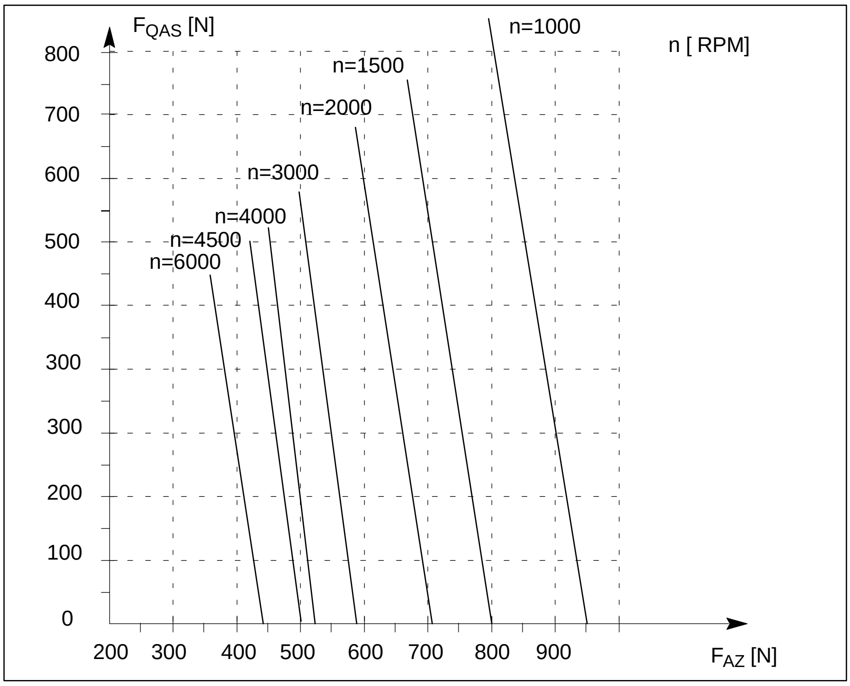
Cantilever force 1FK6060

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



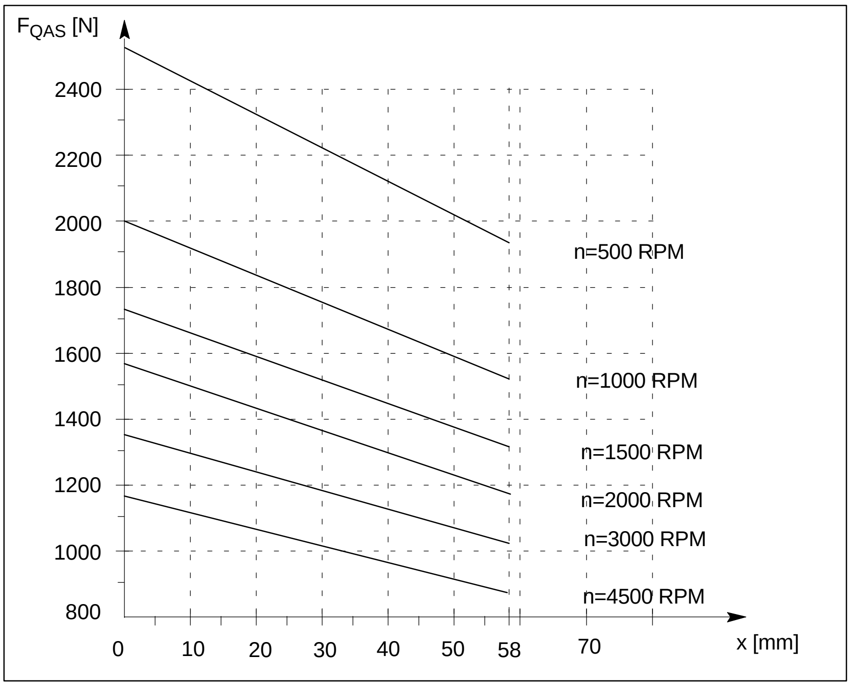
Axial force 1FK6060

Permissible axial force as a function of the cantilever force



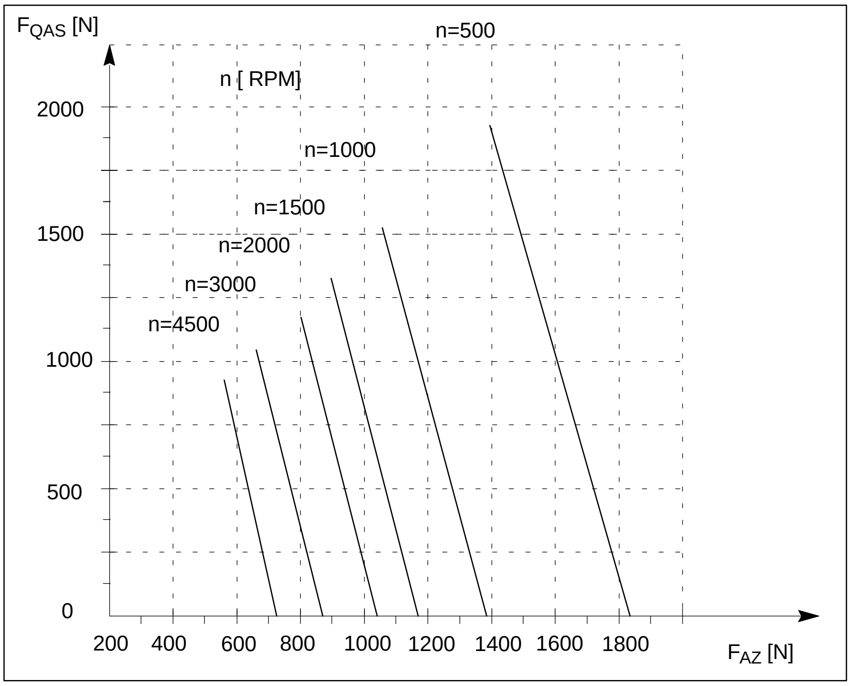
Cantilever force 1FK6080

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



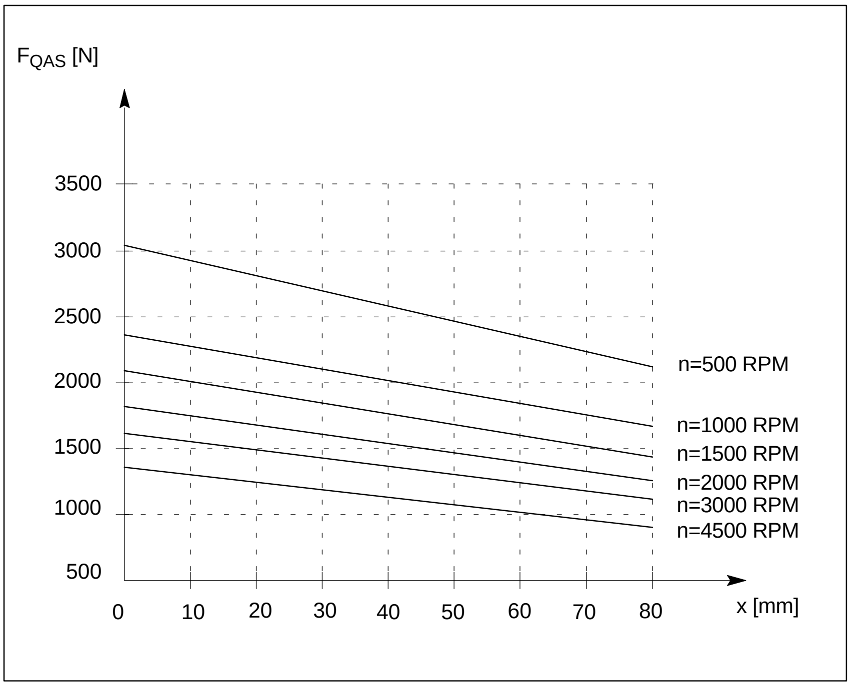
Axial force 1FK6080

Permissible axial force as a function of the cantilever force



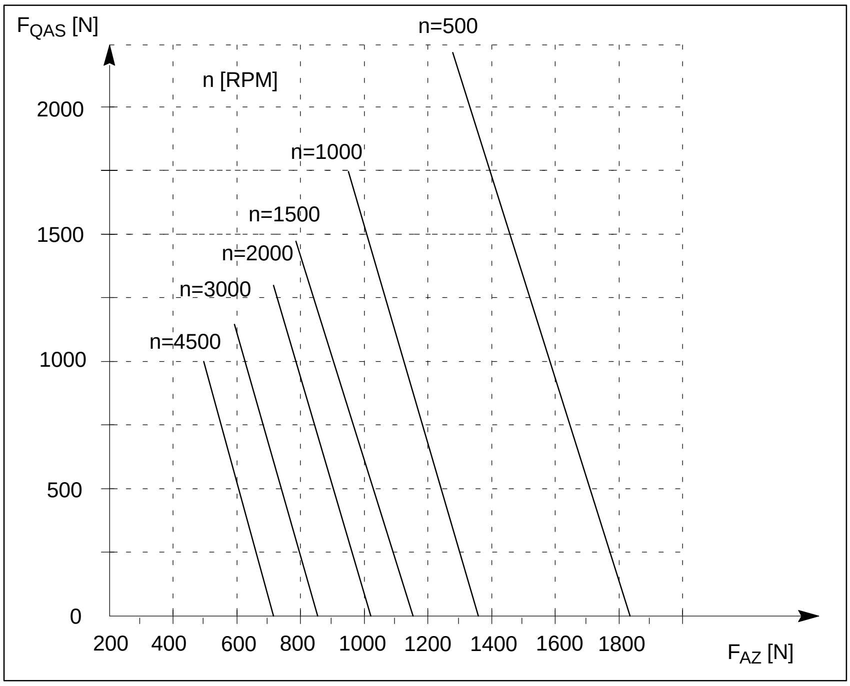
Cantilever force 1FK6100

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



Axial force 1FK6100

Permissible axial force as a function of the cantilever force



■

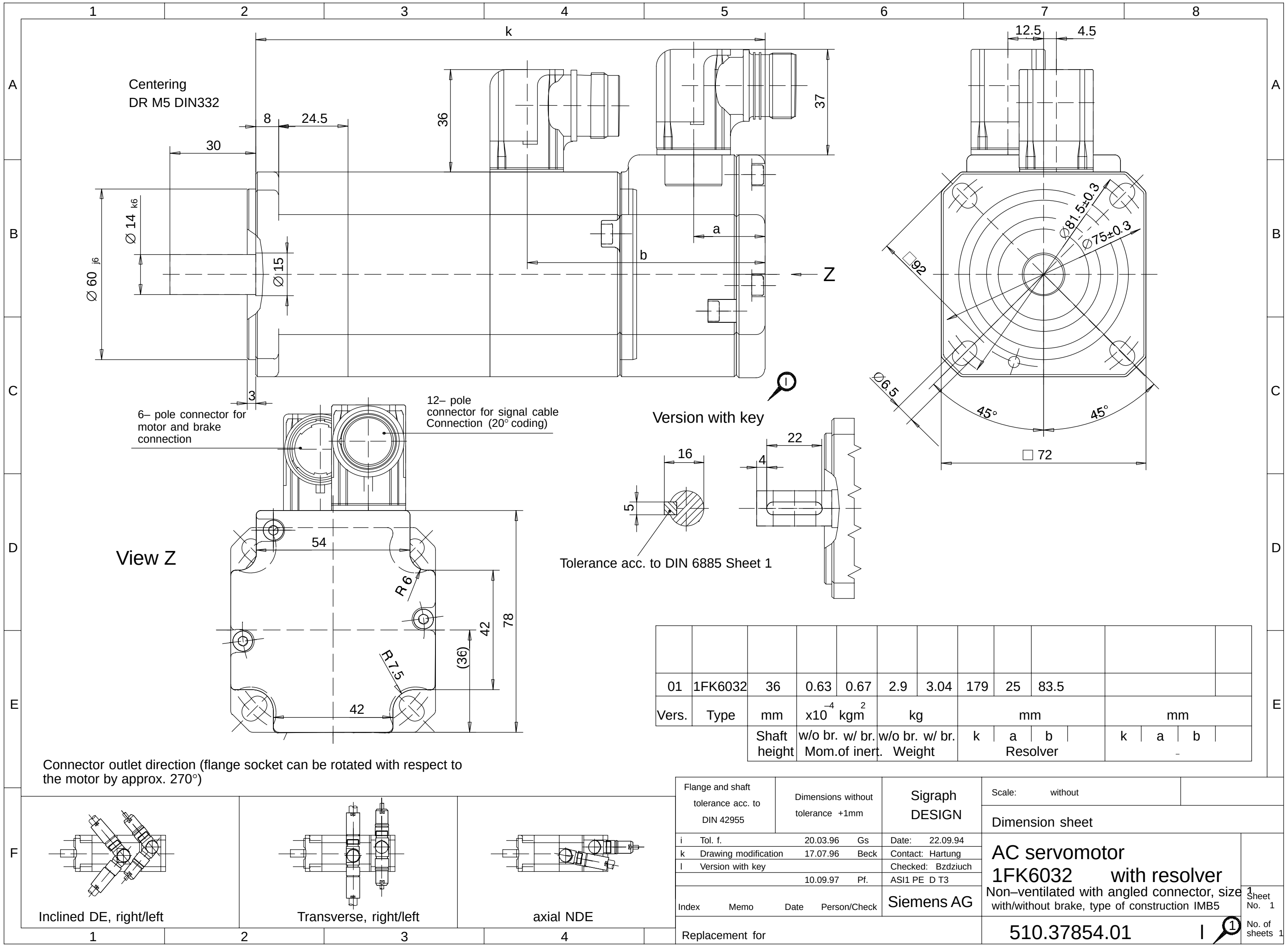
Dimension Drawings

4

Note

Siemens AG reserves the right to change motor dimensions when making mechanical design improvements without prior notice. Dimension drawings can become out–of–date. The latest version of dimension drawings can be requested at no charge.

Standard type of construction, non–ventilated



Vers.	Type	Shaft height	Mom. of inert. w/o br.	Mom. of inert. w/ br.	Weight w/o br.	Weight w/ br.	Resolver k	Resolver a	Resolver b	– k	– a	– b
		mm	$x10^{-4}$ kgm^2		kg		mm			mm		
01	1FK6032	36	0.63	0.67	2.9	3.04	179	25	83.5			

Flange and shaft tolerance acc. to DIN 42955

Dimensions without tolerance +1mm

Sigraph DESIGN

Scale: without

Dimension sheet

Index	Memo	Date	Person/Check
i	Tol. f.	20.03.96	Gs
k	Drawing modification	17.07.96	Beck
l	Version with key		
		10.09.97	Pf.

Date: 22.09.94
Contact: Hartung
Checked: Bzdziuch
ASI1 PE D T3

Siemens AG

AC servomotor
1FK6032 with resolver
Non–ventilated with angled connector, size 1
with/without brake, type of construction IMB5

Sheet No. 1
No. of sheets 1

Replacement for

510.37854.01 l

Fig. 4-1 1FK6032 non–ventilatedwith angled connector, size 1

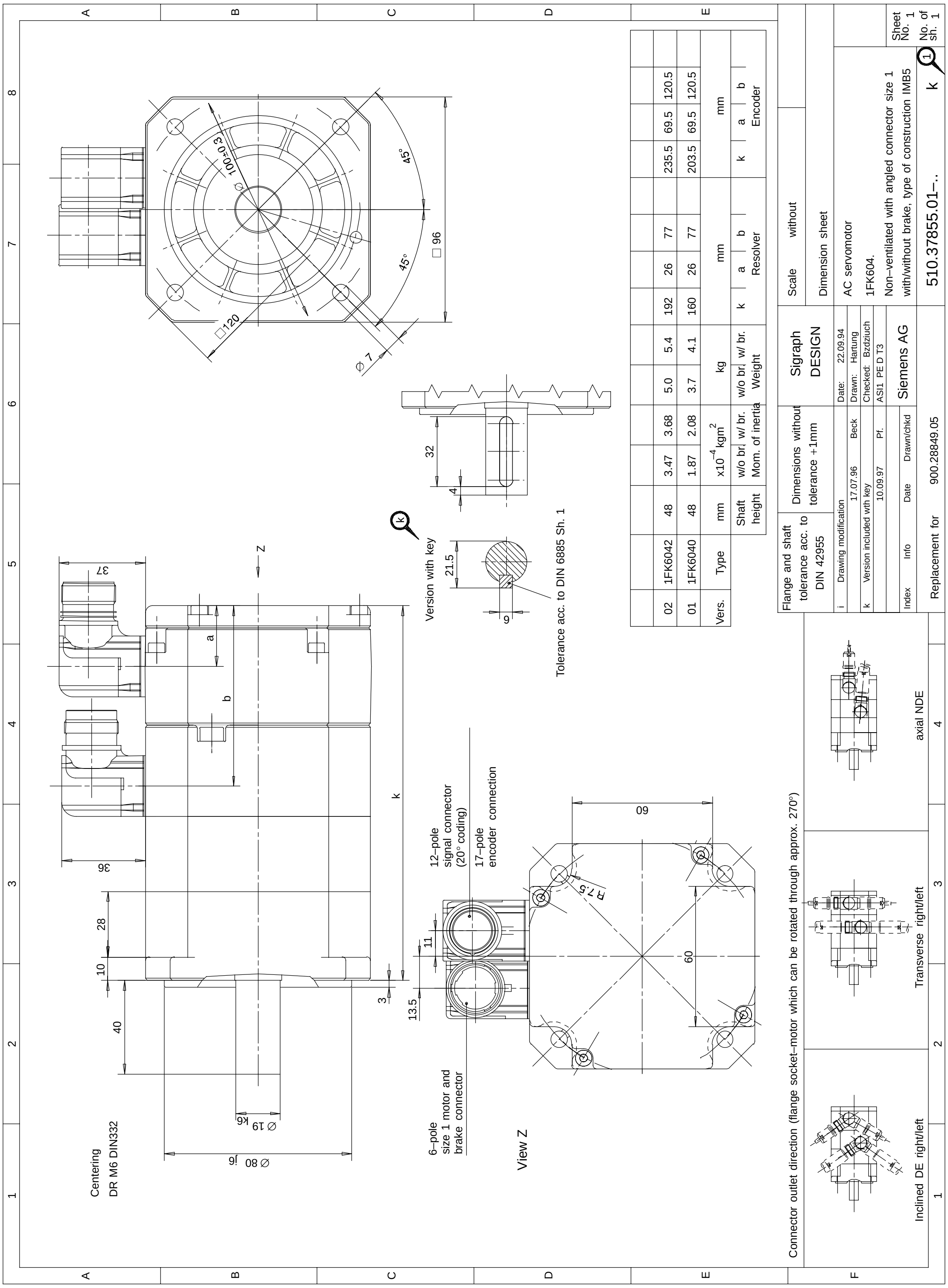
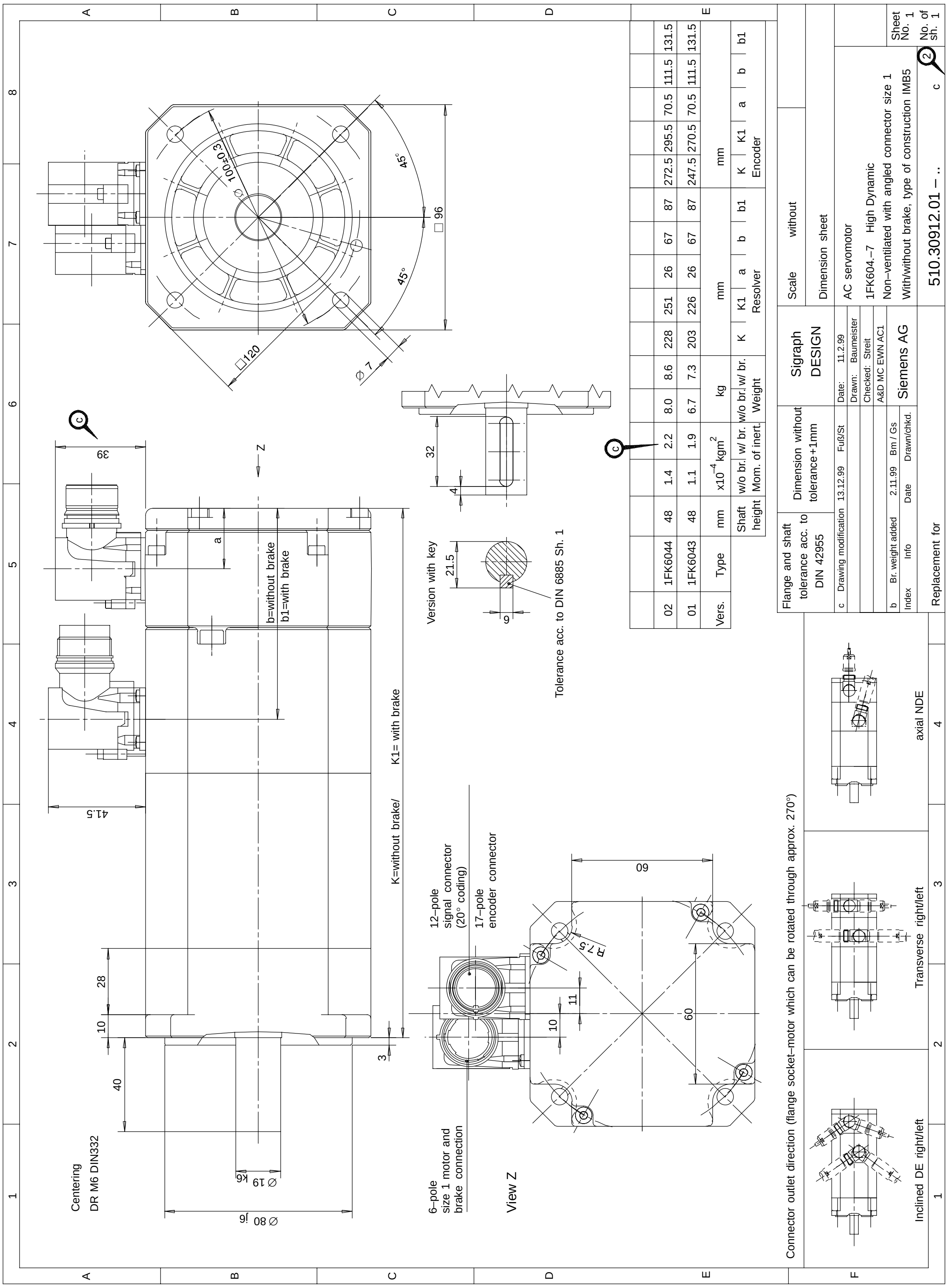


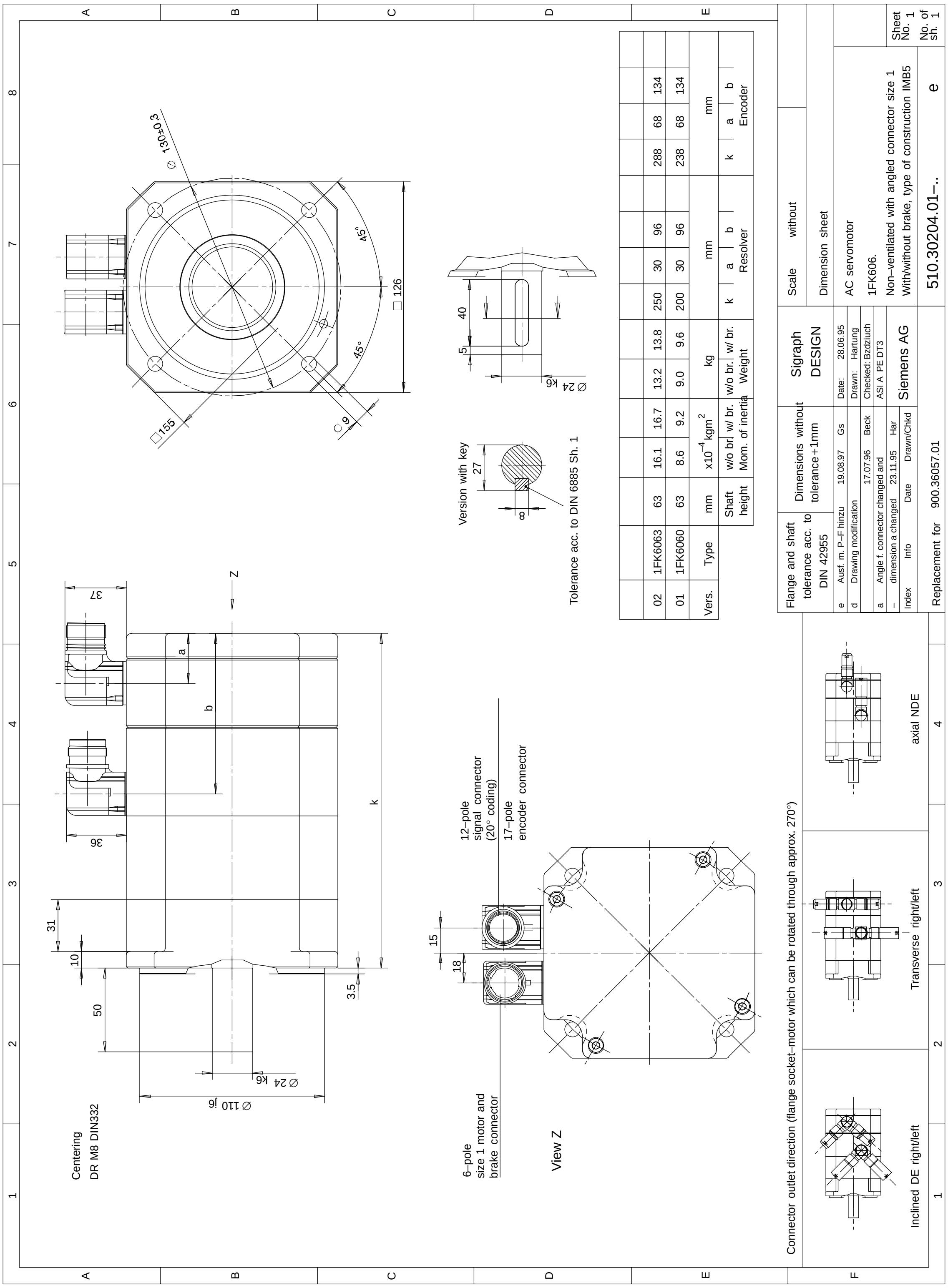
Fig. 4-2 1FK604□ non–ventilated with angled connector, size 1

1FK6



Vers.	Type	Shaft height	Mom. of inert. w/o br.	Mom. of inert. w/ br.	Weight w/o br.	Weight w/ br.	Resolver K	Resolver K1	Resolver a	Resolver b	Resolver b1	Encoder K	Encoder K1	Encoder a	Encoder b	Encoder b1
		mm	$x10^{-4}$ kgm^2		kg		mm					mm				
02	1FK6044	48	1.4	2.2	8.0	8.6	228	251	26	67	87	272.5	295.5	70.5	111.5	131.5
01	1FK6043	48	1.1	1.9	6.7	7.3	203	226	26	67	87	247.5	270.5	70.5	111.5	131.5

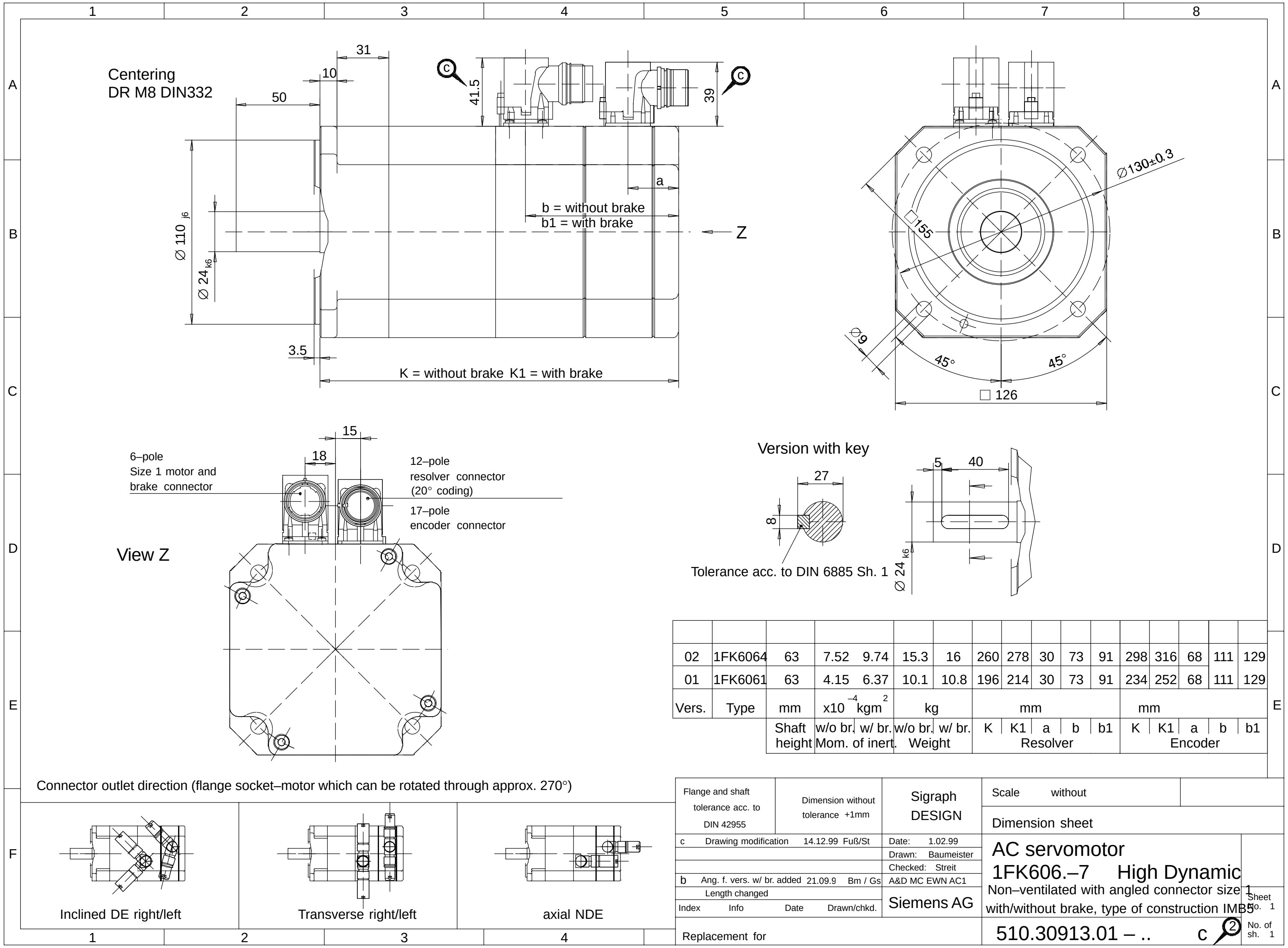
Fig. 4-3 1FK604□–7 non–ventilated with angled connector, size 1



Vers.	Type	Shaft height (mm)	Mom. of inertia w/o br. ($x10^{-4}$ kgm^2)	Mom. of inertia w/ br. ($x10^{-4}$ kgm^2)	Weight w/o br. (kg)	Weight w/ br. (kg)	Resolver k (mm)	Resolver a (mm)	Resolver b (mm)	Encoder k (mm)	Encoder a (mm)	Encoder b (mm)
02	1FK6063	63	16.1	16.7	13.2	13.8	250	30	96	288	68	134
01	1FK6060	63	8.6	9.2	9.0	9.6	200	30	96	238	68	134

Fig. 4-4 1FK606□ non–ventilated with angled connector, size 1

Fig. 4-5 1FK606□–7 non–ventilated with angled connector, size 1



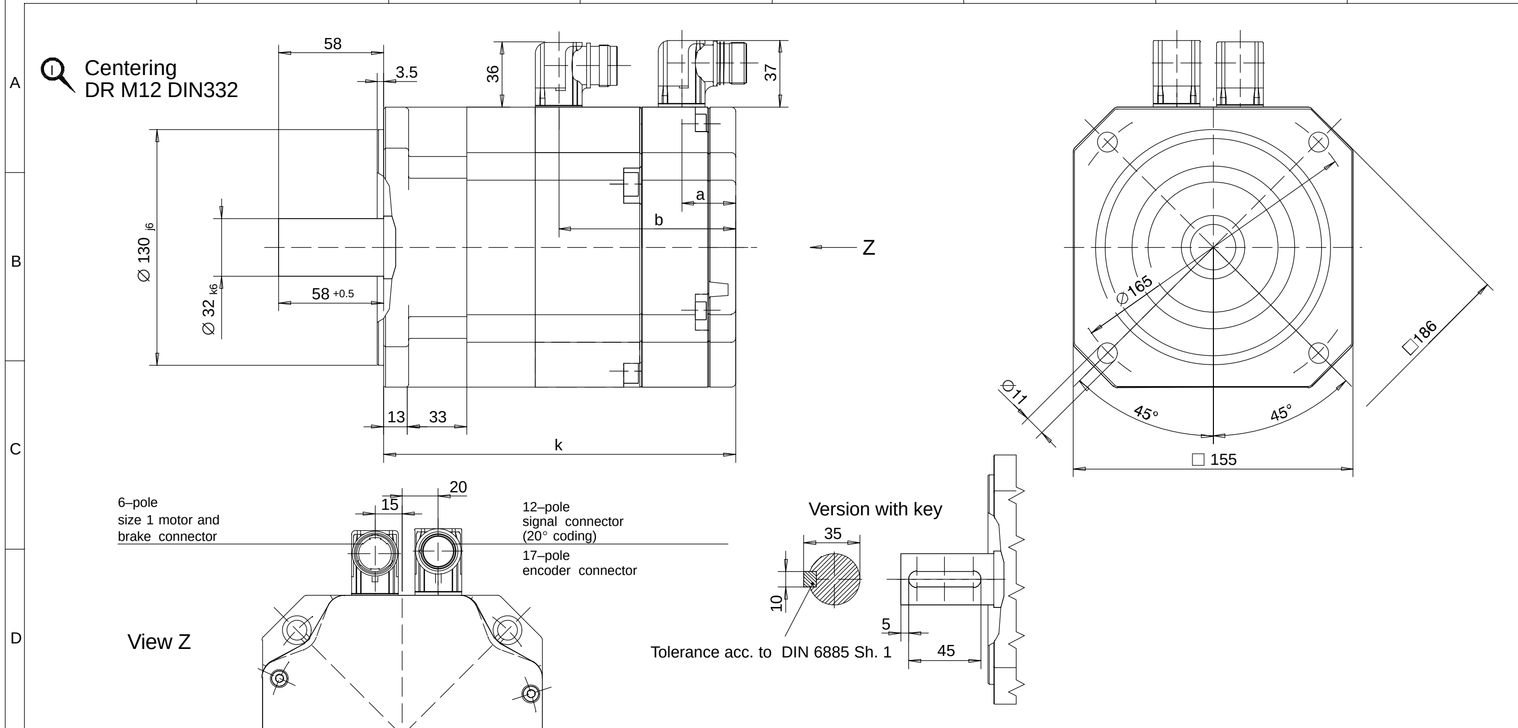
Vers.	Type	Shaft height	Mom. of inert. w/o br.	Mom. of inert. w/ br.	Weight w/o br.	Weight w/ br.	Resolver K	Resolver K1	Resolver a	Resolver b	Resolver b1	Encoder K	Encoder K1	Encoder a	Encoder b	Encoder b1
		mm	$x10^{-4}$ kgm^2		kg		mm					mm				
02	1FK6064	63	7.52	9.74	15.3	16	260	278	30	73	91	298	316	68	111	129
01	1FK6061	63	4.15	6.37	10.1	10.8	196	214	30	73	91	234	252	68	111	129

Flange and shaft tolerance acc. to DIN 42955
Dimension without tolerance +1mm
Sigraph DESIGN
Scale without
Dimension sheet

Index	Info	Date	Drawn/chkd.
c	Drawing modification	14.12.99	Fuß/St
b	Ang. f. vers. w/ br. added; Length changed	21.09.9	Bm / Gs

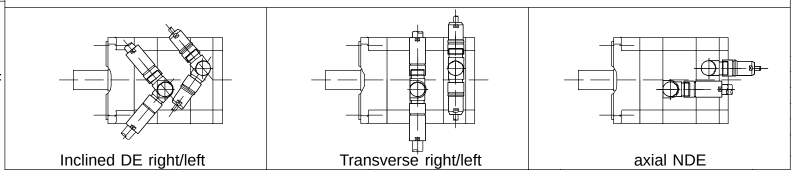
Date: 1.02.99
Drawn: Baumeister
Checked: Streit
A&D MC EWN AC1
Siemens AG

AC servomotor
1FK606.–7 High Dynamic
Non–ventilated with angled connector size 1
with/without brake, type of construction IMB5
Sheet No. 1
No. of sh. 1
Replacement for
510.30913.01 – .. c



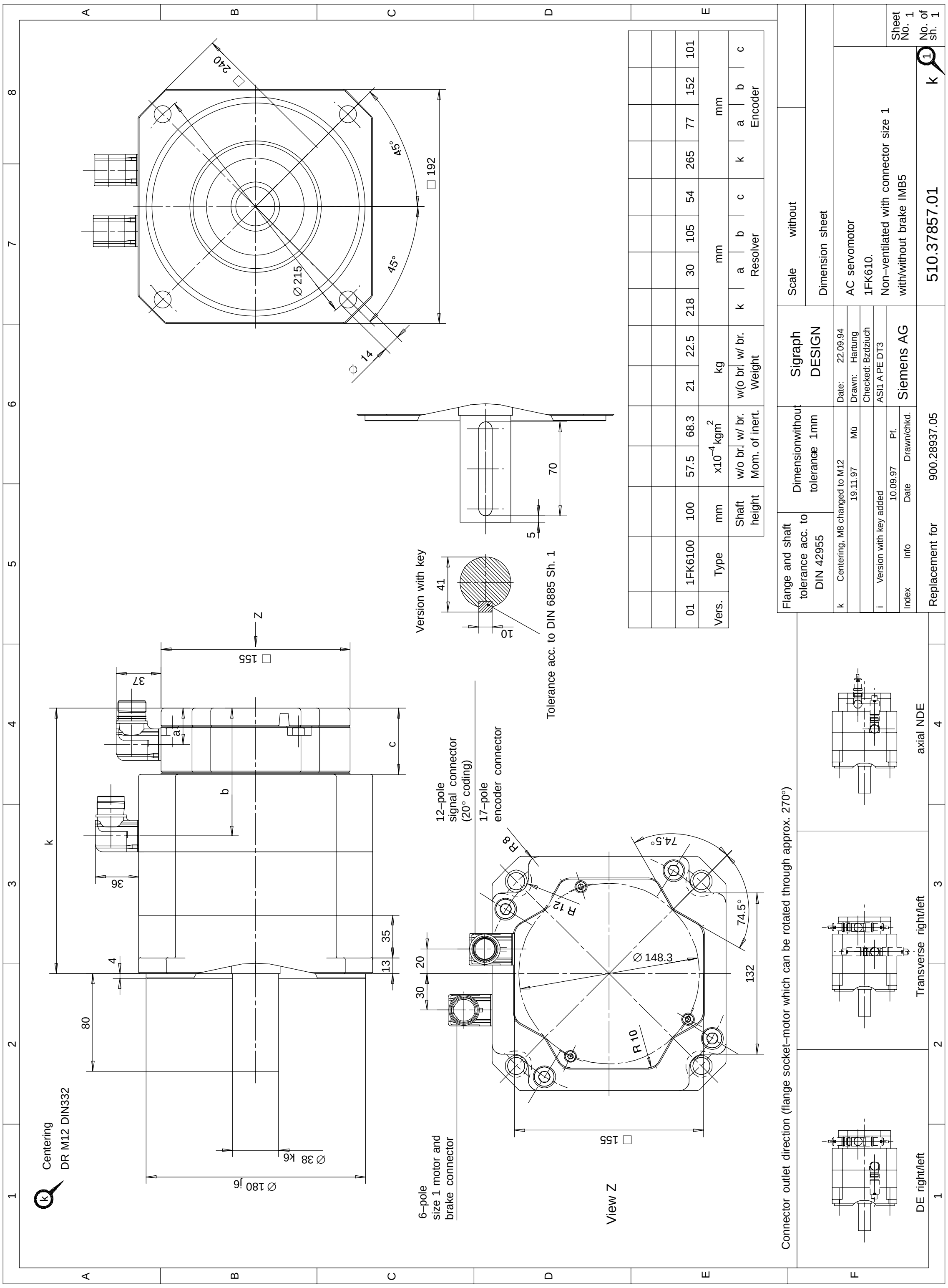
02	1FK6083	80	27.1	29.4	17	18.2	233	30	98		280	77	145	
01	1FK6080	80	16.1	18.4	12.5	13.7	195	30	98		242	77	145	
Vers.	Type	mm	$x10^{-4}$ kgm²		kg		mm				mm			
		Shaft height	w/o br. Mom. of inert.	w/ br.	w/o br. Weight	w/ br.	k Resolver	a	b		k Encoder	a	b	

Connector outlet direction (flange socket–motor wich can be rotated through approx. 270°)



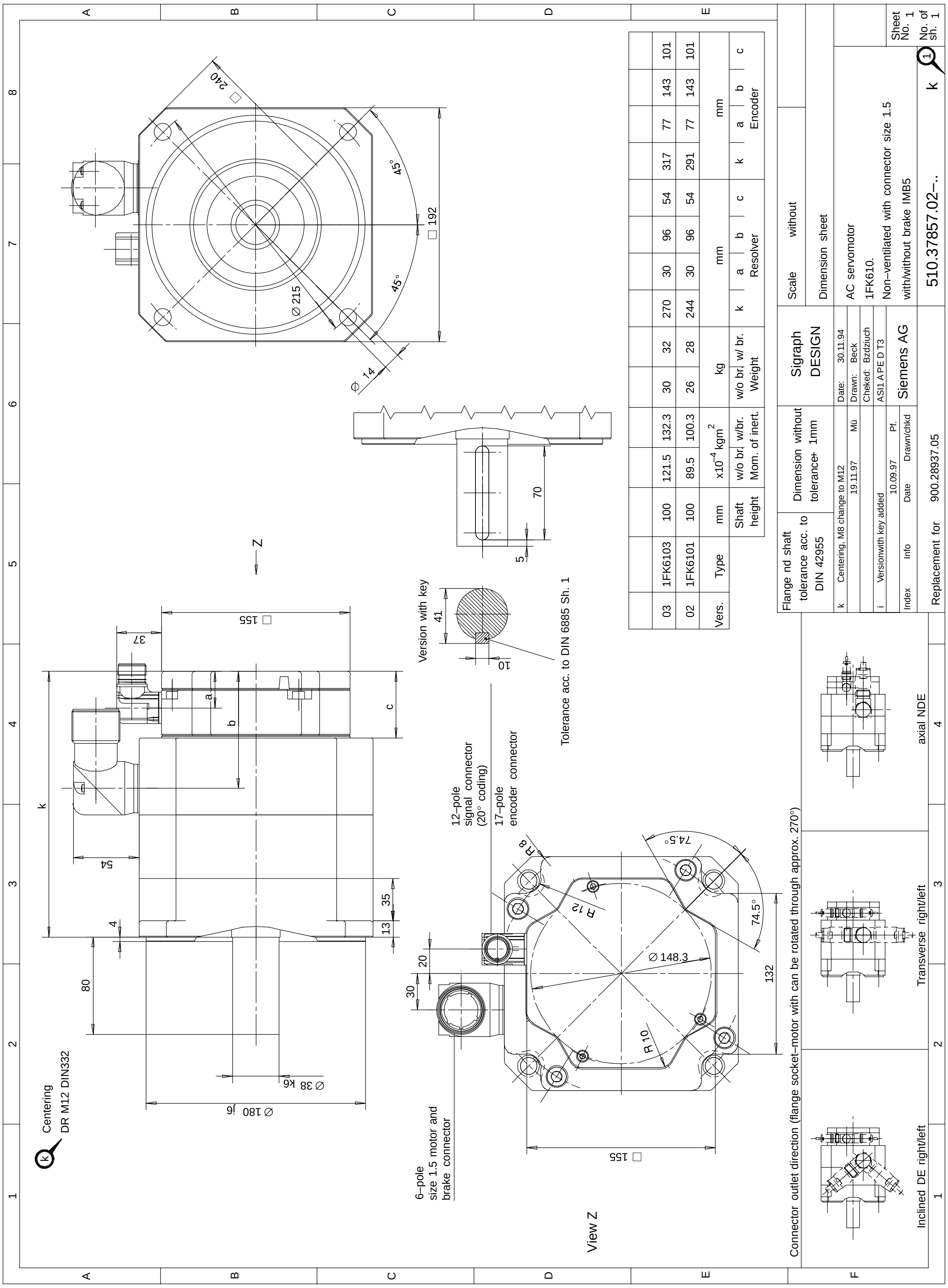
Flange and shaft tolerance acc. to DIN 42955	Dimension without tolerance +1mm	Sigraph DESIGN	Scale without
			Dimension sheet
l Centering, M8 changed to M12 19.11.97 Mü		Date: 22.09.94 Drawn: Hartung Checked: Bzdziuch ASI1 A PE DT3	AC servomotor 1FK608. Non–ventilated with connector size 1 with/without brake, type of constr. IMB5
k Version with key added 10.09.97 Pf.			Sheet No. 1
Index Info Date Drawn/Chkd.		Siemens AG	No. of sh. 1
Replacement for 900.28736.05			510.37856.01–.. l

Fig. 4-6 1FK608□ non–ventilatedwith connector, size 1



Vers.	Type	Shaft height	Mom. of inert. w/o br.	Mom. of inert. w/ br.	Weight w/o br.	Weight w/ br.	Resolver k	Resolver a	Resolver b	Resolver c	Encoder k	Encoder a	Encoder b	Encoder c
		mm	$x10^{-4}$ kgm²		kg		mm				mm			
01	1FK6100	100	57.5	68.3	21	22.5	218	30	105	54	265	77	152	101

Fig. 4-7 1FK6100 non–ventilated with connector, size 1



Vers.	Type	Shaft height (mm)	Mom. of inert. w/o br. ($x10^{-4}$ kgm^2)	Mom. of inert. w/br. ($x10^{-4}$ kgm^2)	Weight w/o br. (kg)	Weight w/ br. (kg)	Resolver k (mm)	Resolver a (mm)	Resolver b (mm)	Resolver c (mm)	Encoder k (mm)	Encoder a (mm)	Encoder b (mm)	Encoder c (mm)
03	1FK6103	100	121.5	132.3	30	32	270	30	96	54	317	77	143	101
02	1FK6101	100	89.5	100.3	26	28	244	30	96	54	291	77	143	101

Fig. 4-8 1FK610□ non–ventilated with connector, size 1.5

■

1FK6

Notes

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5

Notes

1PH2 AC Built–in Motors

Notes

1 Motor Description

1.1 Characteristics and technical data

Applications

The 1PH2 series has been developed for closed–loop speed controlled main spindles for turning, milling, grinding and for machining centers. The built–in motor is a compact drive solution, where the mechanical motor power is transferred directly to the spindle without using any mechanical transmission elements.

Characteristics

1PH2 motors are liquid–cooled induction motors, which are supplied as components. A complete motor spindle unit is created after the motor components have been mounted on the spindle.

The motor series has been adapted to the requirements of lathes and milling machines and machining centers. They differ as far as the following points are concerned:

1PH2 with sleeve:

- The rotor with sleeve is finish machined. Additional machining after assembly is not required.
- Maximum speed: 10,000 RPM.
- Rated torque: 750 Nm (S1 duty).
- The torque is transferred to the spindle without any play and is force–locked using a cylindrical stage press fit.
- The rotor with sleeve is pre–balanced and can be removed.

1PH2 without sleeve:

- The rotor is finished machined. Additional machining after assembly is not required.
- Version without sleeve; therefore a lower moment of inertia and minimum acceleration times.
- Max. speed: 18,000 RPM.
- Rated torque: 250 Nm (S1 duty).
- The torque is transferred to the spindle without any play and is force–locked using a cylindrical stage press fit.
- For rotors without sleeve, it is not possible to disassemble the spindle rotor unit without damaging the rotor.
- The rotor without sleeve is not balanced.
- The rotor can be mounted onto conventional spindles
- It is possible to thread tool clamping devices, compressed air and cooling medium lines.

Technical features

Note

The motors (with the exception of 1PH218. and 1PH225.) can be fed from a DC link voltage up to 700 V DC.

Table 1-1 1PH2 motors

Technical features	Version
Motor type	Induction motor with squirrel–cage rotor
Type of construction (similar to ISO)	Individual components: Stator, rotor, motor encoder
Degree of protection (acc. to EN 60034-5; IEC 60034-5)	IP 00
Cooling	Water cooling with T_{H2O} = 25 °C and Q = 8 l/min
Thermal motor protection (acc. to IEC 60034-6)	2 PTC thermistors (1 PTC as reserve)
Winding insulation (acc. to IEC 60034)	Temperature rise class F for a cooling medium temperature of +25 °C
Motor voltage	Max.: 3–ph. 430 V AC
Speed control range	> 1: 500 000
Connection type	Motor: free cable ends, l = 1.5 m , preferably l = 0.5 m Motor encoder: Plug connection (flange–mounted socket is supplied with the encoder system) PTC thermistor: via encoder connector
Encoder system 1) (not included in the scope of supply)	Toothed–wheel encoder1) SIZAG2
Balancing quality	Rotors with sleeve are pre–balanced; Rotors without sleeve are not pre–balanced

Fig. 1-1 1PH2 rotor and stator

1) Due to the lower actual value resolution with SIZAG 2 (256/512 increments per revolution), the motor is only con–ditionally capable of C axis operation. Refer to the Chapter, Toothed–wheel encoders SIZAG 2, Page GE/2–1 (GE).

Design

Typical mounting

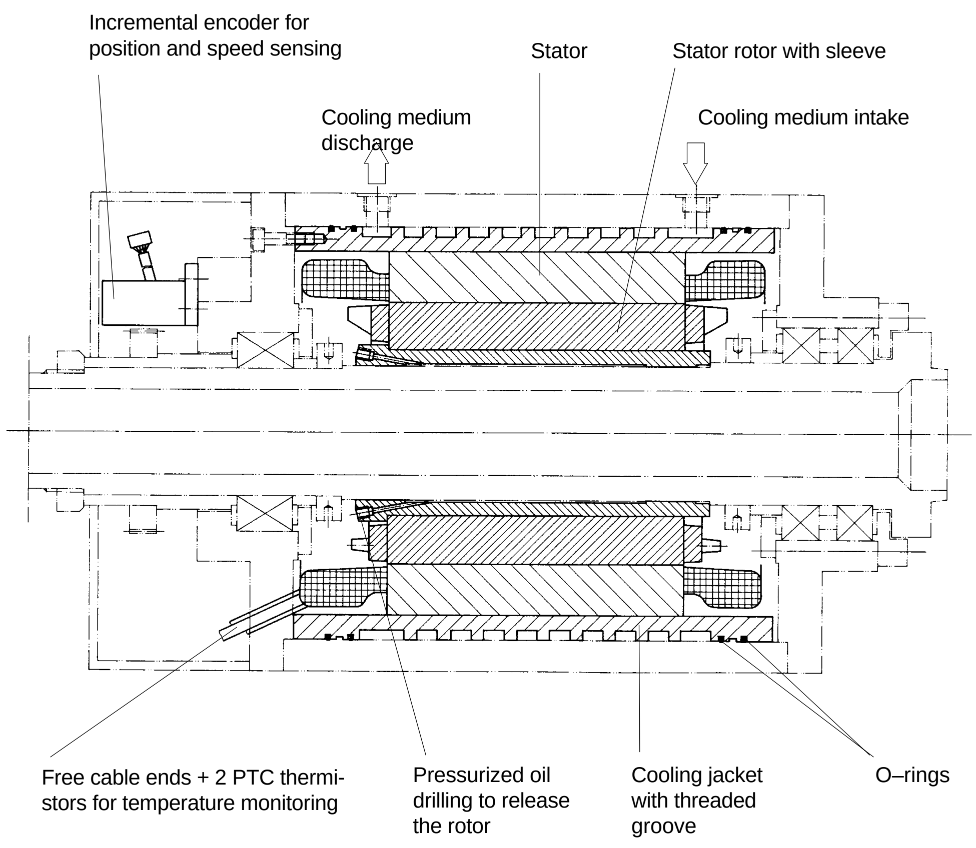


Fig. 1-2 Typical installation for mounting directly onto the main spindle

Scope of supply

- Finish machined rotor
- Stator with winding, cooling jacket with threaded groove and O–rings

1PH2

Technical data

Engineering data

Table 1-2 Ordering and engineering data for motors, standard version

AC main spindle motor	Rated speed	Max. speed	Rated torque		No–load current	Rated volt–age	Rated motor output for duty type acc. to DIN VDE 0530 1)				Rated current for duty type acc. to IEC 60034 1)		
	n_{rated} [RPM]	n_{max} [RPM]	M [Nm]		I_0 [A]	U_N [V]	P_{rated} [kW]				I_{rated} [A]		
Order No.			△T = 70 K	△T = 105 K			S1 △T = 70 K	S1 △T = 105 K	S6–60 %	S6–40 %	S1	S6–60 %	S6–40 %
Builti–in motors with sleeve, rated speed 1500 RPM													
1PH2 093–6WF4□	1500	10000	48	60	11	308	7,5	9,4	8,2	9,0	24	26	28
1PH2 095–6WF4□			64	83	14	333	10,1	13	11	12	30	32	34
1PH2 113–6WF4□	1500	10000	95	118	22	253	15,1	18,5	17	19	56	61	67
1PH2 115–6WF4□			105	137	22	281	16,5	21,5	18,5	21	55	60	66
1PH2 117–6WF4□			115	151	25	274	18,1	23,7	20,5	23	60	67	74
1PH2 118–6WF4□			146	197	33	260	23,6	30,9	26,0	29,5	82	90	100
Built–in motors with sleeve, rated speed, 750 RPM, 600 RPM, 500 RPM													
1PH2 182–6WC41	750	8000	150	183	17	270	11,8	14,4	14,8	17,7	37	44	52
1PH2 184–6WP41	600	8000	230	281	26	215	14,5	17,7	18,1	22	56	68	80
1PH2 186–6WB41	500	8000	350	428	31	248	18,3	22,4	21,8	25,8	65	77	87
1PH2 188–6WB41	500	6000	450	551	38	255	23,6	28,8	29	33	78	92	103
1PH2 254–6WB41	500	6000	550	673	42	185	28,8	35,3	36	40,6	117	141	161
1PH2 256–6WB41	500	4000	750	918	54	255	39,3	48,1	48,8	55,0	119	143	158
Built–in motors without sleeve, rated speed 200 RPM or 1500 RPM													
1PH2 092–4WG42	2000	18000	22	34	11	208	4,7	7,1	5,2	5,8	22	23	25
1PH2 096–4WG42			48	76	22	215	10,1	15,9	11	12,3	43	46	50
1PH2 123–4WF42	1500	16000	73	108	21	173	11,5	17	13,5	16	57	64	74
1PH2 127–4WF42			134	203	33	211	21	31,9	25	29	85	97	108
1PH2 128–4WF42			159	235	37	204	25	36,9	29,5	35	101	116	132
1PH2 143–4WF42	1500	12000	191	286	42	246	30	44,9	36	42	101	116	132
1PH2 147–4WF42			242	350	44	263	38	55	46	53	116	136	153

1) Data for △T = 70 K and rated speed, if not otherwise specified

Winding temperature rise ΔT = 105 K:

1PH2 built–in motors can be utilized, instead of a winding temperature rise ΔT = 70 K, with ΔT = 105 K. This means that a higher torque is available from the same motor size, (refer to Table 1-2). In this case, the user must be aware of the increased temperature at the spindle bearings. The larger main spindle modules must be selected as for ΔT = 70 K (on request).

In order to achieve the nominal operating values, the special cooling and mounting conditions must be maintained.

Dimensions

Table 1-3 Dimensions, 1PH2 motors

Main spindle motor Type	Standard spindle diameter d [mm]	Inner rotor diameter d_i [mm]	Outer stator diameter D_A [mm]	Overall outer diameter D [mm]	Total length L [mm]
Built–in motors with sleeve					
1PH2093–6WF4□ 1PH2095–6WF4□	67	85	180	205	250 300
1PH2113–6WF4□ 1PH2115–6WF4□ 1PH2117–6WF4□ 1PH2118–6WF4□	82	100	220	250	290 310 330 390
1PH2182–6WC41 1PH2184–6WP41 1PH2186–6WB41 1PH2188–6WB41	122	150	280	320	320 410 540 645
1PH2254–6WB41 1PH2256–6WB41	165	195	390	430	480 590
Built–in motors without sleeve					
1PH2092–4WG42 1PH2096–4WG42	48	48	180	205	195 300
1PH2123–4WF42 1PH2127–4WF42 1PH2128–4WF42	64	64	235	265	260 380 450
1PH2143–4WF42 1PH2147–4WF42	75	75	280	310	385 440

1PH2

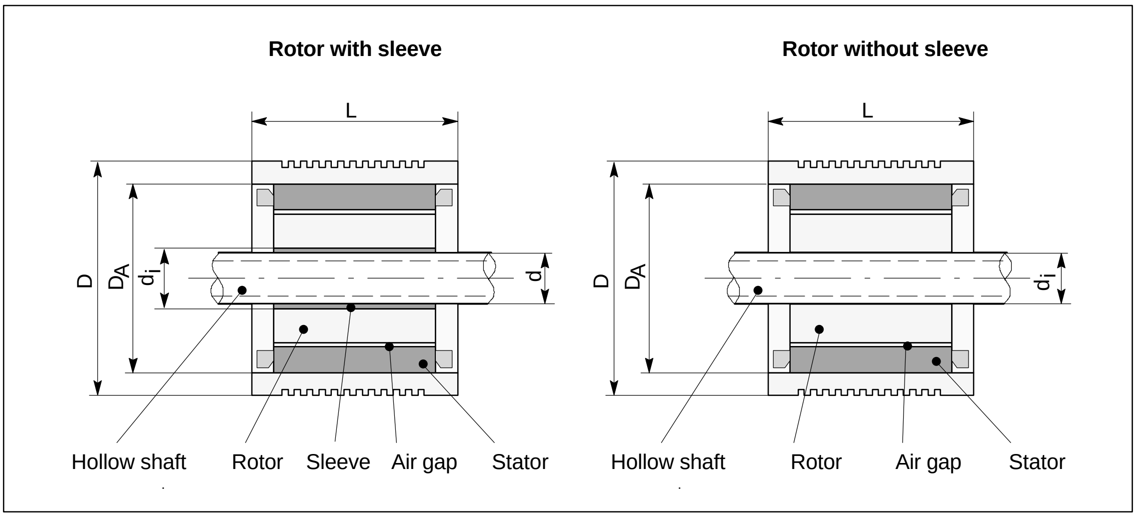


Fig. 1-3 Dimensions

Assignment

Motor – drive converter

The following currents refer to the SIMODRIVE 611 drive converter system, analog and digital.

Table 1-4 Assignment, motor – SIMODRIVE

Motor type	Power module
Built–in motors with sleeve	
1PH2093	24/32/32 A
1PH2095	30/40/51 A
1PH2113	60/80/102 A
1PH2115	60/80/102 A
1PH2117	60/80/102 A
1PH2118	85/110/127 A
1PH2182	45/60/76 A
1PH2184	60/80/102 A
1PH2186	85/110/127 A
1PH2188	85/110/127 A
1PH2254	120/150/193 A
1PH2256	120/150/193 A
Built–in motors without sleeve	
1PH2092	24/32/32 A
1PH2096	45/60/76 A
1PH2123	60/80/102 A
1PH2127	85/110/127 A
1PH2128	120/150/193 A
1PH2143	120/150/193 A
1PH2147	120/150/193 A

1.2 Cooling

The built–in motor stators are liquid–cooled. The user must connect the duct, which is used for cooling, to the cooling circuit. The following conditions must be maintained:

Cooling medium and cooling quantity

An anti–corrosion agent (e.g.Tyfocor) must be added to the water. In this case, the following ratio must not be exceeded:

Water:	75 %
Anti–corrosion agent:	25 %

Adequate heat transfer is achieved

with a flow of: 8 l/min

When using another cooling medium (e.g. oil, cooling–lubricating medium), it may be necessary to reduce the output, in order to limit the thermal loading on the spindle bearings.

In order to calculate the power reduction (de–rating), the following cooling medium characteristics must be known:

Specific gravity	ρ [kg/m^3]
Specific thermal capacity	c_p [J/(kg $*$ K)]

Note

For oil–water mixtures with less than 10 % oil, the motor output does not have to be reduced. The cooling medium must be pre–cleaned or filtered in order to prevent the cooling circuit being blocked.

1PH2

Maximum permissible partical size after filtering: 100 µm

The cooling duct geometry has been designed so that the power losses of the stator, and some of the rotor losses, can be dissipated. All of the built–in motors have the same geometry.

Cooling medium pressure

Maximum pressure drop across the motor:	0.3 bar
Maximum pressure at the inlet:	7.0 bar

Cooling medium inlet temperature

Recommended: $\geq$25 °C

In order to prevent moisture condensation, the cooling medium inlet temperature can, depending on the ambient temperature, be up to 40 °C.

The motors are designed for operation at 40 °C cooling medium temperature, but still maintaining all of the nominal motor data. In this case, an additional thermal decoupling between the motor components and the spindle bearings must be used, in order to avoid critical bearing temperatures.

Cooling powers

For a cooling medium temperature of 25 °C, the following cooling powers must be provided in continuous operation:

Table 1-5 Cooling powers

Built–in motors with sleeve		Built–in motors without sleeve	
Motor type	Cooling power [W]	Motor type	Cooling power[W]
1PH2093	1900	1PH2092	1200
1PH2095	2300	1PH2096	2200
1PH2113	2900	1PH2123	2200
1PH2115	3000	1PH2127	3500
1PH2117	3200	1PH2128	4000
1PH2118	4000	1PH2143	4000
1PH2182	2250	1PH2147	4800
1PH2184	2850		
1PH2186	3550		
1PH2188	4300		
1PH2254	3600		
1PH2256	4050		

Cooling units

In order to guarantee a cooling medium inlet temperature of 20 °C, a cooling unit should be used.

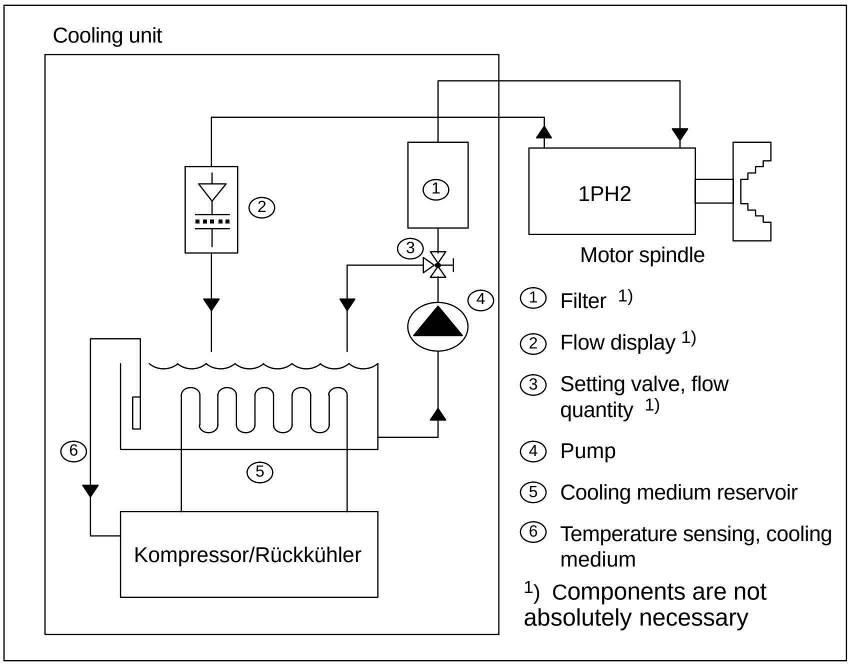


Fig. 1-4 Example of a cooling circuit

Several motors can be operated from one cooling unit

The cooling units are included in the scope of supply of the 1PH2 motors.

Table 1-6 Manufacturers of cooling units for water–cooled motors

Helmut Schimke **Industriekühlanlagen** **Ginsterweg 25–27** **42781 Haan** **Tel.: 02129/943 80** **Fax: 02129/943 99**	**Hyfra** **Industriekühlanlagen** **Industriestr.** **56593 Krunkel** **Tel.: 02687/8980** **Fax: 02687/89825**	**Riedel Kältetechnik** **Äuß. Bayreuther Str. 55** **90409 Nürnberg** **Tel.: 0911/51902–56** **Fax: 0911/51902–34**	**KKT Kraus** **Industriekühlung** **Industriestr. 23** **91207 Lauf** **Tel.: 09123/174–40** **Fax: 09123/174–84**

1.3 Machine safety

Caution

Electrical equipment and systems must be installed, so that they do not represent any hazard. Information is provided in VDE 0113 (EN 60204–1).

Degree of protection

The motor components have degree of protection IP 00.

The spindle manufacturer establishes the final degree of protection as a result of the spindle housing that is used. Protection against contact (shock hazard protection), foreign bodies and water for electrical equipment is defined according to DIN IEC 34 Part 5.

Recommended: IP 44 (minimum degree of protection)

Shock hazard protection

Caution

Protective measures against direct as well as indirect contact are required to prevent accidents caused by touching and coming into contact with active components. Information is provided in DIN VDE 0100, Part 410 and DIN VDE 0106, Part 100.

Note

When grounding, it should be ensure that there is a good electrical connection between the protective conductor and spindle box. This connection must be protected against corrosion
(e.g. apply a coating of Vaseline to bare contact surfaces).

Protection against indirect contact

The stator assembly is connected (electrically) with the cooling jacket. In order to guarantee adequate electrical connection to the spindle box, the cooling jakket must be connected to the spindle box through a good electrical connection. The effective contact surface is considered to be the cross–section. The spindle manufacturer is responsible in ensuring that the motor spindle is correctly grounded.

Recommended grounding

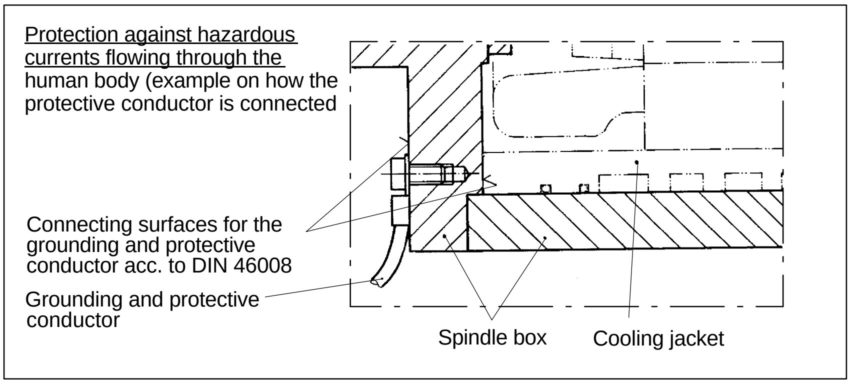


Fig. 1-5 Recommended grounding, motor spindle

High–voltage test

The stators of the built–in motors must be subjec to a high–voltage test according to VDE 0530. However, the Standards Commission recommends that a high–voltage test, according to VDE 0530, is repeated when electric components are installed (e.g. built–in motors) after the final assembly.

Warning

If the user carries–out an additional high–voltage test, the cable ends of the temperature sensors must be short–circuited for the test! If the test voltage was to be connected to the temperature sensor, it would be destroyed.

Thermal motor protection

A PTC thermistor is integrated in the stator winding to sense the motor temperature. Technical data, refer to Chapter 1.2.1, Encoder systems (GE).

The sensing and evaluation is realized in the drive converter, whose closed–loop control takes into account the temperature characteristics of the motor resistances.

An external tripping unit is not required. The PTC thermistor function is monitored. If a fault situation develops, an approprite signal is output to the drive converter. If the motor temperature increases, a pre–alarm, motor overtemperature, signal is output, which must be externally evaluated. If this signal is not observed, the drive converter shuts down when the motor limiting temperature is exceeded. The appropriate fault signal is output.

Note

Observe the polarity when connecting–up PTC thermistors! The PTC thermistor characteristic is polarity–dependent.

Polarity:
1PH2092 to 1PH2147
brown conductor = +temp
white conductor = –temp

1PH2182 to 1PH2256
yellow conductor = +temp
green conductor = –temp

1.4 Assembly

1.4.1 Rotor

Design

The squirrel–cage rotor has an inner bore, machined to the final dimensions.

Note

- **Built–in motors with sleeve:**

  The rotor is located on an inner sleeve with a stage press fit. This press fit can be released using pressurized oil. The contact surfaces are not damaged.

- **Built–in motors without sleeve:**

  The force is transferred, play–free without sleeve, which means that lower moments of inertia are achieved. The rotor bore permits, a hollow spindle through which tool clamping devices, compressed air and cooling–medium lines can be fed.

The spindle manufacturer mounts the rotor onto the spindle using a thermal technique. For play–free and force–locked torque transmission, the spindle must be machined, in the area of the press fit, to the specified dimensions and tolerances.

1PH2

Dimensions

The dimensions can be taken from the dimension drawings in Chapter 4.

A minimum spindle wall thickness is required in the area of the press fit:

Table 1-7 Spindle wall thickness

Motor types	Spindle wall thickness [mm]
Built–in motors with sleeve	
1PH2093 – 095	9
1PH2113 – 118	11
1PH2182 – 188	15
1PH2254 – 256	15
Built–in motors without sleeve	
1PH2092 – 096	10
1PH2123 – 128	13
1PH2143 – 147	15

Pressurized oil connection

(only for 1PH2 motors with sleeve)

The pressurized oil connections to release the rotor are provided in the rotor. If an outer spindle diameter is required, which exceeds the standard value, then the bores for the oil pressure release must be located in the spindle.

For centered assembly without damaging the inner rotor bore, the introductory zone must have a larger inner diameter.

Assembly

Warning

Safe working procedures must be ensured when mounting, releasing and re–using parts and components which were previously used. Refer to the instructions and information in DIN 15055.

Preparation

The rotor is thermally mounted onto the spindle. The following preparatory measures must be made:

- The rotor must be mounted in a dry and dust–free environment.
- Suitable tools and equipment must be used.
- The mounting surfaces must be free of any dirt, machining grooves and damage which could have a negative impact on establishing the pressurized oil film when disassembling the rotor[1)].
- The anti–corrosion agent on the mounting surfaces of the rotor sleeve must be removed.
- Clean the oil connection bores[1)]. The caps must unscrewed from the oil connections.
- Preparing to mount the rotor:

  A recommended mounting procedure is illustrated in Fig.1-6. In this case, the hot rotor is supported in the vertical position so that it can accept the spindle.

1) only for built–in motors with sleeve

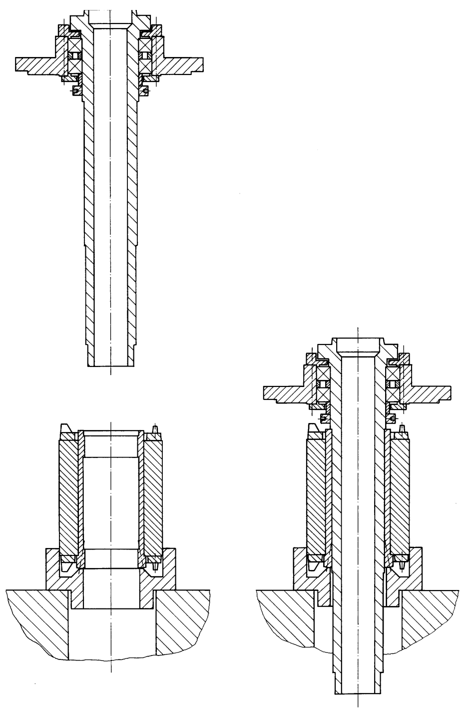


Fig. 1-6 Mounting the rotor onto the spindle

Introducing the rotor into the spindle

- Heat–up the rotor in an oven to T = 180 °C up to max. 200 °C.

Note

Observe the hazards due to hot parts.

Maximum spindle temperature before assembly: 30 °C

- Quickly introduce the spindle into the correct position.
- Allow the rotor and spindle to cool down to room temperature.
- Re–close the oil connections using the caps supplied, and secure using Loctite 243[1)].
- After the rotor has been mounted onto the spindle for the first time, we recommend that the position of the rotor on the spindle is clearly marked on the face side[1)]. This means, that if the rotor is subsequently mounted on the spindle, it will not be necessary to finely balance the complete spindle.
- Check the radial eccentricity. The maximum permissible radial eccentricity deviation, referred to the spindle axis, is 0.05 mm.

1) only for built–in motors for turning applications (lathe applications)

- If the parts do not line–up as required after room temperature has been reached, then this can be achieved by applying oil pressure[1)]. It is important that the information and instructions in the disassembly section are observed.

  Recommended viscosity of the disassembly fluid: 300 mm^2/s at 20 °C

  After this procedure has been completed, the oil must flow–out between the joint surfaces. The spindle–rotor assembly can be fully loaded after approx. 24 hours.

Disassembly

Built–in motors with sleeve

If the spindle has to be repaired (e.g. bearings replaced), it may be necessary to disassemble the spindle. The rotor can be released from the spindle axis using pressurized oil.

The following procedure must be followed:

Warning

Observe all of the relevant safety procedures when releasing the rotor from the spindle assembly
Provide a protective barrier, e.g. Perspex/plastic sheet.

- Release both of the studs on the face side of the rotor and check that the area around the oil connection bores is free of accumulated dirt.
- Mount the spindle in a vertical position so that the oil connection bores are located horizontally one above the other. Also provide an end stop. When the oil pressure is established, the rotor can release extremely quickly! Provide a set–up which will then hold the rotor after it has been released (refer to Fig. 1-7).
- Connect a suitable, manually operated oil pump to one of the two oil connection bores. The manually operated oil pump must be provided with a manometer to measure the oil pressure.
- Pump in oil at the lower bore of the spindle–rotor assembly until this oil is discharged at the upper oil connection outlet. Close this oil connection outlet using the stud provided.

  For disassembly, a disassembly fluid with a viscosity of 900 mm^2/s at 20 °C is recommended (e.g. LH DF 900 from SFK).

Table 1-8 Maximum oil pressure

Motortype	Maximum oil pressure p_{max}
1PH2 093–095 1PH2 113–118	800 bar 800 bar
1PH2 182–188 1PH2 254–256	600 bar 770 bar

If the oil pressure increases above the specified values, this operation must be immediately stopped.

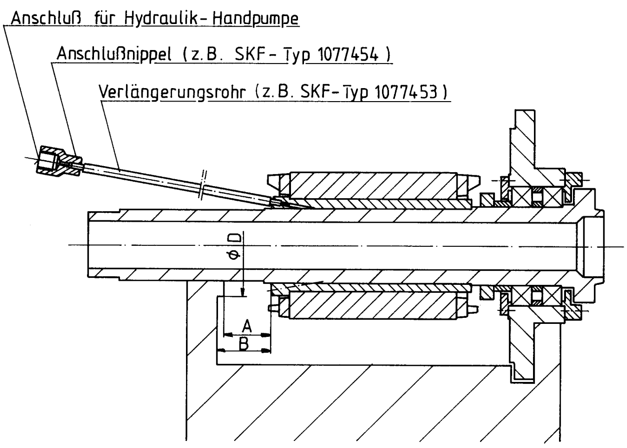
1) only for built–in motors with sleeve

- Slowly increase the pressure in the rotor–spindle assembly to approx. 2/3 p_{max}, and allow this to take effect for approx. 15 min. This will then allow the oil to be distributed and to penetrate into the joint surfaces. During this time, ensure that the oil pressure does not sink.
- Then, gradually increase the pressure step–by–step and, monitoring the oil pressure, release the rotor from the spindle.

Warning

Observe the maximum oil pressure!

- After a separating oil film has been established between the joint surfaces, the axial force caused by the various diameters, allows the rotor to slide off the spindle without having to apply an external force.
- Remove the rotor from the spindle.
- This release pressure causes radial and tangential stressing in the components. When selecting a suitable spindle material, the stressing, which occurs in the spindle when releasing the rotor, must be taken into account. Calculation equations for ring–shaped–sections are, for example, defined in DIN 7190.



Maße / Typ	A	B	ΦD
1PH2093...095	35	42	92
1PH2113 ... 118	35	42	107

Fig. 1-7 Disassembly, built–in motors with sleeve

1PH2

Built–in motors without sleeve

Generally, it is not possible to remove the rotor without causing some damage. This should be taken into account in the mechanical design (e.g. service, replacing bearings), by having a design where the bearings on the drive end and non–drive end can be disassembled.

Disassembly can also be realized, for example, by cutting the rotor away or by releasing it thermally.

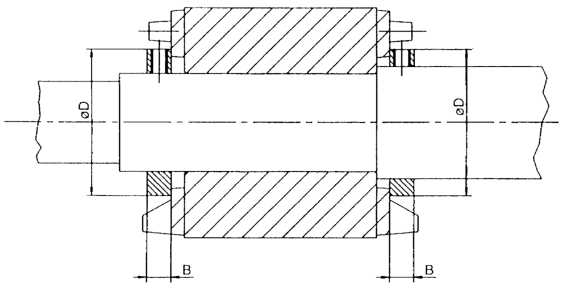
Balancing (acc. to VDI 2060, DIN ISO 1940)

- The rotors with sleeve are supplied with the following balancing quality levels: (reference speed 3600 RPM)

Table 1-9 Balancing quality

Motor types	Balancing quality level
Built–in motors with sleeve	
1PH2093 – 095 1PH2113 – 118 1PH2182 – 188 1PH2254 – 256	G 2.5 G 2.5 G 2.5 G 2.5

- The rotors without sleeve are not balanced



	D	B	U[1)]
1PH209□–4	72	12	400 gmm
1PH212□–4	104	12	1100 gmm
1PH214□–4	119	12	1500 gmm

Balancing disk (not included in the scope of supply) – material: steel

Fig. 1-8 Recommended, balancing disk balancing for built–in motors without sleeve

- After the rotor has been mounted on the spindle, it may be necessary to finely balance the complete spindle–rotor assembly. The required balancing planes should then be provided on the spindle system. It is not permissible to remove metal from the short–circuit ring.

1) required balancing equalization for each balancing disk

1.4.2 Stator

Design

The stator of built–in motors consists of a wound stator core, which is pressed into a cooling (jacket). An open spiral–shaped cooling duct is machined into the outer surface of the cooling jacket. The spindle manufacturer must insert the stator into the spindle housing.

Dimensions

The dimensions can be taken from the dimension drawings in Chapter 4.

Spindle housing

The spindle housing seals–off the open stator cooling duct to the outside. The inner contour of the spindle housing in the stator area must fit the external contour of the cooling jacket.

The spindle housing must fulfill the following functions:

- Seal the open cooling duct to the outside.
- Center the stator to the spindle.
- Accept the spindle with bearings.
- Cooling medium inlet and outlet.
- Accept the stator torque
- Retain the spindle in the machine tool.
- Degree of protection of the motor spindle acc. to IEC 34, Part 5/VDE 0530, Part 5.
- Drilling at the lowest point on the drive end and non–drive end to allow condensation water to drain (acc. to DIN IEC 34, S10; code 5b).
- The following minimum insulating clearances must be observed (minimum air clearances):

Table 1-10 Minimun insulating clearances

Supply voltage in [V]	≤ 500	> 500 to 660
Min. air clearance in [mm]	4.5	6

1PH2

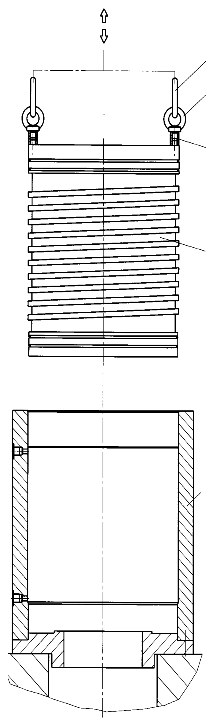


Fig. 1-9 Transporting and installing the built–in motor stator

Assembly

The spindle manufacturer mounts the stator in the spindle housing and bolts it into place. The following procedure must be observed:

- The mounting should be done in a dry, dust–free environment.
- Suitable tools and equipment must be used.
- The joint surfaces and the O–ring grooves must be free of any dirt accumulation, machining scores, swarf and damage. Sharp edges in the spindle housing must be carefully removed.
- In order to guarantee correct sealing and the ability to disassemble, a suitable anti–corrosion agent must be applied to the area between the spindle housing and cooling jacket, which does not come into contact with the cooling liquid.
- Attach the 4 O–rings and slightly grease.
- Allow the stator to slide into the spindle housing, centered (refer to Fig. 1-9). Suitable transport lugs, e.g. ring bolts according to DIN 580 should be used to hoist the built–in stator.
- Bolt the stator to the spindle housing on the face side. Tighten–up the bolts evenly, measuring the tightening torque.
- The motor spindle cooling duct should be filled with a liquid, and the liquid pressure continually increased to 7 bar. This checks that the O–rings seal correctly. If leaks occur, the sealing surfaces and the O–rings should be checked, and if required, replaced.

1.4.3 Electrical connection

The connecting cables are brought out as free cable ends, and as standard, have the following conductor cross–sections (Cu) and outer diameter:

Connecting cables

Table 1-11 Cable cross–section, connecting cable

Motor type	Cable cross–section [mm^2]	Outer cable diameter [mm]
Built–in motors with sleeve		
1PH2093	2.5	3.6–4.4
1PH2095	4	4.3–5.5
1PH2113	10	6.4–7.9
1PH2115	10	6.4–7.9
1PH2117	10	6.4–7.9
1PH2118	16	7.5–9.0
1PH2182	6	max. 5.6
1PH2184	10	max. 7.2
1PH2186	10	max. 7.2
1PH2188	16	max. 9.2
1PH2254	25	max. 11
1PH2256	25	max. 11
Built–in motors without sleeve		
1PH2092	4	4.3–5.5
1PH2096	6	4.9–6.3
1PH2123	10	6.4–7.9
1PH2127	16	7.5–9.0
1PH2128	25	9.5–11.0
1PH2143	25	9.5–11.0
1PH2147	25	9.5–11.0

Instructions for using cables is specified in VDE 0298, Part 3.

We recommend that the free cable ends are fed–out of the spindle box in a suitable protective tubing with cable gland. Effective cable strain relief must be ensured.

■

Notes

Order Designations

2

Order designation

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

The first block has seven positions and designates the motor type. Additional features are coded in the second block. The third block is provided for additional information and data.

1	P	H	2	.	.	.	–	.	.	.	.	.	–	Z

AC built–in induction motor

Frame size
09: D_A = 180 mm
11: D_A = 220 mm
12: D_A = 235 mm
14: D_A = 280 mm
18: D_A = 280 mm
25: D_A = 390 mm

Length

Pole number

Cooling type
W = liquid cooling

Rated speed
B = 500 RPMn
P = 600 RPM
C = 750 RPM
F = 500 RPM
G = 2000 RPM

Winding versions
4 = standard version

Built–in motor

4–pole:	6–pole:
1 = with sleeve	1 = cable length 1.5 m
2 = without sleeve	2 = cable length 0.5 m

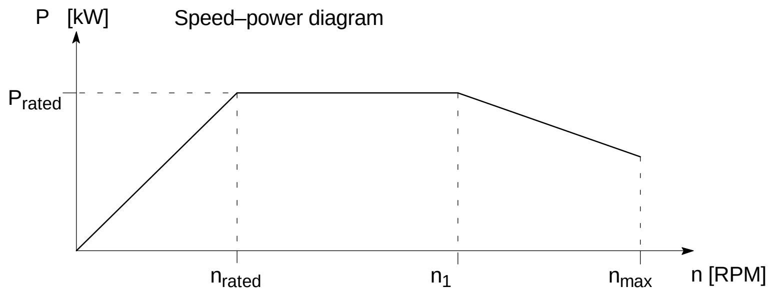
Additional data, specify in plain text

Selection help

In addition to the characteristic electrical data (rated torque M_{rated}, rated speed n_{rated}, maximum speed n_{max}), the required mounting dimensions must also be taken into account. On one hand, it should be checked as to whether the overall diameter D and the overall length L of the motor correspond to the mounting space availble. On the other hand, it must be ensured that the inner bore of the rotor is large enough to accept the spindle.

In order to simplify selecting the most suitable built–in motor, the following checklist is intended to help you to define the motor from Table 1-2.

User:	Date:	
Machine:	Type:	
Checklist:		
Rated torque	M_{rated}	[Nm]
Rated speed	n_{rated}	[RPM]
Maximum speed	n_{max}	[RPM]
Transition speed	n_1	[RPM]
Rated output	P_{rated}	[kW]
Space available:		
Outer motor diameter	D	[mm]
Motor length	L	[mm]
Spindle geometry:		
Outer spindle diameter in the motor area	d	[mm]
Outer spindle diameter in the encoder area	$d_{encoder}$	[mm]
Internal spindle diameter	d_S	[mm]



$$M_{rated} = \frac{P_{rated} * 9.55}{n_{rated}} \quad (M_{rated} \text{ in Nm})$$

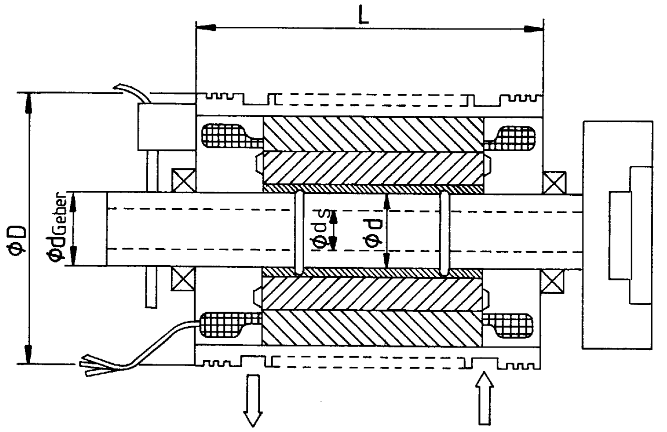


Fig. 2-1 Checklist terminology

■

Notes

3 Technical Data and Characteristics

3.1 Speed–power diagrams

The built–in motors must be continuously cooled in operation, independent of the duty type.

Note

Depending on the motor spindle design, various levels of friction losses occur (e.g. bearing losses, turbulence losses, losses at shaft glands etc.).

As the built–in motor manufacturer does not know these losses, the motor outputs and torques, specified in this documentation, refer to the values, which the built–in motor rotor transfers to the spindle. In order to determine the net shaft output, the total frictional losses must be subtracted from the specified values.

The dotted lines in the digrams indicate the power limit of the particular SIMODRIVE 611 for the specified built–in motor. The power module is specified.

3.1.1 Built–in motors with sleeve

Table 3-1 AC built–in motor 1PH2093–6WF4

Rated output P_{rated} [kW]	Rated speed n_{rated} [RPM]	Rated torque M_{rated} [Nm]	Rated current I_{rated} [A]	Time constant (therm.) T_{th} [min]	Max. speed n_{max} [RPM]	Moment of inertia J [kgm^2]	Weight m [kg]
7.5	1500	48	24	4	10000	0.028	34

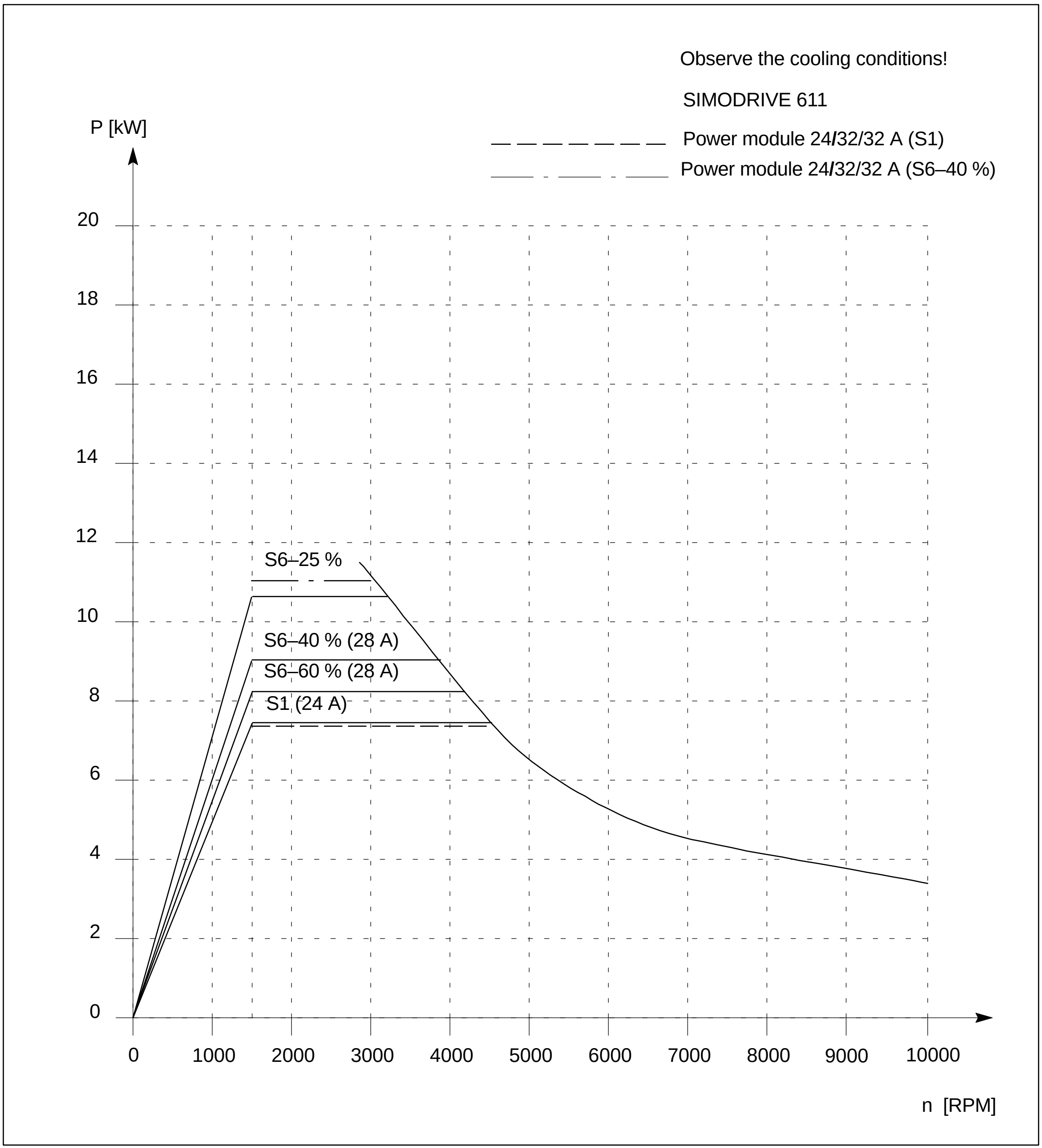


Fig. 3-1 Speed–power diagram 1PH2093–6WF4

Table 3-2 AC built–in motor 1PH2095–6WF4

Rated output P_{rated} [kW]	Rated speed n_{rated} [RPM]	Rated torque M_{rated} [Nm]	Rated current I_{rated} [A]	Time constant (therm.) T_{th} [min]	Max. speed n_{max} [RPM]	Moment of inertia J [kgm^2]	Weight m [kg]
10	1500	64	30	4	10000	0.036	44

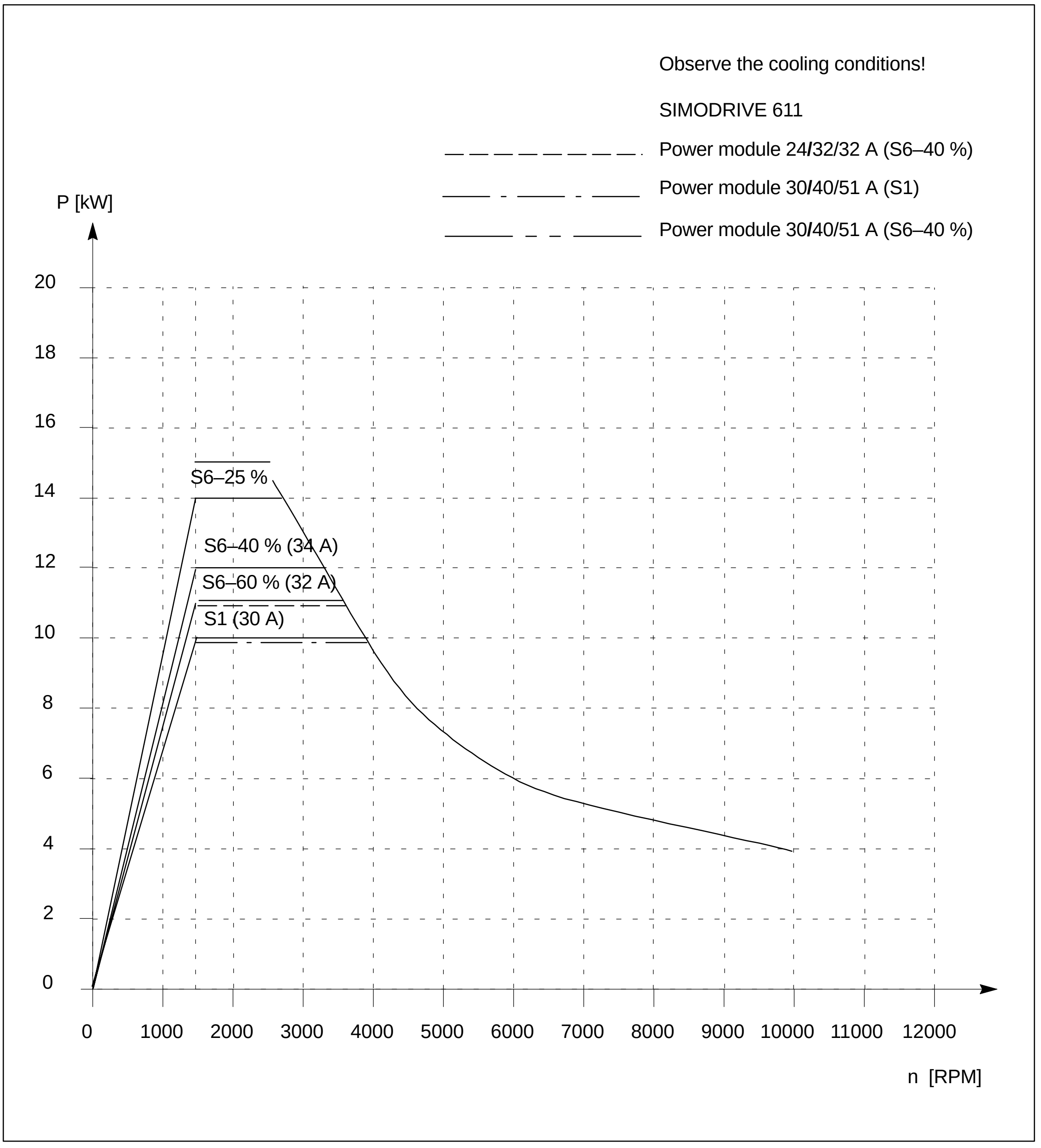


Fig. 3-2 Speed–power diagram 1PH2095–6WF4

1PH2

Table 3-3 AC built–in motor 1PH2113–6WF4

Rated output P_{rated} [**kW**]	Rated speed n_{rated} [**RPM**]	Rated torque M_{rated} [**Nm**]	Rated current I_{rated} [**A**]	Time constant (therm.) T_{th} [**min**]	Max. speed n_{max} [**RPM**]	Moment of inertia J [**kgm²**]	Weight m [**kg**]
15	1500	95	56	6	10000	0.066	59

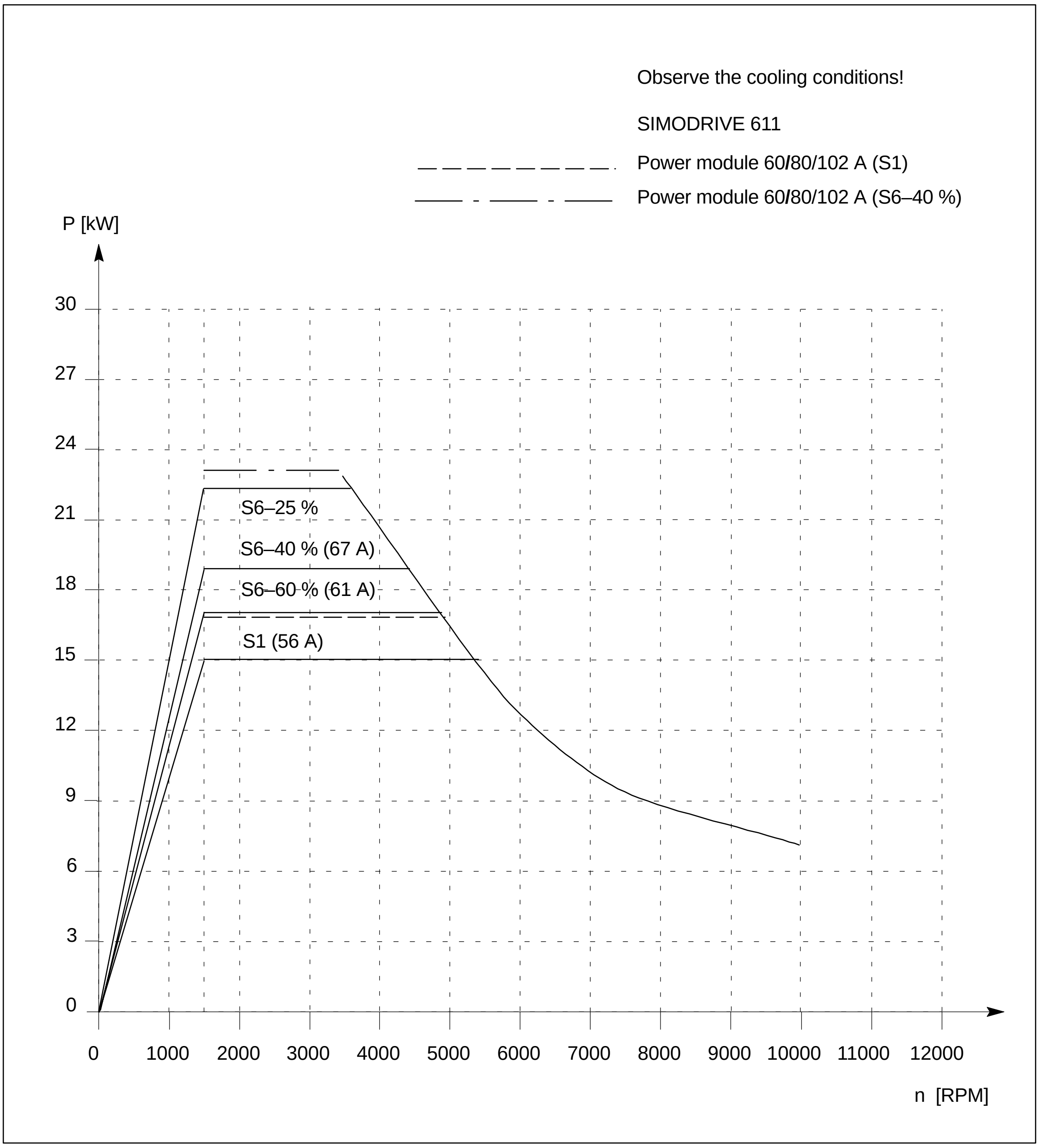


Fig. 3-3 Speed–power diagram 1PH2113–6WF4

 6SN1197–0AA20

Table 3-4 AC built–in motor 1PH2115–6WF4

Rated output P_{rated} [kW]	Rated speed n_{rated} [RPM]	Rated torque M_{rated} [Nm]	Rated current I_{rated} [A]	Time constant (therm.) T_{th} [min]	Max. speed n_{max} [RPM]	Moment of inertia J [kgm²]	Weight m [kg]
16.5	1500	105	55	6	10000	0.073	65

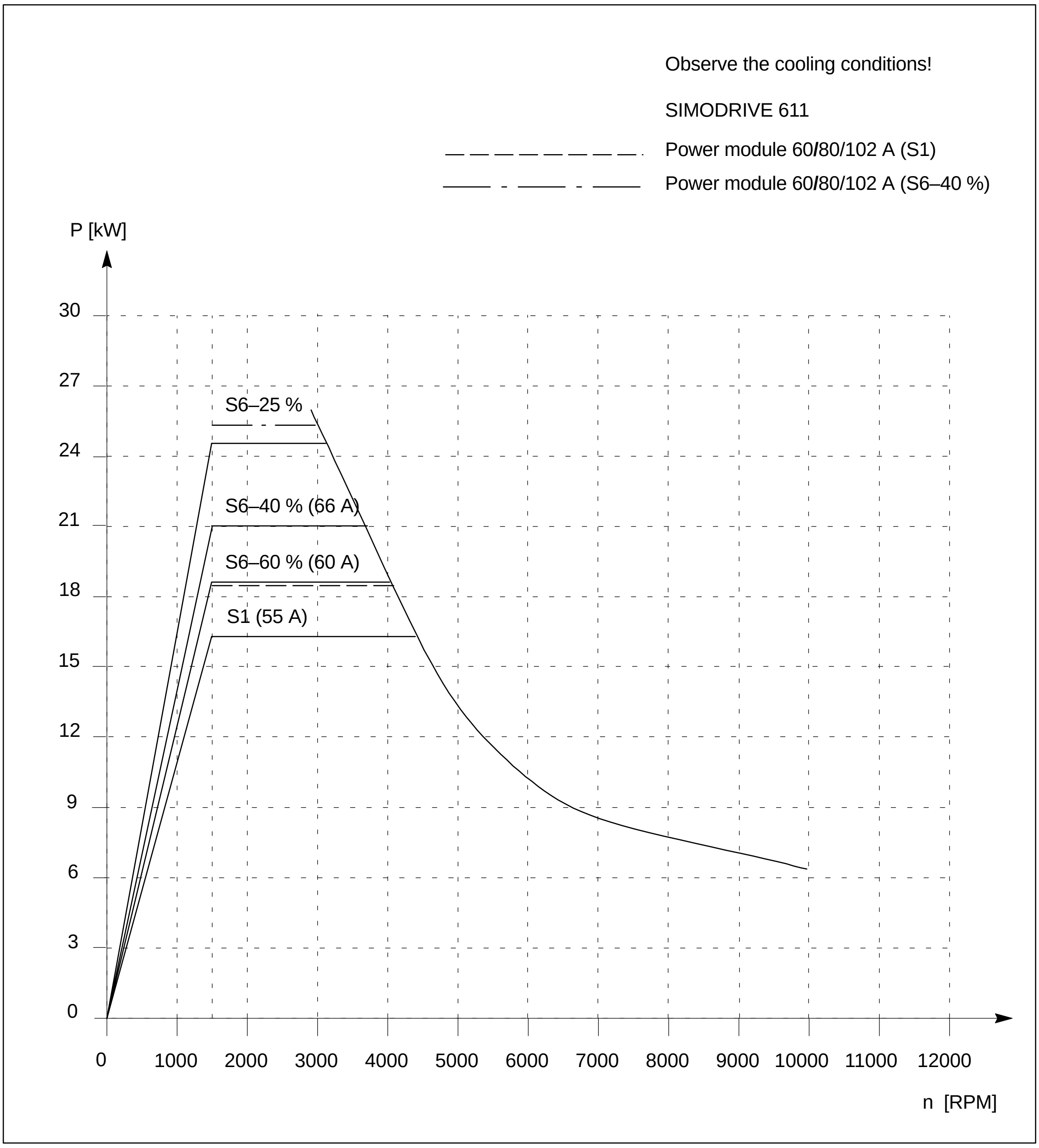


Fig. 3-4 Speed–power diagram 1PH2115–6WF4

Table 3-5 AC built–in motor 1PH2117–6WF4

Rated output P_{rated} [kW]	Rated speed n_{rated} [RPM]	Rated torque M_{rated} [Nm]	Rated current I_{rated} [A]	Time constant (therm.) T_{th} [min]	Max. speed n_{max} [RPM]	Moment of inertia J [kgm^2]	Weight m [kg]
18	1500	115	60	6	10000	0.079	72

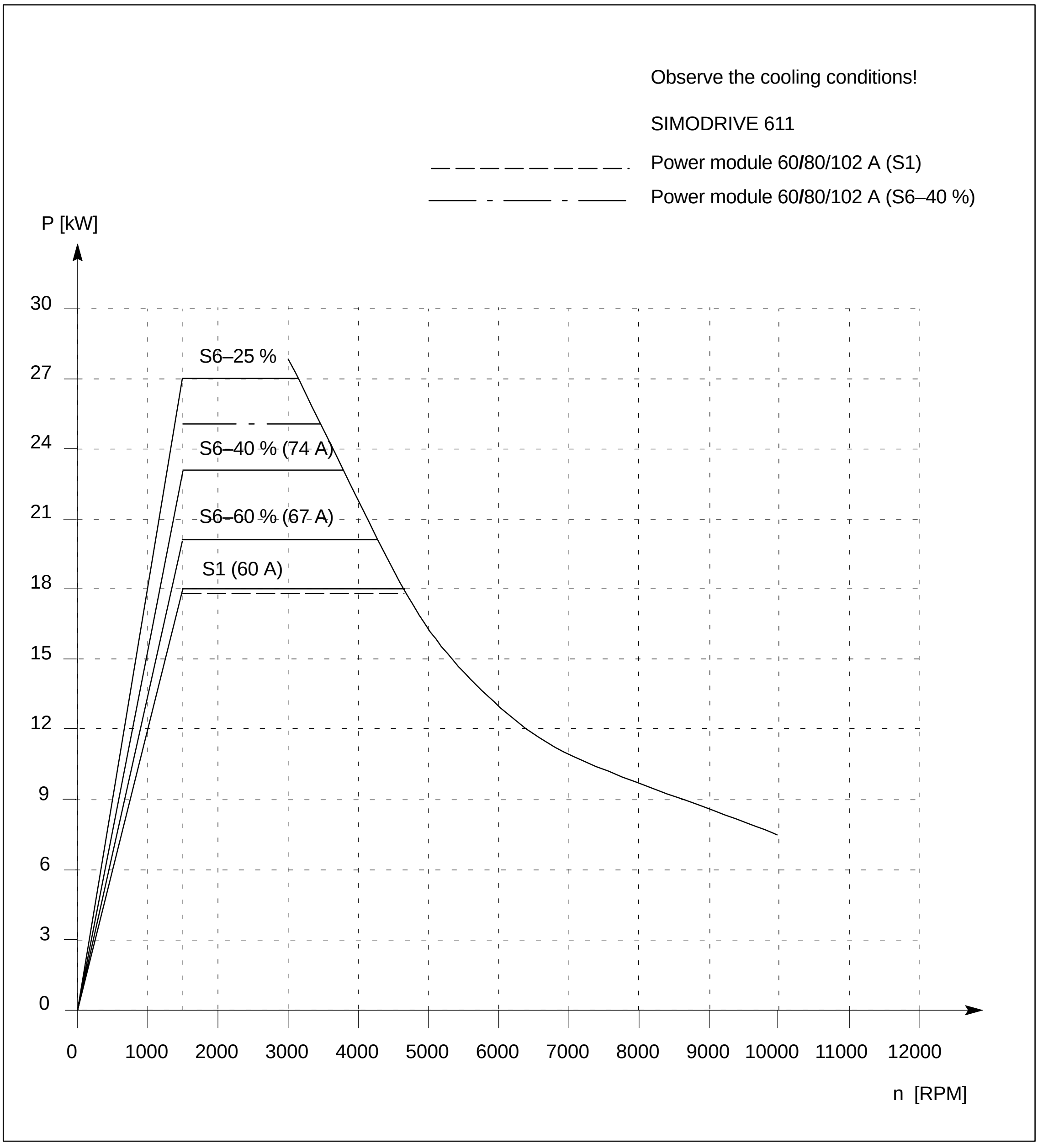


Fig. 3-5 Speed–power diagram 1PH2117–6WF4

Table 3-6 AC built–in motor 1PH2118–6WF4

Rated output P_{rated} [kW]	Rated speed n_{rated} [RPM]	Rated torque M_{rated} [Nm]	Rated current I_{rated} [A]	Time constant (therm.) T_{th} [min]	Max. speed n_{max} [RPM]	Moment of inertia J [kgm^2]	Weight m [kg]
23	1500	146	82	6	10000	0.100	89

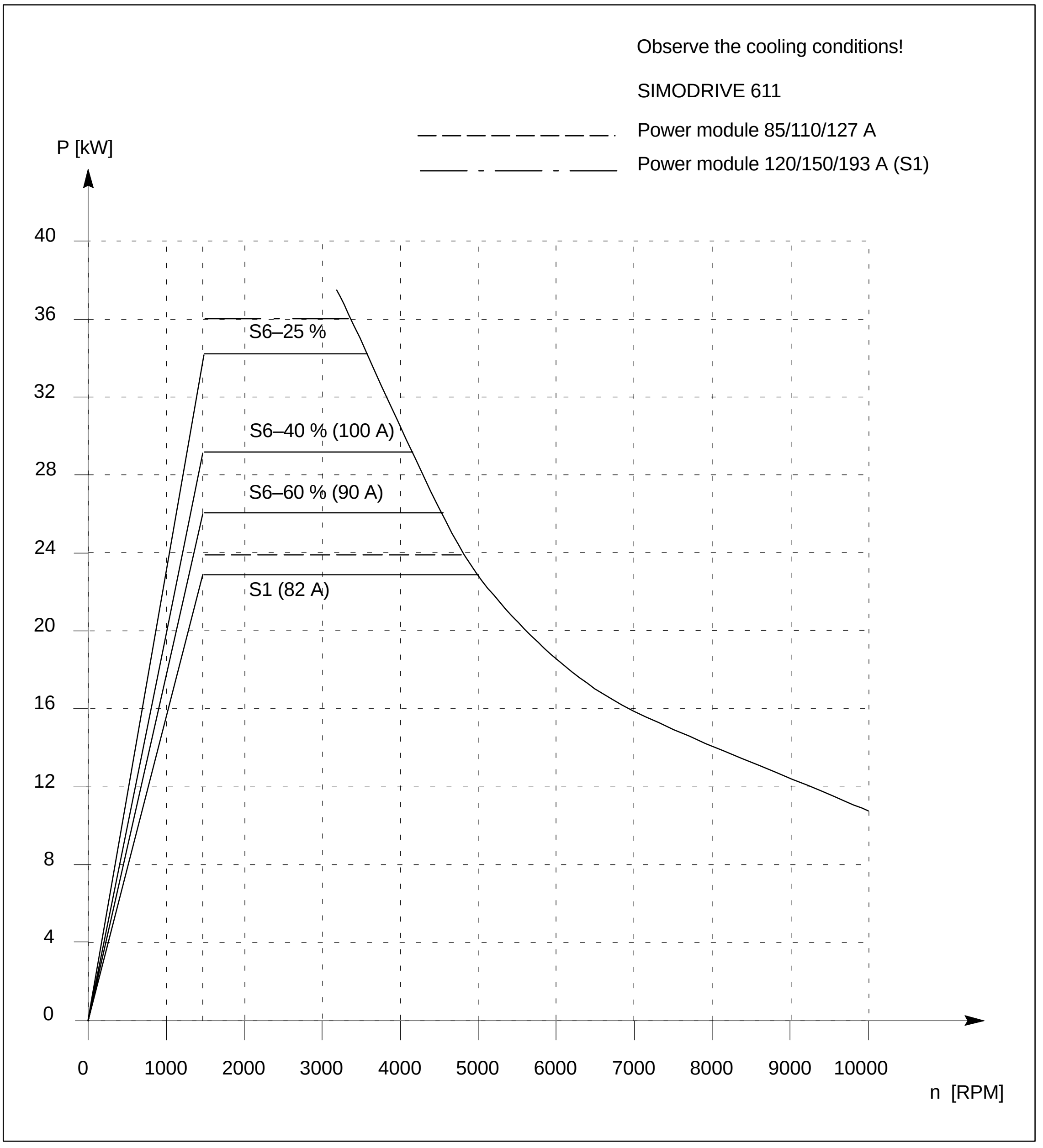


Fig. 3-6 Speed–power diagram 1PH2118–6WF41

1PH2

Table 3-7 AC built–in motor 1PH2182–6WC4

Rated output P_{rated} [kW]	Rated speed n_{rated} [RPM]	Rated torque M_{rated} [Nm]	Rated current I_{rated} [A]	Time constant (therm.) T_{th} [min]	Max. speed n_{max} [RPM]	Moment of inertia J [kgm^2]	Weight m [kg]
11.8	750	150	37	20	8000	0.218	98

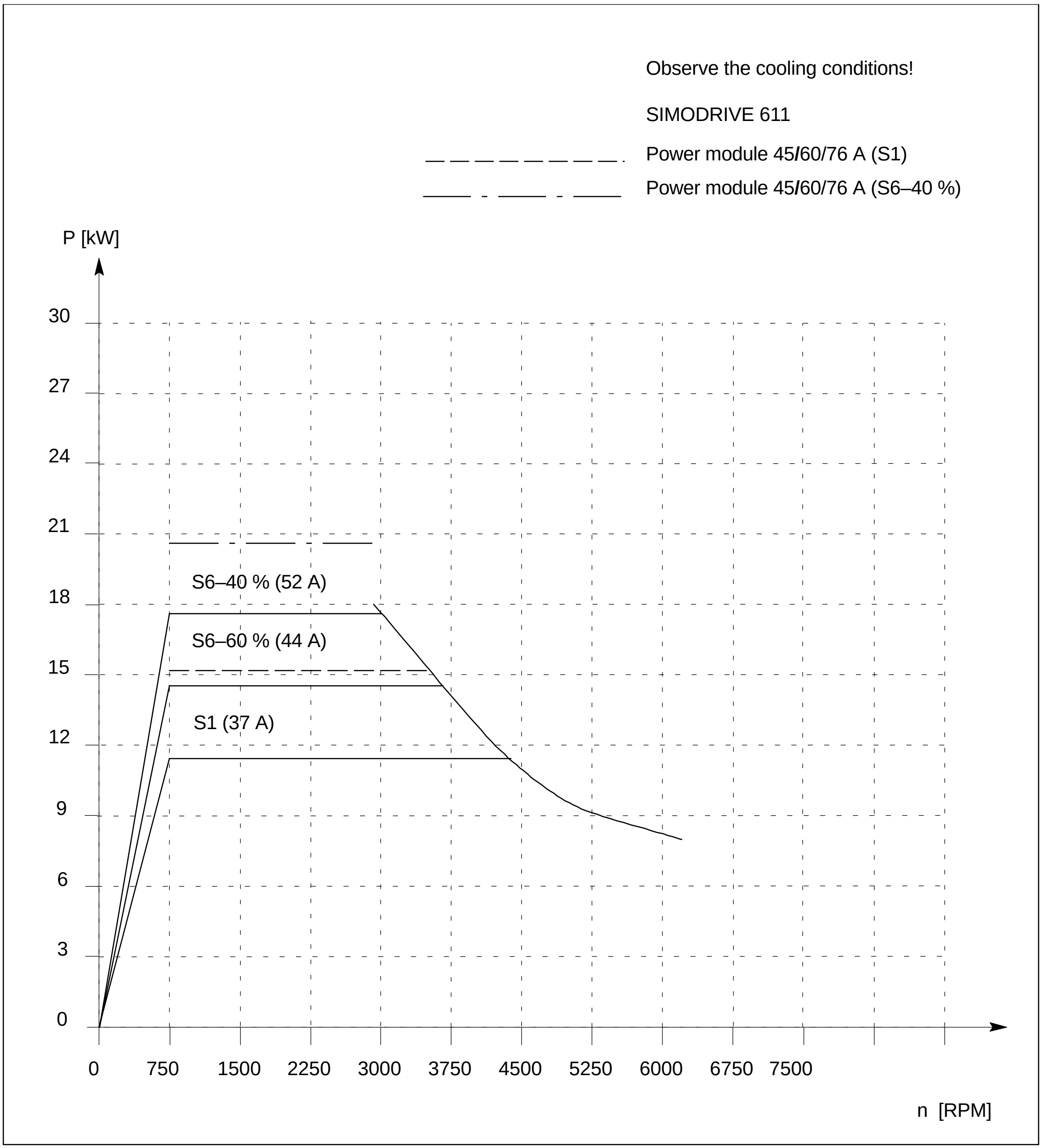


Fig. 3-7 Speed–power diagram 1PH2182–6WC4

 6SN1197–0AA20

Table 3-8 AC built–in motor 1PH2184–6WP41

Rated output P_{rated} [kW]	Rated speed n_{rated} [RPM]	Rated torque M_{rated} [Nm]	Rated current I_{rated} [A]	Time constant (therm.) T_{th} [min]	Max. speed n_{max} [RPM]	Moment of inertia J [kgm^2]	Weight m [kg]
14.5	600	230	56	20	8000	0.306	136

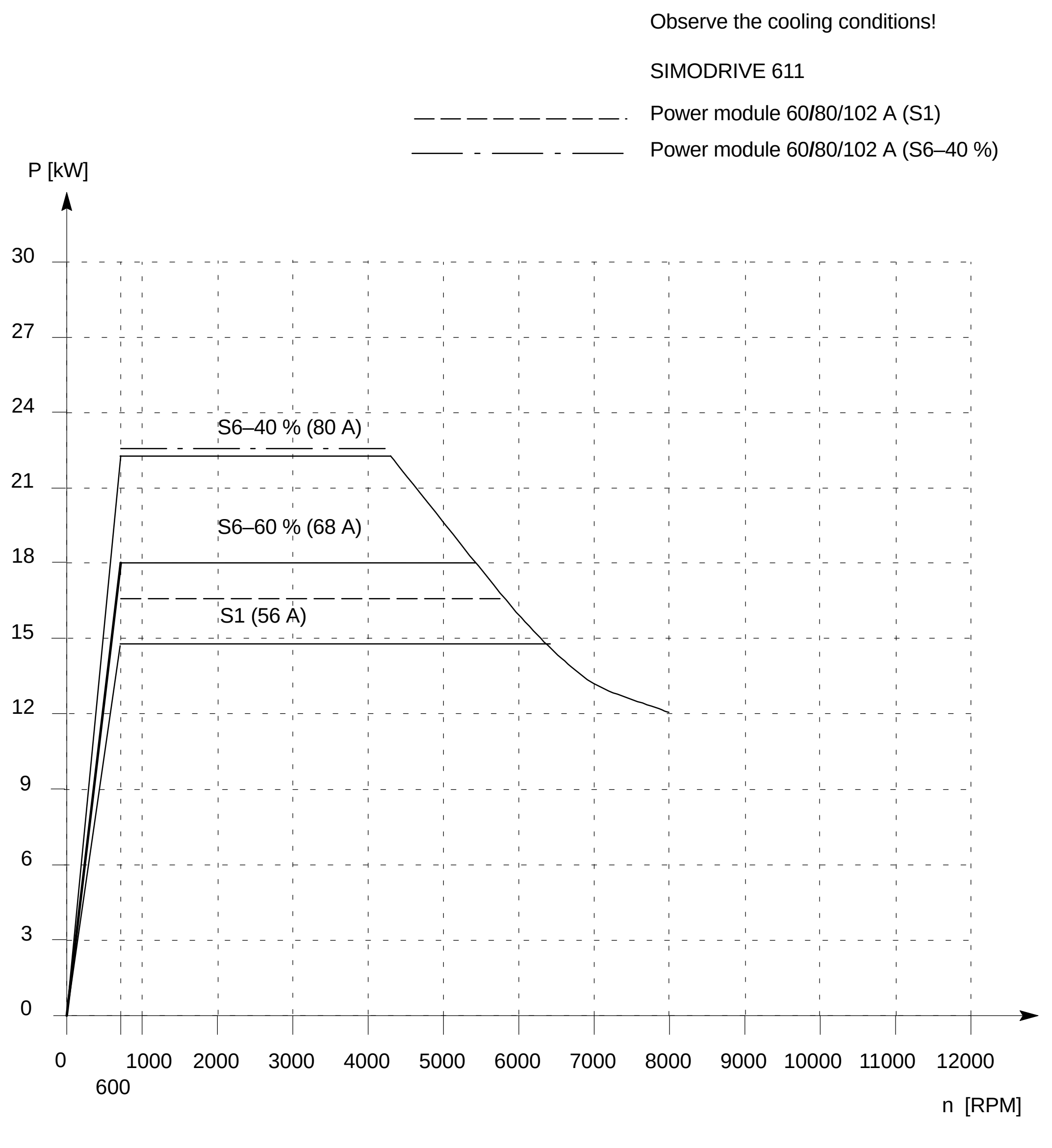


Fig. 3-8 Speed–power diagram 1PH2184–6WP41

Table 3-9 AC built–in motor 1PH2186–6WB41

Rated output P_{rated} [kW]	Rated speed n_{rated} [RPM]	Rated torque M_{rated} [Nm]	Rated current I_{rated} [A]	Time constant (therm.) T_{th} [min]	Max. speed n_{max} [RPM]	Moment of inertia J [kgm^2]	Weight m [kg]
18.3	500	350	65	20	8000	0.428	191

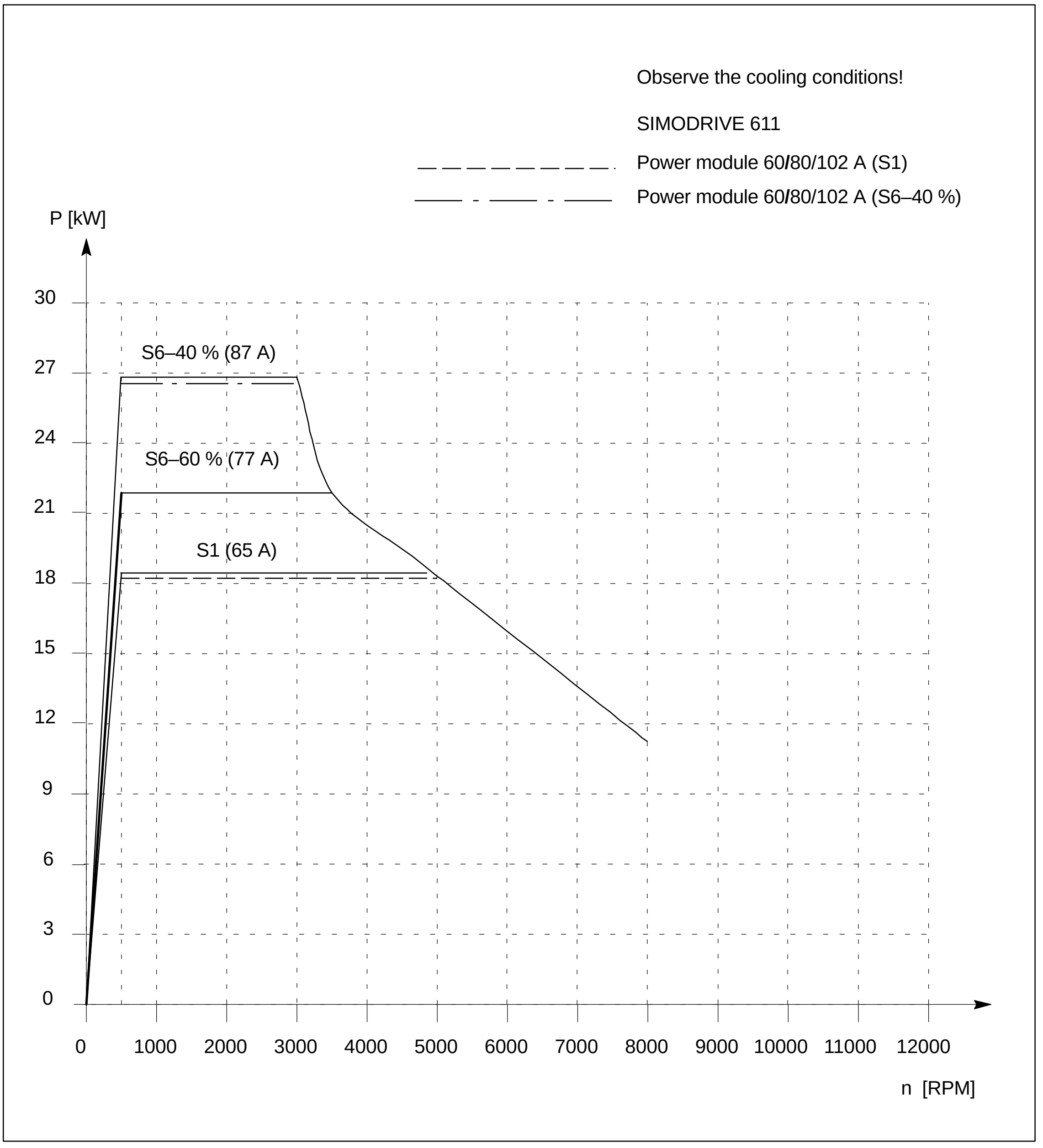


Fig. 3-9 Speed–power diagram 1PH2186–6WB41

Table 3-10 AC built–in motor 1PH2188–6WB41

Rated output P_{rated} [kW]	Rated speed n_{rated} [RPM]	Rated torque M_{rated} [Nm]	Rated current I_{rated} [A]	Time constant (therm.) T_{th} [min]	Max. speed n_{max} [RPM]	Moment of inertia J [kgm^2]	Weight m [kg]
23.6	500	450	78	20	6000	1.018	237

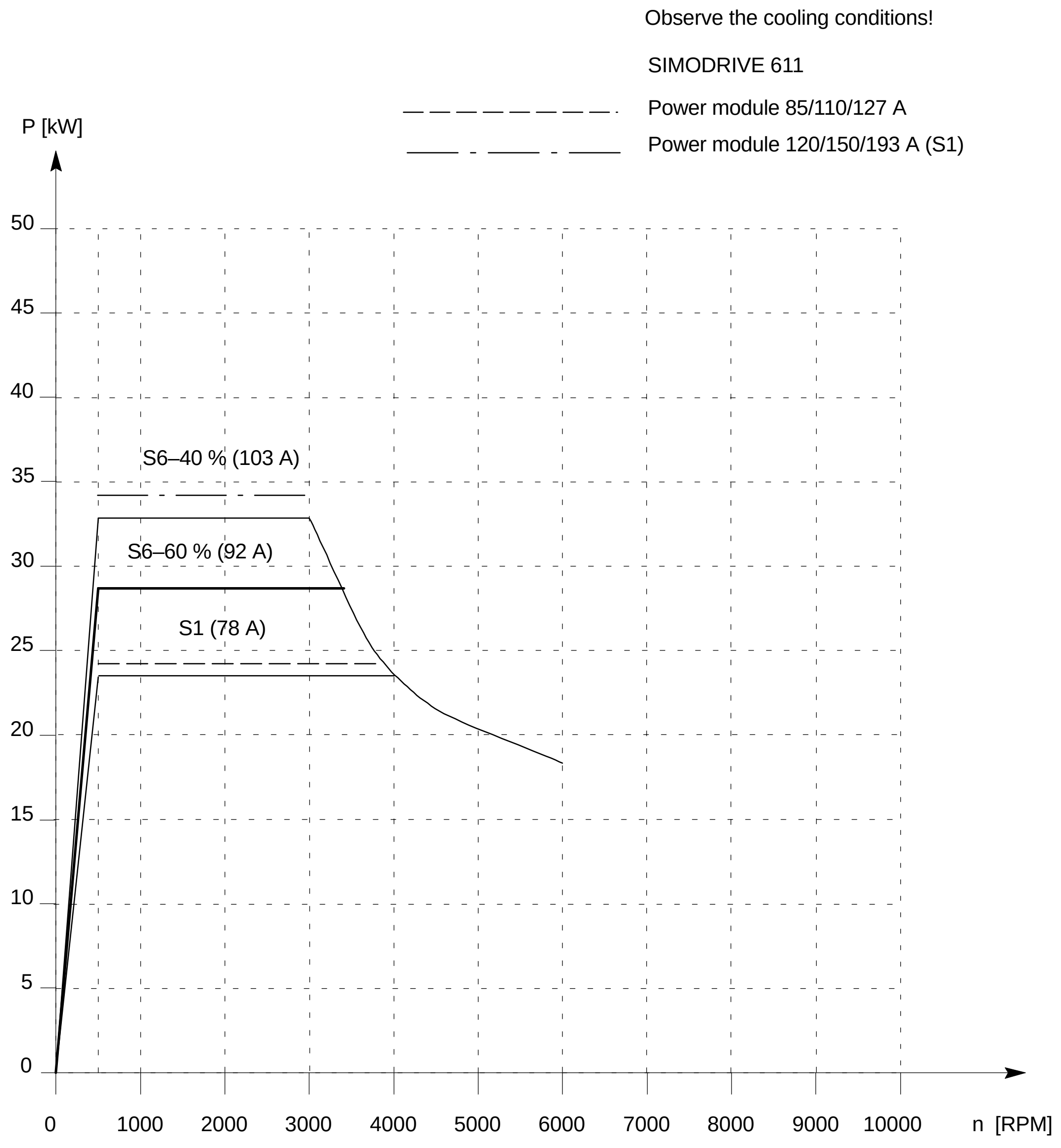


Fig. 3-10 Speed–power diagram 1PH2188–6WB41

1PH2

Table 3-11 AC built–in motor 1PH2254–6WB41

Rated output P_{rated} [**kW**]	**Rated speed** n_{rated} [**RPM**]	**Rated torque** M_{rated} [**Nm**]	**Rated current** I_{rated} [**A**]	**Time constant (therm.)** T_{th} [**min**]	**Max. speed** n_{max} [**RPM**]	**Moment of inertia** J [kgm^2]	**Weight** m [**kg**]
28.8	500	550	117	20	6000	1.215	260

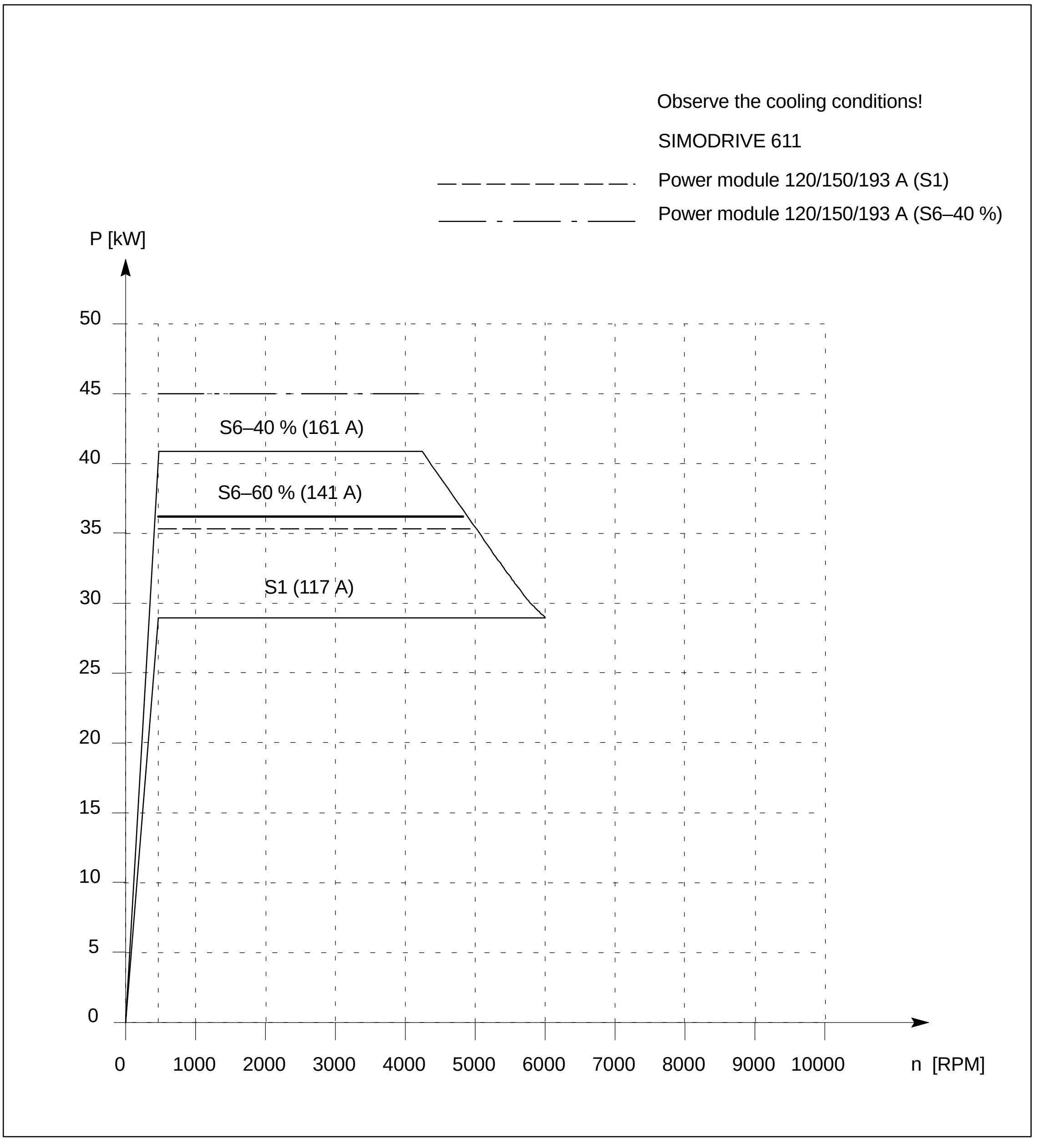


Fig. 3-11 Speed–power diagram 1PH2254–6WB41

Table 3-12 AC built–in motor 1PH2256–6WB41

Rated output P_{rated} [kW]	Rated speed n_{rated} [RPM]	Rated torque M_{rated} [Nm]	Rated current I_{rated} [A]	Time constant (therm.) T_{th} [min]	Max. speed n_{max} [RPM]	Moment of inertia J [kgm^2]	Weight m [kg]
39.3	500	750	119	20	4000	1.649	344

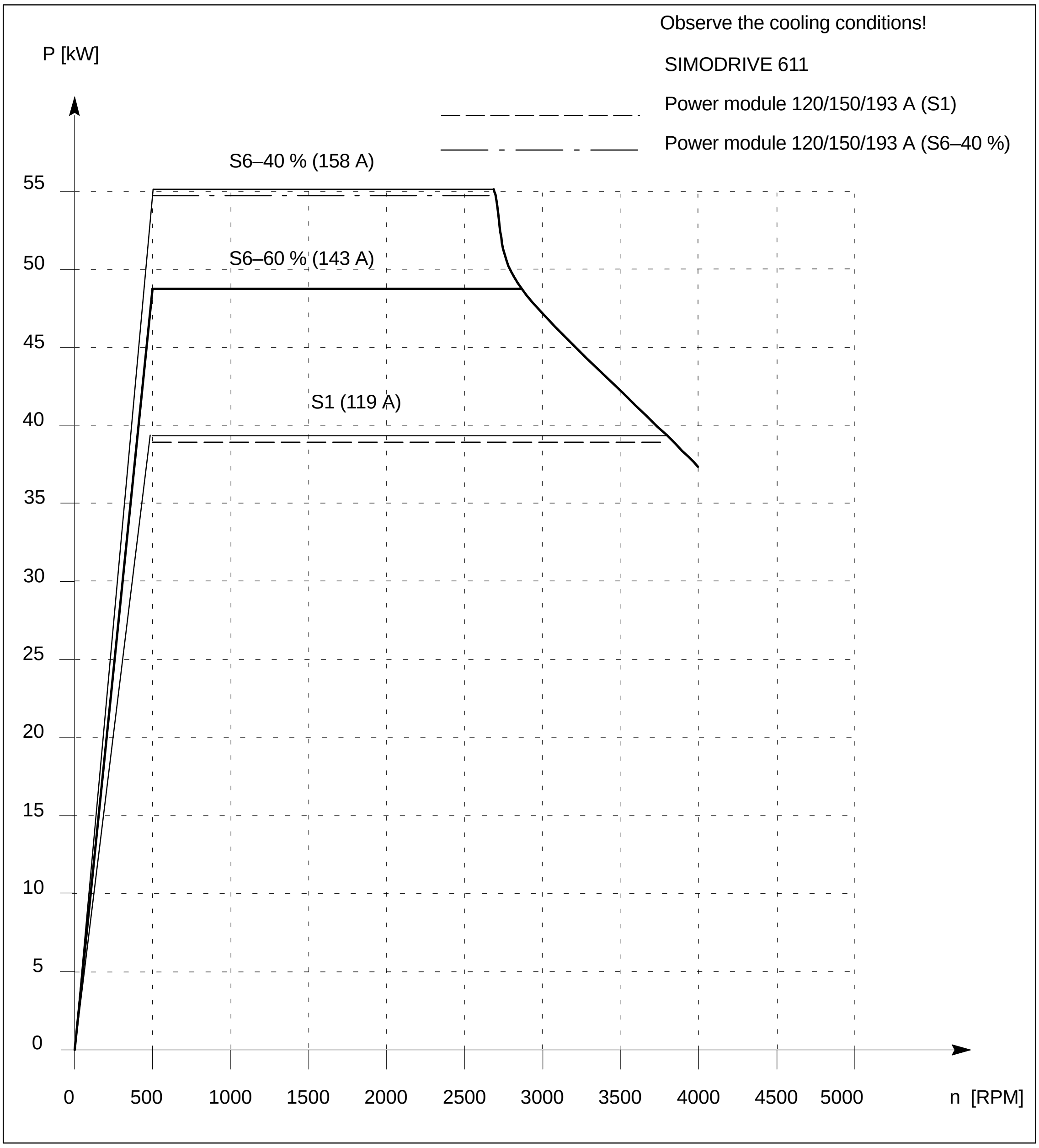


Fig. 3-12 Speed–power diagram 1PH2256–6WB41

3.1.2 Built–in motors without sleeve

Table 3-13 AC built–in motor 1PH2092–4WG42

Rated output P_{rated} [kW]	Rated speed n_{rated} [RPM]	Rated torque M_{rated} [Nm]	Rated current I_{rated} [A]	Time constant (therm.) T_{th} [min]	Max. speed n_{max} [RPM]	Moment of inertia J [kgm²]	Weight m [kg]
4.7	2000	22	22	4	18000	0.01	26

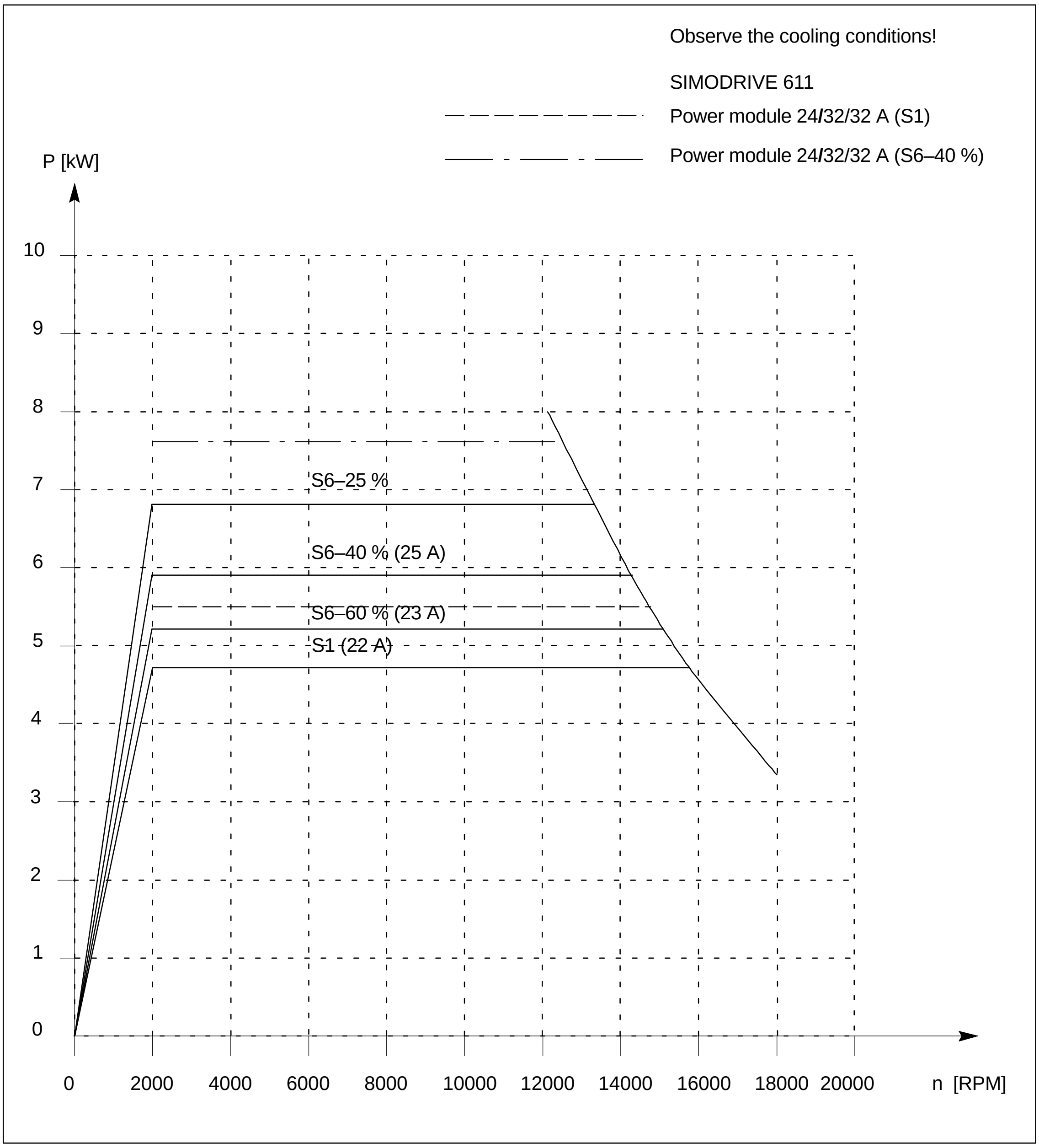


Fig. 3-13 Speed–power diagram 1PH2092–4WG42

Table 3-14 AC built–in motor 1PH2096–4WG42

Rated output P_{rated} [kW]	Rated speed n_{rated} [RPM]	Rated torque M_{rated} [Nm]	Rated current I_{rated} [A]	Time constant (therm.) T_{th} [min]	Max. speed n_{max} [RPM]	Moment of inertia J [kgm^2]	Weight m [kg]
10	2000	48	43	4	18000	0.021	47

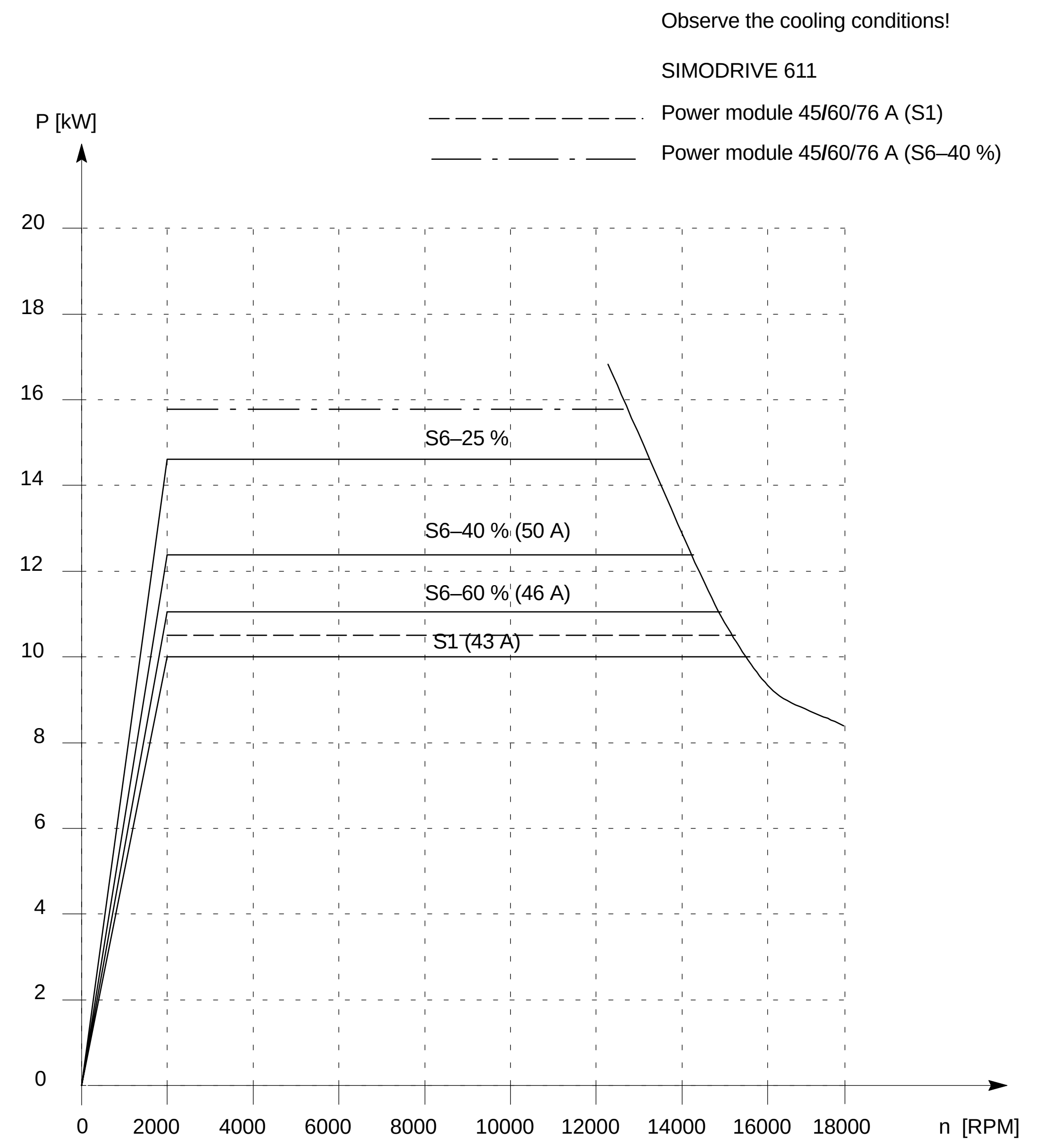


Fig. 3-14 Speed–power diagram 1PH2096–4WG42

1PH2

Table 3-15 AC built–in motor 1PH2123–4WF42

Rated output P_{rated} [kW]	Rated speed n_{rated} [RPM]	Rated torque M_{rated} [Nm]	Rated current I_{rated} [A]	Time constant (therm.) T_{th} [min]	Max. speed n_{max} [RPM]	Moment of inertia J [kgm^2]	Weight m [kg]
11.5	1500	73	57	8	16000	0.044	62

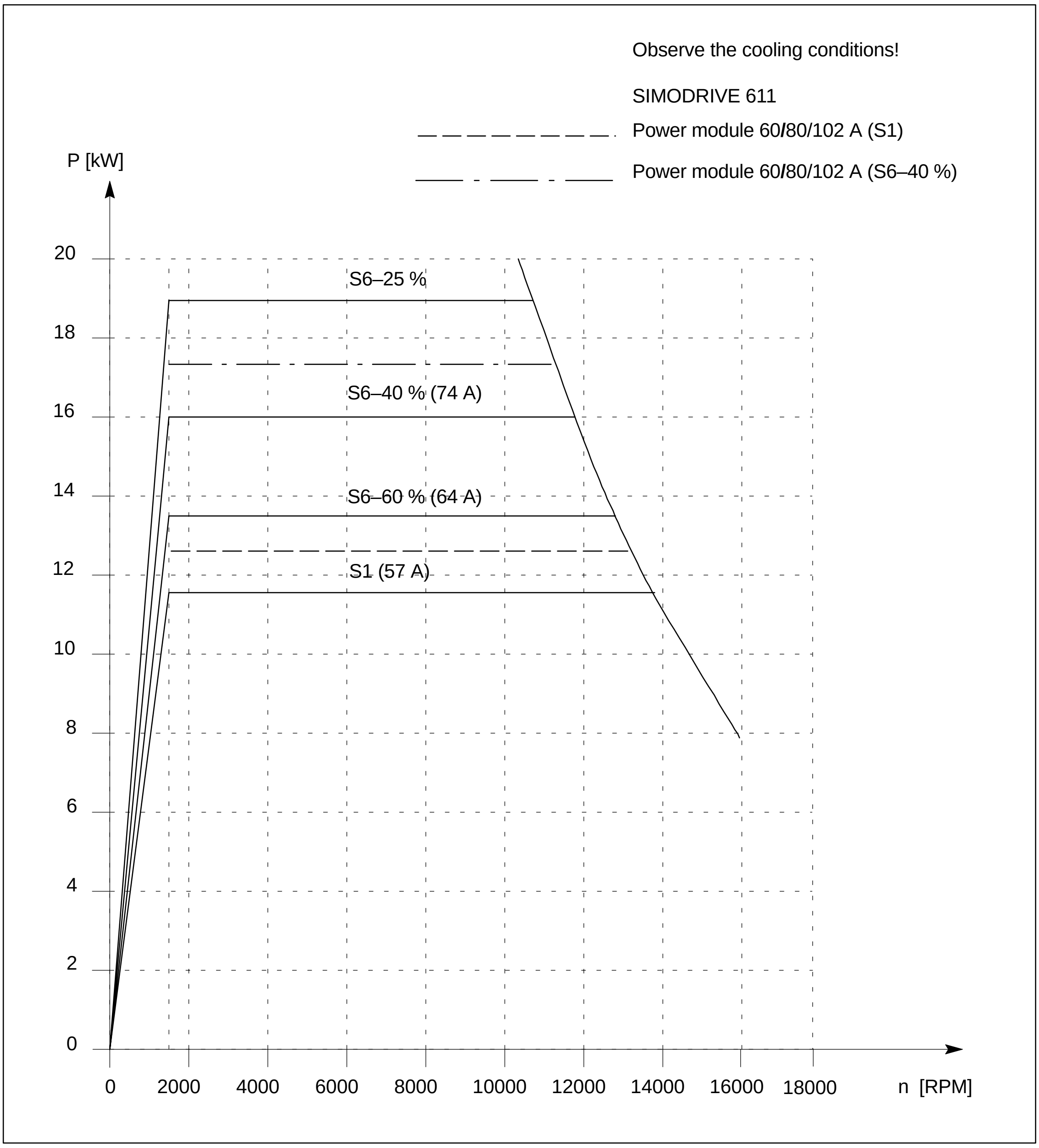


Fig. 3-15 Speed–power diagram 1PH2123–4WF42

Table 3-16 AC built–in motor 1PH2127–4WF42

Rated output P_{rated} [kW]	Rated speed n_{rated} [RPM]	Rated torque M_{rated} [Nm]	Rated current I_{rated} [A]	Time constant (therm.) T_{th} [min]	Max. speed n_{max} [RPM]	Moment of inertia J [kgm^2]	Weight m [kg]
21	1500	134	85	8	16000	0.081	104

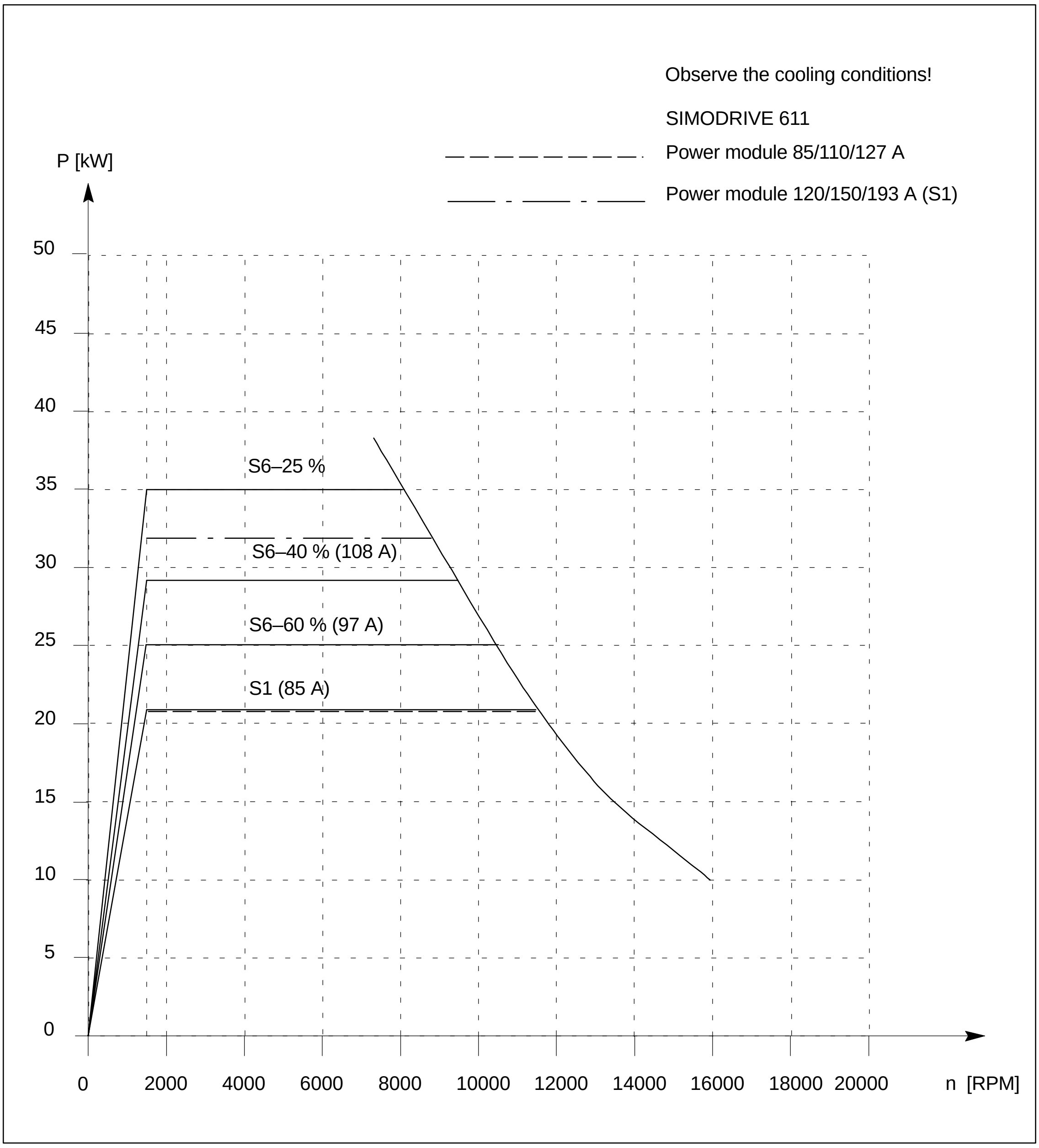


Fig. 3-16 Speed–power diagram 1PH2127–4WF42

Table 3-17 AC built–in motor 1PH2128–4WF42

Rated output P_{rated} [kW]	Rated speed n_{rated} [RPM]	Rated torque M_{rated} [Nm]	Rated current I_{rated} [A]	Time constant (therm.) T_{th} [min]	Max. speed n_{max} [RPM]	Moment of inertia J [kgm²]	Weight m [kg]
25	1500	159	101	8	16000	0.103	127

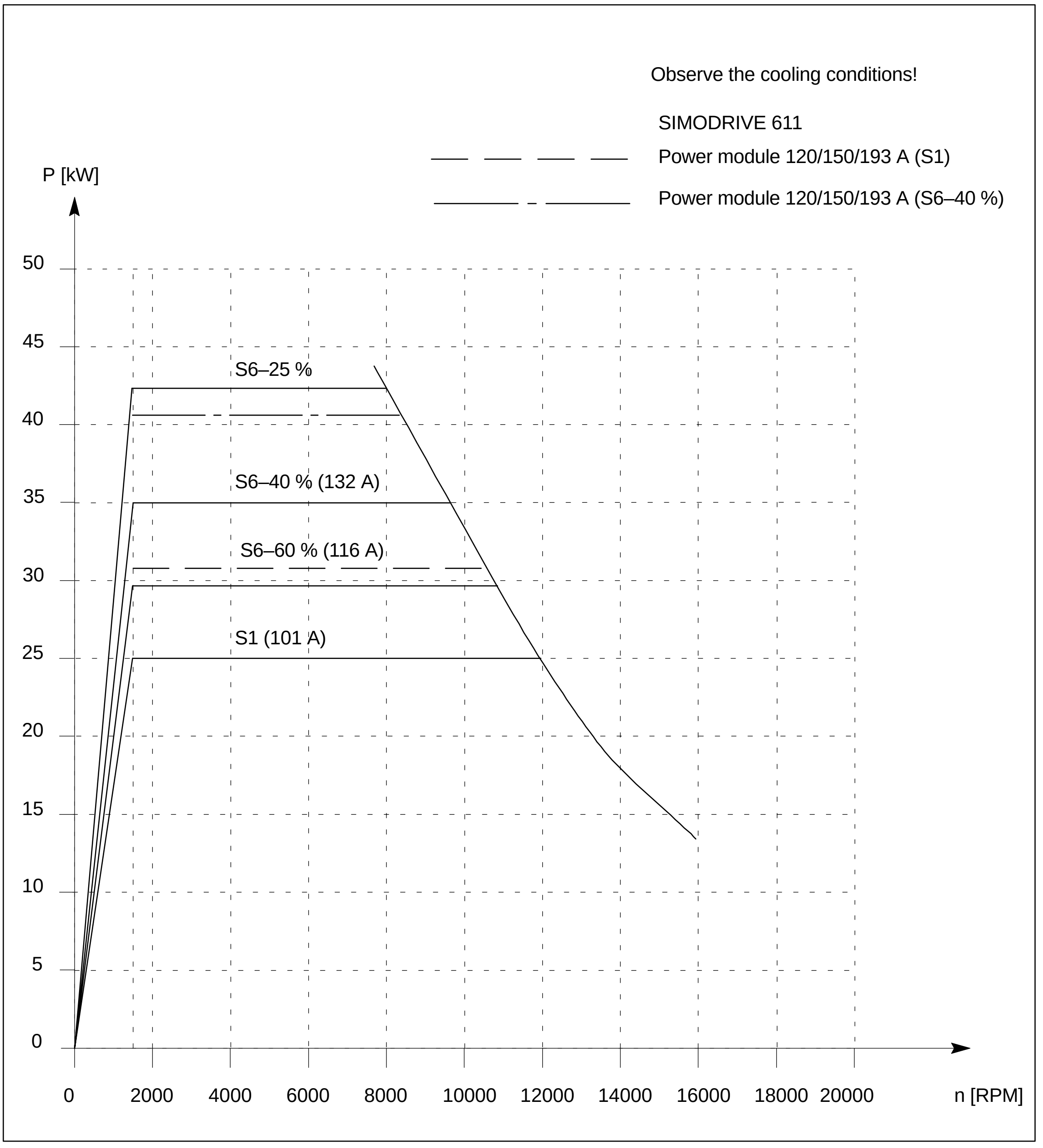


Fig. 3-17 Speed–power diagram 1PH2128–4WF42

Table 3-18 AC built–in motor 1PH2143–4WF42

Rated output P_{rated} [**kW**]	**Rated speed** n_{rated} [**RPM**]	**Rated torque** M_{rated} [**Nm**]	**Rated current** I_{rated} [**A**]	**Time constant (therm.)** T_{th} [**min**]	**Max. speed** n_{max} [**RPM**]	**Moment of inertia J** [**kgm^2**]	**Weight m** [**kg**]
30	1500	191	101	10	12000	0.154	137

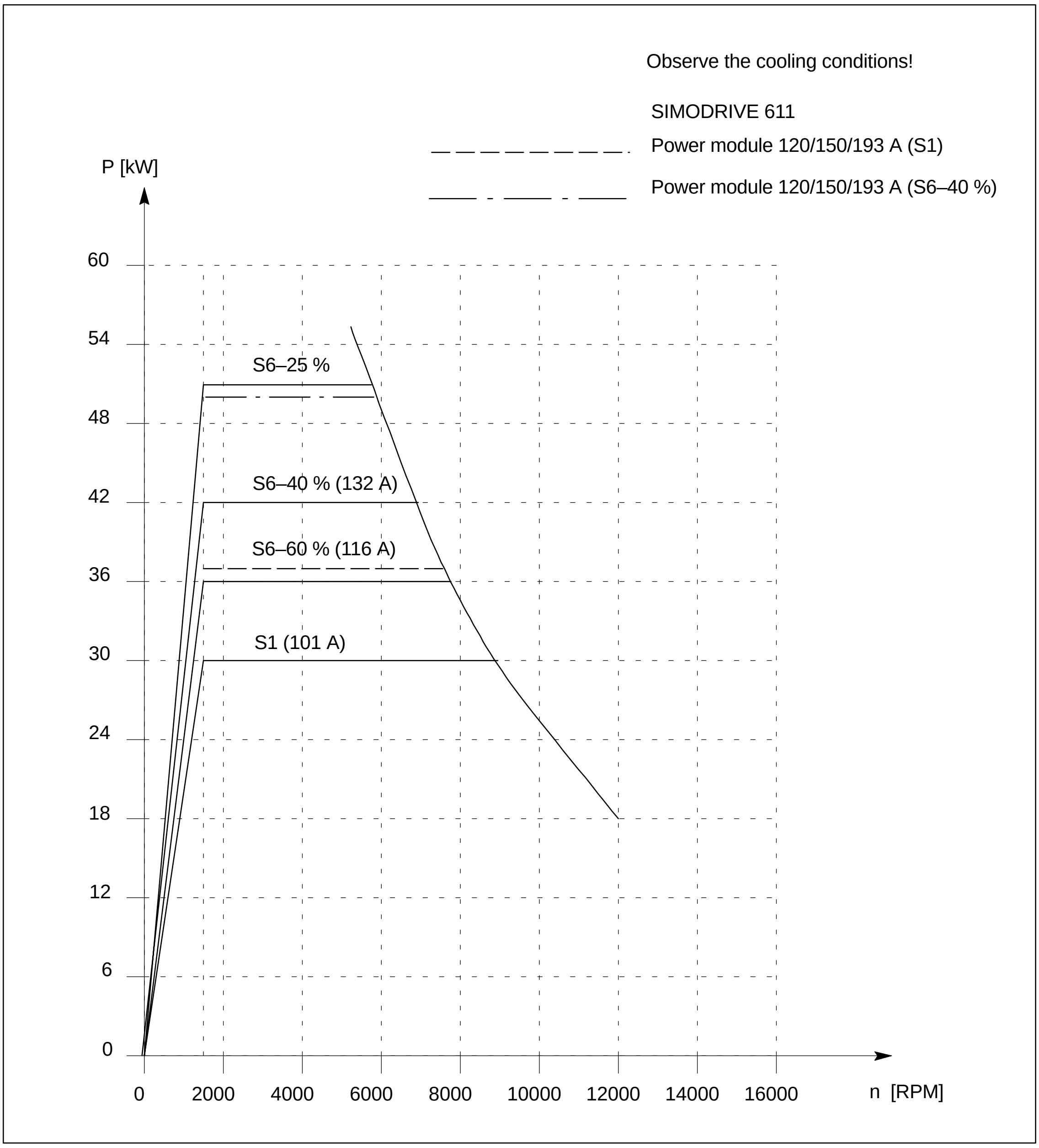


Fig. 3-18 Speed–power diagram 1PH2143–4WF42

1PH2

Table 3-19 AC built–in motor 1PH2147–4WF42

Rated output P_{rated} [kW]	Rated speed n_{rated} [RPM]	Rated torque M_{rated} [Nm]	Rated current I_{rated} [A]	Time constant (therm.) T_{th} [min]	Max. speed n_{max} [RPM]	Moment of inertia J [kgm^2]	Weight m [kg]
38	1500	242	116	10	12000	0.187	164

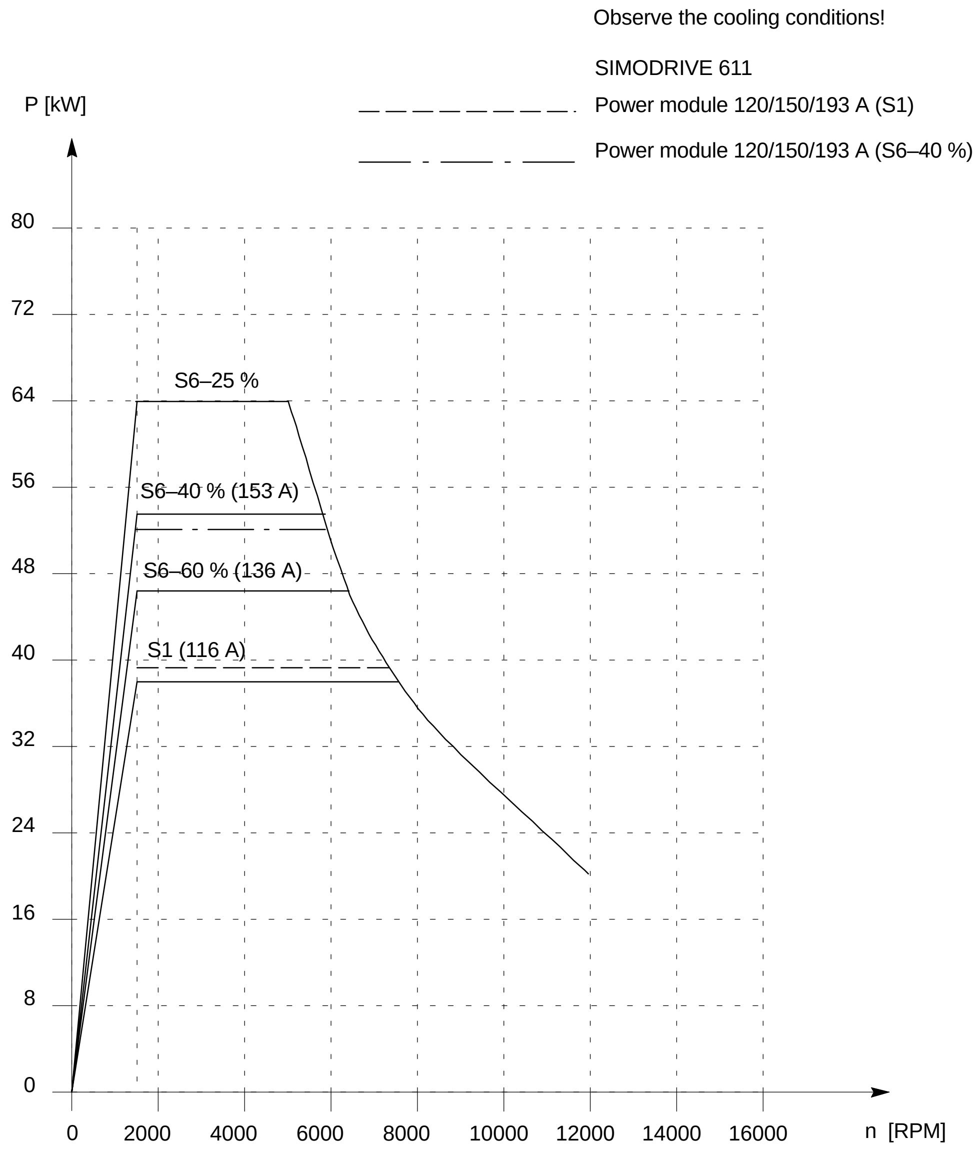


Fig. 3-19 Speed–power diagram 1PH2147–4WF42

■

Dimension Drawings 4

Note

Siemens AG reserves the right to change motor dimensions within the scope of design improvements without prior notice. Dimension drawings can go out of date. Up–to–date dimension drawings can be requested at no charge.

Version with sleeve

Version without sleeve

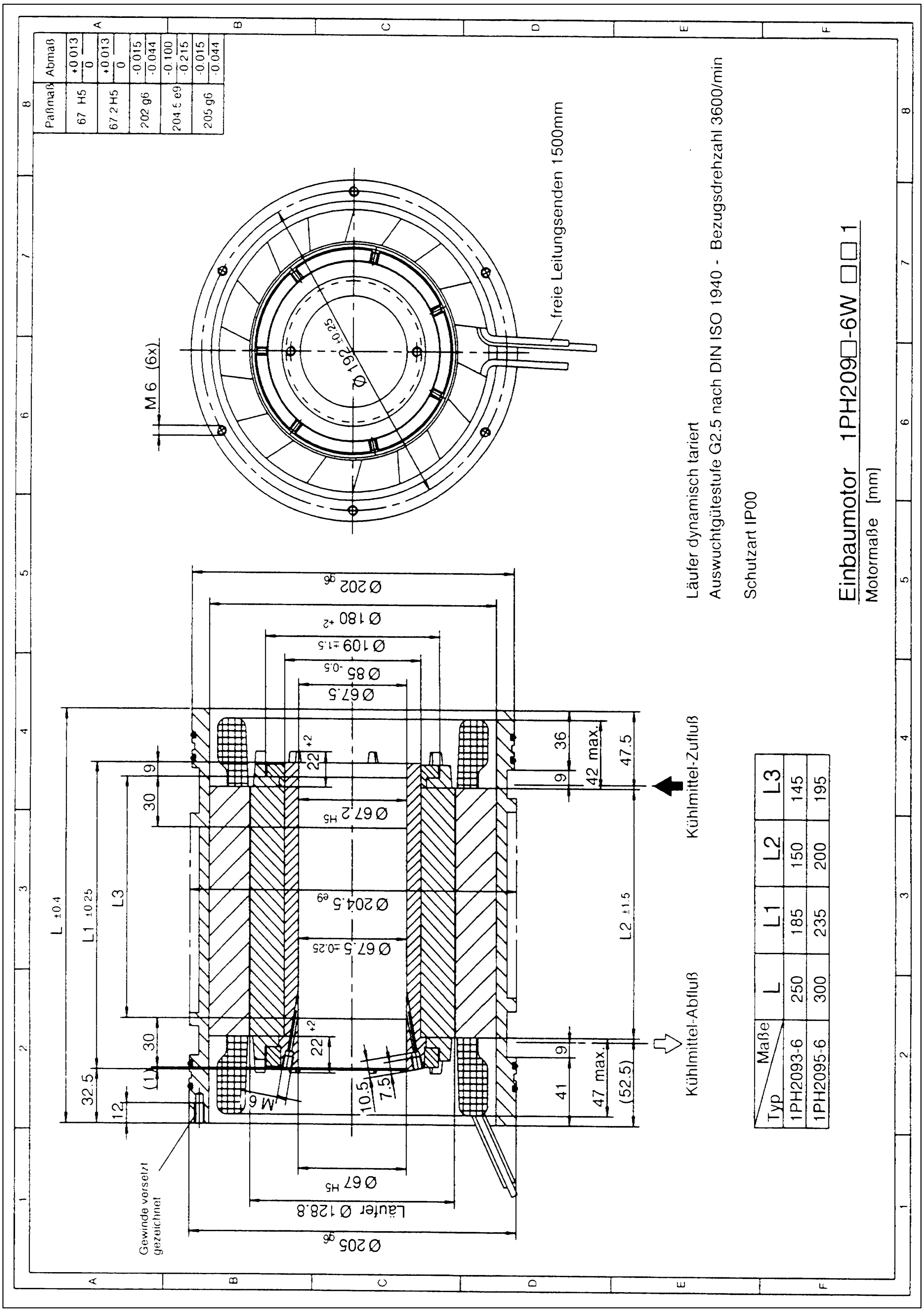
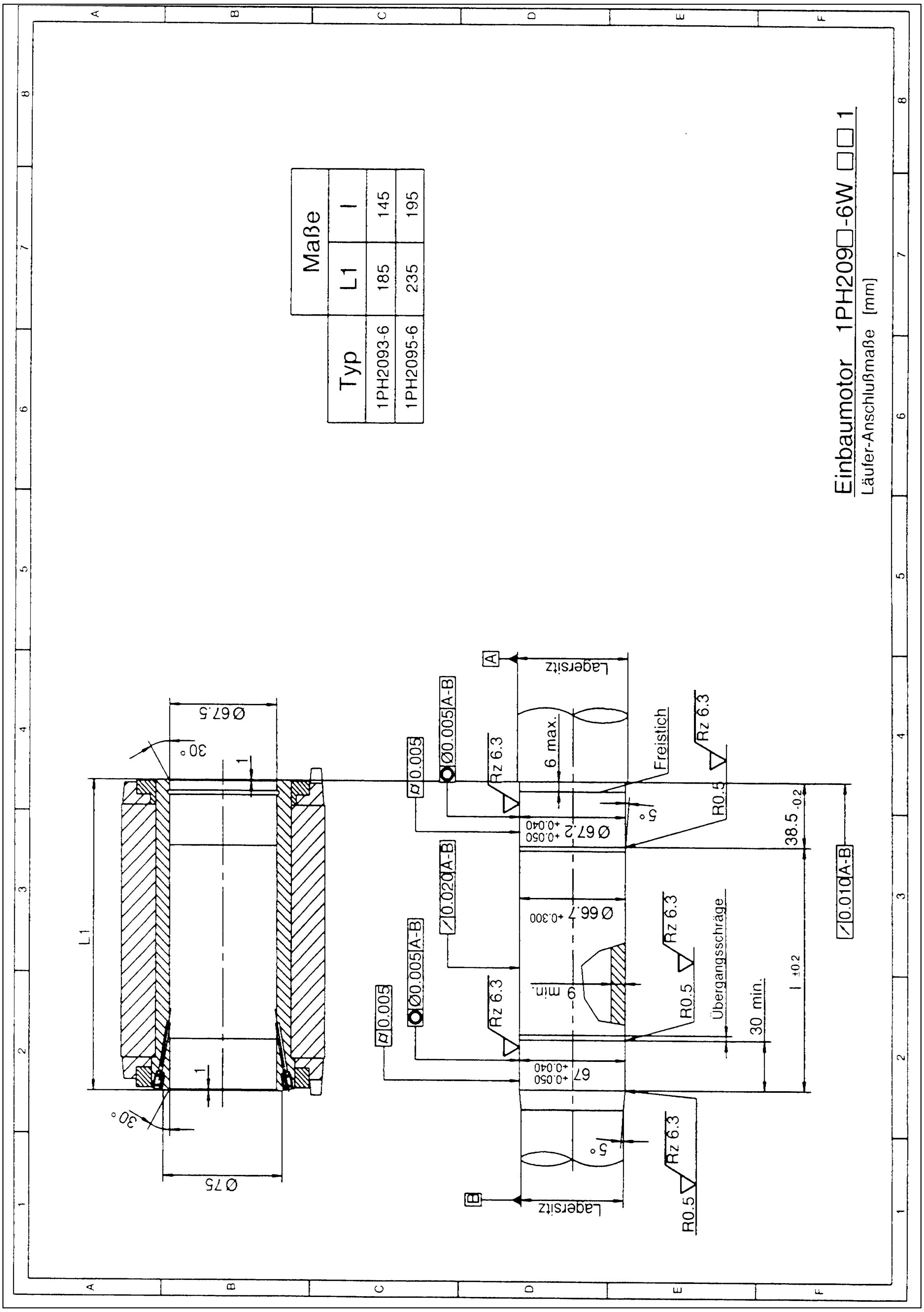


Fig. 4-1 1PH209□–6W motor dimensions



1PH2

Fig. 4-2 1PH209□–6W rotor companion dimensions

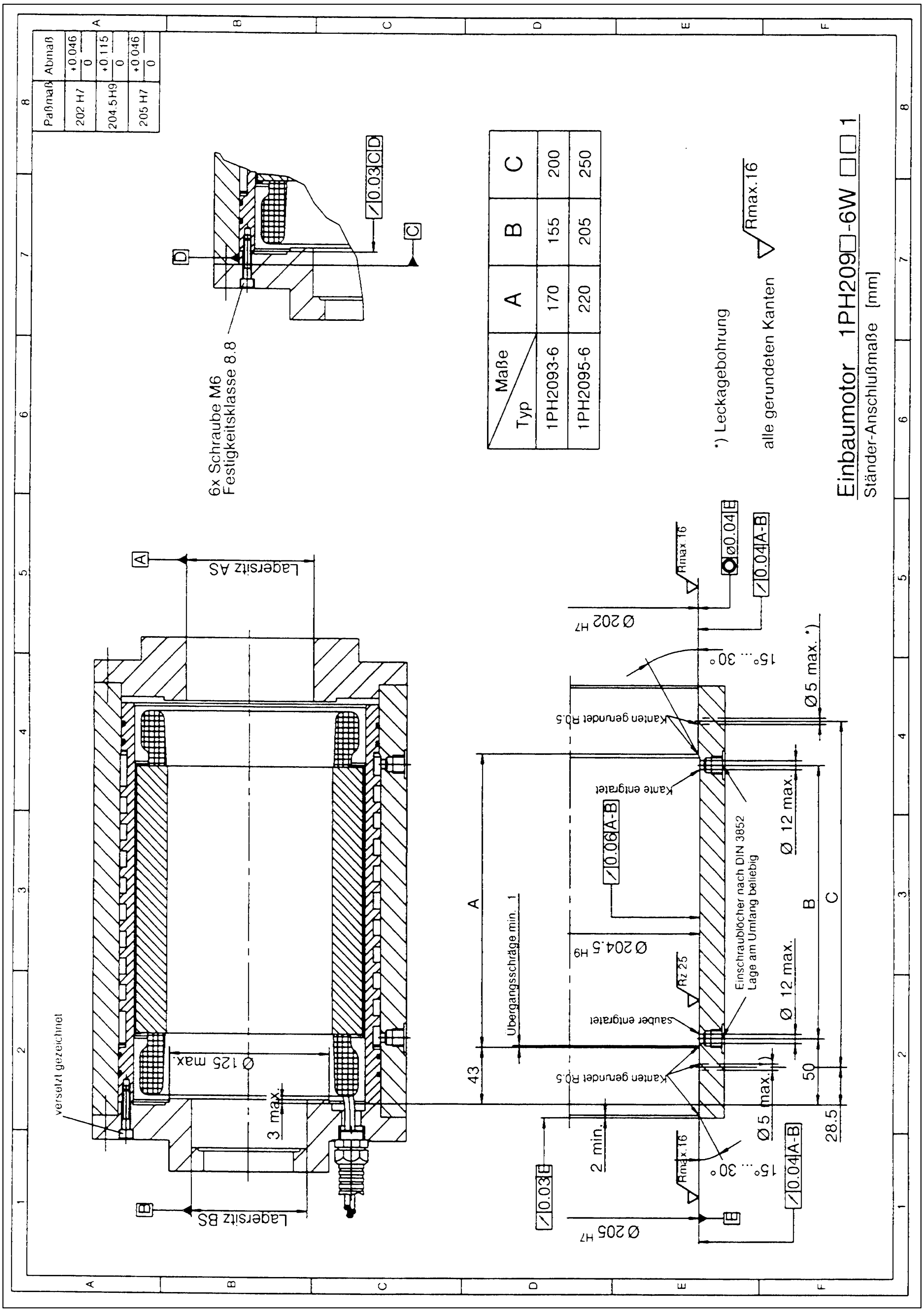


Fig. 4-3 1PH209□–6W stator companion dimensions

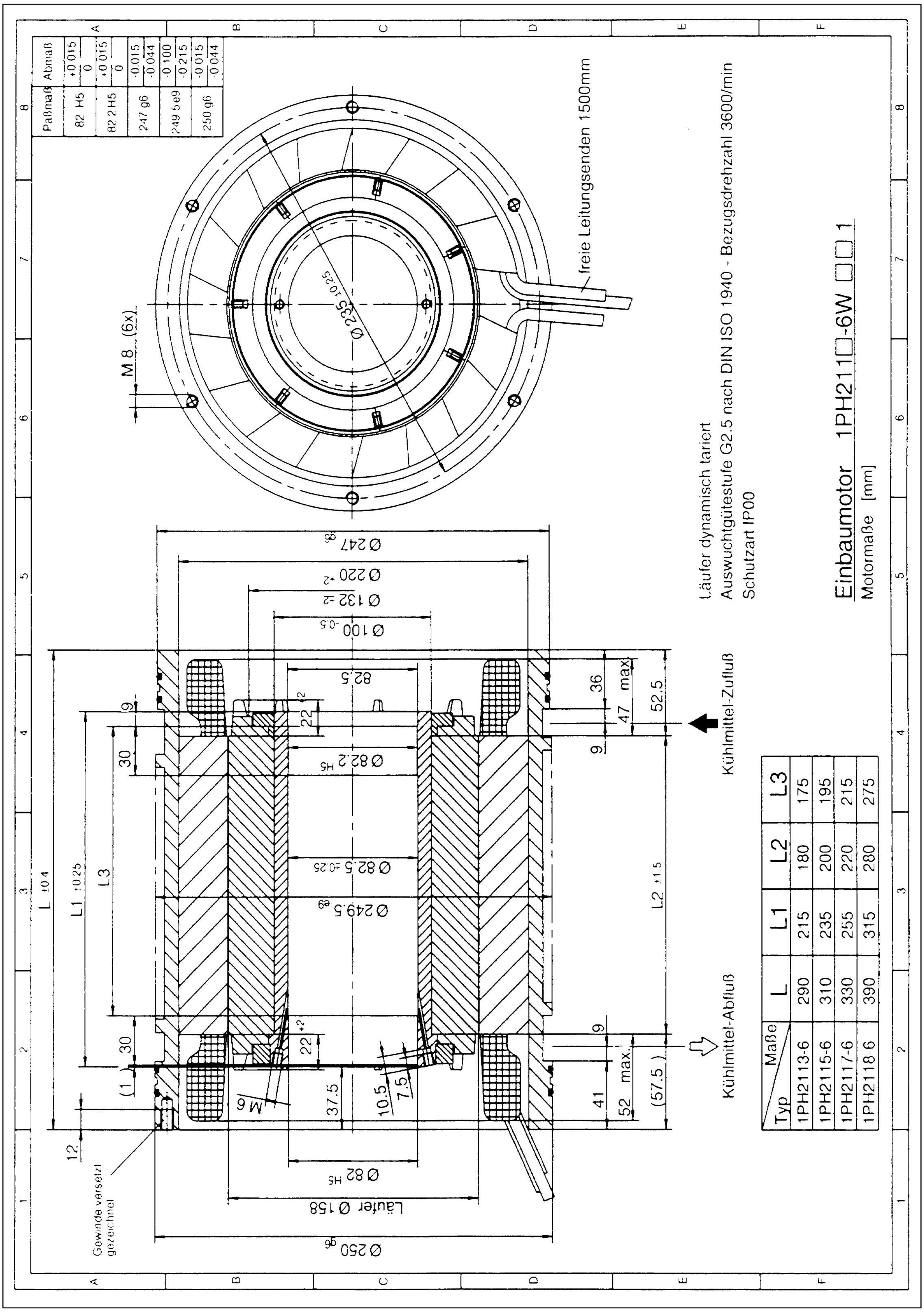


Fig. 4-4 1PH211□–6W motor dimensions

1PH2

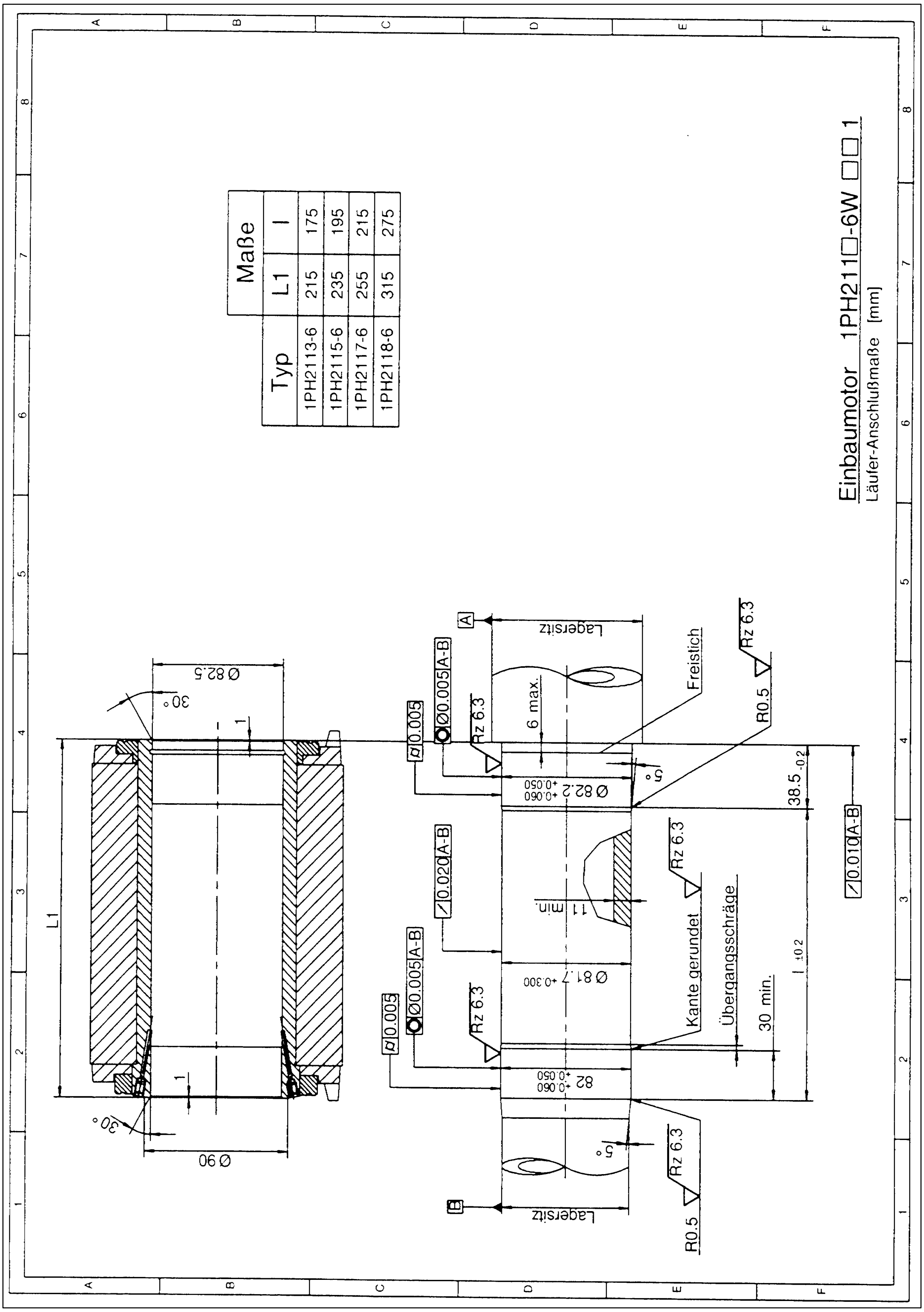


Fig. 4-5 1PH211□–6W rotor companion dimensions

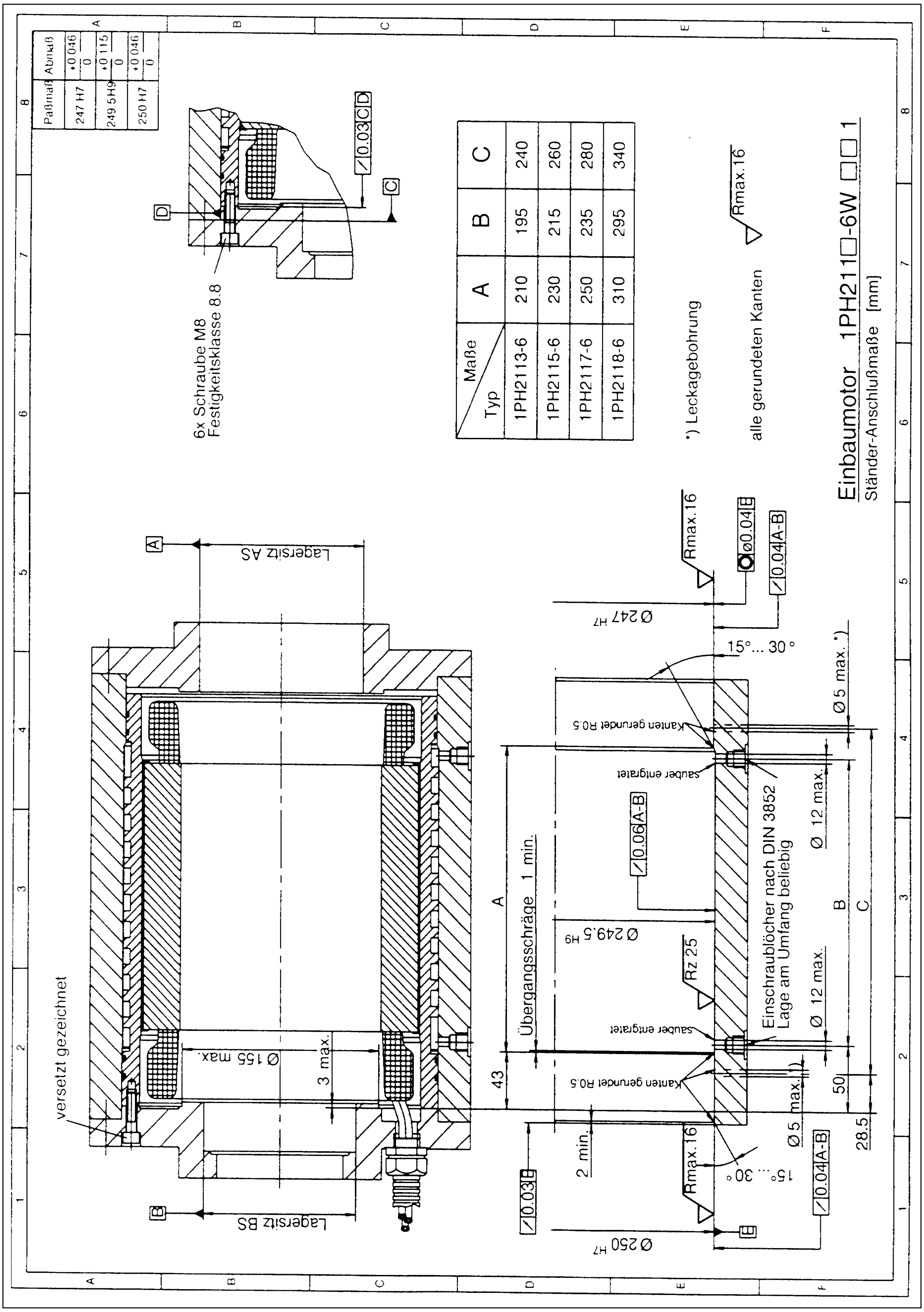


Fig. 4-6 1PH211□–6W stator companion dimensions

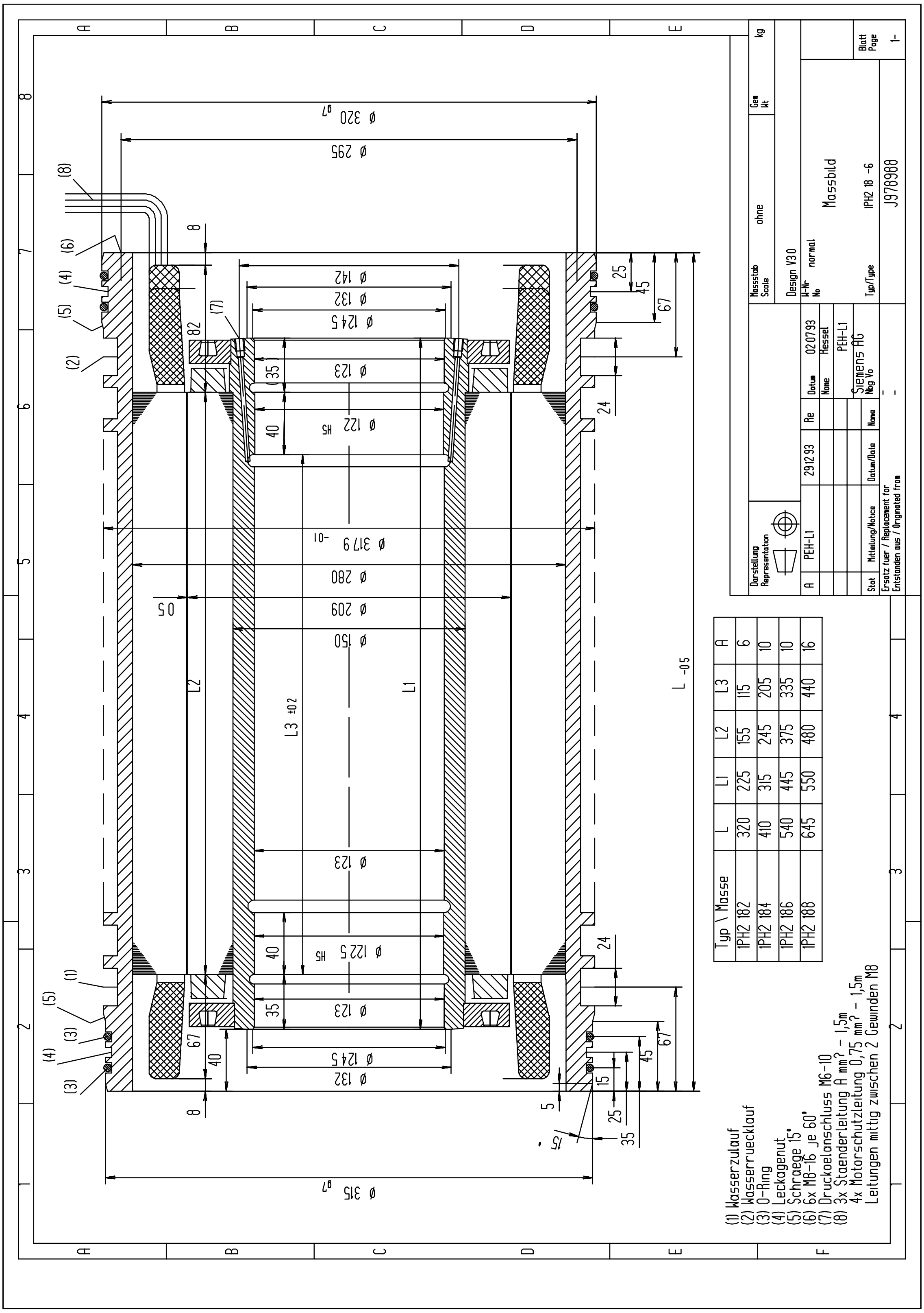
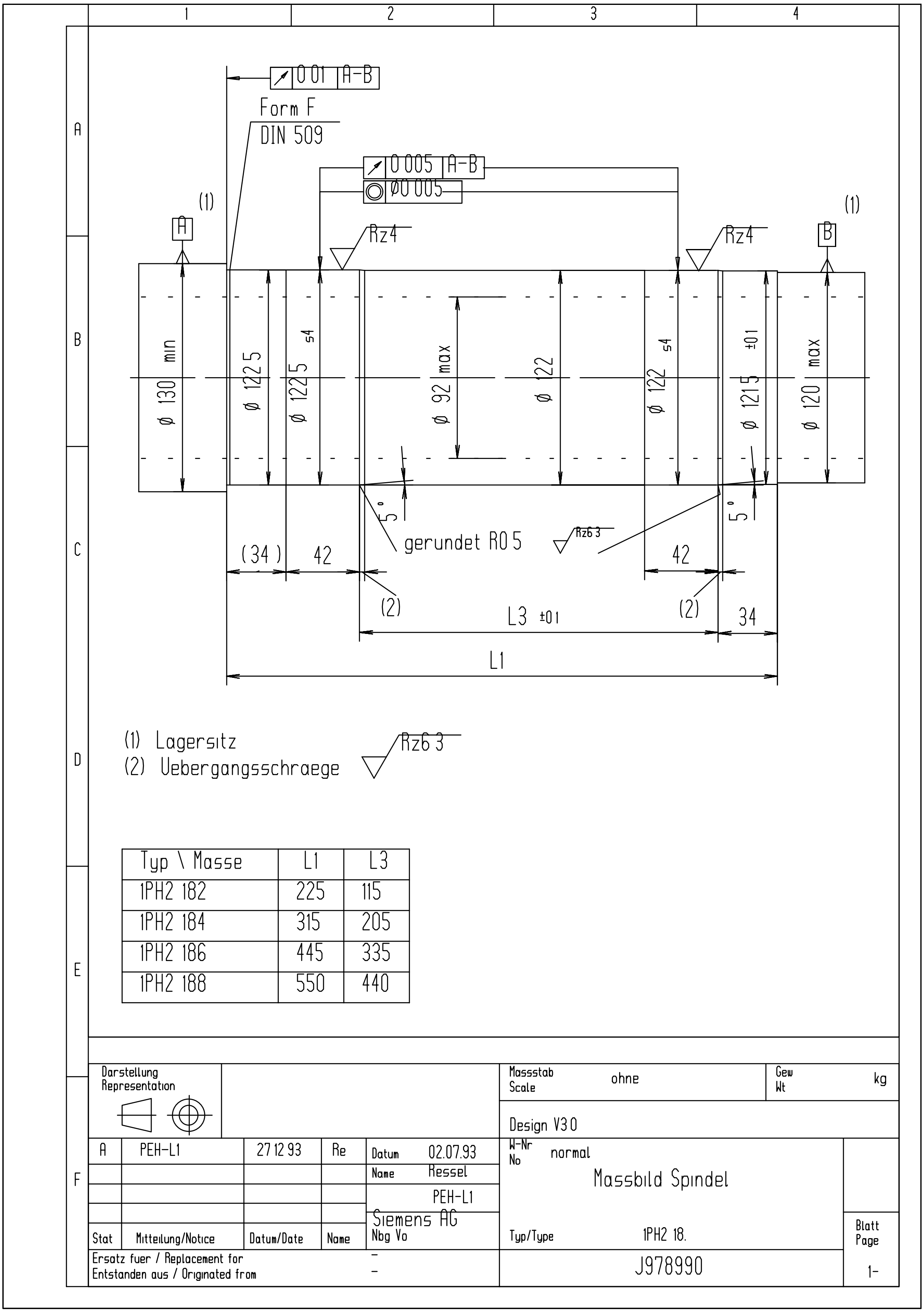


Fig. 4-7 1PH218□–6W motor dimensions (dimension drawing)



Typ \ Masse	L1	L3
1PH2 182	225	115
1PH2 184	315	205
1PH2 186	445	335
1PH2 188	550	440

Fig. 4-8 1PH218□–6W rotor companion dimensions (spindle)

1PH2

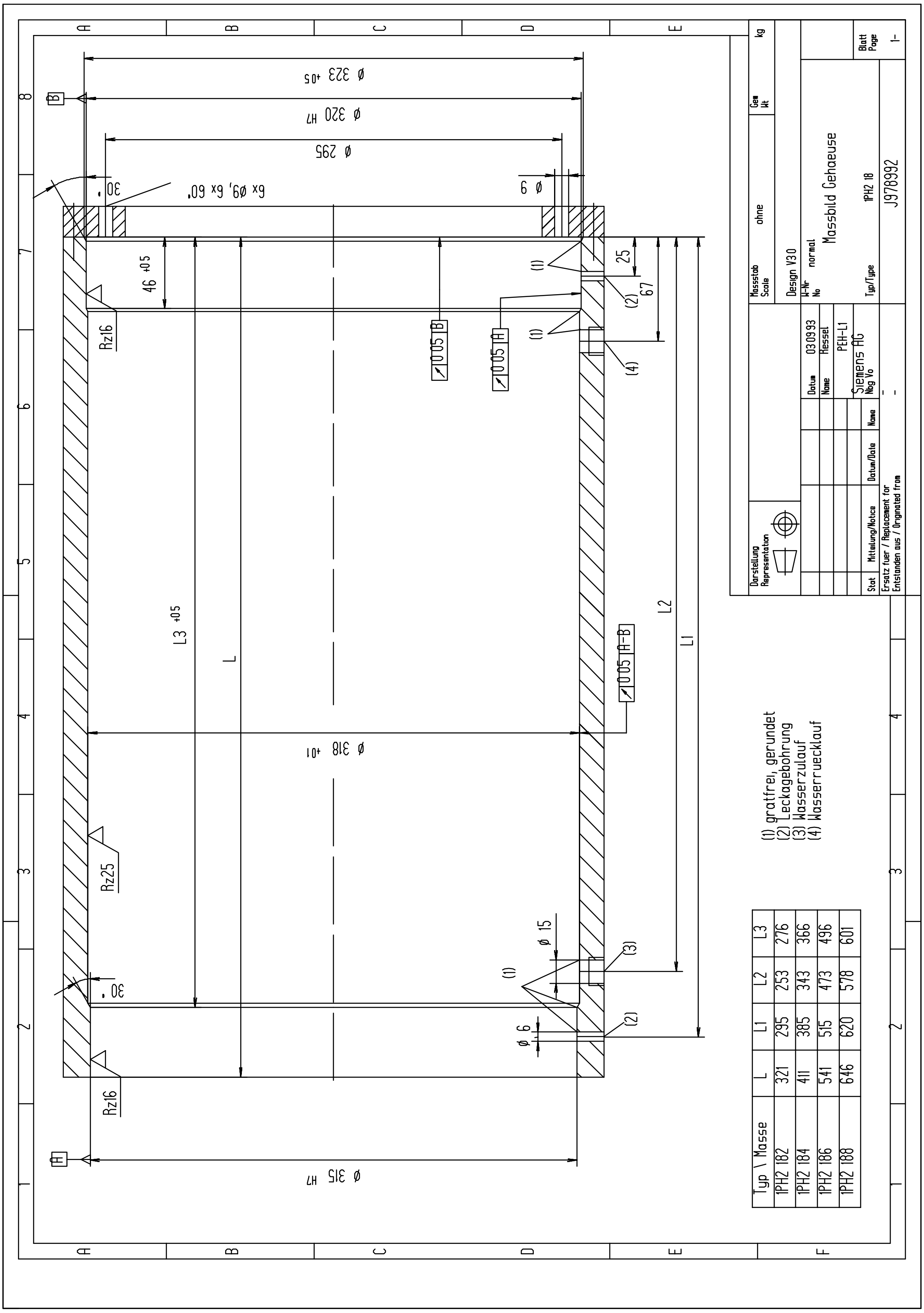


Fig. 4-9 1PH218□–6W stator companion dimensions (housing)

1PH2

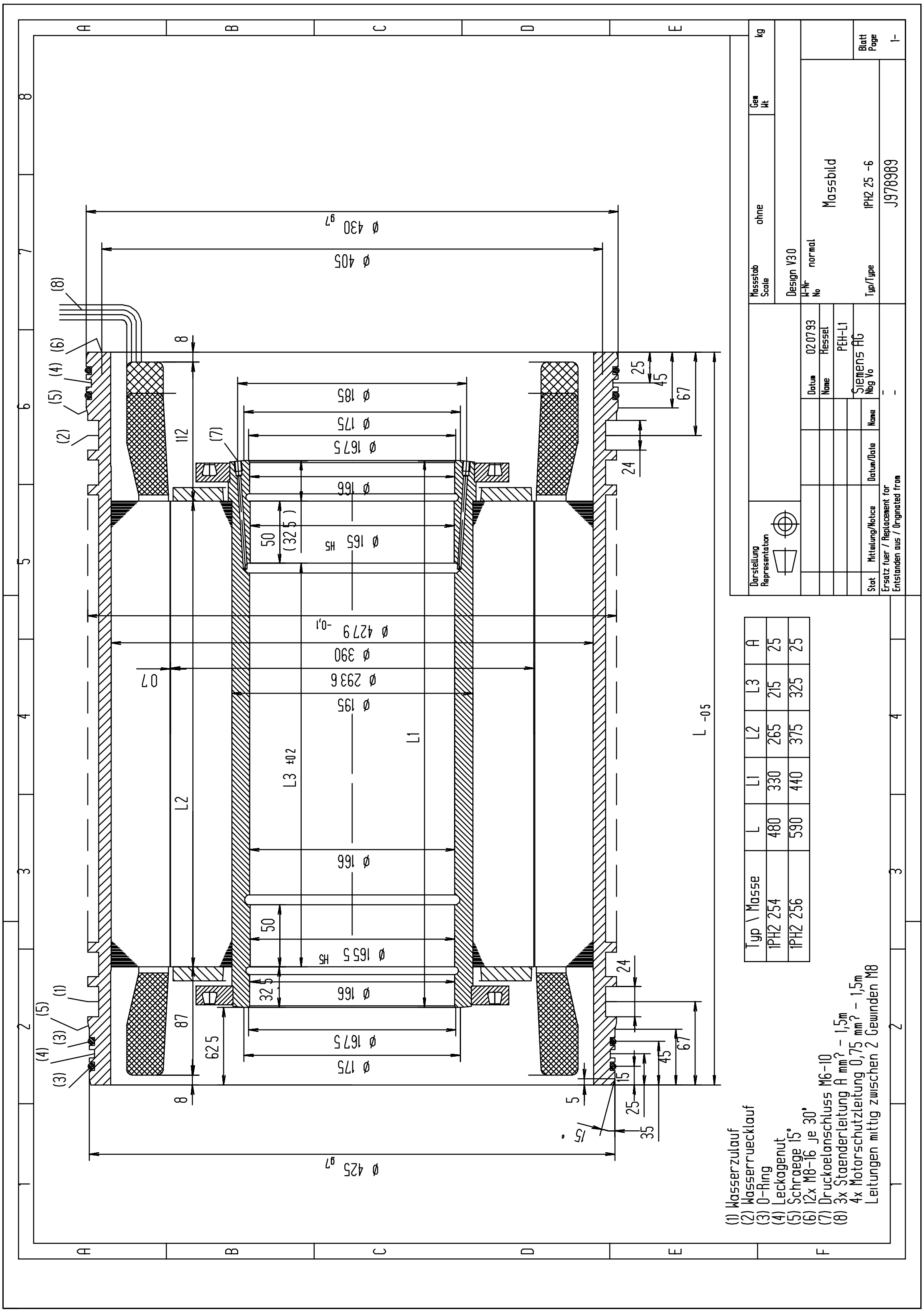
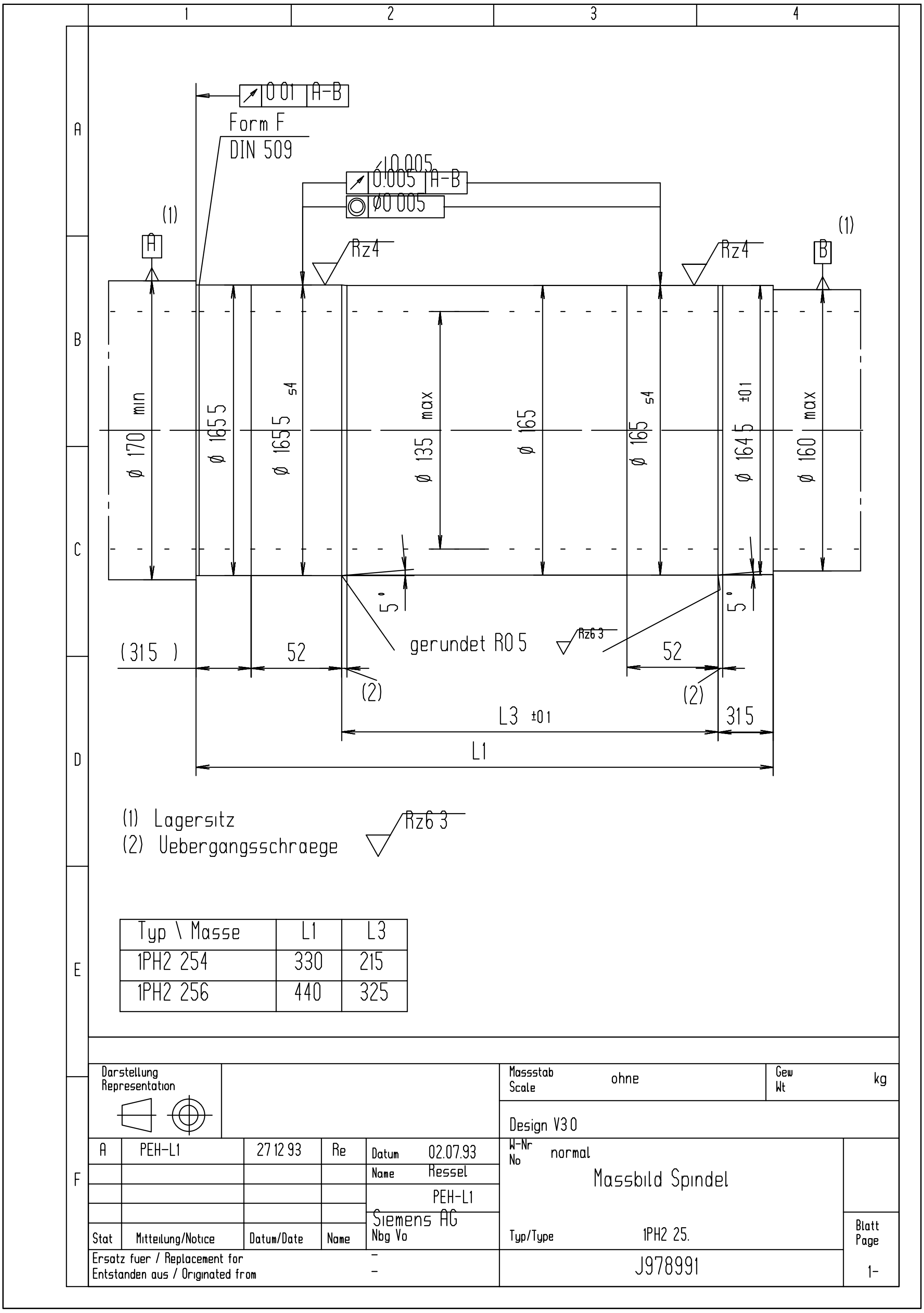


Fig. 4-10 1PH225□–6W motor dimensions (dimension drawing)



Typ \ Masse	L1	L3
1PH2 254	330	215
1PH2 256	440	325

Fig. 4-11 1PH225□–6W rotor companion dimensions (spindle)

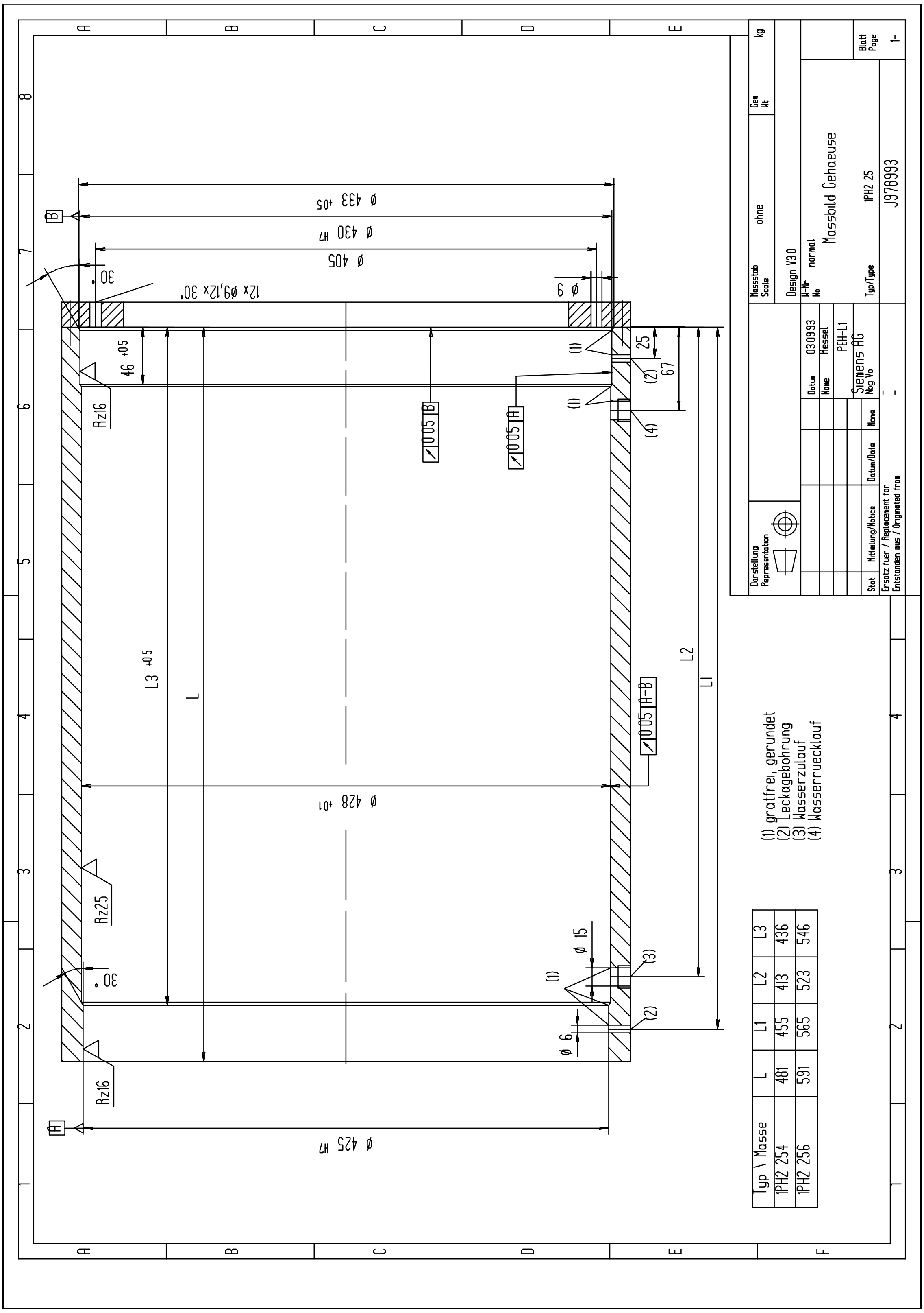


Fig. 4-12 1PH225□–6W stator companion dimensions (housing)

1PH2

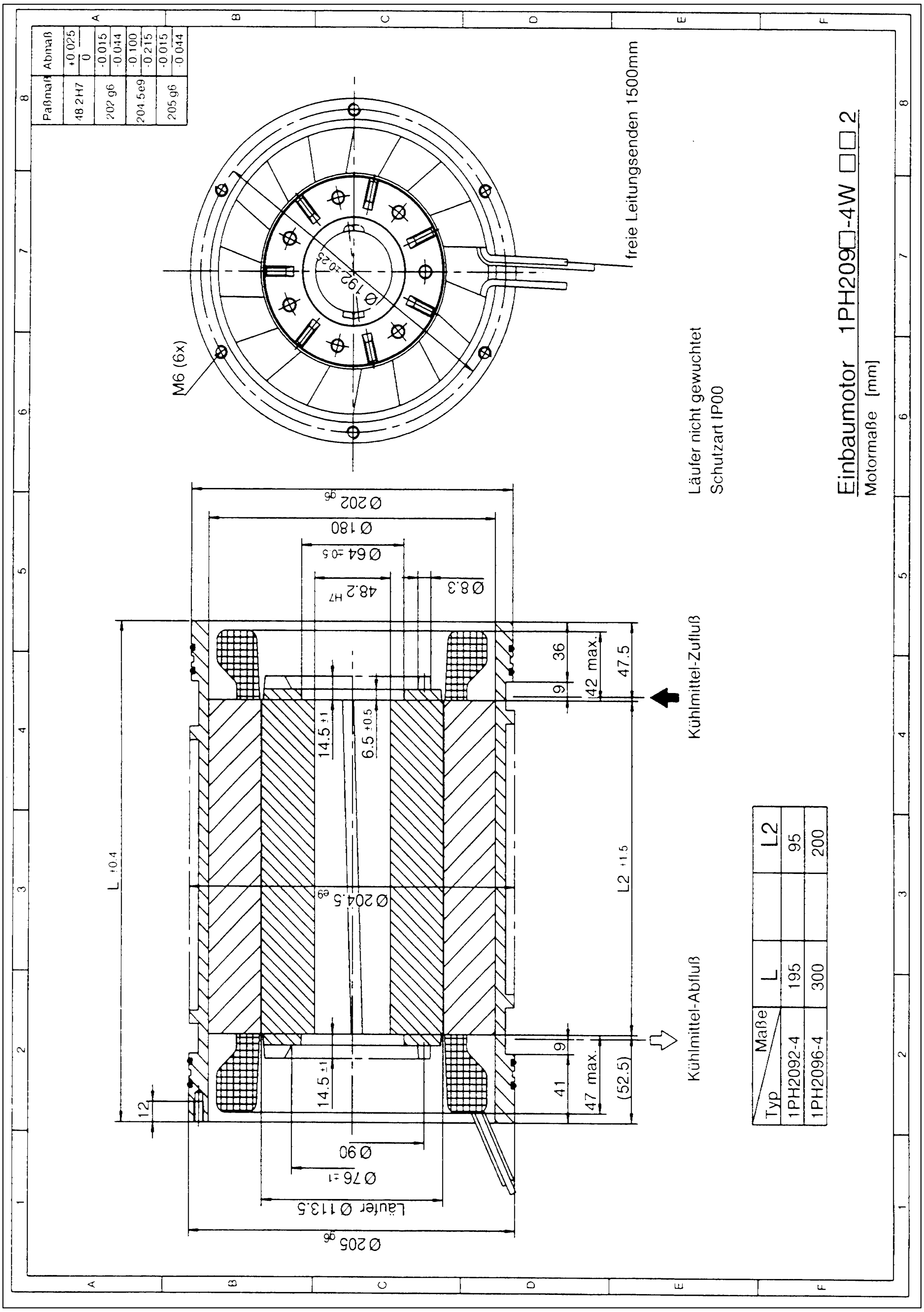


Fig. 4-13 1PH209□–4W motor dimensions

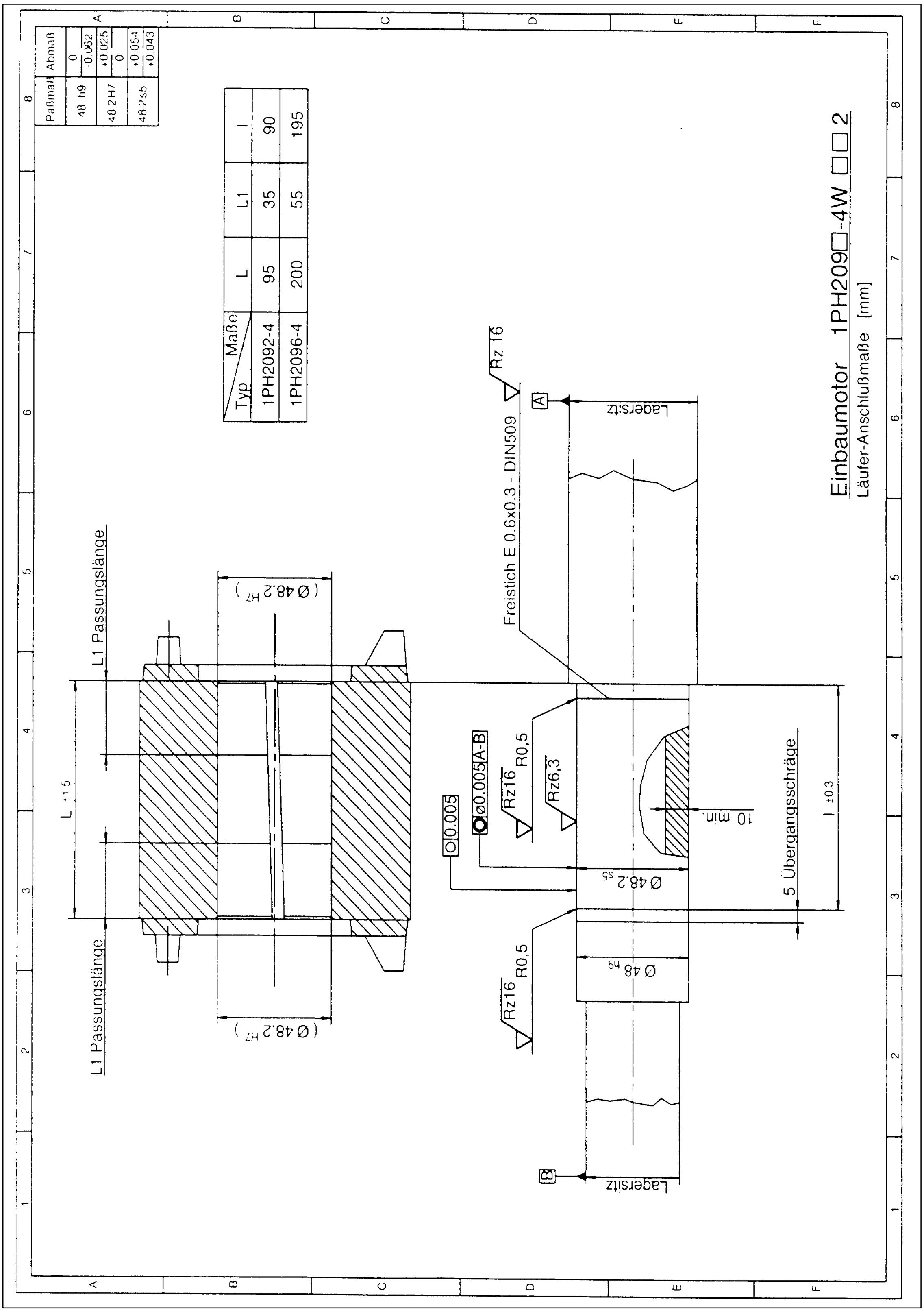


Fig. 4-14 1PH209□–4W rotor companion dimensions

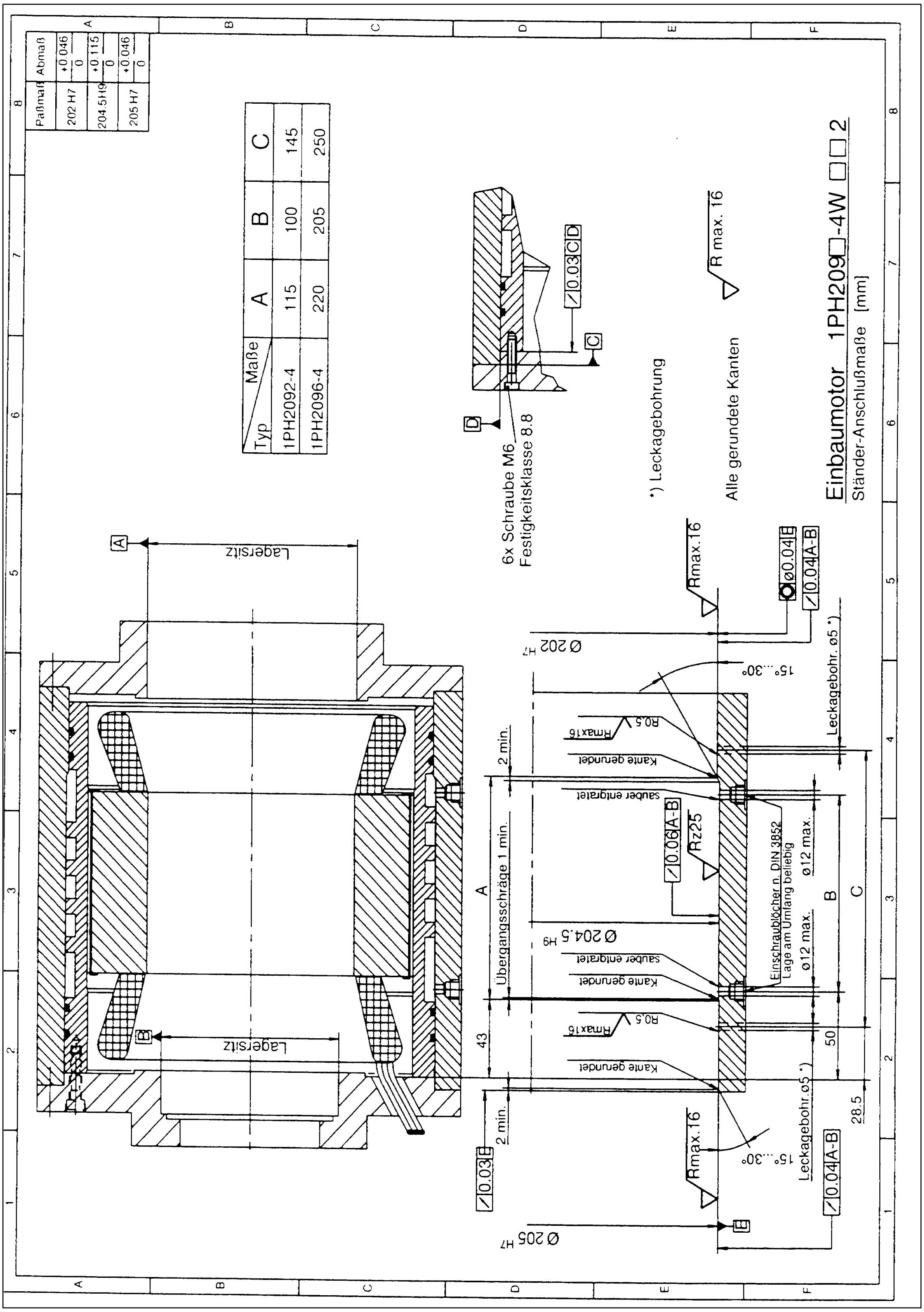


Fig. 4-15 1PH209□–4W stator companion dimensions

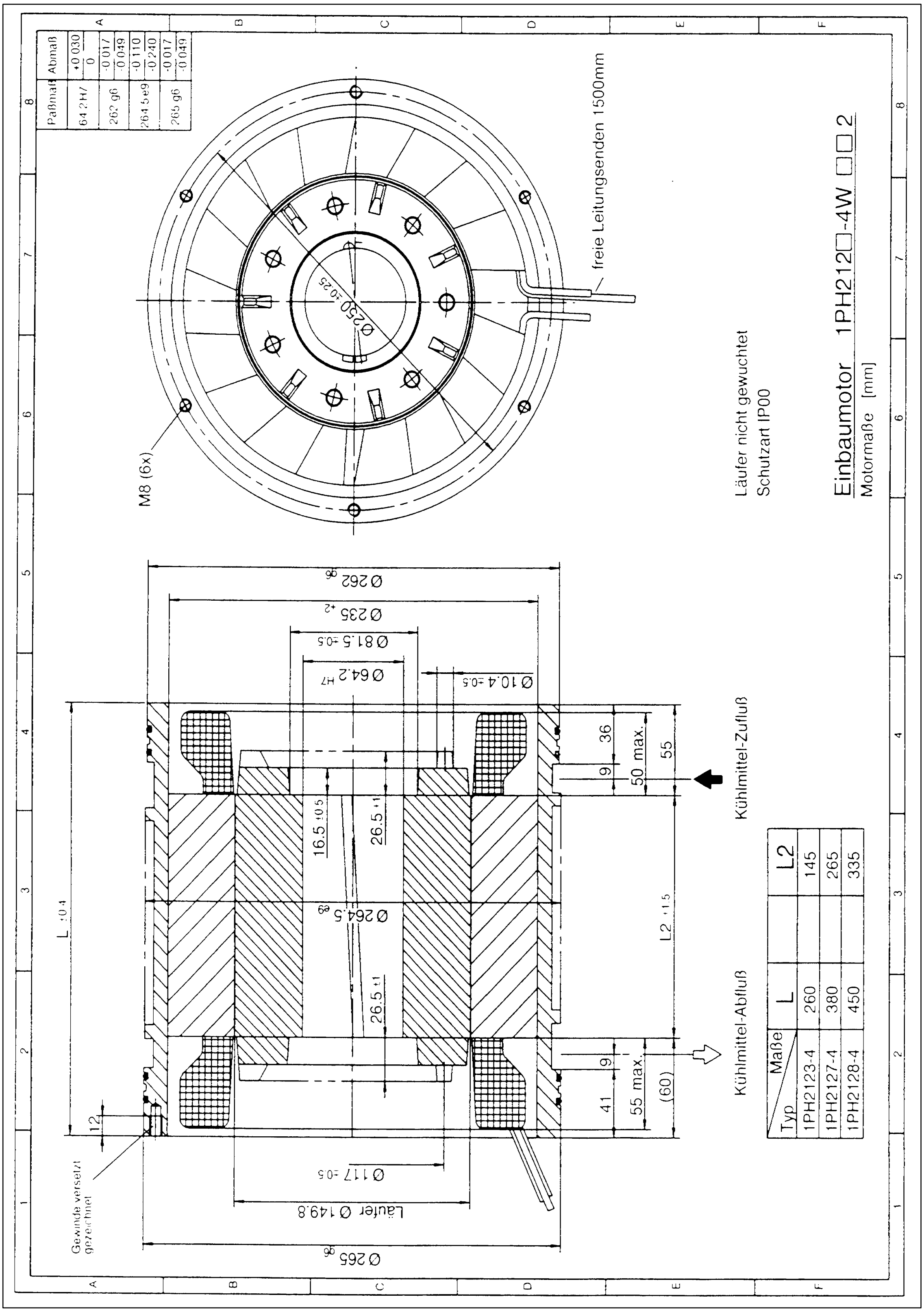


Fig. 4-16 1PH212□–4W motor dimensions

1PH2

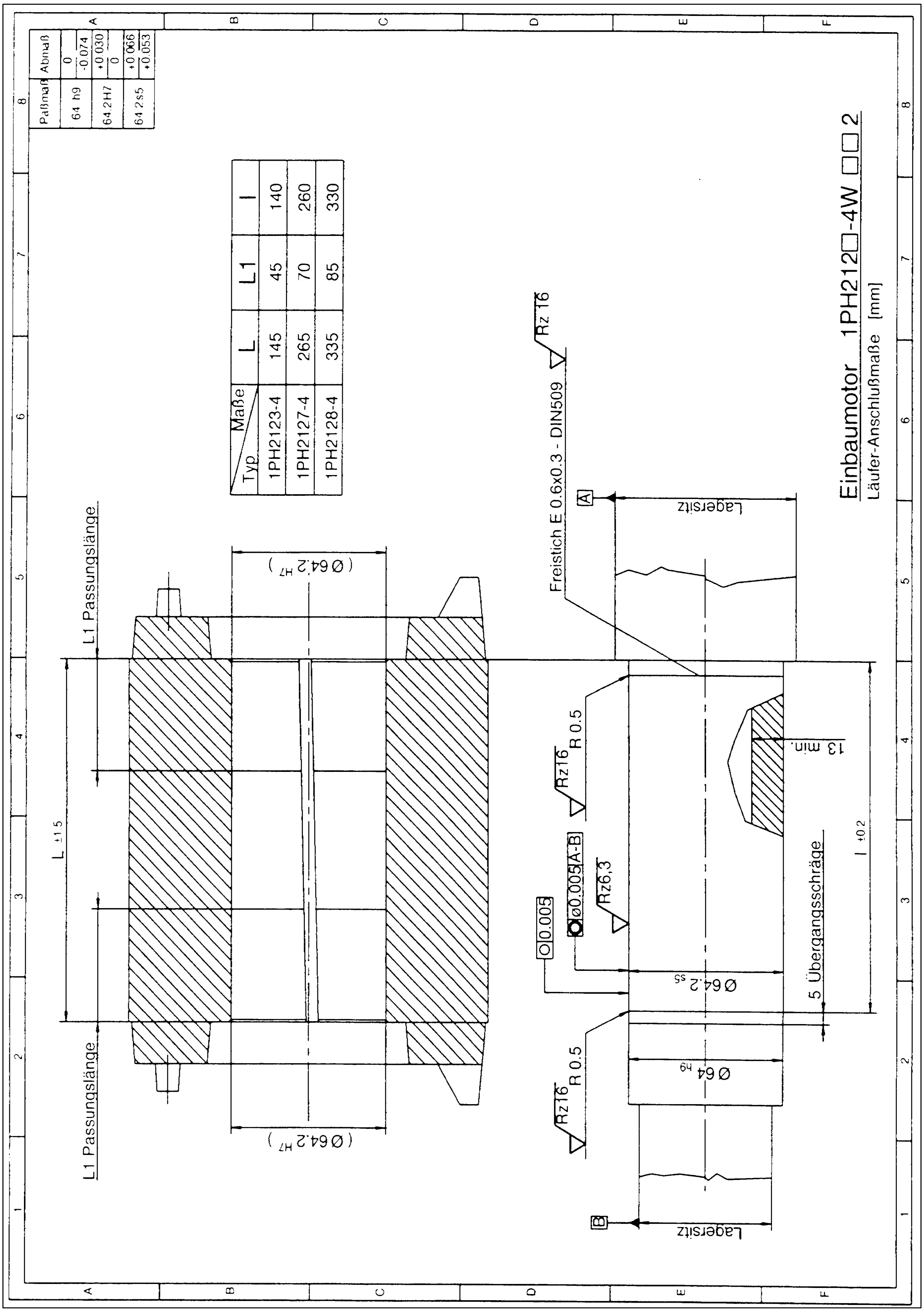


Fig. 4-17 1PH212□–4W rotor companion dimensions

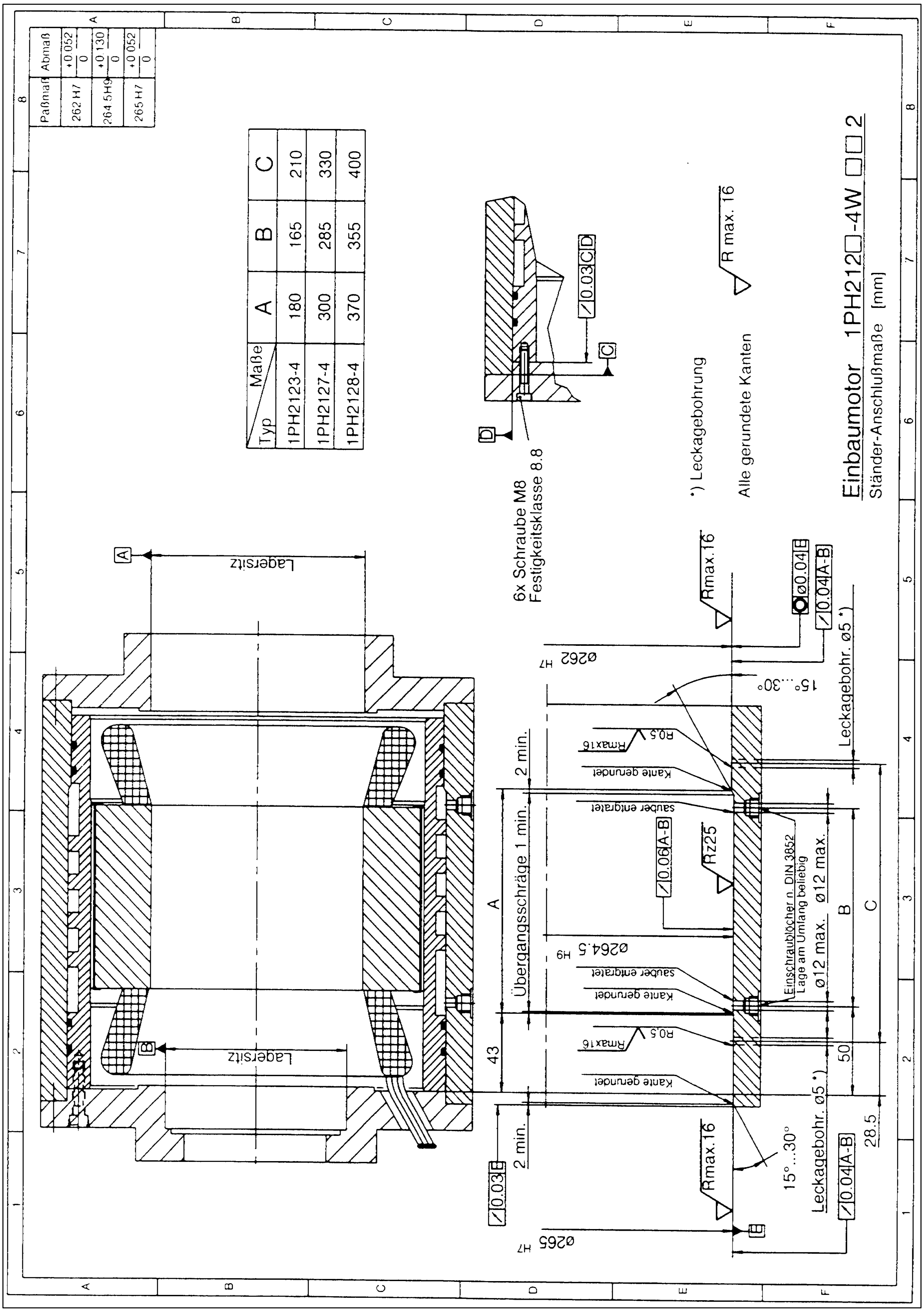


Fig. 4-18 1PH212□–4W stator companion dimensions

1PH2

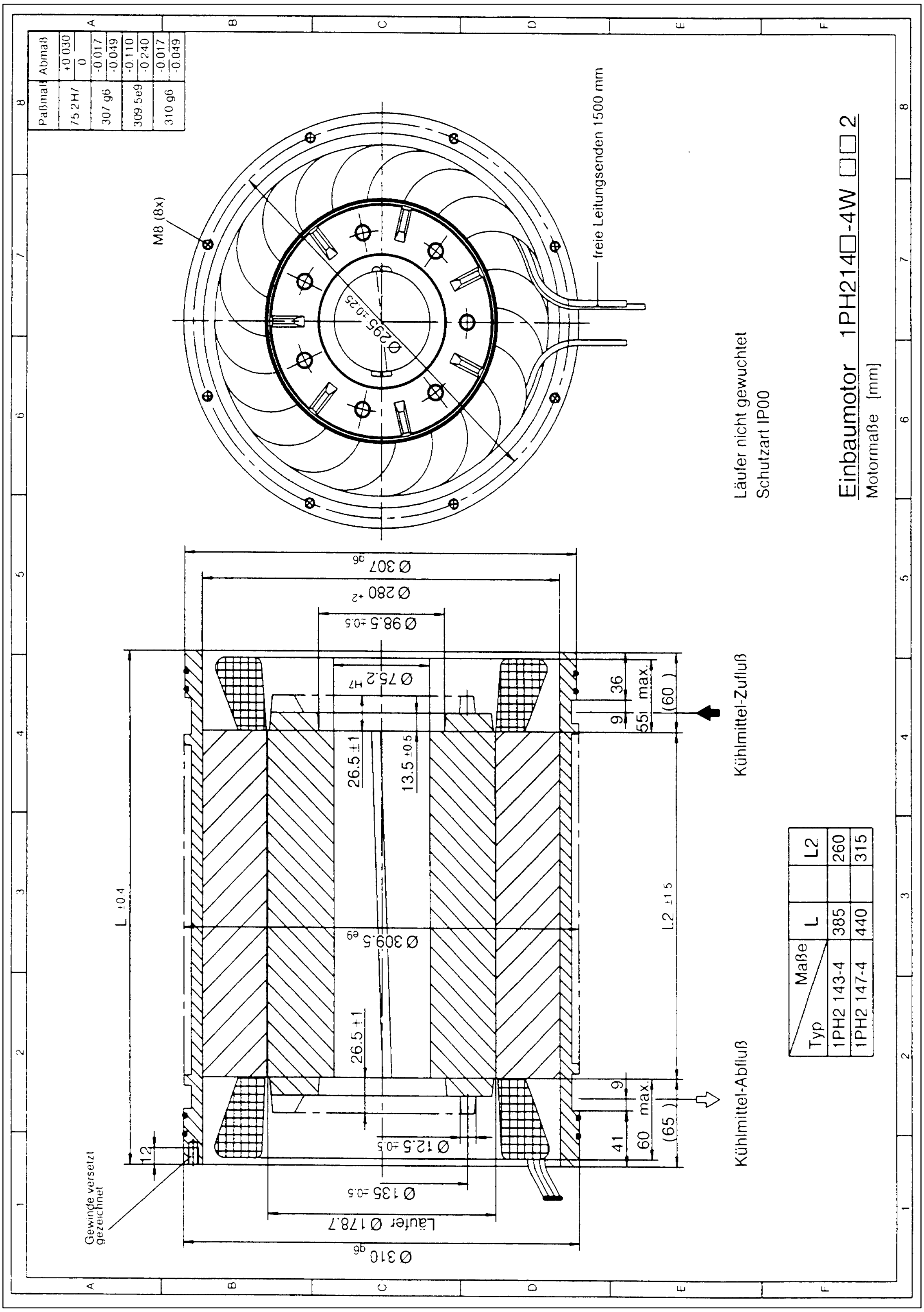


Fig. 4-19 1PH214□–4W motor dimensions

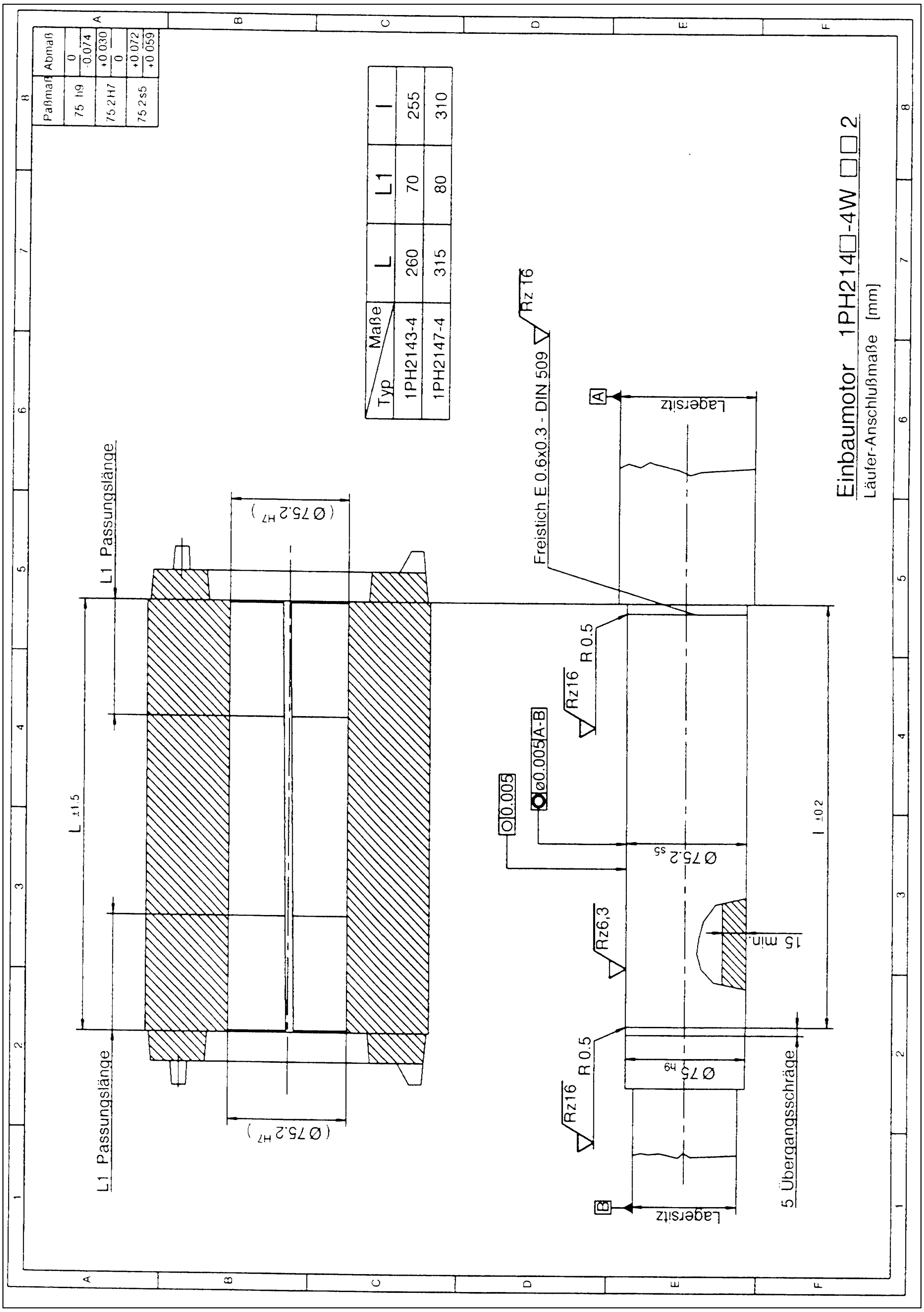


Fig. 4-20 1PH214□–4W rotor companion dimensions

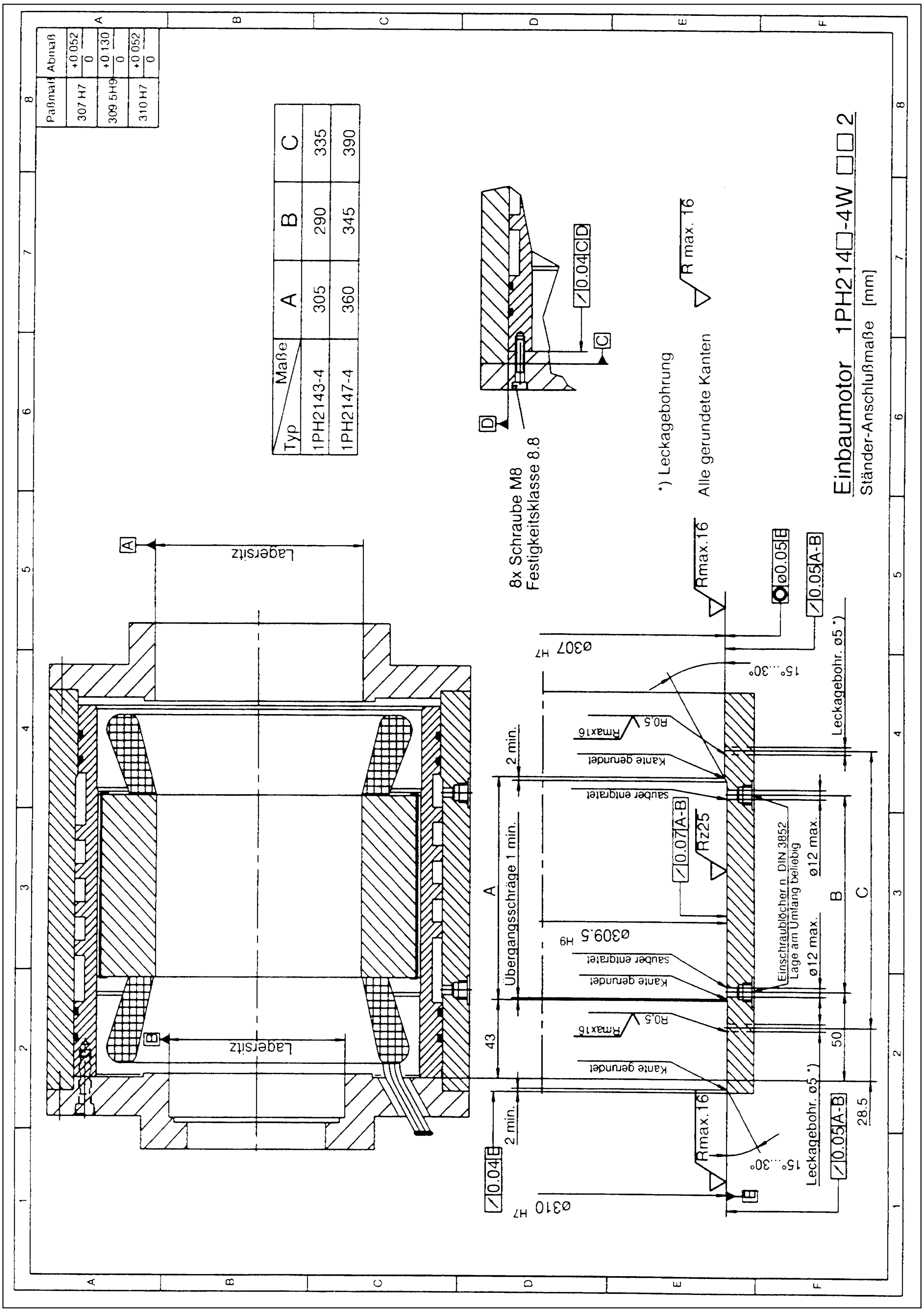


Fig. 4-21 1PH214□–4W stator companion dimensions

■

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5

Notes

1PH4 AC Main Spindle Motors

Notes

Motor Description 1

1.1 Characteristics and technical data

Applications

The 1PH4 series is suitable for closed–loop speed control of main spindles on machine tools, transfer lines and special–purpose machines.

With the compact type of construction of machine tools, the power loss of the electric drives can influence the machining quality. The resulting demand for cool–running motors resulted in the 1PH4 water–cooled AC main spindle motors.

Characteristics

1PH4 motors are water–cooled, squirrel–cage induction motors. Speeds of up to 12000 RPM can be achieved as a result of the compact design.

Depending on the shaft height, the 1PH4 series has rated outputs from 7.5 to 52 kW at rated speeds of 1500 RPM.

The output of water–cooled 1PH4 motors can be increased up to 40 % over air–cooled motors.

The 1PH4 series is flange and shaft compatible to the air–cooled 1PH7 AC motors.

Technical features

Note

The motors can be fed from a DC link voltage of up to 700 V DC.

Table 1-1 Motors, standard version

Technical features	Version
Motor type	Induction motor with squirrel–cage rotor
Type of construction (acc. to IEC 60034-7)	IM B35, IM V15, IM V36
Degree of protection (acc. to IEC 60034-5)	IP 65 (shaft gland IP 55)
Cooling	Water cooling (≤ 25 °C, otherwise de–rating)
Thermal motor protection (acc. to IEC 60034-6)	PTC thermistor
Winding insulation (acc. to IEC 60034)	Temperature rise class F for a cooling–medium temperature of +25 °C
Motor voltage	Max.: 3–ph. 430 V AC
Motor noise (acc. to DIN 45635) tolerance +3 dB	Up to shaft height 132: max. 69 dB (A) shaft height 160: max. 71 dB (A)
Speed control range	> 1: 500 000
Terminal box arrangement	Top
Connection type	Motor: via terminal box Encoder: via signal connector

Table 1-1 Motors, standard version

Technical features	Version
Encoder system	Integrated optical encoder • speed sensing • indirect position sensing (incremental)
Balancing	Standard: Full key balancing (dynamic) (acc. to DIN ISO 8821)
Shaft end	Cylindrical (acc. to DIN 748, Part 3); with keyway and (acc. to DIN 6885); full shaft up to shaft height 132: Tolerance zone k6 shaft height 160: Tolerance zone m6
Bearing design (DE)	Double bearing design1) (deep–groove ball bearings and roller bearings)
Flange version, radial eccentricity	Tolerance N (acc. to DIN 42 955)
Vibration severity (acc. to IEC 60034-14)	Level R
Paint finish	Anthracite

Options,

Table 1-2 Options

Technical features	Version
Terminal box arrangement	Terminal box, mounted left or right
Balancing	Half key balancing (dynamic) (acc. to DIN ISO 8821) Code: “H” at the face shaft end
Shaft end	Cylindrical; without keyway and without key (acc. to DIN 748, Part 3); full shaft Tolerance zone k6 (up to shaft height 132) Tolerance zone m6 (up to shaft height 160)
Bearing design (DE)	Single bearing for couplings or planetary gearbox mounting; bearing is designed for increased speeds
Flange version, radial eccentricity	Tolerance R (acc. to DIN 42 955)
Vibration severity (acc. IEC 60034-14)	Grade S (single/double bearing design) Grade SR for shaft height 100 to 160 (single bearing design)
Mounted/integrated components	• Changeover gearbox • Holding brake
Rating plate	2. Rating plate supplied loose

1) not suitable for coupling operation; minimum cantilever force required.

Table 1-3 Technical data – drive converter assignment 1PH4

Motor type 1PH4...	n_{rated}	n_{max} 2)	M_{rated}	n_{max} with L37 2)	I_0	U_N	Rated motor output for duty type (acc. to EN 60 034) P_{rated} [kW]			Rated motor current for duty type (acc. to EN 60 034) I_{rated} [A]			Drive converter module for motor duty type (acc. to EN 60 034) [A]		
	(RPM)	(RPM)	(Nm)	(RPM)	(A)	(V)	S1	S6–60 %	S6–40 %	S1	S6–60 %	S6–40 %	S1	S6–60 %	S6–40 %
Shaft height 100 mm															
103–4NF26	1500	9000	48	12 000	12	265	7,5	8,75	10	26	29	32	24/32 1)	24/32	24/32
105–4NF26			70		16	263	11	12,75	14,75	38	42	47	45/60	45/60	45/60
107–4NF26			90		19	265	14	16,25	18,75	46	52	58	45/60 1)	45/60	45/60
Shaft height 132 mm															
133–4NF26	1500	8000	95	10 000	17	229	15	18	21	55	65	74	60/80	60/80	60/80
135–4NF26			140		26	251	22	26,5	31	73	86	99	85/110	85/110	85/110
137–4NF26			170		31	265	27	32,5	38	85	100	114	85/110	85/110	85/110 1)
138–4NF26			190		34	244	30	36	42	102	119	136	120/150	120/150	120/150
Shaft height 160 mm															
163–4NF26	1500	6500	235	8000	44	286	37	45	52,5	107	125	142	120/150	120/150	120/150
167–4NF26			293		49	315	46	55	65	120	138	158	120/150	120/150	120/150 1)
168–4NF26			331		59	284	52	62,5	73	148	173	197	200/250	200/250	200/250

1) It may be necessary to use a higher–rating module; refer to diagram
2) Max. speed for S1 and S6 outputs, refer to the speed–power diagram; max. continuous operating speed, refer to Table 1–8

1.2 Cooling

1PH4 main spindle motors are water–cooled in order to achieve a higher power density.

A closed–water circuit with heat exchanger is required for operation.

Cooling medium

An anti–corrosion agent (e.g. Tyfocor) should be added to the water. In this case, the ratio of

Water: 75%
Anti–corrosion agent: 25 % should not be exceeded.

An adequate thermal transfer is achieved with a flow rate of:
8l/min

When using a different cooling medium (e.g. oil, cooling–lubricating medium) it may be necessary to reduce the output (de–rating), in order not to exceed the thermal motor limit.

The following cooling medium characteristics must be known in order to calculate the de–rating required:

Specific gravity ρ [kg/m^3]
Specific thermal capacity c_p [J/(kg K)]

Note

For oil–water mixtures with less than 10% oil, the motor output does not have to be reduced. The cooling medium must be pre–cleaned or filtered in order to prevent the cooling circuit from becoming blocked.

Maximum permissible particle size after filtering: 100 µm

The cooling duct geometry is designed so that the stator power loss and part of the rotor losses are dissipated. The geometry is identical for all built–in motors.

Cooling medium temperature

Recommendation: up to 25 °C

In order to prevent moisture condensation, the cooling–medium inlet temperature can, depending on the ambient temperature, be up to 40 °C.

When the cooling–medium temperature increases, the rated output P_N is reduced as follows:

Table 1-4 Decrease in the rated output

Cooling medium temperature [°C]	Reduction in the rated output [%]
30	100
40	95
50	90
60	85

Cooling powers and cooling quantity

Table 1-5 Cooling power and cooling quantity

Type	Cooling water flow [l/min] ± 0.75	Cooling power [W]	Connection	Max. permissible pressure [bar]
1PH4103 1PH4105 1PH4107	6 6 6	1900 2600 3000	G 1/4	7
1PH4133 1PH4135 1PH4137 1PH4138	8 8 8 8	2750 3500 4100 4500	G 3/8	
1PH4163 1PH4167 1PH4168	10 10 10	4600 5400 6200	G 1/2	

Cooling units

Refer to Chapter 1.2, AC main spindle motor 1PH2

1PH4

1.3 Degree of protection, thermal motor protection

Degree of protection (acc. to IEC 34–5)

The motor components have, as standard, degree of protection IP 65.

The motors have degree of protection IP 55 at the shaft gland.

Thermal motor protection

A PTC thermistor is integrated in the stator winding to sense the motor temperature.

Technical data, refer to Chapter 1.2.1, Encoder systems (GE).

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

An external tripping unit is not required. The function of the PTC thermistor is monitored. An appropriate signal is output to the drive converter when a fault condition develops. When the motor temperature increases, a “pre–alarm motor overtemperature” relay signal is output, which must be externally evaluated. If this signal is not observed, when the motor limiting temperature is exceeded, the drive converter shuts down with the appropriate fault message.

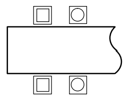
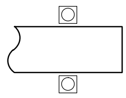
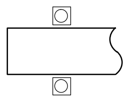
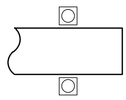
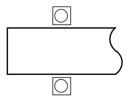
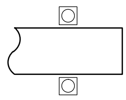
1.4 Bearing concept

Standard:

Double–bearing design on the drive end (deep–goove ball bearings and roller bearings). The double–bearing design is not suitable for couplings.

Bearing versions

Table 1-6 Bearing versions

Application	Bearing design/ option	Bearing design/option	
		Drive end	Non–drive end
Belt drive • Minimum cantilever force required • For high cantilever forces	**Standard** double–bearing design		
Coupling–out drive or planetary gearbox • Reduced cantilever force is permissible	**K00, (K02, K03)** Single bearing design		
Increased maximum speed • Cantilever–free out–drive required, e.g. coupling	**L37** Single–bearing design ”spindle bearing design”		

1PH4

Bearing change intervals (t_{LW})

For single and double–bearing designs, for a cooling medium temperature of +25 °C, bearing temperature +85 °C and horizontal mounting position.

Table 1-7 Bearing change intervals for shaft heights 100, 132 and 160

	Double–bearing design (standard)		Single–bearing design (K00)		Bearing design for increased speeds (L37)	
Shaft heights [mm]	Average operating speed n_m []	Average operating speed n_m [RPM]	Average operating speed n_m [RPM]	Average operating speed n_m [RPM]	Average operating speed n_m [RPM]	Average operating speed n_m [RPM]
100	$n_m < 2500$	$2500 < n_m < 6000$	$n_m < 4000$	$4000 < n_m < 7000$	$n_m \leq 8000$	$8000 < n_m < 12000$
132	$n_m < 2000$	$2000 < n_m < 5500$	$n_m < 3500$	$3500 < n_m < 6500$	$n_m \leq 6000$	$6000 < n_m < 10000$
160	$n_m < 1500$	$1500 < n_m < 4500$	$n_m < 3000$	$3000 < n_m < 5000$	$n_m \leq 5000$	$5000 < n_m < 8000$
t_{LW}[h]	16000	8000	20000	10000	16000	8000

Grease change interval

0.8 t_{LW} (t_{LW} = bearing change interval)

 6SN1197–0AA20

Continuous speed

The maximum permissible continuous operating speed depends on the bearing design and the shaft height:

Table 1-8 Assignment between the max. speed/continuous operating speed and shaft height and bearings

Shaft height [mm]	**Double–bearing design** [RPM]	**Single–bearing design** [RPM]	**Bearing design for increased speeds** [RPM]
100	7500/5600	9000/6500	12000/10000
132	6700/5200	8000/6000	10000/9250
160	5300/4000	6500/4500	8000/7000

1.5 Vibration severity – limit values

Within the 1PH□ series, the vibration severity limit values are identical!

The diagrams are provided in Chapter 2.1, General information on AC induction motors (AL A).

1.6 Options

1.6.1 Holding brake

Application

A single–surface brake can be mounted on the drive end to hold the motor shaft at standstill without any play.

Design

The drive end bearing end shield is supplied with special outer bearing cover design to mount the solenoid assembly (brake assembly). Customers can bolt–on the solenoid assembly. The brake armature disk should be bolted to the drive–out element (pulley belt or similar).

The brakes have no slip rings and are maintenance–free. Both of the friction surfaces are metal.

Retrofit: Not possible

Degree of protection

IP 00

Supply voltage

24 V DC ±10 %

Mode of operation

The brake operates according to the working principle, i.e. the brake is released when it is in a no–current condition.

The brake may only be applied when the motor is at a standstill.

The holding brake must be released (no–current condition) when the gearbox ratio is changed and when the motor is operational. After the brake has been released, there is no residual braking torque.

After mounting to the motor, the brake should be checked to ensure that it is functioning correctly.

Caution

The holding brake is only designed for a limited numbr of emergency braking operations. It is not permissible to use it as operating brake.

Before removing the solenoid assembly, voltage must be applied to the holding brake, so that the membrane spring is not overextended.

Selection data

The holding brakes described here, cannot be used in conjunction with two–stage changeover gearboxes.

Table 1-9 Holding brake selection

Holding brake	Code
For motors, shaft heights 100...160	
The motor is prepared for mounting a holding brake; the customer must mount the holding brake	**G95**
Motor with mounted ZF holding brake	**G46**

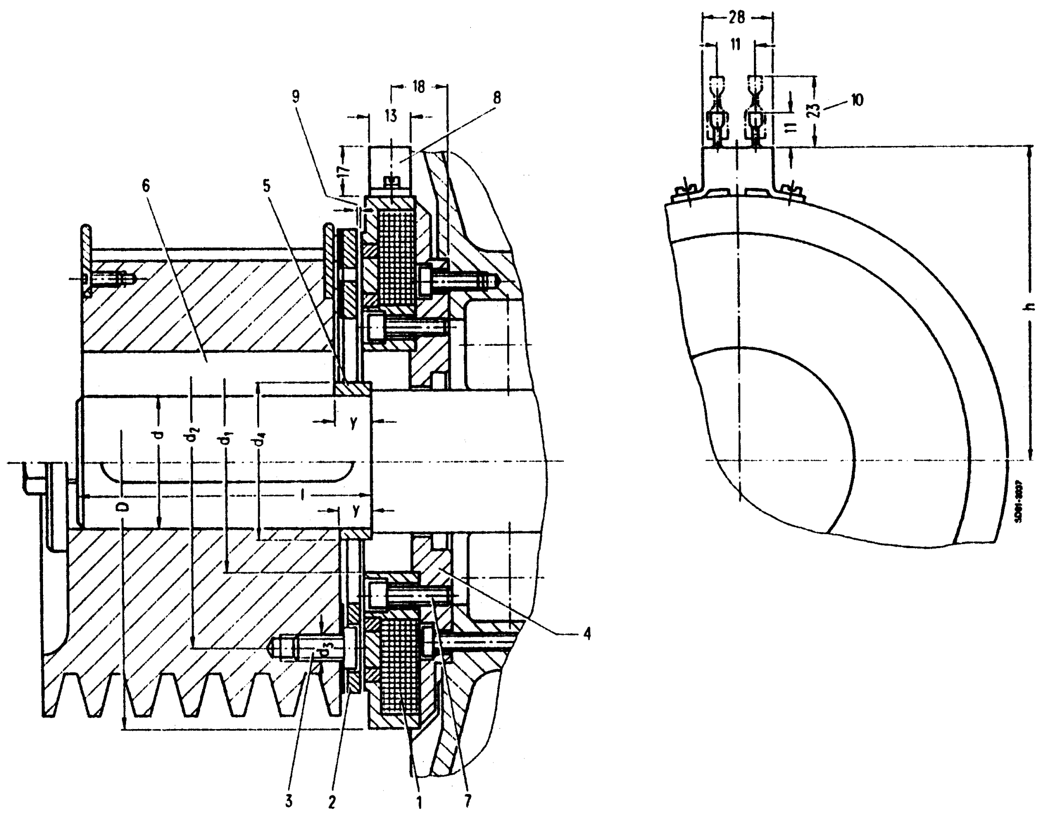
Technical data

Table 1-10 Technical data, holding brake

Motor type	**Holding brake**				
1PH4	**ZF type**	**Order No.**	**Holding torque** [**Nm**]	**Power consump-tion, ap-prox.** 1) [**W**]	**Closing time** [**ms**]
Shaft height 100	EB 3M	2LX2 146–0	30	20	100
Shaft height 132	EB 8M	2LX2 145–0	100	34	130
Shaft height 160	EB 8M	2LX2 145–0	100	34	130

1) Coil temperature, 20 °C

Dimensions **Single–surface holding brake for motors, shaft heights 100 to 160**



1 Electromagnetic single–surface brake
2 Brake armature disk
3 Three Allen screws acc. to DIN 7984 or 6912
4 Special version of the outer DE bearing cover
5 Adjustment ring to adjust the air gap or as endstop for the tensioning elements (variable for tolerance equalization)
6 Space for the tensioning element
7 Four Allen screws, M 5x15 and M 6x20 acc. to DIN 912
8 Electrical connection: Faston connector DIN 46244 A6, 3–0.8
9 Airgap s = 0.5 mm between the brake assembly and armature disk
10 Removal dimension for the Faston sleeve, size 6.3

Fig. 1-1 Mounting a holding brake on the drive end of AC motors, 1PH4 10□ to 1PH4 16□ as example: Mounting the armature disk to a belt pulley with key (upper halves) or to a toothed belt pulley for tensioning elements (lower halves)

Table 1-11 Dimensions for mounting single–surface holding brake [mm]

Motor	DE shaft end								
1PH4	**d**	**D**	**l**	**h**	**y**	d_1 H8	d_2 ∅	d_3 3x displaced through +/–0.1	d_4 max. 120°
Shaft ht. 100 1PH4 103 105 107	38	118	80	77	15	45	94	M6	42
Shaft ht. 132 1PH4 133 135 137 138	42	167	110	100	11	70	118	M8	60
Shaft ht. 160 1PH4 163 167 168	55	167	110	100	7	70	118	M8	63

1.6.2 Changeover gearbox

Changeover gearbox

The shaft end of 1PH4 motors is compatible with the air–cooled 1PH7 motors. This allows the same gearboxes to be used (refer to Chapter 1.8 for 1PH7 AC main spindle motors).

The seal between the motor flange and gearbox flange for shaft heights 132 and 160 must be sealed using a sealing compound (e.g. Terostat 93, from Teroson) due to the discontinuous centering edge.

1.7 Encoders

Refer to Chapter 1.5, 1PH7 AC main spindle motors.

1.8 Mounting

Refer to Chapter 1.7, 1PH7 AC main spindle motors.

■

Notes

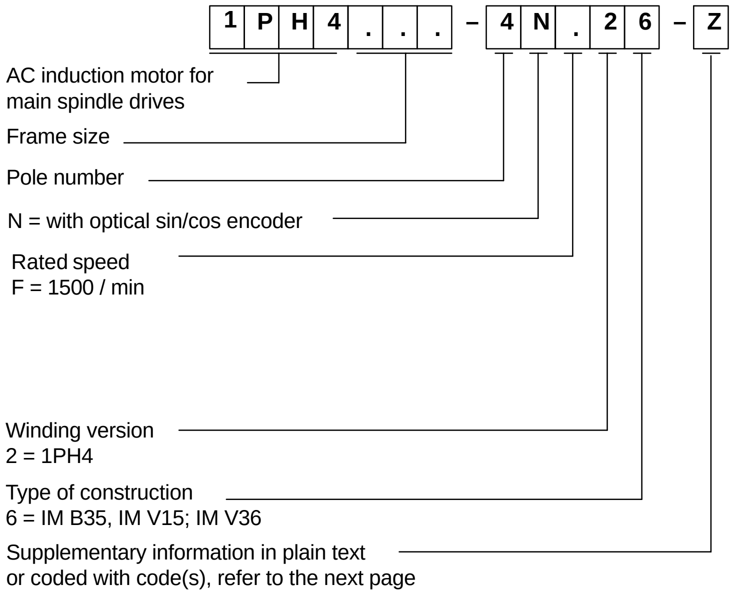
Order Designations 2

Order designation

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

The first block has seven positions and designates the motor type. Additional design features are coded in the second block. The third block is provided for additional data and information.

Please note that not every theoretical possible combination is available. Please refer to the ordering tables for possible combinations.



When ordering special AC motor versions, in addition, a code must be specified for each required version.

1PH4

Supplementary data for options

Option	Code
Terminal box arrangement (when viewing the drive end)	
• on the side, right	**K09**
• on the side, left	**K10**
• the small terminal box and signal connector rotated through 90° (cable entry from the drive end)	**K83**
• the small terminal box and signal connector rotated through 90° (cable entry from the non–drive end	**K84**
• the terminal box and signal connector rotated through 180°	**K85**
Bearing version on the drive end	
• single–bearing design for coupling, planetary gearbox or for low up to medium cantilever forces	**K00**
• single–bearing design for increased speeds	**L37**
• radial shaft sealing ring; oil–tight	**K18**
Vibration severity (acc. to IEC 34–14, DIN VDE 0530, Part 14)	
• grade S for double–bearing design	**K05** 1) 4)
• grade S for single–bearing design	**K02** 1) 4)
• grade SR single–bearing designs	**K03** 1) 4)
Shaft and flange accuracy (acc. to DIN 42955)	
• tolerance R	**K04** 2)
Drive shaft end AS	
• shaft end ”B” (without keyway)	**K42**
Balancing	
• half–key balancing	**L69**
Gearboxes 5)	
• the motor is prepared for mounting a 2LG43 ZF changeover gearbox	**K00** 3)
Holding brake	
• motor with mounted holding brake (drive end)	**G46** 4)
Others	
• 2nd rating plate, supplied loose	**K31**
• without encoder system	**H30**

1) automatically includes version K04
2) increased shaft accuracy
3) for 2LG42 gearboxes (old version), use G97+K00;
G97=non–standard cylindrical shaft end for shaft height 100, shaft end diameter 28x60mm
4) cannot be combined with gearbox mounting
5) a sealing compound (e.g. Terostat 93, Teroson Company) must be used to establish the seal between the motor flange and gearbox flange for shaft heights 132 and 160 due to the discontinuous centering profile.

■

Technical Data and Characteristics 3

3.1 Speed–power diagrams

AC motors for main spindle drives must be continuously cooled in operation, independent of the duty type.

The dotted lines in the diagrams indicate the power limit of the particular drive converter for the specified AC motor. The power module is specified.

The outputs are specified for a relative power–on duration of 25 %, 40 % and 60 %.

Table 3-1 AC main spindle motor 1PH4103–4NF2

Rated output P_{rated} [kW]	Rated speed n_{rated} [RPM]	Rated torque M_{rated} [Nm]	Rated current I_{rated} [A]	Time constant (therm.) T_{th} [min]	Max. speed n_{max} [RPM]	Moment of inertia J [kgm^2]	Weight m [kg]
7.5	1500	48	26	6	9000	0.017	52

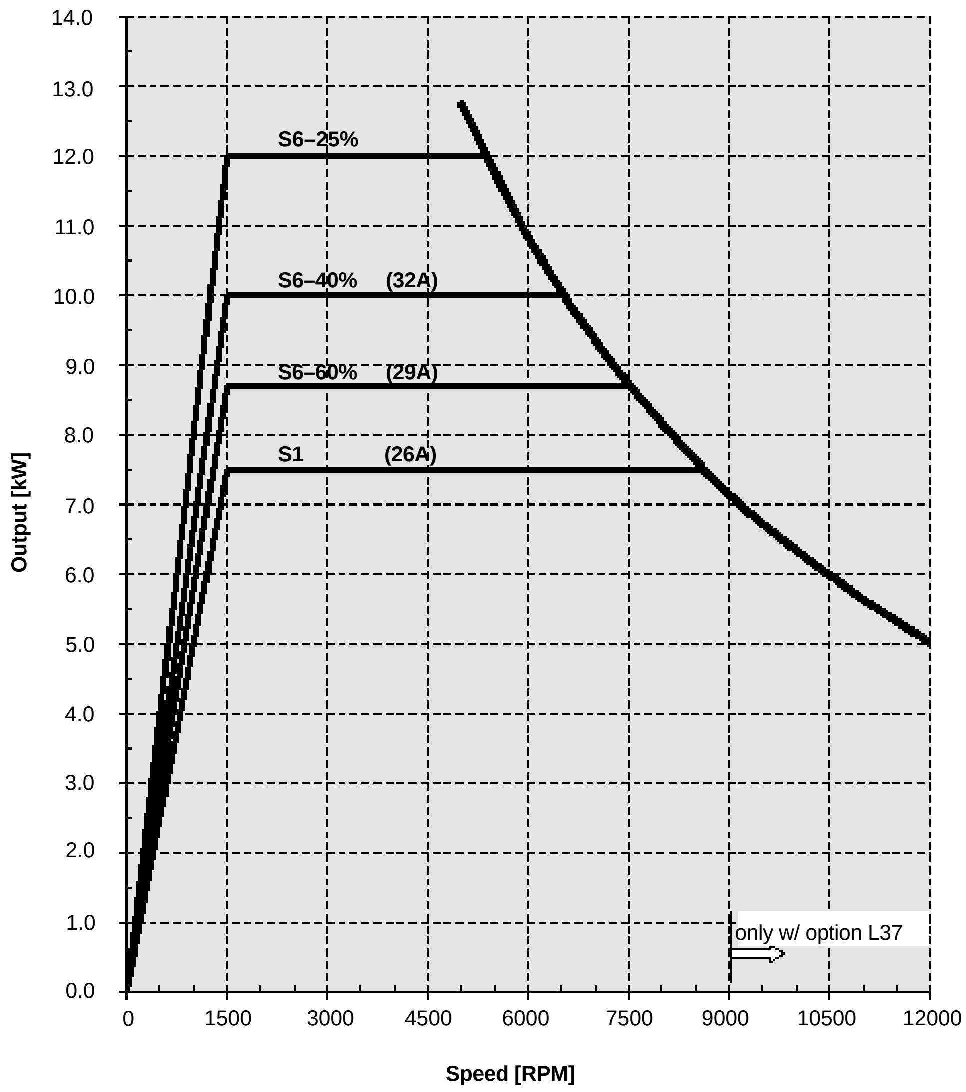


Fig. 3-1 Speed–power diagram 1PH4103–4NF2

Table 3-2 AC main spindle motor 1PH4105–4NF2

Rated output P_{rated} [kW]	Rated speed n_{rated} [RPM]	Rated torque M_{rated} [Nm]	Rated current I_{rated} [A]	Time constant (therm.) T_{th} [min]	Max. speed n_{max} [RPM]	Moment of inertia J [kgm^2]	Weight m [kg]
11	1500	70	38	6	9000	0.024	67

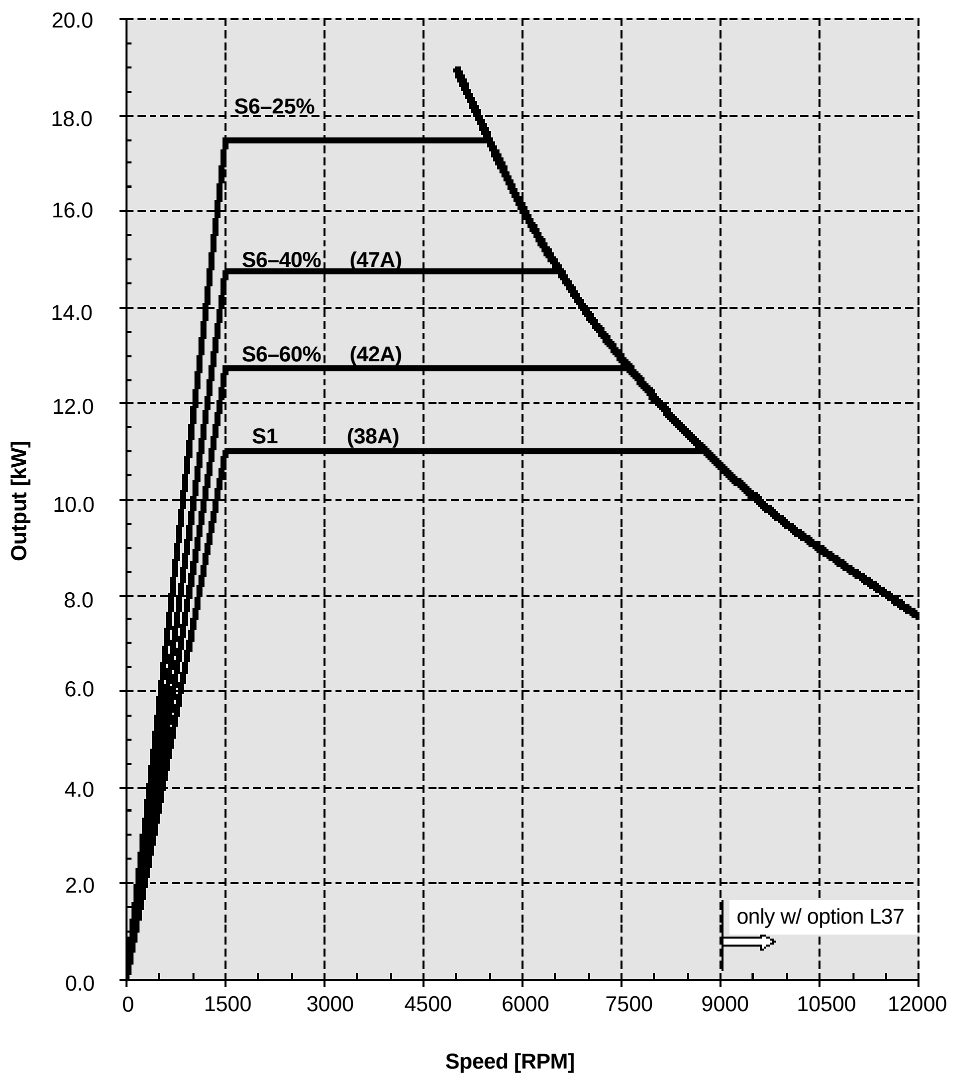


Fig. 3-2 Speed–power diagram 1PH4105–4NF2

1PH4

Table 3-3 AC main spindle motor 1PH4107–4NF2

Rated output P_{rated} [kW]	Rated speed n_{rated} [RPM]	Rated torque M_{rated} [Nm]	Rated current I_{rated} [A]	Time constant (therm.) T_{th} [min]	Max. speed n_{max} [RPM]	Moment of inertia J [kgm^2]	Weight m [kg]
14	1500	90	46	6	9000	0.031	80

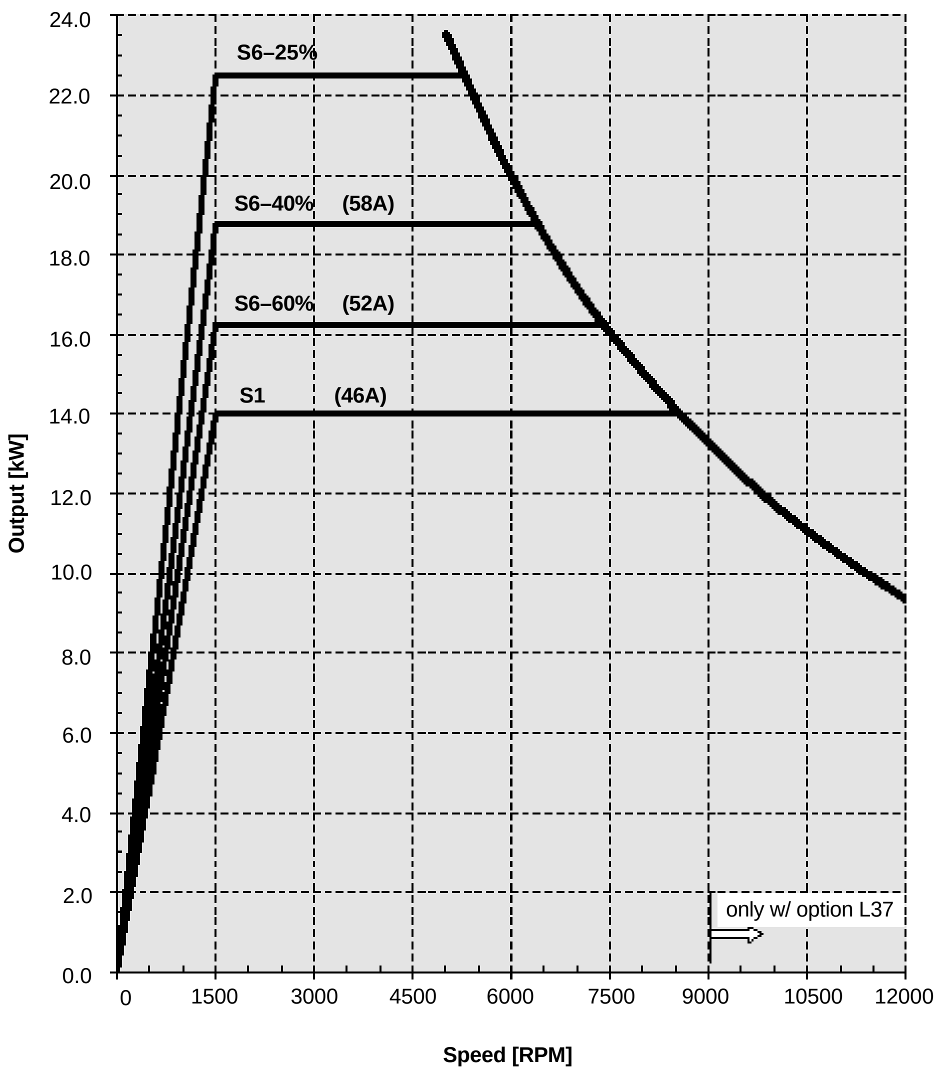


Fig. 3-3 Speed–power diagram 1PH4107–4NF2

Table 3-4 AC main spindle motor 1PH4133–4NF2

Rated output P_{rated} [kW]	Rated speed n_{rated} [RPM]	Rated torque M_{rated} [Nm]	Rated current I_{rated} [A]	Time constant (therm.) T_{th} [min]	Max. speed n_{max} [RPM]	Moment of inertia J [kgm^2]	Weight m [kg]
15	1500	95	55	11	8000	0.046	90

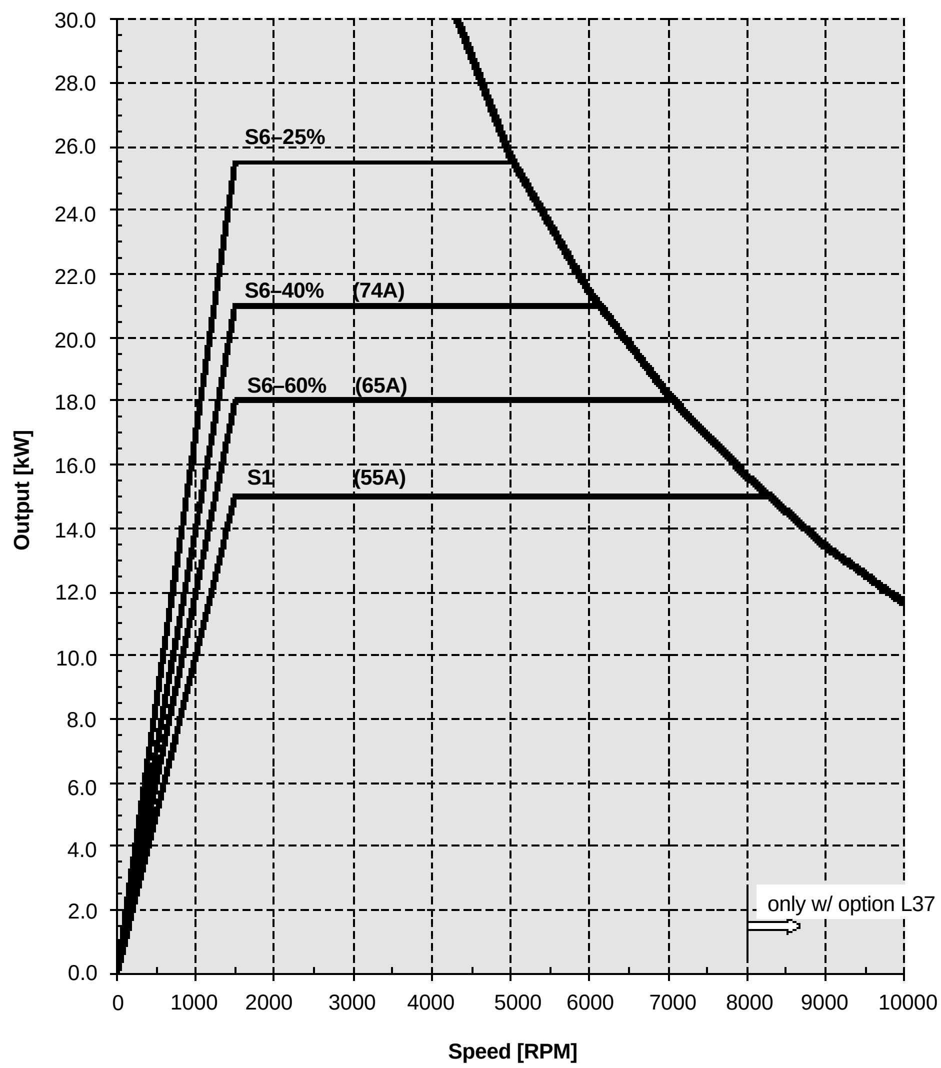


Fig. 3-4 Speed–power diagram 1PH4133–4NF2

Table 3-5 AC main spindle motor 1PH4135–4NF2

Rated output P_{rated} [kW]	Rated speed n_{rated} [RPM]	Rated torque M_{rated} [Nm]	Rated current I_{rated} [A]	Time constant (therm.) T_{th} [min]	Max. speed n_{max} [RPM]	Moment of inertia J [kgm^2]	Weight m [kg]
22	1500	140	73	11	8000	0.071	112

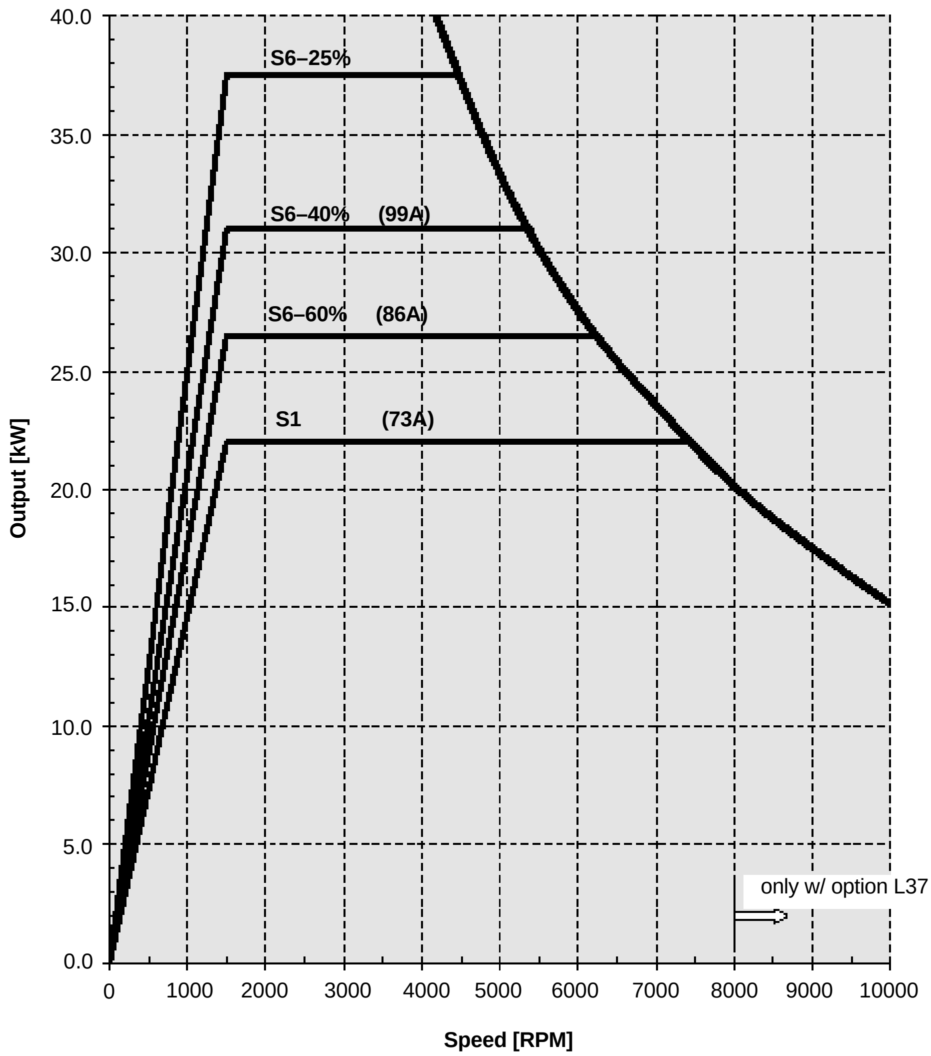


Fig. 3-5 Speed–power diagram 1PH4135–4NF2

Table 3-6 AC main spindle motor 1PH4137–4NF2

Rated output P_{rated} [kW]	Rated speed n_{rated} [RPM]	Rated torque M_{rated} [Nm]	Rated current I_{rated} [A]	Time constant (therm.) T_{th} [min]	Max. speed n_{max} [RPM]	Moment of inertia J [kgm²]	Weight m [kg]
27	1500	170	85	11	8000	0.085	130

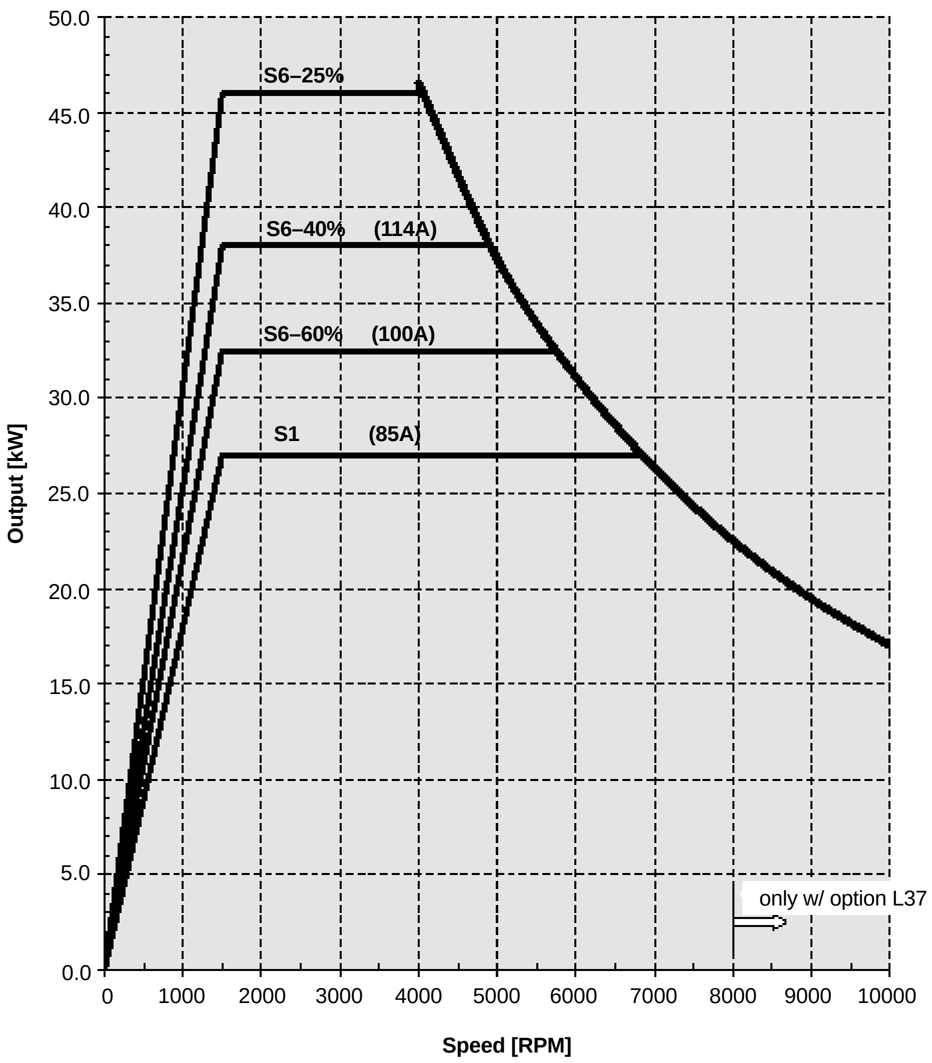


Fig. 3-6 Speed–power diagram 1PH4137–4NF2

1PH4

Table 3-7 AC main spindle motor 1PH4138–4NF2

Rated output P_{rated} [kW]	Rated speed n_{rated} [RPM]	Rated torque M_{rated} [Nm]	Rated current I_{rated} [A]	Time constant (therm.) T_{th} [min]	Max. speed n_{max} [RPM]	Moment of inertia J [kgm^2]	Weight m [kg]
30	1500	190	102	11	8000	0.104	150

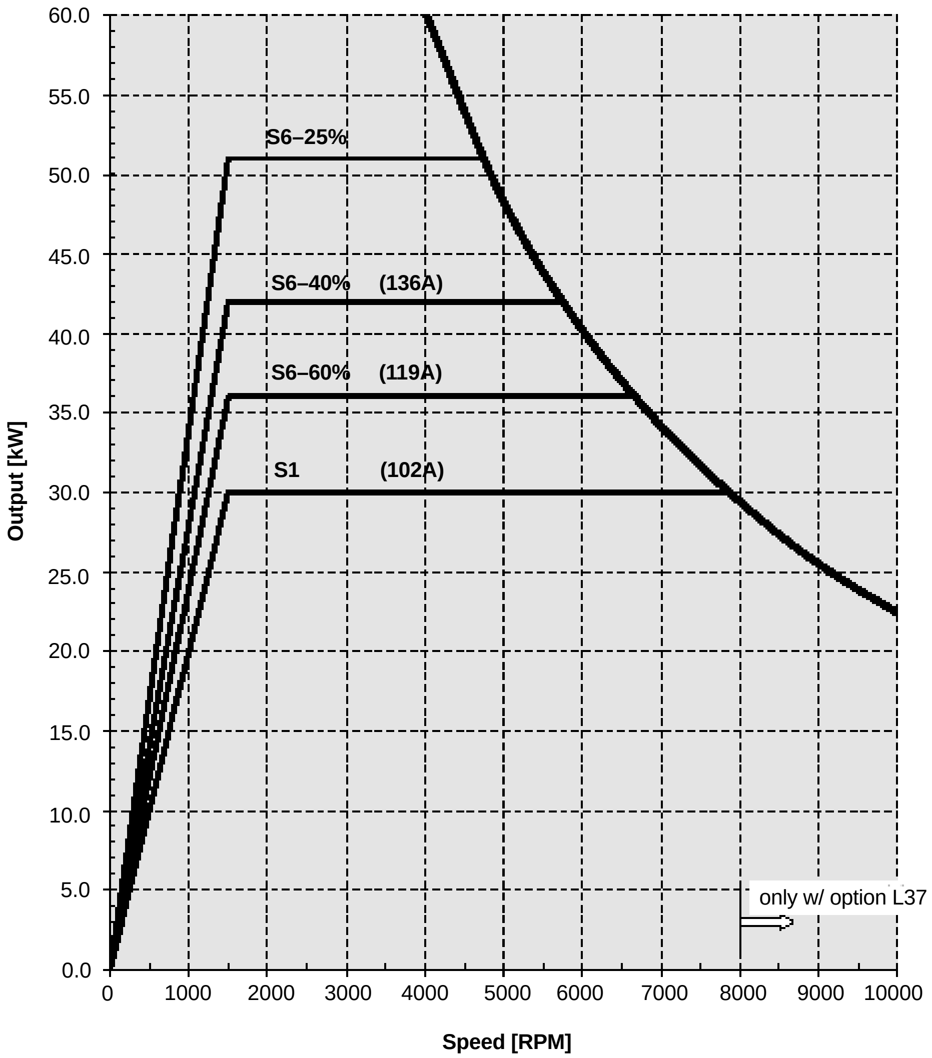


Fig. 3-7 Speed–power diagram 1PH4138–4NF2

Table 3-8 AC main spindle motor 1PH4163–4NF2

Rated output P_{rated} [kW]	Rated speed n_{rated} [RPM]	Rated torque M_{rated} [Nm]	Rated current I_{rated} [A]	Time constant (therm.) T_{th} [min]	Max. speed n_{max} [RPM]	Moment of inertia J [kgm^2]	Weight m [kg]
37	1500	235	107	14	6500	0.17	175

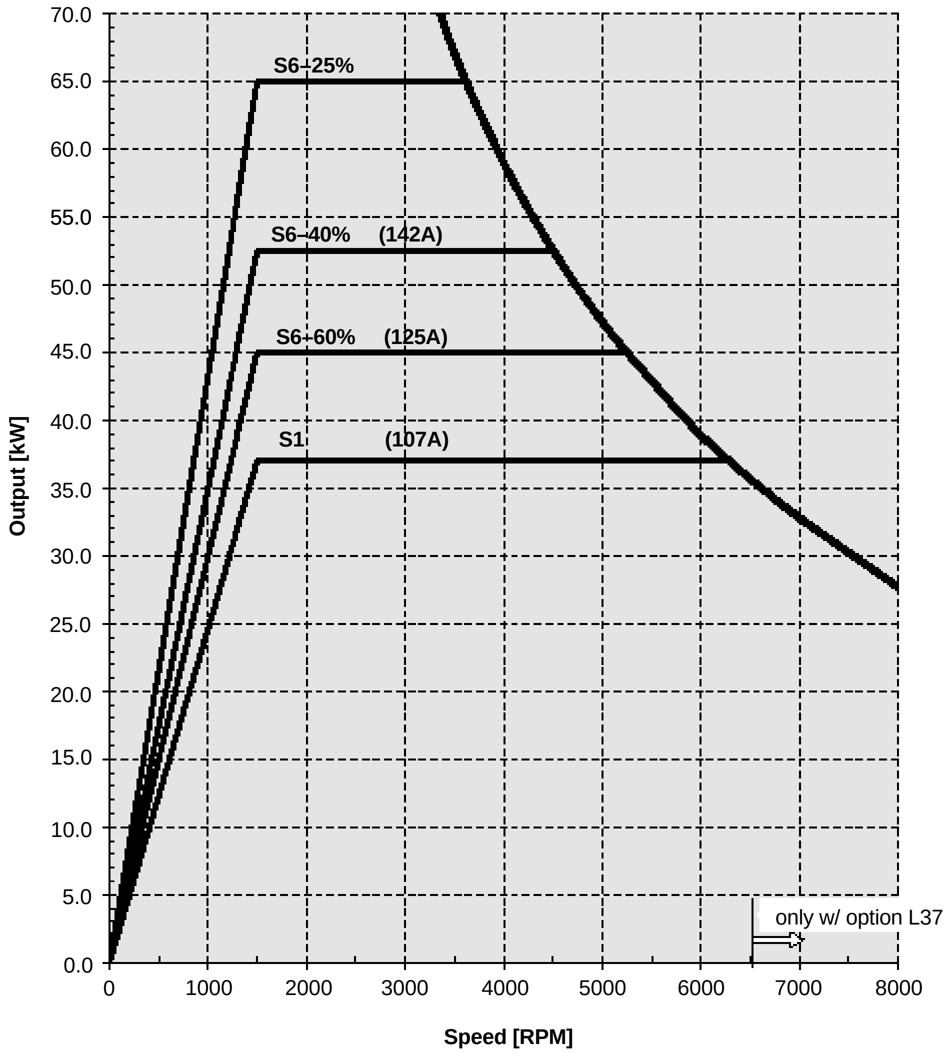


Fig. 3-8 Speed–power diagram 1PH4163–4NF2

1PH4

Table 3-9 AC main spindle motor 1PH4167–4NF2

Rated output P_{rated} [kW]	Rated speed n_{rated} [RPM]	Rated torque M_{rated} [Nm]	Rated current I_{rated} [A]	Time constant (therm.) T_{th} [min]	Max. speed n_{max} [RPM]	Moment of inertia J [kgm^2]	Weight m [kg]
46	1500	293	120	14	6500	0.206	210

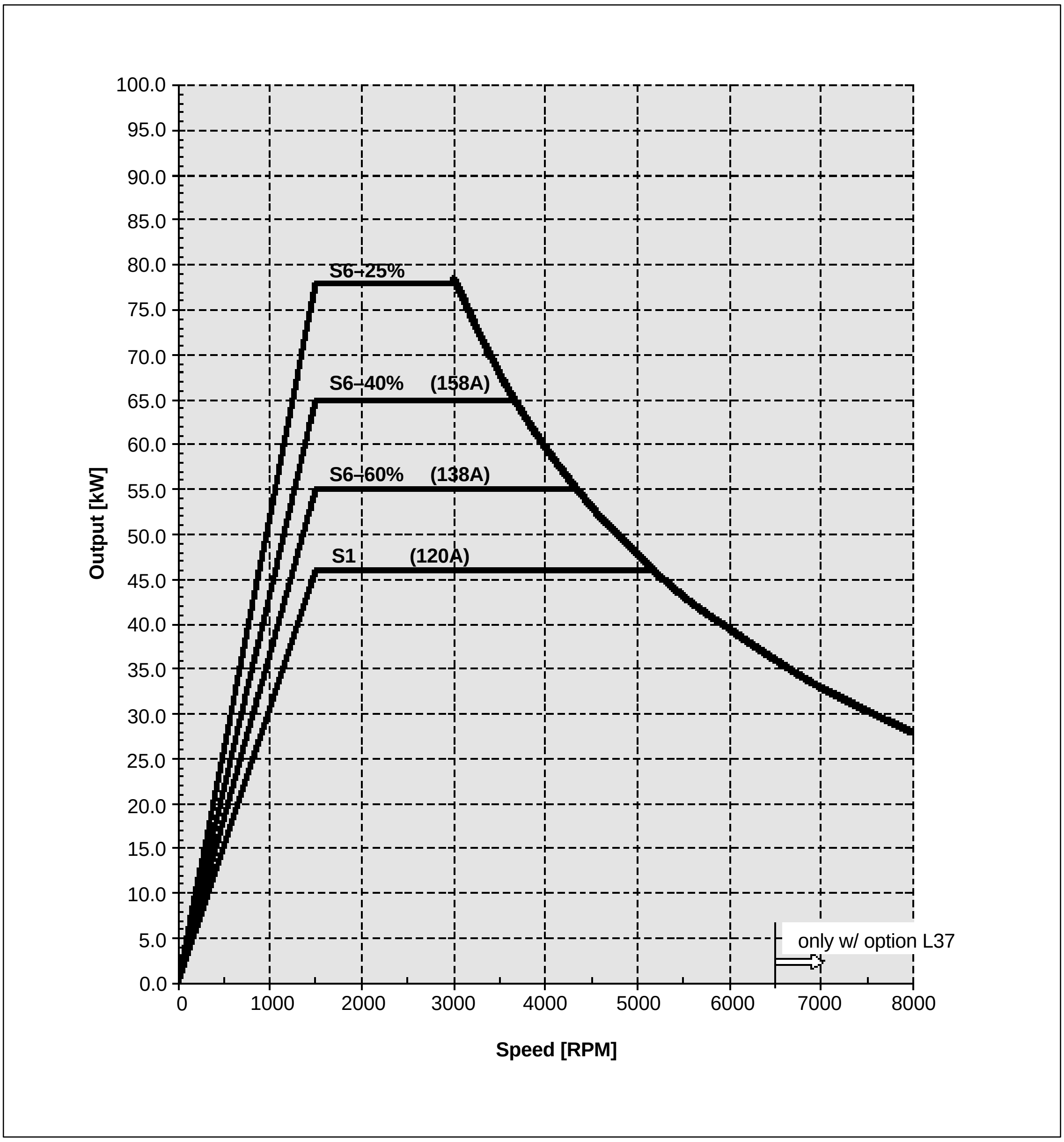


Fig. 3-9 Speed–power diagram 1PH4167–4NF2

Table 3-10 AC main spindle motor 1PH4168–4NF2

Rated output P_{rated} [kW]	Rated speed n_{rated} [RPM]	Rated torque M_{rated} [Nm]	Rated current I_{rated} [A]	Time constant (therm.) T_{th} [min]	Max. speed n_{max} [RPM]	Moment of inertia J [kgm^2]	Weight m [kg]
52	1500	331	148	14	6500	0.22	240

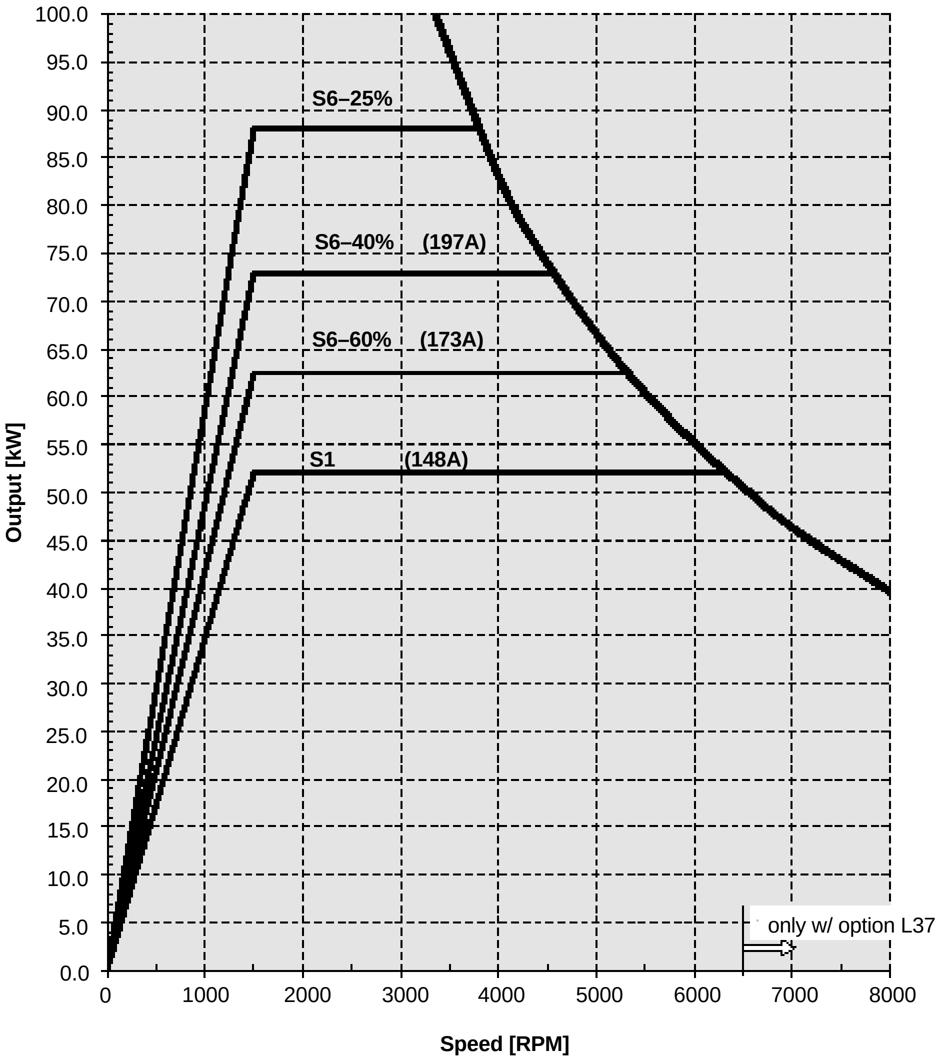


Fig. 3-10 Speed–power diagram 1PH4168–4NF2

1PH4

3.2 Cantilever/axial force diagrams

1PH4 main spindle motors have a double–bearing design at the drive end, and can accept high cantilever forces for belt drives.

Definition, refer to Chapter 2.1, General information on AC induction motors AL A.

Cantilever force

Caution

When using mechanical transmission elements, which apply a cantilever force to the shaft end, then it must be ensured tht the **maximum limit values**, specified in the cantilever–force diagrams, **are not exceeded** .

Note

For applications with extremely low cantilever force stressing, it must be ensured that the motor shaft is subject to a **min. cantilever force, specified in the diagrams**. If the cantilever forces are too low, this can cause the cylindrical roller bearings to rotate in an undefined fashion which results in increased bearing wear.

Single–bearing designs should be used for applications such as these.

The maximum permissible and the minimum required cantilever forces are shown in the following diagrams.

Axial force

The maximum permissible axial forces F_{AAS} for horizontal motor mounting for shaft heights 100 to160, are specified in the following force diagrams.

The force diagrams and tables are only valid for standard drive shaft ends; for non–standard drive shaft end dimensions, each operating case is defined specifically according to the permissible force stressing.

For forces which go beyond this, please contact us.

Note

When using option L37 (increased speed) for motors, shaft heights 100 to 160, it should be observed, that the motors are only suitable for operation without cantilever forces!

Rotor weight forces

Explanations are provided in Chapterl AL A, General information on AC induction motors, Page AL A/2–5.

Table 3-11 Bearing alignment force and the force due to the rotor weight

Motor type	F_L in [N]	F_C in [N]
1PH4103 1PH4105 1PH4107	125 155 205	320 320 320
1PH4133 1PH4135 1PH4137 1PH4138	215 305 365 445	360 360 360 360
1PH4163 1PH4167 1PH4168	500 590 665	520 520 520

Table 3-12 Axial forces F_A for double–bearing designs (standard) as a function of the speed

1PH410□–4	**Speed n in [RPM]**	**1500**	**2000**	**3000**	**4000**	**5000**	**6000**	**7500**
	Axial force FA in [N]	1440	1270	1050	920	830	760	690
1PH413□–4	**Speed n in [RPM]**	**1500**	**2000**	**3000**	**4000**	**5000**	**6700**	
	Axial force FA in [N]	1520	1330	1090	950	850	730	
1PH416□–4	**Speed n in [RPM]**	**1500**	**2000**	**3000**	**4000**	**5300**		
	Axial force FA in [N]	2080	1830	1520	1340	1180		

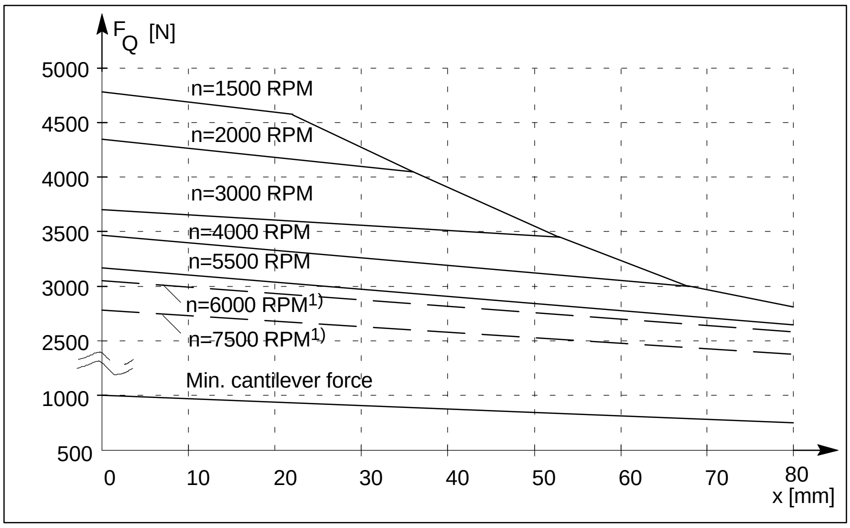
Cantilever force 1PH410□

Permissible cantilever forces for double–bearing designs (standard).

Permissible cantilever force F_Q at a distance x from the shaft shoulder for a nominal bearing lifetime of 20 000 h.

Maximum continuous operating speed n_{s1max} = 5600 RPM
Mechanical limiting speed n_{max} = 9000 RPM

1PH4



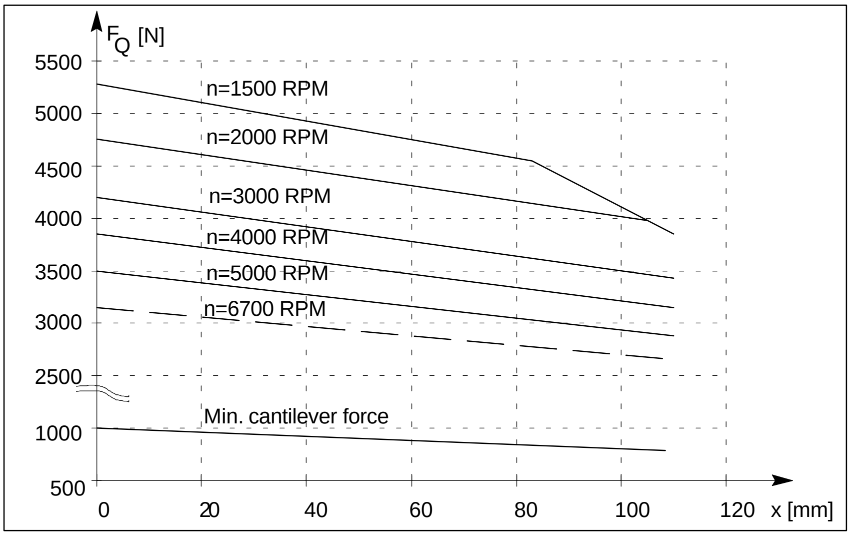
1) Permissible for continuous operation, however, reduced bearing lifetime

Cantilever force 1PH413□

Permissible cantilever forces for double–bearing design (standard).

Permissible cantilever force F_Q at a distance x from the shaft shoulder for a nominal bearing lifetime of 20 000 h.

Max. continuous operating speed n_{s1max} = 5200 RPM
Mechanical limiting speed n_{max} = 8000 RPM

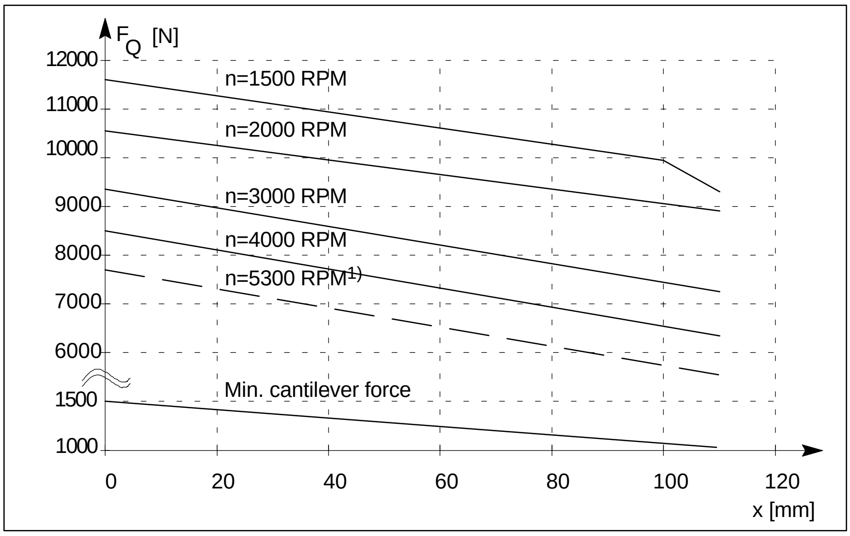


Cantilever force 1PH416□

Permissible cantilever forces for double–bearing designs (standard).

Permissible cantilever force F_Q at a distance x from the shaft shoulder for a nominal bearing lifetime of 20 000 h.

Max. continuous operating speed n_{s1max} = 4000 RPM
Mechanical limiting speed n_{max} = 6500 RPM

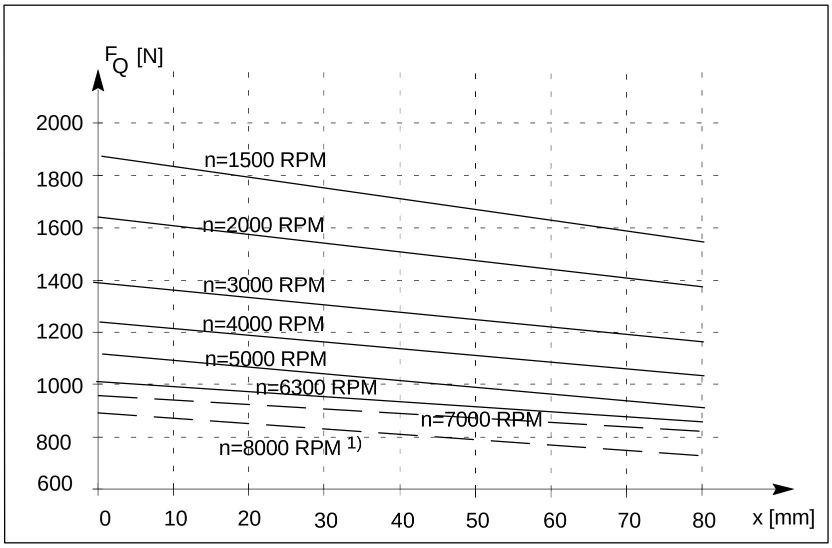


Cantilever force 1PH410□

Permissible cantilever forces for 1PH410 single–bearing designs (option K00)

Permissible cantilever force F_Q at a distance x from the shaft shoulder for a nominal bearing lifetime of 20 000 h. 1)

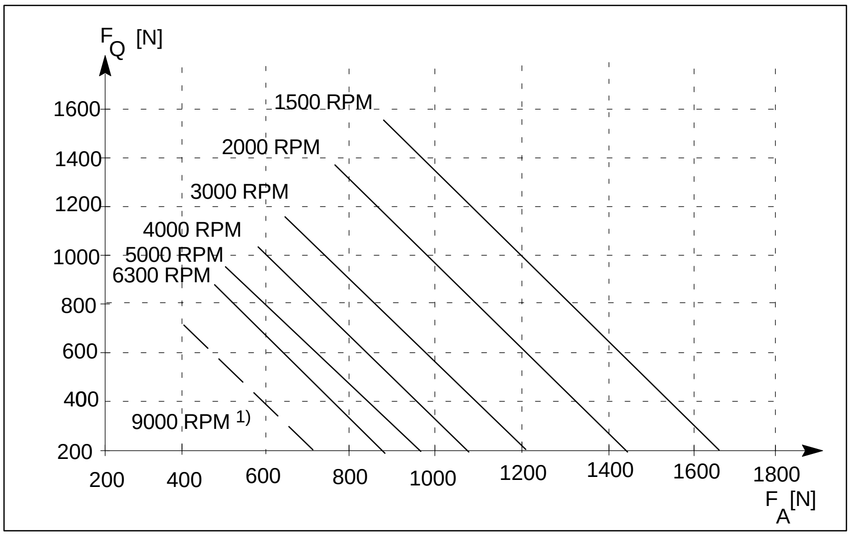
Max. continuous operating speed n_{s1max} = 6500 RPM
Mechanical limiting speed n_{max} = 9000 RPM



Cantilever force 1PH410□

Permissible cantilever forces for 1PH410 single–bearing designs (option K00) as a function of the axial forces

Permissible cantilever force F_Q as a function of axial force F_A for a nominal bearing lifetime of 20 000 h.



1) Permissible for continuous operation, however, reduced bearing lifetime

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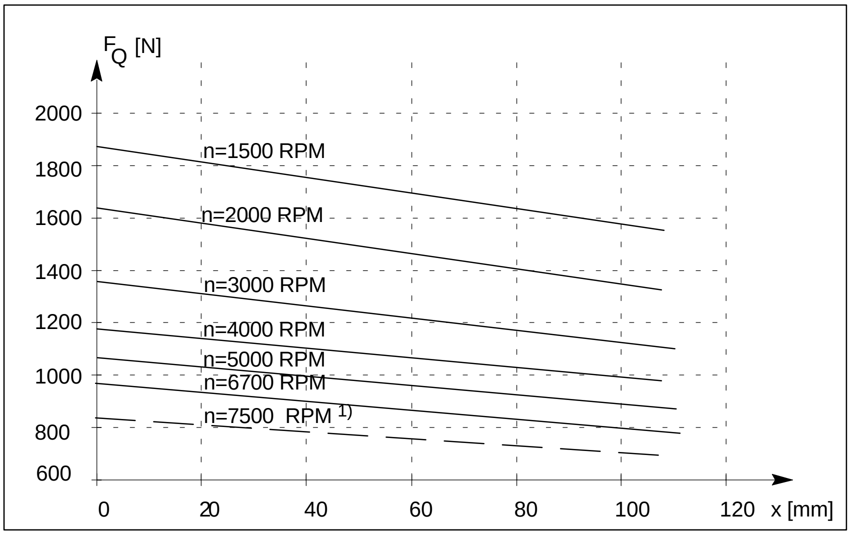
Cantilever force 1PH413□

Permissible cantilever forces for 1PH413 single–bearing designs (option K00).

Permissible cantilever force F_Q at a distance x from the shaft shoulder for a nominal bearing lifetime of 20 000 h. 1)

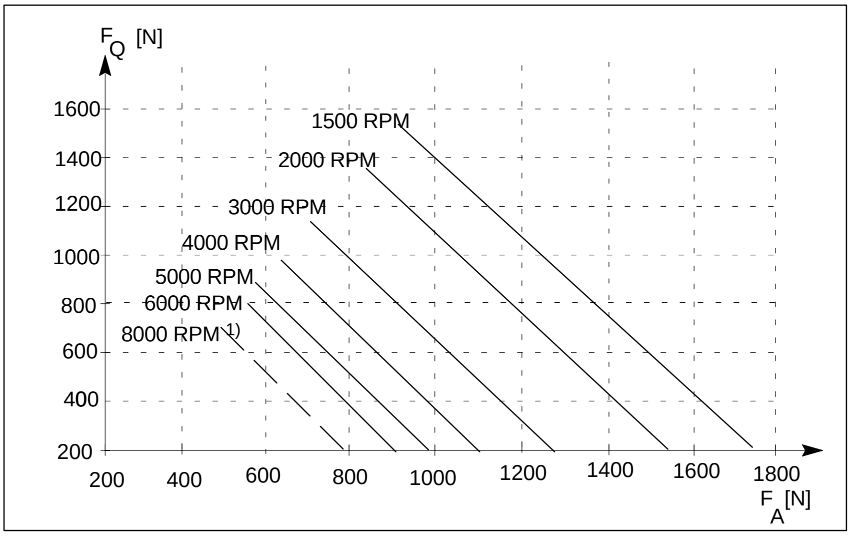
Max. continuous operating speed n_{s1max} = 6000 RPM
Mechanical limiting speed n_{max} = 8000 RPM



Cantilever force 1PH413□

Permissible cantilever forces for 1PH413 single–bearing designs (option K00) as a function of the axial forces

Permissible cantilever force F_Q as a function of axial force F_A for a nominal bearing lifetime of 20 000 h.



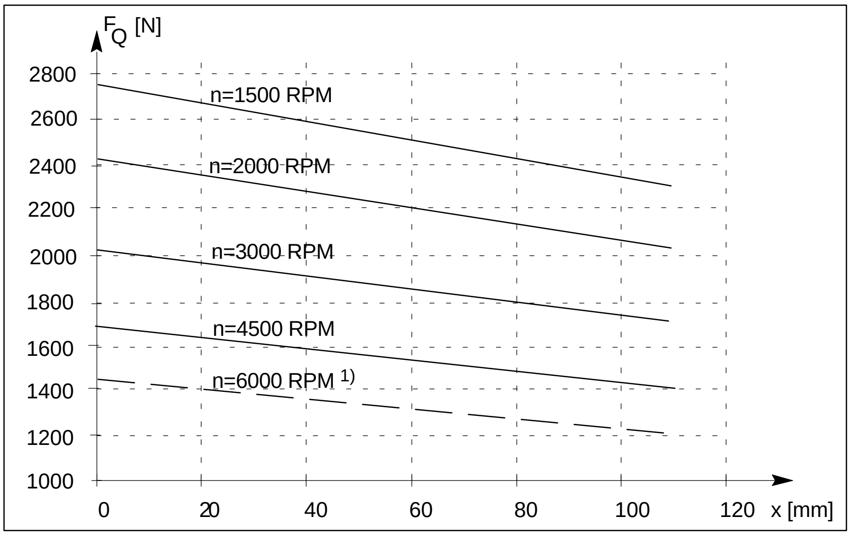
1) Permissible for continuous operation, however, reduced bearing lifetime

Cantilever force 1PH416□

Permissible cantilever forces for 1PH416 single–bearing designs (option K00).

Permissible cantilever force F_Q at a distance x from the shaft shoulder for a nominal bearing lifetime of 20 000 h. 1)

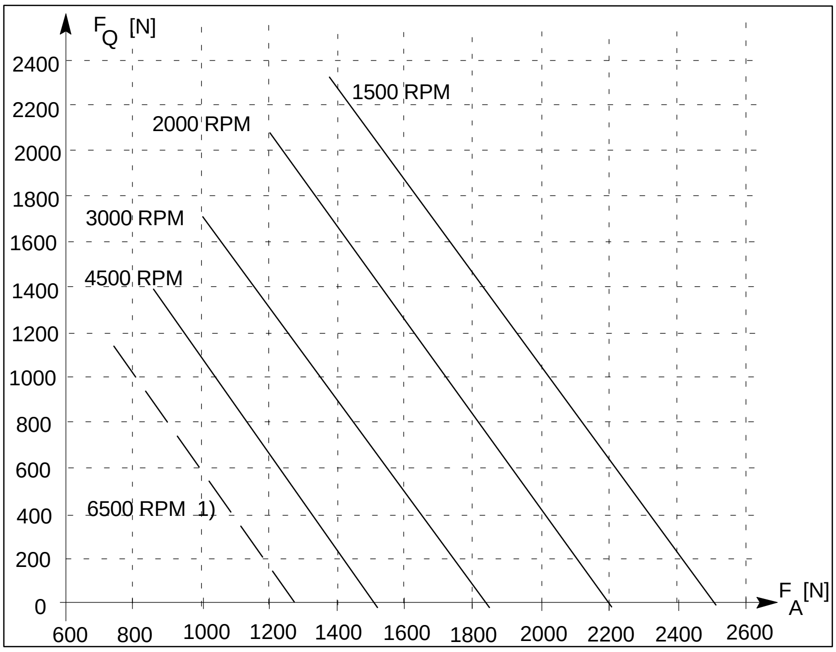
Max. continuous operating speed n_{s1max} = 4500 RPM
Mechanical limiting speed n_{max} = 6500 RPM



Cantilever force 1PH416□

Permissible cantilever forces for 1PH416 single–bearing designs (option K00) as a function of the axial forces.

Permissible cantilever force F_Q as a function of axial force F_A for a nominal bearing lifetime of 20 000 h.



1PH4

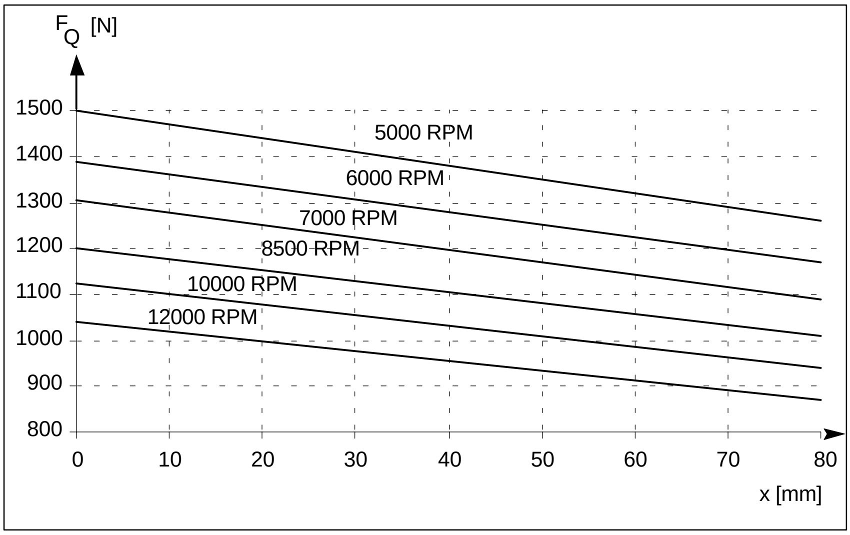
1) Permissible for continuous operation, however, reduced bearing lifetime

Cantilever force 1PH410□

Permissible cantilever forces for 1PH410 single–bearing designs (option K00 with L37)

Permissible cantilever force F_Q at a distance x from the shaft shoulder for a nominal bearing lifetime of 10 000 h. 1)

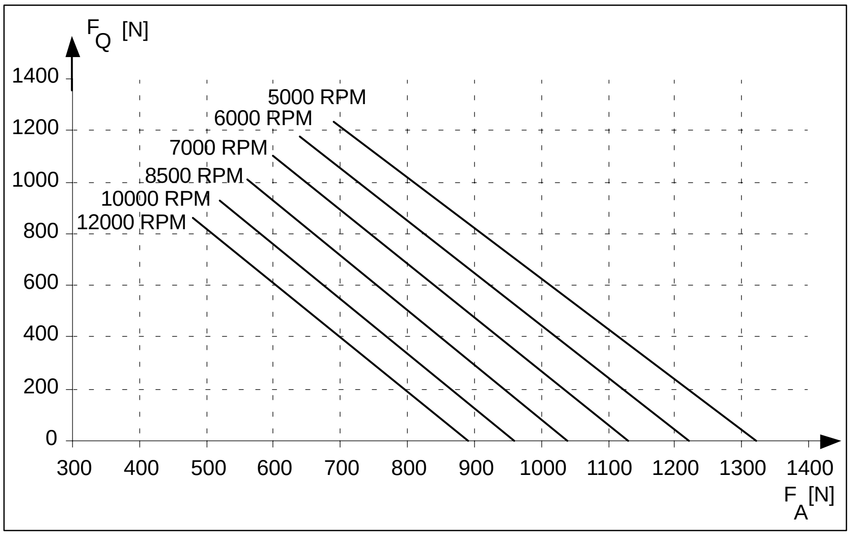
Max. continuous operating speed n_{s1max} = 10000 RPM
Mechanical limiting speed n_{max} = 12000 RPM



Cantilever force 1PH410□

Permissible cantilever forces for 1PH410 single–bearing designs (option K00 with L37) as a function of the axial forces

Permissible cantilever force F_Q as a function of axial force F_A for a nominal bearing lifetime of 10 000 h.



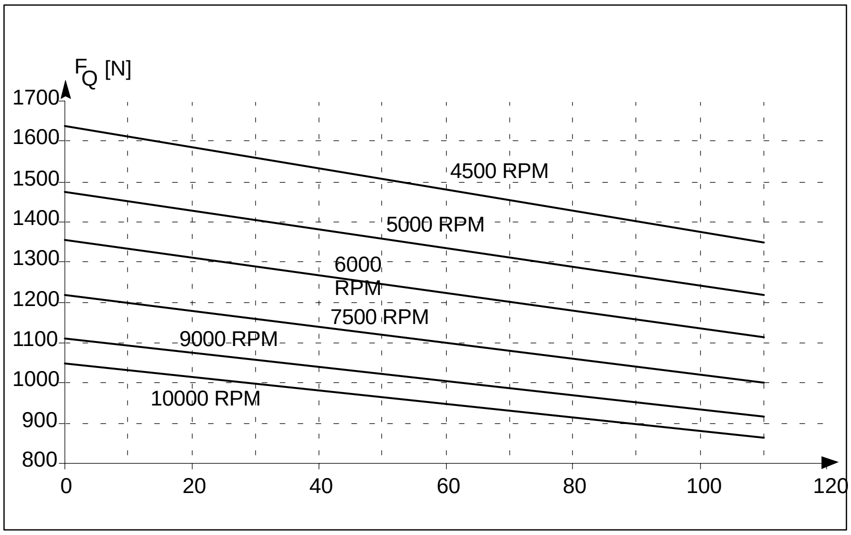
1) Permissible for continuous operation, however, reduced bearing lifetime

Cantilever force 1PH413□

Permissible cantilever forces for 1PH413 single–bearing designs (option K00 with L37).

Permissible cantilever force F_Q at a distance x from the shaft shoulder for a nominal bearing lifetime of 10 000 h. [1)]

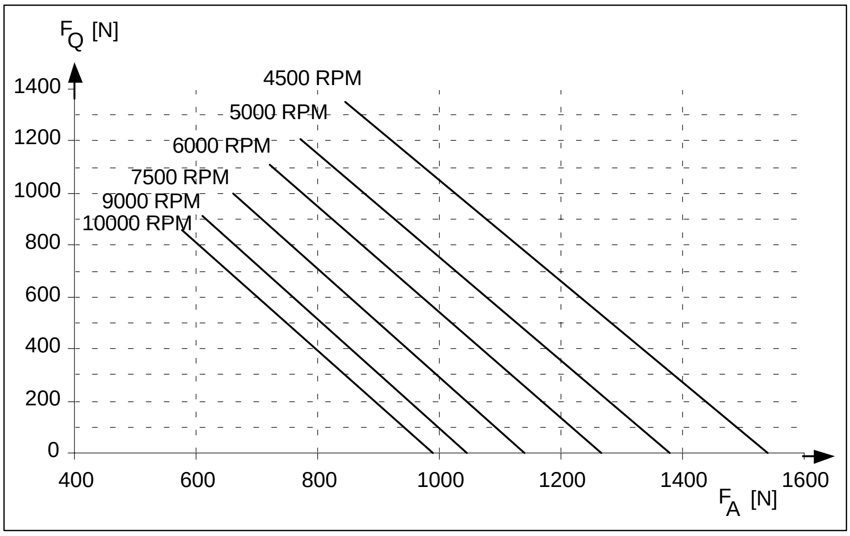
Max. continuous operating speed n_{s1max} = 9250 RPM
Mechanical limiting speed n_{max} = 10000 RPM



Cantilever force 1PH413□

Permissible cantilever forces for 1PH413 single–bearing designs (option K00 with L37) as a function of the axial forces

Permissible cantilever force F_Q as a function of axial force F_A for a nominal bearing lifetime of 10 000 h.



1PH4

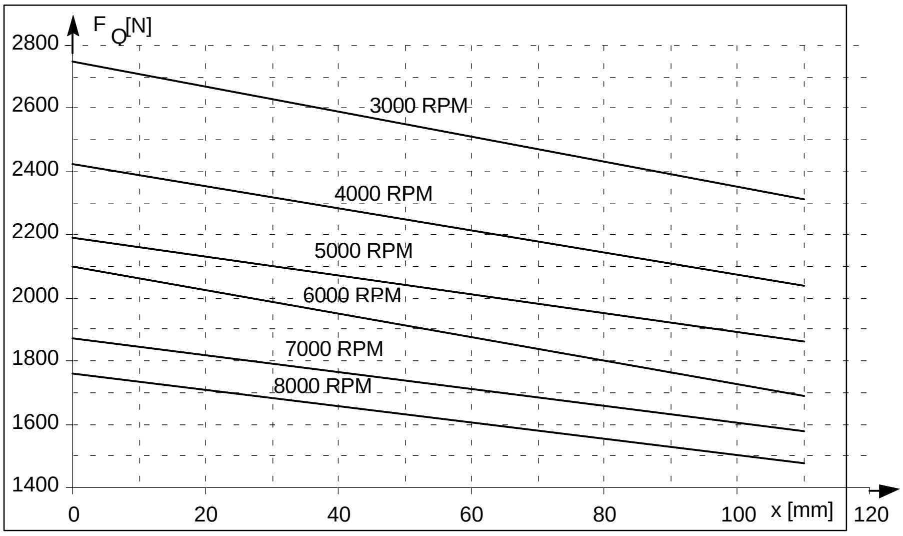
1) Permissible for continuous operation, however, reduced bearing lifetime

Cantilever force 1PH416□

Permissible cantilever forces for 1PH416 single–bearing designs (option K00 with L37).

Permissible cantilever force F_Q at a distance x from the shaft shoulder for a nominal bearing lifetime of 10 000 h. [1)]

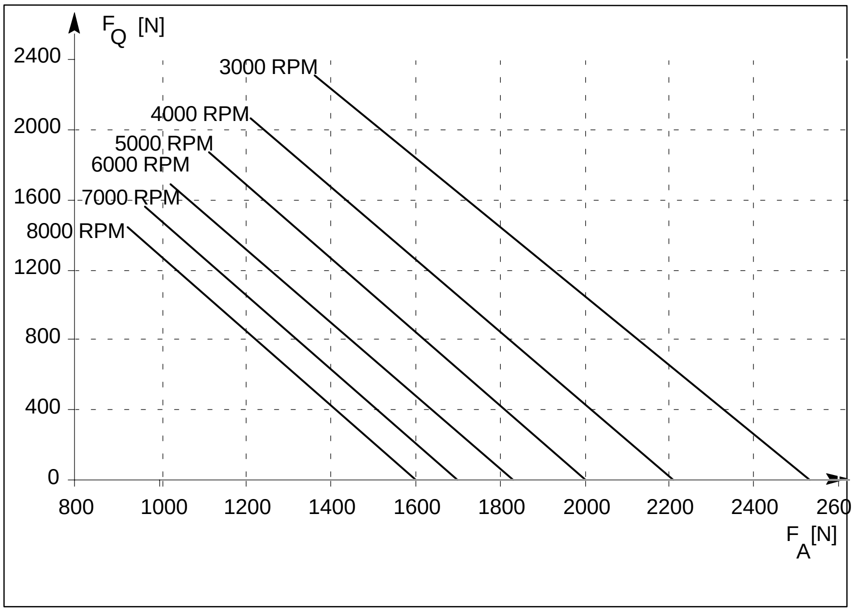
Ma. continuous operating speed n_{s1max} = 7000 RPM
Mechanical limiting speed n_{max} = 8000 RPM



Cantilever force 1PH416□

Permissible cantilever forces for 1PH416 single–bearing designs (option K00 with L37) as a function of the axial forces.

Permissible cantilever force F_Q as a function of axial force F_A for a nominal bearing lifetime of 10 000 h.



1) Permissible for continuous operation, however, reduced bearing lifetime

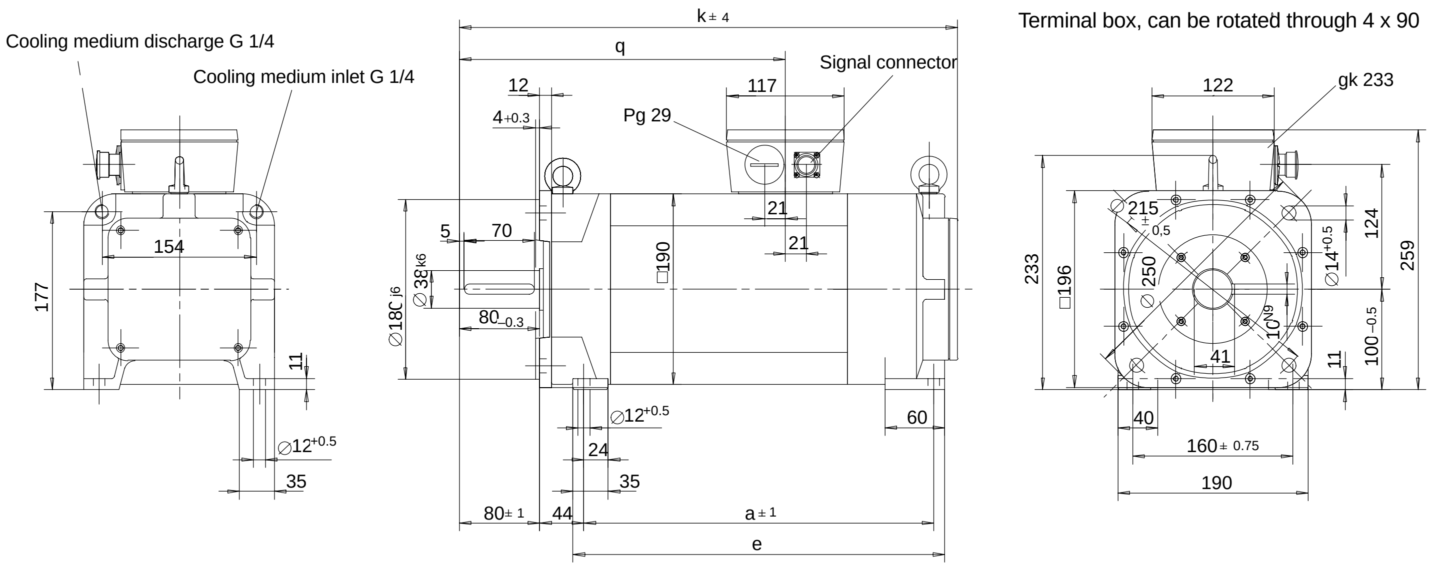
■

Dimension Drawings 4

Note

Siemens AG reserves the right to change motor dimensions within the scope of design improvements without prior notice. Dimension drawings can go out of date. Up–to–date dimension drawings can be requested at no charge.

Fig. 4-1 1PH4 10.-4 type of construction IMB 35



Tolerance, key and keyway acc. to DIN 6885 T1
Flange size A250 acc. to DIN 42948
Shaft centering DR M12 acc. to DIN 332
Mounting flange and shaft end acc. to DIN 42955–N
Type of construction IMB35

Type	k	q	a	e	
1PH4 107–4	621	450	474	496	
1PH4 105–4	556	385	409	431	
1PH4 103–4	496	325	349	371	

Dim. w/o toler. ± 2.5 mm

Sigraph DESIGN

Scale 1:4 (f.1PH4 103–4)

Material
Ancilliaries/Instruction Manual No.
Model / Item No.

Date: 6.11.1995
Drawn; Kümmeth
Chkd. Heerlein
ASI1 A PE D T4

Index Info Date Drawn/chkd

Siemens AG

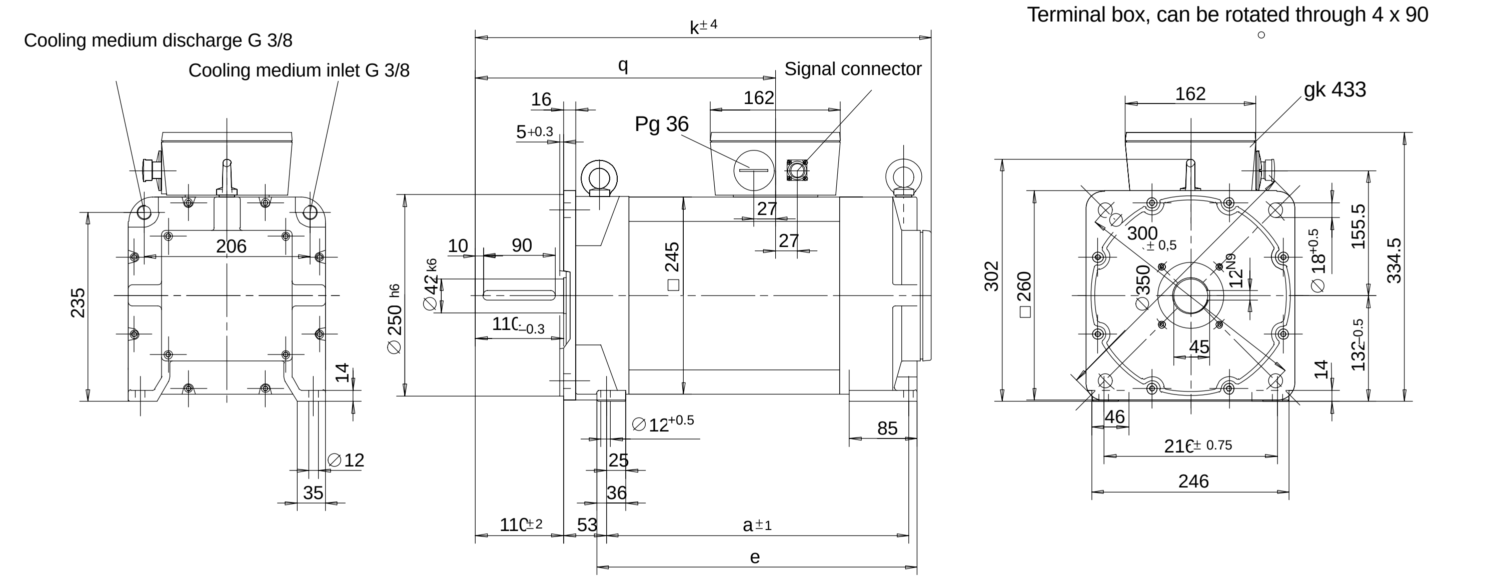
Dimension drawing 1PH4 10.–4
Type of construction IMB5

Dheet No. 1
No. of sh. 1

Replacement for

510.37033.10

Fig. 4-2 1PH4 13.-4 type of construction IMB 35



Tolerance, key and keyway acc. to DIN 6885 T1
Flange size A350 acc. to DIN 42948
Shaft centering DR M12 acc. to DIN 332
Mounting flange and shaft end acc. to DIN 42955–N
Type of construction IMB35
ERN

(a)

Type	k	q	a	e
1PH4 139–4	758	564	567	589
1PH4 138–4	723	529	532	554
1PH4 137–4	688	494	497	519
1PH4 135–4	638	444	447	469
1PH4 133–4	568	374	377	399

Dim. w/o toler. ± 2.5 mm
Sigraph DESIGN
Scale 1:5 (f.1PH4 133–4)
Material
Ancilliaries/Instruction Manual No.
MOdel/Item No.
Date: 8.11.1995
Drawn: Kümmeth
Chkd.: Heerlein
ASI1 PE D T4

Index	Info	Date	Drawn/chkd
a	1PH4 139–4 added	10.12.1998	Küm/He

Siemens AG

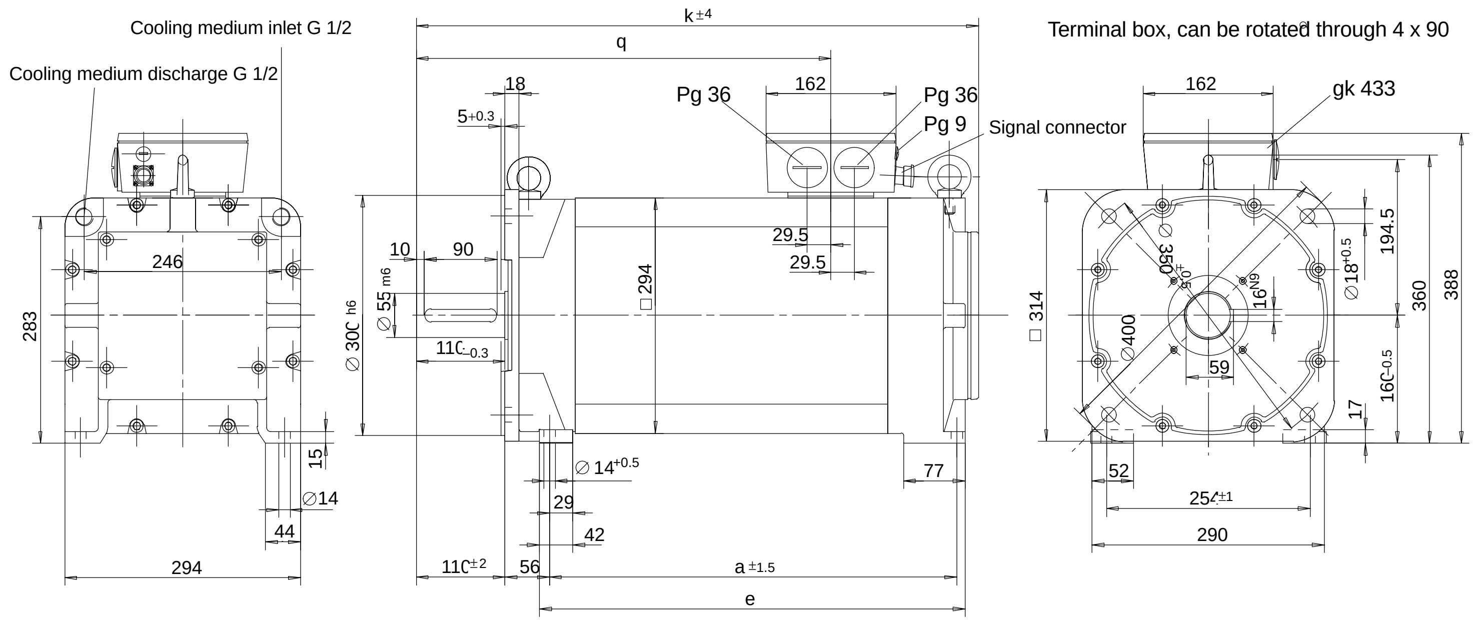
Dimension drawing
1PH4 13.–4
Type of construction IMB5

Sheet No. 1
No. of sh. 1

510.37034.10 a

Replacement for

Fig. 4-3 1PH4 16.-4 type of construction IMB 35



Tolerance, key and keyway acc. to DIN 6885 T1
Flange size A400 acc. to DIN 42948
Shaft centering DR M20 acc. to DIN 332
Mounting flange and shaft end acc. to DIN 42955–N
Type of construction IMB 35
ERN / HTL

Type	k	q	a	e
1PH4 168–4	801	617	608	632
1PH4 167–4	756	572	563	587
1PH4 163–4	701	517	508	532

Dim. w/o toler. ± 2.5 mm	Sigraph DESIGN	Scale 1:5 (f.1PH4 163–4)	
		Material Anciliaries/Instruction Manual No. Model / Item No.	
	Date: 10.12.1996 Drawn: Buhl D. Chkd. Heerlein ASI1 A PE D AC2	Dimension drawing 1PH4 16.–4 Type of construction IMB 35	Sheet No. 1
Index Info Date Drawn/chkd	Siemens AG		
Replacement for 510.37035.10		510.37036.10	No. of sh. 1

5 Index

Notes

1PH7 AC Main Spindle Motors

Notes

Motor Description 1

1.1 Characteristics and technical data

Applications

The1PH7 series is suitable for closed–loop speed control of main spindles on machine tools, transfer lines and special purpose machines.

Characteristics

1PH7 motors are air–cooled four–pole squirrel–cage induction motors.

Depending on the shaft height, the 1PH7 series has rated outputs from 3.7 to100 kW at rated speeds from 500 to 2500 RPM.

- Wide constant–power range
- Short length
- Full rated torque is continually available, even at standstill
- High overload capability
- Clean contour as a result of the integrated terminal box (for shaft heights 100–160)

Technical features

Note

The motors can be fed from a DC link voltage of up to 700 V DC. For shaft heights 180 and 225, the appropriate version should be ordered.

Table 1-1 Technical features

Technical features	Version				
Shaft height	100	132	160	180	225
Type of construction (acc. to IEC 60034-7)	IM B3[1)]; IM B5; IM B35;		IM B3; IM B35		
Degree of protection (acc. to IEC 60034-5)	IP 55; fan IP 54[2)]				
Cooling	Air cooling/separately–driven fan on the non–drive end Air–flow direction: from the drive end to the non–drive end				
Winding insulation (acc. to IEC 60034-6)	Temperature rise class F for a cooling medium temperature of 40 °C.				
Thermal motor protection (acc. to IEC 60034-6)	PTC thermistor (acc. to IEC 34-6) in the stator winding				

1PH7

1) IM B3 not for core types

2) not for dusts, which are flammable, explosive, chemically agressive, or are electrically conducting

Tabelle 1-1 Technical features, continued

Technical features	Version				
Shaft height	100	132	160	180	225
Motor voltage	Max.: 3–ph. 430 V AC				
Motor noise (acc. to DIN 45635/part 10) Tolerance +3 dB	70 dB (A)		75 dB (A) 2)	78 dB (A) 3)	81 dB (A) 1) 3)
Vibration stressing (acc. to IEC 68-2-6)	0.4 g at 63 Hz				
Terminal box arrangement	Top				
Cable entry (when viewing the drive end) power cable: signal cable:	right right			right left	
Connection type	Motor: via terminal box Encoders: via connector (17-pin; the mating connector is not included in the scope of supply) Fan: via terminal box				
Encoder system	Integrated optical encoder (techn. description, refer to Section GE) • Speed sensing • Indirect position sensing (incremental)				
Balancing	Standard: Half–key balancing (dynamic) (acc. to IEC and EN 60034–14) Code: “H” at the face shaft end				
Shaft end	Cylindrical; without keyway and without key (acc. to DIN 748; Part 3)				
Bering design (drive end; standard)	Suitable for belt drives and coupling out–drives. Please observe the version in the Order No. [MLFB]			Suitable for belt drives	
Flange design, Radial eccentricity	Tolerance R (acc. to DIN 42 955)			Tolerance N (cc. to DIN 42 955)	
Vibration severity (acc. to IEC 60034-14)	Level R Grade S for core types (refer to the order code)				
Paint finish	Without paint finish				
Installation altitude	≤ 1000 m above sea level, otherwise de–rating (acc. to IEC and EN 60034–1): 2000 m factor 0.94 2500 m factor 0.9				
Rating plate	2, 1 on the motor, 1 supplied loose in the terminal box				
Documentation	An Instruction Manual is supplied with the motor				

1) refer to the speed–power diagrams

2) for 60Hz line operation, a plate is available (on request) to reduce the sound pressure level

3) for shaft heights 180 and 225, a muffler (on request) is available to reduce the sound pressure level.

Options

Table 1-2 Options

Technical features	Version				
Shaft height	100	132	160	180	225
Type of construction[1]	All mounting positions are possible (refer to Chapter AL A)				
Cooling [3]	Air flow direction: From the non–drive end to the drive end				
Cable entry [2] [3] Power cable: Signal cable:	left NDE or left DE			left DE NDE or right NDE DE	
Shaft end	Cylindrical (acc. to DIN 748; Part 3) with keyway and key (acc. to DIN 6885)				
	Tolerance zone: k6		Tolerance zone: m6		
Bearing design	Standard			• Bearing designs for couplings • Bearing design for couplings and increased speed (only shaft height 180) • bearing design for increased cantilever force	
Flange version, radial eccentricity	Standard			Tolerance R (acc. to DIN 42 955)	
Vibration severity (acc. to IEC 60034-14)	Grade S [4] Grade SR (=S/1.6)			Grades S and SR only when a coupling is used	
Mounted integrated components	The motors can be supplied complete with a flange–mounted gearbox				
Balancing [3]	Full key balancing (dynamic) (acc. to IEC and EN 60034–1)				
Sealing	Drive end flange with shaft sealing ring (for occasional splashes of oil or oil mist, lubricate the sealing ring				

1PH7

1) for shaft heights 180 and 225, ensure that the correct hoisting concept is used
2) only for the specified combination
3) not for core types
4) for core types, included in the basic version

Technical data

Table 1-3 Technical data of 1PH7 AC motors

AC motor Order No.	Rated output P_{rated} [kW]	Rated speed n_{rated} [RPM]	Rated torque M_{rated} [Nm]	Rated current I_{rated} [A]	Moment of inertia J [kgm^2]	Max. 2) speed n_{max} [RPM]	Increased max. speed [RPM]	I_0 [A]	U_N [V]
Shaft height 100 mm									
1PH7101-□NF□□	3.7	1500	24	10	0.017	9000	12000	5.9	350
1PH7103-□ND□□	3.7	1000	35	10	0.017	9000	12000	4.8	343
1PH7103-□NF□□	5.5	1500	35	13	0.017	9000	12000	5.4	350
1PH7101-□NG□□	7.0	2000	33	17.5	0.017	9000	12000	8.3	343
1PH7105-□NF□□	7.0	1500	45	17.5	0.029	9000	12000	9.4	346
1PH7107-□ND□□	6.25	1000	60	17.5	0.029	9000	12000	8.9	319
1PH7107-□NF□□	9.0	1500	57	23.5	0.029	9000	12000	11.0	336
1PH7107-□NG□□	10.5	2000	50	26	0.029	9000	12000	12.2	350
Shaft height 132 mm									
1PH7131-□NF□□	11	1500	70	24	0.076	8000	10000	8.4	350
1PH7133-□ND□□	12.0	1000	115	30	0.076	8000	10000	12.7	336
1PH7133-□NF□□	15	1500	95	34	0.076	8000	10000	14.0	346
1PH7133-□NG□□	20.0	2000	95	45	0.076	8000	10000	17.4	350
1PH7135-□NF□□	18.5	1500	118	42	0.109	8000	10000	17.0	350
1PH7137-□ND□□	17.0	1000	162	43	0.109	8000	10000	18.5	322
1PH7137-□NF□□	22.0	1500	140	57	0.109	8000	10000	22.8	308
1PH7137-□NG□□	28.0	2000	134	60	0.109	8000	10000	21.4	350
Shaft height 160 mm									
1PH7163-□NB□□	12.0	500	229	30	0.19	6500	8000	12.5	339
1PH7163-□ND□□	22.0	1000	210	55	0.19	6500	8000	24.1	315
1PH7163-□NF□□	30.0	1500	191	72	0.19	6500	8000	30.1	319
1PH7163-□NG□□	36.0	2000	172	85	0.19	6500	8000	37.2	333
1PH7167-□NB□□	16.0	500	306	37	0.23	6500	8000	12.7	350
1PH7167-□ND□□	28.0	1000	267	71	0.23	6500	8000	33.1	312
1PH7167-□NF□□	37.0	1500	236	82	0.23	6500	8000	31.9	350
1PH7167-□NG□□	41.0	2000	196	89	0.23	6500	8000	39.7	350
Shaft height 180 mm									
1PH7184-□NT□□	21.5	500	410	76	0.5	5000	7000	40	235
1PH7184-□ND□□	39	1000	372	90	0.5	5000	7000	42	335
1PH7184-□NE□□	40.0	1250	305	85	0.5	5000	7000	46.2	380
1PH7184-□NF□□	51	1500	325	120	0.5	5000	7000	64	335
1PH7184-□NL□□	78	2500	298	171	0.5	5000	7000	77	340
1PH7186-□NT□□	29.6	500	565	106	0.67	5000	7000	56	228
1PH7186-□ND□□	51	1000	487	116	0.67	5000	7000	58	340
1PH7186-□NE□□	60.0	1250	458	117	0.67	5000	7000	63	400
Shaft height 225 mm 3)									
1PH7224-□NC□□	55.0	700	750	114	1.48	4500	5500	63.5	380
1PH7224-□ND□□	71.0	1000	678	161	1.48	4500	5500	78.5	335
1PH7224-□NF□□	100.0	1500	636	185	1.48	4500	5500	73	385

Complete order designation, refer to Chapter 2 or Catalog NC 60.1.

1) Motors with a grey background are core types
2) For continuous operation (with 30% $n_{max,}$ 60% $n_{max,}$ 10 % standstill) for a 10 min duty cycle, max. continuous speed and bearing change interval, refer to Chapter 1.4
3) For bearing designs for increased cantilever force n_{max}=4500 RPM

Table 1-4 Technical data - drive converter assignment 1PH7

Motor type 1PH7...	n_{rated}	n_{max} 1)	M_{rated}	Rated motor output for duty type acc. to EN 60034–1 P_{rated} [kW]				Rated motor current for duty type acc. to EN 60034–1 I_{rated} [A]				Drive converter module for motor duty type acc. to EN 60034–1 [A]			
				S1	S6–60 %	S6–40 %	S6–25 %	S1	S6–60 %	S6–40 %	S6–25 %	S1	S6–60 %	S6–40 %	S6–25 %
101–_NF_	1500	9000	24	3,7	4,5	5,25	6,25	10	11,5	12,5	15	24/32/32	24/32/32	24/32/32	24/32/32
103–_ND_	1000		35	3,7	4,5	5,25	–	10	11,5	13	–	24/32/32	24/32/32	24/32/32	–
103–_NF_	1500		35	5,5	6,7	7,7	9,0	13	16	18	20,5	24/32/32	24/32/32	24/32/32	24/32/32
103–_NG_	2000		33	7	8,5	10	11,5	17,5	20,5	23,5	26	24/32/32	24/32/32	24/32/32	24/32/32
105–_NF_	1500		45	7	8,5	10	12,5	17,5	21	23,5	28	24/32/32	24/32/32	24/32/32	24/32/32
107–_ND_	1000		60	6,25	7,5	8,8	10,5	17,5	20,5	23	26,5	24/32/32	24/32/32	24/32/32	24/32/32
107–_NF_	1500		57	9	11	13	16	23,5	27,5	31	37	24/32/32	30/40/51	30/40/51	30/40/51
107–_NG_	2000		50	10,5	12,5	14,5	17,5	26	28,5	33	38	30/40/51	30/40/51	30/40/51	30/40/51
131–_NF_	1500	8000	70	11	13,5	16,5	20	24	29	34	41	24/32/32	30/40/51	30/40/51	30/40/51
133–_ND_	1000		115	12	15	18,5	22	30	36	43	50	30/40/51	45/60/76	45/60/76	45/60/76
133–_NF_	1500		95	15	18,5	23	27	34	41	49	56	45/60/76	45/60/76	45/60/76	45/60/76
133–_NG_	2000		95	20	25	30	36	45	54	63	73	45/60/76	60/80/102	60/80/102	60/80/102
135–_NF_	1500		118	18,5	23	28	33	42	50	58	67	45/60/76	45/60/76	45/60/76	60/80/102
137–_ND_	1000		162	17	20,5	25	29	43	50	60	68	45/60/76	45/60/76	45/60/76	60/80/102
137–_NF_	1500		140	22	27,5	33	40	57	68	79	92	60/80/102	60/80/102	60/80/102	85/110/127
137–_NG_	2000		134	28	35	43	50	60	73	87	100	60/80/102	85/110/127	85/110/127	85/110/127
163–_NB_	500	6500	229	12	15	18	–	30	36	42	–	30/40/51	45/60/76	45/60/76	–
163–_ND_	1000		210	22	27	33	40	55	65	77	93	60/80/102	60/80/102	60/80/102	85/110/127
163–_NF_	1500		191	30	37	45	54	72	86	102	120	85/110/127	85/110/127	85/110/127	120/150/193
163–_NG_	2000		172	36	44	52	62	85	100	114	133	85/110/127	85/110/127	120/150/193	120/150/193
167–_NB_	500		306	16	19,5	24	–	37	44	53	–	45/60/76	45/60/76	45/60/76	–
167–_ND_	1000		267	28	34,5	42	50	71	85	100	117	85/110/127	85/110/127	85/110/127	120/150/193
167–_NF_	1500		236	37	46	56	67	82	97	115	134	85/110/127	85/110/127	120/150/193	120/150/193
167–_NG_	2000		196	41	51	61	74	89	106	124	145	120/150/193	120/150/193	120/150/193	120/150/193
184–_NT_	500	5000	411	21,5	26,5	30,5	35	76	90	103	118	85/110/127	85/110/127	85/110/127	85/110/127
184–_ND_	1000		372	39	48	58	–	90	106	126	–	120/150/193	120/150/193	120/150/193	–
184–_NE_	1250		306	40	50	56	66 2)	85	100	110	127 2)	85/110/127	85/110/127	85/110/127	–
184–_NF_	1500		325	51	68	81	–	120	149	174	–	120/150/193	200/250/257	200/250/257	–
184–_NL_	2500		298	78	97	115	–	172	204	237	–	200/250/257	200/250/257	200/250/257	
186–_NT_	500		565	29,6	36,5	43	54 2)	106	126	147	186 2)	120/150/193	120/150/193	120/150/193	–
186–_ND_	1000		487	51	65	77	–	118	141	164	–	120/150/193	200/250/257	200/250/257	–
186–_NE_	1250		458	60	71	80	106 2)	120	135	150	193 2)	120/150/193	120/150/193	120/150/193	–
224–_NC_	700	4500	750	55	66,4	75	98 2)	117	135	149	193 2)	120/150/193	120/150/193	120/150/193	–
224–_ND_	1000		678	71	88	105	–	164	190	222	–	200/250/257	200/250/193	200/250/257	–
224–_NF_	1500		637	100	126	136	141 2)	188	230	248	257 2)	200/250/257	200/250/193	200/250/257	–

1) max. speed for S1 and S6 duty, refer to speed–power diagram
2) for S6 – 16%

1PH7

1.2 Cooling

Note

- 1PH7 main spindle motors are force–ventilated. When mounting the motor, please ensure that the motor can be well ventilated. This is especially important for encapsulated designs. It is not permissible that the hot discharged air is drawn–in again.
- Surface temperatures can exceed 100 °C .

Mounting

The fan is mounted axially on the non–drive end.

The following min. clearance must be maintained to customer–specific mounted components and the air discharge opening:

Table 1-5 Min. clearance to customer–specific components

Shaft height [**mm**]	**Min. clearance** [**mm**]
100	30
132	60
160	80
180	100
225	100

The following minimum clearance S between the air intake and discharge openings and adjacent components must be observed:

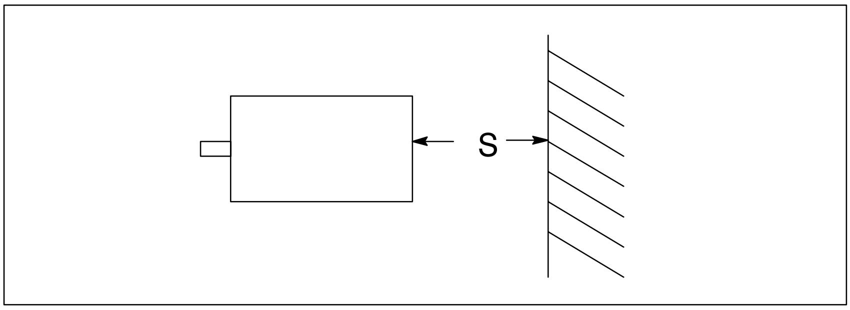


Fig. 1-1 Minimum clearance to air intake and air discharge openings

Table 1-6 Minimum clearance to air intake and discharge openings

	Clearance S /mm
Shaft height 100	30
Shaft height 132	60
Shaft height 160	80
Shaft height 180	80
Shaft height 225	80

Air flow direction

Standard: from the DE to the NDE
Option: from the NDE to the DE.

- For shaft heights 180 and 225, the length changes (refer to the dimension drawing)
- not for core types

Air discharge

Shaft heights 100 to 160: axial
Shaft heights 180 and 225: radial to the right (when viewing the DE); the fan can be rotated through 4 x 90°

Ambient/cooling–medium temperature

Operation: T = –15 °C to +40 °C (without any restrictions)
Bearing design: T = –20 °C to +70 °C

When the temperature is increased, the rated output P_N is reduced as follows:

Table 1-7 Reduction of the rated output

Temperature	Shaft height [mm]	Reduction
> 40 °C to 50 °C	100 to 225	to 92 % P_N

Air flow

Table 1-8 Air flow

1PH7 Shaft height [mm]	Air flow [l/sec]
100	40
132	105
160	150
180	200
225	330

Supply for separa-tely–driven fans

Table 1-9 Voltage

Shaft height [mm]	Voltage [V]
100 to 225 100 to 160 180 to 225 100 to 225	3–ph. 400 V AC, 50 Hz,(10 %) or 3–ph. 400 V AC, 60 Hz (10 %) 3–ph. 400 V AC 60 Hz (+10%) 3–ph. 480 V AC 60 Hz (–10%)

Table 1-10 Current drain

Motor type	I_{rated} A , at 400V, 50 Hz	I_{max} A , at 480V, 60 Hz	I_{rated} A , at 400V, 60 Hz
1PH710□	0.3 A	0.13 A	0.08 A
1PH713□	0.26 A	0.26 A	0.19 A
1PH716□	0.24 A	0.30 A	0.31 A
1PH718□	1.1 A	1.3 A	
1PH722□	1.8 A	2.3 A	

Recommended-connection

- The connection is realized through the terminal box.
- The fan should be connected through a motor–protection circuit–breaker.

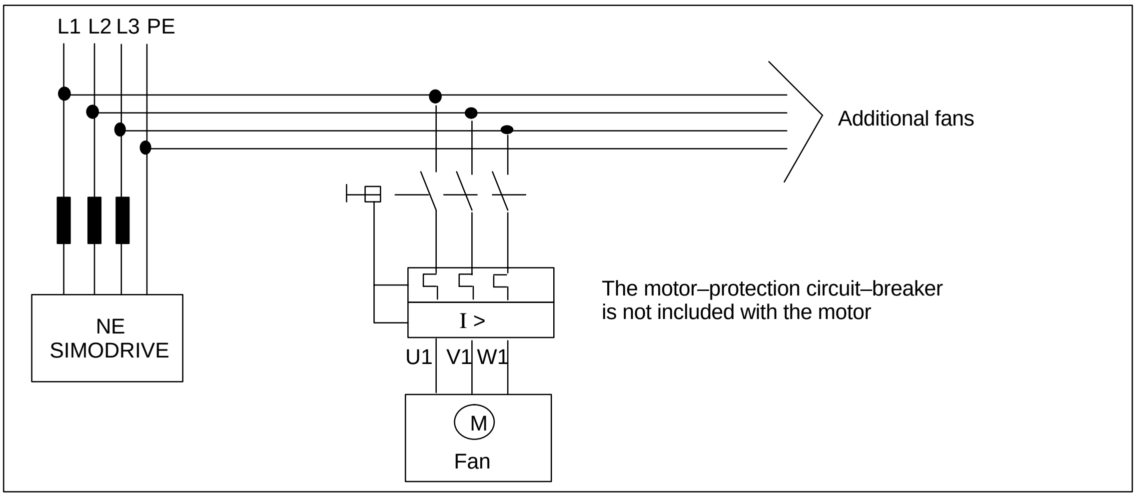


Fig. 1-2 Recommended connection

Fan control

In order to minimize the motor noise at standstill, the fan can be shut down at n < n_{min} and when the controller enable is removed (alternatively, pulse enable). Refer to Fig. 1-3 for an example of the fan control.

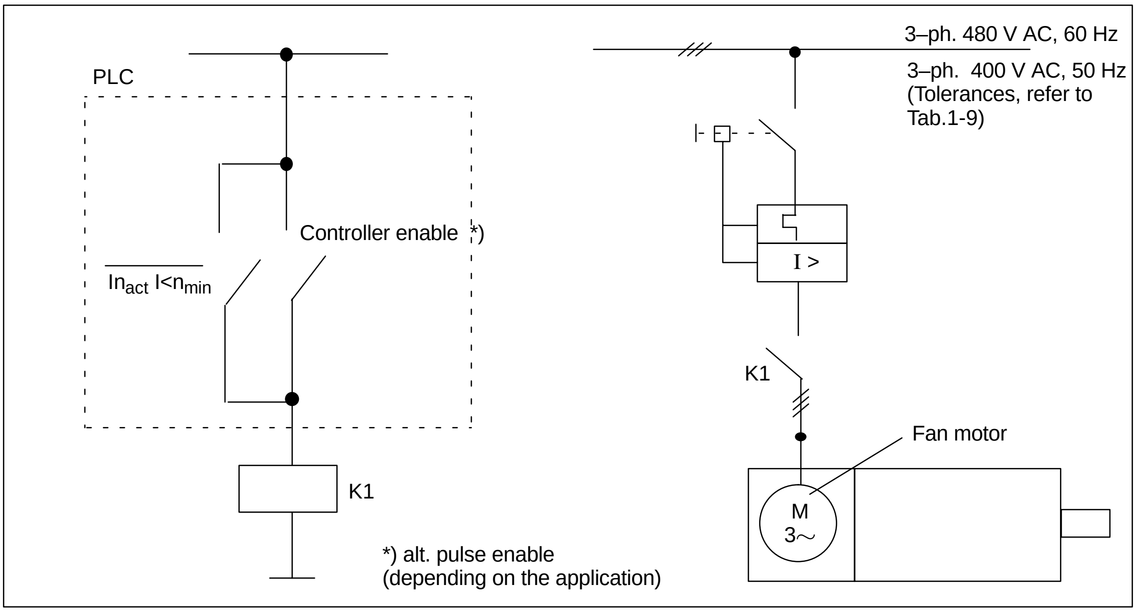


Fig. 1-3 Example: Fan control

1.3 Thermal motor protection

Thermal motor protection

A PTC thermistor is integrated in the stator winding to sense the motor temperature.

Technical data in Chapter 1.2.1, Encoder systems (GE).

The sensing and evaluation is made in the associated SIMODRIVE/SINUMERIK unit, whose closed–loop control takes into account the temperature characteristics of the motor resistances.

An external tripping unit is not required. The PTC thermistor function is monitored. An appropriate signal is output to the drive converter when a fault develops.

Connection: via encoder

Warning

If the user carries–out an additional high–voltage test, the cable ends of the temperature sensors must be short–circuited before the test! If the test voltage was to be applied to the temperature sensor, the temperature sensor would be destroyed.

1.4 Bearing design

Bearing design

1PH7 AC main spindle motors are suitable for the following drive types

- coupling out–drive
- belt drive

Shaft heights 100 to 160: Deep–groove ball bearings on the DE and NDE sides

—> suitable for coupling and belt drives

Shaft heights 180 and 225: Deep–groove ball bearings on the DE and NDE sides

—> suitable for coupling drives

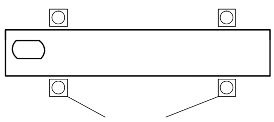
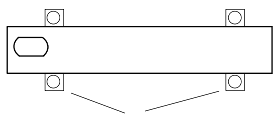
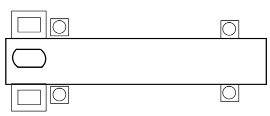
Shaft heights 180 and 225: Cylindrical roller bearings and deep–groove ball bearings on the drive side and deep–groove ball bearings on the non–drive side

—> suitable for belt drives

Bearing versions:

The bearing versions and their application are summarized in the following table.

Table 1-11 Bearing versions

Application	Bearing arrangement	
	Shaft heights 100 to 160	**Shaft heights 180 and 225**
• Coupling drive • Planetary gearbox low cantilever forces	 Deep–groove ball bearings	 Deep–groove ball bearings
• Belt drive with normal cantilever force • Pinion drive with straight teeth		 Cylindrical- roller bearings Deep–groove balal bearings Min. cantilever force required !
• Belt drive with increased cantilever force	—	 Cylindrical- roller bearings Deep–groove ball bearings Min. cantilever force required !

1PH7

Bearing change intervals, shaft heights 100 to 225 (t_{LW})

For coupling and belt drives, for a cooling medium temperature +30C°, bearing temperature +85 °C and horizontal mounting

Table 1-12 Recommended bearing change intervals

Type	**Average operating speed**[1)] **n_m [RPM]**		**Continuous speed n_{s1} [RPM]**
1PH710□	$n_m \leq 2500$	$2500 < n_m < 6000$	$n_{s1} \leq 5500$
1PH713□	$n_m \leq 2000$	$2000 < n_m < 5500$	$n_{s1} \leq 4500$
1PH716□	$n_m \leq 1500$	$1500 < n_m < 4500$	$n_{s1} \leq 3700$
1PH718□	$n_m \leq 1500$	$1500 < n_m < 4000$	$n_{s1} \leq 3500$ [2)]
1PH7224	$n_m \leq 1500$	$1500 < n_m < 3500$	$n_{s1} \leq 3100$ [2)]
t_{LW} [h]	16000	8000	8000

Table 1-13 Recommended bearing change intervals with increased maximum speed

Type	**Average operating speed n_m [RPM]**	**Continuous speed n_{s1} [RPM]**
1PH710□	$8000 \leq n_m \leq 12000$	$n_{s1} \leq 10000$
1PH713□	$6000 \leq n_m \leq 10000$	$n_{s1} \leq 8500$
1PH716□	$5000 \leq n_m \leq 8000$	$n_{s1} \leq 7000$
1PH718□	$1500 \leq n_m \leq 7000$	$n_{s1} \leq 4500$
1PH7224	$1500 \leq n_m \leq 5500$	$n_{s1} \leq 3600$
t_{LW} [h]	8000	8000

1) A speed duty cycle is assumed (speed duty cycle with lower speeds and standstill intervals).
2) For increased cantilever force: Shaft height 180: ns1 3000 RPM
Shaft height 225: ns1 2700 RPM

Continuous speed

The maximum permissible continuous operating speed n_{s1} depends on the bearing design and the shaft height according to the following table:

Table 1-14 Assignment, max. speed to the shaft height and bearing design

Shaft height [mm]	Coupling drive, belt drive [RPM]		Belt drive with increased cantilever force [RPM]		Increased maximum speed [RPM]	
	n_{max}[1)]	n_{s1}[2)]	n_{max}[1)]	n_{s1}[2)]	n_{max}[1)]	n_{s1}[2)]
100	9000	5500	–	–	12000	10000
132	8000	4500	–	–	10000	8500
160	6500	3700	–	–	8000	7000
180	5000	3500	5000	3000	7000[3)]	4500[3)]
225	4500	3100	4500	2700	5500[3)]	3600[3)]

!

Important

If the motor is operated at speeds between n n_{s1} and n_{max}, a speed duty cycle with low speeds and standstill intervals is assumed, in order to guarantee that the grease is distributed in the bearing.

1PH7

1) mechanical limiting speed (permissible for 10 min cycle with: 3 min n_{max}, 6 min 2/3 n_{max}, 1 min standstill)
2) maximum continuous operating speed
3) only coupling out drive permissible

1.5 Encoders

An incremental encoder is integrated in the non–drive end bearing shield to sense the speed and rotor position.

Application

Main spindle and C–axis operation

Connection

The actual value cable is fed to the drive converter. In order to eliminate noise being coupled–in, the actual value cables must be routed separately away from the power cables.

Pre–assembled Siemens cables can be taken from Catalog NC Z/NC60.1.

Technical data

Technical data and signal characteristics, refer to Chapter 1.2, Encoders (GE).

1.6 Vibration severity limit values

The vibration severity limit values are the same within the 1PH□ series!

In order to maintain the vibration severity limit values for shaft heights 160, 180 and 225 for type of construction IM B35, the motor feet have to be supported.

Generally, it is not possible to have a high cantilever force load capability at the same time as high speed and high vibration quality, as the various requirements demand various bearing designs.

The diagrams are provided in Chapter 2.1, General information on AC induction motors (AL A).

Permissible induced vibration

In order to guarantee perfect functioning and a long lifetime, the vibration values, specified in the following table, should not be exceeded at the motor. Please inquire for higher values.

Table 1-15 Vibration values

Vibration frequency	**Vibration values for shaft heights**		
		Shaft heights 100 to 160	Shaft heights 180 and 225
< 6.3 Hz	Vibration travel s [mm]	≤ 0.16	≤ 0.25
6.3...63 Hz	Vibration velocity v_{aM} [mm/s]	≤ 4.5	≤ 7.1
> 63 Hz	Vibration acceleration a [m/s^2]	≤ 2.55	≤ 4.0

1.7 Mounting 1PH4/7 motors

Mounting instructions

Warning

Electric motors have parts and components which are at hazardous voltage levels. If motors are not correctly handled, this can result in death, severe bodily injury as well as significant material damage. Therefore, please observe all of the warning information in this Chapter and on the product itself.

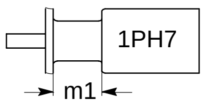
- Only appropriately **qualified personnel** may service/maintain the motor.
- The motor must be isolated from the line supply and grounded before starting any work on the motor.
- Only spare parts certified by the manufacturer may be used.
- The specified maintenance intervals and measures as well as the repair and replacement procedures which are specified, must be observed.

Warning

- All of the hoisting lugs must be used when transporting the motors!
- Any work carried–out must be made with the plant/system in a no–voltage condition (powered–down)!
- The motor must be connected–up according to the circuit diagrams supplied.
- In the terminal box, it should be ensured that the connecting cables are insulated with respect to the terminal panel cover.
- After the motor has been installed and mounted, the brake (if available) must be checked to ensure that it functions correctly!

Note

Flange mounting is only possible using studs and nuts. The clearance for threading on nuts between the motor flange and motor enclosure in accordance with DIN 42677.

Shaft height		
100	44 mm	
132	50 mm	
160	65 mm	
180,	70 mm	
225	90 mm	

Cable outlet, NDE

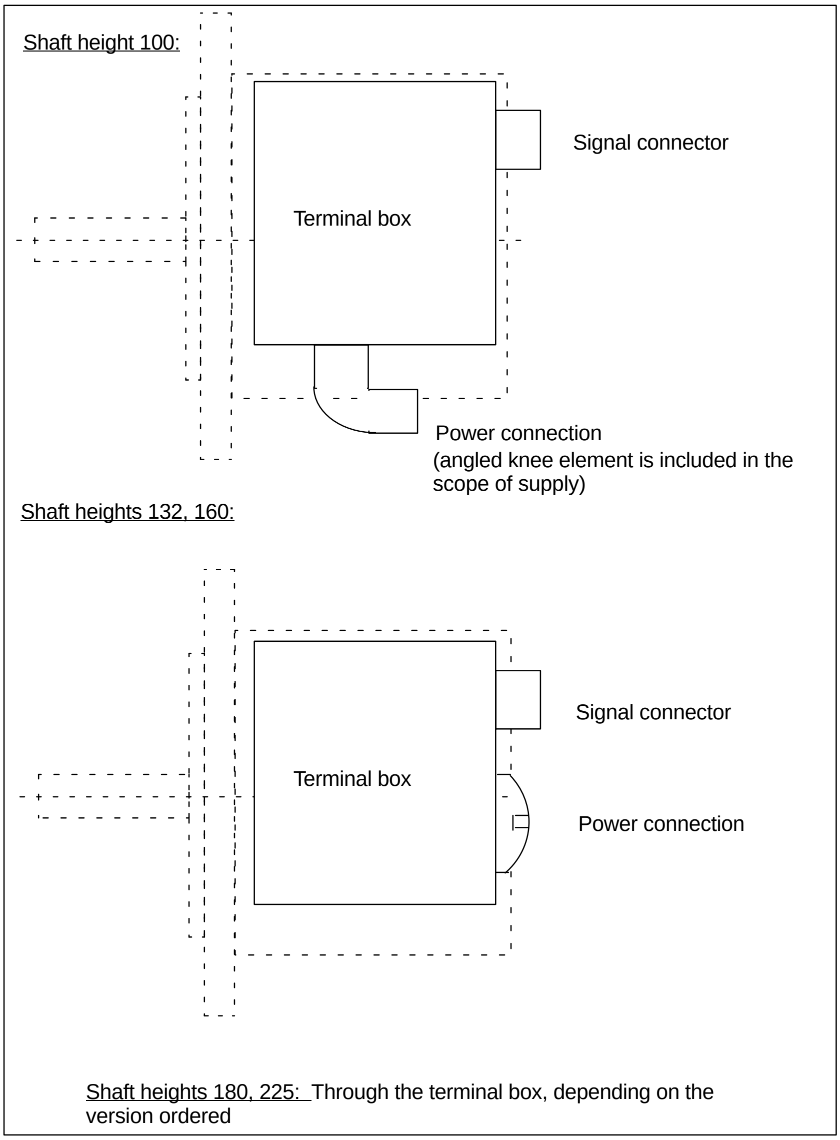


Fig. 1-4 Cable outlet

Mounting instructions

The following mounting instructions must be observed:

For high–speed machines, after mounting couplings or belt pulleys, we recommend that the complete unit is dynamically re–balanced.

Use suitable equipment when attaching drive elements. Use the thread at the shaft end.

Do not subject the shaft end to heavy blows or axial force.

Especially for high–speed motors with flange mounting, ensure that the mounting is stiff in order to position the natural mounting frequency as high as possible above the maximum rotational frequency.

For flange mounting, if the mounting is too “soft”, the vibration quality of the drive unit could be diminished. For type of construction IM B35, foot mounting on the non–drive end must be supported in order to maintain the vibration severity limit values.

Note

1PH7 main spindle motors are force–ventilated. When mounting the motors, it must be ensured that the motor can be well ventilated. This is especially true for encapsulated designs. It is not permissible that the hot discharged air is drawn–in again.

Mounting air–cooled motors so that the cooling air flow is not obstructed (also refer to Chapter 1.2, “Cooling”).

The caps on the 1PH7 mounting holes must be re–located after the motor has been mounted.

⚠

Caution

Liquid must be prevented from accumulating in the flange, both for vertical as well as horizontal mounting. Otherwise, this will have a negative impact on the bearing and bearing grease.

Natural frequency when mounted

The motor is a system which can oscillate with its own natural frequency, which for all 1PH motors, is above the specified maximum speed.

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

This can result in undesirable oscillations in the drive train.

Note

It should be ensured that the motors are carefully mounted and that the foundations are adequately stiff. Additional elasticity in the foundation can result in resonance effects relating to the natural mounted frequencies at the operating speed. This results in inadmissibly high vibration values.

The natural frequency when mounted depends on various factors and can be influenced by the following points:

- For transmission elements (gearbox, belt, coupling, pinion, etc.)
- Stiffness of the machine onto which the motor is mounted
- Stiffness of the motor in the area of the feet and customer flange
- Motor weight
- Machine weight or weight in the vicinity of the motor
- Damping characteristics of the motor and the machine tool
- Mounting types, mounting position (IM B5; IM B3; IM B35; IM V1; etc.)
- Weight distribution of the motor, i.e. length, shaft height

1.8 Options

1.8.1 Gearbox mounting

The following prerequisites must be fulfilled in order to be able to mount ZF changeover gearboxes onto the motors:

Shaft heights 100 to 160:

- Type of construction IM B5, IM B35 or IM V15
- Shaft with key and full key balancing

Shaft heights 180 and 225:

- Type of construction IM B35
- Bearing design for coupling drives
- Vibration severity grade R
- Flange and shaft accuracy R
- Shaft with key and full key balancing
- Degree of protection IP 55 prepared for mounting ZF gearbox

If you have any questions regarding the gearbox, then please contact ZF directly:

ZF Friedrichshafen AG
Antriebstechnik Maschinenbau
D-88038 Friedrichshafen
Telephone: (0 75 41) 77 - 0
Telefax: (0 75 41) 77 - 34 70
Internet: http://www.ZF–Group.de

1.8.2 Gearboxes

Application

- If the drive torque at low speeds is not adequate.
- If the constant power range is not adequate to be able to utilize the cutting power over the complete speed range.

The following advantages are obtained by locating the gearbox outside the spindle box:

- Gearbox oscillations and vibrations are not transferred to the machine.
- Separate lubricating systems for the main spindle (grease) and the changeover gearbox (oil).
- No noise and no temperature changes due to gearbox pinions in the spindle box.
- The drive power can be transferred, instead of via belts, also via a pinion (on request) or coaxially via an equalization coupling from the gearbox out drive.

Characteristics

- Planetary gearbox design
- Gearbox efficiency: greater than 95 %
- Gearboxes are available for motors, shaft heights 100 to 225
- Changeover gearboxes are available for drive outputs of up to 100 kW
- Type of construction: IM B35 (IM V15) and IM B5 (IM V1) of the motors can be accommodated

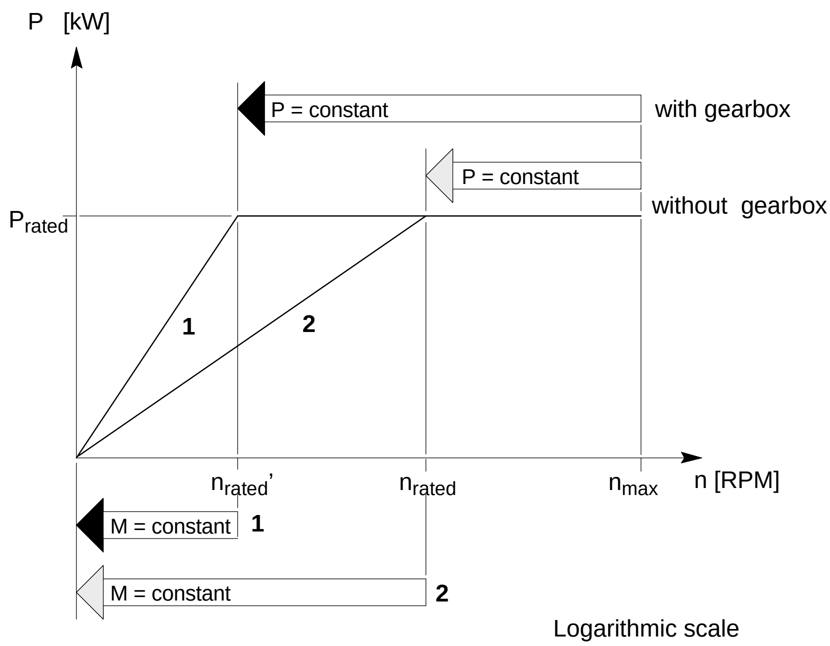
---

Note

1PH7 and 1PH4 motors are only designed for stressing levels in accordance with the specifications (refer to the cantilever force diagram and maximum torque in the Planning Guide).

When using force/torque increasing elements, e.g. a gearbox, the increased mechanical stressing (e.g. as a result of belt pre–tension forces), must be handled by the appropriate reinforcing element. The system designer must take this into account. For a gearbox, this means, that e.g. increased belt pre–tensioning forces must be handled by the gearbox, and must be transferred to the machine.

For drive units, which, e.g. are mounted to the gearbox flange or gearbox housing, motors with type of construction IM B35 must be supported on the non–drive end to prevent any stressing.



n_{rated}	Rated speed
n_{rated}'	Rated speed with two–stage changeover gearbox
n_{max}	max. permissible speedl
P_{rated}	Rated output and also constant output of the AC motor in the speed range from n_{rated} up to n_{max} or n_{rated}' to n_{max}
M	Torque

Fig. 1-5 Speed–power diagram when using a two–stage changeover gearbox to extend the speed range with constant power of the AC motors for main spindle drives

Example:

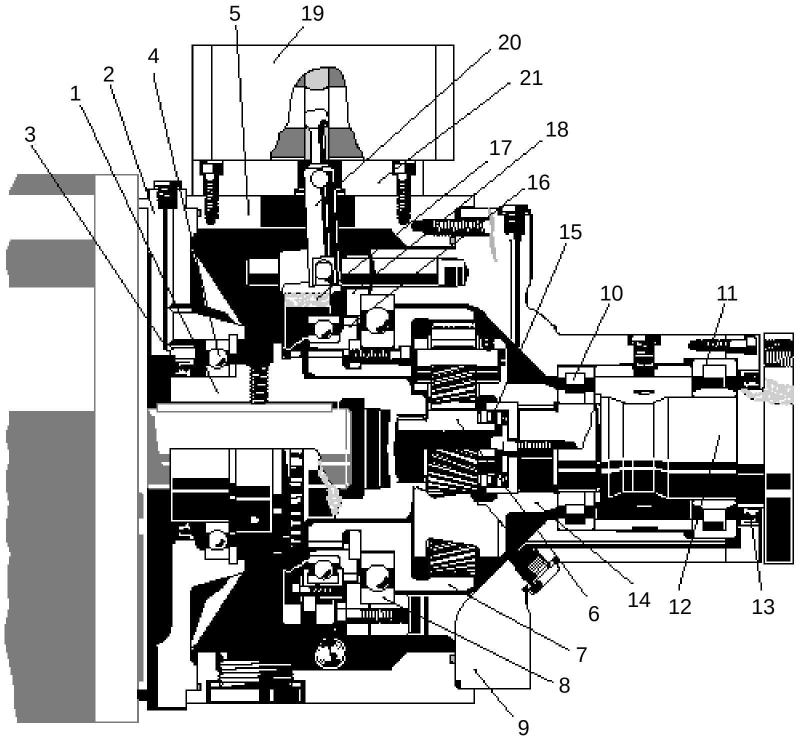
AC motor without changeover gearbox:

For P = constant of n_{rated} = 1500 RPM up to n_{max} = 6300 RPM, a constant power control range greater than 1:4 is possible.

The same AC motor with changeover gearbox:

For gearbox stage i_1 = 4 and i_2 = 1, a constant power control range greater than 1:16 is possible (n_{rated}' = 375 RPM up to n_{max} = 6300 RPM).

Design



1 Drive hub
2 Adapter plate
3 Radial shaft sealing ring
4 Hub bearing
5 Gearbox housing
6 Sun gear
7 Annular gear
8 Annular gear bearing
9 Bearing housing
10 Drive–out bearing
11 Drive–out bearing
12 Drive shaft
13 Radial shaft sealing ring
14 Planetary gear support assembly
15 Axial bearing with plate springs
16 Sliding sleeve
17 Shift fork
18 Brake disk
19 Solenoid
20 Shift shaft
21 Plate

Fig. 1-6 Gearbox design (1PH7: shaft heights 100-160 / 1PH4: shaft heights 100-160)

The following is valid for the changeover gearbox:

Changeover position I: $i_1 = 4$
Changeover position II: $i_2 = 1$

Both gearbox ratios are electrically switched, and each position is monitored using a limit switch.

The gearbox outdrive is coaxial with the motor shaft.

Play (measured at the gearbox outdrive):
Standard: 30 angular minutes (for shaft heights 100-160)
40 angular minutes (for shaft heights 180 / 225)
For milling and machining with interrupted cutting, on request, shaft heights 100–160 are available in the following special versions:

- Lower play: max. 20’
- Lower play for increased requirements: max. 15’

1PH7

Belt pulley

- The belt pulley should be in the form of a cup wheel.
- The gearbox out drive shaft has a flange with outer centering and tapped holes to mount the belt pulley.
- The complete drive should be as stiff as possible, and belts with high cross–sections should be used. This has a positive impact on the smooth running characteristics of the drive.

Technical data

Type	Motor shaft height	Order No.	Max. speed n_{max}	Rated torque (S1 duty)			Max. torque (S6 duty, 10 min duty duration, max 60% power–on duration)			Weight	Out–drive housing a10
				Drive	Out–drive		Drive	Out–drive			
ZF desig.			RPM	Nm	i=1 Nm	i=4 Nm	Nm	i=1 Nm	i=4 Nm	kg	mm
2K 120	100	2LG4312 -...	8000[2)] 9000[3)]	120	120	480	140	140	560	30	100
2K 250	132	2LG4315 -...	6300 8000[3)]	250	250	1000	400	400	1600	62	116
2K 300	160	2LG4320 -...	6300 8000[3)]	300	300	1200	400	400	1600	70	140
2K 800[1)]	184	2LG4250 -...	4000	800	800	3200	900	900	3600	110	160
2K 801[1)] 2K 802	186 225	2LG4260 -... 2LG4270 -...	4000	800	800	3200	900	900	3600	110	160

!

Important

The gearbox data are decisive when engineering the complete drive unit (motor with gearbox), .

Please refer to the Catalog 2K – gearboxes from ZF (Zahnradfabrik Friedrichshafen) for additional binding technical data and engineering information (e.g. lubrication, temperature rise, permissible cantilever forces, examples).
For AC motors 1PH4 168 or 1PH7 167-2NB, the torque, for example, can be reduced to 300 Nm. For motors, shaft heights 100 and 132, the maximum motor speed should be limited to the permissible speed of the 2K 120 / 2K 250 gearbox.

1) Can be supplied with holding brake (option).
2) Higher maximum speeds of 8000 ... 9000 RPM for more than 20 % power–on duration are only possible using injection lubrication.
3) Permissible with gearbox oil cooling for a gearbox stage i = 1.

Electrical supply

For the changeover unit: 24 V DC 10 %

The mechanical changeover unit requires a separate supply

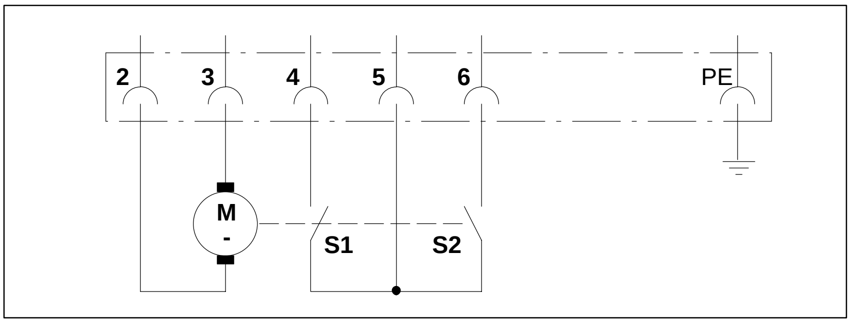


Fig. 1-7 Circuit diagram

Connector (this belongs to the scope of supply):
Manufacturer, Harting; 7-pin + PE, type HAN 7D

Table 1-16 Explanation of the connections

Connector contact No.	Number and designation	Input	Out-put	Voltage	Current
2 and 3	1 changeover unit	0	–	24 V DC	I_{max} = 5 A (pull–in current)
4 and 6	2 limit swit-ches	0	0	24 V DC V_{max} =42 V DC	I_{max} = 5 A

Table 1-17 Control sequence

Gearbox stage changeover	Connector contact number			
	2	3	4/5 (S1)	5/6 (S2)
When changing from stage i_2 to i_1				
a Initial position (f) b Changeover operation c Mechanical changeover to the end stop[1)]	+24 V DC	0 V	0 0 L	L 0 0
When changing from stage i_1 to i_2				
d Initial position (c) e Changeover operation f Mechanical changeover to the end stop [1)]	0 V	+24 V DC	L 0 0	0 0 L

L Contact closed 0 Contact open

1PH7

1) After the changeover operation, a limit switch (S1 or S2) outputs a signal to the control to no longer energize the changeover unit.

Vibration severity grade

Motor + gearbox: Tolerance R (acc. to DIN ISO 2373)

This also applies if the motor is ordered with tolerance S.

Gearbox stage changeover

- The gearbox stage may only be changed over at standstill; e.g. while a tool is being changed.
- During the changeover, execute approximately 5 direction of rotation changes per second. The gears usually mesh at the first direction of rotation change, so that changeover times of the between 300 and 400 ms can be achieved. The “oscillation” function is provided for the same purpose in the 611 Analog drive converter.
- Changeover without oscillation should be avoided.
- The motor may only accelerate 200 ms after the changeover has been completed.

The changeover operation must be monitored using a time relay. The changeover operation must be reversed after 2 s, if the changeover command was not able to be executed. A time limit of 10 s should be provided for approximately 4 to 5 additional changeover attempts.

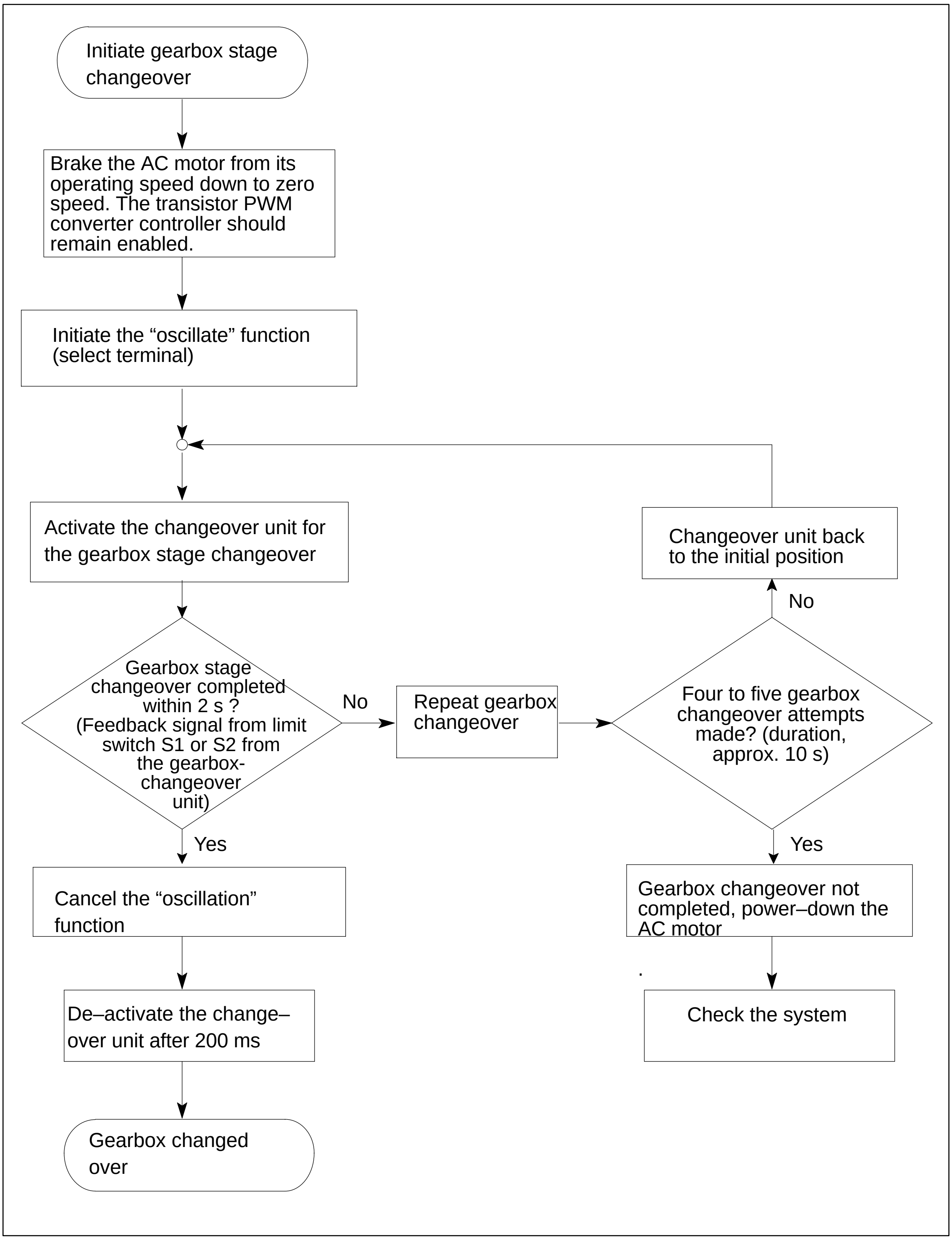


Fig. 1-8 Sequence of a gearbox stage changeover

1PH7

Lubrication

Splash lubrication

Oil level check:	Through a sight glass

The oil level depends on the mounting position:

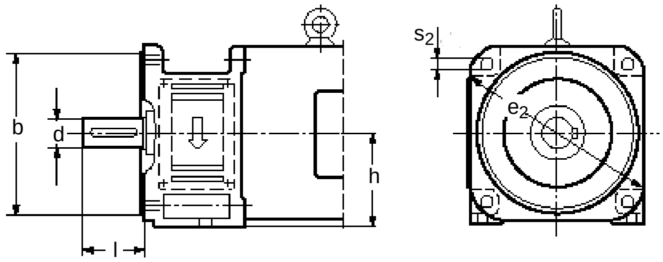
Horizontal and vertical:	Center of the sight glass[1)]
In an inclined position:	Indicate on the angled oil level indicator (mount additionally)
Oils which can be used:	HLP 32 acc. to ISO-VG 68
Oil drain plugs:	Located at both sides

Splash lubrication

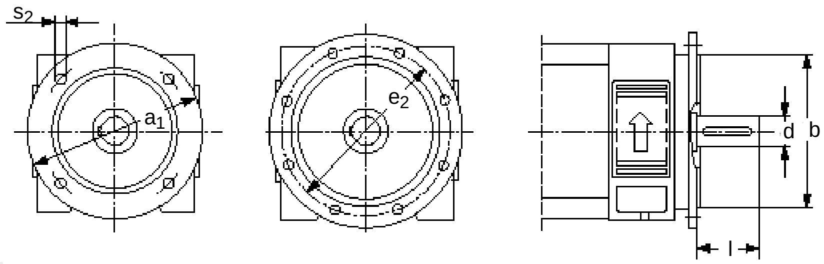
For 2K120 / 2K121 / 2K250 and 2K300 gearboxes when mounted vertically V1 V3, circulating oil lubrication is required. The type of circulating oil lubrication depends on the operating temperature level in use.
Gerboxes 2K800 / 2K801 / 2K802 and 2K2100 must always be operated with oil circulating lubrication (also refer to the mounting drawings).
For continuous operation, or operation over a longer time period in one gearbox stage, and for intermittent operation with short no–load intervals, circulating oil lubrication is required.

Several applications require a low operating temperature level. For this reason, we recommend a specific circulating oil lubrication. The oil intake quantity is 1 to 1.5 l/min with an oil pressure of approx. 1.5 bar.
The approximate oil intake and outlet positions on the gearbox are illustrated in Figs. 1-10 and 1-11. The precise dimensions should be taken from the relevant mounting drawings.

1) The oil volume data on the rating plate is only an approximate value.



for changeover gearboxes, for motor frame sizes 100, 132 and 160



for changeover gearboxes, for motor frame sizes 180 and 225

Fig. 1-9 Flange dimensions for AC motors
(dimensions, refer to Table 1-18)

Table 1-18 Flange dimensions for AC motors

Two–stage changeover gearbox	Motor frame size	Standard motor dimensions						
		h	**d**	**l**	**b_1**	**e_1**	**a_1**	**s_1**
2 K 120	101, 103, 105, 107	100–0.5	38 k_6	80	180 j_6	215 ± 0.5	–	14 ± 0.2
2 K 250	131, 132, 133, 135, 137	132–0.5	42 k_6	110	250 h_6	300 ± 0.5	–	18 ± 0.2
2 K 300	163, 167	160–0.5	55 k_6	110	300 h_6	350 ± 0.5	–	18 ± 0.2
2 K 800	184	180–0.5	60 k_6	140	300 h_6	350 ± 0.5	400	19 ± 0.2
2 K 801	186	180–0.5	65 k_6	140	350 h_6	400 ± 0.5	450	19 ± 0.2
2 K 802	224	225–0.5	75 k_6	140	450 h_6	500 ± 0.5	550	19 ± 0.2

- Changeover gearbox for frame size 100

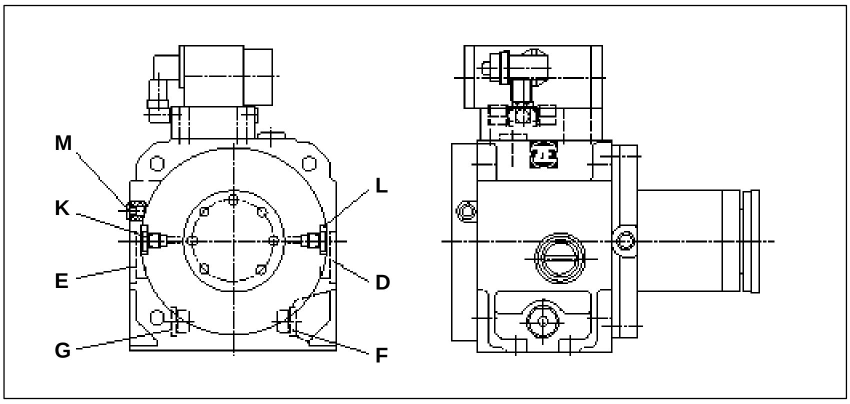


Fig. 1-10 Changeover gearbox with changeover unit for frame size 100

Table 1-19 Connections for the oil circulating lubrication

<table>
<tr><th>Max. pressure</th><th>Oil return connection</th><th>Oil inlet connection</th><th>Mounting position</th></tr>
<tr><td>0.2 bar
1.5 bar</td><td rowspan="3">D
Main direction of rotation, clockwise 1)

E
Main direction or rotation, counter–clockwise 1)</td><td rowspan="2">M (0.5 dm³/min)
K/L (1.0 dm³/min)</td><td rowspan="2">V1
(closed version)</td></tr>
<tr><td>1.5 bar</td></tr>
<tr><td>1.5 bar</td><td>G (1.5 dm³/min)
main direction of rotation, clockwise
F (1.5 dm³/min)
main direction of rotation, counter clockwise</td><td>B5
V1</td></tr>
<tr><td colspan="4">Oil circulating lubrication required for V1/V3</td></tr>
</table>

1) View of the gearbox drive from the motor

- Changeover gearbox for frame sizes 132 and 160

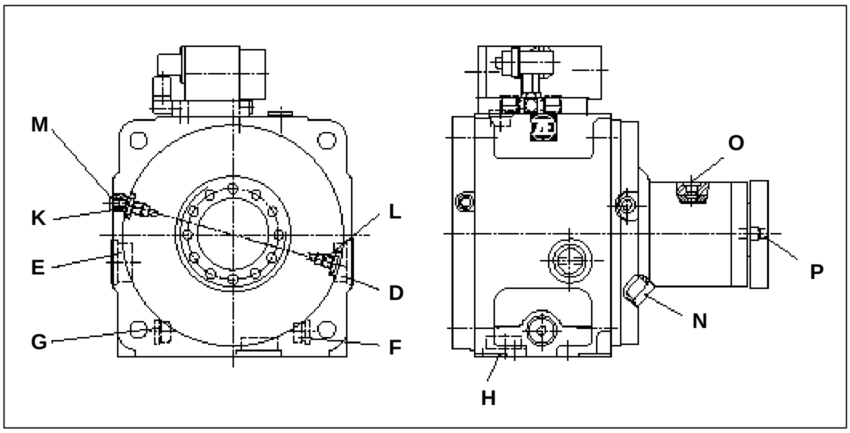


Fig. 1-11 Changeover gearbox with changeover unit for frame sizes 132 and 160

Table 1-20 Connections for oil circulating lubrication

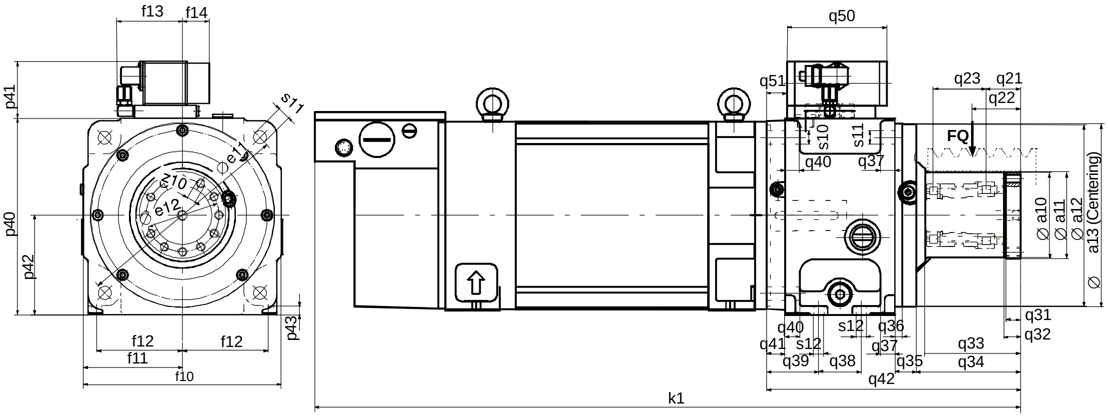
<table>
<tr><th>Max. pressure</th><th>Oil return connection</th><th>Oil inlet connection</th><th>Mounting position</th></tr>
<tr><td>2 bar</td><td>H</td><td>P (1.5 dm^3/min)</td><td>V3</td></tr>
<tr><td>0.5 bar
1.5 bar</td><td rowspan="3">D
Main direction of rottion, clockwise [1]

E
Main direction or rotation, counter–clockwise [1]</td><td rowspan="2">M (0.5 dm^3/min)
N (1.5 dm^3/min)</td><td rowspan="2">V1
(closed version)</td></tr>
<tr><td>1.5 bar</td></tr>
<tr><td>1.5 bar</td><td>G (1.5 dm^3/min)
main direction of rotation, clockwise
F (1.5 dm^3/min)
main direction of rotation, counter–clockwise</td><td>B5
V1</td></tr>
<tr><td colspan="4">Oil circulating lubrication required for V1/V3
Connection = is additionally possible (0.5 dm^3/min)</td></tr>
</table>

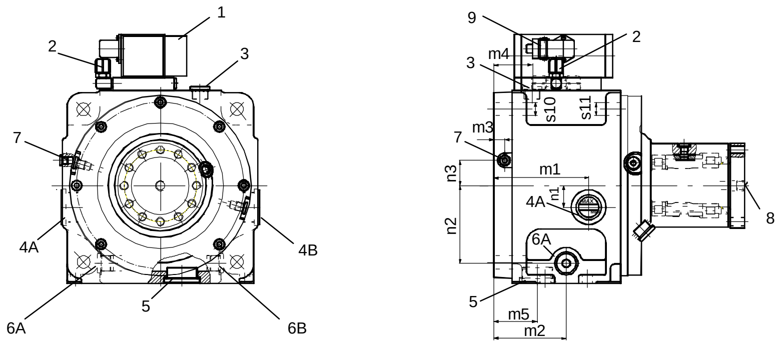
1) View of the gearbox drive from the motor

Dimension drawings with changeover gearboxes

Gearbox dimensions



Oil supply connections



for changeover gearboxes for motor frame sizes 100 to 160

1	Changeover unit (solenoid, 24 V DC, 5 A)
2	Vent valve
2	Oil filling plug
4A	Oil level sight glass or oil return for main dir. of rotation, counter–clockwise and circulating oil lubrication
4B	Oil level sight glass or oil return for main direction of rotation, clockwise and circulating oil lubrication
5	Oil drain plug for type of construction IM B35
6A	Oil feed for the main direction of rotation, clockwise and circulating oil lubrication
6B	Oil feed for the main direction of rotation, counter–clockwise and circulating oil lubrication
7	Oil feed for type of construction IM V15 (must be connected)
8	Oil feed for type of construction IM V36
9	Connector, Harting, Type HAN 8 U

Fig. 1-12 AC motor and gearbox dimensions

Table 1-21 Two–stage changeover gearbox for AC motors 1PH7 and 1PH4 (dimensions, overview 1)

Motor		Dimensions in mm																
Frame size	Type	a10	a11	a12	a13	e11	e12	f10	f11	f12	f13	f14	h	m1	m2	m3	m4	m5
		Out drive housing	k6		g6	0.2							Sh. hgt.					
100	1PH7 101	100	100	188	190	215	80	208	104	92	86.6	42.4	100	107	90.5	15	45	–
	1PH7 103																	
	1PH7 105																	
	1PH7 107																	
	1PH4 103	100	100	188	190	215	80	208	104	92	86.6	42.4	100	107	90.5	15	45	–
	1PH4 105																	
	1PH4 107																	
132	1PH7 131	116	118	249	250	300	100	270	135	117	89.5	39.5	132	131	100	15	53	60
	1PH7 133																	
	1PH7 135																	
	1PH7 137																	
	1PH4 133	116	118	249	250	300	100	270	135	117	89.5	39.5	132	131	100	15	53	60
	1PH4 135																	
	1PH4 137																	
	1PH4 138																	
160	1PH7 163	140	130	249	250	350	100	326	163	145	89.5	39.5	160	131	100	15	53	60
	1PH7 167																	
	1PH4 163	140	130	249	250	350	100	326	163	145	89.5	39.5	160	131	100	15	53	60
	1PH4 167																	
	1PH4 168																	

Table 1-22 Two–stage changeover gearbox for AC motors 1PH7 and 1PH4 (dimensions, overview 2)

Motor		Dimensions in mm															
Frame size	**Type**	**n1**	**n2**	**n3**	**p40**	**p41**	**p42**	**p43**	**q21**	**q22**	**q23**	**q31**	**q32**	**q33**	**q34**	**q35**	**q36**
100	1PH7 101	17	80	30	209	92	108	12	42	57–67	75	15	17.5	–	116	26	10
	1PH7 103																
	1PH7 105																
	1PH7 107																
	1PH4 103	17	80	30	209	92	108	12	42	57–67	75	15	17.5	–	116	26	10
	1PH4 105																
	1PH4 107																
132	1PH7 131	30	108	35	268	78	136	12	46.9	57–66	72.1	20	22.5	129.5	142.5	29	10
	1PH7 133																
	1PH7 135																
	1PH7 137																
	1PH4 133	30	108	35	268	78	136	12	46.9	57–66	72.1	20	22.5	129.5	142.5	29	10
	1PH4 135																
	1PH4 137																
	1PH4 138																
160	1PH7 163	30	135	35	324	78	164	17	48.2	74–83	69.8	20	22.5	–	142.5	29	10
	1PH7 167																
	1PH4 163	30	135	35	324	78	164	17	48.2	74–83	69.8	20	22.5	–	142.5	29	10
	1PH4 167																
	1PH4 168																

Table 1-23 Two–stage changeover gearbox for 1PH7 and 1PH4 (dimensions, overview 3)

Motor		Dimensions in mm													
Frame size	Type	q37	q38	q39	q40	q41	q42	q50	q51	s10	s11	s12	z10 Thread	No. of tapped hoes	Motor with gearbox, total length k1
100	1PH7 101	18	55	63	18	25	298	136	12	14	14	14	M8	8x45°	709
	1PH7 103														709
	1PH7 105														804
	1PH7 107														804
	1PH4 103	18	55	63	18	25	298	136	12	14	14	14	M8	8x45°	714
	1PH4 105														774
	1PH4 107														839
132	1PH7 131	20	58	71	20	25	346.5	136	28	18	18	14	M12	12x30°	885
	1PH7 133														885
	1PH7 135														970
	1PH7 137														970
	1PH4 133	20	58	71	20	25	346.5	136	28	18	18	14	M12	12x30°	805
	1PH4 135														875
	1PH4 137														925
	1PH4 138														960
160	1PH7 163	20	58	71	23	25	346.5	136	28	18	18	14	M12	12x30°	987
	1PH7 167														1047
	1PH4 163	20	58	71	23	25	346.5	136	28	18	18	14	M12	12x30°	938
	1PH4 167														993
	1PH4 168														1024

■

Notes

Order designations

2

Order designation (standard version)

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

The first block has seven positions and designates the motor type. Additional features are coded in the second block. The third block is provided for additional information.

Shaft heights 100 to 160

1	P	H	7	.	.	.	–	2	N	.	.	.	–	0	.	.	.

AC induction motor, main spindle drives

Frame size

Encoder system
N = with optical sin/cos incremental encoder

Rated speed[1])
B = 500 RPM
D = 1000 RPM
F = 1500 RPM
G = 2000 RPM

Terminal box arrangement/cable outlet direction
0 = top/right
2 = top/NDE
3 = top/left

Type of construction
0 = IM B3 (IM V5, IM V6), standard hoisting concept
2 = IM B5 (IM V1, IM V3), standard hoisting (not for shaft height 160)
3 = IM B35 (IM V15, IM V36)

Bearing design, vibration severity, shaft and flange precision

Bearing design	Vibration severity grade	Shaft and flange precision
B =Coupling/belt out–drive	R	R
C =Coupling/belt out–drive	S	R
D =Coupling/belt out–drive	SR	R
L=Coupling/belt out–drive[2)]	SR	R

Shaft version; cooling

	Shaft	Airflow dir.	Air discharge dir.
A	Key and half key balancing	DE ⇒ NDE	axial
B	Key and half key balancing	NDE ⇒ DE	axial
C	Key and full key balancing	DE ⇒ NDE	axial
D	Key and full key balancing	NDE ⇒DE	axial
J	Smooth shaft (no keyway)	DE ⇒ NDE	axial
K	Smooth shaft (no keyway)	NDE ⇒DE	axial

Degree of protection
0 IP 55; fan IP 54
2 IP 55; fan IP 54;
DE flange with shaft sealing ring

1) not for every shaft height
2) version for increased maximum speed, only in conjunction with vibration severity grade SR.
option not possible for: –prepared for mounting a ZF gearbox
–shaft sealing ring

1PH7

Order designation (core type)

Shaft heights 100 to 160

1 P H 7 . . . – 2 N . 0 . – 0 C . 0

AC induction motor, main spindle drives

Frame size

Encoder system
N = with optical sin/cos incremental encoder

Rated speed[1)]
D = 1000 RPM
F = 1500 RPM
G = 2000 RPM

Terminal box arrangement/outlet direction
0 = top/right

Type of construction
2 = IM B5 (IM V1, IM V3), standard hoisting concept (shaft heights 100 and 132)
3 = IM B35 (IM V15, IM V36) (shaft height 160)

Bearing design, vibration severity, shaft and flange precision

Bearing design	Vibration severity grade	Shaft and flange precision
C =Coupling/belt out–drive	S	R

Shaft version; cooling

	Shaft	Air flow dir.	Discharge direction
A	Key and halfkey balancing	DE ⇒ NDE	axial
J	Smooth shaft (no keyway)	DE ⇒ NDE	axial

Degree of protection
0 IP 55; Fan IP 54

1) not for every shaft height

Shaft heights 180 and 225

1 P H 7 . . . – . N . . . – 0 . . .

AC induction motor main spindle drives

Frame size

Fan connection
2 = separately–driven fan 3–ph. 400 V AC/50 Hz or 3–ph. 480 V/60 Hz
3=as for 2; additionally for DC link voltage < 700 V [9]

Encoder system
N = with optical sin/cos incremental encoder

Rated speed [5]

T=	500 RPM	C =	700 RPM
D =	1000 RPM	E =	1250 RPM
F =	1500 RPM	L =	2500 RPM

Terminal box arrangement/outlet direction [1)3)]
0 = top/right
1 = top/DE
2 = top/NDE
3 = top/left

Type of construction
0 = IM B3, standard hoisting concept
1 = IM B3, hoisting concept for vertical types of construction [2]
3 = IM B35, standard hoisting concept
5 = IM B35, hoisting concept for vertical types of construction

Bearing design, vibration severity, shaft and flange precision

	Bearing design	Vibration severity level	Shaft/flange precision
A =	Coupling out–drive	R	N
B =	Coupling out–drive	R	R
C =	Coupling out–drive	S	R
D =	Coupling out–drive	SR	R
E =	Belt drive	R	N
F =	Belt drive	R	R
G=	Belt drive with increased cantilever force	R	N [8]
H=	Belt drive with increased cantilever force	R	R [8]
J=	Coupling drive (only shaft height 180)	S	R [6]

Shaft version; cooling

	Shaft	Airflow dir.	Air discharge dir. [3]
A	Key and half key balancing	DE ⇒ NDE	right
B [7]	Key and half key balancing	NDE ⇒ DE	axial
C	key and half key balancing	DE ⇒ NDE	right
D [7]	Key and full key balancing	NDE ⇒ DE	axial
J	Smooth shaft (without key way)	DE ⇒ NDE	right
K [7]	Smooth shaft (without key way)	NDE ⇒ DE	axial

Degree of protection
0 = IP 55
2 = IP 55 prepared for mounting a ZF gearbox [4]

Paint finish
primed, without final paint finish
primed, without final paint finish

1) Signal connector outlet shifted through 180°.
2) Not IM V6 (shaft facing upwards)
3) When viewing the DE
4) Only in conjunction with type of construction IM B35 and IM V15, bearing design suitable for using a coupling, vibration severity grade R, shaft and flange precision R, key and full key balancing
5) not for every shaft height
6) Design for increased maximum speed (n_{max}=7000 RPM); not for mounted gearbox
7) The motor is longer
8) n_{max}=4500 for shaft height 225
9) Simodrive 611 drive converter supply voltage
3–ph. 480 V AC +6%–10% (i.e. $V_{DC\ link}$=680 V), it is possible to operate the system on a 680 V DC link voltage.

■

1PH7

Notes

Technical Data and Characteristics 3

3.1 Speed–power diagrams

The AC motors for main spindle drives must be continuously ventilated in operation, independent of the duty type.

The dotted lines in the diagram indicate the power limit of the particular drive converter for the specified AC motor. The power module is specified.

The outputs for duty type S6 for a relative power–on duration of 25 %, 40 % and 60 % are specified (10 min duty cycle).

Speeds designated with [1)] are optional.

Table 3-1 AC main spindle motor 1PH7101–2NF□□

Rated output P_{rated} [**kW**]	**Rated speed** n_{rated} [**RPM**]	**Rated torque** M_{rated} [**Nm**]	**Rated current** I_{rated} [**A**]	**Time constant (therm.)** T_{th} [**min**]	**Max. speed** n_{max} [**RPM**]	**Moment of inertia** J [**kgm²**]	**Weight** m [**kg**]
3.7	1500	24	10	20	9000	0.017	40

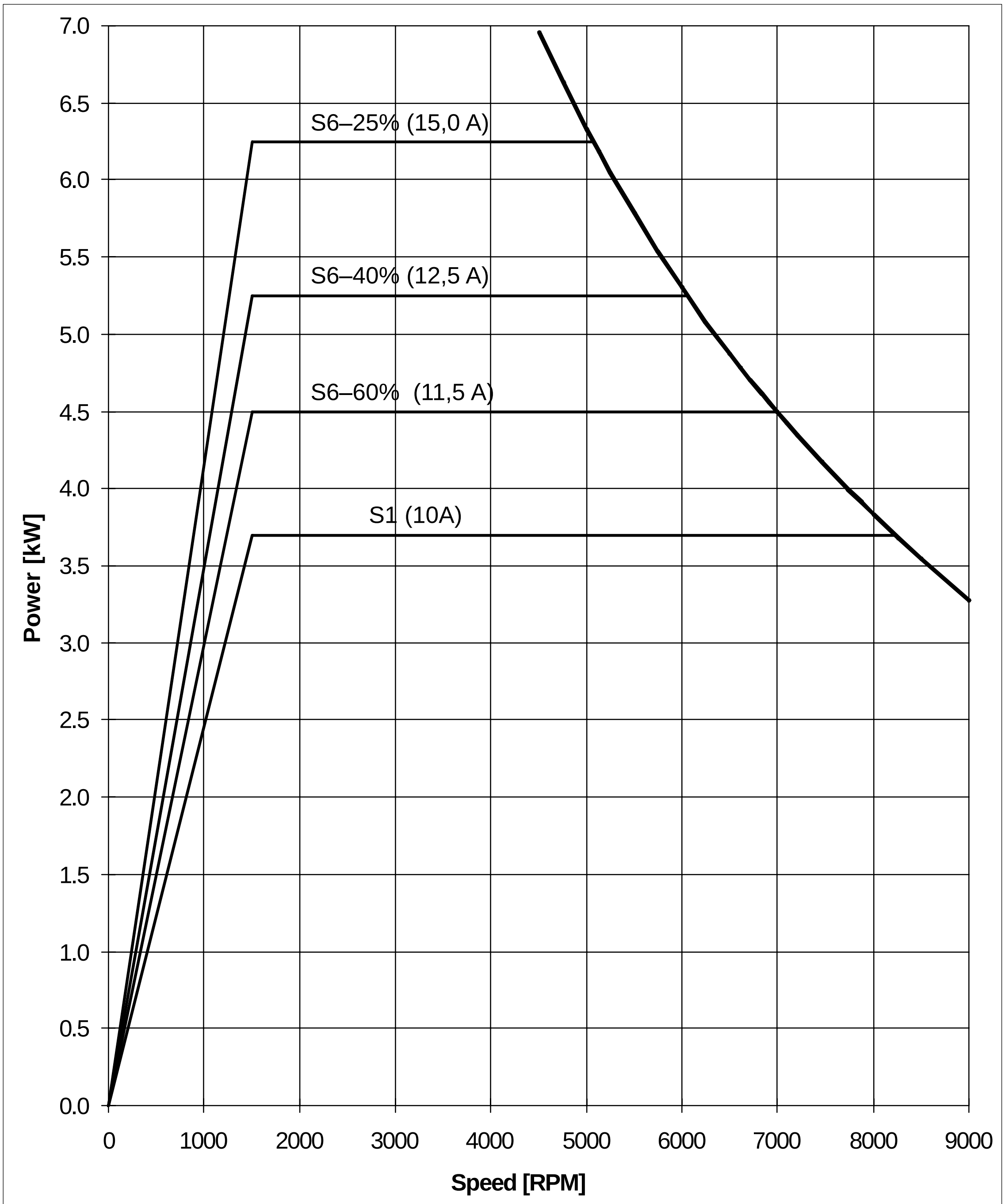


Fig. 3-1 Speed–power diagram 1PH7101–2NF□□

Table 3-2 AC main spindle motor 1PH7101–2NF☐☐–0**L**

Rated output P_{rated} [**kW**]	Rated speed n_{rated} [**RPM**]	Rated torque M_{rated} [**Nm**]	Rated current I_{rated} [**A**]	Time constant (therm.) T_{th} [**min**]	Max. speed n_{max} [**RPM**]	Moment of inertia J [**kgm²**]	Weight m [**kg**]
3.7	1500	24	10	20	12000	0.017	40

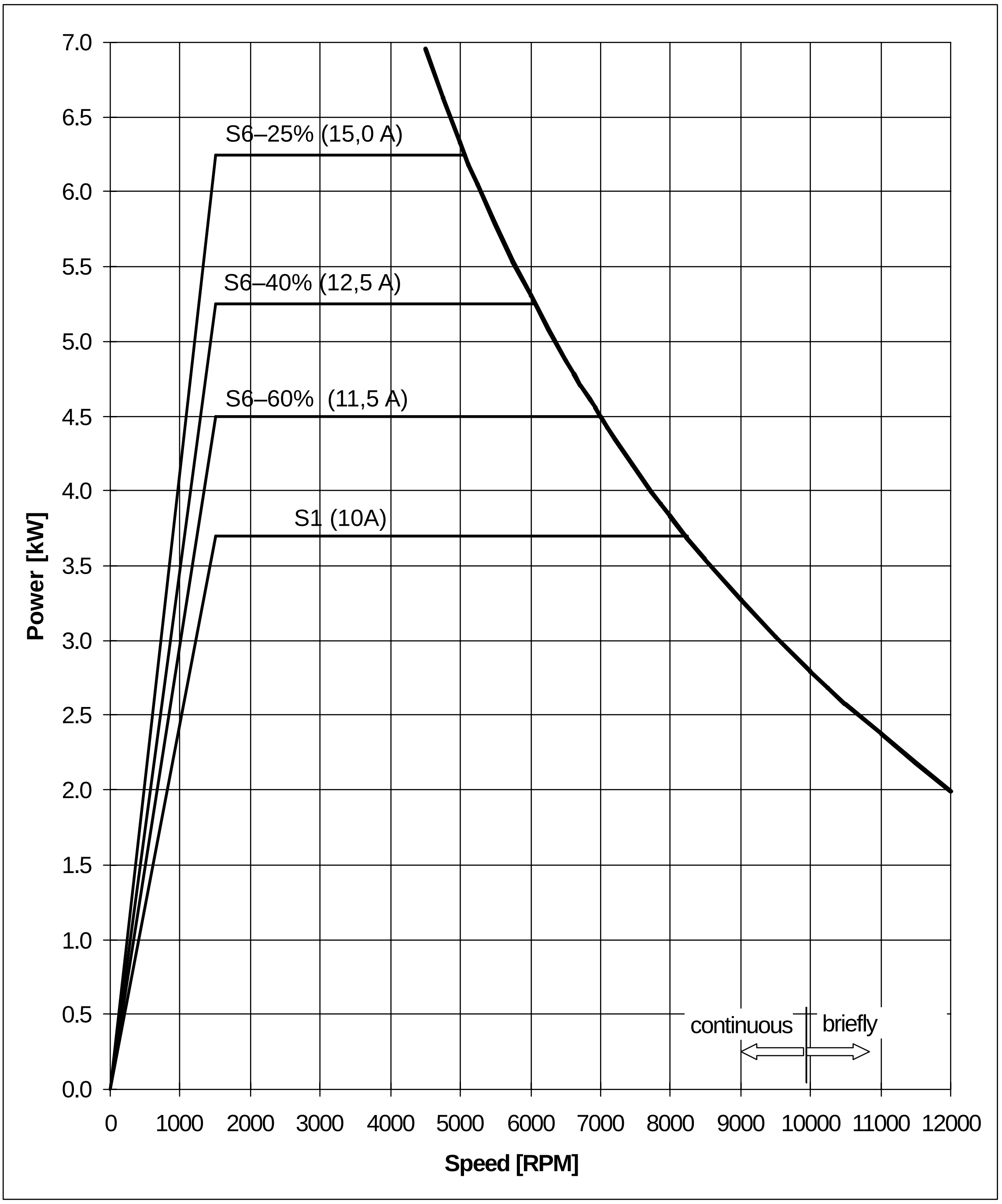


Fig. 3-2 Speed–power diagram 1PH7101–2NF☐☐–0**L**

1PH7

Table 3-3 AC main spindle motor 1PH7103-2ND

Rated output P_{rated} [kW]	Rated speed n_{rated} [RPM]	Rated torque M_{rated} [Nm]	Rated current I_{rated} [A]	Time constant (therm.) T_{th} [min]	Max. speed n_{max} [RPM]	Moment of inertia J [kgm^2]	Weight m [kg]
3.7	1000	35	10	20	9000	0.017	40

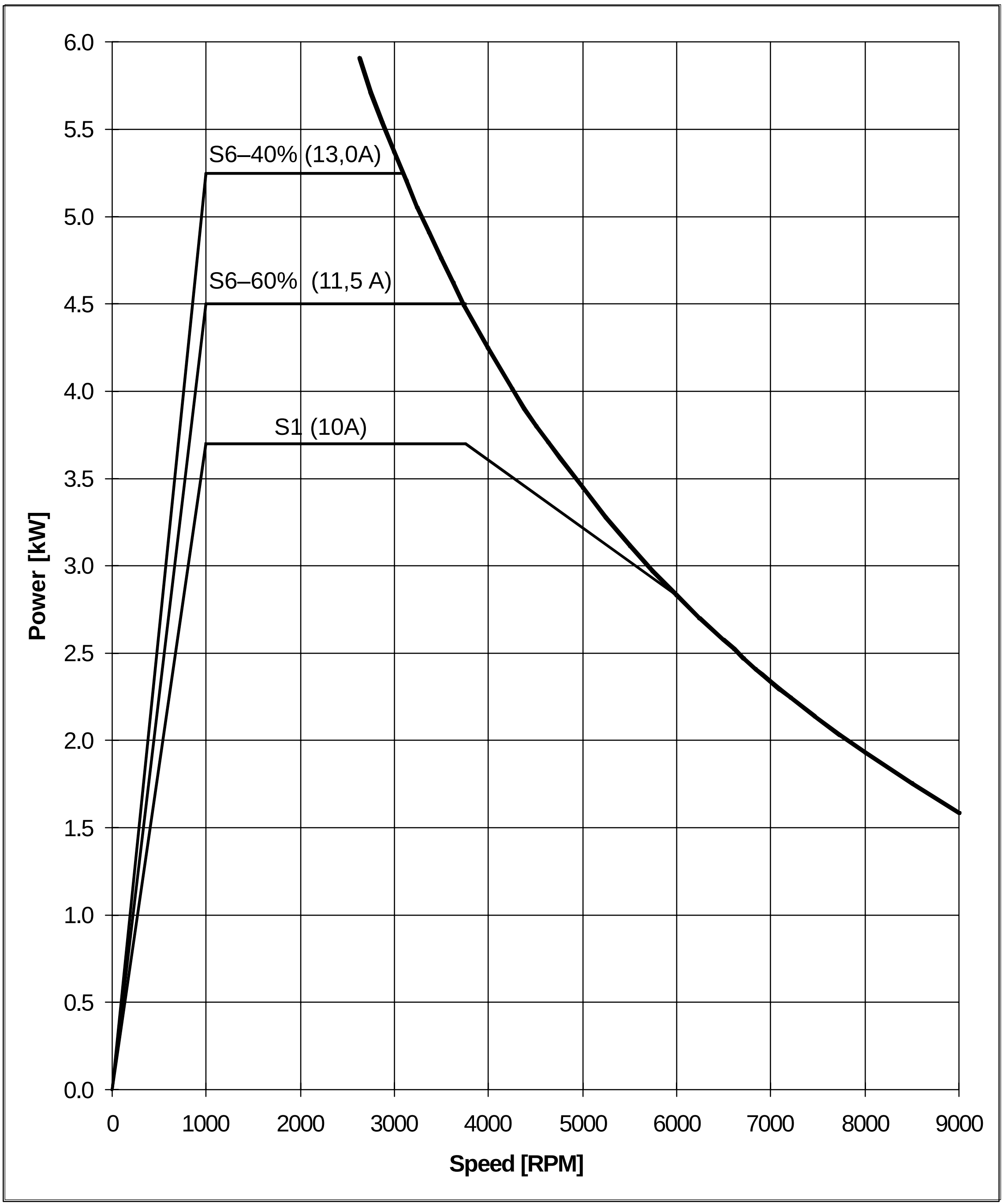


Fig. 3-3 Speed–power diagram 1PH7103-2ND

Table 3-4 AC main spindle motor 1PH7103-2ND□□–0**L**

Rated output P_{rated} [**kW**]	**Rated speed** n_{rated} [**RPM**]	**Rated torque** M_{rated} [**Nm**]	**Rated current** I_{rated} [**A**]	**Time constant (therm.)** T_{th} [**min**]	**Max. speed** n_{max} [**RPM**]	**Moment of inertia** **J** [kgm^2]	**Weight** **m** [**kg**]
3.7	1000	35	10	20	12000	0.017	40

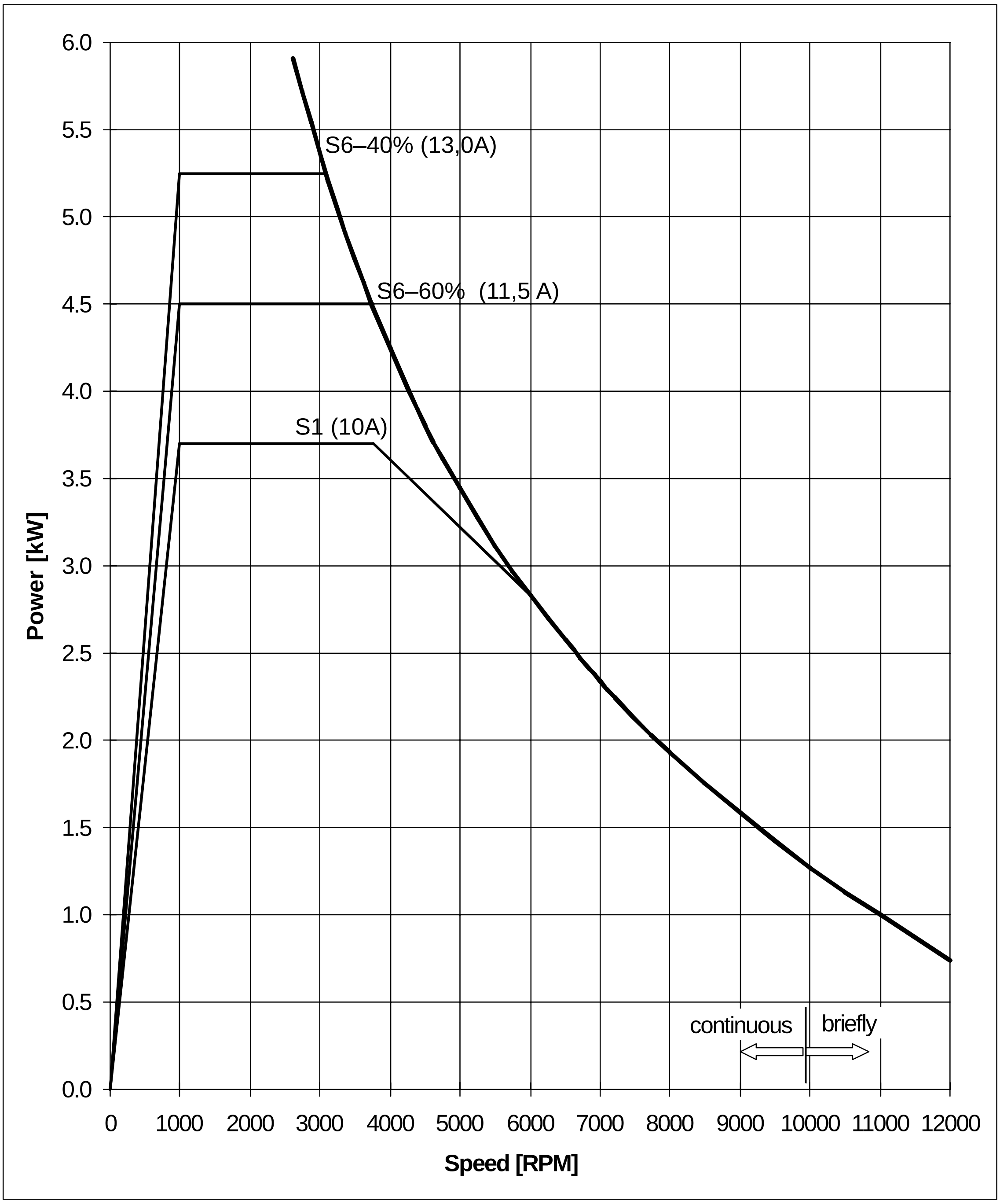


Fig. 3-4 Speed–power diagram 1PH7103-2ND□□–0**L**

Table 3-5 AC main spindle motor 1PH7103-2NF

Rated output P_{rated} [kW]	Rated speed n_{rated} [RPM]	Rated torque M_{rated} [Nm]	Rated current I_{rated} [A]	Time constant (therm.) T_{th} [min]	Max. speed n_{max} [RPM]	Moment of inertia J [kgm^2]	Weight m [kg]
5.5	1500	35	13	20	9000	0.017	40

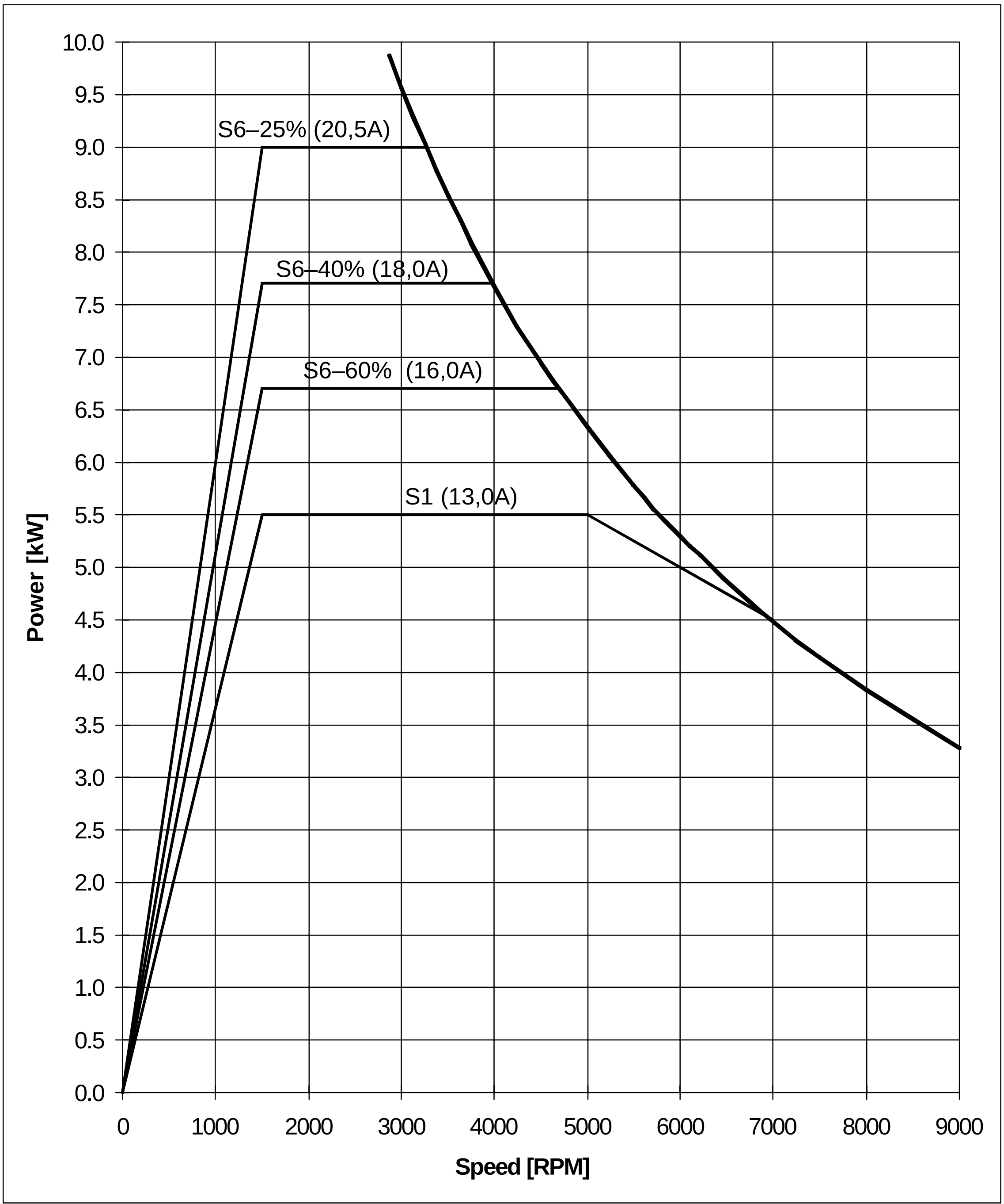


Fig. 3-5 Speed–power diagram 1PH7103-2NF

Table 3-6 AC main spindle motor 1PH7103-2NF□□–0**L**

Rated output P_{rated} [kW]	Rated speed n_{rated} [RPM]	Rated torque M_{rated} [Nm]	Rated current I_{rated} [A]	Time constant (therm.) T_{th} [min]	Max. speed n_{max} [RPM]	Moment of inertia J [kgm^2]	Weight m [kg]
5.5	1500	35	13	20	12000	0.017	40

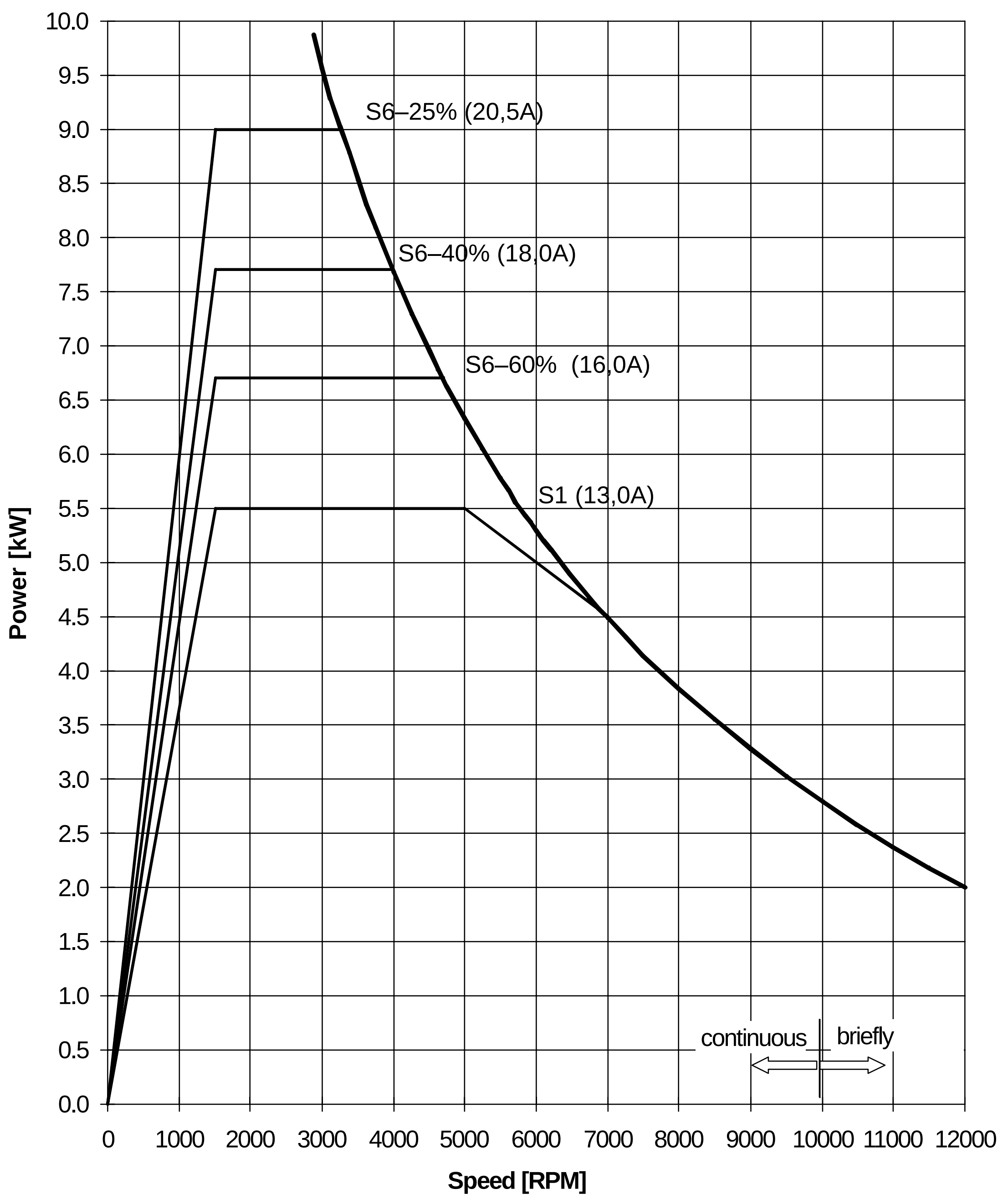


Fig. 3-6 Speed–power diagram 1PH7103-2NF□□–0**L**

1PH7

Table 3-7 AC main spindle motor 1PH7103–2NG□□

Rated output P_{rated} [kW]	Rated speed n_{rated} [RPM]	Rated torque M_{rated} [Nm]	Rated current I_{rated} [A]	Time constant (therm.) T_{th} [min]	Max. speed n_{max} [RPM]	Moment of inertia J [kgm^2]	Weight m [kg]
7	2000	33	17.5	20	9000	0.017	40

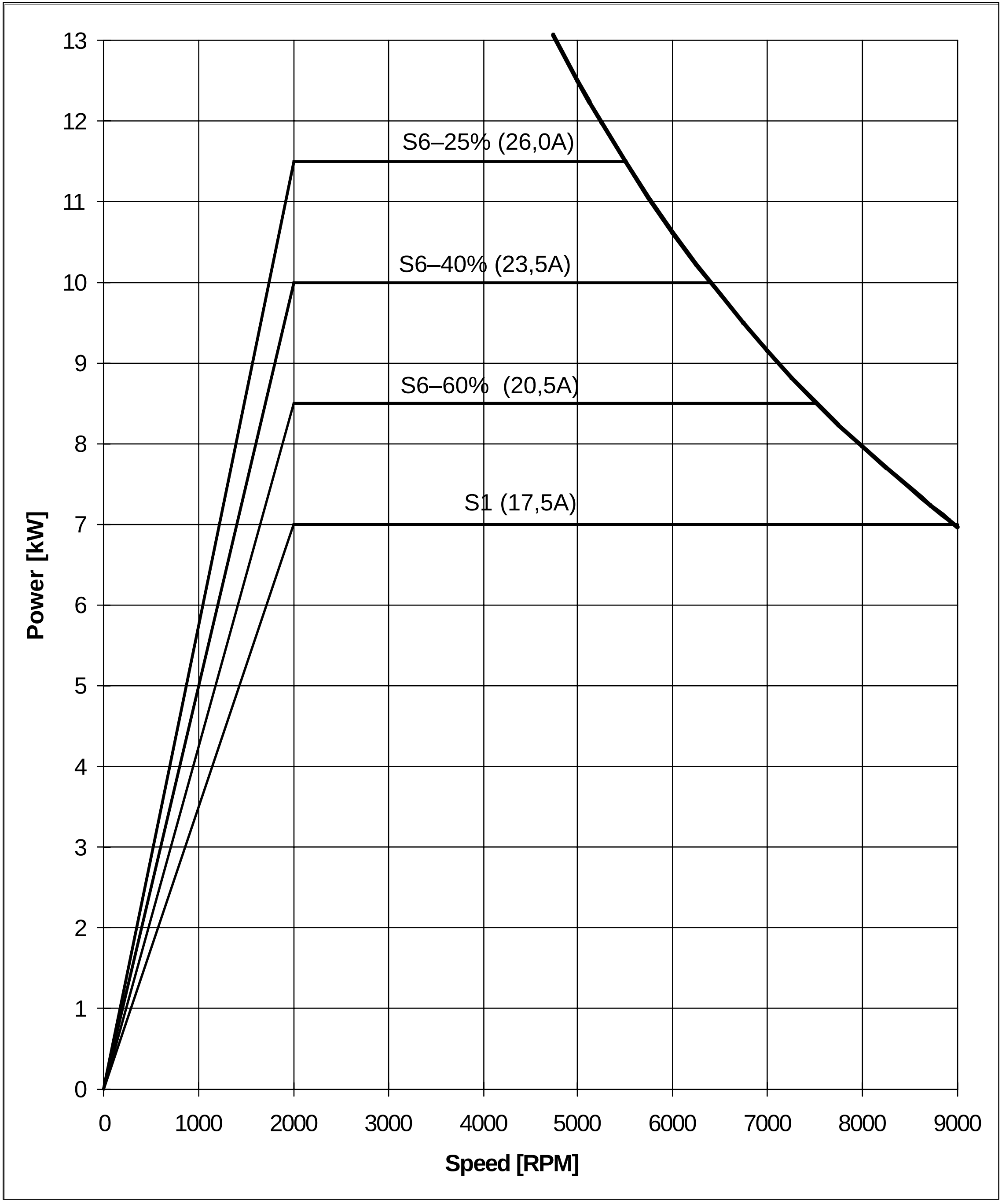


Fig. 3-7 Speed–power diagram 1PH7103–2NG□□

Table 3-8 AC main spindle motor 1PH7103–2NG☐☐–0**L**

Rated output P_{rated} [kW]	Rated speed n_{rated} [RPM]	Rated torque M_{rated} [Nm]	Rated current I_{rated} [A]	Time constant (therm.) T_{th} [min]	Max. speed n_{max} [RPM]	Moment of inertia J [kgm^2]	Weight m [kg]
7	2000	33	17.5	20	12000	0.017	40

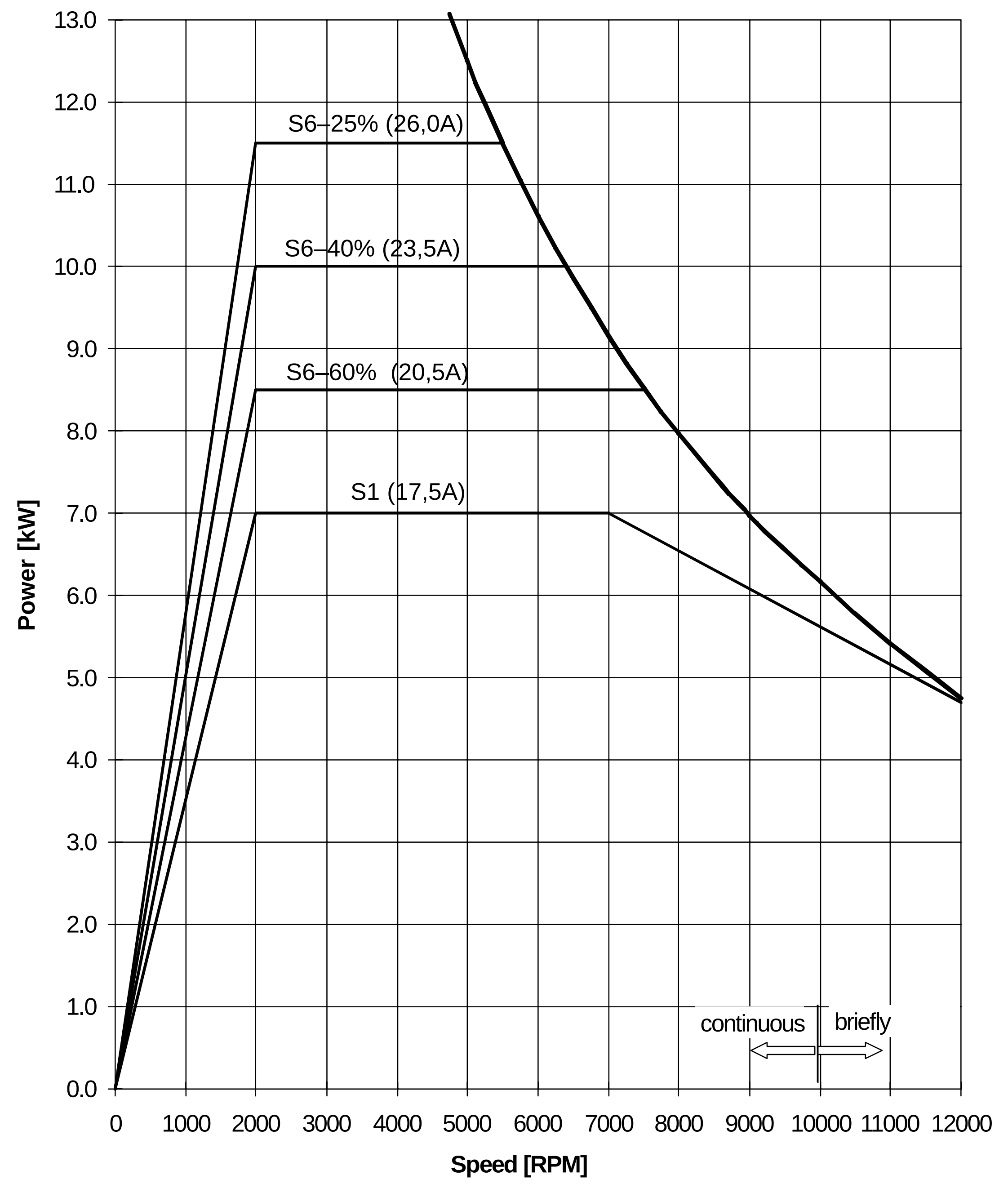


Fig. 3-8 Speed–power diagram 1PH7103–2NG☐☐–0**L**

1PH7

Table 3-9 AC main spindle motor 1PH7105–2NF□□

Rated output P_{rated} [kW]	Rated speed n_{rated} [RPM]	Rated torque M_{rated} [Nm]	Rated current I_{rated} [A]	Time constant (therm.) T_{th} [min]	Max. speed n_{max} [RPM]	Moment of inertia J [kgm^2]	Weight m [kg]
7.0	1500	45	17.5	20	9000	0.029	63

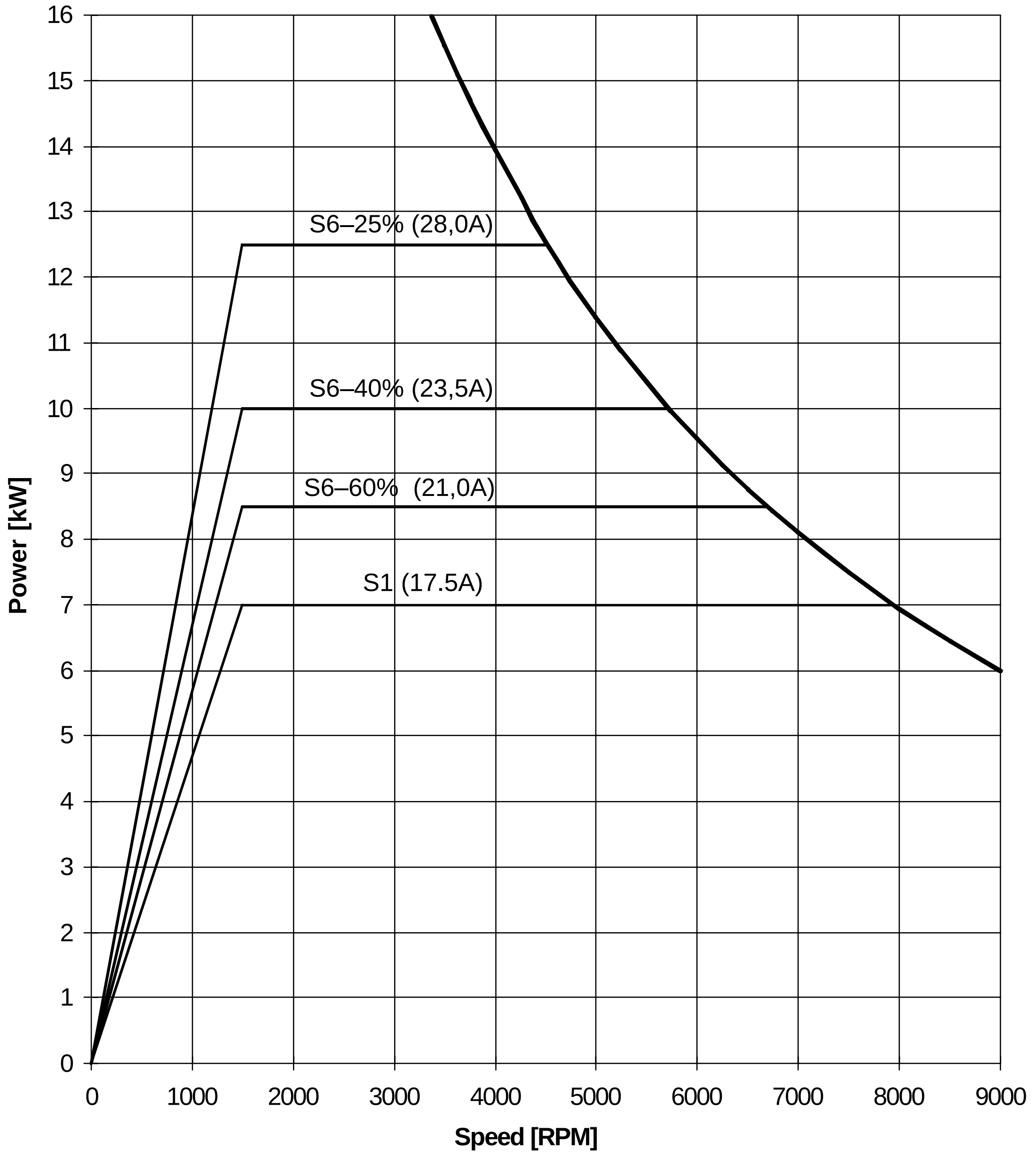


Fig. 3-9 Speed–power diagram 1PH7105–2NF□□

Table 3-10 AC main spindle motor 1PH7105–2NF□□–0**L**

Rated output P_{rated} [**kW**]	**Rated speed** n_{rated} [**RPM**]	**Rated torque** M_{rated} [**Nm**]	**Rated current** I_{rated} [**A**]	**Time constant (therm.)** T_{th} [**min**]	**Max. speed** n_{max} [**RPM**]	**Moment of inertia** J [**kgm²**]	**Weight** m [**kg**]
7.0	1500	45	17.5	20	12000	0.029	63

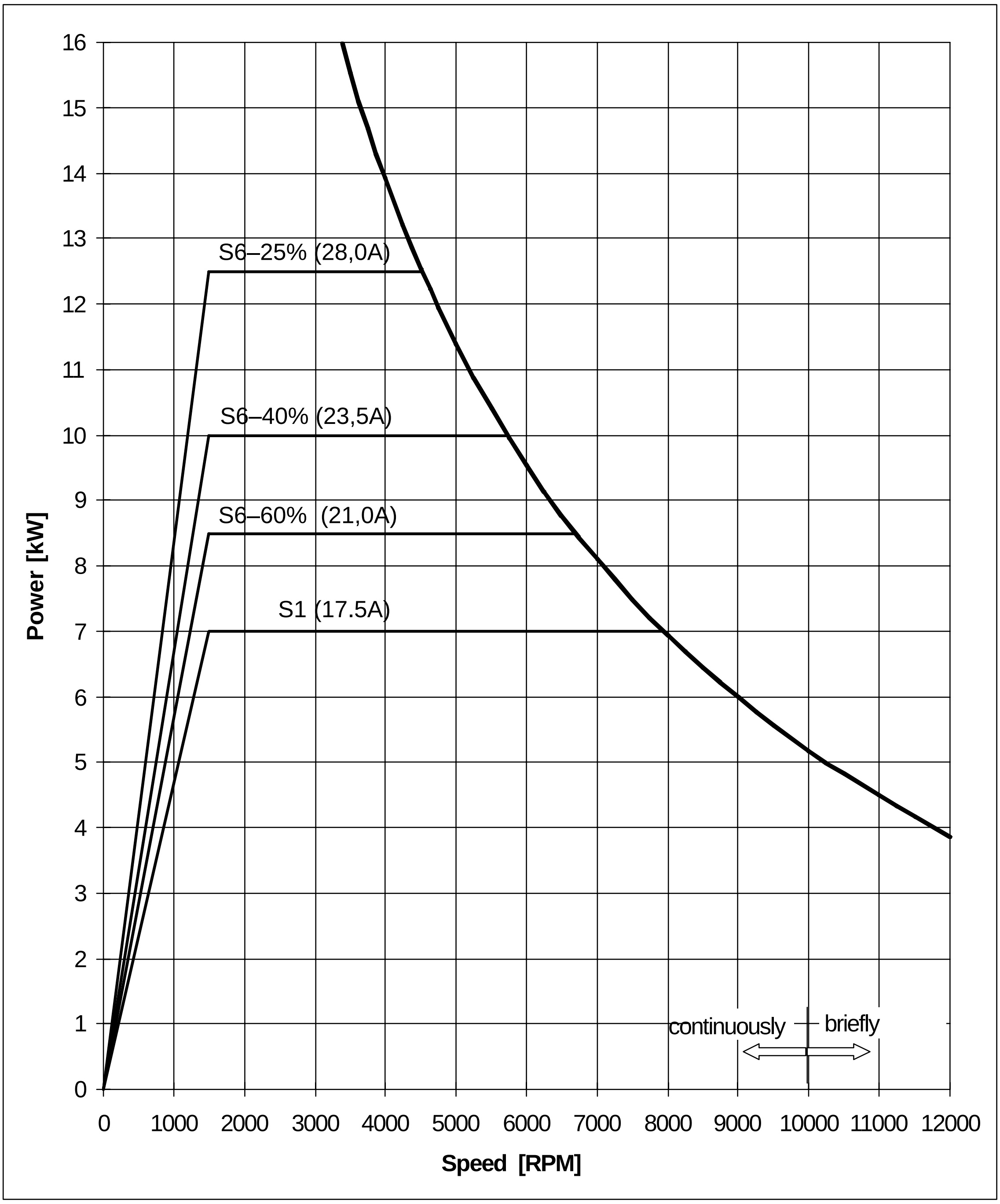


Fig. 3-10 Speed–power diagram 1PH7105–2NF□□–0**L**

1PH7

Table 3-11 AC main spindle motor 1PH7107-2ND

Rated output P_{rated} [**kW**]	**Rated speed** n_{rated} [**RPM**]	**Rated torque** M_{rated} [**Nm**]	**Rated current** I_{rated} [**A**]	**Time constant (therm.)** T_{th} [**min**]	**Max. speed** n_{max} [**RPM**]	**Moment of inertia** J [**kgm^2**]	**Weight** m [**kg**]
6.25	1000	60	17.5	20	9000	0.029	63

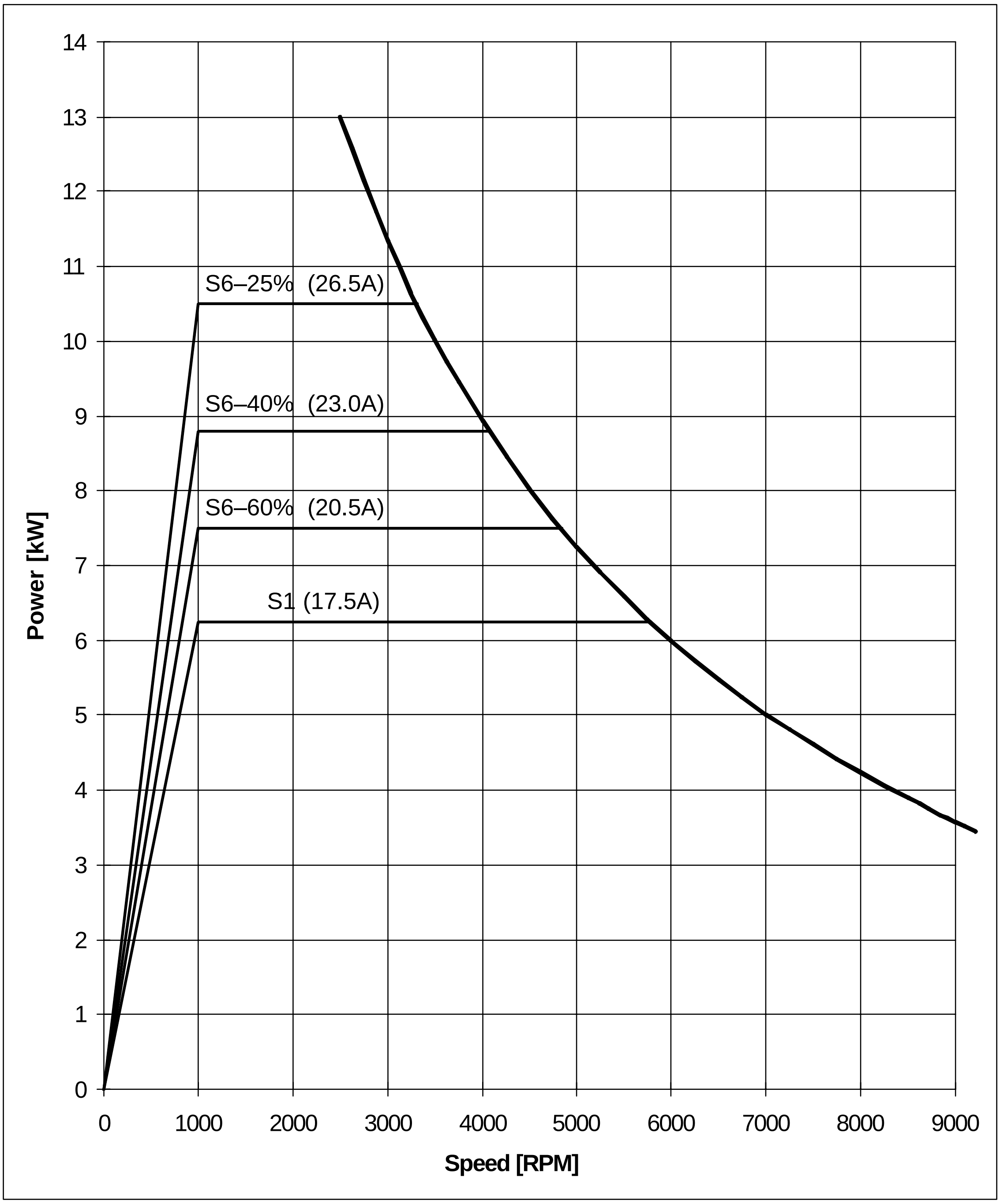


Fig. 3-11 Speed–power diagram 1PH7107-2ND

Table 3-12 AC main spindle motor 1PH7107-2ND□□–0**L**

Rated output P_{rated} [kW]	Rated speed n_{rated} [RPM]	Rated torque M_{rated} [Nm]	Rated current I_{rated} [A]	Time constant (therm.) T_{th} [min]	Max. speed n_{max} [RPM]	Moment of inertia J [kgm²]	Weight m [kg]
6.25	1000	60	17.5	20	12000	0.029	63

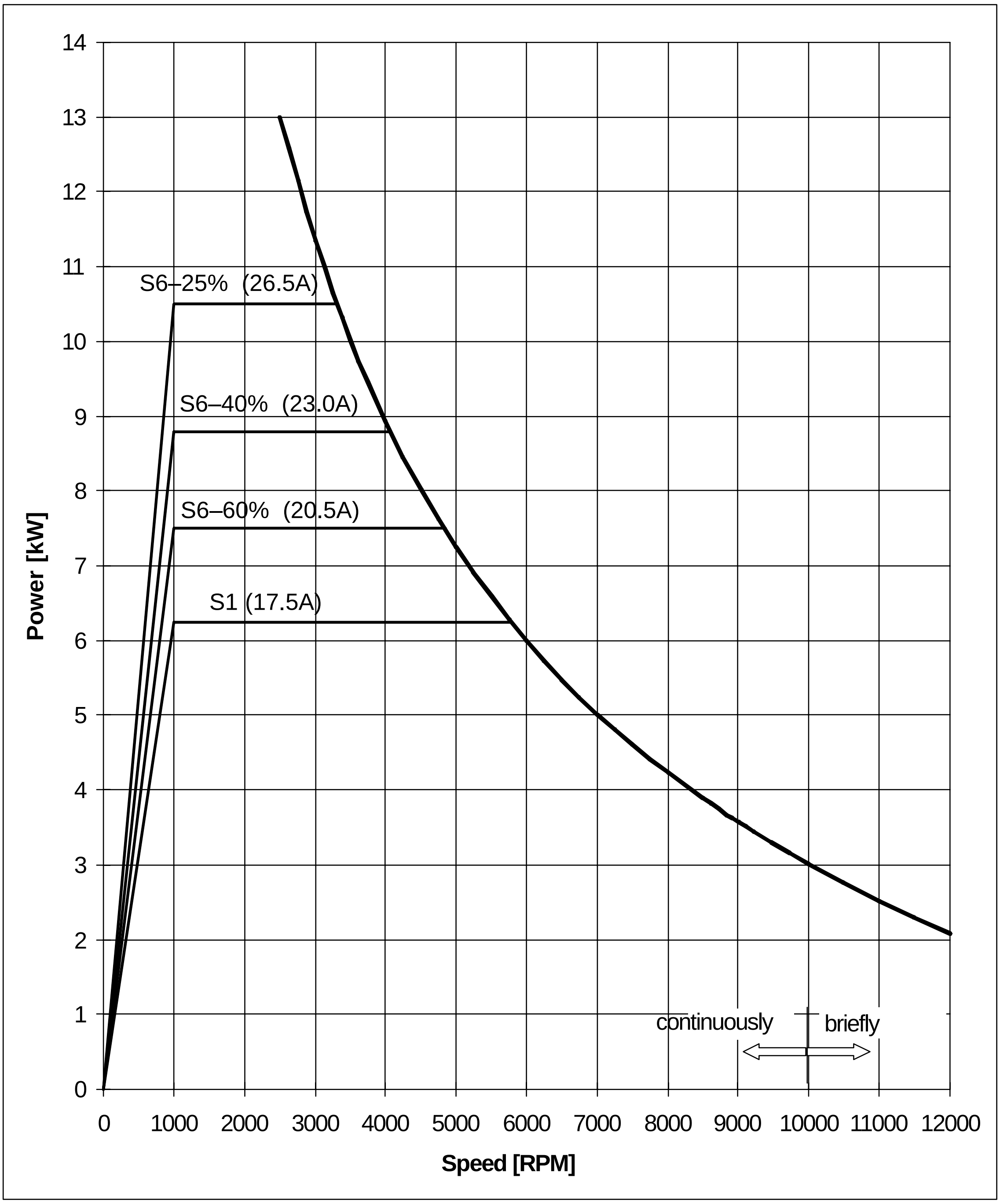


Fig. 3-12 Speed–power diagram 1PH7107-2ND□□–0**L**

1PH7

Table 3-13 AC main spindle motor 1PH7107–2NF□□

Rated output P_{rated} [kW]	Rated speed n_{rated} [RPM]	Rated torque M_{rated} [Nm]	Rated current I_{rated} [A]	Time constant (therm.) T_{th} [min]	Max. speed n_{max} [RPM]	Moment of inertia J [kgm²]	Weight m [kg]
9.0	1500	57	23.5	20	9000	0.029	63

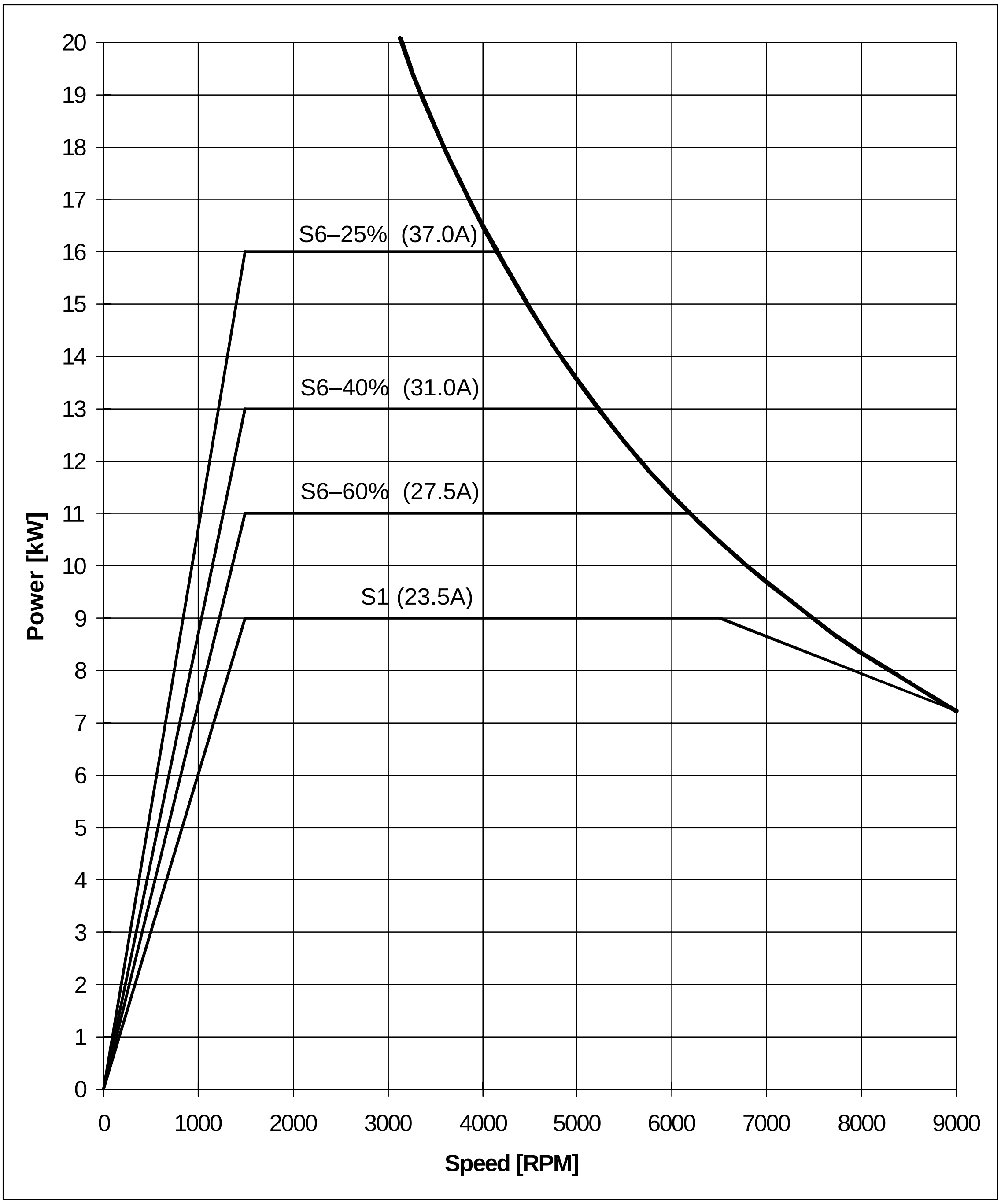


Fig. 3-13 Speed–power diagram 1PH7107–2NF□□

Table 3-14 AC main spindle motor 1PH7107–2NF□□–0**L**

Rated output P_{rated} [**kW**]	Rated speed n_{rated} [**RPM**]	Rated torque M_{rated} [**Nm**]	Rated current I_{rated} [**A**]	Time constant (therm.) T_{th} [**min**]	Max. speed n_{max} [**RPM**]	Moment of inertia J [**kgm²**]	Weight m [**kg**]
9.0	1500	57	23.5	20	12000	0.029	63

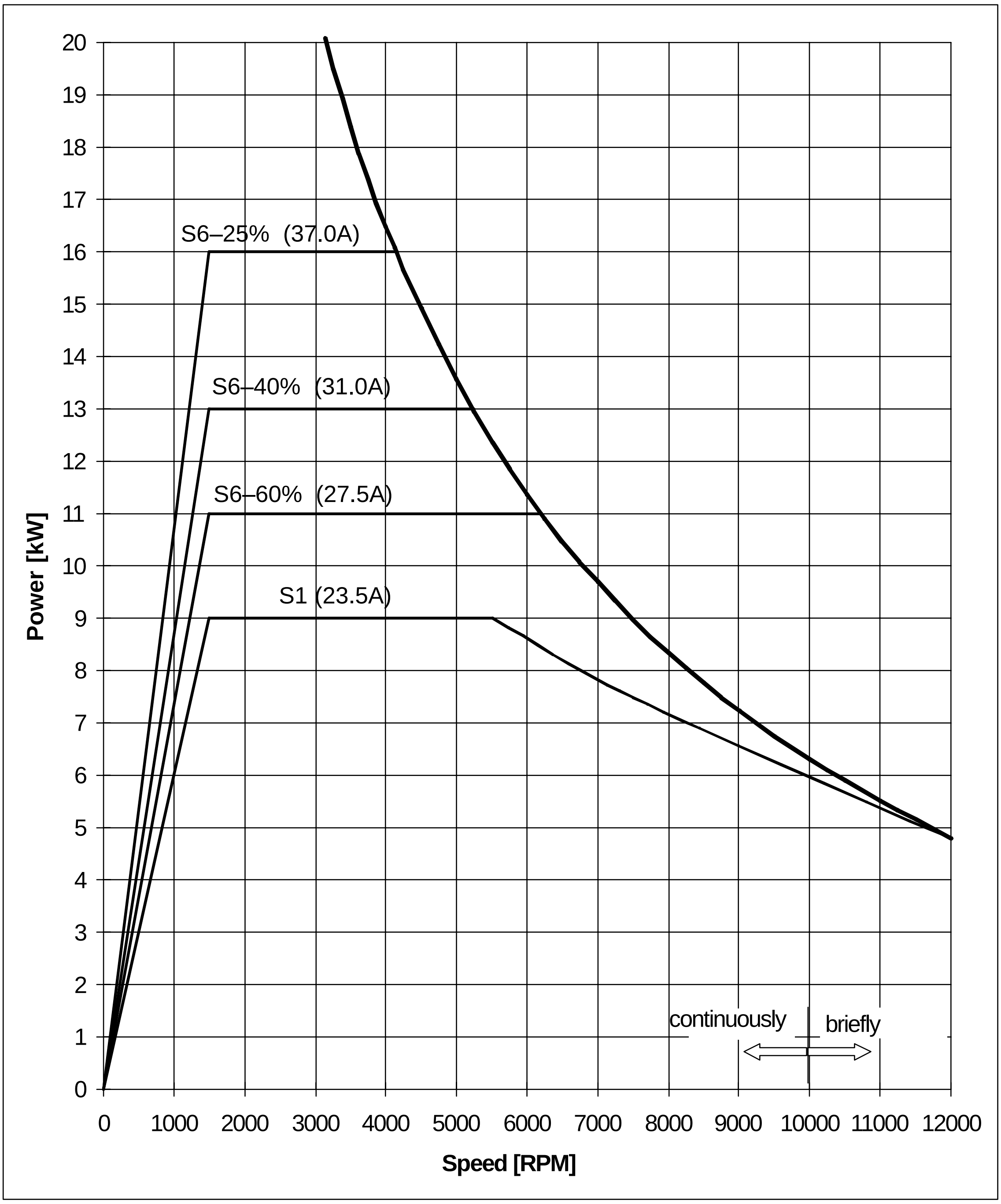


Fig. 3-14 Speed–power diagram 1PH7107–2NF□□–0**L**

1PH7

Table 3-15 AC main spindle motor 1PH7107-2NG

Rated output P_{rated} [kW]	Rated speed n_{rated} [RPM]	Rated torque M_{rated} [Nm]	Rated current I_{rated} [A]	Time constant (therm.) T_{th} [min]	Max. speed n_{max} [RPM]	Moment of inertia J [kgm^2]	Weight m [kg]
10.5	2000	50	26	20	9000	0.029	63

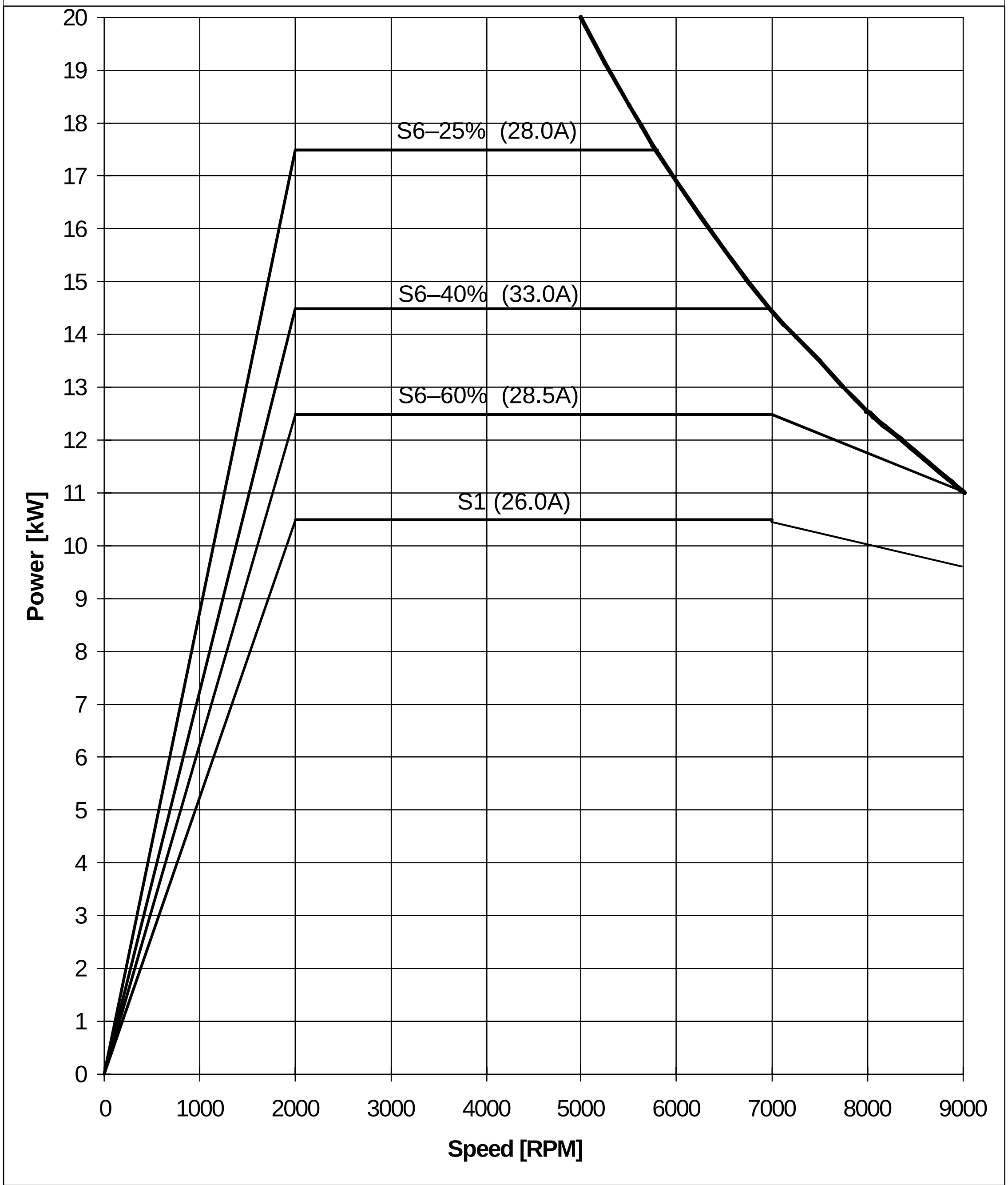


Fig. 3-15 Speed–power diagram 1PH7107-2NG

Table 3-16 AC main spindle motor 1PH7107-2NG□□–0**L**

Rated output P_{rated} [**kW**]	**Rated speed** n_{rated} [**RPM**]	**Rated torque** M_{rated} [**Nm**]	**Rated current** I_{rated} [**A**]	**Time constant (therm.)** T_{th} [**min**]	**Max. speed** n_{max} [**RPM**]	**Moment of inertia** J [**kgm²**]	**Weight** m [**kg**]
10.5	2000	50	26	20	12000	0.029	63

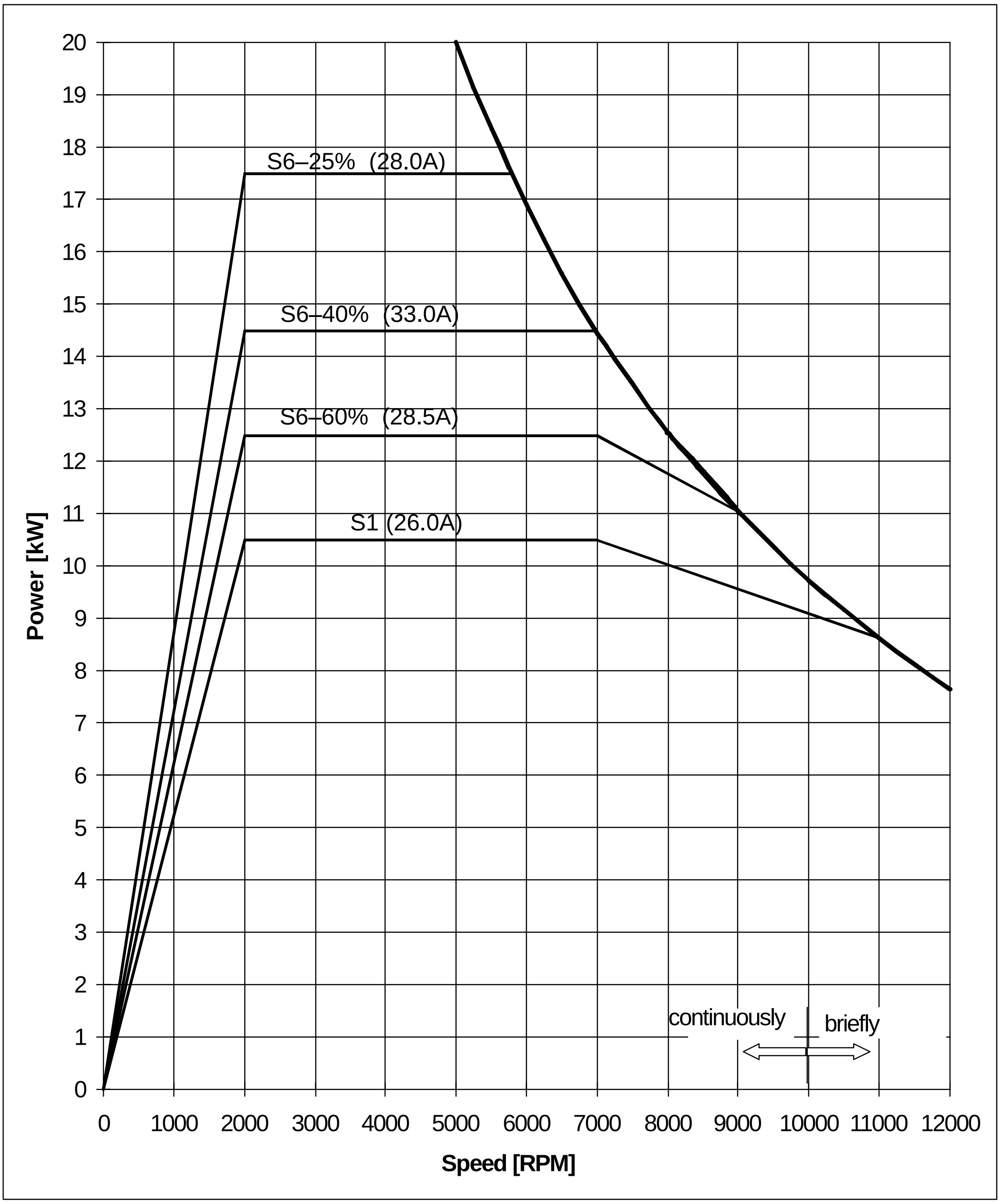


Fig. 3-16 Speed–power diagram 1PH7107-2NG□□–0**L**

1PH7

Table 3-17 AC main spindle motor 1PH7131–2NF□□

Rated output P_{rated} [kW]	Rated speed n_{rated} [RPM]	Rated torque M_{rated} [Nm]	Rated current I_{rated} [A]	Time constant (therm.) T_{th} [min]	Max. speed n_{max} [RPM]	Moment of inertia J [kgm^2]	Weight m [kg]
11	1500	70	24	30	8000	0.076	90

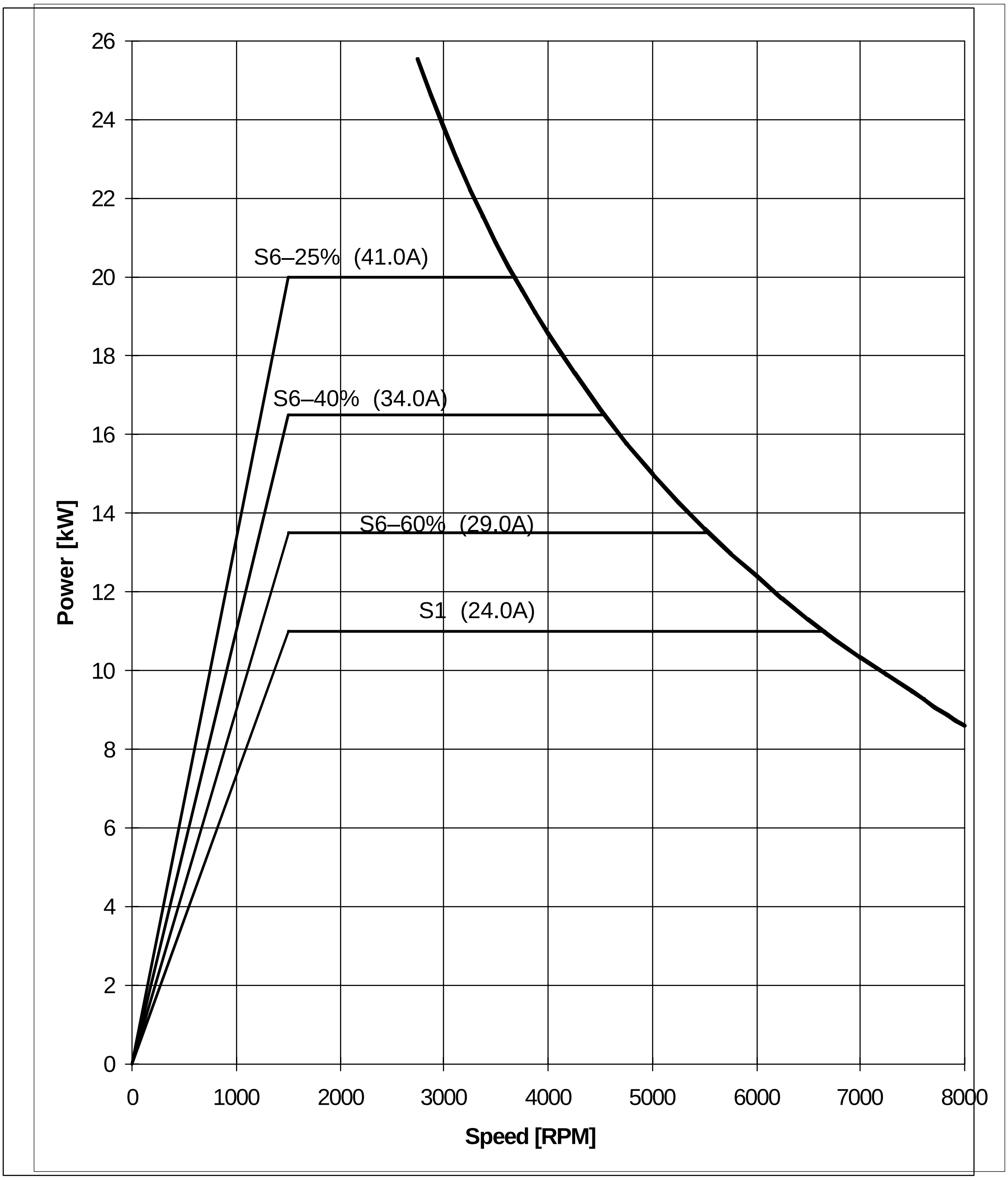


Fig. 3-17 Speed–power diagram 1PH7131–2NF□□

Table 3-18 AC main spindle motor 1PH7131–2NF□□–0**L**

Rated output P_{rated} [kW]	Rated speed n_{rated} [RPM]	Rated torque M_{rated} [Nm]	Rated current I_{rated} [A]	Time constant (therm.) T_{th} [min]	Max. speed n_{max} [RPM]	Moment of inertia J [kgm^2]	Weight m [kg]
11	1500	70	24	30	10000	0.076	90

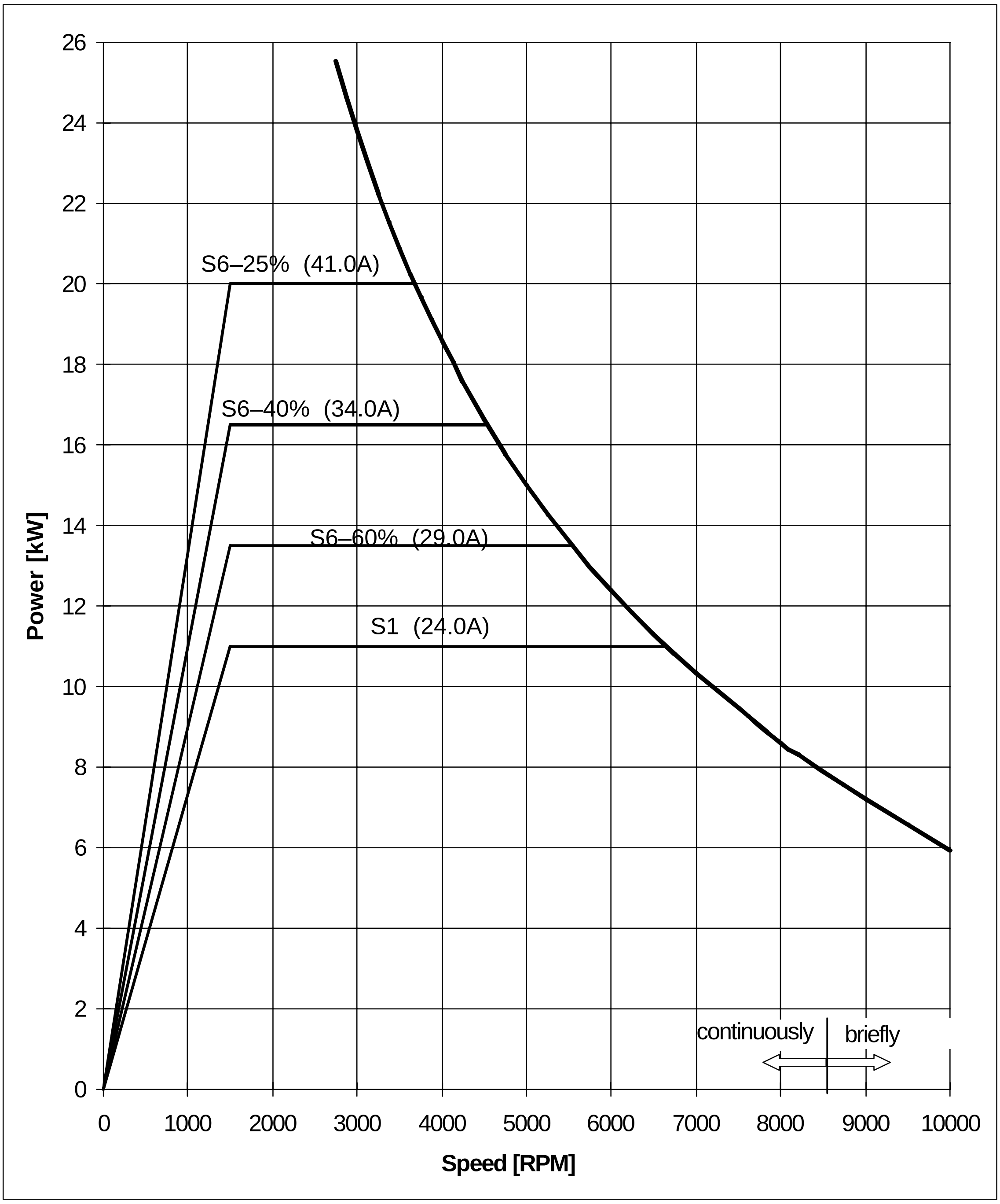


Fig. 3-18 Speed–power diagram 1PH7131–2NF□□–0**L**

1PH7

Table 3-19 AC main spindle motor 1PH7133–2ND□□

Rated output P_{rated} [kW]	Rated speed n_{rated} [RPM]	Rated torque M_{rated} [Nm]	Rated current I_{rated} [A]	Time constant (therm.) T_{th} [min]	Max. speed n_{max} [RPM]	Moment of inertia J [kgm^2]	Weight m [kg]
12	1000	115	30	30	8000	0.076	90

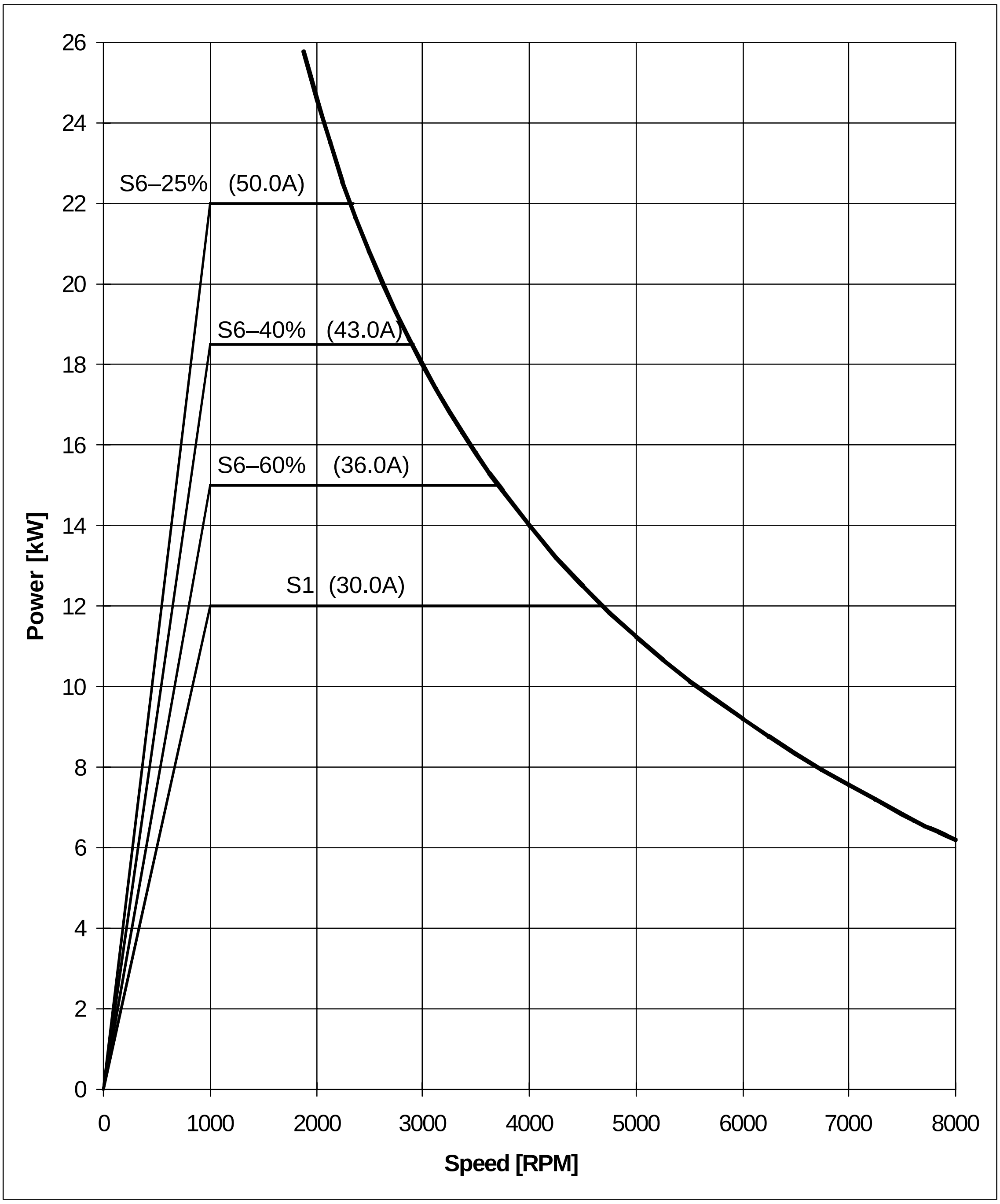


Fig. 3-19 Speed–power diagram 1PH7133–2ND□□

Table 3-20 AC main spindle motor 1PH7133–2ND□□–0**L**

Rated output P_{rated} [kW]	Rated speed n_{rated} [RPM]	Rated torque M_{rated} [Nm]	Rated current I_{rated} [A]	Time constant (therm.) T_{th} [min]	Max. speed n_{max} [RPM]	Moment of inertia J [kgm²]	Weight m [kg]
12	1000	115	30	30	10000	0.076	90

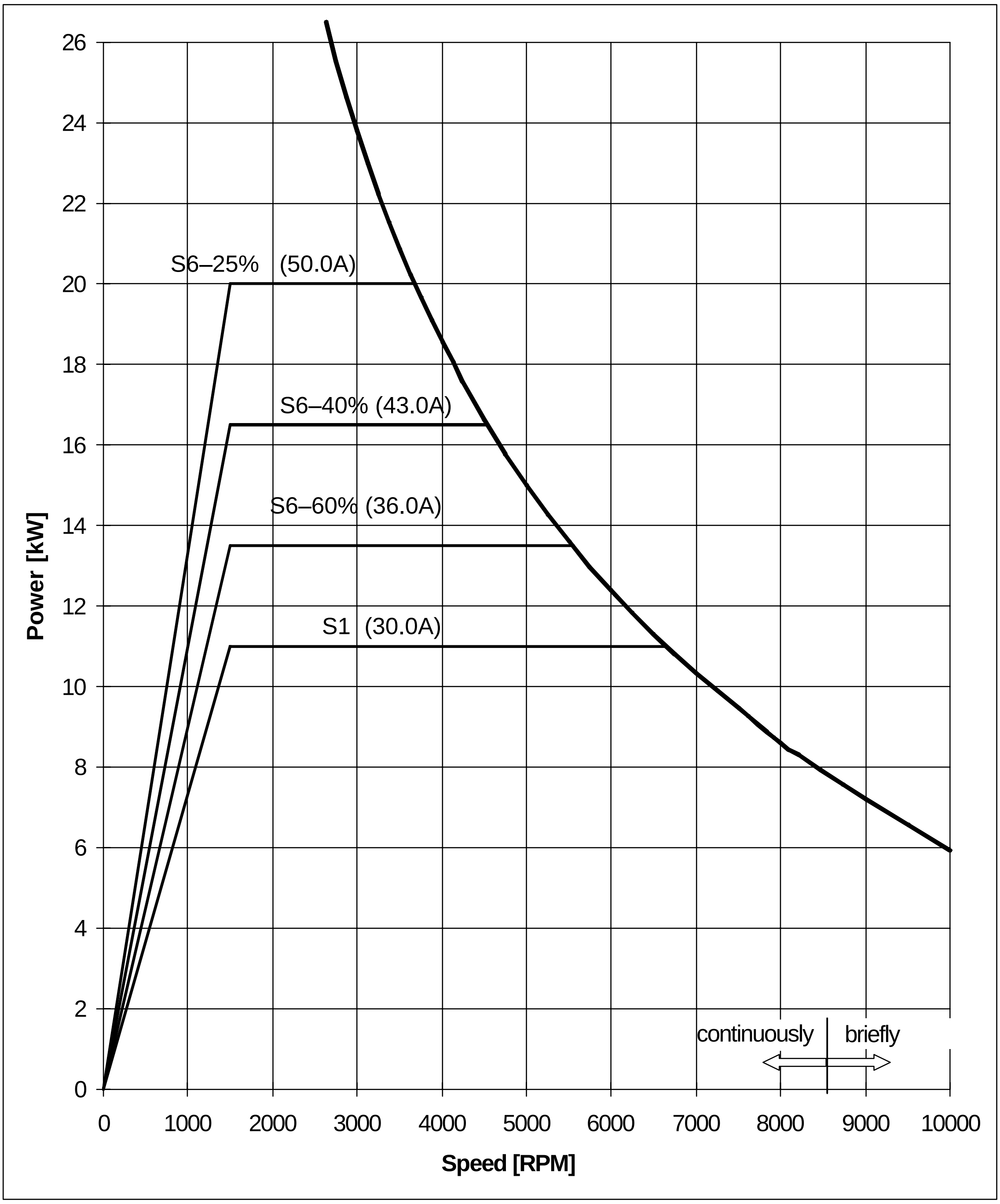


Fig. 3-20 Speed–power diagram 1PH7133–2ND□□–0**L**

1PH7

Table 3-21 AC main spindle motor 1PH7133-2NF

Rated output P_{rated} [kW]	Rated speed n_{rated} [RPM]	Rated torque M_{rated} [Nm]	Rated current I_{rated} [A]	Time constant (therm.) T_{th} [min]	Max. speed n_{max} [RPM]	Moment of inertia J [kgm^2]	Weight m [kg]
15	1500	95	34	30	8000	0.076	90

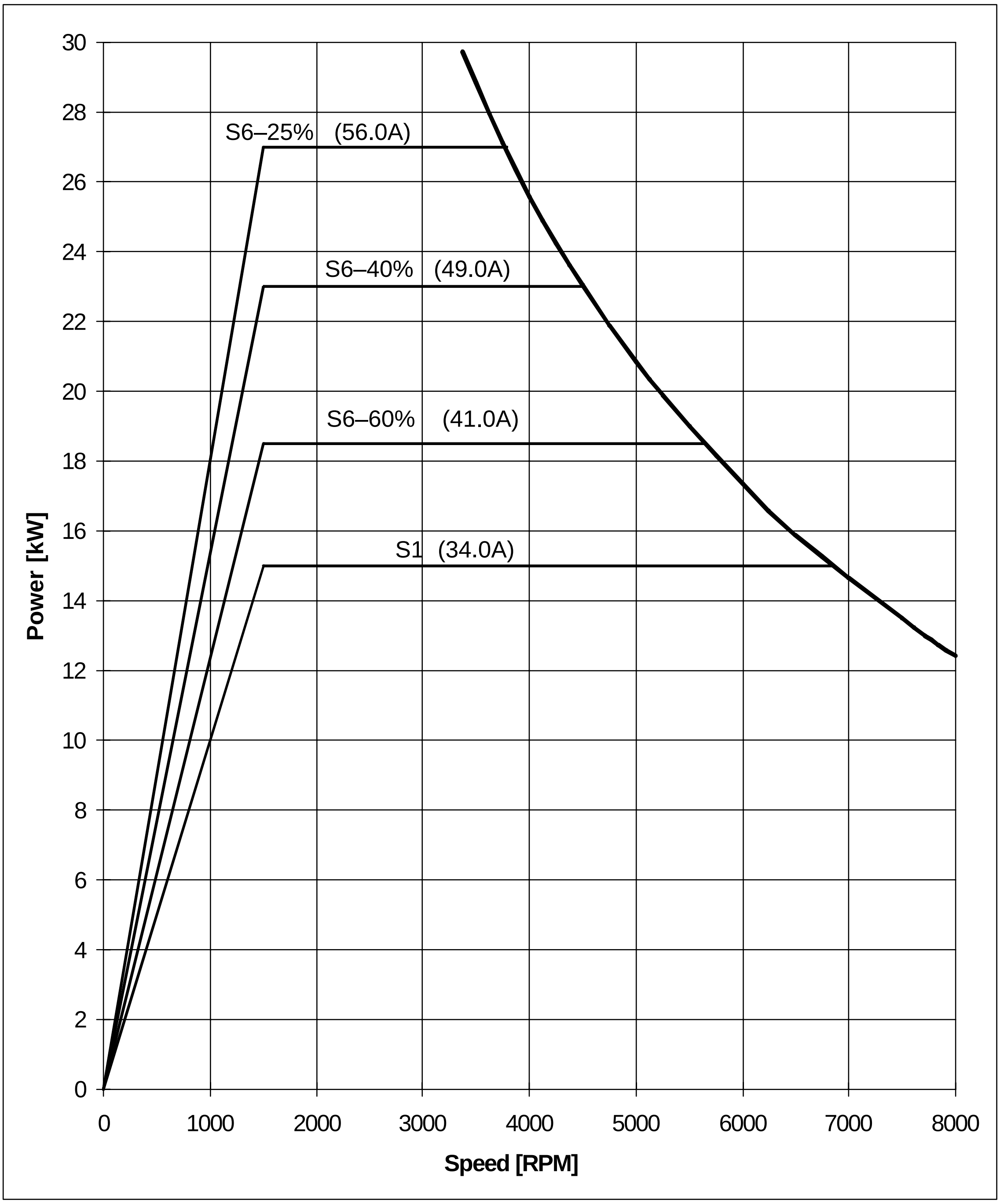


Fig. 3-21 Speed–power diagram 1PH7133-2NF

Table 3-22 AC main spindle motor 1PH7133-2NF□□–0**L**

Rated output P_{rated} [kW]	Rated speed n_{rated} [RPM]	Rated torque M_{rated} [Nm]	Rated current I_{rated} [A]	Time constant (therm.) T_{th} [min]	Max. speed n_{max} [RPM]	Moment of inertia J [kgm^2]	Weight m [kg]
15	1500	95	34	30	10000	0.076	90

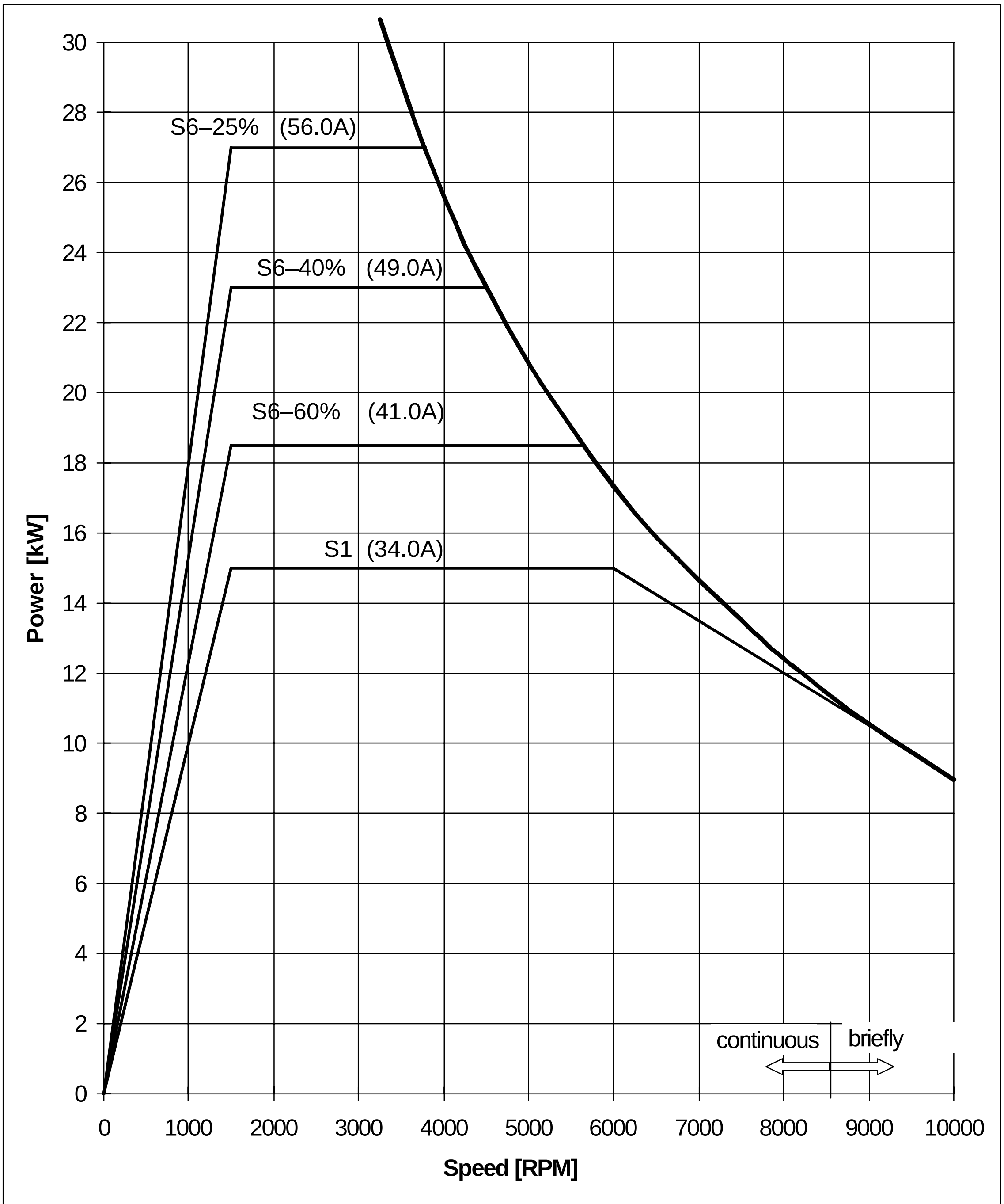


Fig. 3-22 Speed–power diagram 1PH7133-2NF□□–0**L**

1PH7

Table 3-23 AC main spindle motor 1PH7133–2NG□□

Rated output P_{rated} [kW]	Rated speed n_{rated} [RPM]	Rated torque M_{rated} [Nm]	Rated current I_{rated} [A]	Time constant (therm.) T_{th} [min]	Max. speed n_{max} [RPM]	Moment of inertia J [kgm²]	Weight m [kg]
20	2000	95	45	30	8000	0.076	90

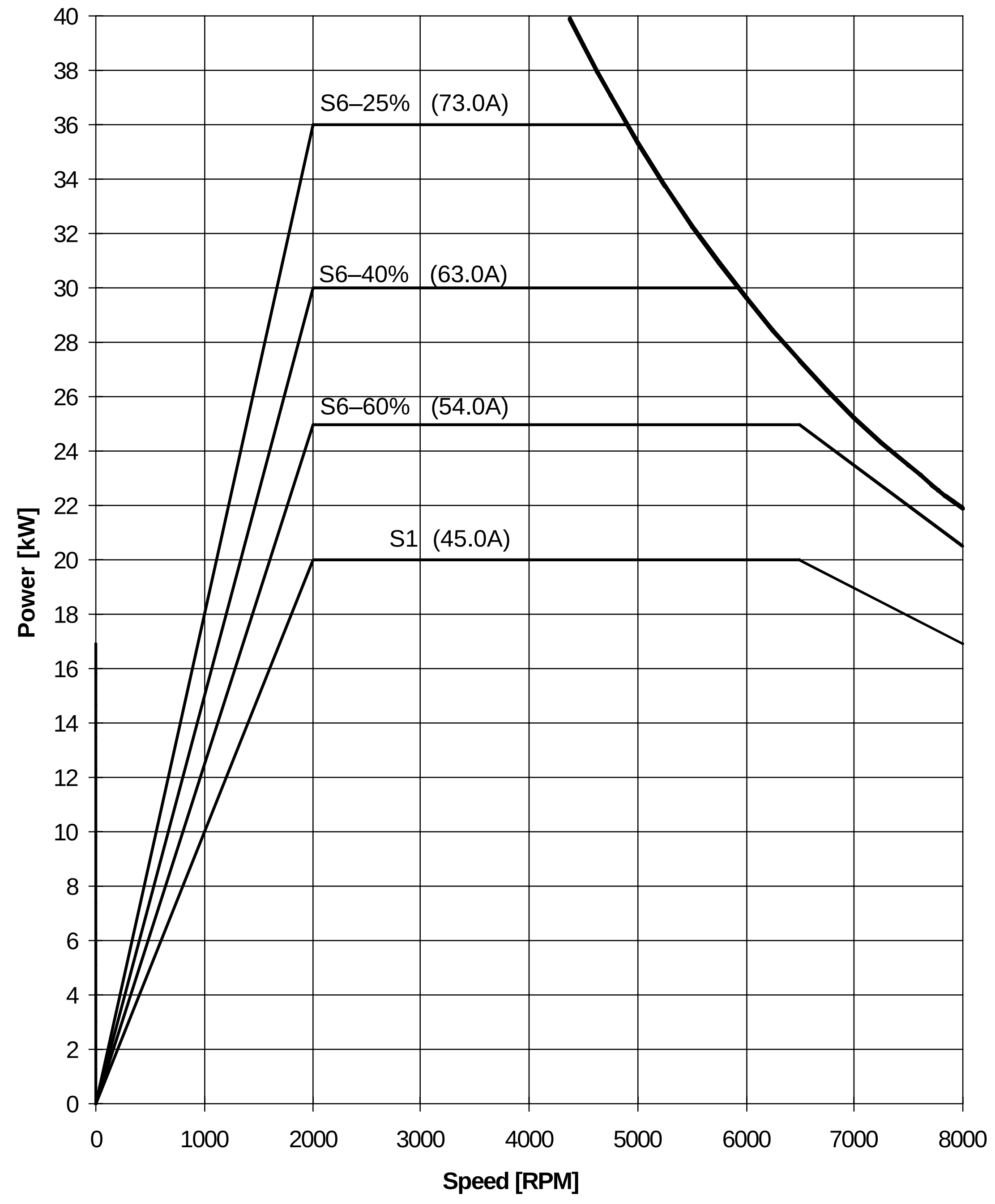


Fig. 3-23 Speed–power diagram 1PH7133–2NG□□

Table 3-24 AC main spindle motor 1PH7133–2NG□□–0**L**

Rated output P_{rated} [**kW**]	**Rated speed** n_{rated} [**RPM**]	**Rated torque** M_{rated} [**Nm**]	**Rated current** I_{rated} [**A**]	**Time constant (therm.)** T_{th} [**min**]	**Max. speed** n_{max} [**RPM**]	**Moment of inertia** J [**kgm²**]	**Weight** m [**kg**]
20	2000	95	45	30	10000	0.076	90

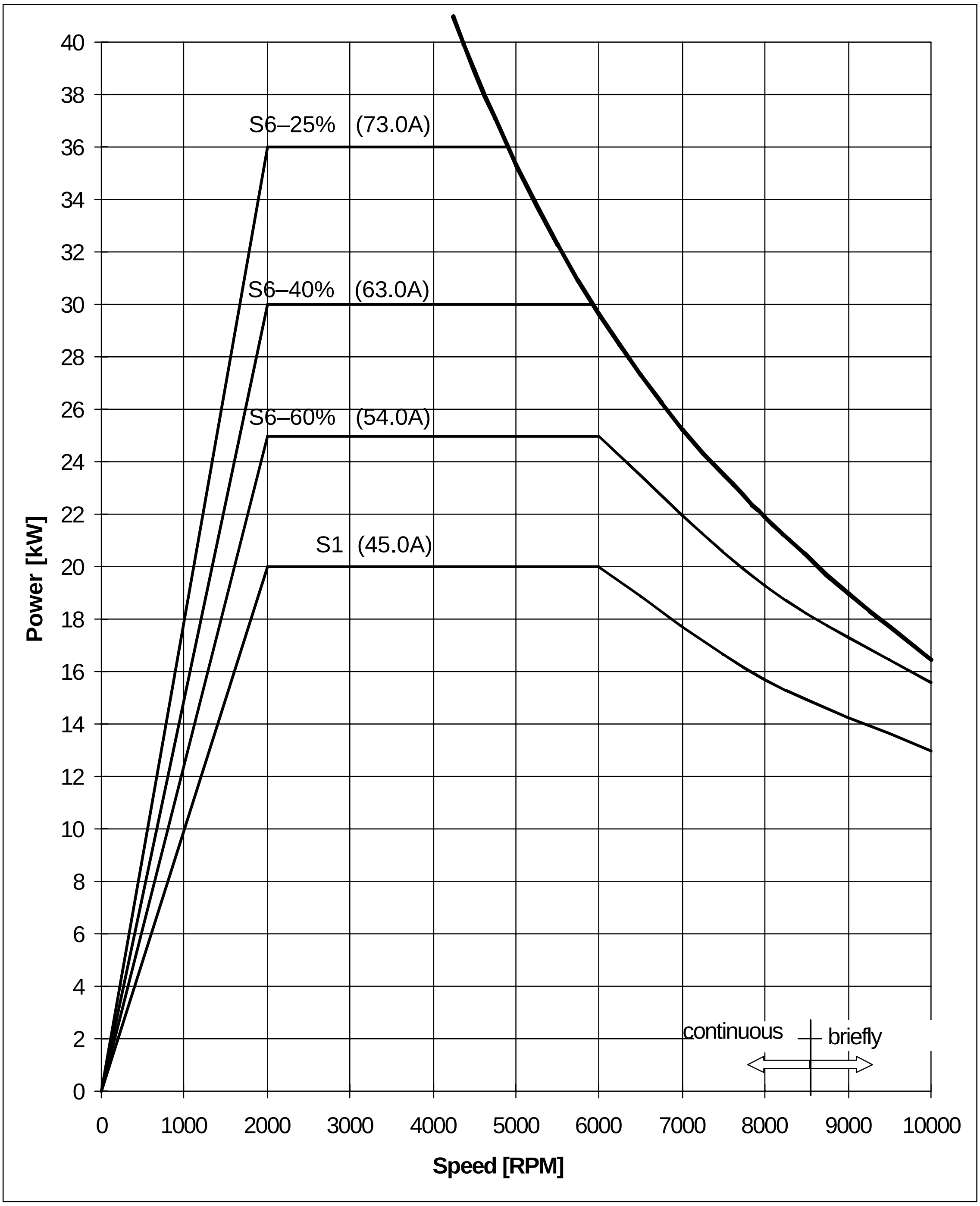


Fig. 3-24 Speed–power diagram 1PH7133–2NG□□–0**L**

1PH7

Table 3-25 AC main spindle motor 1PH7135-2NF

Rated output P_{rated} [kW]	Rated speed n_{rated} [RPM]	Rated torque M_{rated} [Nm]	Rated current I_{rated} [A]	Time constant (therm.) T_{th} [min]	Max. speed n_{max} [RPM]	Moment of inertia J [kgm^2]	Weight m [kg]
18.5	1500	118	42	30	8000	0.109	130

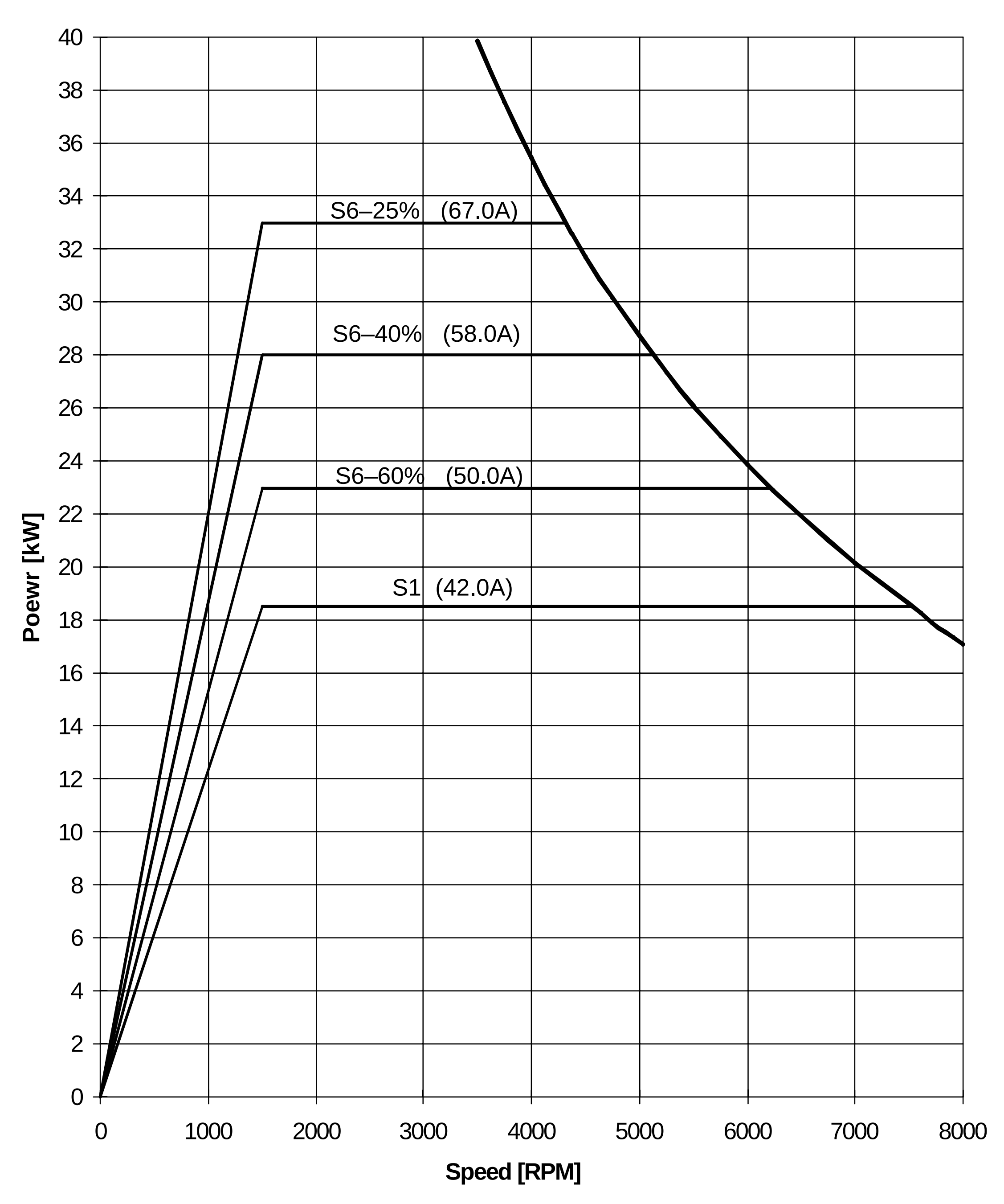


Fig. 3-25 Speed–power diagram 1PH7135-2NF

Table 3-26 AC main spindle motor 1PH7135-2NF□□–0**L**

Rated output P_{rated} [**kW**]	**Rated speed** n_{rated} [**RPM**]	**Rated torque** M_{rated} [**Nm**]	**Rated current** I_{rated} [**A**]	**Time constant (therm.)** T_{th} [**min**]	**Max. speed** n_{max} [**RPM**]	**Moment of inertia** J [kgm^2]	**Weight** m [**kg**]
18.5	1500	118	42	30	10000	0.109	130

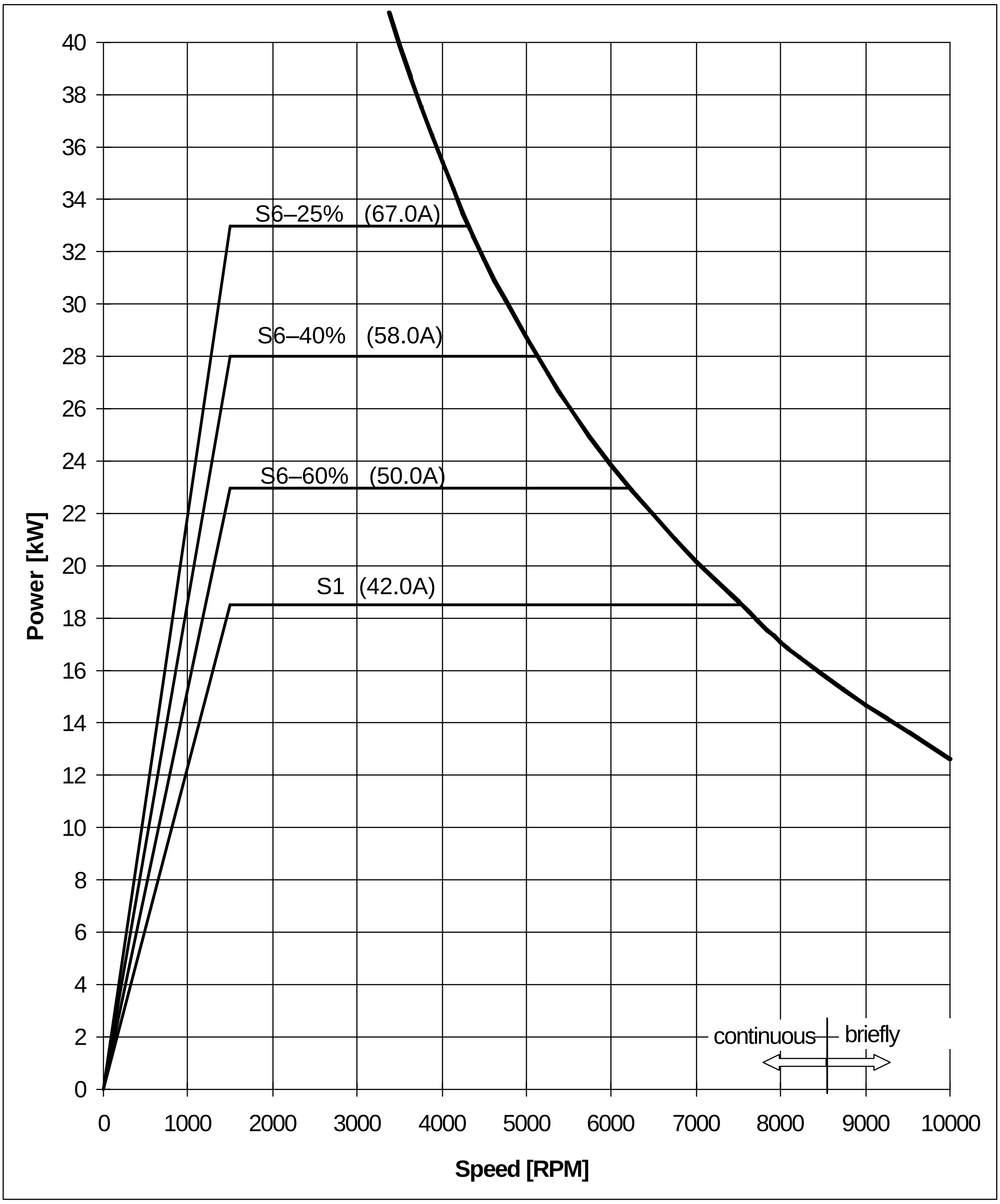


Fig. 3-26 Speed–power diagram 1PH7135-2NF□□–0**L**

Table 3-27 AC main spindle motor 1PH7137–2ND□□

Rated output P_{rated} [kW]	Rated speed n_{rated} [RPM]	Rated torque M_{rated} [Nm]	Rated current I_{rated} [A]	Time constant (therm.) T_{th} [min]	Max. speed n_{max} [RPM]	Moment of inertia J [kgm^2]	Weight m [kg]
17	1000	162	43	30	8000	0.109	130

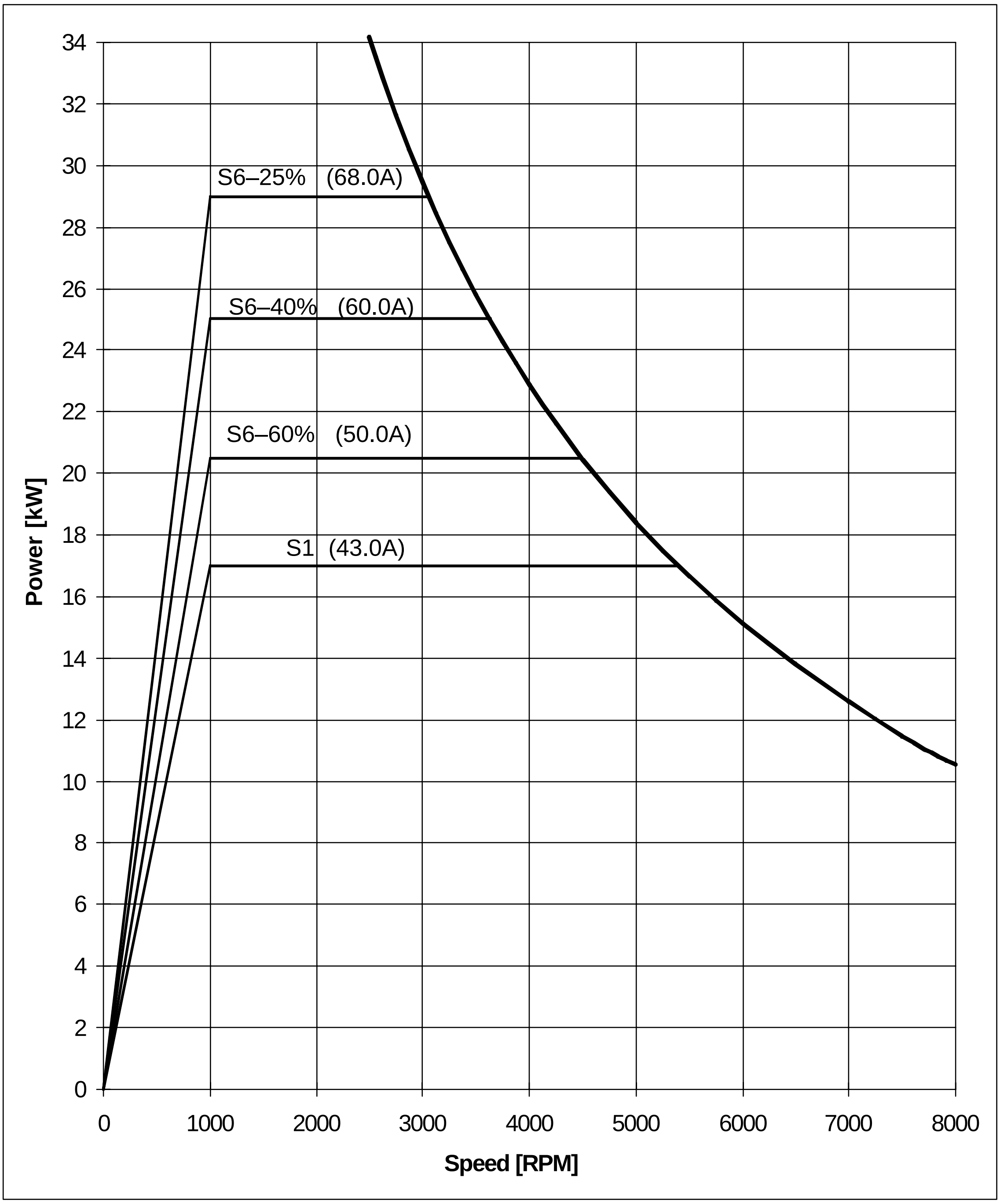


Fig. 3-27 Speed–power diagram 1PH7137–2ND□□

Table 3-28 AC main spindle motor 1PH7137–2ND□□–0**L**

Rated output P_{rated} [kW]	Rated speed n_{rated} [RPM]	Rated torque M_{rated} [Nm]	Rated current I_{rated} [A]	Time constant (therm.) T_{th} [min]	Max. speed n_{max} [RPM]	Moment of inertia J [kgm^2]	Weight m [kg]
17	1000	162	43	30	10000	0.109	130

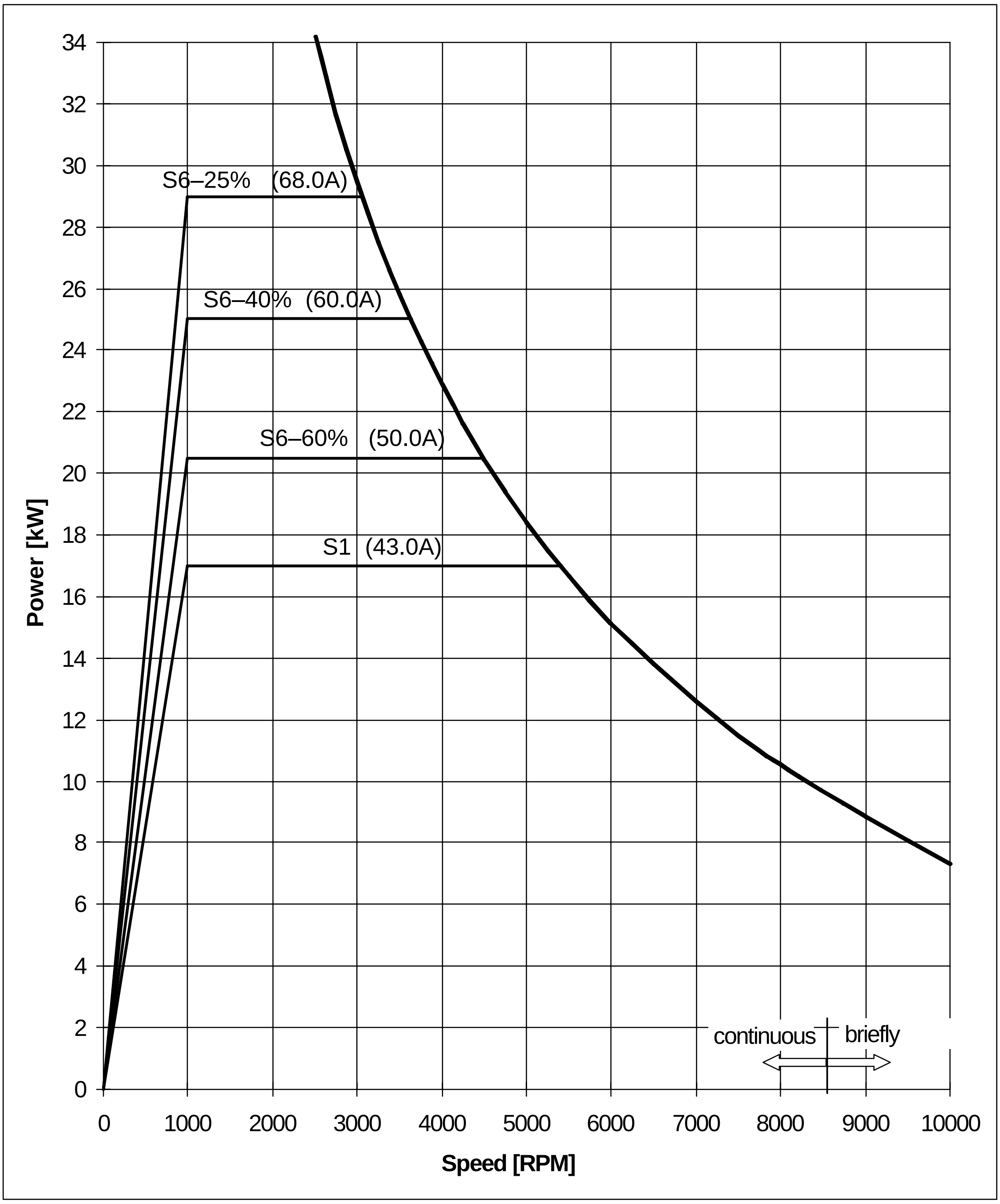


Fig. 3-28 Speed–power diagram 1PH7137–2ND□□–0**L**

1PH7

Table 3-29 AC main spindle motor 1PH7137–2NF□□

Rated output P_{rated} [**kW**]	**Rated speed** n_{rated} [**RPM**]	**Rated torque** M_{rated} [**Nm**]	**Rated current** I_{rated} [**A**]	**Time constant (therm.)** T_{th} [**min**]	**Max. speed** n_{max} [**RPM**]	**Moment of inertia** J [**kgm²**]	**Weight** m [**kg**]
28	1500	134	57	30	8000	0.109	130

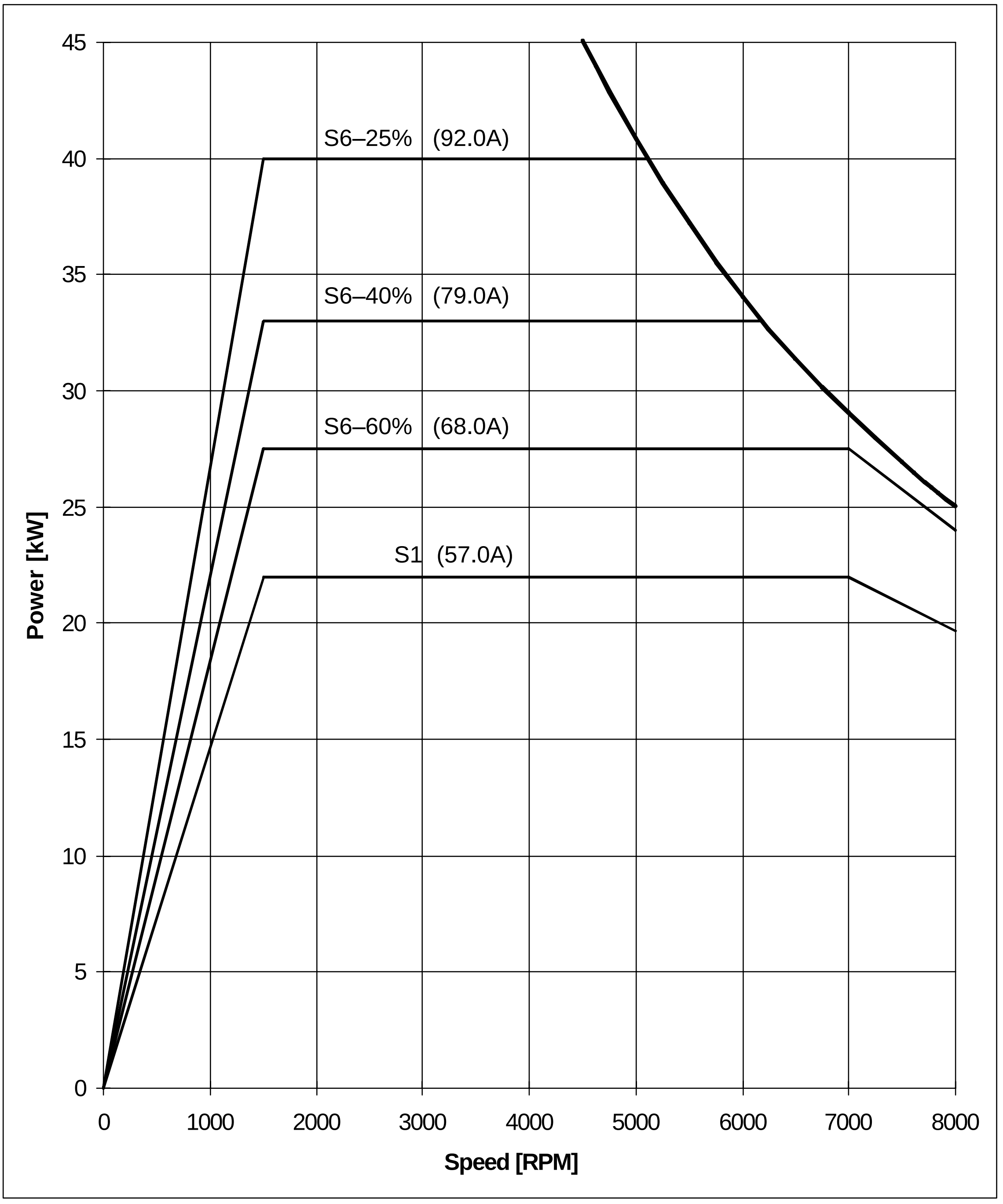


Fig. 3-29 Speed–power diagram 1PH7137–2NF□□

Table 3-30 AC main spindle motor 1PH7137–2NF□□–0**L**

Rated output P_{rated} [kW]	Rated speed n_{rated} [RPM]	Rated torque M_{rated} [Nm]	Rated current I_{rated} [A]	Time constant (therm.) T_{th} [min]	Max. speed n_{max} [RPM]	Moment of inertia J [kgm^2]	Weight m [kg]
28	1500	134	57	30	10000	0.109	130

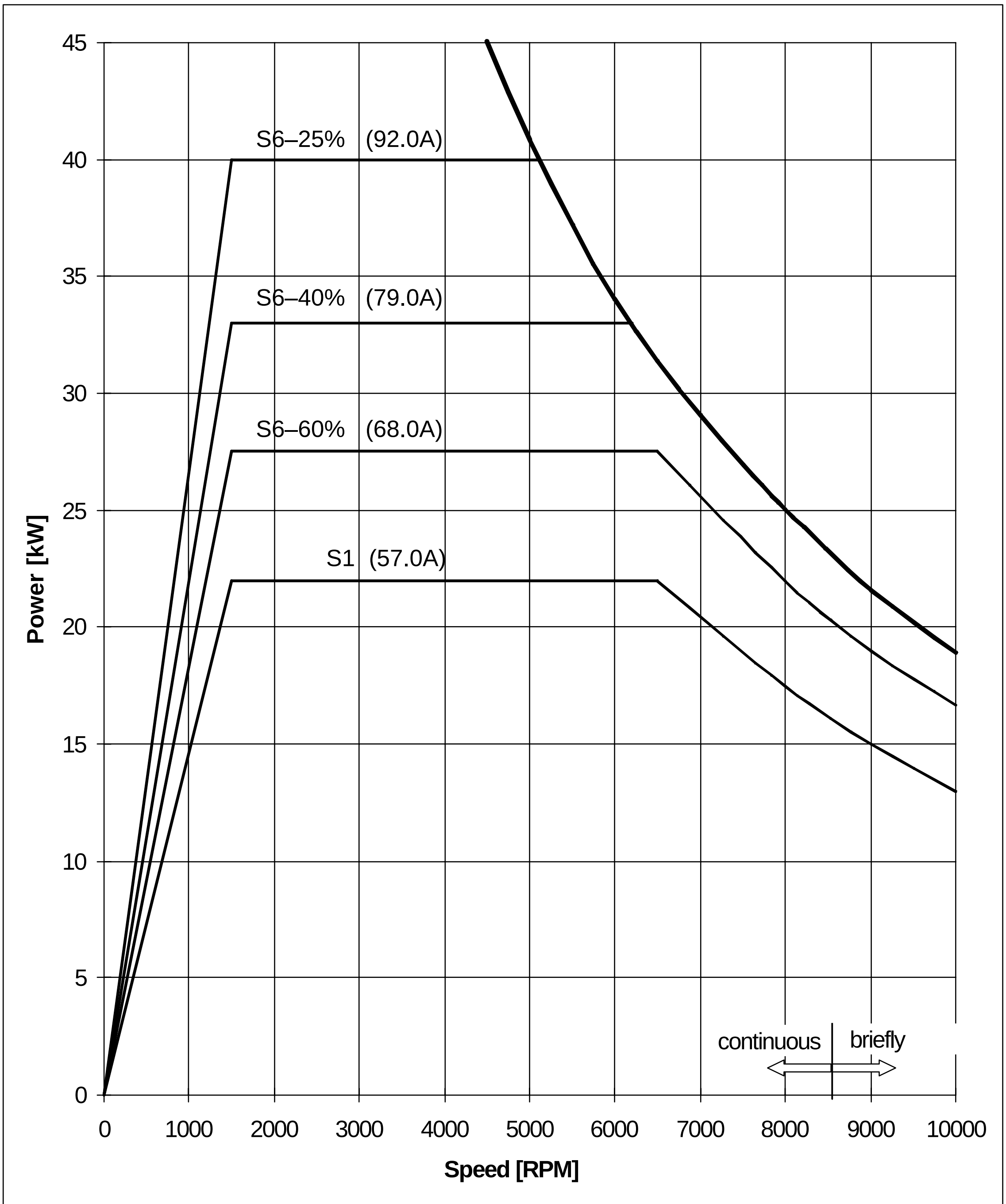


Fig. 3-30 Speed–power diagram 1PH7137–2NF□□–0**L**

1PH7

Table 3-31 AC main spindle motor 1PH7137–2NG□□

Rated output P_{rated} [kW]	Rated speed n_{rated} [RPM]	Rated torque M_{rated} [Nm]	Rated current I_{rated} [A]	Time constant (therm.) T_{th} [min]	Max. speed n_{max} [RPM]	Moment of inertia J [kgm^2]	Weight m [kg]
28	2000	134	60	30	8000	0.109	130

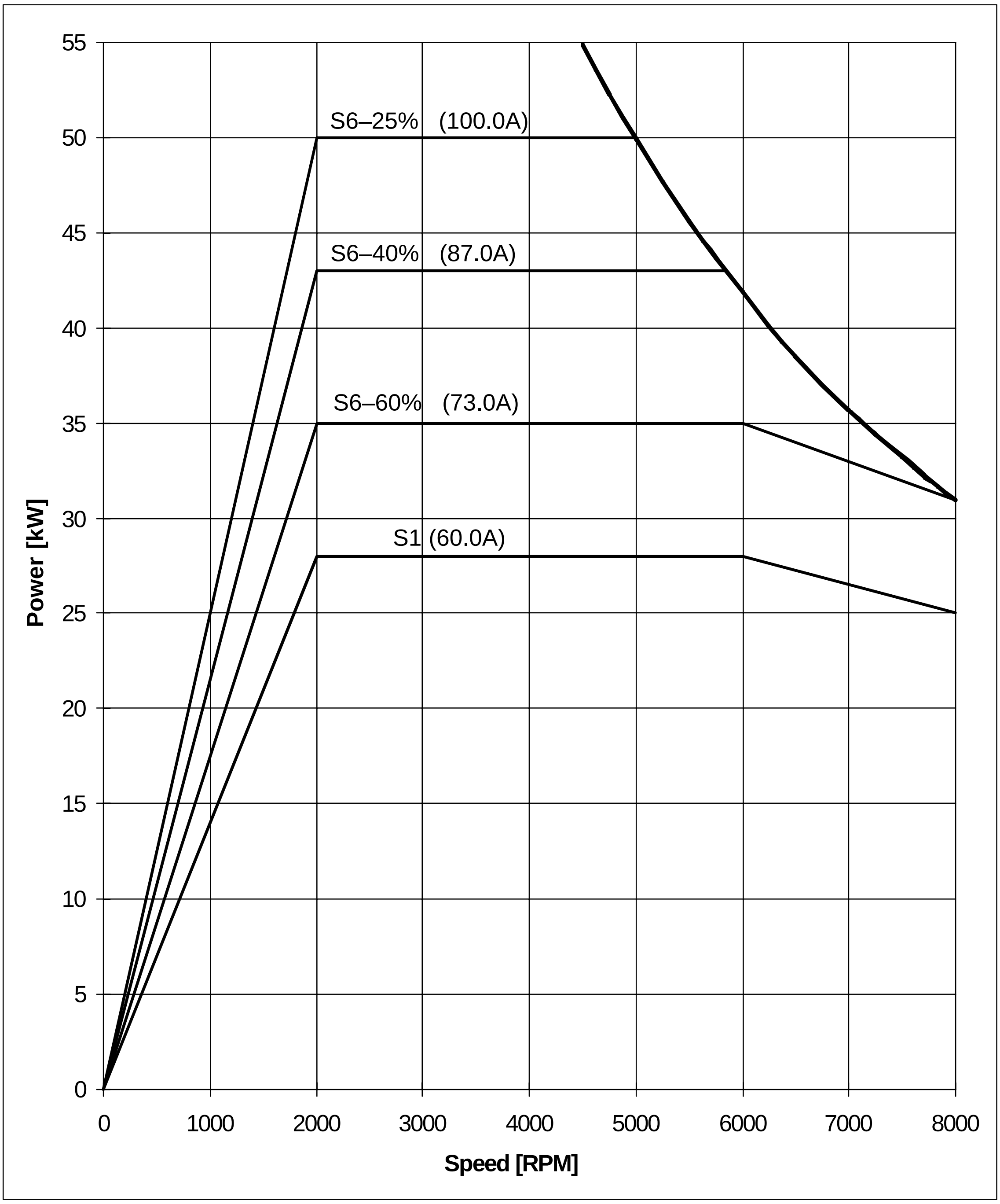


Fig. 3-31 Speed–power diagram 1PH7137–2NG□□

Table 3-32 AC main spindle motor 1PH7137–2NG□□–0**L**

Rated output P_{rated} [kW]	Rated speed n_{rated} [RPM]	Rated torque M_{rated} [Nm]	Rated current I_{rated} [A]	Time constant (therm.) T_{th} [min]	Max. speed n_{max} [RPM]	Moment of inertia J [kgm^2]	Weight m [kg]
28	2000	134	60	30	10000	0.109	130

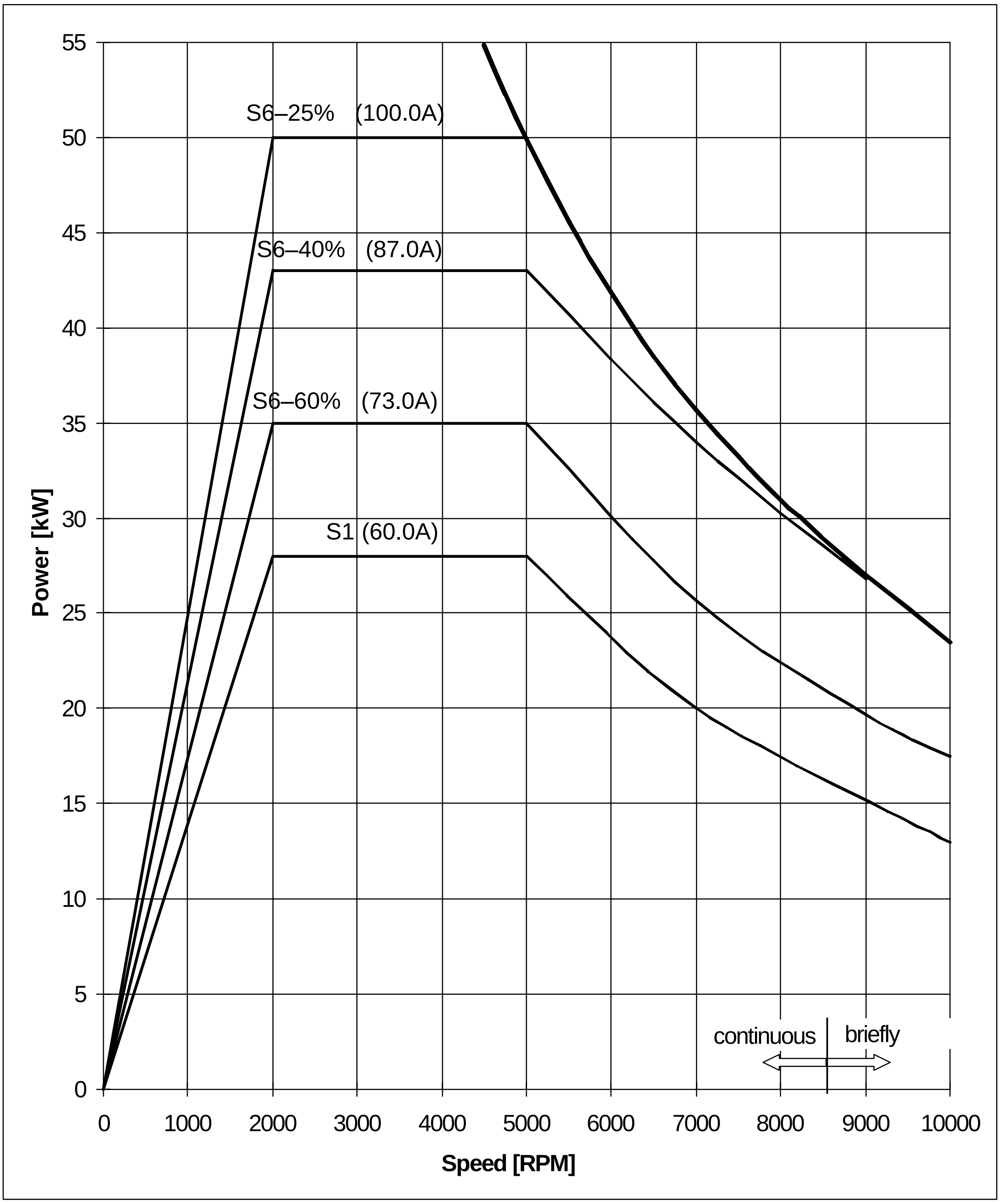


Fig. 3-32 Speed–power diagram 1PH7137–2NG□□–0**L**

1PH7

Table 3-33 AC main spindle motor 1PH7163-2NB

Rated output P_{rated} [**kW**]	**Rated speed** n_{rated} [**RPM**]	**Rated torque** M_{rated} [**Nm**]	**Rated current** I_{rated} [**A**]	**Time constant (therm.)** T_{th} [**min**]	**Max. speed** n_{max} [**RPM**]	**Moment of inertia** **J** [**kgm^2**]	**Weight** **m** [**kg**]
12	500	229	30	35	6500	0.19	180

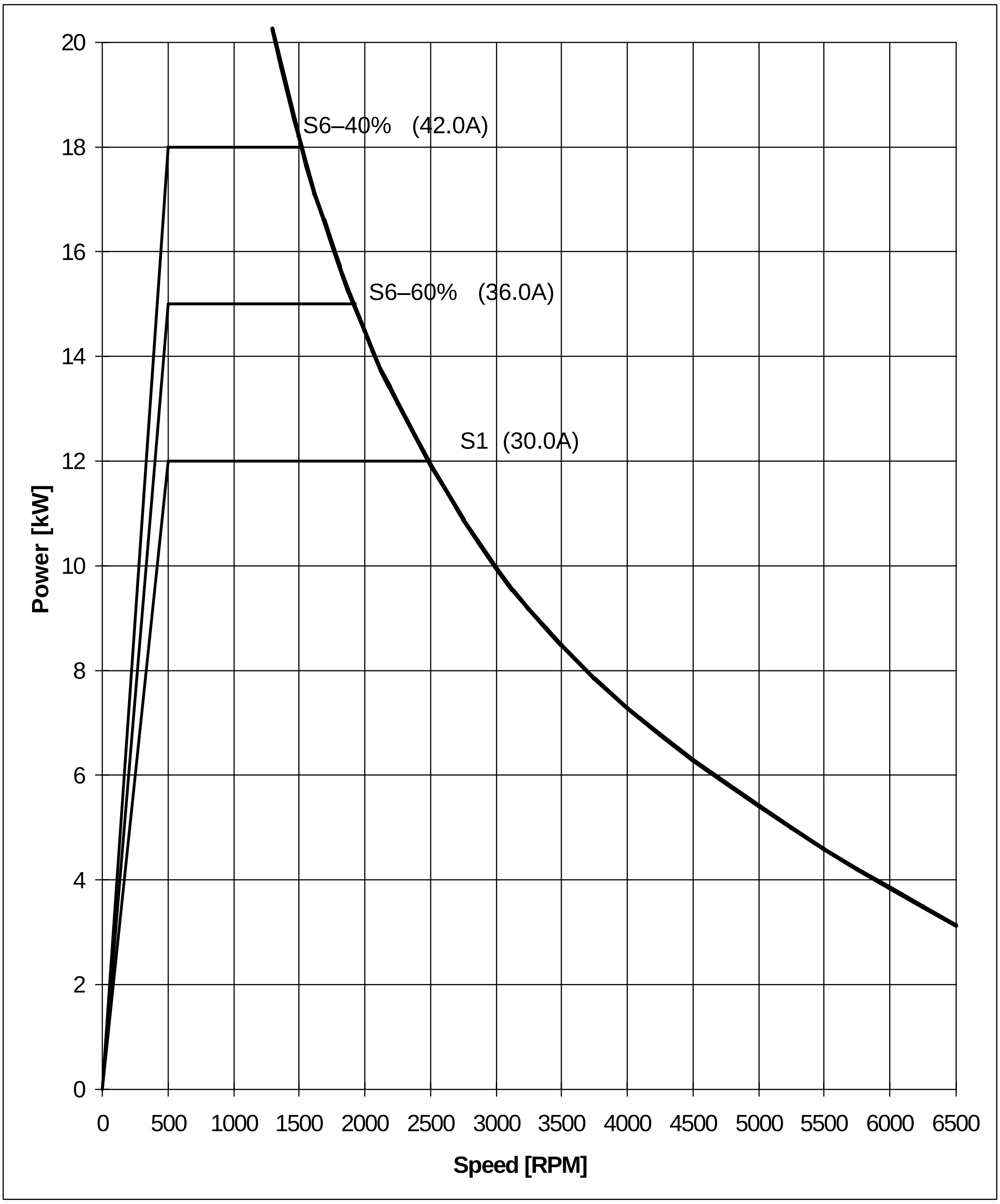


Fig. 3-33 Speed–power diagram 1PH7163-2NB

Table 3-34 AC main spindle motor 1PH7163-2NB□□–0**L**

Rated output P_{rated} [kW]	Rated speed n_{rated} [RPM]	Rated torque M_{rated} [Nm]	Rated current I_{rated} [A]	Time constant (therm.) T_{th} [min]	Max. speed n_{max} [RPM]	Moment of inertia J [kgm²]	Weight m [kg]
12	500	229	30	35	8000	0.19	180

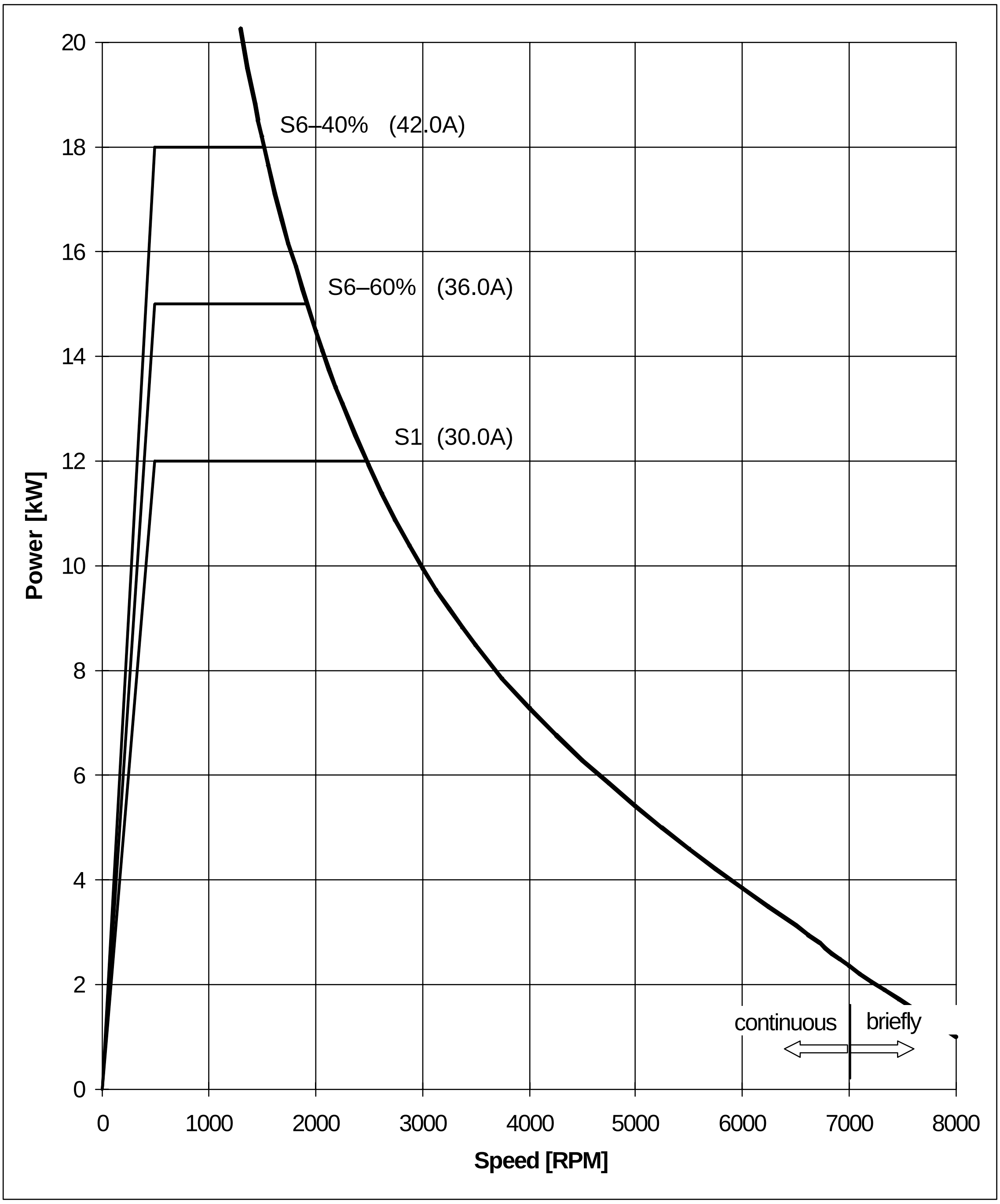


Fig. 3-34 Speed–power diagram 1PH7163-2NB□□–0**L**

Table 3-35 AC main spindle motor 1PH7163–2ND□□

Rated output P_{rated} [kW]	Rated speed n_{rated} [RPM]	Rated torque M_{rated} [Nm]	Rated current I_{rated} [A]	Time constant (therm.) T_{th} [min]	Max. speed n_{max} [RPM]	Moment of inertia J [kgm^2]	Weight m [kg]
22	1000	210	55	35	6500	0.19	180

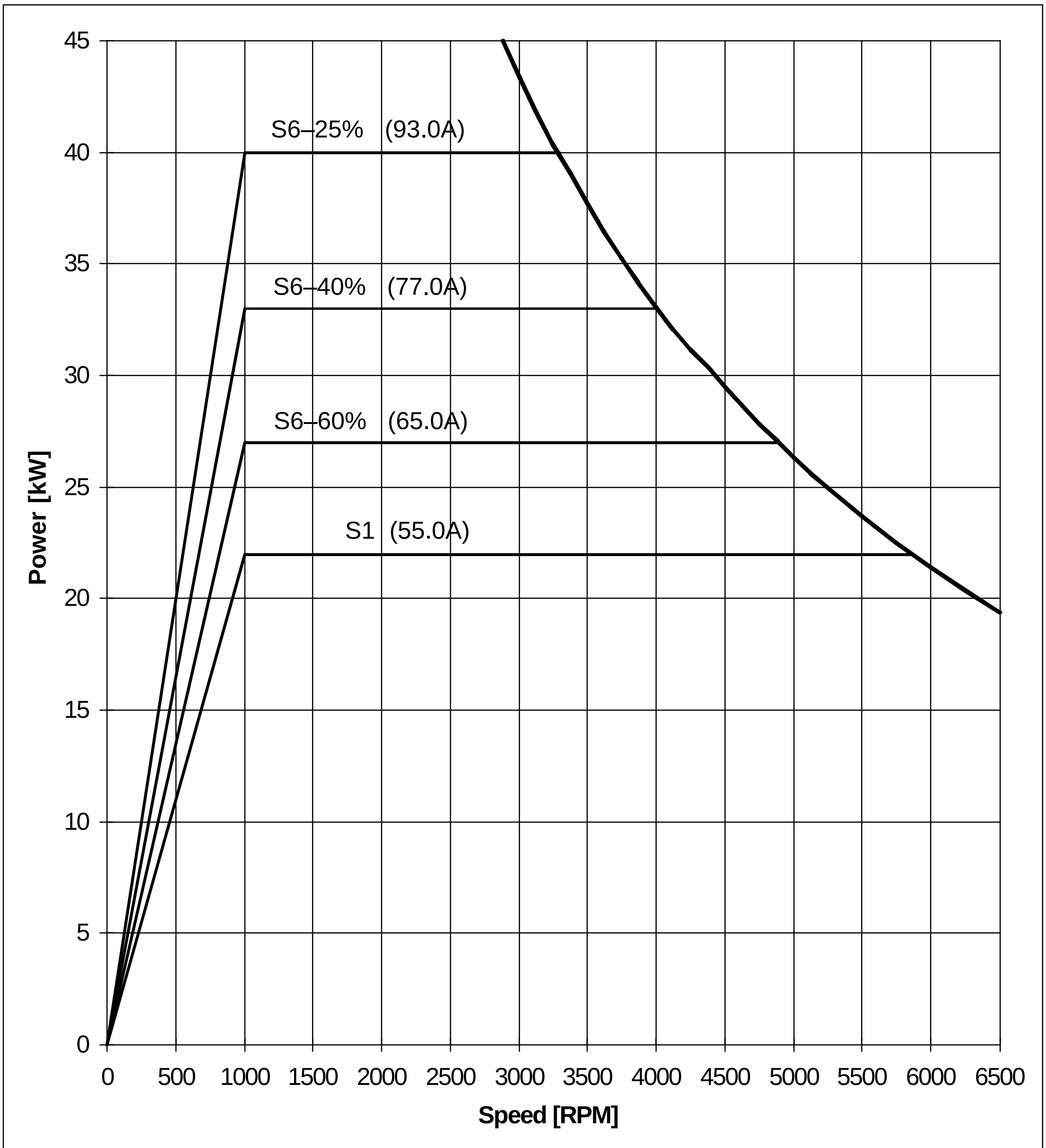


Fig. 3-35 Speed–power diagram 1PH7163–2ND□□

Table 3-36 AC main spindle motor 1PH7163–2ND□□–0**L**

Rated output P_{rated} [kW]	Rated speed n_{rated} [RPM]	Rated torque M_{rated} [Nm]	Rated current I_{rated} [A]	Time constant (therm.) T_{th} [min]	Max. speed n_{max} [RPM]	Moment of inertia J [kgm²]	Weight m [kg]
22	1000	210	55	35	8000	0.19	180

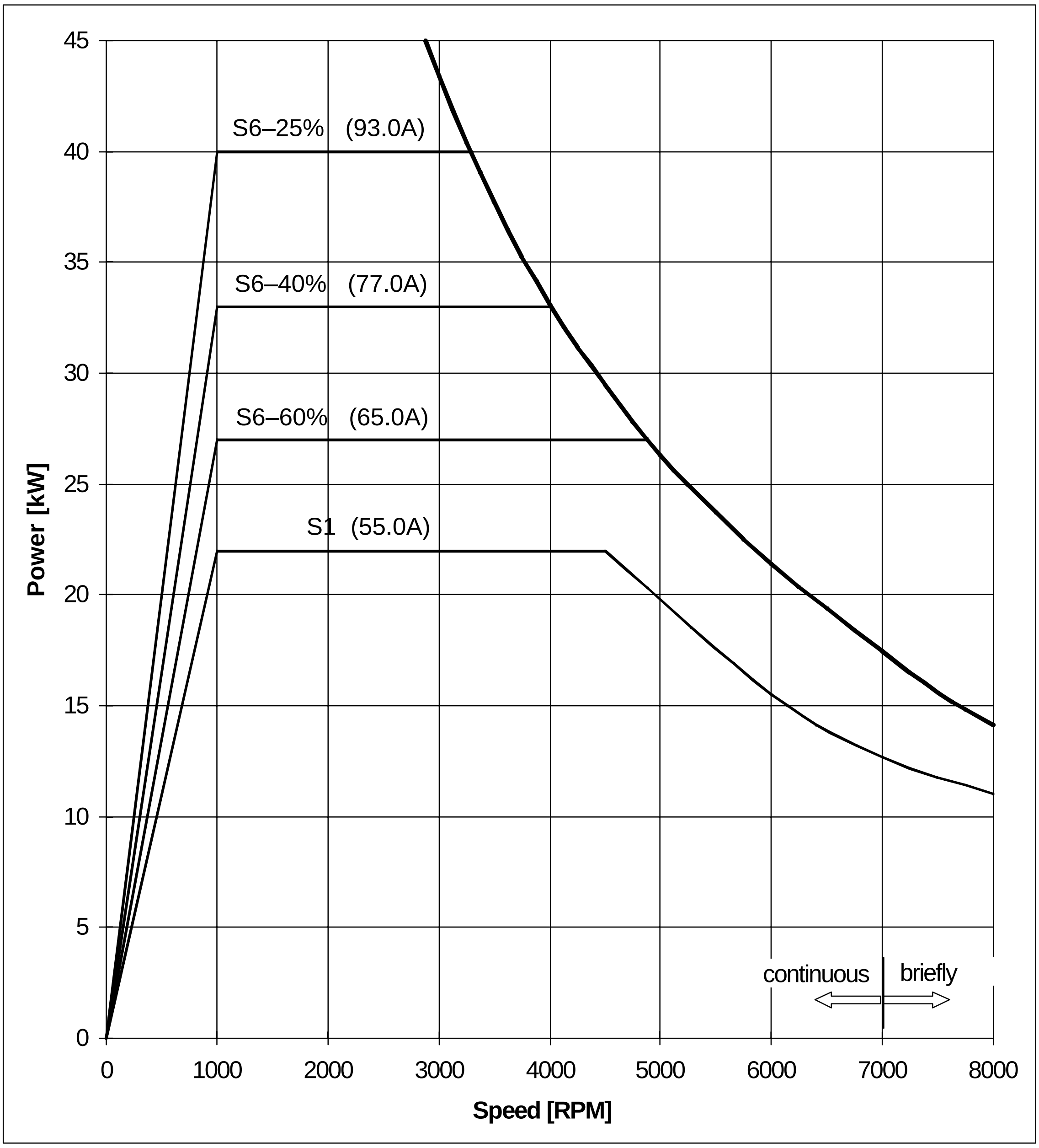


Fig. 3-36 Speed–power diagram 1PH7163–2ND□□–0**L**

Speed [RPM]

1PH7

Table 3-37 AC main spindle motor 1PH7163–2NF□□

Rated output P_{rated} [kW]	Rated speed n_{rated} [RPM]	Rated torque M_{rated} [Nm]	Rated current I_{rated} [A]	Time constant (therm.) T_{th} [min]	Max. speed n_{max} [RPM]	Moment of inertia J [kgm^2]	Weight m [kg]
30	1500	191	72	35	6500	0.19	180

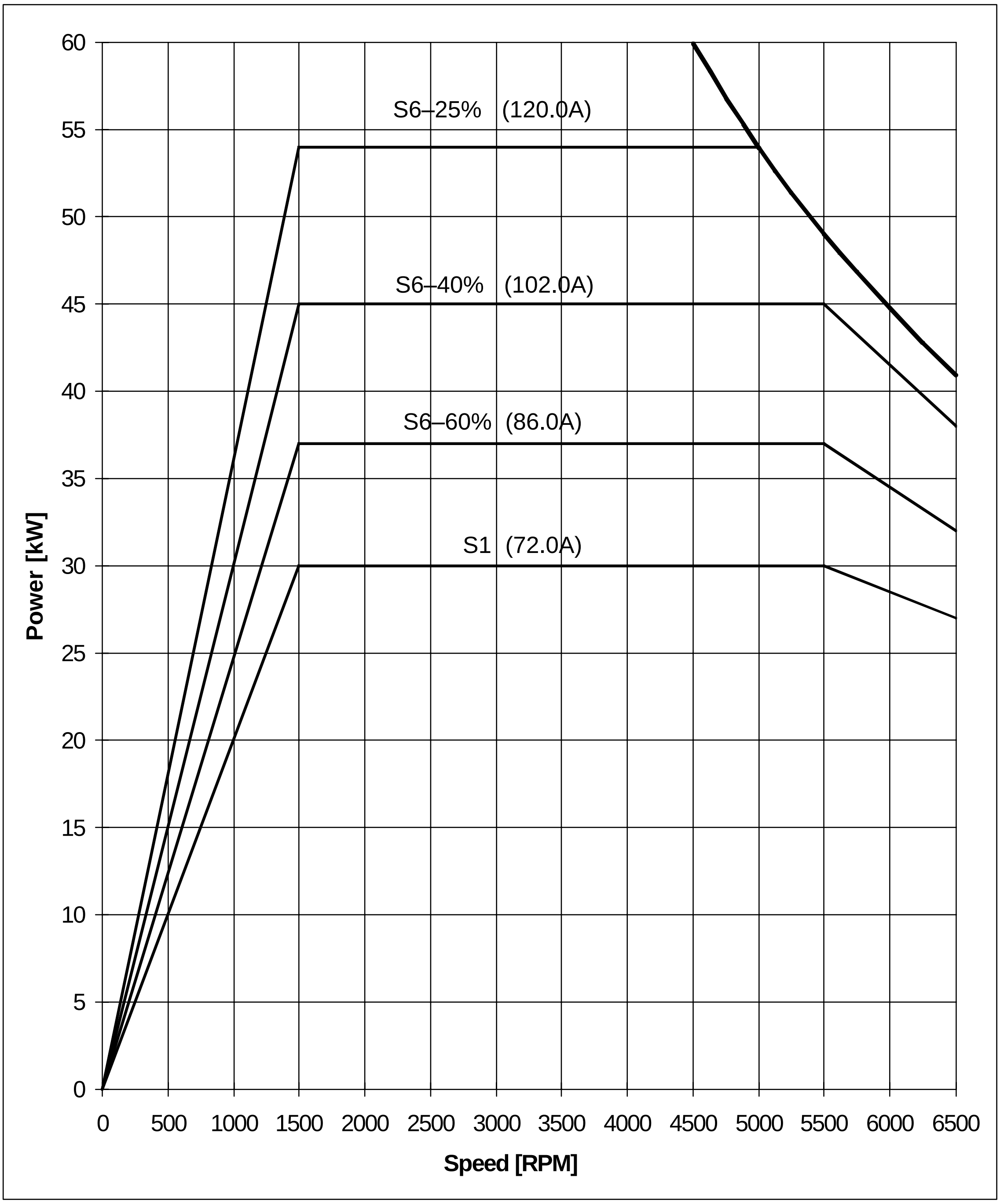


Fig. 3-37 Speed–power diagram 1PH7163–2NF□□

Table 3-38 AC main spindle motor 1PH7163–2NF□□–0**L**

Rated output P_{rated} [kW]	Rated speed n_{rated} [RPM]	Rated torque M_{rated} [Nm]	Rated current I_{rated} [A]	Time constant (therm.) T_{th} [min]	Max. speed n_{max} [RPM]	Moment of inertia J [kgm²]	Weight m [kg]
30	1500	191	72	35	8000	0.19	180

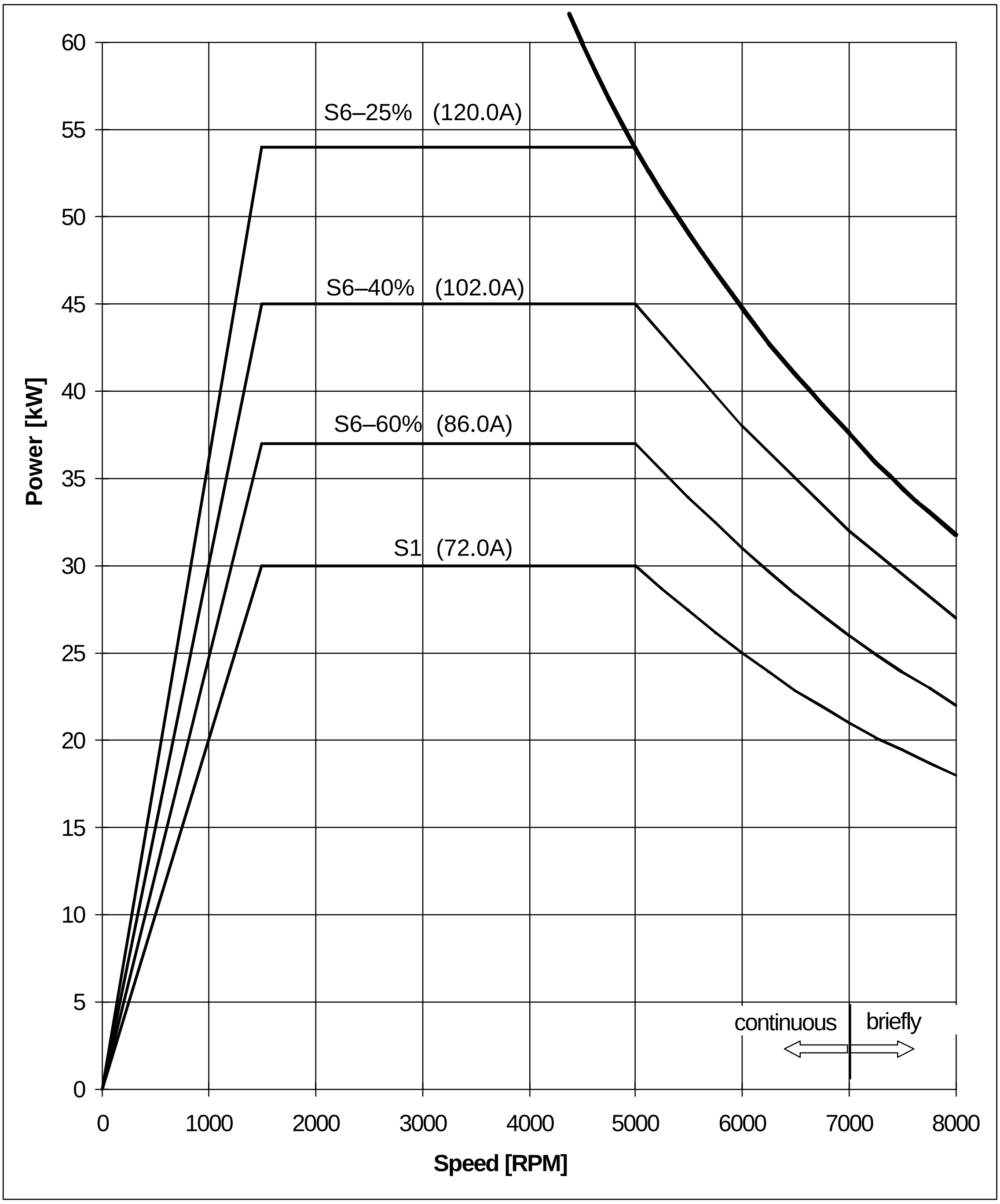


Fig. 3-38 Speed–power diagram 1PH7163–2NF□□–0**L**

1PH7

Table 3-39 AC main spindle motor 1PH7163-2NG4

Rated output P_{rated} [kW]	Rated speed n_{rated} [RPM]	Rated torque M_{rated} [Nm]	Rated current I_{rated} [A]	Time constant (therm.) T_{th} [min]	Max. speed n_{max} [RPM]	Moment of inertia J [kgm^2]	Weight m [kg]
36	2000	172	85	35	6500	0.19	180

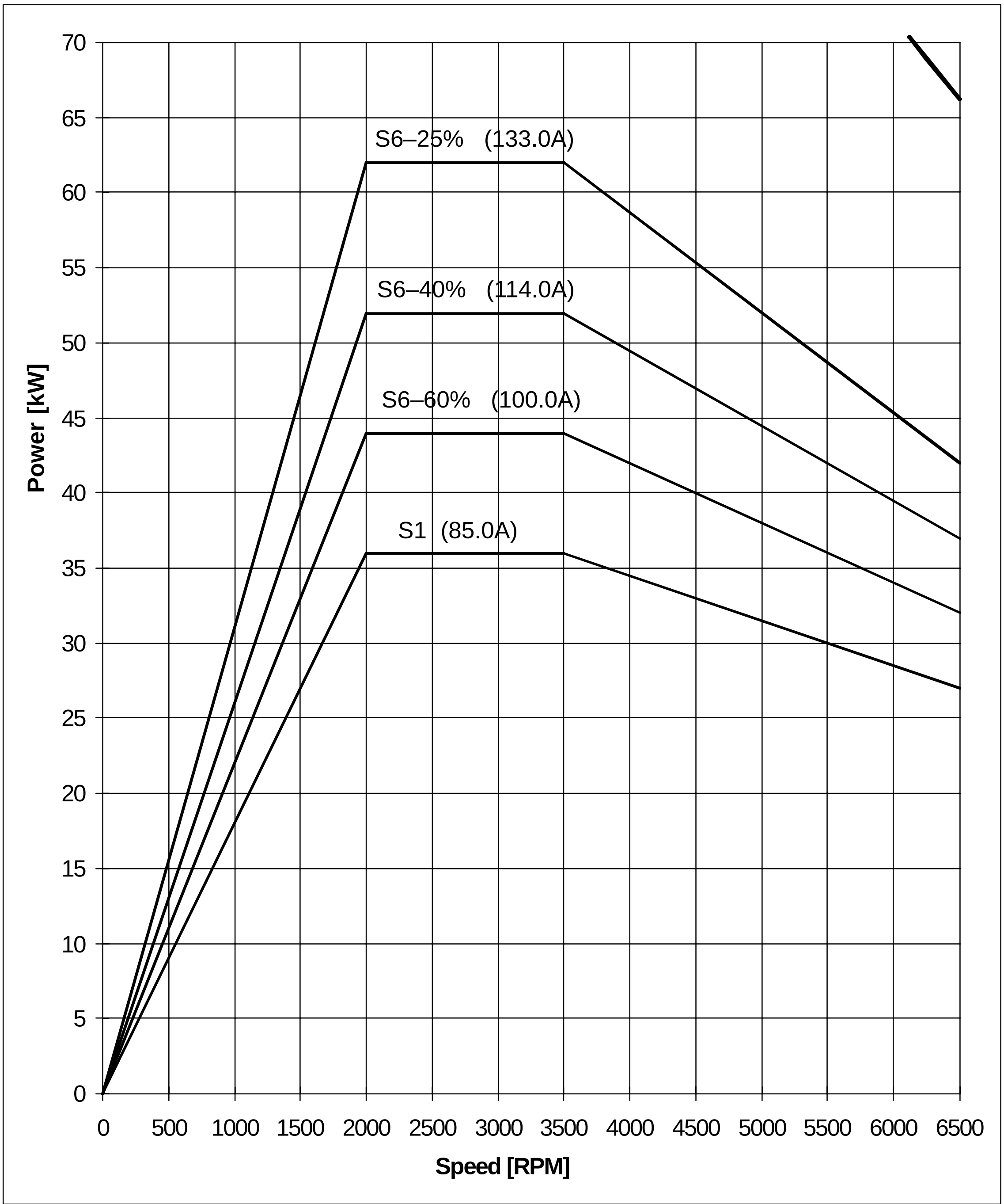


Fig. 3-39 Speed–power diagram 1PH7163-2NG4

Table 3-40 AC main spindle motor 1PH7163-2NG4□□–0**L**

Rated output P_{rated} [kW]	Rated speed n_{rated} [RPM]	Rated torque M_{rated} [Nm]	Rated current I_{rated} [A]	Time constant (therm.) T_{th} [min]	Max. speed n_{max} [RPM]	Moment of inertia J [kgm^2]	Weight m [kg]
36	2000	172	85	35	8000	0.19	180

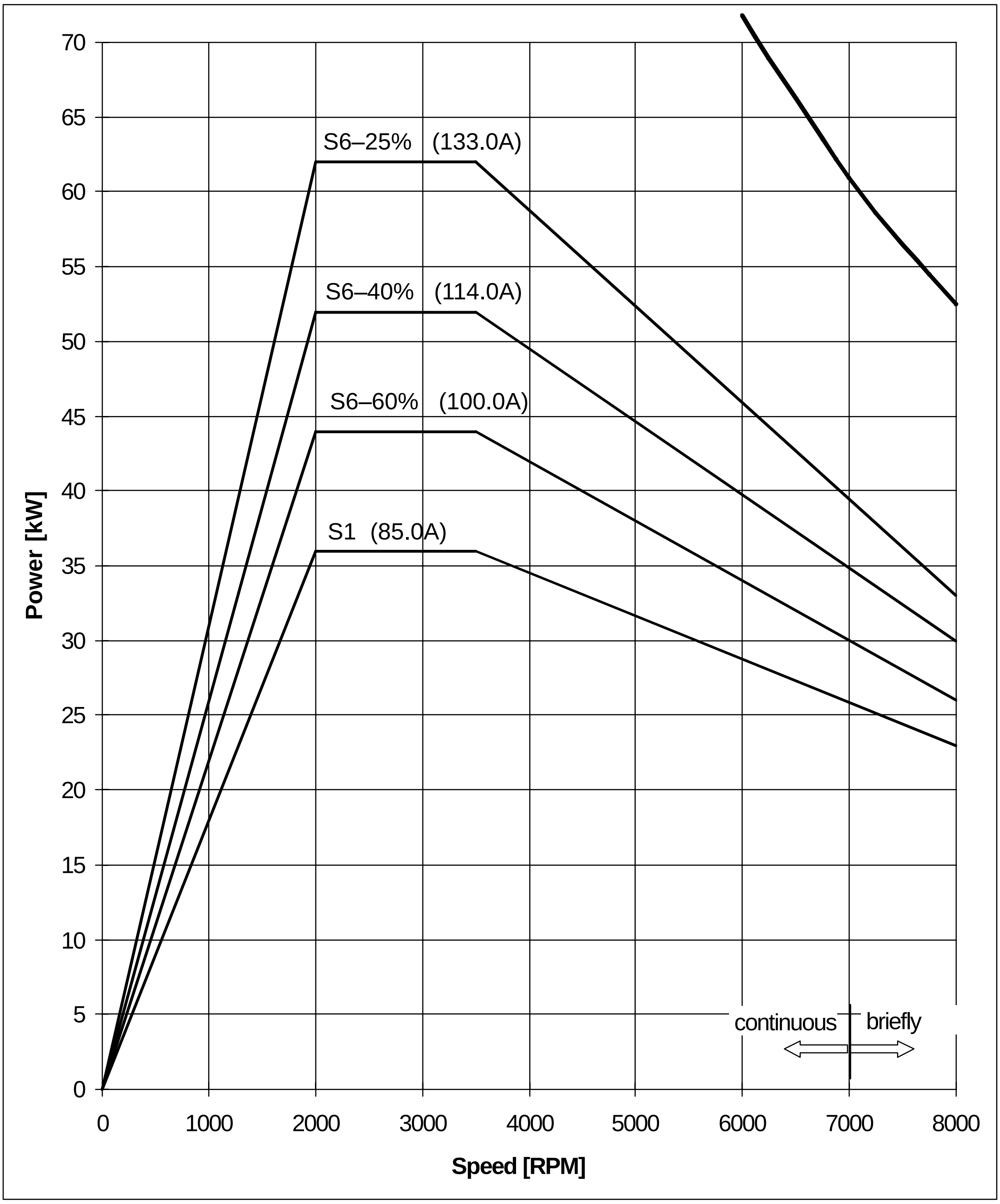


Fig. 3-40 Speed–power diagram 1PH7163-2NG4□□–0**L**

1PH7

Table 3-41 AC main spindle motor 1PH7167-2NB4

Rated output P_{rated} [kW]	Rated speed n_{rated} [RPM]	Rated torque M_{rated} [Nm]	Rated current I_{rated} [A]	Time constant (therm.) T_{th} [min]	Max. speed n_{max} [RPM]	Moment of inertia J [kgm^2]	Weight m [kg]
16	500	306	37	35	6500	0.23	228

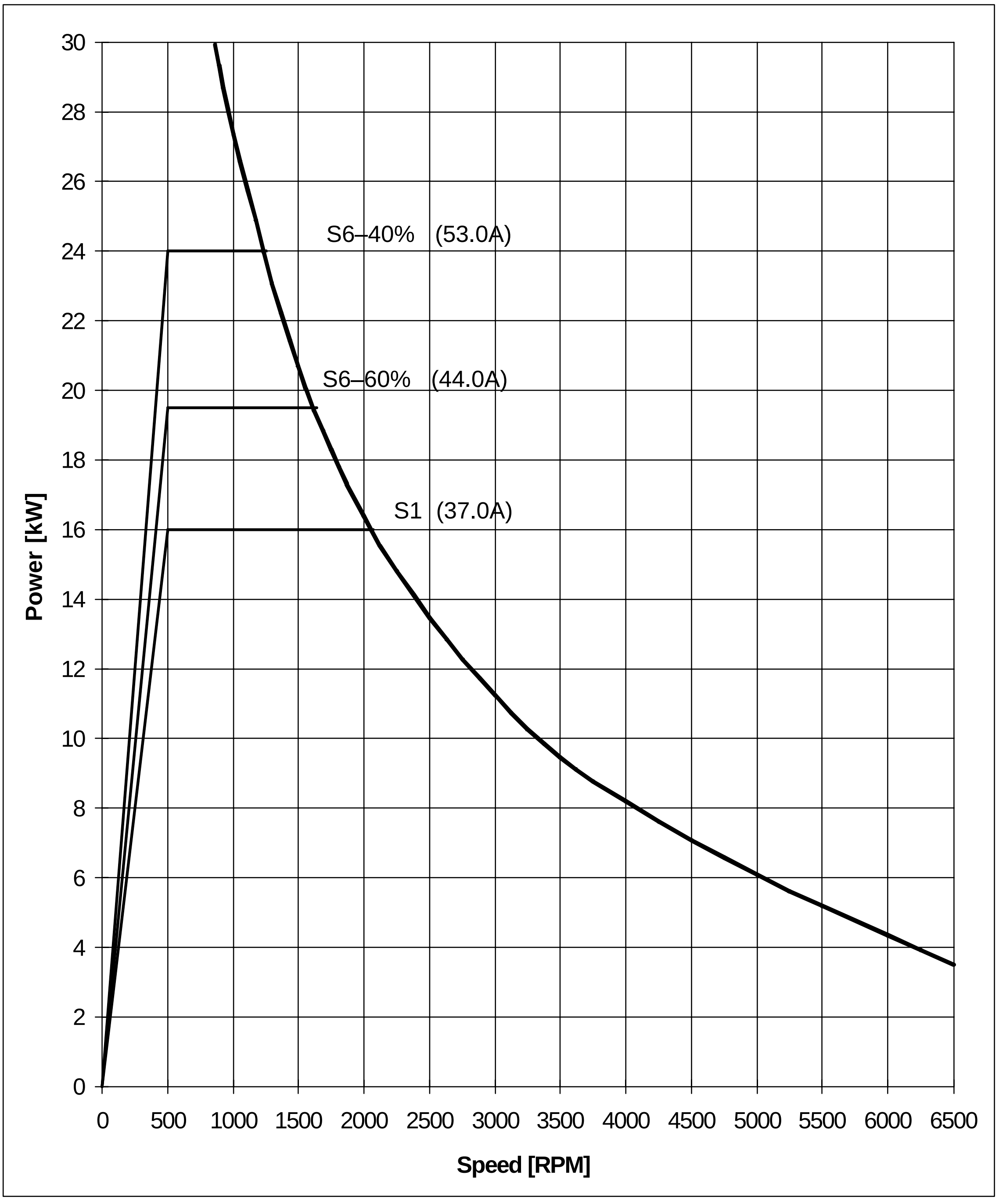


Fig. 3-41 Speed–power diagram 1PH7167-2NB4

Table 3-42 AC main spindle motor 1PH7167-2NB4□□–0**L**

Rated output P_{rated} [kW]	Rated speed n_{rated} [RPM]	Rated torque M_{rated} [Nm]	Rated current I_{rated} [A]	Time constant (therm.) T_{th} [min]	Max. speed n_{max} [RPM]	Moment of inertia J [kgm^2]	Weight m [kg]
16	500	306	37	35	8000	0.23	228

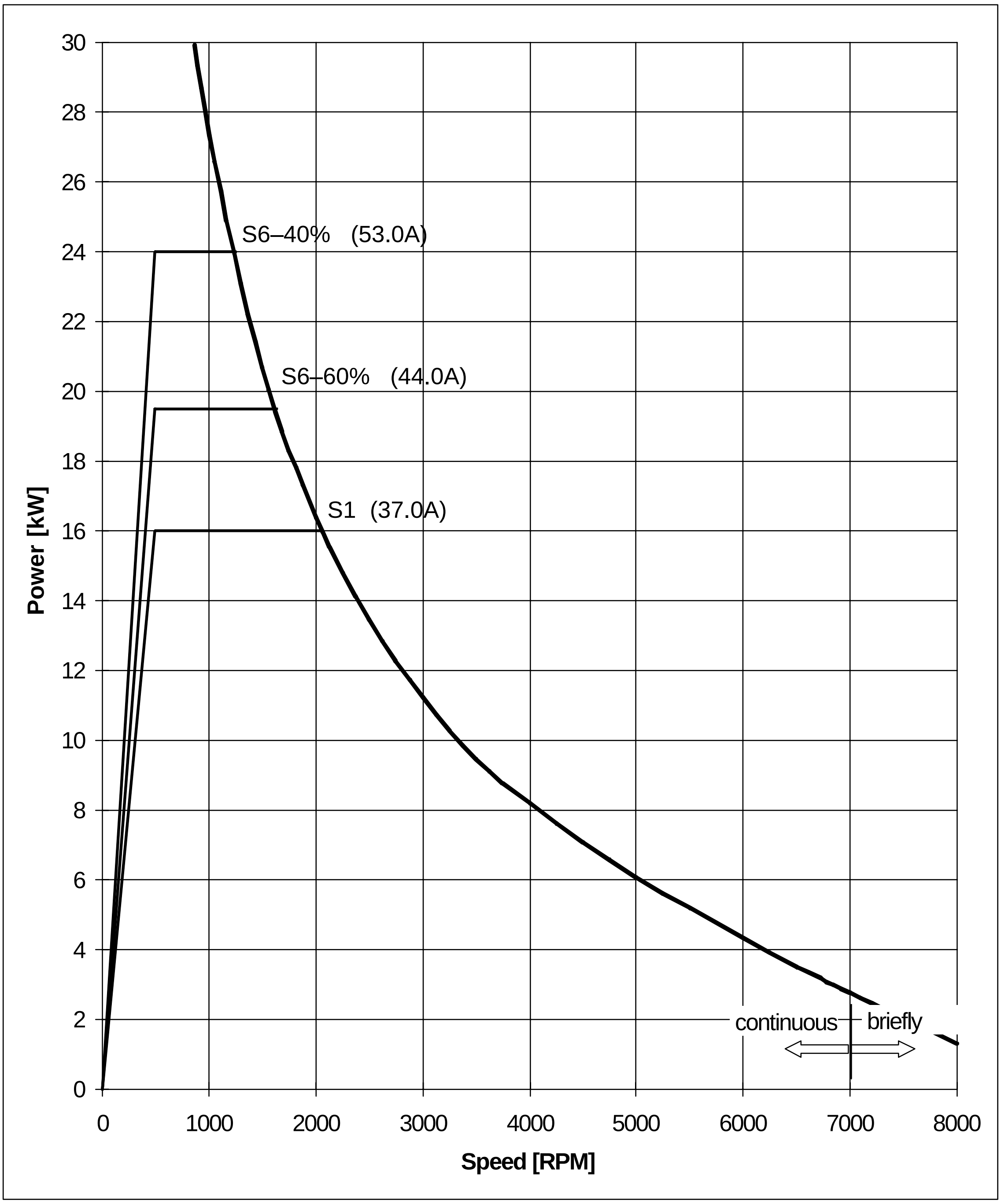


Fig. 3-42 Speed–power diagram 1PH7167-2NB4□□–0**L**

1PH7

Table 3-43 AC main spindle motor 1PH7167-2ND4

Rated output P_{rated} [kW]	Rated speed n_{rated} [RPM]	Rated torque M_{rated} [Nm]	Rated current I_{rated} [A]	Time constant (therm.) T_{th} [min]	Max. speed n_{max} [RPM]	Moment of inertia J [kgm²]	Weight m [kg]
28	1000	267	71	35	6500	0.23	228

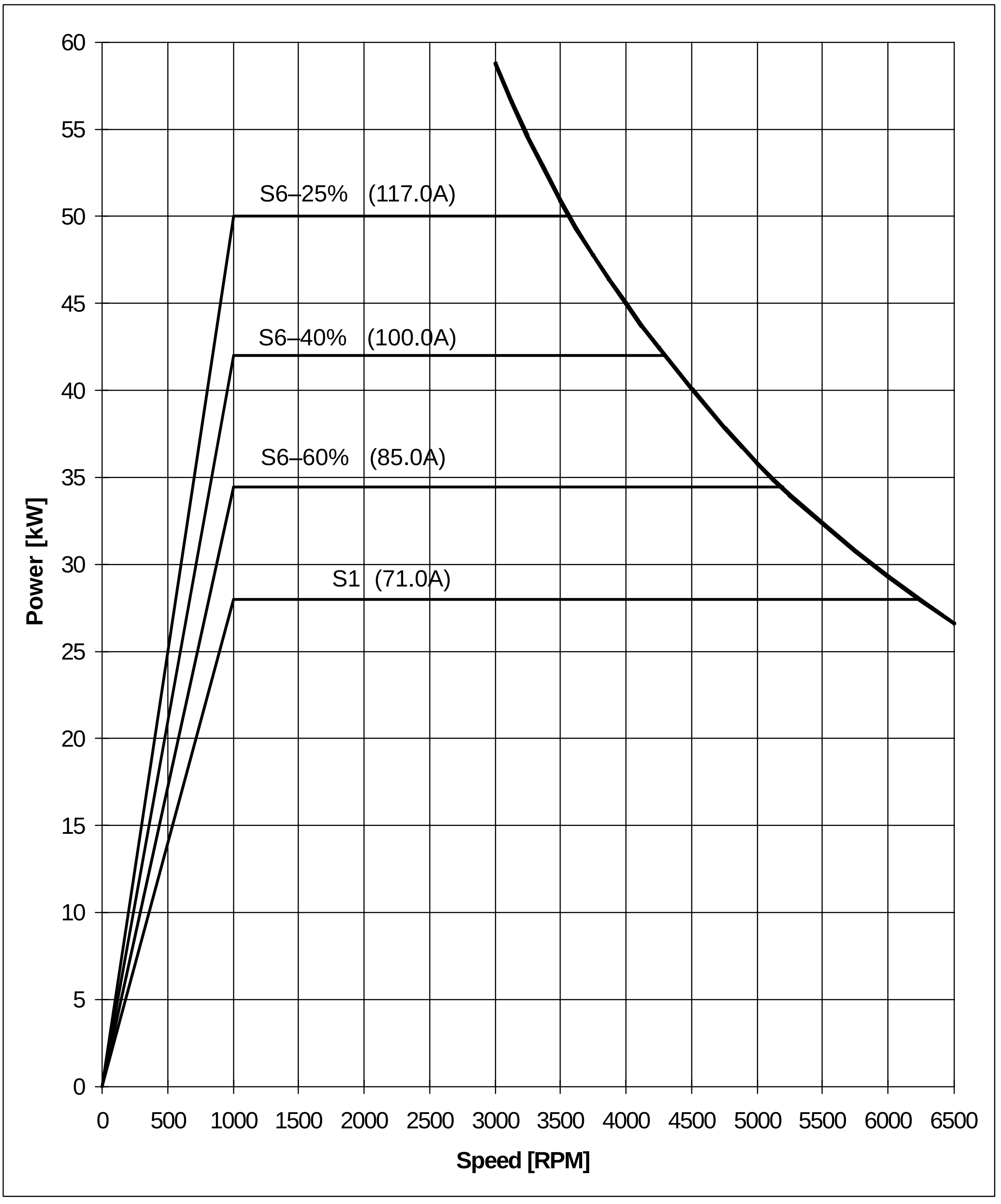


Fig. 3-43 Speed–power diagram 1PH7167-2ND4

Table 3-44 AC main spindle motor 1PH7167-2ND4☐☐–0**L**

Rated output P_{rated} [kW]	Rated speed n_{rated} [RPM]	Rated torque M_{rated} [Nm]	Rated current I_{rated} [A]	Time constant (therm.) T_{th} [min]	Max. speed n_{max} [RPM]	Moment of inertia J [kgm²]	Weight m [kg]
28	1000	267	71	35	8000	0.23	228

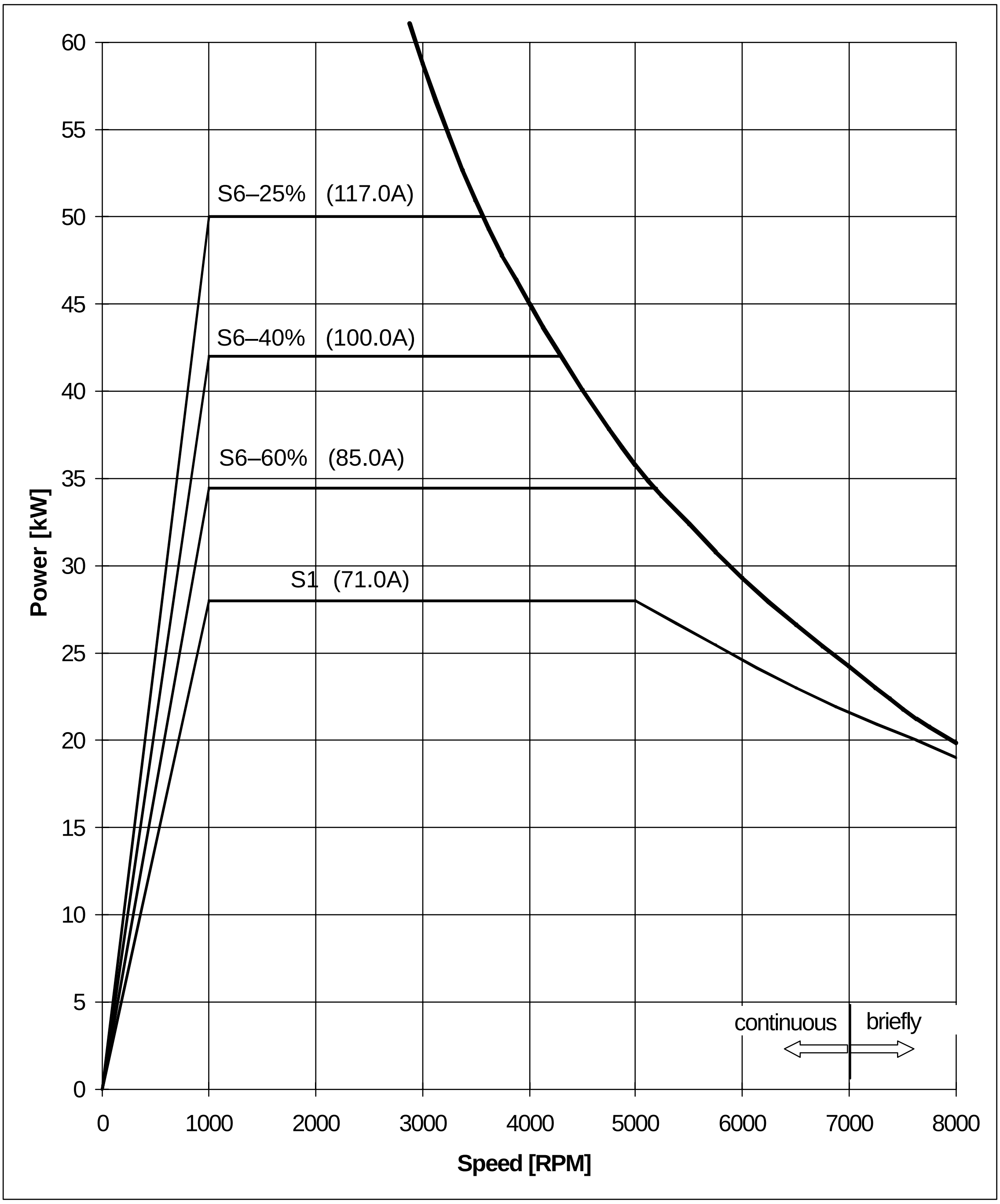


Fig. 3-44 Speed–power diagram 1PH7167-2ND4☐☐–0**L**

1PH7

Table 3-45 AC main spindle motor 1PH7167–2NF□□

Rated output P_{rated} [kW]	Rated speed n_{rated} [RPM]	Rated torque M_{rated} [Nm]	Rated current I_{rated} [A]	Time constant (therm.) T_{th} [min]	Max. speed n_{max} [RPM]	Moment of inertia J [kgm^2]	Weight m [kg]
37	1500	236	82	35	6500	0.23	228

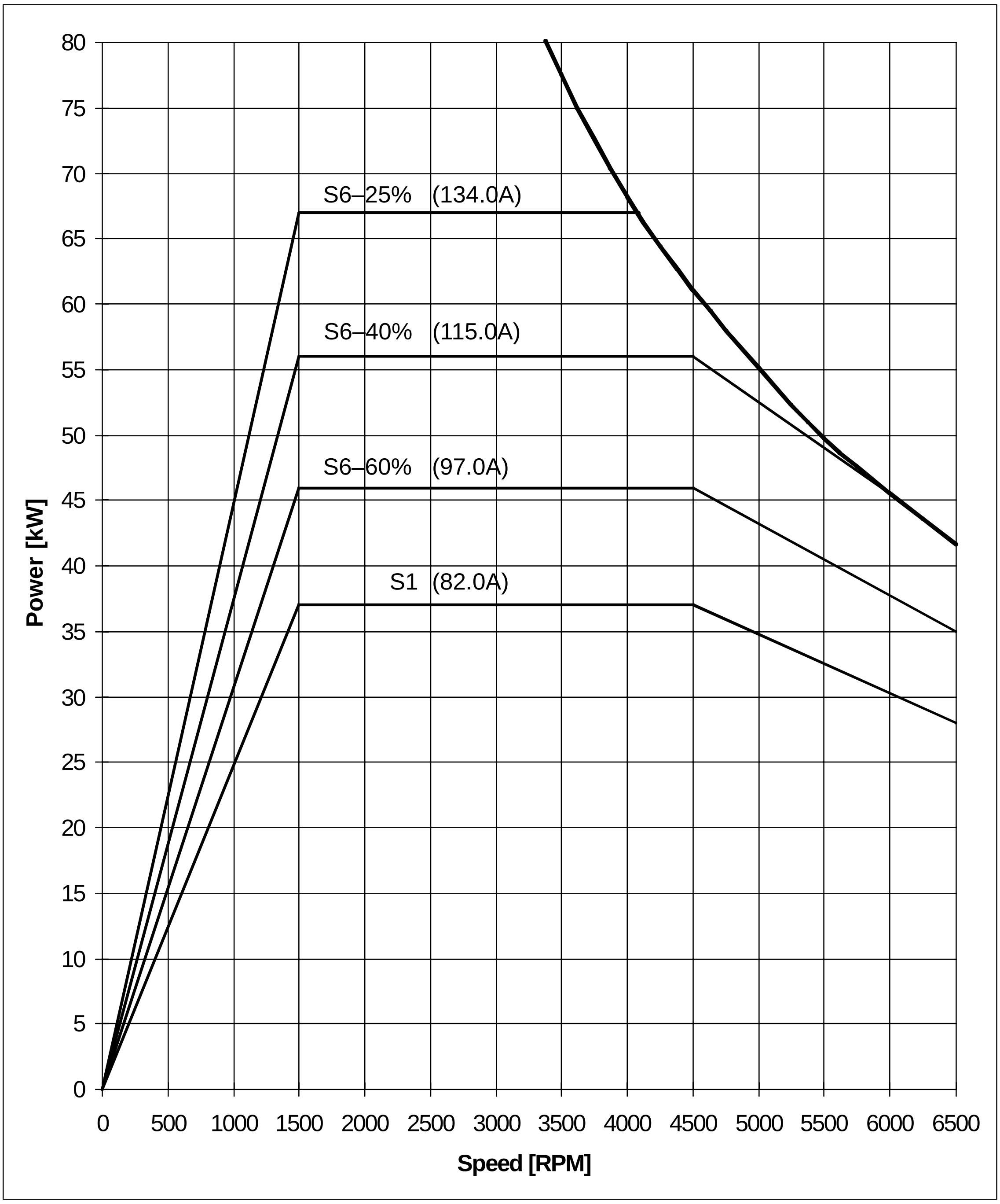


Fig. 3-45 Speed–power diagram 1PH7167–2NF□□

Table 3-46 AC main spindle motor 1PH7167–2NF□□–0**L**

Rated output P_{rated} [kW]	Rated speed n_{rated} [RPM]	Rated torque M_{rated} [Nm]	Rated current I_{rated} [A]	Time constant (therm.) T_{th} [min]	Max. speed n_{max} [RPM]	Moment of inertia J [kgm^2]	Weight m [kg]
37	1500	236	82	35	8000	0.23	228

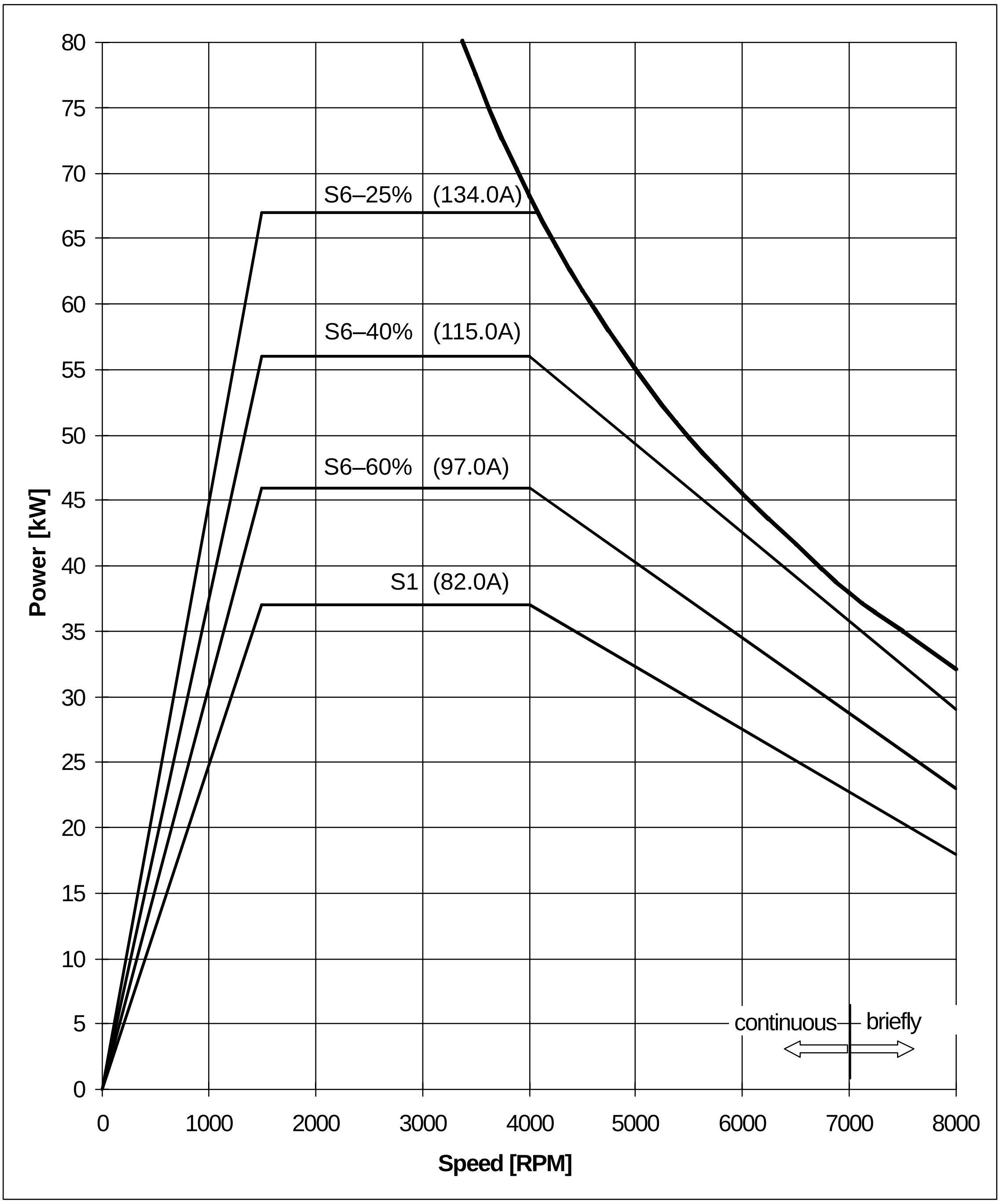


Fig. 3-46 Speed–power diagram 1PH7167–2NF□□–0**L**

1PH7

Table 3-47 AC main spindle motor 1PH7167-2NG

Rated output P_{rated} [kW]	Rated speed n_{rated} [RPM]	Rated torque M_{rated} [Nm]	Rated current I_{rated} [A]	Time constant (therm.) T_{th} [min]	Max. speed n_{max} [RPM]	Moment of inertia J [kgm^2]	Weight m [kg]
41	2000	196	89	35	6500	0.23	228

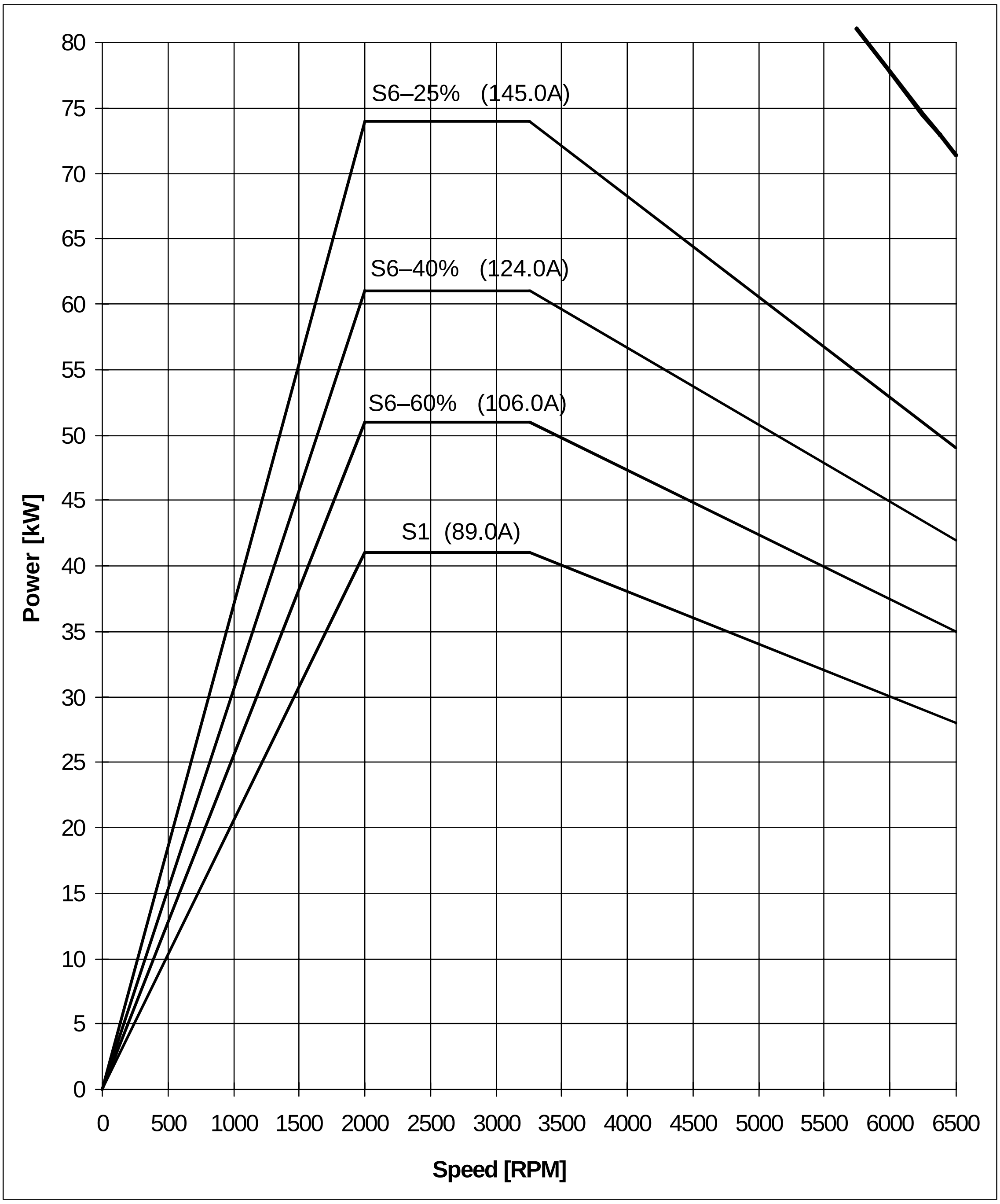


Fig. 3-47 Speed–power diagram 1PH7167-2NG

Table 3-48 AC main spindle motor 1PH7167-2NG□□–0**L**

Rated output P_{rated} [**kW**]	**Rated speed** n_{rated} [**RPM**]	**Rated torque** M_{rated} [**Nm**]	**Rated current** I_{rated} [**A**]	**Time constant (therm.)** T_{th} [**min**]	**Max. speed** n_{max} [**RPM**]	**Moment of inertia J** [**kgm²**]	**Weight m** [**kg**]
41	2000	196	89	35	8000	0.23	228

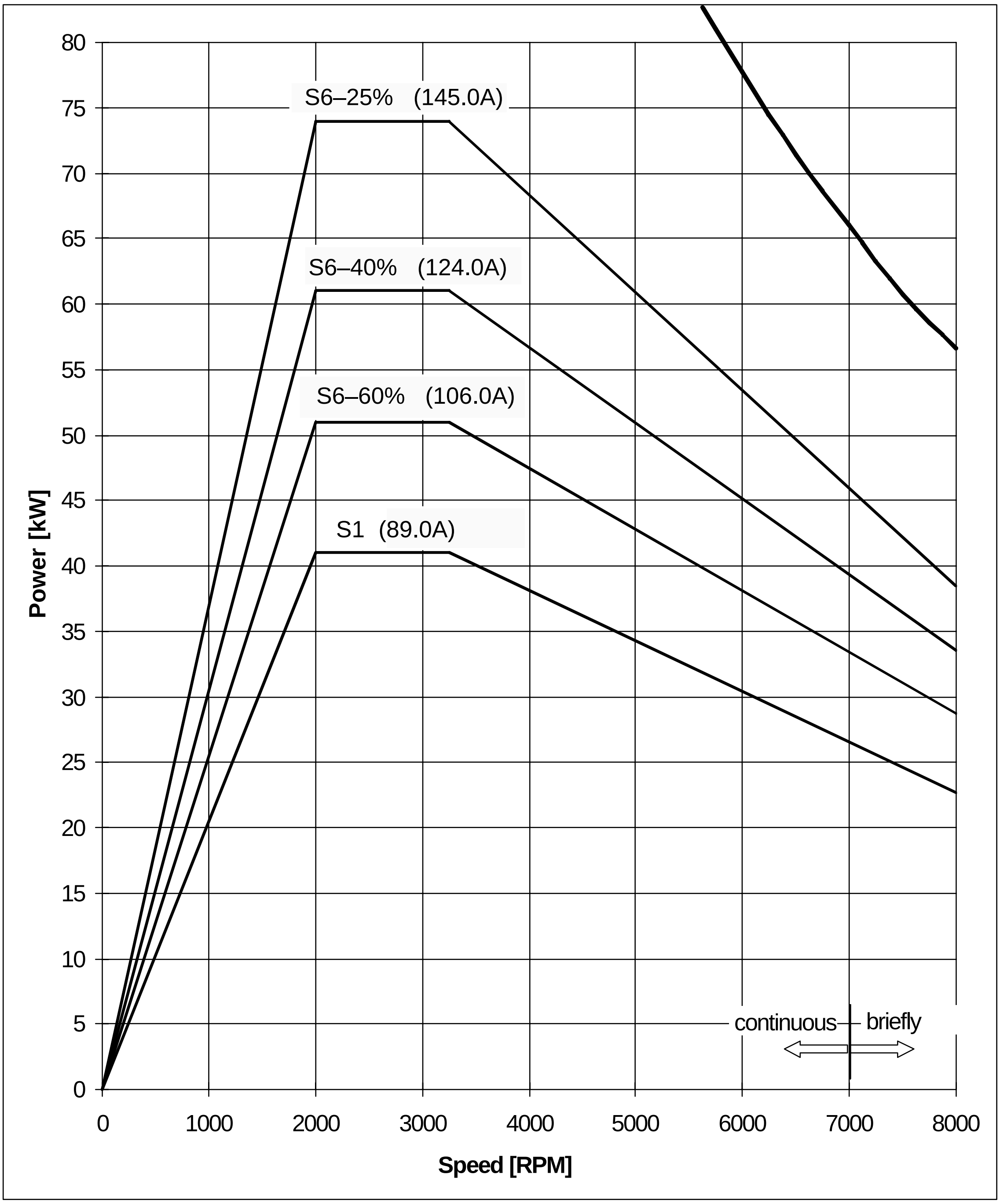


Fig. 3-48 Speed–power diagram 1PH7167-2NG□□–0**L**

1PH7

Table 3-49 AC main spindle motor 1PH7184–□NT□□

Rated output P_{rated} [**kW**]	**Rated speed** n_{rated} [**RPM**]	**Rated torque** M_{rated} [**Nm**]	**Rated current** I_{rated} [**A**]	**Time constant (therm.)** T_{th} [**min**]	**Max. speed** n_{max} [**RPM**]	**Moment of inertia** J [**kgm²**]	**Weight** m [**kg**]
21.5	500	411	76	40	5000 7000 [1)]	0.5	390

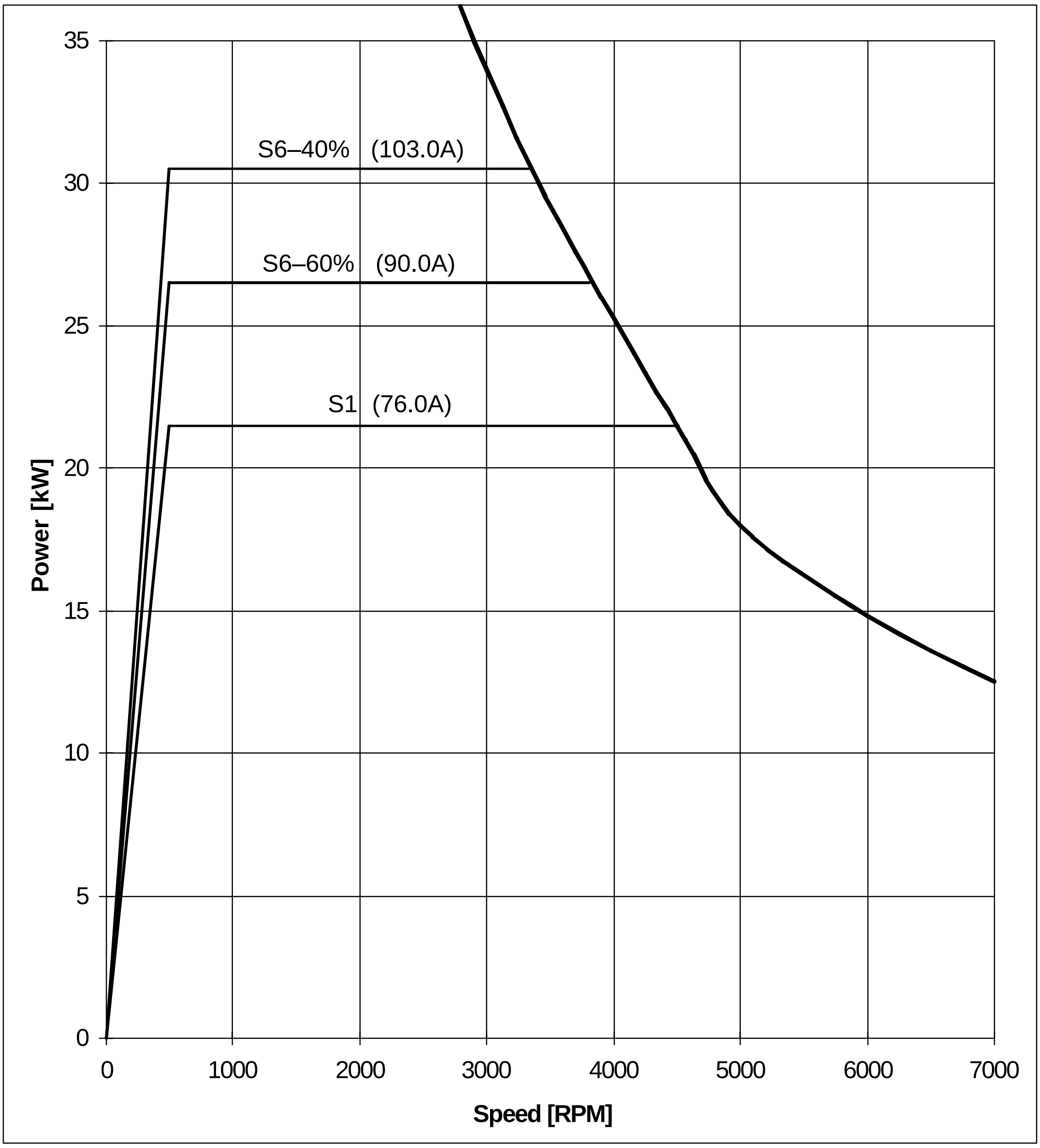


Fig. 3-49 Speed–power diagram 1PH7184–□NT□□

1) optional

Table 3-50 AC main spindle motor 1PH7184–□ND□□

Rated output P_{rated} [kW]	Rated speed n_{rated} [RPM]	Rated torque M_{rated} [Nm]	Rated current I_{rated} [A]	Time constant (therm.) T_{th} [min]	Max. speed n_{max} [RPM]	Moment of inertia J [kgm^2]	Weight m [kg]
39	1000	372	90		5000 7000 1)		

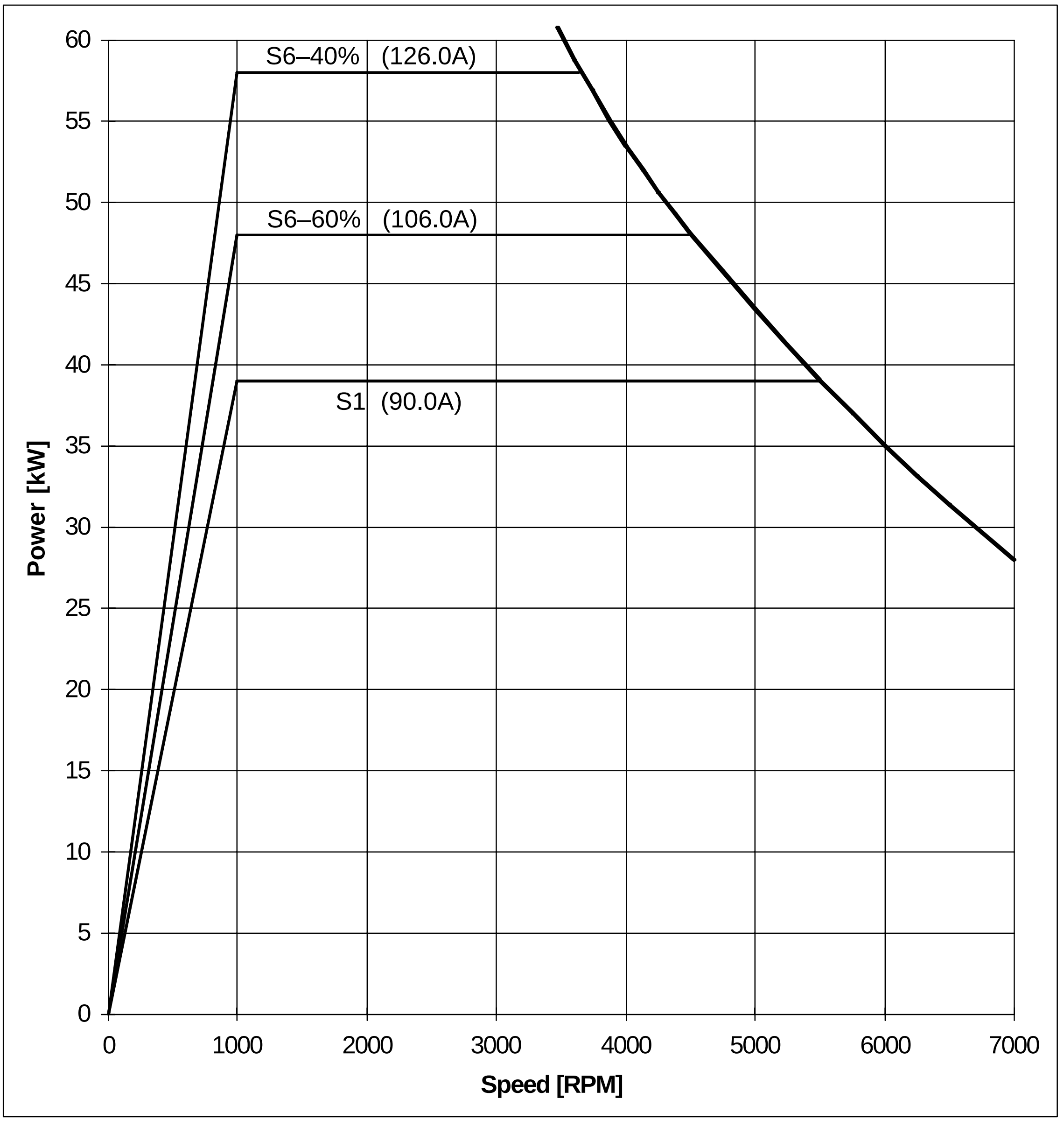


Fig. 3-50 Speed–power diagram 1PH7184–□ND□□

1) optional

1PH7

Table 3-51 AC main spindle motor 1PH7184–□NE□□

Rated output P_{rated} [kW]	Rated speed n_{rated} [RPM]	Rated torque M_{rated} [Nm]	Rated current I_{rated} [A]	Time constant (therm.) T_{th} [min]	Max. speed n_{max} [RPM]	Moment of inertia J [kgm^2]	Weight m [kg]
40	1250	306	85	40	5000 7000 1)	0.5	390

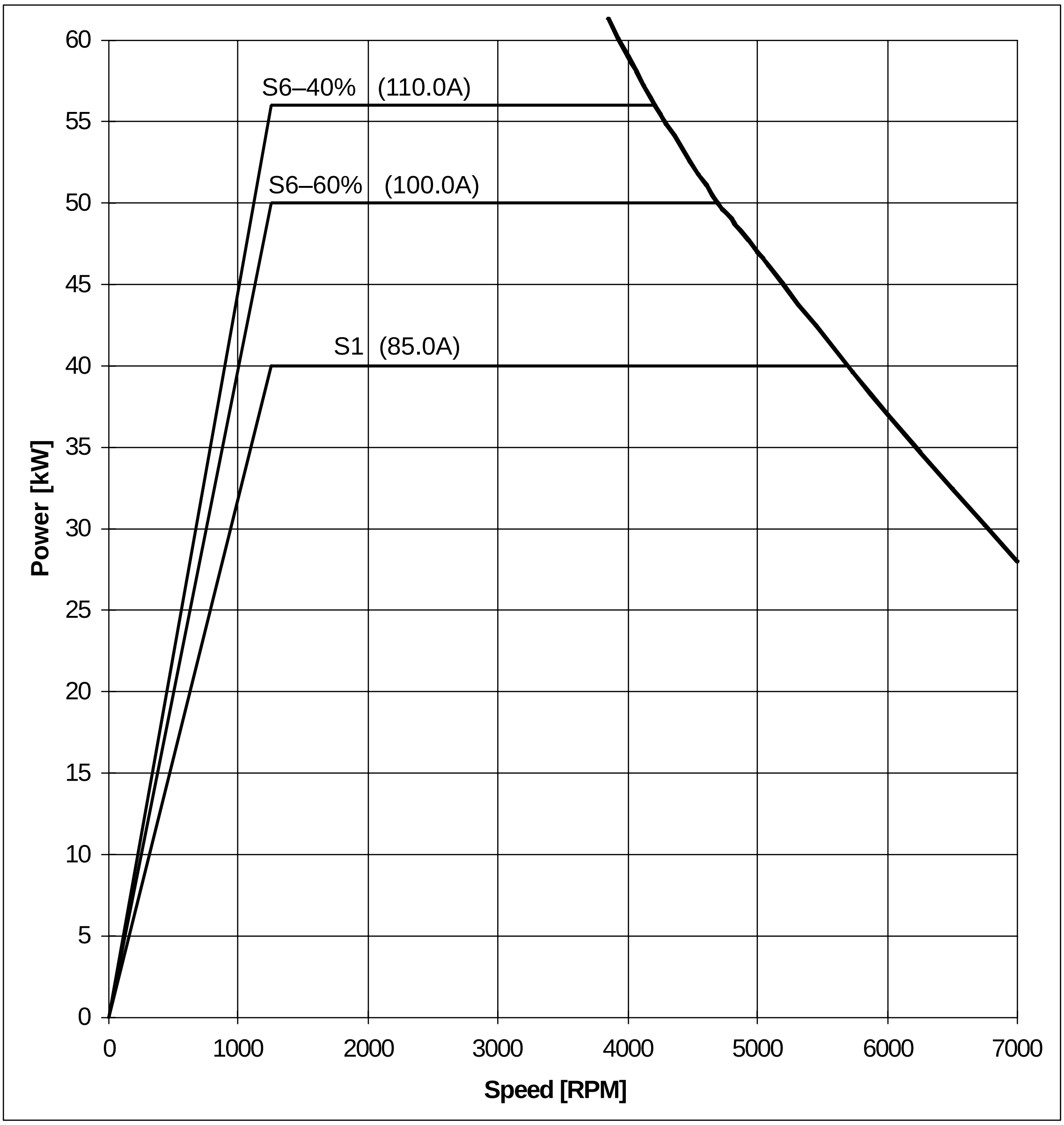


Fig. 3-51 Speed–power diagram 1PH7184–□NE□□

1) optional

Table 3-52 AC main spindle motor 1PH7184–□NF□□

Rated output P_{rated} [kW]	Rated speed n_{rated} [RPM]	Rated torque M_{rated} [Nm]	Rated current I_{rated} [A]	Time constant (therm.) T_{th} [min]	Max. speed n_{max} [RPM]	Moment of inertia J [kgm^2]	Weight m [kg]
51	1500	325	120	40	5000 7000 1)	0.5	390

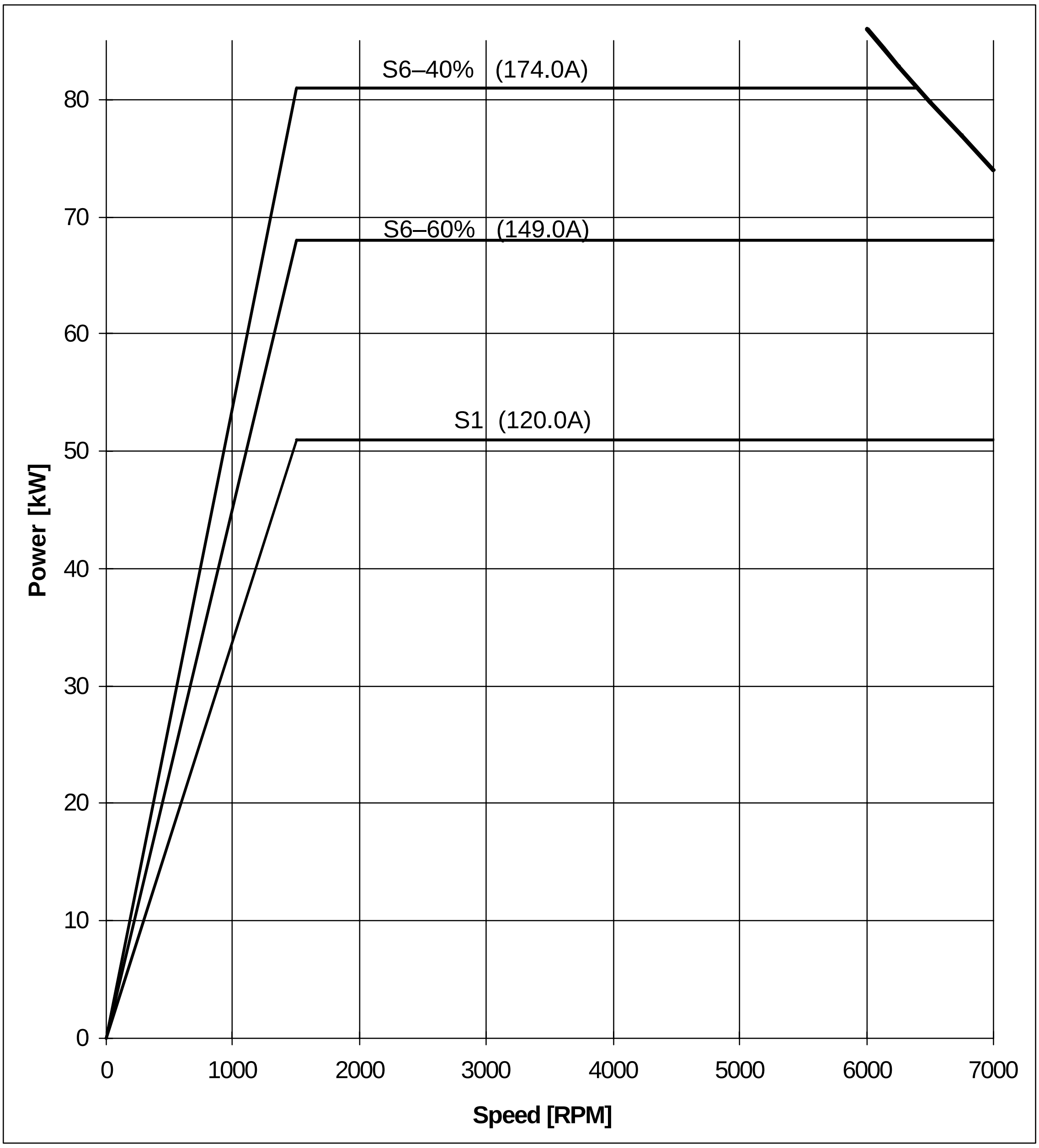


Fig. 3-52 Speed–power diagram 1PH7184–□NF□□

1) optional

Table 3-53 AC main spindle motor 1PH7184–□NL□□

Rated output P_{rated} [kW]	Rated speed n_{rated} [RPM]	Rated torque M_{rated} [Nm]	Rated current I_{rated} [A]	Time constant (therm.) T_{th} [min]	Max. speed n_{max} [RPM]	Moment of inertia J [kgm²]	Weight m [kg]
78	2500	298	172	40	5000 7000 1)	0.5	390

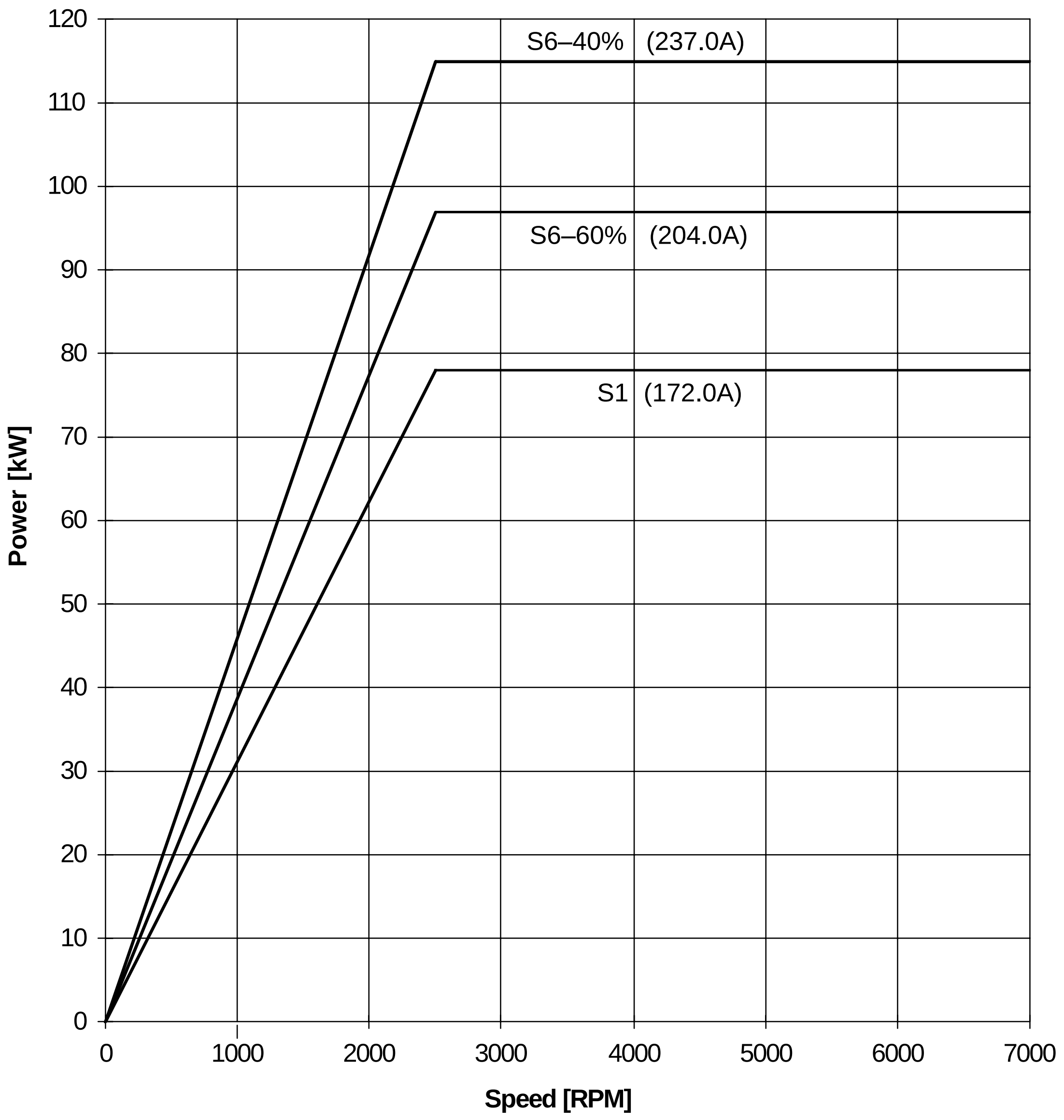


Fig. 3-53 Speed–power diagram 1PH7184–□NL□□

1) optional

Table 3-54 AC main spindle motor 1PH7186–□NT□□

Rated output P_{rated} [kW]	Rated speed n_{rated} [RPM]	Rated torque M_{rated} [Nm]	Rated current I_{rated} [A]	Time constant (therm.) T_{th} [min]	Max. speed n_{max} [RPM]	Moment of inertia J [kgm²]	Weight m [kg]
29.6	500	565	106	40	5000 7000 1)	0.67	460

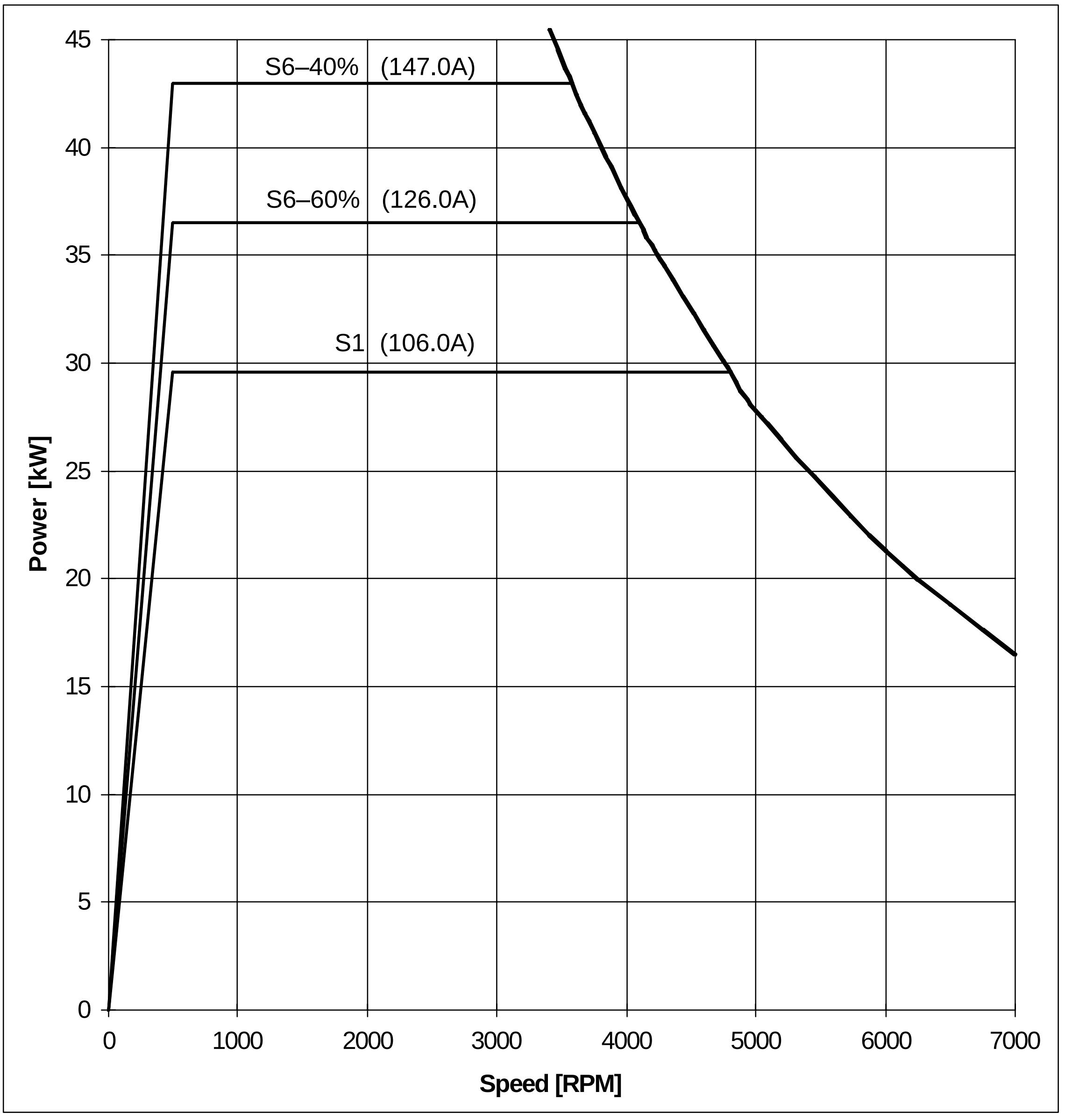


Fig. 3-54 Speed–power diagram 1PH7186–□NT□□

1) optional

Table 3-55 AC main spindle motor 1PH7186–□ND□□

Rated output P_{rated} [**kW**]	Rated speed n_{rated} [**RPM**]	Rated torque M_{rated} [**Nm**]	Rated current I_{rated} [**A**]	Time constant (therm.) T_{th} [**min**]	Max. speed n_{max} [**RPM**]	Moment of inertia J [**kgm²**]	Weight m [**kg**]
51	1000	487	118	40	5000 7000 1)	0.67	460

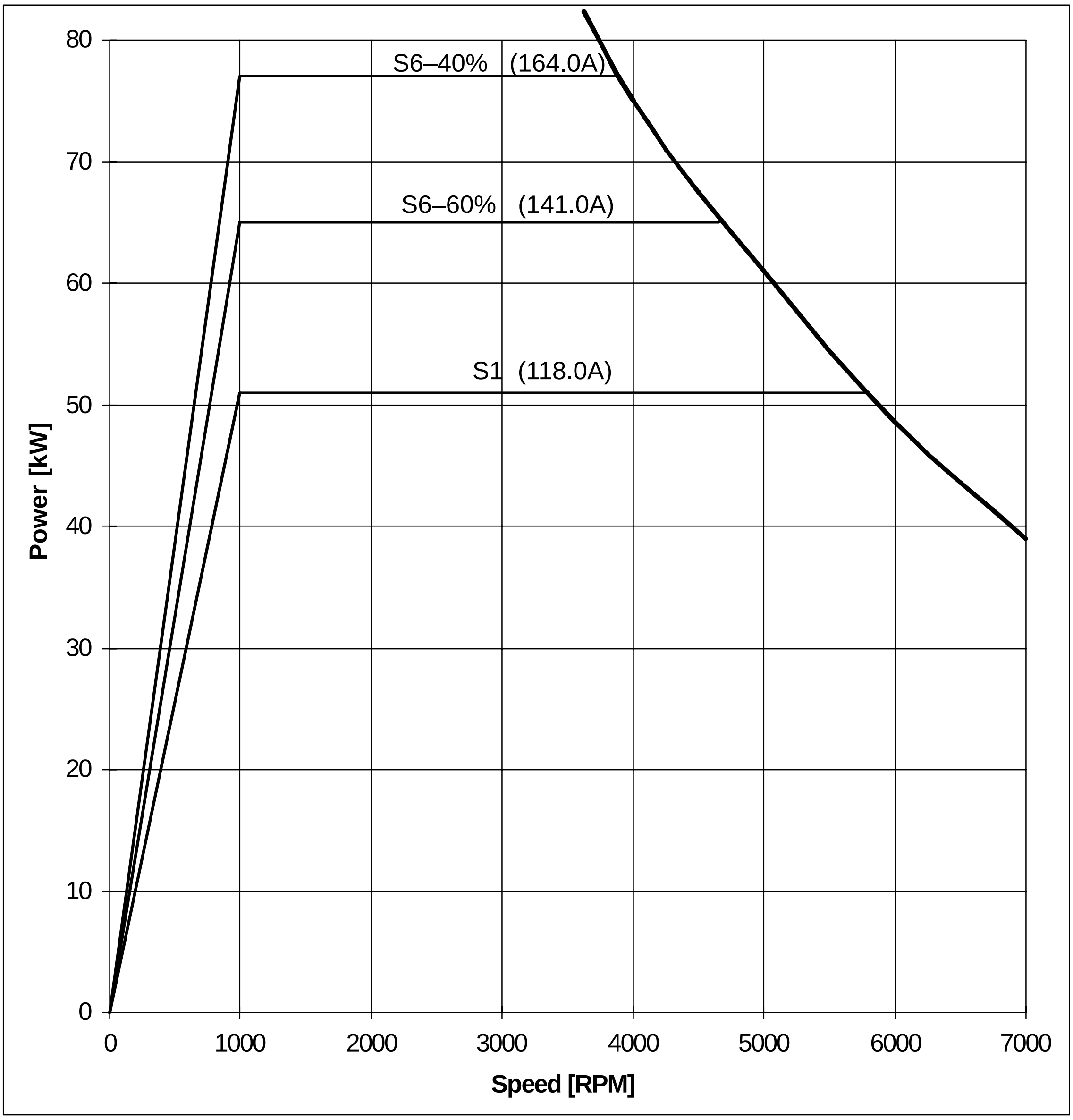


Fig. 3-55 Speed–power diagram 1PH7186–□ND□□

1) optional

Table 3-56 AC main spindle motor 1PH7186–□NE□□

Rated output P_{rated} [kW]	Rated speed n_{rated} [RPM]	Rated torque M_{rated} [Nm]	Rated current I_{rated} [A]	Time constant (therm.) T_{th} [min]	Max. speed n_{max} [RPM]	Moment of inertia J [kgm²]	Weight m [kg]
60	1250	458	120	40	5000 7000 1)	0.67	460

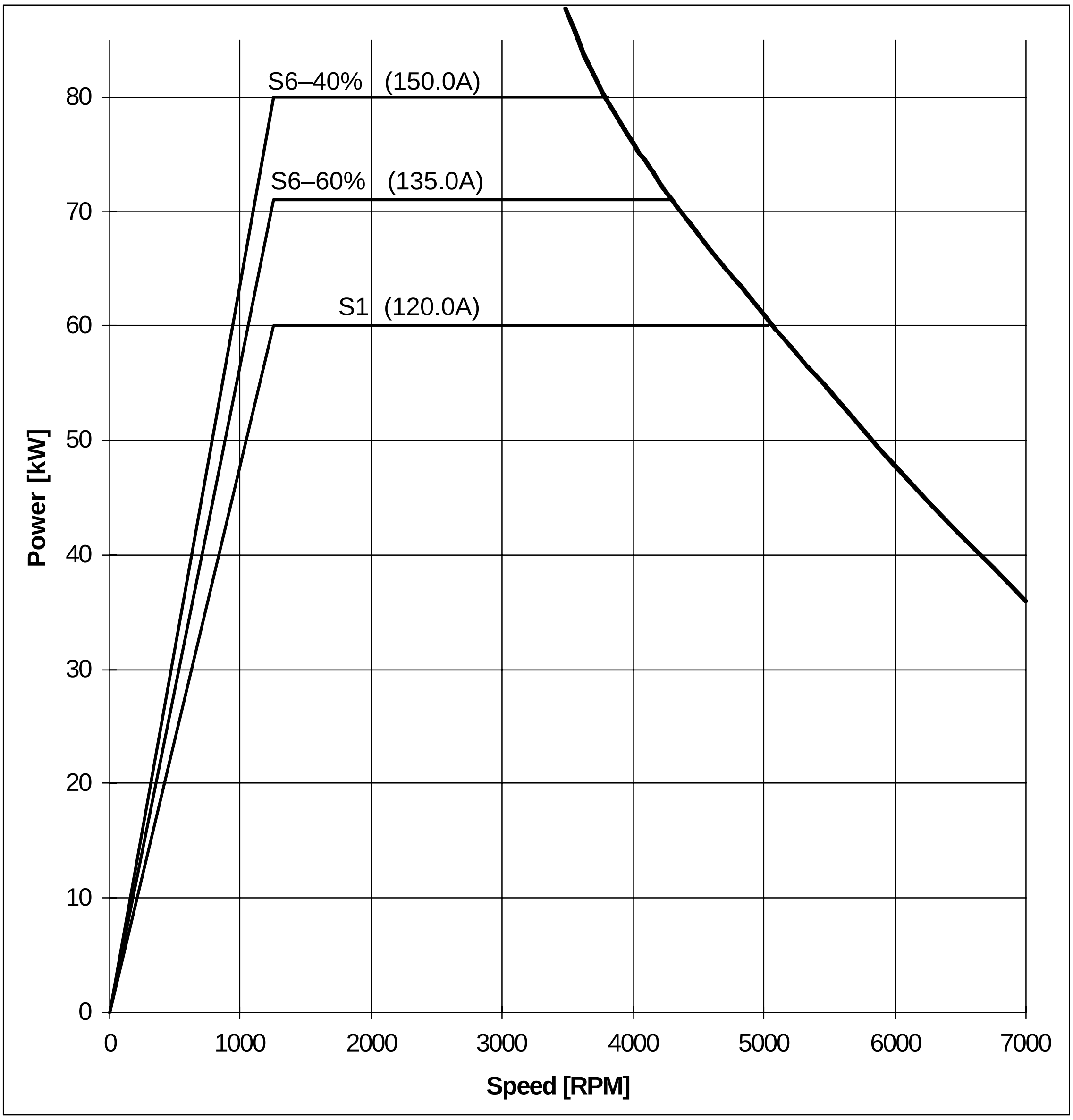


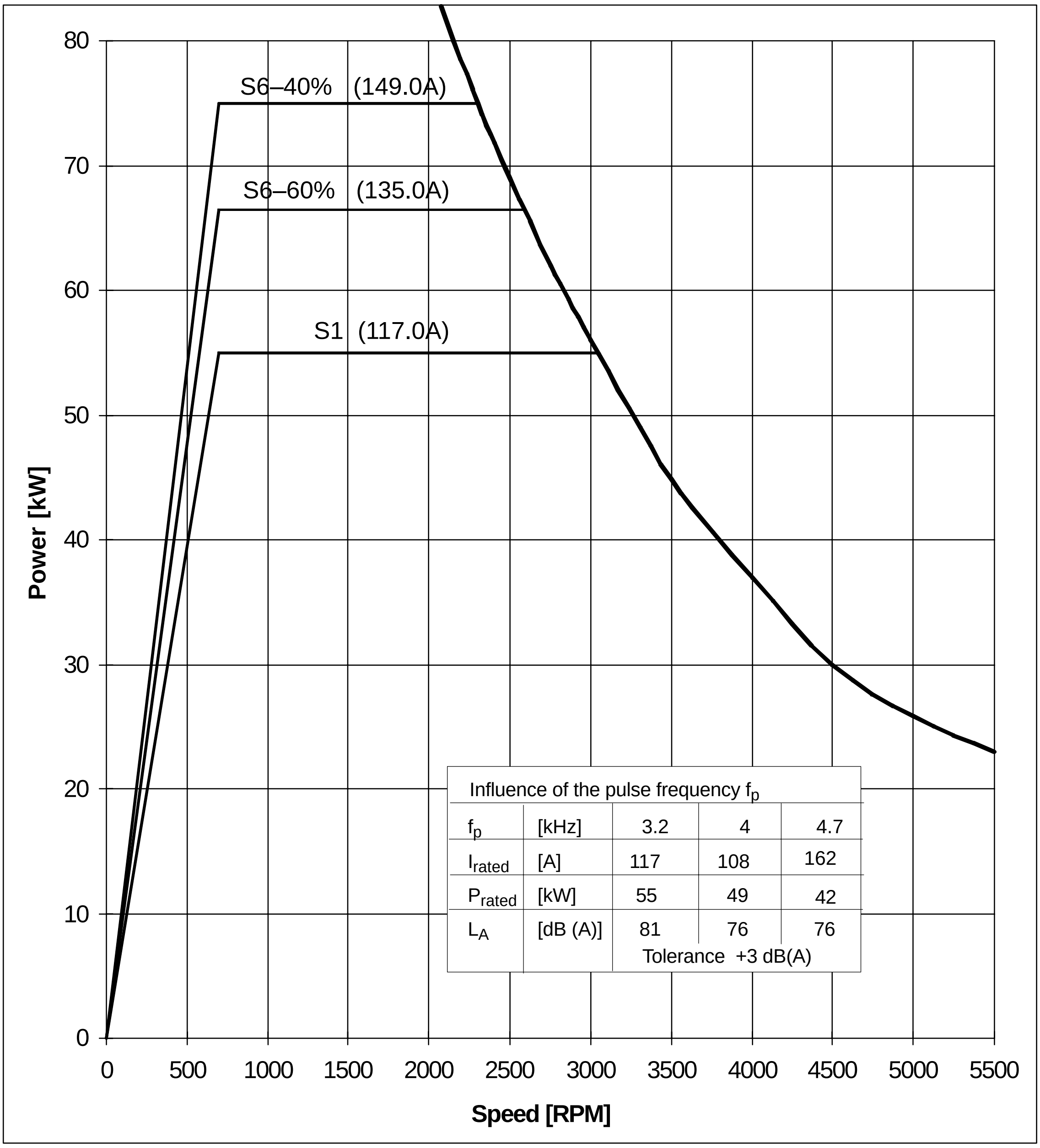
Fig. 3-56 Speed–power diagram 1PH7186–□NE□□

1) optional

1PH7

Table 3-57 AC main spindle motor 1PH7224–□NC□□

Rated output P_{rated} [kW]	Rated speed n_{rated} [RPM]	Rated torque M_{rated} [Nm]	Rated current I_{rated} [A]	Time constant (therm.) T_{th} [min]	Max. speed n_{max} [RPM]	Moment of inertia J [kgm²]	Weight m [kg]
55	700	750	117	40	4500 5500 1)	1.48	650



Influence of the pulse frequency f_p				
f_p	[kHz]	3.2	4	4.7
I_{rated}	[A]	117	108	162
P_{rated}	[kW]	55	49	42
L_A	[dB (A)]	81	76	76
		Tolerance +3 dB(A)		

Fig. 3-57 Speed–power diagram 1PH7224–□NC□□

1) optional

Table 3-58 AC main spindle motor 1PH7224–□ND□□

Rated output P_{rated} [kW]	Rated speed n_{rated} [RPM]	Rated torque M_{rated} [Nm]	Rated current I_{rated} [A]	Time constant (therm.) T_{th} [min]	Max. speed n_{max} [RPM]	Moment of inertia J [kgm^2]	Weight m [kg]
71	1000	678	164	40	4500 5500 1)	1.48	650

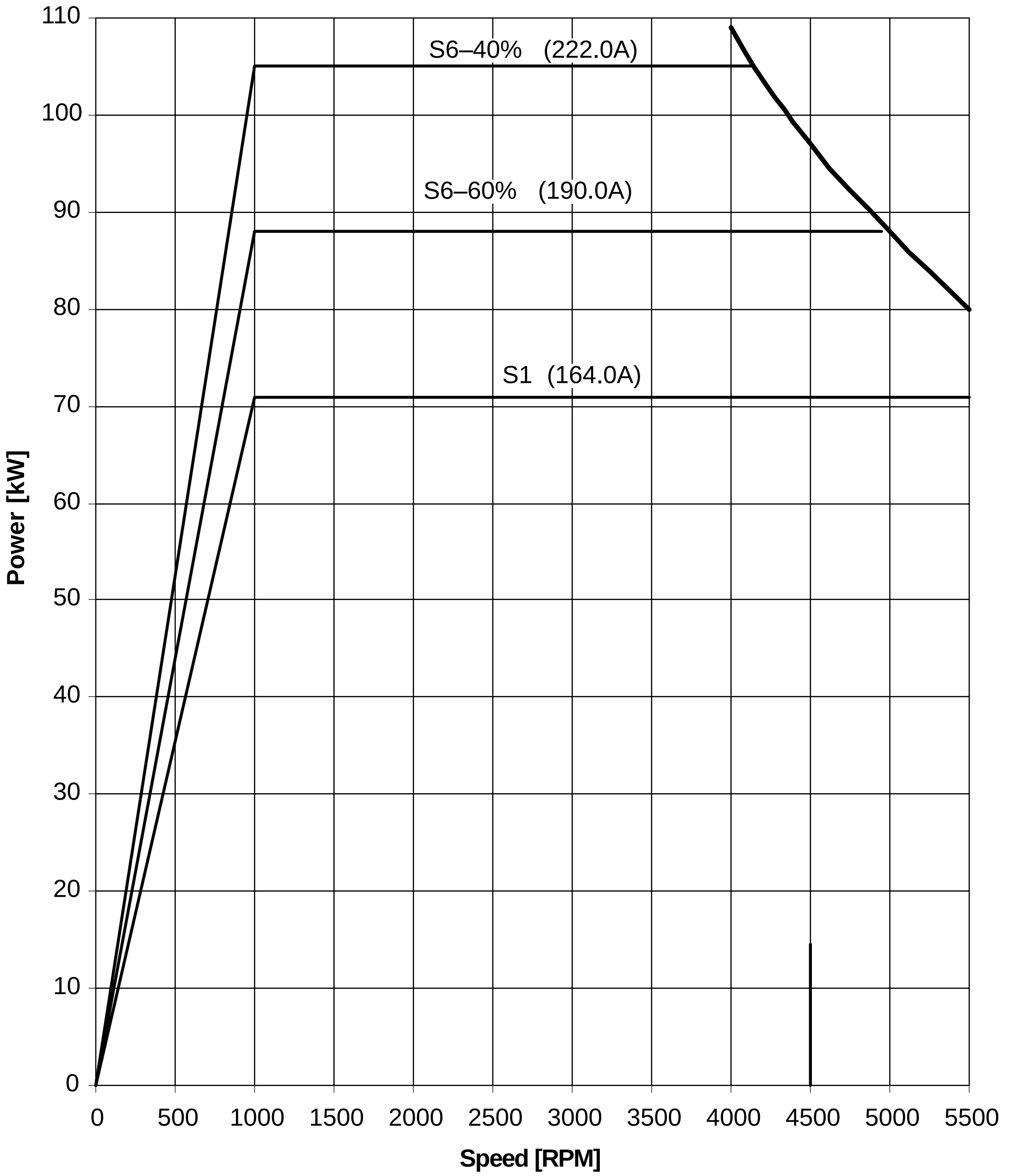


Fig. 3-58 Speed–power diagram 1PH7224–□ND□□

1) optional

1PH7

Table 3-59 AC main spindle motor 1PH7224–□NF□□

Rated output P_{rated} [**kW**]	**Rated speed** n_{rated} [**RPM**]	**Rated torque** M_{rated} [**Nm**]	**Rated current** I_{rated} [**A**]	**Time constant (therm.)** T_{th} [**min**]	**Max. speed** n_{max} [**RPM**]	**Moment of inertia** **J** [**kgm^2**]	**Weight** **m** [**kg**]
100	1500	637	188	40	4500 5500 1)	1.48	650

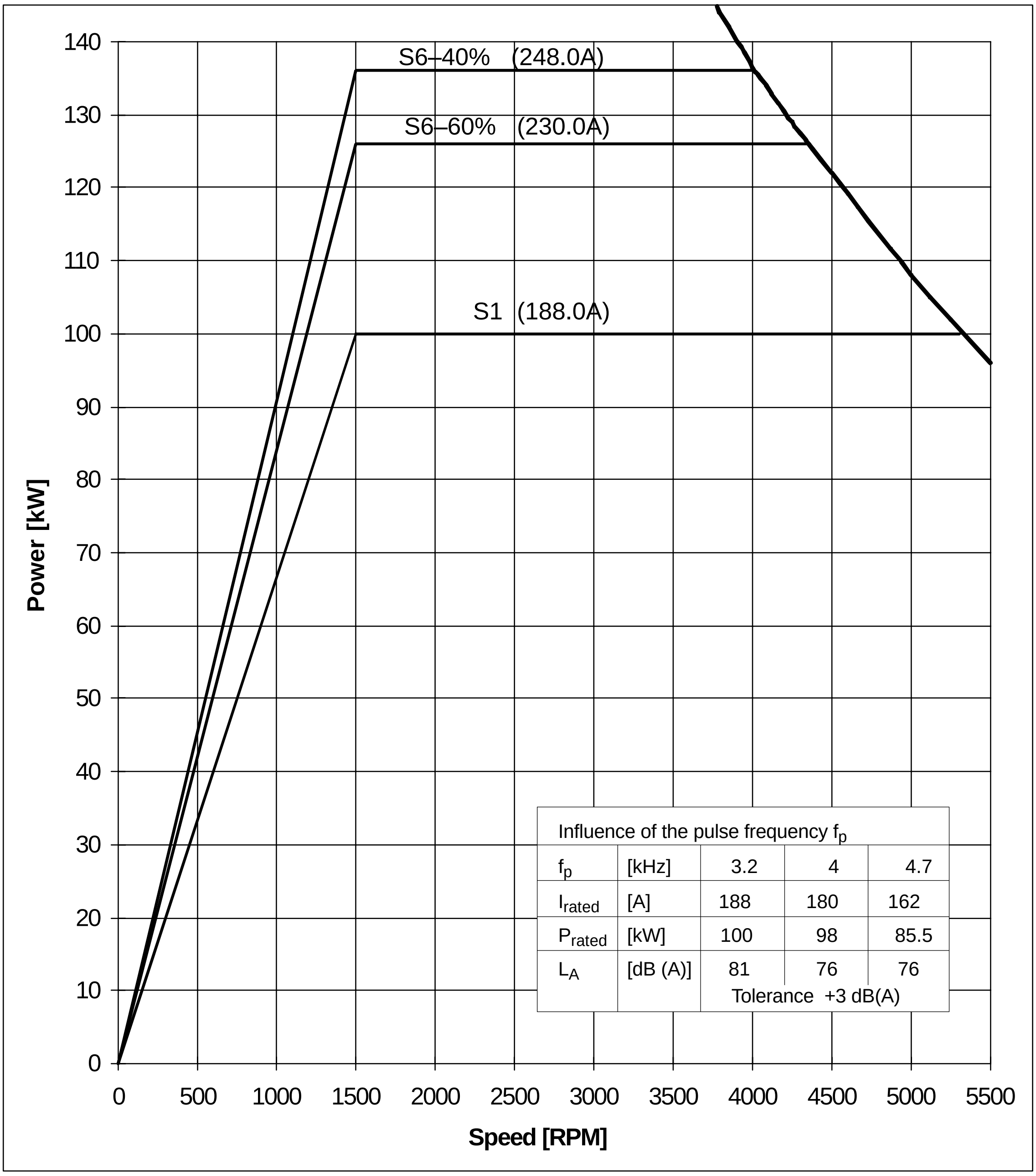


Fig. 3-59 Speed–power diagram 1PH7224–□NF□□

1) optional

3.2 Cantilever/axial force diagrams

General information, refer to Chapter AL A.

Cantilever force

Caution

When using mechanical transmission elements, which subject the shaft end to a cantilever force, then please observe that the **maximum cantilever force, specified in the cantilever force diagrams, is not exceeded.**

Note for shaft heights 180 and 225

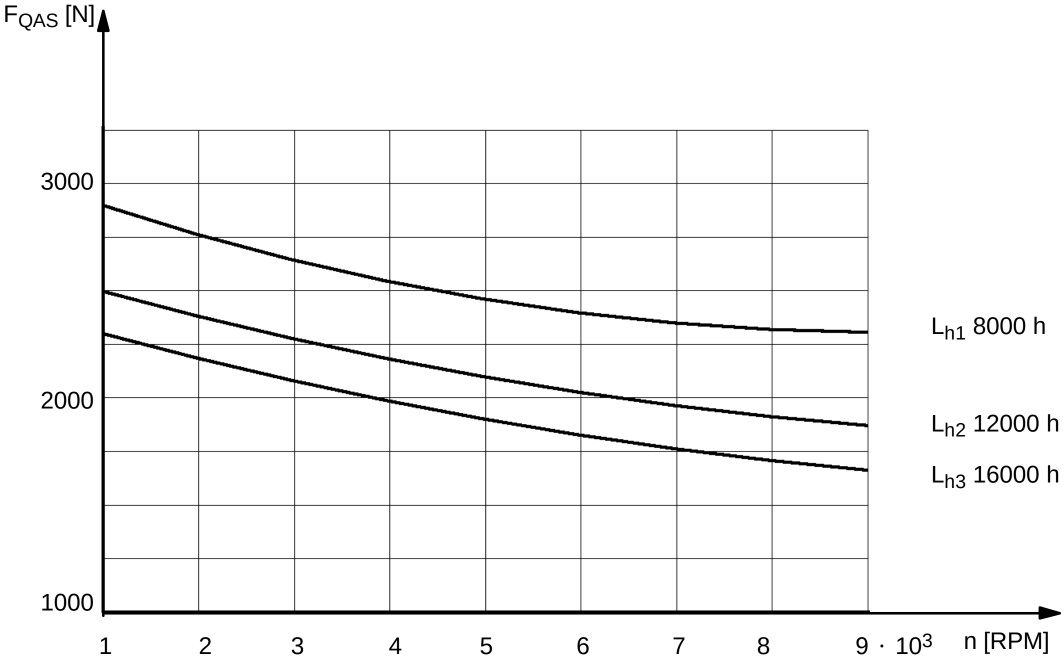
For applications with extremely low cantilever force stressing, it should be ensured that the motor shaft has a **minimum cantilever force, specified in the diagrams**. Lower cantilever forces can result in the cylindrical roller bearings rolling in an undefined fashion. This can result in increased bearing wear and higher noise.

For these applications, the bearing design should be selected for a coupling out–drive.

The maximum permissible and the minimum required cantilever forces are shown in the following diagrams.

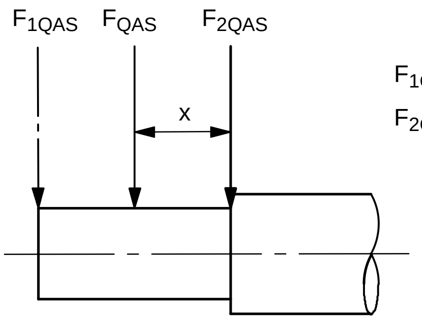
Cantilever force shaft height 100

Permissible cantilever force for a standard bearing design



DE bearing: 6308

NDE bearing: 6208



$F_{1QAS} = 0.9\ F_{QAS}$

$F_{2QAS} = 1.1\ F_{QAS}$

x = 40 mm

Estimated lifetime for other operating conditions (F_{QAS}; n)

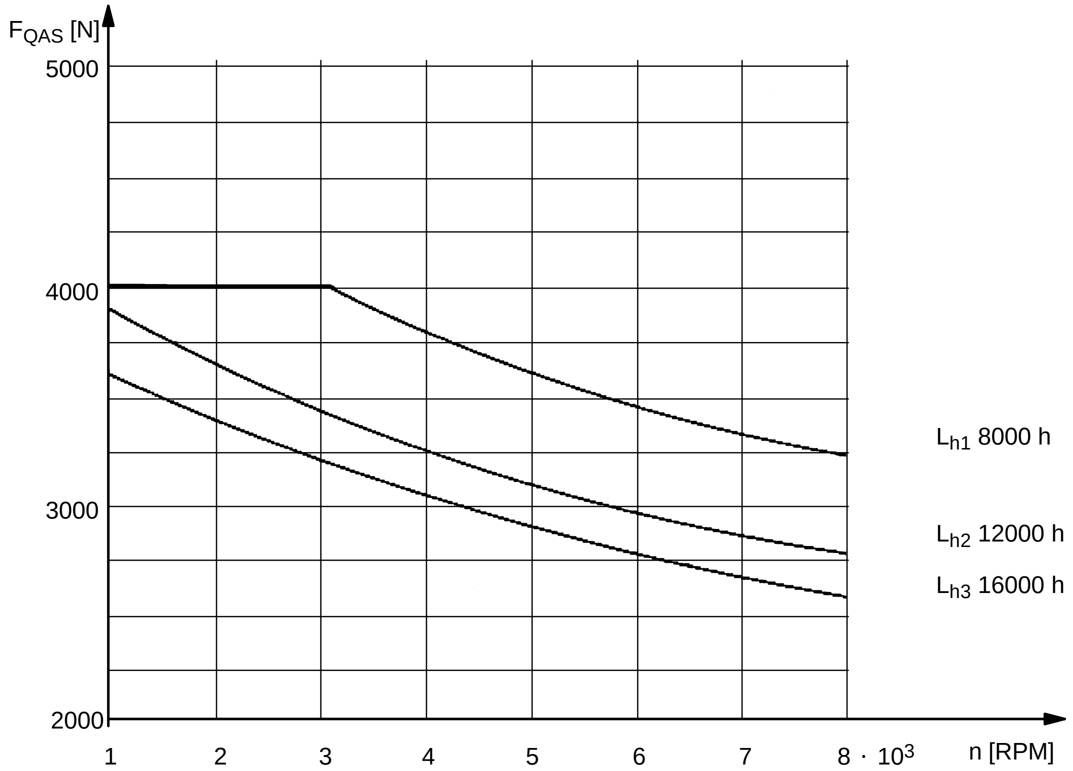
$$L_{htot} = \frac{100}{\frac{q_1}{L_{h1}} + \frac{q_2}{L_{h2}} + \frac{q_3}{L_{h3}}}$$

q = Time for which this is effective [%] under constant conditions

Fig. 3-60 Cantilever force diagram shaft height 100 for standard bearings

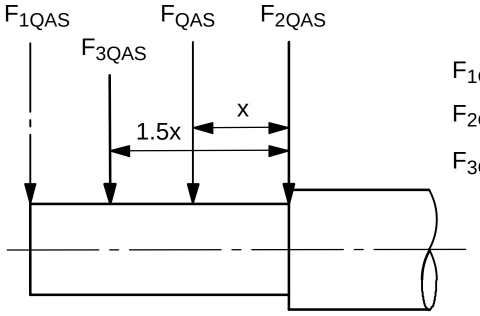
Cantilever force shaft height 132

Permissible cantilever force for a standard design.



DE bearing: 6310

NDE bearing: 6210



F_{1QAS} = max. 2000 N

F_{2QAS} = 1.1 F_{QAS}

F_{3QAS} = max. 2500 N

x = 55 mm

Estimated lifetime for other operating conditions (F_{QAS}; n)

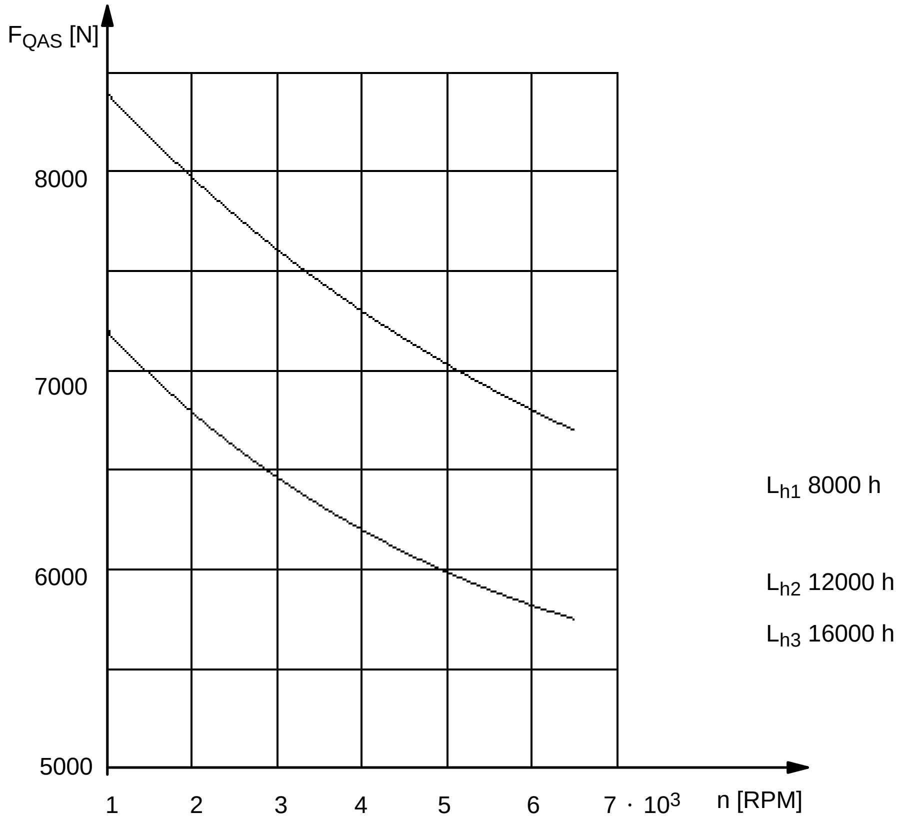
$$L_{htot} = \frac{100}{\frac{q_1}{L_{h1}} + \frac{q_2}{L_{h2}} + \frac{q_3}{L_{h3}}}$$

q = Time for which this is effective [%] under constant conditions

Fig. 3-61 Cantilever force diagram shaft height 132 for standard bearings

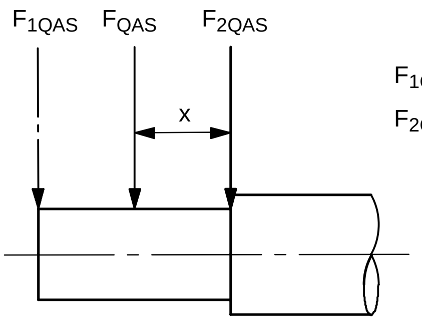
Cantilever force shaft height 160

Permissible cantilever force for a standard design.



DE bearing: 6312

NDE bearing: 6212



$F_{1QAS} = 0.9\ F_{QAS}$

$F_{2QAS} = 1.1\ F_{QAS}$

x = 55 mm

Estimated lifetime for other operating conditions (F_{QAS}; n)

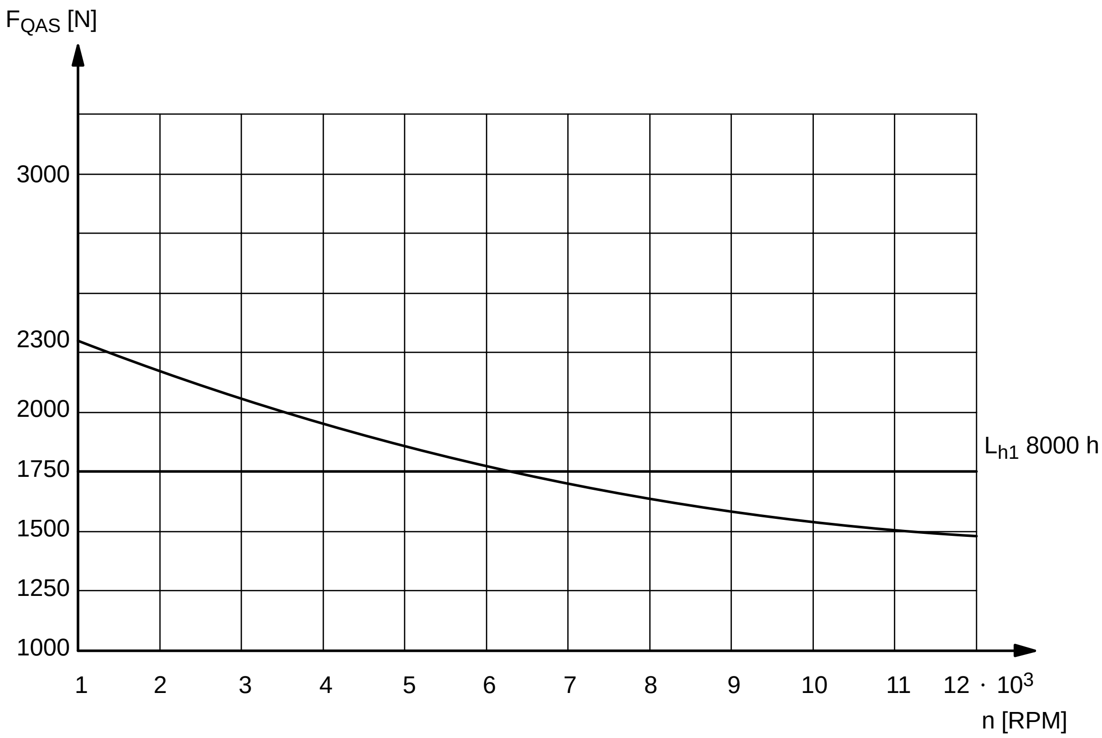
$$L_{htot} = \frac{100}{\frac{q_1}{L_{h1}} + \frac{q_2}{L_{h2}} + \frac{q_3}{L_{h3}}}$$

q = Time for which this is effective [%] under constant conditions

Fig. 3-62 Cantilever force diagram shaft height 160 for standard bearings

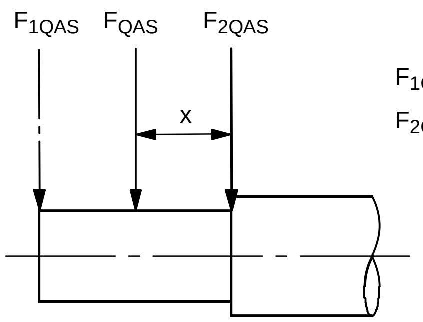
Cantilever force shaft height 100

Permisible cantilever forces for increased max. speed.



DE bearing: 6208

NDE bearing: 6208



$F_{1QAS} = 0.9\ F_{QAS}$

$F_{2QAS} = 1.1\ F_{QAS}$

x = 40 mm

Estimated lifetime for other operating conditions (F_{QAS}; n)

$$L_{htot} = \frac{100}{\frac{q_1}{L_{h1}} + \frac{q_2}{L_{h2}} + \frac{q_3}{L_{h3}}}$$

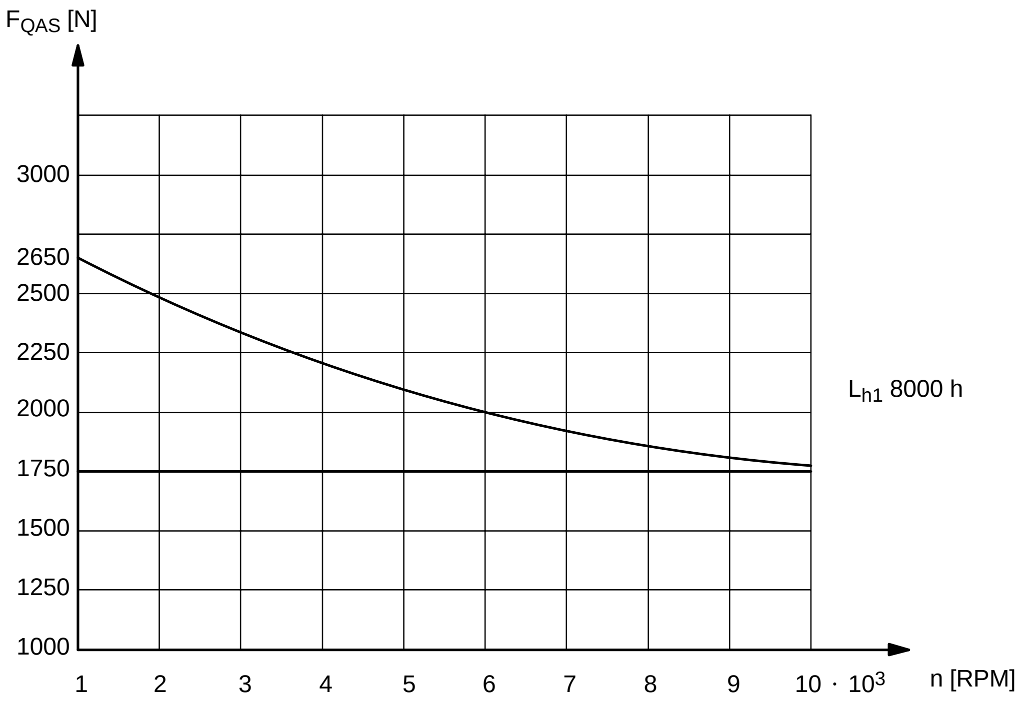
q = Time for which this is effective [%] under constant conditions

Fig. 3-63 Cantilever force diagram shaft height 100 at increased max. speed

1PH7

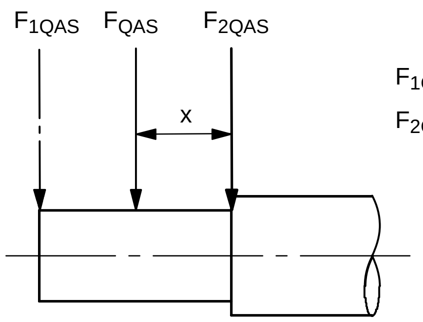
Cantilever force shaft height 132

Permisible cantilever forces for increased max. speed.



DE bearing: 6210

NDE bearing: 6210



$F_{1QAS} = 0.9\ F_{QAS}$

$F_{2QAS} = 1.1\ F_{QAS}$

x = 55 mm

Estimated lifetime for other operating conditions (F_{QAS}; n)

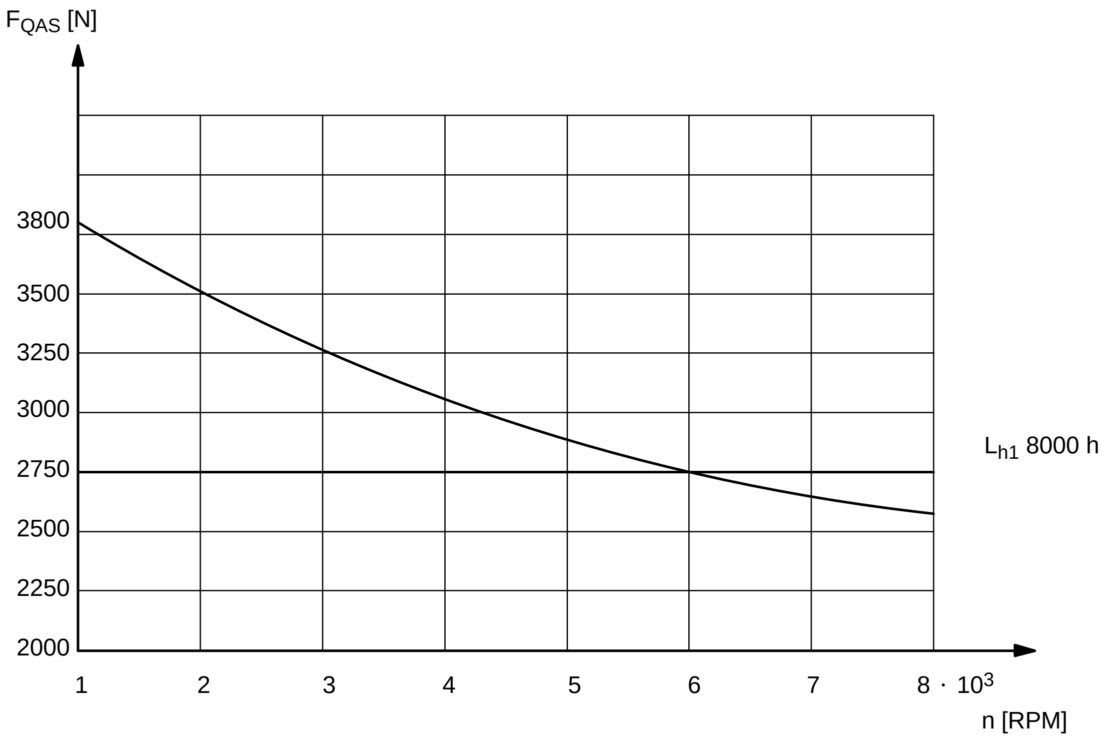
$$L_{htot} = \frac{100}{\frac{q_1}{L_{h1}} + \frac{q_2}{L_{h2}} + \frac{q_3}{L_{h3}}}$$

q = Time for which this is effective [%] under constant conditions

Fig. 3-64 Cantilever force diagram shaft height 132 at increased max. speed

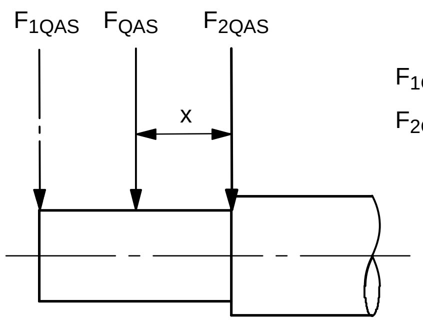
Cantilever force shaft height 160

Permisible cantilever forces for increased max. speed.



DE bearing: 6212

NDE bearing: 6212



$F_{1QAS} = 0.9\ F_{QAS}$

$F_{2QAS} = 1.1\ F_{QAS}$

x = 55 mm

Estimated lifetime for other operating conditions (F_{QAS}; n)

$$L_{htot} = \frac{100}{\frac{q_1}{L_{h1}} + \frac{q_2}{L_{h2}} + \frac{q_3}{L_{h3}}}$$

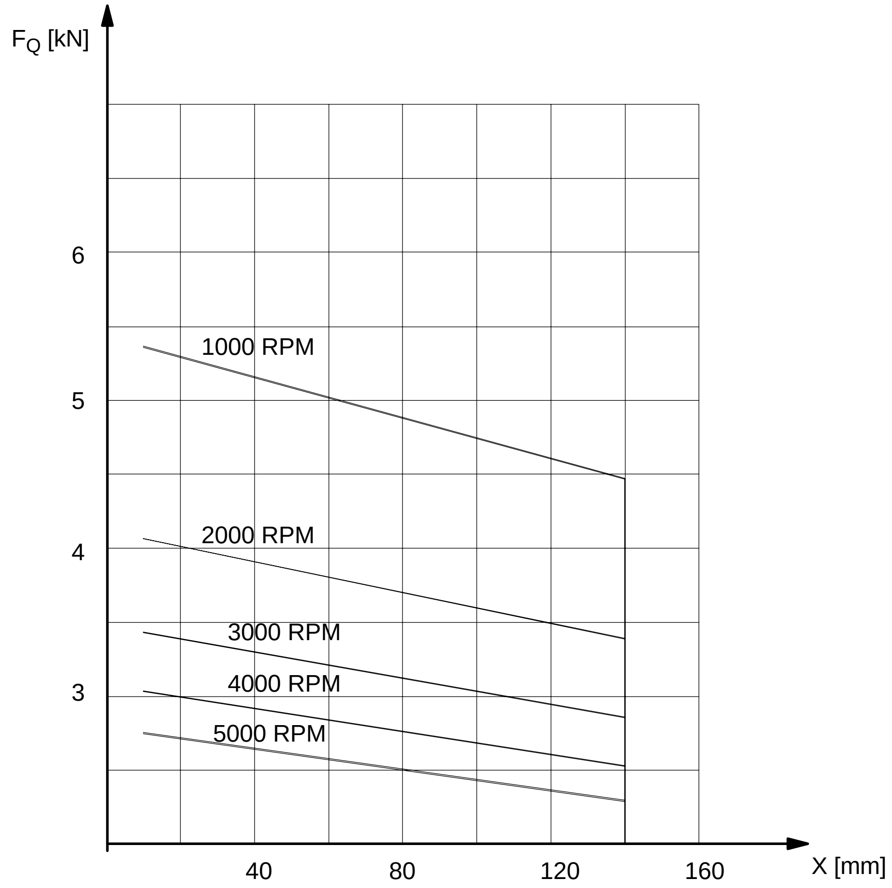
q = Time for which this is effective [%] under constant conditions

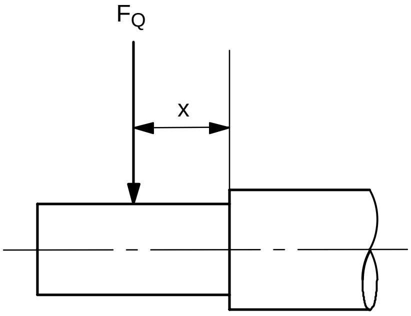
Fig. 3-65 Cantilever force diagram shaft height 160 at increased max. speed

1PH7

Cantilever force shaft height 180

Permissible cantilever forces for coupling drives.





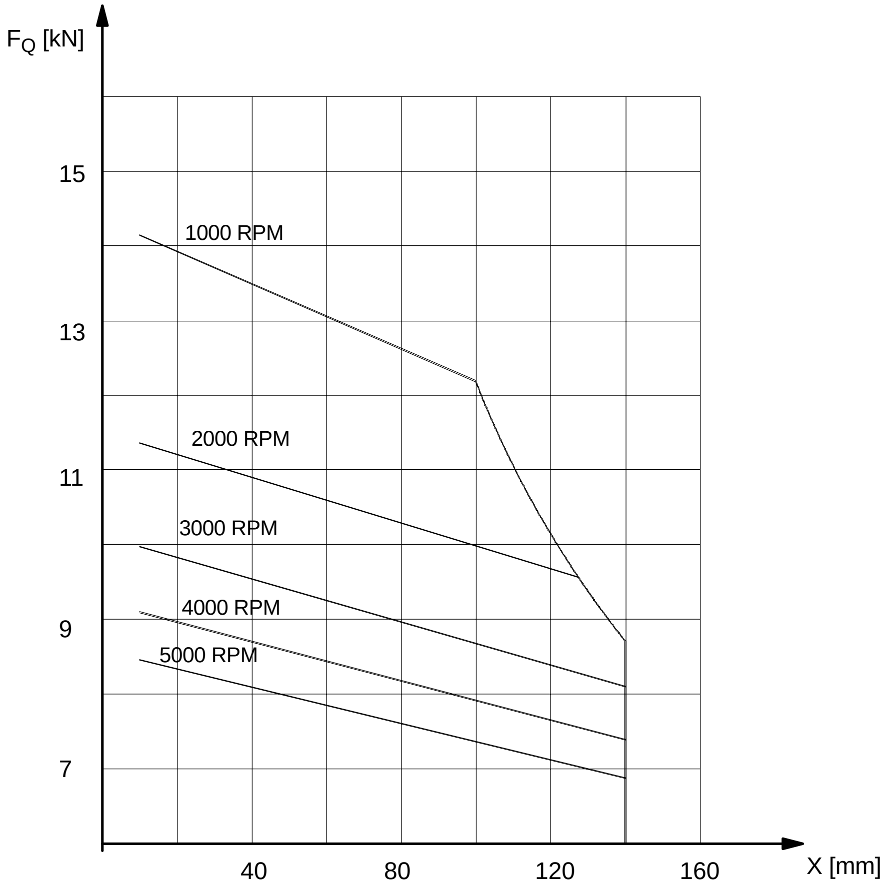
n: Average speed [RPM]

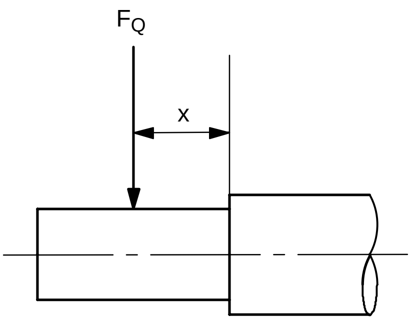
Bearing	DE: 62 14	12.0
	NDE: 62 14	12.0

Fig. 3-66 Cantilever force diagram shaft height 180 with coupling drive out

Cantilever force shaft height 180

Permissible cantilever forces for belt drives.





n: Average speed [RPM]

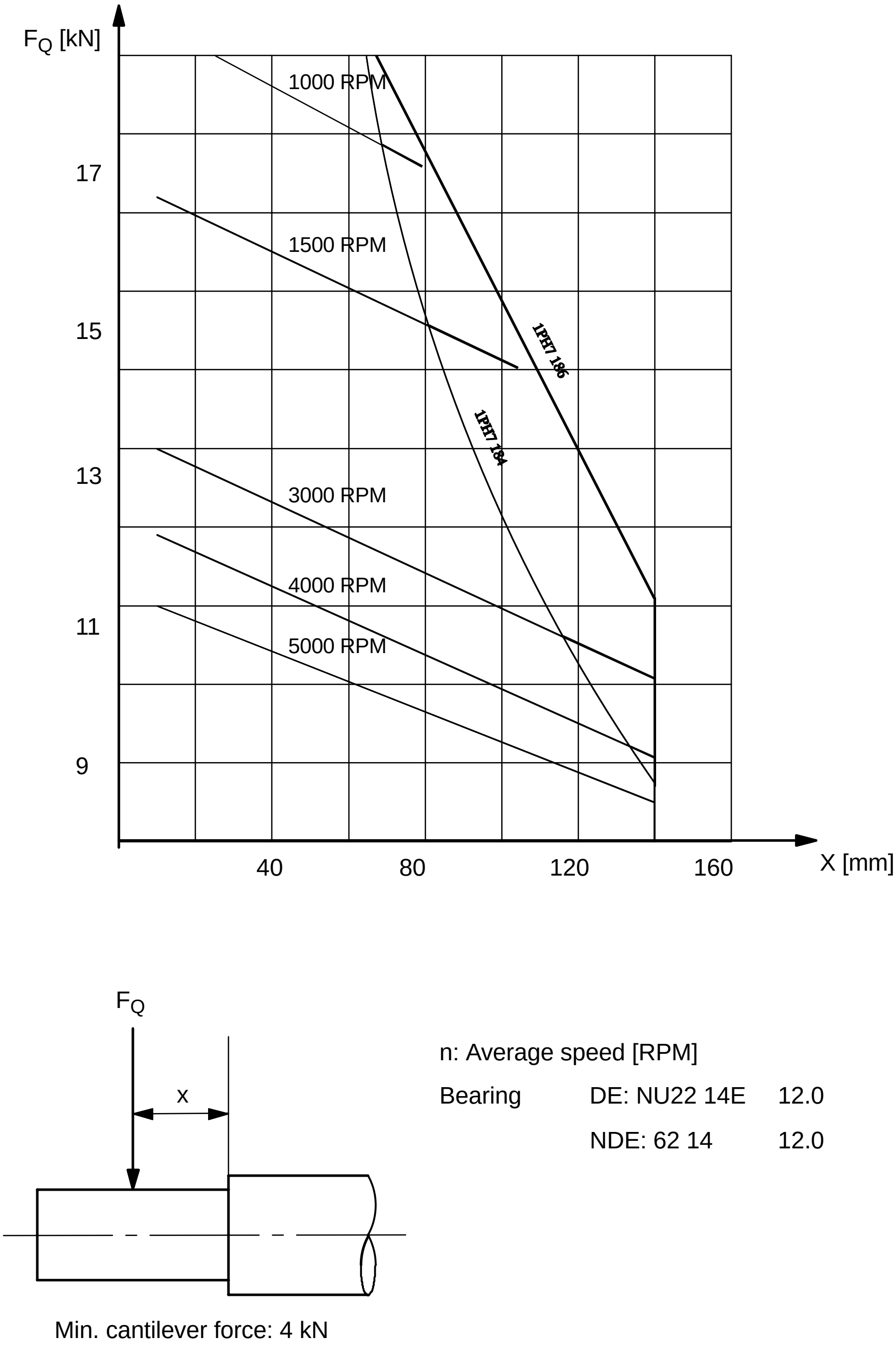
Bearing	DE: NU2 14E	12.0
	NDE: 62 14	12.0

Min. cantilever force: 3 kN

Fig. 3-67 Cantilever force diagram shaft height 180 for belt drives

Cantilever force shaft height 180

Permissible increased cantilever forces for belt drives.



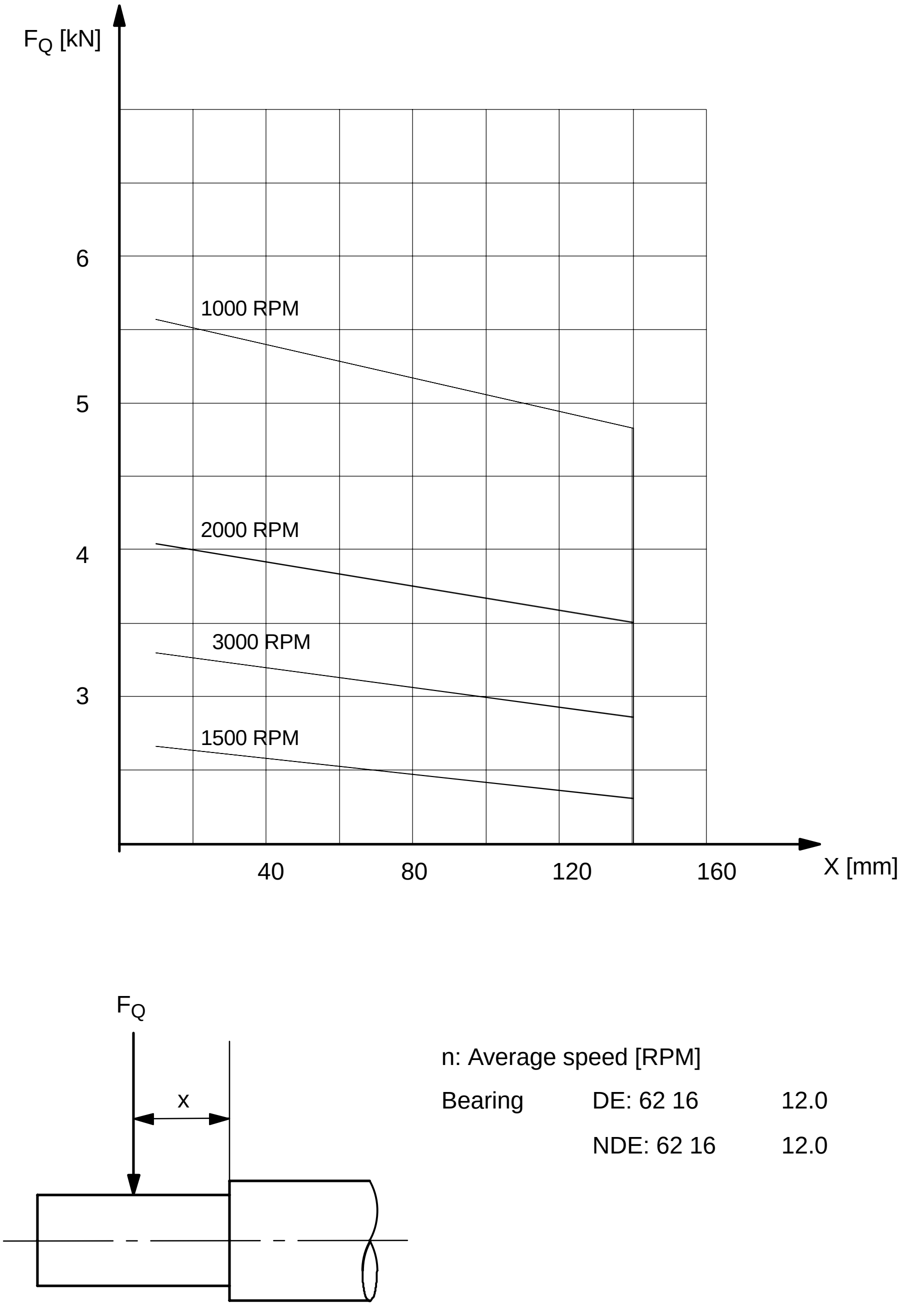
n: Average speed [RPM]

Bearing	DE: NU22 14E	12.0
	NDE: 62 14	12.0

Fig. 3-68 Cantilever force diagram shaft height 180 for belt drives (increased cantilever force)

Cantilever force shaft height 225

Permissible cantilever forces for coupling drives.



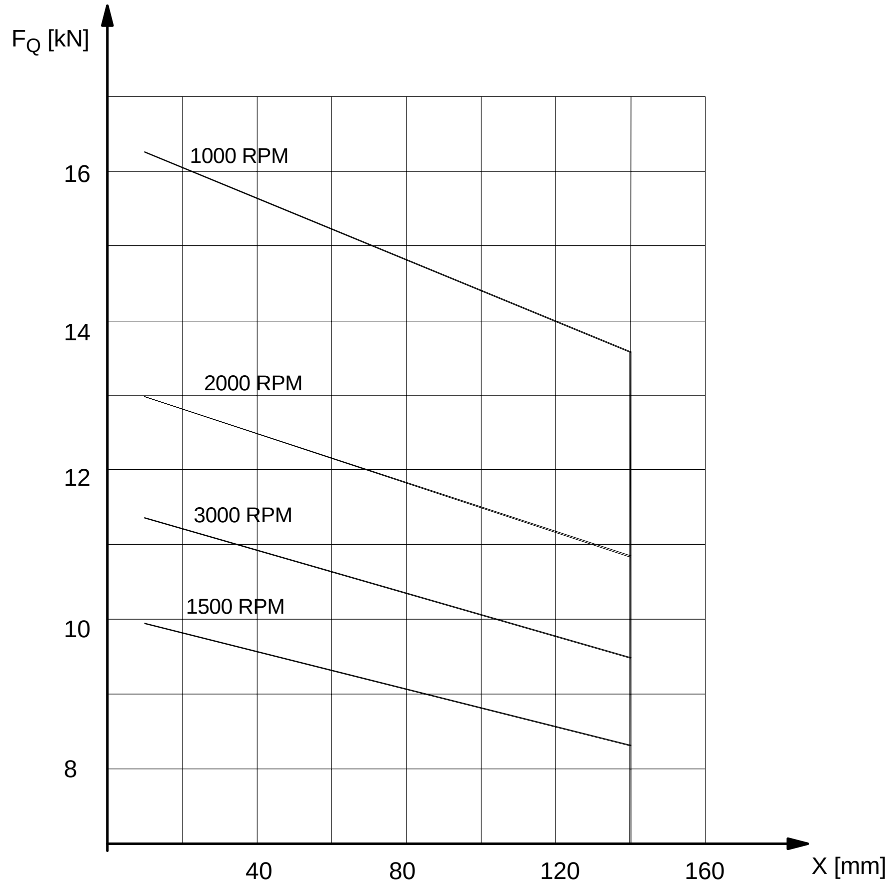
n: Average speed [RPM]

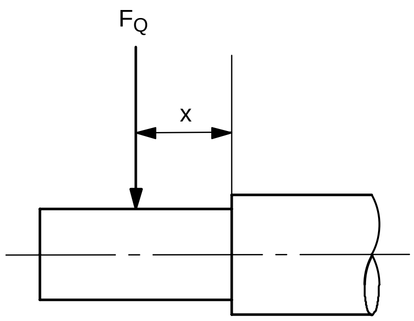
Bearing	DE: 62 16	12.0
	NDE: 62 16	12.0

Fig. 3-69 Cantilever force diagram shaft height 225 with coupling drive out

Cantilever force shaft height 225

Permissible cantilever forces for belt drives





n: Average speed [RPM]

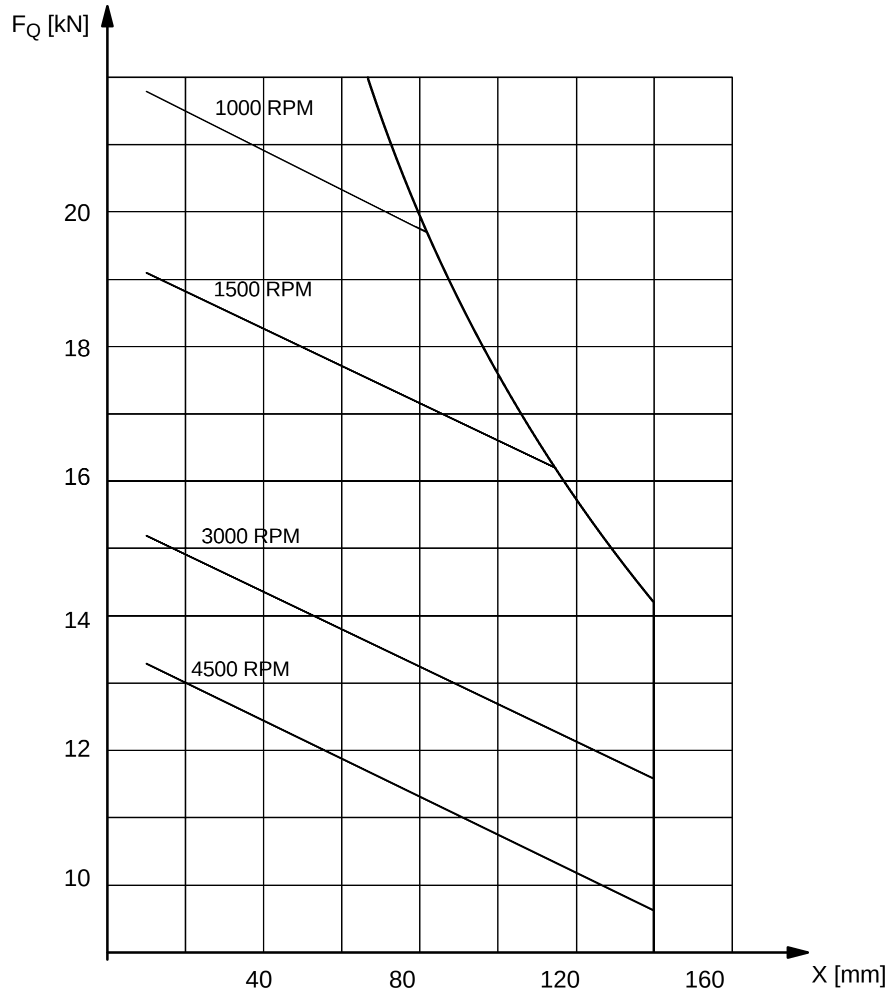
Bearing	DE: NU2 16E	12.0
	NDE: 62 16	12.0

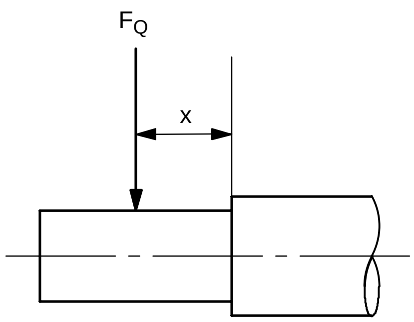
Min. cantilever force: 4 kN

Fig. 3-70 Cantilever force diagram shaft height 225 for belt drives

Cantilever force shaft height 225

Permissible increased cantilever forces for belt drives.





n: Average speed [RPM]

Bearing	DE: NU22 16E	12.0
	NDE: 62 16	12.0

Min. cantilever force: 5 kN

Fig. 3-71 Cantilever force diagram shaft height 225 for belt drives (increased cantilever force)

Axial force

The maximum axial forces F_{AZ} for horizontal motor mounting, for shaft heights 100 to 160, are specified in the following force diagrams.

The force diagrams and tables are only valid for standard drive shaft ends; for non–standard drive shaft end dimensions, the permissible forces are defined on a case–for–case basis.

Please contact us for forces which go beyond these values

Shaft heights 180 and 225

Generally, only low axial forces occur for coupling, belt or pinion drives with straight tooth designs. The locating bearing is adequately dimensioned, so that these forces can be accepted in all mounting positions. The following forces due to the weight of the drive element are permissible if perfect oscillation and vibration characteristics are to be obtained at the shaft end:

- shaft height 180: max 500 N
- shaft height 225: max. 600 N

For pinion drives with helical teeth, please inquire.

Note

- Permissible axial force at the shaft end, not taking into account the bearing alignment force of the rotor weight, the mounting position as well as the force direction.
- For an explanation of axial force stressing, refer to Section AL A/2–5.

Rotor weight forces; bearing alignment forces

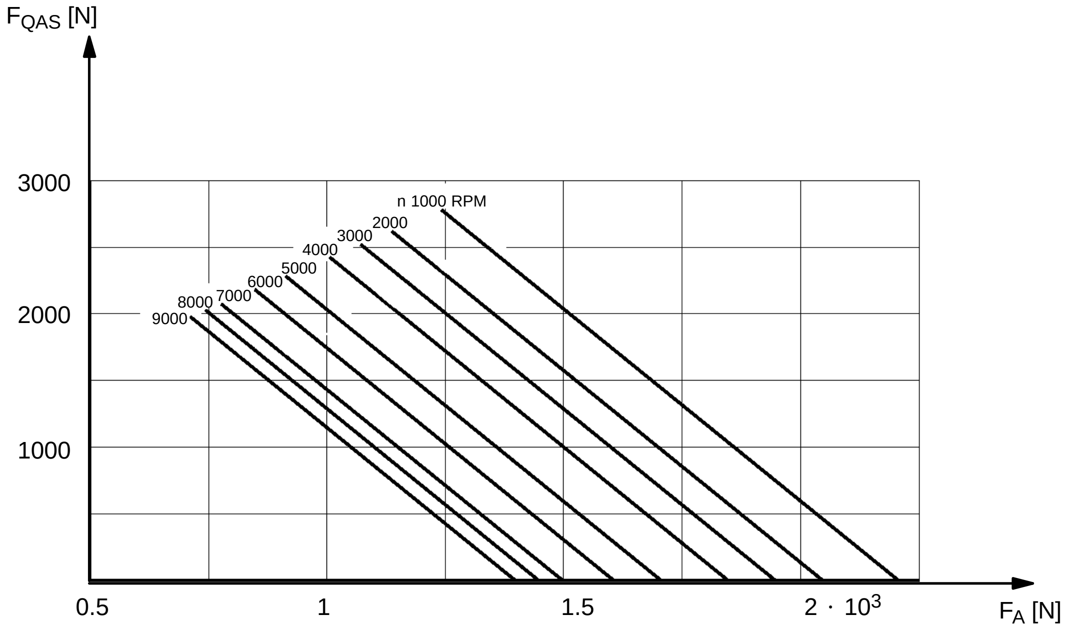
Table 3-60 Weight F_L and bearing alignment force F_C of the rotor

Motor type	F_L [N]	F_C [N]
1PH7101 1PH7103 1PH7105 1PH7107	125 125 200 200	400
1PH7133 1PH7135 1PH7137	290 410 410	600
1PH7163 1PH7167	520 630	800
1PH7184 1PH7186	980 1220	500 1)
1PH7224	1720	550 1)

1) only for coupling drives

Axial force shaft height 100

Axial force at the shaft end.



Permissible axial force at the shaft end

DE bearing: 6308 F_C = 400 N
NDE bearing: 6208

——— L_h = 12000 h
F_C = Bearing alignment force

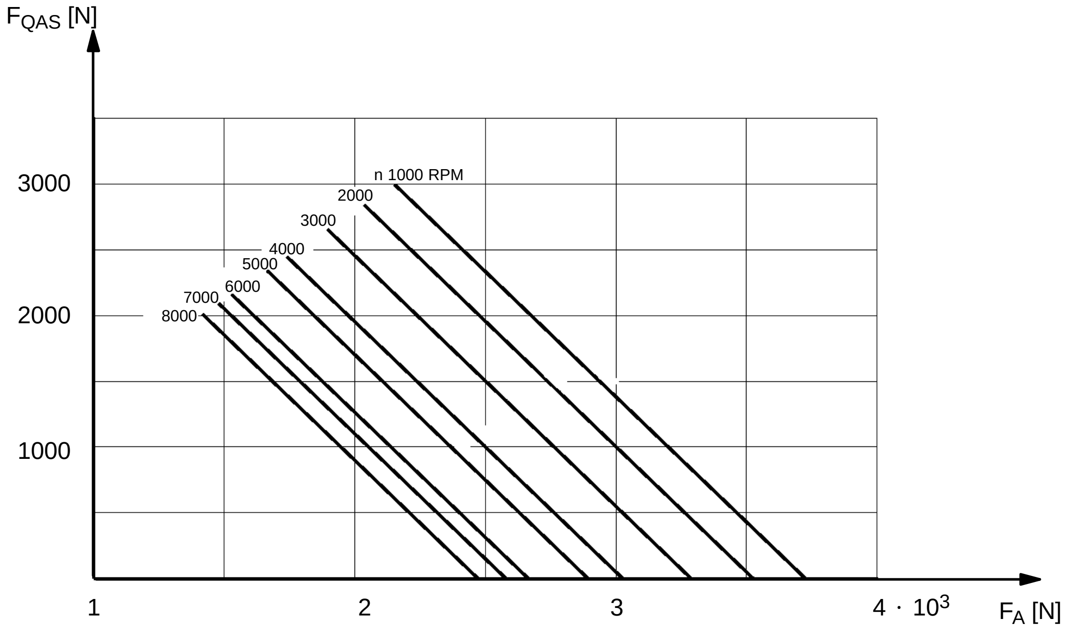
Fig. 3-72 Axial force diagram and the shaft end, shaft height 100

Refer to Section AL A/2–5, to determine the axial force

1PH7

Axial force shaft height 132

Axial force at the shaft end.



Permissible axial force at the shaft end

DE bearing: 6310 F_C = 600 N
NDE bearing: 6210

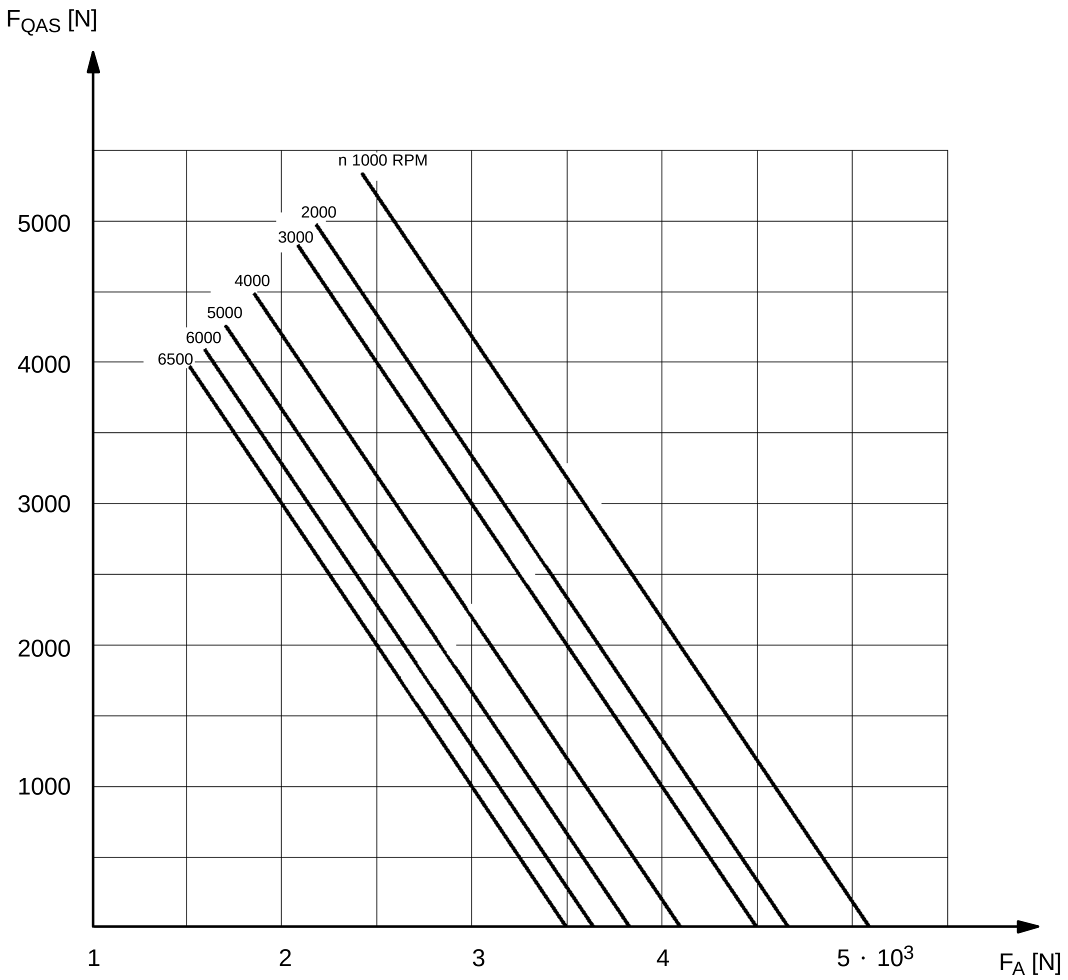
——— L_h = 12000 h

F_C = Bearing alignment force

Fig. 3-73 Axial force diagram and the shaft end, shaft height 132

Axial force shaft height 160

Permissible axial force at the shaft end.



Permissible axial force at the shaft end

DE bearing: 6312 F_C = 800 N
NDE bearing: 6212

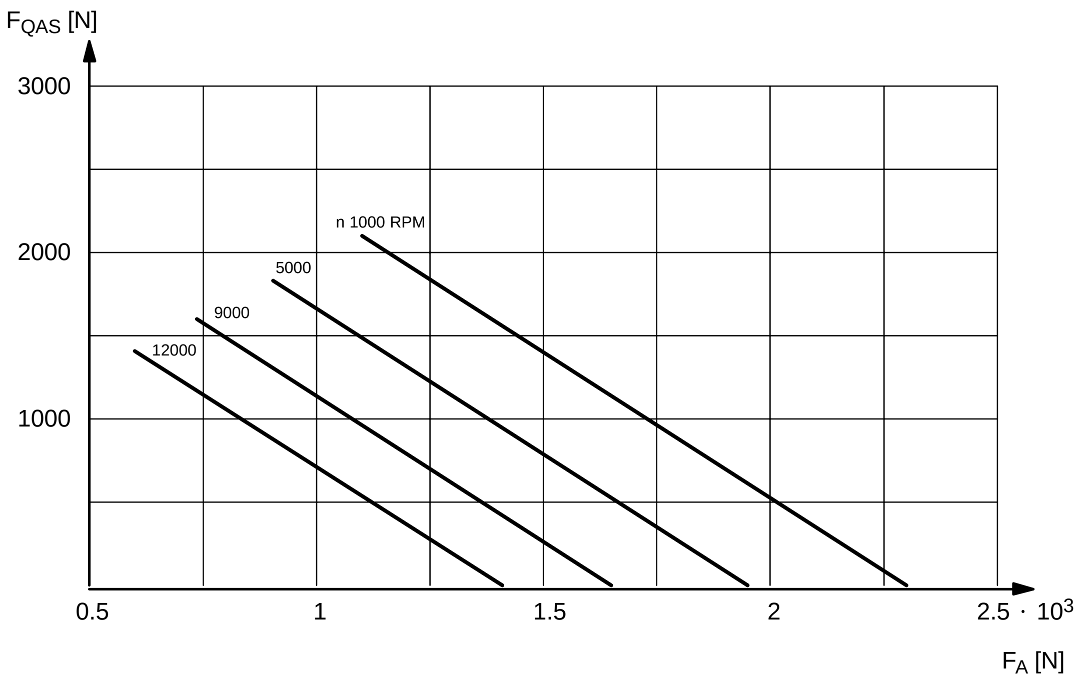
———— L_h = 12000 h
F_C = Bearing alignment force

Fig. 3-74 Axial force diagram and the shaft end, shaft height 160

1PH7

Axial force shaft height 100

Axial force at the shaft end at increased max. speed.



Permissible axial force at the shaft end

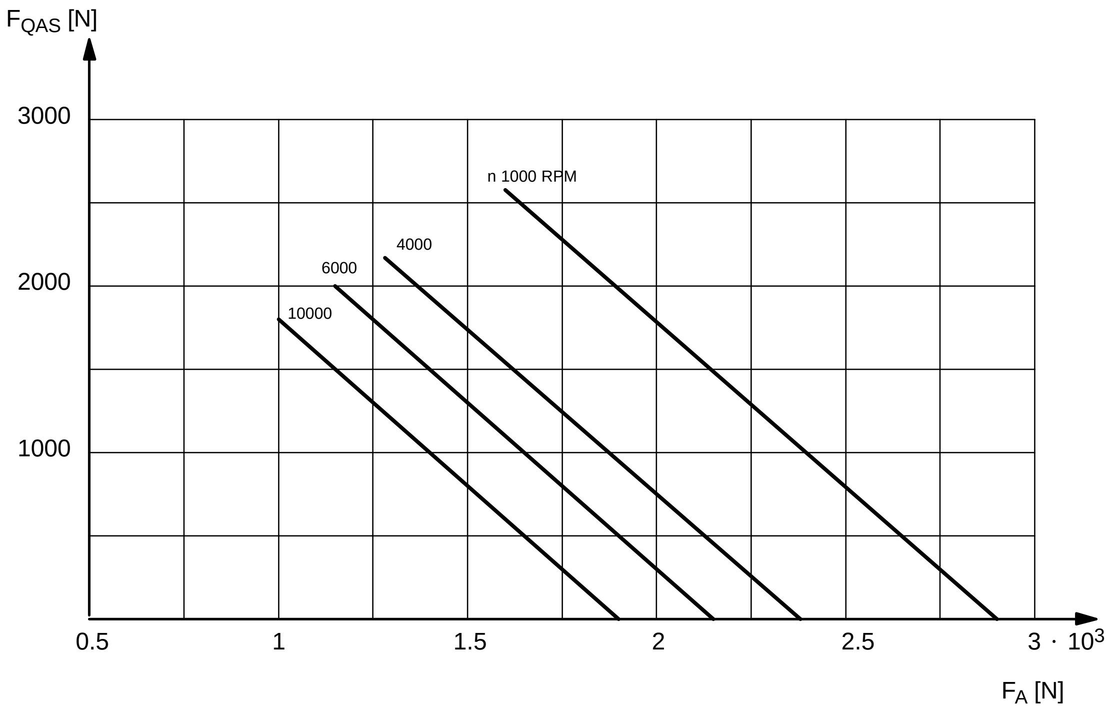
DE bearing: 6208 F_C = 400 N
NDE bearing: 6208

———— L_h = 8000 h
F_C = Bearing alignment force

Fig. 3-75 Axial force diagram at the shaft end, shaft height 100 (increased max. speed)

Axial force shaft height 132

Axial force at the shaft end at increased max. speed.



Permissible axial force at the shaft end

DE bearing: 6210 F_C = 400 N

NDE bearing: 6210

——— L_h = 8000 h

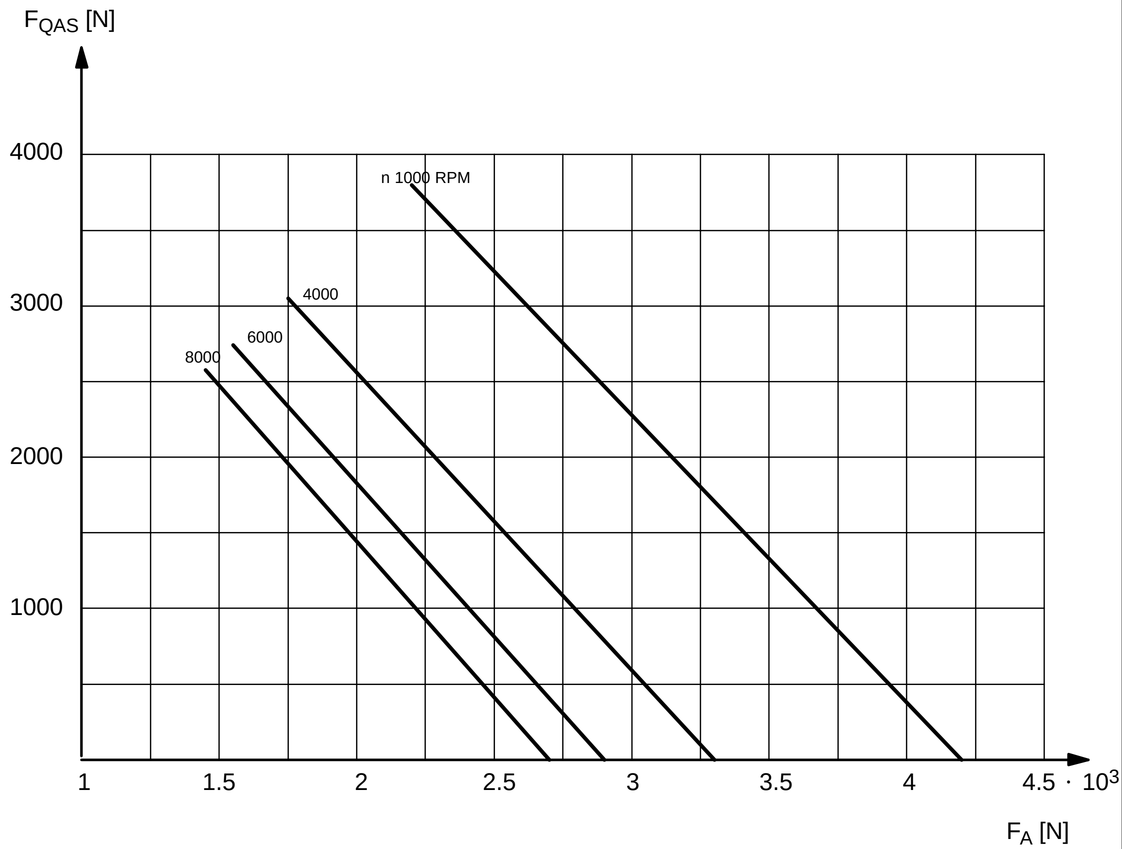
F_C = Bearing alignment force

Fig. 3-76 Axial force diagram at the shaft end, shaft height 132 (increased max. speed)

1PH7

Axial force shaft height 160

Axial force at the shaft end at increased max. speed.



Permissible axial force at the shaft end

DE bearing: 6212 F_C = 400 N
NDE bearing: 6212

——— L_h = 8000 h
F_C = Bearing alignment force

Fig. 3-77 Axial force diagram at the shaft end, shaft height 160 (increased max. speed)

■

4 Dimension Drawings

For 1PH7 motors, the following deviations are permissible for the dimensions specified in the following table.

Table 4-1 Permissible dimension deviations

Dimension	Permissible deviations		
a,b	to 250 mm above 250 mm to 500 mm above 500 mm to 750 mm		± 0.75 mm ± 1.0 mm ± 1.5 mm
b_1	to 230 mm above 230 mm	DIN 7160	j6 h6
d, d_1	to 11 mm above 11 mm to 50 mm above 50 mm	DIN 7160	j6 k6 m6
e_1	to 200 mm above 200 mm to 500 mm		± 0.25 mm ± 0.5 mm
h	above 50 mm to 250 mm above 250 mm to 500 mm	DIN 747	–0.5 mm –1.0 mm
i, i_1, i_2	to 85 mm above 85 mm to 130 mm above 130 mm to 240 mm		± 0.75 mm ± 1.0 mm ± 1.5 mm
u, t, u_1, t_1		acc. to DIN 6885 Sheet 1	

Note

Siemens AG reserves the right to change motor dimensions within the scope of design improvements without prior notice. Dimension drawings can go out of date. Up–to–date dimension drawings can be requested at no charge.

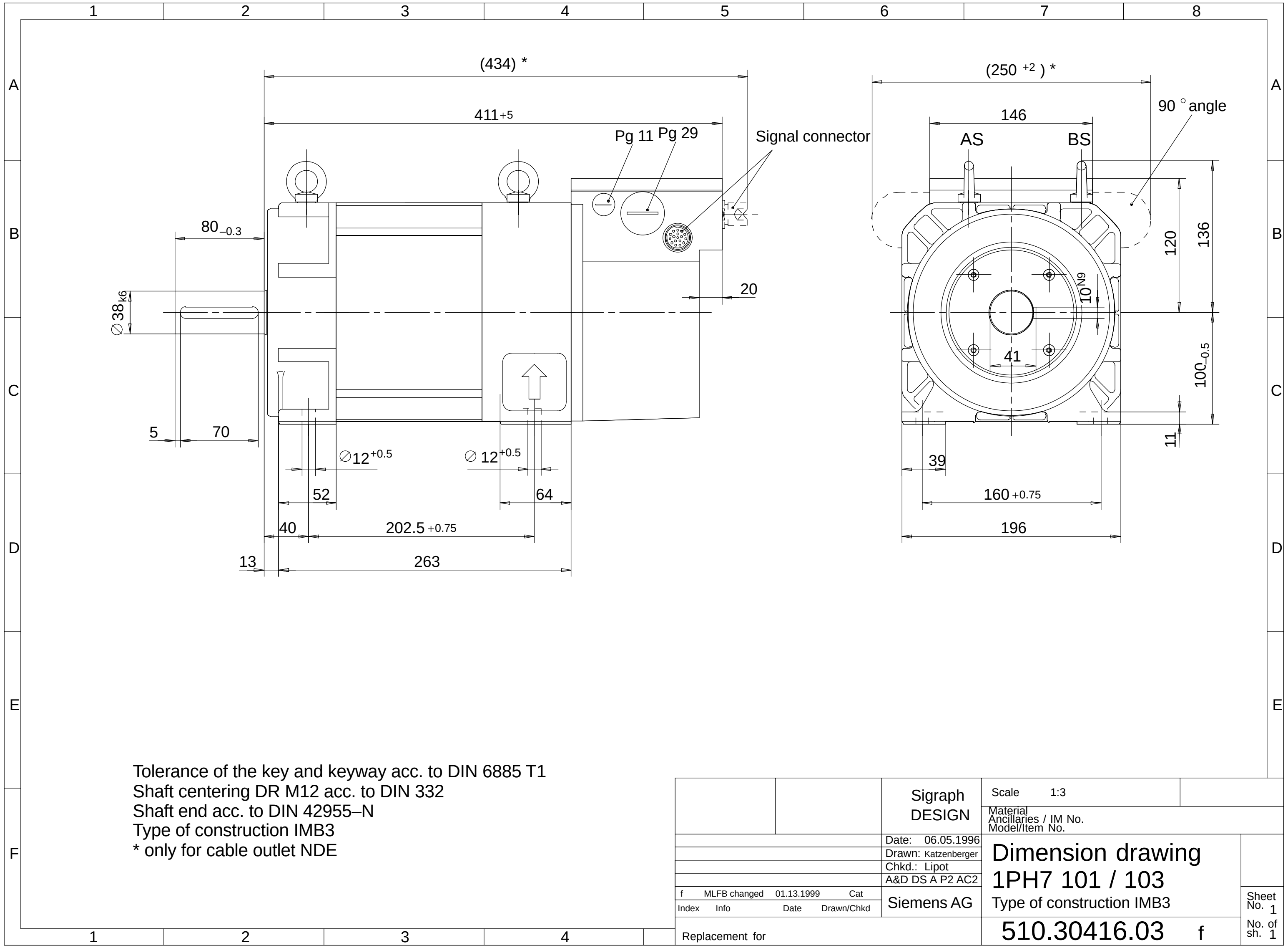
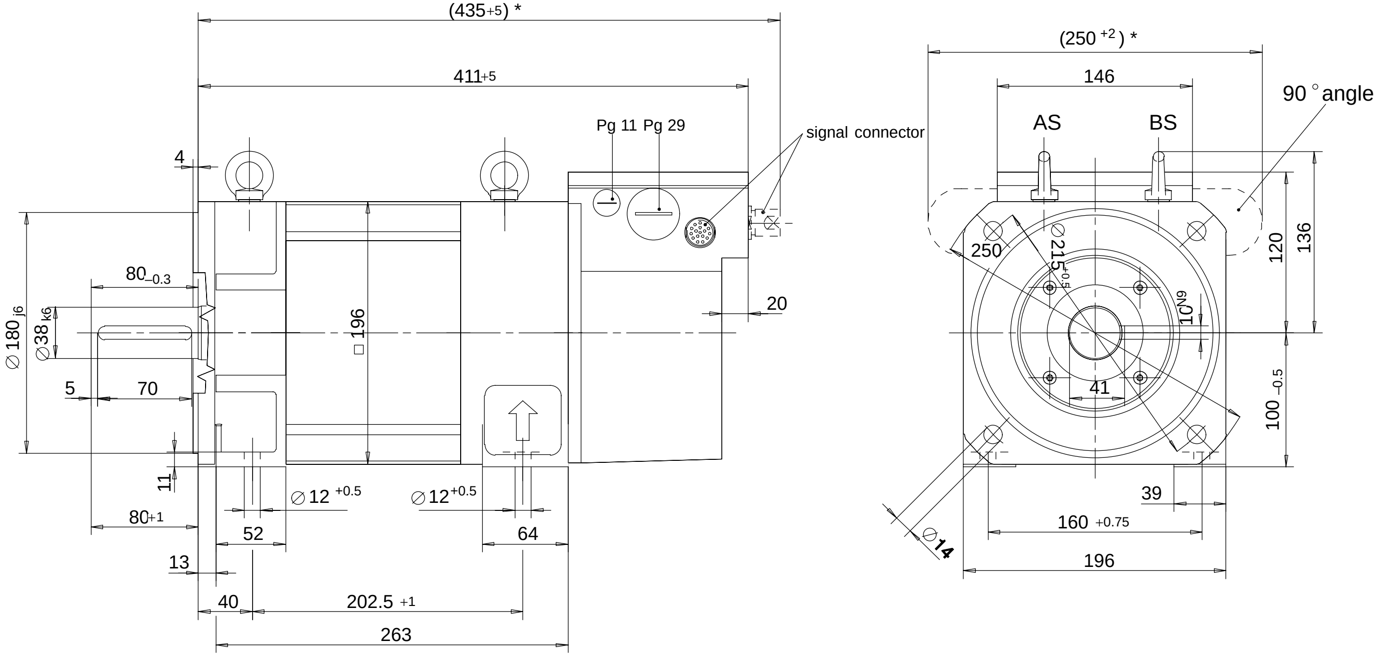


Fig. 4-1 1PH7 101/103, type of construction IM B3

 6SN1197–0AA20

Fig. 4-2 1PH7 101/103, type of construction IM B35



Tolerance of the key and keyway acc. to DIN 6885 T1
Flange size A250 acc. to DIN 42948
Shaft centering DR M12 acc. to DIN 332
Mounting flange and shaft end acc. DIN 42955–N
Type of construction iMB35
* Only for cable outlet NDE

Index	Info	Date	Drawn/chkd.
a	Dim. 234 ch. to 250+2	15.12.97	Stf / Li
b	Text corrected	13.07.98	Di/Kat
c	MLFB changed	01.13.1999	Kat

Sigraph DESIGN
Scale 1:3
Material Ancillaries / IM No. MOdel/Item No.
Date: 13.11.1997
drawn: Stumpf
Chkd.: Lipot
A&D DS A P2 AC2
Siemens AG

Dimension drawing 1PH7 101 / 103
Type of construction IMB35

Sheet No. 1
No. of sh. 1
510.30418.03 c
Replacement for

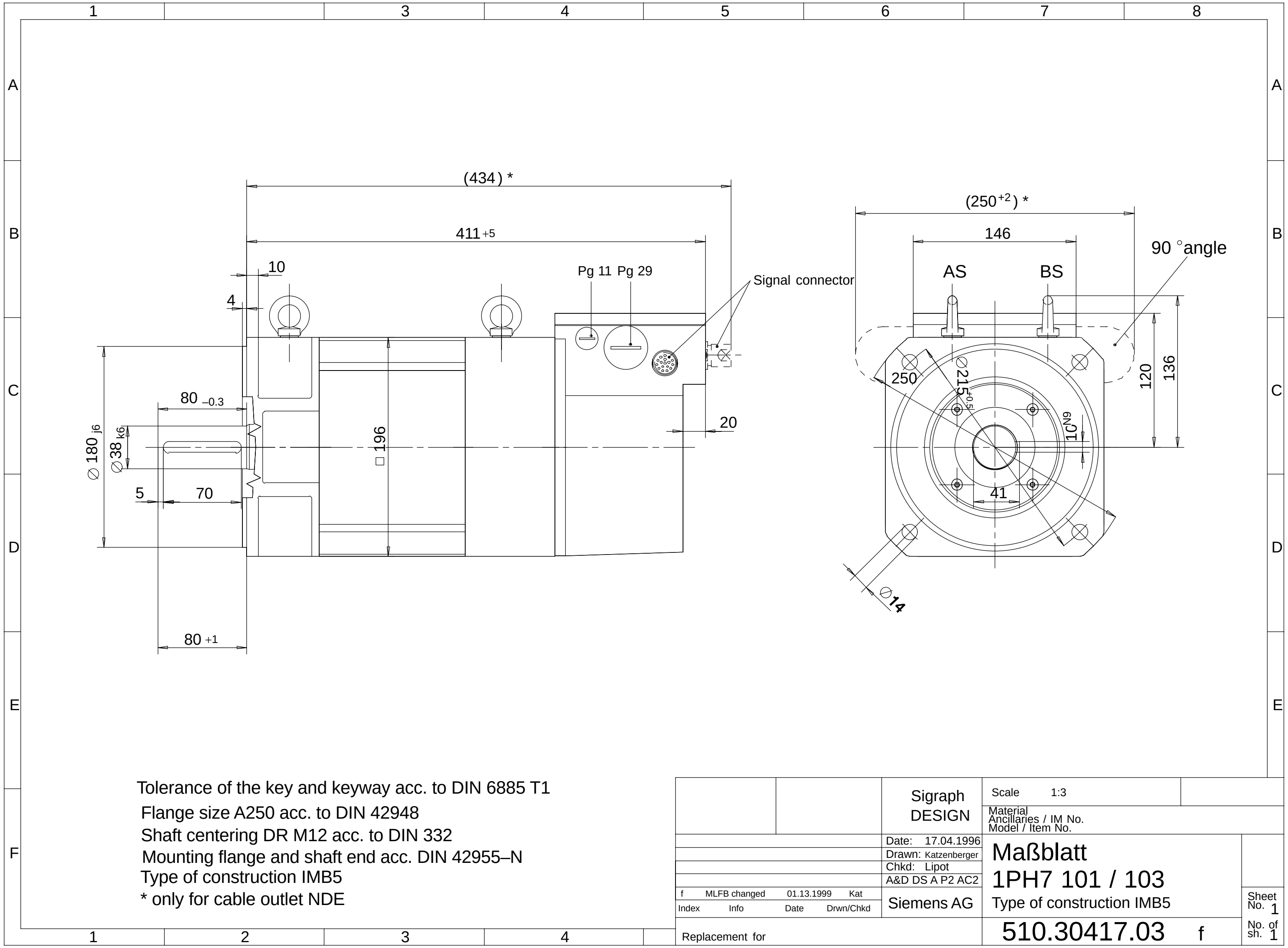
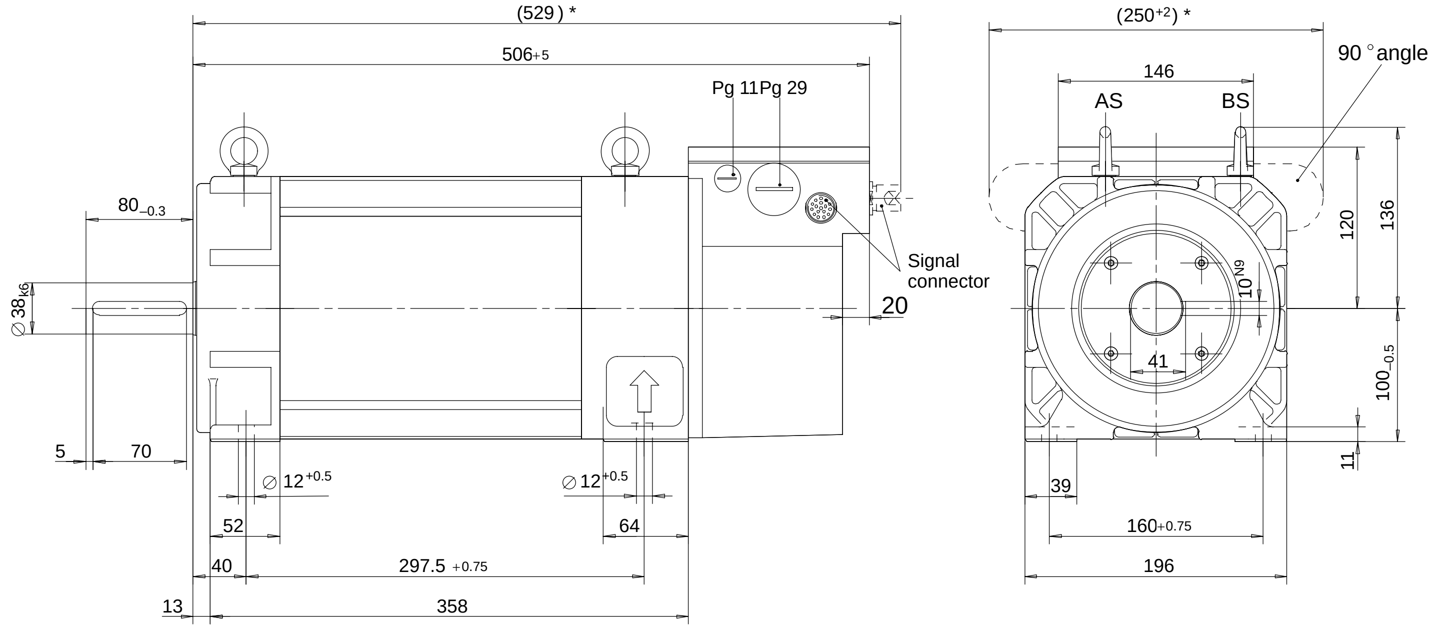


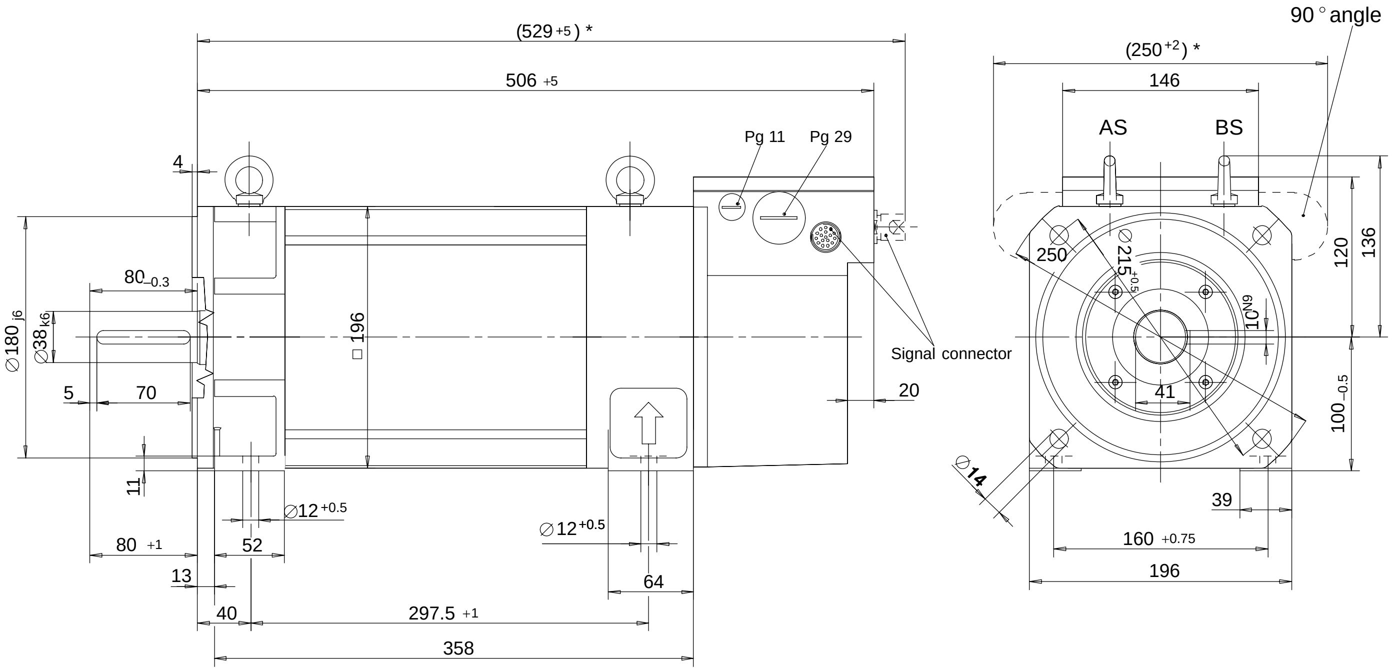
Fig. 4-3 1PH7 101/103, type of construction IM B5

Fig. 4-4 1PH7 105/107, type of construction IM B3



Tolerance of the key and keyway acc. to DIN 6885 T1
Shaft centering DR M12 acc. to DIN 332
Shaft end acc. to DIN 42955–N
Type of construction IMB3
* only for cable outlet NDE

DESIGN	Scale 1:3
	Mateial / Ancillaries / IM No. / Model / Item No.
Date: 06.05.1996	Dimension drawing 1PH7 105 / 107
Drawn Katzenberger	
Chkd: Lipot	
A&D DS A P2 AC2	
f MLFB changed 01.03.1999 Cat	
Index Info Date Drwn/Chkd	Siemens AG / Type of construction IMB3 / Sheet No. 1
Replacement for	510.30416.07 f / No. of sh. 1



Tolerance of the key and keyway acc. to DIN 6885 T1
Flange size A250 acc. to DIN 42948
Shaft centering DR M12 acc. to DIN 332
Mounting flange and shaft end acc. DIN 42955–N
Type of construction IMB35
* only for cable outlet NDE

Index	Info	Date	Drawn/Chkd		
a	Dim. 234 ch. to 250+2	16.12.97	Stf / Li	Date: 14.11.1997	
b	Text corrected	13.07.98	Di/Kat	Drawn: Stumpf	
c	MLFB changed	01.03.1999	Cat	Chkd.: Lipot	
				A&D DS A P2 AC2	

Sigraph DESIGN
Scale 1:3
Material
Ancillaries / IM No.
Model / Item No.
Dimension drawing
1PH7 105 / 107
Type of construction iMB35
Siemens AG
Sheet No. 1
No. of sh. 1
510.30418.07 c
Replacement for:

Fig. 4-5 1PH7 105/107, type of construction IM B35

Fig. 4-6 1PH7 105/107, type of construction IM B5

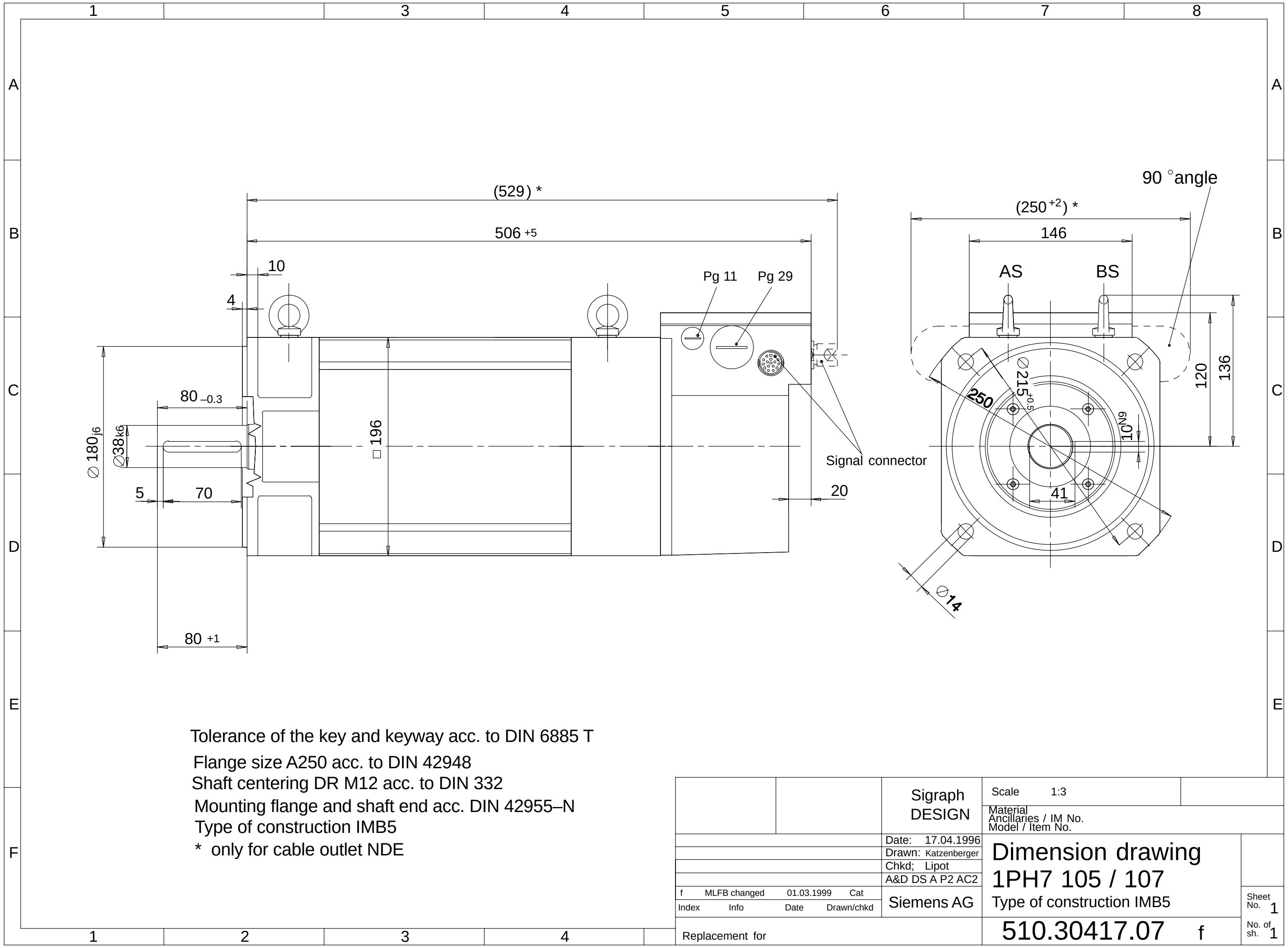
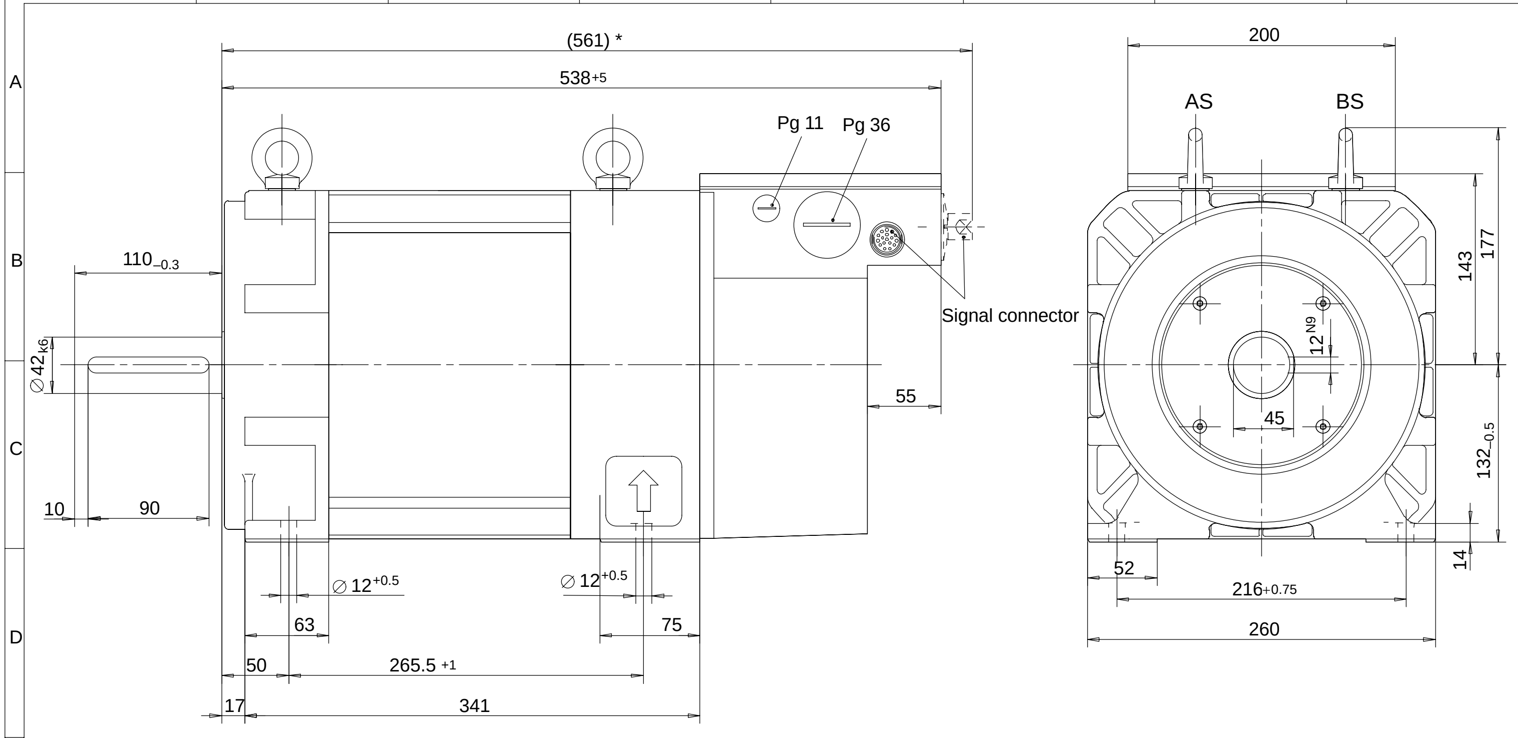


Fig. 4-7 1PH7 131/133, type of construction IM B3



Tolerance of the key and keyway acc. to DIN 6885 T1
Shaft centering DR M16 acc. to DIN 332
Shaft end acc. to DIN 42955–N
Type of construction IMB3
* only for cable outlet NDE

Index	Info	Date	Drawn/Chkd
d	MLFB changed	01.03.1999	Cat
c	Cable outlet NDE added	12.11.97	Stf / Li
b	PF–Maß berichtigt	24.01.1997	Cat
a	MLFB changed	28.06.1996	Cat

Sigraph DESIGN
Scale 1:3
Material
Ancillaries / IM No.
Model / Item No.
Date: 06.05.1996
Drawn: Katzenberger
Chkd: Lipot
A&D DS A P2 AC2
Siemens AG

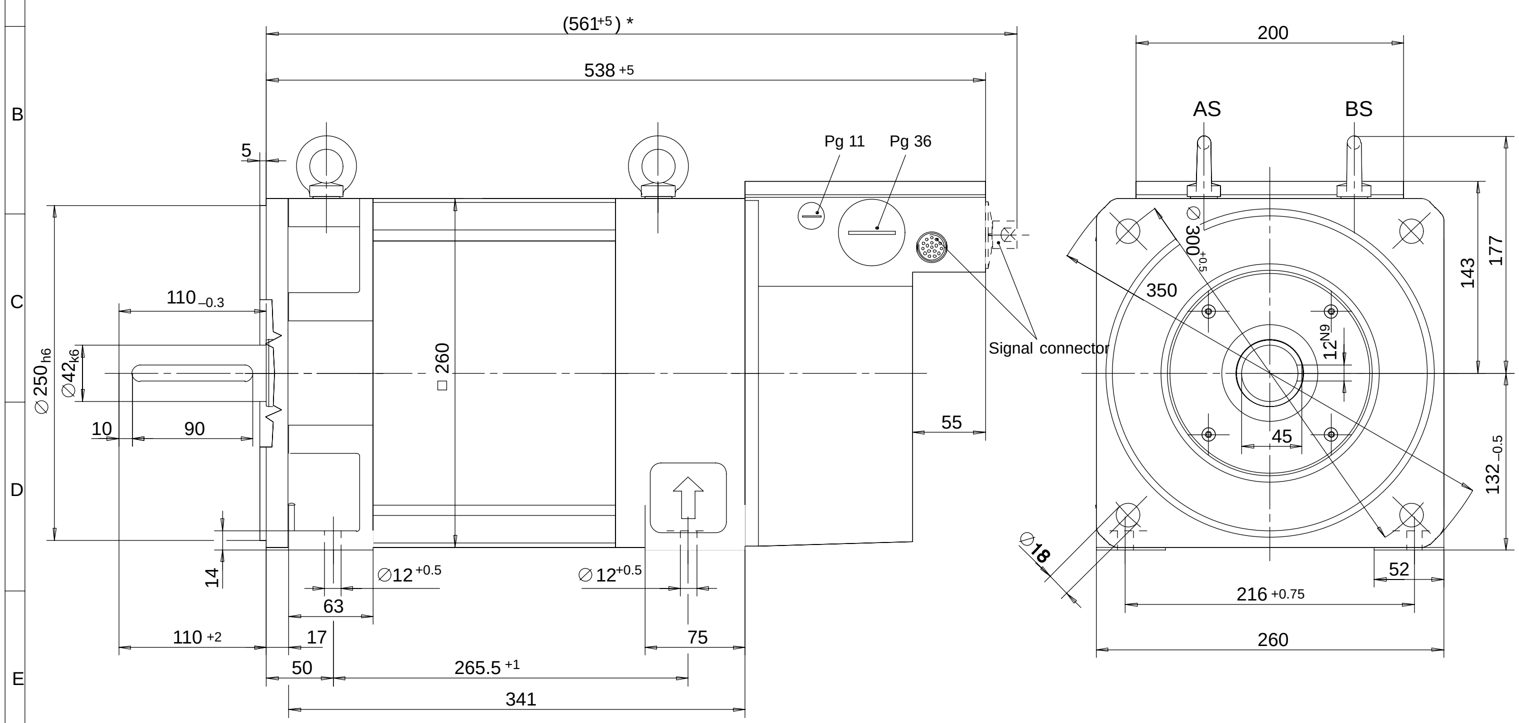
Dimension drawing
1PH7 131 / 133
Type of construction IMB3

Sheet No. 1
No. of sh. 1

510.30405.33 d

Replacement for

Fig. 4-8 1PH7 131/133, type of construction IM B35



Tolerance of the key and keyway acc. to DIN 6885 T1
Flange size A350 acc. to DIN 42948
Shaft centering DR M16 acc. to DIN 332
Mounting flange and shaft end acc. DIN 42955–N
Type of construction IMB35
* Only for cable outlet NDE

Sigraph DESIGN	scale 1:3		
	Mateial Ancillaries / IM No. Model / Item No.		
Date 14.11.1997	Dimension drawing 1PH7 131 / 133		
Drawn Stumpf			
Chkd Lipot			
A&D DS A P2 AC2			
a MLFB changed 01.03.1999 Cat	Siemens AG	Type of construction IMB35	Sheet No. 1
Index Info Date Drawn/chkd			
Replacement for		510.30407.33 a	No. of sh. 1

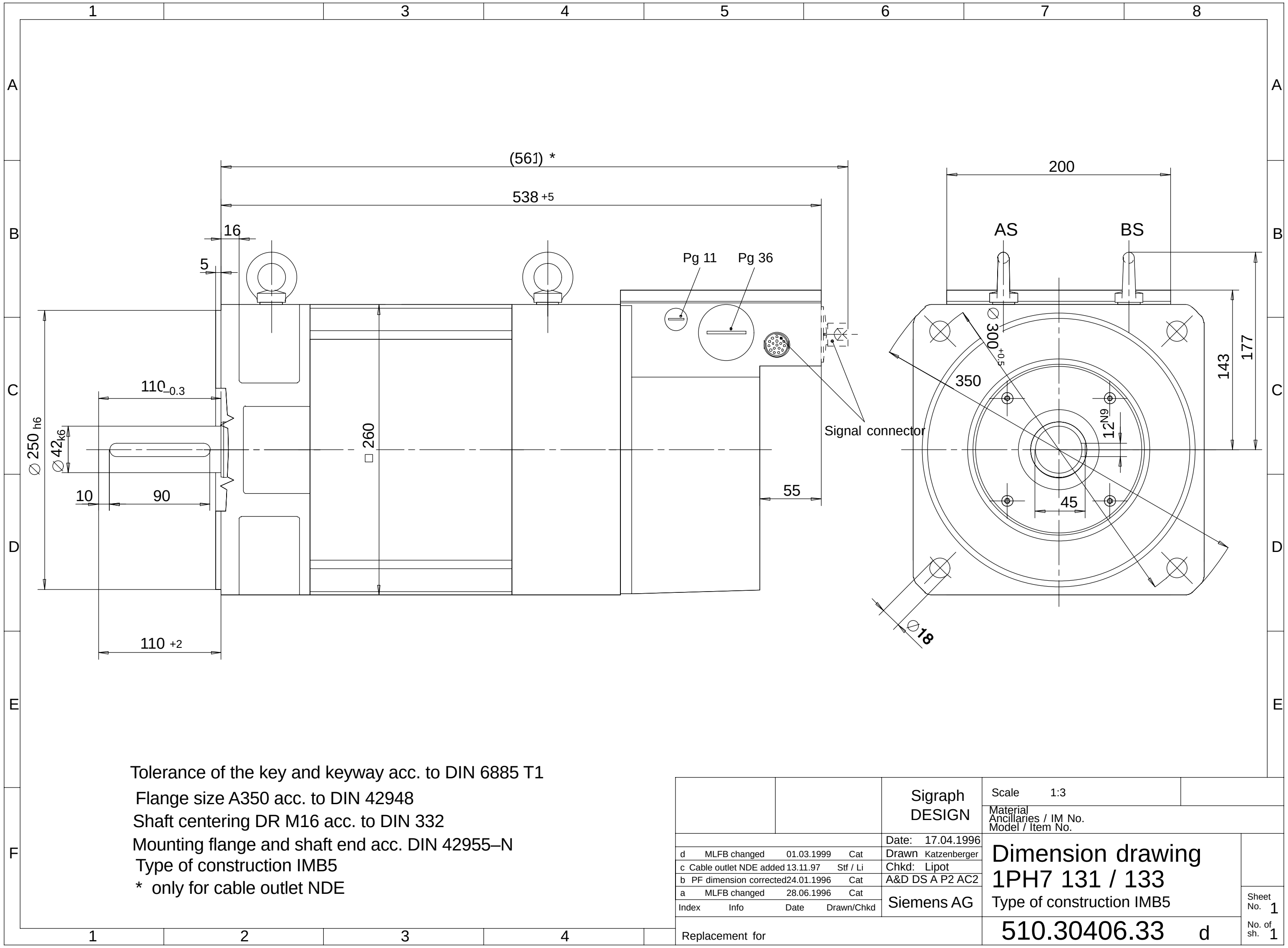
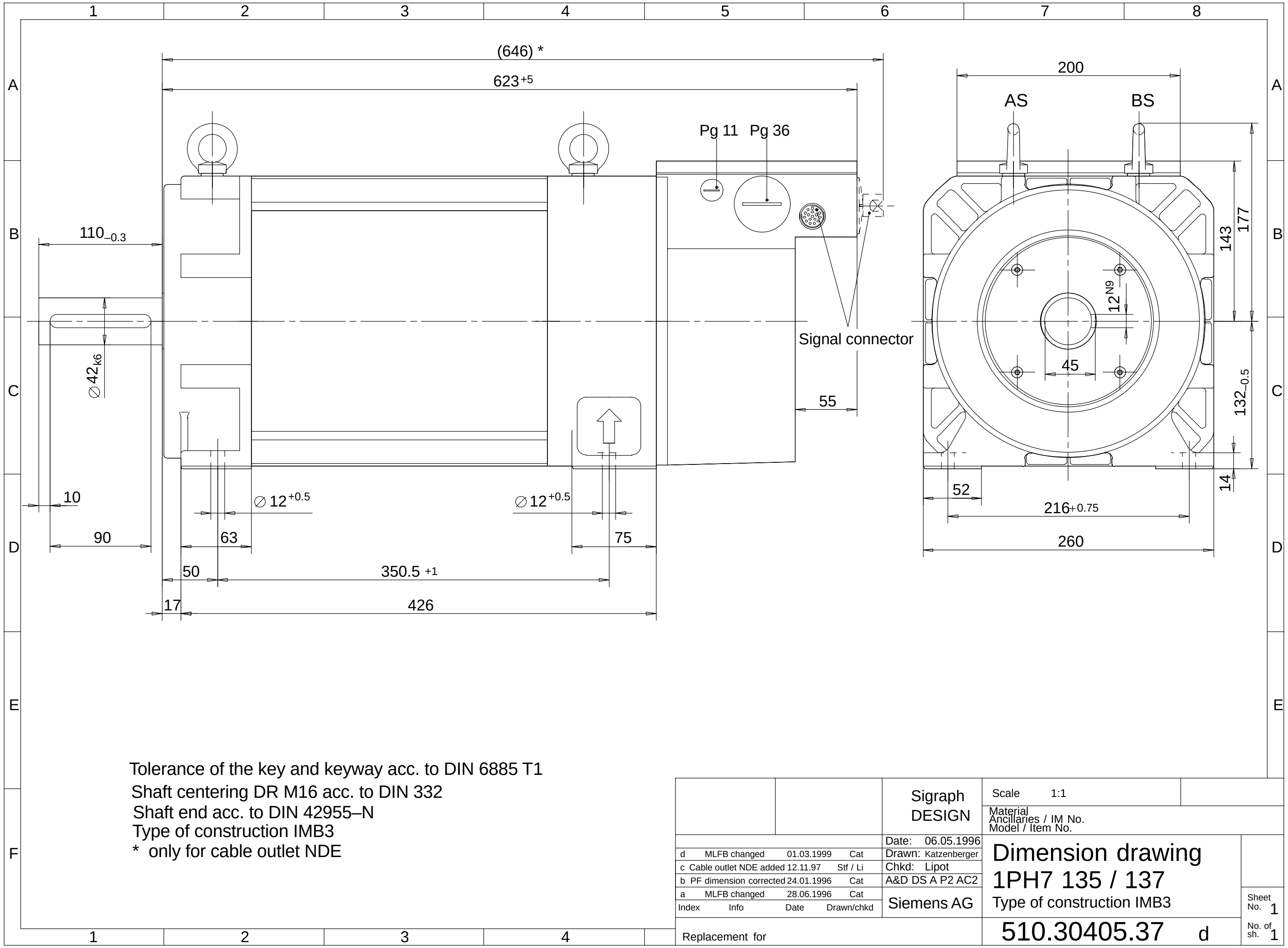
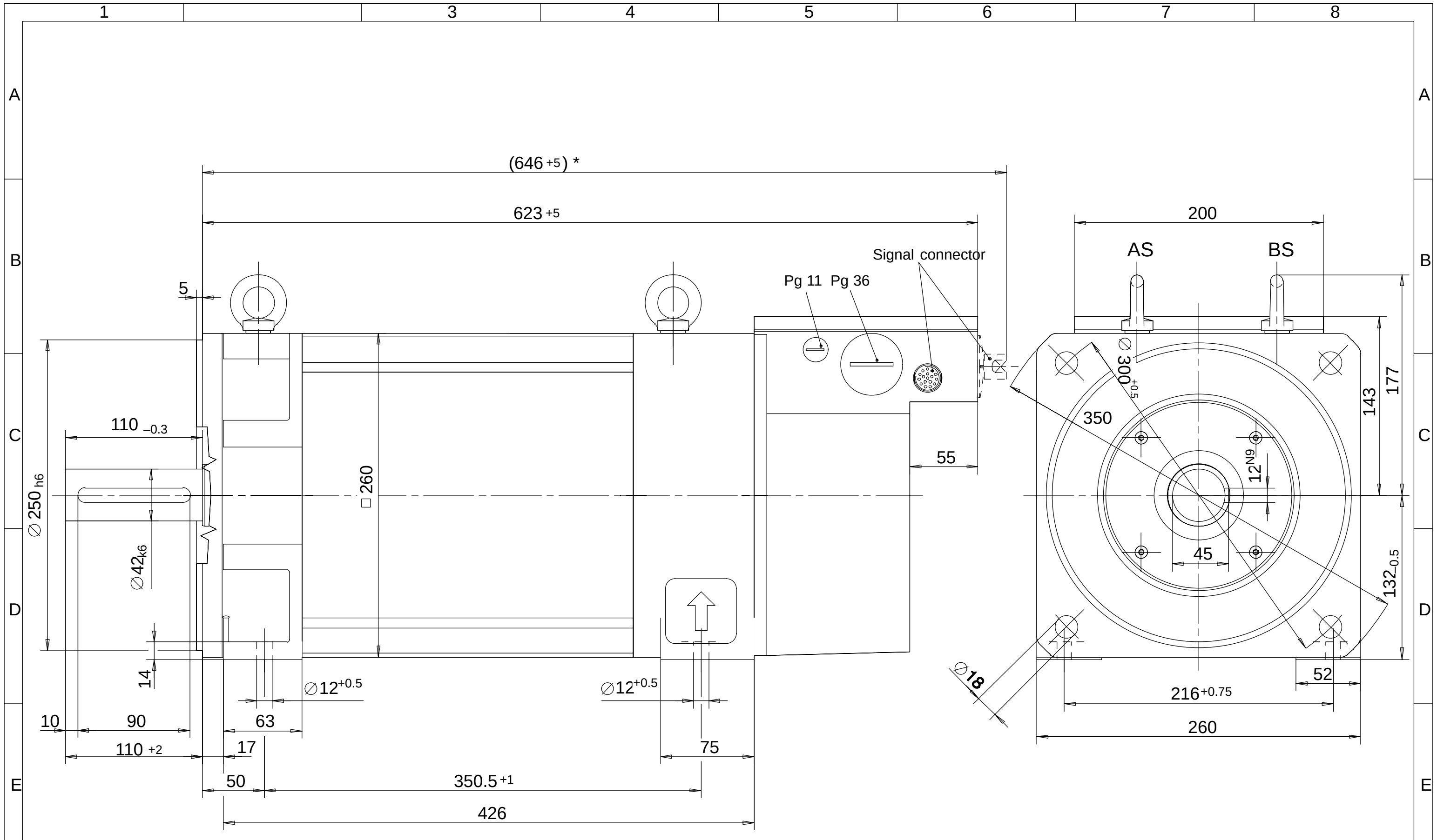


Fig. 4-9 1PH7 131/133, type of construction IM B5

Fig. 4-10 1PH7 135/137, type of construction IM B3

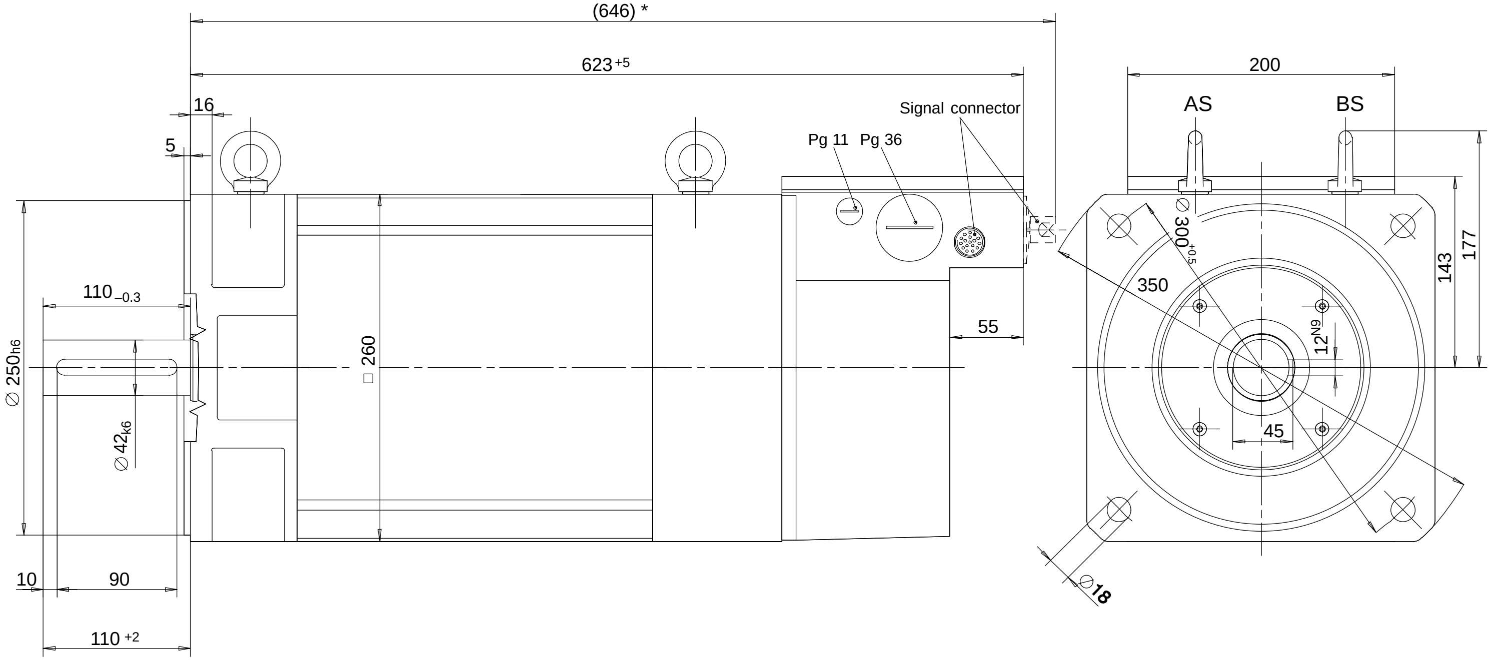




Tolerance of the key and keyway acc. to DIN 6885 T1
Flanschgröße A350 nach DIN 42948
Shaft centering DR M16 acc. to DIN 332
Mounting flange and shaft end acc. DIN 42955–N
Type of construction IMB35
* only for cable outlet NDE

Sigraph DESIGN	Scale 1:3		
	Material / Ancillaries / IM No. / Model / Item No.		
Date: 14.11.1997 / Drawn: Stumpf / Chkd: Lipot / A&D DS A P2 AC2	Dimension drawing 1PH7 135 / 137		
a MLFB changed 01.03.1999 Cat / Index Info Date Drawn/Chkd	Siemens AG	Type of construction IMB35	Sheet No. 1
Replacement for		510.30407.37 a	No. of sh. 1

Fig. 4-11 1PH7 135/137, type of construction IM B35



Tolerance of the key and keyway acc. to DIN 6885 T1
Flange size A350 acc. to DIN 42948
Shaft centering DR M16 acc. to DIN 332
Mounting flange and shaft end acc. DIN 42955–N
Type of construction IMB5
* only for cable outlet NDE

Index	Info	Date	Drawn/chkd
d	MLFB changed	01.03.1999	Kat
c	Cable outlet NDE added	13.11.97	Stf / Li
b	PF dimension corrected	24.01.1997	Kat
a	MLFB changed	28.06.1996	Kat

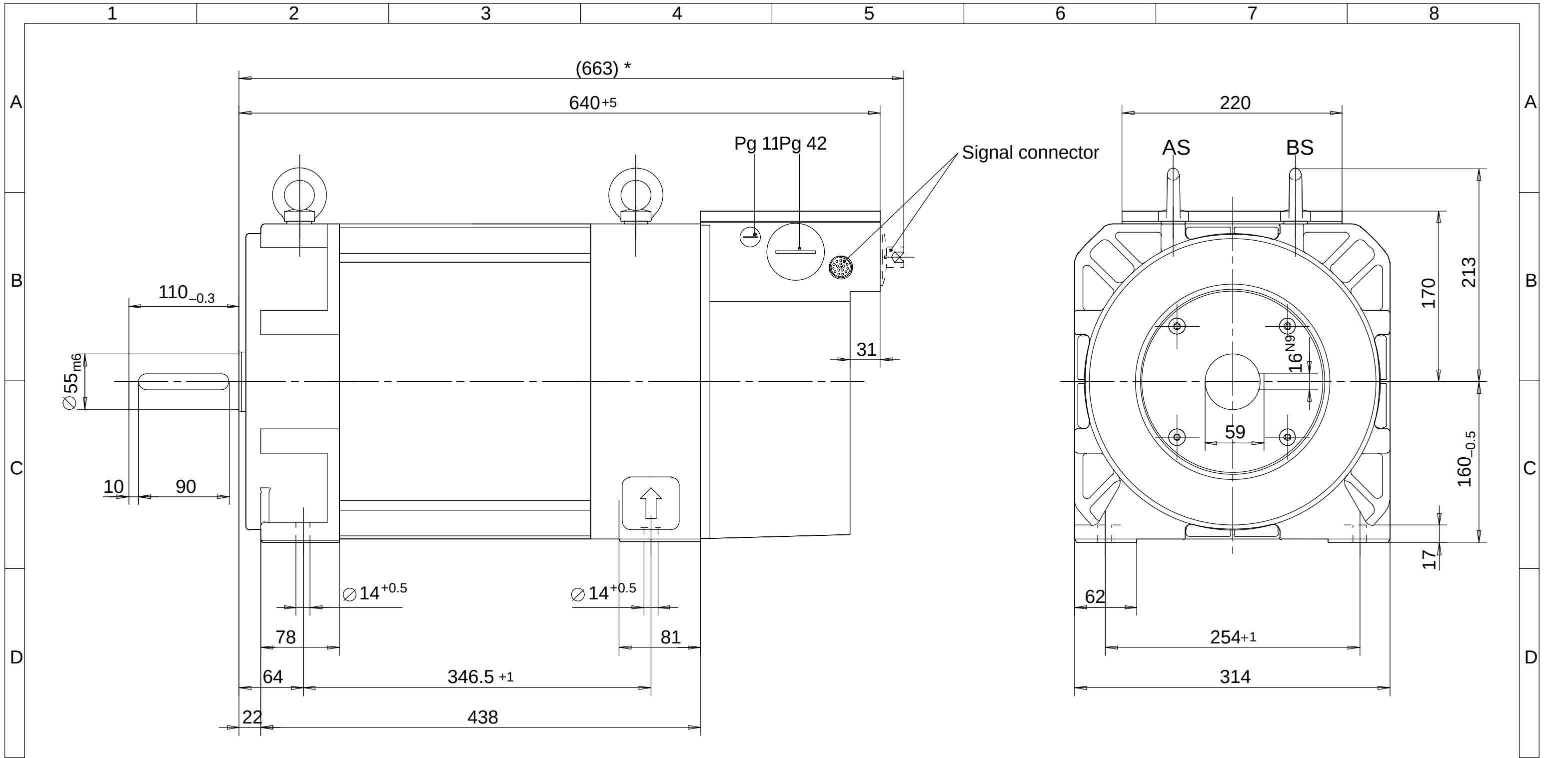
Sigraph DESIGN
Date: 17.04.1996
Drawn: Katzenberger
Chkd: Lipot
A&D DS A P2 AC2
Siemens AG
Scale 1:3
Material
Ancillaries / IM No.
Model / Item No.

Dimension drawing
1PH7 135 / 137
Type of construction IMB5

Sheet No. 1
No. of sh. 1

Replacement for
510.30406.37 d

Fig. 4-12 1PH7 135/137, type of construction IM B5



Tolerance of the key and keyway acc. to DIN 6885 T1
Shaft centering DR M20 acc. to DIN 332
Shaft end acc. to DIN 42955–N
Type of construction IMB3
* only for cable outlet NDE

Index	Info	Date	Drawn/chkd
e	MLFB changed	01.03.1999	Cat
d	Cable outlet NDE added	13.11.97	Stf / Li
c	PF dimension corrected	24.01.1997	Cat
b	Dimension corrected	07.01.1997	Cat
a	MLFB changed	28.06.1996	Cat

Sigraph DESIGN
Date: 06.05.1996
Drawn Katzenberger
Chkd: Lipot
A&D DS A P2 AC2
Siemens AG

Scale 1:4
Mateial
Ancillaries / IM No.
Model / Item No.

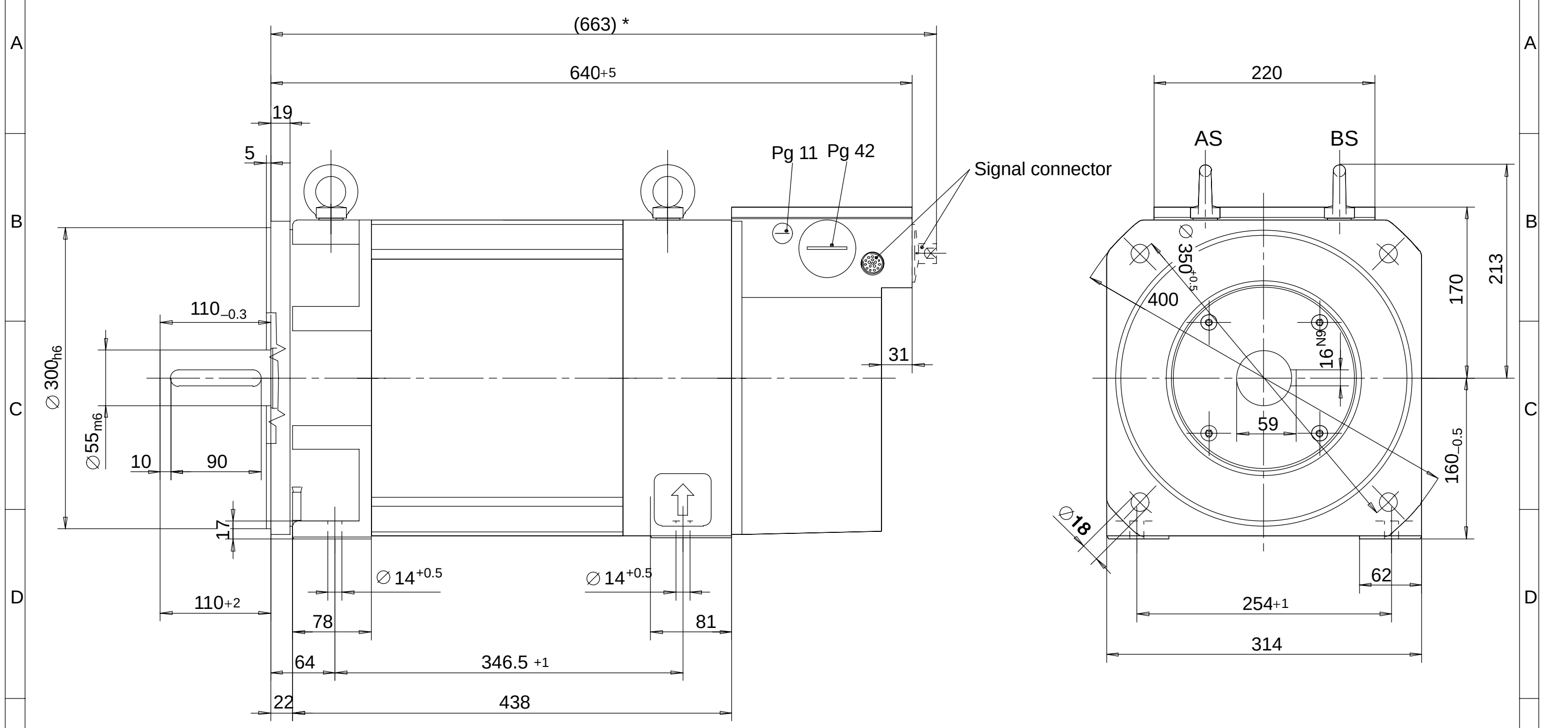
Dimension drawing
1PH7 163
Type of construction IMB3

Sheet No. 1
No. of sh. 1

Replacement for
510.30424.63 e

Fig. 4-13 1PH7 163, type of construction IM B3

1PH7



Tolerance of the key and keyway acc. to DIN 6885 T1
Flange size A400 acc. to DIN 42948
Shaft centering DR M20 acc. to DIN 332
Mounting flange and shaft end acc. DIN 42955–N
Type of construction IMB35
* only for cable outlet NDE

Index	Info	Date	Drawn/chkd
e	MLFB changed	01.03.1999	Cat
d	Cable outlet NDE added	13.11.97	Stf / Li
c	PF dimension corrected	24.01.1997	Cat
b	Dimension correctec	07.01.1997	Cat
a	MLFB changed	28.06.1996	Cat

Sigraph DESIGN
Scale 1:4
Material
Ancillaries / IM No.
Model / Item No.
Date: 06.05.1996
Drawn: Katzenberger
Chkd: Lipot
A&D DS A P2 AC2
Siemens AG

Dimension drawing
1PH7 163
Type of construction IMB35

Sheet No. 1
No. of sh. 1
Replacement for
510.30425.63 e

Fig. 4-14 1PH7 163, type of construction IM B35

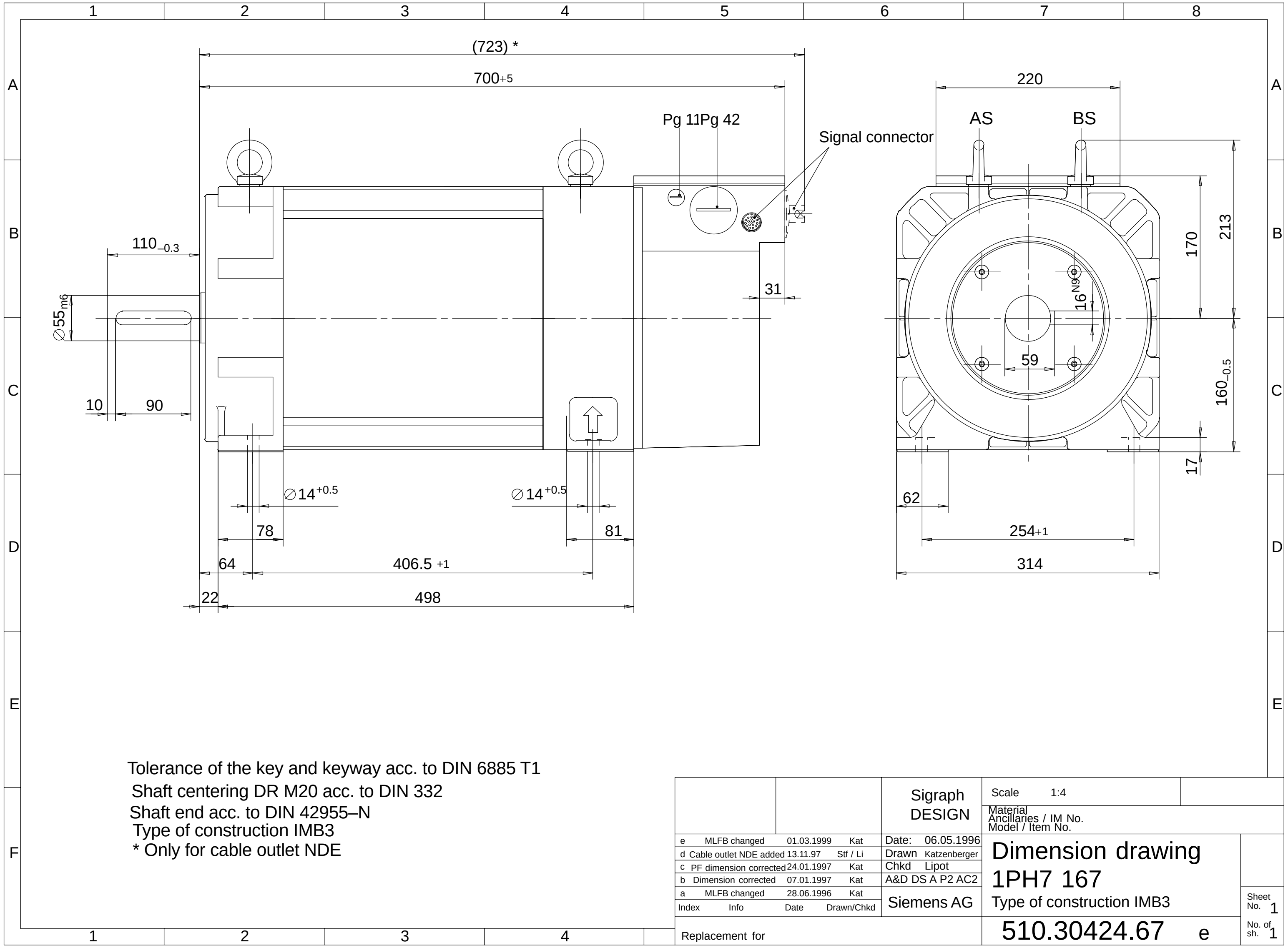
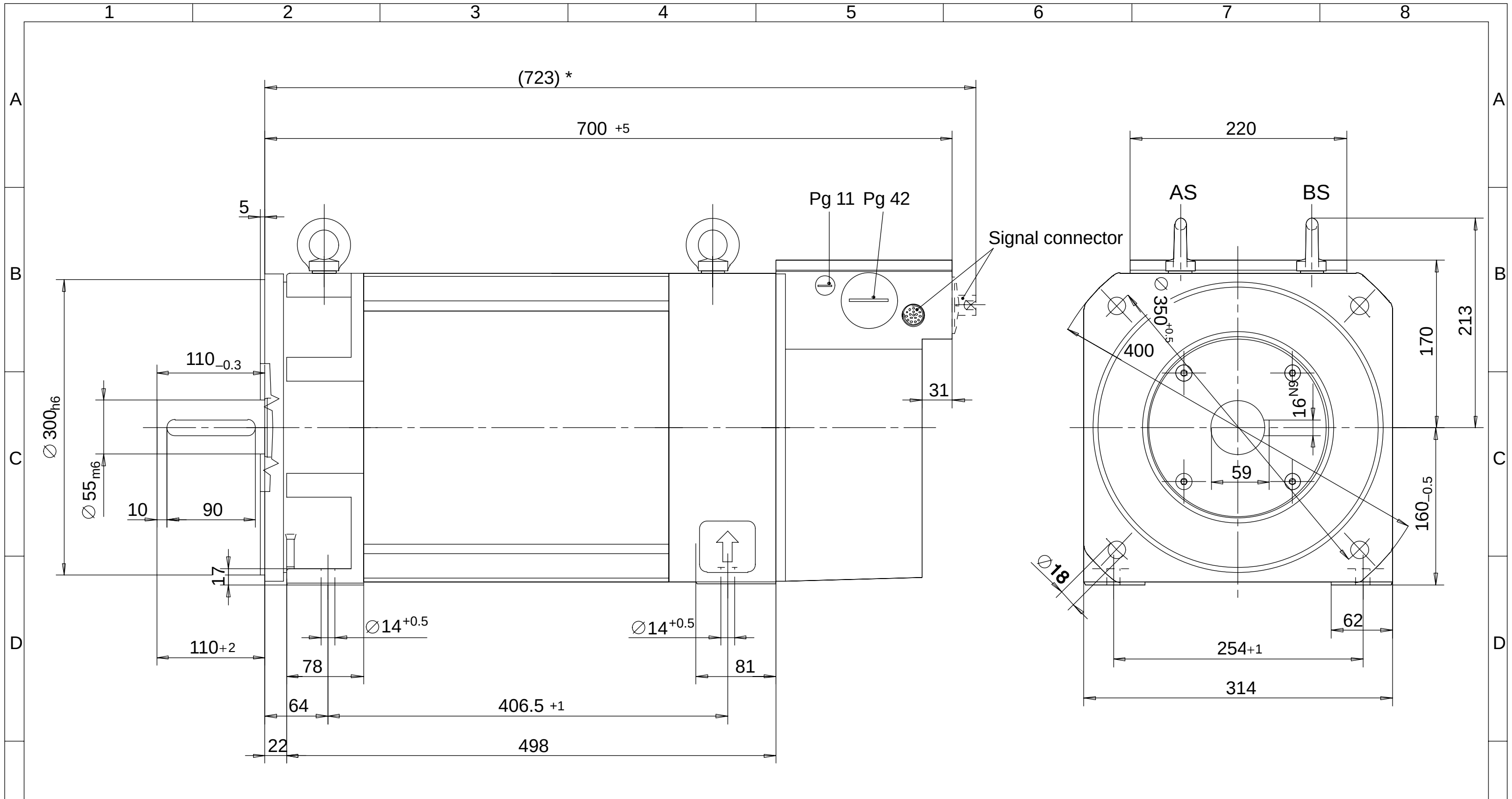


Fig. 4-15 1PH7 167, type of construction IM B3

Fig. 4-16 1PH7 167, type of construction IM B35



Tolerance of the key and keyway acc. to DIN 6885 T1
Flange size A400 acc. to DIN 42948
Shaft centering DR M20 acc. to DIN 332
Mounting flange and shaft end acc. DIN 42955–N
Typr of construction imB35
* only for cable ooutlet NDE

Index	Info	Date	Drawn/Chkd
e	MLFB changed	01.03.1999	Kat
d	Cable outlet NDE added	13.11.97	Stf / Li
c	PF dimension corrected	24.01.1997	Kat
b	Dimension corrected	07.01.1997	Kat
a	MLFB changed	28.06.1996	Kat

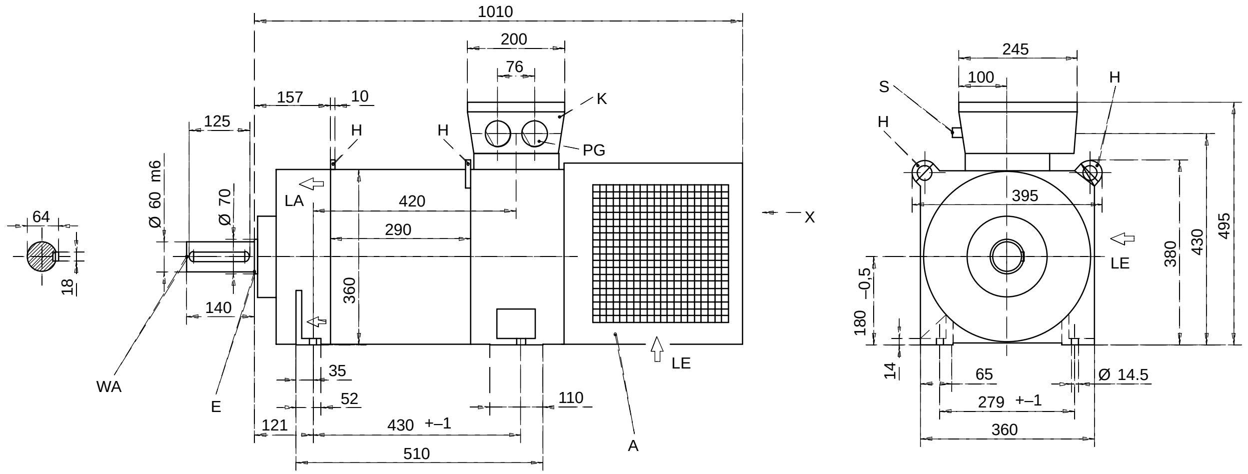
Sigraph DESIGN
Scale 1:4
Material
Ancillaries / IM No.
Model / Item No.
Date: 06.05.1996
Drawn: Katzenberger
Chkd: Lipot
A&D DS A P2 AC2
Siemens AG

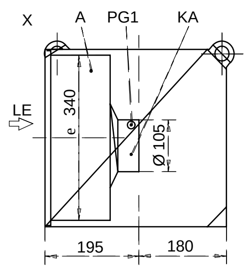
Dimension drawing
1PH7 167
Type of construction IMB35

Sheet No. 1
No. of sh. 1

Replacement for
510.30425.67 e

Fig. 4-17 1PH7 184, type of construction IM B3, air flow direction (NDE —> DE)



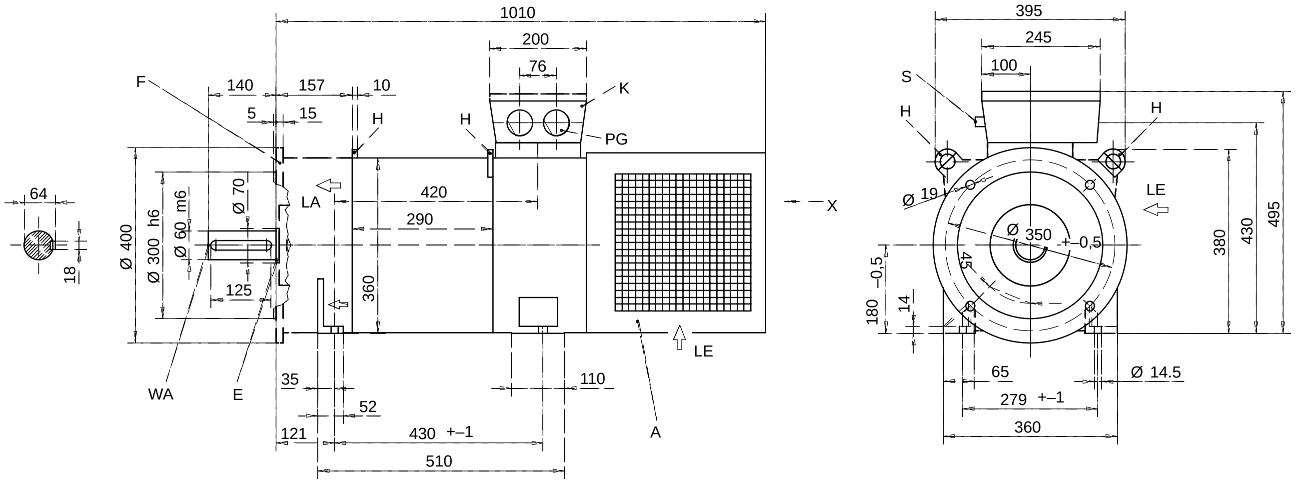


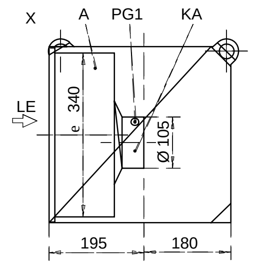
WA	Wellenende 60m6 x 140 nach DIN 748 mit Zentrierbohrung DR M20 nach DIN 332 Shaft extension 60m6 x 140 to DIN 748 with tapped centre hole DR M20 to DIN 332
E	Freistich E1.6 x 0.3 nach DIN 509 / Relief groove E1.6 x 0.3 to DIN 509
K	Klemmenkasten geeignet für Leiterquerschnitt bis 2 x 50 mm Terminal box suitable for conductor cross section up to 2 x 50 mm
KA	Klemmenkasten für Lüftermotor / Terminal box for fan motor
A	Fremdlüfteraggregat / Seperately driven fan
LE	Lufteintritt / Air inlet LA Luftaustritt / Air outlet
H	Hebeöse / Lifting eye
PG	Leitungseinführung 2 x Pg42 / Cable entry 2 x Pg42
PG1	Leitungseinführung Pg13,5 / Cable entry Pg13,5
S	Stecker für Impulsgeber u. Temperaturfühler Connector for pulse generator and temperature sensor

Bauform / Type of construction	IM B3	Schutzart / Type of protection	IP55	Maschinengewicht / Weight of machine	380 kg

Darstellung / Representation		Maßstab / Scale: ohne	Gew. / Wt.
		Design V3.8A00	
	Datum 23.06.00	W–Nr. / No. normal, BS – AS	1XB7322
	Name Krenzer	MASZBILD / Dimension Drawing	
	A&D LD S44A		
Stat. Mitteilung/Noti Datum/Da Name	Siemens AG Nbg Vo	Typ/Type 1PH7 184	Blatt / Page
Ersatz für / Replacement for Entstanden aus / Originated from –	U820172	U820363	1–

1PH7



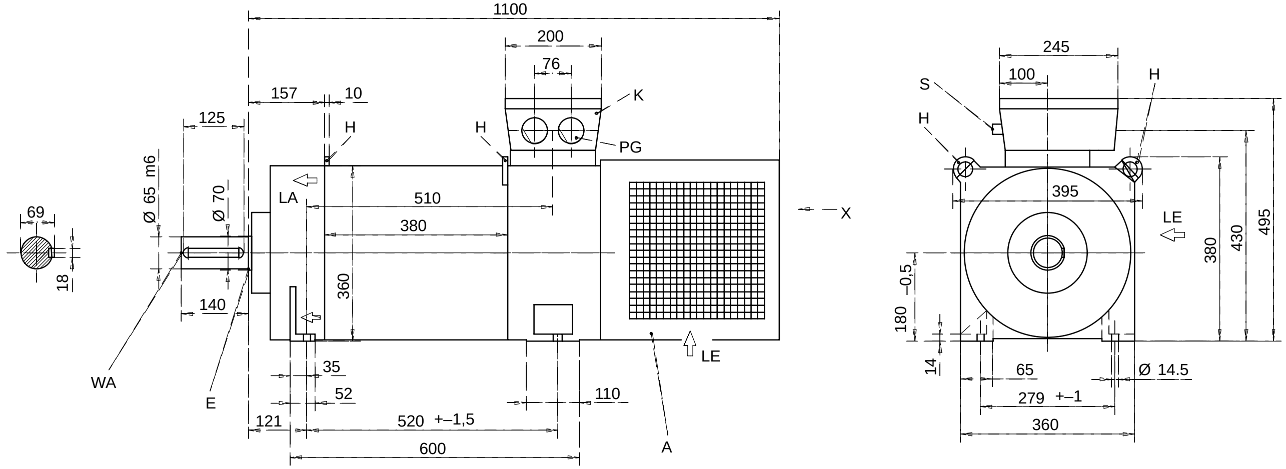


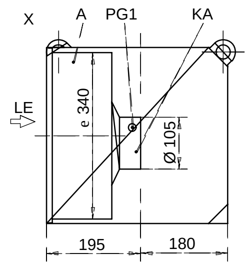
F	Befestigungsflansch A400 nach DIN 42948 Mounting flange A400 to DIN 42948
WA	Wellenende 60m6 x 140 nach DIN 748 mit Zentrierbohrung DR M20 nach DIN 332 Shaft extension 60m6 x 140 to DIN 748 with tapped centre hole DR M20 to DIN 332
E	Freistich E1.6 x 0.3 nach DIN 509 / Relief groove E1.6 x 0.3 to DIN 509
K	Klemmenkasten geeignet für Leiterquerschnitt bis 2 x 50 mm Terminal box suitable for conductor cross section up to 2 x 50 mm
KA	Klemmenkasten für Lüftermotor / Terminal box for fan motor
A	Fremdlüfteraggregat / Seperately driven fan
LE	Lufteintritt / Air inlet LA Luftaustritt / Air outlet
H	Hebeöse / Lifting eye
PG	Leitungseinführung 2 x Pg42 / Cable entry 2 x Pg42
PG1	Leitungseinführung PG13,5 / Cable entry PG13,5
S	Stecker für Impulsgeber u. Temperaturfühler Connector for pulse generator and temperature sensor

Bauform / Type of construction	Schutzart / Type of protection	Maschinengewicht / Weight of machine
IM B35	IP55	400 kg

Darstellung / Representation	
Maßstab / Scale	ohne
Gew. / Wt.	
Design	V3.8A00
Datum	06.07.00
Name	Krenzer
	A&D LD S44A
	Siemens AG Nbg Vo
W–Nr. / No.	normal, BS – AS 1XB7322
	MASZBILD Dimension Drawing
Typ/Type	1PH7 184
Stat. / Mitteilung/Noti / Datum/Date / Name	
Ersatz für / Replacement for	–
Entstanden aus / Originated from	U820357
	U820364
Blatt / Page	1–

Fig. 4-18 1PH7 184, type of construction IM B35, air flow direction (NDE —> DE)



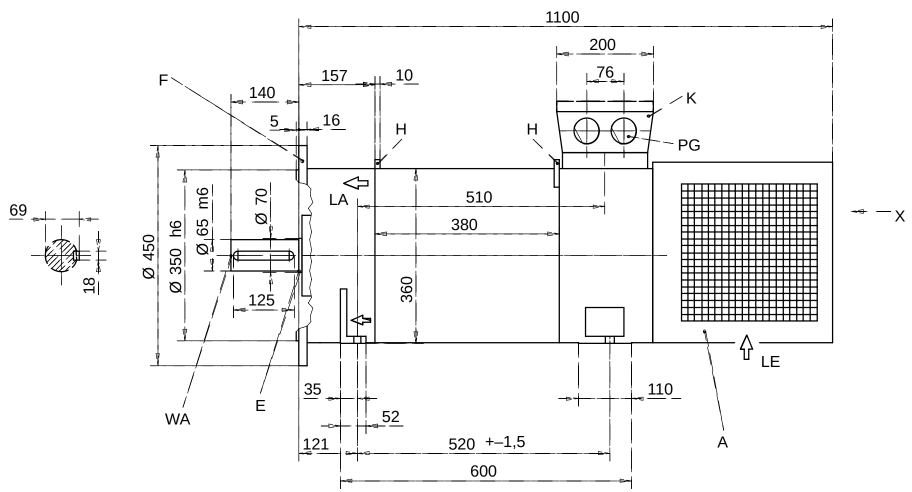


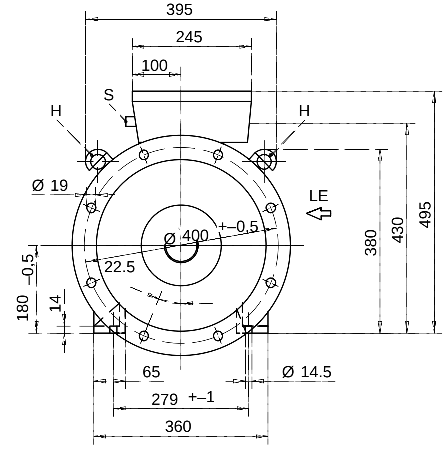
WA	Wellenende 65m6 x 140 nach DIN 748 mit Zentrierbohrung DR M20 nach DIN 332 Shaft extension 65m6 x 140 to DIN 748 with tapped centre hole DR M20 to DIN 332
E	Freistich E1.6 x 0.3 nach DIN 509 / Relief groove E1.6 x 0.3 to DIN 509
K	Klemmenkasten geeignet für Leiterquerschnitt bis 2 x 50 mm Terminal box suitable for conductor cross section up to 2 x 50 mm
KA	Klemmenkasten für Lüftermotor / Terminal box for fan motor
A	Fremdlüfteraggregat / Seperately driven fan
LE	Lufteintritt / Air inlet LA Luftaustritt / Air outlet
H	Hebeöse / Lifting eye
PG	Leitungseinführung 2 x Pg42 / Cable entry 2 x Pg42
PG1	Leitungseinführung Pg13,5 / Cable entry Pg13,5
S	Stecker für Impulsgeber u. Temperaturfühler Connector for pulse generator and temperature sensor

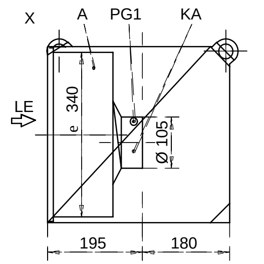
Bauform / Type of construction: IM B3	Schutzart / Type of protection: IP55	Maschinengewicht / Weight of machine: 450 kg
Darstellung / Representation	Maßstab / Scale: ohne	Gew. / Wt.
	Design V3.8A00	
Datum 06.07.00; Name Krenzer; A&D LD S44A; Siemens AG Nbg Vo	W–Nr. / No.: normal, BS – AS	1XB7322
Stat. Mitteilung/Noti Datum/Da Name	Maszbild / Dimension Drawing	
Ersatz für / Replacement for: U820233	Typ/Type: 1PH7 186	Blatt / Page
Entstanden aus / Originated from: –	U820366	1–

Fig. 4-19 1PH7 186, type of construction IM B3, air flow direction (NDE —> DE)

Fig. 4-20 1PH7 186, type of construction IM B35, air flow direction (NDE —> DE)







F Befestigungsflansch A450 nach DIN 42948
Mounting flange A450 to DIN 42948

WA Wellenende 65m6 x 140 nach DIN 748 mit Zentrierbohrung DR M20 nach DIN 332
Shaft extension 65m6 x 140 to DIN 748 with tapped centre hole DR M20 to DIN 332

E Freistich E1.6 x 0.3 nach DIN 509 / Relief groove E1.6 x 0.3 to DIN 509

K Klemmenkasten geeignet für Leiterquerschnitt bis 2 x 50 mm
Terminal box suitable for conductor cross section up to 2 x 50 mm

KA Klemmenkasten für Lüftermotor / Terminal box for fan motor

A Fremdlüfteraggregat / Seperately driven fan

LE Lufteintritt / Air inlet LA Luftaustritt / Air outlet

H Hebeöse / Lifting eye

PG Leitungseinführung 2 x Pg42 / Cable entry 2 x Pg42

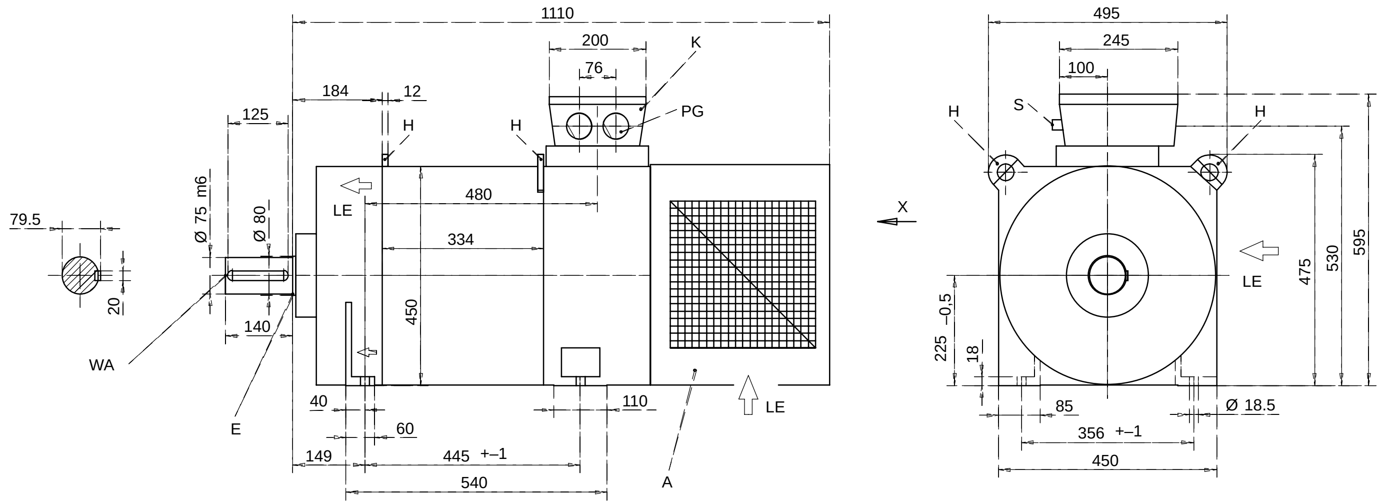
PG1 Leitungseinführung PG13,5 / Cable entry PG13,5

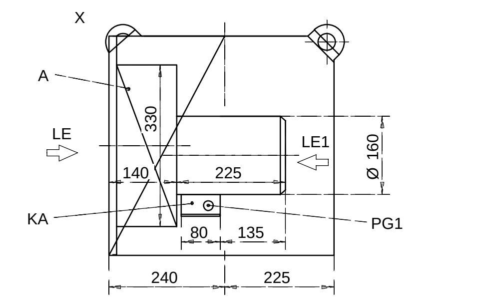
S Stecker für Impulsgeber u. Temperaturfühler
Connector for pulse generator and temperature sensor

Bauform Type of construction IM B35	Schutzart Type of protection IP55	Maschinengewicht Weight of machine 470 kg

Darstellung Representation		Maßstab Scale ohne	Gew. Wt.
		Design V3.8A00	
Datum 23.06.00	W–Nr. No. normal, BS – AS	1XB7322	
Name Krenzer	MASZBILD Dimension Drawing		
A&D LD S44A			
Siemens AG Nbg Vo	Typ/Type 1PH7 186		Blatt Page
Stat. Mitteilung/Notice Datum/Date Name			
Ersatz für / Replacement for –			
Entstanden aus / Originated from U820360	U820367		1–

Fig. 4-21 1PH7 224, type of construction IM B3, air flow direction (NDE —> DE)

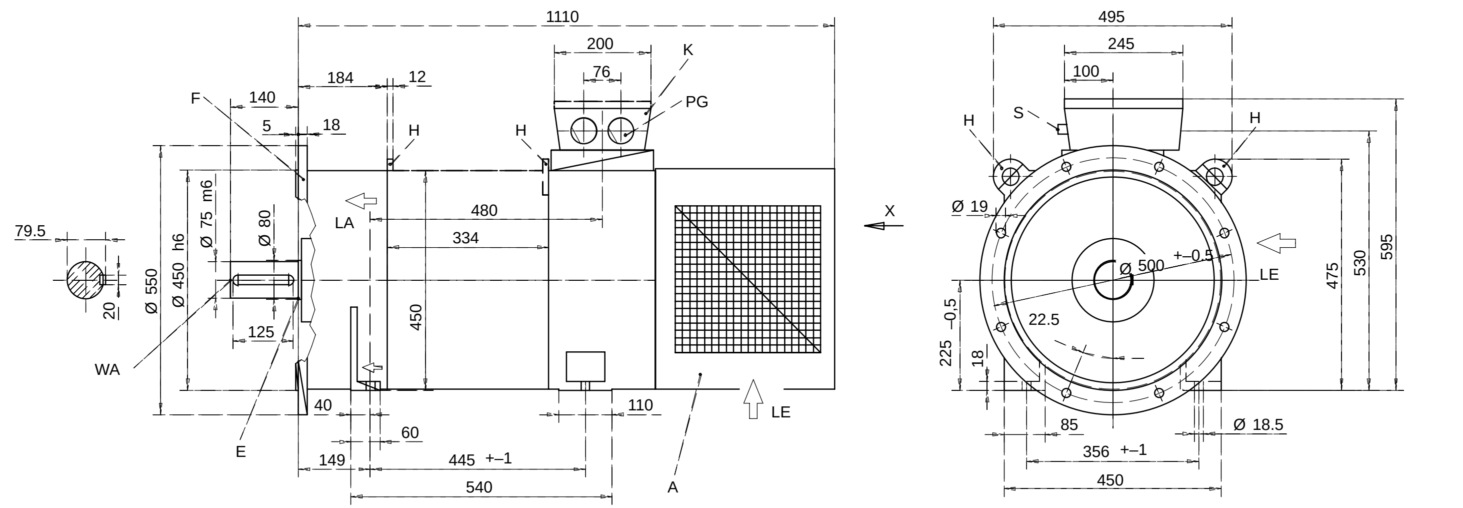


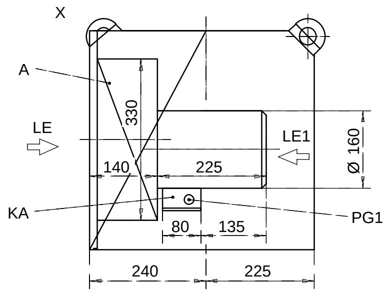


WA	Wellenende 75m6 x 140 nach DIN 748 mit Zentrierbohrung DR M20 nach DIN 332 Shaft extension 75m6 x 140 to DIN 748 with tapped centre hole DR M20 to DIN 332
E	Freistich E1.6 x 0.3 nach DIN 509 / Relief groove E1.6 x 0.3 to DIN 509
K	Klemmenkasten geeignet für Leiterquerschnitt bis 2 x 50 mm Terminal box suitable for conductor cross section up to 2 x 50 mm
KA	Klemmenkasten für Lüftermotor / Terminal box for fan motor
A	Fremdllüfteraggregat / Seperately driven fan
LE	Lufteintritt / Air inlet LA Luftaustritt / Air outlet
H	Hebeöse / Lifting eye
PG	Leitungseinführung 2 x Pg42 / Cable entry 2 x Pg42
PG1	Leitungseinführung M16x1,5 + M25x1,5 / Cable entry M16x1,5 + M25x1,5
S	Stecker für Impulsgeber u. Temperaturfühler Connector for pulse generator and temperature sensor
LE1	Lufteintritt Fremdlüftermotor / Air inlet for seperately driven fan motor

Bauform / Type of construction	Schutzart / Type of protection	Maschinengewicht / Weight of machine
IM B3	IP55	640 kg

Darstellung / Representation	
Maßstab / Scale	ohne
Gew. / Wt.	
Design	V3.8A00
Datum	25.07.00
Name	krenzer
A&D LD	S44A
Siemens AG	Nbg Vo
W–Nr. / No.	BS —> AS 1XB7322
	MASZBILD Dimension Drawing
Typ/Type	1PH7 224
Stat. Mitteilung/Noti Datum/Da Name	
Ersatz für / Replacement for	–
Entstanden aus / Originated from	C437444
	U820383
Blatt / Page	1–

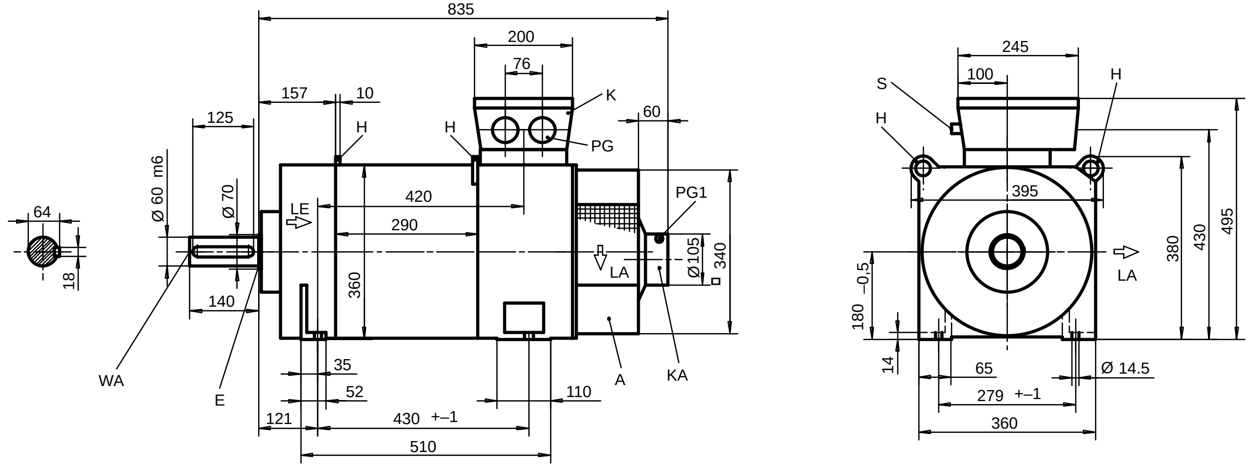




F	Befestigungsflansch A550 nach DIN 42948 Mounting flange A550 to DIN 42948
WA	Wellenende 75m6 x 140 nach DIN 748 mit Zentrierbohrung DR M20 nach DIN 332 Shaft extension 75m6 x 140 to DIN 748 with tapped centre hole DR M20 to DIN 332
E	Freistich E1.6 x 0.3 nach DIN 509 / Relief groove E1.6 x 0.3 to DIN 509
K	Klemmenkasten geeignet für Leiterquerschnitt bis 2 x 50 mm Terminal box suitable for conductor cross section up to 2 x 50 mm
KA	Klemmenkasten für Lüftermotor / Terminal box for fan motor
A	Fremdlüfteraggregat / Seperately driven fan
LE	Lufteintritt / Air inlet LA Luftaustritt / Air outlet
H	Hebeöse / Lifting eye
PG	Leitungseinführung 2 x Pg42 / Cable entry 2 x Pg42
PG1	Leitungseinführung M16x1,5 + M25x1,5 / Cable entry M16x1,5 + M25x1,5
S	Stecker für Impulsgeber u. Temperaturfühler Connector for pulse generator and temperature sensor
LE1	Lufteintritt Fremdlüftermotor / Air inlet for seperately driven fan motor

Bauform / Type of construction: IM B35	Schutzart / Type of protection: IP55	Maschinengewicht / Weight of machine: 660 kg
Darstellung / Representation	Maßstab / Scale: ohne	Gew. / Wt.
	Design V3.8A00	
kre — Datum 25.07.00; Name Krenzer; A&D LD S44; Siemens AG Nbg Vo	W–Nr. / No. BS —> AS 1XB7322	
	MASZBILD Dimension Drawing	
Stat. Mitteilung/Noti Datum/Da Name	Typ/Type 1PH7 224	Blatt / Page
Ersatz für / Replacement for – Entstanden aus / Originated from C437466	U820384	1–

Fig. 4-22 1PH7 224, type of construction IM B35, air flow direction (NDE —> DE)



WA Wellenende 60m6 x 140 nach DIN 748 mit Zentrierbohrung DR M20 nach DIN 332
Shaft extension 60m6 x 140 to DIN 748 with tapped centre hole DR M20 to DIN 332

E Freistich E1.6 x 0.3 nach DIN 509 / Relief groove E1.6 x 0.3 to DIN 509

K Klemmenkasten geeignet für Leiterquerschnitt bis 2 x 50 mm
Terminal box suitable for conductor cross section up to 2 x 50 mm

KA Klemmenkasten für Lüftermotor / Terminal box for fan motor

A Fremdlüfteraggregat / Seperatly driven fan

LE Lufteintritt / Air inlet LA Luftaustritt / Air outlet

H Hebeöse / Lifting eye

PG Leitungseinführung 2 x Pg42 / Cable entry 2 x Pg42

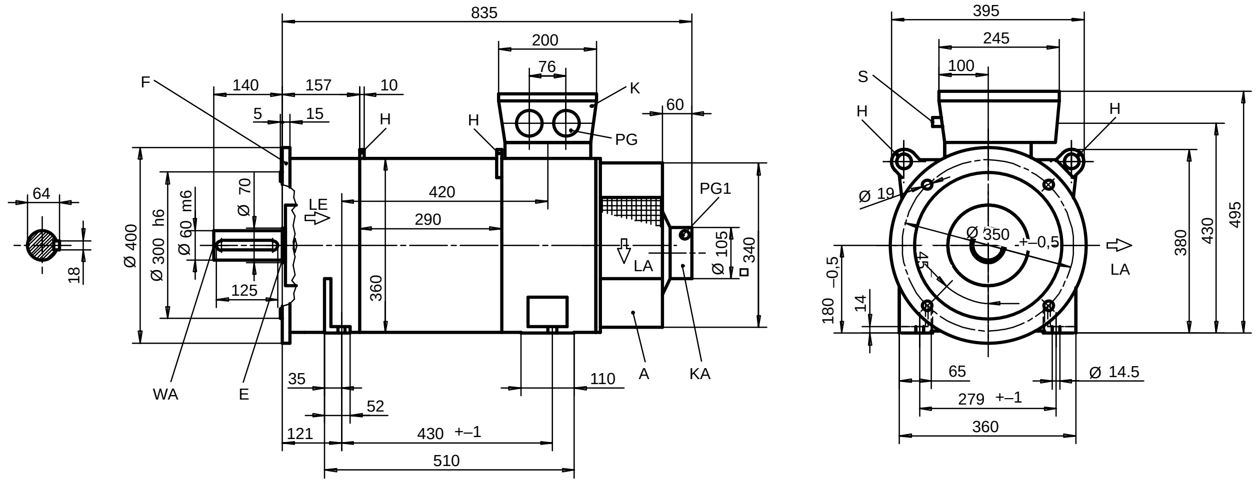
PG1 Leitungseinführung Pg13,5 / Cable entry Pg13,5

S Stecker für Impulsgeber u. Temperaturfühler
Connector for pulse generator and temperature sensor

Bauform / Type of construction: IM B3	Schutzart / Type of protection: IP55	Maschinengewicht / Weight of machine: 370 kg
Darstellung / Representation	Maßstab / Scale: ohne	Gew. / Wt.
	Design V3.8A00	
Datum 23.06.00	W–Nr. / No. normal–UL	1XB7322
Name Krenzer	MASZBILD / Dimension Drawing	
A&D LD S44A		
Siemens AG Nbg Vo	Typ/Type 1PH7 184	Blatt / Page
Stat. Mitteilung/Noti Datum/Da Name		
Ersatz für / Replacement for C437442		
Entstanden aus / Originated from –	U820356	1–

Fig. 4-23 1PH7 184, type of construction IM B3, air flow direction (DE —> NDE)

Fig. 4-24 1PH7 184, type of construction IM B35, air flow direction (DE —> NDE)



F Befestigungsflansch A400 nach DIN 42948
Mounting flange A400 to DIN 42948

WA Wellenende 60m6 x 140 nach DIN 748 mit Zentrierbohrung DR M20 nach DIN 332
Shaft extension 60m6 x 140 to DIN 748 with tapped centre hole DR M20 to DIN 332

E Freistich E1.6 x 0.3 nach DIN 509 / Relief groove E1.6 x 0.3 to DIN 509

K Klemmenkasten geeignet für Leiterquerschnitt bis 2 x 50 mm
Terminal box suitable for conductor cross section up to 2 x 50 mm

KA Klemmenkasten für Lüftermotor / Terminal box for fan motor

A Fremdlüfteraggregat / Seperatly driven fan

LE Lufteintritt / Air inlet LA Luftaustritt / Air outlet

H Hebeöse / Lifting eye

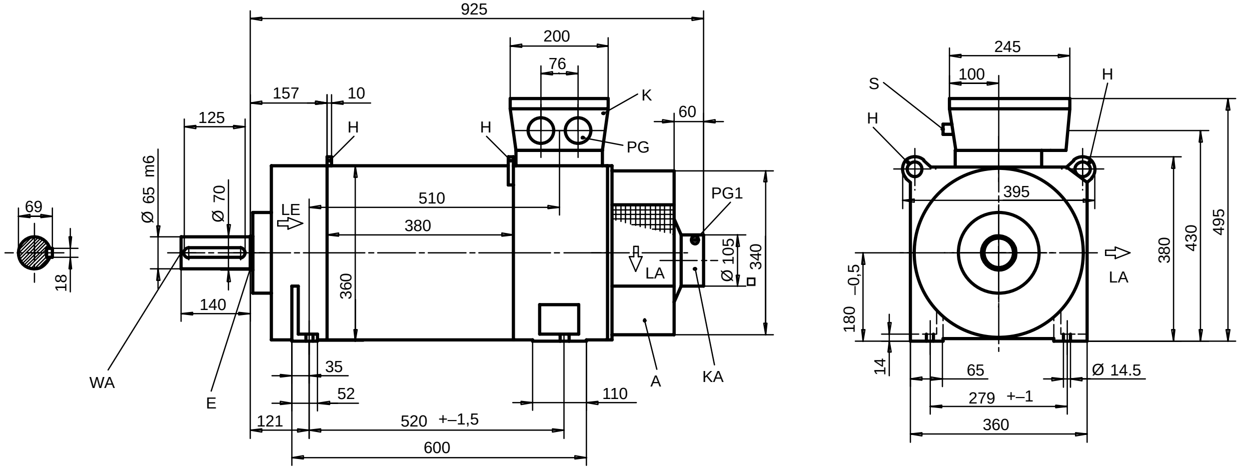
PG Leitungseinführung 2 x Pg42 / Cable entry 2 x Pg42

PG1 Leitungseinführung Pg13,5 / Cable entry Pg13,5

S Stecker für Impulsgeber u. Temperaturfühler
Connector for pulse generator and temperature sensor

Bauform / Type of construction	IM B35	Schutzart / Type of protection	IP55	Maschinengewicht / Weight of machine	390 kg

Darstellung / Representation		Maßstab / Scale: ohne	Gew. / Wt.
		Design V3.8A00	
Datum 23.06.00	Name Krenzer	W–Nr / No.: normal–UL	1XB7322
A&D LDS44A		MASZBILD / Dimension Drawing	
Stat. Mitteilung/Noti Datum/Da Name	Siemens AG Nbg Vo	Typ/Type: 1PH7 184	Blatt / Page
Ersatz für / Replacement for	C437412		
Entstanden aus / Originated from	–	U820357	1–



WA Wellenende 65m6 x 140 nach DIN 748 mit Zentrierbohrung DR M20 nach DIN 332
Shaft extension 65m6 x 140 to DIN 748 with tapped centre hole DR M20 to DIN 332

E Freistich E1.6 x 0.3 nach DIN 509 / Relief groove E1.6 x 0.3 to DIN 509

K Klemmenkasten geeignet für Leiterquerschnitt bis 2 x 50 mm
Terminal box suitable for conductor cross section up to 2 x 50 mm

KA Klemmenkasten für Lüftermotor / Terminal box for fan motor

A Fremdlüfteraggregat / Seperatly driven fan

LE Lufteintritt / Air inlet LA Luftaustritt / Air outlet

H Hebeöse / Lifting eye

PG Leitungseinführung 2 x Pg42 / Cable entry 2 x Pg42

PG1 Leitungseinführung Pg13,5 / Cable entry Pg13,5

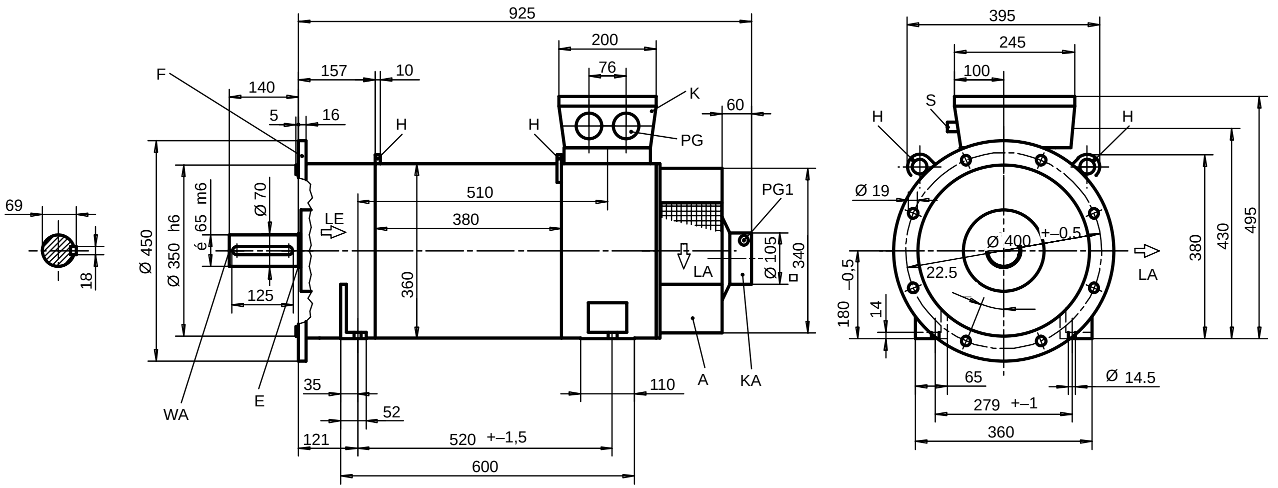
S Stecker für Impulsgeber u. Temperaturfühler
Connector for pulse generator and temperature sensor

Bauform / Type of construction IM B3	Schutzart / Type of protection IP55	Maschinengewicht / Weight of machine 440 kg

Darstellung / Representation	Maßstab / Scale ohne	Gew. / Wt.
	Design V3.8A00	
Datum 23.06.00	W–Nr. No. normal–UL	1XB7322
Name Krenzer	MASZBILD / Dimension Drawing	
A&D LD S44A		
Siemens AG Nbg Vo	Typ/Type 1PH7 186	Blatt / Page
Stat. Mitteilung/Noti Datum/Da Name		
Ersatz für / Replacement for C437443	U820359	1–
Entstanden aus / Originated from –		

Fig. 4-25 1PH7 186, type of construction IM B3, air flow direction (DE —> NDE)

Fig. 4-26 1PH7 186, type of construction IM B35, air flow direction (DE —> NDE)



F Befestigungsflansch A450 nach DIN 42948
Mounting flange A450 to DIN 42948

WA Wellenende 65m6 x 140 nach DIN 748 mit Zentrierbohrung DR M20 nach DIN 332
Shaft extension 65m6 x 140 to DIN 748 with tapped centre hole DR M20 to DIN 332

E Freistich E1.6 x 0.3 nach DIN 509 / Relief groove E1.6 x 0.3 to DIN 509

K Klemmenkasten geeignet für Leiterquerschnitt bis 2 x 50 mm
Terminal box suitable for conductor cross section up to 2 x 50 mm

KA Klemmenkasten für Lüftermotor / Terminal box for fan motor

A Fremdlüfteraggregat / Seperatly driven fan

LE Lufteintritt / Air inlet LA Luftaustritt / Air outlet

H Hebeöse / Lifting eye

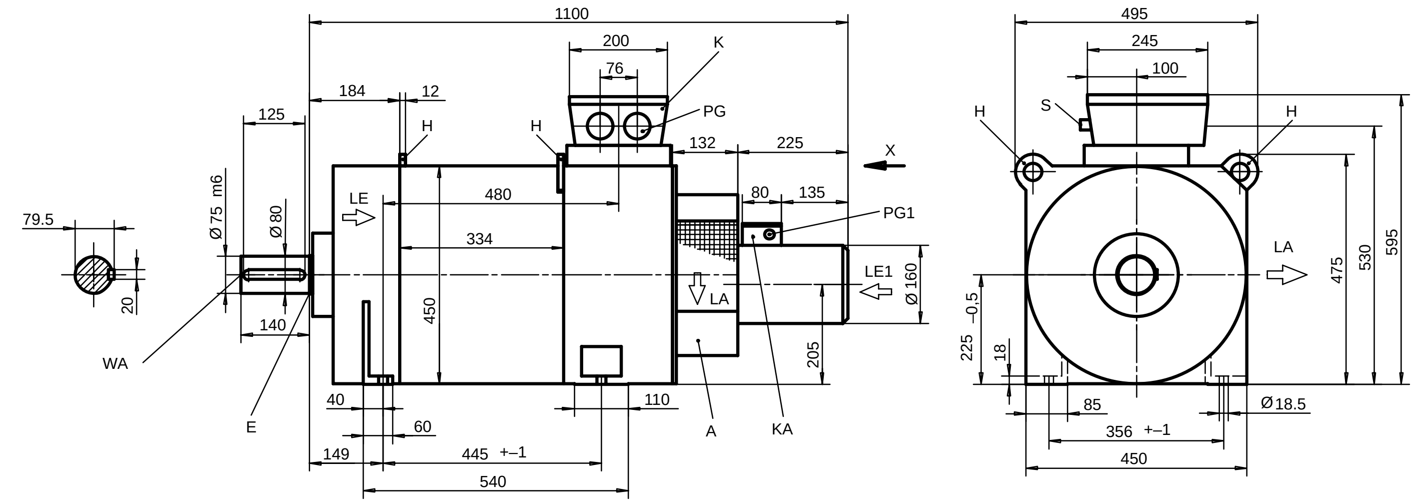
PG Leitungseinführung 2 x Pg42 / Cable entry 2 x Pg42

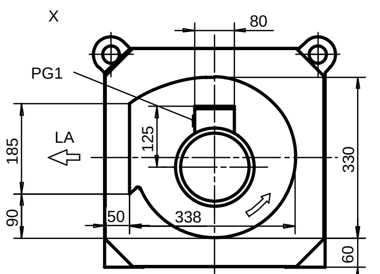
PG1 Leitungseinführung Pg13,5 / Cable entry Pg13,5

S Stecker für Impulsgeber u. Temperaturfühler
Connector for pulse generator and temperature sensor

Bauform / Type of construction	IM B35	Schutzart / Type of protection	IP55	Maschinengewicht / Weight of machine	460 kg

Darstellung / Representation
Maßstab / Scale: ohne
Gew. / Wt.
Design V3.8A00
Datum 23.06.00
Name Krenzer
A&D LD S44A
Siemens AG Nbg Vo
W–Nr. / No.: normal–UL 1XB7322
MASZBILD
Dimension Drawing
Typ/Type 1PH7 186
Blatt / Page 1–
Stat. Mitteilung/Not Datum/Da Name
Ersatz für / Replacement for C437500
Entstanden aus / Originated from –
U820360





WA Wellenende 75m6 x 140 nach DIN 748 mit Zentrierbohrung DR M20 nach DIN 332
Shaft extension 75m6 x 140 to DIN 748 with tapped centre hole DR M20 to DIN 332

E Freistich E1.6 x 0.3 nach DIN 509 / Relief groove E1.6 x 0.3 to DIN 509

K Klemmenkasten geeignet für Leitungsquerschnitt bis 2 x 50 mm
Terminal box suitable for conductor cross section up to 2 x 50 mm

KA Klemmenkasten für Lüftermotor / Terminal box for fan motor

A Fremdlüfteraggregat / Seperatly driven fan

LE Lufteintritt / Air inlet LA Luftaustritt / Air outlet

H Hebeöse / Lifting eye

PG Leitungseinführung 2 x Pg42 / Cable entry 2 x Pg42

PG1 Leitungseinführung M16x1,5 + M25x1,5 / Cable entry M16x1,5 + M25x1,5

S Stecker für Impulsgeber u. Temperaturfühler
Connector for pulse generator and temperature sensor

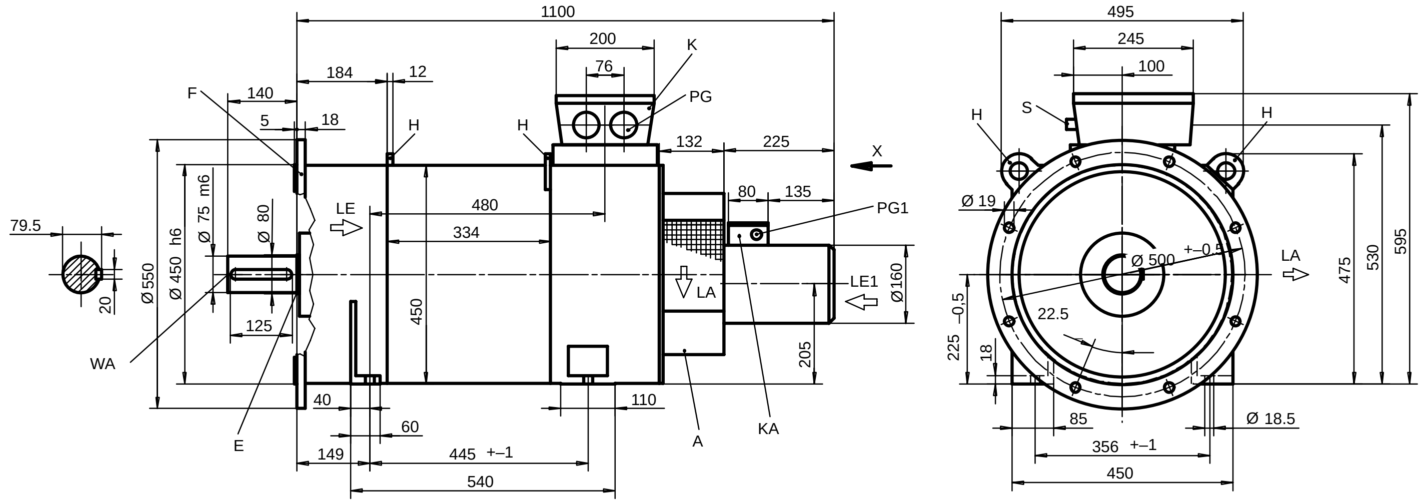
LE1 Lufteintritt Fremdlüftermotor / Air inlet for seperatly driven fan motor

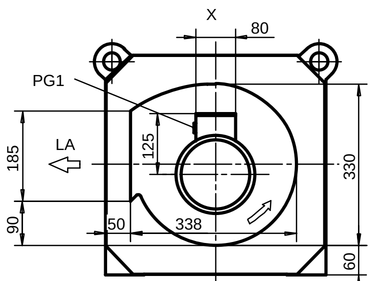
Bauform / Type of construction: IM B3	Schutzart / Type of protection: IP55	Maschinengewicht / Weight of machine: 630 kg

Darstellung / Representation		Maßstab / Scale: ohne	Gew. / Wt.
		Design V3.8A00	
AC 09.06.99 kre	Datum 12.02.97 / Name ped2hpst	W–Nr / No.: normal	1XB7322
	A&D DSPED	MASZBILD / Dimension Drawing	
Stat. Mitteilung/Noti Datum/Da Name	Siemens AG / Nbg Vo	Typ/Type: 1PH7 224	Blatt / Page
Ersatz für / Replacement for – / Entstanden aus / Originated from –		C437444	1–

Fig. 4-27 1PH7 224, type of construction IM B3, air flow direction (DE —> NDE)

Fig. 4-28 1PH7 224, type of construction IM B35, air flow direction (DE —> NDE)





F Befestigungsflansch A550 nach DIN 42948
Mounting flange A550 to DIN 42948

WA Wellenende 75m6 x 140 nach DIN 748 mit Zentrierbohrung DR M20 nach DIN 332
Shaft extension 75m6 x 140 to DIN 748 with tapped centre hole DR M20 to DIN 332

E Freistich E1.6 x 0.3 nach DIN 509 / Relief groove E1.6 x 0.3 to DIN 509

K Klemmenkasten geeignet für Leitungsquerschnitt 2 x 50 mm
Terminal box suitable for conductor cross section up to 2 x 50 mm

KA Klemmenkasten für Lüftermotor / Terminal box for fan motor

A Fremdlüfteraggregat / Seperatly driven fan

LE Lufteintritt / Air inlet LA Luftaustritt / Air outlet

H Hebeöse / Lifting eye

PG Leitungseinführung 2 x Pg42 / Cable entry 2 x Pg42

PG1 Leitungseinführung M16x1,5 + M25x1,5 / Cable entry M16x1,5 + M25x1,5

S Stecker für Impulsgeber u. Temperaturfühler
Connector for pulse generator and temperature sensor

LE1 Lufteintritt Fremdlüftermotor / Air inlet for seperatly driven fan motor

Bauform / Type of construction	IM B35	Schutzart / Type of protection	IP55	Maschinengewicht / Weight of machine	650 kg

Darstellung / Representation		Maßstab / Scale: ohne	Gew. / Wt.
		Design V3.8A00	
AC 09.06.99 kre	Datum 13.02.97 / Name ped2hpsi	W–Nr. / No. normal	1XB7322
	A&D DSPED	MASZBILD / Dimension Drawing	
Stat. Mitteilung/Noti Datum/Da Name	Siemens AG / Nbg Vo	Typ/Type 1PH7 224	Blatt / Page
Ersatz für / Replacement for – / Entstanden aus / Originated from –		C437466	1–

Index

5

Notes

Encoder Systems (GE)

GE

Notes

1 Motor Encoders

1.1 Motor 1FT5

1.1.1 Integrated encoders

Temperature sensor

Type:	Q63100–P426–M135 (characteristic DIN 44081)
Resistance when cold (20 °C):	< 250 Ohm
Connection:	via an encoder cable
Response temperature:	155 °C ± 5 °C
Shaft heights 36 and 48:	2 integrated PTC thermistors (in series)
Shaft heights 63 to 132:	1 integrated PTC thermistor

The change in resistance is **not** proportional to the winding temperature change.

The evaluation circuit signal in the SIMODRIVE converter must be externally evaluated.

High, brief overload conditions, require additional protective measures, as a result of the thermal coupling time of the sensor.

The temperature sensor cables are included in the pre–assembled encoder cables.

Caution

The integrated temperature sensor protects the servomotors from overload conditions up to $4 * I_{0\ 60\ K}$.

For servomotors (shaft heights 36 and 48), the temperature sensor only protects up to $2 * I_{0\ 60\ K}$.

For thermally critical load situations, i.e. high overload when the motor is at a standstill, adequate protection is no longer provided. For example, a thermal overcurrent relay must be provided as additional protection.

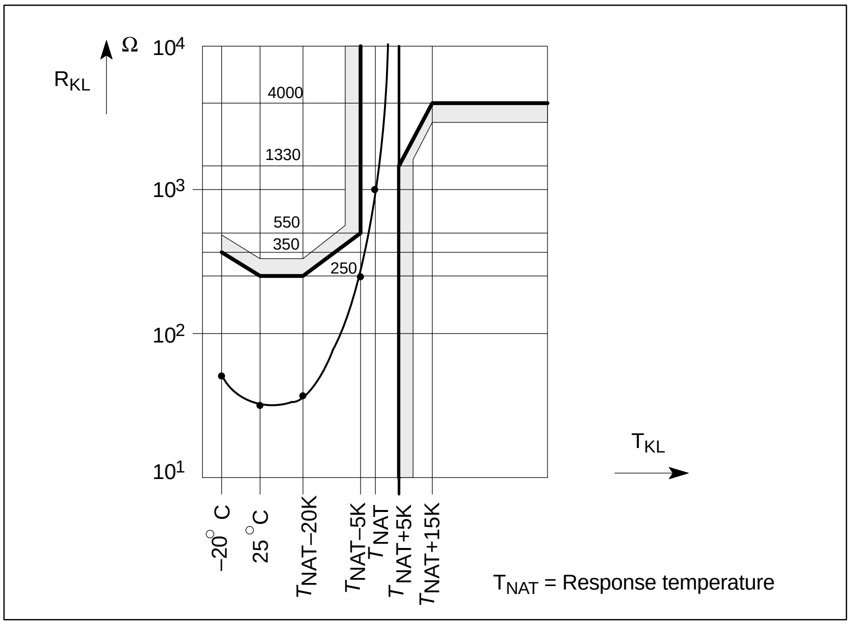


Fig. 1-1 Temperature characteristic

Tachometer system

Version: Brushless analog encoder system

Coupling: On the NDE side through the taper (integr. in the motor)

Application:

- Tachometer for speed actual value sensing;
- Magnetic devices or a Hall switch system as rotor position encoder for inverter control

Output signals:

- Trapezoidal voltage signals from the tachometer
- Absolute signal for the rotor position
  18 pieces of information per motor revolution

Table 1-1 Technical data, 1FU tachometer system

Technical data	**1FU1030** Shaft heights 36 and 48	**1FU1050** Shaft heights 63 to 132
	Hall switch system	Magnetic device
Speed (mech. limiting speed)	8000 RPM	8000 RPM
Peak value, phase voltage at rated speed	16/40 V	40 V
Voltage tolerance	+15 %, –5 %	±8 %
Voltage calibration	±20 %	±20 %
Peak ripple	≤ 1 %	≤ 0.5 %
Linearity error	≤ 0.2 %	≤ 0.2 %
Reversing error	≤ 0.2 %	≤ 0.2 %

Encoder cable: 6FX□202–2CB31–□□□0
Performance/Standard Length

Mating connector: 6FX2003–0CE12

Pulse encoder ROD 320.005

Version:	Optical encoder system with different pulse numbers (refer to the Catalog)
Coupling:	On the NDE side through the taper (integrated in the motor)
Application:	Indirect meas. system for a digital position control loop
Evaluation:	Incremental
Output signals:	Squarewave; RS422 (TTL)

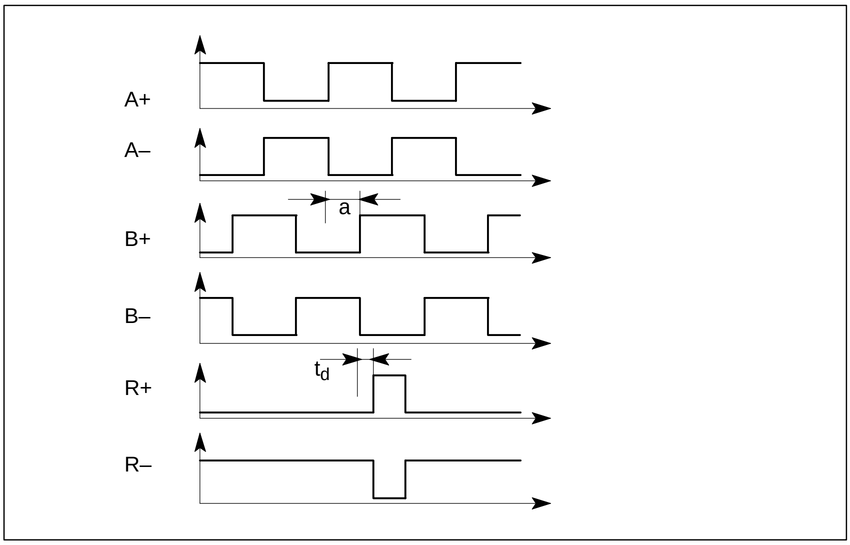


Fig. 1-2 Signal characteristics for a clockwise direction or rotation

The servomotors may only be utilized for a temperature rise of ΔT = 60 K.

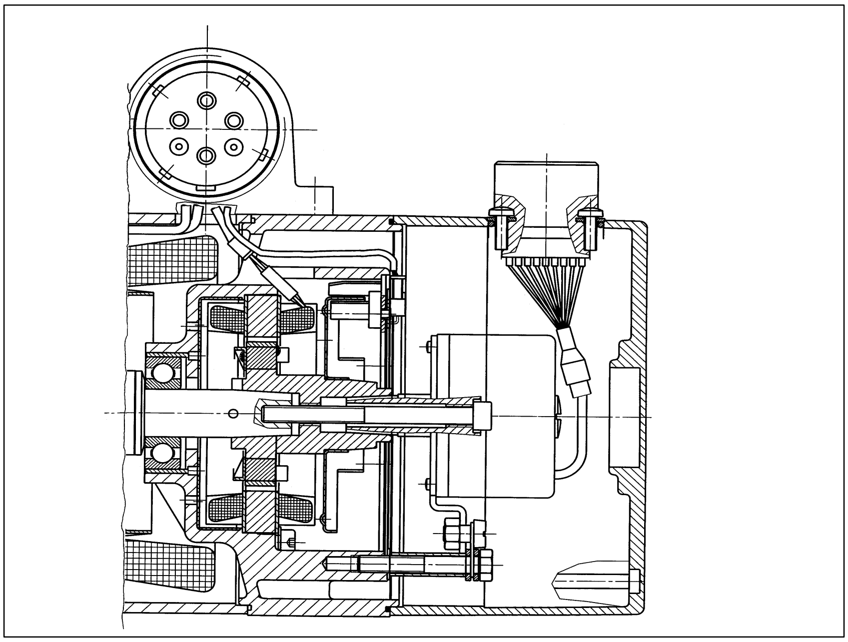


Fig. 1-3 1FT5 servomotors with integrated ROD 320.005 pulse encoder

GE

Table 1-2 Technical data, ROD 320.005 pulse encoder

Mechanical speed Electrical speed Operating voltage Current drain Frequency range	Max. 8500 RPM Dependent on the pulse No. (refer below) 5 V DC $\pm$5 % $\leq$150 mA (without load) 0 to 300 kHz
Edge clearance Delay U_{a0} zu U_{a1} and U_{a2} Output load capability	a $\geq$ 420 ns $t_d \leq$ 50 ns $I_{high} \leq$ DC 20 mA $I_{low} \leq$ DC 20 mA; $C_{Load} \leq$ 1000 pF
Short–circuit strength	Briefly, all outputs to 0 V; 1 output continuously at $\leq$ 25 °C
Light source	LED which is vibration proof
Operating temperature	–30 °C to +100 °C
Intrinsic moment of inertia	$0.035 * 10^{-4}$ kgm^2
Weight	0.25 kg

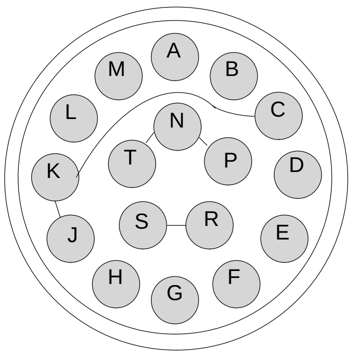
Maximum electrical speed:

$$n_{max} = \frac{f_g * 10^3 * 60}{\text{Pulse No.}} \text{ [RPM]}$$

f_g [kHz] limiting frequency (–3dB)

Connection, 17–pin flange–mounted socket (connector pins)

PIN No.	Signal
A	A+
B	B+
C, J, K	+5 V
D	A–
E	B–
F	R+
G	R–
H	Shield
N, P, T	0 V
R, S	Jumper
L	$\overline{\text{Vas}}$[1]



When viewing the connector side (pins)

Mating connector: 6FC9348–7AV01 (socket)

Pre–assembled cable: Refer to Catalog NC Z

1) Noise signal: LED monitoring

1.1.2 Mounted encoders

Incremental encoders ROD426

Version:	Optical encoder system with different pulse numbers (refer to Catalog)
Coupling:	On the NDE side through a compression or spring–loaded coupling (mounted on the motor); synchronous flange
Application:	Indirect measuring system for the digital closed–loop control circuit
Evaluation:	Incremental
Output signals:	Squarewave; RS422 (TTL) 2 channels, displaced through 90° electricalt 1 zero pulse per revolution

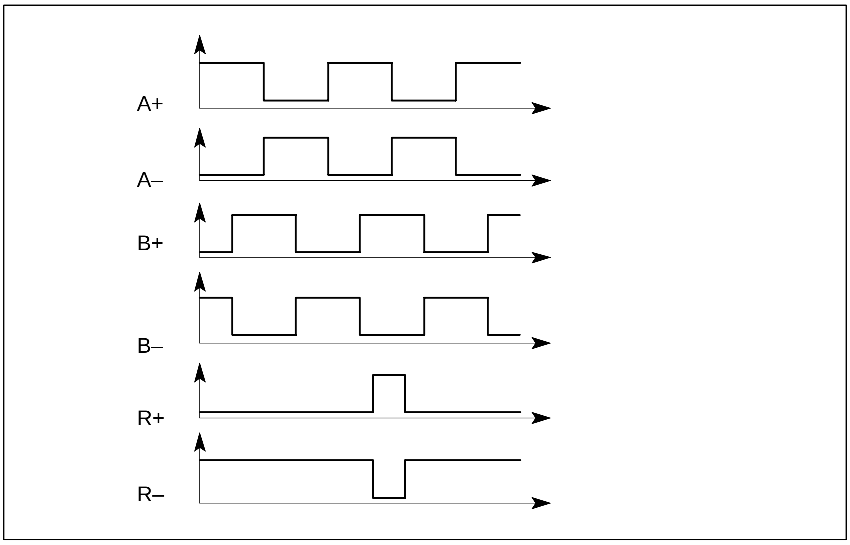


Fig. 1-4 Signal characteristics for a clockwise direction of rotation

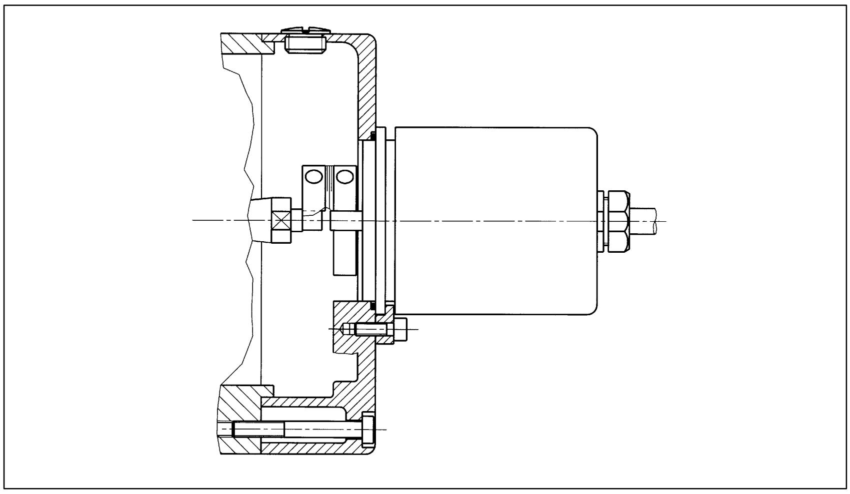


Fig. 1-5 1FT5 servomotor with mounted rotary encoder

GE

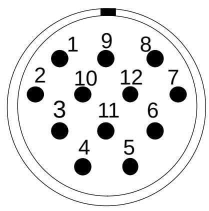
 6SN1197–0AA20

Table 1-3 Technical data, ROD426 pulse encoder

Speed Operating voltage Current drain Frequency range	Max.12 000 RPM 5 V DC ±5 % ≤ 150 mA (without load) 0 kHz to 300 kHz
Signal level Minimum edge clearance V_{a1} to V_{a2} Electrical resolution	RS 422 (TTL) ≥ 0.45μs at 300kHz 500 to 5000 pulses/revolution (corrresponds to the resolution of a pulse disk); with external multiplication, up to 20 000 pulses/revolution
Degree of protection (acc. to DIN 40050)	• without shaft input: IP 67 • with shaft input: IP 64
Operating temperature Storage temperature	–30 °C to +100 °C –30 °C to +80 °C
Vibration stressing (acc. to DIN IEC 68–2–6) Shock stressing (acc. to DIN IEC 68–2–29)	$100\ m/s^2$ (50...2000 Hz) $1000\ m/s^2$ (11 ms)
Moment of inertia of the mounted encoder including coupling and motor shaft	$0.0175 * 10^{-4}\ kgm^2$
Moment of inertia of the encoder	$1.45 * 10^{-6}\ kgm^2$
Weight	0.25 kg

12–pin connection (connector pins)

PIN No.	Signal
1	B–
2	+5 V sense
3	R+
4	R–
5	A+
6	A–
7	$\overline{\text{Uas}}$ [1)]
8	B+
9	not connected
10	0 V
11	0 V sense
12	+5 V



When viewing the connector side (pins)

Mating connector 6FX2003–0CE12 (socket)

Pre–assembled cables: refer to Catalog NC Z

1) Noise signal: LED monitoring

Prepared for encoder mounting, synchronous flange

For encoders with synchronous flange (ROD 426 mounting–compatible).

Order designation: G51

Version: Shaft heights 36 and 48 with VMA coupling
Shaft heights 63 to 132 with spring–disk coupling

The following encoders can be mounted:

SIMODRIVE sensor incremental encoders with synchronous flange

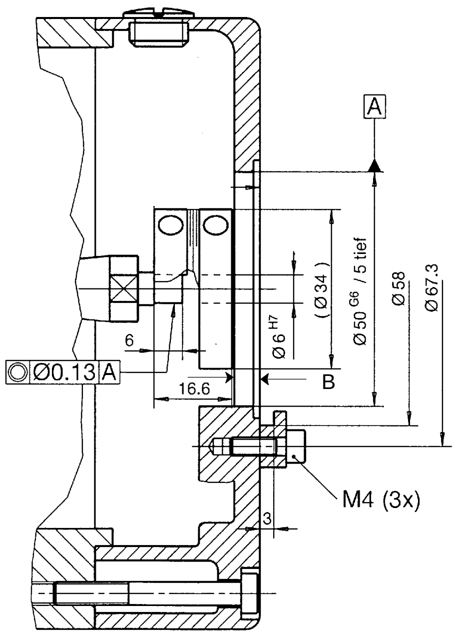
- 6FX2001–2□□□ with RS 422 (TTL)
- 6FX2001–3□□□ with sinusoidal $1V_{pp}$
- 6FX2001–4□□□ with HTL

as well as mounting–compatible encoders

SIMODRIVE sensor absolute value encoders with synchronous flange

- 6FX2001–5□□□ with SSI or Profibus DP

as well as mounting–compatible encoders.



Type	B ±1
1FT503□	5.9
1FT504□	7.1
1FT506□	6.3
1FT507□	5.9
1FT510□	5.9
1FT513□	5.9

Fig. 1-6 Mounting absolute angle encoders with standard pulse encoder flange onto motors 1FT503□ to1FT513□

GE

1.2 1FT6, 1FK6, 1PH motors

1.2.1 Temperature sensors

Type:	KTY 84
Resistance when cold (20 °C):	Approx. 580 Ohm
Resistance when hot (100 °C):	Approx. 1000 Ohm
Connection:	Via encoder cable
Response temperature:	Pre–alarm at 120 °C Shutdown at 155 °C ± 5 °C
Application:	1FT6, 1FK6, 1PH2, 1PH4, 1PH7

The resistance change is proportional to the winding temperature change for 1PH motors, the temperature characteristic is generally taken into account in the closed–loop control.

The pre–alarm signal of the evaluation circuit in the SIMODRIVE drive converter can be externally evaluated.

High, brief overload conditions require additional protective measures, as a result of the thermal coupling time of the sensor. If the overload condition ($4 \cdot M_0$) lasts for longer than 4s, additional protection must be provided.

The temperature sensor conductors are included in the encoder cable.

Warning

- If the user carries–out an additional high–voltage test, the ends of the temperature sensor cables must be short–circuited before the test! If a test voltage is applied to a temperature sensor, it will be destroyed.
- Observe the polarity when connecting–up (for 1PH2)!

Caution

The integrated temperature sensor protects the servomotors from overload conditions up to $4 * I_{0\ 60K}$ (≥ shaft height 63) and speed <> 0.

For servomotors (shaft heights 28, 36 and 48) the temperature sensor only protects up to $2 * I_{0\ 60K}$ and speed <> 0.

For thermally critical load situations, e.g. high overload at motor standstill, adequate protection is no longer provided. For example, a thermal overcurrent relay must be provided as additional protection.

If they are available, reduced data for standstill are specified.

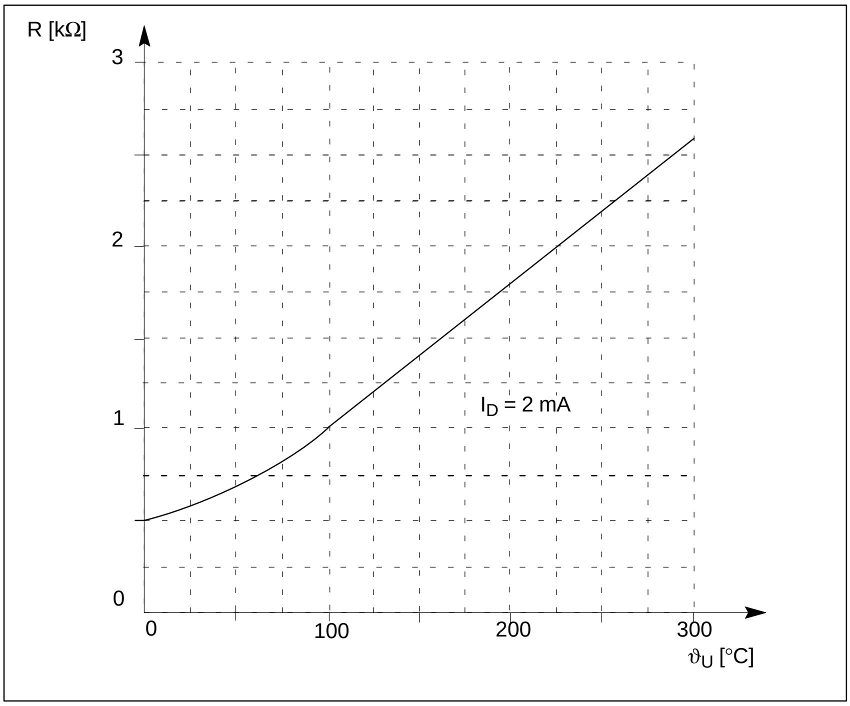


Fig. 1-7 Temperature characteristic

GE

1.2.2 Integrated encoders

Incremental encoders 1 V_{pp}

Version: Optical encoder system

Coupling: On the NDE (integrated in the motor)

Application:
- Tacho for speed actual value sensing
- Rotor position encoder for inverter control
- Indirect measuring system for the position control loop

Evaluation: Incremental

Output signals: Sinusoidal

Connection: Connector

Application: 1FT6, 1FK6, 1PH7, 1PH4

Note

When an encoder is replaced, the relative position of the encoder system to the motor EMF must be adjusted (not for 1PH motors).

Adjustment:
When adjusting, the motor is rotated in the clockwise direction when viewing the drive end. The rotor is rotated so that a zero crossover of the motor EMF V_{U-Y} [1)] with a positive gradient coincides with the encoder reference signal. For a 6–pole motor, the following signal characteristics are obtained after adjustment (the reference signal is shown somewhat thicker):

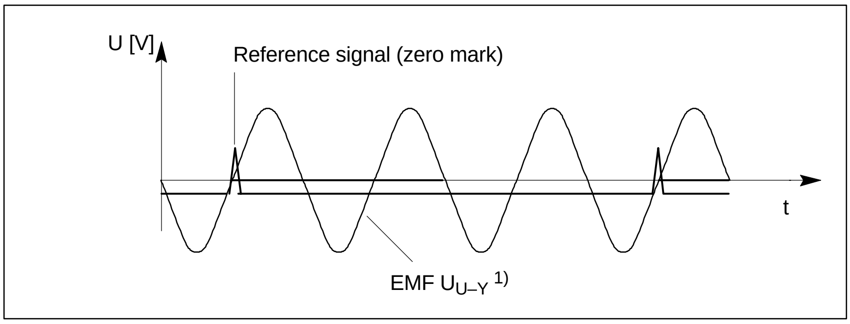


Fig. 1-8 Signal characteristics of the motor EMF and reference signal

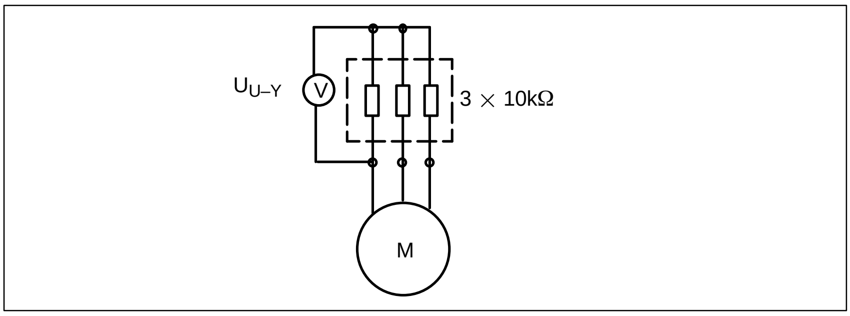


Fig. 1-9 A recommendation as to how an artificial neutral point can be created

1) V_{U-Y}: Phase voltage of phase U with respect to the artifical neutral point (refer to Fig. 1-9)

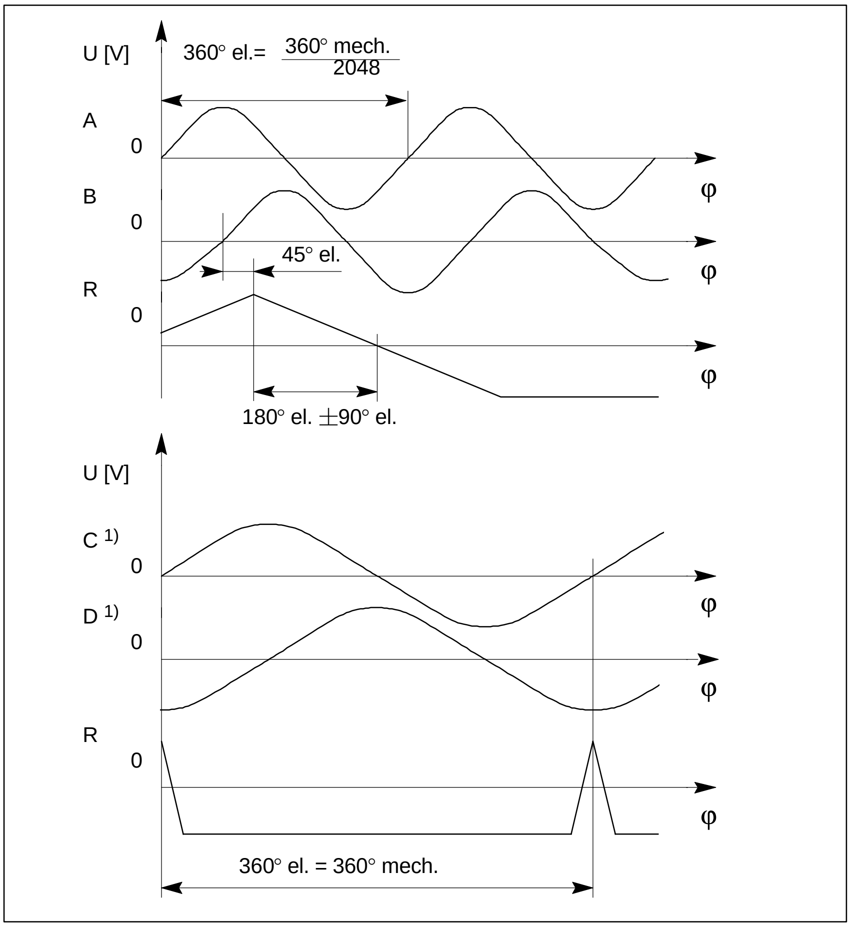


Fig. 1-10 Signal characteristics and assignment for a positive direction of rotation (clockwise direction of rotation when viewing the drive end); C–D signals only in combination with 1FT/1FK

Table 1-4 Technical data, ERN1381/1387 incremental encoder

Mech. limiting speed	12 000 RPM
Operating voltage Current drain Pulse number Incremental signals Accuracy	5V± 5% max. 300 mA 2048 1 V_{pp} ±40”
Vibration immunity Vibration (55–2000 Hz) Shock (10 ms)	 100 m/s^2 acc. to DIN IEC 68–2–6 1000 m/s^2 acc. to DIN IEC 68–2–27
Operating temperature Storage temperature	–15 °C to +120 °C –20 °C to +80 °C

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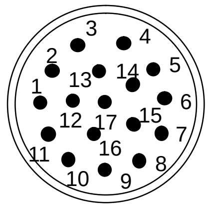
1) not for ERN 1381

Connection: 17–pin flange–mounted socket (plug contact)

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



View of the connector side (pins)

Mating connector 6FX2003–0CE17 (socket)

Pre–assembled cables: 6FX□002–2CA□1–□□□0

Length

3 611 digital MSD/FD5
611 analog MSD

8 = Motion Control 800
5 = Motion Control 500

Cable length: max. 50 m

1) for ERN 1381 ”not connected”

Absolute value encoder

Version:	Optical/ magnetic encoder system (basic absolute value encoder: inductive)
Coupling:	On the NDE (integrated in the motor)
Application:	• Tachometer for speed actual value sensing • Rotor position encoder for inverter control • Indirect measuring system for the position control loop
Evaluation:	Incremental and absolute; (4096 revolutions, which can be differentiated between)
Output signals:	Sinusoidal and serial interface
Connection:	Connector
Application:	1FT6; 1FK6 (EQI only in 1FK6)

Note

When replacing the encoder, the relative position of the encoder system to the motor EMF must be adjusted.

Adjustment

The adjustment can be made in two different ways.

a) A zero crossover of the EMF V_{U-Y} (phase U with respect to the neutral point) with a positive gradient, must coincide with the falling edge of the MSB (Most Significant Bit) of the “normalized electrical rotor position” within one revolution.

b) A zero crossover of EMF V_{U-Y} (phase U with respect to the neutral point) with a positive gradient, must coincide with the falling edge of the electrical rotor position.

The formation of the neutral point is explained in Fig. 1-9 on Page GE/1-10.

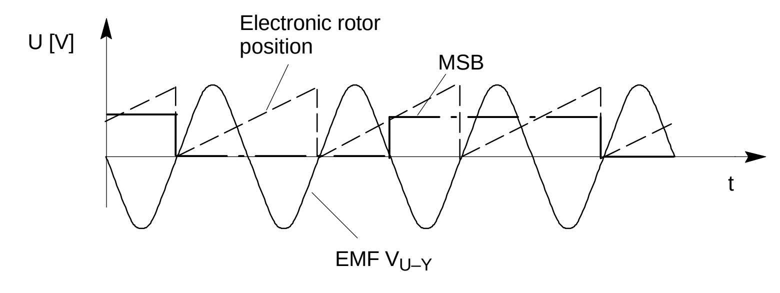


Fig. 1-11 Signal characteristics and assignment for a positive direction of rotation (clockwise of rotation when viewing the DE)

GE

c)

1. Slightly release the screws for the torque support.
2. The following signals must be monitored when making the adjustment:
   – Motor EMF V_{U-Y} (electromotive force) (2, Fig.1-11)
   – “Normalized electrical rotor position” using the D/A converter function of the 611D drive
3. The encoders are rotated so that a signal characteristic, as shown in Fig. 1-11 is obtained.
4. Tighten the screws of the torque support.

Table 1-5 Technical data, absolute value encoder EnDat

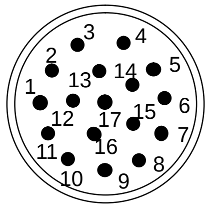
Mech. limiting speed	12 000 RPM
Operating voltage Current drain Resolution, incremental Resolution, absolute Incremental signals Serial absolute position Accuracy	5 V $\pm$ 5% max. 300 mA 2048 periods per revolution (EQI: 32) 4096 revolutions; coded 1 Vpp RS 486 $\pm$40” (basic absolute value encoder $\pm$ 400”)
Vibration immunity Vibration (55–2000 Hz) Shock (6 ms)	 100 m/s^2 acc. to DIN IEC 68–2–6 1000 m/s^2 acc. to DIN IEC 68–2–27
Operating temperature Storage temperature	–15 °C to +115 °C –20 °C to +80 °C

Note

The rated motor torque is reduced due to the reduced maximum operating temperature of the absolute value encoder with respect to incremental encoders (refer to the motor technical data)!

Connection: 17–pin flange–mounted socket (plug 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 connector side (pins)

Mating connector	6FX2003–0CE17 (socket)
Pre–assembled cables:	refer to Catalog NC Z

GE

Resolvers

Version: Inductive encoder system (2 and multi–pole) [2)]

Coupling: On the NDE (integrated in the motor)

Application:
- Tachometer for speed actual value sensing
- Rotor position encoder for inverter control
- Indirect measuring system for the position control loop

Connection: Connector

Application: 1FK6

Note

The position of the encoder system to the motor EMF must be adjusted when replacing the encoder.

Adjustment

Clockwise direction of rotation: When viewing the motor drive end (Example for: 2–pole resolvers and 6–pole motors)

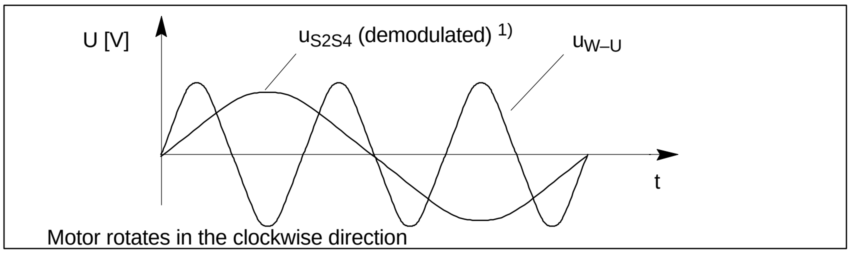


Fig. 1-12 Signal characteristics and assignment for a positive direction of rotation (clockwise direction of rotation when viewing the drive end

A zero crossover of the phase–to–phase EMF $V_{W-U} = V_W - V_U$ with a positive gradient, must coincide with the zero crossover of the demodulated resolver signal U_{S2S4} with a positive gradient.

Table 1-6 Technical data, resolver

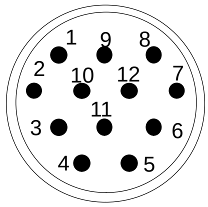
Mech. limiting speed	15 000 RPM
Excitation voltage Excitation frequency Current drain	5 V (rms) to 13 V (rms) 4 kHz to 10 kHz < 80 mA (rms)
Angular accuracy (bandwidth)	< 14’
Pole No. Ratio	2, 4 or 6 [2)] 0.5
Vibration immunity Vibration (50–2000 Hz) Shock (11 ms)	 200 m/s^2 1000 m/s^2
Operating temperature Storage temperature	–55 °C to +155 °C to 155 °C

1) U_{S2S4} can only be measured with supplementary electronics

2) The pole number is the same as the motor pole number

Connection: 12–pin flange–mounted socket (pins)

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 connector side (pins)

Mating connector 6FX2003–0CE12 (socket)

Pre–assembled cables: 6FX□002–2CF01–□□□0

Length

2=Performance
4=Standard

■

GE

Notes

Toothed–Wheel Encoders SIZAG 2

2

Applications

For speed and position sensing for 1PH2 and 1FE1 built–in motors or as spindle encoders for conventional spindle drives.

Note

The toothed–wheel encoder is not included in the scope of supply of 1PH2 and 1FE1 motors.

Output signals

Sinusoidal signals

- Incremental track for position sensing and speed control
- Zero track as reference signal
- Clearance track for modifying the amplitude at power–on

Design

- Toothed–wheel encoder
  with 256 or 512 teeth; module m = 0.3 or 0.5.
  Various inner and outer diameters (refer to the technical data and dimension drawings).
- Scanning head
  with connecting cable and flange–mounted socket including mounting materials (are included); module m = 0.3 or 0.5.

Note

Only toothed–wheels and scanning heads with the same module as for m may be combined.

Connection

Table 2-1 Connecting cables, toothed–wheel encoder

	611 digital	611 analog	611 analog and high–resolution position
Spindle encoder (direct measuring system)	6FX2002–2CA15–□□□□	6FX2002–2CA71–□□□□	6FX2002–2CA51–□□□□
Motor encoder (incirect measuring system)	6FX2002–2CA31–□□□□	6FX2002–2CA51–□□□□	6FX2002–2CA51–□□□□

!

Important

- Grounding should be realized to ensure high frequency immunity.
- The scanning head and the flange–mounted socket must be mounted on grounded metal to guarantee the noise immunity.

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Scope of supply

- Toothed–wheel
- Scanning head with connecting cable
- Split flange–mounted socket with retaining screws
- Feeler gauge
  - for module m=0.3: 0.15 mm
  - for module m=0.5: 0.30 mm

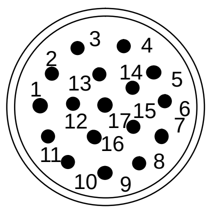
Technical data

Table 2-2 Technical data

Mechanical limiting speed	for Z=512 nmax.=12000 RPM for Z=256 nmax.=24000 RPM
Operating voltage Current drain Incremental signals Number of teeth Absolute accuracy for ideal mounting	5V± 5% 250 mA (typ.) 1 V_{pp} 256 or 512 ±36” mech. for Z=512 teeth ±72” mech. for Z=256 teeth Error if incorrectly centered (dependent on the toothed–wheel used (refer to Table 2–1)
Degree of protection	IP65 acc. to DIN 40050
Operating temperature and storage temperature	–20 °C to +85 °C
Vibration immunity Vibration (0–2000 Hz) Shock (11 ms)	 200 m/s^2 acc. to DIN IEC 68–2–6 1000 m/s^2 acc. to DIN IEC 68–2–27
Weight (scanning head)	approx. 0.3 kg

Connection: 17–pin flange–mounted socket (plug contacts)

PIN No.	Signal
1	A +
2	A –
3	R +
4	not connected
5	not connected
6	not connected
7	M encoder
8	+ temp
9	– temp
10	P encoder
11	B +
12	B –
13	R –
14	not connected
15	0 V sense
16	5 V sense
17	inner screen



When viewing the connector side (pins)

Mating connector: 6FX2003–0CE17 (socket)

Connecting cable at the encoder: with split flange–mounted socket, permissible bending radius:
> 100 mm when continuously bent
> 52 mm when only bent once

2.1 Toothed–wheel versions and order designations

Table 2-3 Overview, toothed–wheel versions

Order designation	Z	a [mm]	m	d_{iz} [mm]	d_k [mm]	b [mm]	Ground [g]	J [$kgm^2 \cdot 10^{-3}$]	Error per 1 μm eccentricity ["]
6FX2001–8RA03–1B	256	0.15	0.3	45	77.4	15	360	2.9	5.3
6FX2001–8RA03–1C	256	0.15	0.3	60	77.4	15	220	2.1	5.3
6FX2001–8RA03–1D	512	0.15	0.3	80	154.2	15	1600	48.3	2.7
6FX2001–8RA03–1E	512	0.15	0.3	110	154.2	15	1070	38.5	2.7
6FX2001–8RA05–1F	256	0.3	0.5	65	129.0	15	1140	23.8	3.2
6FX2001–8RA05–1G	512	0.3	0.5	150	257.0	15	4000	364.2	1.6

Z No. of teeth
a Clearance between the toothed wheel crown circle and the scanning head
m Module
d_{iz} Inside diameter; fit H6
d_k Crown circuit diameter
b Toothed–wheel width
J Moment of inertia

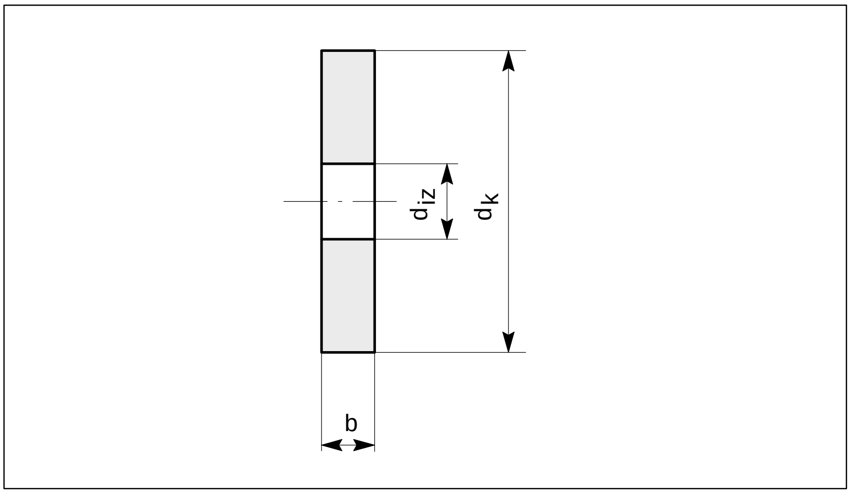


Fig. 2-1 Dimension drawing

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2.2 Scanning head versions and order designations

Table 2-4 Overview, scanning head versions

Order designation	Module m	Connecting cable
6FX2001–8AA03 6FX2001–8AA05	0.3 0.5	0.5 m 0.5 m
6FX2001–8AJ03 6FX2001–8AJ05	0.3 0.5	2.0 m 2.0 m
6FX2001–8AK03 6FX2001–8AK05	0.3 0.5	0.2 m 0.2 m

2.3 Assignment, encoders to 1PH2 motors

Assignment, motor–encoder

We recommend the following assignments:

Table 2-5 Assignment, encoder

Motortype	Scanning head	Toothed–wheel
1PH2 092	6FX2001–8A□03	6FX2001–8RA03–1B
1PH2 096	6FX2001–8A□03	6FX2001–8RA03–1B
1PH2 123	6FX2001–8A□03	6FX2001–8RA03–1C
1PH2 127	6FX2001–8A□03	6FX2001–8RA03–1C
1PH2 128	6FX2001–8A□03	6FX2001–8RA03–1C
1PH2 143	6FX2001–8A□05	6FX2001–8RA05–1F
1PH2 147	6FX2001–8A□05	6FX2001–8RA05–1F
1PH2 093	6FX2001–8A□05	6FX2001–8RA05–1F
1PH2 095	6FX2001–8A□05	6FX2001–8RA05–1F
1PH2 113	6FX2001–8A□03	6FX2001–8RA03–1D
1PH2 115	6FX2001–8A□03	6FX2001–8RA03–1D
1PH2 117	6FX2001–8A□03	6FX2001–8RA03–1D
1PH2 118	6FX2001–8A□03	6FX2001–8RA03–1D
1PH2 182	6FX2001–8A□03	6FX2001–8RA03–1E
1PH2 184	6FX2001–8A□03	6FX2001–8RA03–1E
1PH2 186	6FX2001–8A□03	6FX2001–8RA03–1E
1PH2 188	6FX2001–8A□03	6FX2001–8RA03–1E
1PH2 254	6FX2001–8A□05	6FX2001–8RA05–1G
1PH2 256	6FX2001–8A□05	6FX2001–8RA05–1G

□: K=0.2m connecting cable length
A=0.5m connecting cable length
J=2 m connecting cable length

Note

When commissioning the system, it should be checked that the scanning and toothed–wheel combination is correct!

Only toothed wheels and scanning heads with an 8 at the 8th position of the order designation may be combined with one another.

Toothed–wheel and scanning head, which are combined, must have the same module (→ with the same number at the 12th position in the order designation).

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2.4 Recommended mounting

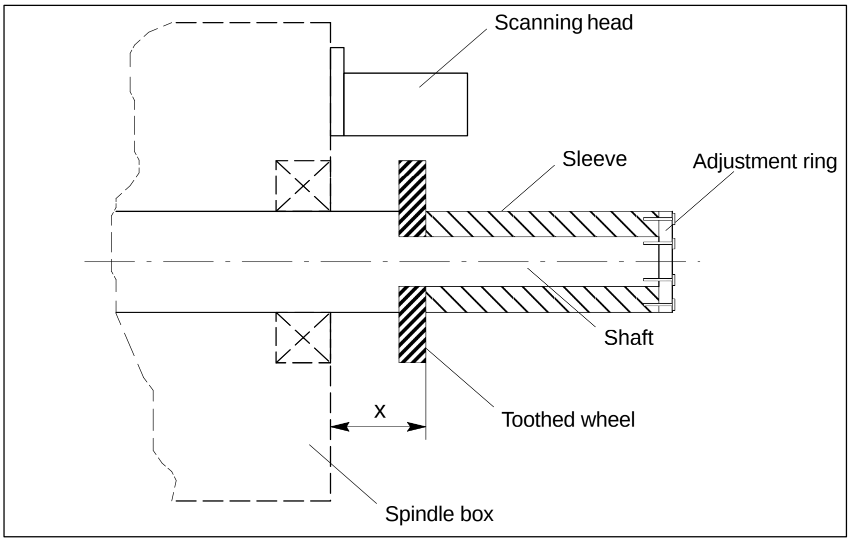

Fig. 2-2 Recommended mounting, toothed–wheel encoder

Note

- It must be ensured that the incremental track and zero track are correctly arranged (refer to the assembly drawing, Fig. 2-5).
- Before assembly, the mounting surfaces as well as, if necessary, the toothed wheel and scanning head must be cleaned.
- The connecting cable may only be inserted if the equipment is in a no–voltage condition!
- The toothed–wheel must be handled extremely carefully. The toothed–wheel encoder will be destroyed even if the teeth are slightly damaged.
- Ensure that the shield is correctly routed.
- When assembling, observe the specified direction of rotation.
- Ensure that the flange–mounted socket is correctly mounted (refer to the mounting instructions.
- The specified tolerances must also be maintained in operation (temperature, speed, vibration etc.).
- It must be ensured that no particles of dirt (metal chips etc.) can enter the working space of the toothed–wheel encoder. This could destroy the toothed–wheel and/or scanning head.
- When connecting the temperature sensor, observe the polarity.

Toothed–wheel assembly

Mounting:

The toothed–wheel and the spindle must form a transition fit, e.g. H6 – j6.
The toothed–wheel can be pressed against a shaft shoulder using a sleeve, so that a friction–locked connection is obtained. It is also possible to mount the toothed–wheel to a shaft shoulder using axial screws (also refer to the Mounting Instructions).

Mounting equipment: None
Tolerances:

The data refer to the corresponding mounting drawing.

Radial eccentricity of the shaft under the toothed wheel:	< 10 µm
Radial eccentricity (with the toothed–wheel mounted):	< 20 µm
Concentricity of the shaft shoulder and retaining sleeve:	< 10 µm

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Scanning head

Mounting:

The scanning head must be mounted in accordance with the mounting instructions.

If required, strain relieve the connecting cable. Ensure that the flange–mounted socket is grounded through the largest possible surface area.

The cables for the temperature sensors must be connected to the appropriate motor connections. When the toothed–wheel encoder is used as autonomous spindle encoder, the temperature sensor connections are not required.

!

Important

It is not permissible to adjust the system using the encoder signals!

The 6EX2007–1AA00 encoder diagnostics unit may **not** be used for adjustment.

The adjustment must be made with the feeler gauge included.

Mounting equipment (not included in the scope of supply):

- 4 M6 × 20 mm screws with spring washer and washer
- Torque wrench with hexagon size 5 attachment socket

Tolerances:

The data refer to the appropriate mounting drawing.

Radial eccentricity at the crown circle and at the clearance track disk of the mounted toothed wheel :	< 20 μm
Axial position of the toothed wheel (refer to Fig. 2–2) and the mounting drawing (dimension x)	x=38 mm ± 0.1mm
The position changes, obtained as a result of the various operating statuses (e.g. temperature rise) may be, relative to dimension x:	+1 mm/–0.2 mm
Tangential offset between the scanning head and the shaft center point:	< ± 0.1 mm
Clearance, toothed–wheel crown circle and the scanning head:	
Module m = 0.3	a = 0.15 mm
Module m = 0.5	a = 0.3 mm
Tilt angle, axial and tangential	90° ± 5’

2.5 Dimension drawings and mounting drawings

Note

Siemens AG reserves the right to change machine dimensions as part of mechanical design improvements, without prior notice. Dimension drawings can go out of date, the latest dimension drawings can be requested at no change.

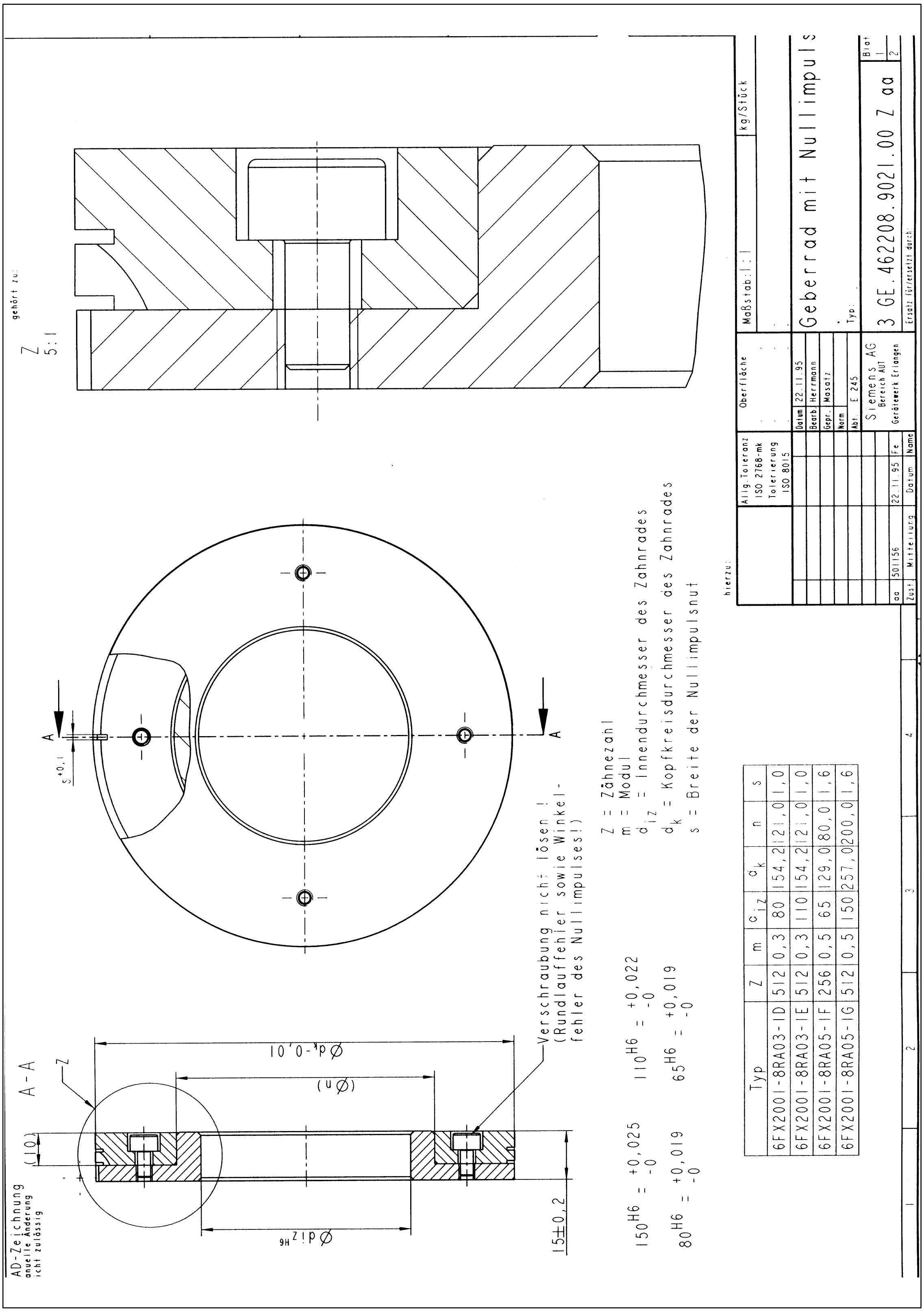

Fig. 2-3 Encoder wheel with zero pulse

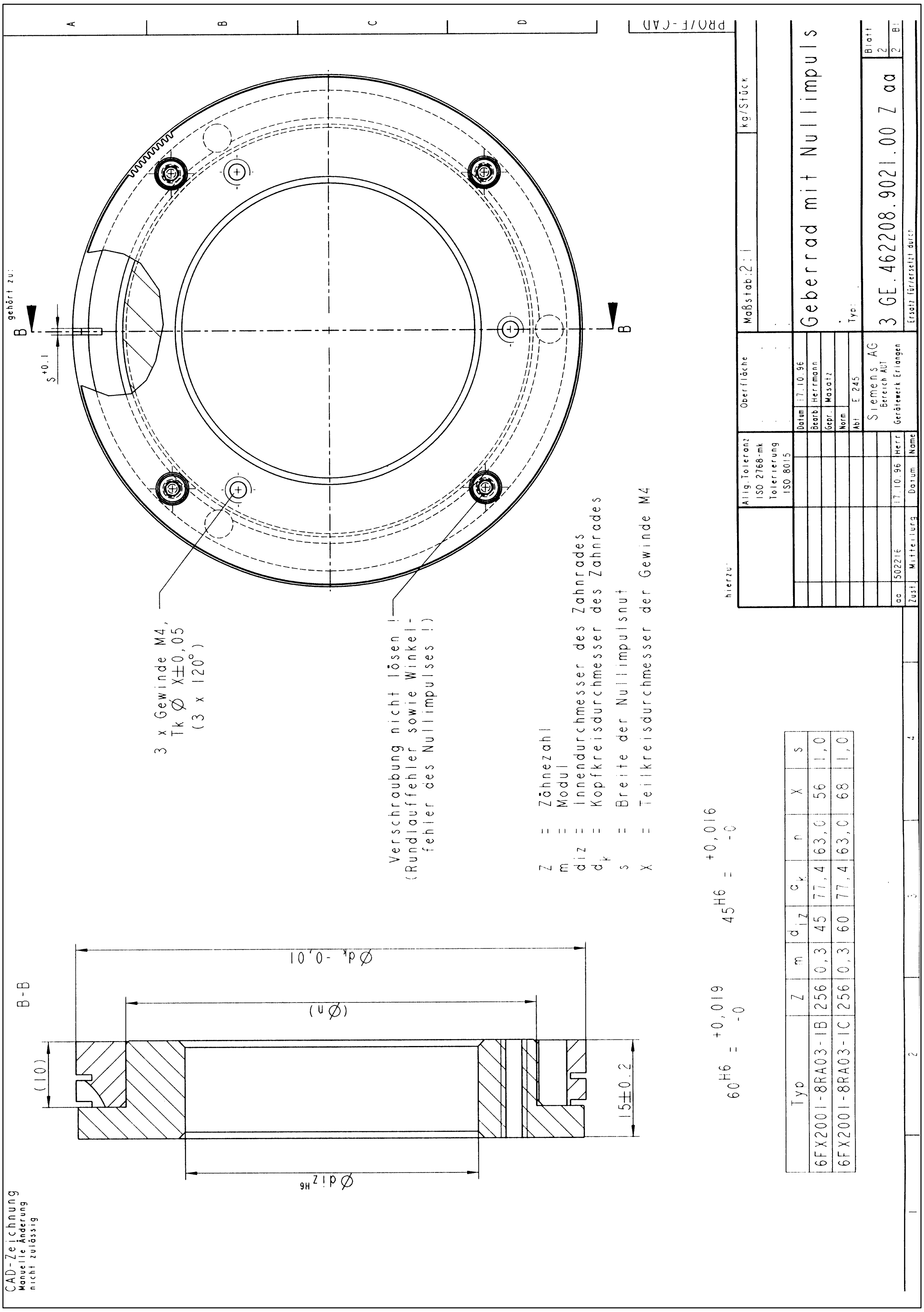

Fig. 2-4 Encoder wheel with zero pulse

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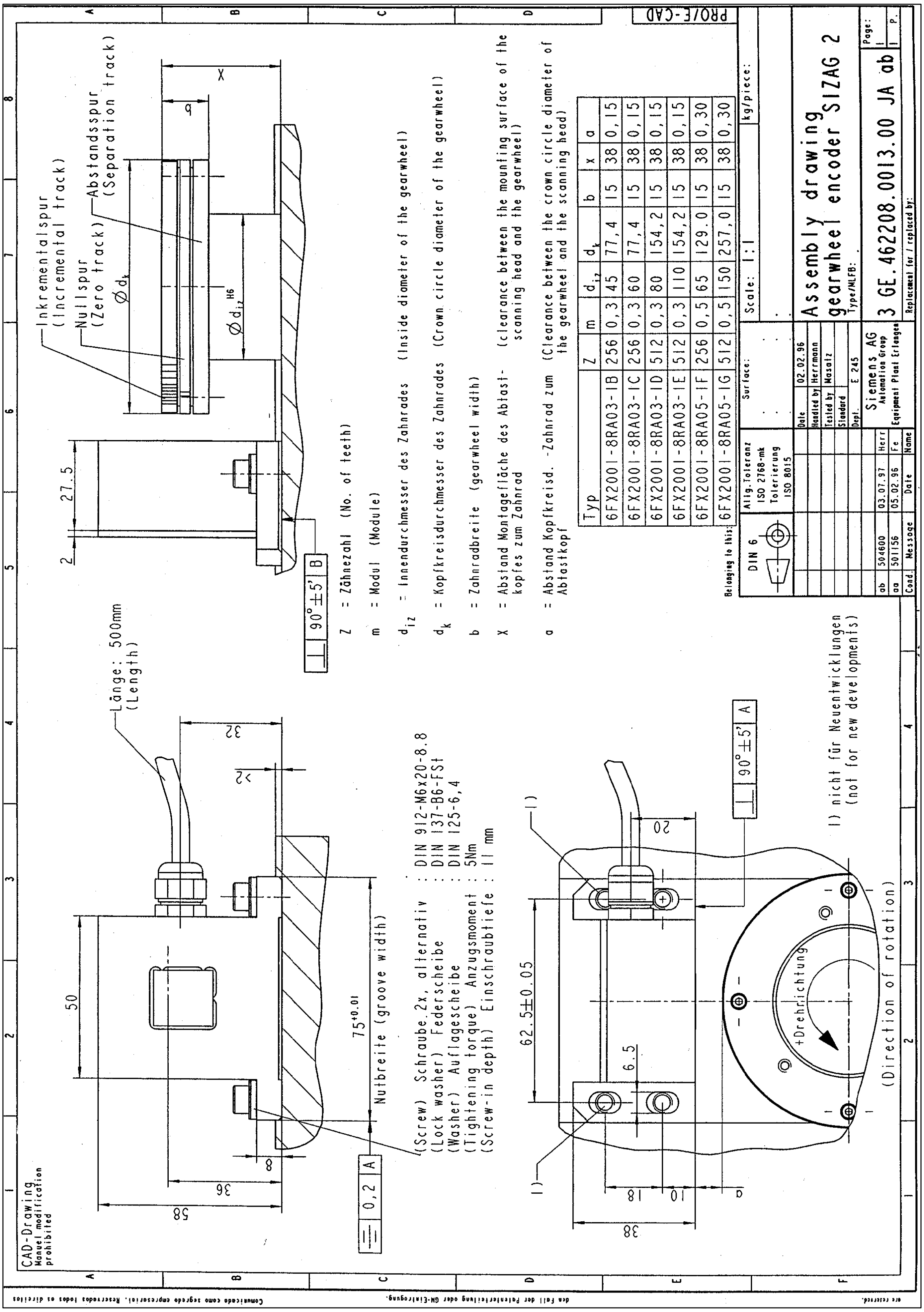

Typ	Z	m	d_{iz}	d_k	b	x	a
6FX2001-8RA03-1B	256	0,3	45	77,4	15	38	0,15
6FX2001-8RA03-1C	256	0,3	60	77,4	15	38	0,15
6FX2001-8RA03-1D	512	0,3	80	154,2	15	38	0,15
6FX2001-8RA03-1E	512	0,3	110	154,2	15	38	0,15
6FX2001-8RA05-1F	256	0,5	65	129,0	15	38	0,30
6FX2001-8RA05-1G	512	0,5	150	257,0	15	38	0,30

Fig. 2-5 Mounting drawing, toothed–wheel encoder SIZAG 2

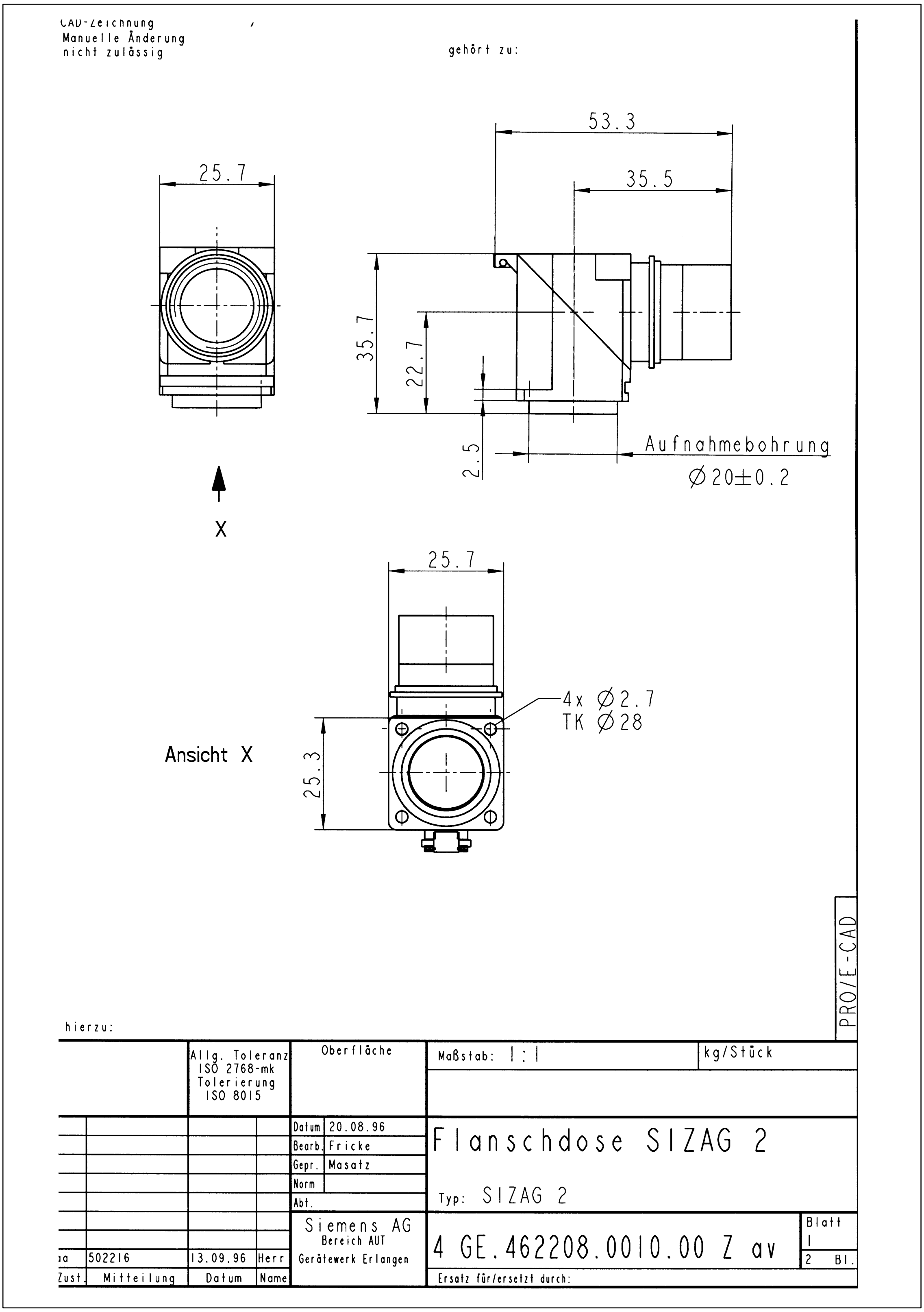

Fig. 2-6 Montagezeichnung Flange–mounted socket SIZAG 2

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Notes

3 Index

Notes

EEC Declaration of Conformity

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Note

Attached is an excerpt from the EEC Declaration of Conformity No. 002 V 01.08.96. The complete EEC Declaration of Conformity is provided in the brochure ”EMV Directives for SINUMERIK and SIROTEC control systems”.

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SIEMENS

EG-Konformitätserklärung

No. 664.20010.01/08.96

Hersteller:	Siemens Aktiengesellschaft Bereich Antriebs-, Schalt- und Installationstechnik Geschäftsgebiet Drehzahlveränderbare Antriebe
Anschrift:	Siemensstraße 15 97615 Bad Neustadt a. d. Saale Bundesrepublik Deutschland
Produktbezeichnung:	**Drehstrom-Synchronmotor, Servoantrieb** **Typ 1FT5...** **Achshöhe 28 bis 132**

Das bezeichnete Produkt stimmt mit den Vorschriften folgender Europäischer Richtlinie überein:

73/23/EWG Richtlinie des Rates zur Rechtsangleichung der Rechtsvorschriften der Mitgliedstaaten betreffend elektrischer Betriebsmittel zur Verwendung innerhalb bestimmter Spannungsgrenzen geändert durch RL 93/68/EWG des Rates

Die Übereinstimmung mit den Vorschriften dieser Richtlinie wird nachgewiesen durch die vollständige Einhaltung folgender Normen:

EN 60 204-1
EN 60 034-1
EN 60 034-5
EN 60 034-6
EN 60 034-9
Die Sicherheitshinweise und Betriebsanleitungen sind zu beachten.

Erstmalige Anbringung der CE-Kennzeichnung: 96

Siemens Aktiengesellschaft

Bad Neustadt, den 13/8/96

i.V. Dr. H. P. Zerbes ....

Dr. Hans Peter Zerbes, Leiter der
Produktionseinheit Drehzahlveränderbare Antriebe
Standort Bad Neustadt

i.V. ....

Dr. Gerhard Huth, Techn. Leiter der
Produktionseinheit Drehzahlveränderbare Antriebe
Standort Bad Neustadt

Diese Erklärung bescheinigt die Übereinstimmung mit den genannten Richtlinien, ist jedoch keine Zusicherung von Eigenschaften im Sinne der Produkthaftung.

SIEMENS

EG-Konformitätserklärung

No. 664.20011.01/08.96

Hersteller:	Siemens Aktiengesellschaft Bereich Antriebs-, Schalt- und Installationstechnik Geschäftsgebiet Drehzahlveränderbare Antriebe
Anschrift:	Siemensstraße 15 97615 Bad Neustadt a. d. Saale Bundesrepublik Deutschland
Produktbezeichnung:	**Drehstrom-Synchronmotor, Servoantrieb** **Typ 1FT6...** **Achshöhe 36 bis 132**

Das bezeichnete Produkt stimmt mit den Vorschriften folgender Europäischer Richtlinie überein:

73/23/EWG Richtlinie des Rates zur Rechtsangleichung der Rechtsvorschriften der Mitgliedstaaten betreffend elektrischer Betriebsmittel zur Verwendung innerhalb bestimmter Spannungsgrenzen geändert durch RL 93/68/EWG des Rates

Die Übereinstimmung mit den Vorschriften dieser Richtlinie wird nachgewiesen durch die vollständige Einhaltung folgender Normen:

EN 60 204-1
EN 60 034-1
EN 60 034-5
EN 60 034-6
EN 60 034-9
Die Sicherheitshinweise und Betriebsanleitungen sind zu beachten.

Erstmalige Anbringung der CE-Kennzeichnung: 96

Siemens Aktiengesellschaft

Bad Neustadt, den 13/8/96

i.V. [signature] — Dr. Hans Peter Zerbes, Leiter der Produktionseinheit Drehzahlveränderbare Antriebe Standort Bad Neustadt

i.V. [signature] — Dr. Gerhard Huth, Techn. Leiter der Produktionseinheit Drehzahlveränderbare Antriebe Standort Bad Neustadt

Diese Erklärung bescheinigt die Übereinstimmung mit den genannten Richtlinien, ist jedoch keine Zusicherung von Eigenschaften im Sinne der Produkthaftung.

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SIEMENS

EG-Konformitätserklärung

No. 664.20012.01/06.96

Hersteller:	Siemens Aktiengesellschaft Bereich Antriebs-, Schalt- und Installationstechnik Geschäftsgebiet Drehzahlveränderbare Antriebe
Anschrift:	Siemensstraße 15 97615 Bad Neustadt a. d. Saale Bundesrepublik Deutschland
Produktbezeichnung:	**Drehstrom-Synchronmotor, Servoantrieb** **Typ 1FK6...** **Achshöhe 36 bis 100**

Das bezeichnete Produkt stimmt mit den Vorschriften folgender Europäischer Richtlinie überein:

73/23/EWG	Richtlinie des Rates zur Rechtsangleichung der Rechtsvorschriften der Mitgliedstaaten betreffend elektrischer Betriebsmittel zur Verwendung innerhalb bestimmter Spannungsgrenzen geändert durch RL 93/68/EWG des Rates

Die Übereinstimmung mit den Vorschriften dieser Richtlinie wird nachgewiesen durch die vollständige Einhaltung folgender Normen:

EN 60 204-1
EN 60 034-1
EN 60 034-5
EN 60 034-6
EN 60 034-9
Die Sicherheitshinweise und Betriebsanleitungen sind zu beachten.

Erstmalige Anbringung der CE-Kennzeichnung: 96

Siemens Aktiengesellschaft

Bad Neustadt, den 21/6/96

i.V. [signature]	i.V. [signature]
Dr. Hans Peter Zerbes, Leiter der Produktionseinheit Drehzahlveränderbare Antriebe Standort Bad Neustadt	Dr. Gerhard Huth, Techn. Leiter der Produktionseinheit Drehzahlveränderbare Antriebe Standort Bad Neustadt

Diese Erklärung bescheinigt die Übereinstimmung mit den genannten Richtlinien, ist jedoch keine Zusicherung von Eigenschaften im Sinne der Produkthaftung.

SIEMENS

EG-Konformitätserklärung

No. 664.20006.01/06.96

Hersteller:	Siemens Aktiengesellschaft Bereich Antriebs-, Schalt- und Installationstechnik Geschäftsgebiet Drehzahlveränderbare Antriebe
Anschrift:	Siemensstraße 15 97615 Bad Neustadt a. d. Saale Bundesrepublik Deutschland
Produktbezeichnung:	**Drehstrom-Asynchronmotor** **Typ 1PH2...** **mit Käfigläufer, Hauptspindelantrieb** **(Einbaumotor)**

Das bezeichnete Produkt stimmt mit den Vorschriften folgender Europäischer Richtlinie überein:

73/23/EWG Richtlinie des Rates zur Rechtsangleichung der Rechtsvorschriften der Mitgliedstaaten betreffend elektrischer Betriebsmittel zur Verwendung innerhalb bestimmter Spannungsgrenzen geändert durch RL 93/68/EWG des Rates

Die Sicherheitshinweise und Betriebsanleitungen sind zu beachten.

Erstmalige Anbringung der CE-Kennzeichnung: 96

Siemens Aktiengesellschaft

Bad Neustadt, den 21/6/96

i.V. Zerbes ....

Dr. Hans Peter Zerbes, Leiter der Produktionseinheit Drehzahlveränderbare Antriebe Standort Bad Neustadt

i.V. Huth ....

Dr. Gerhard Huth, Techn. Leiter der Produktionseinheit Drehzahlveränderbare Antriebe Standort Bad Neustadt

Diese Erklärung bescheinigt die Übereinstimmung mit den genannten Richtlinien, ist jedoch keine Zusicherung von Eigenschaften im Sinne der Produkthaftung.

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SIEMENS

EG-Konformitätserklärung

No. 664.20007.01/08.96

Hersteller:	Siemens Aktiengesellschaft Bereich Antriebs-, Schalt- und Installationstechnik Geschäftsgebiet Drehzahlveränderbare Antriebe
Anschrift:	Siemensstraße 15 97615 Bad Neustadt a. d. Saale Bundesrepublik Deutschland
Produktbezeichnung:	**Drehstrom-Asynchronmotor** **Typ 1PH4..., 1PH6...** **mit Käfigläufer, Hauptspindelantrieb** **Achshöhe 100 bis 160**

Das bezeichnete Produkt stimmt mit den Vorschriften folgender Europäischer Richtlinie überein:

73/23/EWG Richtlinie des Rates zur Rechtsangleichung der Rechtsvorschriften der Mitgliedstaaten betreffend elektrischer Betriebsmittel zur Verwendung innerhalb bestimmter Spannungsgrenzen geändert durch RL 93/68/EWG des Rates

Die Übereinstimmung mit den Vorschriften dieser Richtlinie wird nachgewiesen durch die vollständige Einhaltung folgender Normen:

EN 60 204-1
EN 60 034-1
EN 60 034-5
EN 60 034-6
EN 60 034-9
Die Sicherheitshinweise und Betriebsanleitungen sind zu beachten.

Erstmalige Anbringung der CE-Kennzeichnung: 96

Siemens Aktiengesellschaft

Bad Neustadt, den 13/8/96

i.V. Dr. H.-P. Zerbes

Dr. Hans Peter Zerbes, Leiter der
Produktionseinheit Drehzahlveränderbare Antriebe
Standort Bad Neustadt

i.V.

Dr. Gerhard Huth, Techn. Leiter der
Produktionseinheit Drehzahlveränderbare Antriebe
Standort Bad Neustadt

Diese Erklärung bescheinigt die Übereinstimmung mit den genannten Richtlinien, ist jedoch keine Zusicherung von Eigenschaften im Sinne der Produkthaftung.

SIEMENS

EG-Konformitätserklärung

No. A1A 3435.K001 D / 04.96

Hersteller:	Siemens Aktiengesellschaft Bereich Antriebs-, Schalt- und Installationstechnik Geschäftsgebiet Drehzahlveränderbare Antriebe Produktionseinheit Motoren Nürnberg
Anschrift:	Vogelweiherstraße 1 - 15 90441 Nürnberg Bundesrepublik Deutschland
Produktbezeichnung:	**Drehstromasynchronmaschine 1PA6 ..., 1PH7 ... und 1PH6 ... Achshöhe 180 bis 225**

Das bezeichnete Produkt stimmt mit den Vorschriften folgender Europäischer Richtlinie überein:

Richtlinie 73/23/EWG — Richtlinie des Rates zur Rechtsangleichung der Rechtsvorschriften der Mitgliedsstaaten betreffend elektrischer Betriebsmittel zur Verwendung innerhalb bestimmter Spannungsgrenzen geändert durch RL 93/68/EWG des Rates

Die Übereinstimmung mit den Vorschriften dieser Richtlinie wird nachgewiesen durch die Einhaltung folgender Normen:

Harmonisierte Europäische Normen:
EN 60 034-1
EN 60 034-5
EN 60 034-6
EN 60 034-9
EN 60 204-1

Sicherheitshinweise und Betriebsanleitungen sind zusätzlich zu beachten.

Erstmalige Anbringung der CE-Kennzeichnung: 1996

Siemens Aktiengesellschaft

Nürnberg, den 11.04.96

i.V. K. Karger
Stephan Karger, Leiter des Geschäftszweigs Antriebssysteme Standort Erlangen

i.V. E. Auernhammer
Erich Auernhammer, Techn. Leiter der Produktionseinheit Drehzahlveränderbare Antriebe Standort Nürnberg

Diese Erklärung bescheinigt die Übereinstimmung mit den genannten Richtlinien, ist jedoch keine Zusicherung von Eigenschaften im Sinne der Produkthaftung.

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To SIEMENS AG A&D MC BMS Postfach 3180 D–91050 Erlangen Tel. 0180 / 525 – 8008 / 5009 [Hotline] Fax 09131 / 98 –1145 email: motioncontrol.docu@erlf.siemens.de	**Recommendations** **Corrections** for documentation: SIMODRIVE AC Motors for Feed and Main Spindle Drives Manufacturer Documentation
From Name Company address/Dept. Street Postal/Zip code: City: Telephone: / Telefax: /	Planning Guide Order No.: 6SN1197–0AA20–0BP4 Edition: 11.00 If you come across printing errors in this document, please let us know using this form. We would also be grateful for any recommendations and suggestions.

Recommendations and/or corrections

SIMODRIVE

General Documentation

SINUMERIK SIMODRIVE

Catalog
Ordering Documentation NC 60.1
Technical Documentation NC 60.2

SINUMERIK SIROTEC SIMODRIVE
Accessories

Catalog
Accessories NC Z

Manufacturer Documentation

SIMODRIVE
611

Planning Guide
AC Motors for Feed and Main Spindle Drives

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611

Planning Guide
Transistor PWM Inverters for AC Feed Drives and AC Main Spindle Drives

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611

Description
Commissioning Software for Main Spindle and Induction Motor Modules Version 2.00

SINUMERIK SIROTEC

EMC Guidelines for SINUMERIK and SIROTEC Controls

Service Documentation

SIMODRIVE
611

Start–up Instructions
Transistor PWM Inverters for AC Feed Drives and AC Main Spindle Drives

Electronic Documentation

SINUMERIK SIMODRIVE
840D/810D/ FM–NC/611/ Motors

DOC ON CD
The SINUMERIK System
Order No.:
6FC5298–5CA00–0BG2

SINUMERIK SIMODRIVE
840C

DOC ON CD
Order No.:
6FC5198–6CA00–0BG1